Appendix A – Interchange Modification Justification Report

Interstate Modification Justification Report

Interstate 229 - Exit 4 (Cliff Avenue)

Sioux Falls, SD

S.P. No. MINN05HN

SDDOT 147016 | October 28, 2020

SEH

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Executive Summary

This Interchange Modification Justification Report (IMJR) provides technical analysis related to the proposed changes to the existing Cliff Avenue interchange (Exit 4) on Interstate 229 (I-229) in Sioux Falls, SD.

The proposed action is a reconfiguration of the existing Cliff Avenue interchange on Interstate 229 in Sioux Falls, SD. The action is proposed to bring the existing interchange up to current design standards and provide improved safety and operational capacity for future traffic demand for all roadway users.

The existing Exit 4 interchange was first identified as having safety and capacity problems during the 2010 Decennial Interstate Corridor Study and more recently with the I-229 Major Investment Study (MIS), both included recommendations for interchange improvements at the Exit 4 interchange.

No adverse impacts to the Interstate highway system are forecast due to the proposed changes at the interchange. However, the design year 2050 traffic forecasts show impacts to the Interstate system due to regional growth in the metropolitan area.

Due to the impacts in the 2050 design year, an interim year of 2035 was evaluated to estimate the time-frame for the freeway mainline impacts in the study area. This evaluation resulted in no impacts along northbound I-229. Southbound I-229 would have capacity impacts along the 2-lane segments at each interchange in the study area in the No Build conditions. If these sections of I-229 are expanded they will operate within operational and safety goals with any build alternative; however at a minimum all bridge structures should be designed to accommodate the additional lanes.

The Federal policy considerations and requirements have been addressed in the Recommendations section of this report including the two technical requirements for approval.

The proposed change is a reconfiguration of an existing interchange and improvements to the existing arterial facility. These changes will correct existing deficiencies including:

- Safety
- Operations
- Intersection Spacing
- Non-motorized facilities

The proposed changes, as part of Alternative 6, do not result in any new access points on the Interstate Highway System.

The concept alternatives for the interchange and changes to the crossroad arterial street satisfy current design standards and meet the transportation needs within the study area.

Mass transit reaches a limited market in South Dakota and High Occupancy Vehicle (HOV) facilities are currently not in use because they have not been shown to be economically feasible at this time. Neither mass transit nor HOV facilities will correct design deficiencies or provide sufficient relief to future travel demands within the study planning horizon year.

The operational and safety analysis contained in this study show that the proposed build alternatives are not expected to adversely affect the safety or efficiency of the interstate system. The build

alternatives are also expected to improve access management and non-motorized facilities on the crossroad in the vicinity of the interchange area.

The proposal is the result of land use and transportation plans prepared within the Metropolitan Planning Organization (MPO) process, including the Sioux Falls MPO Long Range Transportation Plan. While the preliminary engineering for this project is included in the current Statewide Transportation Improvement Plan (STIP) for 2020-2023, the 2025-2028 Developmental STIP includes the funding and construction years.

Analysis techniques included evaluation of operational capacity using the Highway Capacity Manual (HCM), 6th Edition, techniques via the Highway Capacity Software (HCS) Version 7. Highway Safety Manual (HSM) techniques were used to the extent possible in this report; the Federal Highway Administration's (FHWA) Interactive Highway Safety Design Model (IHSDM) was utilized. Other techniques and reference materials are detailed in the Methods and Assumptions document prepared for this study and signed by the City of Sioux Falls, SDDOT, and FHWA participants on September 21, 2018 and modified as necessary throughout the study. The Methods and Assumptions document is included in **Appendix K**.

Contents

Contents (continued)

List of Tables

Contents (continued)

List of Figures

Contents (continued)

List of Appendices

Interstate Modification Justification Report

Interstate 229 - Exit 4 (Cliff Avenue)

Prepared for the South Dakota Department of Transportation in cooperation with the Federal Highway Administration and the City of Sioux Falls.

1 Introduction

The South Dakota Department of Transportation (SDDOT) has initiated an assessment of the existing interchange on Interstate 229 (I-229) at Cliff Avenue (Exit 4) in Sioux Falls, South Dakota.

This Interchange Modification Justification Report (IMJR) is the culmination of several steps that have been completed to document the benefits and impacts associated with a range of modification alternatives for the existing interchange. This document was completed following the outline provided in the Federal Highway Administration (FHWA) August 2010 Interstate System Access Informational Guide and meets the requirements of the Access to the Interstate System policy printed in the Federal Register on August 27, 2009 and updated on May 22, 2017.

The interchange study project evaluated both the Minnesota Avenue (Exit 3) and Cliff Avenue (Exit 4) interchanges with I-229; however, the delivery of the project was to separate the two interchange documents as two separate actions. Therefore, this IMJR will include a larger study area encompassing the entire interchange study, but contain information regarding the Cliff Avenue (Exit 4) interchange for approvals.

1.1 Background

SDDOT, the City of Sioux Falls, and FWHA have conducted an interchange study to evaluate the design, safety, and operations, as well as policy and funding implications, of modifying the Cliff Avenue (Exit 4) interchange along I-229.

The existing interchange serves as an urban arterial corridor that carries a significant amount of commuting traffic in southern Sioux Falls. The IMJR is being prepared in conjunction with applicable environmental reviews and analyses, and will provide the traffic analysis for the selection of the preferred alternative design.

1.2 Purpose

The purpose of the project is to improve travel mobility and safety at the I-229 interchange with Cliff Avenue (Exit 4) and along the Cliff Avenue corridor for all roadway users. The transportation planning process will be used to shape the project's objectives and purpose and need in the National Environmental Policy Act (NEPA) process.

The existing Exit 4 interchange was first identified as having safety and capacity problems during the 2010 Decennial Interstate Corridor Study, which identified the need for improvements at the

interchange. The 2010 study also recommended the widening of I-229 in the study area to add an additional lane in each direction by the forecast year 2020.

The more recent I-229 Major Investment Study (MIS) was completed and included recommendations for interchange improvements at the Exit 4 interchange. The MIS allowed the City of Sioux Falls, the Sioux Falls Metropolitan Planning Organization (MPO), the SDDOT, FHWA, and others to help determine the vision for the I-229 Corridor. The I-229 Exit 4 (Cliff Avenue) Corridor Study was a subarea study of the I-229 MIS.

Neither the MIS nor the subarea study recommended the need for I-229 capacity improvements through the forecast year 2035. This study continues the previous planning work and provides the necessary evaluations for consideration by SDDOT and FHWA.

1.3 Project Location

The subject interchange is at mileage reference marker 4 on I-229, in southern Sioux Falls, SD. The interchange is approximately four miles east/northeast of the I-29/I-229 system interchange and six miles south of the I-229/I-90 system interchange. The adjacent interchanges along I-229 are Minnesota Avenue (Exit 3) and 26th Street (Exit 5); the interchange spacing is approximately 1-mile to either side of the subject interchange.

This location is within the Sioux Falls MPO and within the developed urban area of the city. The Cliff Avenue corridor is a primary commuter route between downtown and the urban/suburban residential areas throughout the southern Sioux Falls metropolitan area.

Cliff Avenue is a five-lane principal arterial through the project area; there is a two way left turn lane (TWLTL) north and south of the interchange. Major intersections include 33rd Street, and 49th Street; however there are many local roadway intersections and driveway access locations, as well as access to Lincoln High School which is just north of the interchange.

1.4 Logical Termini

As the existing interchange is in the developed area of the city, the project termini extends away from the study interchange. The study area is shown in **Figure 1**; both Exits 3 and 4 are marked on the figure, as the interchanges were studied together. **Figure 2** shows an aerial view of the four study interchanges.

- Western Limits along I-229: the closest service interchange to the west is Minnesota Avenue (Exit 3), this interchange is approximately 1-mile west. As the Exit 3 and Exit 4 interchanges were studied together, the next interchange to the west is Western Avenue (Exit 2) and is approximately 1-mile west of the Minnesota Avenue interchange. Therefore, this interchange is a reasonable west terminus for this project.
- Eastern Limits along I-229: the closest service interchange to the east is 26th Street (Exit 5), this interchange is approximately 1-mile east. Therefore, this interchange is a reasonable east terminus for this project.
- Northern Limits along Cliff Avenue: the interchange project only intends to reconstruct Cliff Avenue at the interchange; therefore the next signalized intersection to the north is the intersection of Cliff Avenue at 33rd Street.

- Southern Limits along Cliff Avenue: the interchange project only intends to reconstruct Cliff Avenue at the interchange; therefore the next signalized intersection to the south is 49th Street.

Figure 1 – Project Study Area (Location Map)

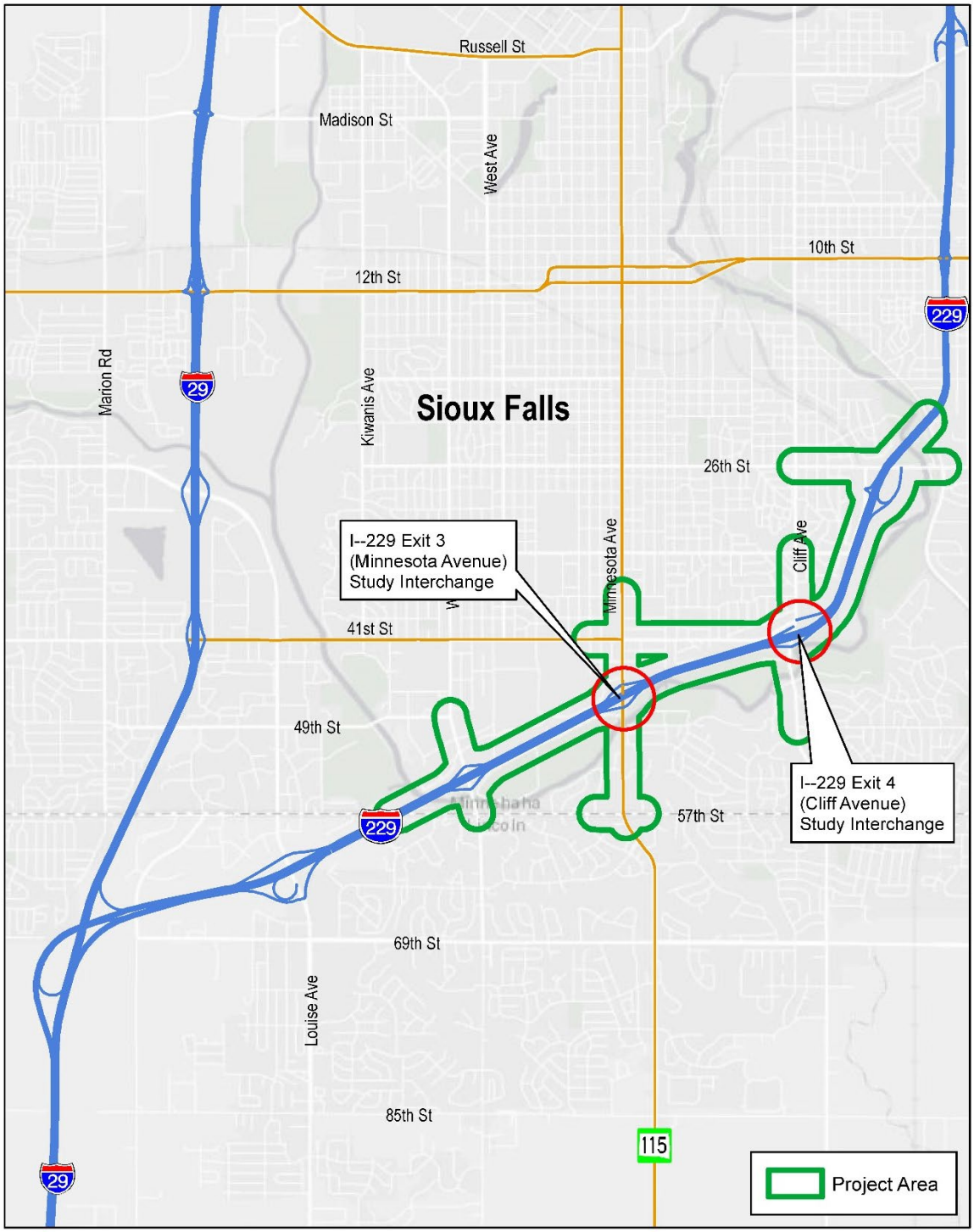
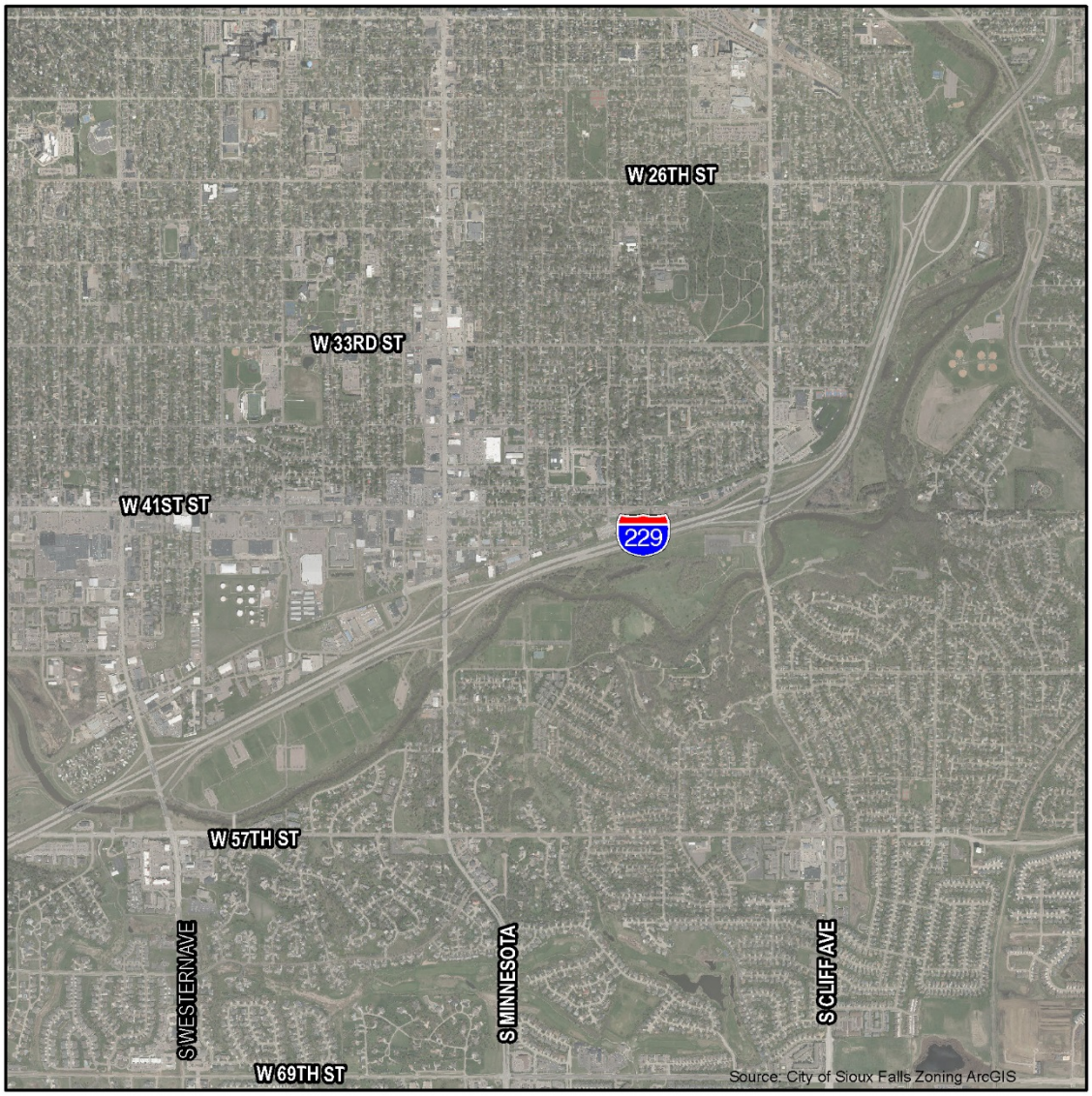


Figure 2 – Project Area Existing Configuration



2 Methodology

This Interchange Modification Justification Report (IMJR) demonstrates that the action associated with implementing the proposed project does not have any fatal flaws. Demonstrating that no fatal flaws exist does not endorse the action, but rather allows for the conclusion that the identified access alternatives are not flawed from the perspective of traffic operations and safety, as required by FHWA. Fatal flaws would include a proposed interchange justification that:

- Does not provide full access to public roadway.
- Would negatively impact interstate facility traffic operations and cannot be reasonably mitigated.
- Would negatively impact interstate facility/cross street safety and cannot be reasonably mitigated.
- Conflicts with, or is inconsistent with, local and regional plans.
- Would create the potential for environmental consequences which could not be mitigated.

This IMJR, including the analysis and documentation, was developed through the following steps:

- Establish an appropriate study area; determined in the Methods and Assumption document and represented in the previous **Figure 1**.
- Data gathering; review available traffic volume data, crash history, land use, and any other additional information.
- Review previous interstate and/or traffic studies, and coordinate with preparation of the environmental studies as part of the NEPA process, including the feasible alternatives and the best technical solution developed through the IMJR.
- Determine existing and future operational and safety characteristics of both the interstate and local cross street facilities to address FHWA requirements for interstate access modifications.
- Prepare and deliver the IMJR.

Traffic forecasts were prepared using output from the regional travel demand model maintained by the City of Sioux Falls. Analysis techniques included evaluation of operational capacity using the Highway Capacity Manual (HCM), 6th Edition, techniques via the Highway Capacity Software (HCS) Version 7. Highway Safety Manual (HSM) techniques were used to the extent possible in this report.

This IMJR document is organized in accordance with section 3.5.3 of FHWA's *Interstate Systems Access Information Guide*, August 2010.

This IMJR was developed with oversight from FHWA, SDDOT, City of Sioux Falls, and other project partners following the criteria outlined in the Methods and Assumptions (M&A) document for the study. The final M&A document is attached in **Appendix K**.

A Study Advisory Team (SAT) was set up and includes representatives of the SDDOT, FHWA, City of Sioux Falls, and the Sioux Falls Metropolitan Planning Organization (MPO). The SAT was formed to guide the study through completion.

3 Existing Conditions

The study area consists of four interchanges along I-229, including Western Avenue, Minnesota Avenue, Cliff Avenue, and 26th Street interchanges; this includes over 4-miles of I-229. Along the cross streets, a total of approximately 4-miles of arterial roadway, including I-229 study intersections, were evaluated.

Within the study area, the transportation system is comprised of the entire range of functional classification from local streets through interstate routes.

3.1 Demographics

The Sioux Falls metropolitan area enjoys a strong economy and sustained population growth. During the period 1980 – 2010 the population grew at a steady rate of between 2% and 2.5% per year. Even in the face of the recent recession, the population continued to grow with the 2010 Census showing the city with a population of 153,888; the 2018 Census Bureau estimated a current population of 181,883. The Metropolitan Statistical Area (MSA) had a population of 228,261. This area includes the four counties surrounding the City of Sioux Falls.

3.2 Existing Land Use

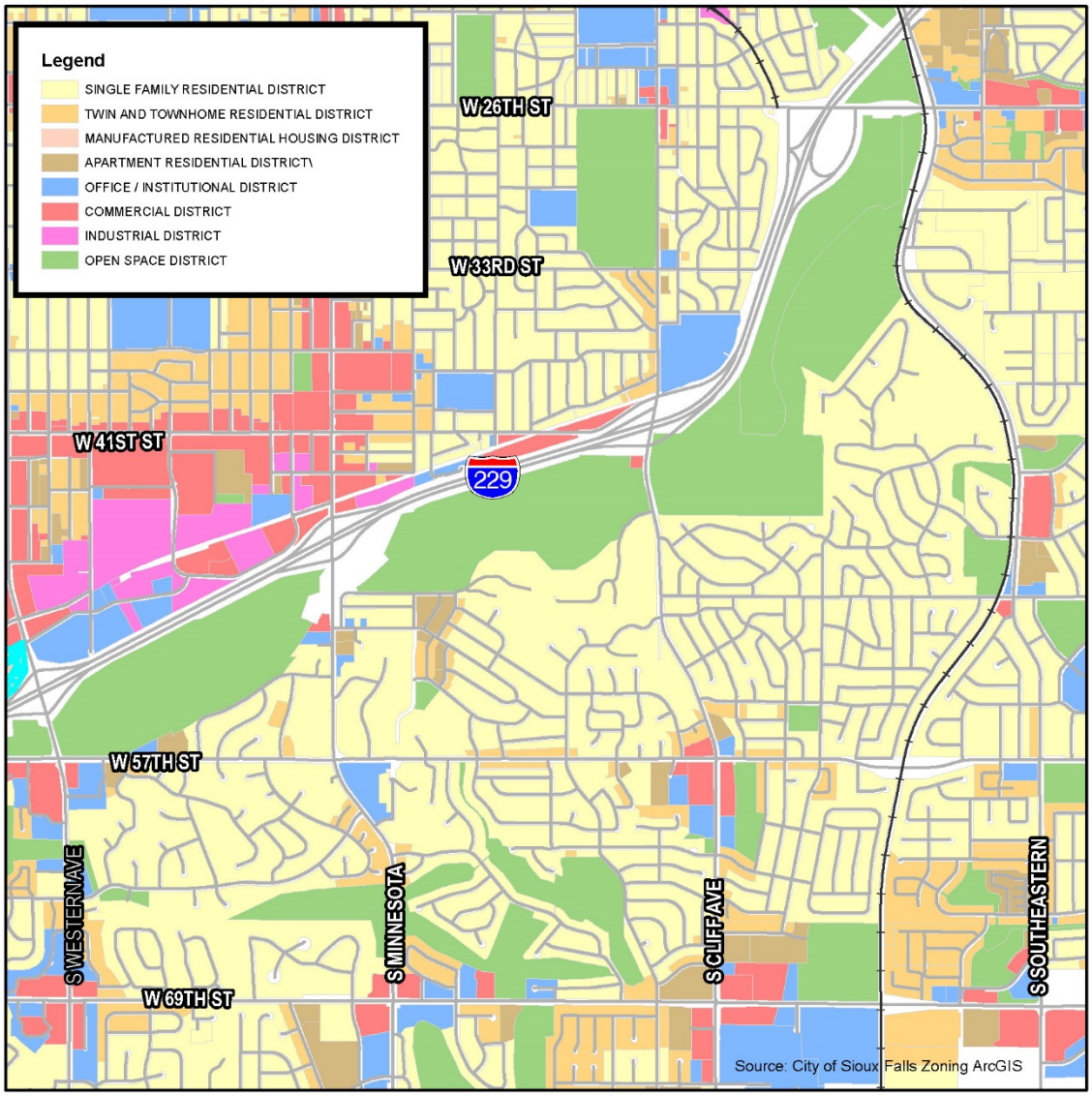
The entire study area is comprised of a mix of many different land uses including commercial, industrial, retail, and residential. The flood plain of the Big Sioux River and associated parks and open space are also present.

Directly north of I-229, along Cliff Avenue, there is a mix of residential uses as well as a high school directly in the northeast quadrant of the interchange. Directly south of I-229 is a significant amount of park land, which transitions to mostly residential uses.

The study area Traffic Analysis Zones (TAZ's) currently reflect the existing population and employment inputs. The future year TAZ's show limited increases in population and employment inputs in the established neighborhoods; however outside of the study area to the south and east, there are increases due to regional growth.

The current City of Sioux Falls zoning for the study area is represented in **Figure 3**.

Figure 3 – Existing Zoning Map



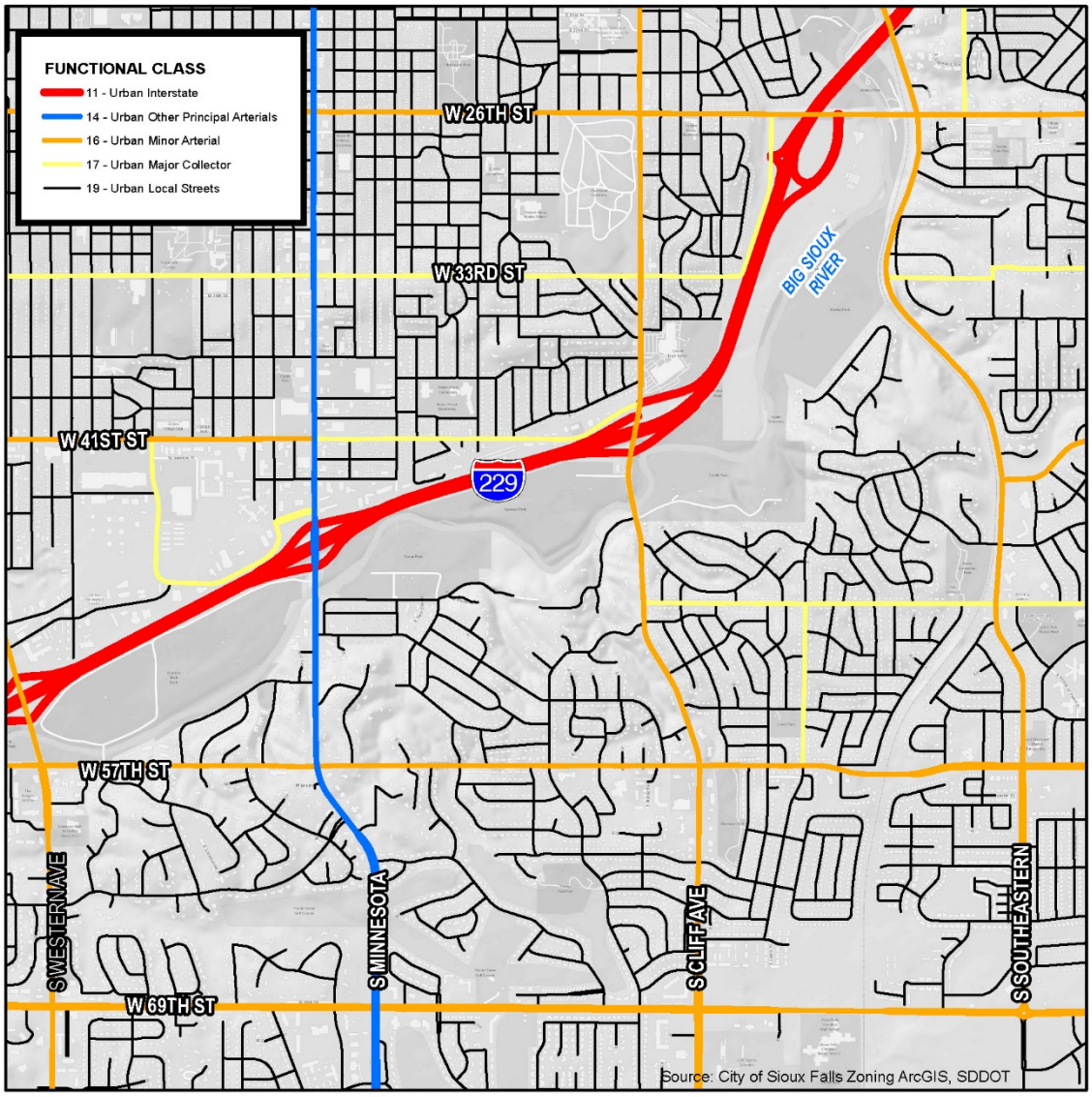
3.3 Existing Roadway Network

The existing roadway network, represented by their Federal functional classification, surrounding the project area is shown in **Figure 4**.

The existing major roadways within the study area include:

- **I-229** – urban interstate facility, currently two continuous lanes in each direction with auxiliary lanes provided between the four study area interchanges.
- **S. Western Avenue** – 4-lane divided urban minor arterial; transitions to a 5-lane section with a two way left turn lane (TWLTL) north of I-229.
- **S. Minnesota Avenue** – 5-lane urban principal arterial; two through lanes in each direction with a TWLTL.
- **S. Cliff Avenue** – 5-lane urban minor arterial; two through lanes in each direction with a TWLTL.
- **E. 26th Street** – urban minor arterial varying between 3- and 5-lane sections. 26th Street will be reconstructed to a 4-lane divided roadway through the I-229 interchange as part of an on-going interchange project (2019/2020 construction).
- **W. 57th Street** – urban minor arterial varying between a 4-lane undivided and 5-lane roadway.
- **W. 49th Street** – this roadway is currently discontinuous between Western Avenue and Minnesota Avenue; while not currently funded, the connection is anticipated to be completed before the 2050 horizon year. West of Western Avenue, 49th Street is a 4-lane undivided urban minor arterial. West of Minnesota Avenue, 49th is an urban major collector that extends for only approximately 700 feet before it terminates. It is anticipated that the functional classification between Western Avenue and Minnesota Avenue will change upon the connection's completion.
- **W. 41st Street** - 5-lane urban minor arterial west of Minnesota Avenue; to the east it transitions from a 5-lane urban major collector to a 3-lane urban major collector.
- **E. 41st Street** – 2-lane undivided urban collector west of Cliff Avenue.
- **E. 37th Street** – 2-lane urban local roadway.
- **E. 49th Street** – 2-lane undivided urban major collector roadway.
- **E. 33rd Street** – 2-lane undivided urban major collector roadway.
- **S. Yeager Road** – 2-lane undivided urban major collector roadway.
- **S. Southeastern Avenue** – urban minor arterial transitioning between a 3-lane and 4-lane roadway. Southeastern Avenue will be reconstructed to a 4-lane divided roadway through the 26th Street intersection as part of the 2019-2020 interchange project.

Figure 4 – Existing Federal Functional Classification



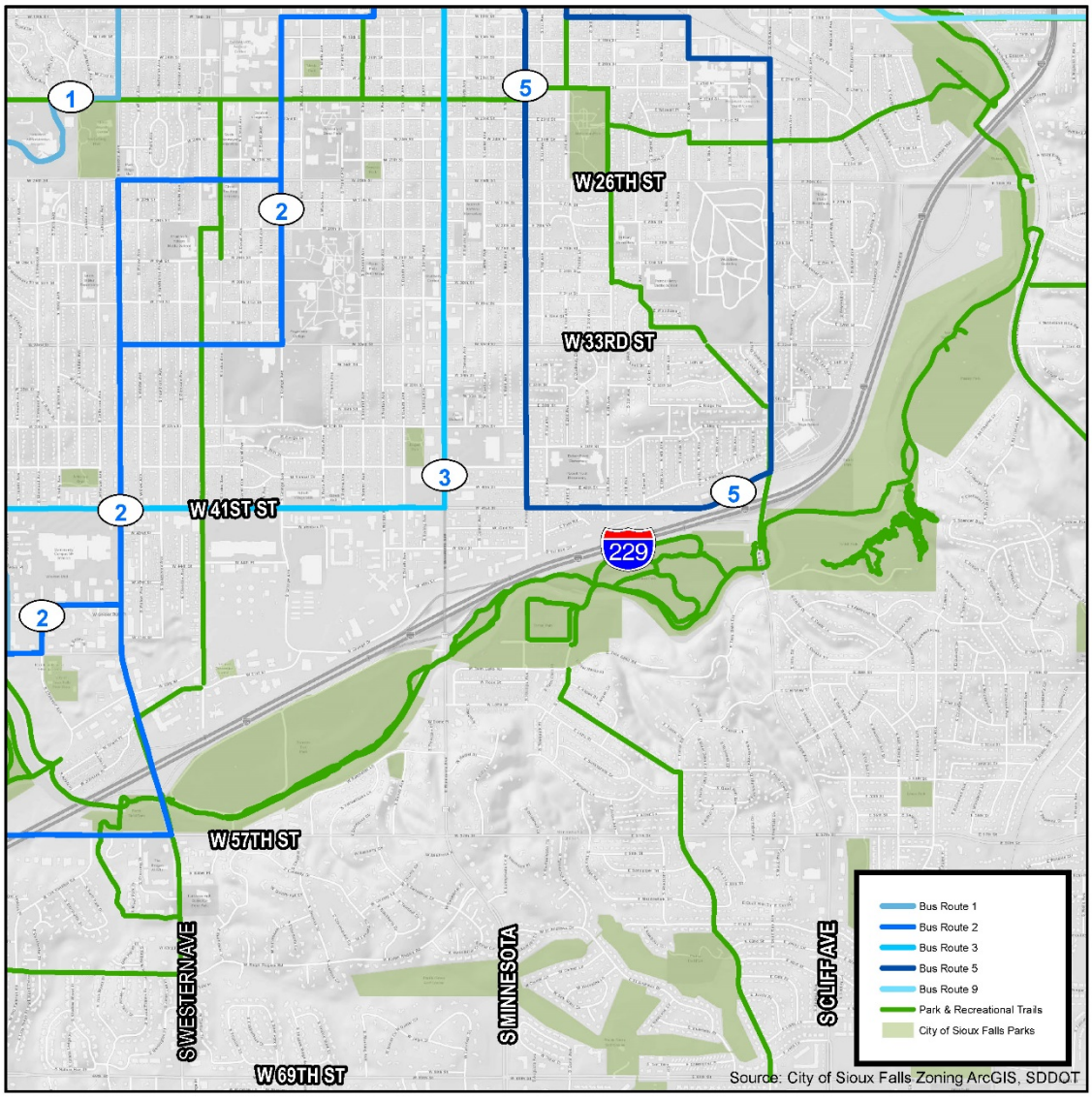
3.4 Alternative Travel Modes

Travel within the study area is primarily by automobile. Pedestrian and bicycle modes are used mainly for recreation, although bicycle commuters use the River Greenway bike trail system and street signed routes throughout the study area. Lincoln High School, located on Cliff Avenue, generates a significant amount of pedestrian volumes on the Cliff Avenue corridor.

The area is partially served by municipal transit routes 2, 3, and 5. These bus routes operate on portions of 57th Street, Western Avenue, Cliff Avenue, and 41st Street. Buses operate on headways that vary from about 30 to 60 minutes and routes wind through neighborhoods to serve passenger destinations.

The following **Figure 5** shows the existing bus routes and the existing bike trail system.

Figure 5 – Existing Bus Routes and Trail System



3.5 Interchanges

The following is a description and aerial photograph of the four existing interchanges within the entire project study area.

3.5.1 I-229 at Western Avenue (Exit 2)

This service interchange along I-229 is a standard diamond configuration as shown in **Figure 6**. All ramp connections are currently single lane ramps at the merge and diverge locations with I-229, with full auxiliary lanes provided between the adjacent interchanges on either side. At this interchange, Western Avenue travels over I-229 on a single bridge structure.

Both ramp terminal intersections are currently controlled by traffic signals with approximately 675 feet between the intersections. The nearest intersection north of the interchange is approximately 500 feet away at 51st Street (minor street stop control), the nearest intersection to the south is approximately 750 feet away at 57th Street (traffic signal control).

Directly south of the interchange, Western Avenue includes a bridge structure over the Big Sioux River; this structure currently limits the southbound approach capacity and storage to the 57th Street intersection.

Figure 6 – Existing I-229 at Western Avenue Interchange

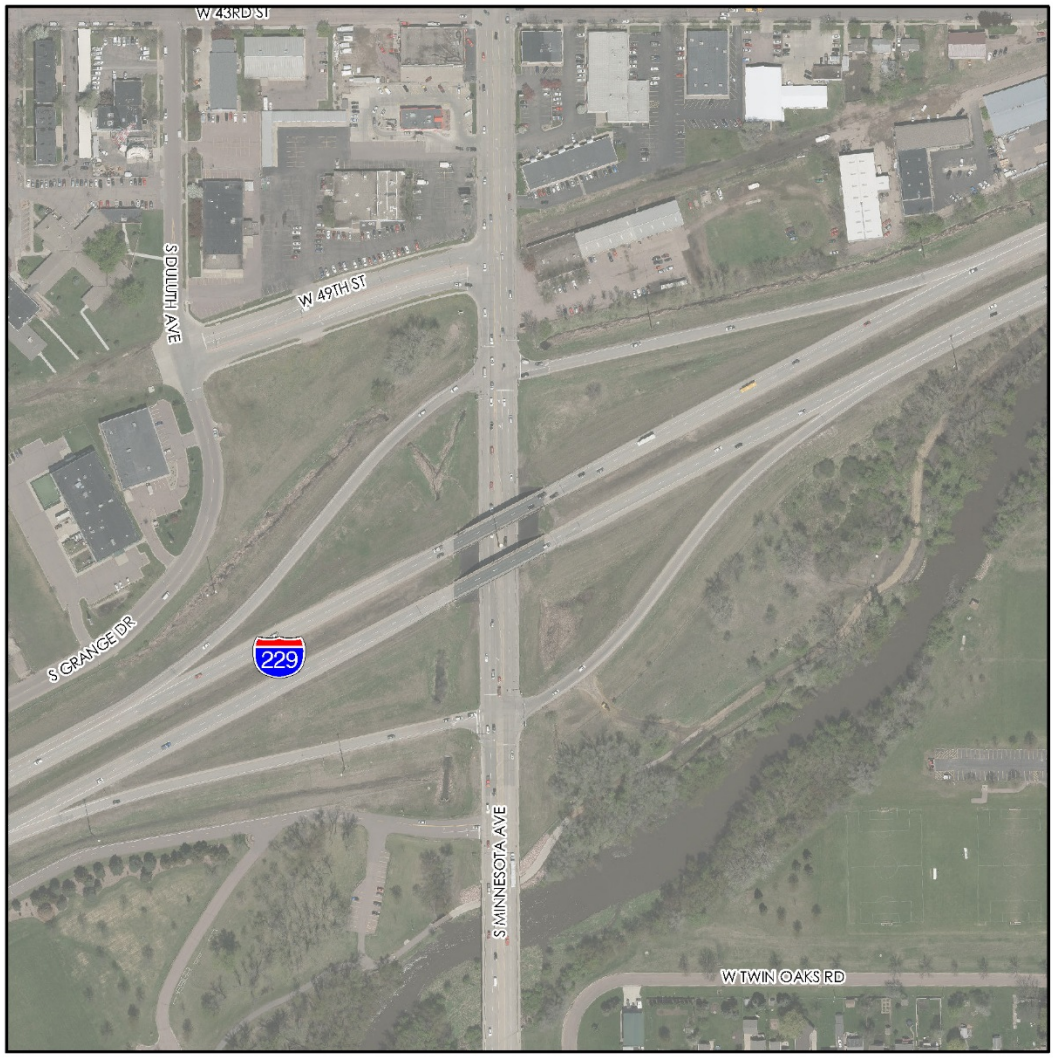
3.5.2 I-229 at Minnesota Avenue (Exit 3)

This service interchange along I-229 is a standard diamond configuration as shown in **Figure 7**. All ramp connections are currently single lane ramps at the merge and diverge locations with I-229, with full auxiliary lanes provided between the adjacent interchanges on either side. At this interchange, I-229 travels over Minnesota Avenue on two separate bridge structures.

Both ramp terminal intersections are currently controlled by traffic signals with approximately 675 feet between the intersections. The nearest intersection north of the interchange is approximately 200 feet away at 49th Street (minor street stop control), the nearest intersection to the south is approximately 200 feet away at Park Access Road (minor street stop control)).

Directly south of the interchange, Minnesota Avenue includes a bridge structure over the Big Sioux River.

Figure 7 – Existing I-229 at Minnesota Avenue Interchange



3.5.3 I-229 at Cliff Avenue (Exit 4)

This service interchange along I-229 is a modified diamond configuration as shown in **Figure 8**. The southbound I-229 off ramp is aligned with 41st Street and the southbound entrance ramp is a standalone T-intersection. All ramp connections are currently single lane ramps at the merge and diverge locations with I-229, with full auxiliary lanes provided between the adjacent interchanges on either side. At this interchange, I-229 travels over Cliff Avenue on two separate bridge structures.

The 41st Street/southbound I-229 exit ramp terminal intersection and the northbound I-229 ramp terminal intersection are currently controlled by traffic signals with approximately 800 feet between the intersections; the southbound entrance ramp intersection is uncontrolled and is less than 200 feet south of 41st Street. The nearest intersection north of the interchange is approximately 150 feet away at Lincoln High School (minor street stop control), the nearest intersection to the south is approximately 400 feet away at Park Access Road (minor street stop control); however there are two additional driveways between the intersections.

Figure 8 – Existing I-229 at Cliff Avenue Interchange

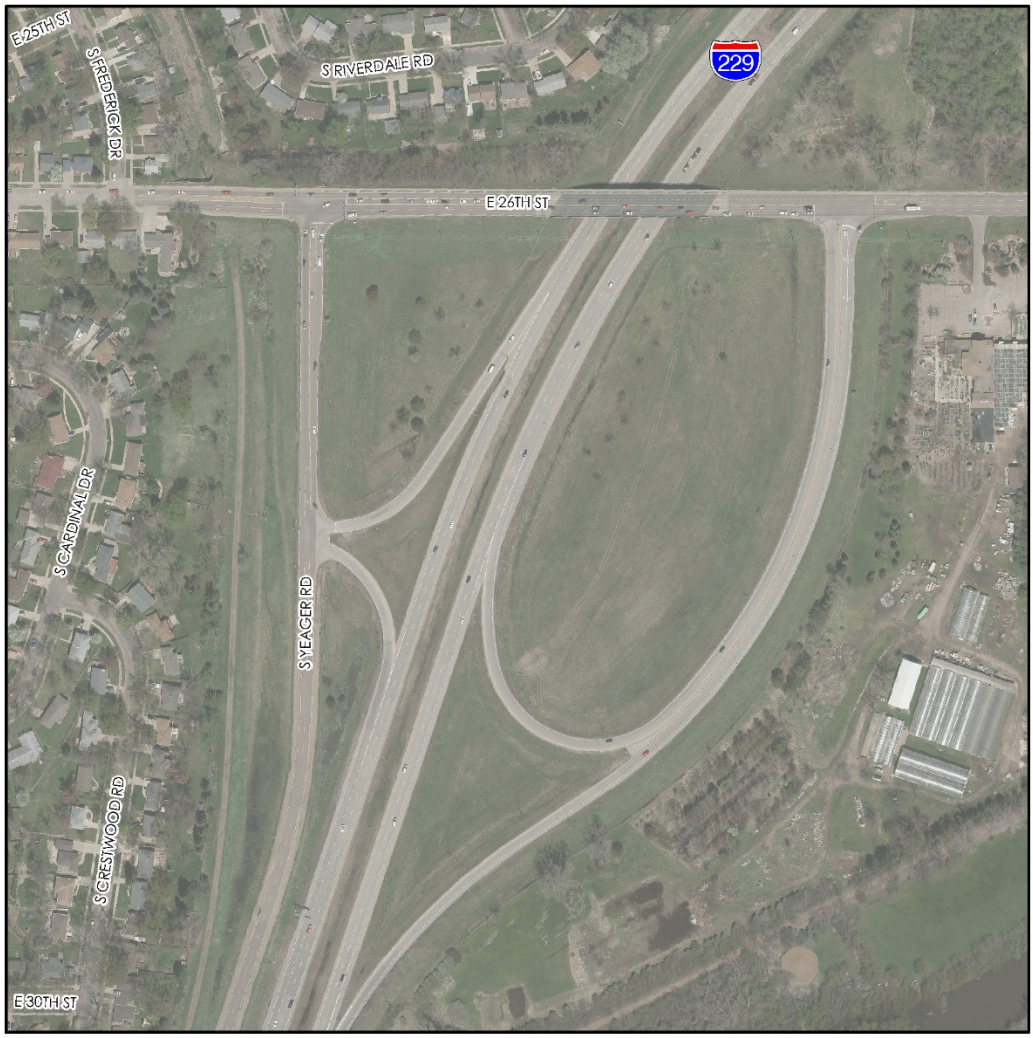
3.5.4 I-229 at 26th Street (Exit 5)

This service interchange is an unconventional interchange configuration as shown in **Figure 9**. The northbound I-229 ramps are a standard folded diamond configuration, while the southbound I-229 ramps are a buttonhook configuration connecting to Yeager Road. All ramp connections are currently single lane ramps at the merge and diverge locations with I-229; full auxiliary lanes are provided between the adjacent interchange to the south only. At this interchange, 26th Street travels over I-229 on a single bridge structure.

Currently, the 26th Street/Yeager Road intersection and the northbound ramp terminal intersection are controlled by traffic signals with approximately 1,100 feet between the intersections; the southbound ramp terminal intersection at Yeager Road includes stop control for the exit ramp.

A project is currently underway to reconstruct the interchange area and is slated to be complete after the 2020 construction season. Therefore, the existing conditions will use the current configuration, but all future analysis years will use the proposed reconfiguration.

Figure 9 – Existing I-229 at 26th Street Interchange

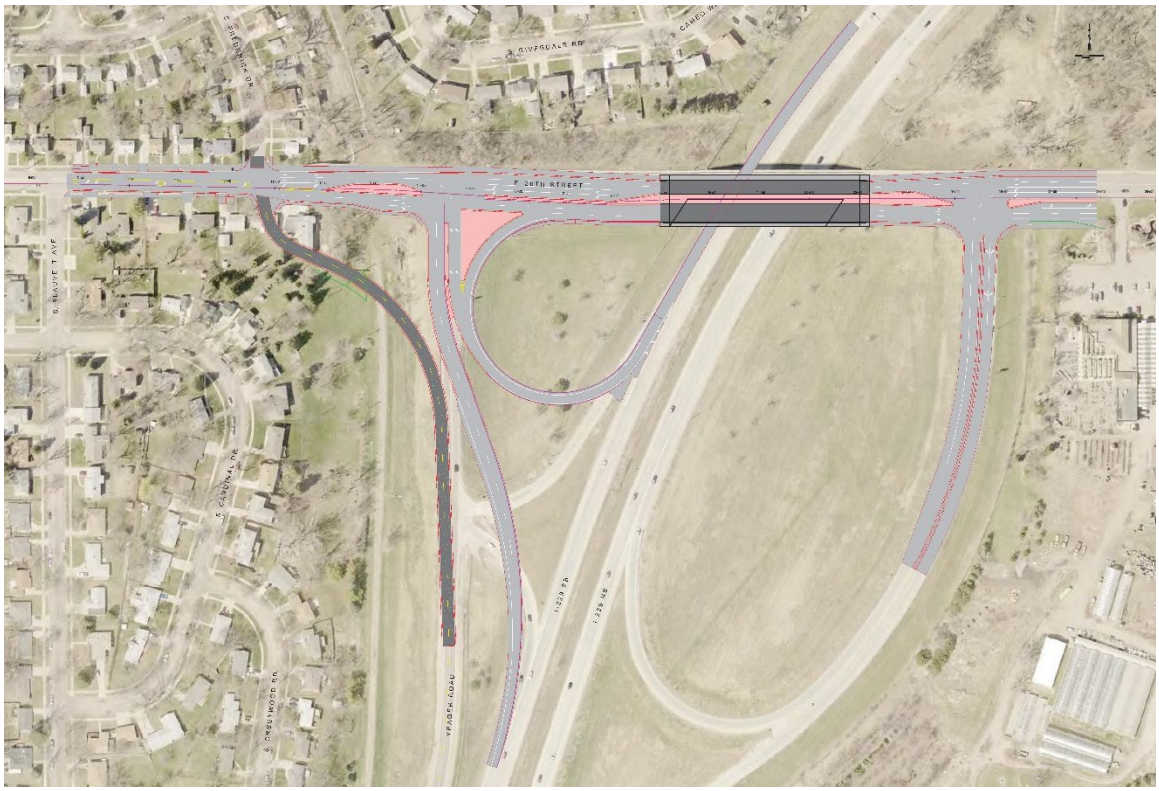


The proposed reconfiguration will reconstruct the interchange to a standard folded diamond configuration as shown in **Figure 10**. The northbound I-229 ramp connections will be widened near the ramp terminal intersection, but are unchanged near the ramp gores. The southbound ramp configuration will be entirely reconfigured.

Yeager Road will be realigned to connect to 26th Street west of its current location and will no longer be related to the interchange. A new southbound exit loop ramp will be constructed and directly tie into 26th Street; this new ramp terminal intersection is essentially in the same location as the existing 26th Street/Yeager Road intersection. The first intersection to the west will be approximately 400 feet away at the new Yeager Road intersection.

26th Street will be widened and additional turn lanes will be provided at the ramp terminal intersections; both will be controlled by traffic signals. The 26th Street at Yeager Road intersection will be under minor street stop control. The expansion of 26th Street will extend to the east and include significant reconfiguration of the intersection with Southeastern Avenue. The first intersection to the east will be approximately 300 feet away at a business driveway, with the first major intersection approximately 1,250 feet away at Southeastern Avenue.

Figure 10 – Proposed I-229 at 26th Street Interchange (2020)



3.6 Existing Data

The data used to create this document came from the participating agencies including the SDDOT and the City of Sioux Falls. The most recent data available was used in the analysis including traffic counts, crash data, signal timing data, and the travel demand forecast model.

The existing freeway traffic counts and intersection turning movements at all study intersections can be found in **Appendix I**, *I-229 Exit 3 and Exit 4 Interchange Study – Traffic Forecasts* memorandum.

3.6.1 Origin Destination Study

An origin-destination (OD) study was developed for I-229 based on data from a 3rd party vendor platform, StreetLight Data Incorporated. The platform uses global positioning system (GPS) information and location based service (LBS) information from both connected vehicles (cars and trucks) and cell phones.

A full OD study was conducted along I-229 between I-29 and I-90, including all nine service interchanges between the two system interchanges. The full results can be found in the *I-229 Exits 3 & 4 Interchange Study: Origin-Destination Study* memorandum, which can be found attached in **Appendix J**.

The platform allowed for 1-year worth of data to be pulled for the entire I-229 corridor; a total of 375,000 personal LBS trips and 265,000 commercial GPS trips were captured along the corridor. Personal vehicle GPS data did not provide sufficient trip counts. The data only produced approximately 40,000 trips, therefore, it was not used in the evaluation.

The data is sorted out by day of the week and grouped by hours throughout the day. For this OD analysis, the weekday trips during the AM and PM peak periods, 6am to 9am and 3pm to 6pm, were tabulated for use in this study evaluation.

For this report, the information regarding the weaving percentages between the study interchanges was utilized in the operational weaving analysis. **Table 1** shows the results of the six weaving segments within this interchange project area.

Table 1 – Origin-Destination Weaving Results

Ramp Weaving Segment		Avg Weekday 24-hr Data	Avg Weekday AM Peak	Avg Weekday PM Peak
NB I-229	Exit 2 to Exit 3	20%	20%	18%
NB I-229	Exit 3 to Exit 4	17%	20%	18%
NB I-229	Exit 4 to Exit 5	24%	11%	27%
SB I-229	Exit 5 to Exit 4	18%	15%	19%
SB I-229	Exit 4 to Exit 3	23%	20%	24%
SB I-229	Exit 3 to Exit 2	32%	32%	30%

3.7 Operational Performance

A traffic operations study was conducted for the project area using 2018 traffic volumes. A total of twenty-nine existing intersections and sixteen ramp junctions were analyzed within the interchange study area.

Analysis techniques included evaluation of operational capacity using the Highway Capacity Manual (HCM), 6th Edition, techniques via the Highway Capacity Software (HCS) Version 7.

It should be noted that the HCM does not recommend using the merge and diverge analysis procedures when a full length auxiliary lane is provided; the methodologies were derived from acceleration and deceleration lengths of 1,500 feet or less. Page 14-30 of the HCM 6th Edition says:

- The freeway segment downstream of the on-ramp or upstream of the off-ramp is simply considered to be a basic freeway segment with an additional lane.
- The case of an on-ramp followed by an off-ramp lane drop may be a weaving segment and should be evaluated with the procedures of Chapter 13, Freeway Weaving Segments.

Therefore, for this analysis both the basic lane and weaving segment analysis were conducted on all freeway mainline segments that include full auxiliary lanes between ramp connections.

3.7.1 Level of Service Criteria

The freeway and arterial Level of Service (LOS) criteria presented in the following tables were used to evaluate the traffic operations in the study area; the information is from the SDDOT Road Design Manual (Chapter 15) and based on the Highway Capacity Manual (HCM).

Table 2 – Freeway – LOS Criteria

Level of Service (LOS)	Description	Density (pc/mi/ln)
A	Free-flow operation	≤ 11.0
B	Reasonably free-flow operation; minimal restriction on lane changes & maneuvers	> 11.0 to 18.0
C	Near free-flow operation; noticeable restriction on lane changes & other maneuvers	> 18.0 to 26.0
D	Speed decline with increasing flows; significant restriction on lane changes & other maneuvers	> 26.0 to 35.0
E	Facility operates at capacity; very few gaps for lane changes & other maneuvers; frequent disruptions & queues	> 35.0 to 45.0
F	Unstable flow; operational breakdown	> 45.0

Source: SDDOT Road Design Manual (Table 15-1)

Table 3 – Signalized Intersection Control – LOS Criteria

Level of Service (LOS)	Description	Signalized Delay (sec/veh)
A	Very minimal queueing; excellent corridor progression	≤ 10.00
B	Some queuing; good corridor progression	> 10.0 to 20.0
C	Regular queueing; not all demand may be serviced on some cycles (cycle failure)	> 20.0 to 35.0
D	Queue lengths increased; routine cycle failures	> 35.0 to 55.0
E	Majority of cycles fail	> 55.0 to 80.0
F	Volume to capacity ratio approaches 1.0; very long queues, almost all cycles fail	> 80.0

Source: SDDOT Road Design Manual (Table 15-5)

Table 4 – All-Way Stop & Two Way Stop Intersection Control – LOS Criteria

Level of Service (LOS)	Description	Un-signalized Delay (sec/veh)
A	Queuing is rare	≤ 10.00
B	Occasional queueing	> 10.0 to 15.0
C	Regular queueing	> 15.0 to 25.0
D	Queue lengths increase	> 25.0 to 35.0
E	Significant queueing	> 35.0 to 50.0
F	Volume to capacity ratio approaches 1.0; very long queues	> 50.0

Source: SDDOT Road Design Manual (Table 15-6 and 15-7)

The SDDOT has established a minimum of LOS C on urban interstate highway corridors, including ramp terminal intersections.

The City of Sioux Falls has established a minimum of LOS D on arterial signalized intersections and any intersection movement at LOS E or better.

3.7.2 Existing Operations

The summation of the existing traffic operations analysis show that mainline I-229 operates acceptably. All existing ramp junctions and weaving segments operate at a LOS C or better during the AM and PM peak hours.

Results for the individual segments and ramp junctions of I-229 are shown in **Figure 11** as well as **Table 5**.

Figure 11 – Existing 2018 Freeway Configuration and LOS

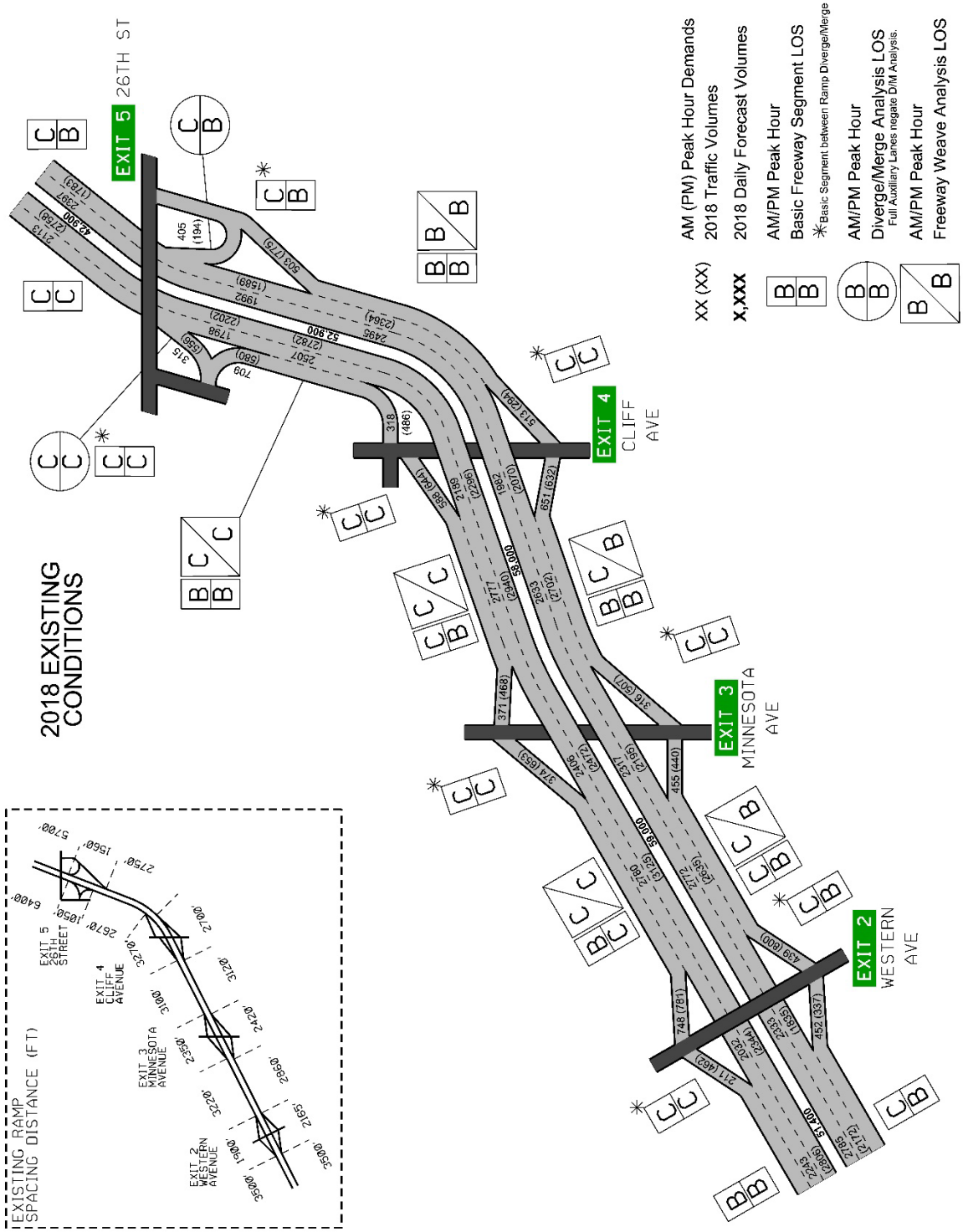


Table 5 – Existing 2018 I-229 Freeway Operations Summary

Road	Description	Analysis Type	AM Peak LOS	PM Peak LOS
NB I-229	NB I-229: southwest of Exit 2	Basic	C	B
	NB I-229: between Exit 2 Exit and Entrance Ramps	Basic	C	B
	NB I-229: between Exit 2 and Exit 3	Basic	C	B
		Weave	C	B
	NB I-229: between Exit 3 Exit and Entrance Ramps	Basic	C	C
	NB I-229: between Exit 3 and Exit 4	Basic	B	B
		Weave	C	B
	NB I-229: between Exit 4 Exit and Entrance Ramps	Basic	C	C
	NB I-229: between Exit 4 and Exit 5	Basic	B	B
		Weave	B	B
	NB I-229: between Exit 5 Exit and Entrance Ramps	Basic	C	B
	NB I-229: Exit 5 Entrance Ramp	Merge	C	B
	NB I-229: northeast of Exit 5	Basic	C	B
SB I-229	SB I-229: northeast of Exit 5	Basic	C	C
	SB I-229: Exit 5 Exit Ramp	Diverge	C	C
	SB I-229: between Exit 5 Exit and Entrance Ramps	Basic	C	C
	SB I-229: between Exit 5 and Exit 4	Basic	B	B
		Weave	C	C
	SB I-229: between Exit 4 Exit and Entrance Ramps	Basic	C	C
	SB I-229: between Exit 4 and Exit 3	Basic	C	B
		Weave	C	C
	SB I-229: between Exit 3 Exit and Entrance Ramps	Basic	C	C
	SB I-229: between Exit 3 and Exit 2	Basic	B	C
		Weave	C	C
	SB I-229: between Exit 2 Exit and Entrance Ramps	Basic	C	C
	SB I-229: southwest of Exit 2	Basic	B	B

The project study area also includes twenty-nine arterial intersections identified for operational analysis. **Table 6** summarizes the results of the existing traffic analysis for the ramp terminal intersections as well as adjacent major intersections within the study area. The existing lane configurations of each study intersection, with turn lane storage and the intersection LOS results, can be found in **Appendix A**.

Available storage for turning vehicles plays an important role in the operations of an intersection. The HCM software does not properly handle lane blockage conditions, providing LOS results that are not reflective of actual operations. The HCM methodologies provide a “Queue Storage Ratio” (RQ) which is the maximum stacking of queued vehicles (SDDOT recommends the 95th percentile queue) divided by the available storage length provided for the movement. If the RQ is above 1.0, it represents a queue that is spilling outside of the available storage and blocking other movements at the intersection. At any intersection where the RQ is above 1.0 for a

movement, it is SDDOT preference to state the intersection has failing operations, regardless of the overall delay at the intersection.

Throughout all four interchange areas many intersections, including ramp termini, operate at unacceptable LOS during the peak hours. A total of 22 of the study intersections have at least one peak hour operating under failing conditions.

Table 6 – Existing 2018 Arterial Intersection Control – LOS Criteria

Major Roadway	Intersecting Roadway	Control Type	AM Peak	PM Peak
Western Avenue	W 49th Street	Signal	B	C
Western Avenue	I-229 SB Ramp Terminal	Signal	C	**C***
Western Avenue	I-229 NB Ramp Terminal	Signal	C	**C***
Western Avenue	W 57th Street	Signal	D	**D***
Minnesota Avenue	W 37th Street	Signal	C	**C-**
Minnesota Avenue	W 41st Street	Signal	**C***	**E-**
Minnesota Avenue	W 49th Street	Minor Stop	**C-**	**F**
Minnesota Avenue	I-229 SB Ramp Terminal	Signal	B	**B-**
Minnesota Avenue	I-229 NB Ramp Terminal	Signal	**C-**	**B***
Minnesota Avenue	Yankton Park Entrance	Minor Stop	B	**F**
Minnesota Avenue	W Lotta Street	Minor Stop	**E-**	**E-**
Minnesota Avenue	W 57th Street	Signal	**C***	**D***
Cliff Avenue	E 33rd Street	Signal	B	C
Cliff Avenue	36th St/LHS Entrance #4	Minor Stop	C	C
Cliff Avenue	38th St/LHS Entrance #3	Minor Stop	**F**	D
Cliff Avenue	LHS Entrance #2	Minor Stop	C	A
Cliff Avenue	LHS Entrance #1	Minor Stop	**F**	**E**
Cliff Avenue	41st St/I-229 SB Exit Ramp	Signal	**B***	**C***
Cliff Avenue	I-229 SB Entrance Ramp	No Control	C	D
Cliff Avenue	I-229 NB Ramp Terminal	Signal	**C***	B
Cliff Avenue	Spencer Park Entrance	Minor Stop	C	C
Cliff Avenue	E 49th Street	Signal	**B***	B
26th Street	S Cliff Avenue	Signal	**C***	**D***
26th Street	S Yeager Road	Signal	B	**C***
26th Street	I-229 NB Ramp Terminal	Signal	**B***	**F**
26th Street	Southeastern Avenue	Signal	**C***	D
Yeager Road	I-229 SB Ramp Terminal	Minor Stop	**F**	**F**
41st Street	S Norton Avenue	Signal	**A-**	B
41st Street	S Phillips Avenue	Signal	C	C

Notes: *Intersection considered failing due to LOS and/or Queue Storage Ratio.*

- Average Intersection LOS shown, individual movements and/or approaches may be different. Minor Street Stop Control intersections LOS represents the worst minor approach LOS; major roadway would operate at LOS A.

*- " * " Queue Storage Ratio greater than 1.0 for at least 1 movement, results in failing intersection.*

- " – " At least one movement operates at a LOS F (not noted if intersection is at LOS F)

3.8 Existing Safety Issues

A comprehensive safety analysis was conducted for the entire project area for this study. The analysis included the most recent 5-years of crash history available from the SDDOT. This included the five calendar years of 2013 through 2017.

The crash records were segregated into crashes for each of the study intersections and the arterial and freeway segments. The type and severity of the crashes were reviewed and crash rates and critical rates were calculated for each.

Crash severity is comprised of 5 separate types including fatal, an incapacitating injury (Severity A), a non-incapacitating injury (Severity B), a possible injury (Severity C), or a property damage only (PD) crash; wild animal hits are coded in a separate category.

Crash rates are expressed as the number of crashes per million entering vehicles (MEV) at an intersection or along a segment. The critical crash rate is a statistical value that is unique to each intersection. It is based on vehicular exposure and the average crash rate for similar intersection or segment; a crash rate higher than the critical rates indicates a sustained crash problem. A critical crash rate index is calculated by dividing the crash rate by the critical rate. Any index value above 1.0 indicates a crash rate at or exceeding the critical rate.

The average crash rate for an urban freeway system, provided by SDDOT, was 1.09 crashes per MEV. The City of Sioux Falls provided the most recent average crash data, from 2015, for the varying arterial roadway and intersection control types.

A total of 1,939 crashes occurred within the entire project area during the 5-year analysis period. A total of 1,209 occurred at the study intersections, 443 crashes occurred along the study area roadway segments, and 287 crashes occurred along the freeway mainline or ramp connections.

The following tables show the severity breakdown of the study area intersections, roadway segments, and freeway segments.

All freeway mainline segments are well below the calculated critical rates, see **Table 7**. Approximately 53%, 137 crashes of the 259 total, were single vehicles departing the roadway or an animal hit. Approximately 25% of the crashes were rear end collisions and 14% were side swipe. Poor weather conditions were only observed in approximately 28% of the mainline crashes.

Along the I-229 ramp connections, only one of the study area ramps is above the critical rate, see **Table 8**. The 26th Street entrance loop ramp had a total of 10 crashes; all were single vehicles departing the roadway with 3 caused by too high of speeds and 5 had poor road surface conditions.

Table 7 – Crash History – I-229 Mainline

	Description	Crash Severity							Rate Information		
	Segment	Fatal	A	B	C	PD	Wild Animal	Total	Crash Rate	Critical Rate	Critical Index
Northbound I-229	Exit 2 Diverge	0	0	1	1	9	1	12	0.92	1.87	0.49
	Exit 2 between Ramps	0	0	0	0	5	0	5	0.31	1.80	0.17
	Exit 2 Merge	0	0	0	3	3	0	6	0.41	1.82	0.22
	Between Exits 2 & 3	0	0	1	0	1	0	2	0.07	1.61	0.04
	Exit 3 Diverge	0	0	2	1	10	2	15	1.01	1.82	0.55
	Exit 3 between Ramps	1	0	3	1	7	2	14	0.72	1.72	0.42
	Exit 3 Merge	0	0	0	0	5	0	5	0.34	1.82	0.19
	Between Exits 3 & 4	0	0	0	0	2	1	3	0.10	1.59	0.06
	Exit 4 Diverge	0	0	1	2	3	1	7	0.47	1.82	0.26
	Exit 4 between Ramps	0	0	0	4	4	2	10	0.46	1.69	0.27
	Exit 4 Merge	0	0	1	0	9	2	12	0.86	1.85	0.47
	Between Exits 4 & 5	0	0	0	0	2	1	3	0.12	1.64	0.07
	Exit 5 Diverge	0	0	0	4	10	2	16	1.15	1.85	0.62
	Exit 5 between Ramps	0	0	0	0	1	1	2	0.22	2.03	0.11
	Exit 5 Merge	0	0	1	1	4	3	9	0.85	1.97	0.43
Southbound I-229	Exit 5 Diverge	0	0	0	2	4	1	7	0.63	1.94	0.32
	Exit 5 between Ramps	0	0	0	0	0	0	0	0.00	2.27	0.00
	Exit 5 Merge	0	0	0	1	4	5	10	0.72	1.85	0.39
	Between Exits 5 & 4	0	0	0	1	2	3	6	0.24	1.65	0.15
	Exit 4 Diverge	1	1	3	1	8	2	16	1.16	1.85	0.63
	Exit 4 between Ramps	0	0	1	4	14	2	21	0.81	1.64	0.49
	Exit 4 Merge	0	0	0	0	13	0	13	0.85	1.81	0.47
	Between Exits 4 & 3	0	0	0	0	2	1	3	0.10	1.59	0.06
	Exit 3 Diverge	0	0	0	0	4	0	4	0.26	1.81	0.14
	Exit 3 between Ramps	0	0	0	2	17	0	19	0.67	1.61	0.42
	Exit 3 Merge	0	0	0	0	9	0	9	0.56	1.80	0.31
	Between Exits 3 & 2	0	0	0	1	4	0	5	0.15	1.56	0.10
	Exit 2 Diverge	0	1	0	2	6	0	9	0.56	1.80	0.31
	Exit 2 between Ramps	0	1	0	0	7	0	8	0.53	1.82	0.29
	Exit 2 Merge	0	0	0	3	5	0	8	0.58	1.85	0.31
	TOTAL	**2**	**3**	**14**	**34**	**174**	**32**	**259**	n/a	n/a	n/a

- All mainline segments are Urban Interstate with a Statewide Average Crash Rate of 1.09.

Table 8 – Crash History – I-229 Ramp Connections

	Description	Crash Severity							Rate Information		
	Segment	Fatal	A	B	C	PD	Wild Animal	Total	Crash Rate	Critical Rate	Critical Index
NB I-229 Ramps	Exit 2 Off Ramp	0	0	0	0	1	0	1	0.74	3.78	0.20
	Exit 2 On Ramp	0	0	0	0	1	0	1	0.33	2.81	0.12
	Exit 3 Off Ramp	0	0	0	0	1	0	1	0.48	3.20	0.15
	Exit 3 On Ramp	0	0	0	0	2	0	2	0.94	3.17	0.30
	Exit 4 Off Ramp	0	0	0	0	0	0	0	0.00	3.00	0.00
	Exit 4 On Ramp	0	0	0	0	1	0	1	0.50	3.25	0.15
	Exit 5 Off Ramp	0	0	0	0	3	0	3	0.45	2.21	0.20
	Exit 5 On Ramp	0	0	1	1	8	0	10	**4.60**	**3.14**	**1.46**
SB I-229 Ramps	Exit 5 Off Ramp	0	0	0	0	0	0	0	0.00	4.16	0.00
	Exit 5 On Ramp	0	0	0	0	0	0	0	0.00	3.41	0.00
	Exit 4 Off Ramp	0	0	0	0	1	0	1	0.45	3.12	0.14
	Exit 4 On Ramp	0	0	0	0	0	0	0	0.00	2.93	0.00
	Exit 3 Off Ramp	0	0	0	0	3	0	3	1.52	3.26	0.47
	Exit 3 On Ramp	0	0	0	0	2	0	2	0.80	2.99	0.27
	Exit 2 Off Ramp	0	0	0	0	1	0	1	0.35	2.86	0.12
	Exit 2 On Ramp	0	0	0	1	1	0	2	1.85	4.14	0.45
	TOTAL	**0**	**0**	**1**	**2**	**25**	**0**	**28**			

- All mainline segments are Urban Interstate with a Statewide Average Crash Rate of 1.09.
- **Bold/Shaded** indicates a calculated crash rate that is at or exceeding than the critical rate.

There are 12 existing intersections that exceed the calculated critical rate and 5 additional intersections approaching (within 15%) the critical rates. **Table 9** shows the intersection crashes throughout the project area and **Table 10** shows the arterial roadway segment crashes.

Approximately 67% of all intersection and arterial segment crashes occurred during the afternoon hours, with approximately 25% occurring between 12pm and 3pm and approximately 42% between 3pm and 6pm. This timeframe is typically when traffic is increased to the highest levels with commuters and retail trips. Weather does not seem to be a factor with the arterial crashes; less than 15% of all crashes occurred on a roadway due to poor weather conditions.

Along Cliff Avenue, only the intersection at 41st Street/I-229 SB Exit Ramp is above the critical rate, with almost 70% of the crashes being rear end collisions. The majority of crashes involve southbound and eastbound vehicles which could be related to lack of right turn lanes and congestion at the intersection. At Otonka Trail, the majority of the crashes involved Cliff Avenue traffic rear ending each other due to following too close or failing to yield. All roadway segments along Cliff Avenue are below the critical rates.

Table 9 – Crash History – Arterial Intersections

	Description	Crash Severity							Rate Information		
	Intersection	Fatal	A	B	C	PD	Wild Animal	Total	Crash Rate	Critical Rate	Critical Index
Minnesota Avenue	at 37th St *	0	1	6	10	46	0	63	**1.07**	**0.86**	**1.25**
	at 41st St *	1	0	7	12	80	0	100	**1.33**	**1.24**	**1.08**
	at 49th St	0	1	1	9	31	0	42	**0.81**	**0.48**	**1.69**
	at I-229 SB Ramp *	0	0	1	13	44	0	58	**0.99**	**0.86**	**1.15**
	at I-229 NB Ramp *	0	0	4	4	34	0	42	0.77	0.87	0.89
	at Yankton Trail Park	0	0	1	1	2	0	4	0.10	0.49	0.20
	at Lotta St	0	0	1	5	14	0	20	0.48	0.49	0.98
	at 57th St *	0	1	2	14	50	0	67	0.93	1.24	0.75
Cliff Avenue	at 33rd St *	0	0	2	4	21	0	27	0.64	0.91	0.71
	at 36th St/LHS Ent #4	0	0	2	2	5	0	9	0.25	0.50	0.50
	at 38th St/LHS Ent #3	0	0	1	3	9	0	13	0.33	0.50	0.66
	at Lincoln HS Ent #2	0	0	0	0	1	0	1	0.03	0.50	0.06
	at Pam Road	0	0	1	4	1	0	6	0.15	0.49	0.30
	at Lincoln HS Ent #1	0	0	0	0	0	0	0	0.00	0.50	0.00
	at 41st St/I-229 SB *	0	1	2	8	54	0	65	**1.31**	**0.88**	**1.49**
	at I-229 SB Ent Ramp	0	0	0	2	11	0	13	0.35	0.50	0.70
	at I-229 NB Ramp *	0	2	0	6	18	0	26	0.53	0.88	0.60
	at Spencer Park Ent	0	0	1	0	4	0	5	0.13	0.49	0.26
	at Twin Oaks Estates	0	0	0	2	8	0	10	0.23	0.48	0.48
	at Otonka Trail	0	0	0	5	13	0	18	0.41	0.48	0.85
	at 49th St *	0	0	1	3	20	0	24	0.64	0.93	0.69
Western	at 49th St*	0	1	7	16	47	0	71	**1.49**	**1.31**	**1.13**
	at I-229 SB Ramp *	0	0	4	10	33	0	47	0.79	0.85	0.92
	at I-229 NB Ramp *	0	0	1	11	31	0	43	**0.88**	**0.88**	**1.00**
	at 57th St *	1	1	5	10	45	0	62	0.94	1.26	0.75
26th St	at Cliff Ave *	0	1	11	23	58	0	93	**1.99**	**1.32**	**1.51**
	at Yeager Road *	0	0	1	10	30	0	41	**1.21**	**0.95**	**1.28**
	at I-229 NB Ramp *	0	0	5	16	70	0	91	**1.54**	**0.86**	**1.80**
	at Southeastern Ave *	0	0	5	17	55	0	77	1.17	1.26	0.93
Yeager Rd at I-229 SB Ramp		0	1	0	6	9	0	16	**1.21**	**0.68**	**1.79**
41st St at Norton Ave *		0	1	5	5	30	0	41	**0.94**	**0.90**	**1.04**
41st St at Phillips Ave *		0	0	1	2	11	0	14	0.76	1.06	0.71
TOTAL		**2**	**11**	**78**	**233**	**885**	**0**	**1209**	n/a	n/a	n/a

- *Signalized Intersection
- **Bold/Shaded** indicates a calculated crash rate that is at or exceeding than the critical rate.
- **Shaded** crash rates indicated approaching the critical crash rate with an index of 0.85 or greater.

Table 10 – Crash History – Arterial Segments

Roadway Description		Crash Severity							Rate Information		
	From / To	Fatal	A	B	C	PD	Wild Animal	Total	Crash Rate	Critical Rate	Critical Index
Minnesota Ave	37th St / 41st St	0	0	5	3	46	0	54	4.56	4.66	0.98
	41st St / 49th St	0	0	2	2	30	0	34	3.52	4.77	0.74
	I-229 SB Ramp / I-229 NB Ramp	0	0	0	0	3	0	3	0.49	3.85	0.13
	Yankton Trail Park / Lotta St	0	0	0	0	1	1	2	0.32	5.33	0.06
	Lotta St / 57th St	0	0	0	2	12	5	19	1.22	4.52	0.27
Cliff Avenue	26th St / 33rd St	0	0	2	1	8	0	11	0.89	4.58	0.19
	33rd St / 36th St / LHS Ent #4	0	1	0	0	1	0	2	0.36	5.31	0.07
	36th St / / 38th St	0	0	2	1	4	0	7	2.49	6.25	0.40
	I-229 SB Entrance Ramp / I-229 NB Ramp	0	0	0	1	1	0	2	0.51	5.94	0.09
	I-229 NB Ramp / Spencer Park	0	0	0	0	0	1	1	0.37	6.36	0.06
	Spencer Park / Twin Oaks Estates	0	0	2	0	4	0	6	1.22	5.64	0.22
	Twin Oaks Estates / Otonka Trail	0	0	0	0	4	0	4	1.41	6.11	0.23
	Otonka Trail / 49th St	0	0	0	0	4	1	5	0.79	5.02	0.16
Western	49th St / I-229 SB Ramp	0	2	6	11	51	0	70	**5.23**	**4.52**	**1.16**
	I-229 SB Ramp / I-229 NB Ramp	0	0	0	1	1	0	2	0.42	4.08	0.10
	I-229 NB Ramp / 57th St	0	0	0	0	4	0	4	0.86	4.10	0.21
26th St	Cliff Ave / Yeager St	0	0	2	7	41	0	50	5.43	6.41	0.85
	Yeager St / I-229 NB Ramp	0	1	1	2	5	0	9	1.30	5.18	0.25
	I-229 NB Ramp / Southeastern Ave	0	0	1	2	12	1	16	1.44	4.74	0.30
41st St	Norton Ave / Minnesota Ave	0	0	4	12	53	0	69	**10.74**	**5.14**	**2.09**
	Minnesota Ave / Phillips Ave	0	0	0	0	4	0	4	1.13	7.36	0.15
	Phillips Ave / Carter Pl	0	1	0	4	13	0	18	**1.84**	**1.82**	**1.01**
	Carter Pl / Cliff Ave	0	0	0	0	5	0	5	0.51	1.80	0.28
57th -Western Ave/Minnesota Ave		1	1	3	8	27	6	46	1.66	4.17	0.40
TOTAL		**1**	**6**	**30**	**57**	**334**	**15**	**443**	n/a	n/a	n/a

- Segments not listed did not contain crashes, see intersection specific crashes.
- **Bold/Shaded** indicates a calculated crash rate that is at or exceeding than the critical rate.

Along Minnesota Avenue, the major intersections between 37th Street and the I-229 ramp terminal intersection are all at or above the critical rate; over half of the crashes are rear end collisions which is expected with a signalized intersection. However, at the 41st Street signal, over 40% of the crashes are right angle crashes which could be caused by congestion and the existing phasing scheme at the intersection (split phase). At Lotta Street, the majority of the crashes involved Minnesota Avenue traffic rear ending each other due to following too close or

failing to yield. All roadway segments are below the critical rates; however, between 37th and 41st Streets there is a high number of crashes due to turning traffic at all the access locations.

Along Western Avenue, the 49th Street intersection and both ramp terminal intersections are above the critical rates. As typical with signalized intersections, the majority (65%) of crashes are rear end collisions at all three intersections. However, at the 49th Street signal, over 30% of the crashes are right angle crashes. Many were caused by left turning vehicles not yielding to through traffic. The roadway segment between 49th and the southbound I-229 ramp terminal intersection is above the critical rate with a high number of rear end and angle crashes likely due to the number of driveway access locations along the roadway.

Along 26th Street, all four signalized intersections are at or exceeding the critical rates. As typical with signalized intersections, the majority (56%) of crashes are rear end collisions. However, at both Cliff Avenue and Southeastern Avenue, between 40% and 50% of the crashes are right angle crashes. All roadway segments are below the critical crash rates.

The intersection of Yeager Road and the I-229 southbound ramp terminal is also above the critical rate; almost 70% of the crashes at this minor street stop control are angle crashes due to the high amount of turning traffic, limited gaps, and vehicles failing to yield.

With the impending 26th Street interchange project, three of these intersections, as well as the Yeager Road and southbound ramp terminal, will be reconstructed and should see significantly improved safety and operations.

The 26th Street and Cliff Avenue intersection, as previously mentioned, has a high angle crash occurrence (53%). It should also be noted that just over 51% of the crashes have occurred in the last two years of the analysis period. There does not appear to be a clear cause of the crashes as they include all directions of traffic, with an even distribution of failure to yield, following too closely, and disregard of traffic control. There have also been 3 pedestrian crashes at this intersection in the last 5-year period.

Along 41st Street, the intersection with Norton Avenue is above the critical rate as well as the segments between Norton Avenue-Minnesota Avenue and Phillips Avenue-Carter Place. At the Norton Avenue intersection, approximately 80% of the crashes involved eastbound traffic, with the majority (66%) being rear end collisions; the majority of crashes cited failure to yield or following too closely. The roadway segment between Norton Avenue and Minnesota Avenue has a high number of rear end and angle crashes likely due to the many driveway and access locations along the roadway. The roadway segment between Phillips Avenue and Carter Place had 67% of the crashes occurring in the eastbound direction with many following too closely; there was also five crashes that involved parked vehicles.

3.8.1 Cliff Avenue Interchange Area Crashes

At the Cliff Avenue interchange, a total of 96 crashes occurred along the freeway mainline or ramp connections, 217 crashes occurred at intersections along Cliff Avenue and 29 crashes occurred on the roadway between the study intersections along Cliff Avenue.

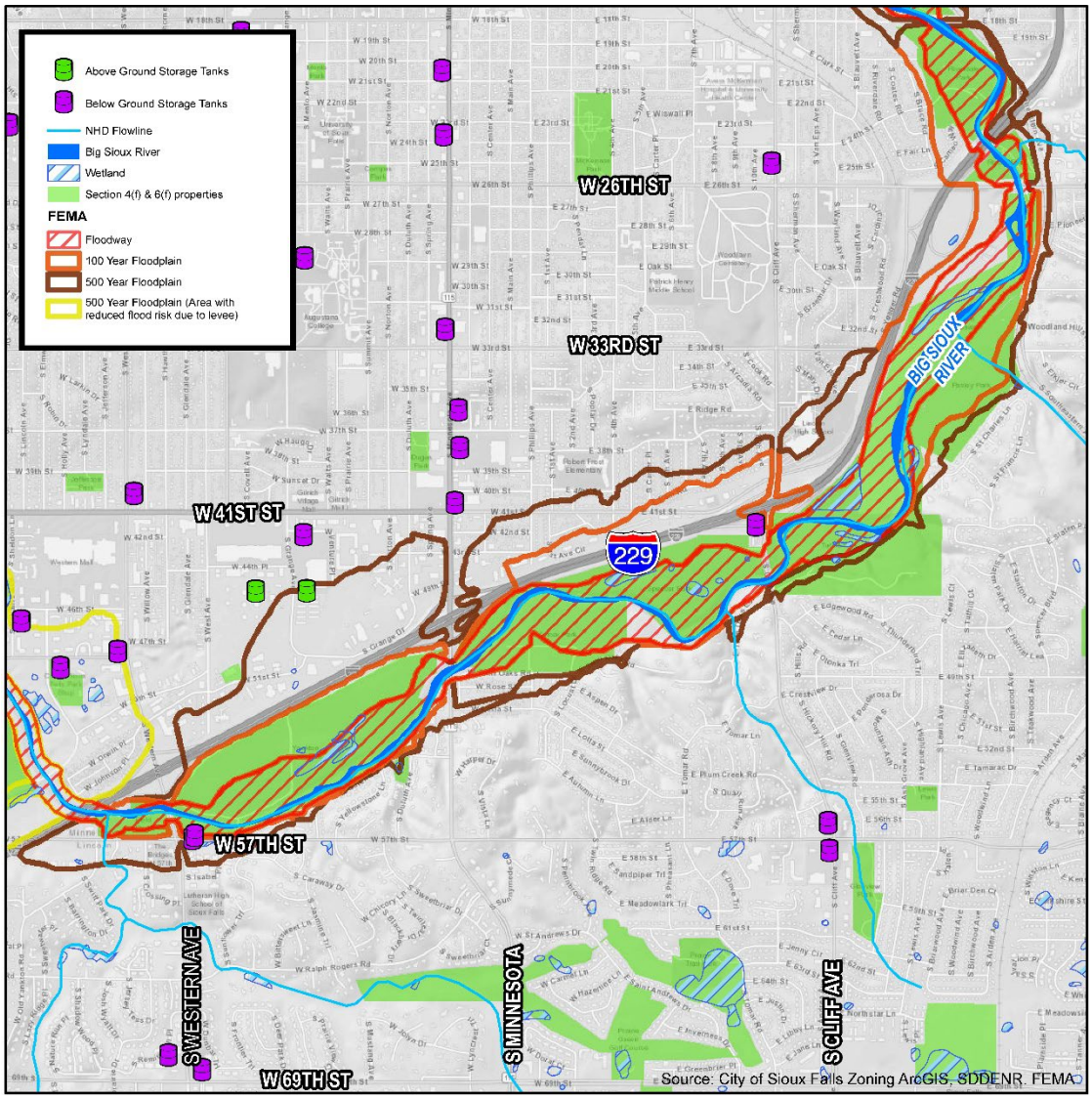
As mentioned previously, the interstate mainline, freeway ramp connections, and Cliff Avenue roadway segments are all below the critical rates. Approximately 65% of the intersection crashes along Cliff Avenue occurred at the four signalized intersections. These intersections all have high traffic volumes, intersection capacity constraints, and poor access management.

3.9 Existing Environmental Constraints

Environmental constraints are being evaluated through the Environmental Screening Report (ESR) that is being prepared concurrently with this IMJR. The study area includes portions of the Big Sioux River floodplain and associated parks, riparian and wooded areas. An overview of the study area surrounding the existing interchanges shows the most potential environmental constraints could be the wetlands, Section 4(f)/6(f) properties, and floodplains surrounding the interchanges. The interchange is surrounded by parks, trails, and pockets of residential properties that may have noise impacts and will be evaluated as part of the environmental documentation.

An ESR is being developed in conjunction with the IMJR as part of the NEPA process. The NEPA document will compare each alternative and their environmental impacts compared to the No Build alternative. **Figure 12** shows the locations of the known environmental constraints within the project area.

Figure 12 – Known Potential Environmental Constraints



4 Project Need

Previous studies including the 2010 Decennial Interstate Corridor Study and the I-229 Major Investment Study (MIS) have identified the need to improve the I-229 Exit 4 interchange to address safety concerns, correct geometric deficiencies, and improve operations during the peak periods.

The timing of interchange reconfiguration projects in South Dakota typically is controlled by the need to replace the existing pavement and/or structures. A combination of all the various needs at an interchange defines the overall need for an interchange to be reconfigured.

Geometric Deficiencies

Since the interchange was constructed in the early 1960's, geometric design standards have changed. As a result some of the existing geometric characteristics no longer meet current design standards. Some of the deficiencies include:

- Substandard shoulder widths on the ramp connections; left and right shoulders.
- Control of access of adjacent intersections to the ramp terminal intersections are less than desirable. There are currently full access intersections on either side within 250 feet of the ramp terminal intersections.

Pavement

The need to replace or rehabilitate the pavement is often the driving force behind the timing of when the majority of construction projects on the state highway system occur.

The pavement on the existing I-229 mainline through the project area is Continuously Reinforced Concrete (CRCP) and was resurfaced in 2001; many of the ramp connections were also resurfaced at this time. The I-229 pavement is in good condition.

The pavement along Cliff Avenue, according to the 2020 Pavement Management Analysis website for the City of Sioux Falls, currently has a Pavement Condition Index (PCI) that varies between 39 and 54; this ranges from "Poor" to "Fair" pavement conditions. The relative remaining life for these ranges is between 5 and 12 years.

As the remaining life of the pavement is relatively short, it is appropriate to evaluate existing and future traffic operations of the existing interchange configuration before replacing the existing pavement.

Structural

The need to replace or rehabilitate a structure is another critical consideration for timing of construction projects on the state highway system.

I-229 has two separate bridges over Cliff Avenue, both structures are currently in fair condition. The concrete bridges were constructed in 1959 and have exceeded their 50 year design life.

It is appropriate to evaluate the existing and future traffic operations before replacing or rehabilitating a structure with the expectations for continued service life.

Transportation Demand

The existing intersection traffic operations showed that all the study intersections along Cliff Avenue, including the I-229 ramp terminal intersections, have failing congestion issues during the PM peak hour; the AM peak operates at mostly acceptable delays but with many queue storage issues. The existing I-229 freeway mainline, ramp connections, and weaving segments all operate acceptably under current volumes. Details pertaining to the existing traffic operations can be found in the previous **Section 3.7**.

The lack of continuous multi-modal facilities along Cliff Avenue causes significant concerns for non-motorized users traveling along the corridor.

With the increased local and regional growth surrounding the interchange and the Sioux Falls metropolitan area, traffic operations will degrade significantly by the design year 2050. The I-229 freeway will begin to have unacceptable LOS and almost all Cliff Avenue intersections will see increased delays, longer queues, and failing operations. Details pertaining to the future No Build operations can be found in **Section 6**.

Safety

The Cliff Avenue (Exit 4) interchange was ranked 14th out of the 126 interchanges included in Phase 1 of the 2010 Decennial Interstate Corridor Study.

A review of the reported crashes between 2013 and 2017 shows that the 41st Street/I-229 Southbound ramp terminal intersection is significantly above the calculated critical rates and should be addressed.

5 Alternatives

The purpose of this chapter is to discuss the I-229 freeway facility and proposed access modifications at the Cliff Avenue (Exit 4) interchange.

The I-229 Major Investment Study (MIS) was completed and included recommendations for the Exit 4 interchange. The MIS allowed the City of Sioux Falls, the Sioux Falls Metropolitan Planning Organization (MPO), the SDDOT, FHWA, and others to help determine the vision for the I-229 corridor.

The I-229 Exit 4 (Cliff Avenue) Corridor Study was a subarea study of the I-229 MIS. The study included 8 interchange alternatives, including an added loop ramp and variations of a single point urban interchange (SPUI). The results of the alternative screening reduced the recommended alternatives to three for further evaluation, these include:

- **Cliff-1**: NB Cliff to SB I-229 Loop Ramp.
- **Cliff-6**: SPUI, 41st Realigned to the north.
- **Cliff-7**: SPUI, SB I-229 Off-Ramp Thru & Rights at 41st Street

More information regarding the I-229 MIS and the various alternatives in the Exit 4 subarea study can be found at the following website: http://www.i229study.com/

5.1 Design Criteria

The primary design principles and criteria that were used to guide the design process include:

- Basic Lane Capacity
- Route Continuity
- Lane Balance
- Interchange Spacing
- Ramp Spacing

These criteria are described in the American Association of State Highway and Transportation Official's (AASHTO) Policy on Geometric Design of Highways and Streets 2011 edition.

The existing design speed for I-229 is 70 mph, with a posted speed limit of 65 mph. The design speed of this project will follow the existing design speed.

5.1.1 Basic Lane Capacity

The basic number of lanes is defined as a minimum number of lanes designated and maintained over a significant length of a corridor, regardless of changes in traffic volumes and lane-balance. An assessment of basic lane needs is an indicator of minimum capacity requirements; it is not an indicator of the actual capacity. **Table 11**, below, summarizes the basic lane volumes for LOS C, LOS D and LOS E from the Highway Capacity Manual (HCM).

Table 11 – Basic Lane Capacity

Free Flow Speed (mph)	Per-Lane Volume Threshold (pcphpl) / (Vehicle Density (pc/mi/ln))		
	LOS C	LOS D	LOS E
75 mph	1,750 / (26.0)	2,110 / (35.0)	2,400 / (45.0)
70 mph	1,690 / (26.0)	2,080 / (35.0)	2,400 / (45.0)
65 mph	**1,630 / (26.0)**	**2,030 / (35.0)**	**2,350 / (45.0)**
60 mph	1,560 / (26.0)	2,010 / (35.0)	2,300 / (45.0)
55 mph	1,430 / (26.0)	1,900 / (35.0)	2,250 / (45.0)

Source: Highway Capacity Manual 6th Edition, Exhibit 12-4; HCM 2010, Exhibit 11-17

Table 12 represents the maximum peak hour traffic volumes along I-229 compared to the basic roadway capacity; typically the maximum peak hour volumes for northbound I-229 is during the AM peak and for southbound I-229 is during the PM peak. If the basic lane need exceeds the number of lanes provided it would represent a capacity constraint on the roadway indicated by a LOS D or LOS E. As recommended in the Methods and Assumptions document, all future year evaluations assumed a peak hour factor of 0.9 in this evaluation.

Under the existing 2018 conditions, all traffic demands are below the basic capacity thresholds for LOS C throughout the project area. Under the year of opening 2024 conditions, all traffic demands would still be below the basic capacity thresholds for LOS C throughout the project area.

By 2050, many of the southbound I-229 segments will be at LOS D/E and require additional lanes due to the increased regional traffic demands. Along northbound I-229 there are two segments that will be at LOS D and require additional lanes.

To mitigate the basic lane capacity needs along southbound I-229, three continuous travel lanes would be required from the 10th Street entrance ramp through the Louise Avenue exit ramp. Northbound I-229 would require three continuous travel lanes between the Louise Avenue entrance ramp and the Cliff Avenue exit ramp.

Regional growth in the surrounding metro area is the main culprit for the capacity constraints, not the interchange reconfiguration, therefore a mid-term analysis year of 2035 was evaluated. In this interim year, all northbound I-229 segments operate at a LOS C or better. The existing two lane segments between the exit and entrance ramps along southbound I-229 are at LOS D at the interchanges of 26th Street, Minnesota Avenue, and Western Avenue; the segment at the Cliff Avenue interchange is within 4% of capacity threshold in 2035.

Table 12 – Basic Lane Assessment - I-229 No Build

Description			Basic # Lanes	2018 Existing		2024 No Build		2035 No Build		2050 No Build	
	From	To		Peak Traffic	LOS	Peak Traffic	LOS	Peak Traffic	LOS	Peak Traffic	LOS
NB I-229	NB Louise Ave Entrance	Western Ave Exit	3	2785	B	2950	B	3230	C	3595	C
	Western Ave Exit	Western Ave Entrance	2	2333	C	2480	C	2725	C	3045	**D**
	Western Ave Entrance	Minnesota Ave Exit	3	2772	B	2930	B	3185	C	3520	C
	Minnesota Ave Exit	Minnesota Ave Entrance	2	2317	C	2460	C	2715	C	3040	**D**
	Minnesota Ave Entrance	Cliff Ave Exit	3	2702	B	2920	B	3260	C	3720	C
	Cliff Ave Exit	Cliff Ave Entrance	2	2070	B	2225	C	2470	C	2800	C
	Cliff Ave Entrance	26th St Exit	3	2495	B	2620	B	2835	B	3215	C
	26th St Exit	26th St Entrance	2	1992	B	2075	B	2225	C	2420	C
	26th St Entrance	10th St Exit	2 / 3*	2397	C	2505	B	2690	B	2930	B
SB I-229	10th St Entrance	26th St Exit	2 / 3*	2758	C	3140	B	3710	C	4520	**D**
	26th St Exit	26th St Entrance	2	2202	C	2495	C	2940	**D**	3575	**D**
	26th St Entrance	Cliff Ave Exit	3	2782	B	3085	B	3545	C	4190	C
	Cliff Ave Exit	Cliff Ave Entrance	2	2296	C	2500	C	2825	C	3290	**D**
	Cliff Ave Entrance	Minnesota Ave Exit	3	2940	B	3190	C	3580	C	4120	C
	Minnesota Ave Exit	Minnesota Ave Entrance	2	2472	C	2715	C	3090	**D**	3655	**E**
	Minnesota Ave Entrance	Western Ave Exit	3	3125	B	3375	C	3765	C	4315	C
	Western Ave Exit	Western Ave Entrance	2	2344	C	2580	C	2955	**D**	3485	**D**
	Western Ave Entrance	Louise Ave Exit	3	2806	B	3100	B	3555	C	4195	C

- Traffic is the highest/maximum peak hour volume in either of the AM or PM peak hours.
- **Bold/Shaded** indicates a LOS D or worse
- Underlined LOS criteria indicates the volume is within 10% of next LOS threshold.
- " * " Additional lane added between 10th Street and 26th Street by 2020.

5.1.2 Route Continuity

A route continuity evaluation is used to determine if any forced lane changes are required to continue along a specific highway. A forced lane change occurs when either an established through lane is dropped at a major fork diverge or when an auxiliary lane is added to the left side

of the roadway to accommodate the design of a major fork diverge and the through traffic must change lanes in order to continue.

Route continuity is currently satisfied for I-229 in the project area; I-229 has two continuous travel lanes in both directions which connect to both the I-29 and I-90 system interchanges. The proposed interchange design modifications would not alter the current route continuity of I-229.

5.1.3 Lane Balance

The concept of lane balance is intended to smooth traffic flow through and beyond an interchange. The AASHTO definition of lane balance is as follows:

1. At entrances, the number of lanes beyond the merging of two traffic streams should not be less than the sum of all traffic lanes on the merging roadways minus one.
2. At exits, the number of approach lanes on the highway must be equal to the number of lanes on the highway beyond the exit, plus the number of lanes on the exit, minus one. Exceptions to this principle occur at cloverleaf loop-ramp exits that follow a loop-ramp entrance and at exits between closely spaced interchanges (i.e. interchanges where the distance between the end of the taper of the entrance terminal and the beginning of the taper of the exit terminal is less than 1,500 ft). In these cases, the auxiliary lane may be dropped in a single-lane exit with the number of lanes on the approach roadway being equal to the number of through lanes beyond the exit plus the lane on the exit.
3. The traveled way of the highway should be reduced by not more than one traffic lane at a time.

Lane balance is satisfied at all entrances in the project area. Lane balance is not satisfied at the exit ramp locations that are fed by a full auxiliary; to fully satisfy the criteria, escape lanes would need to be provided after the exit ramp to ensure vehicles would not become trapped in the auxiliary lane.

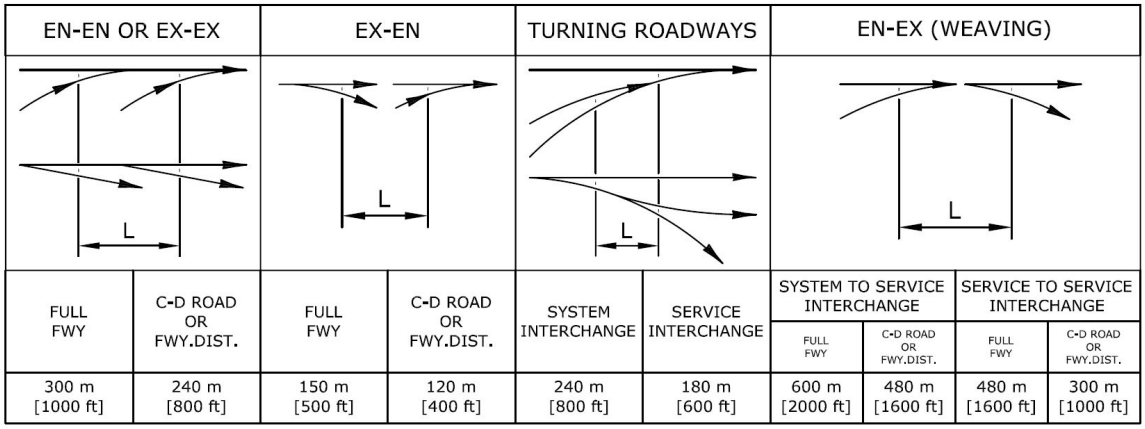
5.1.4 Interchange Spacing

In urban or urbanizing areas, the minimum recommended interchange spacing is 1-mile. The four existing I-229 interchanges all currently meet the 1-mile spacing.

5.1.5 Ramp Spacing

The distance between freeway ramps can be one of the most important features to impact freeway operations. SDDOT has established guidelines for desired interchange ramp spacing based on AASHTO criteria and these guidelines are documented in the SDDOT Road Design Manual, Chapter 13, and are shown in **Figure 13.**

Figure 13 – AASHTO/SDDOT Ramp Spacing Criteria



The primary goal for ramp spacing is “desirable” spacing; the shortest acceptable spacing is “minimum” spacing. **Table 13** summarizes the existing and No Build ramp spacing for I-229; all ramp spacing is greater than the “desirable” ramp spacing for I-229. The proposed ramp configurations will be discussed in **Table 14** as each alternative has differing spacing conditions.

Table 13 – I-229 Ramp Spacing – Existing/No Build

	Description		Ramp Type	Desirable Space (ft)	Minimum Space (ft)	Existing (ft)	No Build (ft)
	From	To					
NB I-229	NB Louise Ave Entrance	Western Ave Exit	EN-EX	2000	1500	3500	3500
	Western Ave Exit	Western Ave Entrance	EX-EN	750	500	2165	2165
	Western Ave Entrance	Minnesota Ave Exit	EN-EX	2000	1500	2860	2860
	Minnesota Ave Exit	Minnesota Ave Entrance	EX-EN	750	500	2420	2420
	Minnesota Ave Entrance	Cliff Ave Exit	EN-EX	2000	1500	3120	3120
	Cliff Ave Exit	Cliff Ave Entrance	EX-EN	750	500	2700	2700
	Cliff Ave Entrance	26th St Exit	EN-EX	2000	1500	2750	2750
	26th St Exit	26th St Entrance	EX-EN	750	500	1560	1560
	26th St Entrance	10th St Exit	EN-EX	2000	1500	5700	5700
SB I-229	10th St Entrance	26th St Exit	EN-EX	2000	1500	6400	6400
	26th St Exit	26th St Entrance	EX-EN	750	500	1050	**1200**
	26th St Entrance	Cliff Ave Exit	EN-EX	2000	1500	2670	**2520**
	Cliff Ave Exit	Cliff Ave Entrance	EX-EN	750	500	3270	3270
	Cliff Ave Entrance	Minnesota Ave Exit	EN-EX	2000	1500	3100	3100
	Minnesota Ave Exit	Minnesota Ave Entrance	EX-EN	750	500	3350	3350
	Minnesota Ave Entrance	Western Ave Exit	EN-EX	2000	1500	3220	3220
	Western Ave Exit	Western Ave Entrance	EX-EN	750	500	1900	1900
	Western Ave Entrance	Louise Ave Exit	EN-EX	2000	1500	3500	3500

- All ramp spacing distances are approximate.
- No Build includes reconfiguration of 26th Street Interchange.
- **Bolded** indicates a change from the Existing conditions.

In all three proposed alternatives, the northbound I-229 Cliff Avenue ramp exit and entrance gores are located in essentially the same location as the existing/No Build conditions, therefore there are no spacing issues along northbound I-229. **Table 14** only represents the changes that occur on southbound I-229 for the proposed Build alternatives.

Table 14 – Southbound I-229 Ramp Spacing – Proposed Build Conditions

Description			Ramp Type	Desirable Space (ft)	No Build (ft)	Build 1 (ft)	Build 6 (ft)	Build 7 (ft)
	From	To						
SB I-229	10th St Entrance	26th St Exit	EN-EX	2000	6400	6400	6400	6400
	26th St Exit	26th St Entrance	EX-EN	750	1200	1200	1200	1200
	26th St Entrance	Cliff Ave Exit	EN-EX	2000	2520	2520	2520	2520
	Cliff Ave Exit	Cliff Ave Entrance	EX-EN	750	3270	n/a	3270	3270
	Cliff Ave Entrance	NB Cliff Ave Entrance	EX-EN	750	**n/a**	**1850**	**n/a**	**n/a**
	NB Cliff Ave Entrance	SB Cliff Ave Entrance	EN-EN	1500	**n/a**	**1950**	**n/a**	**n/a**
	Cliff Ave Entrance	Minnesota Ave Exit	EN-EX	2000	3100	**2570**	3100	3100
	Minnesota Ave Exit	Minnesota Ave Entrance	EX-EN	750	2350	2350	2350	2350
	Minnesota Ave Entrance	Western Ave Exit	EN-EX	2000	3220	3220	3220	3220
	Western Ave Exit	Western Ave Entrance	EX-EN	750	1900	1900	1900	1900
	Western Ave Entrance	Louise Ave Exit	EN-EX	2000	3500	3500	3500	3500

- All ramp spacing distances are approximate.
- "**n/a**" indicates that spacing does not exist in that alternative.
- **Bolded** indicates a change from the No Build conditions.
- Northbound I-229 spacing will remain as the No Build conditions and is therefore not represented in this table. .

In all proposed alternatives, the desirable ramp spacing is either met or exceeded along the southbound I-229 corridor.

5.2 I-229 at Cliff Avenue Interchange Alternatives

Constructed in the early 1960's, the Cliff Avenue (Exit 4) interchange consists of a modified diamond configuration. Northbound I-229 has a standard diamond configuration with the ramp terminal intersection controlled by a traffic signal, the southbound exit ramp aligns with 41st Street and is controlled by a traffic signal. The southbound entrance ramp is an uncontrolled intersection less than 200 feet south of the 41st Street signal.

The MIS recommended three proposed build alternatives during the screening process; this study evaluated the three alternatives in addition to the No Build conditions.

5.2.1 Alternative 0 – No Build

This alternative does not alter the current configuration of the existing Cliff Avenue interchange or apply any improvements along Cliff Avenue or mainline I-229.

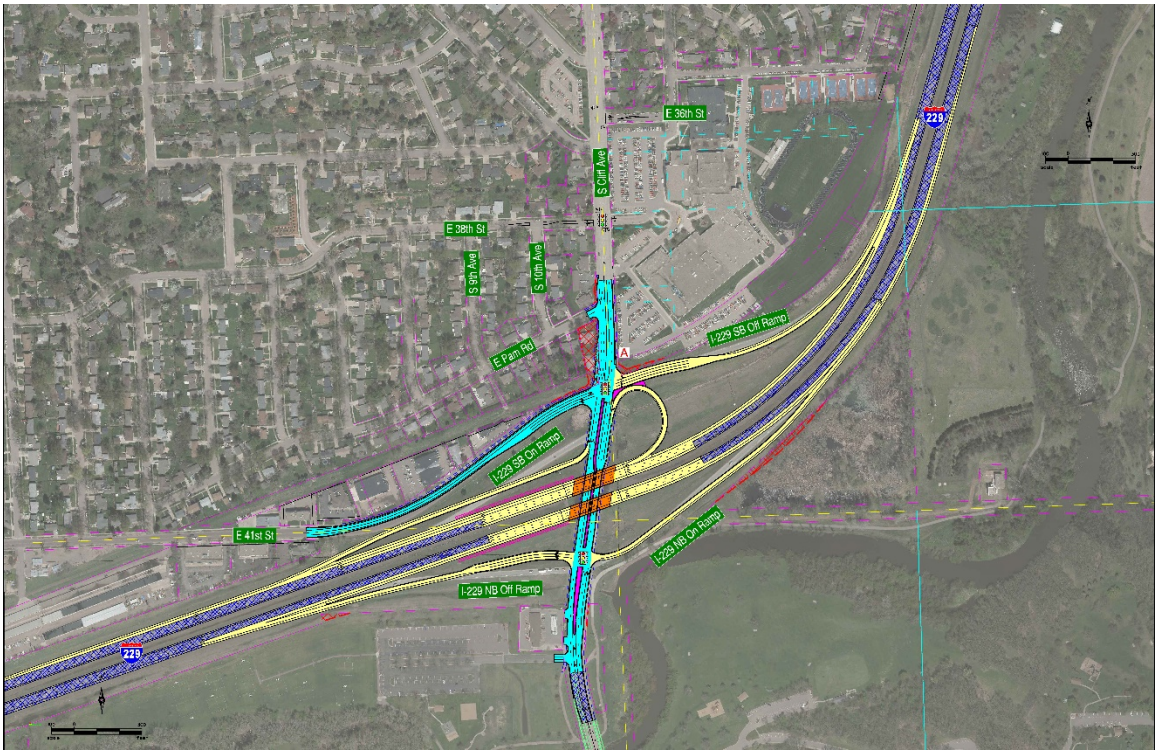
5.2.2 Alternative Cliff-1

This alternative is carried forward from the I-229 MIS recommendations. The northbound I-229 ramp terminal would remain a standard diamond configuration with additional turn lanes to improve capacity.

The southbound I-229 ramps would be significantly reconfigured. The I-229 entrance ramp would be split into two ramps with a new entrance ramp access on southbound I-229. The southbound Cliff Avenue ramp would be a free right turn movement and the northbound Cliff Avenue traffic would have a free right turn onto a new loop ramp connection. The southbound I-229 exit ramp would connect to the 41st Street intersection; this connection helps relieve the closely spaced intersection issues.

Along Cliff Avenue, a 4-lane divided roadway would be provided directly to the north with the south Lincoln High School driveway access being reduced to a right-in/right-out (RI/RO) access. To the south, a median would be constructed to just north of the Spencer Park intersection resulting in RI/RO access for the existing business driveways.

Figure 14 – Alternative Cliff-1



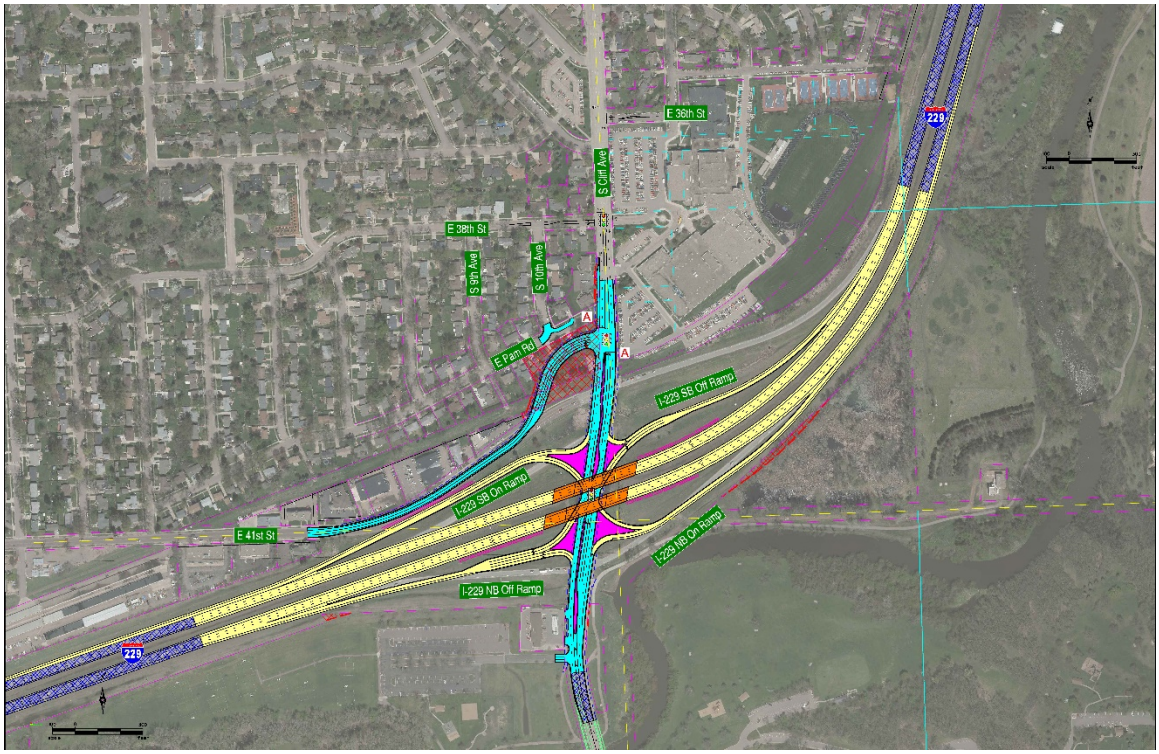
5.2.3 Alternative Cliff-6

This alternative is carried forward from the I-229 MIS recommendations; the existing diamond interchange would be reconfigured to a Single Point Urban Interchange (SPUI). W 41st Street would be realigned to the north to provide better intersection spacing with the proposed interchange design.

The 41st Street realignment creates a significant amount of right-of-way impacts and would require Pam Road to be closed to Cliff Avenue. The configuration creates a weaving condition along northbound Cliff Avenue between the southbound I-229 right turning vehicles wanting to use 41st Street to the west.

Along Cliff Avenue, a 4-lane divided roadway would be provided directly to the north with the south Lincoln High School driveway access being reduced to a RI/RO. To the south, a median would be constructed to just north of the Spencer Park intersection resulting in RI/RO access for the existing business driveways.

Figure 15 – Alternative Cliff-6



5.2.4 Alternative Cliff-7

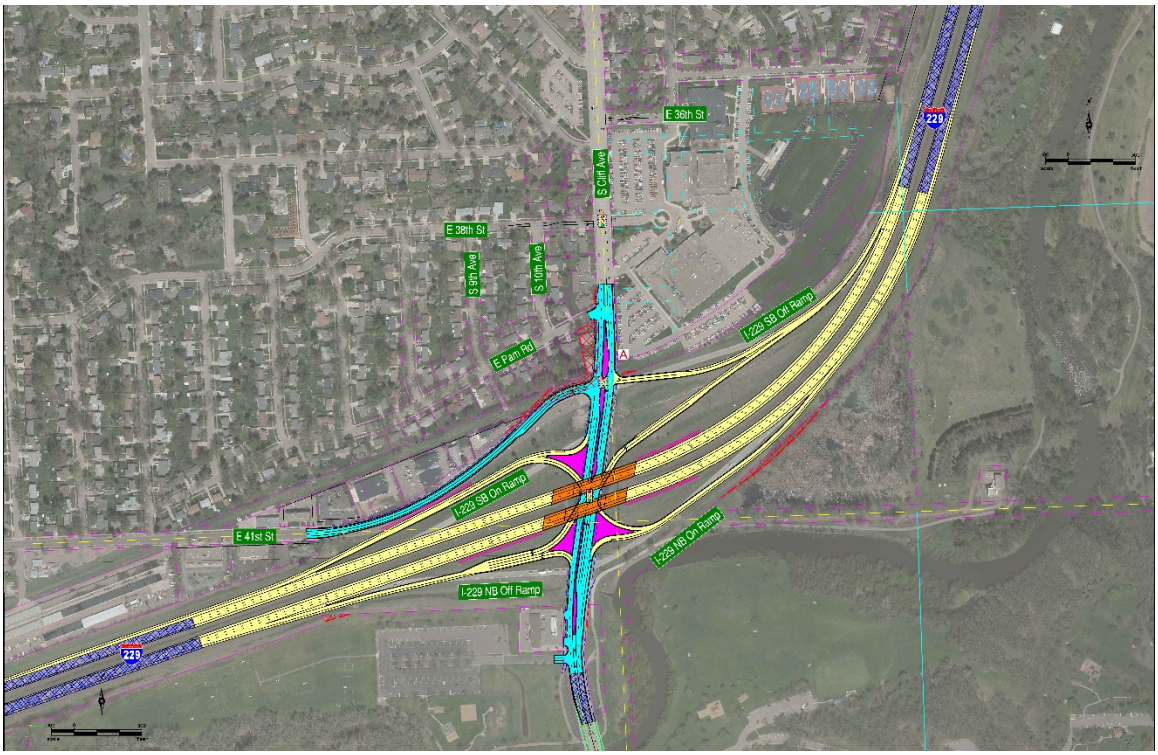
This alternative is carried forward from the I-229 MIS recommendations; the existing diamond interchange would be reconfigured to a SPUI with a modified southbound ramp connection.

The northbound I-229 ramps are of typical SPUI design and the southbound I-229 entrance ramp is also typical of a SPUI design.

The southbound I-229 exit ramp would be significantly reconfigured from a standard SPUI design. The I-229 exit ramp would be split into directional ramps for Cliff Avenue. The southbound Cliff Avenue traffic would tie into the traditional SPUI intersection. The northbound Cliff Avenue traffic would connect to the 41st Street intersection; this connection helps relieve the closely spaced intersection and weaving issues.

Along Cliff Avenue, a 4-lane divided roadway would be provided directly to the north with the south Lincoln High School driveway access being reduced to a RI/RO. To the south, a median would be constructed to just north of the Spencer Park intersection resulting in RI/RO access for the existing business driveways.

Figure 16 – Alternative Cliff-7



5.3 Dismissed Alternatives

The I-229 Major Investment Study initially included 8 interchange alternatives for the Cliff Avenue interchange with I-229. The project process narrowed the number down and ultimately recommended the three alternatives carried forward in this evaluation.

For more information on the previously dismissed alternatives from the MIS, see the I-229 Exit 4 (Cliff Avenue) Crossroad Corridor Study. The evaluation and elimination of these alternatives will be incorporated by reference into the NEPA process and provide a basis for screening out the alternatives.

In addition to the MIS dismissed alternatives, a modification to Alternative 6 was explored as part of this analysis. An offset SPUI design was explored with the SPUI intersection located near the existing southern ramp terminal intersection which became known as Alternative 6B. This design provides better intersection spacing and would require 41st Street to not be realigned; however, the design requires 6 separate bridge structures along I-229 to relocate the southbound I-229 ramps to the south side. Due to the increased number of structures, this alternative was removed from consideration.

5.4 Surrounding Project Interchanges

Congestion and safety issues occur on the surrounding project area interchanges; while not explicitly requiring FHWA approval as part of this document, mitigations to the project interchanges were explored as part of the overall study (see **Section 6** for more discussion).

5.4.1 Western Avenue Interchange

The diamond interchange has both operational and safety issues under existing conditions. These issues will be exacerbated as traffic demands increase to the 2050 design year. While there are currently no plans to reconstruct the interchange, capacity improvements within the next 5 to 10 years are currently being explored by SDDOT and would be included in all future No Build conditions.

To mitigate poor operations, additional turning lanes were explored to provide acceptable traffic operations through the design year.

At the south I-229 ramp terminal intersection, the addition of southbound dual left turn lanes to enter northbound I-229 are needed to reach acceptable operations through 2050. The movement is projected to have over 500 vehicles making the movement during the PM peak hours and the SDDOT is currently planning this modification.

Additional improvements may be required to keep acceptable operations through the 2050 design year, including that the eastbound approach may need separate dual left turn lanes and a separate right turn lane in order to serve the long term future demands. At the southbound I-229 ramp terminal intersection, the addition of a separate southbound right turn lane was explored. The separation of the southbound approach traffic allows the northbound left turn to operate acceptably under protected/permissive conditions.

5.4.2 Minnesota Avenue Interchange

This interchange was studied as part of the overall project; however a separate Interstate Modification Justification Report (IMJR) was prepared to discuss the alternatives that were evaluated.

This document will assume a standard diamond configuration for the freeway analysis and that the arterial intersections along Minnesota Avenue will be addressed in that IMJR document.

5.4.3 26th Street Interchange

This interchange is currently being reconstructed and is slated to be completed by the year 2020; the proposed design is discussed in **Section 3.5.4** of this document. The proposed interchange design will provide acceptable traffic safety and operations at the ramp terminal intersections through the design year.

5.5 Surrounding Arterial Improvements

The City of Sioux Falls and SDDOT have planned intersection improvements throughout the project area. The following is a brief list of planned intersection improvements included in all future No Build conditions:

- 26th Street at Southeastern Avenue:
  - Reconstructed as part of the 26th Street Interchange project.
  - Additional turn lanes and turn lane storage on 26th Street.
  - Northbound and southbound dual left turn lanes and separated right turn lanes on Southeastern Avenue approaches.
- Western Avenue at 49th Street:
  - The east leg will be constructed to include a left turn lane, two through lanes and a right turn lane.
  - A northbound separate right turn lane will also be constructed.
- Minnesota Avenue at 41st Street:
  - Eastbound and westbound approaches reconfigured with dual left turn lanes to remove existing split phase signal operations.
  - Eastbound right turn lane will be added.
- Minnesota Avenue at 37th Street:
  - Separated right turn lanes added for both eastbound and westbound approaches.
- Cliff Avenue between Tomar Road and 56th Street:
  - Expand existing 3-lane roadway to 4-lane roadway.

6 Future Year Traffic

The design year for this project is 2050 with an anticipated year of opening of 2024. With the year of opening so close to the existing conditions and the design year over 25 years out, a mid-term forecast year of 2035 was also developed to aid in development of roadway network planning for additional capacity along the interstate system.

As previously noted, the HCM does not recommend using the merge and diverge analysis procedures when a full length auxiliary lane is provided; see Page 14-30 of the HCM 6th Edition. Therefore, any analysis which includes a full auxiliary lane to a ramp connection would not include merge/diverge analysis. It would only include the basic lane and weaving analysis on all freeway mainline segments that include full auxiliary lanes between ramp connections.

6.1 Future Year Traffic Forecasts

Traffic forecasts were prepared using the latest version of the Regional Travel Demand Model (RTDM) for the Metropolitan Planning Organization (MPO) area; this model is maintained by the City of Sioux Falls and the Sioux Falls MPO. As part of the interchange project, traffic forecasts were developed for all intersections and roadway segments within the project area.

The latest version of the RTDM is an activity based model that provides more realistic trip routing than the previous version of the demand model. It should be noted that all previous studies in the project area, including the MIS, utilized the previous trip based RTDM models and therefore the traffic forecasts may have significant variations between the previous and current forecast demands.

The full traffic forecast memorandum, *I-229 Exits 3 & 4 Interchange Study – Traffic Forecasts* memorandum is provided in **Appendix I**.

6.2 Design Year Analysis

The 2050 design year traffic forecasts resulted in significant growth throughout the southern Sioux Falls metropolitan area, including the immediate project area.

The projected traffic forecast volumes resulted in the same volumes between the No Build and Build scenarios. The proposed build alternatives add capacity to the interchange area, but do not add significant capacity that would alter regional route choices.

Poor operational performance outside the immediate project construction area would not be impacted by proposed build conditions and therefore the project is not required to mitigate these areas. This includes operational problems that may exist along Western Avenue and 26th Street, as well as I-229 outside the immediate interchange area.

Appendix C includes all HCS summary sheets for the 2050 No Build conditions analysis, **Appendix D** includes all HCS summary sheets for the 2050 Build conditions.

6.2.1 2050 No Build Conditions

The summation of the 2050 No Build traffic operations analysis show that mainline I-229 operates with poor LOS along both northbound and southbound I-229. Northbound I-229 has LOS D operations on the 2-lane segments underneath Western Avenue and over both Minnesota Avenue and Cliff Avenue. Southbound I-229 has LOS D operations through much of the project

area with LOS E on the 2-lane segments at the interchanges of 26th Street and Minnesota Avenue. Results for the individual segments and ramp junctions of I-229 are shown in **Figure 17** as well as **Table 15**.

Figure 17 – 2050 No Build Freeway Configuration and LOS

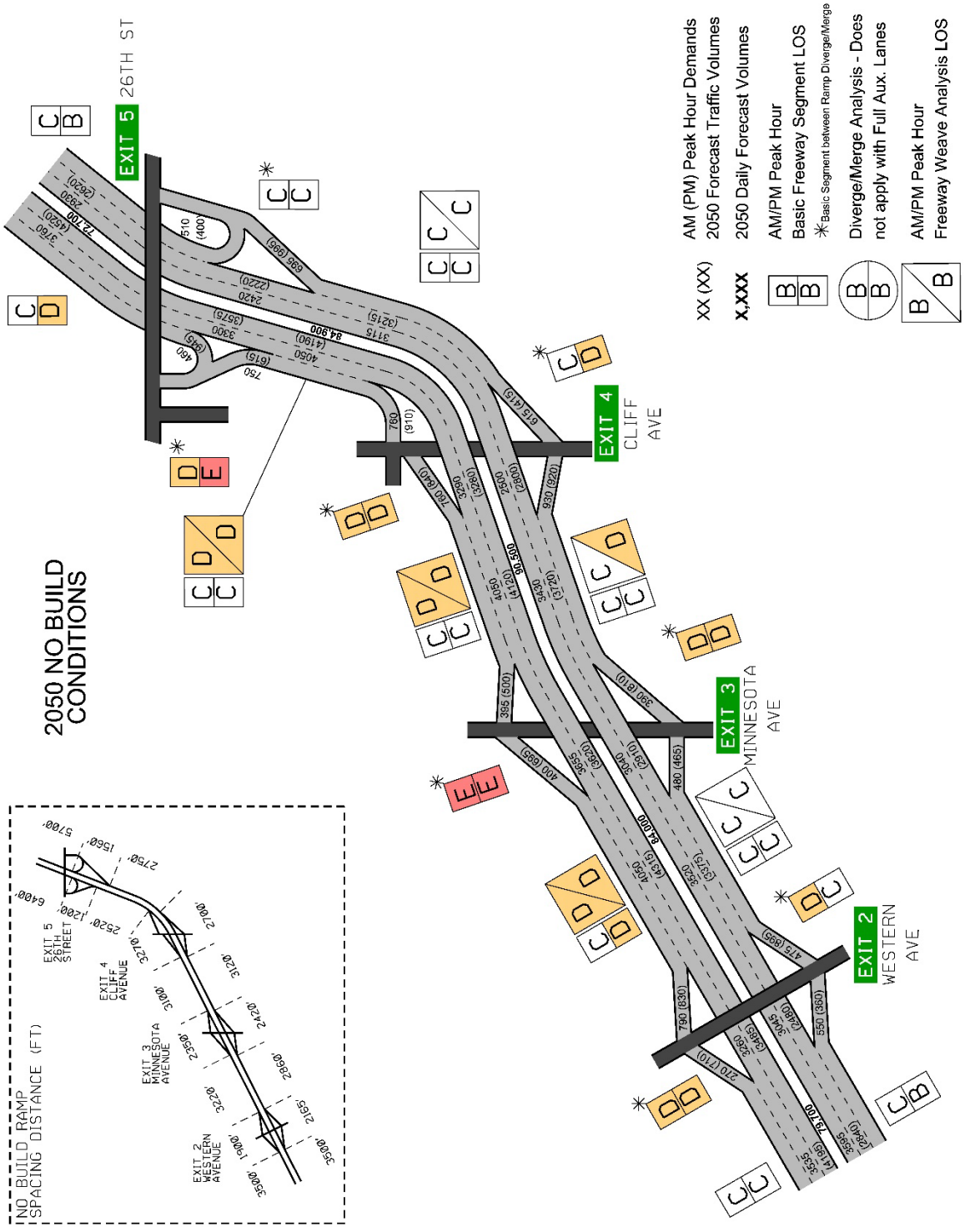


Table 15 – 2050 No Build I-229 Freeway Operations Summary

Road	Description	Analysis Type	AM Peak LOS	PM Peak LOS
NB I-229	NB I-229: southwest of Exit 2	Basic	C	B
	NB I-229: between Exit 2 Exit and Entrance Ramps	Basic	**D**	C
	NB I-229: between Exit 2 and Exit 3	Basic	C	C
		Weave	C	C
	NB I-229: between Exit 3 Exit and Entrance Ramps	Basic	**D**	**D**
	NB I-229: between Exit 3 and Exit 4	Basic	C	C
		Weave	C	**D**
	NB I-229: between Exit 4 Exit and Entrance Ramps	Basic	C	**D**
	NB I-229: between Exit 4 and Exit 5	Basic	C	C
		Weave	C	C
	NB I-229: between Exit 5 Exit and Entrance Ramps	Basic	C	C
	NB I-229: northeast of Exit 5	Basic	C	B
SB I-229	SB I-229: northeast of Exit 5	Basic	C	**D**
	SB I-229: between Exit 5 Exit and Entrance Ramps	Basic	**D**	**E**
	SB I-229: between Exit 5 and Exit 4	Basic	C	C
		Weave	**D**	**D**
	SB I-229: between Exit 4 Exit and Entrance Ramps	Basic	**D**	**D**
	SB I-229: between Exit 4 and Exit 3	Basic	C	C
		Weave	**D**	**D**
	SB I-229: between Exit 3 Exit and Entrance Ramps	Basic	**E**	**E**
	SB I-229: between Exit 3 and Exit 2	Basic	C	**D**
		Weave	**D**	**D**
	SB I-229: between Exit 2 Exit and Entrance Ramps	Basic	**D**	**D**
	SB I-229: southwest of Exit 2	Basic	C	C

- **Bold/Shaded** indicates a LOS D or worse

The project study area also includes twenty-nine arterial intersections identified for operational analysis. **Table 16** summarizes the results of the 2050 No Build traffic analysis for the ramp terminal intersections as well as adjacent major intersections within the study area. The 2050 No Build lane configurations of each study intersection, with turn lane storage and the intersection LOS results, can be found in **Appendix A**.

Throughout all four interchange areas many intersections, including ramp termini, operate at unacceptable LOS during the peak hours. Through planned capacity improvements and signal timing/phasing changes, some intersections are actually improved over the existing conditions; for instance the 26th Street ramp terminal intersections will both operate at a LOS C or better. However the total number of failing intersections is the same as the existing conditions, with 22 study intersections having at least one peak hour operate under failing conditions.

Table 16 – 2050 No Build Arterial Intersection Control – LOS Criteria

Major Roadway	Intersecting Roadway	Control Type	AM Peak	PM Peak
Western Avenue	W 49th Street	Signal	C	**E-**
Western Avenue	I-229 SB Ramp Terminal	Signal	C	**C***
Western Avenue	I-229 NB Ramp Terminal	Signal	C	B
Western Avenue	W 57th Street	Signal	**D***	**D-**
Minnesota Avenue	W 37th Street	Signal	C	C
Minnesota Avenue	W 41st Street	Signal	C	**E-**
Minnesota Avenue	W 49th Street	Minor Stop	**F**	**F**
Minnesota Avenue	I-229 SB Ramp Terminal	Signal	B	**C-**
Minnesota Avenue	I-229 NB Ramp Terminal	Signal	C	**E-**
Minnesota Avenue	Yankton Park Entrance	Minor Stop	**B-**	**F**
Minnesota Avenue	W Lotta Street	Minor Stop	**F**	**F**
Minnesota Avenue	W 57th Street	Signal	**C***	**E-**
Cliff Avenue	E 33rd Street	Signal	C	C
Cliff Avenue	36th St/LHS Entrance #4	Minor Stop	**F**	D
Cliff Avenue	38th St/LHS Entrance #3	Minor Stop	**F**	**F**
Cliff Avenue	LHS Entrance #2	Minor Stop	D	B
Cliff Avenue	LHS Entrance #1	Minor Stop	**F**	**F**
Cliff Avenue	41st St/I-229 SB Exit Ramp	Signal	**D-**	**E-**
Cliff Avenue	I-229 SB Entrance Ramp	No Control	**F**	**F**
Cliff Avenue	I-229 NB Ramp Terminal	Signal	**D-**	C
Cliff Avenue	Spencer Park Entrance	Minor Stop	D	**E-**
Cliff Avenue	E 49th Street	Signal	**E-**	**C***
26th Street	S Cliff Avenue	Signal	**C***	**D***
26th Street	S Yeager Road	Minor Stop	**E**	**F**
26th Street	I-229 SB Ramp Terminal	Signal	B	C
26th Street	I-229 NB Ramp Terminal	Signal	B	C
26th Street	Southeastern Avenue	Signal	**E-**	**E-**
41st Street	S Norton Avenue	Signal	B	B
41st Street	S Phillips Avenue	Signal	**B***	**C***

Notes: *Intersection considered failing due to LOS and/or Queue Storage Ratio.*

- Average Intersection LOS shown, individual movements and/or approaches may be different. Minor Street Stop Control intersections LOS represents the worst minor approach LOS; major roadway would operate at LOS A.

*- " * " Queue Storage Ratio greater than 1.0 for at least 1 movement, results in failing intersection.*

- " – " At least one movement operates at a LOS F (not noted if intersection is at LOS F)

6.2.2 2050 Build Conditions

The proposed build alternatives would add additional spot location capacity improvements to serve the 2050 Build traffic conditions. The improvements would bring the immediate project area traffic operations analysis to acceptable LOS along both northbound and southbound I-229.

The existing 2-lane freeway segments over both Minnesota Avenue and Cliff Avenue will need 3-lanes to serve the future demands at LOS C; this applies to northbound and southbound I-229. This modification would remove the weaving segment between Exit 3 and Exit 4 as there would no longer be a continuous auxiliary lane between the ramps. Having 3-continuous lanes through both the Exit 3 and Exit 4 interchanges would require the ramps to have standard merge and diverge connections.

Along northbound I-229, the Exit 3 and Exit 4 merge and diverge locations can be designed to current SDDOT standards with the appropriate deceleration and acceleration lanes. Along southbound I-229, the merge locations can also be designed to SDDOT standards. The two diverge locations would require additional deceleration length to achieve LOS C; approximately 500 feet of deceleration is needed at each diverge location.

For the analysis of the Exit 4 IMJR, it was assumed the Exit 3 interchange would remain a standard diamond configuration for the freeway analysis; one diverge and one merge location.

Results for the individual segments and ramp junctions of I-229 are shown in **Figure 18** as well as **Table 17**. The figure is representative of the build Alternative 6 or 7 with a single exit and entrance ramp location for the Exit 4 interchange for southbound I-229; Alternative 1 would split the entrance ramp into two separate ramp access locations as denoted in the table.

Outside of the immediate project area there are LOS D/E operations surrounding the 26th Street and Western Avenue interchanges. As these operations are the same between the No Build and Build conditions, no mitigations are required as part of this evaluation.

It should be noted that the two southbound I-229 weaving segments between Exits 5 and 4 and Exits 3 and 2 still remain at LOS D; however, the change in lane configuration did result in an improved density calculation when compared to the No Build condition.

Figure 18 – 2050 Build Freeway Configuration and LOS

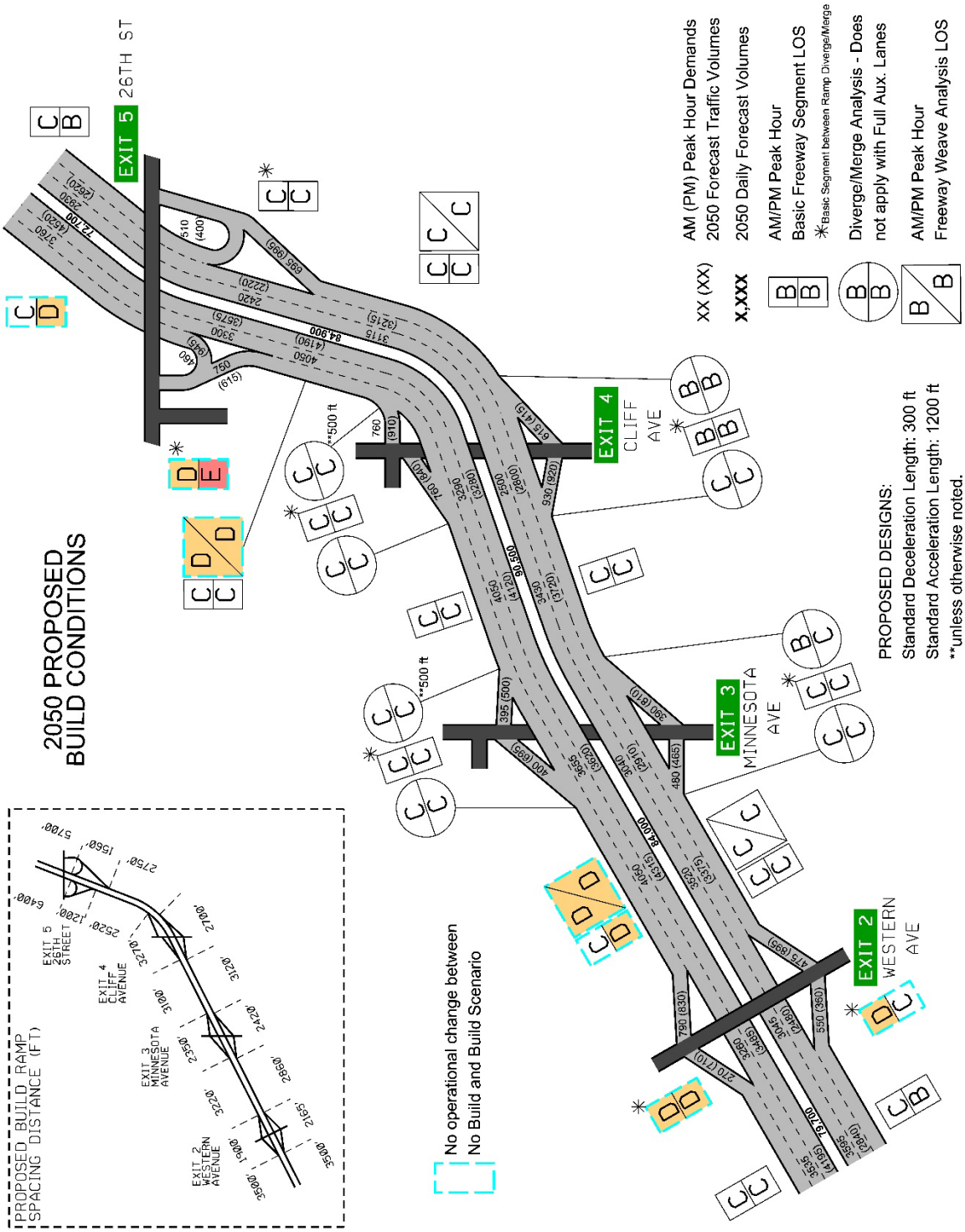


Table 17 – 2050 Build I-229 Freeway Operations Summary

Road	Description	Analysis Type	AM Peak LOS	PM Peak LOS
NB I-229	NB I-229: southwest of Exit 2	Basic	C	B
	NB I-229: between Exit 2 Exit and Entrance Ramps	Basic	**D**	C
	NB I-229: between Exit 2 and Exit 3	Basic	C	C
		Weave	C	C
	NB I-229: Exit 3 Exit Ramp	Diverge	C	C
	NB I-229: between Exit 3 Exit and Entrance Ramps	Basic	C	C
	NB I-229: Exit 3 Entrance Ramp	Merge	B	C
	NB I-229: between Exit 3 and Exit 4	Basic	C	C
	NB I-229: Exit 4 Exit Ramp	Diverge	C	C
	NB I-229: between Exit 4 Exit and Entrance Ramps	Basic	B	B
	NB I-229: Exit 4 Entrance Ramp	Merge	B	B
	NB I-229: between Exit 4 and Exit 5	Basic	C	C
		Weave	C	C
	NB I-229: between Exit 5 Exit and Entrance Ramps	Basic	C	C
	NB I-229: northeast of Exit 5	Basic	C	B
SB I-229	SB I-229: northeast of Exit 5	Basic	C	**D**
	SB I-229: between Exit 5 Exit and Entrance Ramps	Basic	**D**	**E**
	SB I-229: between Exit 5 and Exit 4	Basic	C	C
		Weave	**D**	**D**
	SB I-229: Exit 4 Exit Ramp	Diverge	C	C
	SB I-229: between Exit 4 Exit and Entrance Ramps	Basic	C	C
	SB I-229: Exit 4 NB Entrance Ramp **(Alt 1)**	Merge	C	B
	SB I-229: between Exit 4 Entrance Ramps **(Alt 1)**	Basic	C	C
	SB I-229: Exit 4 SB Entrance Ramp **(Alt 1)**	Merge	C	C
	SB I-229: Exit 4 SB Entrance Ramp **(Alt 6/7)**	Merge	C	C
	SB I-229: between Exit 4 and Exit 3	Basic	C	C
	SB I-229: Exit 3 Exit Ramp	Diverge	C	C
	SB I-229: between Exit 3 Exit and Entrance Ramps	Basic	C	C
	SB I-229: Exit 3 Entrance Ramp	Merge	C	C
	SB I-229: between Exit 3 and Exit 2	Basic	C	**D**
		Weave	**D**	**D**
	SB I-229: between Exit 2 Exit and Entrance Ramps	Basic	**D**	**D**
	SB I-229: southwest of Exit 2	Basic	C	C

- **Bold/Shaded** indicates a LOS D or worse
- Along Northbound I-229, all three build alternatives have the same freeway operations.
- Along Southbound I-229, all three build alternatives have the same freeway operations unless otherwise noted.
- There is no operational change between the No Build and Build outside of the immediate interchange area and therefore no mitigations were considered.

The project study area includes twenty-nine arterial intersections identified for operational analysis. Many of these intersections are outside of the immediate Exit 4 interchange area, therefore, mitigations were not considered. **Table 18** summarizes the results of the 2050 Build traffic analysis for the ramp terminal intersections as well as adjacent major intersections within the study area.

The interchange and arterial improvements proposed at the Exit 4 interchange and along the Cliff Avenue corridor will not change operations from the No Build conditions along Western Avenue, Minnesota Avenue, and 26th Street. While no intersection mitigations are required at these intersections, discussion about the operations is provided below.

- Along Western Avenue, the new connection of 49th Street between Western Avenue and Minnesota Avenue draws a lot of traffic to the intersection and major capacity improvements will be necessary at the Western Avenue and 49th Street intersection. The I-229 ramp terminal intersections at Western Avenue have acceptable delays, but there are storage capacity issues for the northbound left turn movement. The Western Avenue at 57th Street intersection has ample capacity for the majority of the turning movements, however the southbound approach is limited by the Big Sioux River bridge and storage capacity is an issue.
- Minnesota Avenue mitigations are being developed as part of the Exit 3 IMJR and will provide recommendations for the immediate I-229 interchange area.
- Along 26th Street there is significant traffic growth by 2050 that the on-going construction improvement project will not be adequate enough to handle. The intersection of 26th Street at Cliff Avenue has acceptable delays, but additional turn lane storage would be needed. The minor stop control intersection at Yeager Road will have long delays for the minor approach and should be considered for a reduced access intersection control. The interchange ramp terminals will operate well through 2050; however, the increased volumes along Southeastern Avenue create long delays at the intersection that would require significant capacity improvements.

Along Cliff Avenue, the intersections outside of the immediate interchange area would have the same traffic operations in all three alternatives. The following improvements are necessary at the intersections outside of the interchange area:

- Cliff at 36th Street: no change, poor LOS but low volume.
- Cliff at 38th Street: possible traffic control change, minor stop fails.
  - RI/RO conversion of Lincoln High School (LHS) Access #1 brings additional left turns out at this intersection.
  - Traffic signal will provide LOS C or better; remove mid-block pedestrian signal.
- Cliff at LHS Access #1: minimum convert to RI/RO
  - Access closure may be more appropriate due to proximity to intersections.
  - The Study Advisory Team recommended that under Alternative 6 this access was later studied as a 4th leg to the 41st Street Intersection.
- Cliff at Spencer Park: no change, minor stop failing but very low volume.
- Cliff at 49th Street: extend storage lanes.

Table 18 – 2050 Build Arterial Intersection Control – LOS Criteria

Major Roadway	Intersecting Roadway	Control Type	AM Peak	PM Peak
Western Avenue	W 49th Street	Signal	C	**E-**
Western Avenue	I-229 SB Ramp Terminal	Signal	C	**C***
Western Avenue	I-229 NB Ramp Terminal	Signal	C	B
Western Avenue	W 57th Street	Signal	**D***	**D-**
Minnesota Avenue	W 37th Street	Signal	C	C
Minnesota Avenue	W 41st Street	Signal	C	**E-**
Minnesota Avenue	W 49th Street	Minor Stop	**F**	**F**
Minnesota Avenue	I-229 SB Ramp Terminal	Signal	B	**C-**
Minnesota Avenue	I-229 NB Ramp Terminal	Signal	C	**E-**
Minnesota Avenue	Yankton Park Entrance	Minor Stop	**B-**	**F**
Minnesota Avenue	W Lotta Street	Minor Stop	**F**	**F**
Minnesota Avenue	W 57th Street	Signal	**C***	**E-**
Cliff Avenue	E 33rd Street	Signal	C	C
Cliff Avenue	36th St/LHS Entrance #4	Minor Stop	**E-**	D
Cliff Avenue	38th St/LHS Entrance #3	**Signal**	C	B
Cliff Avenue	LHS Entrance #2	Minor Stop	D	B
Cliff Avenue	LHS Entrance #1	**RI/RO**	**E**	B
Cliff Avenue	41st St/I-229 SB Exit Ramp	**See Table 19 and Figure 19 for Interchange Alternatives**		
Cliff Avenue	I-229 SB Entrance Ramp			
Cliff Avenue	I-229 NB Ramp Terminal			
Cliff Avenue	Spencer Park Entrance	Minor Stop	D	**E-**
Cliff Avenue	E 49th Street	Signal	**D***	**C***
26th Street	S Cliff Avenue	Signal	**C***	**D***
26th Street	S Yeager Road	Minor Stop	**E**	**F**
26th Street	I-229 SB Ramp Terminal	Signal	B	C
26th Street	I-229 NB Ramp Terminal	Signal	B	C
26th Street	Southeastern Avenue	Signal	**E-**	**E-**
41st Street	S Norton Avenue	Signal	B	B
41st Street	S Phillips Avenue	Signal	**B***	**C***

Notes: *Intersection considered failing due to LOS and/or Queue Storage Ratio.*

- Average Intersection LOS shown, individual movements and/or approaches may be different. Minor Street Stop Control intersections LOS represents the worst minor approach LOS; major roadway would operate at LOS A.

*- " * " Queue Storage Ratio greater than 1.0 for at least 1 movement, results in failing intersection.*

- " – " At least one movement operates at a LOS F (not noted if intersection is at LOS F)

All three proposed build alternatives are able to provide LOS C or better operations at the ramp terminal intersections.

Table 19 summarizes the results of the 2050 Build traffic analysis for the Cliff Avenue ramp terminal intersections.

Table 19 – 2050 Build Interchange Intersection Control – LOS Criteria

ALT	Major Roadway	Intersecting Roadway	Control Type	AM Peak	PM Peak
1	Cliff Avenue	W 41st Street/I-229 SB Ramp	Signal	C	C
	Cliff Avenue	I-229 SB Entrance Ramp	None	A	A
	Cliff Avenue	I-229 NB Ramp Terminal	Signal	C	C
6	Cliff Avenue	41st Street	Signal	B	C
	Cliff Avenue	I-229 SPUI	Signal	C	C
7	Cliff Avenue	W 41st Street/I-229 SB Ramp	Signal	B	C
	Cliff Avenue	I-229 SPUI	Signal	C	C

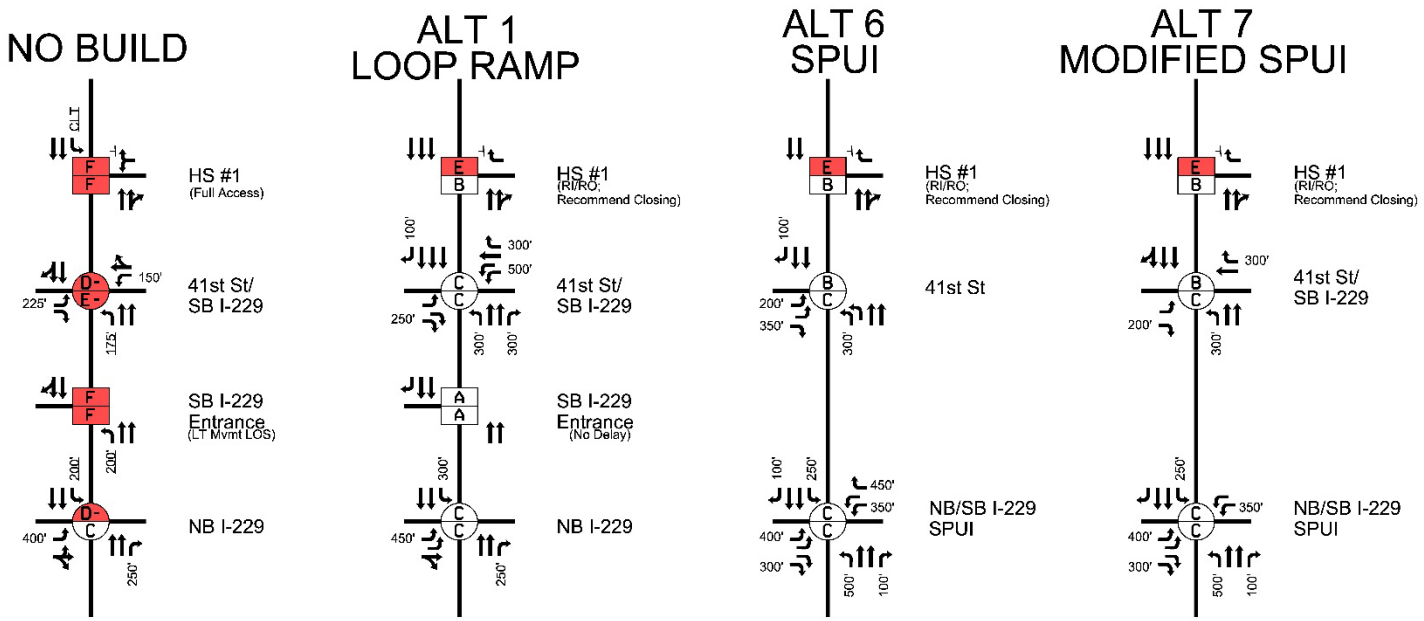
Notes:

- For Alternatives 1, the SB Entrance is a free right turn movement south of the 41st Street intersection; the NB Entrance ramp is located near the 41st Street intersection though it is a free movement as well.

- For Alternative 7, the SB exit ramp splits with SB traffic going to the SPUI and WB/NB traffic going to 41st Street.

The lane configurations needed for each proposed alternative, including the No Build, are represented in **Figure 19**.

Figure 19 – 2050 Build Cliff Avenue Interchange Configurations and LOS



6.3 Mid-Term Year Analysis

As the future year 2050 traffic forecasts resulted in such significant growth and is extended beyond the typical 20-year design standard, a mid-term year of 2035 was evaluated. The 2035 forecast year still shows a significant amount of growth throughout the southern Sioux Falls metropolitan area, including the immediate project area.

The projected traffic forecast volumes resulted in the same volumes between the No Build and Build scenarios. The proposed build alternatives add capacity to the interchange area, but do not add significant capacity that would alter regional route choices.

Poor operational performance outside the immediate project area would not be impacted by proposed build conditions and therefore the project is not required to mitigate these areas. This includes operational problems that may exist along Western Avenue and 26th Street, as well as I-229 outside the immediate interchange area.

Appendix E includes all HCS summary sheets for the 2035 No Build conditions analysis, **Appendix F** includes all HCS summary sheets for the 2035 Build conditions.

6.3.1 2035 No Build Conditions

The summation of the 2035 No Build traffic operations analysis show that mainline I-229 operates with poor LOS along southbound I-229; however, northbound I-229 is expected to operate at a LOS C or better on all freeway segments in 2035.

Southbound I-229 has LOS D operations on the 2-lane segments at each of the four study interchanges. Results for the individual segments and ramp junctions of I-229 are shown in **Figure 20** as well as **Table 20**.

Figure 20 – 2035 No Build Freeway Configuration and LOS

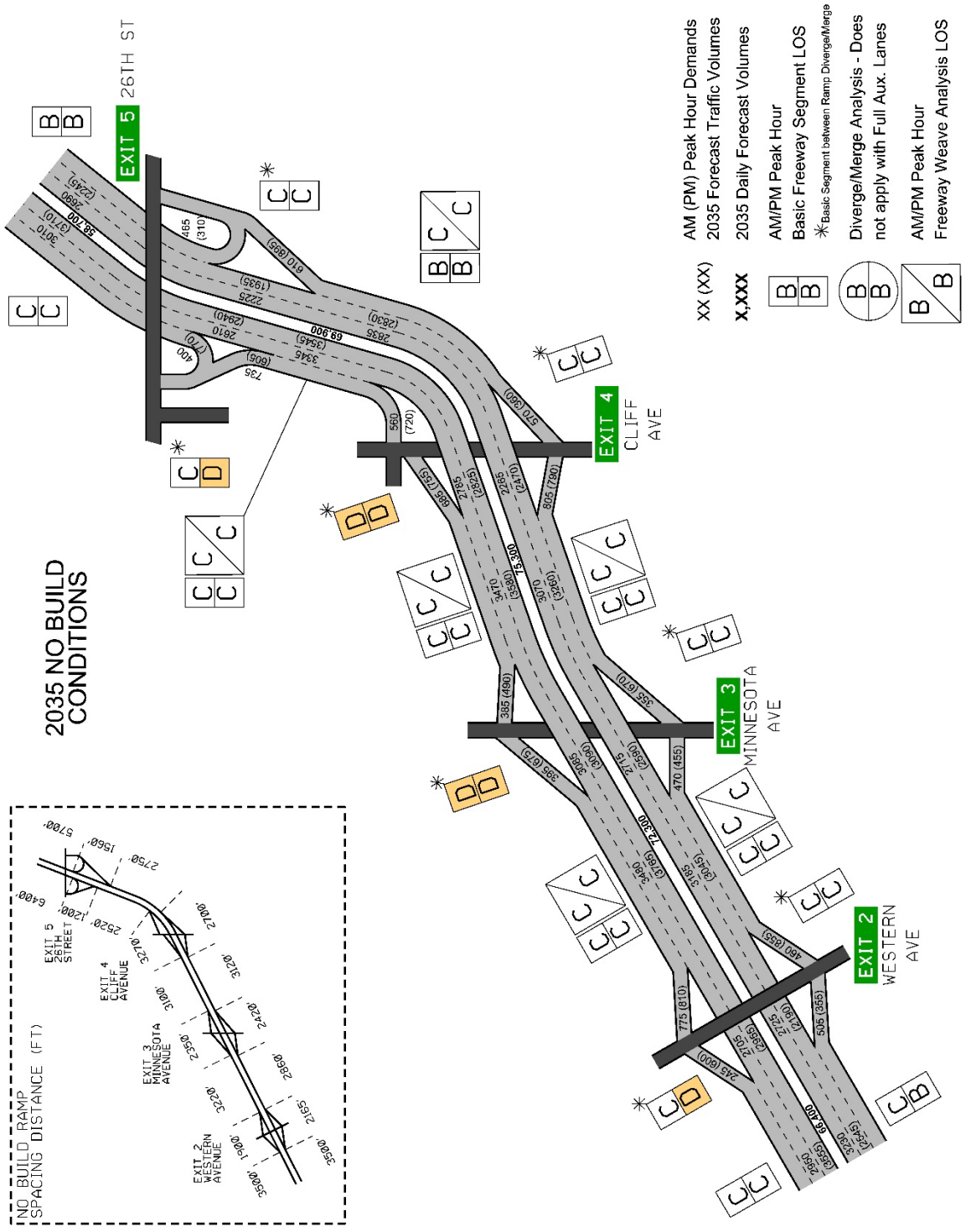


Table 20 – 2035 No Build I-229 Freeway Operations Summary

Road	Description	Analysis Type	AM Peak LOS	PM Peak LOS
NB I-229	NB I-229: southwest of Exit 2	Basic	C	B
	NB I-229: between Exit 2 Exit and Entrance Ramps	Basic	C	C
	NB I-229: between Exit 2 and Exit 3	Basic	C	C
		Weave	C	C
	NB I-229: between Exit 3 Exit and Entrance Ramps	Basic	C	C
	NB I-229: between Exit 3 and Exit 4	Basic	C	C
		Weave	C	C
	NB I-229: between Exit 4 Exit and Entrance Ramps	Basic	C	C
	NB I-229: between Exit 4 and Exit 5	Basic	B	B
		Weave	C	C
	NB I-229: between Exit 5 Exit and Entrance Ramps	Basic	C	C
	NB I-229: northeast of Exit 5	Basic	B	B
SB I-229	SB I-229: northeast of Exit 5	Basic	C	C
	SB I-229: between Exit 5 Exit and Entrance Ramps	Basic	C	**D**
	SB I-229: between Exit 5 and Exit 4	Basic	C	C
		Weave	C	C
	SB I-229: between Exit 4 Exit and Entrance Ramps	Basic	**D**	**D**
	SB I-229: between Exit 4 and Exit 3	Basic	C	C
		Weave	C	C
	SB I-229: between Exit 3 Exit and Entrance Ramps	Basic	**D**	**D**
	SB I-229: between Exit 3 and Exit 2	Basic	C	C
		Weave	C	C
	SB I-229: between Exit 2 Exit and Entrance Ramps	Basic	C	**D**
	SB I-229: southwest of Exit 2	Basic	C	C

- **Bold/Shaded** indicates a LOS D or worse

The project study area includes twenty-nine arterial intersections identified for operational analysis. **Table 21** summarizes the results of the 2035 No Build traffic analysis for the ramp terminal intersections as well as adjacent major intersections within the study area. The 2035 No Build lane configurations of each study intersection, with turn lane storage and the intersection LOS results, can be found in **Appendix A**.

Throughout all four interchange areas many intersections, including ramp termini, operate at unacceptable LOS during the peak hours. Through planned capacity improvements and signal timing/phasing changes, some intersections are actually improved over the existing conditions; for instance the Western Avenue and 26th Street ramp terminal intersections will operate at a LOS C or better. The total number of failing intersections is slightly reduced compared to the existing conditions, with only 19 study intersections having at least one peak hour operate under failing conditions.

Table 21 – 2035 No Build Arterial Intersection Control – LOS Criteria

Major Roadway	Intersecting Roadway	Control Type	AM Peak	PM Peak
Western Avenue	W 49th Street	Signal	C	**E-**
Western Avenue	I-229 SB Ramp Terminal	Signal	C	C
Western Avenue	I-229 NB Ramp Terminal	Signal	B	B
Western Avenue	W 57th Street	Signal	**D***	**D***
Minnesota Avenue	W 37th Street	Signal	C	C
Minnesota Avenue	W 41st Street	Signal	C	**D-**
Minnesota Avenue	W 49th Street	Minor Stop	**F**	**F**
Minnesota Avenue	I-229 SB Ramp Terminal	Signal	B	**C***
Minnesota Avenue	I-229 NB Ramp Terminal	Signal	C	**D***
Minnesota Avenue	Yankton Park Entrance	Minor Stop	**B-**	**F**
Minnesota Avenue	W Lotta Street	Minor Stop	**F**	**F**
Minnesota Avenue	W 57th Street	Signal	C	**D***
Cliff Avenue	E 33rd Street	Signal	B	C
Cliff Avenue	36th St/LHS Entrance #4	Minor Stop	D	C
Cliff Avenue	38th St/LHS Entrance #3	Minor Stop	**F**	**F**
Cliff Avenue	LHS Entrance #2	Minor Stop	C	B
Cliff Avenue	LHS Entrance #1	Minor Stop	**F**	**F**
Cliff Avenue	41st St/I-229 SB Exit Ramp	Signal	**C***	**E-**
Cliff Avenue	I-229 SB Entrance Ramp	No Control	**F**	**F**
Cliff Avenue	I-229 NB Ramp Terminal	Signal	**C***	C
Cliff Avenue	Spencer Park Entrance	Minor Stop	C	**D-**
Cliff Avenue	E 49th Street	Signal	**D-**	**B***
26th Street	S Cliff Avenue	Signal	**C***	**D***
26th Street	S Yeager Road	Minor Stop	C	**F**
26th Street	I-229 SB Ramp Terminal	Signal	B	B
26th Street	I-229 NB Ramp Terminal	Signal	B	C
26th Street	Southeastern Avenue	Signal	D	D
41st Street	S Norton Avenue	Signal	B	B
41st Street	S Phillips Avenue	Signal	**B***	**B***

Notes: *Intersection considered failing due to LOS and/or Queue Storage Ratio.*

- Average Intersection LOS shown, individual movements and/or approaches may be different. Minor Street Stop Control intersections LOS represents the worst minor approach LOS; major roadway would operate at LOS A.

*- " * " Queue Storage Ratio greater than 1.0 for at least 1 movement, results in failing intersection.*

- " – " At least one movement operates at a LOS F (not noted if intersection is at LOS F)

6.3.2 2035 Build Conditions

The proposed build alternatives would add additional spot location capacity improvements to serve the 2035 Build traffic conditions. The improvements would bring the immediate project area traffic operations analysis along mainline I-229 to an acceptable LOS along southbound I-229; northbound I-229 is already at LOS C or better.

The existing 2-lane freeway segments on southbound I-229, over both Minnesota Avenue and Cliff Avenue, would need 3-lanes to serve the future forecasted demands at LOS C. This modification would remove the weaving segment between Exit 3 and Exit 4 as there would no longer be a continuous auxiliary lane between the ramps. Having 3-continuous southbound lanes through both the Exit 3 and Exit 4 interchanges would require the ramps to have standard merge and diverge connections.

Along northbound I-229, the Exit 3 and Exit 4 merge and diverge locations would not be required to be modified before 2035. As a result, the existing access location can remain unchanged. The proposed bridge structures at the interchange should be designed to accommodate a future 3rd northbound lane to carry the future 2050 traffic demands.

Along southbound I-229, the merge locations can be designed to SDDOT standards; however the two diverge locations would require additional deceleration length to achieve LOS C; approximately 500 feet of deceleration is needed at each diverge location.

For the analysis of the Exit 4 IMJR, it was assumed the Exit 3 interchange would remain a standard diamond configuration for the freeway analysis; with one diverge and one merge location.

Results for the individual segments and ramp junctions of I-229 are shown in **Figure 21** as well as **Table 22**. The figure is representative of the build Alternative 6 or 7, with a single exit and entrance ramp location for the Exit 4 interchange with southbound I-229; Alternative 1 would split the entrance ramp into two separate ramp access locations as denoted in the table.

Outside of the immediate project area there are two LOS D segments along southbound I-229; they are located at the 2-lane segments of the 26th Street and Western Avenue interchanges. As these operations are the same between the No Build and Build conditions, no mitigations are required as part of this evaluation.

Figure 21 – 2035 Build Freeway Configuration and LOS

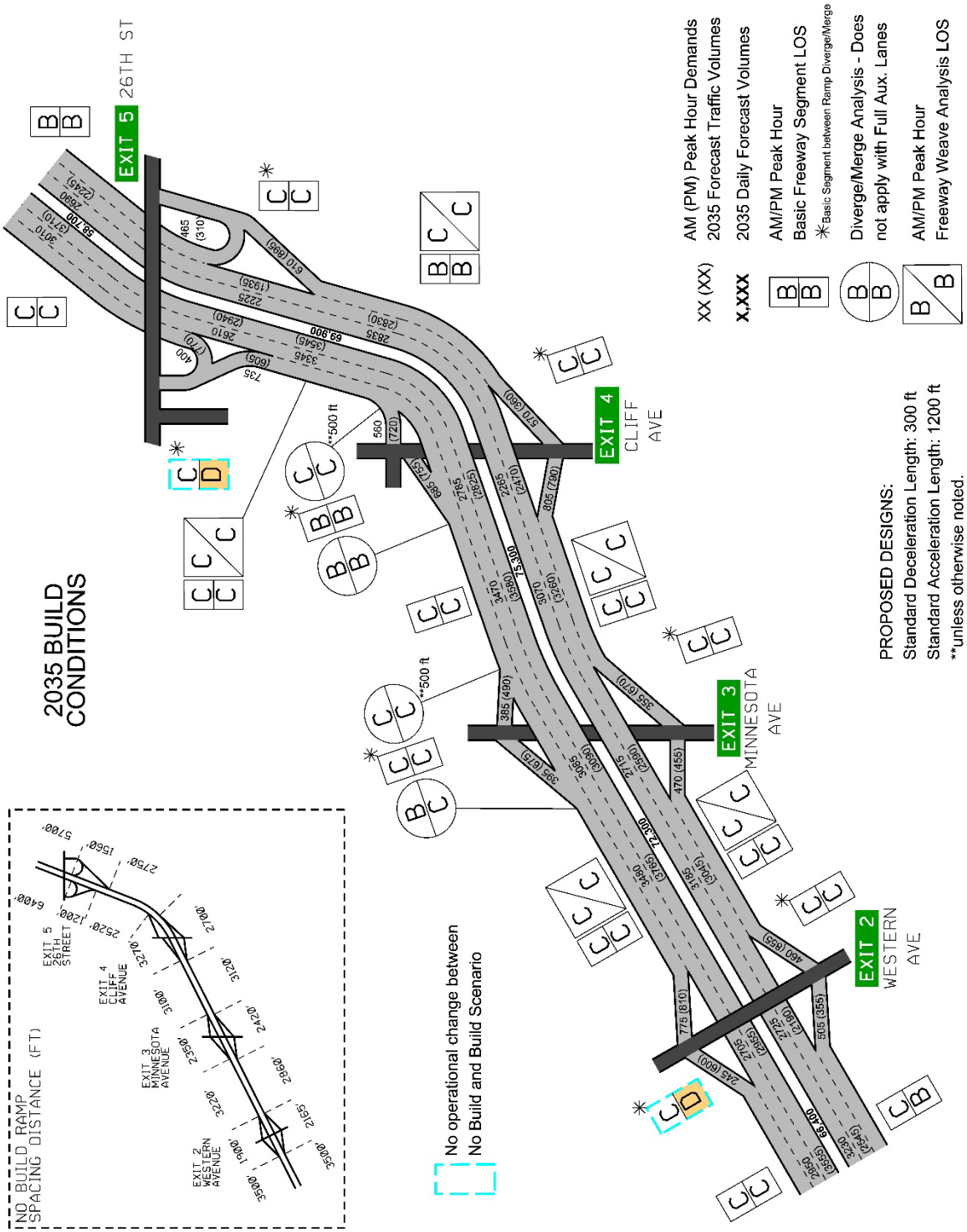


Table 22 – 2035 Build I-229 Freeway Operations Summary

Road	Description	Analysis Type	AM Peak LOS	PM Peak LOS
NB I-229	NB I-229: southwest of Exit 2	Basic	C	B
	NB I-229: between Exit 2 Exit and Entrance Ramps	Basic	C	C
	NB I-229: between Exit 2 and Exit 3	Basic	C	C
		Weave	C	C
	NB I-229: between Exit 3 Exit and Entrance Ramps	Basic	C	C
	NB I-229: between Exit 3 and Exit 4	Basic	C	C
		Weave	C	C
	NB I-229: between Exit 4 Exit and Entrance Ramps	Basic	C	C
	NB I-229: between Exit 4 and Exit 5	Basic	B	B
		Weave	C	C
	NB I-229: between Exit 5 Exit and Entrance Ramps	Basic	C	C
	NB I-229: northeast of Exit 5	Basic	B	B
SB I-229	SB I-229: northeast of Exit 5	Basic	C	C
	SB I-229: between Exit 5 Exit and Entrance Ramps	Basic	C	**D**
	SB I-229: between Exit 5 and Exit 4	Basic	C	C
		Weave	C	C
	SB I-229: Exit 4 Exit Ramp	Diverge	C	C
	SB I-229: between Exit 4 Exit and Entrance Ramps	Basic	B	B
	SB I-229: Exit 4 NB Entrance Ramp **(Alt 1)**	Merge	B	B
	SB I-229: between Exit 4 Entrance Ramps **(Alt 1)**	Basic	C	C
	SB I-229: Exit 4 SB Entrance Ramp **(Alt 1)**	Merge	B	B
	SB I-229: Exit 4 SB Entrance Ramp **(Alt 6/7)**	Merge	B	B
	SB I-229: between Exit 4 and Exit 3	Basic	C	C
	SB I-229: Exit 3 Exit Ramp	Diverge	C	C
	SB I-229: between Exit 3 Exit and Entrance Ramps	Basic	C	C
	SB I-229: Exit 3 Entrance Ramp	Merge	B	C
	SB I-229: between Exit 3 and Exit 2	Basic	C	C
		Weave	C	C
	SB I-229: between Exit 2 Exit and Entrance Ramps	Basic	C	**D**
	SB I-229: southwest of Exit 2	Basic	C	C

- **Bold/Shaded** indicates a LOS D or worse
- Along Northbound I-229, all three build alternatives have the same freeway operations.
- Along Southbound I-229, all three build alternatives have the same freeway operations unless otherwise noted.
- There is no operational change between the No Build and Build outside of the immediate interchange area and therefore no mitigations were considered.

The project study area includes twenty-nine arterial intersections identified for operational analysis. Many of these intersections are outside of the immediate Exit 3 interchange area, therefore, mitigations were not considered. **Table 23** summarizes the results of the 2035 Build traffic analysis for the ramp terminal intersections as well as adjacent major intersections within the study area.

The interchange and arterial improvements proposed at the Exit 3 interchange and along the Minnesota Avenue corridor will not change operations from the No Build conditions along Western Avenue, Cliff Avenue, and 26th Street. While no intersection mitigations are required at these intersections, discussion about the operations is provided below.

- Along Western Avenue, the new connection of 49th Street between Western Avenue and Minnesota Avenue draws a lot of traffic and capacity improvements will be necessary at the Western Avenue and 49th Street intersection. The I-229 ramp terminal intersections at Western Avenue operate at a LOS C or better. The Western Avenue at 57th Street intersection has ample capacity for the majority of the turning movements, however the southbound approach is limited by the Big Sioux River bridge and storage capacity is an issue.
- Minnesota Avenue mitigations are being developed as part of the Exit 3 IMJR and will provide recommendations for the immediate I-229 interchange area.
- Along 26th Street, the intersection of 26th Street at Cliff Avenue has acceptable delays, but additional turn lane storage will be needed. The minor stop control intersection at Yeager Road will have delay issues for the minor approach and should be considered for a reduced access intersection control. The interchange ramp terminal intersections and the intersection of Southeastern Avenue will all operate at acceptable levels.

Along Cliff Avenue, the intersections outside of the immediate interchange area would have the same traffic operations in all three alternatives. The following improvements are necessary at the intersections outside of the interchange area:

- Cliff at 36th Street: no change, poor LOS but low volume.
- Cliff at 38th Street: possible traffic control change, minor stop fails.
  - RI/RO conversion of Lincoln High School (LHS) Access #1 brings additional left turns out at this intersection.
  - Traffic signal will provide LOS C or better; remove mid-block pedestrian signal.
- Cliff at LHS Access #1: minimum convert to RI/RO
  - Access closure may be more appropriate due to proximity to intersections.
- Cliff at Spencer Park: no change, minor stop failing but very low volume.
- Cliff at 49th Street: extend storage lanes.

Table 23 – 2035 Build Arterial Intersection Control – LOS Criteria

Major Roadway	Intersecting Roadway	Control Type	AM Peak	PM Peak
Western Avenue	W 49th Street	Signal	C	**E-**
Western Avenue	I-229 SB Ramp Terminal	Signal	C	C
Western Avenue	I-229 NB Ramp Terminal	Signal	B	B
Western Avenue	W 57th Street	Signal	**D***	**D***
Minnesota Avenue	W 37th Street	Signal	C	C
Minnesota Avenue	W 41st Street	Signal	C	**D-**
Minnesota Avenue	W 49th Street	Minor Stop	**F**	**F**
Minnesota Avenue	I-229 SB Ramp Terminal	Signal	B	**C***
Minnesota Avenue	I-229 NB Ramp Terminal	Signal	C	**D***
Minnesota Avenue	Yankton Park Entrance	Minor Stop	**B-**	**F**
Minnesota Avenue	W Lotta Street	Minor Stop	**F**	**F**
Minnesota Avenue	W 57th Street	Signal	C	**D***
Cliff Avenue	E 33rd Street	Signal	B	C
Cliff Avenue	36th St/LHS Entrance #4	Minor Stop	D	C
Cliff Avenue	38th St/LHS Entrance #3	**Signal**	B	B
Cliff Avenue	LHS Entrance #2	Minor Stop	C	B
Cliff Avenue	LHS Entrance #1	**RI/RO**	D	B
Cliff Avenue	41st St/I-229 SB Exit Ramp	**See Table 24 and Figure 22 for Interchange Alternatives**		
Cliff Avenue	I-229 SB Entrance Ramp			
Cliff Avenue	I-229 NB Ramp Terminal			
Cliff Avenue	Spencer Park Entrance	Minor Stop	C	**D-**
Cliff Avenue	E 49th Street	Signal	**C***	**B***
26th Street	S Cliff Avenue	Signal	**C***	**D***
26th Street	S Yeager Road	Minor Stop	C	**F**
26th Street	I-229 SB Ramp Terminal	Signal	B	B
26th Street	I-229 NB Ramp Terminal	Signal	B	C
26th Street	Southeastern Avenue	Signal	D	D
41st Street	S Norton Avenue	Signal	B	B
41st Street	S Phillips Avenue	Signal	**B***	**B***

Notes: *Intersection considered failing due to LOS and/or Queue Storage Ratio.*

- Average Intersection LOS shown, individual movements and/or approaches may be different. Minor Street Stop Control intersections LOS represents the worst minor approach LOS; major roadway would operate at LOS A.

*- " * " Queue Storage Ratio greater than 1.0 for at least 1 movement, results in failing intersection.*

- " – " At least one movement operates at a LOS F (not noted if intersection is at LOS F)

All three proposed build alternatives are able to provide LOS C or better operations at the ramp terminal intersections; the interchange capacity for the design year 2050 analysis was maintained for the 2035 build analysis.

Table 24 summarizes the results of the 2035 Build traffic analysis for the Minnesota Avenue ramp terminal intersections.

Table 24 – 2035 Build Interchange Intersection Control – LOS Criteria

ALT	Major Roadway	Intersecting Roadway	Control Type	AM Peak	PM Peak
1	Cliff Avenue	W 41st Street/I-229 SB Ramp	Signal	C	C
	Cliff Avenue	I-229 SB Entrance Ramp	None	A	A
	Cliff Avenue	I-229 NB Ramp Terminal	Signal	B	C
6	Cliff Avenue	41st Street	Signal	B	C
	Cliff Avenue	I-229 SPUI	Signal	C	C
7	Cliff Avenue	W 41st Street/I-229 SB Ramp	Signal	B	B
	Cliff Avenue	I-229 SPUI	Signal	C	B

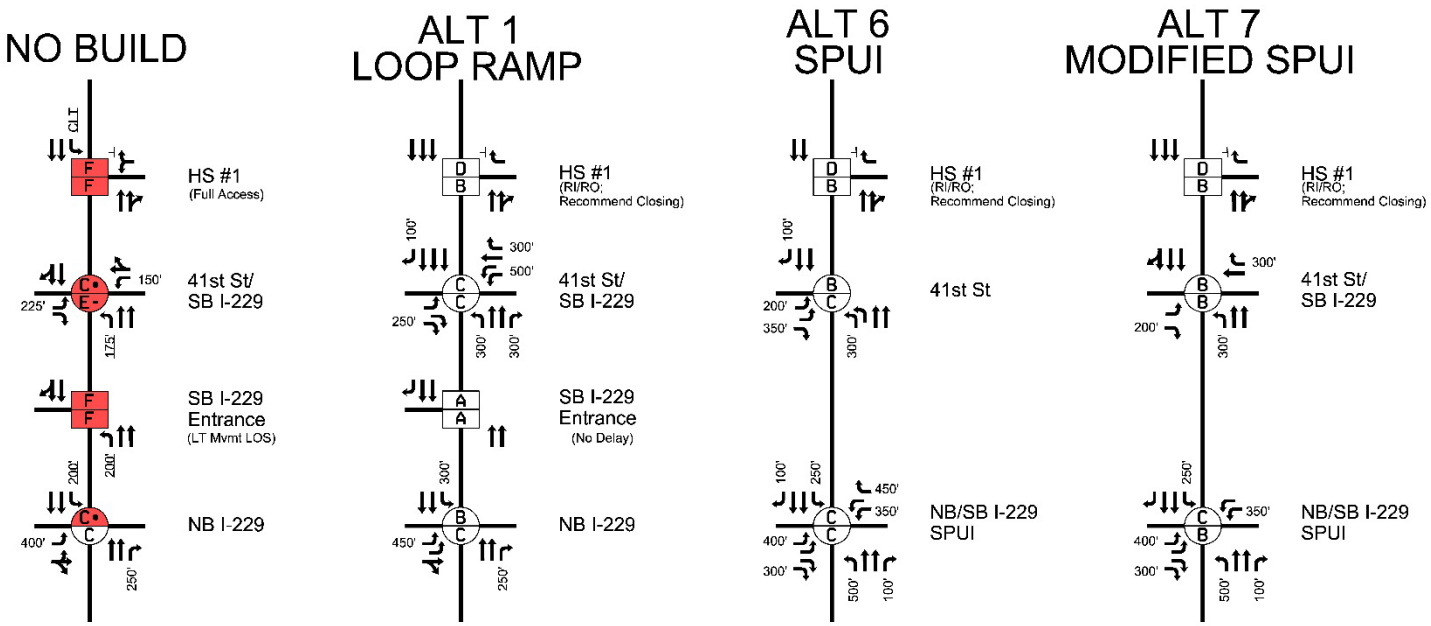
Notes:

- For Alternatives 1, the SB Entrance is a free right turn movement south of the 41st Street intersection; the NB Entrance ramp is located near the 41st Street intersection though it is a free movement as well.

- For Alternative 7, the SB exit ramp splits with SB traffic going to the SPUI and WB/NB traffic going to 41st Street.

The lane configurations needed for each proposed alternative, including the No Build, are represented in **Figure 22**.

Figure 22 – 2035 Build Cliff Avenue Interchange Configurations and LOS



6.4 Year of Opening Analysis

The interchange project is expected to be open to traffic by the year 2024. The forecast opening year still shows some areas of significant growth throughout the southern Sioux Falls metropolitan area, including the immediate project area.

The projected traffic forecast volumes resulted in the same volumes between the No Build and Build scenarios. The proposed build alternatives add capacity to the interchange area, but do not add significant capacity that would alter regional route choices.

Poor operational performance outside the immediate project construction area would not be impacted by proposed build conditions and therefore the project is not required to mitigate these areas. This includes operational problems that may exist along Western Avenue and 26th Street, as well as I-229 outside the immediate interchange area.

Appendix G includes all HCS summary sheets for the 2024 No Build conditions analysis, **Appendix H** includes all HCS summary sheets for the 2024 Build conditions.

6.4.1 2024 No Build Conditions

The summation of the 2024 No Build traffic operations analysis show that mainline I-229 is expected to continue to operate at a LOS C or better on all freeway segments in 2024.

Results for the individual segments and ramp junctions of I-229 are shown in **Figure 23** as well as **Table 25**.

Figure 23 – 2024 No Build Freeway Configuration and LOS

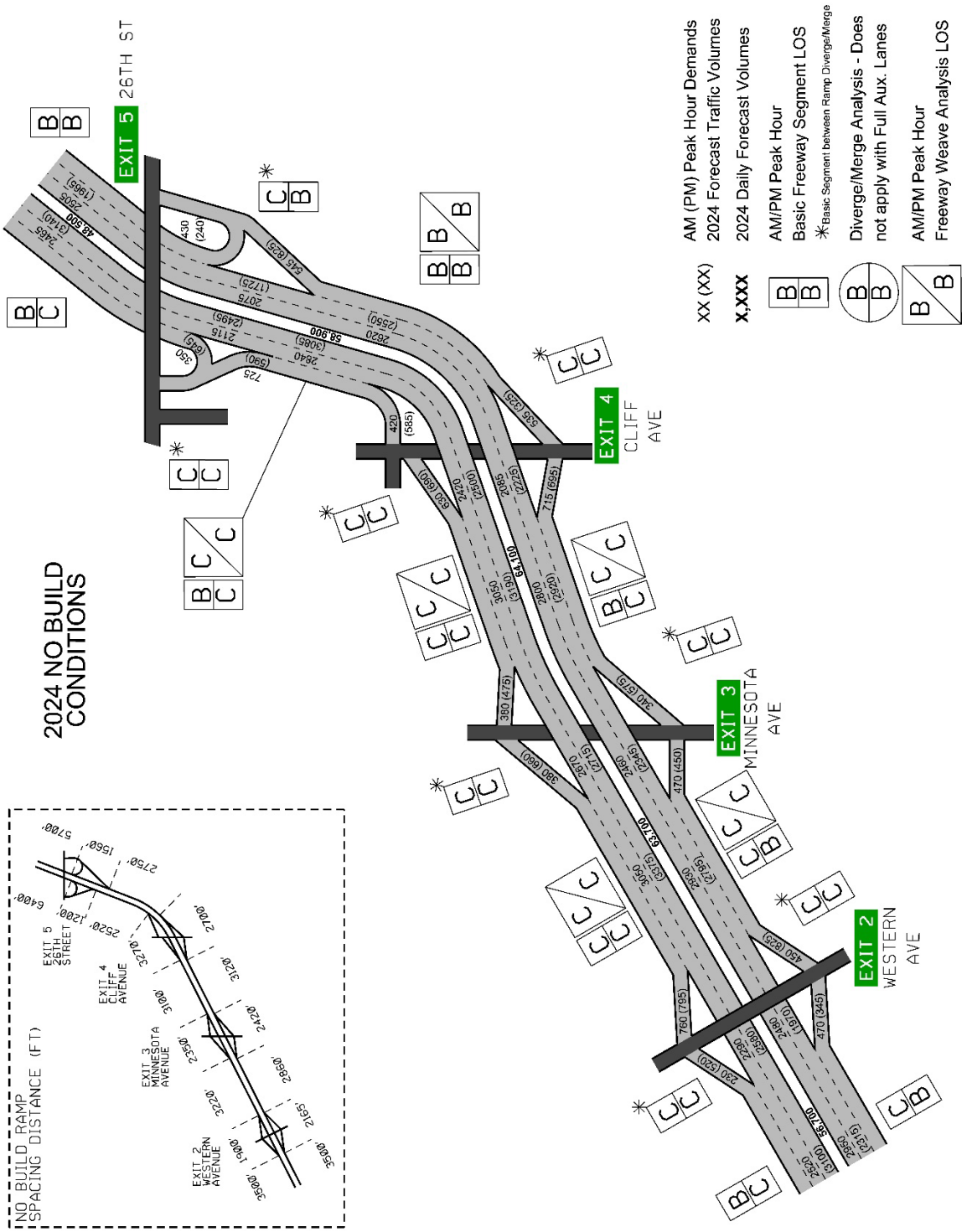


Table 25 – 2024 No Build I-229 Freeway Operations Summary

Road	Description	Analysis Type	AM Peak LOS	PM Peak LOS
NB I-229	NB I-229: southwest of Exit 2	Basic	C	B
	NB I-229: between Exit 2 Exit and Entrance Ramps	Basic	C	C
	NB I-229: between Exit 2 and Exit 3	Basic	C	B
		Weave	C	C
	NB I-229: between Exit 3 Exit and Entrance Ramps	Basic	C	C
	NB I-229: between Exit 3 and Exit 4	Basic	B	C
		Weave	C	C
	NB I-229: between Exit 4 Exit and Entrance Ramps	Basic	C	C
	NB I-229: between Exit 4 and Exit 5	Basic	B	B
		Weave	B	B
	NB I-229: between Exit 5 Exit and Entrance Ramps	Basic	C	B
	NB I-229: northeast of Exit 5	Basic	B	B
SB I-229	SB I-229: northeast of Exit 5	Basic	B	C
	SB I-229: between Exit 5 Exit and Entrance Ramps	Basic	C	C
	SB I-229: between Exit 5 and Exit 4	Basic	B	C
		Weave	C	C
	SB I-229: between Exit 4 Exit and Entrance Ramps	Basic	C	C
	SB I-229: between Exit 4 and Exit 3	Basic	C	C
		Weave	C	C
	SB I-229: between Exit 3 Exit and Entrance Ramps	Basic	C	C
	SB I-229: between Exit 3 and Exit 2	Basic	C	C
		Weave	C	C
	SB I-229: between Exit 2 Exit and Entrance Ramps	Basic	C	C
	SB I-229: southwest of Exit 2	Basic	B	C

- **Bold/Shaded** indicates a LOS D or worse

The project study area includes twenty-nine arterial intersections identified for operational analysis. **Table 26** summarizes the results of the 2024 No Build traffic analysis for the ramp terminal intersections as well as adjacent major intersections within the study area. The 2024 No Build lane configurations of each study intersection, with turn lane storage and the intersection LOS results, can be found in **Appendix A**.

Throughout all four interchange areas many intersections, including ramp termini, operate at unacceptable LOS during the peak hours. Through planned capacity improvements and signal timing/phasing changes, some intersections are actually improved over the existing conditions; for instance the Western Avenue and 26th Street ramp terminal intersections will operate at a LOS C or better. The total number of failing intersections is slightly reduced compared to the existing conditions, with only 17 study intersections having at least one peak hour operate under failing conditions.

Table 26 – 2024 No Build Arterial Intersection Control – LOS Criteria

Major Roadway	Intersecting Roadway	Control Type	AM Peak	PM Peak
Western Avenue	W 49th Street	Signal	B	D
Western Avenue	I-229 SB Ramp Terminal	Signal	B	C
Western Avenue	I-229 NB Ramp Terminal	Signal	B	B
Western Avenue	W 57th Street	Signal	**D***	**D***
Minnesota Avenue	W 37th Street	Signal	B	B
Minnesota Avenue	W 41st Street	Signal	C	**D-**
Minnesota Avenue	W 49th Street	Minor Stop	**F**	**F**
Minnesota Avenue	I-229 SB Ramp Terminal	Signal	B	**B***
Minnesota Avenue	I-229 NB Ramp Terminal	Signal	B	**C***
Minnesota Avenue	Yankton Park Entrance	Minor Stop	B	**F**
Minnesota Avenue	W Lotta Street	Minor Stop	**F**	**F**
Minnesota Avenue	W 57th Street	Signal	C	**D***
Cliff Avenue	E 33rd Street	Signal	B	C
Cliff Avenue	36th St/LHS Entrance #4	Minor Stop	C	C
Cliff Avenue	38th St/LHS Entrance #3	Minor Stop	**F**	**F**
Cliff Avenue	LHS Entrance #2	Minor Stop	C	A
Cliff Avenue	LHS Entrance #1	Minor Stop	**F**	**E**
Cliff Avenue	41st St/I-229 SB Exit Ramp	Signal	**B***	**D-**
Cliff Avenue	I-229 SB Entrance Ramp	No Control	C	**F**
Cliff Avenue	I-229 NB Ramp Terminal	Signal	B	C
Cliff Avenue	Spencer Park Entrance	Minor Stop	C	**D-**
Cliff Avenue	E 49th Street	Signal	**C***	B
26th Street	S Cliff Avenue	Signal	**C***	**D***
26th Street	S Yeager Road	Minor Stop	C	**F**
26th Street	I-229 SB Ramp Terminal	Signal	B	B
26th Street	I-229 NB Ramp Terminal	Signal	B	B
26th Street	Southeastern Avenue	Signal	C	C
41st Street	S Norton Avenue	Signal	B	B
41st Street	S Phillips Avenue	Signal	B	**B***

Notes: *Intersection considered failing due to LOS and/or Queue Storage Ratio.*

- Average Intersection LOS shown, individual movements and/or approaches may be different. Minor Street Stop Control intersections LOS represents the worst minor approach LOS; major roadway would operate at LOS A.

*- " * " Queue Storage Ratio greater than 1.0 for at least 1 movement, results in failing intersection.*

- " – " At least one movement operates at a LOS F (not noted if intersection is at LOS F)

6.4.2 2024 Build Conditions

The proposed build alternatives would not require capacity improvements to I-229 in the 2024 year of opening.

However, the 2035 mid-term forecast year showed a need for southbound I-229 capacity, the existing 2-lane freeway segments over both Minnesota Avenue and Cliff Avenue have impacts. These segments should be constructed with 3-lanes to serve the future forecast demands at LOS C. This modification would remove the weaving segment between Exit 3 and Exit 4 as there would no longer be a continuous auxiliary lane between the ramps. Having 3-continuous southbound lanes through both the Exit 3 and Exit 4 interchanges would require the ramps to have standard merge and diverge connections.

Along northbound I-229, the Exit 3 and Exit 4 merge and diverge locations would not be required to be modified before 2035 and the existing access location can remained unchanged for the year of opening condition. The proposed bridge structures at the interchange should be designed to accommodate a future 3rd northbound lane to carry the 2050 traffic demands.

For the analysis of the Exit 4 IMJR, it was assumed the Exit 3 interchange would remain a standard diamond configuration for the freeway analysis; with one diverge and one merge location.

Results for the individual segments and ramp junctions of I-229 are shown in **Figure 24** as well as **Table 27**. The figure is representative of the build Alternative 6 and 7, with a single exit and entrance ramp location for the Exit 4 interchange with southbound I-229; Alternative 1 would split the entrance ramp into two separate ramp access locations as denoted in the table.

Figure 24 – 2024 Build Freeway Configuration and LOS

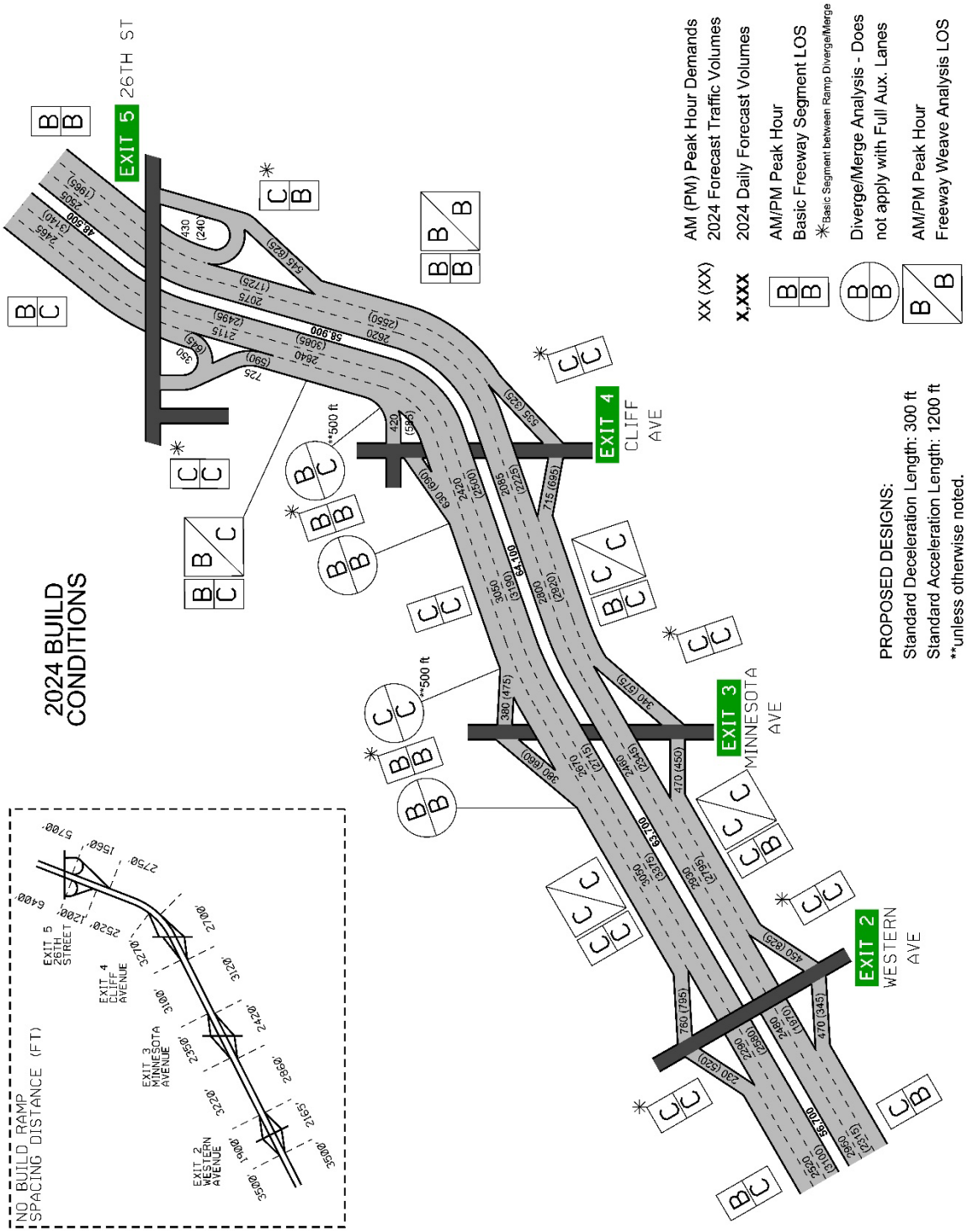


Table 27 – 2024 Build I-229 Freeway Operations Summary

Road	Description	Analysis Type	AM Peak LOS	PM Peak LOS
NB I-229	NB I-229: southwest of Exit 2	Basic	C	B
	NB I-229: between Exit 2 Exit and Entrance Ramps	Basic	C	C
	NB I-229: between Exit 2 and Exit 3	Basic	C	B
		Weave	C	C
	NB I-229: between Exit 3 Exit and Entrance Ramps	Basic	C	C
	NB I-229: between Exit 3 and Exit 4	Basic	B	C
		Weave	C	C
	NB I-229: between Exit 4 Exit and Entrance Ramps	Basic	C	C
	NB I-229: between Exit 4 and Exit 5	Basic	B	B
		Weave	B	B
	NB I-229: between Exit 5 Exit and Entrance Ramps	Basic	C	B
	NB I-229: northeast of Exit 5	Basic	B	B
SB I-229	SB I-229: northeast of Exit 5	Basic	B	C
	SB I-229: between Exit 5 Exit and Entrance Ramps	Basic	C	C
	SB I-229: between Exit 5 and Exit 4	Basic	B	C
		Weave	B	C
	SB I-229: Exit 4 Exit Ramp	Diverge	B	C
	SB I-229: between Exit 4 Exit and Entrance Ramps	Basic	B	B
	SB I-229: Exit 4 NB Entrance Ramp **(Alt 1)**	Merge	B	B
	SB I-229: between Exit 4 Entrance Ramps **(Alt 1)**	Basic	B	B
	SB I-229: Exit 4 SB Entrance Ramp **(Alt 1)**	Merge	B	B
	SB I-229: Exit 4 SB Entrance Ramp **(Alt 6/7)**	Merge	B	B
	SB I-229: between Exit 4 and Exit 3	Basic	C	C
	SB I-229: Exit 3 Exit Ramp	Diverge	C	C
	SB I-229: between Exit 3 Exit and Entrance Ramps	Basic	B	B
	SB I-229: Exit 3 Entrance Ramp	Merge	B	B
	SB I-229: between Exit 3 and Exit 2	Basic	C	C
		Weave	C	C
	SB I-229: between Exit 2 Exit and Entrance Ramps	Basic	C	C
	SB I-229: southwest of Exit 2	Basic	B	C

- **Bold/Shaded** indicates a LOS D or worse
- Along Northbound I-229, all three build alternatives have the same freeway operations.
- Along Southbound I-229, all three build alternatives have the same freeway operations unless otherwise noted.
- There is no operational change between the No Build and Build outside of the immediate interchange area and therefore no mitigations were considered.

The project study area includes twenty-nine arterial intersections identified for operational analysis. Many of these intersections are outside of the immediate Exit 3 interchange area, therefore, mitigations were not considered. **Table 28** summarizes the results of the 2024 Build traffic analysis for the ramp terminal intersections as well as adjacent major intersections within the study area.

The interchange and arterial improvements proposed at the Exit 3 interchange and along the Minnesota Avenue corridor will not change operations from the No Build conditions along Western Avenue, Cliff Avenue, and 26th Street. While no intersection mitigations are required at these intersections, discussion about the operations is provided below.

- Along Western Avenue, the new connection of 49th Street will be constructed with enough capacity to serve the 2024 demands at the Western Avenue and 49th Street intersection. The I-229 ramp terminal intersections at Western Avenue operate at a LOS C or better. The Western Avenue at 57th Street intersection has ample capacity for the majority of the turning movements, however the southbound approach is limited by the Big Sioux River bridge and storage capacity is an issue.
- Minnesota Avenue mitigations are being developed as part of the Exit 3 IMJR and will provide recommendations for the immediate I-229 interchange area.
- Along 26th Street, the intersection of 26th Street at Cliff Avenue has acceptable delays, but additional turn lane storage will be needed. The minor stop control intersection at Yeager Road will have delay issues for the minor approach and should be considered for a reduced access intersection control. The interchange ramp terminal intersections and the intersection of Southeastern Avenue will all operate at acceptable levels.

Along Cliff Avenue, the intersections outside of the immediate interchange area would have the same traffic operations in all three alternatives. The following improvements are necessary at the intersections outside of the interchange area:

- Cliff at 36th Street: no change, poor LOS but low volume.
- Cliff at 38th Street: possible traffic control change, minor stop fails.
  - RI/RO conversion of Lincoln High School (LHS) Access #1 brings additional left turns out at this intersection.
  - Traffic signal will provide LOS C or better; remove mid-block pedestrian signal.
- Cliff at LHS Access #2: no change.
- Cliff at LHS Access #1: minimum convert to RI/RO
  - Access closure may be more appropriate due to proximity to intersections.
- Cliff at Spencer Park: no change, minor stop failing but very low volume.
- Cliff at 49th Street: extend storage lanes.

Table 28 – 2024 Build Arterial Intersection Control – LOS Criteria

Major Roadway	Intersecting Roadway	Control Type	AM Peak	PM Peak
Western Avenue	W 49th Street	Signal	B	D
Western Avenue	I-229 SB Ramp Terminal	Signal	B	C
Western Avenue	I-229 NB Ramp Terminal	Signal	B	B
Western Avenue	W 57th Street	Signal	**D***	**D***
Minnesota Avenue	W 37th Street	Signal	B	B
Minnesota Avenue	W 41st Street	Signal	C	**D-**
Minnesota Avenue	W 49th Street	Minor Stop	**F**	**F**
Minnesota Avenue	I-229 SB Ramp Terminal	Signal	B	**B***
Minnesota Avenue	I-229 NB Ramp Terminal	Signal	B	**C***
Minnesota Avenue	Yankton Park Entrance	Minor Stop	B	**F**
Minnesota Avenue	W Lotta Street	Minor Stop	**F**	**F**
Minnesota Avenue	W 57th Street	Signal	C	**D***
Cliff Avenue	E 33rd Street	Signal	B	C
Cliff Avenue	36th St/LHS Entrance #4	Minor Stop	C	C
Cliff Avenue	38th St/LHS Entrance #3	**Signal**	B	B
Cliff Avenue	LHS Entrance #2	Minor Stop	C	A
Cliff Avenue	LHS Entrance #1	**RI/RO**	C	B
Cliff Avenue	41st St/I-229 SB Exit Ramp	**See Table 29 and Figure 25 for Interchange Alternatives**		
Cliff Avenue	I-229 SB Entrance Ramp			
Cliff Avenue	I-229 NB Ramp Terminal			
Cliff Avenue	Spencer Park Entrance	Minor Stop	C	**D-**
Cliff Avenue	E 49th Street	Signal	**C***	B
26th Street	S Cliff Avenue	Signal	**C***	**D***
26th Street	S Yeager Road	Minor Stop	C	**F**
26th Street	I-229 SB Ramp Terminal	Signal	B	B
26th Street	I-229 NB Ramp Terminal	Signal	B	B
26th Street	Southeastern Avenue	Signal	C	C
41st Street	S Norton Avenue	Signal	B	B
41st Street	S Phillips Avenue	Signal	B	**B***

Notes: *Intersection considered failing due to LOS and/or Queue Storage Ratio.*

- Average Intersection LOS shown, individual movements and/or approaches may be different. Minor Street Stop Control intersections LOS represents the worst minor approach LOS; major roadway would operate at LOS A.

*- " * " Queue Storage Ratio greater than 1.0 for at least 1 movement, results in failing intersection.*

- " – " At least one movement operates at a LOS F (not noted if intersection is at LOS F)

All three proposed build alternatives are able to provide LOS C or better operations at the ramp terminal intersections; the interchange capacity for the design year 2050 analysis was maintained for the 2024 build analysis.

Table 29 summarizes the results of the 2024 Build traffic analysis for the Minnesota Avenue ramp terminal intersections.

Table 29 – 2024 Build Interchange Intersection Control – LOS Criteria

ALT	Major Roadway	Intersecting Roadway	Control Type	AM Peak	PM Peak
1	Cliff Avenue	W 41st Street/I-229 SB Ramp	Signal	B	C
	Cliff Avenue	I-229 SB Entrance Ramp	None	A	A
	Cliff Avenue	I-229 NB Ramp Terminal	Signal	B	B
6	Cliff Avenue	41st Street	Signal	B	B
	Cliff Avenue	I-229 SPUI	Signal	C	B
7	Cliff Avenue	W 41st Street/I-229 SB Ramp	Signal	B	B
	Cliff Avenue	I-229 SPUI	Signal	B	B

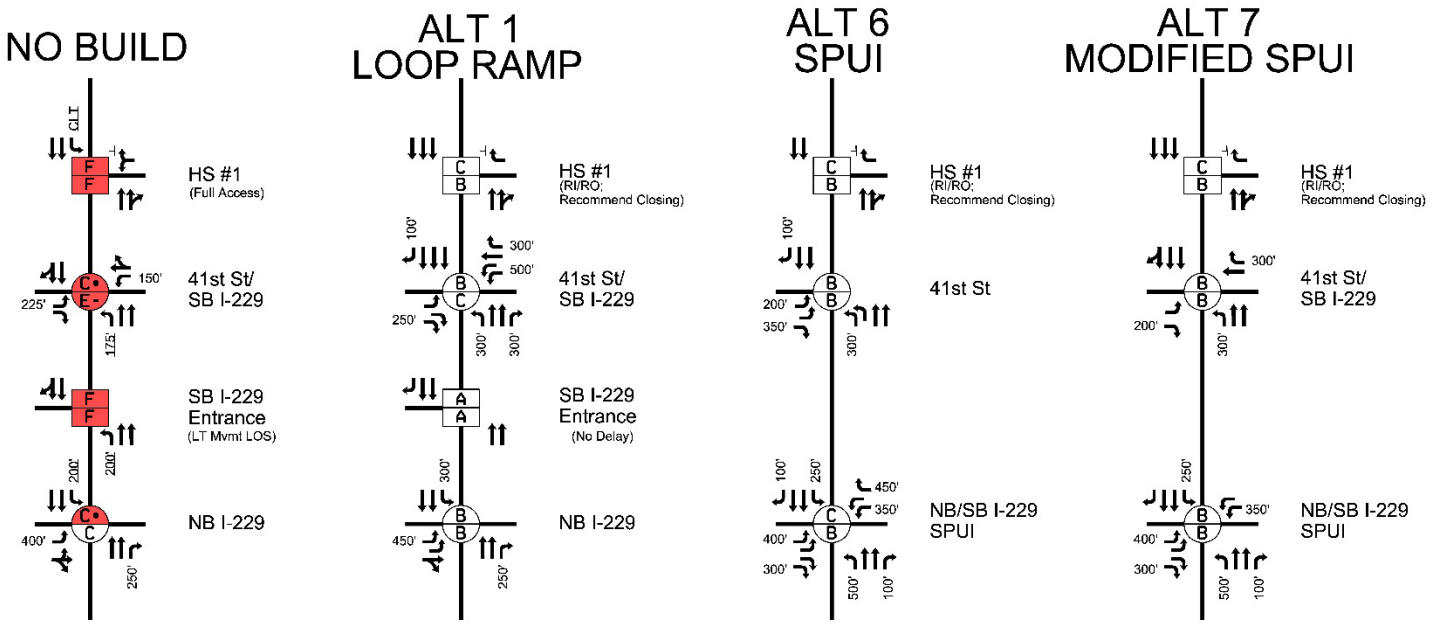
Notes:

- For Alternatives 1, the SB Entrance is a free right turn movement south of the 41st Street intersection; the NB Entrance ramp is located near the 41st Street intersection though it is a free movement as well.

- For Alternative 7, the SB exit ramp splits with SB traffic going to the SPUI and WB/NB traffic going to 41st Street.

The lane configurations needed for each proposed alternative, including the No Build, is represented in **Figure 25**.

Figure 25 – 2024 Build Cliff Avenue Interchange Configurations and LOS



6.5 Design Year Sensitivity Analysis

As all of the proposed alternatives were designed to provide acceptable traffic operations through the 2050 design year, a sensitivity analysis was conducted at the interchange to test for excess capacity of the proposed interchange designs.

A 10% increase in the 2050 traffic volumes was used to evaluate the proposed designs. **Table 30** represents the LOS results of the sensitivity analysis; all three alternatives would have movements that operate under failing conditions.

Alternative 1 would have LOS F movements at both the ramp terminal intersections and would require additional capacity to improve operations.

In Alternatives 6 and 7, the SPUI intersection would remain at a LOS C. For Alternative 6, the eastbound approach at 41st Street fails; while this is outside of the interchange area, it is still considered failing based on an overall approach failure. For Alternative 7 the failing movement is part of the interchange and would require additional capacity to improve operations.

Therefore Alternatives 6 and 7 have more excess capacity out of the three proposed interchange alternatives.

Table 30 – 2050 Build Sensitivity Interchange Intersection Control – LOS Criteria

ALT	Major Roadway	Intersecting Roadway	Control Type	AM Peak	PM Peak
1	Cliff Avenue	W 41st Street/I-229 SB Ramp	Signal	**D-**	**D-**
	Cliff Avenue	I-229 SB Entrance Ramp	None	A	A
	Cliff Avenue	I-229 NB Ramp Terminal	Signal	**C-**	**D-**
6	Cliff Avenue	41st Street	Signal	B	**D-**
	Cliff Avenue	I-229 SPUI	Signal	C	C
7	Cliff Avenue	W 41st Street/I-229 SB Ramp	Signal	C	**D-**
	Cliff Avenue	I-229 SPUI	Signal	C	C

Notes: *Intersection considered failing due to LOS and/or Queue Storage Ratio.*

- Average Intersection LOS shown, individual movements and/or approaches may be different.

*- " * " Queue Storage Ratio greater than 1.0 for at least 1 movement, results in failing intersection.*

- " – " At least one movement operates at a LOS F (not noted if intersection is at LOS F)

7 Alternatives Analysis

The interchange alternatives were analyzed and compared to determine which may be the most appropriate for meeting the project needs. The areas of analysis and comparison are discussed in the following sections.

7.1 Conformance with Transportation Plans

State and local transportation plans have consistently identified a need for an improved interchange at I-229 and Cliff Avenue (Exit 4) that meets design standards and provides adequate safety and capacity improvements to serve the existing and future travel demand. The following transportation plans have identified the study interchange:

- Sioux Falls MPO 2040 Long Range Transportation Plan
- 2010 Decennial Interstate Corridor Study
- I-229 Major Investment Study

All retained interchange alternatives satisfy this conformance.

7.2 Compliance with Policies and Engineering Standards

Alternative 0, the No Build condition, by its definition will not address the known geometric needs of the existing interchange and therefore does not comply with these standards.

Each of the proposed interchange alternatives has used the latest design guidance from AASHTO, FHWA, and SDDOT; final design of any of the options may be accomplished without conflict with geometric design standards.

Access management was examined at adjacent local street intersections and driveway locations; this includes the SDDOT and City of Sioux Falls spacing.

- SDDOT design standards call for access spacing of at least 100’ from the radius of the ramp termini when rebuilding an existing urban interchange. However, it is further recommended extending the control of access to meet the access spacing requirements established by South Dakota Administrative Rule 70:09; the Administrative Rules call for unsignalized access spacing of 100’ to 660’ and minimum signalized access spacing of 1320’, depending on the classification of the arterial street (Cliff Avenue is not within SDDOT jurisdiction and is not currently classified in the State system). With reconstructing an existing interchange, a minimum spacing of 100’ is required for the first unsignalized access.
- City of Sioux Falls design standards call for ¼ mile full access spacing on arterial roadways like Cliff Avenue, but list spacing of unsignalized partial access as “varies”. Other guidelines and research recommends signalized intersections no closer than ¼ mile from interchange ramp termini, but allow unsignalized partial access at spacing less than ¼ mile.

To the south of I-229, all three alternatives fully satisfy both spacing standards; the first unsignalized access is approximately 180’ south of the SPUI right turn merge and the first signalized access would be approximately 2,700’ south.

To the north of I-229, all three alternatives would satisfy the unsignalized access spacing with between 300’ and 400’ of spacing. However, none of the alternatives would fully satisfy the signalized spacing criteria; however all are improved over the existing conditions.

- Alternative Cliff-1 would have the first unsignalized access approximately 400 ft north at Pam Road and the first signalized intersection approximately 2,000 feet at 33rd Street; however 38th Street may become signalized and be approximately 750 feet north.
- Alternative Cliff-6 would provide more separation between 41st Street and the interchange; this provides at least 340' of spacing. The next unsignalized access approximately 500 ft north at 38th Street; however this intersection may become signalized and would require coordination.
- Alternative Cliff-7 would have the first unsignalized access approximately 400 ft north at Pam Road and the first signalized intersection approximately 2,000 feet north at 33rd Street; however 38th Street may become signalized and be approximately 750 feet north.

7.3 Environmental Impacts

An Environmental Scan Report (ESR) is being developed in conjunction with the IMJR. This document will compare each alternative and their environmental impacts compared to the No Build alternative. The ESR will ultimately recommend the NEPA documentation necessary for the proposed interchange project.

7.4 Safety

All Build alternatives are expected to show a safety benefit when compared to the No Build alternative. A predictive analysis of the alternatives was conducted using FHWA's Interactive Highway Safety Design Model (IHSDM); this is a faithful implementation of the crash prediction methods documented in Part C of the Highway Safety Manual (HSM). IHSDM output sheets are provided in **Appendix L**.

The IHSDM model limits include I-229 from the eastern gore area of Exit 3 and the western gore area of Exit 5; the arterial corridor includes Cliff Avenue from 33rd Street to 49th Street. It should be noted that the ramp terminal intersections are now included in the arterial corridor analysis; previous versions of IHSDM had the ramp terminals separated out from the arterial.

Table 31 shows the analysis results, all proposed Build alternatives have a significant reduction in predicted crashes when compared to the No Build condition.

Table 31 – Predicted Crashes (IHSDM) Results (2024 to 2050)

Facility Type	Crash Type	No Build	Build 1	Build 6	Build 7
Freeway Mainline	Fatal/Injury	186	175	176	176
	Property Only	366	338	331	331
Ramp Connections	Fatal/Injury	35	35	38	35
	Property Only	34	35	47	42
Arterial Corridor & Intersections	Fatal/Injury	378	367	279	290
	Property Only	734	671	560	591
ALTERNATIVE TOTALS	Fatal/Injury	599	576	493	501
	Property Only	1,134	1,045	938	965
	TOTAL	**1,733**	**1,621**	**1,431**	**1,465**
	% Reduction	**-**	**6.4%**	**17.4%**	**15.4%**

When comparing the crashes by facility type, the freeway mainline crashes are predicted to have a reduction of approximately 40 crashes for each build alternative; this is approximately an 8% reduction in freeway mainline crashes. The additional southbound entrance ramp access in alternative 1 has a negligible change compared to the other alternatives.

For the ramp connections, the difference between the No Build and all three build alternatives are fairly minor in the total quantity of crashes predicted; however, alternatives 6 and 7 see a slight increase in total crashes on the ramp connections.

The biggest impact in reduction of predicted crashes occurs on the arterial corridor. The changes on the arterial include a significant amount of center median being constructed, as well as some access changes along the corridor. Build alternatives 6 and 7 provide essentially the same crash benefit; these two alternatives provides more of a crash reduction due to the reduced number of intersections at the interchange junction.

Utilizing the FHWA's Grant Program guidance on estimated crash costs by severity, a monetary value for each alternative was calculated based on the linear crash estimations between 2024 and 2050. The FHWA guideline for crash cost estimation is as follows:

- Fatal Crash: ……..$9,600,000
- Severity A Crash: ……$459,100
- Severity B Crash: ……$125,000
- Severity C Crash: ……..$63,900
- Property Damage Only Crash: ……..$3,200

Applying the above crash costs to the estimated IHSDM information for each alternative produced the following total crash costs over the 26-year analysis period:

- No Build: $76,793,783
- Alternative 1: $73,892,885; reduction of $2,900,898
- Alternative 6: $60,823,664; reduction of $15,970,119
- Alternative 7: $62,015,545; reduction of $14,778,238

Based on the safety analysis, both Alternatives 6 and 7 have a significant safety benefit over the existing, No Build, and Alternative 1 conditions.

7.5 Operational Performance

The operations analysis of the alternative scenarios were evaluated using appropriate level of service techniques. All alternatives were evaluated with forecast demands for the opening year of 2024, a mid-term year of 2035, and a design year of 2050.

The existing roadway network has both safety and operational deficiencies within the project area, these problems will be exacerbated as traffic levels increase. The proposed interchange alternatives will provide acceptable traffic operations for all users within the project area based on the traffic operations analysis as discussed in **Section 6.0** of this document.

Regardless of the recommended interchange configuration, the 2050 analysis indicated that both directions of I-229 will need capacity improvements at the existing 2-lane segments between the exit and entrance ramps over both Minnesota Avenue and Cliff Avenue. The 2035 analysis indicated that southbound I-229 would also need capacity improvements at these two locations, but northbound I-229 would not require these improvements in 2035.

It is recommended to construct the southbound 3-lane segments as part of the initial construction project, the northbound 3-lane segment are not necessary at this time or through 2035. However, if no mainline improvements are initiated as part of the initial construction, the proposed I-229 bridges should be designed to accommodate the 3-lane section in each direction of I-229. It should be noted that Alternatives 2C and 2D would require a 4-lane bridge section for southbound I-229 over Minnesota Avenue to accommodate the three mainline through lanes and the loop ramp acceleration lane.

The majority of the 29 study intersections are not impacted by the proposed build alternatives and did not require mitigation as there was no operational change between the No Build and Build scenarios.

The intersections along Cliff Avenue between 33rd Street and W 49th Streetill need additional capacity and signal timing/phasing improvements to serve the future traffic demands. The AM peak hour has a high northbound volume using Cliff Avenue, however the existing two through lanes are able to serve the traffic as the minor street approaches are relatively low. In the PM peak hour, southbound Cliff Avenue has not only a significant through demand, but the minor street approaches are also at their peak volumes, this combination results in the need for capacity improvements surrounding the interchange area.

In alternatives 1 and 7, Cliff Avenue will require a 3rd southbound through lane from north of 41st Street to the I-229 interchange ramps; alternative 6 did not require the 3rd southbound lane. The intersection of Cliff Avenue at 38th Street will need to have a traffic signal installed to provide acceptable LOS for the minor street approaches; the existing mid-block pedestrian signal can be removed and reconfiguration of the high school parking lot may be required.

At the Cliff Avenue and I-229 interchange, all three proposed build alternatives provide acceptable traffic operations through the 2050 design year; the lane configurations for all three alternatives result in approximately the same roadway width near the 41st Street intersection. However, the sensitivity analysis showed that Alternatives 6 and 7 have more excess capacity when compared to Alternative 1.

7.6 Evaluation of Alternatives

A matrix comparing the No Build alternative to each Build alternative is shown in **Table 32** below. Based on the information within the matrix, Alternative 6 or Alternative 7 provide a better technical solution than the No Build or Alternative 1.

Table 32 – Alternatives Evaluation Matrix

	Evaluation Criteria	Alternative 0	Build Alternatives		
		No Build	Cliff-1	Cliff-6	Cliff-7
Plans	Meets SDDOT Design Criteria	No	Yes	Yes	Yes
	Meets SDDOT Access Spacing Criteria	No	Yes	Yes	Yes
	Meets City Access Spacing Criteria	No	No	No	No
	Access Closures	0	1	2	1
ROW	Acquisitions - Residential	n/a	1	6	1
	Acquisitions - Business	n/a	0	1	0
	Total Acreage of ROW Required *	n/a	0.8	2.7	1.1
Environmental	Wetlands (acres)	0.0	1.1	1	1.9
	City Parks (acres) - **Section 4(f)**	0.0	0.31	0.31	0.31
	City Parks (acres) - **Section 6(f)**	0.0	0.0	0.0	0.0
	Sioux Falls Bike Trail - **Section 4(f)**	0.0	Note[1]	Note[1]	Note[1]
	Sioux Falls Bike Trail - **Section 6(f)**	0.0	Note[1]	Note[1]	Note[1]
	Former RR - ROW acres (SHPO impact)	0.0	0.17	0.64	0.41
Traffic Safety & Operations	Safety Improvement (2024 through 2050 Crashes)	No (1733 crashes)	Yes (1624 crashes)	Yes (1431 crashes)	Yes (1465 crashes)
	Operational Performance	Poor	Good	Good	Good
	Sensitivity Performance (10% Increase)	Poor	Fair LOS D	Good LOS C	Fair LOS D
	Worst I-229 Performance 2050 (within Project Limits)	LOS D	LOS C	LOS C	LOS C
	Worst Ramp Terminal Performance 2050	LOS F (queue issues)	LOS C	LOS C	LOS C
	Non-Motorized Facilities (assumes all build alternatives would benefit from RRFB's)	Poor - narrow sidewalks only	Good - Trail and Sidewalk Provided; North Ramp has free right movements	Fair - Trail and Sidewalk Provided; Both Ramps have multiple free right movements	Fair - Trail and Sidewalk Provided; Both Ramps have multiple free right movements
Construction	Maintenance of Traffic During Construction	n/a	Fair	Fair	Fair
	Allows for Phased Construction	n/a	Yes	Yes	Yes
	Interchange Stucture Costs ($M)	n/a	$5.0	$14.0	$14.0
	Interchange Roadway Costs ($M)	n/a	$9.6	$14.0	$14.2
	Arterial Roadway Costs ($M)	n/a	$3.8	$3.6	$3.9
	Arterial Roadway Costs - city portion ($M)	n/a	$0.7	$0.9	$0.6
	Costs (Millions in 2018 dollars)	**n/a**	**$19.1**	**$32.5**	**$32.7**
	Additional considerations				
	Interstate Pavement Replacement Cost ($M)	n/a	$6.2	$3.6	$3.6
	Total Project Costs (Millions in 2018 dollars)	**n/a**	**$25.3**	**$36.1**	**$36.3**
	Relocate Trail Cost ($M)	n/a	$1.4	$1.4	$1.4

* Does not include City owned Park parcels

Note 1: Temporary disturbance during construction/relocate in place.

7.7 Coordination

The Cliff Avenue interchange project is being done in conjunction with a City of Sioux Falls project to reconstruct the Cliff Avenue corridor with the interchange area. As such, coordination between City and SDDOT staff has been ongoing and will continue through the construction phase of both projects.

The Cliff Avenue corridor, including the interchange with I-229, has been the subject of agency coordination and public involvement as part of both the I-229 MIS and the current interchange study and NEPA process. Public meetings have been held for both the MIS and the current project.

A significant amount of information regarding the current project can be found at the following web address:

https://www.i229exits3and4.com/

7.8 Alternative Recommendation

Based on the technical analysis contained in this Interchange Modification Justification Report (IMJR), and input from the Study Advisory Team, it was determined that **Alternative 6** provides the best technical solution for the transportation needs in the study area and is recommended to move forward for FHWA approval.

8 Funding Plan

The 2020-2023 Statewide Transportation Improvement Program (STIP) does not contain a project for reconstruction of the I-229 and Cliff Avenue interchange. Preliminary engineering funds are included in 2025 for I-229 at Cliff Avenue.

The interchange reconstruction project is in the SDDOT's developmental program and anticipated to be constructed in 2025. Current SDDOT budget estimates for interchange improvements are shown below.

Current construction cost estimates for the interchange and I-229 mainline work are $36.1 Million in 2018 dollars.

Table 33 – Anticipated Funding Allocation Breakdown

Project Number	State Category	Federal Category	Federal Funds ($ million)	State Funds ($ million)	City Funds ($ million)	Other Funds ($ million)	Total Funds ($ million)
Minn05HN	Interstate	National Highway Performance Program (NHPP)	$28.747	$2.853	$0.00	$0.00	**$31.60**
Minn05HN	Local Urban System	Surface Transportation Block Grant Program	$3.688	$0.812	$0.00	$0.00	**$4.50**
X	Sioux Falls Capital Improvements Program	None	$0.00	$0.00	$0.00	$0.00	**$0.00**
TOTALS			**$32.44**	**$3.66**	$0.00	$0.00	**$36.10**

Note: As funding is fluid, category breakdown may be different at the time of project authorization.

It should be noted that the analysis year of opening (2024) was anticipated to occur prior to funding allocations and programming of the construction in 2025.

9 Recommendations

Section 111 of Title 23 USC provides that before proceeding with the modification of existing access or the addition of access to the Interstate System, it is necessary to gain approval from the U.S. Secretary of Transportation.

The authority to administer 23 USC 111 has been delegated to the FHWA pursuant to 49 CFR 1.48(b)(10). The FHWA published a policy statement in the Federal Reserve on October 22, 1990 (55 FR 42670), which was modified on February 11, 1998 (63 FR 7045) and on August 27, 2009 (74 FR 20679). The latest update to the policy statement was on May 22, 2017 (23 CFR 630C).

The FHWA Policy on Access to the Interstate System requires all requests for new or revised access points on completed Interstate highways must closely adhere to the planning and environmental review processes as required in 23 CFR 450 and 771.

In this statement of policy, two technical policy requirements were identified for use by FHWA to do a technical evaluation of new or revised access points to the Interstate System. The policy requirements and a discussion of the proposed project conformance to each requirement are discussed in the following sections.

The technical analysis contained in this Interchange Modification Justification Report (IMJR) has found that **Alternative 6** provides the best technical solution for the transportation needs in the study area.

9.1 Policy Number One

An operational and safety analysis has concluded that the proposed change in access does not have a significant adverse impact on the safety and operation of the Interstate facility (which includes mainline lanes, existing, new, or modified ramps, and ramp intersections with crossroad) or on the local street network based on both the current and the planned future traffic projections. The analysis should, particularly in urbanized areas, include at least the first adjacent existing or proposed interchange on either side of the proposed change in access (Title 23, Code of Federal Regulations (CFR), paragraphs 625.2(a), 655.603(d) and 771.111(f)). The crossroads and the local street network, to at least the first major intersection on either side of the proposed change in access, should be included in this analysis to the extent necessary to fully evaluate the safety and operational impacts that the proposed change in access and other transportation improvements may have on the local street network (23 CFR 625.2(a) and 655.603(d)).

Requests for a proposed change in access should include a description and assessment of the impacts and ability of the proposed changes to safely and efficiently collect, distribute, and accommodate traffic on the Interstate facility, ramps, intersection of ramps with crossroad, and local street network (23 CFR 625.2(a) and 655.603(d)). Each request should also include a conceptual plan of the type and location of the signs proposed to support each design alternative (23 U.S.C. 109(d) and 23 CFR 655.603(d)).

An extensive safety and operations analysis was conducted for the study area, as previous sections of this report presented. The results show that the proposed build scenarios are not expected to adversely affect the safety or efficiency of the Interstate system. The proposed build alternative is expected to improve safety, operations, and access management on the crossroad in the interchange area.

Results indicate the freeway mainline segments of I-229 will need capacity improvements, regardless of any interchange design alternative, by the design year 2050 due to regional growth in the Sioux Falls metropolitan area. The analysis showed that southbound I-229 would need capacity improvements by the mid-term year of 2035, northbound I-229 would still operate acceptably.

As the interchange build alternatives themselves do not cause an adverse impact to the interstate system, the interchanges could be constructed with no improvements along I-229 and tie back into the existing auxiliary lanes. However, with capacity needs within 10-years of the project construction, the additional lanes will be included at the time of the interchange reconstruction.

Figures 26 and 27 are repeated from Section 6 of this report representing the 2050 design year No Build and Build freeway operational results.

Arterial network operations analysis was conducted on 29 intersections within the study area as previous sections have presented. The proposed build alternatives have no change in operations at the surrounding interchanges and arterial corridors and therefore no improvements were deemed necessary on the surrounding arterial intersections.

Along Cliff Avenue, spot turn lane capacity and storage lane extensions were also found to be necessary. These improvements bring the ramp terminal intersections to a LOS C or better and all other intersections to a LOS D or better.

Two intersection control changes are necessary to improve both safety and operations:

- Cliff Avenue at 38th Street should be controlled by a traffic signal.
- Cliff Avenue at southern high school access should at a minimum be converted to a RI/RO access at the new 41st Street intersection created with Alternative 6.
  - The City of Sioux Falls is currently working with Lincoln High School on the potential to include an east leg into the school site as part of the alternative. The analysis showed the additional leg would operate acceptably until the 2050 design year, where the PM peak hour would begin to have some failing operations. As this intersection is not connected to the interstate system as part of this alternative, and does not make any changes within the interchange area, the decision to include the additional leg at the intersection is not required at this time.
    - It should be noted that converting the S Cliff Avenue southbound right turn lane at 41st Street to a shared through-right lane would provide acceptable operations in the 2050 design year with only a lane marking change and no reconstruction.

Figure 28 represents the preferred Alternative 6 interchange design, as well as the potential improvement to the 41st Street intersection to incorporate access into Lincoln High School as described above.

The predictive crash modeling showed the proposed build alternative would provide approximately a 15% reduction in predicted crashes between 2024 and 2050; this includes a reduction of up to 8% of crashes along the interstate and ramp connections. Based on estimated crash costs, this will provide a crash savings of approximately $16 million over the No Build.

A signing plan has been developed for the proposed interchange and interstate improvements which is provided in **Appendix M** and is represented in **Figure 29**.

Figure 26 – 2050 No Build Freeway Configuration and LOS

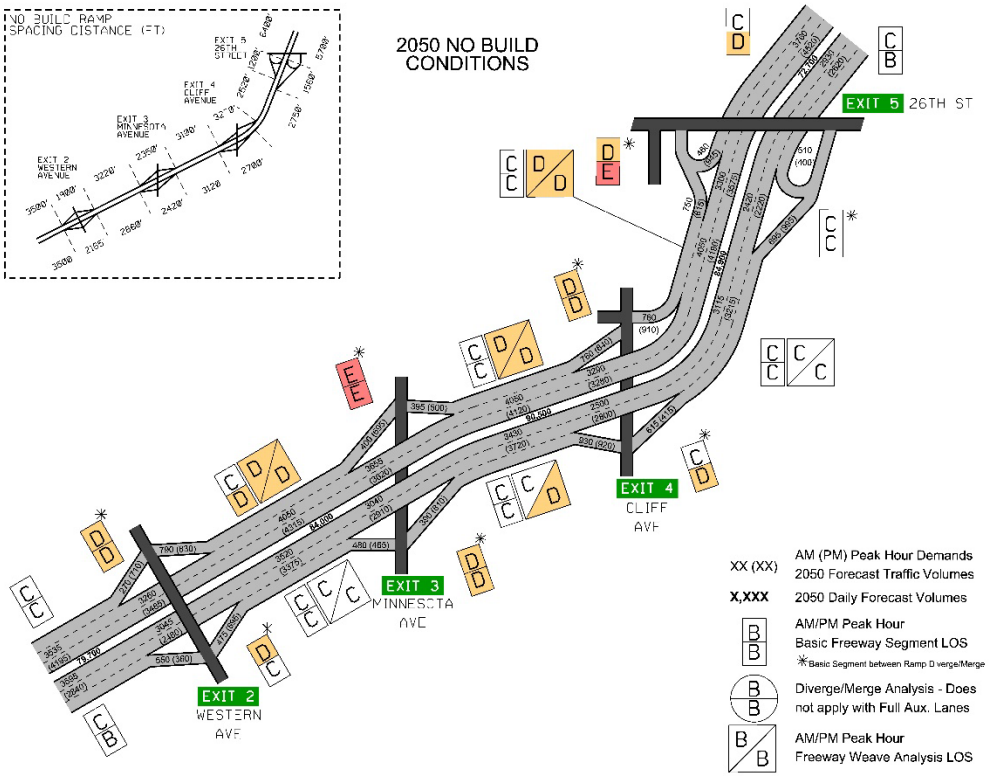


Figure 27 – 2050 Build Freeway Configuration and LOS

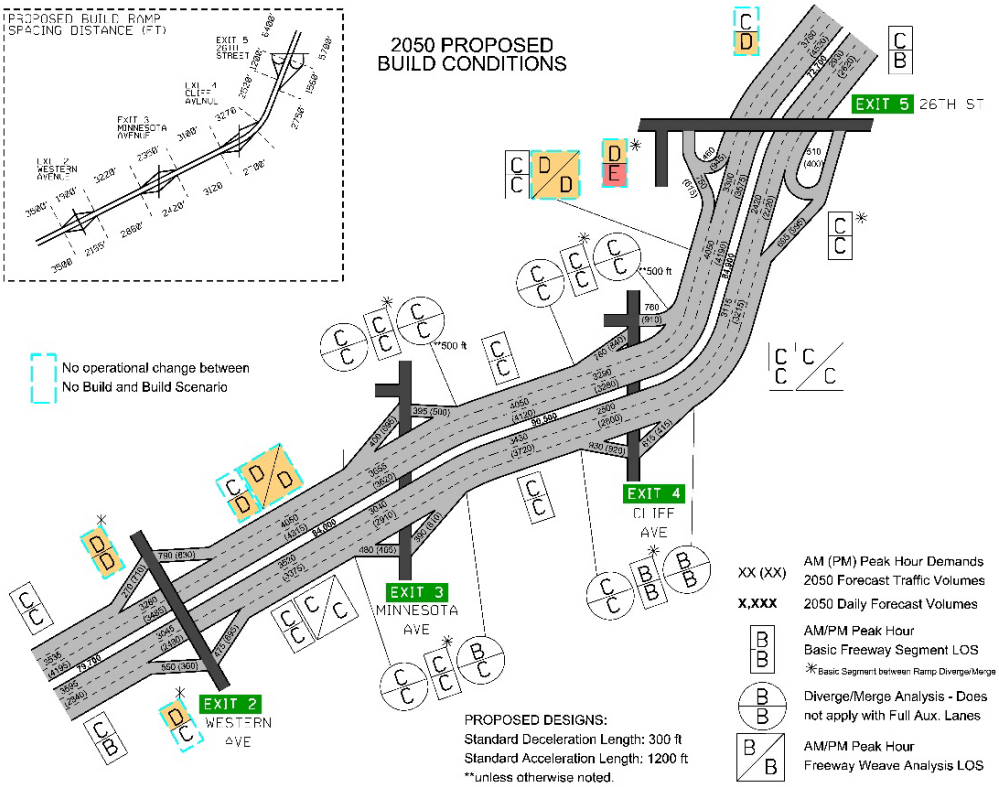


Figure 28 – Preferred Interchange Design – Alternative 6

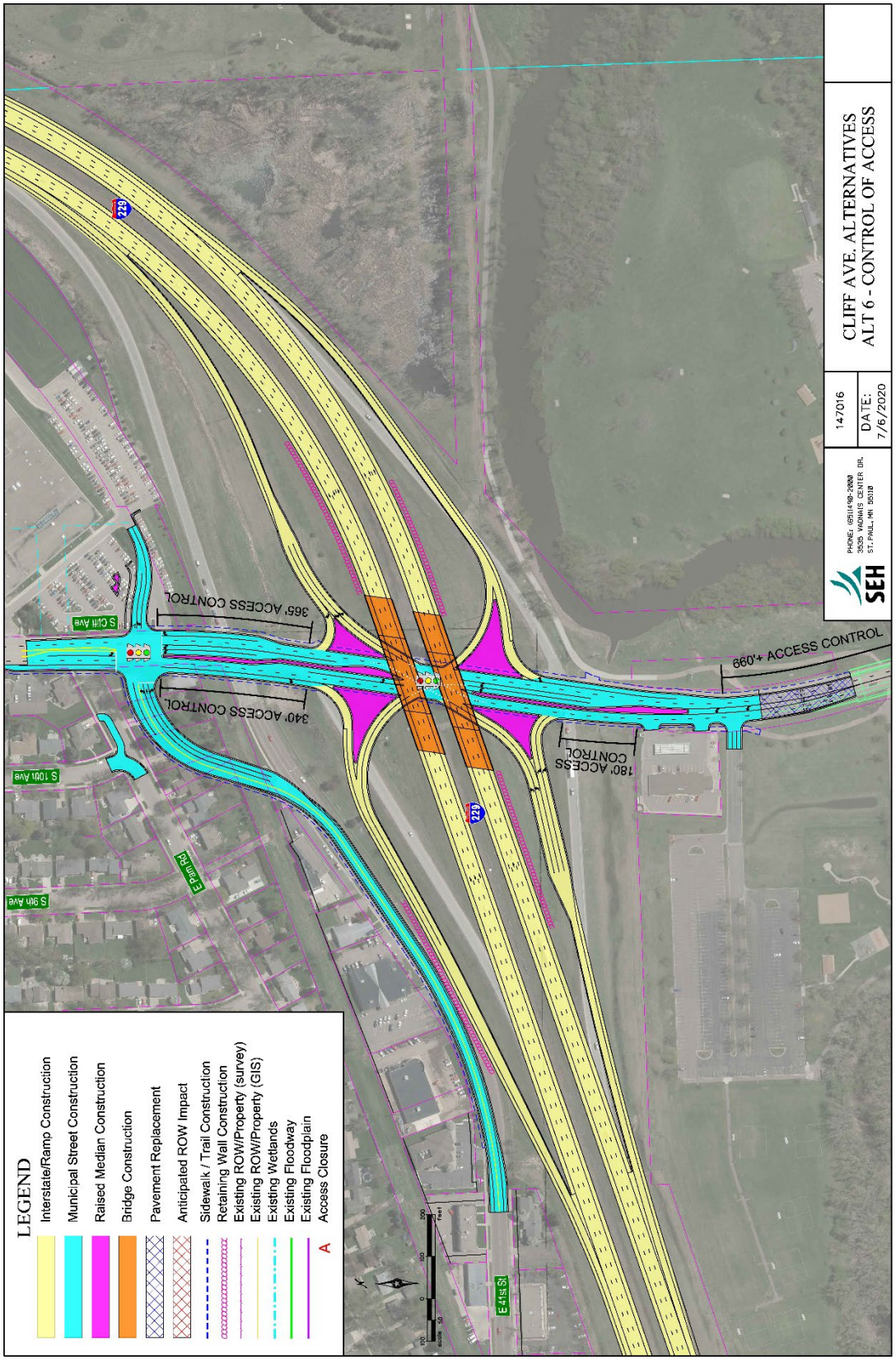
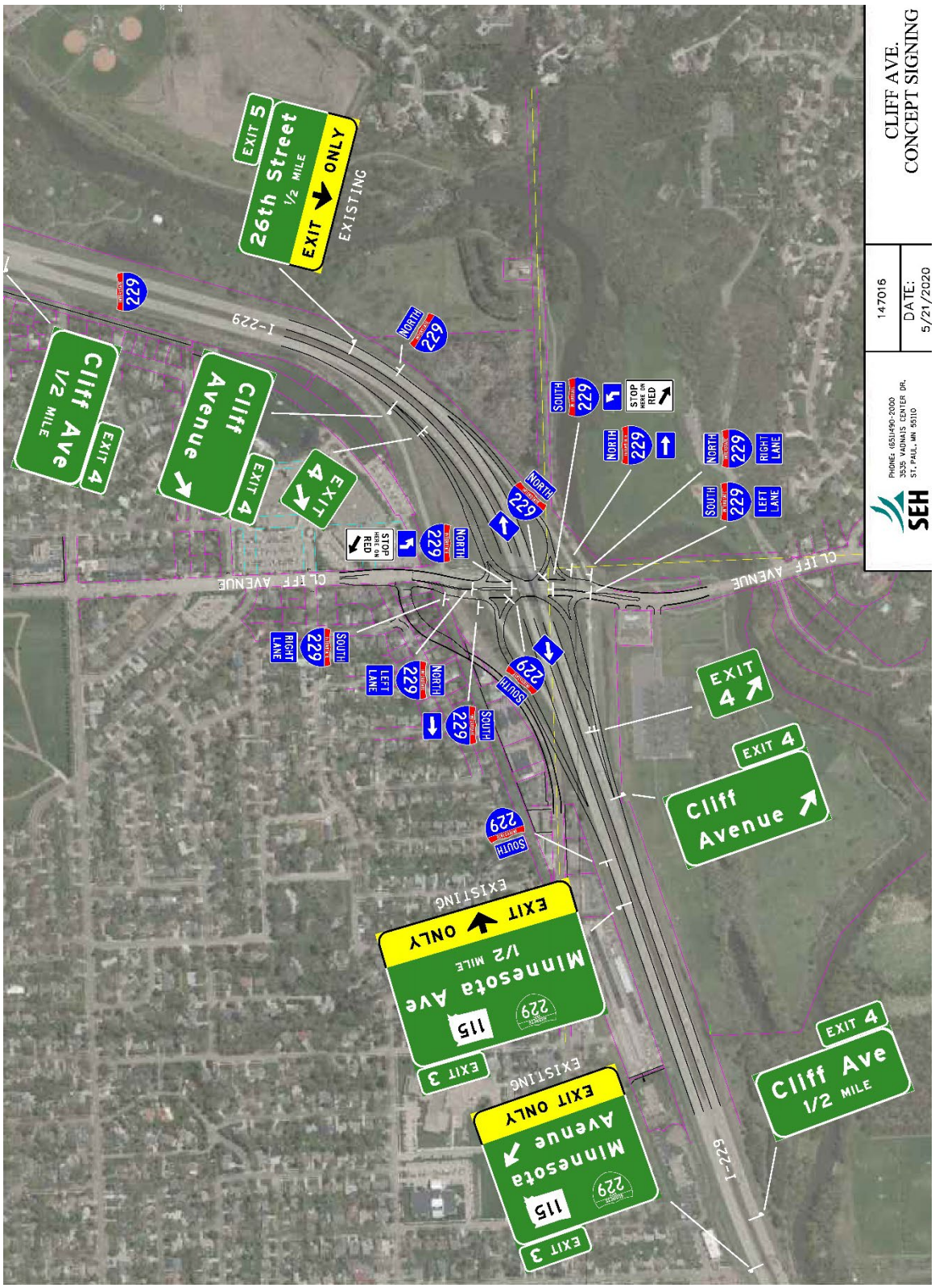


Figure 29 – Alternative 6 – Conceptual Signing Plan



9.2 Policy Number Two

The proposed access connects to a public road only and will provide for all traffic movements. Less than "full interchanges" may be considered on a case-by-case basis for applications requiring special access, such as managed lanes (e.g., transit or high occupancy vehicle and high occupancy toll lanes) or park and ride lots. The proposed access will be designed to meet or exceed current standards (23 CFR 625.2(a), 625.4(a)(2), and 655.603(d)). In rare instances where all basic movements are not provided by the proposed design, the report should include a full-interchange option with a comparison of the operational and safety analyses to the partial-interchange option. The report should also include the mitigation proposed to compensate for the missing movements, including wayfinding signage, impacts on local intersections, mitigation of driver expectation leading to wrong-way movements on ramps, etc. The report should describe whether future provision of a full interchange is precluded by the proposed design.

Upon completion, all connections associated with the project will connect to public roads, and will provide for all traffic movements. The design geometrics have been developed in accordance with SDDOT and FHWA design standards for interchanges.

Interstate Modification Justification Report – Appendix Materials

Contents Page:

Appendix A

Arterial Intersection Figures

FIGURE A1
2018 EXISTING CONDITIONS

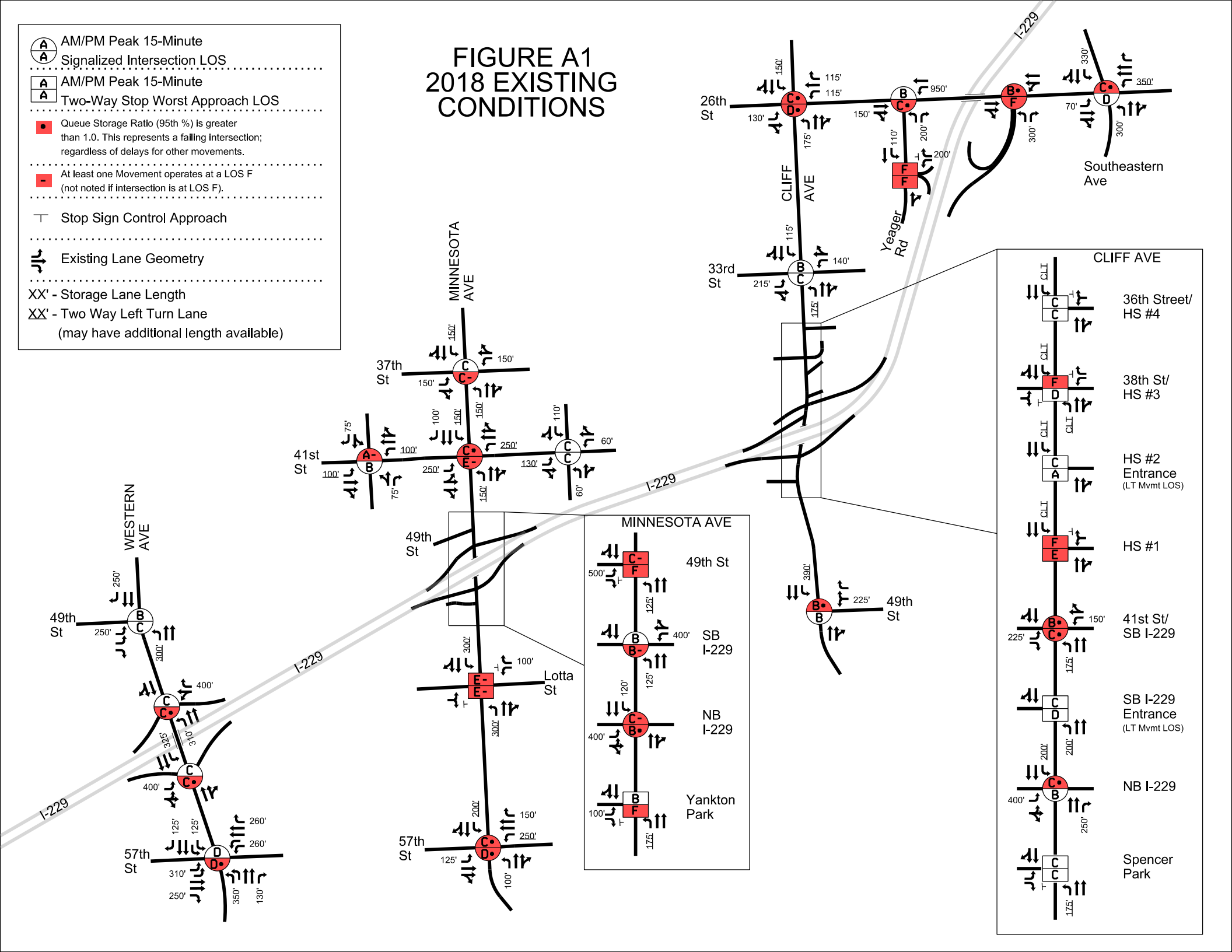


FIGURE A2
2050 NO BUILD CONDITIONS

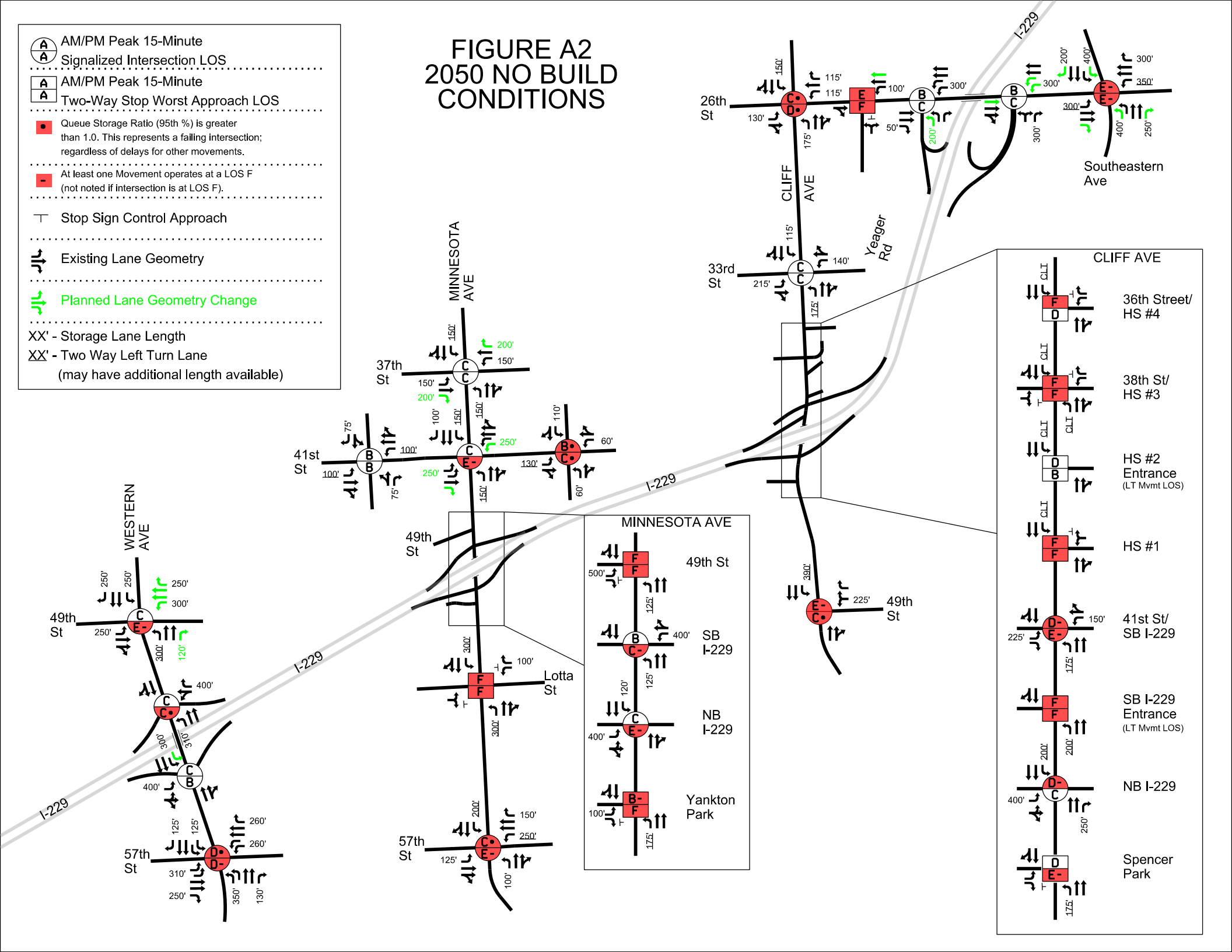


FIGURE A3
2050 PROPOSED BUILD CONDITIONS

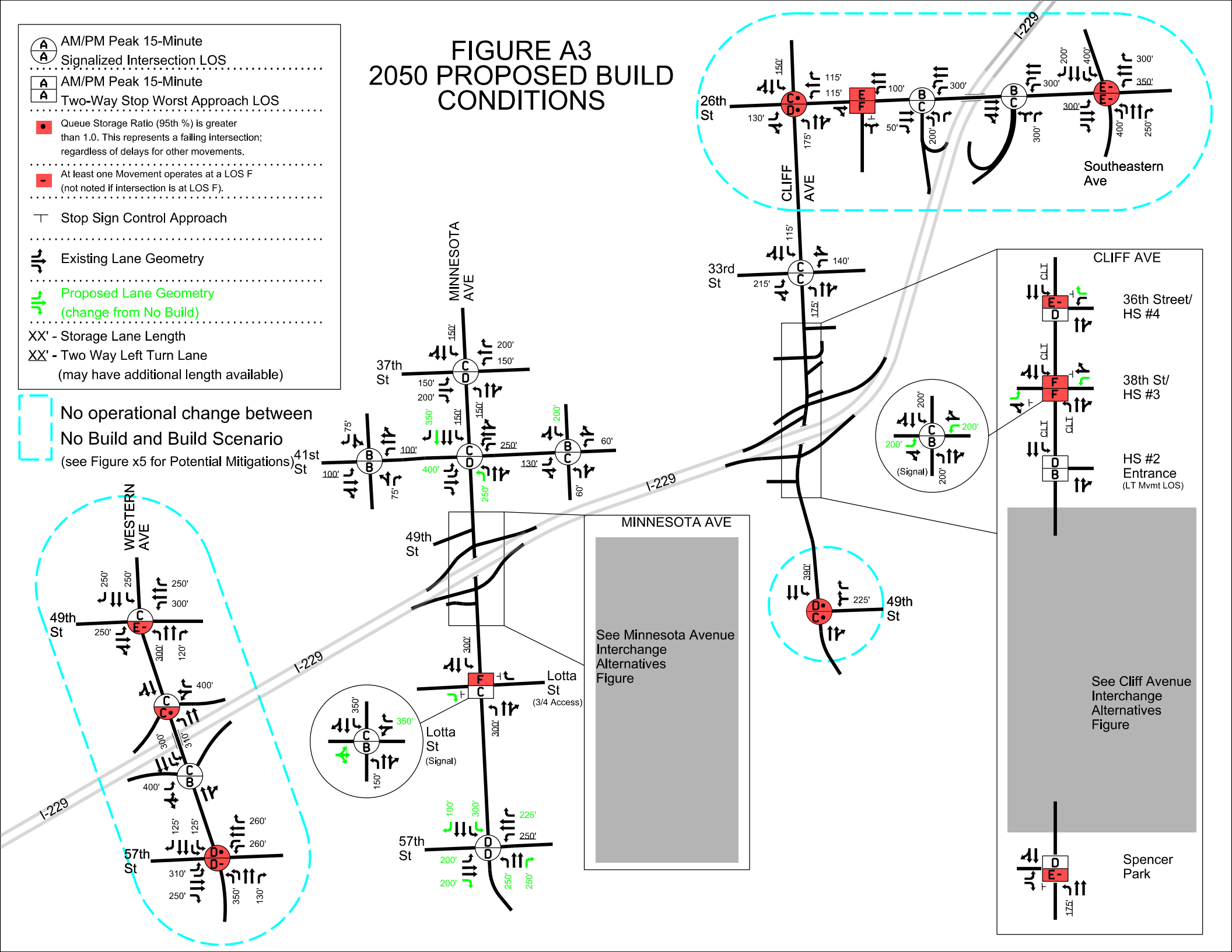


FIGURE A4
2050 PROPOSED CLIFF AVENUE ALTERNATIVES

AM/PM Peak 15-Minute Signalized Intersection LOS

AM/PM Peak 15-Minute Two-Way Stop Worst Approach LOS

Queue Storage Ratio (95th %) is greater than 1.0. This represents a failing intersection; regardless of delays for other movements.

At least one Movement operates at a LOS F (not noted if intersection is at LOS F).

Stop Sign Control Approach

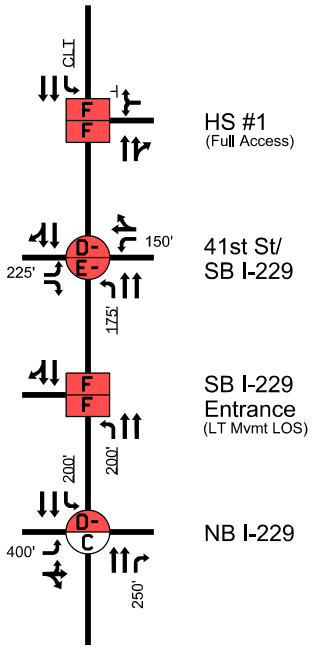
Existing Lane Geometry

Proposed Lane Geometry

XX' - Storage Lane Length

XX' - Two Way Left Turn Lane (may have additional length available)

NO BUILD



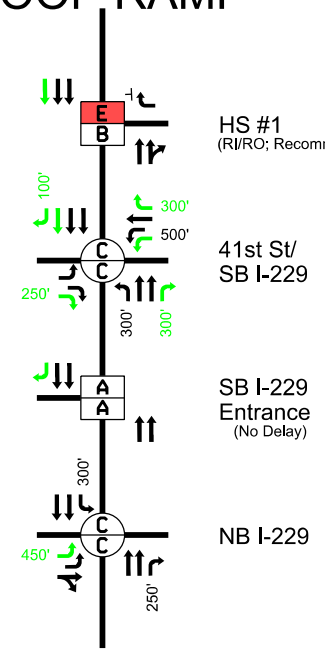
HS #1
(Full Access)

41st St/
SB I-229

SB I-229
Entrance
(LT Mvmt LOS)

NB I-229

ALT 1
LOOP RAMP



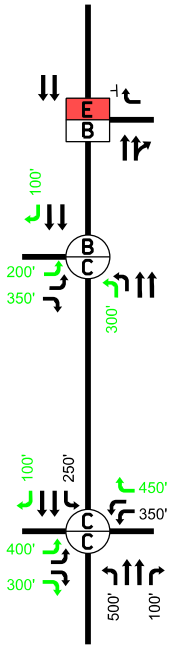
HS #1
(RI/RO; Recommend Closing)

41st St/
SB I-229

SB I-229
Entrance
(No Delay)

NB I-229

ALT 6
SPUI

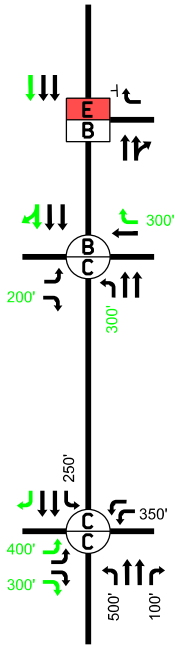


HS #1
(RI/RO; Recommend Closing)

41st St

NB/SB I-229
SPUI

ALT 7
MODIFIED SPUI



HS #1
(RI/RO; Recommend Closing)

41st St/
SB I-229

NB/SB I-229
SPUI

FIGURE A6
2035 NO BUILD CONDITIONS

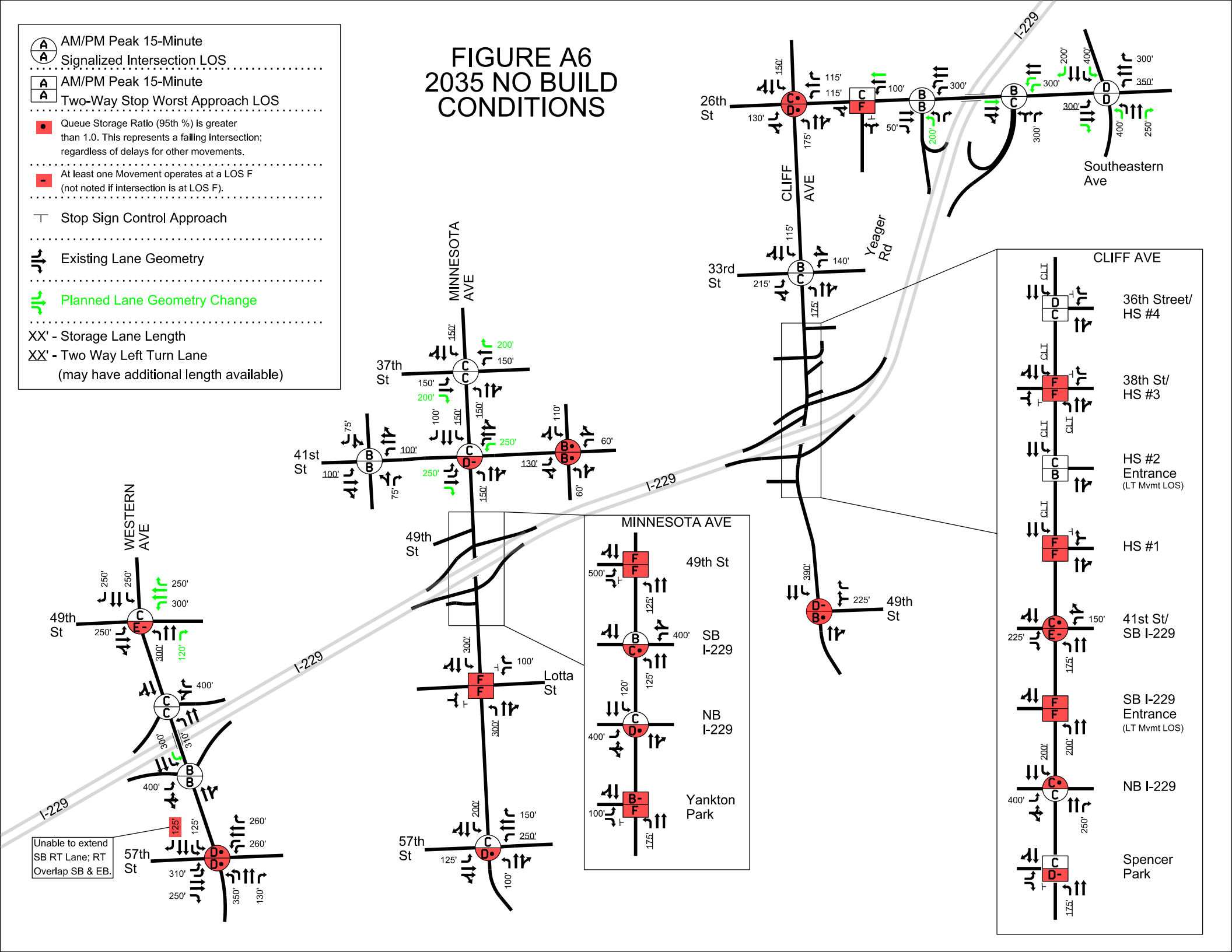


FIGURE A7
2035 PROPOSED BUILD CONDITIONS

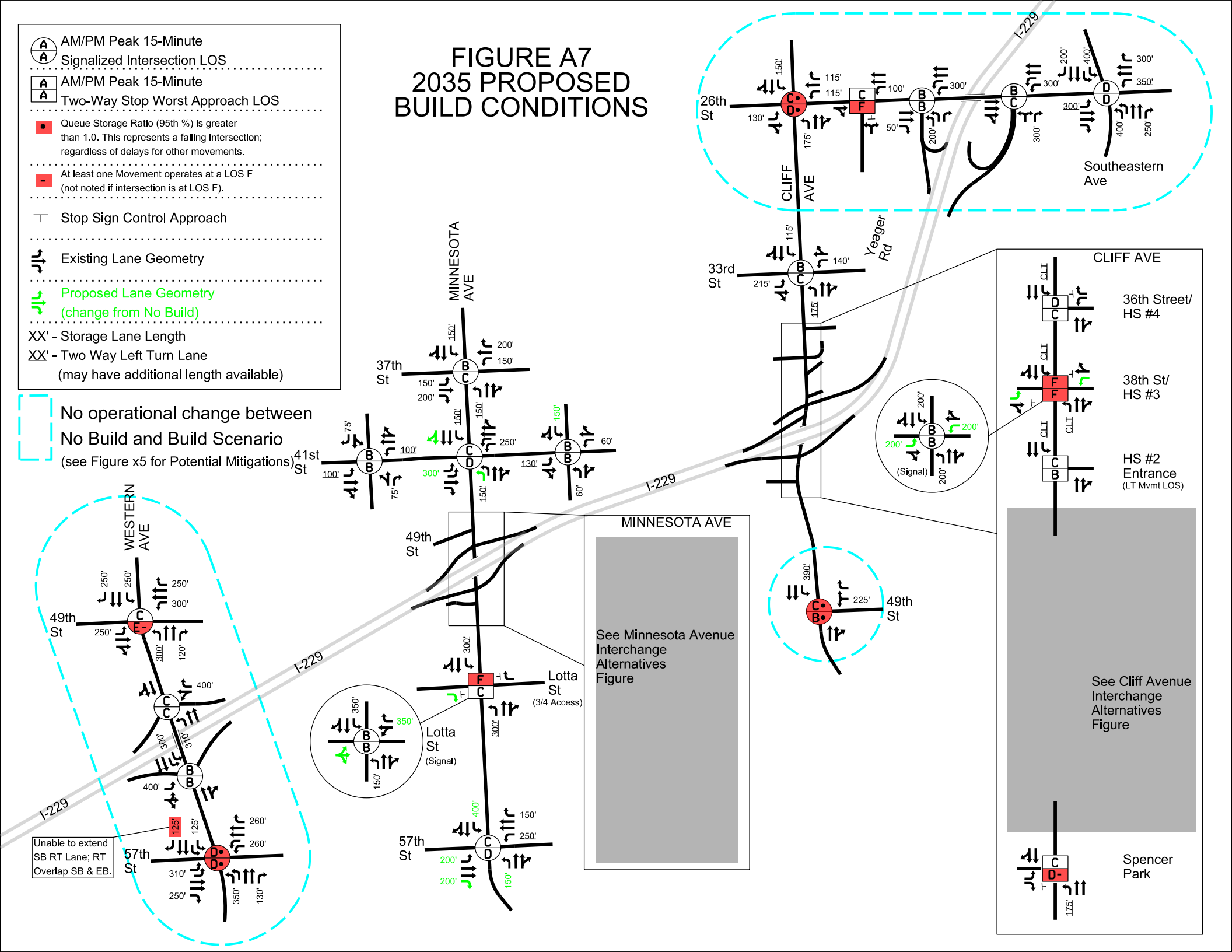


FIGURE A8
2035 PROPOSED
CLIFF AVENUE
ALTERNATIVES

AM/PM Peak 15-Minute Signalized Intersection LOS

AM/PM Peak 15-Minute Two-Way Stop Worst Approach LOS

Queue Storage Ratio (95th %) is greater than 1.0. This represents a failing intersection; regardless of delays for other movements.

At least one Movement operates at a LOS F (not noted if intersection is at LOS F).

Stop Sign Control Approach

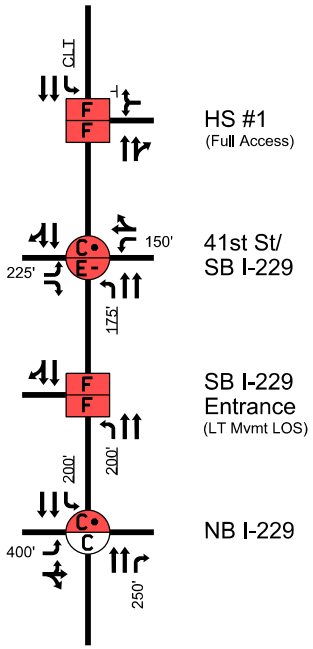
Existing Lane Geometry

Proposed Lane Geometry

XX' - Storage Lane Length

XX' - Two Way Left Turn Lane (may have additional length available)

NO BUILD



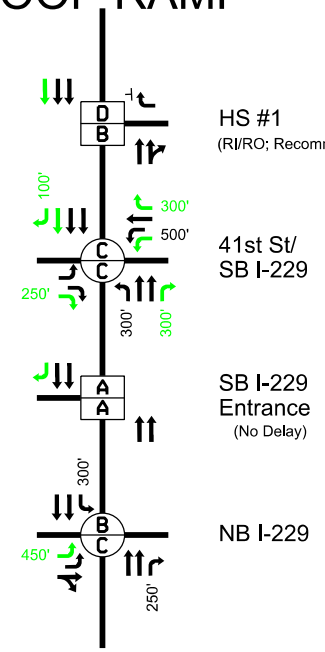
HS #1
(Full Access)

41st St/
SB I-229

SB I-229
Entrance
(LT Mvmt LOS)

NB I-229

ALT 1
LOOP RAMP



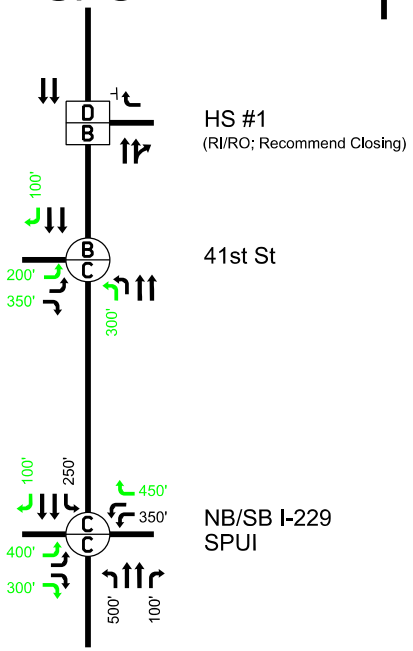
HS #1
(RI/RO; Recommend Closing)

41st St/
SB I-229

SB I-229
Entrance
(No Delay)

NB I-229

ALT 6
SPUI

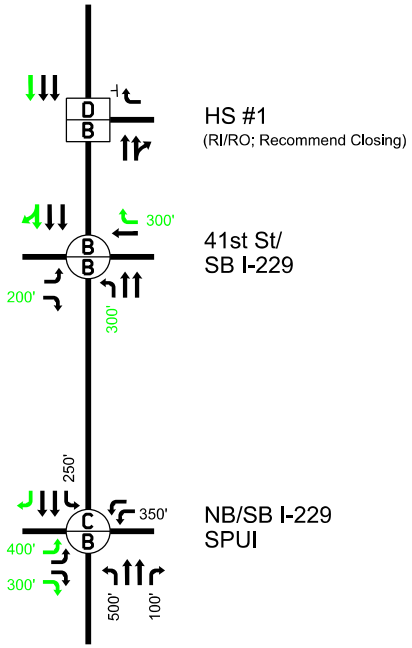


HS #1
(RI/RO; Recommend Closing)

41st St

NB/SB I-229
SPUI

ALT 7
MODIFIED SPUI

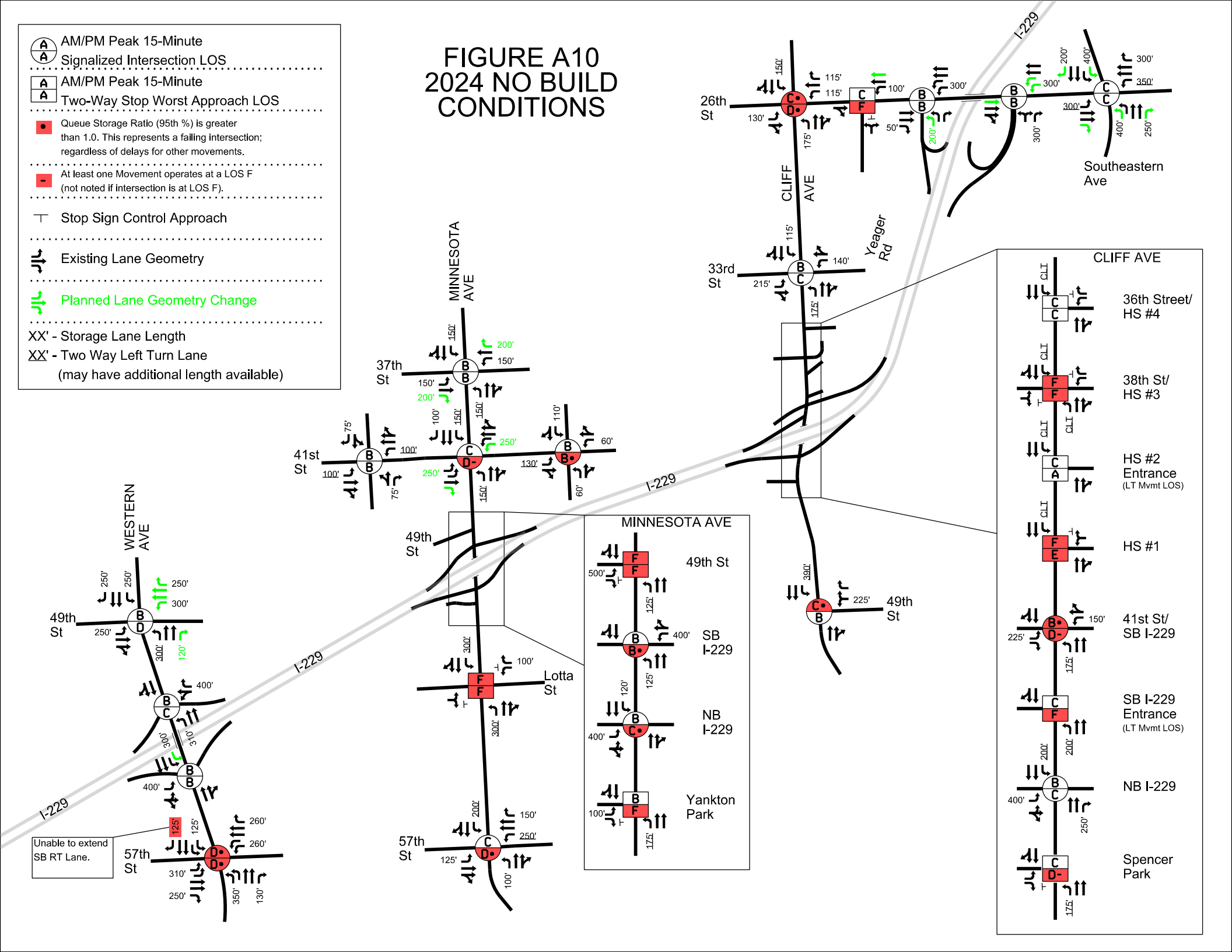


HS #1
(RI/RO; Recommend Closing)

41st St/
SB I-229

NB/SB I-229
SPUI

FIGURE A10
2024 NO BUILD CONDITIONS



FIUGURE A11
2024 PROPOSED BUILD CONDITIONS

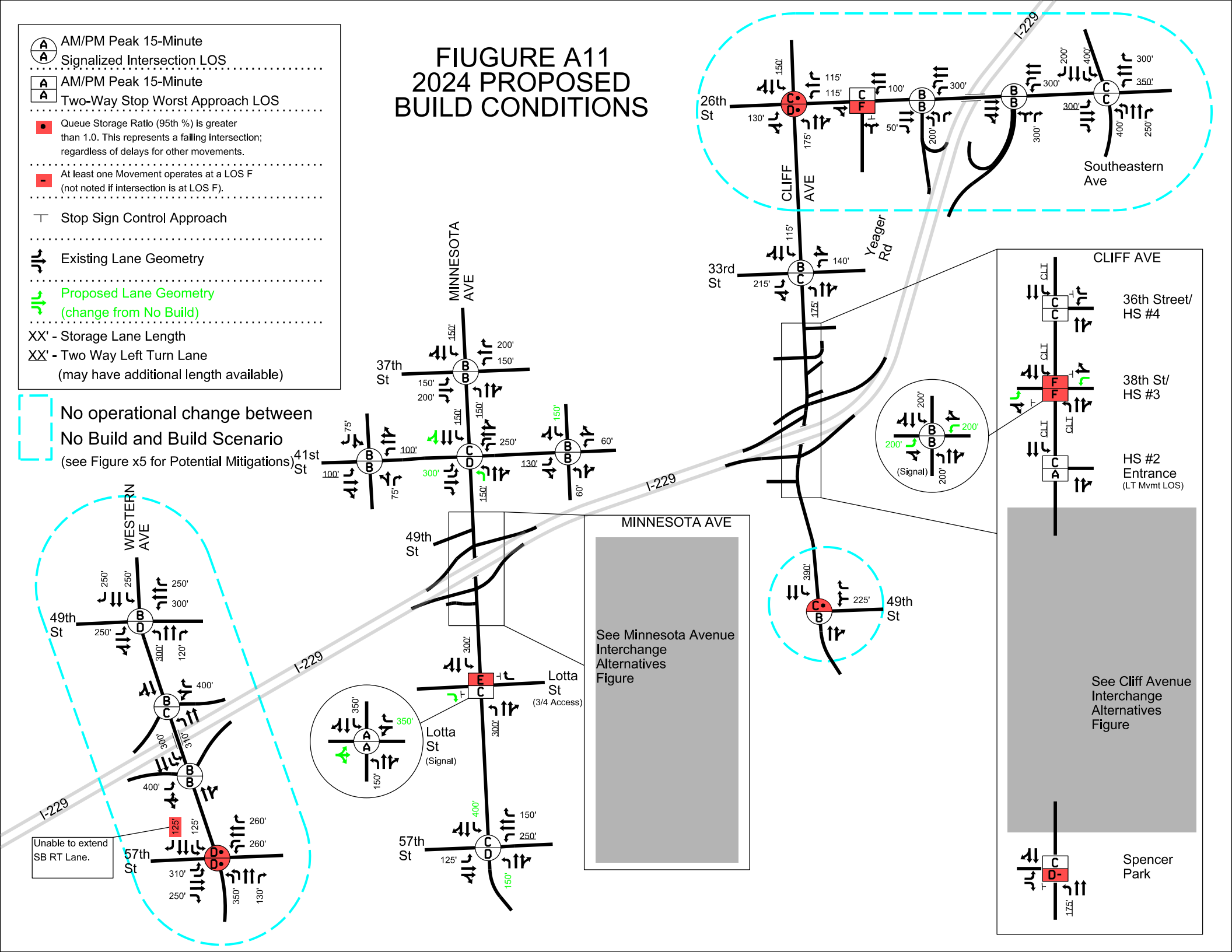


FIGURE A12
2024 PROPOSED
CLIFF AVENUE
ALTERNATIVES

AM/PM Peak 15-Minute Signalized Intersection LOS

AM/PM Peak 15-Minute Two-Way Stop Worst Approach LOS

Queue Storage Ratio (95th %) is greater than 1.0. This represents a failing intersection; regardless of delays for other movements.

At least one Movement operates at a LOS F (not noted if intersection is at LOS F).

Stop Sign Control Approach

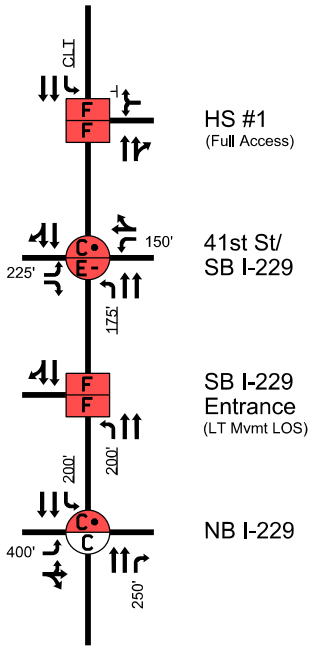
Existing Lane Geometry

Proposed Lane Geometry

XX' - Storage Lane Length

XX' - Two Way Left Turn Lane (may have additional length available)

NO BUILD



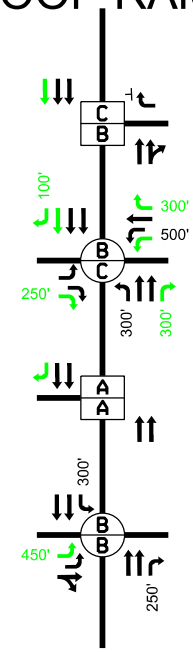
HS #1
(Full Access)

41st St/
SB I-229

SB I-229
Entrance
(LT Mvmt LOS)

NB I-229

ALT 1
LOOP RAMP



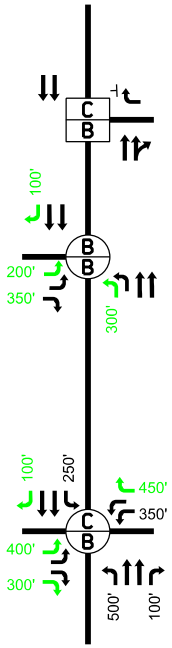
HS #1
(RI/RO; Recommend Closing)

41st St/
SB I-229

SB I-229
Entrance
(No Delay)

NB I-229

ALT 6
SPUI

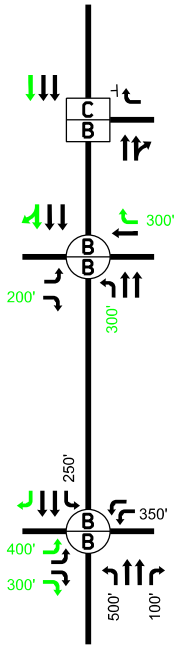


HS #1
(RI/RO; Recommend Closing)

41st St

NB/SB I-229
SPUI

ALT 7
MODIFIED SPUI



HS #1
(RI/RO; Recommend Closing)

41st St/
SB I-229

NB/SB I-229
SPUI

Appendix B

HCS Analysis Summary – 2018 Existing Conditions

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/5/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - west of Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2785	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.83	Flow Rate (V_p), pc/h/ln	1186
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.51
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/5/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - west of Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2172	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.93	Flow Rate (V_p), pc/h/ln	809
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.35
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	13.1
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/5/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - between Western Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2333	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.84	Flow Rate (V_p), pc/h/ln	1472
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.64
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	23.8
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/5/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - between Western Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	1835	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.91	Flow Rate (V_p), pc/h/ln	1048
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.45
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	17.0
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/5/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - between Western and Minnesota		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2772	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.84	Flow Rate (V_p), pc/h/ln	1166
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.50
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	18.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/5/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - between Western and Minnesota		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2635	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.93	Flow Rate (V_p), pc/h/ln	982
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.42
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	15.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	11/6/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - Western to Minnesota		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2860	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1966	351	88	367
Peak Hour Factor (PHF)	0.84	0.84	0.84	0.81
Total Trucks, %	6.00	6.00	6.00	6.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.943	0.943	0.943	0.943
Flow Rate (v_i), pc/h	2482	443	111	480
Weaving Flow Rate (v_w), pc/h	923	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2593	Density-Based Capacity (c_{IWL}), pc/h/ln		2172
Total Flow Rate (v), pc/h	3516	Demand Flow-Based Capacity (c_{IW}), pc/h		9125
Volume Ratio (VR)	0.263	Weaving Segment Capacity (c_W), veh/h		6145
Minimum Lane Change Rate (LC_{MIN}), lc/h	923	Adjusted Weaving Area Capacity, pc/h		6516
Maximum Weaving Length (L_{MAX}), ft	5190	Volume-to-Capacity Ratio (v/c)		0.54

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	742	Average Weaving Speed (S_W),mi/h	56.1
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1506	Average Non-Weaving Speed (S_{NW}), mi/h	52.7
Weaving Lane Change Rate (LC_W), lc/h	1232	Average Speed (S), mi/h	53.6
Weaving Lane Change Rate (LC_{All}), lc/h	2738	Density (D), pc/mi/ln	21.9
Weaving Intensity Factor (W)	0.218	Level of Service (LOS)	C

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	11/6/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - Western to Minnesota		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2860	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1539	656	144	296
Peak Hour Factor (PHF)	0.91	0.86	0.86	0.97
Total Trucks, %	4.00	4.00	4.00	4.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.962	0.962	0.962	0.962
Flow Rate (v_i), pc/h	1758	793	174	317
Weaving Flow Rate (v_w), pc/h	1110	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	1932	Density-Based Capacity (c_{IWL}), pc/h/ln		2087
Total Flow Rate (v), pc/h	3042	Demand Flow-Based Capacity (c_{IW}), pc/h		6575
Volume Ratio (VR)	0.365	Weaving Segment Capacity (c_W), veh/h		6023
Minimum Lane Change Rate (LC_{MIN}), lc/h	1110	Adjusted Weaving Area Capacity, pc/h		6261
Maximum Weaving Length (L_{MAX}), ft	6292	Volume-to-Capacity Ratio (v/c)		0.49

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	553	Average Weaving Speed (S_W),mi/h	55.9
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1370	Average Non-Weaving Speed (S_{NW}), mi/h	52.1
Weaving Lane Change Rate (LC_W), lc/h	1419	Average Speed (S), mi/h	53.4
Weaving Lane Change Rate (LC_{All}), lc/h	2789	Density (D), pc/mi/ln	19.0
Weaving Intensity Factor (W)	0.222	Level of Service (LOS)	B

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/5/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - between Minnesota Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2317	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.85	Flow Rate (V_p), pc/h/ln	1446
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.62
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	23.4
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/5/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - between Minnesota Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2195	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.93	Flow Rate (V_p), pc/h/ln	1226
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.53
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.8
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/5/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - between Minnesota and Cliff		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2633	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.87	Flow Rate (V_p), pc/h/ln	1070
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.46
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	17.3
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/5/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - between Minnesota and Cliff		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2702	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.92	Flow Rate (V_p), pc/h/ln	1018
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.44
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	16.5
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	11/6/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - Minnesota to Cliff		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	3120	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1729	253	63	588
Peak Hour Factor (PHF)	0.85	0.88	0.88	0.79
Total Trucks, %	6.00	6.00	6.00	6.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.943	0.943	0.943	0.943
Flow Rate (v_i), pc/h	2157	305	76	789
Weaving Flow Rate (v_w), pc/h	1094	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2233	Density-Based Capacity (c_{IWL}), pc/h/ln		2138
Total Flow Rate (v), pc/h	3327	Demand Flow-Based Capacity (c_{IW}), pc/h		7295
Volume Ratio (VR)	0.329	Weaving Segment Capacity (c_W), veh/h		6048
Minimum Lane Change Rate (LC_{MIN}), lc/h	1094	Adjusted Weaving Area Capacity, pc/h		6414
Maximum Weaving Length (L_{MAX}), ft	5897	Volume-to-Capacity Ratio (v/c)		0.52

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	697	Average Weaving Speed (S_W),mi/h	56.0
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1573	Average Non-Weaving Speed (S_{NW}), mi/h	51.8
Weaving Lane Change Rate (LC_W), lc/h	1419	Average Speed (S), mi/h	53.1
Weaving Lane Change Rate (LC_{All}), lc/h	2992	Density (D), pc/mi/ln	20.9
Weaving Intensity Factor (W)	0.219	Level of Service (LOS)	C

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	11/6/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - Minnesota to Cliff		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	3120	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1654	416	91	541
Peak Hour Factor (PHF)	0.93	0.91	0.91	0.84
Total Trucks, %	4.00	4.00	4.00	4.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.962	0.962	0.962	0.962
Flow Rate (v_i), pc/h	1849	475	104	669
Weaving Flow Rate (v_w), pc/h	1144	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	1953	Density-Based Capacity (c_{IWL}), pc/h/ln		2104
Total Flow Rate (v), pc/h	3097	Demand Flow-Based Capacity (c_{IW}), pc/h		6504
Volume Ratio (VR)	0.369	Weaving Segment Capacity (c_W), veh/h		6072
Minimum Lane Change Rate (LC_{MIN}), lc/h	1144	Adjusted Weaving Area Capacity, pc/h		6312
Maximum Weaving Length (L_{MAX}), ft	6336	Volume-to-Capacity Ratio (v/c)		0.49

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	609	Average Weaving Speed (S_W),mi/h	56.1
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1516	Average Non-Weaving Speed (S_{NW}), mi/h	51.8
Weaving Lane Change Rate (LC_W), lc/h	1469	Average Speed (S), mi/h	53.3
Weaving Lane Change Rate (LC_{All}), lc/h	2985	Density (D), pc/mi/ln	19.4
Weaving Intensity Factor (W)	0.218	Level of Service (LOS)	B

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/5/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - between Cliff Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	1982	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.88	Flow Rate (V_p), pc/h/ln	1194
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.52
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.3
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/5/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - between Cliff Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2070	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.93	Flow Rate (V_p), pc/h/ln	1157
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.50
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	18.7
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/5/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - between Cliff and 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2495	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.86	Flow Rate (V_p), pc/h/ln	1026
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.44
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	16.6
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/5/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - between Cliff and 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2364	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.91	Flow Rate (V_p), pc/h/ln	900
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.39
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	14.6
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	11/6/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - Cliff to 26th		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2750	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1535	457	56	447
Peak Hour Factor (PHF)	0.88	0.78	0.78	0.86
Total Trucks, %	6.00	6.00	6.00	6.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.943	0.943	0.943	0.943
Flow Rate (v_i), pc/h	1850	621	76	551
Weaving Flow Rate (v_w), pc/h	1172	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	1926	Density-Based Capacity (c_{IWL}), pc/h/ln		2068
Total Flow Rate (v), pc/h	3098	Demand Flow-Based Capacity (c_{IW}), pc/h		6349
Volume Ratio (VR)	0.378	Weaving Segment Capacity (c_W), veh/h		5850
Minimum Lane Change Rate (LC_{MIN}), lc/h	1172	Adjusted Weaving Area Capacity, pc/h		6204
Maximum Weaving Length (L_{MAX}), ft	6436	Volume-to-Capacity Ratio (v/c)		0.50

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	530	Average Weaving Speed (S_W),mi/h	55.7
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1309	Average Non-Weaving Speed (S_{NW}), mi/h	51.6
Weaving Lane Change Rate (LC_W), lc/h	1474	Average Speed (S), mi/h	53.1
Weaving Lane Change Rate (LC_{All}), lc/h	2783	Density (D), pc/mi/ln	19.4
Weaving Intensity Factor (W)	0.228	Level of Service (LOS)	B

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	11/6/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - Cliff to 26th		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2750	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1374	215	79	696
Peak Hour Factor (PHF)	0.93	0.84	0.84	0.89
Total Trucks, %	4.00	4.00	4.00	4.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.962	0.962	0.962	0.962
Flow Rate (v_i), pc/h	1536	266	98	813
Weaving Flow Rate (v_w), pc/h	1079	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	1634	Density-Based Capacity (c_{IWL}), pc/h/ln		2051
Total Flow Rate (v), pc/h	2713	Demand Flow-Based Capacity (c_{IW}), pc/h		6030
Volume Ratio (VR)	0.398	Weaving Segment Capacity (c_W), veh/h		5801
Minimum Lane Change Rate (LC_{MIN}), lc/h	1079	Adjusted Weaving Area Capacity, pc/h		6030
Maximum Weaving Length (L_{MAX}), ft	6659	Volume-to-Capacity Ratio (v/c)		0.45

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	449	Average Weaving Speed (S_W),mi/h	56.1
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1249	Average Non-Weaving Speed (S_{NW}), mi/h	52.9
Weaving Lane Change Rate (LC_W), lc/h	1381	Average Speed (S), mi/h	54.1
Weaving Lane Change Rate (LC_{All}), lc/h	2630	Density (D), pc/mi/ln	16.7
Weaving Intensity Factor (W)	0.218	Level of Service (LOS)	B

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/5/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - between 26th Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	1992	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.85	Flow Rate (V_p), pc/h/ln	1242
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.54
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	20.1
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/5/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - between 26th Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	1589	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.88	Flow Rate (V_p), pc/h/ln	938
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.40
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	15.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	11/6/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - Exit 5 Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	65.0	25.0
Segment Length (L) / Acceleration Length (LA),ft	1500	950
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	1992	405
Peak Hour Factor (PHF)	0.85	0.82
Total Trucks, %	6.00	6.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.943	0.943
Flow Rate (vi),pc/h	2485	524
Capacity (c), pc/h	4700	1900
Volume-to-Capacity Ratio (v/c)	0.64	0.28

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Density in Ramp Influence Area (DR), pc/mi/ln	22.8
Distance to Upstream Ramp (LUP), ft	-	Speed Index (M)	0.353
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	56.9
Prop. Freeway Vehicles in Lane 1 and 2 (PM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	-
Flow in Lanes 1 and 2 (v12), pc/h	2485	Ramp Junction Speed (S), mi/h	56.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	3009	Average Density (D), pc/mi/ln	26.4
Level of Service (LOS)	C		

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	11/6/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - Exit 5 Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	65.0	25.0
Segment Length (L) / Acceleration Length (LA),ft	1500	950
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	1589	194
Peak Hour Factor (PHF)	0.88	0.69
Total Trucks, %	6.00	6.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.943	0.943
Flow Rate (vi),pc/h	1915	298
Capacity (c), pc/h	4700	1900
Volume-to-Capacity Ratio (v/c)	0.47	0.16

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Density in Ramp Influence Area (DR), pc/mi/ln	16.7
Distance to Upstream Ramp (LUP), ft	-	Speed Index (M)	0.309
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	57.9
Prop. Freeway Vehicles in Lane 1 and 2 (PM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	-
Flow in Lanes 1 and 2 (v12), pc/h	1915	Ramp Junction Speed (S), mi/h	57.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	2213	Average Density (D), pc/mi/ln	19.1
Level of Service (LOS)	B		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/5/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - north of 26th		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2397	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.84	Flow Rate (V_p), pc/h/ln	1513
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.65
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	24.5
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/5/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - north of 26th		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	1783	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.89	Flow Rate (V_p), pc/h/ln	1042
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.45
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	16.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/6/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - north of 26th		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2113	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.78	Flow Rate (V_p), pc/h/ln	1423
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.61
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	23.0
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/6/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - north of 26th		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2758	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1578
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.68
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	25.5
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Diverge Report

Project Information			
Analyst	Graham Johnson, PE	Date	11/6/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - Exit 5		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	65.0	25.0
Segment Length (L) / Deceleration Length (LA),ft	1500	420
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	2113	315
Peak Hour Factor (PHF)	0.78	0.86
Total Trucks, %	5.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.952
Flow Rate (vi),pc/h	2846	385
Capacity (c), pc/h	4700	1900
Volume-to-Capacity Ratio (v/c)	0.61	0.20

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Density in Ramp Influence Area (DR), pc/mi/ln	24.9
Distance to Upstream Ramp (LUP), ft	-	Speed Index (D)	0.593
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influenece Area Speed (SR), mi/h	51.4
Prop. Freeway Vehicles in Lane 1 and 2 (PD)	1.000	Outer Lanes Freeway Speed (SO), mi/h	-
Flow in Lanes 1 and 2 (v12), pc/h	2846	Ramp Junction Speed (S), mi/h	51.4
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	27.7
Level of Service (LOS)	C		

HCS7 Freeway Diverge Report

Project Information			
Analyst	Graham Johnson, PE	Date	11/6/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - Exit 5		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	65.0	25.0
Segment Length (L) / Deceleration Length (LA),ft	1500	420
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	2758	556
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3156	636
Capacity (c), pc/h	4700	1900
Volume-to-Capacity Ratio (v/c)	0.67	0.33

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Density in Ramp Influence Area (DR), pc/mi/ln	27.6
Distance to Upstream Ramp (LUP), ft	-	Speed Index (D)	0.615
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influenece Area Speed (SR), mi/h	50.9
Prop. Freeway Vehicles in Lane 1 and 2 (PD)	1.000	Outer Lanes Freeway Speed (SO), mi/h	-
Flow in Lanes 1 and 2 (v12), pc/h	3156	Ramp Junction Speed (S), mi/h	50.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	31.0
Level of Service (LOS)	C		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/6/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - between 26th Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	1798	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.76	Flow Rate (V_p), pc/h/ln	1242
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.54
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	20.1
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/6/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - between 26th Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2202	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1260
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.54
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	20.4
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/6/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - between 26th and Cliff		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2507	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.81	Flow Rate (V_p), pc/h/ln	1084
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.47
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	17.5
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/6/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - between 26th and Cliff		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2782	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.92	Flow Rate (V_p), pc/h/ln	1038
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.45
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	16.8
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	11/6/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - 26th to Cliff		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2670	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1586	603	106	212
Peak Hour Factor (PHF)	0.76	0.90	0.90	0.76
Total Trucks, %	5.00	5.00	5.00	5.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.952	0.952	0.952	0.952
Flow Rate (v_i), pc/h	2192	704	124	293
Weaving Flow Rate (v_w), pc/h	997	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2316	Density-Based Capacity (c_{IWL}), pc/h/ln		2126
Total Flow Rate (v), pc/h	3313	Demand Flow-Based Capacity (c_{IW}), pc/h		7973
Volume Ratio (VR)	0.301	Weaving Segment Capacity (c_W), veh/h		6072
Minimum Lane Change Rate (LC_{MIN}), lc/h	997	Adjusted Weaving Area Capacity, pc/h		6378
Maximum Weaving Length (L_{MAX}), ft	5595	Volume-to-Capacity Ratio (v/c)		0.52

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	618	Average Weaving Speed (S_W),mi/h	55.8
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1346	Average Non-Weaving Speed (S_{NW}), mi/h	52.5
Weaving Lane Change Rate (LC_W), lc/h	1295	Average Speed (S), mi/h	53.5
Weaving Lane Change Rate (LC_{All}), lc/h	2641	Density (D), pc/mi/ln	20.6
Weaving Intensity Factor (W)	0.224	Level of Service (LOS)	C

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	11/6/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - 26th to Cliff		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2670	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1826	470	110	376
Peak Hour Factor (PHF)	0.90	0.88	0.88	0.82
Total Trucks, %	3.00	3.00	3.00	3.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.971	0.971	0.971	0.971
Flow Rate (v_i), pc/h	2089	550	129	472
Weaving Flow Rate (v_w), pc/h	1022	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2218	Density-Based Capacity (c_{IWL}), pc/h/ln		2115
Total Flow Rate (v), pc/h	3240	Demand Flow-Based Capacity (c_{IW}), pc/h		7619
Volume Ratio (VR)	0.315	Weaving Segment Capacity (c_W), veh/h		6161
Minimum Lane Change Rate (LC_{MIN}), lc/h	1022	Adjusted Weaving Area Capacity, pc/h		6345
Maximum Weaving Length (L_{MAX}), ft	5745	Volume-to-Capacity Ratio (v/c)		0.51

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	592	Average Weaving Speed (S_W),mi/h	55.8
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1326	Average Non-Weaving Speed (S_{NW}), mi/h	52.5
Weaving Lane Change Rate (LC_W), lc/h	1320	Average Speed (S), mi/h	53.5
Weaving Lane Change Rate (LC_{All}), lc/h	2646	Density (D), pc/mi/ln	20.2
Weaving Intensity Factor (W)	0.224	Level of Service (LOS)	C

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/6/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - between Cliff Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2189	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.82	Flow Rate (V_p), pc/h/ln	1402
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.60
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	22.7
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/6/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - between Cliff Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2296	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1314
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.57
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	21.3
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/6/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - between Cliff and Minnesota		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2777	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.85	Flow Rate (V_p), pc/h/ln	1144
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.49
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	18.5
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/6/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - between Cliff and Minnesota		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2940	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.92	Flow Rate (V_p), pc/h/ln	1097
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.47
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	17.8
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	11/6/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - Cliff to Minnesota		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	3100	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1936	470	118	253
Peak Hour Factor (PHF)	0.82	0.97	0.97	0.74
Total Trucks, %	5.00	5.00	5.00	5.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.952	0.952	0.952	0.952
Flow Rate (v_i), pc/h	2480	509	128	359
Weaving Flow Rate (v_w), pc/h	868	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2608	Density-Based Capacity (c_{IWL}), pc/h/ln		2201
Total Flow Rate (v), pc/h	3476	Demand Flow-Based Capacity (c_{IW}), pc/h		9600
Volume Ratio (VR)	0.250	Weaving Segment Capacity (c_W), veh/h		6286
Minimum Lane Change Rate (LC_{MIN}), lc/h	868	Adjusted Weaving Area Capacity, pc/h		6603
Maximum Weaving Length (L_{MAX}), ft	5054	Volume-to-Capacity Ratio (v/c)		0.53

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	808	Average Weaving Speed (S_W),mi/h	56.3
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1640	Average Non-Weaving Speed (S_{NW}), mi/h	53.2
Weaving Lane Change Rate (LC_W), lc/h	1191	Average Speed (S), mi/h	53.9
Weaving Lane Change Rate (LC_{All}), lc/h	2831	Density (D), pc/mi/ln	21.5
Weaving Intensity Factor (W)	0.210	Level of Service (LOS)	C

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	11/6/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - Cliff to Minnesota		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	3100	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1983	489	155	313
Peak Hour Factor (PHF)	0.90	0.91	0.91	0.94
Total Trucks, %	3.00	3.00	3.00	3.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.971	0.971	0.971	0.971
Flow Rate (v_i), pc/h	2269	553	175	343
Weaving Flow Rate (v_w), pc/h	896	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2444	Density-Based Capacity (c_{IWL}), pc/h/ln		2186
Total Flow Rate (v), pc/h	3340	Demand Flow-Based Capacity (c_{IW}), pc/h		8955
Volume Ratio (VR)	0.268	Weaving Segment Capacity (c_W), veh/h		6368
Minimum Lane Change Rate (LC_{MIN}), lc/h	896	Adjusted Weaving Area Capacity, pc/h		6558
Maximum Weaving Length (L_{MAX}), ft	5243	Volume-to-Capacity Ratio (v/c)		0.51

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	758	Average Weaving Speed (S_W),mi/h	56.3
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1606	Average Non-Weaving Speed (S_{NW}), mi/h	53.2
Weaving Lane Change Rate (LC_W), lc/h	1219	Average Speed (S), mi/h	54.0
Weaving Lane Change Rate (LC_{All}), lc/h	2825	Density (D), pc/mi/ln	20.6
Weaving Intensity Factor (W)	0.210	Level of Service (LOS)	C

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/6/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - between Minnesota Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2406	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.87	Flow Rate (V_p), pc/h/ln	1452
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.63
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	23.5
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/6/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - between Minnesota Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2472	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1414
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.61
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	22.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/6/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - between Minnesota and Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2780	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.88	Flow Rate (V_p), pc/h/ln	1106
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.48
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	17.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/6/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - between Minnesota and Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3125	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.91	Flow Rate (V_p), pc/h/ln	1179
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.51
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.1
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	11/6/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - Minnesota to Western		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	3220	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1778	254	120	628
Peak Hour Factor (PHF)	0.87	0.87	0.87	0.81
Total Trucks, %	5.00	5.00	5.00	5.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.952	0.952	0.952	0.952
Flow Rate (v_i), pc/h	2147	307	145	814
Weaving Flow Rate (v_w), pc/h	1121	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2292	Density-Based Capacity (c_{IWL}), pc/h/ln		2146
Total Flow Rate (v), pc/h	3413	Demand Flow-Based Capacity (c_{IW}), pc/h		7317
Volume Ratio (VR)	0.328	Weaving Segment Capacity (c_W), veh/h		6129
Minimum Lane Change Rate (LC_{MIN}), lc/h	1121	Adjusted Weaving Area Capacity, pc/h		6438
Maximum Weaving Length (L_{MAX}), ft	5886	Volume-to-Capacity Ratio (v/c)		0.53

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	738	Average Weaving Speed (S_W),mi/h	56.0
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1640	Average Non-Weaving Speed (S_{NW}), mi/h	51.5
Weaving Lane Change Rate (LC_W), lc/h	1451	Average Speed (S), mi/h	52.9
Weaving Lane Change Rate (LC_{All}), lc/h	3091	Density (D), pc/mi/ln	21.5
Weaving Intensity Factor (W)	0.219	Level of Service (LOS)	C

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	11/6/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - Minnesota to Western		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	3220	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1887	457	196	585
Peak Hour Factor (PHF)	0.90	0.81	0.81	0.93
Total Trucks, %	3.00	3.00	3.00	3.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.971	0.971	0.971	0.971
Flow Rate (v_i), pc/h	2159	581	249	648
Weaving Flow Rate (v_w), pc/h	1229	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2408	Density-Based Capacity (c_{IWL}), pc/h/ln		2138
Total Flow Rate (v), pc/h	3637	Demand Flow-Based Capacity (c_{IW}), pc/h		7101
Volume Ratio (VR)	0.338	Weaving Segment Capacity (c_W), veh/h		6228
Minimum Lane Change Rate (LC_{MIN}), lc/h	1229	Adjusted Weaving Area Capacity, pc/h		6414
Maximum Weaving Length (L_{MAX}), ft	5995	Volume-to-Capacity Ratio (v/c)		0.57

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	775	Average Weaving Speed (S_W),mi/h	55.8
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1663	Average Non-Weaving Speed (S_{NW}), mi/h	50.3
Weaving Lane Change Rate (LC_W), lc/h	1559	Average Speed (S), mi/h	52.0
Weaving Lane Change Rate (LC_{All}), lc/h	3222	Density (D), pc/mi/ln	23.3
Weaving Intensity Factor (W)	0.226	Level of Service (LOS)	C

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/6/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - between Western Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2032	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.86	Flow Rate (V_p), pc/h/ln	1241
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.54
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	20.1
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/6/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - between Western Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2344	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1341
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.58
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	21.7
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/6/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - west of Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2243	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.86	Flow Rate (V_p), pc/h/ln	913
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.39
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	14.8
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	11/6/2018
Agency	SEH Inc.	Analysis Year	2018
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - west of Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

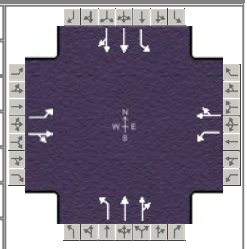
Demand Volume veh/h	2806	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.88	Flow Rate (V_p), pc/h/ln	1095
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.47
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	17.7
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

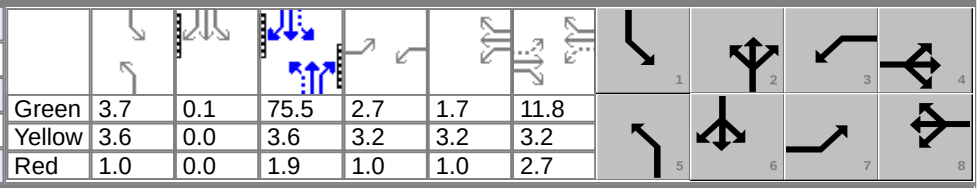
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Nov 26, 2018	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.84
Urban Street	Minnesota Avenue	Analysis Year	2018	Analysis Period	1> 7:15
Intersection	37th Street	File Name	01-02-04-05 Minnesota Avenue 2018 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	28	64	45	95	68	96	63	1453	79	86	746	10

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	71	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	3.7	0.1	75.5	2.7	1.7	11.8						
Yellow	3.6	0.0	3.6	3.2	3.2	3.2						
Red	1.0	0.0	1.9	1.0	1.0	2.7						

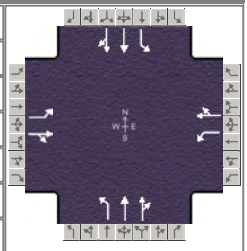
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	4.0	1.1	4.0	1.1	4.0
Phase Duration, s	6.9	17.7	12.8	23.6	8.3	81.0	8.4	81.2
Change Period, ($Y+R_c$), s	4.2	5.9	4.2	5.9	4.6	5.5	4.6	5.5
Max Allow Headway (*MAH*), s	4.3	4.3	4.3	4.3	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	4.1	11.0	8.8	15.7	3.8		3.9	
Green Extension Time (g_e), s	0.0	0.9	0.0	0.9	0.1	0.0	0.2	0.0
Phase Call Probability	0.67	1.00	0.98	1.00	0.92		0.93	
Max Out Probability	1.00	0.09	1.00	0.05	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	33	130		113	195		75	914	910	80	351	350
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1695		1734	1648		1734	1821	1788	1734	1821	1812
Queue Service Time (g_s), s	2.1	9.0		6.8	13.7		1.8	44.8	46.1	1.9	8.4	8.5
Cycle Queue Clearance Time (g_c), s	2.1	9.0		6.8	13.7		1.8	44.8	46.1	1.9	8.4	8.5
Green Ratio (*g/C*)	0.12	0.10		0.19	0.15		0.66	0.63	0.63	0.66	0.63	0.63
Capacity (*c*), veh/h	119	167		215	243		518	1146	1125	178	1148	1143
Volume-to-Capacity Ratio (*X*)	0.280	0.777		0.527	0.803		0.145	0.797	0.809	0.448	0.306	0.306
Back of Queue (*Q*), ft/ln (95 th percentile)	43.2	191.8		140.3	262.2		30.9	670.6	668.8	57	145.6	143.7
Back of Queue (*Q*), veh/ln (95 th percentile)	1.7	7.6		5.5	10.3		1.2	26.4	26.8	2.2	5.7	5.7
Queue Storage Ratio (*RQ*) (95 th percentile)	0.29	0.00		0.94	0.00		0.21	0.00	0.00	0.38	0.00	0.00
Uniform Delay (d_1), s/veh	47.6	52.8		43.0	49.4		7.7	16.5	16.8	20.4	7.5	7.5
Incremental Delay (d_2), s/veh	1.3	7.5		2.0	7.9		0.1	5.8	6.3	1.6	0.6	0.6
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	48.9	60.3		45.0	57.3		7.9	22.4	23.1	22.0	8.1	8.2
Level of Service (LOS)	D	E		D	E		A	C	C	C	A	A
Approach Delay, s/veh / LOS	58.0	E		52.8	D		22.1	C		9.5	A	
Intersection Delay, s/veh / LOS	23.9						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.31	B	2.31	B	1.88	B	1.88	B
Bicycle LOS Score / LOS	0.76	A	1.00	A	2.05	B	1.31	A

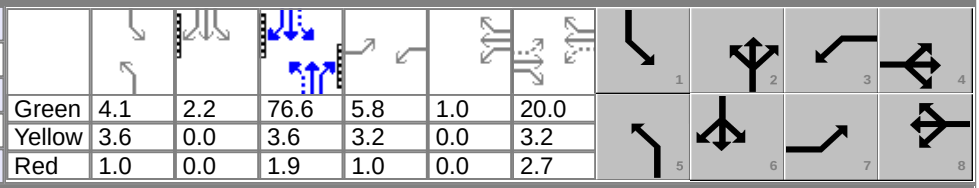
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Nov 26, 2018	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.95
Urban Street	Minnesota Avenue	Analysis Year	2018	Analysis Period	1> 16:30
Intersection	37th Street	File Name	01-02-04-05 Minnesota Avenue 2018 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	66	129	97	143	120	101	74	953	52	152	1458	45

Signal Information			
Cycle, s	130.0	Reference Phase	2
Offset, s	71	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	4.1	2.2	76.6	5.8	1.0	20.0
Yellow	3.6	0.0	3.6	3.2	0.0	3.2
Red	1.0	0.0	1.9	1.0	0.0	2.7

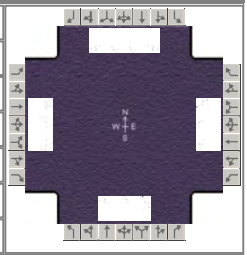
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	4.0	1.1	4.0	1.1	4.0
Phase Duration, s	10.0	25.9	11.0	26.9	8.7	82.1	10.9	84.4
Change Period, ($Y+R_c$), s	4.2	5.9	4.2	5.9	4.6	5.5	4.6	5.5
Max Allow Headway (*MAH*), s	4.3	4.3	4.3	4.3	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	6.3	20.0	8.8	19.5	4.3		6.2	
Green Extension Time (g_e), s	0.0	0.0	0.0	0.4	0.0	0.0	0.2	0.0
Phase Call Probability	0.92	1.00	1.00	1.00	0.94		0.99	
Max Out Probability	1.00	1.00	1.00	1.00	1.00		0.41	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	69	238		151	233		78	534	524	144	714	708
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1691		1734	1683		1734	1821	1788	1734	1821	1802
Queue Service Time (g_s), s	4.3	18.0		6.8	17.5		2.3	22.1	22.1	4.2	30.7	30.6
Cycle Queue Clearance Time (g_c), s	4.3	18.0		6.8	17.5		2.3	22.1	22.1	4.2	30.7	30.6
Green Ratio (*g/C*)	0.20	0.15		0.21	0.16		0.62	0.59	0.59	0.64	0.61	0.61
Capacity (*c*), veh/h	146	260		164	272		244	1074	1054	363	1105	1093
Volume-to-Capacity Ratio (*X*)	0.474	0.913		0.919	0.855		0.319	0.497	0.497	0.395	0.646	0.647
Back of Queue (*Q*), ft/ln (95 th percentile)	91.2	390.5		178.8	357.9		42.5	369.9	358.9	76	413.2	399.6
Back of Queue (*Q*), veh/ln (95 th percentile)	3.6	15.4		7.0	14.1		1.7	14.6	14.4	3.0	16.3	16.0
Queue Storage Ratio (*RQ*) (95 th percentile)	0.61	0.00		1.19	0.00		0.28	0.00	0.00	0.51	0.00	0.00
Uniform Delay (d_1), s/veh	44.9	54.1		50.8	53.0		14.3	15.5	15.5	12.1	14.3	14.1
Incremental Delay (d_2), s/veh	2.4	33.6		47.2	22.3		0.7	1.6	1.7	0.3	1.5	1.5
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	47.2	87.7		98.0	75.2		15.0	17.1	17.2	12.5	15.8	15.6
Level of Service (LOS)	D	F		F	E		B	B	B	B	B	B
Approach Delay, s/veh / LOS	78.6	E		84.2	F		17.0	B		15.4	B	
Intersection Delay, s/veh / LOS	29.4						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.31	B	2.31	B	1.89	B	1.89	B
Bicycle LOS Score / LOS	0.99	A	1.12	A	1.42	A	1.92	B

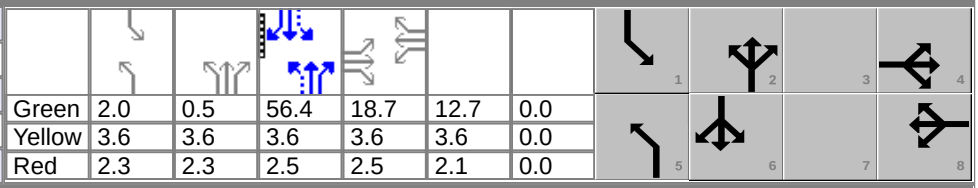
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Nov 26, 2018	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.81
Urban Street	Minnesota Avenue	Analysis Year	2018	Analysis Period	1> 7:15
Intersection	41st Street	File Name	01-02-04-05 Minnesota Avenue 2018 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	216	140	84	124	140	45	123	1058	60	20	509	145

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	85	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	2.0	0.5	56.4	18.7	12.7	0.0
Yellow	3.6	3.6	3.6	3.6	3.6	0.0
Red	2.3	2.3	2.5	2.5	2.1	0.0

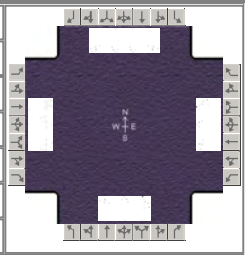
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		10.0		10.0	1.1	4.0	1.1	3.0
Phase Duration, s		24.8		18.4	14.3	68.9	7.9	62.5
Change Period, ($Y+R_c$), s		6.1		5.7	5.9	6.1	5.9	6.1
Max Allow Headway (*MAH*), s		5.1		3.2	3.2	0.0	5.2	0.0
Queue Clearance Time (g_s), s		17.2		12.2	8.2		2.7	
Green Extension Time (g_e), s		1.5		0.5	0.2	0.0	0.0	0.0
Phase Call Probability		1.00		1.00	1.00		0.50	
Max Out Probability		0.87		0.06	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	227	183	134	153	116	112	186	849	842	21	523	149
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1802	1598	1762	1850	1699	1762	1821	1786	1734	1734	1568
Queue Service Time (g_s), s	15.2	11.4	9.2	10.2	7.2	7.6	6.2	39.8	40.8	0.7	9.2	6.2
Cycle Queue Clearance Time (g_c), s	15.2	11.4	9.2	10.2	7.2	7.6	6.2	39.8	40.8	0.7	9.2	6.2
Green Ratio (*g/C*)	0.16	0.16	0.16	0.11	0.11	0.11	0.56	0.52	0.52	0.49	0.47	0.47
Capacity (*c*), veh/h	271	281	250	186	196	180	534	953	935	137	1629	737
Volume-to-Capacity Ratio (*X*)	0.837	0.650	0.536	0.821	0.594	0.624	0.348	0.891	0.901	0.150	0.321	0.202
Back of Queue (*Q*), ft/ln (95 th percentile)	311.6	234.2	172.2	210.8	153.1	148.5	111.6	331.1	322.1	14.6	161	104.5
Back of Queue (*Q*), veh/ln (95 th percentile)	12.3	9.2	6.9	8.4	6.1	5.9	4.5	13.0	12.7	0.6	6.3	4.2
Queue Storage Ratio (*RQ*) (95 th percentile)	1.25	0.00	0.00	0.84	0.00	0.00	0.74	0.00	0.00	0.10	0.00	1.04
Uniform Delay (d_1), s/veh	49.1	47.5	46.6	52.5	51.2	51.4	14.3	10.2	10.0	21.8	15.0	16.9
Incremental Delay (d_2), s/veh	15.8	4.1	2.5	6.0	1.1	1.3	0.1	6.9	7.6	0.7	0.5	0.6
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	65.0	51.6	49.2	58.6	52.3	52.7	14.4	17.1	17.6	22.5	15.5	17.5
Level of Service (LOS)	E	D	D	E	D	D	B	B	B	C	B	B
Approach Delay, s/veh / LOS	56.6	E		54.9	D		17.1	B		16.1	B	
Intersection Delay, s/veh / LOS	27.2						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.31	B	2.48	B	2.26	B	2.27	B
Bicycle LOS Score / LOS	0.94	A	0.80	A	1.75	B	1.17	A

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Nov 26, 2018	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.95
Urban Street	Minnesota Avenue	Analysis Year	2018	Analysis Period	1> 16:30
Intersection	41st Street	File Name	01-02-04-05 Minnesota Avenue 2018 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	406	267	269	222	311	45	229	701	88	34	1164	358

Signal Information			
Cycle, s	130.0	Reference Phase	2
Offset, s	69	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4
Green	2.7	1.5	54.9	25.9	15.3	0.0	5	6	7	8
Yellow	3.6	3.6	3.6	3.6	3.6	0.0				
Red	2.3	2.3	2.5	2.5	2.1	0.0				

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		10.0		10.0	1.1	4.0	1.1	3.0
Phase Duration, s		32.0		21.0	16.0	68.4	8.6	61.0
Change Period, ($Y+R_c$), s		6.1		5.7	5.9	6.1	5.9	6.1
Max Allow Headway (*MAH*), s		5.2		3.2	3.2	0.0	5.2	0.0
Queue Clearance Time (g_s), s		27.9		17.3	12.1		3.3	
Green Extension Time (g_e), s		0.0		0.0	0.0	0.0	0.1	0.0
Phase Call Probability		1.00		1.00	1.00		0.68	
Max Out Probability		1.00		1.00	1.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	385	315	240	234	190	185	265	466	448	31	1074	238
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1809	1552	1762	1850	1768	1762	1821	1749	1734	1734	1568
Queue Service Time (g_s), s	25.9	21.9	19.0	15.3	13.1	13.4	10.1	18.1	17.4	1.3	32.2	11.0
Cycle Queue Clearance Time (g_c), s	25.9	21.9	19.0	15.3	13.1	13.4	10.1	18.1	17.4	1.3	32.2	11.0
Green Ratio (*g/C*)	0.20	0.20	0.20	0.12	0.12	0.12	0.52	0.48	0.48	0.44	0.42	0.42
Capacity (*c*), veh/h	346	360	309	207	218	208	286	873	838	290	1464	662
Volume-to-Capacity Ratio (*X*)	1.113	0.873	0.775	1.127	0.873	0.887	0.929	0.534	0.534	0.108	0.734	0.360
Back of Queue (*Q*), ft/ln (95 th percentile)	705	446.1	328	484.7	312.2	311.9	249.5	275.6	250.2	25.9	459.9	165.9
Back of Queue (*Q*), veh/ln (95 th percentile)	27.8	17.6	13.1	19.4	12.5	12.5	10.0	10.8	9.9	1.0	18.1	6.6
Queue Storage Ratio (*RQ*) (95 th percentile)	2.82	0.00	0.00	1.94	0.00	0.00	1.66	0.00	0.00	0.17	0.00	1.66
Uniform Delay (d_1), s/veh	52.1	50.5	49.3	57.4	56.4	56.5	29.2	15.4	14.3	21.4	27.6	19.3
Incremental Delay (d_2), s/veh	82.5	20.7	12.3	100.8	28.9	32.8	30.6	2.0	2.0	0.2	2.3	1.0
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	134.6	71.2	61.6	158.1	85.3	89.3	59.8	17.3	16.4	21.6	29.8	20.3
Level of Service (LOS)	F	E	E	F	F	F	E	B	B	C	C	C
Approach Delay, s/veh / LOS	94.7	F		114.5	F		26.5	C		28.0	C	
Intersection Delay, s/veh / LOS	55.9						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.31	B	2.62	C	2.27	B	2.35	B
Bicycle LOS Score / LOS	1.26	A	0.99	A	1.37	A	1.75	B

HCS7 Two-Way Stop-Control Report

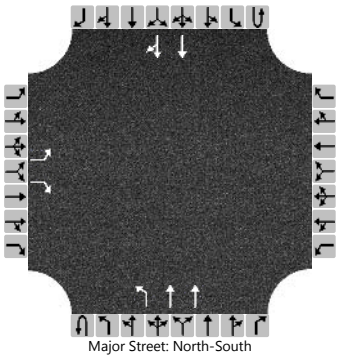
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	11/27/2018
Analysis Year	2018
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at 49th Ave
Jurisdiction	Sioux Falls, SD
East/West Street	49th Avenue
North/South Street	Minnesota Avenue
Peak Hour Factor	0.87
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration		L		R						L	T				T	TR
Volume (veh/h)		5		99					0	127	1773				768	21
Percent Heavy Vehicles (%)		2		2					2	2						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized		No														
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5		6.9						4.1						
Critical Headway (sec)		6.84		6.94						4.14						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.52		3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		6		114						146						
Capacity, c (veh/h)		30		554						746						
v/c Ratio		0.19		0.21						0.20						
95% Queue Length, Q_{95} (veh)		0.6		0.8						0.7						
Control Delay (s/veh)		149.4		13.2						11.0						
Level of Service (LOS)		F		B						B						
Approach Delay (s/veh)		19.7								0.7						
Approach LOS		C														

HCS7 Two-Way Stop-Control Report

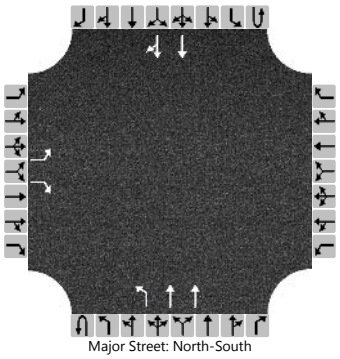
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	11/27/2018
Analysis Year	2018
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at 49th Ave
Jurisdiction	Sioux Falls, SD
East/West Street	49th Avenue
North/South Street	Minnesota Avenue
Peak Hour Factor	0.95
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration		L		R						L	T				T	TR
Volume (veh/h)		5		181					0	107	1142				1851	19
Percent Heavy Vehicles (%)		2		2					2	2						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized		No														
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5		6.9						4.1						
Critical Headway (sec)		6.84		6.94						4.14						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.52		3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		5		191						113						
Capacity, c (veh/h)		9		247						291						
v/c Ratio		0.57		0.77						0.39						
95% Queue Length, Q_{95} (veh)		1.2		5.6						1.8						
Control Delay (s/veh)		631.3		55.7						25.0						
Level of Service (LOS)		F		F						C						
Approach Delay (s/veh)		71.1								2.1						
Approach LOS		F														

HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	Diamond
Analyst	Graham Johnson	Analysis Date	Nov 26, 2018	Segment Distance, ft	683
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 North Ramp	PHF	0.87	Arterial Direction	North-South
File Name	01-02-04-05 Minnesota Avenue 2018 AM.xus				
Project Description	I-229 Exits 3 and 4				

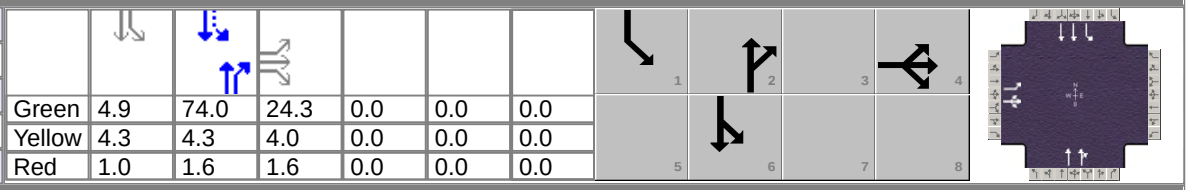
Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h				130	0	241	98	1659			591	276
Intersection Two Demand (*v*), veh/h	389	1	65					1368	215	100	621	

Signal One Information	
Cycle, s	120.0
Offset, s	38
Uncoordinated	No
Force Mode	Fixed

Green	4.2	82.0	17.3	0.0	0.0	0.0
Yellow	3.6	3.6	4.0	0.0	0.0	0.0
Red	1.0	2.2	2.0	0.0	0.0	0.0

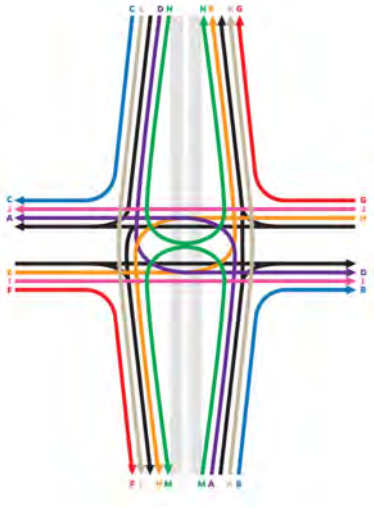
Signal Two Information	
Cycle, s	120.0
Offset, s	38
Uncoordinated	No
Force Mode	Fixed

Green	4.9	74.0	24.3	0.0	0.0	0.0
Yellow	4.3	4.3	4.0	0.0	0.0	0.0
Red	1.0	1.6	1.6	0.0	0.0	0.0



Interchange Results

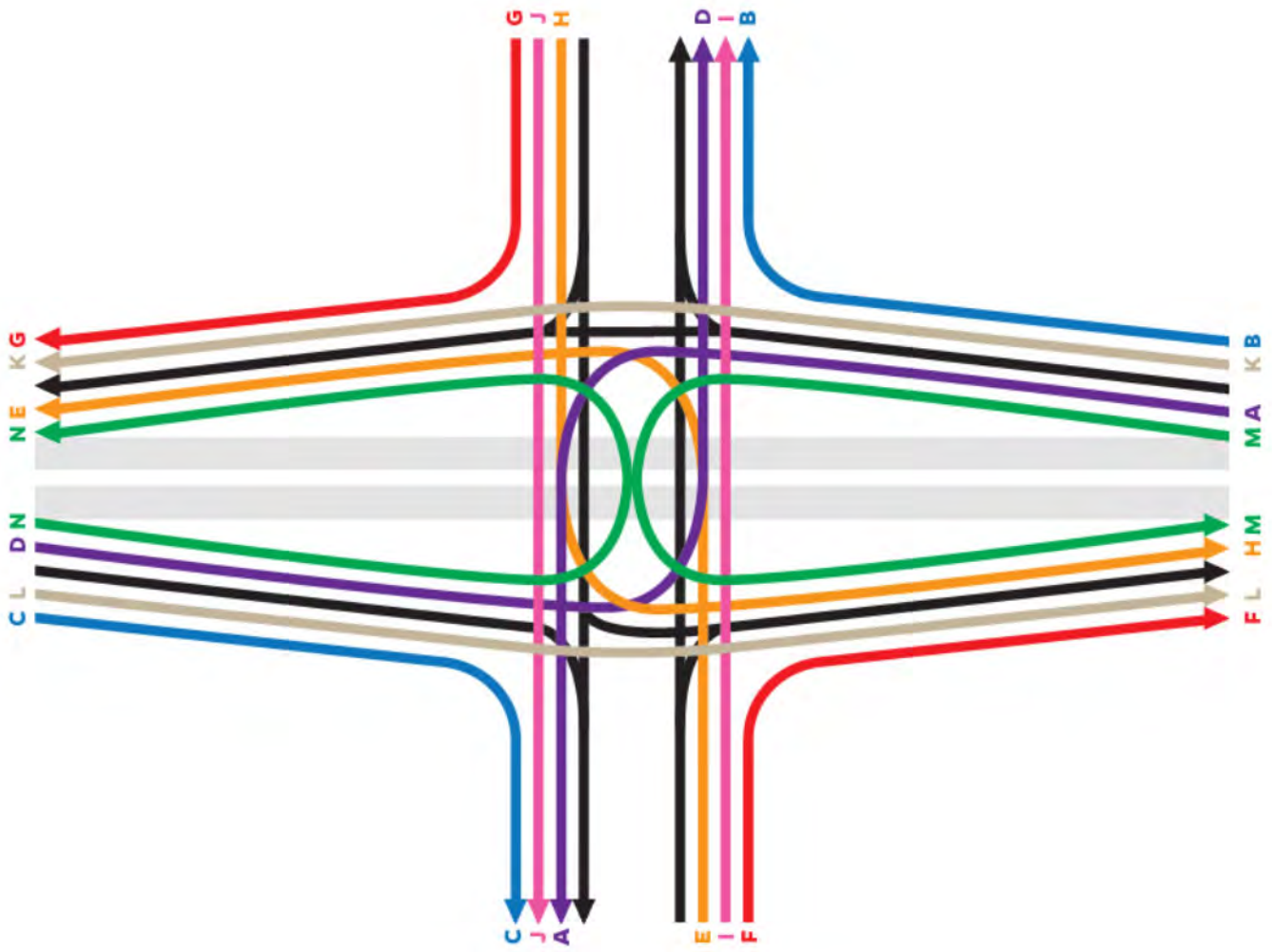
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	0	7.8	0.0	7.8	No	No	A
B	0	0.0	0.0	0.0	No	No	A
C	0	0.0	0.0	0.0	No	No	A
D	0	17.5	0.0	17.5	No	No	B
E	0	7.3	0.0	7.3	No	No	A
F	0	7.3	0.0	7.3	No	No	A
G	0	0.0	0.0	0.0	No	No	A
H	0	7.0	0.0	7.0	No	No	A
I	1816	24.8	0.0	24.8	No	No	B
J	544	14.8	0.0	14.8	No	No	A
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh				51.2	73.2		8.0	7.3			7.8	4.8
Level of Service (LOS)				D	E		A	A			A	A
Approach Delay, s/veh / LOS	0.0			63.4	E		7.3	A		6.4	A	
Intersection Delay, s/veh / LOS	13.2						B					

Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	67.2	44.5						17.5	18.9	34.4	7.0	
Level of Service (LOS)	E	D						B	B	C	A	
Approach Delay, s/veh / LOS	58.7	E		0.0			18.2	B		10.8	B	
Intersection Delay, s/veh / LOS	22.4						C					

Interchange Graphic



HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	Diamond
Analyst	Graham Johnson	Analysis Date	Nov 26, 2018	Segment Distance, ft	683
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 North Ramp	PHF	0.95	Arterial Direction	North-South
File Name	01-02-04-05 Minnesota Avenue 2018 PM.xus				
Project Description	I-229 Exits 3 and 4				

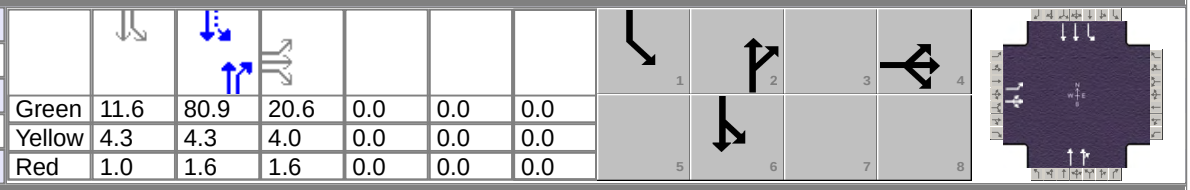
Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h				231	0	237	129	1012			1508	524
Intersection Two Demand (*v*), veh/h	294	0	146					847	182	325	1414	

Signal One Information	
Cycle, s	130.0
Offset, s	63
Uncoordinated	No
Force Mode	Fixed

Green	5.0	88.7	20.0	0.0	0.0	0.0
Yellow	3.6	3.6	4.0	0.0	0.0	0.0
Red	1.0	2.2	2.0	0.0	0.0	0.0

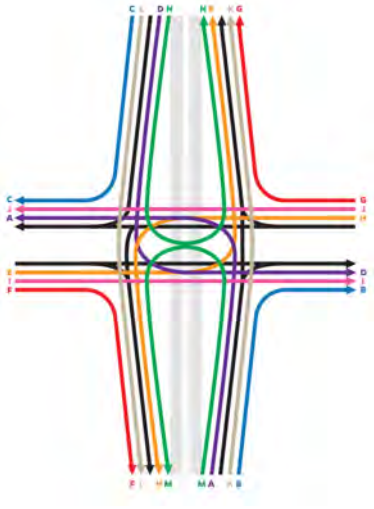
Signal Two Information	
Cycle, s	130.0
Offset, s	63
Uncoordinated	No
Force Mode	Fixed

Green	11.6	80.9	20.6	0.0	0.0	0.0
Yellow	4.3	4.3	4.0	0.0	0.0	0.0
Red	1.0	1.6	1.6	0.0	0.0	0.0



Interchange Results

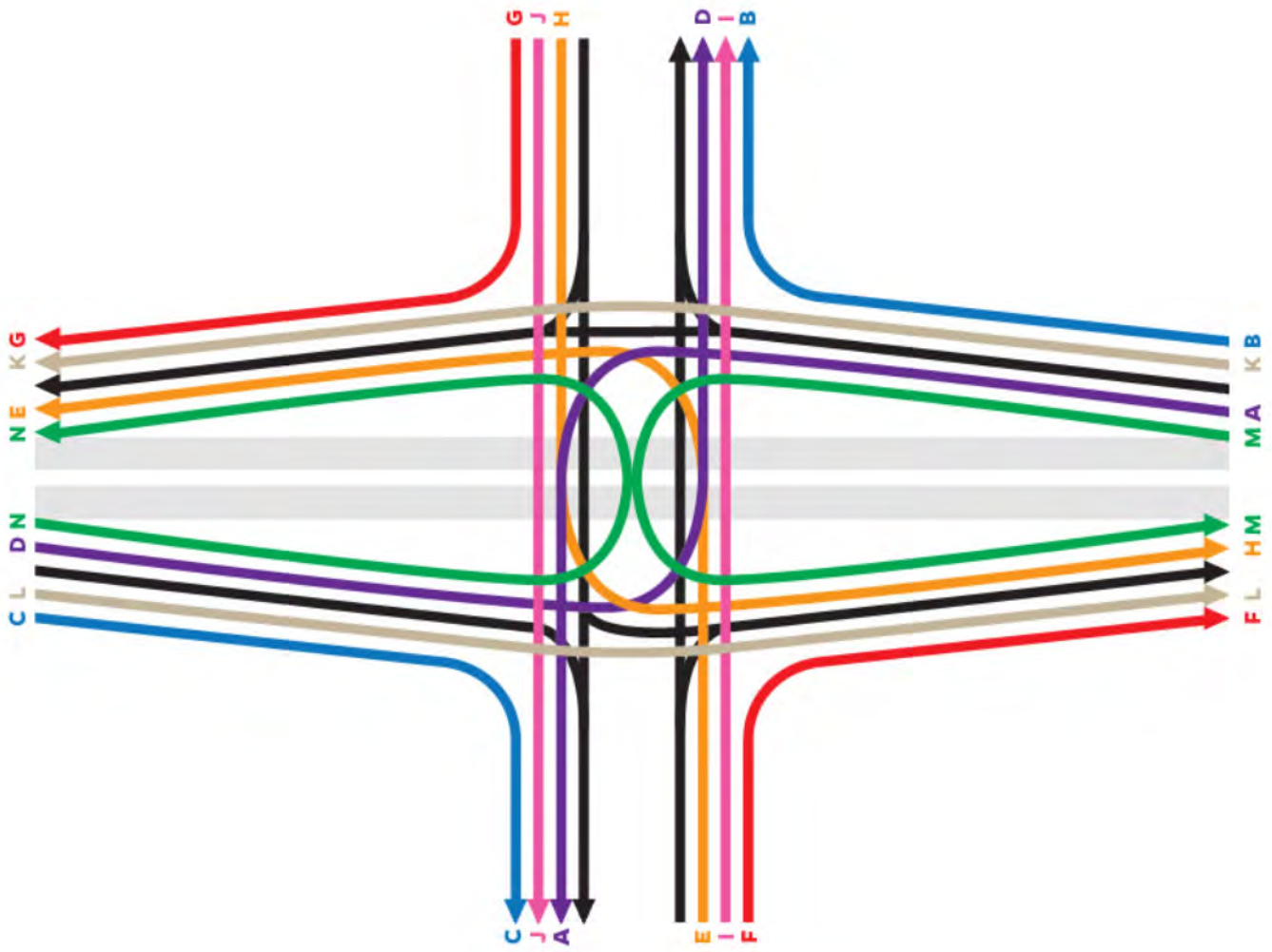
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	0	8.7	0.0	8.7	No	No	A
B	0	0.0	0.0	0.0	No	No	A
C	0	0.0	0.0	0.0	No	No	A
D	0	12.8	0.0	12.8	No	No	A
E	0	4.9	0.0	4.9	No	No	A
F	0	4.9	0.0	4.9	No	No	A
G	0	0.0	0.0	0.0	No	No	A
H	0	7.0	0.0	7.0	No	No	A
I	1095	17.6	0.0	17.6	No	No	B
J	1206	15.8	0.0	15.8	No	No	B
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh				87.7	64.3		45.9	4.9			8.7	7.6
Level of Service (LOS)				F	E		D	A			A	A
Approach Delay, s/veh / LOS	0.0			78.2		E	9.5		A	8.2		A
Intersection Delay, s/veh / LOS	17.5						B					

Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	75.9	58.7						12.8	11.9	24.8	7.0	
Level of Service (LOS)	E	E						B	B	C	A	
Approach Delay, s/veh / LOS	69.1		E	0.0			12.3		B	10.4		B
Intersection Delay, s/veh / LOS	17.9						B					

Interchange Graphic



HCS7 Two-Way Stop-Control Report

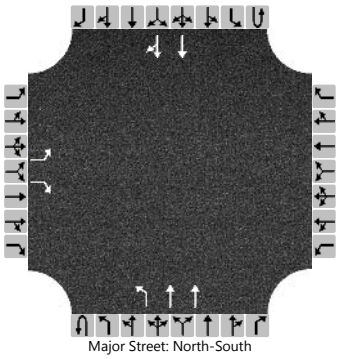
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	11/27/2018
Analysis Year	2018
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at Yankton
Jurisdiction	Sioux Falls, SD
East/West Street	Yankton Trail
North/South Street	Minnesota Avenue
Peak Hour Factor	0.88
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration		L		R						L	T				T	TR
Volume (veh/h)		0		2					0	1	1583				683	3
Percent Heavy Vehicles (%)		2		2					2	2						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized		No														
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5		6.9						4.1						
Critical Headway (sec)		6.84		6.94						4.14						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.52		3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		0		2						1						
Capacity, c (veh/h)		86		609						833						
v/c Ratio		0.00		0.00						0.00						
95% Queue Length, Q_{95} (veh)		0.0		0.0						0.0						
Control Delay (s/veh)		47.1		10.9						9.3						
Level of Service (LOS)		E		B						A						
Approach Delay (s/veh)		10.9								0.0						
Approach LOS		B														

HCS7 Two-Way Stop-Control Report

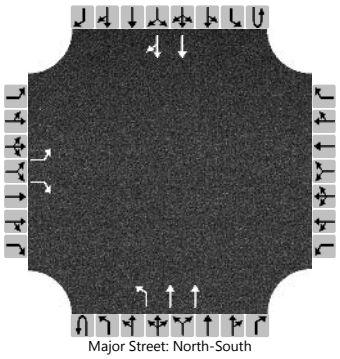
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	11/27/2018
Analysis Year	2018
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at Yankton
Jurisdiction	Sioux Falls, SD
East/West Street	Yankton Trail
North/South Street	Minnesota Avenue
Peak Hour Factor	0.88
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration		L		R						L	T				T	TR
Volume (veh/h)		3		10					0	46	1026				1441	119
Percent Heavy Vehicles (%)		2		2					2	2						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized		No														
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5		6.9						4.1						
Critical Headway (sec)		6.84		6.94						4.14						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.52		3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		3		11						52						
Capacity, c (veh/h)		24		287						347						
v/c Ratio		0.14		0.04						0.15						
95% Queue Length, Q_{95} (veh)		0.4		0.1						0.5						
Control Delay (s/veh)		179.5		18.0						17.2						
Level of Service (LOS)		F		C						C						
Approach Delay (s/veh)		55.3								0.7						
Approach LOS		F														

HCS7 Two-Way Stop-Control Report

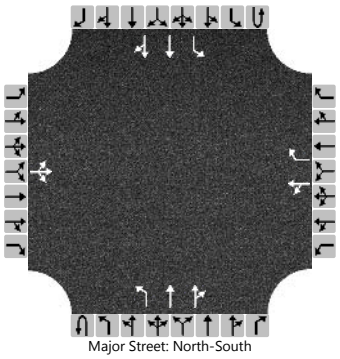
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	11/27/2018
Analysis Year	2018
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at Lotta St
Jurisdiction	Sioux Falls, SD
East/West Street	Lotta St
North/South Street	Minnesota Avenue
Peak Hour Factor	0.88
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	1	0	1	2	0	0	1	2	0
Configuration			LTR			LT		R		L	T	TR		L	T	TR
Volume (veh/h)		0	0	3		7	0	171	0	8	1413	9	0	34	642	9
Percent Heavy Vehicles (%)		2	2	2		3	3	2	2	2			2	2		
Proportion Time Blocked																
Percent Grade (%)		0				0										
Right Turn Channelized						No										
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5	6.5	6.9		7.5	6.5	6.9		4.1				4.1		
Critical Headway (sec)		7.54	6.54	6.94		7.56	6.56	6.94		4.14				4.14		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.52	4.02	3.32		3.53	4.03	3.32		2.22				2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			3			8		194		9				39		
Capacity, c (veh/h)			627			28		324		863				399		
v/c Ratio			0.01			0.28		0.60		0.01				0.10		
95% Queue Length, Q_{95} (veh)			0.0			0.9		3.7		0.0				0.3		
Control Delay (s/veh)			10.8			177.3		31.5		9.2				15.0		
Level of Service (LOS)			B			F		D		A				B		
Approach Delay (s/veh)		10.8				37.2				0.1				0.7		
Approach LOS		B				E										

HCS7 Two-Way Stop-Control Report

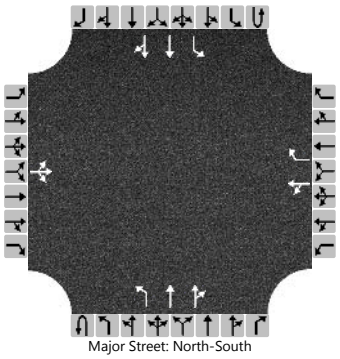
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	11/27/2018
Analysis Year	2018
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at Lotta St
Jurisdiction	Sioux Falls, SD
East/West Street	Lotta St
North/South Street	Minnesota Avenue
Peak Hour Factor	0.93
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	1	0	1	2	0	0	1	2	0
Configuration			LTR			LT		R		L	T	TR		L	T	TR
Volume (veh/h)		0	0	1		10	0	76	0	2	996	27	0	150	1301	0
Percent Heavy Vehicles (%)		2	2	2		3	3	2	2	2			2	2		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized					No											
Median Type | Storage	Undivided															

Critical and Follow-up Headways

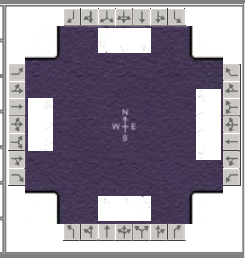
Base Critical Headway (sec)		7.5	6.5	6.9		7.5	6.5	6.9		4.1				4.1		
Critical Headway (sec)		7.54	6.54	6.94		7.56	6.56	6.94		4.14				4.14		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.52	4.02	3.32		3.53	4.03	3.32		2.22				2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			1			11		82		2				161		
Capacity, c (veh/h)			382			23		479		484				630		
v/c Ratio			0.00			0.47		0.17		0.00				0.26		
95% Queue Length, Q_{95} (veh)			0.0			1.4		0.6		0.0				1.0		
Control Delay (s/veh)			14.4			261.4		14.1		12.5				12.7		
Level of Service (LOS)			B			F		B		B				B		
Approach Delay (s/veh)	14.4				42.8				0.0				1.3			
Approach LOS	B				E											

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Nov 26, 2018	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.81
Urban Street	Minnesota Avenue	Analysis Year	2018	Analysis Period	1> 7:15
Intersection	57th Street	File Name	08 Minnesota at 57th 2018 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	117	244	87	60	611	228	116	715	26	91	422	60

Signal Information			
Cycle, s	101.7	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	6.3	1.3	33.3	4.4	3.4	31.2
Yellow	4.0	0.0	4.3	4.0	0.0	3.9
Red	1.0	0.0	1.6	1.0	0.0	1.9

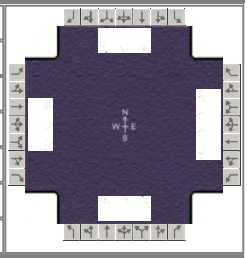
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	12.8	40.5	9.4	37.0	12.6	40.6	11.3	39.2
Change Period, ($Y+R_c$), s	5.0	5.8	5.0	5.8	5.0	5.9	5.0	5.9
Max Allow Headway (*MAH*), s	3.7	5.7	3.7	5.7	3.7	5.6	3.7	5.6
Queue Clearance Time (g_s), s	7.7	10.6	5.0	21.6	7.5	24.5	6.3	15.4
Green Extension Time (g_e), s	0.3	11.2	0.1	9.6	0.3	10.2	0.3	9.6
Phase Call Probability	0.98	1.00	0.88	1.00	0.98	1.00	0.96	1.00
Max Out Probability	0.00	0.31	0.19	0.46	0.00	0.50	0.00	0.60

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	144	200	190	74	754	189	143	457	452	112	296	287
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1680	1734	1734	1543	1734	1821	1803	1734	1821	1753
Queue Service Time (g_s), s	5.7	8.3	8.6	3.0	19.6	9.8	5.5	22.5	22.5	4.3	13.3	13.4
Cycle Queue Clearance Time (g_c), s	5.7	8.3	8.6	3.0	19.6	9.8	5.5	22.5	22.5	4.3	13.3	13.4
Green Ratio (*g/C*)	0.39	0.34	0.34	0.35	0.31	0.31	0.40	0.34	0.34	0.39	0.33	0.33
Capacity (*c*), veh/h	285	621	572	382	1065	474	364	621	614	240	597	574
Volume-to-Capacity Ratio (*X*)	0.507	0.323	0.332	0.194	0.708	0.399	0.393	0.736	0.736	0.468	0.496	0.499
Back of Queue (*Q*), ft/ln (95 th percentile)	107.4	166.2	156.1	55.4	331.5	169.8	102	392.3	383	81.8	250.4	240.7
Back of Queue (*Q*), veh/ln (95 th percentile)	4.2	6.5	6.2	2.2	13.0	6.7	4.0	15.4	15.3	3.2	9.9	9.6
Queue Storage Ratio (*RQ*) (95 th percentile)	0.86	0.00	0.00	0.22	0.00	1.13	1.02	0.00	0.00	0.27	0.00	0.00
Uniform Delay (d_1), s/veh	23.3	24.9	24.9	22.7	31.2	27.8	20.8	29.5	29.5	23.5	27.5	27.5
Incremental Delay (d_2), s/veh	1.0	0.5	0.6	0.2	1.8	0.9	0.5	3.6	3.6	1.1	1.1	1.2
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	24.3	25.4	25.5	22.9	33.0	28.8	21.4	33.1	33.1	24.5	28.6	28.7
Level of Service (LOS)	C	C	C	C	C	C	C	C	C	C	C	C
Approach Delay, s/veh / LOS	25.1	C		31.5	C		31.5	C		28.0	C	
Intersection Delay, s/veh / LOS	29.7						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.29	B	2.30	B	2.54	C	2.30	B
Bicycle LOS Score / LOS	0.93	A	1.33	A	1.36	A	1.06	A

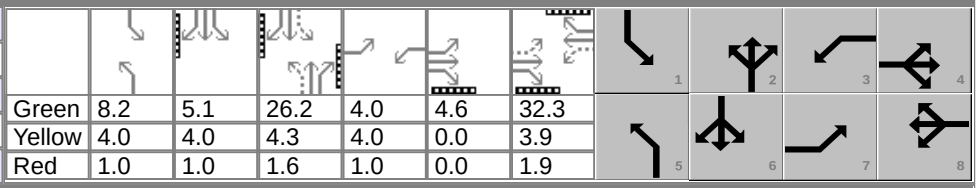
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Nov 26, 2018	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.92
Urban Street	Minnesota Avenue	Analysis Year	2018	Analysis Period	1> 16:30
Intersection	57th Street	File Name	08 Minnesota at 57th 2018 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	147	806	128	59	488	155	124	538	94	322	880	66

Signal Information			
Cycle, s	107.1	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	8.2	5.1	26.2	4.0	4.6	32.3		
Yellow	4.0	4.0	4.3	4.0	0.0	3.9		
Red	1.0	1.0	1.6	1.0	0.0	1.9		

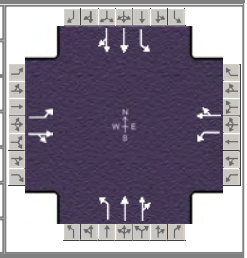
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	13.7	42.7	9.0	38.1	13.2	32.1	23.3	42.2
Change Period, ($Y+R_c$), s	5.0	5.8	5.0	5.8	5.0	5.9	5.0	5.9
Max Allow Headway (*MAH*), s	3.7	5.6	3.7	5.6	3.7	5.6	3.7	5.6
Queue Clearance Time (g_s), s	8.6	29.1	4.7	15.5	8.1	21.1	17.3	30.1
Green Extension Time (g_e), s	0.2	7.7	0.0	8.3	0.2	5.1	0.9	1.6
Phase Call Probability	0.99	1.00	0.85	1.00	0.98	1.00	1.00	1.00
Max Out Probability	0.08	0.67	1.00	0.81	0.02	0.64	0.00	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	160	507	486	64	530	152	135	345	331	350	517	505
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1745	1734	1734	1543	1734	1821	1735	1734	1821	1779
Queue Service Time (g_s), s	6.6	27.1	27.1	2.7	13.5	8.2	6.1	19.0	19.1	15.3	28.1	28.1
Cycle Queue Clearance Time (g_c), s	6.6	27.1	27.1	2.7	13.5	8.2	6.1	19.0	19.1	15.3	28.1	28.1
Green Ratio (*g/C*)	0.40	0.34	0.34	0.34	0.30	0.30	0.32	0.24	0.24	0.43	0.34	0.34
Capacity (*c*), veh/h	360	627	601	174	1044	465	231	445	424	414	618	603
Volume-to-Capacity Ratio (*X*)	0.443	0.809	0.809	0.369	0.508	0.328	0.583	0.776	0.779	0.845	0.838	0.838
Back of Queue (*Q*), ft/ln (95 th percentile)	123.4	474	451.5	53.2	244.4	142.4	120.4	353.1	336.8	271.7	509.6	493
Back of Queue (*Q*), veh/ln (95 th percentile)	4.9	18.7	18.1	2.1	9.6	5.6	4.7	13.9	13.5	10.7	20.1	19.7
Queue Storage Ratio (*RQ*) (95 th percentile)	0.99	0.00	0.00	0.21	0.00	0.95	1.20	0.00	0.00	0.91	0.00	0.00
Uniform Delay (d_1), s/veh	22.7	31.9	31.9	27.5	30.9	29.0	29.3	37.7	37.8	24.7	32.7	32.7
Incremental Delay (d_2), s/veh	0.6	6.3	6.6	1.0	0.7	0.7	1.7	5.1	5.4	3.6	10.5	10.7
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	23.4	38.2	38.5	28.5	31.6	29.7	31.0	42.8	43.2	28.3	43.2	43.4
Level of Service (LOS)	C	D	D	C	C	C	C	D	D	C	D	D
Approach Delay, s/veh / LOS	36.3	D		30.9	C		41.0	D		39.5	D	
Intersection Delay, s/veh / LOS	37.3						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.30	B	2.30	B	2.47	B	2.31	B
Bicycle LOS Score / LOS	1.44	A	1.10	A	1.16	A	1.62	B

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Nov 26, 2018	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.86
Urban Street	Cliff Avenue	Analysis Year	2018	Analysis Period	1> 7:15
Intersection	33rd Street	File Name	09 Cliff at 33rd 2018 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	63	80	25	35	112	9	81	908	13	1	321	55

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	0.1	3.8	60.9	2.8	2.2	10.4
Yellow	3.6	0.0	3.6	3.6	0.0	3.6
Red	1.0	0.0	1.5	1.0	0.0	1.9

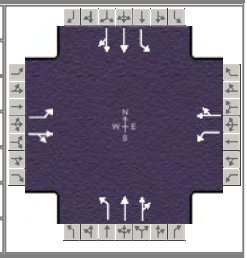
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	4.0	1.1	4.0	1.1	4.0
Phase Duration, s	9.6	18.1	7.4	15.9	8.5	69.7	4.7	66.0
Change Period, ($Y+R_c$), s	4.6	5.5	4.6	5.5	4.6	5.1	4.6	5.1
Max Allow Headway (*MAH*), s	4.2	4.1	4.2	4.1	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	5.7	8.6	4.1	9.6	4.0		2.0	
Green Extension Time (g_e), s	0.0	0.8	0.0	0.8	0.3	0.0	0.0	0.0
Phase Call Probability	0.87	1.00	0.68	1.00	0.93		0.03	
Max Out Probability	1.00	0.00	0.85	0.00	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	73	122		41	141		94	537	534	1	223	215
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1746		1734	1797		1734	1821	1812	1734	1821	1728
Queue Service Time (g_s), s	3.7	6.6		2.1	7.6		2.0	14.8	14.8	0.0	5.4	5.5
Cycle Queue Clearance Time (g_c), s	3.7	6.6		2.1	7.6		2.0	14.8	14.8	0.0	5.4	5.5
Green Ratio (*g/C*)	0.15	0.13		0.13	0.10		0.66	0.65	0.65	0.61	0.61	0.61
Capacity (*c*), veh/h	194	221		172	187		666	1177	1171	326	1109	1052
Volume-to-Capacity Ratio (*X*)	0.378	0.553		0.237	0.752		0.141	0.456	0.456	0.004	0.201	0.204
Back of Queue (*Q*), ft/ln (95 th percentile)	74.8	134.3		41.9	167.7		30.5	244.1	239.3	0.4	98.5	93.7
Back of Queue (*Q*), veh/ln (95 th percentile)	2.9	5.3		1.6	6.6		1.2	9.6	9.6	0.0	3.9	3.7
Queue Storage Ratio (*RQ*) (95 th percentile)	0.35	0.00		0.30	0.00		0.17	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d_1), s/veh	37.7	41.0		38.8	43.5		6.4	8.9	8.9	8.5	8.7	8.7
Incremental Delay (d_2), s/veh	1.2	2.2		0.7	6.0		0.1	1.3	1.3	0.0	0.4	0.4
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	38.9	43.2		39.5	49.5		6.5	10.1	10.1	8.5	9.1	9.2
Level of Service (LOS)	D	D		D	D		A	B	B	A	A	A
Approach Delay, s/veh / LOS	41.6	D		47.3	D		9.8	A		9.1	A	
Intersection Delay, s/veh / LOS	16.2						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.30	B	2.31	B	1.87	B	1.88	B
Bicycle LOS Score / LOS	0.81	A	0.79	A	1.45	A	0.85	A

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Nov 26, 2018	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.88
Urban Street	Cliff Avenue	Analysis Year	2018	Analysis Period	1> 16:30
Intersection	33rd Street	File Name	09 Cliff at 33rd 2018 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	97	166	78	62	113	11	59	478	68	15	1144	81

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	1.5	1.9	53.5	4.6	2.3	16.4
Yellow	3.6	0.0	3.6	3.6	0.0	3.6
Red	1.0	0.0	1.5	1.0	0.0	1.9

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	4.0	1.1	4.0	1.1	4.0
Phase Duration, s	11.5	24.2	9.2	21.9	8.0	60.5	6.1	58.6
Change Period, ($Y+R_c$), s	4.6	5.5	4.6	5.5	4.6	5.1	4.6	5.1
Max Allow Headway (*MAH*), s	4.2	4.2	4.2	4.2	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	7.2	17.6	5.3	9.1	3.7		2.4	
Green Extension Time (g_e), s	0.0	1.1	0.0	1.4	0.1	0.0	0.0	0.0
Phase Call Probability	0.95	1.00	0.86	1.00	0.84		0.38	
Max Out Probability	1.00	0.09	1.00	0.01	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	110	277		70	141		67	316	304	17	703	689
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1722		1734	1793		1734	1821	1742	1734	1821	1778
Queue Service Time (g_s), s	5.2	15.6		3.3	7.1		1.7	9.4	9.4	0.4	29.2	29.4
Cycle Queue Clearance Time (g_c), s	5.2	15.6		3.3	7.1		1.7	9.4	9.4	0.4	29.2	29.4
Green Ratio (*g/C*)	0.23	0.19		0.21	0.16		0.57	0.55	0.55	0.55	0.53	0.53
Capacity (*c*), veh/h	308	322		164	295		224	1008	964	451	974	951
Volume-to-Capacity Ratio (*X*)	0.358	0.860		0.428	0.478		0.299	0.314	0.316	0.038	0.722	0.725
Back of Queue (*Q*), ft/ln (95 th percentile)	101.6	303		67.4	146.6		31.1	177.1	168.1	7.7	472.5	460
Back of Queue (*Q*), veh/ln (95 th percentile)	4.0	11.9		2.7	5.8		1.2	7.0	6.7	0.3	18.6	18.4
Queue Storage Ratio (*RQ*) (95 th percentile)	0.47	0.00		0.48	0.00		0.18	0.00	0.00	0.07	0.00	0.00
Uniform Delay (d_1), s/veh	31.7	39.4		33.7	37.9		14.9	12.1	12.1	10.7	17.6	17.7
Incremental Delay (d_2), s/veh	0.7	10.5		1.8	1.2		0.7	0.8	0.9	0.0	4.6	4.8
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	32.4	49.9		35.5	39.1		15.7	12.9	12.9	10.7	22.2	22.5
Level of Service (LOS)	C	D		D	D		B	B	B	B	C	C
Approach Delay, s/veh / LOS	44.9	D		37.9	D		13.2	B		22.2	C	
Intersection Delay, s/veh / LOS	24.4						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.30	B	2.30	B	1.89	B	1.89	B
Bicycle LOS Score / LOS	1.13	A	0.84	A	1.05	A	1.65	B

HCS7 Two-Way Stop-Control Report

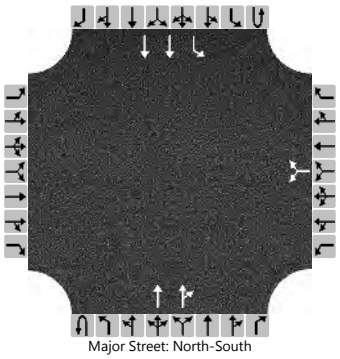
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	11/27/2018
Analysis Year	2018
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at 36th St
Jurisdiction	Sioux Falls, SD
East/West Street	36th Street
North/South Street	Cliff Avenue
Peak Hour Factor	0.89
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	2	0	0	1	2	0
Configuration							LR				T	TR		L	T	
Volume (veh/h)						23		39			1046	41	0	50	480	
Percent Heavy Vehicles (%)						2		2					2	2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized																
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)						7.5		6.9						4.1		
Critical Headway (sec)						6.84		6.94						4.14		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.52		3.32						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							70							56		
Capacity, c (veh/h)							297							567		
v/c Ratio							0.23							0.10		
95% Queue Length, Q_{95} (veh)							0.9							0.3		
Control Delay (s/veh)							20.8							12.1		
Level of Service (LOS)							C							B		
Approach Delay (s/veh)						20.8							1.1			
Approach LOS						C										

HCS7 Two-Way Stop-Control Report

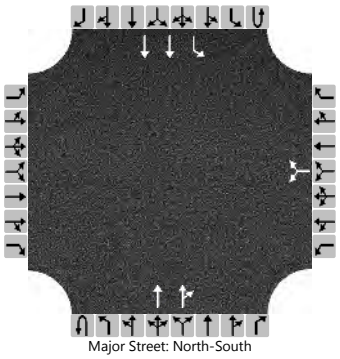
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	11/27/2018
Analysis Year	2018
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at 36th St
Jurisdiction	Sioux Falls, SD
East/West Street	36th Street
North/South Street	Cliff Avenue
Peak Hour Factor	0.89
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	2	0	0	1	2	0
Configuration							LR				T	TR		L	T	
Volume (veh/h)						18		4			601	19	0	2	1282	
Percent Heavy Vehicles (%)						2		2					2	2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized																
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)						7.5		6.9						4.1		
Critical Headway (sec)						6.84		6.94						4.14		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.52		3.32						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							25							2		
Capacity, c (veh/h)							296							895		
v/c Ratio							0.08							0.00		
95% Queue Length, Q_{95} (veh)							0.3							0.0		
Control Delay (s/veh)							18.3							9.0		
Level of Service (LOS)							C							A		
Approach Delay (s/veh)						18.3								0.0		
Approach LOS						C										

HCS7 Two-Way Stop-Control Report

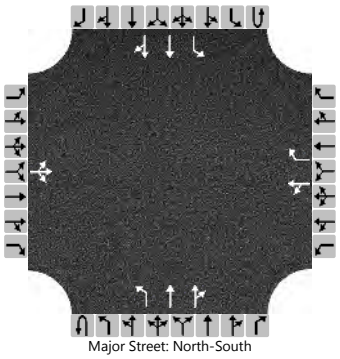
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	11/27/2018
Analysis Year	2018
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at 38th/HS #1
Jurisdiction	Sioux Falls, SD
East/West Street	38th Street/HS #1
North/South Street	Cliff Avenue
Peak Hour Factor	0.89
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	1	0	1	2	0	0	1	2	0
Configuration			LTR			LT		R		L	T	TR		L	T	TR
Volume (veh/h)		7	3	74		62	6	82	0	42	1100	114	0	13	647	38
Percent Heavy Vehicles (%)		2	2	2		2	2	2	2	2			2	2		
Proportion Time Blocked																
Percent Grade (%)		0				0										
Right Turn Channelized						No										
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5	6.5	6.9		7.5	6.5	6.9		4.1				4.1		
Critical Headway (sec)		7.54	6.54	6.94		7.54	6.54	6.94		4.14				4.14		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.52	4.02	3.32		3.52	4.02	3.32		2.22				2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			94			76		92		47				15		
Capacity, c (veh/h)			340			95		392		841				500		
v/c Ratio			0.28			0.81		0.23		0.06				0.03		
95% Queue Length, Q_{95} (veh)			1.1			4.3		0.9		0.2				0.1		
Control Delay (s/veh)			19.6			125.1		17.0		9.5				12.4		
Level of Service (LOS)			C			F		C		A				B		
Approach Delay (s/veh)		19.6				66.0				0.3				0.2		
Approach LOS		C				F										

HCS7 Two-Way Stop-Control Report

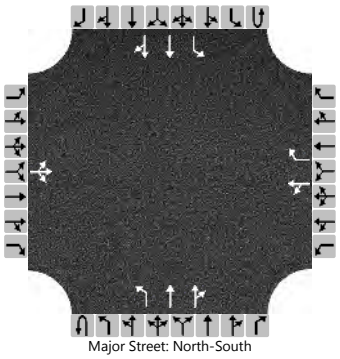
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	11/27/2018
Analysis Year	2018
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at 38th/HS #1
Jurisdiction	Sioux Falls, SD
East/West Street	38th Street/HS #1
North/South Street	Cliff Avenue
Peak Hour Factor	0.87
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	1	0	1	2	0	0	1	2	0
Configuration			LTR			LT		R		L	T	TR		L	T	TR
Volume (veh/h)		12	0	68		37	1	15	0	34	656	9	0	3	1285	25
Percent Heavy Vehicles (%)		2	2	2		2	2	2	2	2			2	2		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized					No											
Median Type | Storage	Left Only								1							

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5	6.5	6.9		7.5	6.5	6.9		4.1				4.1		
Critical Headway (sec)		7.54	6.54	6.94		7.54	6.54	6.94		4.14				4.14		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.52	4.02	3.32		3.52	4.02	3.32		2.22				2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			92			44		17		39				3		
Capacity, c (veh/h)			257			135		616		441				844		
v/c Ratio			0.36			0.32		0.03		0.09				0.00		
95% Queue Length, Q_{95} (veh)			1.6			1.3		0.1		0.3				0.0		
Control Delay (s/veh)			26.6			43.9		11.0		14.0				9.3		
Level of Service (LOS)			D			E		B		B				A		
Approach Delay (s/veh)	26.6				34.6				0.7				0.0			
Approach LOS	D				D											

HCS7 Two-Way Stop-Control Report

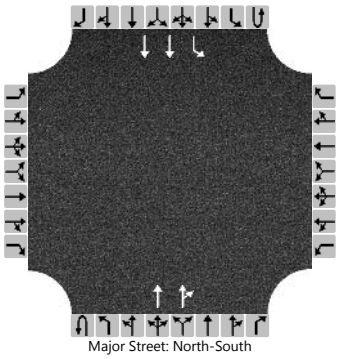
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	11/27/2018
Analysis Year	2018
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at HS #2
Jurisdiction	Sioux Falls, SD
East/West Street	HS #2 Entrance
North/South Street	Cliff Avenue
Peak Hour Factor	0.91
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	0	2	0	0	1	2	0
Configuration											T	TR		L	T	
Volume (veh/h)											1256	102	0	110	673	
Percent Heavy Vehicles (%)													2	2		
Proportion Time Blocked																
Percent Grade (%)																
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)														4.1		
Critical Headway (sec)														4.14		
Base Follow-Up Headway (sec)														2.2		
Follow-Up Headway (sec)														2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)														121		
Capacity, c (veh/h)														446		
v/c Ratio														0.27		
95% Queue Length, Q_{95} (veh)														1.1		
Control Delay (s/veh)														16.0		
Level of Service (LOS)														C		
Approach Delay (s/veh)													2.3			
Approach LOS																

HCS7 Two-Way Stop-Control Report

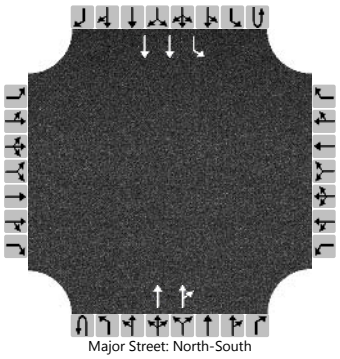
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	11/27/2018
Analysis Year	2018
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at HS #2
Jurisdiction	Sioux Falls, SD
East/West Street	HS #2 Entrance
North/South Street	Cliff Avenue
Peak Hour Factor	0.87
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	0	2	0	0	1	2	0
Configuration											T	TR		L	T	
Volume (veh/h)											699	17	0	12	1378	
Percent Heavy Vehicles (%)													2	2		
Proportion Time Blocked																
Percent Grade (%)																
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)														4.1		
Critical Headway (sec)														4.14		
Base Follow-Up Headway (sec)														2.2		
Follow-Up Headway (sec)														2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)														14		
Capacity, c (veh/h)														803		
v/c Ratio														0.02		
95% Queue Length, Q_{95} (veh)														0.1		
Control Delay (s/veh)														9.6		
Level of Service (LOS)														A		
Approach Delay (s/veh)													0.1			
Approach LOS																

HCS7 Two-Way Stop-Control Report

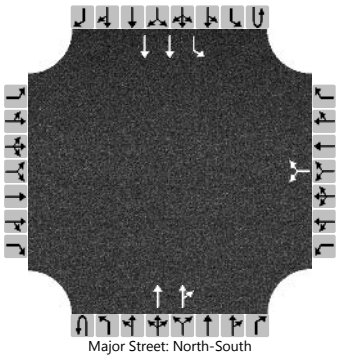
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	11/27/2018
Analysis Year	2018
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at HS #1
Jurisdiction	Sioux Falls, SD
East/West Street	HS #1
North/South Street	Cliff Avenue
Peak Hour Factor	0.94
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	2	0	0	1	2	0
Configuration							LR				T	TR		L	T	
Volume (veh/h)						18		51			1307	277	0	44	629	
Percent Heavy Vehicles (%)						2		2					2	2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized																
Median Type | Storage						Undivided										

Critical and Follow-up Headways

Base Critical Headway (sec)						7.5		6.9						4.1		
Critical Headway (sec)						6.84		6.94						4.14		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.52		3.32						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							73							47		
Capacity, c (veh/h)							128							376		
v/c Ratio							0.57							0.12		
95% Queue Length, Q_{95} (veh)							2.9							0.4		
Control Delay (s/veh)							65.7							15.9		
Level of Service (LOS)							F							C		
Approach Delay (s/veh)						65.7							1.0			
Approach LOS						F										

HCS7 Two-Way Stop-Control Report

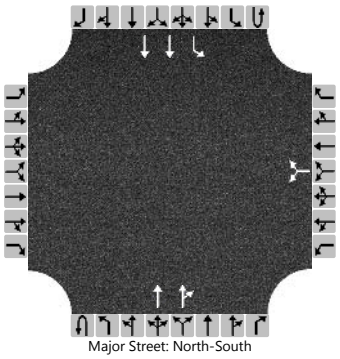
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	11/27/2018
Analysis Year	2018
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at HS #1
Jurisdiction	Sioux Falls, SD
East/West Street	HS #1
North/South Street	Cliff Avenue
Peak Hour Factor	0.88
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	2	0	0	1	2	0
Configuration							LR				T	TR		L	T	
Volume (veh/h)						16		8			708	9	0	0	1378	
Percent Heavy Vehicles (%)						2		2					2	2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized																
Median Type | Storage						Undivided										

Critical and Follow-up Headways

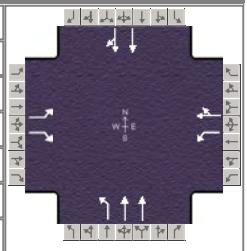
Base Critical Headway (sec)						7.5		6.9						4.1		
Critical Headway (sec)						6.84		6.94						4.14		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.52		3.32						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							27							0		
Capacity, c (veh/h)							136							808		
v/c Ratio							0.20							0.00		
95% Queue Length, Q_{95} (veh)							0.7							0.0		
Control Delay (s/veh)							38.1							9.5		
Level of Service (LOS)							E							A		
Approach Delay (s/veh)						38.1							0.0			
Approach LOS						E										

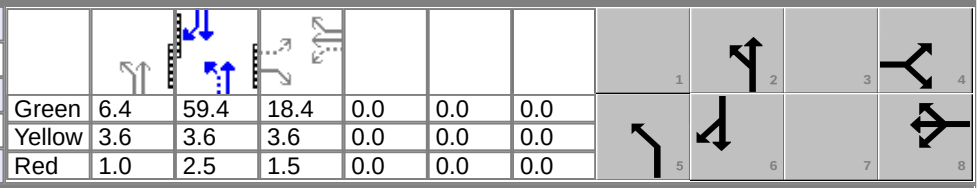
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Nov 26, 2018	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.91
Urban Street	Cliff Avenue	Analysis Year	2018	Analysis Period	1> 7:15
Intersection	41st St/SB I-229	File Name	14-16-18 Cliff Avenue 2018 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	90		100	196	93	29	172	1465			562	85

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	71	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	6.4	59.4	18.4	0.0	0.0	0.0		
Yellow	3.6	3.6	3.6	0.0	0.0	0.0		
Red	1.0	2.5	1.5	0.0	0.0	0.0		

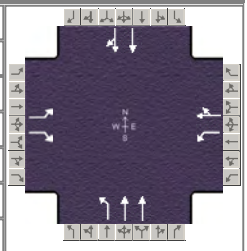
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2		6
Case Number		5.0		6.0	1.0	4.0		8.3
Phase Duration, s		23.5		23.5	11.0	76.5		65.5
Change Period, ($Y+R_c$), s		5.1		5.1	4.6	6.1		6.1
Max Allow Headway (*MAH*), s		5.2		5.2	5.2	0.0		0.0
Queue Clearance Time (g_s), s		16.3		13.6	5.9			
Green Extension Time (g_e), s		2.1		2.5	0.5	0.0		0.0
Phase Call Probability		1.00		1.00	0.99			
Max Out Probability		0.45		0.23	0.40			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14	3	8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h	99		110	215	134		189	1610			377	361
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1255		1543	1734	1746		1734	1734			1821	1737
Queue Service Time (g_s), s	7.6		6.3	11.6	6.8		3.9	25.7			11.7	10.1
Cycle Queue Clearance Time (g_c), s	14.3		6.3	11.6	6.8		3.9	25.7			11.7	10.1
Green Ratio (*g/C*)	0.18		0.18	0.18	0.18		0.68	0.70			0.59	0.59
Capacity (*c*), veh/h	219		285	392	322		526	2440			1081	1031
Volume-to-Capacity Ratio (*X*)	0.452		0.386	0.550	0.416		0.359	0.660			0.349	0.350
Back of Queue (*Q*), ft/ln (95 th percentile)	111		109.9	221.7	136.3		62.3	338.3			190.6	170.9
Back of Queue (*Q*), veh/ln (95 th percentile)	4.4		4.3	8.7	5.4		2.5	13.3			7.5	6.8
Queue Storage Ratio (*RQ*) (95 th percentile)	0.49		0.00	1.48	0.00		0.36	0.00			0.00	0.00
Uniform Delay (d_1), s/veh	42.3		35.8	38.0	36.0		7.1	8.2			10.3	9.7
Incremental Delay (d_2), s/veh	2.1		1.2	1.7	1.2		0.6	1.4			0.9	0.9
Initial Queue Delay (d_3), s/veh	0.0		0.0	0.0	0.0		0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	44.4		37.0	39.7	37.3		7.7	9.6			11.1	10.6
Level of Service (LOS)	D		D	D	D		A	A			B	B
Approach Delay, s/veh / LOS	40.5	D		38.8	D		9.4	A		10.9	B	
Intersection Delay, s/veh / LOS	15.2						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.30	B	2.13	B	1.63	B	1.88	B
Bicycle LOS Score / LOS		F	1.06	A	1.97	B	1.07	A

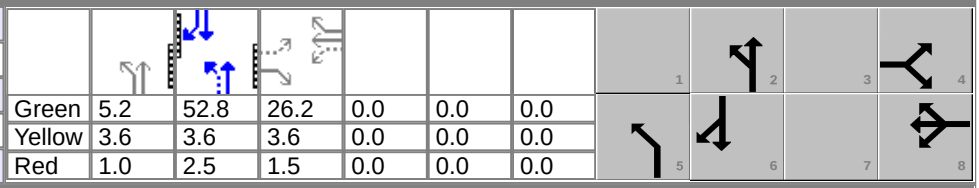
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Nov 26, 2018	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.93
Urban Street	Cliff Avenue	Analysis Year	2018	Analysis Period	1> 16:30
Intersection	41st St/SB I-229	File Name	14-16-18 Cliff Avenue 2018 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	151		231	366	84	36	118	530			1257	137

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	62	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	5.2	52.8	26.2	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.0	2.5	1.5	0.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2		6
Case Number		5.0		6.0	1.0	4.0		8.3
Phase Duration, s		31.3		31.3	9.8	68.7		58.9
Change Period, (*Y+R c*), s		5.1		5.1	4.6	6.1		6.1
Max Allow Headway (*MAH*), s		5.2		5.2	5.2	0.0		0.0
Queue Clearance Time (*g s*), s		19.7		23.7	5.2			
Green Extension Time (*g e*), s		3.8		2.5	0.2	0.0		0.0
Phase Call Probability		1.00		1.00	0.97			
Max Out Probability		0.60		1.00	1.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14	3	8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h	162		248	394	129		127	570			836	822
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1261		1543	1734	1728		1734	1734			1821	1758
Queue Service Time (*g s*), s	11.8		14.2	21.7	6.0		3.2	7.4			36.7	41.4
Cycle Queue Clearance Time (*g c*), s	17.7		14.2	21.7	6.0		3.2	7.4			36.7	41.4
Green Ratio (*g/C*)	0.26		0.26	0.26	0.26		0.60	0.63			0.53	0.53
Capacity (*c*), veh/h	327		404	526	453		196	2171			962	929
Volume-to-Capacity Ratio (*X*)	0.496		0.614	0.748	0.285		0.647	0.263			0.869	0.884
Back of Queue (*Q*), ft/ln (95 th percentile)	169.2		235.7	378.5	115.2		84.2	121			623.2	612.8
Back of Queue (*Q*), veh/ln (95 th percentile)	6.7		9.3	14.9	4.5		3.3	4.8			24.5	24.5
Queue Storage Ratio (*RQ*) (95 th percentile)	0.75		0.00	2.52	0.00		0.48	0.00			0.00	0.00
Uniform Delay (*d 1*), s/veh	36.5		32.5	35.2	29.4		22.1	8.4			21.1	21.0
Incremental Delay (*d 2*), s/veh	1.7		2.7	5.5	0.5		5.0	0.3			8.5	9.7
Initial Queue Delay (*d 3*), s/veh	0.0		0.0	0.0	0.0		0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	38.2		35.2	40.7	29.9		27.1	8.7			29.6	30.7
Level of Service (LOS)	D		D	D	C		C	A			C	C
Approach Delay, s/veh / LOS	36.4		D	38.0		D	12.0		B	30.1		C
Intersection Delay, s/veh / LOS	28.3						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.29	B	2.12	B	1.65	B	1.89	B
Bicycle LOS Score / LOS		F	1.35	A	1.06	A	1.72	B

HCS7 Two-Way Stop-Control Report

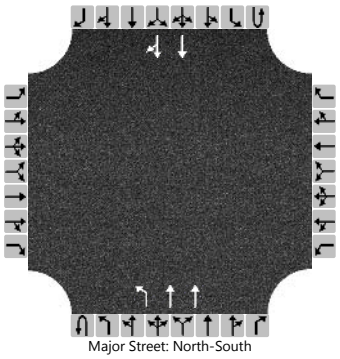
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	11/27/2018
Analysis Year	2018
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at SB I-229 Ent
Jurisdiction	Sioux Falls, SD
East/West Street	SB I-229 Entrance Ramp
North/South Street	Cliff Avenue
Peak Hour Factor	0.91
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	1	2	0	0	0	2	0
Configuration										L	T				T	TR
Volume (veh/h)									0	357	1637				627	231
Percent Heavy Vehicles (%)									2	2						
Proportion Time Blocked																
Percent Grade (%)																
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)										4.1						
Critical Headway (sec)										4.14						
Base Follow-Up Headway (sec)										2.2						
Follow-Up Headway (sec)										2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)										392						
Capacity, c (veh/h)										723						
v/c Ratio										0.54						
95% Queue Length, Q_{95} (veh)										3.3						
Control Delay (s/veh)										15.7						
Level of Service (LOS)										C						
Approach Delay (s/veh)									2.8							
Approach LOS																

HCS7 Two-Way Stop-Control Report

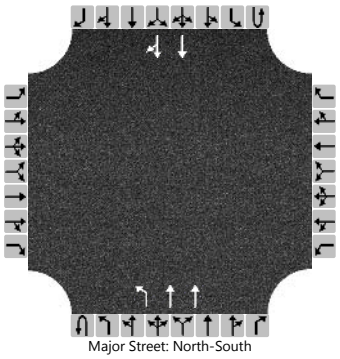
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	11/27/2018
Analysis Year	2018
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at SB I-229 Ent
Jurisdiction	Sioux Falls, SD
East/West Street	SB I-229 Entrance Ramp
North/South Street	Cliff Avenue
Peak Hour Factor	0.93
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	1	2	0	0	0	2	0
Configuration										L	T				T	TR
Volume (veh/h)									0	148	648				1358	496
Percent Heavy Vehicles (%)									2	2						
Proportion Time Blocked																
Percent Grade (%)																
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

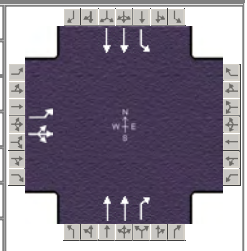
Base Critical Headway (sec)										4.1						
Critical Headway (sec)										4.14						
Base Follow-Up Headway (sec)										2.2						
Follow-Up Headway (sec)										2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)										159						
Capacity, c (veh/h)										285						
v/c Ratio										0.56						
95% Queue Length, Q_{95} (veh)										3.2						
Control Delay (s/veh)										32.6						
Level of Service (LOS)										D						
Approach Delay (s/veh)									6.1							
Approach LOS																

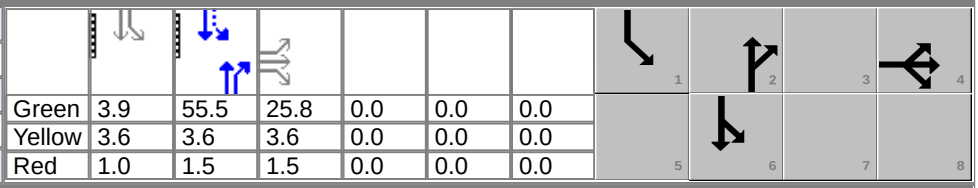
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Nov 26, 2018	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2018	Analysis Period	1> 7:15
Intersection	I-229 South Ramp	File Name	14-16-18 Cliff Avenue 2018 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	481	0	170					1513	424	89	538	

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	56	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	3.9	55.5	25.8	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.0	1.5	1.5	0.0	0.0	0.0

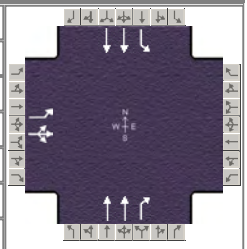
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4				2	1	6
Case Number		10.0				7.3	1.0	4.0
Phase Duration, s		30.9				60.6	8.5	69.1
Change Period, ($Y+R_c$), s		5.1				5.1	4.6	5.1
Max Allow Headway (*MAH*), s		5.3				0.0	5.2	0.0
Queue Clearance Time (g_s), s		24.3					4.1	
Green Extension Time (g_e), s		1.5				0.0	0.1	0.0
Phase Call Probability		1.00					0.92	
Max Out Probability		1.00					1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14					2	12	1	6	
Adjusted Flow Rate (*v*), veh/h	401	306						1351	334	91	549	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1603						1771	1506	1734	1678	
Queue Service Time (g_s), s	22.3	18.3						22.5	9.0	2.1	8.3	
Cycle Queue Clearance Time (g_c), s	22.3	18.3						22.5	9.0	2.1	8.3	
Green Ratio (*g/C*)	0.26	0.26						0.55	0.55	0.61	0.64	
Capacity (*c*), veh/h	447	413						1966	836	273	2148	
Volume-to-Capacity Ratio (*X*)	0.896	0.740						0.687	0.400	0.332	0.255	
Back of Queue (*Q*), ft/ln (95 th percentile)	436.3	332.2						267.9	121.5	37.6	138.7	
Back of Queue (*Q*), veh/ln (95 th percentile)	17.2	13.1						10.5	4.8	1.5	5.5	
Queue Storage Ratio (*RQ*) (95 th percentile)	1.09	0.00						0.00	0.49	0.19	0.00	
Uniform Delay (d_1), s/veh	35.8	39.5						10.4	7.8	11.7	9.7	
Incremental Delay (d_2), s/veh	18.8	6.6						1.4	1.0	1.0	0.3	
Initial Queue Delay (d_3), s/veh	0.0	0.0						0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	54.6	46.1						11.9	8.8	12.7	10.0	
Level of Service (LOS)	D	D						B	A	B	A	
Approach Delay, s/veh / LOS	50.9	D		0.0			11.3	B		10.4	B	
Intersection Delay, s/veh / LOS	20.3						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.39	B	2.32	B	1.37	A	1.67	B
Bicycle LOS Score / LOS	1.65	B			2.22	B	1.06	A

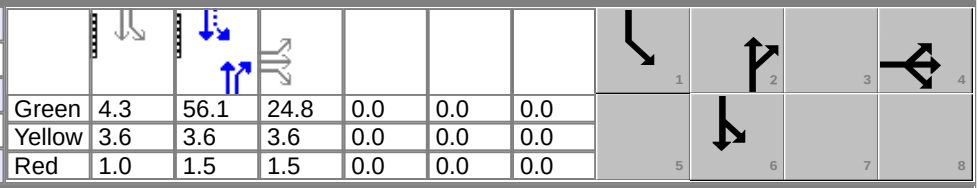
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Nov 26, 2018	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.92
Urban Street	Cliff Avenue	Analysis Year	2018	Analysis Period	1> 16:30
Intersection	I-229 South Ramp	File Name	14-16-18 Cliff Avenue 2018 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	195	0	437					601	185	109	1249	

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	48	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	4.3	56.1	24.8	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.0	1.5	1.5	0.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4				2	1	6
Case Number		10.0				7.3	1.0	4.0
Phase Duration, s		29.9				61.2	8.9	70.1
Change Period, ($Y+R_c$), s		5.1				5.1	4.6	5.1
Max Allow Headway (*MAH*), s		5.4				0.0	5.2	0.0
Queue Clearance Time (g_s), s		23.9					4.4	
Green Extension Time (g_e), s		1.0				0.0	0.1	0.0
Phase Call Probability		1.00					0.94	
Max Out Probability		1.00					1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14					2	12	1	6	
Adjusted Flow Rate (*v*), veh/h	180	344						584	122	103	1183	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1529						1682	1465	1734	1751	
Queue Service Time (g_s), s	8.7	21.9						7.0	2.6	2.4	17.9	
Cycle Queue Clearance Time (g_c), s	8.7	21.9						7.0	2.6	2.4	17.9	
Green Ratio (*g/C*)	0.25	0.25						0.56	0.56	0.62	0.65	
Capacity (*c*), veh/h	431	380						1888	822	554	2275	
Volume-to-Capacity Ratio (*X*)	0.418	0.905						0.309	0.148	0.186	0.520	
Back of Queue (*Q*), ft/ln (95 th percentile)	170.5	403.9						108.4	38.5	39.1	257.3	
Back of Queue (*Q*), veh/ln (95 th percentile)	6.7	15.9						4.3	1.5	1.5	10.1	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.43	0.00						0.00	0.15	0.20	0.00	
Uniform Delay (d_1), s/veh	31.5	37.6						8.1	6.5	8.0	9.3	
Incremental Delay (d_2), s/veh	0.9	22.8						0.4	0.4	0.2	0.7	
Initial Queue Delay (d_3), s/veh	0.0	0.0						0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	32.4	60.4						8.5	6.9	8.2	10.0	
Level of Service (LOS)	C	E						A	A	A	A	
Approach Delay, s/veh / LOS	50.8	D		0.0			8.3	A		9.8	A	
Intersection Delay, s/veh / LOS	17.9						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.40	B	2.32	B	1.37	A	1.86	B
Bicycle LOS Score / LOS	1.35	A			1.14	A	1.71	B

HCS7 Two-Way Stop-Control Report

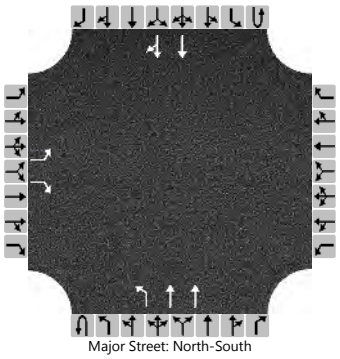
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	11/27/2018
Analysis Year	2018
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at Spencer Park
Jurisdiction	Sioux Falls, SD
East/West Street	Spencer Park Road
North/South Street	Cliff Avenue
Peak Hour Factor	0.88
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration		L		R						L	T				T	TR
Volume (veh/h)		1		1					0	2	1936				705	3
Percent Heavy Vehicles (%)		2		2					2	2						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized		No														
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5		6.9						4.1						
Critical Headway (sec)		6.84		6.94						4.14						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.52		3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		1		1						2						
Capacity, c (veh/h)		176		598						815						
v/c Ratio		0.01		0.00						0.00						
95% Queue Length, Q_{95} (veh)		0.0		0.0						0.0						
Control Delay (s/veh)		25.6		11.0						9.4						
Level of Service (LOS)		D		B						A						
Approach Delay (s/veh)		18.3								0.0						
Approach LOS		C														

HCS7 Two-Way Stop-Control Report

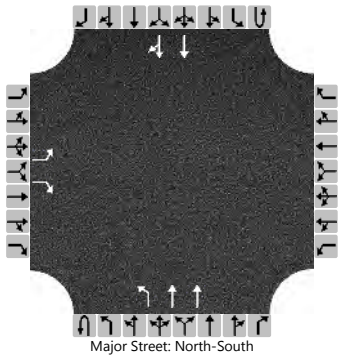
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	11/27/2018
Analysis Year	2018
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at Spencer Park
Jurisdiction	Sioux Falls, SD
East/West Street	Spencer Park Road
North/South Street	Cliff Avenue
Peak Hour Factor	0.91
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration		L		R						L	T				T	TR
Volume (veh/h)		3		15					0	16	783				1662	24
Percent Heavy Vehicles (%)		2		2					2	2						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized		No														
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

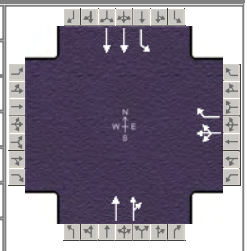
Base Critical Headway (sec)		7.5		6.9						4.1						
Critical Headway (sec)		6.84		6.94						4.14						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.52		3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		3		16						18						
Capacity, c (veh/h)		92		270						323						
v/c Ratio		0.04		0.06						0.05						
95% Queue Length, Q_{95} (veh)		0.1		0.2						0.2						
Control Delay (s/veh)		45.6		19.2						16.8						
Level of Service (LOS)		E		C						C						
Approach Delay (s/veh)		23.6								0.3						
Approach LOS		C														

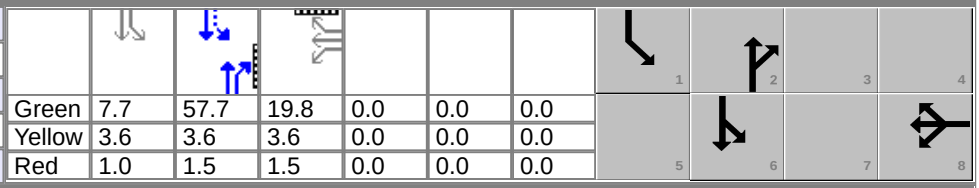
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Nov 26, 2018	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.84
Urban Street	Cliff Avenue	Analysis Year	2018	Analysis Period	1> 7:15
Intersection	49th Street	File Name	14-16-18 Cliff Avenue 2018 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				35	0	590		1258	11	171	502	

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	3	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	7.7	57.7	19.8	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.0	1.5	1.5	0.0	0.0	0.0

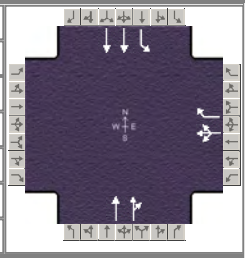
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase				8		2	1	6
Case Number				11.0		8.3	1.0	4.0
Phase Duration, s				24.9		62.8	12.3	75.1
Change Period, (*Y+R c*), s				5.1		5.1	4.6	5.1
Max Allow Headway (*MAH*), s				5.3		0.0	5.1	0.0
Queue Clearance Time (*g s*), s				18.0			6.7	
Green Extension Time (*g e*), s				1.9		0.0	1.0	0.0
Phase Call Probability				1.00			1.00	
Max Out Probability				0.27			0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement				3	8	18		2	12	1	6	
Adjusted Flow Rate (*v*), veh/h					183	263		879	878	204	598	
Adjusted Saturation Flow Rate (*s*), veh/h/ln					1636	1585		1870	1865	1781	1781	
Queue Service Time (*g s*), s					11.0	16.0		42.2	34.4	4.7	6.1	
Cycle Queue Clearance Time (*g c*), s					11.0	16.0		42.2	34.4	4.7	6.1	
Green Ratio (*g/C*)					0.20	0.20		0.58	0.58	0.67	0.70	
Capacity (*c*), veh/h					324	314		1079	1076	251	2492	
Volume-to-Capacity Ratio (*X*)					0.565	0.837		0.815	0.816	0.811	0.240	
Back of Queue (*Q*), ft/ln (95 th percentile)					217.6	288.7		388.5	383.5	153.1	89.7	
Back of Queue (*Q*), veh/ln (95 th percentile)					8.7	11.4		15.3	15.3	6.0	3.5	
Queue Storage Ratio (*RQ*) (95 th percentile)					0.00	1.28		0.00	0.00	0.39	0.00	
Uniform Delay (*d 1*), s/veh					43.5	38.5		12.6	12.7	23.5	5.4	
Incremental Delay (*d 2*), s/veh					2.2	11.2		3.0	3.0	8.6	0.2	
Initial Queue Delay (*d 3*), s/veh					0.0	0.0		0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh					45.7	49.8		15.6	15.7	32.2	5.6	
Level of Service (LOS)					D	D		B	B	C	A	
Approach Delay, s/veh / LOS	0.0			48.1		D	15.7		B	12.4		B
Intersection Delay, s/veh / LOS	19.6						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.15	B	2.32	B	2.24	B	1.34	A
Bicycle LOS Score / LOS			1.22	A	1.73	B	1.15	A

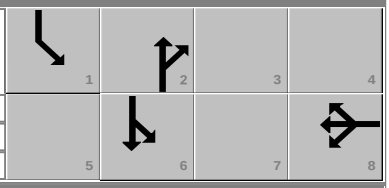
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Nov 26, 2018	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.93
Urban Street	Cliff Avenue	Analysis Year	2018	Analysis Period	1> 16:30
Intersection	49th Street	File Name	14-16-18 Cliff Avenue 2018 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				46	0	190		542	53	457	1150	

Signal Information			
Cycle, s	52.3	Reference Phase	2
Offset, s	3	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	11.5	18.1	8.0	0.0	0.0	0.0			
Yellow	3.6	3.6	3.6	0.0	0.0	0.0			
Red	1.0	1.5	1.5	0.0	0.0	0.0			

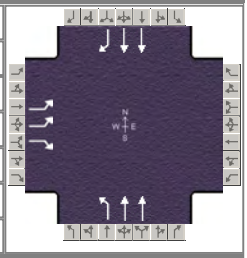
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase				8		2	1	6
Case Number				11.0		8.3	1.0	4.0
Phase Duration, s				13.1		23.2	16.1	39.2
Change Period, ($Y+R_c$), s				5.1		5.1	4.6	5.1
Max Allow Headway (*MAH*), s				5.3		3.0	5.1	3.0
Queue Clearance Time (g_s), s				7.1		12.7	9.9	11.7
Green Extension Time (g_e), s				1.1		5.3	1.5	5.4
Phase Call Probability				0.98		1.00	1.00	1.00
Max Out Probability				0.04		0.06	0.78	0.05

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement				3	8	18		2	12	1	6	
Adjusted Flow Rate (*v*), veh/h					90	163		404	392	491	1237	
Adjusted Saturation Flow Rate (*s*), veh/h/ln					1708	1585		1870	1811	1781	1781	
Queue Service Time (g_s), s					2.6	5.1		10.7	9.5	7.9	9.7	
Cycle Queue Clearance Time (g_c), s					2.6	5.1		10.7	9.5	7.9	9.7	
Green Ratio (*g/C*)					0.15	0.15		0.35	0.35	0.60	0.65	
Capacity (*c*), veh/h					261	242		645	625	624	2322	
Volume-to-Capacity Ratio (*X*)					0.346	0.674		0.626	0.627	0.787	0.532	
Back of Queue (*Q*), ft/ln (95 th percentile)					46.6	90.5		153.8	146.9	121.1	86.3	
Back of Queue (*Q*), veh/ln (95 th percentile)					1.9	3.6		6.1	5.9	4.8	3.4	
Queue Storage Ratio (*RQ*) (95 th percentile)					0.00	0.40		0.00	0.00	0.31	0.00	
Uniform Delay (d_1), s/veh					21.5	20.9		14.3	14.3	8.8	4.9	
Incremental Delay (d_2), s/veh					1.1	4.6		0.4	0.4	5.0	0.1	
Initial Queue Delay (d_3), s/veh					0.0	0.0		0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh					22.6	25.5		14.7	14.7	13.8	5.0	
Level of Service (LOS)					C	C		B	B	B	A	
Approach Delay, s/veh / LOS	0.0			24.5		C	14.7		B	7.5		A
Intersection Delay, s/veh / LOS	11.1						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.13	B	2.30	B	1.89	B	1.33	A
Bicycle LOS Score / LOS			0.91	A	1.02	A	1.91	B

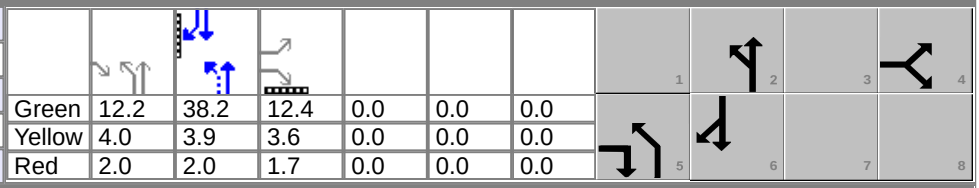
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Nov 21, 2018	Area Type	Other
Jurisdiction	Sioux Falls	Time Period	AM	PHF	0.82
Urban Street	Western Avenue	Analysis Year	2018	Analysis Period	1> 7:15
Intersection	49th Street	File Name	19-20-21-22 Western 2018 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	205		173				327	732			408	99

Signal Information			
Cycle, s	80.0	Reference Phase	2
Offset, s	21	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	12.2	38.2	12.4	0.0	0.0	0.0
Yellow	4.0	3.9	3.6	0.0	0.0	0.0
Red	2.0	2.0	1.7	0.0	0.0	0.0

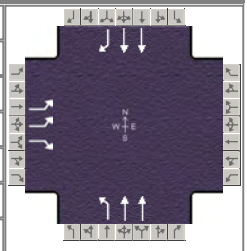
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			5	2		6
Case Number		9.0			1.0	4.0		7.3
Phase Duration, s		17.7			18.2	62.3		44.1
Change Period, ($Y+R_c$), s		5.3			6.0	5.9		5.9
Max Allow Headway (*MAH*), s		5.2			5.1	0.0		0.0
Queue Clearance Time (g_s), s		10.8			10.2			
Green Extension Time (g_e), s		1.6			2.0	0.0		0.0
Phase Call Probability		1.00			1.00			
Max Out Probability		0.62			0.06			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14				5	2			6	16
Adjusted Flow Rate (*v*), veh/h	250		211				399	893			776	188
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684		1543				1734	1734			1734	1543
Queue Service Time (g_s), s	5.4		8.8				8.2	8.2			13.8	5.8
Cycle Queue Clearance Time (g_c), s	5.4		8.8				8.2	8.2			13.8	5.8
Green Ratio (*g/C*)	0.15		0.31				0.66	0.71			0.48	0.48
Capacity (*c*), veh/h	520		474				567	2446			1657	738
Volume-to-Capacity Ratio (*X*)	0.480		0.445				0.703	0.365			0.468	0.255
Back of Queue (*Q*), ft/ln (95 th percentile)	100.1		142.9				122.8	100.7			235.2	89.9
Back of Queue (*Q*), veh/ln (95 th percentile)	3.9		5.6				4.8	4.0			9.3	3.5
Queue Storage Ratio (*RQ*) (95 th percentile)	0.40		0.00				0.49	0.00			0.00	0.36
Uniform Delay (d_1), s/veh	30.9		22.2				9.8	4.7			17.8	12.5
Incremental Delay (d_2), s/veh	1.0		0.9				2.3	0.4			0.8	0.7
Initial Queue Delay (d_3), s/veh	0.0		0.0				0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	31.9		23.2				12.1	5.1			18.6	13.2
Level of Service (LOS)	C		C				B	A			B	B
Approach Delay, s/veh / LOS	27.9		C	0.0			7.3		A	17.5		B
Intersection Delay, s/veh / LOS	14.4						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.31	B	2.31	B	0.65	A	2.08	B
Bicycle LOS Score / LOS		F			1.55	B	1.00	A

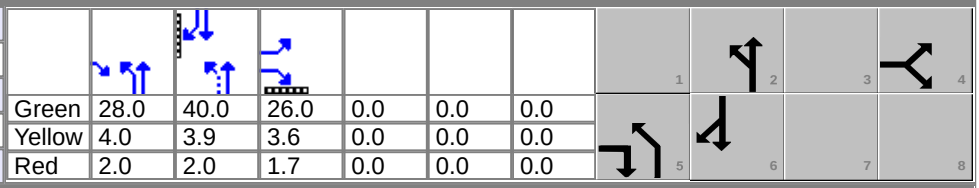
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Nov 21, 2018	Area Type	Other
Jurisdiction	Sioux Falls	Time Period	PM	PHF	0.91
Urban Street	Western Avenue	Analysis Year	2018	Analysis Period	1> 16:30
Intersection	49th Street	File Name	19-20-21-22 Western 2018 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	303		521				445	767			918	280

Signal Information			
Cycle, s	111.2	Reference Phase	2
Offset, s	43	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	28.0	40.0	26.0	0.0	0.0	0.0
Yellow	4.0	3.9	3.6	0.0	0.0	0.0
Red	2.0	2.0	1.7	0.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			5	2		6
Case Number		9.0			1.0	4.0		7.3
Phase Duration, s		31.3			34.0	79.9		45.9
Change Period, ($Y+R_c$), s		5.3			6.0	5.9		5.9
Max Allow Headway (*MAH*), s		5.3			5.1	3.1		3.1
Queue Clearance Time (g_s), s		28.0			18.2	13.9		20.4
Green Extension Time (g_e), s		0.0			2.1	4.8		4.4
Phase Call Probability		1.00			1.00	1.00		1.00
Max Out Probability		1.00			0.29	0.00		0.03

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14				5	2			6	16
Adjusted Flow Rate (*v*), veh/h	333		573				489	843			713	159
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684		1543				1734	1734			1734	1543
Queue Service Time (g_s), s	9.3		26.0				16.2	11.9			18.4	8.2
Cycle Queue Clearance Time (g_c), s	9.3		26.0				16.2	11.9			18.4	8.2
Green Ratio (*g/C*)	0.23		0.49				0.63	0.67			0.36	0.36
Capacity (*c*), veh/h	788		749				645	2307			1247	555
Volume-to-Capacity Ratio (*X*)	0.423		0.764				0.759	0.365			0.571	0.287
Back of Queue (*Q*), ft/ln (95 th percentile)	182.1		484.7				292.2	190.7			302.4	143
Back of Queue (*Q*), veh/ln (95 th percentile)	7.2		19.1				11.5	7.5			11.9	5.6
Queue Storage Ratio (*RQ*) (95 th percentile)	0.73		0.00				0.97	0.00			0.00	0.57
Uniform Delay (d_1), s/veh	36.2		23.4				15.4	8.2			28.7	25.4
Incremental Delay (d_2), s/veh	1.7		7.3				8.2	0.4			1.6	1.1
Initial Queue Delay (d_3), s/veh	0.0		0.0				0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	37.9		30.7				23.6	8.7			30.3	26.5
Level of Service (LOS)	D		C				C	A			C	C
Approach Delay, s/veh / LOS	33.3		C	0.0			14.1		B	29.6		C
Intersection Delay, s/veh / LOS	24.1						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.32	B	2.43	B	0.67	A	2.11	B
Bicycle LOS Score / LOS		F			1.59	B	1.51	B

HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc.			Interchange Type	Diamond
Analyst	Graham Johnson	Analysis Date	Nov 21, 2018	Segment Distance, ft	700
Jurisdiction	Sioux Falls	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 North Ramp	PHF	0.84	Arterial Direction	North-South
File Name	19-20-21-22 Western 2018 AM.xus				
Project Description	I-229 Exits 3 and 4				

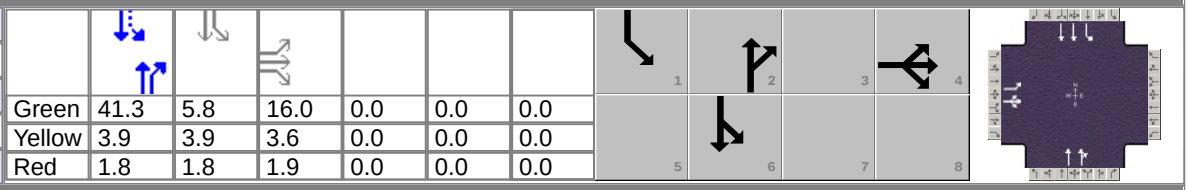
Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h				283	0	465	87	924			493	124
Intersection Two Demand (*v*), veh/h	303	0	149					708	290	149	627	

Signal One Information	
Cycle, s	80.0
Offset, s	66
Uncoordinated	No
Force Mode	Fixed

Green	32.8	4.4	24.7	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0

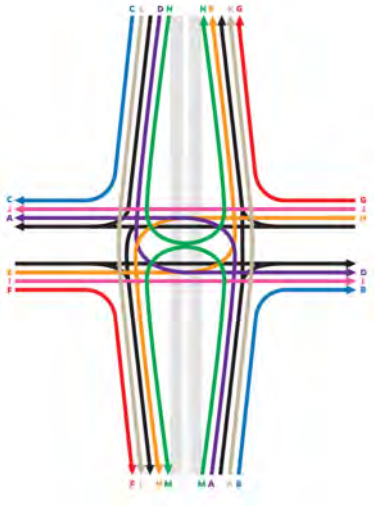
Signal Two Information	
Cycle, s	80.0
Offset, s	66
Uncoordinated	No
Force Mode	Fixed

Green	41.3	5.8	16.0	0.0	0.0	0.0
Yellow	3.9	3.9	3.6	0.0	0.0	0.0
Red	1.8	1.8	1.9	0.0	0.0	0.0



Interchange Results

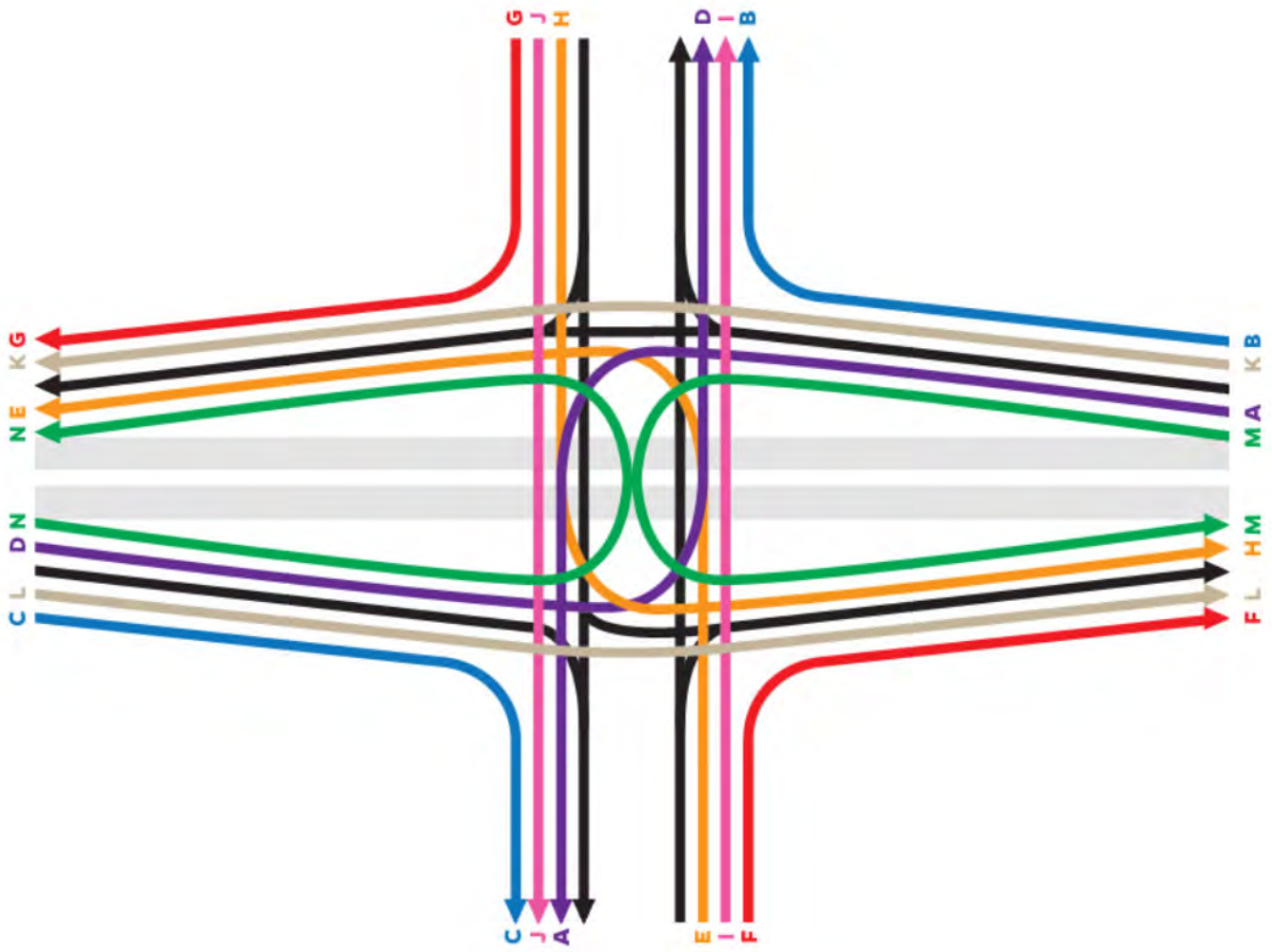
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	0	19.5	0.0	19.5	No	No	B
B	0	0.0	0.0	0.0	No	No	A
C	0	0.0	0.0	0.0	No	No	A
D	0	20.3	0.0	20.3	No	No	B
E	0	15.2	0.0	15.2	No	No	B
F	0	15.2	0.0	15.2	No	No	B
G	0	0.0	0.0	0.0	No	No	A
H	0	5.8	0.0	5.8	No	No	A
I	1149	35.5	0.0	35.5	No	No	C
J	627	25.3	0.0	25.3	No	No	B
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh					25.4	30.5	28.4	15.2			19.5	18.2
Level of Service (LOS)					C	C	C	B			B	B
Approach Delay, s/veh / LOS	0.0			28.1	C		16.3	B		18.9	B	
Intersection Delay, s/veh / LOS	20.3						C					

Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	32.3	40.0						20.3	21.4	34.3	5.8	
Level of Service (LOS)	C	D						C	C	C	A	
Approach Delay, s/veh / LOS	36.2	D		0.0			20.8	C		11.3	B	
Intersection Delay, s/veh / LOS	20.9						C					

Interchange Graphic



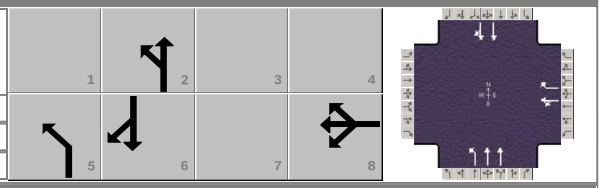
HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc.			Interchange Type	Diamond
Analyst	Graham Johnson	Analysis Date	Nov 21, 2018	Segment Distance, ft	700
Jurisdiction	Sioux Falls	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 North Ramp	PHF	0.92	Arterial Direction	North-South
File Name	19-20-21-22 Western 2018 PM.xus				
Project Description	I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h				305	2	474	150	855			1239	310
Intersection Two Demand (*v*), veh/h	226	2	109					779	319	479	1065	

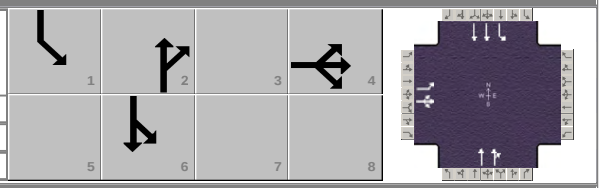
Signal One Information	
Cycle, s	120.0
Offset, s	11
Uncoordinated	No
Force Mode	Fixed

Green	70.9	5.0	26.2	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0



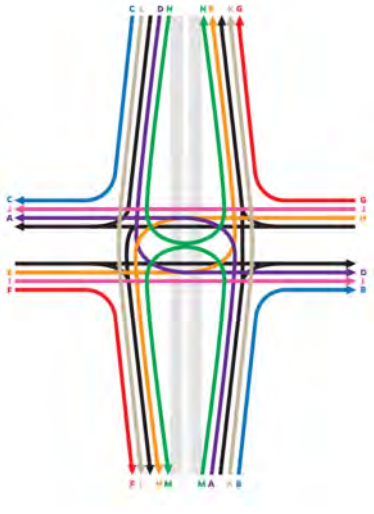
Signal Two Information	
Cycle, s	120.0
Offset, s	11
Uncoordinated	No
Force Mode	Fixed

Green	71.4	15.7	16.0	0.0	0.0	0.0
Yellow	3.9	3.9	3.6	0.0	0.0	0.0
Red	1.8	1.8	1.9	0.0	0.0	0.0



Interchange Results

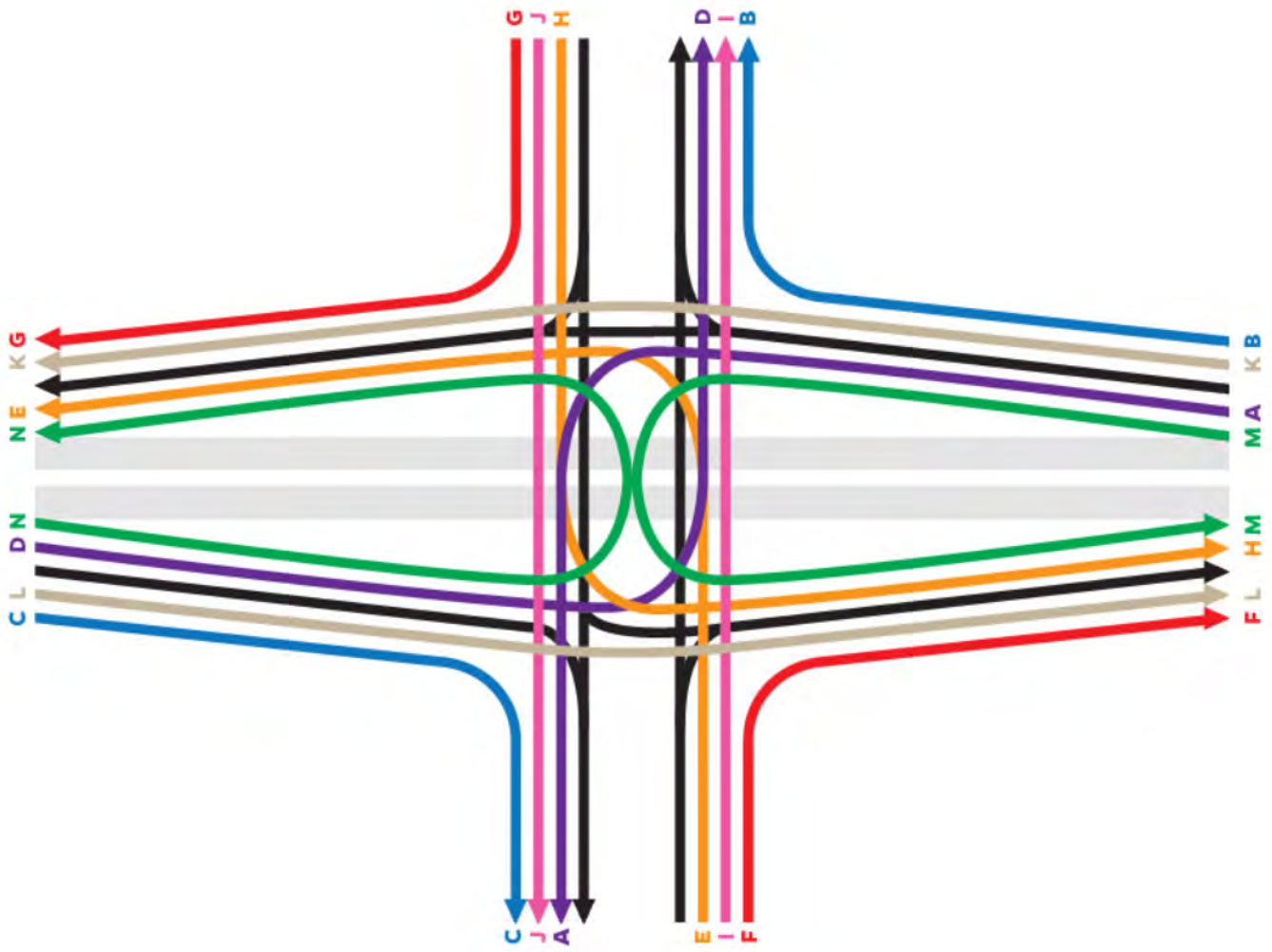
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	0	11.6	0.0	11.6	No	No	A
B	0	0.0	0.0	0.0	No	No	A
C	0	0.0	0.0	0.0	No	No	A
D	0	17.5	0.0	17.5	No	No	B
E	0	8.8	0.0	8.8	No	No	A
F	0	8.8	0.0	8.8	No	No	A
G	0	0.0	0.0	0.0	No	No	A
H	0	4.0	0.0	4.0	No	No	A
I	1093	26.3	0.0	26.3	No	No	B
J	625	15.6	0.0	15.6	No	No	B
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh					65.1	71.2	57.0	8.8			11.6	12.3
Level of Service (LOS)					E	E	E	A			B	B
Approach Delay, s/veh / LOS	0.0			68.0		E	16.0		B	12.0		B
Intersection Delay, s/veh / LOS	27.7						C					

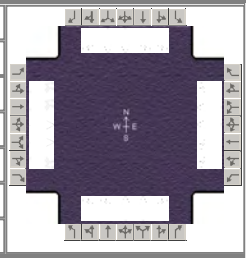
Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	53.5	56.9						17.5	16.1	43.3	4.0	
Level of Service (LOS)	D	E						B	B	D	A	
Approach Delay, s/veh / LOS	55.2		E	0.0			16.9		B	16.2		B
Intersection Delay, s/veh / LOS	21.2						C					

Interchange Graphic



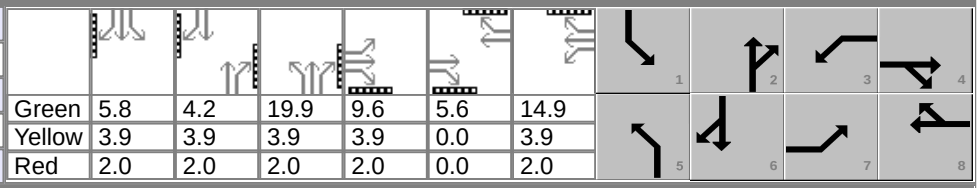
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Nov 21, 2018	Area Type	Other
Jurisdiction	Sioux Falls	Time Period	AM	PHF	0.87
Urban Street	Western Avenue	Analysis Year	2018	Analysis Period	1> 7:15
Intersection	57th Street	File Name	19-20-21-22 Western 2018 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	242	360	126	91	575	234	137	522	41	121	437	218

Signal Information			
Cycle, s	89.5	Reference Phase	2
Offset, s	75	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	5.8	4.2	19.9	9.6	5.6	14.9
Yellow	3.9	3.9	3.9	3.9	0.0	3.9
Red	2.0	2.0	2.0	2.0	0.0	2.0

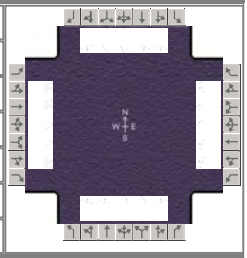
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	15.5	21.2	20.8	26.5	25.8	35.9	11.7	21.8
Change Period, ($Y+R_c$), s	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9
Max Allow Headway (*MAH*), s	2.6	5.0	4.7	4.7	3.0	3.0	5.0	3.1
Queue Clearance Time (g_s), s	9.2	12.1	4.4	18.2	8.8	31.0	5.6	14.5
Green Extension Time (g_e), s	0.4	3.2	3.2	2.3	1.8	0.0	0.4	1.4
Phase Call Probability	1.00	1.00	0.93	1.00	1.00	1.00	0.97	1.00
Max Out Probability	0.00	0.00	0.62	0.84	0.72	1.00	0.20	0.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	278	414	99	105	661	171	298	1134	57	139	502	147
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1734	1543	1684	1734	1543	1684	1734	1543	1684	1734	1543
Queue Service Time (g_s), s	7.2	10.1	5.1	2.4	16.2	8.6	6.8	29.0	2.3	3.6	12.5	7.8
Cycle Queue Clearance Time (g_c), s	7.2	10.1	5.1	2.4	16.2	8.6	6.8	29.0	2.3	3.6	12.5	7.8
Green Ratio (*g/C*)	0.11	0.17	0.17	0.17	0.23	0.23	0.22	0.34	0.34	0.06	0.18	0.18
Capacity (*c*), veh/h	361	591	263	561	796	354	749	1162	517	217	615	274
Volume-to-Capacity Ratio (*X*)	0.770	0.701	0.376	0.187	0.830	0.483	0.398	0.977	0.109	0.640	0.817	0.538
Back of Queue (*Q*), ft/ln (95 th percentile)	135.3	195.1	88.6	43.7	295.6	147.6	106.6	417	35.9	72.7	226.4	122.8
Back of Queue (*Q*), veh/ln (95 th percentile)	5.3	7.7	3.5	1.7	11.6	5.8	4.2	16.4	1.4	2.9	8.9	4.8
Queue Storage Ratio (*RQ*) (95 th percentile)	0.44	0.00	0.35	0.17	0.00	0.57	0.30	0.00	0.28	0.58	0.00	0.98
Uniform Delay (d_1), s/veh	38.9	35.0	32.9	32.1	32.8	29.9	29.7	29.4	16.8	40.9	35.4	6.7
Incremental Delay (d_2), s/veh	1.3	2.1	1.2	0.1	6.1	1.4	0.0	10.4	0.0	4.3	1.0	0.6
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	40.2	37.1	34.1	32.2	38.9	31.3	29.8	39.8	16.8	45.1	36.5	7.3
Level of Service (LOS)	D	D	C	C	D	C	C	D	B	D	D	A
Approach Delay, s/veh / LOS	37.8	D		36.8	D		36.9	D		32.6	C	
Intersection Delay, s/veh / LOS	36.2						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.61	C	2.71	C	2.69	C	2.64	C
Bicycle LOS Score / LOS	1.14	A	1.26	A	1.14	A	1.14	A

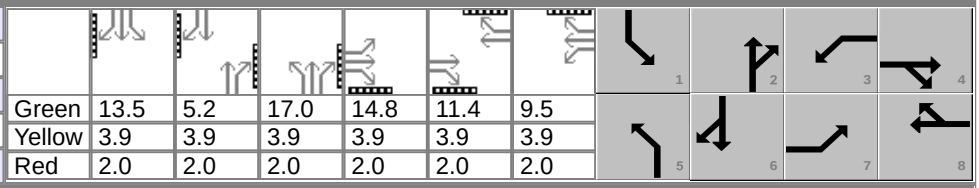
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Nov 21, 2018	Area Type	Other
Jurisdiction	Sioux Falls	Time Period	PM	PHF	0.91
Urban Street	Western Avenue	Analysis Year	2018	Analysis Period	1> 16:30
Intersection	57th Street	File Name	19-20-21-22 Western 2018 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	358	770	164	130	555	194	268	546	116	301	633	240

Signal Information			
Cycle, s	106.9	Reference Phase	2
Offset, s	15	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	13.5	5.2	17.0	14.8	11.4	9.5		
Yellow	3.9	3.9	3.9	3.9	3.9	3.9		
Red	2.0	2.0	2.0	2.0	2.0	2.0		

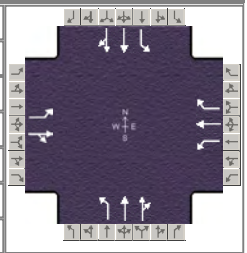
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	20.7	37.9	15.4	32.7	22.9	34.1	19.4	30.6
Change Period, ($Y+R_c$), s	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9
Max Allow Headway (*MAH*), s	2.6	5.0	4.6	4.6	2.9	2.9	5.0	3.1
Queue Clearance Time (g_s), s	14.2	26.2	6.3	19.1	13.8	25.4	12.2	22.6
Green Extension Time (g_e), s	0.6	5.8	3.3	3.9	2.2	2.7	1.3	2.0
Phase Call Probability	1.00	1.00	0.99	1.00	1.00	1.00	1.00	1.00
Max Out Probability	0.00	0.19	0.37	0.20	0.18	0.03	0.14	0.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	393	846	136	143	610	131	390	795	111	331	696	181
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1734	1543	1684	1734	1543	1684	1734	1543	1684	1734	1543
Queue Service Time (g_s), s	12.2	24.2	7.3	4.3	17.1	7.4	11.8	23.4	6.1	10.2	20.6	11.0
Cycle Queue Clearance Time (g_c), s	12.2	24.2	7.3	4.3	17.1	7.4	11.8	23.4	6.1	10.2	20.6	11.0
Green Ratio (*g/C*)	0.14	0.30	0.30	0.09	0.25	0.25	0.16	0.26	0.26	0.13	0.23	0.23
Capacity (*c*), veh/h	466	1040	463	301	869	387	537	914	407	427	801	357
Volume-to-Capacity Ratio (*X*)	0.844	0.814	0.294	0.475	0.702	0.338	0.727	0.869	0.272	0.775	0.868	0.508
Back of Queue (*Q*), ft/ln (95 th percentile)	224.2	397.8	123.7	82.6	299.1	128.5	196.2	355.8	101.2	200.4	349.1	171.8
Back of Queue (*Q*), veh/ln (95 th percentile)	8.8	15.7	4.9	3.3	11.8	5.1	7.7	14.0	4.0	7.9	13.7	6.8
Queue Storage Ratio (*RQ*) (95 th percentile)	0.72	0.00	0.49	0.32	0.00	0.49	0.56	0.00	0.78	1.60	0.00	1.37
Uniform Delay (d_1), s/veh	45.0	34.7	28.8	46.3	36.5	32.8	42.8	37.6	22.5	45.2	39.6	5.7
Incremental Delay (d_2), s/veh	1.6	3.3	0.5	0.4	2.0	0.7	1.0	2.4	0.1	4.2	2.5	0.4
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	46.6	38.0	29.3	46.8	38.5	33.5	43.8	40.0	22.5	49.4	42.0	6.1
Level of Service (LOS)	D	D	C	D	D	C	D	D	C	D	D	A
Approach Delay, s/veh / LOS	39.6	D		39.1	D		39.7	D		38.7	D	
Intersection Delay, s/veh / LOS	39.3						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.66	C	2.69	C	2.69	C	2.65	C
Bicycle LOS Score / LOS	1.62	B	1.22	A	1.29	A	1.48	A

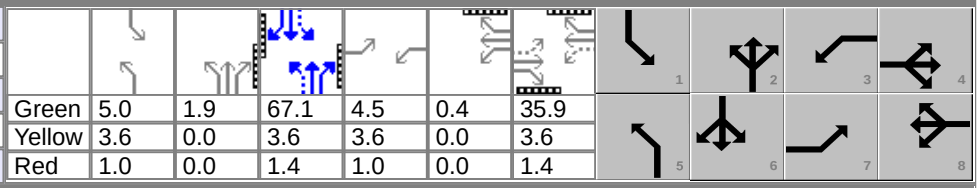
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Nov 26, 2018	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.87
Urban Street	26th Street	Analysis Year	2018	Analysis Period	1> 7:15
Intersection	Cliff Avenue	File Name	23 26th at Cliff 2018 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	49	191	35	54	339	240	106	867	21	70	313	31

Signal Information			
Cycle, s	134.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	5.0	1.9	67.1	4.5	0.4	35.9						
Yellow	3.6	0.0	3.6	3.6	0.0	3.6						
Red	1.0	0.0	1.4	1.0	0.0	1.4						

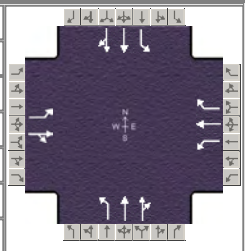
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	9.1	40.9	9.5	41.3	11.4	74.0	9.6	72.1
Change Period, ($Y+R_c$), s	4.6	5.0	4.6	5.0	4.6	5.0	4.6	5.0
Max Allow Headway (*MAH*), s	4.2	6.2	4.2	6.2	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	5.1	17.9	5.5	28.6	6.5		5.0	
Green Extension Time (g_e), s	0.0	8.5	0.0	7.7	0.4	0.0	0.2	0.0
Phase Call Probability	0.88	1.00	0.90	1.00	0.99		0.95	
Max Out Probability	1.00	0.04	1.00	0.13	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	56	248		62	390	190	122	509	506	80	193	191
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1784		1734	1821	1543	1734	1821	1809	1734	1821	1781
Queue Service Time (g_s), s	3.1	15.9		3.5	26.6	13.7	4.5	25.2	25.2	3.0	7.9	8.0
Cycle Queue Clearance Time (g_c), s	3.1	15.9		3.5	26.6	13.7	4.5	25.2	25.2	3.0	7.9	8.0
Green Ratio (*g/C*)	0.30	0.27		0.30	0.27	0.27	0.55	0.52	0.52	0.54	0.50	0.50
Capacity (*c*), veh/h	169	478		286	493	418	583	938	932	291	913	892
Volume-to-Capacity Ratio (*X*)	0.333	0.520		0.217	0.790	0.454	0.209	0.543	0.543	0.276	0.212	0.214
Back of Queue (*Q*), ft/ln (95 th percentile)	63.8	297.2		68.9	476.8	235.1	83.6	426.8	417.9	57	161.3	156.7
Back of Queue (*Q*), veh/ln (95 th percentile)	2.5	11.7		2.7	18.8	9.3	3.3	16.8	16.7	2.2	6.4	6.3
Queue Storage Ratio (*RQ*) (95 th percentile)	0.49	0.00		0.60	0.00	2.04	0.48	0.00	0.00	0.38	0.00	0.00
Uniform Delay (d_1), s/veh	36.9	41.7		34.6	45.3	40.6	14.7	21.9	21.9	17.8	18.7	18.7
Incremental Delay (d_2), s/veh	1.1	1.9		0.4	6.3	1.6	0.2	2.3	2.3	0.5	0.5	0.5
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	38.1	43.6		35.0	51.6	42.3	14.9	24.1	24.1	18.3	19.2	19.2
Level of Service (LOS)	D	D		C	D	D	B	C	C	B	B	B
Approach Delay, s/veh / LOS	42.6	D		47.2	D		23.1	C		19.0	B	
Intersection Delay, s/veh / LOS	30.8						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.31	B	2.31	B	2.21	B	1.92	B
Bicycle LOS Score / LOS	0.99	A	1.55	B	1.43	A	0.87	A

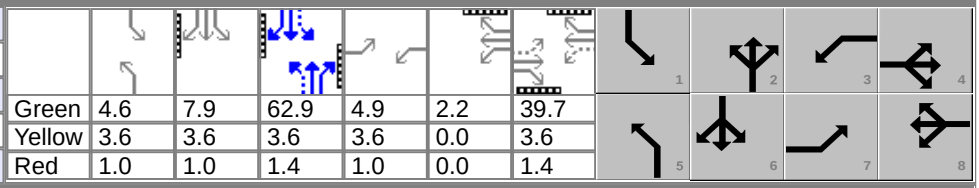
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Nov 26, 2018	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	26th Street	Analysis Year	2018	Analysis Period	1> 16:30
Intersection	Cliff Avenue	File Name	23 26th at Cliff 2018 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	51	313	93	79	283	74	57	507	87	279	1029	66

Signal Information			
Cycle, s	146.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	4.6	7.9	62.9	4.9	2.2	39.7		
Yellow	3.6	3.6	3.6	3.6	0.0	3.6		
Red	1.0	1.0	1.4	1.0	0.0	1.4		

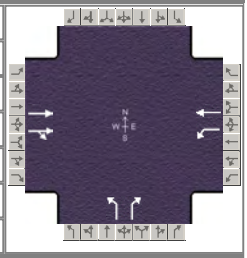
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	9.5	44.7	11.7	46.9	9.2	67.9	21.7	80.4
Change Period, ($Y+R_c$), s	4.6	5.0	4.6	5.0	4.6	5.0	4.6	5.0
Max Allow Headway (*MAH*), s	4.2	6.2	4.2	6.2	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	5.4	37.6	7.3	23.7	5.0		15.9	
Green Extension Time (g_e), s	0.0	2.1	0.0	6.9	0.0	0.0	1.2	0.0
Phase Call Probability	0.90	1.00	0.97	1.00	0.92		1.00	
Max Out Probability	1.00	1.00	1.00	0.25	1.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	57	440		88	314	66	63	331	318	310	608	597
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1755		1734	1821	1543	1734	1821	1737	1734	1821	1788
Queue Service Time (g_s), s	3.4	35.6		5.3	21.7	4.6	3.0	18.5	18.6	13.9	35.4	35.4
Cycle Queue Clearance Time (g_c), s	3.4	35.6		5.3	21.7	4.6	3.0	18.5	18.6	13.9	35.4	35.4
Green Ratio (*g/C*)	0.31	0.27		0.32	0.29	0.29	0.46	0.43	0.43	0.56	0.52	0.52
Capacity (*c*), veh/h	240	477		160	522	442	225	785	749	490	941	923
Volume-to-Capacity Ratio (*X*)	0.236	0.923		0.548	0.602	0.148	0.282	0.422	0.424	0.633	0.646	0.647
Back of Queue (*Q*), ft/ln (95 th percentile)	69.1	657.6		110	395.5	83.3	58.6	338.5	322.7	247	577.5	561
Back of Queue (*Q*), veh/ln (95 th percentile)	2.7	25.9		4.3	15.6	3.3	2.3	13.3	12.9	9.7	22.7	22.4
Queue Storage Ratio (*RQ*) (95 th percentile)	0.53	0.00		0.96	0.00	0.72	0.33	0.00	0.00	1.65	0.00	0.00
Uniform Delay (d_1), s/veh	38.1	51.7		40.3	44.9	38.8	24.3	28.9	28.9	19.5	25.6	25.6
Incremental Delay (d_2), s/veh	0.5	23.6		2.9	2.8	0.3	0.7	1.7	1.8	1.4	3.4	3.5
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	38.6	75.3		43.2	47.7	39.1	25.0	30.6	30.7	20.8	29.0	29.1
Level of Service (LOS)	D	E		D	D	D	C	C	C	C	C	C
Approach Delay, s/veh / LOS	71.1	E		45.7	D		30.1	C		27.4	C	
Intersection Delay, s/veh / LOS	37.5						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.32	B	2.32	B	2.14	B	1.93	B
Bicycle LOS Score / LOS	1.31	A	1.26	A	1.08	A	1.74	B

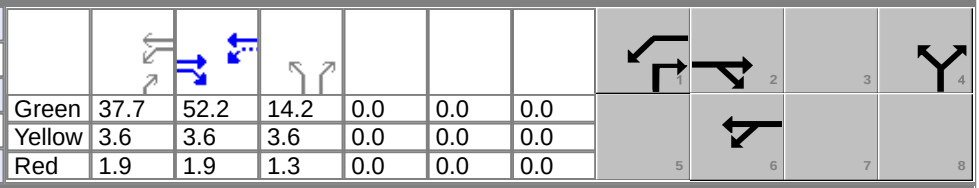
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Nov 27, 2018	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.86
Urban Street	26th Street	Analysis Year	2018	Analysis Period	1> 7:15
Intersection	Yeager Road	File Name	24-25-26 26th Street 2018 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		254	54	701	606		129		194			

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	37.7	52.2	14.2	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.9	1.9	1.3	0.0	0.0	0.0

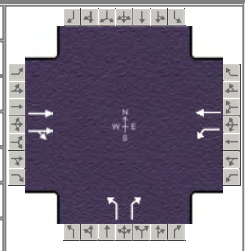
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		4		
Case Number		8.3	1.0	4.0		9.0		
Phase Duration, s		57.7	43.2	100.9		19.1		
Change Period, ($Y+R_c$), s		5.5	5.5	5.5		4.9		
Max Allow Headway (*MAH*), s		0.0	4.2	0.0		4.3		
Queue Clearance Time (g_s), s			33.7			13.7		
Green Extension Time (g_e), s		0.0	4.1	0.0		0.5		
Phase Call Probability			1.00			1.00		
Max Out Probability			0.01			1.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		7		14			
Adjusted Flow Rate (*v*), veh/h		179	173	806	697		150		226			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1821	1719	1734	1821		1734		1543			
Queue Service Time (g_s), s		10.2	7.6	31.7	8.2		10.0		11.7			
Cycle Queue Clearance Time (g_c), s		10.2	7.6	31.7	8.2		10.0		11.7			
Green Ratio (*g/C*)		0.44	0.44	0.77	0.80		0.12		0.43			
Capacity (*c*), veh/h		793	749	966	1448		205		667			
Volume-to-Capacity Ratio (*X*)		0.226	0.231	0.834	0.481		0.731		0.338			
Back of Queue (*Q*), ft/ln (95 th percentile)		151.4	144.8	206.8	87.4		214.6		195.2			
Back of Queue (*Q*), veh/ln (95 th percentile)		6.0	5.8	8.1	3.4		8.4		7.7			
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.22	0.00		0.00		0.78			
Uniform Delay (d_1), s/veh		21.2	21.3	6.9	1.7		51.1		22.7			
Incremental Delay (d_2), s/veh		0.7	0.7	1.8	0.6		8.5		0.3			
Initial Queue Delay (d_3), s/veh		0.0	0.0	0.0	0.0		0.0		0.0			
Control Delay (*d*), s/veh		21.9	22.0	8.6	2.2		59.6		23.0			
Level of Service (LOS)		C	C	A	A		E		C			
Approach Delay, s/veh / LOS	21.9	C		5.7	A		37.6	D		0.0		
Intersection Delay, s/veh / LOS	13.6						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.92	B	0.64	A	2.16	B	1.97	B
Bicycle LOS Score / LOS	0.78	A	3.00	C		F		

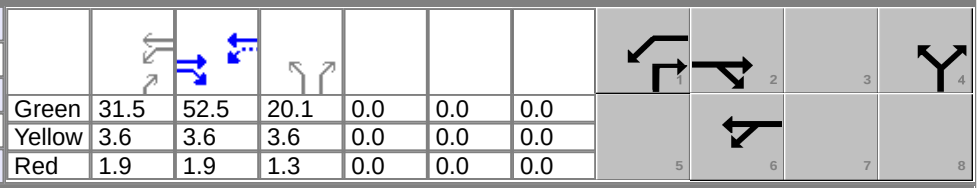
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Nov 27, 2018	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.92
Urban Street	26th Street	Analysis Year	2018	Analysis Period	1> 16:30
Intersection	Yeager Road	File Name	24-25-26 26th Street 2018 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		627	75	579	471		97		515			

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	31.5	52.5	20.1	0.0	0.0	0.0						
Yellow	3.6	3.6	3.6	0.0	0.0	0.0						
Red	1.9	1.9	1.3	0.0	0.0	0.0						

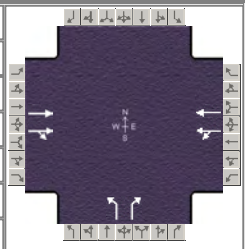
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		4		
Case Number		8.3	1.0	4.0		9.0		
Phase Duration, s		58.0	37.0	95.0		25.0		
Change Period, ($Y+R_c$), s		5.5	5.5	5.5		4.9		
Max Allow Headway (*MAH*), s		0.0	4.2	0.0		4.4		
Queue Clearance Time (g_s), s			24.3			22.1		
Green Extension Time (g_e), s		0.0	1.7	0.0		0.0		
Phase Call Probability			1.00			1.00		
Max Out Probability			0.42			1.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		7		14			
Adjusted Flow Rate (*v*), veh/h		385	372	629	511		105		560			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1821	1757	1734	1821		1734		1543			
Queue Service Time (g_s), s		18.1	18.2	22.3	9.4		6.5		20.1			
Cycle Queue Clearance Time (g_c), s		18.1	18.2	22.3	9.4		6.5		20.1			
Green Ratio (*g/C*)		0.44	0.44	0.72	0.75		0.17		0.43			
Capacity (*c*), veh/h		797	768	718	1358		291		664			
Volume-to-Capacity Ratio (*X*)		0.484	0.484	0.876	0.377		0.363		0.844			
Back of Queue (*Q*), ft/ln (95 th percentile)		328	314.4	279.6	136		130.3		571.1			
Back of Queue (*Q*), veh/ln (95 th percentile)		12.9	12.6	11.0	5.4		5.1		22.5			
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.29	0.00		0.00		2.28			
Uniform Delay (d_1), s/veh		24.1	24.1	11.1	3.9		44.3		30.6			
Incremental Delay (d_2), s/veh		2.1	2.2	10.8	0.6		0.8		9.7			
Initial Queue Delay (d_3), s/veh		0.0	0.0	0.0	0.0		0.0		0.0			
Control Delay (*d*), s/veh		26.2	26.3	21.9	4.4		45.0		40.3			
Level of Service (LOS)		C	C	C	A		D		D			
Approach Delay, s/veh / LOS	26.2	C		14.1	B		41.0	D		0.0		
Intersection Delay, s/veh / LOS	24.7						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.92	B	0.65	A	2.16	B	1.97	B
Bicycle LOS Score / LOS	1.11	A	2.37	B		F		

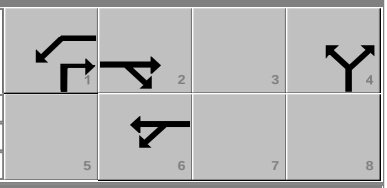
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Nov 27, 2018	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.87
Urban Street	26th Street	Analysis Year	2018	Analysis Period	1> 7:15
Intersection	NB I-229 Ramp	File Name	24-25-26 26th Street 2018 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		361	87	318	1188		119		384			

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	79	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	25.0	54.9	25.1	0.0	0.0	0.0						
Yellow	3.6	3.6	3.6	0.0	0.0	0.0						
Red	1.0	1.9	1.3	0.0	0.0	0.0						

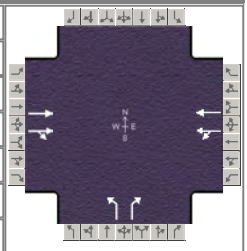
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		4		
Case Number		8.3	0.0	14.0		9.0		
Phase Duration, s		60.4	29.6	90.0		30.0		
Change Period, (*Y+R c*), s		5.5	4.6	5.5		4.9		
Max Allow Headway (*MAH*), s		0.0	0.0	0.0		4.4		
Queue Clearance Time (*g s*), s						27.1		
Green Extension Time (*g e*), s		0.0	0.0	0.0		0.0		
Phase Call Probability						1.00		
Max Out Probability						1.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		7		14			
Adjusted Flow Rate (*v*), veh/h		268	253	787	944		137		441			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1821	1699	1102	1706		1734		1543			
Queue Service Time (*g s*), s		15.3	10.5	19.9	26.6		8.1		25.1			
Cycle Queue Clearance Time (*g c*), s		15.3	10.5	19.9	26.6		8.1		25.1			
Green Ratio (*g/C*)		0.46	0.46	0.70	0.70		0.21		0.42			
Capacity (*c*), veh/h		833	777	820	1201		363		644			
Volume-to-Capacity Ratio (*X*)		0.321	0.326	0.959	0.786		0.377		0.685			
Back of Queue (*Q*), ft/ln (95 th percentile)		137.2	190.7	533.3	174.3		162.3		409.7			
Back of Queue (*Q*), veh/ln (95 th percentile)		5.4	7.6	21.3	6.9		6.4		16.1			
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.00	0.00		0.00		1.37			
Uniform Delay (*d 1*), s/veh		12.2	18.6	14.1	3.9		40.7		28.5			
Incremental Delay (*d 2*), s/veh		1.0	1.1	13.9	2.5		0.6		3.0			
Initial Queue Delay (*d 3*), s/veh		0.0	0.0	0.0	0.0		0.0		0.0			
Control Delay (*d*), s/veh		13.2	19.7	28.0	6.4		41.4		31.5			
Level of Service (LOS)		B	B	C	A		D		C			
Approach Delay, s/veh / LOS	16.3	B		16.2	B		33.9	C		0.0		
Intersection Delay, s/veh / LOS	19.8						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.69	B	0.67	A	2.16	B	2.16	B
Bicycle LOS Score / LOS	0.91	A	1.92	B		F		

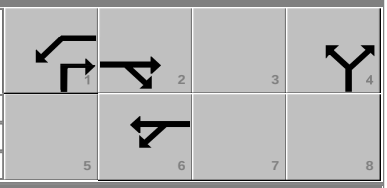
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Nov 27, 2018	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.94
Urban Street	26th Street	Analysis Year	2018	Analysis Period	1> 16:30
Intersection	NB I-229 Ramp	File Name	24-25-26 26th Street 2018 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		1046	96	98	997		53		722			

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	79	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	10.0	66.9	28.1	0.0	0.0	0.0						
Yellow	3.6	3.6	3.6	0.0	0.0	0.0						
Red	1.0	1.9	1.3	0.0	0.0	0.0						

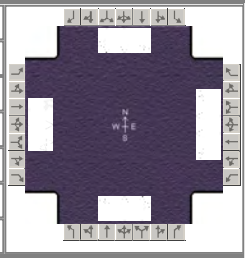
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		4		
Case Number		8.3	0.0	14.0		9.0		
Phase Duration, s		72.4	14.6	87.0		33.0		
Change Period, (*Y+R* $_c$), s		5.5	4.6	5.5		4.9		
Max Allow Headway (*MAH*), s		0.0	0.0	0.0		4.4		
Queue Clearance Time (g_s), s						30.1		
Green Extension Time (g_e), s		0.0	0.0	0.0		0.0		
Phase Call Probability						1.00		
Max Out Probability						1.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		7		14			
Adjusted Flow Rate (*v*), veh/h		629	612	513	677		56		768			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1821	1767	874	1677		1734		1543			
Queue Service Time (g_s), s		31.4	26.7	10.0	19.5		3.1		28.1			
Cycle Queue Clearance Time (g_c), s		31.4	26.7	78.3	19.5		3.1		28.1			
Green Ratio (*g/C*)		0.56	0.56	0.68	0.68		0.23		0.32			
Capacity (*c*), veh/h		1015	985	630	1139		406		490			
Volume-to-Capacity Ratio (*X*)		0.620	0.621	0.815	0.594		0.139		1.567			
Back of Queue (*Q*), ft/ln (95 th percentile)		348.9	381	301.8	222		61.1		1937.3			
Back of Queue (*Q*), veh/ln (95 th percentile)		13.7	15.2	12.1	8.7		2.4		76.3			
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.00	0.00	0.00		0.00		6.46			
Uniform Delay (d_1), s/veh		13.7	16.1	13.7	6.2		36.4		41.0			
Incremental Delay (d_2), s/veh		2.1	2.1	8.9	1.8		0.2		265.1			
Initial Queue Delay (d_3), s/veh		0.0	0.0	0.0	0.0		0.0		0.0			
Control Delay (*d*), s/veh		15.8	18.3	22.6	8.0		36.5		306.1			
Level of Service (LOS)		B	B	C	A		D		F			
Approach Delay, s/veh / LOS	17.0	B		14.3	B		287.7	F		0.0		
Intersection Delay, s/veh / LOS	84.5						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.67	B	0.67	A	2.16	B	2.16	B
Bicycle LOS Score / LOS	1.49	A	1.45	A		F		

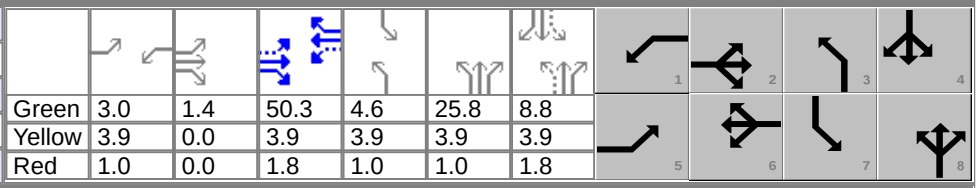
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Nov 27, 2018	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.87
Urban Street	26th Street	Analysis Year	2018	Analysis Period	1> 7:15
Intersection	Southeastern Ave	File Name	24-25-26 26th Street 2018 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	62	566	117	37	1017	225	457	575	46	48	93	32

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	18	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	3.0	1.4	50.3	4.6	25.8	8.8
Yellow	3.9	0.0	3.9	3.9	3.9	3.9
Red	1.0	0.0	1.8	1.0	1.0	1.8

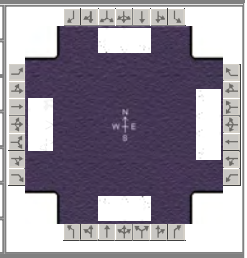
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6	3	8	7	4
Case Number	1.1	4.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	9.3	57.4	7.9	56.0	40.2	45.2	9.5	14.5
Change Period, ($Y+R_c$), s	4.9	5.7	4.9	5.7	4.9	5.7	4.9	5.7
Max Allow Headway (*MAH*), s	4.2	0.0	4.2	0.0	4.2	4.1	4.2	4.1
Queue Clearance Time (g_s), s	4.8		3.7		34.1	21.7	5.5	6.7
Green Extension Time (g_e), s	0.1	0.0	0.0	0.0	1.2	3.2	0.0	2.1
Phase Call Probability	0.91		0.76		1.00	1.00	0.84	1.00
Max Out Probability	0.08		0.01		0.53	0.01	1.00	0.46

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	72	400	378	43	1169	201	525	358	350	55	70	68
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1720	1734	1734	1543	1734	1821	1778	1734	1821	1683
Queue Service Time (g_s), s	2.8	14.8	16.3	1.7	35.5	10.4	32.1	19.7	19.7	3.5	4.4	4.7
Cycle Queue Clearance Time (g_c), s	2.8	14.8	16.3	1.7	35.5	10.4	32.1	19.7	19.7	3.5	4.4	4.7
Green Ratio (*g/C*)	0.46	0.43	0.43	0.44	0.42	0.42	0.38	0.33	0.33	0.11	0.07	0.07
Capacity (*c*), veh/h	184	784	741	298	1453	647	613	599	585	181	133	123
Volume-to-Capacity Ratio (*X*)	0.391	0.510	0.511	0.143	0.805	0.311	0.857	0.598	0.599	0.305	0.523	0.554
Back of Queue (*Q*), ft/ln (95 th percentile)	54	231.8	250.4	31.9	558.4	184.3	540.6	349.4	338.2	71.7	98.2	95.6
Back of Queue (*Q*), veh/ln (95 th percentile)	2.1	9.1	10.0	1.3	22.0	7.3	21.3	13.8	13.5	2.8	3.9	3.8
Queue Storage Ratio (*RQ*) (95 th percentile)	0.77	0.00	0.00	0.13	0.00	0.74	1.80	0.00	0.00	0.22	0.00	0.00
Uniform Delay (d_1), s/veh	24.4	16.0	18.6	20.2	30.6	23.3	33.0	33.6	33.7	48.9	53.6	53.7
Incremental Delay (d_2), s/veh	1.2	2.0	2.1	0.2	4.8	1.3	9.8	1.1	1.2	0.9	3.2	3.8
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	25.5	18.0	20.8	20.5	35.4	24.5	42.8	34.8	34.8	49.8	56.7	57.6
Level of Service (LOS)	C	B	C	C	D	C	D	C	C	D	E	E
Approach Delay, s/veh / LOS	19.9	B		33.4	C		38.2	D		55.1	E	
Intersection Delay, s/veh / LOS	33.0						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.28	B	2.28	B	2.51	C	2.33	B
Bicycle LOS Score / LOS	1.18	A	1.65	B	1.51	B	0.65	A

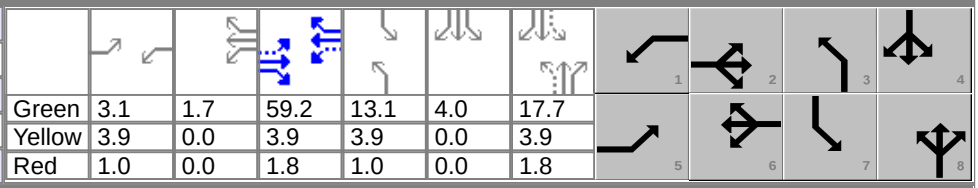
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Nov 27, 2018	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.92
Urban Street	26th Street	Analysis Year	2018	Analysis Period	1> 16:30
Intersection	Southeastern Ave	File Name	24-25-26 26th Street 2018 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	51	1229	488	84	869	129	183	195	89	242	501	43

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	25	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	3.1	1.7	59.2	13.1	4.0	17.7			
Yellow	3.9	0.0	3.9	3.9	0.0	3.9			
Red	1.0	0.0	1.8	1.0	0.0	1.8			

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6	3	8	7	4
Case Number	1.1	4.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	8.0	64.9	9.8	66.6	18.0	23.4	22.0	27.4
Change Period, ($Y+R_c$), s	4.9	5.7	4.9	5.7	4.9	5.7	4.9	5.7
Max Allow Headway (*MAH*), s	4.2	0.0	4.2	0.0	4.2	4.1	4.2	4.1
Queue Clearance Time (g_s), s	3.6		5.1		13.6	11.9	17.1	21.2
Green Extension Time (g_e), s	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.5
Phase Call Probability	0.79		0.95		1.00	1.00	1.00	1.00
Max Out Probability	1.00		1.00		1.00	0.59	1.00	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	46	759	712	91	945	108	199	153	145	263	296	290
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1672	1734	1734	1543	1734	1821	1646	1734	1821	1776
Queue Service Time (g_s), s	1.6	42.1	46.0	3.1	22.1	4.4	11.6	9.4	9.9	15.1	19.1	19.2
Cycle Queue Clearance Time (g_c), s	1.6	42.1	46.0	3.1	22.1	4.4	11.6	9.4	9.9	15.1	19.1	19.2
Green Ratio (*g/C*)	0.52	0.49	0.49	0.53	0.51	0.51	0.26	0.15	0.15	0.30	0.18	0.18
Capacity (*c*), veh/h	287	898	824	170	1760	783	253	269	243	377	329	320
Volume-to-Capacity Ratio (*X*)	0.162	0.846	0.865	0.536	0.537	0.137	0.787	0.569	0.597	0.698	0.901	0.905
Back of Queue (*Q*), ft/ln (95 th percentile)	25.6	481.7	516.4	61.3	356.1	75.1	253.5	201.1	192.5	285.5	416.3	405.6
Back of Queue (*Q*), veh/ln (95 th percentile)	1.0	19.0	20.7	2.4	14.0	3.0	10.0	7.9	7.7	11.2	16.4	16.2
Queue Storage Ratio (*RQ*) (95 th percentile)	0.37	0.00	0.00	0.25	0.00	0.30	0.85	0.00	0.00	0.88	0.00	0.00
Uniform Delay (d_1), s/veh	16.4	23.1	29.2	25.5	20.0	15.6	38.7	47.6	47.8	35.5	48.1	48.2
Incremental Delay (d_2), s/veh	0.0	1.0	1.2	2.6	1.2	0.4	15.2	2.6	3.6	5.6	25.5	26.6
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	16.4	24.1	30.4	28.1	21.2	16.0	53.9	50.2	51.4	41.0	73.6	74.8
Level of Service (LOS)	B	C	C	C	C	B	D	D	D	D	E	E
Approach Delay, s/veh / LOS	26.8	C		21.2	C		52.0	D		63.9	E	
Intersection Delay, s/veh / LOS	36.2						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.28	B	2.27	B	2.50	C	2.45	B
Bicycle LOS Score / LOS	1.98	B	1.43	A	0.90	A	1.19	A

HCS7 Two-Way Stop-Control Report

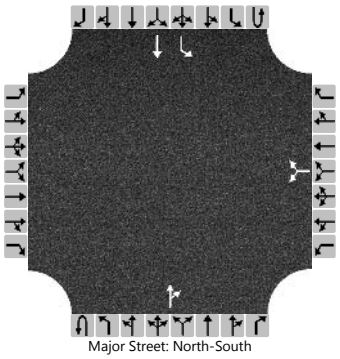
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	11/27/2018
Analysis Year	2018
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Yeager at SB I-229 Ramp
Jurisdiction	Sioux Falls, SD
East/West Street	SB I-229 Ramp
North/South Street	Yeager Road
Peak Hour Factor	0.93
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	1	1	0
Configuration							LR					TR		L	T	
Volume (veh/h)						43		272			51	11		698	57	
Percent Heavy Vehicles (%)						2		2						2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized																
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.42		6.22						4.12		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.52		3.32						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							339							751		
Capacity, c (veh/h)							310							1535		
v/c Ratio							1.09							0.49		
95% Queue Length, Q_{95} (veh)							13.2							2.8		
Control Delay (s/veh)							115.8							9.6		
Level of Service (LOS)							F							A		
Approach Delay (s/veh)						115.8								8.8		
Approach LOS						F										

HCS7 Two-Way Stop-Control Report

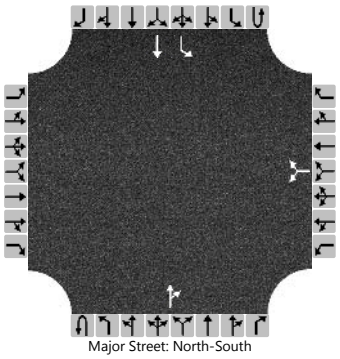
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	11/27/2018
Analysis Year	2018
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Yeager at SB I-229 Ramp
Jurisdiction	Sioux Falls, SD
East/West Street	SB I-229 Ramp
North/South Street	Yeager Road
Peak Hour Factor	0.91
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	1	1	0
Configuration							LR					TR		L	T	
Volume (veh/h)						74		485			130	3		577	77	
Percent Heavy Vehicles (%)						2		2						2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized																
Median Type | Storage		Undivided														

Critical and Follow-up Headways

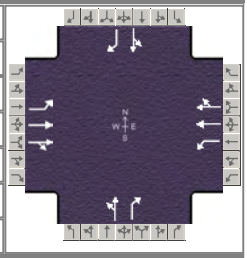
Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.42		6.22						4.12		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.52		3.32						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							614							634		
Capacity, c (veh/h)							368							1436		
v/c Ratio							1.67							0.44		
95% Queue Length, Q_{95} (veh)							37.0							2.3		
Control Delay (s/veh)							338.9							9.5		
Level of Service (LOS)							F							A		
Approach Delay (s/veh)						338.9								8.4		
Approach LOS						F										

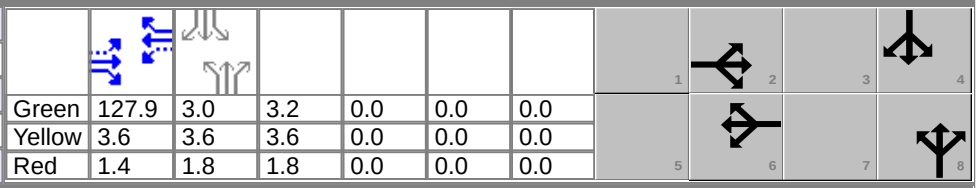
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Nov 27, 2018	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.76
Urban Street	41st Street	Analysis Year	2018	Analysis Period	1> 7:15
Intersection	Norton Ave	File Name	28 41st at Norton 2018 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	16	494	26	9	301	7	10	5	4	4	7	6

Signal Information			
Cycle, s	150.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	127.9	3.0	3.2	0.0	0.0	0.0						
Yellow	3.6	3.6	3.6	0.0	0.0	0.0						
Red	1.4	1.8	1.8	0.0	0.0	0.0						

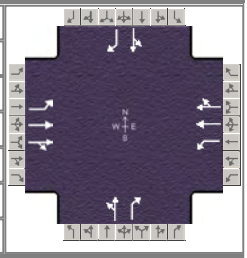
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		6.0		6.0		11.0		11.0
Phase Duration, s		132.9		132.9		8.6		8.4
Change Period, ($Y+R_c$), s		5.0		5.0		5.4		5.4
Max Allow Headway (*MAH*), s		0.0		0.0		5.2		5.2
Queue Clearance Time (g_s), s						3.7		3.2
Green Extension Time (g_e), s		0.0		0.0		0.0		0.0
Phase Call Probability						0.65		0.61
Max Out Probability						0.00		0.25

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	21	345	339	12	203	202		20	5		14	8
Adjusted Saturation Flow Rate (*s*), veh/h/ln	980	1821	1789	757	1821	1806		1762	1543		1789	1543
Queue Service Time (g_s), s	0.5	5.2	5.2	0.4	2.8	2.8		1.7	0.5		1.2	0.8
Cycle Queue Clearance Time (g_c), s	3.3	5.2	5.2	5.6	2.8	2.8		1.7	0.5		1.2	0.8
Green Ratio (*g/C*)	0.85	0.85	0.85	0.85	0.85	0.85		0.02	0.02		0.02	0.02
Capacity (*c*), veh/h	866	1553	1526	668	1553	1541		38	33		36	31
Volume-to-Capacity Ratio (*X*)	0.024	0.222	0.222	0.018	0.131	0.131		0.519	0.158		0.400	0.253
Back of Queue (*Q*), ft/ln (95 th percentile)	4.5	69.6	68.6	3	37.2	37.1		41.7	10.5		29.8	16.1
Back of Queue (*Q*), veh/ln (95 th percentile)	0.2	2.7	2.7	0.1	1.5	1.5		1.6	0.4		1.2	0.6
Queue Storage Ratio (*RQ*) (95 th percentile)	0.05	0.00	0.00	0.03	0.00	0.00		0.00	0.14		0.00	0.21
Uniform Delay (d_1), s/veh	2.1	2.0	2.0	2.5	1.8	1.8		72.6	72.0		72.6	72.4
Incremental Delay (d_2), s/veh	0.1	0.3	0.3	0.0	0.2	0.2		14.7	3.1		9.9	5.9
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Control Delay (*d*), s/veh	2.2	2.3	2.3	2.6	2.0	2.0		87.3	75.1		82.5	78.3
Level of Service (LOS)	A	A	A	A	A	A		F	E		F	E
Approach Delay, s/veh / LOS	2.3	A		2.0	A		84.8	F		81.0	F	
Intersection Delay, s/veh / LOS	5.5						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.82	B	1.82	B	2.33	B	2.33	B
Bicycle LOS Score / LOS	1.07	A	0.83	A	0.53	A	0.52	A

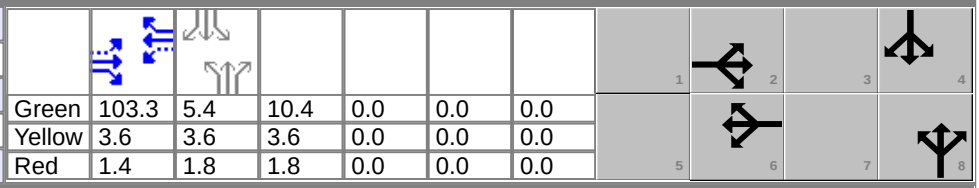
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Nov 27, 2018	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.94
Urban Street	41st Street	Analysis Year	2018	Analysis Period	1> 16:30
Intersection	Norton Ave	File Name	28 41st at Norton 2018 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	32	899	59	20	802	24	72	26	34	15	22	38

Signal Information			
Cycle, s	135.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	103.3	5.4	10.4	0.0	0.0	0.0						
Yellow	3.6	3.6	3.6	0.0	0.0	0.0						
Red	1.4	1.8	1.8	0.0	0.0	0.0						

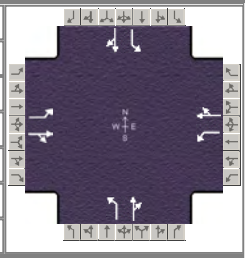
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		6.0		6.0		11.0		11.0
Phase Duration, s		108.3		108.3		15.8		10.8
Change Period, ($Y+R_c$), s		5.0		5.0		5.4		5.4
Max Allow Headway (*MAH*), s		0.0		0.0		5.2		5.3
Queue Clearance Time (g_s), s						9.9		5.5
Green Extension Time (g_e), s		0.0		0.0		0.6		0.2
Phase Call Probability						0.99		0.95
Max Out Probability						0.00		0.01

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	34	515	504	21	442	437		104	36		39	40
Adjusted Saturation Flow Rate (*s*), veh/h/ln	631	1821	1781	553	1821	1802		1757	1543		1785	1543
Queue Service Time (g_s), s	2.4	12.5	12.5	1.8	10.1	10.1		7.9	3.0		2.9	3.5
Cycle Queue Clearance Time (g_c), s	12.5	12.5	12.5	14.3	10.1	10.1		7.9	3.0		2.9	3.5
Green Ratio (*g/C*)	0.77	0.77	0.77	0.77	0.77	0.77		0.08	0.08		0.04	0.04
Capacity (*c*), veh/h	489	1394	1363	426	1394	1379		136	119		72	62
Volume-to-Capacity Ratio (*X*)	0.070	0.370	0.370	0.050	0.317	0.317		0.767	0.303		0.549	0.652
Back of Queue (*Q*), ft/ln (95 th percentile)	16.1	204.2	200.9	10.7	168.2	166.6		181.5	56.7		69.1	74.8
Back of Queue (*Q*), veh/ln (95 th percentile)	0.6	8.0	7.9	0.4	6.6	6.6		7.1	2.2		2.7	2.9
Queue Storage Ratio (*RQ*) (95 th percentile)	0.16	0.00	0.00	0.11	0.00	0.00		0.00	0.76		0.00	1.00
Uniform Delay (d_1), s/veh	6.8	5.2	5.2	7.5	4.9	4.9		61.1	58.8		63.6	63.9
Incremental Delay (d_2), s/veh	0.3	0.8	0.8	0.2	0.6	0.6		12.0	2.0		9.0	15.2
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Control Delay (*d*), s/veh	7.1	5.9	6.0	7.7	5.5	5.5		73.1	60.8		72.6	79.1
Level of Service (LOS)	A	A	A	A	A	A		E	E		E	E
Approach Delay, s/veh / LOS	6.0	A		5.6	A		69.9	E		75.9	E	
Intersection Delay, s/veh / LOS	12.5						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.85	B	1.85	B	2.33	B	2.32	B
Bicycle LOS Score / LOS	1.36	A	1.23	A	0.72	A	0.62	A

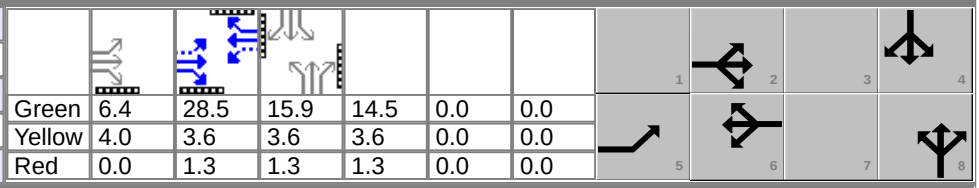
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Nov 27, 2018	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.69
Urban Street	41st Street	Analysis Year	2018	Analysis Period	1> 7:15
Intersection	Phillips Ave	File Name	29 41st at Phillips 2018 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	101	244	8	28	246	102	8	121	50	91	15	159

Signal Information			
Cycle, s	84.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	6.4	28.5	15.9	14.5	0.0	0.0
Yellow	4.0	3.6	3.6	3.6	0.0	0.0
Red	0.0	1.3	1.3	1.3	0.0	0.0

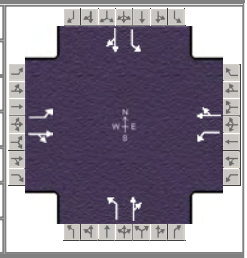
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		4
Case Number	1.0	4.0		6.3		10.0		10.0
Phase Duration, s	10.4	43.8		33.4		19.4		20.8
Change Period, ($Y+R_c$), s	4.0	4.9		4.9		4.9		4.9
Max Allow Headway (*MAH*), s	4.2	0.0		0.0		5.2		5.3
Queue Clearance Time (g_s), s	6.3					13.6		15.1
Green Extension Time (g_e), s	0.2	0.0		0.0		0.9		0.8
Phase Call Probability	0.97					1.00		1.00
Max Out Probability	0.07					0.23		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	146	365		41	504		12	248		132	252	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1811		1017	1730		1734	1730		1734	1564	
Queue Service Time (g_s), s	4.3	11.4		2.3	22.8		0.5	11.6		5.6	13.1	
Cycle Queue Clearance Time (g_c), s	4.3	11.4		3.4	22.8		0.5	11.6		5.6	13.1	
Green Ratio (*g/C*)	0.44	0.46		0.34	0.34		0.17	0.17		0.19	0.19	
Capacity (*c*), veh/h	278	839		419	588		299	298		329	296	
Volume-to-Capacity Ratio (*X*)	0.527	0.435		0.097	0.858		0.039	0.831		0.401	0.851	
Back of Queue (*Q*), ft/ln (95 th percentile)	79.6	212.7		27.2	429		9	238.9		109.2	260.5	
Back of Queue (*Q*), veh/ln (95 th percentile)	3.1	8.4		1.1	16.9		0.4	9.4		4.3	10.3	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.61	0.00		0.45	0.00		0.15	0.00		0.99	0.00	
Uniform Delay (d_1), s/veh	18.8	15.2		19.8	25.8		29.0	33.6		29.9	32.9	
Incremental Delay (d_2), s/veh	1.5	1.6		0.5	15.0		0.1	9.6		1.1	16.6	
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh	20.4	16.8		20.2	40.9		29.0	43.2		31.0	49.5	
Level of Service (LOS)	C	B		C	D		C	D		C	D	
Approach Delay, s/veh / LOS	17.8	B		39.3	D		42.5	D		43.1	D	
Intersection Delay, s/veh / LOS	34.2						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.90	B	1.91	B	1.95	B	1.93	B
Bicycle LOS Score / LOS	1.33	A	1.39	A	0.92	A	1.12	A

HCS7 Signalized Intersection Results Summary

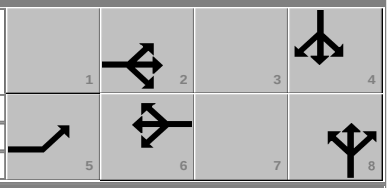
General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Nov 27, 2018	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.94
Urban Street	41st Street	Analysis Year	2018	Analysis Period	1> 16:30
Intersection	Phillips Ave	File Name	29 41st at Phillips 2018 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	117	258	4	15	302	59	25	52	63	108	23	231

Signal Information			
Cycle, s	84.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	5.2	35.0	16.7	8.3	0.0	0.0
Yellow	4.0	3.6	3.6	3.6	0.0	0.0
Red	0.0	1.3	1.3	1.3	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		4
Case Number	1.0	4.0		6.3		10.0		10.0
Phase Duration, s	9.2	49.2		39.9		13.2		21.6
Change Period, ($Y+R_c$), s	4.0	4.9		4.9		4.9		4.9
Max Allow Headway (*MAH*), s	4.2	0.0		0.0		5.3		5.3
Queue Clearance Time (g_s), s	5.2					8.0		16.0
Green Extension Time (g_e), s	0.3	0.0		0.0		0.6		0.7
Phase Call Probability	0.95					0.97		1.00
Max Out Probability	0.00					0.01		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	124	279		16	384		27	122		115	270	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1816		1100	1769		1734	1658		1734	1565	
Queue Service Time (g_s), s	3.2	7.2		0.7	13.6		1.2	6.0		4.8	14.0	
Cycle Queue Clearance Time (g_c), s	3.2	7.2		0.7	13.6		1.2	6.0		4.8	14.0	
Green Ratio (*g/C*)	0.50	0.53		0.42	0.42		0.10	0.10		0.20	0.20	
Capacity (*c*), veh/h	449	957		545	738		172	165		345	311	
Volume-to-Capacity Ratio (*X*)	0.277	0.291		0.029	0.521		0.154	0.744		0.333	0.868	
Back of Queue (*Q*), ft/ln (95 th percentile)	55	132.2		8.6	247.5		23.7	128.5		92.4	281.8	
Back of Queue (*Q*), veh/ln (95 th percentile)	2.2	5.2		0.3	9.7		0.9	5.1		3.6	11.1	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.42	0.00		0.14	0.00		0.39	0.00		0.84	0.00	
Uniform Delay (d_1), s/veh	12.8	11.1		14.5	18.2		34.6	36.8		28.9	32.6	
Incremental Delay (d_2), s/veh	0.3	0.8		0.1	2.6		0.6	9.1		0.8	19.2	
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh	13.2	11.9		14.6	20.8		35.2	45.8		29.7	51.7	
Level of Service (LOS)	B	B		B	C		D	D		C	D	
Approach Delay, s/veh / LOS	12.3	B		20.6	C		43.9	D		45.2	D	
Intersection Delay, s/veh / LOS	27.8						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.89	B	1.90	B	1.95	B	1.94	B
Bicycle LOS Score / LOS	1.15	A	1.15	A	0.73	A	1.12	A

Appendix C

HCS Analysis Summary – Forecast 2050 No Build Conditions

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - west of Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3595	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1412
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.61
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	22.8
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - west of Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2840	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1093
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.47
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	17.7
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - between Western Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3045	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1794
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.77
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	60.6
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	29.6
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - between Western Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2480	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1432
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.62
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	23.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - between Western and Minnesota		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3520	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1383
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.60
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	22.4
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - between Western and Minnesota		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3375	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1299
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.56
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	21.0
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - Western to Minnesota		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2860	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2660	380	95	385
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	6.00	6.00	6.00	6.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.943	0.943	0.943	0.943
Flow Rate (v_i), pc/h	3134	448	112	454
Weaving Flow Rate (v_W), pc/h	902	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	3246	Density-Based Capacity (c_{IWL}), pc/h/ln		2208
Total Flow Rate (v), pc/h	4148	Demand Flow-Based Capacity (c_{IW}), pc/h		11060
Volume Ratio (VR)	0.217	Weaving Segment Capacity (c_W), veh/h		6246
Minimum Lane Change Rate (LC_{MIN}), lc/h	902	Adjusted Weaving Area Capacity, pc/h		6624
Maximum Weaving Length (L_{MAX}), ft	4711	Volume-to-Capacity Ratio (v/c)		0.63

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	928	Average Weaving Speed (S_W),mi/h	55.8
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1641	Average Non-Weaving Speed (S_{NW}), mi/h	51.9
Weaving Lane Change Rate (LC_W), lc/h	1211	Average Speed (S), mi/h	52.7
Weaving Lane Change Rate (LC_{All}), lc/h	2852	Density (D), pc/mi/ln	26.2
Weaving Intensity Factor (W)	0.226	Level of Service (LOS)	C

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - Western to Minnesota		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2860	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2176	734	161	304
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	4.00	4.00	4.00	4.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.962	0.962	0.962	0.962
Flow Rate (v_i), pc/h	2513	848	186	351
Weaving Flow Rate (v_w), pc/h	1199	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2699	Density-Based Capacity (c_{IWL}), pc/h/ln		2135
Total Flow Rate (v), pc/h	3898	Demand Flow-Based Capacity (c_{IW}), pc/h		7792
Volume Ratio (VR)	0.308	Weaving Segment Capacity (c_W), veh/h		6162
Minimum Lane Change Rate (LC_{MIN}), lc/h	1199	Adjusted Weaving Area Capacity, pc/h		6405
Maximum Weaving Length (L_{MAX}), ft	5670	Volume-to-Capacity Ratio (v/c)		0.61

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	772	Average Weaving Speed (S_W),mi/h	55.4
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1528	Average Non-Weaving Speed (S_{NW}), mi/h	50.1
Weaving Lane Change Rate (LC_W), lc/h	1508	Average Speed (S), mi/h	51.6
Weaving Lane Change Rate (LC_{All}), lc/h	3036	Density (D), pc/mi/ln	25.2
Weaving Intensity Factor (W)	0.237	Level of Service (LOS)	C

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - between Minnesota Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3040	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1791
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.77
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	60.7
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	29.5
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - between Minnesota Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2910	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1680
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.72
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.4
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	27.4
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - between Minnesota and Cliff		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3430	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1347
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.58
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	21.8
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - between Minnesota and Cliff		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3720	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1432
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.62
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	23.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - Minnesota to Cliff		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	3120	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2188	312	78	852
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	6.00	6.00	6.00	6.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.943	0.943	0.943	0.943
Flow Rate (v_i), pc/h	2578	368	92	1004
Weaving Flow Rate (v_w), pc/h	1372	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2670	Density-Based Capacity (c_{IWL}), pc/h/ln		2129
Total Flow Rate (v), pc/h	4042	Demand Flow-Based Capacity (c_{IW}), pc/h		7080
Volume Ratio (VR)	0.339	Weaving Segment Capacity (c_W), veh/h		6023
Minimum Lane Change Rate (LC_{MIN}), lc/h	1372	Adjusted Weaving Area Capacity, pc/h		6387
Maximum Weaving Length (L_{MAX}), ft	6006	Volume-to-Capacity Ratio (v/c)		0.63

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	833	Average Weaving Speed (S_W),mi/h	55.3
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1663	Average Non-Weaving Speed (S_{NW}), mi/h	48.7
Weaving Lane Change Rate (LC_W), lc/h	1697	Average Speed (S), mi/h	50.8
Weaving Lane Change Rate (LC_{All}), lc/h	3360	Density (D), pc/mi/ln	26.5
Weaving Intensity Factor (W)	0.240	Level of Service (LOS)	C

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - Minnesota to Cliff		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	3120	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2136	664	146	774
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	4.00	4.00	4.00	4.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.962	0.962	0.962	0.962
Flow Rate (v_i), pc/h	2467	767	169	894
Weaving Flow Rate (v_w), pc/h	1661	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2636	Density-Based Capacity (c_{IWL}), pc/h/ln		2089
Total Flow Rate (v), pc/h	4297	Demand Flow-Based Capacity (c_{IW}), pc/h		6202
Volume Ratio (VR)	0.387	Weaving Segment Capacity (c_W), veh/h		5966
Minimum Lane Change Rate (LC_{MIN}), lc/h	1661	Adjusted Weaving Area Capacity, pc/h		6202
Maximum Weaving Length (L_{MAX}), ft	6536	Volume-to-Capacity Ratio (v/c)		0.69

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	822	Average Weaving Speed (S_W),mi/h	54.8
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1656	Average Non-Weaving Speed (S_{NW}), mi/h	46.2
Weaving Lane Change Rate (LC_W), lc/h	1986	Average Speed (S), mi/h	49.2
Weaving Lane Change Rate (LC_{All}), lc/h	3642	Density (D), pc/mi/ln	29.1
Weaving Intensity Factor (W)	0.255	Level of Service (LOS)	D

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - between Cliff Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2500	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1473
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.64
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	23.8
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - between Cliff Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2800	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1617
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.70
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.7
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	26.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - between Cliff and 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3115	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1223
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.53
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.8
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - between Cliff and 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3215	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1238
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.53
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	20.0
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - Cliff to 26th		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2750	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1873	547	68	627
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	6.00	6.00	6.00	6.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.943	0.943	0.943	0.943
Flow Rate (v_i), pc/h	2207	645	80	739
Weaving Flow Rate (v_W), pc/h	1384	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2287	Density-Based Capacity (c_{IWL}), pc/h/ln		2069
Total Flow Rate (v), pc/h	3671	Demand Flow-Based Capacity (c_{IW}), pc/h		6366
Volume Ratio (VR)	0.377	Weaving Segment Capacity (c_W), veh/h		5853
Minimum Lane Change Rate (LC_{MIN}), lc/h	1384	Adjusted Weaving Area Capacity, pc/h		6207
Maximum Weaving Length (L_{MAX}), ft	6424	Volume-to-Capacity Ratio (v/c)		0.59

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	629	Average Weaving Speed (S_W),mi/h	55.1
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1384	Average Non-Weaving Speed (S_{NW}), mi/h	49.2
Weaving Lane Change Rate (LC_W), lc/h	1686	Average Speed (S), mi/h	51.3
Weaving Lane Change Rate (LC_{All}), lc/h	3070	Density (D), pc/mi/ln	23.9
Weaving Intensity Factor (W)	0.247	Level of Service (LOS)	C

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - Cliff to 26th		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2750	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1917	303	112	883
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	4.00	4.00	4.00	4.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.962	0.962	0.962	0.962
Flow Rate (v_i), pc/h	2214	350	129	1020
Weaving Flow Rate (v_w), pc/h	1370	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2343	Density-Based Capacity (c_{IWL}), pc/h/ln		2076
Total Flow Rate (v), pc/h	3713	Demand Flow-Based Capacity (c_{IW}), pc/h		6504
Volume Ratio (VR)	0.369	Weaving Segment Capacity (c_W), veh/h		5991
Minimum Lane Change Rate (LC_{MIN}), lc/h	1370	Adjusted Weaving Area Capacity, pc/h		6228
Maximum Weaving Length (L_{MAX}), ft	6336	Volume-to-Capacity Ratio (v/c)		0.60

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	644	Average Weaving Speed (S_W),mi/h	55.1
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1395	Average Non-Weaving Speed (S_{NW}), mi/h	49.2
Weaving Lane Change Rate (LC_W), lc/h	1672	Average Speed (S), mi/h	51.2
Weaving Lane Change Rate (LC_{All}), lc/h	3067	Density (D), pc/mi/ln	24.2
Weaving Intensity Factor (W)	0.246	Level of Service (LOS)	C

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - between 26th Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2420	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1426
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.61
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	23.1
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - between 26th Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2220	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1282
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.55
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	20.7
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - north of 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2930	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1151
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.50
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	18.6
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - north of 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2620	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1009
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.44
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	16.3
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - north of 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3760	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1463
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.63
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	23.7
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - north of 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	4520	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1724
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.74
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	28.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - between 26th Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3300	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1926
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.83
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	59.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	32.5
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - between 26th Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3575	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	2046
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.88
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	57.4
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	35.6
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - between 26th and Cliff		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	4050	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1576
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.68
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	25.5
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - between 26th and Cliff		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	4190	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1598
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.69
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.7
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	25.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - 26th to Cliff		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2670	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2653	637	113	647
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	5.00	5.00	5.00	5.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.952	0.952	0.952	0.952
Flow Rate (v_i), pc/h	3096	743	132	755
Weaving Flow Rate (v_w), pc/h	1498	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	3228	Density-Based Capacity (c_{IWL}), pc/h/ln		2113
Total Flow Rate (v), pc/h	4726	Demand Flow-Based Capacity (c_{IW}), pc/h		7571
Volume Ratio (VR)	0.317	Weaving Segment Capacity (c_W), veh/h		6035
Minimum Lane Change Rate (LC_{MIN}), lc/h	1498	Adjusted Weaving Area Capacity, pc/h		6339
Maximum Weaving Length (L_{MAX}), ft	5767	Volume-to-Capacity Ratio (v/c)		0.75

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	862	Average Weaving Speed (S_W),mi/h	54.4
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1534	Average Non-Weaving Speed (S_{NW}), mi/h	46.7
Weaving Lane Change Rate (LC_W), lc/h	1796	Average Speed (S), mi/h	48.9
Weaving Lane Change Rate (LC_{All}), lc/h	3330	Density (D), pc/mi/ln	32.2
Weaving Intensity Factor (W)	0.269	Level of Service (LOS)	D

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - 26th to Cliff		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2670	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2782	498	117	793
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	3.00	3.00	3.00	3.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.971	0.971	0.971	0.971
Flow Rate (v_i), pc/h	3183	570	134	907
Weaving Flow Rate (v_w), pc/h	1477	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	3317	Density-Based Capacity (c_{IWL}), pc/h/ln		2120
Total Flow Rate (v), pc/h	4794	Demand Flow-Based Capacity (c_{IW}), pc/h		7792
Volume Ratio (VR)	0.308	Weaving Segment Capacity (c_W), veh/h		6176
Minimum Lane Change Rate (LC_{MIN}), lc/h	1477	Adjusted Weaving Area Capacity, pc/h		6360
Maximum Weaving Length (L_{MAX}), ft	5670	Volume-to-Capacity Ratio (v/c)		0.75

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	886	Average Weaving Speed (S_W),mi/h	54.4
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1553	Average Non-Weaving Speed (S_{NW}), mi/h	46.7
Weaving Lane Change Rate (LC_W), lc/h	1775	Average Speed (S), mi/h	48.8
Weaving Lane Change Rate (LC_{All}), lc/h	3328	Density (D), pc/mi/ln	32.7
Weaving Intensity Factor (W)	0.269	Level of Service (LOS)	D

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - between Cliff Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3290	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1920
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.83
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	59.3
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	32.4
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - between Cliff Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3280	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1876
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.81
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	59.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	31.4
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - between Cliff and Minnesota		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	4050	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1576
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.68
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	25.5
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - between Cliff and Minnesota		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	4120	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1571
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.68
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	25.4
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - Cliff to Minnesota		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	3100	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	3047	608	152	243
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	5.00	5.00	5.00	5.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.952	0.952	0.952	0.952
Flow Rate (v_i), pc/h	3556	710	177	284
Weaving Flow Rate (v_w), pc/h	994	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	3733	Density-Based Capacity (c_{IWL}), pc/h/ln		2232
Total Flow Rate (v), pc/h	4727	Demand Flow-Based Capacity (c_{IW}), pc/h		11429
Volume Ratio (VR)	0.210	Weaving Segment Capacity (c_W), veh/h		6375
Minimum Lane Change Rate (LC_{MIN}), lc/h	994	Adjusted Weaving Area Capacity, pc/h		6696
Maximum Weaving Length (L_{MAX}), ft	4639	Volume-to-Capacity Ratio (v/c)		0.71

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	1157	Average Weaving Speed (S_W),mi/h	55.6
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1871	Average Non-Weaving Speed (S_{NW}), mi/h	50.3
Weaving Lane Change Rate (LC_W), lc/h	1317	Average Speed (S), mi/h	51.3
Weaving Lane Change Rate (LC_{All}), lc/h	3188	Density (D), pc/mi/ln	30.7
Weaving Intensity Factor (W)	0.231	Level of Service (LOS)	D

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - Cliff to Minnesota		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	3100	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2982	638	202	298
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	3.00	3.00	3.00	3.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.971	0.971	0.971	0.971
Flow Rate (v_i), pc/h	3412	730	231	341
Weaving Flow Rate (v_w), pc/h	1071	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	3643	Density-Based Capacity (c_{IWL}), pc/h/ln		2219
Total Flow Rate (v), pc/h	4714	Demand Flow-Based Capacity (c_{IW}), pc/h		10573
Volume Ratio (VR)	0.227	Weaving Segment Capacity (c_W), veh/h		6464
Minimum Lane Change Rate (LC_{MIN}), lc/h	1071	Adjusted Weaving Area Capacity, pc/h		6657
Maximum Weaving Length (L_{MAX}), ft	4814	Volume-to-Capacity Ratio (v/c)		0.71

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	1129	Average Weaving Speed (S_W),mi/h	55.5
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1853	Average Non-Weaving Speed (S_{NW}), mi/h	49.7
Weaving Lane Change Rate (LC_W), lc/h	1394	Average Speed (S), mi/h	50.9
Weaving Lane Change Rate (LC_{All}), lc/h	3247	Density (D), pc/mi/ln	30.9
Weaving Intensity Factor (W)	0.234	Level of Service (LOS)	D

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - between Minnesota Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3655	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	2133
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.92
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	55.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	38.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - between Minnesota Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3620	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	2071
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.89
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	56.9
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	36.4
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - between Minnesota and Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	4050	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1576
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.68
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	25.5
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - between Minnesota and Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	4315	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1646
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.71
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.6
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	26.7
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - Minnesota to Western		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	3220	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2993	272	128	662
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	5.00	5.00	5.00	5.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.952	0.952	0.952	0.952
Flow Rate (v_i), pc/h	3493	317	149	773
Weaving Flow Rate (v_W), pc/h	1090	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	3642	Density-Based Capacity (c_{IWL}), pc/h/ln		2226
Total Flow Rate (v), pc/h	4732	Demand Flow-Based Capacity (c_{IW}), pc/h		10435
Volume Ratio (VR)	0.230	Weaving Segment Capacity (c_W), veh/h		6357
Minimum Lane Change Rate (LC_{MIN}), lc/h	1090	Adjusted Weaving Area Capacity, pc/h		6678
Maximum Weaving Length (L_{MAX}), ft	4845	Volume-to-Capacity Ratio (v/c)		0.71

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	1173	Average Weaving Speed (S_W),mi/h	55.6
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1918	Average Non-Weaving Speed (S_{NW}), mi/h	49.6
Weaving Lane Change Rate (LC_W), lc/h	1420	Average Speed (S), mi/h	50.9
Weaving Lane Change Rate (LC_{All}), lc/h	3338	Density (D), pc/mi/ln	31.0
Weaving Intensity Factor (W)	0.233	Level of Service (LOS)	D

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - Minnesota to Western		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	3220	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2999	486	209	621
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	3.00	3.00	3.00	3.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.971	0.971	0.971	0.971
Flow Rate (v_i), pc/h	3432	556	239	711
Weaving Flow Rate (v_w), pc/h	1267	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	3671	Density-Based Capacity (c_{IWL}), pc/h/ln		2204
Total Flow Rate (v), pc/h	4938	Demand Flow-Based Capacity (c_{IW}), pc/h		9339
Volume Ratio (VR)	0.257	Weaving Segment Capacity (c_W), veh/h		6420
Minimum Lane Change Rate (LC_{MIN}), lc/h	1267	Adjusted Weaving Area Capacity, pc/h		6612
Maximum Weaving Length (L_{MAX}), ft	5127	Volume-to-Capacity Ratio (v/c)		0.75

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	1182	Average Weaving Speed (S_W),mi/h	55.2
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1924	Average Non-Weaving Speed (S_{NW}), mi/h	48.0
Weaving Lane Change Rate (LC_W), lc/h	1597	Average Speed (S), mi/h	49.7
Weaving Lane Change Rate (LC_{All}), lc/h	3521	Density (D), pc/mi/ln	33.1
Weaving Intensity Factor (W)	0.243	Level of Service (LOS)	D

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - between Western Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3260	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1902
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.82
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	59.5
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	32.0
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - between Western Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3485	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1994
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.86
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	58.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	34.3
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - west of Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3535	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1375
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.59
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	22.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	12/17/2018
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - west of Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

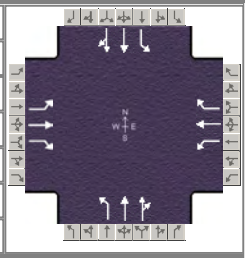
Demand Volume veh/h	4195	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1600
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.69
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.7
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	25.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

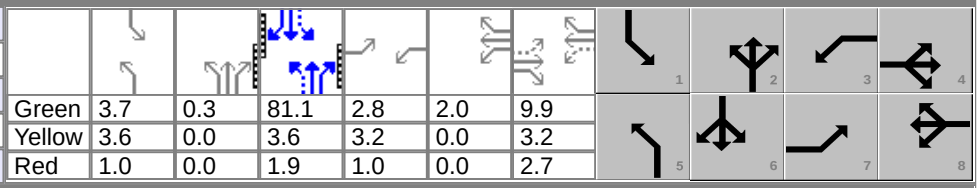
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2050	Analysis Period	1> 7:15
Intersection	37th Street	File Name	01-02-04-05 Minnesota Avenue 2050 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	30	70	55	110	75	105	80	1695	115	90	840	15

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	71	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	3.7	0.3	81.1	2.8	2.0	9.9
Yellow	3.6	0.0	3.6	3.2	0.0	3.2
Red	1.0	0.0	1.9	1.0	0.0	2.7

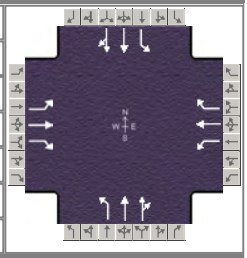
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	3.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	7.0	15.8	9.0	17.9	8.6	86.9	8.3	86.6
Change Period, ($Y+R_c$), s	4.2	5.9	4.2	5.9	4.6	5.5	4.6	5.5
Max Allow Headway (*MAH*), s	4.3	4.3	4.3	4.3	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	4.1	6.9	6.8	10.7	3.9		3.7	
Green Extension Time (g_e), s	0.0	1.3	0.0	1.3	0.3	0.0	0.3	0.0
Phase Call Probability	0.67	1.00	0.98	1.00	0.95		0.93	
Max Out Probability	1.00	0.00	1.00	0.00	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	33	78	61	122	83	117	89	1006	1006	79	376	374
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1543	1734	1821	1568	1734	1821	1780	1734	1821	1810
Queue Service Time (g_s), s	2.1	4.9	4.5	4.8	5.2	8.7	1.9	47.6	50.1	1.7	7.3	7.4
Cycle Queue Clearance Time (g_c), s	2.1	4.9	4.5	4.8	5.2	8.7	1.9	47.6	50.1	1.7	7.3	7.4
Green Ratio (*g/C*)	0.11	0.08	0.08	0.12	0.10	0.10	0.71	0.68	0.68	0.71	0.68	0.68
Capacity (*c*), veh/h	152	150	127	184	181	156	555	1235	1207	165	1231	1223
Volume-to-Capacity Ratio (*X*)	0.219	0.517	0.480	0.663	0.459	0.747	0.160	0.814	0.833	0.477	0.305	0.305
Back of Queue (*Q*), ft/ln (95 th percentile)	43.5	108.8	85.6	83.9	113.4	168.6	30	684.4	696.4	71.8	120.4	119
Back of Queue (*Q*), veh/ln (95 th percentile)	1.7	4.3	3.4	3.3	4.5	6.7	1.2	26.9	27.9	2.8	4.7	4.8
Queue Storage Ratio (*RQ*) (95 th percentile)	0.29	0.00	0.43	0.56	0.00	0.84	0.20	0.00	0.00	0.48	0.00	0.00
Uniform Delay (d_1), s/veh	49.1	52.8	52.6	51.9	51.0	52.6	5.6	13.9	14.3	23.7	5.2	5.3
Incremental Delay (d_2), s/veh	0.7	2.7	2.8	8.5	1.8	6.9	0.1	6.0	6.8	2.0	0.6	0.6
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	49.8	55.5	55.4	60.4	52.8	59.5	5.7	19.8	21.1	25.7	5.8	5.9
Level of Service (LOS)	D	E	E	E	D	E	A	B	C	C	A	A
Approach Delay, s/veh / LOS	54.3	D		58.1	E		19.8	B		7.8	A	
Intersection Delay, s/veh / LOS	22.3						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.31	B	2.31	B	2.06	B	2.06	B
Bicycle LOS Score / LOS	0.77	A	1.02	A	2.22	B	1.35	A

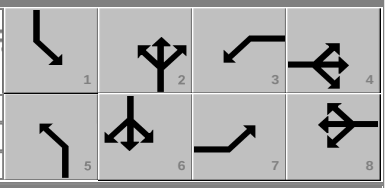
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2050	Analysis Period	1> 16:30
Intersection	37th Street	File Name	01-02-04-05 Minnesota Avenue 2050 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	70	140	140	190	130	110	85	1100	80	160	1700	50

Signal Information			
Cycle, s	130.0	Reference Phase	2
Offset, s	71	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	4.8	2.4	76.7	7.3	0.3	14.1
Yellow	3.6	0.0	3.6	3.2	3.2	3.2
Red	1.0	0.0	1.9	1.0	1.0	2.7

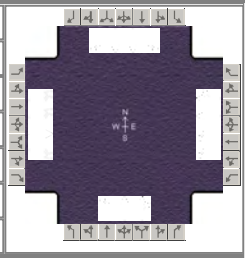
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	3.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	11.5	20.0	16.0	24.5	9.4	82.2	11.8	84.6
Change Period, ($Y+R_c$), s	4.2	5.9	4.2	5.9	4.6	5.5	4.6	5.5
Max Allow Headway (*MAH*), s	4.3	4.3	4.3	4.3	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	7.1	12.8	13.8	11.6	4.8		7.0	
Green Extension Time (g_e), s	0.2	1.3	0.0	1.6	0.2	0.0	0.3	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	0.97		1.00	
Max Out Probability	0.00	0.22	1.00	0.03	0.00		0.40	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	78	156	100	211	144	89	94	663	649	176	960	960
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1543	1734	1821	1543	1734	1821	1777	1734	1821	1803
Queue Service Time (g_s), s	5.1	10.8	8.0	11.8	9.6	6.8	2.8	30.5	30.6	5.0	61.3	62.3
Cycle Queue Clearance Time (g_c), s	5.1	10.8	8.0	11.8	9.6	6.8	2.8	30.5	30.6	5.0	61.3	62.3
Green Ratio (*g/C*)	0.16	0.11	0.11	0.21	0.14	0.14	0.63	0.59	0.59	0.65	0.61	0.61
Capacity (*c*), veh/h	220	197	167	244	260	221	146	1074	1048	300	1108	1097
Volume-to-Capacity Ratio (*X*)	0.354	0.788	0.598	0.866	0.555	0.403	0.647	0.617	0.619	0.584	0.866	0.875
Back of Queue (*Q*), ft/ln (95 th percentile)	104.9	236.3	151.5	144.4	205.2	125.3	88.3	487.1	472.6	69.7	768.9	762.7
Back of Queue (*Q*), veh/ln (95 th percentile)	4.1	9.3	6.0	5.7	8.1	4.9	3.5	19.2	18.9	2.7	30.3	30.5
Queue Storage Ratio (*RQ*) (95 th percentile)	0.70	0.00	0.76	0.96	0.00	0.63	0.59	0.00	0.00	0.46	0.00	0.00
Uniform Delay (d_1), s/veh	47.7	56.5	55.3	48.4	51.9	50.7	30.1	17.2	17.2	16.2	29.8	30.1
Incremental Delay (d_2), s/veh	1.0	8.1	3.4	26.3	1.8	1.2	4.7	2.7	2.7	0.2	0.9	1.0
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	48.7	64.6	58.7	74.7	53.7	51.8	34.9	19.8	20.0	16.3	30.7	31.1
Level of Service (LOS)	D	E	E	E	D	D	C	B	B	B	C	C
Approach Delay, s/veh / LOS	59.1	E		63.3	E		20.9	C		29.7	C	
Intersection Delay, s/veh / LOS	32.6						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.32	B	2.31	B	2.13	B	2.15	B
Bicycle LOS Score / LOS	1.04	A	1.22	A	1.65	B	2.24	B

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2050	Analysis Period	1> 7:15
Intersection	41st Street	File Name	01-02-04-05 Minnesota Avenue 2050 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	255	150	90	130	150	50	130	1240	65	50	620	155

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	88	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	3.2	61.3	4.2	7.0	5.1	10.0
Yellow	3.6	3.6	3.6	3.6	0.0	3.6
Red	2.3	2.5	2.3	2.1	0.0	2.1

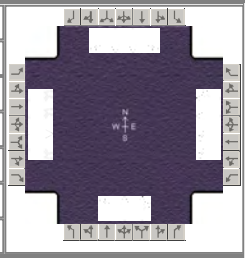
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	4.0	1.3	4.0	1.2	3.0
Phase Duration, s	17.8	20.8	12.7	15.7	10.1	77.5	9.1	76.4
Change Period, ($Y+R_c$), s	5.7	5.7	5.7	5.7	6.1	6.1	5.9	6.1
Max Allow Headway (*MAH*), s	3.1	4.3	3.2	4.3	3.2	0.0	5.2	0.0
Queue Clearance Time (g_s), s	11.9	12.6	7.0	9.6	2.0		3.5	
Green Extension Time (g_e), s	0.2	0.8	0.1	0.4	1.3	0.0	0.2	0.0
Phase Call Probability	1.00	1.00	0.99	1.00	1.00		0.79	
Max Out Probability	1.00	1.00	1.00	1.00	1.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	283	167	100	144	113	109	184	926	923	47	584	108
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1821	1568	1711	1850	1695	1762	1821	1789	1734	1734	1568
Queue Service Time (g_s), s	9.9	10.6	7.1	5.0	7.2	7.6	0.0	37.0	38.3	1.5	7.4	3.0
Cycle Queue Clearance Time (g_c), s	9.9	10.6	7.1	5.0	7.2	7.6	0.0	37.0	38.3	1.5	7.4	3.0
Green Ratio (*g/C*)	0.10	0.13	0.13	0.06	0.08	0.08	0.53	0.59	0.59	0.55	0.59	0.59
Capacity (*c*), veh/h	339	229	197	199	154	141	536	1083	1064	153	2032	919
Volume-to-Capacity Ratio (*X*)	0.835	0.728	0.508	0.725	0.735	0.774	0.344	0.855	0.868	0.307	0.287	0.118
Back of Queue (*Q*), ft/ln (95 th percentile)	208.4	235.1	127.3	101.5	169.2	171.6	126	281.5	274.2	29	120.9	46.1
Back of Queue (*Q*), veh/ln (95 th percentile)	8.2	9.3	5.1	4.1	6.8	6.9	5.0	11.1	10.8	1.1	4.8	1.8
Queue Storage Ratio (*RQ*) (95 th percentile)	0.83	0.00	0.00	0.41	0.00	0.00	0.84	0.00	0.00	0.19	0.00	0.46
Uniform Delay (d_1), s/veh	53.0	50.5	10.3	55.6	53.7	53.9	17.2	7.8	7.7	20.5	8.3	1.4
Incremental Delay (d_2), s/veh	10.8	10.3	2.9	3.8	10.0	15.0	0.1	4.5	5.0	1.5	0.3	0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	63.8	60.8	13.1	59.3	63.7	68.9	17.2	12.3	12.7	21.9	8.7	1.7
Level of Service (LOS)	E	E	B	E	E	E	B	B	B	C	A	A
Approach Delay, s/veh / LOS	53.7	D		63.5	E		12.9	B		8.5	A	
Intersection Delay, s/veh / LOS	23.1						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.31	B	2.52	C	2.25	B	2.47	B
Bicycle LOS Score / LOS	1.40	A	0.79	A	1.80	B	1.21	A

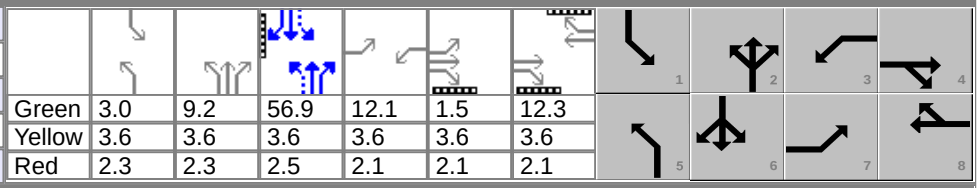
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2050	Analysis Period	1> 16:30
Intersection	41st Street	File Name	01-02-04-05 Minnesota Avenue 2050 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	430	280	285	235	330	50	245	890	95	40	1660	380

Signal Information			
Cycle, s	130.0	Reference Phase	2
Offset, s	73	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	3.0	9.2	56.9	12.1	1.5	12.3		
Yellow	3.6	3.6	3.6	3.6	3.6	3.6		
Red	2.3	2.3	2.5	2.1	2.1	2.1		

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	4.0	1.1	4.0	1.1	3.0
Phase Duration, s	25.0	25.2	17.8	18.0	24.0	78.1	8.9	63.0
Change Period, (*Y+R c*), s	5.7	5.7	5.7	5.7	5.9	6.1	5.9	6.1
Max Allow Headway (*MAH*), s	3.1	4.3	3.2	4.3	3.2	0.0	5.2	0.0
Queue Clearance Time (*g s*), s	20.3	21.5	11.7	14.3	18.8		3.6	
Green Extension Time (*g e*), s	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		0.75	
Max Out Probability	1.00	1.00	0.01	1.00	1.00		1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	478	311	206	261	205	200	283	579	560	38	1591	268
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1821	1568	1711	1850	1788	1762	1821	1759	1734	1734	1568
Queue Service Time (*g s*), s	18.3	19.5	16.7	9.7	12.3	12.3	16.8	21.3	20.6	1.6	56.9	11.2
Cycle Queue Clearance Time (*g c*), s	18.3	19.5	16.7	9.7	12.3	12.3	16.8	21.3	20.6	1.6	56.9	11.2
Green Ratio (*g/C*)	0.15	0.15	0.15	0.09	0.09	0.09	0.59	0.55	0.55	0.46	0.44	0.44
Capacity (*c*), veh/h	500	273	235	319	175	169	301	1009	974	280	1518	686
Volume-to-Capacity Ratio (*X*)	0.955	1.140	0.875	0.818	1.172	1.185	0.942	0.574	0.575	0.137	1.048	0.391
Back of Queue (*Q*), ft/ln (95 th percentile)	376.4	617.7	329.7	193.7	458.7	456.7	448.1	303.3	279.1	30.7	839.4	128.8
Back of Queue (*Q*), veh/ln (95 th percentile)	14.8	24.3	13.2	7.7	18.3	18.3	17.9	11.9	11.0	1.2	33.0	5.2
Queue Storage Ratio (*RQ*) (95 th percentile)	1.51	0.00	0.00	0.77	0.00	0.00	2.99	0.00	0.00	0.20	0.00	1.29
Uniform Delay (*d 1*), s/veh	54.9	55.3	54.1	57.9	58.9	58.9	51.7	12.4	11.6	20.1	29.1	16.2
Incremental Delay (*d 2*), s/veh	29.0	97.7	29.2	2.6	121.8	127.8	31.0	1.9	1.9	0.1	27.8	0.5
Initial Queue Delay (*d 3*), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	83.9	153.0	83.3	60.5	180.6	186.6	82.6	14.3	13.6	20.2	56.9	16.7
Level of Service (LOS)	F	F	F	E	F	F	F	B	B	C	F	B
Approach Delay, s/veh / LOS	105.4	F		135.4	F		27.6	C		50.4	D	
Intersection Delay, s/veh / LOS	66.3						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.31	B	2.61	C	2.28	B	2.57	C
Bicycle LOS Score / LOS	2.13	B	1.04	A	1.62	B	2.30	B

HCS7 Two-Way Stop-Control Report

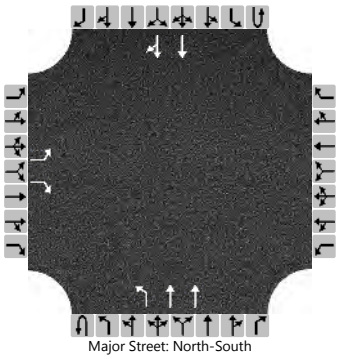
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	1/2/2019
Analysis Year	2050
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at 49th Ave
Jurisdiction	Sioux Falls, SD
East/West Street	49th Avenue
North/South Street	Minnesota Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration		L		R						L	T				T	TR
Volume (veh/h)		30		170					0	325	1835				835	135
Percent Heavy Vehicles (%)		2		2					2	2						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized		No														
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5		6.9						4.1						
Critical Headway (sec)		6.84		6.94						4.14						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.52		3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		33		189						361						
Capacity, c (veh/h)		7		487						643						
v/c Ratio		4.75		0.39						0.56						
95% Queue Length, Q_{95} (veh)		5.5		1.8						3.5						
Control Delay (s/veh)		2706.3		17.0						17.5						
Level of Service (LOS)		F		C						C						
Approach Delay (s/veh)		420.4								2.6						
Approach LOS		F														

HCS7 Two-Way Stop-Control Report

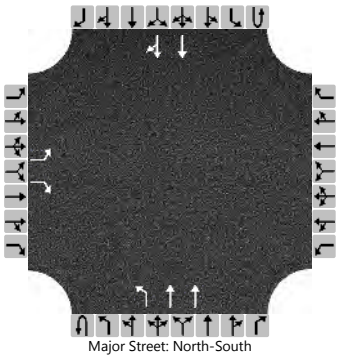
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	1/2/2019
Analysis Year	2050
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at 49th Ave
Jurisdiction	Sioux Falls, SD
East/West Street	49th Avenue
North/South Street	Minnesota Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration		L		R						L	T				T	TR
Volume (veh/h)		15		370					0	310	1180				2320	90
Percent Heavy Vehicles (%)		2		2					2	2						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized		No														
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5		6.9						4.1						
Critical Headway (sec)		6.84		6.94						4.14						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.52		3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		17		411						344						
Capacity, c (veh/h)				143						152						
v/c Ratio				2.88						2.26						
95% Queue Length, Q_{95} (veh)				37.6						28.5						
Control Delay (s/veh)				911.6						635.6						
Level of Service (LOS)				F						F						
Approach Delay (s/veh)										132.2						
Approach LOS																

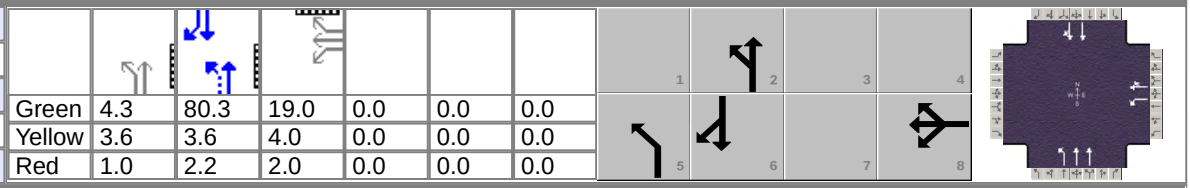
HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	Diamond
Analyst	Graham Johnson	Analysis Date	Jan 3, 2019	Segment Distance, ft	683
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 North Ramp	PHF	0.90	Arterial Direction	North-South
File Name	01-02-04-05 Minnesota Avenue 2050 AM.xus				
Project Description	I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h				140	0	255	105	1905			710	295
Intersection Two Demand (*v*), veh/h	410	0	70					1600	270	120	730	

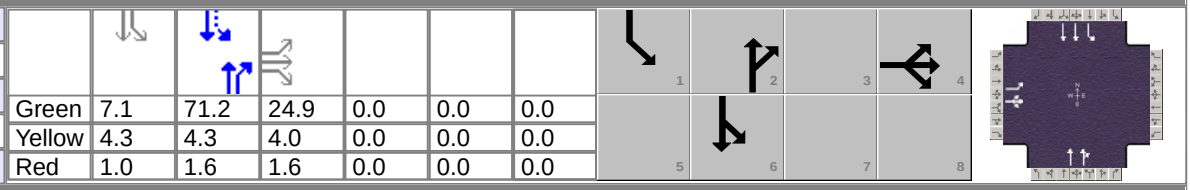
Signal One Information	
Cycle, s	120.0
Offset, s	30
Uncoordinated	No
Force Mode	Fixed

Green	4.3	80.3	19.0	0.0	0.0	0.0
Yellow	3.6	3.6	4.0	0.0	0.0	0.0
Red	1.0	2.2	2.0	0.0	0.0	0.0



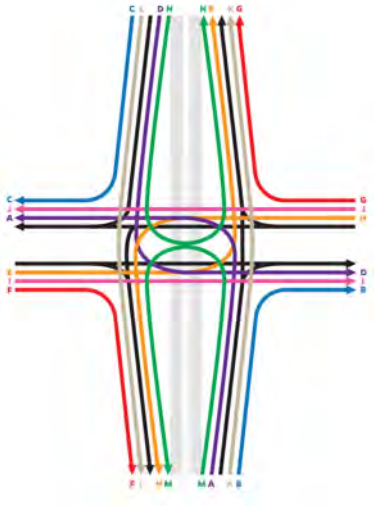
Signal Two Information	
Cycle, s	120.0
Offset, s	30
Uncoordinated	No
Force Mode	Fixed

Green	7.1	71.2	24.9	0.0	0.0	0.0
Yellow	4.3	4.3	4.0	0.0	0.0	0.0
Red	1.0	1.6	1.6	0.0	0.0	0.0



Interchange Results

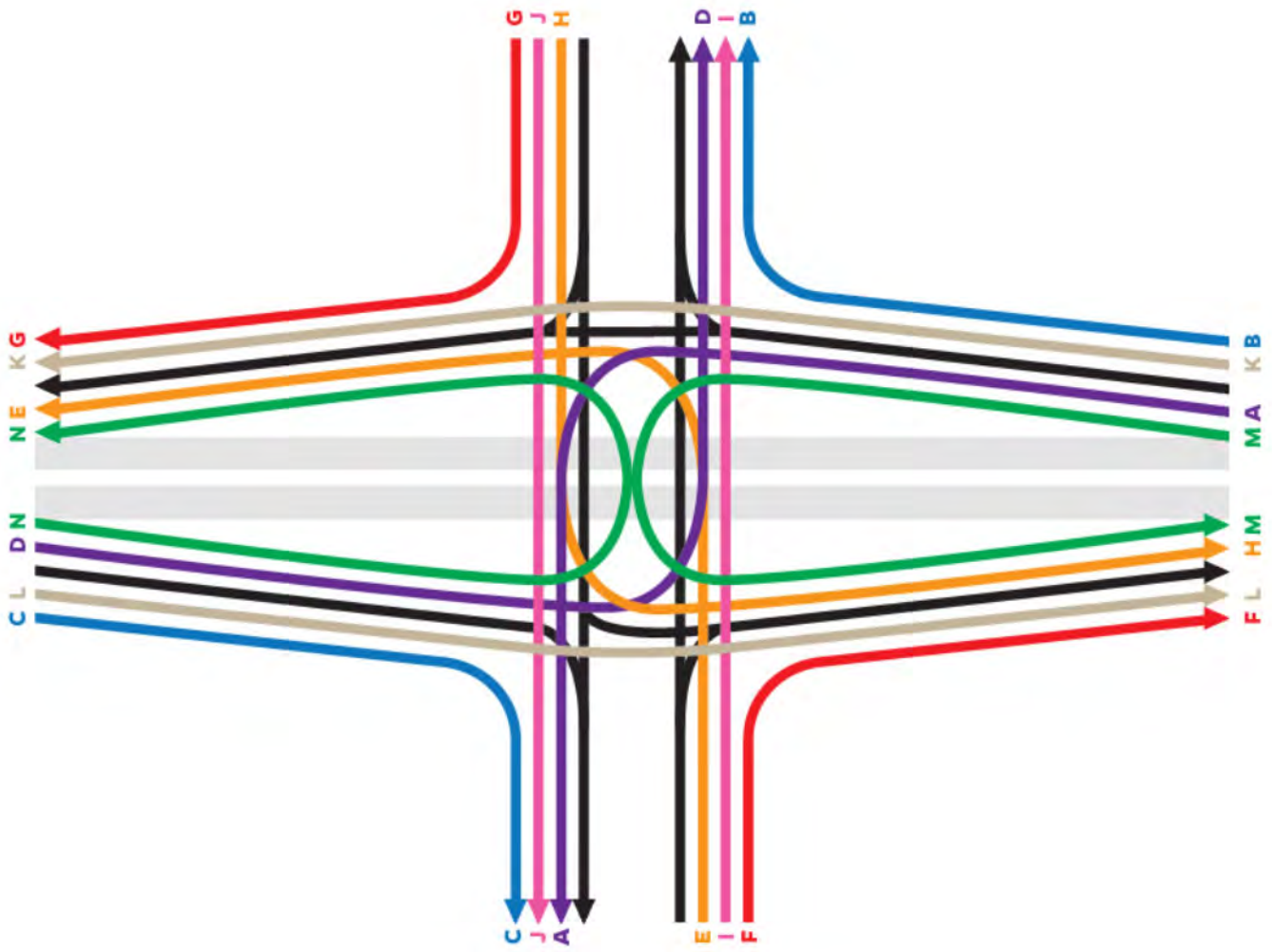
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	0	9.4	0.0	9.4	No	No	A
B	0	0.0	0.0	0.0	No	No	A
C	0	0.0	0.0	0.0	No	No	A
D	0	26.4	0.0	26.4	No	No	B
E	0	6.9	0.0	6.9	No	No	A
F	0	6.9	0.0	6.9	No	No	A
G	0	0.0	0.0	0.0	No	No	A
H	0	7.5	0.0	7.5	No	No	A
I	1947	33.2	0.0	33.2	No	No	C
J	628	16.9	0.0	16.9	No	No	B
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh				49.3	58.9		8.7	6.9			9.4	6.8
Level of Service (LOS)				D	E		A	A			A	A
Approach Delay, s/veh / LOS	0.0			54.6	D		7.0	A		8.2	A	
Intersection Delay, s/veh / LOS	12.3						B					

Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	59.6	52.4						26.4	33.8	46.3	7.5	
Level of Service (LOS)	E	D						C	C	D	A	
Approach Delay, s/veh / LOS	56.9	E		0.0			30.1	C		12.9	B	
Intersection Delay, s/veh / LOS	29.4						C					

Interchange Graphic



HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	Diamond
Analyst	Graham Johnson	Analysis Date	Jan 3, 2019	Segment Distance, ft	683
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 North Ramp	PHF	0.90	Arterial Direction	North-South
File Name	01-02-04-05 Minnesota Avenue 2050 PM.xus				
Project Description	I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h				245	0	255	140	1235			2135	555
Intersection Two Demand (*v*), veh/h	310	0	155					1065	250	560	1820	

Signal One Information	
Cycle, s	130.0
Offset, s	64
Uncoordinated	No
Force Mode	Fixed

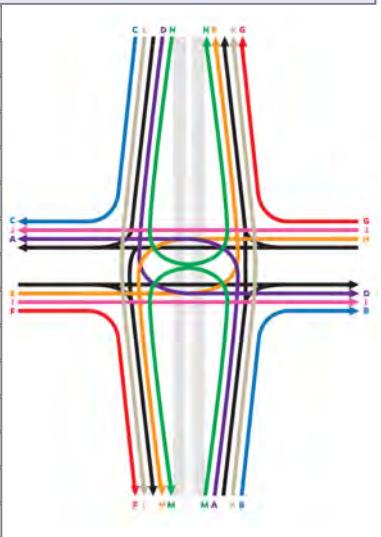
							1	2	3	4	
Green	9.8	83.8	20.0	0.0	0.0	0.0	5	6	7	8	
Yellow	3.6	3.6	4.0	0.0	0.0	0.0					
Red	1.0	2.2	2.0	0.0	0.0	0.0					

Signal Two Information	
Cycle, s	130.0
Offset, s	64
Uncoordinated	No
Force Mode	Fixed

							1	2	3	4	
Green	21.4	69.1	22.7	0.0	0.0	0.0	5	6	7	8	
Yellow	4.3	4.3	4.0	0.0	0.0	0.0					
Red	1.0	1.6	1.6	0.0	0.0	0.0					

Interchange Results

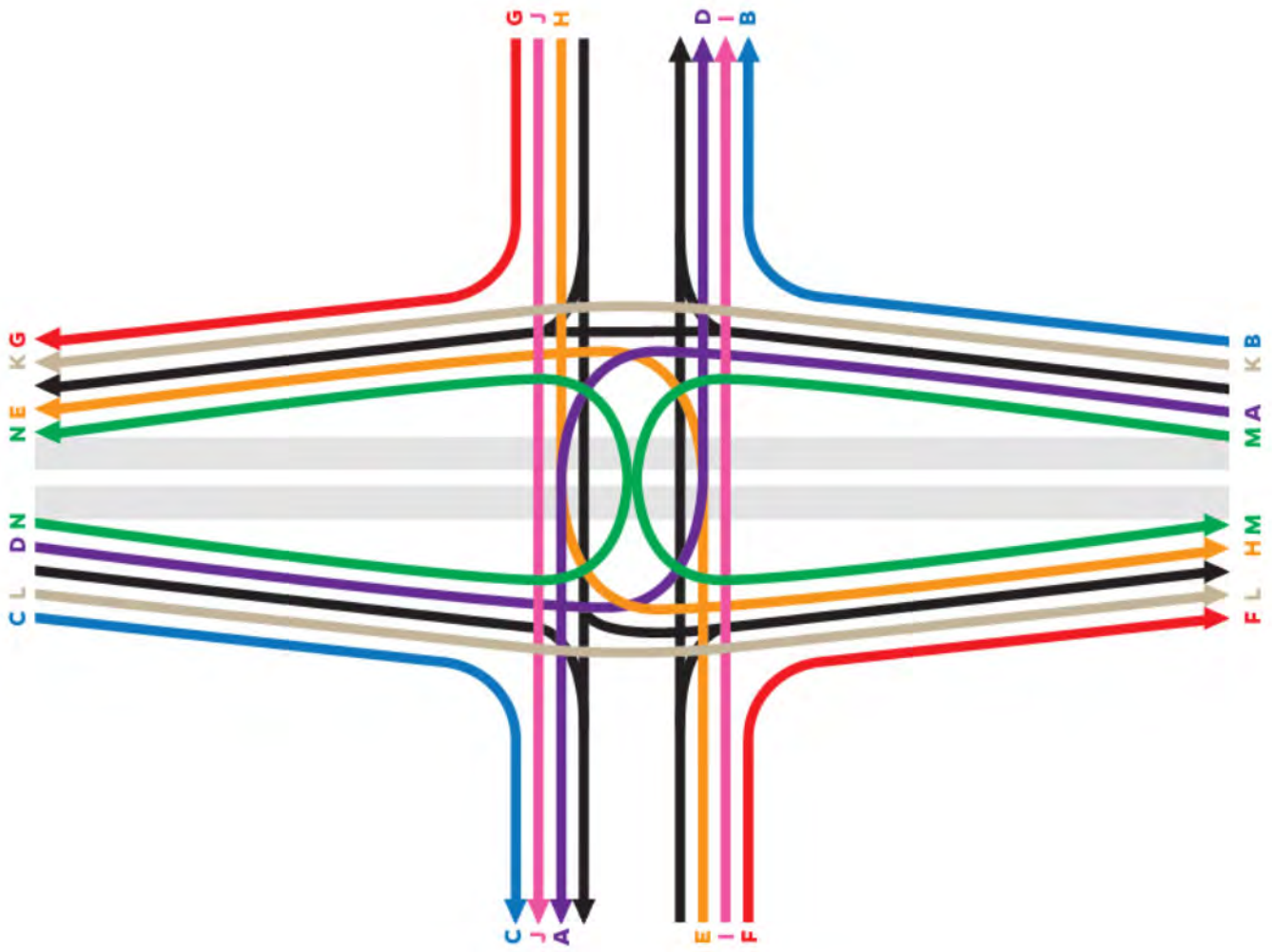
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	0	16.2	0.0	16.2	No	No	B
B	0	0.0	0.0	0.0	No	No	A
C	0	0.0	0.0	0.0	No	No	A
D	0	24.1	0.0	24.1	No	No	B
E	0	5.4	0.0	5.4	No	No	A
F	0	5.4	0.0	5.4	No	No	A
G	0	0.0	0.0	0.0	No	No	A
H	0	10.6	0.0	10.6	No	No	A
I	1369	29.5	0.0	29.5	No	No	B
J	1742	26.9	0.0	26.9	No	No	B
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh				115.4	78.8		52.0	5.4			16.2	20.3
Level of Service (LOS)				F	E		D	A			B	C
Approach Delay, s/veh / LOS	0.0			100.1		F	10.2		B	18.3		B
Intersection Delay, s/veh / LOS	24.3						C					

Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	79.9	61.9						24.1	24.2	289.1	10.6	
Level of Service (LOS)	E	E						C	C	F	B	
Approach Delay, s/veh / LOS	72.4		E	0.0			24.1		C	76.2		E
Intersection Delay, s/veh / LOS	57.9						E					

Interchange Graphic



HCS7 Two-Way Stop-Control Report

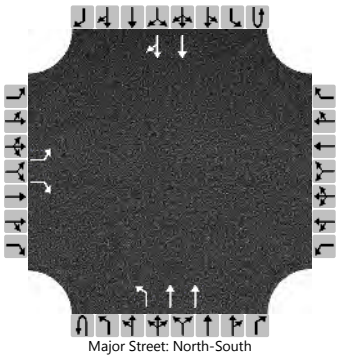
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	1/2/2019
Analysis Year	2050
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at Yankton
Jurisdiction	Sioux Falls, SD
East/West Street	Yankton Trail
North/South Street	Minnesota Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration		L		R						L	T				T	TR
Volume (veh/h)		0		5					0	5	1870				795	5
Percent Heavy Vehicles (%)		2		2					2	2						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized		No														
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5		6.9						4.1						
Critical Headway (sec)		6.84		6.94						4.14						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.52		3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		0		6						6						
Capacity, c (veh/h)		57		561						758						
v/c Ratio		0.00		0.01						0.01						
95% Queue Length, Q_{95} (veh)		0.0		0.0						0.0						
Control Delay (s/veh)		68.0		11.5						9.8						
Level of Service (LOS)		F		B						A						
Approach Delay (s/veh)		11.5								0.0						
Approach LOS		B														

HCS7 Two-Way Stop-Control Report

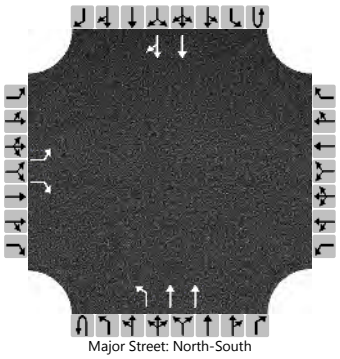
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	1/2/2019
Analysis Year	2050
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at Yankton
Jurisdiction	Sioux Falls, SD
East/West Street	Yankton Trail
North/South Street	Minnesota Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration		L		R						L	T				T	TR
Volume (veh/h)		5		15					0	50	1310				1845	130
Percent Heavy Vehicles (%)		2		2					2	2						
Proportion Time Blocked																
Percent Grade (%)	0															
Right Turn Channelized	No															
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5		6.9						4.1						
Critical Headway (sec)		6.84		6.94						4.14						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.52		3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		6		17						56						
Capacity, c (veh/h)		9		208						237						
v/c Ratio		0.64		0.08						0.23						
95% Queue Length, Q_{95} (veh)		1.3		0.3						0.9						
Control Delay (s/veh)		697.0		23.8						24.8						
Level of Service (LOS)		F		C						C						
Approach Delay (s/veh)	192.1								0.9							
Approach LOS	F															

HCS7 Two-Way Stop-Control Report

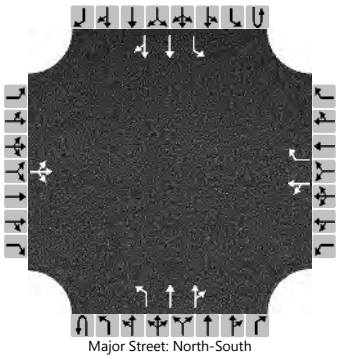
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	1/2/2019
Analysis Year	2050
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at Lotta St
Jurisdiction	Sioux Falls, SD
East/West Street	Lotta St
North/South Street	Minnesota Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	1	0	1	2	0	0	1	2	0
Configuration			LTR			LT		R		L	T	TR		L	T	TR
Volume (veh/h)		0	0	5		50	0	375	0	10	1500	15	0	45	745	10
Percent Heavy Vehicles (%)		2	2	2		3	3	2	2	2			2	2		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized					No											
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5	6.5	6.9		7.5	6.5	6.9		4.1				4.1		
Critical Headway (sec)		7.54	6.54	6.94		7.56	6.56	6.94		4.14				4.14		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.52	4.02	3.32		3.53	4.03	3.32		2.22				2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			6			56		417		11				50		
Capacity, c (veh/h)						21		308		792				376		
v/c Ratio						2.63		1.35		0.01				0.13		
95% Queue Length, Q_{95} (veh)						7.2		21.0		0.0				0.5		
Control Delay (s/veh)						1119.9		212.4		9.6				16.0		
Level of Service (LOS)						F		F		A				C		
Approach Delay (s/veh)					319.1				0.1				0.9			
Approach LOS					F											

HCS7 Two-Way Stop-Control Report

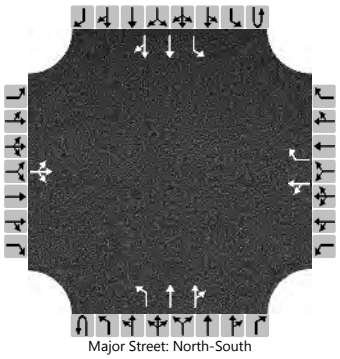
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	1/2/2019
Analysis Year	2050
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at Lotta St
Jurisdiction	Sioux Falls, SD
East/West Street	Lotta St
North/South Street	Minnesota Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	1	0	1	2	0	0	1	2	0
Configuration			LTR			LT		R		L	T	TR		L	T	TR
Volume (veh/h)		0	0	5		20	0	150	0	5	1210	40	0	240	1620	0
Percent Heavy Vehicles (%)		2	2	2		3	3	2	2	2			2	2		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized					No											
Median Type | Storage	Undivided															

Critical and Follow-up Headways

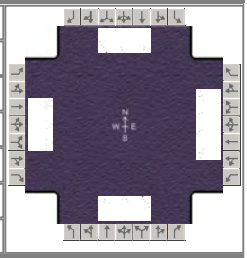
Base Critical Headway (sec)		7.5	6.5	6.9		7.5	6.5	6.9		4.1				4.1		
Critical Headway (sec)		7.54	6.54	6.94		7.56	6.56	6.94		4.14				4.14		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.52	4.02	3.32		3.53	4.03	3.32		2.22				2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			6			22		167		6				267		
Capacity, c (veh/h)			282			5		385		339				489		
v/c Ratio			0.02			4.92		0.43		0.02				0.55		
95% Queue Length, Q_{95} (veh)			0.1			4.2		2.1		0.0				3.2		
Control Delay (s/veh)			18.0			3280.1		21.3		15.8				20.9		
Level of Service (LOS)			C			F		C		C				C		
Approach Delay (s/veh)	18.0				404.7				0.1				2.7			
Approach LOS	C				F											

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2050	Analysis Period	1> 7:15
Intersection	57th Street	File Name	08 Minnesota at 57th 2050 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	140	290	115	80	705	260	140	850	35	110	545	75

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	6.9	1.7	37.3	5.5	3.4	33.5
Yellow	4.0	0.0	4.3	4.0	0.0	3.9
Red	1.0	0.0	1.6	1.0	0.0	1.9

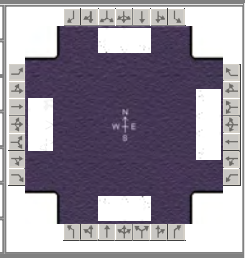
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	13.9	42.7	10.5	39.3	13.6	44.9	11.9	43.2
Change Period, ($Y+R_c$), s	5.0	5.8	5.0	5.8	5.0	5.9	5.0	5.9
Max Allow Headway (*MAH*), s	3.7	5.7	3.7	5.7	3.7	5.6	3.7	5.6
Queue Clearance Time (g_s), s	8.6	12.6	5.8	24.3	8.3	28.3	7.0	19.1
Green Extension Time (g_e), s	0.3	13.7	0.1	9.2	0.3	10.7	0.1	14.1
Phase Call Probability	0.99	1.00	0.93	1.00	0.99	1.00	0.98	1.00
Max Out Probability	0.00	0.23	0.58	0.58	0.00	0.67	1.00	0.47

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	156	224	210	89	783	194	156	492	486	122	345	333
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1663	1734	1734	1543	1734	1821	1799	1734	1821	1753
Queue Service Time (g_s), s	6.6	10.2	10.6	3.8	22.3	11.0	6.3	26.3	26.3	5.0	17.0	17.1
Cycle Queue Clearance Time (g_c), s	6.6	10.2	10.6	3.8	22.3	11.0	6.3	26.3	26.3	5.0	17.0	17.1
Green Ratio (*g/C*)	0.39	0.34	0.34	0.35	0.30	0.30	0.42	0.35	0.35	0.40	0.34	0.34
Capacity (*c*), veh/h	276	611	558	364	1056	470	341	646	638	230	618	595
Volume-to-Capacity Ratio (*X*)	0.564	0.366	0.376	0.244	0.741	0.414	0.456	0.762	0.762	0.531	0.558	0.560
Back of Queue (*Q*), ft/ln (95 th percentile)	127.6	204.3	192.3	73.1	375.1	192.5	119.2	456.3	444.9	96.3	307.8	295.1
Back of Queue (*Q*), veh/ln (95 th percentile)	5.0	8.0	7.7	2.9	14.8	7.6	4.7	18.0	17.8	3.8	12.1	11.8
Queue Storage Ratio (*RQ*) (95 th percentile)	1.02	0.00	0.00	0.29	0.00	1.28	1.19	0.00	0.00	0.32	0.00	0.00
Uniform Delay (d_1), s/veh	25.6	27.7	27.8	24.6	34.4	30.4	22.2	31.4	31.4	25.3	29.6	29.7
Incremental Delay (d_2), s/veh	1.3	0.6	0.7	0.3	2.5	1.0	0.7	4.9	4.9	1.4	1.4	1.4
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	26.9	28.3	28.5	24.8	36.9	31.4	22.9	36.3	36.3	26.7	31.0	31.1
Level of Service (LOS)	C	C	C	C	D	C	C	D	D	C	C	C
Approach Delay, s/veh / LOS	28.0	C		34.9	C		34.5	C		30.4	C	
Intersection Delay, s/veh / LOS	32.6						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.29	B	2.30	B	2.56	C	2.31	B
Bicycle LOS Score / LOS	0.97	A	1.37	A	1.42	A	1.15	A

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2050	Analysis Period	1> 16:30
Intersection	57th Street	File Name	08 Minnesota at 57th 2050 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	155	850	135	75	515	180	135	705	210	475	1060	70

Signal Information			
Cycle, s	149.7	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	10.0	20.0	45.9	7.1	2.9	37.1		
Yellow	4.0	4.0	4.3	4.0	0.0	3.9		
Red	1.0	1.0	1.6	1.0	0.0	1.9		

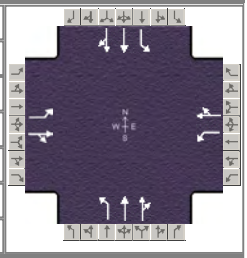
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	15.0	45.8	12.1	42.9	15.0	51.8	40.0	76.8
Change Period, ($Y+R_c$), s	5.0	5.8	5.0	5.8	5.0	5.9	5.0	5.9
Max Allow Headway (*MAH*), s	3.7	5.6	3.7	5.6	3.7	5.6	3.7	5.6
Queue Clearance Time (g_s), s	12.0	42.0	7.3	24.2	10.9	40.9	37.0	43.9
Green Extension Time (g_e), s	0.0	0.0	0.0	11.1	0.0	5.0	0.0	0.0
Phase Call Probability	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00
Max Out Probability	1.00	1.00	1.00	0.73	1.00	0.88	1.00	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	172	547	525	83	572	133	150	497	465	528	631	619
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1745	1734	1734	1543	1734	1821	1704	1734	1821	1784
Queue Service Time (g_s), s	10.0	40.0	40.0	5.3	22.2	10.6	8.9	38.9	38.9	35.0	41.8	41.9
Cycle Queue Clearance Time (g_c), s	10.0	40.0	40.0	5.3	22.2	10.6	8.9	38.9	38.9	35.0	41.8	41.9
Green Ratio (*g/C*)	0.31	0.27	0.27	0.30	0.25	0.25	0.37	0.31	0.31	0.55	0.47	0.47
Capacity (*c*), veh/h	247	487	466	131	860	383	244	558	522	481	862	844
Volume-to-Capacity Ratio (*X*)	0.696	1.125	1.126	0.638	0.665	0.348	0.615	0.890	0.890	1.098	0.732	0.733
Back of Queue (*Q*), ft/ln (95 th percentile)	89.6	1035.8	985.4	112.2	384.9	193.4	186.3	690	644.5	968	671.6	651.4
Back of Queue (*Q*), veh/ln (95 th percentile)	3.5	40.8	39.4	4.4	15.2	7.6	7.3	27.2	25.8	38.1	26.4	26.1
Queue Storage Ratio (*RQ*) (95 th percentile)	0.72	0.00	0.00	0.45	0.00	1.29	1.86	0.00	0.00	3.23	0.00	0.00
Uniform Delay (d_1), s/veh	43.4	54.9	54.9	43.6	50.7	46.3	34.0	49.5	49.5	44.0	31.8	31.8
Incremental Delay (d_2), s/veh	7.7	79.8	80.7	4.1	2.1	0.9	4.1	13.8	14.5	70.3	3.7	3.8
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	51.1	134.6	135.6	47.7	52.8	47.3	38.1	63.3	64.0	114.3	35.4	35.6
Level of Service (LOS)	D	F	F	D	D	D	D	E	E	F	D	D
Approach Delay, s/veh / LOS	123.5	F		51.3	D		60.2	E		58.9	E	
Intersection Delay, s/veh / LOS	74.3						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.38	B	2.31	B	2.54	C	2.31	B
Bicycle LOS Score / LOS	1.51	B	1.14	A	1.40	A	1.95	B

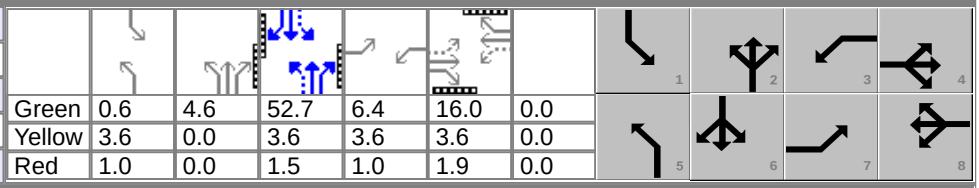
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2050	Analysis Period	1> 7:15
Intersection	33rd Street	File Name	09 Cliff at 33rd 2050 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	90	90	45	90	195	20	110	1180	15	5	360	60

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	0.6	4.6	52.7	6.4	16.0	0.0
Yellow	3.6	0.0	3.6	3.6	3.6	0.0
Red	1.0	0.0	1.5	1.0	1.9	0.0

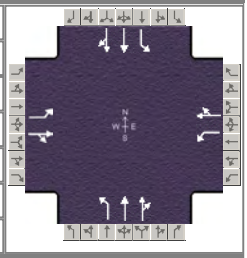
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	4.0	1.1	4.0	1.1	4.0
Phase Duration, s	11.0	21.5	11.0	21.5	9.7	62.4	5.2	57.8
Change Period, ($Y+R_c$), s	4.6	5.5	4.6	5.5	4.6	5.1	4.6	5.1
Max Allow Headway (*MAH*), s	4.2	4.2	4.2	4.2	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	6.8	10.0	6.8	14.9	5.0		2.2	
Green Extension Time (g_e), s	0.0	1.2	0.0	1.1	0.3	0.0	0.0	0.0
Phase Call Probability	0.94	1.00	0.94	1.00	0.97		0.14	
Max Out Probability	1.00	0.01	1.00	0.05	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	100	150		100	239		122	665	663	6	238	229
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1718		1734	1791		1734	1821	1813	1734	1821	1730
Queue Service Time (g_s), s	4.8	8.0		4.8	12.9		3.0	24.6	24.6	0.2	7.1	7.2
Cycle Queue Clearance Time (g_c), s	4.8	8.0		4.8	12.9		3.0	24.6	24.6	0.2	7.1	7.2
Green Ratio (*g/C*)	0.22	0.16		0.22	0.16		0.60	0.57	0.57	0.53	0.53	0.53
Capacity (*c*), veh/h	195	275		256	286		582	1043	1038	208	960	912
Volume-to-Capacity Ratio (*X*)	0.514	0.546		0.391	0.834		0.210	0.638	0.638	0.027	0.248	0.251
Back of Queue (*Q*), ft/ln (95 th percentile)	95.7	159.6		93.7	261.8		50.8	394.9	387.6	2.7	135.5	129.2
Back of Queue (*Q*), veh/ln (95 th percentile)	3.8	6.3		3.7	10.3		2.0	15.5	15.5	0.1	5.3	5.2
Queue Storage Ratio (*RQ*) (95 th percentile)	0.45	0.00		0.67	0.00		0.29	0.00	0.00	0.02	0.00	0.00
Uniform Delay (d_1), s/veh	33.2	38.7		32.5	40.7		9.2	14.4	14.4	13.4	12.9	12.9
Incremental Delay (d_2), s/veh	2.1	1.7		1.0	7.2		0.2	3.0	3.0	0.1	0.6	0.7
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	35.3	40.4		33.5	48.0		9.3	17.4	17.4	13.5	13.5	13.6
Level of Service (LOS)	D	D		C	D		A	B	B	B	B	B
Approach Delay, s/veh / LOS	38.3	D		43.7	D		16.7	B		13.5	B	
Intersection Delay, s/veh / LOS	21.9						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.30	B	2.30	B	1.89	B	1.89	B
Bicycle LOS Score / LOS	0.90	A	1.05	A	1.68	B	0.88	A

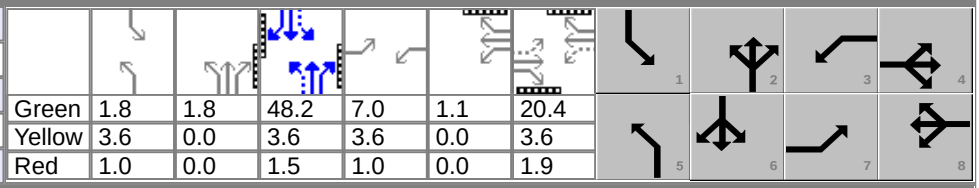
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2050	Analysis Period	1> 16:30
Intersection	33rd Street	File Name	09 Cliff at 33rd 2050 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	105	195	85	125	140	45	65	625	195	20	1205	90

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	1.8	1.8	48.2	7.0	1.1	20.4
Yellow	3.6	0.0	3.6	3.6	0.0	3.6
Red	1.0	0.0	1.5	1.0	0.0	1.9

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	4.0	1.1	4.0	1.1	4.0
Phase Duration, s	11.6	25.9	12.7	26.9	8.2	55.0	6.4	53.3
Change Period, ($Y+R_c$), s	4.6	5.5	4.6	5.5	4.6	5.1	4.6	5.1
Max Allow Headway (*MAH*), s	4.2	4.2	4.2	4.2	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	7.2	19.5	8.2	12.5	4.1		2.6	
Green Extension Time (g_e), s	0.0	0.9	0.0	1.6	0.1	0.0	0.0	0.0
Phase Call Probability	0.96	1.00	0.98	1.00	0.87		0.46	
Max Out Probability	1.00	0.95	1.00	0.05	0.02		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	117	311		139	206		72	475	436	22	726	713
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1727		1734	1745		1734	1821	1672	1734	1821	1776
Queue Service Time (g_s), s	5.2	17.5		6.2	10.5		2.1	17.7	17.7	0.6	34.4	34.7
Cycle Queue Clearance Time (g_c), s	5.2	17.5		6.2	10.5		2.1	17.7	17.7	0.6	34.4	34.7
Green Ratio (*g/C*)	0.27	0.20		0.28	0.21		0.52	0.50	0.50	0.50	0.48	0.48
Capacity (*c*), veh/h	298	352		242	374		185	909	835	289	877	855
Volume-to-Capacity Ratio (*X*)	0.391	0.885		0.573	0.550		0.391	0.522	0.523	0.077	0.828	0.833
Back of Queue (*Q*), ft/ln (95 th percentile)	101.8	355.5		126.5	204.2		39.2	308.7	285	11.7	575.7	561.4
Back of Queue (*Q*), veh/ln (95 th percentile)	4.0	14.0		5.0	8.0		1.5	12.2	11.4	0.5	22.7	22.5
Queue Storage Ratio (*RQ*) (95 th percentile)	0.47	0.00		0.90	0.00		0.22	0.00	0.00	0.10	0.00	0.00
Uniform Delay (d_1), s/veh	29.0	38.7		29.6	35.0		19.6	17.0	17.0	14.3	22.4	22.4
Incremental Delay (d_2), s/veh	0.8	18.0		3.0	1.3		1.3	2.1	2.3	0.1	8.9	9.3
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	29.8	56.7		32.6	36.2		21.0	19.1	19.3	14.4	31.2	31.8
Level of Service (LOS)	C	E		C	D		C	B	B	B	C	C
Approach Delay, s/veh / LOS	49.4	D		34.8	C		19.3	B		31.3	C	
Intersection Delay, s/veh / LOS	30.4						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.30	B	2.29	B	1.90	B	1.90	B
Bicycle LOS Score / LOS	1.19	A	1.06	A	1.30	A	1.69	B

HCS7 Two-Way Stop-Control Report

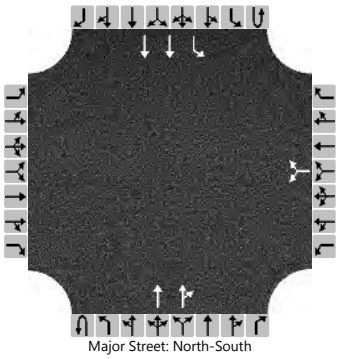
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	1/2/2019
Analysis Year	2050
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at 36th St
Jurisdiction	Sioux Falls, SD
East/West Street	36th Street
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	2	0	0	1	2	0
Configuration							LR				T	TR		L	T	
Volume (veh/h)						50		45			1385	95	0	60	630	
Percent Heavy Vehicles (%)						2		2					2	2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized																
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)						7.5		6.9						4.1		
Critical Headway (sec)						6.84		6.94						4.14		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.52		3.32						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							106							67		
Capacity, c (veh/h)							168							389		
v/c Ratio							0.63							0.17		
95% Queue Length, Q_{95} (veh)							3.5							0.6		
Control Delay (s/veh)							57.0							16.1		
Level of Service (LOS)							F							C		
Approach Delay (s/veh)						57.0								1.4		
Approach LOS						F										

HCS7 Two-Way Stop-Control Report

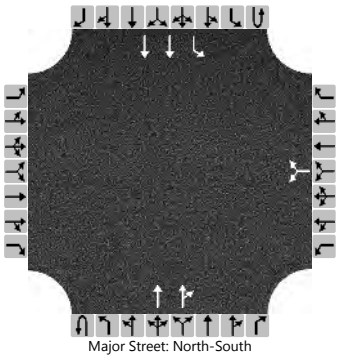
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	1/2/2019
Analysis Year	2050
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at 36th St
Jurisdiction	Sioux Falls, SD
East/West Street	36th Street
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	2	0	0	1	2	0
Configuration							LR				T	TR		L	T	
Volume (veh/h)						35		5			885	30	0	60	1415	
Percent Heavy Vehicles (%)						2		2					2	2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized																
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)						7.5		6.9						4.1		
Critical Headway (sec)						6.84		6.94						4.14		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.52		3.32						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							44							67		
Capacity, c (veh/h)							184							678		
v/c Ratio							0.24							0.10		
95% Queue Length, Q_{95} (veh)							0.9							0.3		
Control Delay (s/veh)							30.7							10.9		
Level of Service (LOS)							D							B		
Approach Delay (s/veh)						30.7								0.4		
Approach LOS						D										

HCS7 Two-Way Stop-Control Report

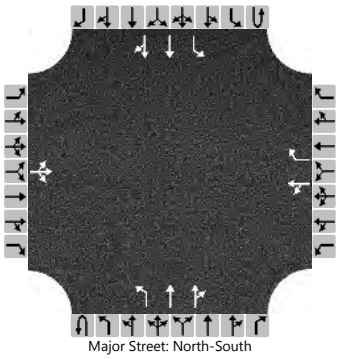
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	1/2/2019
Analysis Year	2050
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at 38th/HS #1
Jurisdiction	Sioux Falls, SD
East/West Street	38th Street/HS #1
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	1	0	1	2	0	0	1	2	0
Configuration			LTR			LT		R		L	T	TR		L	T	TR
Volume (veh/h)		10	5	95		115	10	100	0	75	1335	190	0	20	925	45
Percent Heavy Vehicles (%)		2	2	2		2	2	2	2	2			2	2		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized					No											
Median Type | Storage	Left Only								1							

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5	6.5	6.9		7.5	6.5	6.9		4.1				4.1		
Critical Headway (sec)		7.54	6.54	6.94		7.54	6.54	6.94		4.14				4.14		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.52	4.02	3.32		3.52	4.02	3.32		2.22				2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			122			139		111		83				22		
Capacity, c (veh/h)			27			37		305		643				372		
v/c Ratio			4.59			3.77		0.36		0.13				0.06		
95% Queue Length, Q_{95} (veh)			15.0			16.0		1.6		0.4				0.2		
Control Delay (s/veh)			1914.5			1468.6		23.4		11.4				15.3		
Level of Service (LOS)			F			F		C		B				C		
Approach Delay (s/veh)	1914.5				826.3				0.5				0.3			
Approach LOS	F				F											

HCS7 Two-Way Stop-Control Report

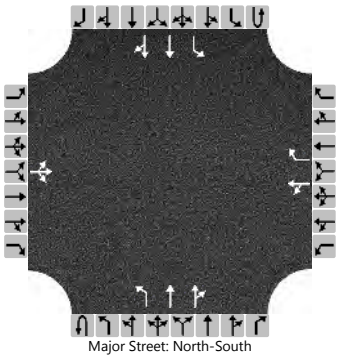
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	1/2/2019
Analysis Year	2050
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at 38th/HS #1
Jurisdiction	Sioux Falls, SD
East/West Street	38th Street/HS #1
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	1	0	1	2	0	0	1	2	0
Configuration			LTR			LT		R		L	T	TR		L	T	TR
Volume (veh/h)		20	0	95		65	5	20	0	55	1060	20	0	5	1580	30
Percent Heavy Vehicles (%)		2	2	2		2	2	2	2	2			2	2		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized					No											
Median Type | Storage	Left Only								1							

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5	6.5	6.9		7.5	6.5	6.9		4.1				4.1		
Critical Headway (sec)		7.54	6.54	6.94		7.54	6.54	6.94		4.14				4.14		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.52	4.02	3.32		3.52	4.02	3.32		2.22				2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			128			78		22		61				6		
Capacity, c (veh/h)			151			46		444		342				577		
v/c Ratio			0.85			1.69		0.05		0.18				0.01		
95% Queue Length, Q_{95} (veh)			5.6			7.7		0.2		0.6				0.0		
Control Delay (s/veh)			95.5			526.7		13.5		17.8				11.3		
Level of Service (LOS)			F			F		B		C				B		
Approach Delay (s/veh)	95.5				412.6				0.9				0.0			
Approach LOS	F				F											

HCS7 Two-Way Stop-Control Report

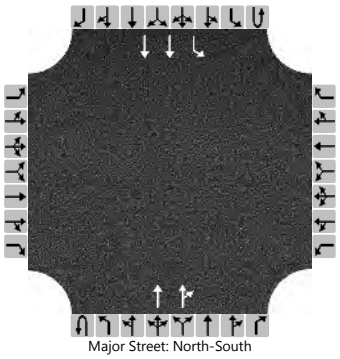
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	1/2/2019
Analysis Year	2050
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at HS #2
Jurisdiction	Sioux Falls, SD
East/West Street	HS #2 Entrance
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	0	2	0	0	1	2	0
Configuration											T	TR		L	T	
Volume (veh/h)											1600	220	0	125	1010	
Percent Heavy Vehicles (%)													2	2		
Proportion Time Blocked																
Percent Grade (%)																
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)														4.1		
Critical Headway (sec)														4.14		
Base Follow-Up Headway (sec)														2.2		
Follow-Up Headway (sec)														2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)														139		
Capacity, c (veh/h)														277		
v/c Ratio														0.50		
95% Queue Length, Q_{95} (veh)														2.6		
Control Delay (s/veh)														30.3		
Level of Service (LOS)														D		
Approach Delay (s/veh)													3.3			
Approach LOS																

HCS7 Two-Way Stop-Control Report

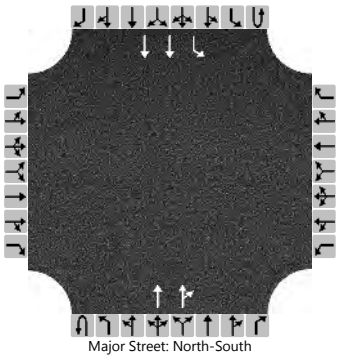
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	1/2/2019
Analysis Year	2050
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at HS #2
Jurisdiction	Sioux Falls, SD
East/West Street	HS #2 Entrance
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	0	2	0	0	1	2	0
Configuration											T	TR		L	T	
Volume (veh/h)											1135	35	0	15	1725	
Percent Heavy Vehicles (%)													2	2		
Proportion Time Blocked																
Percent Grade (%)																
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)														4.1		
Critical Headway (sec)														4.14		
Base Follow-Up Headway (sec)														2.2		
Follow-Up Headway (sec)														2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)														17		
Capacity, c (veh/h)														529		
v/c Ratio														0.03		
95% Queue Length, Q_{95} (veh)														0.1		
Control Delay (s/veh)														12.0		
Level of Service (LOS)														B		
Approach Delay (s/veh)													0.1			
Approach LOS																

HCS7 Two-Way Stop-Control Report

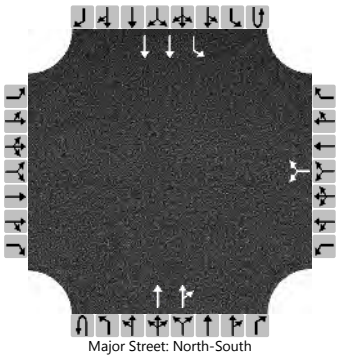
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	1/2/2019
Analysis Year	2050
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at HS #1
Jurisdiction	Sioux Falls, SD
East/West Street	HS #1
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	2	0	0	1	2	0
Configuration							LR				T	TR		L	T	
Volume (veh/h)						40		65			1755	465	0	50	960	
Percent Heavy Vehicles (%)						2		2					2	2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized																
Median Type | Storage						Undivided										

Critical and Follow-up Headways

Base Critical Headway (sec)						7.5		6.9						4.1		
Critical Headway (sec)						6.84		6.94						4.14		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.52		3.32						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							117							56		
Capacity, c (veh/h)							23							185		
v/c Ratio							5.15							0.30		
95% Queue Length, Q_{95} (veh)							14.7							1.2		
Control Delay (s/veh)							2211.4							32.6		
Level of Service (LOS)							F							D		
Approach Delay (s/veh)						2211.4							1.6			
Approach LOS						F										

HCS7 Two-Way Stop-Control Report

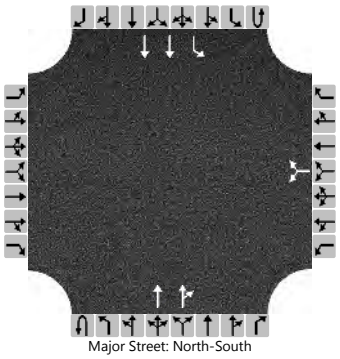
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	1/2/2019
Analysis Year	2050
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at HS #1
Jurisdiction	Sioux Falls, SD
East/West Street	HS #1
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	2	0	0	1	2	0
Configuration							LR				T	TR		L	T	
Volume (veh/h)						35		10			1160	15	0	0	1725	
Percent Heavy Vehicles (%)						2		2					2	2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized																
Median Type | Storage						Undivided										

Critical and Follow-up Headways

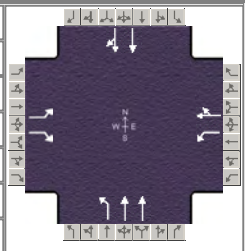
Base Critical Headway (sec)						7.5		6.9						4.1		
Critical Headway (sec)						6.84		6.94						4.14		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.52		3.32						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							50							0		
Capacity, c (veh/h)							44							526		
v/c Ratio							1.14							0.00		
95% Queue Length, Q_{95} (veh)							4.7							0.0		
Control Delay (s/veh)							327.0							11.8		
Level of Service (LOS)							F							B		
Approach Delay (s/veh)						327.0								0.0		
Approach LOS						F										

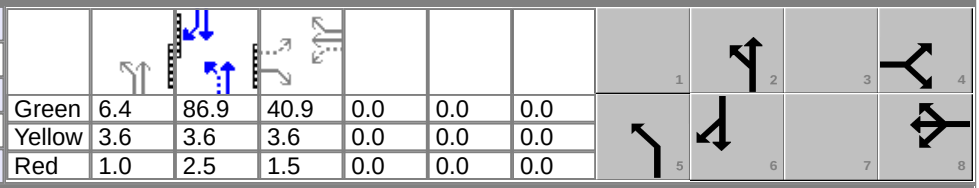
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2050	Analysis Period	1> 7:15
Intersection	41st St/SB I-229	File Name	14-16-18 Cliff Avenue 2050 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	140		120	430	180	150	190	1930			890	110

Signal Information			
Cycle, s	150.0	Reference Phase	2
Offset, s	71	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	6.4	86.9	40.9	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.0	2.5	1.5	0.0	0.0	0.0

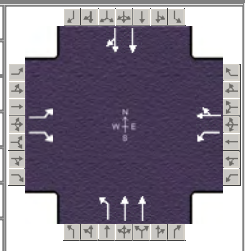
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2		6
Case Number		5.0		6.0	1.0	4.0		8.3
Phase Duration, s		46.0		46.0	11.0	104.0		93.0
Change Period, (*Y+R c*), s		5.1		5.1	4.6	6.1		6.1
Max Allow Headway (*MAH*), s		5.3		5.3	5.2	0.0		0.0
Queue Clearance Time (*g s*), s		42.9		42.9	8.4			
Green Extension Time (*g e*), s		0.0		0.0	0.0	0.0		0.0
Phase Call Probability		1.00		1.00	1.00			
Max Out Probability		1.00		1.00	1.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14	3	8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h	156		133	478	367		211	2144			710	692
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1015		1543	1734	1683		1734	1734			1821	1765
Queue Service Time (*g s*), s	10.5		10.3	40.9	30.4		6.4	84.4			27.2	21.2
Cycle Queue Clearance Time (*g c*), s	40.9		10.3	40.9	30.4		6.4	84.4			27.2	21.2
Green Ratio (*g/C*)	0.27		0.27	0.27	0.27		0.64	0.65			0.58	0.58
Capacity (*c*), veh/h	119		421	521	459		275	2263			1055	1023
Volume-to-Capacity Ratio (*X*)	1.305		0.317	0.917	0.799		0.768	0.948			0.673	0.677
Back of Queue (*Q*), ft/ln (95 th percentile)	463.6		184.6	730.2	516.2		205	1158			245.8	215.7
Back of Queue (*Q*), veh/ln (95 th percentile)	18.3		7.3	28.7	20.3		8.1	45.6			9.7	8.6
Queue Storage Ratio (*RQ*) (95 th percentile)	2.06		0.00	4.87	0.00		1.17	0.00			0.00	0.00
Uniform Delay (*d 1*), s/veh	71.9		43.4	54.8	50.7		21.6	23.7			7.5	6.5
Incremental Delay (*d 2*), s/veh	185.1		0.6	21.5	10.1		13.1	10.1			2.9	3.0
Initial Queue Delay (*d 3*), s/veh	0.0		0.0	0.0	0.0		0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	257.0		44.0	76.2	60.8		34.7	33.8			10.4	9.5
Level of Service (LOS)	F		D	E	E		C	C			B	A
Approach Delay, s/veh / LOS	158.7	F		69.6	E		33.9	C		10.0	A	
Intersection Delay, s/veh / LOS	40.6						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.30	B	2.17	B	1.66	B	1.90	B
Bicycle LOS Score / LOS		F	1.88	B	2.43	B	1.38	A

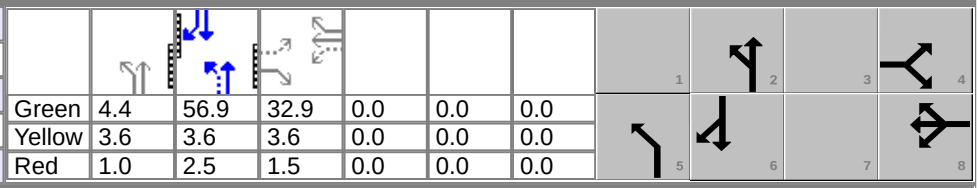
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2050	Analysis Period	1> 16:30
Intersection	41st St/SB I-229	File Name	14-16-18 Cliff Avenue 2050 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	180		250	580	195	135	145	860			1570	190

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	62	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	4.4	56.9	32.9	0.0	0.0	0.0		
Yellow	3.6	3.6	3.6	0.0	0.0	0.0		
Red	1.0	2.5	1.5	0.0	0.0	0.0		

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2		6
Case Number		5.0		6.0	1.0	4.0		8.3
Phase Duration, s		38.0		38.0	9.0	72.0		63.0
Change Period, ($Y+R_c$), s		5.1		5.1	4.6	6.1		6.1
Max Allow Headway (*MAH*), s		5.3		5.3	5.2	0.0		0.0
Queue Clearance Time (g_s), s		34.9		34.9	6.4			
Green Extension Time (g_e), s		0.0		0.0	0.0	0.0		0.0
Phase Call Probability		1.00		1.00	0.99			
Max Out Probability		1.00		1.00	1.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14	3	8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h	200		278	644	367		161	956			1145	1145
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1015		1543	1734	1696		1734	1734			1821	1753
Queue Service Time (g_s), s	11.6		16.9	32.9	21.3		4.4	16.8			63.8	56.9
Cycle Queue Clearance Time (g_c), s	32.9		16.9	32.9	21.3		4.4	16.8			63.8	56.9
Green Ratio (*g/C*)	0.30		0.30	0.30	0.30		0.58	0.60			0.52	0.52
Capacity (*c*), veh/h	173		462	584	507		135	2077			942	907
Volume-to-Capacity Ratio (*X*)	1.157		0.602	1.103	0.723		1.195	0.460			1.215	1.263
Back of Queue (*Q*), ft/ln (95 th percentile)	429.2		272.3	969.4	368		302.5	267.8			1434.6	1492.4
Back of Queue (*Q*), veh/ln (95 th percentile)	16.9		10.7	38.2	14.5		11.9	10.5			56.5	59.7
Queue Storage Ratio (*RQ*) (95 th percentile)	1.91		0.00	6.46	0.00		1.73	0.00			0.00	0.00
Uniform Delay (d_1), s/veh	51.4		33.0	40.4	34.5		29.1	12.2			19.3	16.7
Incremental Delay (d_2), s/veh	117.0		2.6	68.7	5.5		139.3	0.7			97.9	119.0
Initial Queue Delay (d_3), s/veh	0.0		0.0	0.0	0.0		0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	168.3		35.6	109.1	39.9		168.3	12.9			117.2	135.7
Level of Service (LOS)	F		D	F	D		F	B			F	F
Approach Delay, s/veh / LOS	91.1	F		84.0	F		35.4	D		126.4	F	
Intersection Delay, s/veh / LOS	93.5						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.29	B	2.12	B	1.66	B	1.90	B
Bicycle LOS Score / LOS		F	2.16	B	1.41	A	2.10	B

HCS7 Two-Way Stop-Control Report

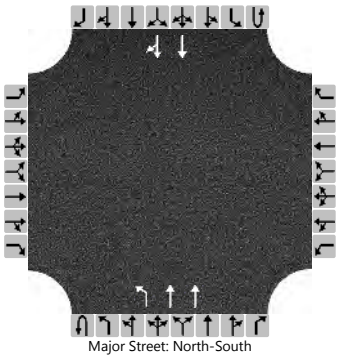
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	1/2/2019
Analysis Year	2050
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at SB I-229 Ent
Jurisdiction	Sioux Falls, SD
East/West Street	SB I-229 Entrance Ramp
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	1	2	0	0	0	2	0
Configuration										L	T				T	TR
Volume (veh/h)									0	505	2120				1185	255
Percent Heavy Vehicles (%)									2	2						
Proportion Time Blocked																
Percent Grade (%)																
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)										4.1						
Critical Headway (sec)										4.14						
Base Follow-Up Headway (sec)										2.2						
Follow-Up Headway (sec)										2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)										561						
Capacity, c (veh/h)										405						
v/c Ratio										1.38						
95% Queue Length, Q_{95} (veh)										27.2						
Control Delay (s/veh)										214.7						
Level of Service (LOS)										F						
Approach Delay (s/veh)									41.3							
Approach LOS																

HCS7 Two-Way Stop-Control Report

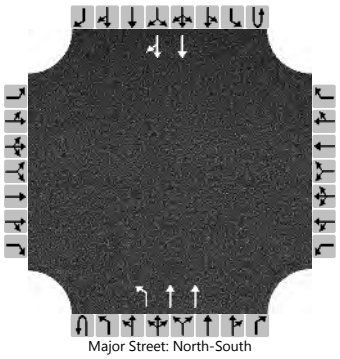
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	1/2/2019
Analysis Year	2050
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at SB I-229 Ent
Jurisdiction	Sioux Falls, SD
East/West Street	SB I-229 Entrance Ramp
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	1	2	0	0	0	2	0
Configuration										L	T				T	TR
Volume (veh/h)									0	185	1005				1745	655
Percent Heavy Vehicles (%)									2	2						
Proportion Time Blocked																
Percent Grade (%)																
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

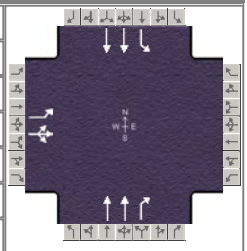
Base Critical Headway (sec)										4.1						
Critical Headway (sec)										4.14						
Base Follow-Up Headway (sec)										2.2						
Follow-Up Headway (sec)										2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)										206						
Capacity, c (veh/h)										154						
v/c Ratio										1.34						
95% Queue Length, Q_{95} (veh)										12.6						
Control Delay (s/veh)										244.4						
Level of Service (LOS)										F						
Approach Delay (s/veh)									38.0							
Approach LOS																

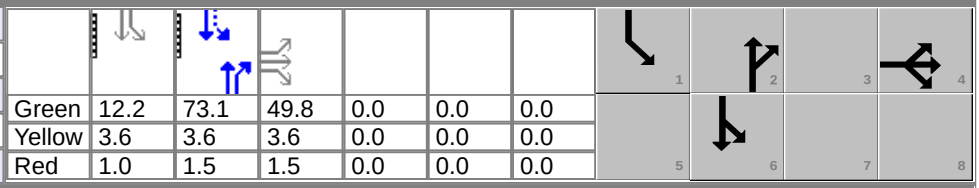
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2050	Analysis Period	1> 7:15
Intersection	I-229 South Ramp	File Name	14-16-18 Cliff Avenue 2050 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	705	0	225					1920	470	145	1040	

Signal Information			
Cycle, s	150.0	Reference Phase	2
Offset, s	61	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	12.2	73.1	49.8	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.0	1.5	1.5	0.0	0.0	0.0

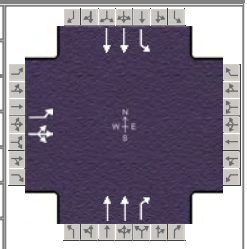
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4				2	1	6
Case Number		10.0				7.3	1.0	4.0
Phase Duration, s		54.9				78.2	16.8	95.1
Change Period, ($Y+R_c$), s		5.1				5.1	4.6	5.1
Max Allow Headway (*MAH*), s		5.3				0.0	5.2	0.0
Queue Clearance Time (g_s), s		48.3					11.9	
Green Extension Time (g_e), s		1.5				0.0	0.3	0.0
Phase Call Probability		1.00					1.00	
Max Out Probability		1.00					0.80	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14					2	12	1	6	
Adjusted Flow Rate (*v*), veh/h	548	429						1947	400	165	1180	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1660						1876	1561	1734	1824	
Queue Service Time (g_s), s	46.3	37.3						73.1	15.6	9.9	27.8	
Cycle Queue Clearance Time (g_c), s	46.3	37.3						73.1	15.6	9.9	27.8	
Green Ratio (*g/C*)	0.33	0.33						0.49	0.49	0.58	0.60	
Capacity (*c*), veh/h	576	551						1829	761	189	2188	
Volume-to-Capacity Ratio (*X*)	0.952	0.779						1.064	0.526	0.869	0.539	
Back of Queue (*Q*), ft/ln (95 th percentile)	816.4	624.4						1022.6	141.2	294.3	430.2	
Back of Queue (*Q*), veh/ln (95 th percentile)	32.1	24.6						40.3	5.6	11.6	16.9	
Queue Storage Ratio (*RQ*) (95 th percentile)	2.04	0.00						0.00	0.56	1.47	0.00	
Uniform Delay (d_1), s/veh	48.9	58.4						23.1	11.3	49.2	16.8	
Incremental Delay (d_2), s/veh	25.6	7.2						31.6	0.5	21.1	0.8	
Initial Queue Delay (d_3), s/veh	0.0	0.0						0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	74.5	65.6						54.7	11.8	70.2	17.6	
Level of Service (LOS)	E	E						F	B	E	B	
Approach Delay, s/veh / LOS	70.6	E		0.0			47.4	D		24.1	C	
Intersection Delay, s/veh / LOS	45.5						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.44	B	2.33	B	1.40	A	1.74	B
Bicycle LOS Score / LOS	2.10	B			2.61	C	1.57	B

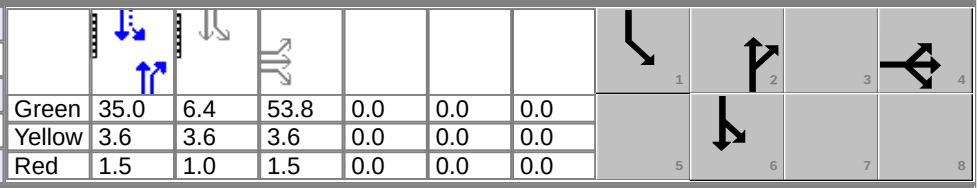
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2050	Analysis Period	1> 16:30
Intersection	I-229 South Ramp	File Name	14-16-18 Cliff Avenue 2050 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	270	0	650					920	285	130	1615	

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	40	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	35.0	6.4	53.8	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.5	1.0	1.5	0.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4				2	1	6
Case Number		10.0				7.3	1.0	4.0
Phase Duration, s		58.9				40.1	11.0	51.1
Change Period, ($Y+R_c$), s		5.1				5.1	5.1	5.1
Max Allow Headway (*MAH*), s		5.4				0.0	5.2	0.0
Queue Clearance Time (g_s), s		47.0					7.9	
Green Extension Time (g_e), s		6.8				0.0	0.0	0.0
Phase Call Probability		1.00					1.00	
Max Out Probability		0.25					1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14					2	12	1	6	
Adjusted Flow Rate (*v*), veh/h	255	712						974	238	189	2345	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1609						1738	1492	1734	1876	
Queue Service Time (g_s), s	9.7	45.0						27.2	9.4	5.9	46.0	
Cycle Queue Clearance Time (g_c), s	9.7	45.0						27.2	9.4	5.9	46.0	
Green Ratio (*g/C*)	0.49	0.49						0.32	0.32	0.35	0.42	
Capacity (*c*), veh/h	849	787						1105	474	189	1568	
Volume-to-Capacity Ratio (*X*)	0.300	0.904						0.881	0.502	1.001	1.496	
Back of Queue (*Q*), ft/ln (95 th percentile)	176.6	670.5						371	132.2	250.9	2515.5	
Back of Queue (*Q*), veh/ln (95 th percentile)	7.0	26.4						14.6	5.2	9.9	99.0	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.44	0.00						0.00	0.53	1.25	0.00	
Uniform Delay (d_1), s/veh	16.8	27.4						24.2	15.4	50.1	32.0	
Incremental Delay (d_2), s/veh	0.3	10.9						8.1	2.9	39.5	224.3	
Initial Queue Delay (d_3), s/veh	0.0	0.0						0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	17.1	38.3						32.3	18.4	89.6	256.3	
Level of Service (LOS)	B	D						C	B	F	F	
Approach Delay, s/veh / LOS	32.7	C		0.0			29.6	C		243.9	F	
Intersection Delay, s/veh / LOS	145.4						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.41	B	2.32	B	1.44	A	1.76	B
Bicycle LOS Score / LOS	2.08	B			1.54	B	2.09	B

HCS7 Two-Way Stop-Control Report

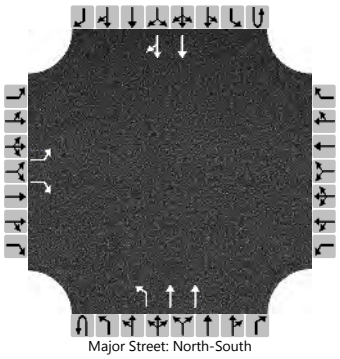
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	1/2/2019
Analysis Year	2050
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at Spencer Park
Jurisdiction	Sioux Falls, SD
East/West Street	Spencer Park Road
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration		L		R						L	T				T	TR
Volume (veh/h)		5		5					0	5	2385				1260	5
Percent Heavy Vehicles (%)		2		2					2	2						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized		No														
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5		6.9						4.1						
Critical Headway (sec)		6.84		6.94						4.14						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.52		3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		6		6						6						
Capacity, c (veh/h)		99		380						482						
v/c Ratio		0.06		0.01						0.01						
95% Queue Length, Q_{95} (veh)		0.2		0.0						0.0						
Control Delay (s/veh)		43.7		14.6						12.6						
Level of Service (LOS)		E		B						B						
Approach Delay (s/veh)		29.2								0.0						
Approach LOS		D														

HCS7 Two-Way Stop-Control Report

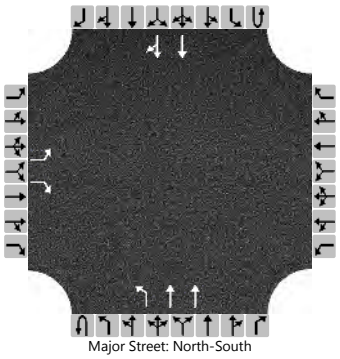
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	1/2/2019
Analysis Year	2050
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at Spencer Park
Jurisdiction	Sioux Falls, SD
East/West Street	Spencer Park Road
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration		L		R						L	T				T	TR
Volume (veh/h)		5		20					0	20	1200				2235	30
Percent Heavy Vehicles (%)		2		2					2	2						
Proportion Time Blocked																
Percent Grade (%)	0															
Right Turn Channelized	No															
Median Type | Storage	Left Only								1							

Critical and Follow-up Headways

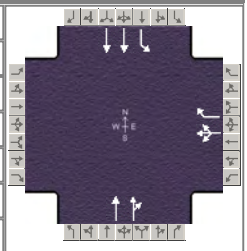
Base Critical Headway (sec)		7.5		6.9						4.1						
Critical Headway (sec)		6.84		6.94						4.14						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.52		3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		6		22						22						
Capacity, c (veh/h)		40		162						177						
v/c Ratio		0.14		0.14						0.13						
95% Queue Length, Q_{95} (veh)		0.4		0.5						0.4						
Control Delay (s/veh)		109.9		30.7						28.3						
Level of Service (LOS)		F		D						D						
Approach Delay (s/veh)	46.6								0.5							
Approach LOS	E															

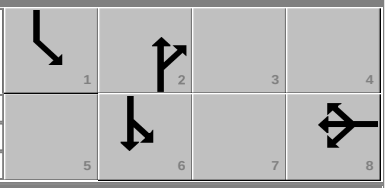
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2050	Analysis Period	1> 7:15
Intersection	49th Street	File Name	14-16-18 Cliff Avenue 2050 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				40	0	900		1615	15	300	1170	

Signal Information			
Cycle, s	150.0	Reference Phase	2
Offset, s	109	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	11.4	91.9	31.9	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.0	1.5	1.5	0.0	0.0	0.0

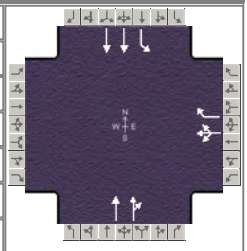
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase				8		2	1	6
Case Number				11.0		8.3	1.0	4.0
Phase Duration, s				37.0		97.0	16.0	113.0
Change Period, (*Y+R c*), s				5.1		5.1	4.6	5.1
Max Allow Headway (*MAH*), s				5.2		0.0	5.1	0.0
Queue Clearance Time (*g s*), s				33.9			13.4	
Green Extension Time (*g e*), s				0.0		0.0	0.0	0.0
Phase Call Probability				1.00			1.00	
Max Out Probability				1.00			1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement				3	8	18		2	12	1	6	
Adjusted Flow Rate (*v*), veh/h					344	367		1203	1203	333	1300	
Adjusted Saturation Flow Rate (*s*), veh/h/ln					1614	1585		1870	1864	1781	1781	
Queue Service Time (*g s*), s					31.9	31.9		54.7	91.9	11.4	24.2	
Cycle Queue Clearance Time (*g c*), s					31.9	31.9		54.7	91.9	11.4	24.2	
Green Ratio (*g/C*)					0.21	0.21		0.61	0.61	0.70	0.72	
Capacity (*c*), veh/h					343	337		1146	1142	183	2562	
Volume-to-Capacity Ratio (*X*)					1.003	1.088		1.050	1.053	1.818	0.507	
Back of Queue (*Q*), ft/ln (95 th percentile)					651.7	717.5		1059.8	1052.4	1054.6	355.8	
Back of Queue (*Q*), veh/ln (95 th percentile)					26.1	28.2		41.7	42.1	41.5	14.0	
Queue Storage Ratio (*RQ*) (95 th percentile)					2.90	3.14		0.00	0.00	2.70	0.00	
Uniform Delay (*d 1*), s/veh					72.9	59.1		17.6	17.5	56.1	9.3	
Incremental Delay (*d 2*), s/veh					49.5	74.5		25.0	26.4	388.6	0.7	
Initial Queue Delay (*d 3*), s/veh					0.0	0.0		0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh					122.4	133.6		42.6	43.9	444.7	10.0	
Level of Service (LOS)					F	F		F	F	F	B	
Approach Delay, s/veh / LOS	0.0			128.2		F	43.2		D	98.7		F
Intersection Delay, s/veh / LOS	75.0						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.16	B	2.33	B	2.32	B	1.35	A
Bicycle LOS Score / LOS			1.66	B	1.98	B	1.84	B

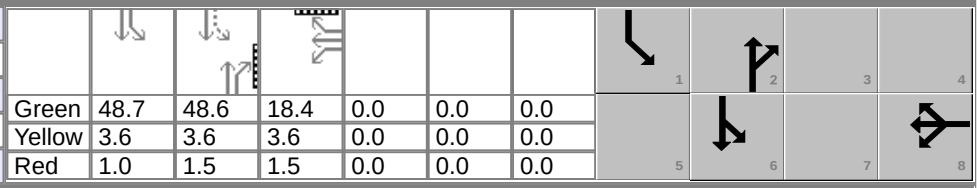
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2050	Analysis Period	1> 16:30
Intersection	49th Street	File Name	14-16-18 Cliff Avenue 2050 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				50	0	250		905	60	640	2230	

Signal Information			
Cycle, s	130.5	Reference Phase	2
Offset, s	6	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	48.7	48.6	18.4	0.0	0.0	0.0		
Yellow	3.6	3.6	3.6	0.0	0.0	0.0		
Red	1.0	1.5	1.5	0.0	0.0	0.0		

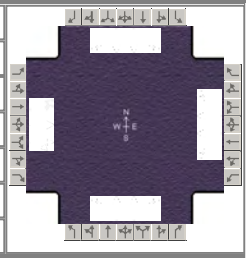
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase				8		2	1	6
Case Number				11.0		8.3	1.0	4.0
Phase Duration, s				23.5		53.7	53.3	107.0
Change Period, ($Y+R_c$), s				5.1		5.1	4.6	5.1
Max Allow Headway (*MAH*), s				5.3		3.0	5.1	3.0
Queue Clearance Time (g_s), s				16.4		45.1	47.5	67.4
Green Extension Time (g_e), s				1.9		3.4	1.2	0.0
Phase Call Probability				1.00		1.00	1.00	1.00
Max Out Probability				0.00		0.70	1.00	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement				3	8	18		2	12	1	6	
Adjusted Flow Rate (*v*), veh/h					153	181		643	630	711	2478	
Adjusted Saturation Flow Rate (*s*), veh/h/ln					1667	1585		1870	1829	1781	1781	
Queue Service Time (g_s), s					11.8	14.4		42.7	43.1	45.5	65.4	
Cycle Queue Clearance Time (g_c), s					11.8	14.4		42.7	43.1	45.5	65.4	
Green Ratio (*g/C*)					0.14	0.14		0.37	0.37	0.76	0.78	
Capacity (*c*), veh/h					235	223		697	682	738	2781	
Volume-to-Capacity Ratio (*X*)					0.651	0.809		0.923	0.925	0.963	0.891	
Back of Queue (*Q*), ft/ln (95 th percentile)					235.1	264.7		670.9	650.7	885	733.2	
Back of Queue (*Q*), veh/ln (95 th percentile)					9.4	10.4		26.4	26.0	34.8	28.9	
Queue Storage Ratio (*RQ*) (95 th percentile)					1.05	1.16		0.00	0.00	2.21	0.00	
Uniform Delay (d_1), s/veh					58.8	54.4		39.2	39.2	34.3	10.3	
Incremental Delay (d_2), s/veh					4.3	9.5		7.7	8.1	24.0	3.9	
Initial Queue Delay (d_3), s/veh					0.0	0.0		0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh					63.1	63.9		46.9	47.3	58.3	14.2	
Level of Service (LOS)					E	E		D	D	E	B	
Approach Delay, s/veh / LOS	0.0			63.5		E	47.1		D	24.0		C
Intersection Delay, s/veh / LOS	32.9						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.16	B	2.33	B	1.93	B	1.33	A
Bicycle LOS Score / LOS			1.04	A	1.37	A	3.12	C

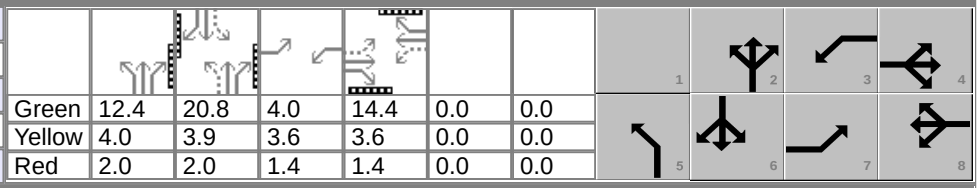
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 2, 2019	Area Type	Other
Jurisdiction	Sioux Falls	Time Period	AM	PHF	0.90
Urban Street	Western Avenue	Analysis Year	2050	Analysis Period	1> 7:15
Intersection	49th Street	File Name	19-20-21-22 Western 2050 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	130	240	110	115	445	295	315	845	200	65	420	60

Signal Information			
Cycle, s	73.4	Reference Phase	2
Offset, s	21	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	12.4	20.8	4.0	14.4	0.0	0.0
Yellow	4.0	3.9	3.6	3.6	0.0	0.0
Red	2.0	2.0	1.4	1.4	0.0	0.0

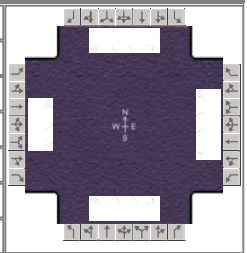
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2		6
Case Number	1.1	4.0	1.1	3.0	1.0	3.0		5.3
Phase Duration, s	9.0	19.4	9.0	19.3	18.4	45.1		26.7
Change Period, ($Y+R_c$), s	5.0	5.0	5.0	5.0	6.0	5.9		5.9
Max Allow Headway (*MAH*), s	3.1	5.1	3.1	5.1	3.1	5.3		5.3
Queue Clearance Time (g_s), s	6.0	8.8	6.0	11.8	11.7	14.7		19.0
Green Extension Time (g_e), s	0.0	5.5	0.0	0.7	0.7	24.9		0.0
Phase Call Probability	0.95	1.00	0.93	1.00	1.00	1.00		1.00
Max Out Probability	1.00	0.00	1.00	1.00	0.00	0.06		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	144	183	173	128	494	217	350	939	167	131	848	91
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1667	1734	1734	1543	1734	1734	1543	597	1734	1543
Queue Service Time (g_s), s	4.0	6.6	6.8	4.0	9.8	9.7	9.7	12.7	4.1	14.8	17.0	3.3
Cycle Queue Clearance Time (g_c), s	4.0	6.6	6.8	4.0	9.8	9.7	9.7	12.7	4.1	14.8	17.0	3.3
Green Ratio (*g/C*)	0.25	0.20	0.20	0.25	0.20	0.20	0.48	0.53	0.53	0.28	0.28	0.28
Capacity (*c*), veh/h	223	356	326	270	678	302	423	1850	824	267	983	438
Volume-to-Capacity Ratio (*X*)	0.647	0.513	0.531	0.474	0.730	0.718	0.827	0.507	0.202	0.491	0.862	0.208
Back of Queue (*Q*), ft/ln (95 th percentile)	101.8	130.9	125.4	78.2	193.7	186.9	158.4	192	56.2	93.9	288.7	52.1
Back of Queue (*Q*), veh/ln (95 th percentile)	4.0	5.2	4.9	3.1	7.6	7.4	6.2	7.6	2.2	3.7	11.4	2.1
Queue Storage Ratio (*RQ*) (95 th percentile)	0.41	0.00	0.00	0.26	0.00	0.75	0.63	0.00	0.47	0.38	0.00	0.21
Uniform Delay (d_1), s/veh	25.8	26.4	26.5	23.6	27.7	27.7	15.9	11.0	9.0	24.2	25.0	20.0
Incremental Delay (d_2), s/veh	5.0	1.6	1.9	0.5	4.3	8.7	1.6	0.3	0.2	1.6	6.7	0.3
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	30.8	28.1	28.4	24.1	32.1	36.4	17.4	11.3	9.1	25.8	31.7	20.3
Level of Service (LOS)	C	C	C	C	C	D	B	B	A	C	C	C
Approach Delay, s/veh / LOS	29.0	C		32.0	C		12.5	B		30.0	C	
Intersection Delay, s/veh / LOS	23.7						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.51	C	2.46	B	2.54	C	2.32	B
Bicycle LOS Score / LOS	0.90	A	1.18	A	1.69	B	0.97	A

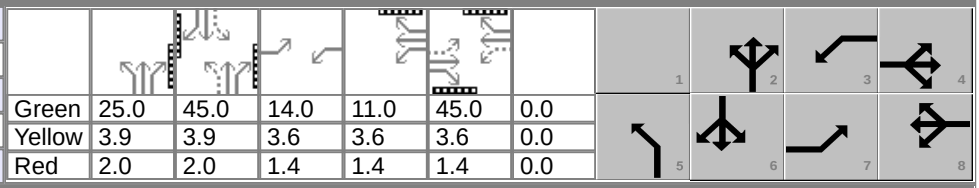
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 2, 2019	Area Type	Other
Jurisdiction	Sioux Falls	Time Period	PM	PHF	0.90
Urban Street	Western Avenue	Analysis Year	2050	Analysis Period	1> 16:30
Intersection	49th Street	File Name	19-20-21-22 Western 2050 PMn.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	155	540	380	355	760	240	320	790	125	80	1115	65

Signal Information			
Cycle, s	166.8	Reference Phase	2
Offset, s	21	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	25.0	45.0	14.0	11.0	45.0	0.0
Yellow	3.9	3.9	3.6	3.6	3.6	0.0
Red	2.0	2.0	1.4	1.4	1.4	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2		6
Case Number	1.1	4.0	1.1	3.0	1.0	3.0		5.3
Phase Duration, s	19.0	50.0	35.0	66.0	30.9	81.8		50.9
Change Period, ($Y+R_c$), s	5.0	5.0	5.0	5.0	5.9	5.9		5.9
Max Allow Headway (*MAH*), s	3.1	5.1	3.1	5.1	3.1	5.2		5.2
Queue Clearance Time (g_s), s	13.9	46.0	32.0	36.1	27.0	32.8		47.0
Green Extension Time (g_e), s	0.1	0.0	0.0	19.2	0.0	27.8		0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00	1.00		1.00
Max Out Probability	0.04	1.00	1.00	0.25	1.00	0.17		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	172	483	428	394	844	178	356	878	106	72	1008	45
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1610	1734	1734	1543	1734	1734	1543	632	1734	1543
Queue Service Time (g_s), s	11.9	44.0	44.0	30.0	34.1	13.8	25.0	30.8	6.7	15.7	45.0	3.7
Cycle Queue Clearance Time (g_c), s	11.9	44.0	44.0	30.0	34.1	13.8	25.0	30.8	6.7	15.7	45.0	3.7
Green Ratio (*g/C*)	0.35	0.27	0.27	0.46	0.37	0.37	0.43	0.46	0.46	0.27	0.27	0.27
Capacity (*c*), veh/h	286	491	434	359	1268	564	303	1578	702	214	935	416
Volume-to-Capacity Ratio (*X*)	0.601	0.984	0.984	1.100	0.666	0.315	1.173	0.556	0.150	0.339	1.078	0.109
Back of Queue (*Q*), ft/ln (95 th percentile)	226.3	849.3	772.4	821.4	537.1	232.4	810.7	484	115.9	113.5	846.4	65.9
Back of Queue (*Q*), veh/ln (95 th percentile)	8.9	33.4	30.4	32.3	21.1	9.1	31.9	19.1	4.6	4.5	33.3	2.6
Queue Storage Ratio (*RQ*) (95 th percentile)	0.91	0.00	0.00	2.74	0.00	0.93	3.24	0.00	0.97	0.45	0.00	0.26
Uniform Delay (d_1), s/veh	40.3	60.5	60.6	54.8	44.4	37.9	55.6	33.2	26.6	50.2	60.9	45.8
Incremental Delay (d_2), s/veh	0.8	36.4	39.0	77.2	0.9	0.5	107.1	0.4	0.1	0.7	45.8	0.1
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	41.1	96.9	99.6	132.0	45.3	38.4	162.7	33.6	26.7	50.9	106.7	45.9
Level of Service (LOS)	D	F	F	F	D	D	F	C	C	D	F	D
Approach Delay, s/veh / LOS	89.1	F		68.6	E		67.3	E		100.7	F	
Intersection Delay, s/veh / LOS	80.0						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.51	C	2.47	B	2.55	C	2.45	B
Bicycle LOS Score / LOS	1.38	A	1.66	B	1.59	B	1.63	B

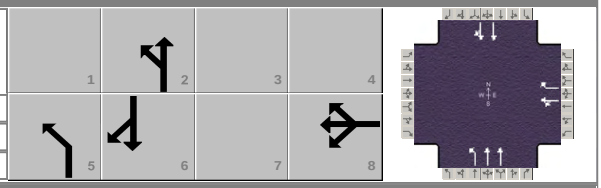
HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc.			Interchange Type	Diamond
Analyst	Graham Johnson	Analysis Date	Jan 2, 2019	Segment Distance, ft	700
Jurisdiction	Sioux Falls	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 North Ramp	PHF	0.90	Arterial Direction	North-South
File Name	19-20-21-22 Western 2050 AM.xus				
Project Description	I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h				300	0	490	130	1130			595	140
Intersection Two Demand (*v*), veh/h	390	0	160					870	310	165	730	

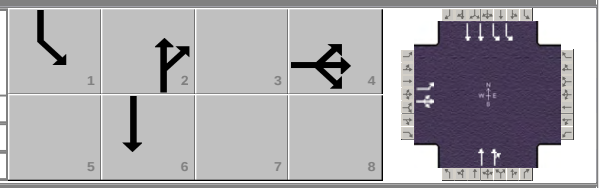
Signal One Information	
Cycle, s	110.0
Offset, s	66
Uncoordinated	No
Force Mode	Fixed

Green	7.1	52.5	32.4	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0



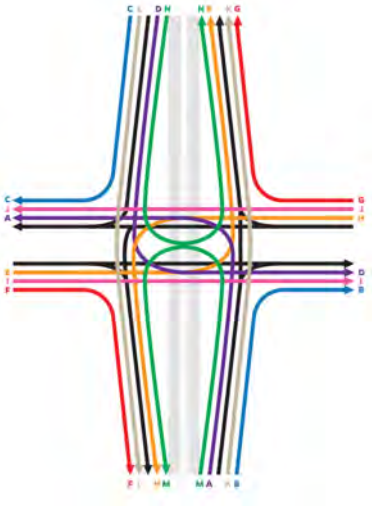
Signal Two Information	
Cycle, s	110.0
Offset, s	66
Uncoordinated	No
Force Mode	Fixed

Green	7.6	61.5	24.0	0.0	0.0	0.0
Yellow	3.9	3.9	3.6	0.0	0.0	0.0
Red	1.8	1.8	1.9	0.0	0.0	0.0



Interchange Results

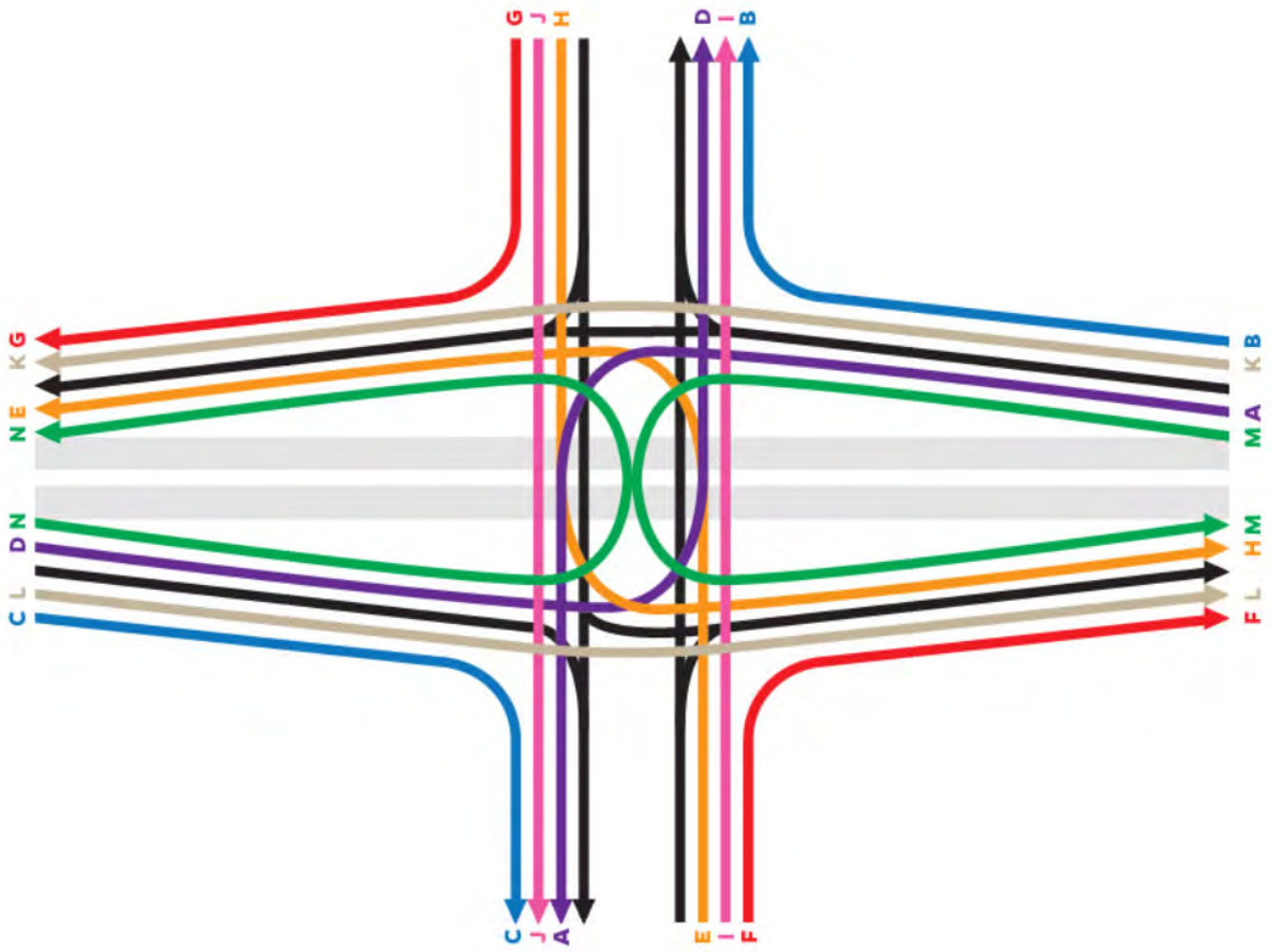
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	0	19.8	0.0	19.8	No	No	B
B	0	0.0	0.0	0.0	No	No	A
C	0	0.0	0.0	0.0	No	No	A
D	0	20.8	0.0	20.8	No	No	B
E	0	14.4	0.0	14.4	No	No	A
F	0	14.4	0.0	14.4	No	No	A
G	0	0.0	0.0	0.0	No	No	A
H	0	0.3	0.0	0.3	No	No	A
I	1351	35.3	0.0	35.3	No	No	C
J	753	20.1	0.0	20.1	No	No	B
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh					35.9	42.7	16.4	14.4			19.8	18.3
Level of Service (LOS)					D	D	B	B			B	B
Approach Delay, s/veh / LOS	0.0			39.5		D	14.6		B	19.1		B
Intersection Delay, s/veh / LOS	21.8						C					

Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	47.2	46.9						20.8	20.0	42.9	0.3	
Level of Service (LOS)	D	D						C	C	D	A	
Approach Delay, s/veh / LOS	47.0		D	0.0			20.4		C	8.2		A
Intersection Delay, s/veh / LOS	21.5						C					

Interchange Graphic



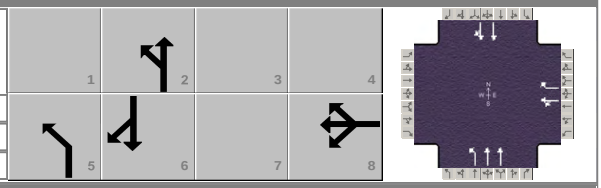
HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc.			Interchange Type	Diamond
Analyst	Graham Johnson	Analysis Date	Jan 2, 2019	Segment Distance, ft	700
Jurisdiction	Sioux Falls	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 North Ramp	PHF	0.90	Arterial Direction	North-South
File Name	19-20-21-22 Western 2050 PMn.xus				
Project Description	I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h				325	5	500	285	845			1380	420
Intersection Two Demand (*v*), veh/h	240	5	115					890	340	550	1155	

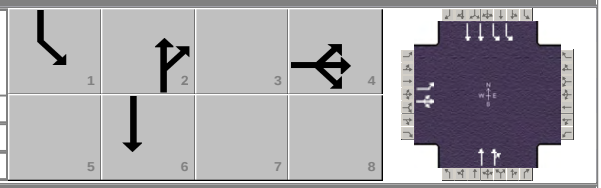
Signal One Information	
Cycle, s	100.0
Offset, s	7
Uncoordinated	No
Force Mode	Fixed

Green	18.0	33.5	30.4	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0



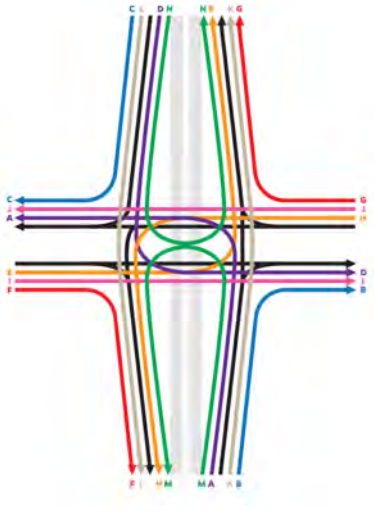
Signal Two Information	
Cycle, s	100.0
Offset, s	7
Uncoordinated	No
Force Mode	Fixed

Green	51.0	16.1	16.0	0.0	0.0	0.0
Yellow	3.9	3.9	3.6	0.0	0.0	0.0
Red	1.8	1.8	1.9	0.0	0.0	0.0



Interchange Results

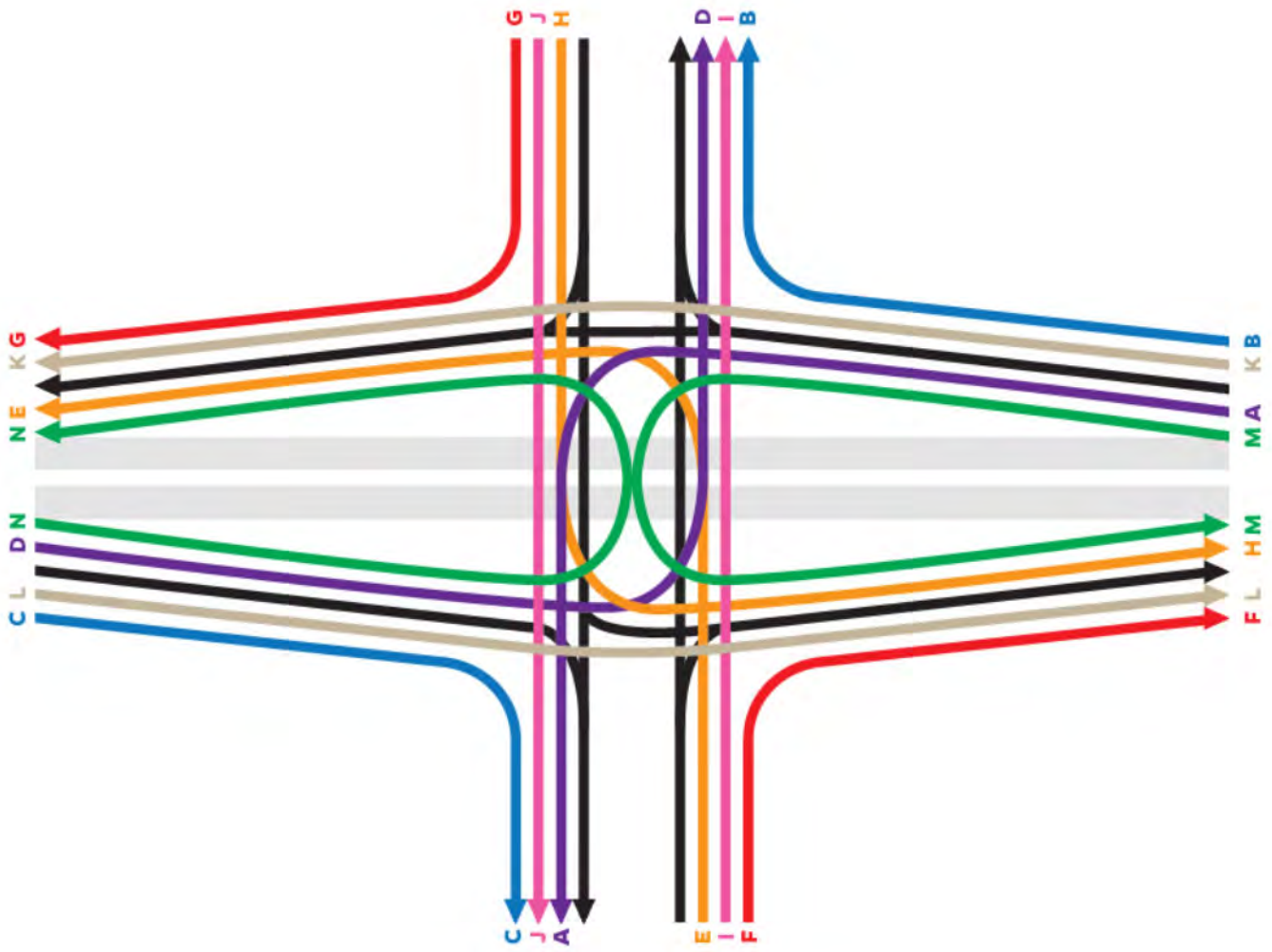
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	0	38.8	0.0	38.8	No	No	C
B	0	0.0	0.0	0.0	No	No	A
C	0	0.0	0.0	0.0	No	No	A
D	0	21.9	0.0	21.9	No	No	B
E	0	13.0	0.0	13.0	No	No	A
F	0	13.0	0.0	13.0	No	No	A
G	0	0.0	0.0	0.0	No	No	A
H	0	0.7	0.0	0.7	No	No	A
I	1128	34.9	0.0	34.9	No	No	C
J	786	39.6	0.0	39.6	No	No	C
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh					33.0	40.8	34.7	13.0			38.8	38.7
Level of Service (LOS)					C	D	C	B			D	D
Approach Delay, s/veh / LOS	0.0			37.0		D	18.5		B	38.8		D
Intersection Delay, s/veh / LOS	29.5						C					

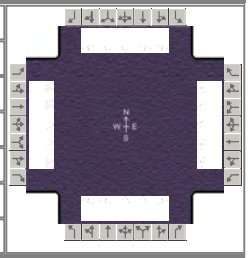
Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	44.7	42.8						21.9	19.0	32.8	0.7	
Level of Service (LOS)	D	D						C	B	C	A	
Approach Delay, s/veh / LOS	43.9		D	0.0			20.5		C	11.1		B
Intersection Delay, s/veh / LOS	19.2						B					

Interchange Graphic



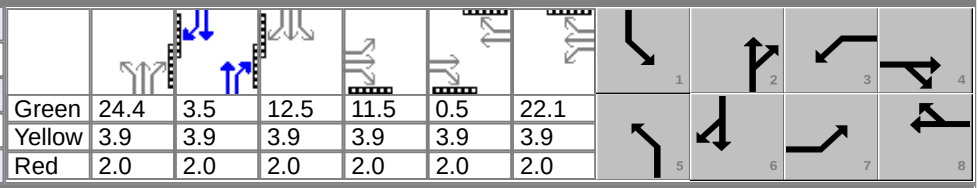
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 2, 2019	Area Type	Other
Jurisdiction	Sioux Falls	Time Period	AM	PHF	0.90
Urban Street	Western Avenue	Analysis Year	2050	Analysis Period	1> 7:15
Intersection	57th Street	File Name	19-20-21-22 Western 2050 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	255	380	135	170	715	250	470	675	50	130	520	240

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	95	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	24.4	3.5	12.5	11.5	0.5	22.1
Yellow	3.9	3.9	3.9	3.9	3.9	3.9
Red	2.0	2.0	2.0	2.0	2.0	2.0

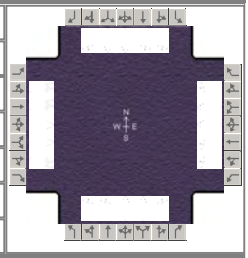
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	17.4	23.8	28.0	34.4	30.3	39.8	18.4	27.9
Change Period, ($Y+R_c$), s	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9
Max Allow Headway (*MAH*), s	2.6	5.0	4.6	4.6	2.6	0.0	5.0	0.0
Queue Clearance Time (g_s), s	11.0	14.8	7.2	26.2	23.2		6.4	
Green Extension Time (g_e), s	0.4	3.2	6.0	2.3	1.2	0.0	6.3	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		0.99	
Max Out Probability	0.00	0.01	0.20	1.00	0.00		0.01	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	283	422	106	189	794	183	682	979	51	144	578	167
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1734	1543	1684	1734	1543	1684	1734	1543	1684	1734	1543
Queue Service Time (g_s), s	9.0	12.8	6.8	5.2	24.2	11.0	21.2	30.0	2.4	4.4	17.6	10.7
Cycle Queue Clearance Time (g_c), s	9.0	12.8	6.8	5.2	24.2	11.0	21.2	30.0	2.4	4.4	17.6	10.7
Green Ratio (*g/C*)	0.10	0.16	0.16	0.20	0.26	0.26	0.22	0.31	0.31	0.11	0.20	0.20
Capacity (*c*), veh/h	352	565	252	676	899	400	748	1067	475	383	692	308
Volume-to-Capacity Ratio (*X*)	0.806	0.747	0.420	0.279	0.883	0.458	0.912	0.918	0.107	0.377	0.835	0.541
Back of Queue (*Q*), ft/ln (95 th percentile)	175.4	241.3	118.3	97.9	426.1	139.8	252.5	413	40.9	84.7	337.2	204.8
Back of Queue (*Q*), veh/ln (95 th percentile)	6.9	9.5	4.7	3.9	16.8	5.5	9.9	16.3	1.6	3.3	13.3	8.1
Queue Storage Ratio (*RQ*) (95 th percentile)	0.57	0.00	0.47	0.38	0.00	0.54	0.72	0.00	0.31	0.68	0.00	1.64
Uniform Delay (d_1), s/veh	48.2	43.9	19.4	37.2	39.1	19.8	34.6	36.8	25.4	45.1	42.3	39.5
Incremental Delay (d_2), s/veh	1.7	2.7	1.5	0.1	9.8	1.1	0.6	4.9	0.1	0.8	11.4	6.7
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	49.8	46.6	20.9	37.3	48.9	21.0	35.1	41.7	25.5	46.0	53.7	46.2
Level of Service (LOS)	D	D	C	D	D	C	D	D	C	D	D	D
Approach Delay, s/veh / LOS	44.4	D		42.6	D		38.6	D		51.0	D	
Intersection Delay, s/veh / LOS	43.1						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.62	C	2.72	C	2.72	C	2.65	C
Bicycle LOS Score / LOS	1.16	A	1.45	A	1.57	B	1.22	A

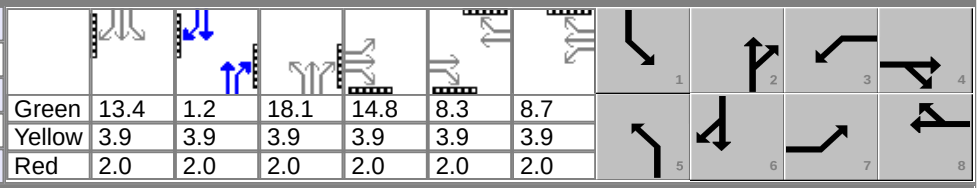
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 2, 2019	Area Type	Other
Jurisdiction	Sioux Falls	Time Period	PM	PHF	0.90
Urban Street	Western Avenue	Analysis Year	2050	Analysis Period	1> 16:30
Intersection	57th Street	File Name	19-20-21-22 Western 2050 PMn.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	380	810	465	150	585	205	610	645	125	320	695	255

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	34	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	13.4	1.2	18.1	14.8	8.3	8.7
Yellow	3.9	3.9	3.9	3.9	3.9	3.9
Red	2.0	2.0	2.0	2.0	2.0	2.0

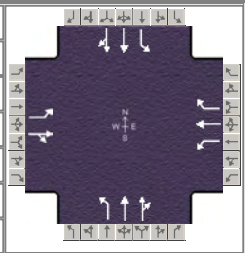
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	20.7	34.9	14.6	28.8	24.0	31.1	19.3	26.5
Change Period, ($Y+R_c$), s	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9
Max Allow Headway (*MAH*), s	2.6	5.0	4.6	4.6	2.6	0.0	5.0	0.0
Queue Clearance Time (g_s), s	14.2	26.9	6.8	19.8	20.1		12.2	
Green Extension Time (g_e), s	0.6	2.2	2.0	2.5	0.0	0.0	1.2	0.0
Phase Call Probability	1.00	1.00	0.99	1.00	1.00		1.00	
Max Out Probability	0.00	1.00	1.00	0.83	1.00		0.41	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	422	900	350	167	650	133	612	648	90	356	772	183
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1734	1543	1684	1734	1543	1684	1734	1543	1684	1734	1543
Queue Service Time (g_s), s	12.2	24.9	20.8	4.8	17.8	7.3	18.1	17.4	4.5	10.2	20.6	10.7
Cycle Queue Clearance Time (g_c), s	12.2	24.9	20.8	4.8	17.8	7.3	18.1	17.4	4.5	10.2	20.6	10.7
Green Ratio (*g/C*)	0.15	0.29	0.29	0.09	0.23	0.23	0.18	0.25	0.25	0.13	0.21	0.21
Capacity (*c*), veh/h	499	1007	448	293	795	354	610	875	389	452	713	317
Volume-to-Capacity Ratio (*X*)	0.846	0.894	0.781	0.568	0.817	0.377	1.005	0.740	0.232	0.786	1.084	0.578
Back of Queue (*Q*), ft/ln (95 th percentile)	222.5	433.1	340.1	90.3	320.4	126.1	327.6	273.4	75.7	201.5	543.3	194.7
Back of Queue (*Q*), veh/ln (95 th percentile)	8.8	17.1	13.4	3.6	12.6	5.0	12.9	10.8	3.0	7.9	21.4	7.7
Queue Storage Ratio (*RQ*) (95 th percentile)	0.72	0.00	1.36	0.35	0.00	0.49	0.94	0.00	0.58	1.61	0.00	1.56
Uniform Delay (d_1), s/veh	41.5	34.0	32.6	43.8	36.5	32.5	40.6	36.1	8.7	41.9	39.7	5.8
Incremental Delay (d_2), s/veh	1.6	10.0	8.6	0.6	6.0	0.9	25.8	2.6	0.6	4.9	58.6	7.5
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	43.0	44.0	41.2	44.5	42.5	33.4	66.5	38.8	9.3	46.8	98.3	13.3
Level of Service (LOS)	D	D	D	D	D	C	F	D	A	D	F	B
Approach Delay, s/veh / LOS	43.2	D		41.6	D		49.4	D		72.5	E	
Intersection Delay, s/veh / LOS	51.7						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.65	C	2.72	C	2.71	C	2.81	C
Bicycle LOS Score / LOS	1.87	B	1.27	A	1.72	B	1.57	B

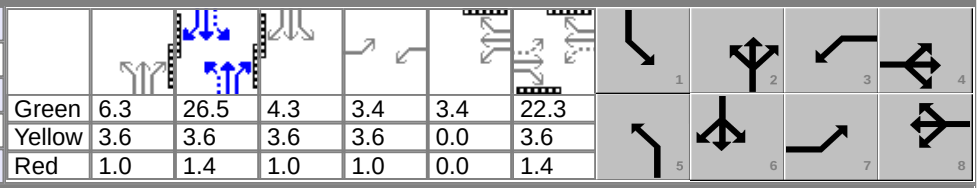
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 2, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	26th Street	Analysis Year	2050	Analysis Period	1> 7:15
Intersection	Cliff Avenue	File Name	23 26th at Cliff 2050 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	55	205	40	120	365	360	115	910	95	125	330	35

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	6.3	26.5	4.3	3.4	3.4	22.3
Yellow	3.6	3.6	3.6	3.6	0.0	3.6
Red	1.0	1.4	1.0	1.0	0.0	1.4

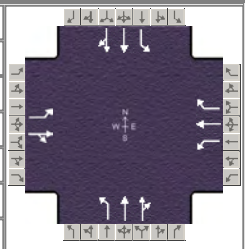
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	3.0	1.2	4.0	1.3	4.0
Phase Duration, s	8.0	27.3	11.4	30.7	10.9	42.4	8.9	40.4
Change Period, ($Y+R_c$), s	4.6	5.0	4.6	5.0	4.6	5.0	5.0	5.0
Max Allow Headway (*MAH*), s	4.2	6.2	4.2	6.2	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	4.3	13.6	7.0	20.4	6.4		2.0	
Green Extension Time (g_e), s	0.0	6.5	0.1	5.2	0.2	0.0	1.0	0.0
Phase Call Probability	0.78	1.00	0.96	1.00	0.96		0.97	
Max Out Probability	1.00	0.58	1.00	0.76	0.34		0.74	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	61	261		133	406	311	128	564	547	139	199	196
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1780		1734	1821	1543	1734	1821	1763	1734	1821	1776
Queue Service Time (g_s), s	2.3	11.6		5.0	18.4	16.2	4.4	23.6	23.6	0.0	6.7	6.8
Cycle Queue Clearance Time (g_c), s	2.3	11.6		5.0	18.4	16.2	4.4	23.6	23.6	0.0	6.7	6.8
Green Ratio (*g/C*)	0.29	0.25		0.33	0.29	0.29	0.39	0.42	0.42	0.32	0.39	0.39
Capacity (*c*), veh/h	203	441		344	519	440	419	757	733	221	717	699
Volume-to-Capacity Ratio (*X*)	0.301	0.592		0.388	0.781	0.707	0.305	0.745	0.746	0.628	0.277	0.280
Back of Queue (*Q*), ft/ln (95 th percentile)	45.3	227.2		94.1	349.7	186.4	80.4	416.4	400.5	141.9	134	130
Back of Queue (*Q*), veh/ln (95 th percentile)	1.8	8.9		3.7	13.8	7.3	3.2	16.4	16.0	5.6	5.3	5.2
Queue Storage Ratio (*RQ*) (95 th percentile)	0.35	0.00		0.82	0.00	1.62	0.46	0.00	0.00	0.95	0.00	0.00
Uniform Delay (d_1), s/veh	25.5	29.8		22.7	29.6	12.3	18.7	22.3	22.3	38.4	18.6	18.6
Incremental Delay (d_2), s/veh	0.8	2.7		0.7	7.4	5.4	0.4	6.6	6.8	2.9	1.0	1.0
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	26.3	32.6		23.4	37.0	17.7	19.2	28.8	29.1	41.3	19.5	19.6
Level of Service (LOS)	C	C		C	D	B	B	C	C	D	B	B
Approach Delay, s/veh / LOS	31.4	C		27.8	C		27.9	C		25.2	C	
Intersection Delay, s/veh / LOS	27.8						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.29	B	2.30	B	2.25	B	1.92	B
Bicycle LOS Score / LOS	1.02	A	1.89	B	1.51	B	0.93	A

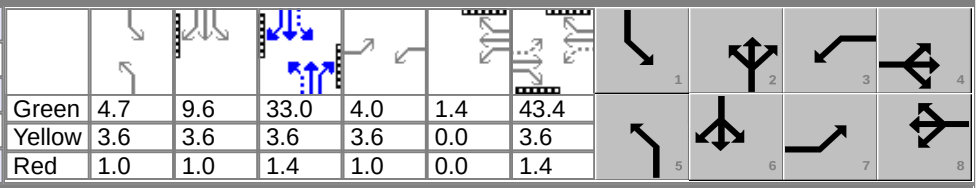
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 2, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	26th Street	Analysis Year	2050	Analysis Period	1> 16:30
Intersection	Cliff Avenue	File Name	23 26th at Cliff 2050 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	55	440	100	110	340	105	60	535	130	300	1080	70

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	4.7	9.6	33.0	4.0	1.4	43.4
Yellow	3.6	3.6	3.6	3.6	0.0	3.6
Red	1.0	1.0	1.4	1.0	0.0	1.4

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	8.6	48.4	10.0	49.8	9.3	38.0	23.6	52.2
Change Period, ($Y+R_c$), s	4.6	5.0	4.6	5.0	4.6	5.0	4.6	5.0
Max Allow Headway (*MAH*), s	4.2	6.2	4.2	6.2	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	4.6	40.3	7.4	21.7	5.3		17.7	
Green Extension Time (g_e), s	0.0	3.2	0.0	10.4	0.0	0.0	1.2	0.0
Phase Call Probability	0.87	1.00	0.98	1.00	0.89		1.00	
Max Out Probability	1.00	1.00	1.00	0.30	1.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	61	589		122	378	100	67	375	353	333	639	628
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1767		1734	1821	1543	1734	1821	1705	1734	1821	1787
Queue Service Time (g_s), s	2.6	38.3		5.4	19.7	5.2	3.3	22.6	22.7	15.7	39.3	39.4
Cycle Queue Clearance Time (g_c), s	2.6	38.3		5.4	19.7	5.2	3.3	22.6	22.7	15.7	39.3	39.4
Green Ratio (*g/C*)	0.40	0.36		0.41	0.37	0.37	0.31	0.28	0.28	0.45	0.39	0.39
Capacity (*c*), veh/h	312	640		174	680	576	150	501	469	396	717	703
Volume-to-Capacity Ratio (*X*)	0.196	0.920		0.703	0.556	0.174	0.446	0.749	0.752	0.841	0.891	0.893
Back of Queue (*Q*), ft/ln (95 th percentile)	51	681.3		128	350.2	90.1	67.1	431.1	406.2	284.8	699.1	680.6
Back of Queue (*Q*), veh/ln (95 th percentile)	2.0	26.8		5.0	13.8	3.5	2.6	17.0	16.2	11.2	27.5	27.2
Queue Storage Ratio (*RQ*) (95 th percentile)	0.39	0.00		1.11	0.00	0.78	0.38	0.00	0.00	1.90	0.00	0.00
Uniform Delay (d_1), s/veh	24.5	36.6		29.8	29.7	25.2	33.0	39.7	39.8	26.6	34.0	34.0
Incremental Delay (d_2), s/veh	0.3	18.8		12.1	1.6	0.3	2.1	9.9	10.6	4.9	15.6	16.0
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	24.8	55.4		41.9	31.4	25.5	35.0	49.6	50.4	31.5	49.6	50.0
Level of Service (LOS)	C	E		D	C	C	D	D	D	C	D	D
Approach Delay, s/veh / LOS	52.5	D		32.5	C		48.7	D		46.0	D	
Intersection Delay, s/veh / LOS	45.5						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.30	B	2.30	B	2.15	B	1.94	B
Bicycle LOS Score / LOS	1.56	B	1.48	A	1.14	A	1.81	B

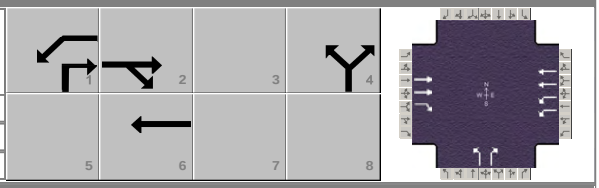
HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	Parclo AB-2Q
Analyst	Graham Johnson	Analysis Date	Jan 2, 2019	Segment Distance, ft	1097
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	North-South
Intersection	NB I-229 Ramp	PHF	0.90	Arterial Direction	East-West
File Name	24-25-26 26th Street 2050 AM.xus				
Project Description	I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h		415	65	685	1230		160		300			
Intersection Two Demand (*v*), veh/h		595	120	155	1435		195	0	500			

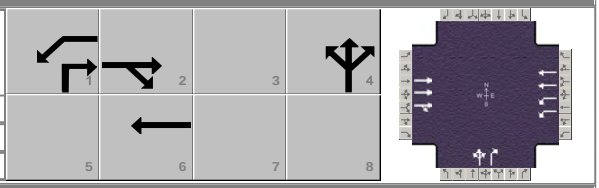
Signal One Information	
Cycle, s	120.0
Offset, s	75
Uncoordinated	No
Force Mode	Fixed

Green	43.4	41.5	19.2	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.9	1.9	1.3	0.0	0.0	0.0



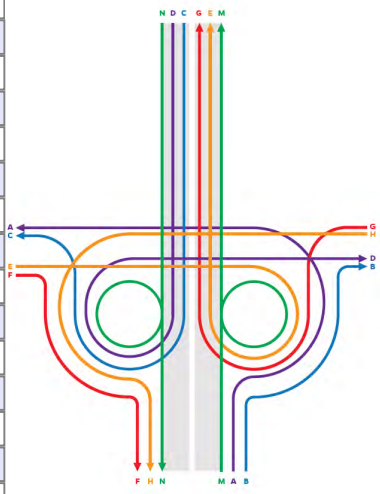
Signal Two Information	
Cycle, s	120.0
Offset, s	75
Uncoordinated	No
Force Mode	Fixed

Green	10.3	67.6	27.1	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.0	1.9	1.3	0.0	0.0	0.0



Interchange Results

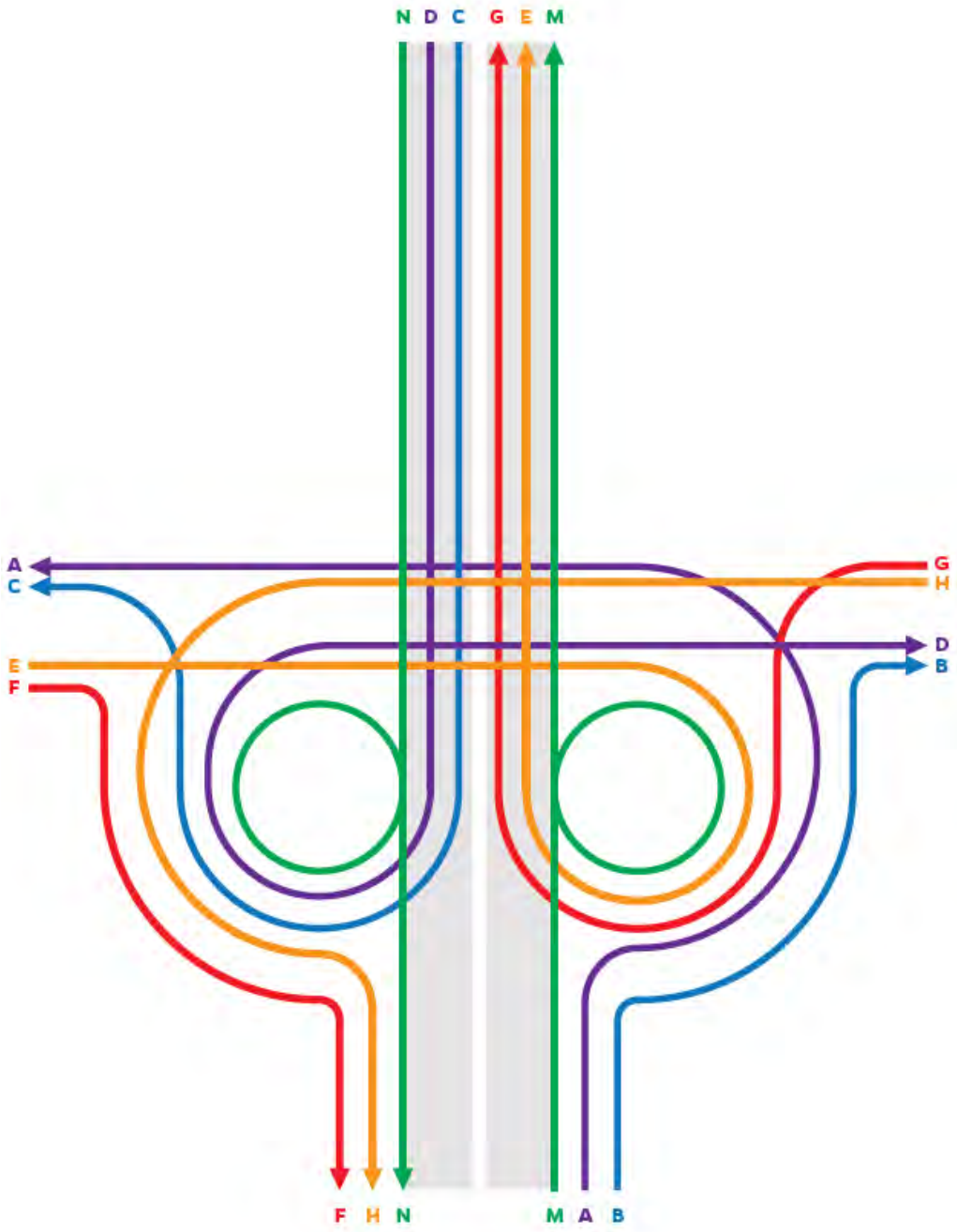
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	217	59.2	0.0	59.2	No	No	D
B	389	35.1	0.0	35.1	No	No	C
C	178	50.3	5.0	55.3	No	No	D
D	333	1.9	5.0	6.9	No	No	A
E	133	49.5	5.0	54.5	No	No	C
F	67	30.8	0.0	30.8	No	No	C
G	219	49.7	5.0	54.7	No	No	C
H	802	29.5	0.0	29.5	No	No	B
I	328	43.6	0.0	43.6	No	No	C
J	1224	8.3	0.0	8.3	No	No	A
K	-	-	0.0	-	-	-	-
L	-	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh		30.8	27.4	27.6	6.4		50.3		0.0			
Level of Service (LOS)		C	C	C	A		D		A			
Approach Delay, s/veh / LOS	30.3	C		14.0	B		17.5	B		0.0		
Intersection Delay, s/veh / LOS	17.2						B					

Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh		12.8	18.8	49.7	1.9			52.8	35.1			
Level of Service (LOS)		B	B	D	A			D	D			
Approach Delay, s/veh / LOS	14.7	B		6.6	A		44.9	D		0.0		
Intersection Delay, s/veh / LOS	14.7						B					

Interchange Graphic



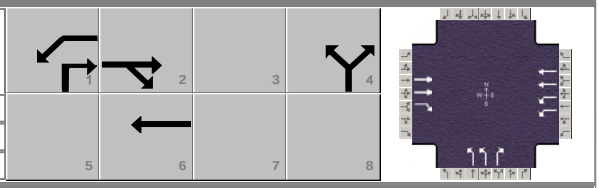
HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	Parclo AB-2Q
Analyst	Graham Johnson	Analysis Date	Jan 2, 2019	Segment Distance, ft	1097
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	North-South
Intersection	SB I-229 Ramp	PHF	0.90	Arterial Direction	East-West
File Name	24-25-26 26th Street 2050 PM.xus				
Project Description	I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h		1390	75	540	970		160		785			
Intersection Two Demand (*v*), veh/h		1930	245	155	1435		75	0	920			

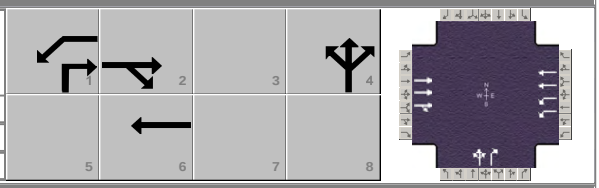
Signal One Information	
Cycle, s	140.0
Offset, s	0
Uncoordinated	No
Force Mode	Fixed

Green	32.5	76.5	15.1	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.9	1.9	1.3	0.0	0.0	0.0



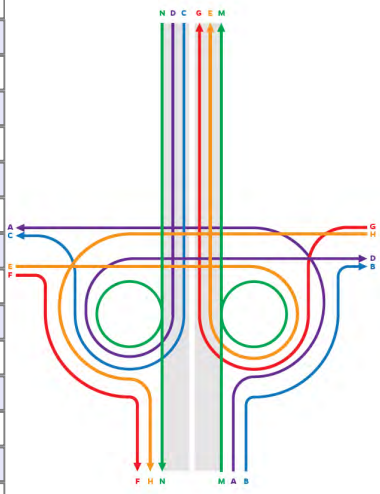
Signal Two Information	
Cycle, s	140.0
Offset, s	0
Uncoordinated	No
Force Mode	Fixed

Green	74.0	11.2	39.8	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.9	1.0	1.3	0.0	0.0	0.0



Interchange Results

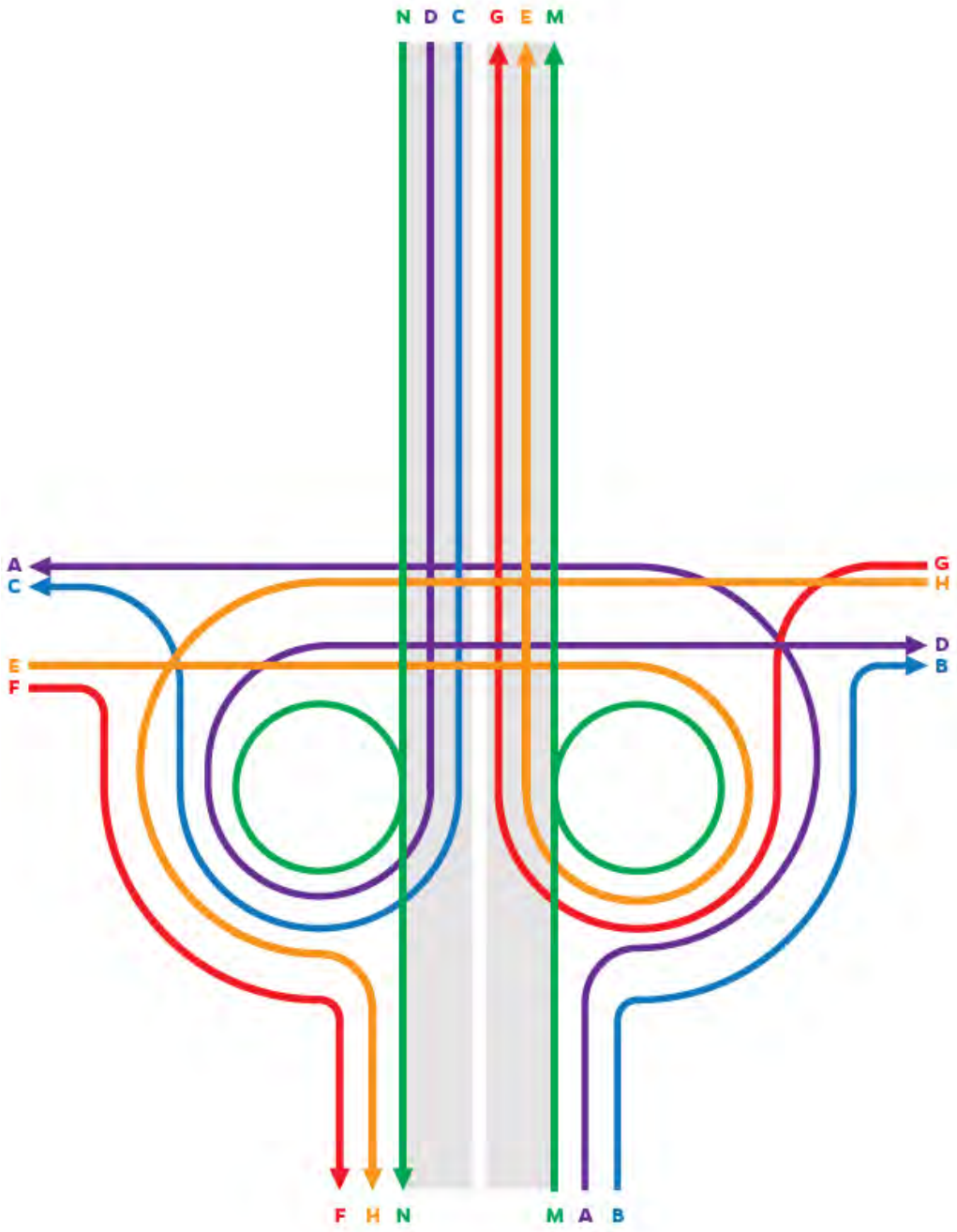
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	83	63.9	0.0	63.9	No	No	D
B	689	42.0	0.0	42.0	No	No	C
C	178	59.8	5.0	64.8	No	No	D
D	872	4.0	5.0	9.0	No	No	A
E	231	65.3	5.0	70.3	No	No	D
F	78	27.1	0.0	27.1	No	No	B
G	172	68.0	5.0	73.0	No	No	D
H	600	60.2	0.0	60.2	No	No	D
I	950	60.5	0.0	60.5	No	No	D
J	994	7.9	0.0	7.9	No	No	A
K	-	-	0.0	-	-	-	-
L	-	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh		27.1	15.5	56.2	3.9		59.8		0.0			
Level of Service (LOS)		C	B	E	A		E		A			
Approach Delay, s/veh / LOS	26.5	C		22.6	C		10.1	B		0.0		
Intersection Delay, s/veh / LOS	21.1						C					

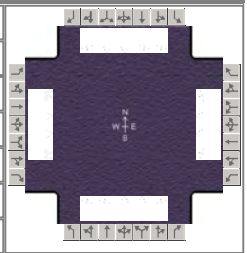
Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh		33.4	38.2	68.0	4.0			60.0	42.0			
Level of Service (LOS)		C	D	E	A			E	D			
Approach Delay, s/veh / LOS	35.0	C		10.2	B		49.5	D		0.0		
Intersection Delay, s/veh / LOS	27.9						C					

Interchange Graphic



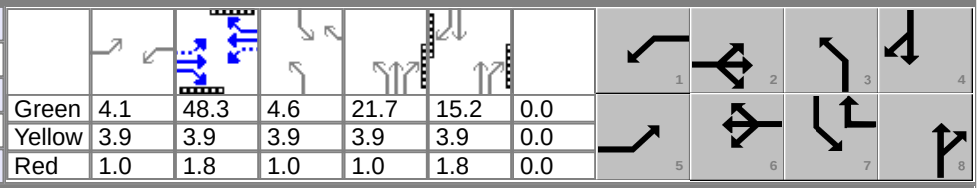
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 2, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	26th Street	Analysis Year	2050	Analysis Period	1> 7:15
Intersection	Southeastern Ave	File Name	24-25-26 26th Street 2050 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	150	715	230	70	1345	485	690	1210	60	75	255	75

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	15	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	4.1	48.3	4.6	21.7	15.2	0.0
Yellow	3.9	3.9	3.9	3.9	3.9	0.0
Red	1.0	1.8	1.0	1.0	1.8	0.0

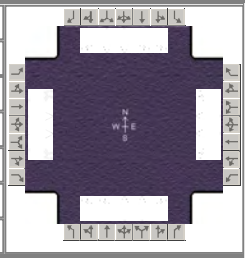
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6	3	8	7	4
Case Number	1.1	3.0	1.1	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	9.0	54.0	9.0	54.0	36.1	47.5	9.5	20.9
Change Period, ($Y+R_c$), s	4.9	5.7	4.9	5.7	4.9	5.7	4.9	5.7
Max Allow Headway (*MAH*), s	4.2	0.0	4.2	0.0	4.2	4.1	4.2	4.1
Queue Clearance Time (g_s), s	6.1		5.2		28.2	43.8	4.9	11.3
Green Extension Time (g_e), s	0.0	0.0	0.0	0.0	3.0	0.0	0.0	2.7
Phase Call Probability	1.00		0.93		1.00	1.00	0.94	1.00
Max Out Probability	1.00		1.00		0.09	1.00	1.00	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	167	794	256	78	1494	372	767	1344	44	83	283	61
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1734		1734	1734	1543	1684	1734	1568	1684	1734	1568
Queue Service Time (g_s), s	4.1	18.7		3.2	48.3	21.3	26.2	41.8	2.3	2.9	9.3	4.3
Cycle Queue Clearance Time (g_c), s	4.1	18.7		3.2	48.3	21.3	26.2	41.8	2.3	2.9	9.3	4.3
Green Ratio (*g/C*)	0.44	0.40		0.44	0.40	0.44	0.26	0.35	0.35	0.04	0.13	0.13
Capacity (*c*), veh/h	119	1396		277	1396	681	876	1207	546	130	439	199
Volume-to-Capacity Ratio (*X*)	1.397	0.569		0.281	1.071	0.547	0.876	1.114	0.081	0.642	0.645	0.308
Back of Queue (*Q*), ft/ln (95 th percentile)	372.5	288.6		60.9	1001.3	331.3	435.6	1001.4	39.2	63.7	193.6	77.1
Back of Queue (*Q*), veh/ln (95 th percentile)	14.7	11.4		2.4	39.4	13.0	17.1	39.4	1.6	2.5	7.6	3.1
Queue Storage Ratio (*RQ*) (95 th percentile)	0.83	0.00		0.24	0.00	1.33	1.02	0.00	0.16	0.17	0.00	0.39
Uniform Delay (d_1), s/veh	34.8	21.5		21.9	35.9	24.7	42.5	39.1	26.2	56.9	49.8	47.6
Incremental Delay (d_2), s/veh	218.4	1.5		0.5	45.5	3.1	6.2	63.0	0.1	8.2	3.2	0.9
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	253.2	23.1	0.0	22.5	81.4	27.8	48.7	102.2	26.3	65.0	53.1	48.5
Level of Service (LOS)	F	C	A	C	F	C	D	F	C	E	D	D
Approach Delay, s/veh / LOS	49.8	D		68.8	E		81.6	F		54.7	D	
Intersection Delay, s/veh / LOS	68.5						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.60	C	2.60	C	2.65	C	2.46	B
Bicycle LOS Score / LOS	1.49	A	2.09	B	2.27	B	0.84	A

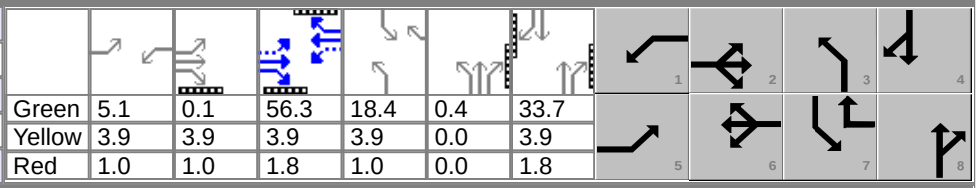
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 2, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	26th Street	Analysis Year	2050	Analysis Period	1> 4:30
Intersection	Southeastern Ave	File Name	24-25-26 26th Street 2050 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	230	1775	845	100	1105	215	345	450	105	330	890	140

Signal Information			
Cycle, s	140.0	Reference Phase	2
Offset, s	64	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	5.1	0.1	56.3	18.4	0.4	33.7
Yellow	3.9	3.9	3.9	3.9	0.0	3.9
Red	1.0	1.0	1.8	1.0	0.0	1.8

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6	3	8	7	4
Case Number	1.1	3.0	1.1	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	15.0	67.0	10.0	62.0	23.6	39.7	23.3	39.4
Change Period, ($Y+R_c$), s	4.9	5.7	4.9	5.7	4.9	5.7	4.9	5.7
Max Allow Headway (*MAH*), s	4.2	0.0	4.2	0.0	4.2	4.1	4.2	4.1
Queue Clearance Time (g_s), s	12.1		7.1		17.6	19.9	16.9	35.7
Green Extension Time (g_e), s	0.0	0.0	0.0	0.0	1.2	6.9	1.5	0.0
Phase Call Probability	1.00		0.99		1.00	1.00	1.00	1.00
Max Out Probability	1.00		1.00		0.07	0.38	0.00	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	228	1760	838	111	1228	183	383	500	89	367	989	122
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1734		1734	1734	1543	1684	1734	1568	1684	1734	1568
Queue Service Time (g_s), s	10.1	61.3		5.1	45.9	8.8	15.6	17.9	6.4	14.9	33.7	9.0
Cycle Queue Clearance Time (g_c), s	10.1	61.3		5.1	45.9	8.8	15.6	17.9	6.4	14.9	33.7	9.0
Green Ratio (*g/C*)	0.49	0.44		0.44	0.40	0.53	0.13	0.24	0.24	0.13	0.24	0.24
Capacity (*c*), veh/h	210	1517		115	1393	823	451	842	381	442	834	377
Volume-to-Capacity Ratio (*X*)	1.084	1.160		0.965	0.881	0.223	0.851	0.593	0.233	0.829	1.186	0.324
Back of Queue (*Q*), ft/ln (95 th percentile)	324.5	1256.8		205	723.6	151.7	291.8	317.4	114	274.8	950	161.3
Back of Queue (*Q*), veh/ln (95 th percentile)	12.8	49.5		8.1	28.5	6.0	11.5	12.5	4.6	10.8	37.4	6.5
Queue Storage Ratio (*RQ*) (95 th percentile)	0.72	0.00		0.82	0.00	0.61	0.69	0.00	0.46	0.73	0.00	0.81
Uniform Delay (d_1), s/veh	37.6	25.8		36.3	38.8	17.3	59.3	46.9	42.5	59.3	53.2	43.8
Incremental Delay (d_2), s/veh	69.6	76.2		72.6	8.3	0.6	7.3	1.1	0.3	4.1	95.8	0.5
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	107.1	102.0	0.0	108.9	47.1	17.9	66.5	48.0	42.8	63.3	148.9	44.3
Level of Service (LOS)	F	F	A	F	D	B	E	D	D	E	F	D
Approach Delay, s/veh / LOS	72.2	E		48.1	D		54.8	D		119.0	F	
Intersection Delay, s/veh / LOS	74.5						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.61	C	2.62	C	2.53	C	2.46	B
Bicycle LOS Score / LOS	3.10	C	1.74	B	1.29	A	1.71	B

HCS7 Two-Way Stop-Control Report

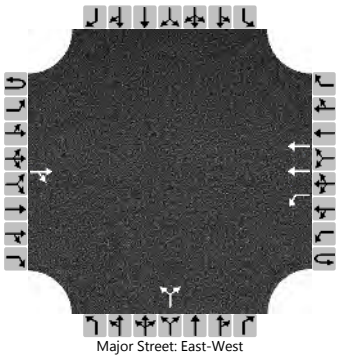
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	1/2/2019
Analysis Year	2050
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	26th St at Yeager Rd
Jurisdiction	Sioux Falls, SD
East/West Street	26th Street
North/South Street	Yeager Road
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	1	2	0		0	1	0		0	0	0
Configuration				TR		L	T				LR					
Volume (veh/h)			430	5		200	1190			25		50				
Percent Heavy Vehicles (%)						2				2		2				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized																
Median Type | Storage						Undivided										

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.5		6.9				
Critical Headway (sec)						4.14				6.84		6.94				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.22				3.52		3.32				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						222					83					
Capacity, c (veh/h)						1076					182					
v/c Ratio						0.21					0.46					
95% Queue Length, Q_{95} (veh)						0.8					2.2					
Control Delay (s/veh)						9.2					40.6					
Level of Service (LOS)						A					E					
Approach Delay (s/veh)						1.3				40.6						
Approach LOS										E						

HCS7 Two-Way Stop-Control Report

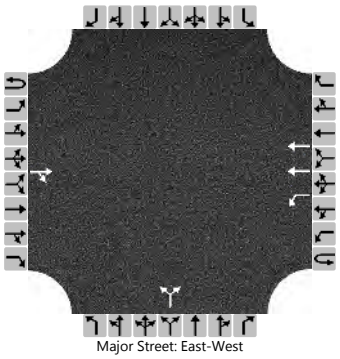
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	1/2/2019
Analysis Year	2050
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	26th St at Yeager Rd
Jurisdiction	Sioux Falls, SD
East/West Street	26th Street
North/South Street	Yeager Road
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	1	2	0		0	1	0		0	0	0
Configuration				TR		L	T				LR					
Volume (veh/h)			1315	10		265	865			25		150				
Percent Heavy Vehicles (%)						2				2		2				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized																
Median Type | Storage						Undivided										

Critical and Follow-up Headways

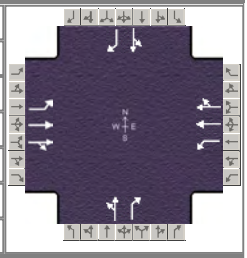
Base Critical Headway (sec)						4.1				7.5		6.9				
Critical Headway (sec)						4.14				6.84		6.94				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.22				3.52		3.32				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						294					194					
Capacity, c (veh/h)						454					39					
v/c Ratio						0.65					4.96					
95% Queue Length, Q_{95} (veh)						4.5					22.6					
Control Delay (s/veh)						26.4					1987.2					
Level of Service (LOS)						D					F					
Approach Delay (s/veh)						6.2				1987.2						
Approach LOS										F						

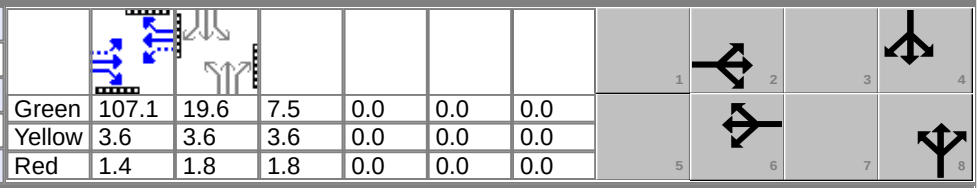
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 2, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	41st Street	Analysis Year	2050	Analysis Period	1> 7:15
Intersection	Norton Ave	File Name	28 41st at Norton 2050 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	20	540	30	10	320	10	15	10	5	10	10	10

Signal Information			
Cycle, s	150.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	107.1	19.6	7.5	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.4	1.8	1.8	0.0	0.0	0.0

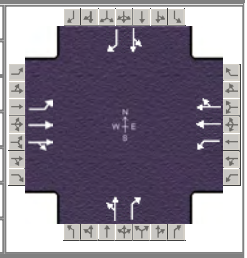
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		6.0		6.0		11.0		11.0
Phase Duration, s		112.1		112.1		12.9		25.0
Change Period, ($Y+R_c$), s		5.0		5.0		5.4		5.4
Max Allow Headway (*MAH*), s		0.0		0.0		5.2		5.2
Queue Clearance Time (g_s), s						4.3		3.7
Green Extension Time (g_e), s		0.0		0.0		0.1		0.1
Phase Call Probability						0.75		1.00
Max Out Probability						0.00		0.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	22	319	314	11	184	183		28	6		22	11
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1015	1821	1787	794	1821	1801		1768	1543		1777	1543
Queue Service Time (g_s), s	1.1	9.1	9.1	0.7	4.8	4.8		2.3	0.5		1.7	0.9
Cycle Queue Clearance Time (g_c), s	5.9	9.1	9.1	9.9	4.8	4.8		2.3	0.5		1.7	0.9
Green Ratio (*g/C*)	0.71	0.71	0.71	0.71	0.71	0.71		0.05	0.05		0.13	0.13
Capacity (*c*), veh/h	740	1300	1276	566	1300	1286		88	77		232	202
Volume-to-Capacity Ratio (*X*)	0.030	0.246	0.246	0.020	0.141	0.142		0.314	0.072		0.096	0.055
Back of Queue (*Q*), ft/ln (95 th percentile)	11.5	167.6	165	6.4	88.3	87.8		50.5	9.9		35.1	17.5
Back of Queue (*Q*), veh/ln (95 th percentile)	0.5	6.6	6.5	0.3	3.5	3.5		2.0	0.4		1.4	0.7
Queue Storage Ratio (*RQ*) (95 th percentile)	0.11	0.00	0.00	0.06	0.00	0.00		0.00	0.13		0.00	0.23
Uniform Delay (d_1), s/veh	7.8	7.4	7.4	9.2	6.8	6.8		68.8	67.9		57.4	57.1
Incremental Delay (d_2), s/veh	0.1	0.5	0.5	0.1	0.2	0.2		2.8	0.6		0.3	0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Control Delay (*d*), s/veh	7.8	7.9	7.9	9.2	7.1	7.1		71.6	68.5		57.7	57.3
Level of Service (LOS)	A	A	A	A	A	A		E	E		E	E
Approach Delay, s/veh / LOS	7.9	A		7.1	A		71.1	E		57.5	E	
Intersection Delay, s/veh / LOS	11.0						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.87	B	1.87	B	2.33	B	2.33	B
Bicycle LOS Score / LOS	1.03	A	0.80	A	0.54	A	0.54	A

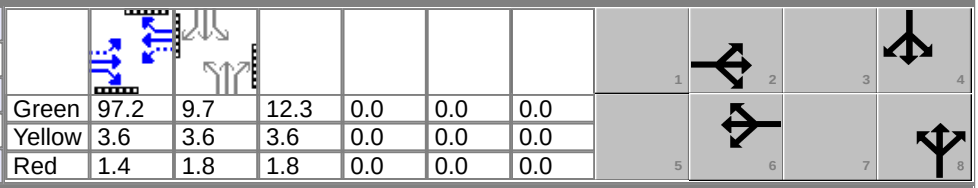
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 2, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	41st Street	Analysis Year	2050	Analysis Period	1> 16:30
Intersection	Norton Ave	File Name	28 41st at Norton 2050 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	35	945	65	25	845	30	80	35	40	20	30	45

Signal Information			
Cycle, s	135.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



	EB			WB			NB			SB		
Green	97.2	9.7		12.3	0.0	0.0	0.0					
Yellow	3.6	3.6		3.6	0.0	0.0	0.0					
Red	1.4	1.8		1.8	0.0	0.0	0.0					

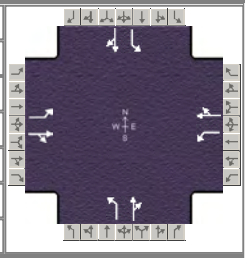
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		6.0		6.0		11.0		11.0
Phase Duration, s		102.2		102.2		17.7		15.1
Change Period, ($Y+R_c$), s		5.0		5.0		5.4		5.4
Max Allow Headway (*MAH*), s		0.0		0.0		5.2		5.3
Queue Clearance Time (g_s), s						11.6		6.0
Green Extension Time (g_e), s		0.0		0.0		0.7		0.3
Phase Call Probability						1.00		0.97
Max Out Probability						0.00		0.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	39	567	555	28	489	483		128	33		56	39
Adjusted Saturation Flow Rate (*s*), veh/h/ln	578	1821	1779	502	1821	1799		1760	1543		1785	1543
Queue Service Time (g_s), s	3.7	17.1	17.1	3.2	13.9	13.9		9.6	2.7		4.0	3.2
Cycle Queue Clearance Time (g_c), s	17.6	17.1	17.1	20.4	13.9	13.9		9.6	2.7		4.0	3.2
Green Ratio (*g/C*)	0.72	0.72	0.72	0.72	0.72	0.72		0.09	0.09		0.07	0.07
Capacity (*c*), veh/h	410	1311	1281	351	1311	1295		160	141		128	111
Volume-to-Capacity Ratio (*X*)	0.095	0.433	0.433	0.079	0.373	0.373		0.797	0.237		0.433	0.350
Back of Queue (*Q*), ft/ln (95 th percentile)	24.3	277	272.3	18.6	233.7	231.5		214.2	50.7		88.9	61.9
Back of Queue (*Q*), veh/ln (95 th percentile)	1.0	10.9	10.7	0.7	9.2	9.1		8.4	2.0		3.5	2.4
Queue Storage Ratio (*RQ*) (95 th percentile)	0.24	0.00	0.00	0.19	0.00	0.00		0.00	0.68		0.00	0.83
Uniform Delay (d_1), s/veh	10.6	7.7	7.7	11.8	7.2	7.2		60.1	57.0		60.0	59.6
Incremental Delay (d_2), s/veh	0.5	1.0	1.1	0.4	0.8	0.8		12.0	1.2		3.2	2.7
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Control Delay (*d*), s/veh	11.1	8.7	8.8	12.3	8.1	8.1		72.1	58.2		63.3	62.3
Level of Service (LOS)	B	A	A	B	A	A		E	E		E	E
Approach Delay, s/veh / LOS	8.8	A		8.2	A		69.2	E		62.9	E	
Intersection Delay, s/veh / LOS	14.7						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.88	B	1.88	B	2.33	B	2.32	B
Bicycle LOS Score / LOS	1.45	A	1.31	A	0.75	A	0.64	A

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 2, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	41st Street	Analysis Year	2050	Analysis Period	1> 7:15
Intersection	Phillips Ave	File Name	29 41st at Phillips 2050 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	170	265	10	30	260	200	10	130	55	170	20	170

Signal Information			
Cycle, s	80.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4
Green	5.8	40.3	20.1	0.0	0.0	0.0	5	6	7	8
Yellow	4.0	3.6	3.6	0.0	0.0	0.0				
Red	0.0	1.3	1.3	0.0	0.0	0.0				

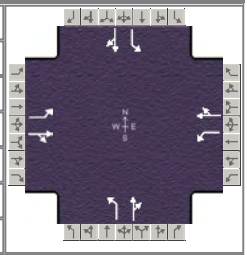
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		4
Case Number	1.0	4.0		6.3		6.0		6.0
Phase Duration, s	9.8	55.0		45.2		25.0		25.0
Change Period, ($Y+R_c$), s	4.0	4.9		4.9		4.9		4.9
Max Allow Headway (*MAH*), s	4.2	0.0		0.0		5.4		5.4
Queue Clearance Time (g_s), s	5.9					10.3		22.1
Green Extension Time (g_e), s	0.0	0.0		0.0		2.6		0.0
Phase Call Probability	0.98					1.00		1.00
Max Out Probability	1.00					0.39		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	189	306		33	511		11	206		189	178	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1809		1074	1689		1207	1729		1176	1573	
Queue Service Time (g_s), s	3.9	6.1		1.3	17.2		0.6	8.1		12.0	7.6	
Cycle Queue Clearance Time (g_c), s	3.9	6.1		1.3	17.2		8.3	8.1		20.1	7.6	
Green Ratio (*g/C*)	0.60	0.63		0.50	0.50		0.25	0.25		0.25	0.25	
Capacity (*c*), veh/h	472	1133		631	850		278	434		267	395	
Volume-to-Capacity Ratio (*X*)	0.400	0.270		0.053	0.601		0.040	0.473		0.708	0.450	
Back of Queue (*Q*), ft/ln (95 th percentile)	60.9	99.6		14.1	278.6		8.4	152.7		194.7	131.7	
Back of Queue (*Q*), veh/ln (95 th percentile)	2.4	3.9		0.6	11.0		0.3	6.0		7.7	5.2	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.47	0.00		0.24	0.00		0.14	0.00		1.77	0.00	
Uniform Delay (d_1), s/veh	10.1	6.7		10.2	14.1		28.8	25.5		34.4	25.3	
Incremental Delay (d_2), s/veh	0.5	0.6		0.2	3.1		0.1	1.1		9.1	1.1	
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh	10.6	7.3		10.3	17.3		28.8	26.6		43.5	26.4	
Level of Service (LOS)	B	A		B	B		C	C		D	C	
Approach Delay, s/veh / LOS	8.6	A		16.8	B		26.7	C		35.2	D	
Intersection Delay, s/veh / LOS	19.8						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.87	B	1.93	B	1.92	B	1.92	B
Bicycle LOS Score / LOS	1.30	A	1.39	A	0.85	A	1.09	A

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 2, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	41st Street	Analysis Year	2050	Analysis Period	1> 16:30
Intersection	Phillips Ave	File Name	29 41st at Phillips 2050 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	125	275	5	20	320	205	30	60	70	140	25	245

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4
Green	4.8	50.7	20.7	0.0	0.0	0.0	5	6	7	8
Yellow	4.0	3.6	3.6	0.0	0.0	0.0				
Red	0.0	1.3	1.3	0.0	0.0	0.0				

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		4
Case Number	1.0	4.0		6.3		6.0		6.0
Phase Duration, s	8.8	64.4		55.6		25.6		25.6
Change Period, ($Y+R_c$), s	4.0	4.9		4.9		4.9		4.9
Max Allow Headway (*MAH*), s	4.2	0.0		0.0		5.4		5.4
Queue Clearance Time (g_s), s	4.8					17.2		19.4
Green Extension Time (g_e), s	0.1	0.0		0.0		1.8		1.2
Phase Call Probability	0.97					1.00		1.00
Max Out Probability	1.00					0.91		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	139	311		22	583		33	144		156	244	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1815		1068	1702		1135	1660		1244	1571	
Queue Service Time (g_s), s	2.8	6.3		0.8	20.5		2.5	6.6		10.9	12.8	
Cycle Queue Clearance Time (g_c), s	2.8	6.3		0.8	20.5		15.2	6.6		17.4	12.8	
Green Ratio (*g/C*)	0.64	0.66		0.56	0.56		0.23	0.23		0.23	0.23	
Capacity (*c*), veh/h	452	1200		681	958		180	382		275	361	
Volume-to-Capacity Ratio (*X*)	0.307	0.259		0.033	0.609		0.185	0.378		0.566	0.677	
Back of Queue (*Q*), ft/ln (95 th percentile)	44.3	103.6		9.1	318.1		32.8	122.8		157.2	227.1	
Back of Queue (*Q*), veh/ln (95 th percentile)	1.7	4.1		0.4	12.5		1.3	4.8		6.2	8.9	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.34	0.00		0.15	0.00		0.55	0.00		1.43	0.00	
Uniform Delay (d_1), s/veh	9.8	6.2		8.8	13.1		38.6	29.2		36.6	31.6	
Incremental Delay (d_2), s/veh	0.4	0.5		0.1	2.9		0.7	0.9		2.7	4.6	
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh	10.1	6.8		8.9	16.0		39.3	30.1		39.2	36.2	
Level of Service (LOS)	B	A		A	B		D	C		D	D	
Approach Delay, s/veh / LOS	7.8	A		15.7	B		31.8	C		37.4	D	
Intersection Delay, s/veh / LOS	20.6						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.86	B	1.95	B	1.93	B	1.93	B
Bicycle LOS Score / LOS	1.23	A	1.49	A	0.78	A	1.15	A

Appendix D

HCS Analysis Summary – Forecast 2050 Build Conditions

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - west of Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3595	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1412
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.61
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	22.8
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - west of Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2840	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1093
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.47
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	17.7
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - between Western Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3045	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1794
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.77
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	60.6
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	29.6
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - between Western Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2480	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1432
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.62
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	23.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - between Western and Minnesota		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3520	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1383
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.60
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	22.4
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - between Western and Minnesota		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3375	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1299
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.56
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	21.0
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	4/29/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - Western to Minnesota		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2860	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	0
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2660	380	95	385
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	6.00	6.00	6.00	6.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.943	0.943	0.943	0.943
Flow Rate (v_i), pc/h	3134	448	112	454
Weaving Flow Rate (v_w), pc/h	902	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	3246	Density-Based Capacity (c_{IWL}), pc/h/ln		2208
Total Flow Rate (v), pc/h	4148	Demand Flow-Based Capacity (c_{IW}), pc/h		11060
Volume Ratio (VR)	0.217	Weaving Segment Capacity (c_W), veh/h		6246
Minimum Lane Change Rate (LC_{MIN}), lc/h	454	Adjusted Weaving Area Capacity, pc/h		6624
Maximum Weaving Length (L_{MAX}), ft	4711	Volume-to-Capacity Ratio (v/c)		0.63

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	928	Average Weaving Speed (S_W),mi/h	56.8
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1641	Average Non-Weaving Speed (S_{NW}), mi/h	55.1
Weaving Lane Change Rate (LC_W), lc/h	763	Average Speed (S), mi/h	55.5
Weaving Lane Change Rate (LC_{All}), lc/h	2404	Density (D), pc/mi/ln	24.9
Weaving Intensity Factor (W)	0.197	Level of Service (LOS)	C

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	4/29/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - Western to Minnesota		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2860	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	0
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2176	734	161	304
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	4.00	4.00	4.00	4.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.962	0.962	0.962	0.962
Flow Rate (v_i), pc/h	2513	848	186	351
Weaving Flow Rate (v_w), pc/h	1199	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2699	Density-Based Capacity (c_{IWL}), pc/h/ln		2135
Total Flow Rate (v), pc/h	3898	Demand Flow-Based Capacity (c_{IW}), pc/h		7792
Volume Ratio (VR)	0.308	Weaving Segment Capacity (c_W), veh/h		6162
Minimum Lane Change Rate (LC_{MIN}), lc/h	351	Adjusted Weaving Area Capacity, pc/h		6405
Maximum Weaving Length (L_{MAX}), ft	5670	Volume-to-Capacity Ratio (v/c)		0.61

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	772	Average Weaving Speed (S_W),mi/h	57.3
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1528	Average Non-Weaving Speed (S_{NW}), mi/h	56.2
Weaving Lane Change Rate (LC_W), lc/h	660	Average Speed (S), mi/h	56.5
Weaving Lane Change Rate (LC_{All}), lc/h	2188	Density (D), pc/mi/ln	23.0
Weaving Intensity Factor (W)	0.183	Level of Service (LOS)	C

HCS7 Freeway Diverge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - Exit 3		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	300
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	3520	480
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	6.00	6.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.943	0.943
Flow Rate (vi),pc/h	4148	566
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.59	0.27

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.349
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1325
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influenece Area Speed (SR), mi/h	57.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.630	Outer Lanes Freeway Speed (SO), mi/h	70.0
Flow in Lanes 1 and 2 (v12), pc/h	2823	Ramp Junction Speed (S), mi/h	60.6
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	22.8
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	25.8

HCS7 Freeway Diverge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - Exit 3		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	300
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	3375	465
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	4.00	4.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.962	0.962
Flow Rate (vi),pc/h	3898	537
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.55	0.26

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.346
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1217
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influenece Area Speed (SR), mi/h	57.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.638	Outer Lanes Freeway Speed (SO), mi/h	70.5
Flow in Lanes 1 and 2 (v12), pc/h	2681	Ramp Junction Speed (S), mi/h	60.6
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	21.4
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	24.6

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - between Minnesota Ramps		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3040	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1194
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.52
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.3
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - between Minnesota Ramps		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2910	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1120
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.48
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	18.1
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - Exit 3 Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	3040	390
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	6.00	6.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.943	0.943
Flow Rate (vi),pc/h	3582	460
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.57	0.22

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.268
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1393
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	58.8
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	61.8
Flow in Lanes 1 and 2 (v12), pc/h	2189	Ramp Junction Speed (S), mi/h	59.8
Flow Entering Ramp-Infl. Area (vR12), pc/h	2649	Average Density (D), pc/mi/ln	22.5
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	18.5

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - Exit 3 Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	2910	810
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	6.00	6.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.943	0.943
Flow Rate (vi),pc/h	3429	954
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.62	0.45

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.295
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1334
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	58.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	62.0
Flow in Lanes 1 and 2 (v12), pc/h	2095	Ramp Junction Speed (S), mi/h	59.3
Flow Entering Ramp-Infl. Area (vR12), pc/h	3049	Average Density (D), pc/mi/ln	24.6
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	21.4

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - between Minnesota and Cliff		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3430	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1347
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.58
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	21.8
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - between Minnesota and Cliff		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3720	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1432
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.62
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	23.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Diverge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - Exit 4		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	300
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	3430	930
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	6.00	6.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.943	0.943
Flow Rate (vi),pc/h	4041	1096
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.57	0.52

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.397
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1151
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influenece Area Speed (SR), mi/h	55.9
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.609	Outer Lanes Freeway Speed (SO), mi/h	70.7
Flow in Lanes 1 and 2 (v12), pc/h	2890	Ramp Junction Speed (S), mi/h	59.4
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	22.7
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	26.4

HCS7 Freeway Diverge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - Exit 4		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	300
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	3720	920
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	4.00	4.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.962	0.962
Flow Rate (vi),pc/h	4297	1063
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.61	0.51

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.394
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1281
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influenece Area Speed (SR), mi/h	55.9
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.604	Outer Lanes Freeway Speed (SO), mi/h	70.2
Flow in Lanes 1 and 2 (v12), pc/h	3016	Ramp Junction Speed (S), mi/h	59.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	24.1
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	27.5

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - between Cliff Ramps		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2500	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	982
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.42
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	15.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - between Cliff Ramps		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2800	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1078
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.47
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	17.4
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - Exit 4 Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	2500	615
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	6.00	6.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.943	0.943
Flow Rate (vi),pc/h	2946	725
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.52	0.35

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.262
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1146
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	59.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	62.7
Flow in Lanes 1 and 2 (v12), pc/h	1800	Ramp Junction Speed (S), mi/h	60.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	2525	Average Density (D), pc/mi/ln	20.4
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	17.4

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - Exit 4 Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	2800	415
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	6.00	6.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.943	0.943
Flow Rate (vi),pc/h	3299	489
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.54	0.23

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.261
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1283
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	59.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	62.2
Flow in Lanes 1 and 2 (v12), pc/h	2016	Ramp Junction Speed (S), mi/h	60.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	2505	Average Density (D), pc/mi/ln	21.0
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	17.3

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - between Cliff and 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3115	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1223
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.53
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.8
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - between Cliff and 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3215	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1238
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.53
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	20.0
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - Cliff to 26th		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2750	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	0
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1873	547	68	627
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	6.00	6.00	6.00	6.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.943	0.943	0.943	0.943
Flow Rate (v_i), pc/h	2207	645	80	739
Weaving Flow Rate (v_w), pc/h	1384	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2287	Density-Based Capacity (c_{IWL}), pc/h/ln		2069
Total Flow Rate (v), pc/h	3671	Demand Flow-Based Capacity (c_{IW}), pc/h		6366
Volume Ratio (VR)	0.377	Weaving Segment Capacity (c_W), veh/h		5853
Minimum Lane Change Rate (LC_{MIN}), lc/h	645	Adjusted Weaving Area Capacity, pc/h		6207
Maximum Weaving Length (L_{MAX}), ft	6424	Volume-to-Capacity Ratio (v/c)		0.59

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	629	Average Weaving Speed (S_W),mi/h	56.7
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1384	Average Non-Weaving Speed (S_{NW}), mi/h	54.5
Weaving Lane Change Rate (LC_W), lc/h	947	Average Speed (S), mi/h	55.3
Weaving Lane Change Rate (LC_{All}), lc/h	2331	Density (D), pc/mi/ln	22.1
Weaving Intensity Factor (W)	0.198	Level of Service (LOS)	C

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - Cliff to 26th		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2750	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	0
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1917	303	112	883
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	4.00	4.00	4.00	4.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.962	0.962	0.962	0.962
Flow Rate (v_i), pc/h	2214	350	129	1020
Weaving Flow Rate (v_w), pc/h	1370	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2343	Density-Based Capacity (c_{IWL}), pc/h/ln		2076
Total Flow Rate (v), pc/h	3713	Demand Flow-Based Capacity (c_{IW}), pc/h		6504
Volume Ratio (VR)	0.369	Weaving Segment Capacity (c_W), veh/h		5991
Minimum Lane Change Rate (LC_{MIN}), lc/h	350	Adjusted Weaving Area Capacity, pc/h		6228
Maximum Weaving Length (L_{MAX}), ft	6336	Volume-to-Capacity Ratio (v/c)		0.60

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	644	Average Weaving Speed (S_W),mi/h	57.4
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1395	Average Non-Weaving Speed (S_{NW}), mi/h	56.5
Weaving Lane Change Rate (LC_W), lc/h	652	Average Speed (S), mi/h	56.8
Weaving Lane Change Rate (LC_{All}), lc/h	2047	Density (D), pc/mi/ln	21.8
Weaving Intensity Factor (W)	0.179	Level of Service (LOS)	C

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - between 26th Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2420	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1426
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.61
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	23.1
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - between 26th Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2220	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1282
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.55
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	20.7
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - north of 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2930	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1151
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.50
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	18.6
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - north of 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2620	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1009
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.44
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	16.3
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - north of 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3760	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1463
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.63
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	23.7
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - north of 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	4520	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1724
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.74
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	28.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - between 26th Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3300	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1926
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.83
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	59.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	32.5
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - between 26th Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3575	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	2046
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.88
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	57.4
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	35.6
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - between 26th and Cliff		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	4050	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1576
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.68
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	25.5
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - between 26th and Cliff		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	4190	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1598
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.69
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.7
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	25.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	4/29/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - 26th to Cliff		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2670	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	0
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2653	637	113	647
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	5.00	5.00	5.00	5.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.952	0.952	0.952	0.952
Flow Rate (v_i), pc/h	3096	743	132	755
Weaving Flow Rate (v_W), pc/h	1498	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	3228	Density-Based Capacity (c_{IWL}), pc/h/ln		2113
Total Flow Rate (v), pc/h	4726	Demand Flow-Based Capacity (c_{IW}), pc/h		7571
Volume Ratio (VR)	0.317	Weaving Segment Capacity (c_W), veh/h		6035
Minimum Lane Change Rate (LC_{MIN}), lc/h	755	Adjusted Weaving Area Capacity, pc/h		6339
Maximum Weaving Length (L_{MAX}), ft	5767	Volume-to-Capacity Ratio (v/c)		0.75

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	862	Average Weaving Speed (S_W),mi/h	56.0
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1534	Average Non-Weaving Speed (S_{NW}), mi/h	52.0
Weaving Lane Change Rate (LC_W), lc/h	1053	Average Speed (S), mi/h	53.2
Weaving Lane Change Rate (LC_{All}), lc/h	2587	Density (D), pc/mi/ln	29.6
Weaving Intensity Factor (W)	0.220	Level of Service (LOS)	D

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	4/29/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - 26th to Cliff		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2670	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	0
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2782	498	117	793
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	3.00	3.00	3.00	3.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.971	0.971	0.971	0.971
Flow Rate (v_i), pc/h	3183	570	134	907
Weaving Flow Rate (v_w), pc/h	1477	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	3317	Density-Based Capacity (c_{IWL}), pc/h/ln		2120
Total Flow Rate (v), pc/h	4794	Demand Flow-Based Capacity (c_{IW}), pc/h		7792
Volume Ratio (VR)	0.308	Weaving Segment Capacity (c_W), veh/h		6176
Minimum Lane Change Rate (LC_{MIN}), lc/h	907	Adjusted Weaving Area Capacity, pc/h		6360
Maximum Weaving Length (L_{MAX}), ft	5670	Volume-to-Capacity Ratio (v/c)		0.75

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	886	Average Weaving Speed (S_W),mi/h	55.6
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1553	Average Non-Weaving Speed (S_{NW}), mi/h	50.8
Weaving Lane Change Rate (LC_W), lc/h	1205	Average Speed (S), mi/h	52.2
Weaving Lane Change Rate (LC_{All}), lc/h	2758	Density (D), pc/mi/ln	30.6
Weaving Intensity Factor (W)	0.232	Level of Service (LOS)	D

HCS7 Freeway Diverge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - Exit 4		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	4050	760
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	5.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.952
Flow Rate (vi),pc/h	4727	887
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.67	0.42

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.378
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1532
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influenece Area Speed (SR), mi/h	56.3
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.601	Outer Lanes Freeway Speed (SO), mi/h	69.2
Flow in Lanes 1 and 2 (v12), pc/h	3195	Ramp Junction Speed (S), mi/h	59.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	26.3
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	27.2

HCS7 Freeway Diverge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - Exit 4		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	4050	910
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	4634	1041
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.66	0.50

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.392
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1452
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influenece Area Speed (SR), mi/h	56.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.596	Outer Lanes Freeway Speed (SO), mi/h	69.5
Flow in Lanes 1 and 2 (v12), pc/h	3182	Ramp Junction Speed (S), mi/h	59.6
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	25.9
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	27.1

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - between Cliff Ramps		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3290	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1280
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.55
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	20.7
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - between Cliff Ramps		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3280	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1251
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.54
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	20.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - Exit 4 Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	3290	760
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	5.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.952
Flow Rate (vi),pc/h	3840	887
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.67	0.42

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.312
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1494
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	57.8
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	61.4
Flow in Lanes 1 and 2 (v12), pc/h	2346	Ramp Junction Speed (S), mi/h	58.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	3233	Average Density (D), pc/mi/ln	26.8
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	22.8

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - Exit 4 Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	3280	840
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3753	961
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.67	0.46

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.314
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1460
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	57.8
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	61.5
Flow in Lanes 1 and 2 (v12), pc/h	2293	Ramp Junction Speed (S), mi/h	58.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	3254	Average Density (D), pc/mi/ln	26.7
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	23.0

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD Cliff Alt 1- SB I-229 - Exit 4 NB Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	3290	505
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	5.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.952
Flow Rate (vi),pc/h	3840	589
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.63	0.28

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.286
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1494
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	58.4
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	61.4
Flow in Lanes 1 and 2 (v12), pc/h	2346	Ramp Junction Speed (S), mi/h	59.4
Flow Entering Ramp-Infl. Area (vR12), pc/h	2935	Average Density (D), pc/mi/ln	24.9
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	20.6

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD Cliff Alt 1- SB I-229 - Exit 4 NB Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	3280	185
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3753	212
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.56	0.10

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.261
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1460
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	59.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	61.5
Flow in Lanes 1 and 2 (v12), pc/h	2293	Ramp Junction Speed (S), mi/h	59.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	2505	Average Density (D), pc/mi/ln	22.1
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	17.5

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD Cliff Alt1- SB I-229 - between Cliff Entrance Ramps		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3795	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1476
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.64
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	23.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD Cliff Alt1- SB I-229 - between Cliff Entrance Ramps		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3465	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1322
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.57
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	21.4
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD Cliff Alt 1- SB I-229 - Exit 4 SB Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	3795	255
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	5.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.952
Flow Rate (vi),pc/h	4429	298
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.67	0.14

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.292
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1723
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	58.3
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	60.6
Flow in Lanes 1 and 2 (v12), pc/h	2706	Ramp Junction Speed (S), mi/h	59.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	3004	Average Density (D), pc/mi/ln	26.7
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	21.3

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD Cliff Alt 1- SB I-229 - Exit 4 SB Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	3465	655
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3965	750
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.67	0.36

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.306
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1542
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	58.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	61.2
Flow in Lanes 1 and 2 (v12), pc/h	2423	Ramp Junction Speed (S), mi/h	59.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	3173	Average Density (D), pc/mi/ln	26.6
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	22.4

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - between Cliff and Minnesota		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	4050	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1576
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.68
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	25.5
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - between Cliff and Minnesota		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	4120	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1571
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.68
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	25.4
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Diverge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - Exit 3		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	4050	395
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	5.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.952
Flow Rate (vi),pc/h	4727	461
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.67	0.22

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.339
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1617
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influenece Area Speed (SR), mi/h	57.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.621	Outer Lanes Freeway Speed (SO), mi/h	68.9
Flow in Lanes 1 and 2 (v12), pc/h	3110	Ramp Junction Speed (S), mi/h	60.7
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	26.0
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	26.5

HCS7 Freeway Diverge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - Exit 3		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	4120	500
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	4714	572
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.67	0.27

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.349
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1591
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influenece Area Speed (SR), mi/h	57.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.616	Outer Lanes Freeway Speed (SO), mi/h	69.0
Flow in Lanes 1 and 2 (v12), pc/h	3123	Ramp Junction Speed (S), mi/h	60.6
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	25.9
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	26.6

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - between Minnesota Ramps		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3655	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1422
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.61
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	23.0
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - between Minnesota Ramps		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3620	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1381
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.60
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	22.3
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - Exit 3 Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	3655	400
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	5.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.952
Flow Rate (vi),pc/h	4266	467
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.67	0.22

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.297
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1659
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	58.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	60.8
Flow in Lanes 1 and 2 (v12), pc/h	2607	Ramp Junction Speed (S), mi/h	59.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	3074	Average Density (D), pc/mi/ln	26.7
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	21.8

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - Exit 3 Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	3620	695
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	4142	795
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.70	0.38

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.322
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1611
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	57.6
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	61.0
Flow in Lanes 1 and 2 (v12), pc/h	2531	Ramp Junction Speed (S), mi/h	58.7
Flow Entering Ramp-Infl. Area (vR12), pc/h	3326	Average Density (D), pc/mi/ln	28.0
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	23.6

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD Minnesota Alt 2C/2D - SB I-229 - Exit 3 NB Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	3655	105
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	5.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.952
Flow Rate (vi),pc/h	4266	123
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.62	0.06

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.273
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1659
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	58.7
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	60.8
Flow in Lanes 1 and 2 (v12), pc/h	2607	Ramp Junction Speed (S), mi/h	59.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	2730	Average Density (D), pc/mi/ln	24.6
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	19.3

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD Minnesota Alt 2C/2D - Exit 3 NB Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	3620	140
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	4142	160
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.61	0.08

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.271
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1611
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	58.8
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	61.0
Flow in Lanes 1 and 2 (v12), pc/h	2531	Ramp Junction Speed (S), mi/h	59.6
Flow Entering Ramp-Infl. Area (vR12), pc/h	2691	Average Density (D), pc/mi/ln	24.1
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	18.9

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD Minnesota Alt 2C/2D - between Minnesota Entrance Ramps		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3760	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1463
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.63
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	23.7
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD Minnesota Alt 2C/2D - SB I-229 - between Minnesota Entrance Ramps		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3760	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1434
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.62
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	23.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD Minnesota Alt 2C/2D - Exit 3 SB Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	3760	295
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	5.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.952
Flow Rate (vi),pc/h	4388	344
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.67	0.16

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.293
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1707
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	58.3
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	60.7
Flow in Lanes 1 and 2 (v12), pc/h	2681	Ramp Junction Speed (S), mi/h	59.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	3025	Average Density (D), pc/mi/ln	26.7
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	21.5

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD Minnesota Alt 2C/2D - SB I-229 - Exit 3 SB Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	3760	555
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	4303	635
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.70	0.30

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.315
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1674
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	57.8
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	60.8
Flow in Lanes 1 and 2 (v12), pc/h	2629	Ramp Junction Speed (S), mi/h	58.8
Flow Entering Ramp-Infl. Area (vR12), pc/h	3264	Average Density (D), pc/mi/ln	28.0
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	23.2

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - between Minnesota and Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	4050	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1576
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.68
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	25.5
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - between Minnesota and Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	4315	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1646
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.71
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.6
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	26.7
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	4/29/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - Minnesota to Western		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	3220	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	0
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2993	272	128	662
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	5.00	5.00	5.00	5.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.952	0.952	0.952	0.952
Flow Rate (v_i), pc/h	3493	317	149	773
Weaving Flow Rate (v_w), pc/h	1090	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	3642	Density-Based Capacity (c_{IWL}), pc/h/ln		2226
Total Flow Rate (v), pc/h	4732	Demand Flow-Based Capacity (c_{IW}), pc/h		10435
Volume Ratio (VR)	0.230	Weaving Segment Capacity (c_W), veh/h		6357
Minimum Lane Change Rate (LC_{MIN}), lc/h	317	Adjusted Weaving Area Capacity, pc/h		6678
Maximum Weaving Length (L_{MAX}), ft	4845	Volume-to-Capacity Ratio (v/c)		0.71

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	1173	Average Weaving Speed (S_W),mi/h	57.1
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1918	Average Non-Weaving Speed (S_{NW}), mi/h	55.1
Weaving Lane Change Rate (LC_W), lc/h	647	Average Speed (S), mi/h	55.5
Weaving Lane Change Rate (LC_{All}), lc/h	2565	Density (D), pc/mi/ln	28.4
Weaving Intensity Factor (W)	0.189	Level of Service (LOS)	D

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	4/29/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - Minnesota to Western		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	3220	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	0
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2999	486	209	621
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	3.00	3.00	3.00	3.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.971	0.971	0.971	0.971
Flow Rate (v_i), pc/h	3432	556	239	711
Weaving Flow Rate (v_w), pc/h	1267	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	3671	Density-Based Capacity (c_{IWL}), pc/h/ln		2204
Total Flow Rate (v), pc/h	4938	Demand Flow-Based Capacity (c_{IW}), pc/h		9339
Volume Ratio (VR)	0.257	Weaving Segment Capacity (c_W), veh/h		6420
Minimum Lane Change Rate (LC_{MIN}), lc/h	556	Adjusted Weaving Area Capacity, pc/h		6612
Maximum Weaving Length (L_{MAX}), ft	5127	Volume-to-Capacity Ratio (v/c)		0.75

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	1182	Average Weaving Speed (S_W),mi/h	56.6
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1924	Average Non-Weaving Speed (S_{NW}), mi/h	53.1
Weaving Lane Change Rate (LC_W), lc/h	886	Average Speed (S), mi/h	54.0
Weaving Lane Change Rate (LC_{All}), lc/h	2810	Density (D), pc/mi/ln	30.5
Weaving Intensity Factor (W)	0.203	Level of Service (LOS)	D

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - between Western Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3260	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1902
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.82
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	59.5
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	32.0
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - between Western Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3485	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1994
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.86
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	58.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	34.3
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - west of Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3535	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1375
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.59
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	22.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2050
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - west of Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

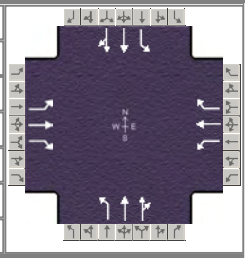
Demand Volume veh/h	4195	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1600
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.69
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.7
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	25.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

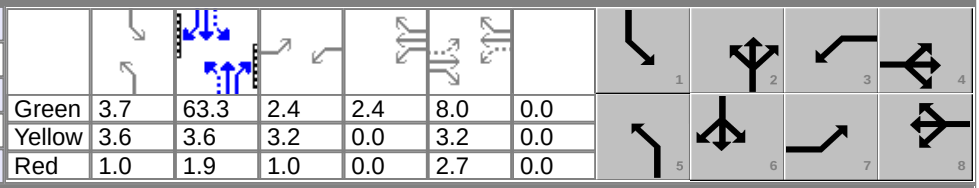
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 2, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2050	Analysis Period	1> 7:15
Intersection	37th Street	File Name	01-02 Minnesota Avenue 2050 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	30	70	55	110	75	105	80	1695	115	90	840	15

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	71	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	3.7	63.3	2.4	2.4	8.0	0.0
Yellow	3.6	3.6	3.2	0.0	3.2	0.0
Red	1.0	1.9	1.0	0.0	2.7	0.0

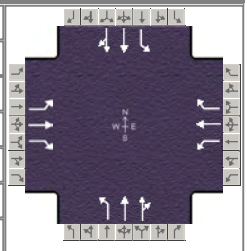
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	3.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	6.6	13.9	9.0	16.3	8.3	68.8	8.3	68.8
Change Period, ($Y+R_c$), s	4.2	5.9	4.2	5.9	4.6	5.5	4.6	5.5
Max Allow Headway (*MAH*), s	4.3	4.3	4.3	4.3	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	3.8	6.1	6.8	9.2	3.8		3.8	
Green Extension Time (g_e), s	0.0	1.2	0.0	1.2	0.3	0.0	0.3	0.0
Phase Call Probability	0.60	1.00	0.97	1.00	0.92		0.92	
Max Out Probability	1.00	0.00	1.00	0.00	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	33	78	61	122	83	117	89	1006	1006	89	424	421
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1543	1734	1821	1568	1734	1821	1780	1734	1821	1810
Queue Service Time (g_s), s	1.8	4.1	3.8	4.8	4.3	7.2	1.8	45.2	47.6	1.8	7.3	7.3
Cycle Queue Clearance Time (g_c), s	1.8	4.1	3.8	4.8	4.3	7.2	1.8	45.2	47.6	1.8	7.3	7.3
Green Ratio (*g/C*)	0.10	0.08	0.08	0.13	0.10	0.10	0.67	0.63	0.63	0.67	0.63	0.63
Capacity (*c*), veh/h	168	146	123	207	189	163	501	1153	1127	165	1153	1146
Volume-to-Capacity Ratio (*X*)	0.199	0.534	0.495	0.591	0.441	0.717	0.177	0.872	0.892	0.538	0.367	0.367
Back of Queue (*Q*), ft/ln (95 th percentile)	35.7	90.6	71.3	43	92.7	137.8	27.7	674.3	690.7	66.6	112.4	110.9
Back of Queue (*Q*), veh/ln (95 th percentile)	1.4	3.6	2.8	1.7	3.6	5.5	1.1	26.5	27.6	2.6	4.4	4.4
Queue Storage Ratio (*RQ*) (95 th percentile)	0.24	0.00	0.36	0.29	0.00	0.69	0.18	0.00	0.00	0.44	0.00	0.00
Uniform Delay (d_1), s/veh	41.0	44.2	44.1	42.0	42.1	43.4	6.0	15.0	15.5	24.2	4.9	4.9
Incremental Delay (d_2), s/veh	0.6	3.0	3.1	4.4	1.6	5.8	0.2	9.2	10.8	2.5	0.8	0.9
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	41.6	47.2	47.1	46.5	43.7	49.2	6.2	24.2	26.2	26.7	5.7	5.8
Level of Service (LOS)	D	D	D	D	D	D	A	C	C	C	A	A
Approach Delay, s/veh / LOS	46.1	D		46.7	D		24.4	C		7.8	A	
Intersection Delay, s/veh / LOS	23.1						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.31	B	2.31	B	2.06	B	2.06	B
Bicycle LOS Score / LOS	0.77	A	1.02	A	2.22	B	1.35	A

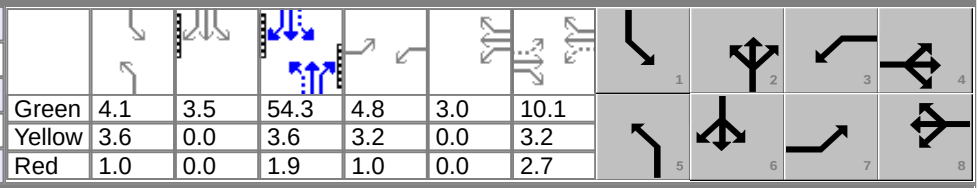
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 2, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2050	Analysis Period	1> 16:30
Intersection	37th Street	File Name	01-02 Minnesota Avenue 2050 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	70	140	140	190	130	110	85	1100	80	160	1700	50

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	71	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	4.1	3.5	54.3	4.8	3.0	10.1
Yellow	3.6	0.0	3.6	3.2	0.0	3.2
Red	1.0	0.0	1.9	1.0	0.0	2.7

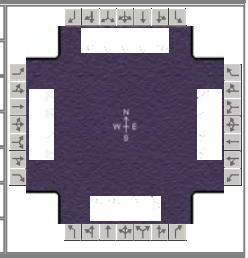
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	3.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	9.0	16.0	12.0	19.0	8.7	59.8	12.2	63.3
Change Period, ($Y+R_c$), s	4.2	5.9	4.2	5.9	4.6	5.5	4.6	5.5
Max Allow Headway (*MAH*), s	4.3	4.3	4.3	4.3	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	6.0	10.4	9.8	9.5	4.4		7.3	
Green Extension Time (g_e), s	0.0	0.0	0.0	0.7	0.0	0.0	0.3	0.0
Phase Call Probability	0.88	1.00	1.00	1.00	0.93		1.00	
Max Out Probability	1.00	1.00	1.00	1.00	1.00		0.27	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	78	156	100	211	144	89	94	663	649	203	1104	1104
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1543	1734	1821	1543	1734	1821	1777	1734	1821	1806
Queue Service Time (g_s), s	4.0	8.4	6.2	7.8	7.5	5.3	2.4	26.1	26.3	5.3	57.8	57.8
Cycle Queue Clearance Time (g_c), s	4.0	8.4	6.2	7.8	7.5	5.3	2.4	26.1	26.3	5.3	57.8	57.8
Green Ratio (*g/C*)	0.15	0.10	0.10	0.19	0.13	0.13	0.58	0.54	0.54	0.63	0.58	0.58
Capacity (*c*), veh/h	200	184	156	228	239	202	143	989	965	321	1053	1044
Volume-to-Capacity Ratio (*X*)	0.389	0.846	0.642	0.925	0.605	0.440	0.662	0.670	0.672	0.632	1.048	1.057
Back of Queue (*Q*), ft/ln (95 th percentile)	81.1	229.1	126	114.5	167	96.4	70.8	423.5	410.9	66.8	858.1	874.1
Back of Queue (*Q*), veh/ln (95 th percentile)	3.2	9.0	5.0	4.5	6.6	3.8	2.8	16.7	16.4	2.6	33.8	35.0
Queue Storage Ratio (*RQ*) (95 th percentile)	0.54	0.00	0.63	0.76	0.00	0.48	0.47	0.00	0.00	0.45	0.00	0.00
Uniform Delay (d_1), s/veh	38.1	44.2	43.2	40.4	41.0	40.1	23.9	16.4	16.4	13.0	17.3	17.4
Incremental Delay (d_2), s/veh	1.2	28.8	8.6	39.5	4.3	1.5	10.0	3.6	3.7	0.6	29.2	32.5
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	39.4	72.9	51.8	79.9	45.3	41.6	33.9	20.0	20.2	13.6	46.5	49.9
Level of Service (LOS)	D	E	D	E	D	D	C	C	C	B	F	F
Approach Delay, s/veh / LOS	58.8	E		61.0	E		21.0	C		45.3	D	
Intersection Delay, s/veh / LOS	40.4						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.31	B	2.32	B	2.13	B	2.15	B
Bicycle LOS Score / LOS	1.04	A	1.22	A	1.65	B	2.23	B

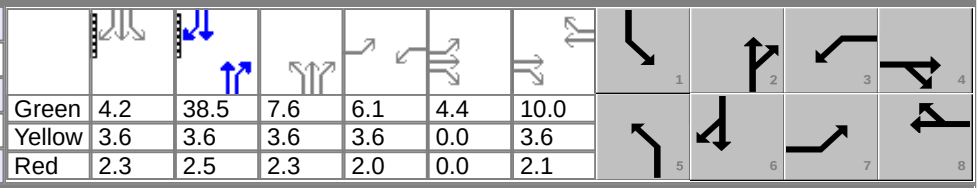
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 2, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2050	Analysis Period	1> 7:15
Intersection	41st Street	File Name	01-02 Minnesota Avenue 2050 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	255	150	90	130	150	50	130	1240	65	50	620	155

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	88	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	4.2	38.5	7.6	6.1	4.4	10.0
Yellow	3.6	3.6	3.6	3.6	0.0	3.6
Red	2.3	2.5	2.3	2.0	0.0	2.1

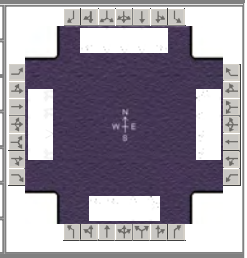
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	4.0	2.0	4.0	2.0	3.0
Phase Duration, s	16.1	20.0	11.7	15.7	13.5	58.1	10.1	54.7
Change Period, ($Y+R_c$), s	5.6	6.1	5.6	6.1	6.1	6.1	5.9	6.1
Max Allow Headway (*MAH*), s	3.1	4.3	3.2	4.3	3.2	0.0	5.2	0.0
Queue Clearance Time (g_s), s	10.2	10.7	6.1	8.2	7.3		5.2	
Green Extension Time (g_e), s	0.3	1.5	0.1	1.3	0.2	0.0	0.2	0.0
Phase Call Probability	1.00	1.00	0.98	1.00	0.99		0.79	
Max Out Probability	0.36	0.06	0.91	0.13	1.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	283	167	100	144	113	109	184	926	923	56	689	128
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1821	1568	1711	1850	1695	1711	1821	1789	1734	1654	1568
Queue Service Time (g_s), s	8.2	8.7	5.9	4.1	5.9	6.2	5.3	47.0	50.1	3.2	8.3	4.6
Cycle Queue Clearance Time (g_c), s	8.2	8.7	5.9	4.1	5.9	6.2	5.3	47.0	50.1	3.2	8.3	4.6
Green Ratio (*g/C*)	0.10	0.14	0.14	0.06	0.10	0.10	0.07	0.52	0.52	0.04	0.49	0.49
Capacity (*c*), veh/h	353	254	219	209	177	162	256	947	930	74	2410	762
Volume-to-Capacity Ratio (*X*)	0.802	0.656	0.457	0.691	0.639	0.673	0.721	0.978	0.992	0.754	0.286	0.168
Back of Queue (*Q*), ft/ln (95 th percentile)	164.3	187.5	102.8	80.6	123.8	120.4	97.3	332.3	343.6	80.6	142.2	71.3
Back of Queue (*Q*), veh/ln (95 th percentile)	6.5	7.4	4.1	3.2	5.0	4.8	3.9	13.1	13.5	3.2	5.6	2.9
Queue Storage Ratio (*RQ*) (95 th percentile)	0.41	0.00	0.00	0.32	0.00	0.00	0.39	0.00	0.00	0.54	0.00	0.20
Uniform Delay (d_1), s/veh	43.7	40.8	15.0	46.0	43.6	43.7	45.0	10.1	10.2	47.4	15.4	2.2
Incremental Delay (d_2), s/veh	4.6	4.1	2.1	1.5	1.4	1.8	3.3	13.8	16.7	19.6	0.3	0.5
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	48.3	44.8	17.1	47.5	45.0	45.5	48.3	23.9	26.9	67.0	15.7	2.7
Level of Service (LOS)	D	D	B	D	D	D	D	C	C	E	B	A
Approach Delay, s/veh / LOS	41.6	D		46.1	D		27.5	C		17.0	B	
Intersection Delay, s/veh / LOS	28.9						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.60	C	2.66	C	2.26	B	2.46	B
Bicycle LOS Score / LOS	1.40	A	0.79	A	1.80	B	0.97	A

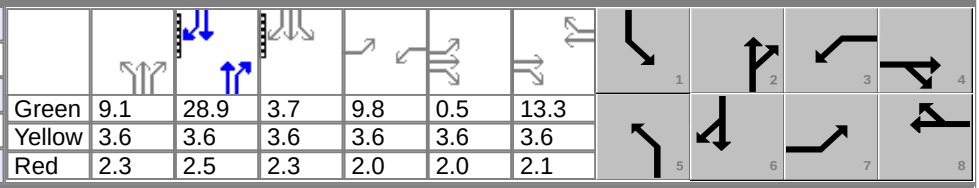
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 2, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2050	Analysis Period	1> 16:30
Intersection	41st Street	File Name	01-02 Minnesota Avenue 2050 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	430	280	285	235	330	50	245	890	95	40	1660	380

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	98	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	9.1	28.9	3.7	9.8	0.5	13.3						
Yellow	3.6	3.6	3.6	3.6	3.6	3.6						
Red	2.3	2.5	2.3	2.0	2.0	2.1						

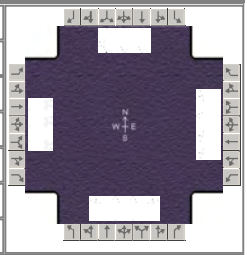
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	4.0	2.0	4.0	2.0	3.0
Phase Duration, s	21.4	25.1	15.4	19.0	15.0	50.0	9.6	44.6
Change Period, ($Y+R_c$), s	5.6	6.1	5.6	6.1	5.9	6.1	6.1	6.1
Max Allow Headway (*MAH*), s	3.1	4.3	3.2	4.3	3.2	0.0	5.2	0.0
Queue Clearance Time (g_s), s	15.9	18.7	9.5	13.6	10.1		4.5	
Green Extension Time (g_e), s	0.0	0.1	0.3	0.0	0.0	0.0	0.3	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		0.71	
Max Out Probability	1.00	1.00	0.12	1.00	1.00		1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	478	311	206	261	215	208	284	563	548	44	1844	311
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1821	1568	1711	1850	1765	1711	1821	1774	1734	1654	1568
Queue Service Time (g_s), s	13.9	16.7	12.2	7.5	11.4	11.6	8.1	20.8	20.6	2.5	36.4	15.2
Cycle Queue Clearance Time (g_c), s	13.9	16.7	12.2	7.5	11.4	11.6	8.1	20.8	20.6	2.5	36.4	15.2
Green Ratio (*g/C*)	0.16	0.19	0.19	0.10	0.13	0.13	0.09	0.44	0.44	0.03	0.38	0.38
Capacity (*c*), veh/h	534	346	298	334	239	228	311	799	779	60	1909	603
Volume-to-Capacity Ratio (*X*)	0.896	0.900	0.690	0.782	0.898	0.912	0.913	0.704	0.704	0.741	0.966	0.516
Back of Queue (*Q*), ft/ln (95 th percentile)	285	377.6	223.2	145.4	292.7	292.8	166	280.4	268.6	68.3	585.3	251.5
Back of Queue (*Q*), veh/ln (95 th percentile)	11.2	14.9	8.9	5.8	11.7	11.7	6.6	11.0	10.6	2.7	23.0	10.1
Queue Storage Ratio (*RQ*) (95 th percentile)	0.71	0.00	0.00	0.58	0.00	0.00	0.66	0.00	0.00	0.46	0.00	0.72
Uniform Delay (d_1), s/veh	41.3	39.6	37.8	44.1	42.9	43.0	38.1	14.6	14.2	47.8	30.1	23.6
Incremental Delay (d_2), s/veh	17.1	25.6	7.3	2.0	31.9	35.9	23.2	3.8	3.9	24.1	14.0	3.1
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	58.4	65.2	45.1	46.1	74.8	78.9	61.3	18.3	18.1	72.0	44.2	26.7
Level of Service (LOS)	E	E	D	D	E	E	E	B	B	E	D	C
Approach Delay, s/veh / LOS	57.8	E		65.1	E		27.0	C		42.3	D	
Intersection Delay, s/veh / LOS	44.1						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.63	C	2.74	C	2.31	B	2.57	C
Bicycle LOS Score / LOS	2.13	B	1.05	A	1.59	B	1.70	B

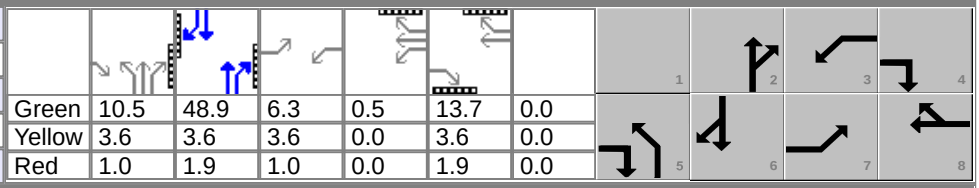
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2050	Analysis Period	1> 7:15
Intersection	49th St/I-229 SB	File Name	03-05-07 Alt 2CD Minnesota Avenue 2050 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	130		170	140	190	65	135	1770	105		835	135

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	71	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	10.5	48.9	6.3	0.5	13.7	0.0
Yellow	3.6	3.6	3.6	0.0	3.6	0.0
Red	1.0	1.9	1.0	0.0	1.9	0.0

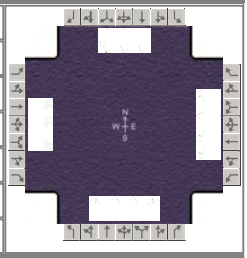
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2		6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0		8.3
Phase Duration, s	10.9	19.2	11.4	19.7	15.1	69.5		54.4
Change Period, ($Y+R_c$), s	4.6	5.5	4.6	5.5	4.6	5.5		5.5
Max Allow Headway (*MAH*), s	4.2	4.3	4.2	4.3	4.2	0.0		0.0
Queue Clearance Time (g_s), s	6.2	12.6	6.5	13.3	10.5			
Green Extension Time (g_e), s	0.2	0.9	0.3	0.9	0.2	0.0		0.0
Phase Call Probability	0.98	1.00	0.99	1.00	0.98			
Max Out Probability	0.99	0.61	0.02	0.65	0.85			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14	3	8	18	5	2	12		6	16
Adjusted Flow Rate (*v*), veh/h	144		189	156	211	72	150	1967	117		282	443
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684		1543	1684	1821	1543	1734	1734			563	1749
Queue Service Time (g_s), s	4.2		10.6	4.5	11.3	4.2	8.5	47.2			21.1	13.6
Cycle Queue Clearance Time (g_c), s	4.2		10.6	4.5	11.3	4.2	8.5	47.2			21.1	13.6
Green Ratio (*g/C*)	0.06		0.24	0.07	0.14	0.14	0.10	0.64			0.49	0.49
Capacity (*c*), veh/h	211		373	228	258	219	182	2218			551	855
Volume-to-Capacity Ratio (*X*)	0.685		0.507	0.682	0.818	0.330	0.825	0.887			0.512	0.518
Back of Queue (*Q*), ft/ln (95 th percentile)	85.1		183.9	91	247.8	75.1	195.7	632.7			76	211.1
Back of Queue (*Q*), veh/ln (95 th percentile)	3.4		7.2	3.6	9.8	3.0	7.7	24.9			3.0	8.3
Queue Storage Ratio (*RQ*) (95 th percentile)	0.43		0.37	0.36	0.00	0.38	0.65	0.00			0.00	0.00
Uniform Delay (d_1), s/veh	45.9		32.8	45.6	41.7	38.6	43.9	15.0			12.0	11.6
Incremental Delay (d_2), s/veh	3.9		1.1	3.6	11.2	0.9	13.7	5.7			3.2	2.1
Initial Queue Delay (d_3), s/veh	0.0		0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	49.8		33.8	49.1	52.8	39.5	57.6	20.7	30.0		15.2	13.8
Level of Service (LOS)	D		C	D	D	D	E	C	C		B	B
Approach Delay, s/veh / LOS	40.8		D	49.3		D	23.7		C	14.4		B
Intersection Delay, s/veh / LOS	26.4						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.60	C	2.30	B	2.23	B	2.09	B
Bicycle LOS Score / LOS		F	1.21	A	2.33	B	1.08	A

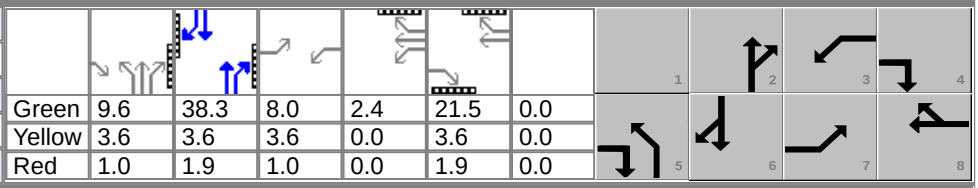
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2050	Analysis Period	1> 16:30
Intersection	49th St/I-229 SB	File Name	03-05-07 Alt 2CD Minnesota Avenue 2050 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	175		370	245	190	65	120	1115	140		2320	90

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	71	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	9.6	38.3	8.0	2.4	21.5	0.0
Yellow	3.6	3.6	3.6	0.0	3.6	0.0
Red	1.0	1.9	1.0	0.0	1.9	0.0

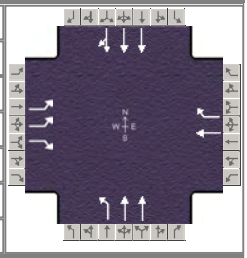
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2		6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0		8.3
Phase Duration, s	12.6	27.0	15.0	29.4	14.2	58.0		43.8
Change Period, ($Y+R_c$), s	4.6	5.5	4.6	5.5	4.6	5.5		5.5
Max Allow Headway (*MAH*), s	4.2	4.3	4.2	4.3	4.2	0.0		0.0
Queue Clearance Time (g_s), s	7.6	23.5	9.9	12.0	9.5			
Green Extension Time (g_e), s	0.4	0.0	0.5	2.4	0.3	0.0		0.0
Phase Call Probability	1.00	1.00	1.00	1.00	0.98			
Max Out Probability	0.07	1.00	0.43	0.14	0.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14	3	8	18	5	2	12		6	16
Adjusted Flow Rate (*v*), veh/h	194		411	272	211	72	133	1239	156		819	468
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684		1543	1684	1821	1543	1734	1734			1565	1788
Queue Service Time (g_s), s	5.6		21.5	7.9	10.0	3.7	7.5	26.4			78.1	22.7
Cycle Queue Clearance Time (g_c), s	5.6		21.5	7.9	10.0	3.7	7.5	26.4			78.1	22.7
Green Ratio (*g/C*)	0.08		0.31	0.10	0.24	0.24	0.10	0.53			0.38	0.38
Capacity (*c*), veh/h	270		479	350	435	368	166	1821			1200	685
Volume-to-Capacity Ratio (*X*)	0.719		0.857	0.777	0.486	0.196	0.803	0.681			0.683	0.683
Back of Queue (*Q*), ft/ln (95 th percentile)	113		418	158.7	201.4	64.5	165.2	400.2			340.1	394
Back of Queue (*Q*), veh/ln (95 th percentile)	4.4		16.5	6.2	7.9	2.5	6.5	15.8			13.4	15.5
Queue Storage Ratio (*RQ*) (95 th percentile)	0.56		0.84	0.63	0.00	0.32	0.55	0.00			0.00	0.00
Uniform Delay (d_1), s/veh	44.9		32.4	43.7	32.8	30.4	44.3	17.6			28.2	28.4
Incremental Delay (d_2), s/veh	3.6		14.3	4.4	0.8	0.3	8.7	2.1			2.6	4.5
Initial Queue Delay (d_3), s/veh	0.0		0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	48.5		46.7	48.1	33.6	30.7	53.0	19.6	30.0		30.8	32.9
Level of Service (LOS)	D		D	D	C	C	D	B	C		C	C
Approach Delay, s/veh / LOS	47.3	D		40.3	D		23.6	C		31.6	C	
Intersection Delay, s/veh / LOS	32.1						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.59	C	2.29	B	2.25	B	2.11	B
Bicycle LOS Score / LOS		F	1.40	A	1.75	B	1.96	B

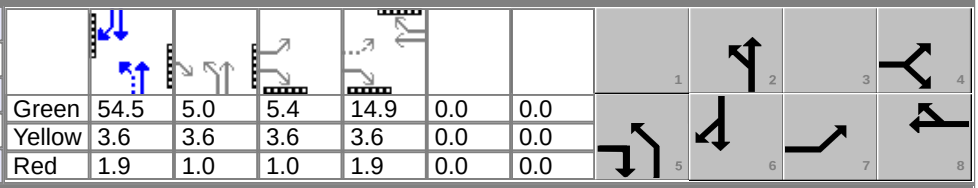
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2050	Analysis Period	1> 7:15
Intersection	49th St/I-229 SB	File Name	03-05-07 Alt 9D Minnesota Avenue 2050 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	130		170		190	65	135	1770			835	135

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	71	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	54.5	5.0	5.4	14.9	0.0	0.0
Yellow	3.6	3.6	3.6	3.6	0.0	0.0
Red	1.9	1.0	1.0	1.9	0.0	0.0

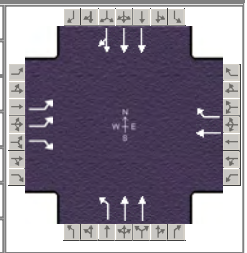
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4		8	5	2		6
Case Number	1.0	3.0		7.3	1.0	4.0		8.3
Phase Duration, s	10.0	30.4		20.4	9.6	69.6		60.0
Change Period, ($Y+R_c$), s	4.6	5.5		5.5	5.5	5.5		5.5
Max Allow Headway (*MAH*), s	4.2	4.3		4.3	4.2	0.0		0.0
Queue Clearance Time (g_s), s	5.5	11.9		13.2	2.0			
Green Extension Time (g_e), s	0.0	1.9		1.7	1.9	0.0		0.0
Phase Call Probability	0.98	1.00		1.00	0.98			
Max Out Probability	1.00	0.00		0.00	1.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14		8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h	144		189		211	72	150	1967			249	392
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684		1543		1821	1543	1734	1734			563	1749
Queue Service Time (g_s), s	3.5		9.9		11.2	4.2	0.0	47.0			26.8	10.7
Cycle Queue Clearance Time (g_c), s	3.5		9.9		11.2	4.2	0.0	47.0			26.8	10.7
Green Ratio (*g/C*)	0.22		0.29		0.15	0.15	0.56	0.64			0.55	0.55
Capacity (*c*), veh/h	412		449		271	230	346	2224			613	951
Volume-to-Capacity Ratio (*X*)	0.350		0.420		0.779	0.315	0.434	0.884			0.407	0.412
Back of Queue (*Q*), ft/ln (95 th percentile)	65.8		168.6		231.4	74.2	144.9	628.3			55.1	176.9
Back of Queue (*Q*), veh/ln (95 th percentile)	2.6		6.6		9.1	2.9	5.7	24.7			2.2	7.0
Queue Storage Ratio (*RQ*) (95 th percentile)	0.33		0.34		0.00	0.37	0.48	0.00			0.00	0.00
Uniform Delay (d_1), s/veh	32.5		28.6		41.0	38.0	30.6	14.9			9.1	9.8
Incremental Delay (d_2), s/veh	0.5		0.6		4.8	0.8	0.9	5.6			1.9	1.3
Initial Queue Delay (d_3), s/veh	0.0		0.0		0.0	0.0	0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	33.0		29.3		45.8	38.8	31.4	20.4			11.0	11.1
Level of Service (LOS)	C		C		D	D	C	C			B	B
Approach Delay, s/veh / LOS	30.9	C		44.0	D		21.2	C		11.1	B	
Intersection Delay, s/veh / LOS	22.2						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.44	B	2.30	B	1.65	B	2.14	B
Bicycle LOS Score / LOS		F	0.96	A	2.23	B	1.08	A

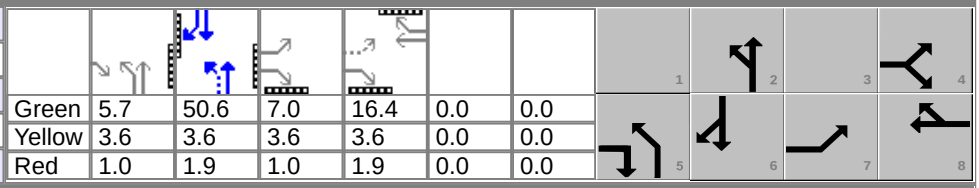
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2050	Analysis Period	1> 16:30
Intersection	49th St/I-229 SB	File Name	03-05-07 Alt 9D Minnesota Avenue 2050 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	175		370		190	65	120	1115			2320	90

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	71	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	5.7	50.6	7.0	16.4	0.0	0.0
Yellow	3.6	3.6	3.6	3.6	0.0	0.0
Red	1.0	1.9	1.0	1.9	0.0	0.0

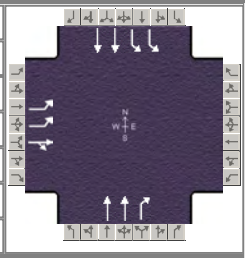
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4		8	5	2		6
Case Number	1.0	3.0		7.3	1.0	4.0		8.3
Phase Duration, s	11.6	33.6		21.9	10.3	66.4		56.1
Change Period, ($Y+R_c$), s	4.6	5.5		5.5	4.6	5.5		5.5
Max Allow Headway (*MAH*), s	4.2	4.3		4.3	4.2	0.0		0.0
Queue Clearance Time (g_s), s	6.6	26.0		13.0	5.5			
Green Extension Time (g_e), s	0.5	2.0		2.2	0.4	0.0		0.0
Phase Call Probability	1.00	1.00		1.00	0.98			
Max Out Probability	0.03	0.34		0.23	0.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14		8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h	194		411		211	72	133	1239			788	451
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684		1543		1821	1543	1734	1734			1565	1788
Queue Service Time (g_s), s	4.6		24.0		11.0	4.1	3.5	21.7			75.9	15.3
Cycle Queue Clearance Time (g_c), s	4.6		24.0		11.0	4.1	3.5	21.7			75.9	15.3
Green Ratio (*g/C*)	0.25		0.34		0.16	0.16	0.58	0.61			0.51	0.51
Capacity (*c*), veh/h	508		521		299	254	171	2113			1584	905
Volume-to-Capacity Ratio (*X*)	0.383		0.789		0.705	0.285	0.779	0.586			0.497	0.498
Back of Queue (*Q*), ft/ln (95 th percentile)	85.4		370		224.1	72.3	87.8	321.9			211.2	247.5
Back of Queue (*Q*), veh/ln (95 th percentile)	3.4		14.6		8.8	2.8	3.5	12.7			8.3	9.7
Queue Storage Ratio (*RQ*) (95 th percentile)	0.43		0.74		0.00	0.36	0.29	0.00			0.00	0.00
Uniform Delay (d_1), s/veh	30.4		29.9		39.5	36.6	23.2	11.9			13.7	14.2
Incremental Delay (d_2), s/veh	0.5		5.7		3.2	0.6	7.4	1.2			1.0	1.7
Initial Queue Delay (d_3), s/veh	0.0		0.0		0.0	0.0	0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	30.9		35.6		42.7	37.2	30.7	13.1			14.7	15.8
Level of Service (LOS)	C		D		D	D	C	B			B	B
Approach Delay, s/veh / LOS	34.1	C		41.3	D		14.8	B		15.1	B	
Intersection Delay, s/veh / LOS	20.4						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.44	B	2.30	B	1.65	B	2.09	B
Bicycle LOS Score / LOS		F	0.96	A	1.62	B	1.96	B

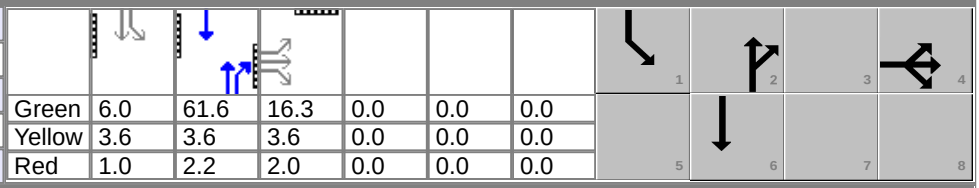
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2050	Analysis Period	1> 7:15
Intersection	I-229 NB Ramp	File Name	03-05-07 Alt 2CD Minnesota Avenue 2050 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	410	0	70					1600	270	120	730	

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	84	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	6.0	61.6	16.3	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.0	2.2	2.0	0.0	0.0	0.0

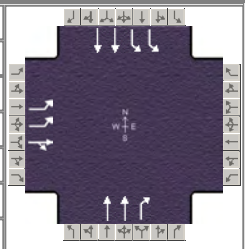
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4				2	1	6
Case Number		10.0				7.3	2.0	4.0
Phase Duration, s		21.9				67.4	10.6	78.1
Change Period, ($Y+R_c$), s		5.6				5.8	4.6	5.8
Max Allow Headway (*MAH*), s		3.2				0.0	3.1	0.0
Queue Clearance Time (g_s), s		15.1					5.9	
Green Extension Time (g_e), s		1.2				0.0	0.3	0.0
Phase Call Probability		1.00					0.98	
Max Out Probability		0.00					0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14					2	12	1	6	
Adjusted Flow Rate (*v*), veh/h	456	56						1872	228	134	816	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1453						1837	1485	1684	1708	
Queue Service Time (g_s), s	13.1	3.3						26.8	1.9	3.9	9.1	
Cycle Queue Clearance Time (g_c), s	13.1	3.3						26.8	1.9	3.9	9.1	
Green Ratio (*g/C*)	0.16	0.16						0.62	0.62	0.06	0.72	
Capacity (*c*), veh/h	550	237						2264	915	203	2469	
Volume-to-Capacity Ratio (*X*)	0.828	0.234						0.827	0.249	0.659	0.330	
Back of Queue (*Q*), ft/ln (95 th percentile)	233.9	53.7						212.6	27.2	74.2	119.3	
Back of Queue (*Q*), veh/ln (95 th percentile)	9.2	2.1						8.4	1.1	2.9	4.7	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.67	0.00						0.00	0.14	0.25	0.00	
Uniform Delay (d_1), s/veh	40.5	36.4						5.2	1.9	45.9	5.4	
Incremental Delay (d_2), s/veh	1.2	0.2						3.6	0.7	1.3	0.3	
Initial Queue Delay (d_3), s/veh	0.0	0.0						0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	41.7	36.6						8.9	2.6	47.2	5.7	
Level of Service (LOS)	D	D						A	A	D	A	
Approach Delay, s/veh / LOS	41.2	D		0.0			8.2	A		11.6	B	
Intersection Delay, s/veh / LOS	13.8						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.43	B	2.47	B	1.77	B	1.88	B
Bicycle LOS Score / LOS	1.33	A		A	2.13	B	1.27	A

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2050	Analysis Period	1> 16:30
Intersection	I-229 NB Ramp	File Name	03-05-07 Alt 2CD Minnesota Avenue 2050 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	310	0	155					1065	250	560	1820	

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	34	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4
Green	14.7	56.9	12.3	0.0	0.0	0.0				
Yellow	3.6	3.6	3.6	0.0	0.0	0.0				
Red	1.0	2.2	2.0	0.0	0.0	0.0	5	6	7	8

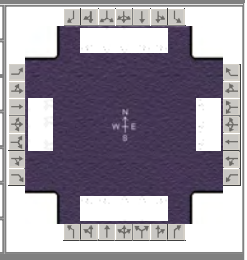
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4				2	1	6
Case Number		10.0				7.3	2.0	4.0
Phase Duration, s		17.9				62.7	19.3	82.1
Change Period, ($Y+R_c$), s		5.6				5.8	4.6	5.8
Max Allow Headway (*MAH*), s		3.2				0.0	3.1	0.0
Queue Clearance Time (g_s), s		12.0					14.6	
Green Extension Time (g_e), s		0.4				0.0	0.1	0.0
Phase Call Probability		1.00					1.00	
Max Out Probability		1.00					1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14					2	12	1	6	
Adjusted Flow Rate (*v*), veh/h	344	139						1222	201	435	1415	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1468						1756	1480	1684	1779	
Queue Service Time (g_s), s	10.0	9.2						30.2	11.5	12.6	2.4	
Cycle Queue Clearance Time (g_c), s	10.0	9.2						30.2	11.5	12.6	2.4	
Green Ratio (*g/C*)	0.12	0.12						0.57	0.57	0.15	0.76	
Capacity (*c*), veh/h	416	181						1999	843	496	2714	
Volume-to-Capacity Ratio (*X*)	0.829	0.767						0.611	0.238	0.878	0.521	
Back of Queue (*Q*), ft/ln (95 th percentile)	205.6	174						508	204.8	222.8	22.3	
Back of Queue (*Q*), veh/ln (95 th percentile)	8.1	6.8						20.0	8.1	8.8	0.9	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.59	0.00						0.00	1.00	0.74	0.00	
Uniform Delay (d_1), s/veh	42.8	42.4						26.3	22.2	40.3	0.4	
Incremental Delay (d_2), s/veh	8.8	10.9						1.4	0.7	10.3	0.5	
Initial Queue Delay (d_3), s/veh	0.0	0.0						0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	51.6	53.4						27.7	22.9	50.6	0.9	
Level of Service (LOS)	D	D						C	C	D	A	
Approach Delay, s/veh / LOS	52.1	D		0.0			27.0	C		12.6	B	
Intersection Delay, s/veh / LOS	23.1						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.43	B	2.47	B	1.78	B	1.88	B
Bicycle LOS Score / LOS	1.29	A		A	1.62	B	2.67	C

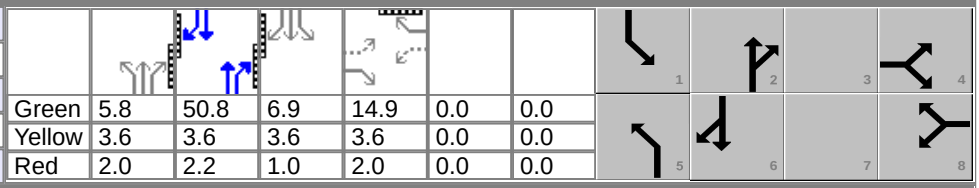
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2050	Analysis Period	1> 7:15
Intersection	I-229 SPUI	File Name	03-05-07 Alt 9D Minnesota Avenue 2050 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	410		70	140		0	105	1495	270	120	590	295

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	83	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	5.8	50.8	6.9	14.9	0.0	0.0
Yellow	3.6	3.6	3.6	3.6	0.0	0.0
Red	2.0	2.2	1.0	2.0	0.0	0.0

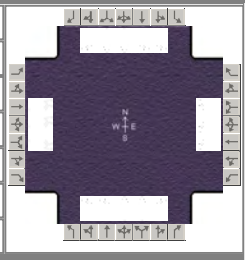
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		5.0		5.0	2.0	3.0	2.0	3.0
Phase Duration, s		20.5		20.5	11.4	68.0	11.5	68.1
Change Period, ($Y+R_c$), s		5.6		5.6	5.6	5.8	5.8	5.8
Max Allow Headway (*MAH*), s		3.1		3.1	3.1	0.0	3.1	0.0
Queue Clearance Time (g_s), s		14.9		6.0	5.5		5.3	
Green Extension Time (g_e), s		0.0		1.2	0.0	0.0	0.3	0.0
Phase Call Probability		1.00		1.00	0.97		0.96	
Max Out Probability		1.00		0.04	1.00		1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14	3		18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	456		78	156		0	123	1745	315	113	558	279
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684		1457	1684		1442	1684	1821	1502	1684	1679	
Queue Service Time (g_s), s	12.9		4.8	4.0		0.0	3.5	17.2	2.2	3.3	6.6	
Cycle Queue Clearance Time (g_c), s	12.9		4.8	4.0		0.0	3.5	17.2	2.2	3.3	6.6	
Green Ratio (*g/C*)	0.15		0.15	0.15		0.15	0.06	0.62	0.62	0.06	0.62	
Capacity (*c*), veh/h	644		216	644		214	195	2265	934	193	2094	
Volume-to-Capacity Ratio (*X*)	0.707		0.359	0.241		0.000	0.627	0.771	0.337	0.586	0.266	
Back of Queue (*Q*), ft/ln (95 th percentile)	242.7		78.1	75.9		0	67.5	109.7	25.7	63.3	96	
Back of Queue (*Q*), veh/ln (95 th percentile)	9.6		3.1	3.0		0.0	2.7	4.3	1.0	2.5	3.8	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.81		0.00	0.25		0.00	0.34	0.00	0.13	0.21	0.00	
Uniform Delay (d_1), s/veh	41.7		38.3	38.0		0.0	44.2	3.1	1.4	45.7	7.3	
Incremental Delay (d_2), s/veh	3.0		0.4	0.1		0.0	3.1	1.2	0.4	2.0	0.3	
Initial Queue Delay (d_3), s/veh	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	44.8		38.7	38.0		0.0	47.4	4.3	1.9	47.7	7.5	0.0
Level of Service (LOS)	D		D	D			D	A	A	D	A	A
Approach Delay, s/veh / LOS	43.9	D		38.0	D		6.4	A		10.1	B	
Intersection Delay, s/veh / LOS	13.8						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.60	C	2.60	C	2.31	B	2.24	B
Bicycle LOS Score / LOS		F		F	2.20	B	1.41	A

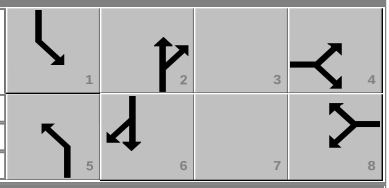
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2050	Analysis Period	1> 16:30
Intersection	I-229 SPUI	File Name	03-05-07 Alt 9D Minnesota Avenue 2050 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	310		155	245		0	140	925	250	560	1575	555

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	34	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	6.8	1.1	56.1	14.5	0.0	0.0
Yellow	3.6	3.6	3.6	3.6	0.0	0.0
Red	2.0	1.0	2.2	2.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		5.0		5.0	2.0	3.0	2.0	3.0
Phase Duration, s		20.1		20.1	12.4	61.9	18.0	67.6
Change Period, ($Y+R_c$), s		5.6		5.6	5.6	5.8	4.6	5.8
Max Allow Headway (*MAH*), s		3.1		3.1	3.1	0.0	3.1	0.0
Queue Clearance Time (g_s), s		13.3		9.3	6.7		13.2	
Green Extension Time (g_e), s		1.2		1.5	0.2	0.0	0.2	0.0
Phase Call Probability		1.00		1.00	0.99		1.00	
Max Out Probability		0.23		0.03	0.00		1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14	3		18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	344		172	272		0	160	1060	229	385	1083	382
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684		1474	1684		1442	1684	1736	1485	1684	1739	
Queue Service Time (g_s), s	9.4		11.3	7.3		0.0	4.7	21.9	10.2	11.2	9.2	
Cycle Queue Clearance Time (g_c), s	9.4		11.3	7.3		0.0	4.7	21.9	10.2	11.2	9.2	
Green Ratio (*g/C*)	0.14		0.14	0.14		0.14	0.07	0.56	0.56	0.13	0.62	
Capacity (*c*), veh/h	631		213	631		209	228	1949	833	452	2148	
Volume-to-Capacity Ratio (*X*)	0.546		0.807	0.431		0.000	0.703	0.544	0.275	0.852	0.504	
Back of Queue (*Q*), ft/ln (95 th percentile)	181.8		203.9	138.5		0	89.2	349.2	165.6	203.3	101.6	
Back of Queue (*Q*), veh/ln (95 th percentile)	7.2		8.0	5.5		0.0	3.5	13.7	6.5	8.0	4.0	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.61		0.00	0.46		0.00	0.45	0.00	0.83	0.68	0.00	
Uniform Delay (d_1), s/veh	40.6		41.4	39.7		0.0	45.7	17.6	15.9	42.6	4.1	
Incremental Delay (d_2), s/veh	0.3		8.6	0.2		0.0	1.5	1.1	0.8	7.4	0.6	
Initial Queue Delay (d_3), s/veh	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	40.9		50.0	39.9		0.0	47.2	18.7	16.7	50.0	4.6	0.0
Level of Service (LOS)	D		D	D			D	B	B	D	A	A
Approach Delay, s/veh / LOS	43.9	D		39.9	D		21.5	C		13.1	B	
Intersection Delay, s/veh / LOS	21.8						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.67	C	2.60	C	2.25	B	2.24	B
Bicycle LOS Score / LOS		F		F	1.65	B	2.95	C

HCS7 Two-Way Stop-Control Report

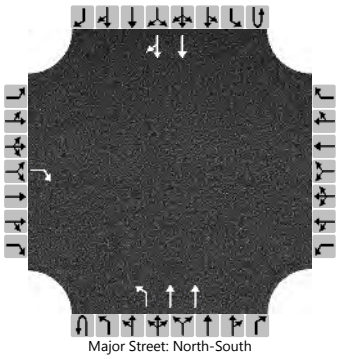
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/1/19
Analysis Year	2050
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at Yankton
Jurisdiction	Sioux Falls, SD
East/West Street	Yankton Trail
North/South Street	Minnesota Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration				R						L	T				T	TR
Volume (veh/h)				5					0	5	1870				795	5
Percent Heavy Vehicles (%)				2					2	2						
Proportion Time Blocked																
Percent Grade (%)	0															
Right Turn Channelized	No															
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)				6.9						4.1						
Critical Headway (sec)				6.94						4.14						
Base Follow-Up Headway (sec)				3.3						2.2						
Follow-Up Headway (sec)				3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)				6						6						
Capacity, c (veh/h)				561						758						
v/c Ratio				0.01						0.01						
95% Queue Length, Q_{95} (veh)				0.0						0.0						
Control Delay (s/veh)				11.5						9.8						
Level of Service (LOS)				B						A						
Approach Delay (s/veh)	11.5								0.0							
Approach LOS	B															

HCS7 Two-Way Stop-Control Report

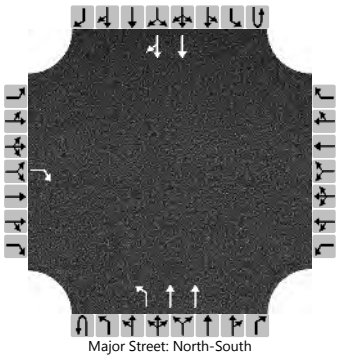
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/1/19
Analysis Year	2050
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at Yankton
Jurisdiction	Sioux Falls, SD
East/West Street	Yankton Trail
North/South Street	Minnesota Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration				R						L	T				T	TR
Volume (veh/h)				20					0	50	1310				1845	130
Percent Heavy Vehicles (%)				2					2	2						
Proportion Time Blocked																
Percent Grade (%)	0															
Right Turn Channelized	No															
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)				6.9						4.1						
Critical Headway (sec)				6.94						4.14						
Base Follow-Up Headway (sec)				3.3						2.2						
Follow-Up Headway (sec)				3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)				22						56						
Capacity, c (veh/h)				208						237						
v/c Ratio				0.11						0.23						
95% Queue Length, Q_{95} (veh)				0.4						0.9						
Control Delay (s/veh)				24.4						24.8						
Level of Service (LOS)				C						C						
Approach Delay (s/veh)	24.4								0.9							
Approach LOS	C															

HCS7 Two-Way Stop-Control Report

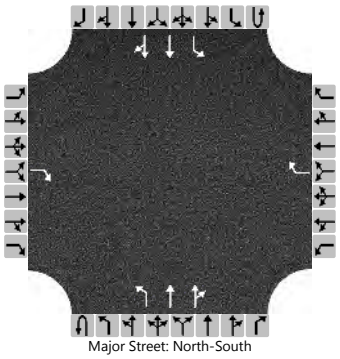
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/1/19
Analysis Year	2050
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at Lotta St
Jurisdiction	Sioux Falls, SD
East/West Street	Lotta St (RI/RO)
North/South Street	Minnesota Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	1		0	0	1	0	1	2	0	0	1	2	0
Configuration				R				R		L	T	TR		L	T	TR
Volume (veh/h)				5				425	0	10	1500	15	0	45	745	10
Percent Heavy Vehicles (%)				2				2	2	2			2	2		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized	Yes				Yes											
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)				6.9				6.9		4.1				4.1		
Critical Headway (sec)				6.94				6.94		4.14				4.14		
Base Follow-Up Headway (sec)				3.3				3.3		2.2				2.2		
Follow-Up Headway (sec)				3.32				3.32		2.22				2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)				6				472		11				50		
Capacity, c (veh/h)				582				308		792				376		
v/c Ratio				0.01				1.53		0.01				0.13		
95% Queue Length, Q_{95} (veh)				0.0				27.1		0.0				0.5		
Control Delay (s/veh)				11.2				287.1		9.6				16.0		
Level of Service (LOS)				B				F		A				C		
Approach Delay (s/veh)	11.2				287.1				0.1				0.9			
Approach LOS	B				F											

HCS7 Two-Way Stop-Control Report

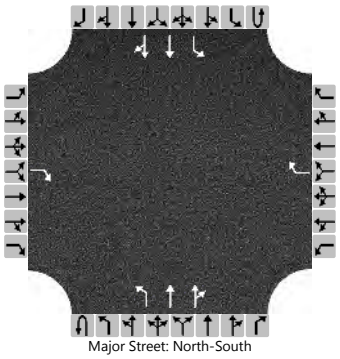
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/1/19
Analysis Year	2050
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at Lotta St
Jurisdiction	Sioux Falls, SD
East/West Street	Lotta St (RI/RO)
North/South Street	Minnesota Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	1		0	0	1	0	1	2	0	0	1	2	0
Configuration				R				R		L	T	TR		L	T	TR
Volume (veh/h)				5				170	0	5	1210	40	0	240	1620	0
Percent Heavy Vehicles (%)				2				2	2	2			2	2		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized	Yes				Yes											
Median Type | Storage	Undivided															

Critical and Follow-up Headways

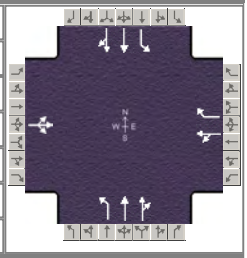
Base Critical Headway (sec)				6.9				6.9		4.1				4.1		
Critical Headway (sec)				6.94				6.94		4.14				4.14		
Base Follow-Up Headway (sec)				3.3				3.3		2.2				2.2		
Follow-Up Headway (sec)				3.32				3.32		2.22				2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)				6				189		6				267		
Capacity, c (veh/h)				282				385		339				489		
v/c Ratio				0.02				0.49		0.02				0.55		
95% Queue Length, Q_{95} (veh)				0.1				2.6		0.0				3.2		
Control Delay (s/veh)				18.0				23.0		15.8				20.9		
Level of Service (LOS)				C				C		C				C		
Approach Delay (s/veh)	18.0				23.0				0.1				2.7			
Approach LOS	C				C											

HCS7 Signalized Intersection Results Summary

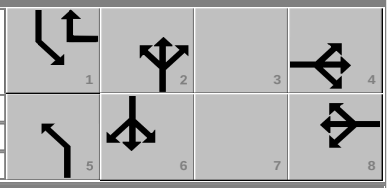
General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2050	Analysis Period	1> 7:15
Intersection	Lotta St	File Name	03-05-07 Alt 2CD Minnesota Avenue 2050 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	55	25	5	105	25	320	10	1500	15	45	745	10

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	119	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	1.4	1.6	66.8	13.8	0.0	0.0
Yellow	4.3	0.0	4.3	3.6	0.0	0.0
Red	1.0	0.0	1.6	1.6	0.0	0.0



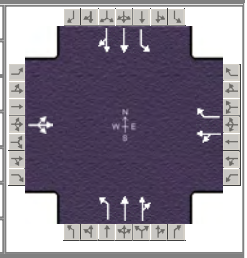
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		8.0		7.0	1.1	4.0	1.1	4.0
Phase Duration, s		19.0		19.0	6.7	72.7	8.3	74.3
Change Period, ($Y+R_c$), s		5.2		5.2	5.3	5.9	5.3	5.9
Max Allow Headway (*MAH*), s		3.5		3.5	3.1	0.0	4.1	0.0
Queue Clearance Time (g_s), s		7.5		15.8	2.3		2.9	
Green Extension Time (g_e), s		0.7		0.0	0.0	0.0	0.0	0.0
Phase Call Probability		1.00		1.00	0.36		0.75	
Max Out Probability		0.22		1.00	1.00		1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h		94			144	222	16	1200	1200	50	420	418
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1530			1443	1543	1734	1821	1815	1734	1821	1812
Queue Service Time (g_s), s		0.0			4.1	13.8	0.3	62.7	63.8	0.9	9.5	9.5
Cycle Queue Clearance Time (g_c), s		5.5			9.6	13.8	0.3	62.7	63.8	0.9	9.5	9.5
Green Ratio (*g/C*)		0.14			0.14	0.17	0.68	0.67	0.67	0.70	0.68	0.68
Capacity (*c*), veh/h		270			264	259	470	1216	1212	129	1245	1239
Volume-to-Capacity Ratio (*X*)		0.349			0.547	0.857	0.034	0.987	0.990	0.389	0.338	0.338
Back of Queue (*Q*), ft/ln (95 th percentile)		99.4			159	284	4	494.3	501.4	37.9	148.3	147.7
Back of Queue (*Q*), veh/ln (95 th percentile)		3.9			6.3	11.2	0.2	19.5	19.7	1.5	5.8	5.8
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00			0.00	0.81	0.00	0.00	0.00	0.11	0.00	0.00
Uniform Delay (d_1), s/veh		39.5			41.3	40.4	5.6	10.0	10.1	26.9	6.5	6.5
Incremental Delay (d_2), s/veh		0.8			1.4	22.7	0.0	14.5	15.2	1.9	0.7	0.7
Initial Queue Delay (d_3), s/veh		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh		40.2			42.6	63.1	5.6	24.6	25.4	28.8	7.2	7.2
Level of Service (LOS)		D			D	E	A	C	C	C	A	A
Approach Delay, s/veh / LOS	40.2	D		55.0	E		24.8	C		8.5	A	
Intersection Delay, s/veh / LOS	24.3						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.30	B	2.30	B	2.04	B	1.64	B
Bicycle LOS Score / LOS	0.64	A	1.09	A	1.89	B	1.22	A

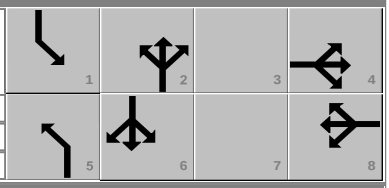
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2050	Analysis Period	1> 16:30
Intersection	Lotta St	File Name	03-05-07 Alt 2CD Minnesota Avenue 2050 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	20	25	5	40	25	130	5	1210	40	240	1620	5

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	13	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	0.7	1.7	64.6	11.4	0.0	0.0
Yellow	4.3	4.3	4.3	3.6	0.0	0.0
Red	1.0	1.0	1.6	1.6	0.0	0.0

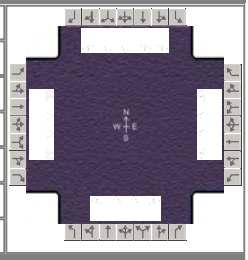
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		8.0		7.0	1.1	4.0	1.1	4.0
Phase Duration, s		16.6		16.6	6.0	70.5	12.9	77.5
Change Period, ($Y+R_c$), s		5.2		5.2	5.3	5.9	5.3	5.9
Max Allow Headway (*MAH*), s		3.5		3.5	3.1	0.0	4.1	0.0
Queue Clearance Time (g_s), s		4.8		11.2	2.1		6.7	
Green Extension Time (g_e), s		0.5		0.2	0.0	0.0	1.0	0.0
Phase Call Probability		1.00		1.00	0.17		1.00	
Max Out Probability		0.01		0.90	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h		56			72	144	7	827	822	267	903	903
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1643			1552	1543	1734	1821	1800	1734	1821	1819
Queue Service Time (g_s), s		0.0			1.3	9.2	0.1	26.8	27.5	4.7	28.0	28.0
Cycle Queue Clearance Time (g_c), s		2.8			4.2	9.2	0.1	26.8	27.5	4.7	28.0	28.0
Green Ratio (*g/C*)		0.11			0.11	0.11	0.65	0.65	0.65	0.74	0.72	0.72
Capacity (*c*), veh/h		237			235	176	192	1176	1162	316	1303	1302
Volume-to-Capacity Ratio (*X*)		0.234			0.308	0.822	0.034	0.703	0.707	0.843	0.693	0.693
Back of Queue (*Q*), ft/ln (95 th percentile)		58.5			75.9	187.6	1.9	316.1	326.7	205.1	363.4	363.4
Back of Queue (*Q*), veh/ln (95 th percentile)		2.3			3.0	7.4	0.1	12.4	12.9	8.1	14.3	14.3
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00			0.00	0.54	0.00	0.00	0.00	0.59	0.00	0.00
Uniform Delay (d_1), s/veh		40.5			41.0	43.3	8.7	9.3	9.7	18.4	8.0	8.0
Incremental Delay (d_2), s/veh		0.5			0.3	13.2	0.0	2.5	2.6	6.1	3.1	3.1
Initial Queue Delay (d_3), s/veh		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh		41.0			41.3	56.5	8.7	11.8	12.2	24.4	11.1	11.1
Level of Service (LOS)		D			D	E	A	B	B	C	B	B
Approach Delay, s/veh / LOS	41.0	D		51.4	D		12.0	B		12.8	B	
Intersection Delay, s/veh / LOS	15.0						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.30	B	2.30	B	1.87	B	1.63	B
Bicycle LOS Score / LOS	0.58	A	0.85	A	1.64	B	2.20	B

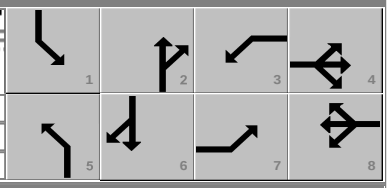
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2050	Analysis Period	1> 7:15
Intersection	57th Street	File Name	08 Minnesota at 57th 2050 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	140	290	115	80	705	260	140	850	35	110	545	75

Signal Information			
Cycle, s	117.2	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	6.3	1.1	36.6	5.7	3.2	37.5
Yellow	4.0	4.0	4.3	4.0	0.0	3.9
Red	1.0	1.0	1.6	1.0	0.0	1.9

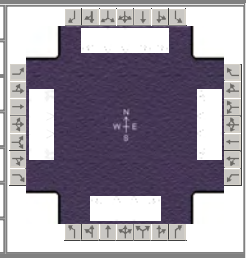
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	3.0	1.1	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	13.9	46.5	10.7	43.3	17.5	48.6	11.3	42.5
Change Period, ($Y+R_c$), s	5.0	5.8	5.0	5.8	5.0	5.9	5.0	5.9
Max Allow Headway (*MAH*), s	3.7	5.7	3.7	5.7	3.7	5.6	3.7	5.6
Queue Clearance Time (g_s), s	8.9	9.8	6.0	25.3	12.3	29.9	6.2	19.1
Green Extension Time (g_e), s	0.0	15.1	0.1	12.2	0.2	12.8	0.3	16.7
Phase Call Probability	0.99	1.00	0.94	1.00	0.99	1.00	0.98	1.00
Max Out Probability	1.00	0.14	0.69	0.34	0.03	0.56	0.00	0.36

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	156	322	111	89	783	194	156	944	33	122	606	72
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1734	1568	1734	1734	1543	1734	1734	1568	1684	1734	1568
Queue Service Time (g_s), s	6.9	7.8	5.8	4.0	23.3	11.5	10.3	27.9	1.6	4.2	17.1	3.9
Cycle Queue Clearance Time (g_c), s	6.9	7.8	5.8	4.0	23.3	11.5	10.3	27.9	1.6	4.2	17.1	3.9
Green Ratio (*g/C*)	0.40	0.35	0.35	0.37	0.32	0.32	0.11	0.36	0.36	0.05	0.31	0.31
Capacity (*c*), veh/h	278	1205	545	425	1110	494	185	1264	571	182	1082	489
Volume-to-Capacity Ratio (*X*)	0.560	0.267	0.204	0.209	0.706	0.394	0.843	0.747	0.058	0.672	0.560	0.148
Back of Queue (*Q*), ft/ln (95 th percentile)	136.3	150.5	100.7	76.5	385.1	199	218.8	448	27.7	84.6	297.1	67.8
Back of Queue (*Q*), veh/ln (95 th percentile)	5.4	5.9	4.0	3.0	15.2	7.8	8.6	17.6	1.1	3.3	11.7	2.7
Queue Storage Ratio (*RQ*) (95 th percentile)	0.68	0.00	0.50	0.31	0.00	0.88	0.88	0.00	0.11	0.28	0.00	0.68
Uniform Delay (d_1), s/veh	26.3	27.5	26.8	24.8	35.0	31.0	51.4	32.5	24.2	54.4	33.6	29.1
Incremental Delay (d_2), s/veh	1.7	0.2	0.3	0.2	1.6	0.9	9.4	2.3	0.1	3.2	0.8	0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	28.1	27.7	27.2	25.0	36.6	31.9	60.8	34.8	24.3	57.6	34.4	29.3
Level of Service (LOS)	C	C	C	C	D	C	E	C	C	E	C	C
Approach Delay, s/veh / LOS	27.7	C		34.7	C		38.1	D		37.5	D	
Intersection Delay, s/veh / LOS	35.2						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.45	B	2.60	C	2.56	C	2.46	B
Bicycle LOS Score / LOS	0.97	A	1.37	A	1.42	A	1.15	A

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2050	Analysis Period	1> 16:30
Intersection	57th Street	File Name	08 Minnesota at 57th 2050 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	155	850	135	75	515	180	135	705	210	475	1060	70

Signal Information			
Cycle, s	113.3	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	11.6	4.3		30.6	5.5	4.4	30.2					
Yellow	4.0	4.0		4.3	4.0	0.0	3.9					
Red	1.0	1.0		1.6	1.0	0.0	1.9					

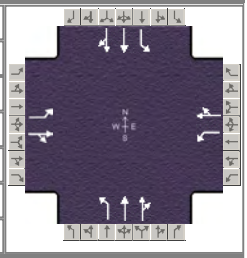
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	3.0	1.1	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	14.9	40.3	10.5	36.0	16.6	36.5	25.9	45.8
Change Period, ($Y+R_c$), s	5.0	5.8	5.0	5.8	5.0	5.9	5.0	5.9
Max Allow Headway (*MAH*), s	3.7	5.6	3.7	5.6	3.7	5.6	3.7	5.6
Queue Clearance Time (g_s), s	9.9	31.5	5.9	18.4	11.6	26.1	19.2	39.7
Green Extension Time (g_e), s	0.0	3.0	0.1	11.7	0.1	3.6	1.8	0.1
Phase Call Probability	1.00	1.00	0.93	1.00	0.99	1.00	1.00	1.00
Max Out Probability	1.00	1.00	0.62	0.69	1.00	1.00	0.00	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	172	944	128	83	572	133	150	783	233	528	1178	72
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1734	1568	1734	1734	1543	1734	1734	1568	1684	1734	1568
Queue Service Time (g_s), s	7.9	29.5	7.0	3.9	16.4	7.9	9.6	24.1	14.5	17.2	37.7	3.5
Cycle Queue Clearance Time (g_c), s	7.9	29.5	7.0	3.9	16.4	7.9	9.6	24.1	14.5	17.2	37.7	3.5
Green Ratio (*g/C*)	0.37	0.30	0.30	0.32	0.27	0.27	0.10	0.27	0.27	0.18	0.35	0.35
Capacity (*c*), veh/h	317	1056	478	164	923	411	178	936	423	623	1221	552
Volume-to-Capacity Ratio (*X*)	0.544	0.894	0.267	0.508	0.620	0.324	0.842	0.837	0.551	0.847	0.964	0.131
Back of Queue (*Q*), ft/ln (95 th percentile)	154.9	505.6	121.9	78.3	291	138.7	221.9	420.4	242.6	299.3	653.6	60.8
Back of Queue (*Q*), veh/ln (95 th percentile)	6.1	19.9	4.9	3.1	11.5	5.5	8.7	16.6	9.7	11.8	25.7	2.4
Queue Storage Ratio (*RQ*) (95 th percentile)	0.77	0.00	0.61	0.31	0.00	0.62	0.89	0.00	0.97	1.00	0.00	0.61
Uniform Delay (d_1), s/veh	27.1	37.6	29.8	31.6	36.5	33.4	49.9	39.0	35.5	44.6	36.0	24.9
Incremental Delay (d_2), s/veh	1.5	10.1	0.5	1.8	1.3	0.8	18.0	7.1	2.3	2.5	17.9	0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	28.6	47.7	30.3	33.4	37.8	34.2	67.9	46.1	37.7	47.1	53.9	25.1
Level of Service (LOS)	C	D	C	C	D	C	E	D	D	D	D	C
Approach Delay, s/veh / LOS	43.3	D		36.7	D		47.3	D		50.7	D	
Intersection Delay, s/veh / LOS	45.8						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.44	B	2.60	C	2.53	C	2.47	B
Bicycle LOS Score / LOS	1.51	B	1.14	A	1.45	A	1.95	B

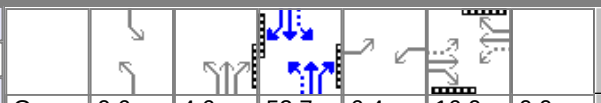
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2050	Analysis Period	1> 7:15
Intersection	33rd Street	File Name	09 Cliff at 33rd 2050 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				

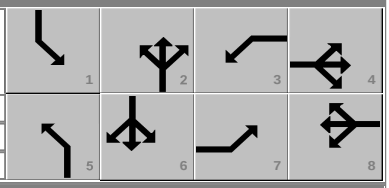


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	90	90	45	90	195	20	110	1180	15	5	360	60

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	0.6	4.6	52.7	6.4	16.0	0.0
Yellow	3.6	0.0	3.6	3.6	3.6	0.0
Red	1.0	0.0	1.5	1.0	1.9	0.0



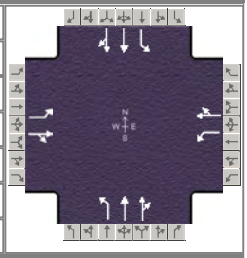
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	4.0	1.1	4.0	1.1	4.0
Phase Duration, s	11.0	21.5	11.0	21.5	9.7	62.4	5.2	57.8
Change Period, ($Y+R_c$), s	4.6	5.5	4.6	5.5	4.6	5.1	4.6	5.1
Max Allow Headway (*MAH*), s	4.2	4.2	4.2	4.2	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	6.8	10.0	6.8	14.9	5.0		2.2	
Green Extension Time (g_e), s	0.0	1.2	0.0	1.1	0.3	0.0	0.0	0.0
Phase Call Probability	0.94	1.00	0.94	1.00	0.97		0.14	
Max Out Probability	1.00	0.01	1.00	0.05	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	100	150		100	239		122	665	663	6	238	229
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1718		1734	1791		1734	1821	1813	1734	1821	1730
Queue Service Time (g_s), s	4.8	8.0		4.8	12.9		3.0	24.6	24.6	0.2	7.1	7.2
Cycle Queue Clearance Time (g_c), s	4.8	8.0		4.8	12.9		3.0	24.6	24.6	0.2	7.1	7.2
Green Ratio (*g/C*)	0.22	0.16		0.22	0.16		0.60	0.57	0.57	0.53	0.53	0.53
Capacity (*c*), veh/h	195	275		256	286		582	1043	1038	208	960	912
Volume-to-Capacity Ratio (*X*)	0.514	0.546		0.391	0.834		0.210	0.638	0.638	0.027	0.248	0.251
Back of Queue (*Q*), ft/ln (95 th percentile)	95.7	159.6		93.7	261.8		50.8	394.9	387.6	2.7	135.5	129.2
Back of Queue (*Q*), veh/ln (95 th percentile)	3.8	6.3		3.7	10.3		2.0	15.5	15.5	0.1	5.3	5.2
Queue Storage Ratio (*RQ*) (95 th percentile)	0.45	0.00		0.67	0.00		0.29	0.00	0.00	0.02	0.00	0.00
Uniform Delay (d_1), s/veh	33.2	38.7		32.5	40.7		9.2	14.4	14.4	13.4	12.9	12.9
Incremental Delay (d_2), s/veh	2.1	1.7		1.0	7.2		0.2	3.0	3.0	0.1	0.6	0.7
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	35.3	40.4		33.5	48.0		9.3	17.4	17.4	13.5	13.5	13.6
Level of Service (LOS)	D	D		C	D		A	B	B	B	B	B
Approach Delay, s/veh / LOS	38.3	D		43.7	D		16.7	B		13.5	B	
Intersection Delay, s/veh / LOS	21.9						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.30	B	2.30	B	1.89	B	1.89	B
Bicycle LOS Score / LOS	0.90	A	1.05	A	1.68	B	0.88	A

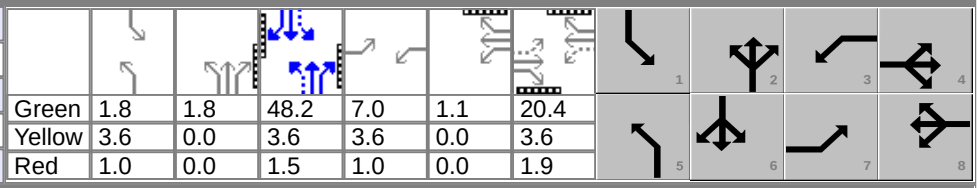
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2050	Analysis Period	1> 16:30
Intersection	33rd Street	File Name	09 Cliff at 33rd 2050 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	105	195	85	125	140	45	65	625	195	20	1205	90

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	1.8	1.8	48.2	7.0	1.1	20.4
Yellow	3.6	0.0	3.6	3.6	0.0	3.6
Red	1.0	0.0	1.5	1.0	0.0	1.9

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	4.0	1.1	4.0	1.1	4.0
Phase Duration, s	11.6	25.9	12.7	26.9	8.2	55.0	6.4	53.3
Change Period, ($Y+R_c$), s	4.6	5.5	4.6	5.5	4.6	5.1	4.6	5.1
Max Allow Headway (*MAH*), s	4.2	4.2	4.2	4.2	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	7.2	19.5	8.2	12.5	4.1		2.6	
Green Extension Time (g_e), s	0.0	0.9	0.0	1.6	0.1	0.0	0.0	0.0
Phase Call Probability	0.96	1.00	0.98	1.00	0.87		0.46	
Max Out Probability	1.00	0.95	1.00	0.05	0.02		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	117	311		139	206		72	475	436	22	726	713
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1727		1734	1745		1734	1821	1672	1734	1821	1776
Queue Service Time (g_s), s	5.2	17.5		6.2	10.5		2.1	17.7	17.7	0.6	34.4	34.7
Cycle Queue Clearance Time (g_c), s	5.2	17.5		6.2	10.5		2.1	17.7	17.7	0.6	34.4	34.7
Green Ratio (*g/C*)	0.27	0.20		0.28	0.21		0.52	0.50	0.50	0.50	0.48	0.48
Capacity (*c*), veh/h	298	352		242	374		185	909	835	289	877	855
Volume-to-Capacity Ratio (*X*)	0.391	0.885		0.573	0.550		0.391	0.522	0.523	0.077	0.828	0.833
Back of Queue (*Q*), ft/ln (95 th percentile)	101.8	355.5		126.5	204.2		39.2	308.7	285	11.7	575.7	561.4
Back of Queue (*Q*), veh/ln (95 th percentile)	4.0	14.0		5.0	8.0		1.5	12.2	11.4	0.5	22.7	22.5
Queue Storage Ratio (*RQ*) (95 th percentile)	0.47	0.00		0.90	0.00		0.22	0.00	0.00	0.10	0.00	0.00
Uniform Delay (d_1), s/veh	29.0	38.7		29.6	35.0		19.6	17.0	17.0	14.3	22.4	22.4
Incremental Delay (d_2), s/veh	0.8	18.0		3.0	1.3		1.3	2.1	2.3	0.1	8.9	9.3
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	29.8	56.7		32.6	36.2		21.0	19.1	19.3	14.4	31.2	31.8
Level of Service (LOS)	C	E		C	D		C	B	B	B	C	C
Approach Delay, s/veh / LOS	49.4	D		34.8	C		19.3	B		31.3	C	
Intersection Delay, s/veh / LOS	30.4						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.30	B	2.29	B	1.90	B	1.90	B
Bicycle LOS Score / LOS	1.19	A	1.06	A	1.30	A	1.69	B

HCS7 Two-Way Stop-Control Report

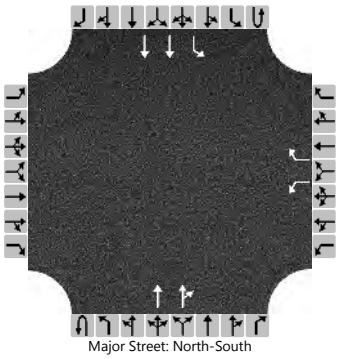
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/1/19
Analysis Year	2050
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at 36th St
Jurisdiction	Sioux Falls, SD
East/West Street	36th Street
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		1	0	1	0	0	2	0	0	1	2	0
Configuration						L		R			T	TR		L	T	
Volume (veh/h)						50		45			1385	95	0	60	630	
Percent Heavy Vehicles (%)						2		2					2	2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized						No										
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)						7.5		6.9						4.1		
Critical Headway (sec)						6.84		6.94						4.14		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.52		3.32						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						56		50						67		
Capacity, c (veh/h)						118		317						389		
v/c Ratio						0.47		0.16						0.17		
95% Queue Length, Q_{95} (veh)						2.1		0.6						0.6		
Control Delay (s/veh)						60.1		18.5						16.1		
Level of Service (LOS)						F		C						C		
Approach Delay (s/veh)						40.4								1.4		
Approach LOS						E										

HCS7 Two-Way Stop-Control Report

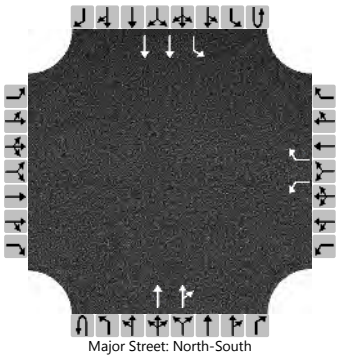
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/1/19
Analysis Year	2050
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at 36th St
Jurisdiction	Sioux Falls, SD
East/West Street	36th Street
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		1	0	1	0	0	2	0	0	1	2	0
Configuration						L		R			T	TR		L	T	
Volume (veh/h)						35		5			885	30	0	60	1415	
Percent Heavy Vehicles (%)						2		2					2	2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized						No										
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)						7.5		6.9						4.1		
Critical Headway (sec)						6.84		6.94						4.14		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.52		3.32						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						39		6						67		
Capacity, c (veh/h)						168		510						678		
v/c Ratio						0.23		0.01						0.10		
95% Queue Length, Q_{95} (veh)						0.9		0.0						0.3		
Control Delay (s/veh)						32.7		12.1						10.9		
Level of Service (LOS)						D		B						B		
Approach Delay (s/veh)						30.1								0.4		
Approach LOS						D										

HCS7 Two-Way Stop-Control Report

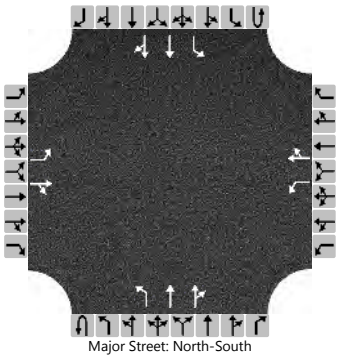
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/1/19
Analysis Year	2050
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at 38th/HS #1
Jurisdiction	Sioux Falls, SD
East/West Street	38th Street/HS #1
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	1	0		1	1	0	0	1	2	0	0	1	2	0
Configuration		L		TR		L		TR		L	T	TR		L	T	TR
Volume (veh/h)		10	5	95		155	10	100	0	75	1335	190	0	70	925	45
Percent Heavy Vehicles (%)		2	2	2		2	2	2	2	2			2	2		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5	6.5	6.9		7.5	6.5	6.9		4.1				4.1		
Critical Headway (sec)		7.54	6.54	6.94		7.54	6.54	6.94		4.14				4.14		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.52	4.02	3.32		3.52	4.02	3.32		2.22				2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		11		111		172		122		83				78		
Capacity, c (veh/h)				125		5		79		643				372		
v/c Ratio				0.89		36.63		1.55		0.13				0.21		
95% Queue Length, Q_{95} (veh)				5.6		23.7		10.0		0.4				0.8		
Control Delay (s/veh)				118.8		17558.0		392.5		11.4				17.2		
Level of Service (LOS)				F		F		F		B				C		
Approach Delay (s/veh)					10432.7				0.5				1.2			
Approach LOS					F											

HCS7 Two-Way Stop-Control Report

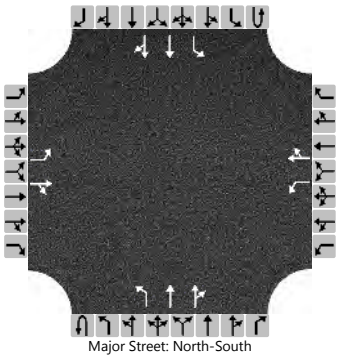
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/1/19
Analysis Year	2050
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at 38th/HS #1
Jurisdiction	Sioux Falls, SD
East/West Street	38th Street/HS #1
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	1	0		1	1	0	0	1	2	0	0	1	2	0
Configuration		L		TR		L		TR		L	T	TR		L	T	TR
Volume (veh/h)		20	0	95		100	5	20	0	55	1060	20	0	5	1580	30
Percent Heavy Vehicles (%)		2	2	2		2	2	2	2	2			2	2		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

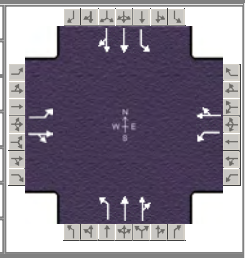
Base Critical Headway (sec)		7.5	6.5	6.9		7.5	6.5	6.9		4.1				4.1		
Critical Headway (sec)		7.54	6.54	6.94		7.54	6.54	6.94		4.14				4.14		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.52	4.02	3.32		3.52	4.02	3.32		2.22				2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		22		106		111		28		61				6		
Capacity, c (veh/h)		6		284		13		42		342				577		
v/c Ratio		3.54		0.37		8.31		0.66		0.18				0.01		
95% Queue Length, Q_{95} (veh)		4.1		1.7		15.0		2.4		0.6				0.0		
Control Delay (s/veh)		2262.4		25.0		3848.1		188.9		17.8				11.3		
Level of Service (LOS)		F		C		F		F		C				B		
Approach Delay (s/veh)	414.1				3116.2				0.9				0.0			
Approach LOS	F				F											

HCS7 Signalized Intersection Results Summary

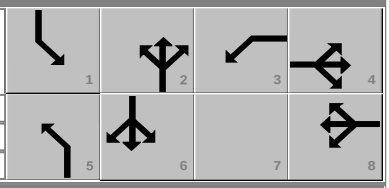
General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 4, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2050	Analysis Period	1> 7:15
Intersection	38th Street/LHS Access	File Name	11 Cliff at 38th Signal 2050 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	10	5	95	165	10	100	75	1335	190	70	925	45

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	3.5	59.6	7.4	9.7	0.0	0.0
Yellow	3.6	3.6	3.6	3.6	0.0	0.0
Red	1.0	1.5	1.0	1.9	0.0	0.0



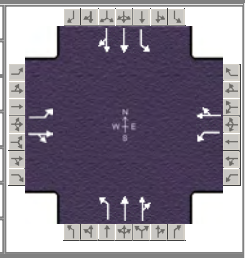
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4	3	8	5	2	1	6
Case Number		6.3	1.0	4.0	1.1	4.0	1.1	4.0
Phase Duration, s		15.2	12.0	27.2	8.2	64.7	8.1	64.6
Change Period, ($Y+R_c$), s		5.5	4.6	5.5	4.6	5.1	4.6	5.1
Max Allow Headway (*MAH*), s		4.4	3.2	4.4	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s		8.9	9.4	8.6	3.9		3.7	
Green Extension Time (g_e), s		0.8	0.0	0.9	0.2	0.0	0.2	0.0
Phase Call Probability		1.00	0.99	1.00	0.90		0.88	
Max Out Probability		0.01	1.00	0.00	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	11	111		183	122		83	856	839	78	543	534
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1269	1555		1734	1565		1734	1821	1742	1734	1821	1791
Queue Service Time (g_s), s	0.8	6.9		7.4	6.6		1.9	35.8	37.5	1.7	17.2	17.2
Cycle Queue Clearance Time (g_c), s	0.8	6.9		7.4	6.6		1.9	35.8	37.5	1.7	17.2	17.2
Green Ratio (*g/C*)	0.10	0.10		0.19	0.22		0.63	0.60	0.60	0.63	0.59	0.59
Capacity (*c*), veh/h	195	151		236	340		356	1085	1038	191	1083	1065
Volume-to-Capacity Ratio (*X*)	0.057	0.737		0.778	0.360		0.234	0.789	0.808	0.406	0.502	0.502
Back of Queue (*Q*), ft/ln (95 th percentile)	11.7	134.6		87.3	117.2		30.8	549.7	547.9	42.6	287.7	279.7
Back of Queue (*Q*), veh/ln (95 th percentile)	0.5	5.3		3.4	4.6		1.2	21.6	21.9	1.7	11.3	11.2
Queue Storage Ratio (*RQ*) (95 th percentile)	0.06	0.00		0.44	0.00		0.15	0.00	0.00	0.21	0.00	0.00
Uniform Delay (d_1), s/veh	41.1	43.9		39.0	33.3		8.9	15.4	15.8	17.8	11.7	11.7
Incremental Delay (d_2), s/veh	0.1	6.8		13.9	0.6		0.3	5.8	6.8	1.4	1.7	1.7
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	41.3	50.7		52.9	33.9		9.3	21.3	22.5	19.2	13.4	13.4
Level of Service (LOS)	D	D		D	C		A	C	C	B	B	B
Approach Delay, s/veh / LOS	49.9	D		45.3	D		21.3	C		13.8	B	
Intersection Delay, s/veh / LOS	21.9						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.31	B	2.29	B	1.88	B	1.88	B
Bicycle LOS Score / LOS	0.69	A	0.99	A	1.95	B	1.44	A

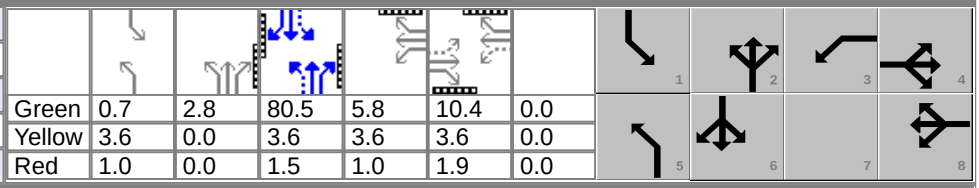
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 4, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2050	Analysis Period	1> 16:30
Intersection	38th Street/LHS Access	File Name	11 Cliff at 38th Signal 2050 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	20	0	95	65	5	20	55	1060	20	5	1580	30

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	0.7	2.8	80.5	5.8	10.4	0.0
Yellow	3.6	0.0	3.6	3.6	3.6	0.0
Red	1.0	0.0	1.5	1.0	1.9	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4	3	8	5	2	1	6
Case Number		6.3	1.0	4.0	1.1	4.0	1.1	4.0
Phase Duration, s		15.9	10.4	26.4	8.1	88.4	5.3	85.6
Change Period, ($Y+R_c$), s		5.5	4.6	5.5	4.6	5.1	4.6	5.1
Max Allow Headway (*MAH*), s		4.4	3.2	4.4	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s		10.0	6.4	3.8	3.3		2.1	
Green Extension Time (g_e), s		0.4	0.0	0.6	0.1	0.0	0.0	0.0
Phase Call Probability		0.99	0.91	1.00	0.87		0.17	
Max Out Probability		0.00	1.00	0.00	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	22	106		72	28		61	602	598	6	895	894
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1382	1543		1734	1592		1734	1821	1809	1734	1821	1809
Queue Service Time (g_s), s	1.8	8.0		4.4	1.8		1.3	18.1	18.1	0.1	38.2	38.6
Cycle Queue Clearance Time (g_c), s	1.8	8.0		4.4	1.8		1.3	18.1	18.1	0.1	38.2	38.6
Green Ratio (*g/C*)	0.09	0.09		0.15	0.17		0.70	0.69	0.69	0.68	0.67	0.67
Capacity (*c*), veh/h	180	134		170	277		203	1264	1255	315	1221	1213
Volume-to-Capacity Ratio (*X*)	0.123	0.788		0.425	0.100		0.302	0.476	0.477	0.018	0.733	0.737
Back of Queue (*Q*), ft/ln (95 th percentile)	29.1	159.3		88.6	32.4		30.8	289.3	283.4	2.1	561	554.2
Back of Queue (*Q*), veh/ln (95 th percentile)	1.1	6.3		3.5	1.3		1.2	11.4	11.3	0.1	22.1	22.2
Queue Storage Ratio (*RQ*) (95 th percentile)	0.15	0.00		0.44	0.00		0.15	0.00	0.00	0.01	0.00	0.00
Uniform Delay (d_1), s/veh	50.9	53.7		45.4	41.7		13.7	8.4	8.4	7.6	12.8	12.9
Incremental Delay (d_2), s/veh	0.3	9.8		0.6	0.2		0.8	1.3	1.3	0.0	3.9	4.0
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	51.2	63.5		46.1	41.8		14.5	9.7	9.7	7.6	16.7	16.9
Level of Service (LOS)	D	E		D	D		B	A	A	A	B	B
Approach Delay, s/veh / LOS	61.3	E		44.9	D		9.9	A		16.8	B	
Intersection Delay, s/veh / LOS	16.7						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.31	B	2.31	B	1.87	B	1.87	B
Bicycle LOS Score / LOS	0.70	A	0.65	A	1.53	B	1.97	B

HCS7 Two-Way Stop-Control Report

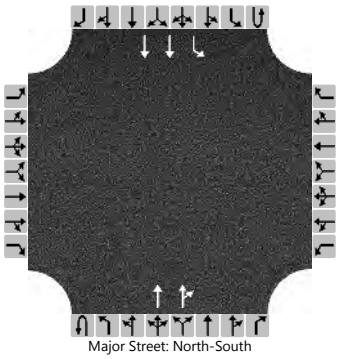
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/1/19
Analysis Year	2050
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at HS #2
Jurisdiction	Sioux Falls, SD
East/West Street	HS #2 Entrance
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	0	2	0	0	1	2	0
Configuration											T	TR		L	T	
Volume (veh/h)											1600	220	0	125	1010	
Percent Heavy Vehicles (%)													2	2		
Proportion Time Blocked																
Percent Grade (%)																
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)														4.1		
Critical Headway (sec)														4.14		
Base Follow-Up Headway (sec)														2.2		
Follow-Up Headway (sec)														2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)														139		
Capacity, c (veh/h)														277		
v/c Ratio														0.50		
95% Queue Length, Q_{95} (veh)														2.6		
Control Delay (s/veh)														30.3		
Level of Service (LOS)														D		
Approach Delay (s/veh)													3.3			
Approach LOS																

HCS7 Two-Way Stop-Control Report

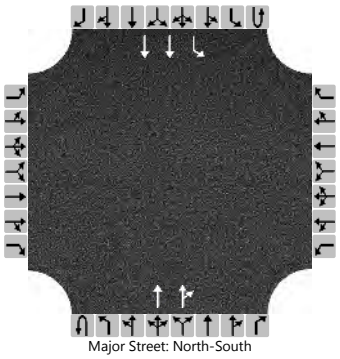
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/1/19
Analysis Year	2050
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at HS #2
Jurisdiction	Sioux Falls, SD
East/West Street	HS #2 Entrance
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	0	2	0	0	1	2	0
Configuration											T	TR		L	T	
Volume (veh/h)											1135	35	0	15	1725	
Percent Heavy Vehicles (%)													2	2		
Proportion Time Blocked																
Percent Grade (%)																
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)														4.1		
Critical Headway (sec)														4.14		
Base Follow-Up Headway (sec)														2.2		
Follow-Up Headway (sec)														2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)														17		
Capacity, c (veh/h)														529		
v/c Ratio														0.03		
95% Queue Length, Q_{95} (veh)														0.1		
Control Delay (s/veh)														12.0		
Level of Service (LOS)														B		
Approach Delay (s/veh)													0.1			
Approach LOS																

HCS7 Two-Way Stop-Control Report

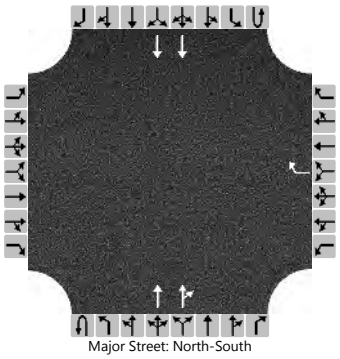
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/1/19
Analysis Year	2050
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at HS #1
Jurisdiction	Sioux Falls, SD
East/West Street	HS #1
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	1	0	0	2	0	0	0	2	0
Configuration								R			T	TR			T	
Volume (veh/h)								65			1755	465			960	
Percent Heavy Vehicles (%)								2								
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized						Yes										
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)								6.9								
Critical Headway (sec)								6.94								
Base Follow-Up Headway (sec)								3.3								
Follow-Up Headway (sec)								3.32								

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)								72								
Capacity, c (veh/h)								168								
v/c Ratio								0.43								
95% Queue Length, Q_{95} (veh)								1.9								
Control Delay (s/veh)								41.5								
Level of Service (LOS)								E								
Approach Delay (s/veh)						41.5										
Approach LOS						E										

HCS7 Two-Way Stop-Control Report

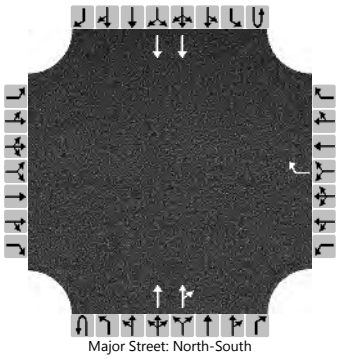
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/1/19
Analysis Year	2050
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at HS #1
Jurisdiction	Sioux Falls, SD
East/West Street	HS #1
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	1	0	0	2	0	0	0	2	0
Configuration								R			T	TR			T	
Volume (veh/h)								10			1160	15			1725	
Percent Heavy Vehicles (%)								2								
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized						Yes										
Median Type | Storage						Undivided										

Critical and Follow-up Headways

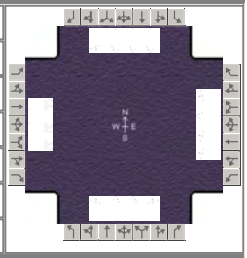
Base Critical Headway (sec)								6.9								
Critical Headway (sec)								6.94								
Base Follow-Up Headway (sec)								3.3								
Follow-Up Headway (sec)								3.32								

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)								11								
Capacity, c (veh/h)								410								
v/c Ratio								0.03								
95% Queue Length, Q_{95} (veh)								0.1								
Control Delay (s/veh)								14.0								
Level of Service (LOS)								B								
Approach Delay (s/veh)						14.0										
Approach LOS						B										

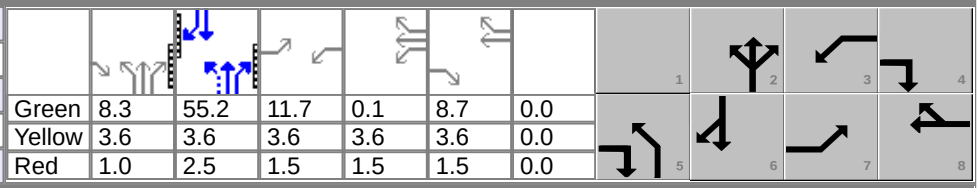
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 1, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2050	Analysis Period	1> 7:15
Intersection	41st St/SB I-229	File Name	14-16 Alt-1 Cliff Avenue 2050 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	140		120	430	180	150	190	1930	505		890	110

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	71	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	8.3	55.2	11.7	0.1	8.7	0.0
Yellow	3.6	3.6	3.6	3.6	3.6	0.0
Red	1.0	2.5	1.5	1.5	1.5	0.0

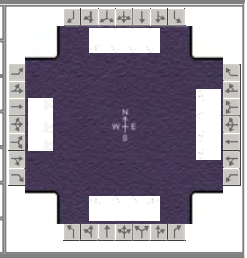
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2		6
Case Number	2.0	3.0	2.0	3.0	1.0	3.0		7.3
Phase Duration, s	16.8	13.8	22.0	19.0	12.9	74.2		61.3
Change Period, ($Y+R_c$), s	5.1	5.1	5.1	5.1	4.6	6.1		6.1
Max Allow Headway (*MAH*), s	3.1	5.3	3.2	5.3	5.2	0.0		0.0
Queue Clearance Time (g_s), s	11.7	6.8	17.4	13.9	8.2			
Green Extension Time (g_e), s	0.1	0.6	0.0	0.1	0.1	0.0		0.0
Phase Call Probability	0.99	1.00	1.00	1.00	1.00			
Max Out Probability	0.91	1.00	1.00	1.00	1.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14	3	8	18	5	2	12		6	16
Adjusted Flow Rate (*v*), veh/h	156		133	478	200	111	211	2144	450		1258	120
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734		1366	1684	1821	1568	1734	1734	1610		1654	
Queue Service Time (g_s), s	9.7		4.8	15.4	11.9	7.3	6.2	67.9	16.3		13.2	
Cycle Queue Clearance Time (g_c), s	9.7		4.8	15.4	11.9	7.3	6.2	67.9	16.3		13.2	
Green Ratio (*g/C*)	0.11		0.15	0.15	0.13	0.13	0.60	0.62	0.62		0.50	
Capacity (*c*), veh/h	184		422	517	231	199	365	2147	997		2489	
Volume-to-Capacity Ratio (*X*)	0.846		0.316	0.923	0.867	0.559	0.578	0.999	0.451		0.505	
Back of Queue (*Q*), ft/ln (95 th percentile)	219.3		74.3	320.2	292.1	138.7	115.3	998.6	246.1		175.9	
Back of Queue (*Q*), veh/ln (95 th percentile)	8.6		2.9	12.6	11.5	5.5	4.5	39.3	9.8		6.9	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00		0.15	0.64	0.00	0.46	0.23	0.00	0.82		0.00	
Uniform Delay (d_1), s/veh	48.3		41.3	45.9	47.1	45.1	12.3	20.9	11.1		10.4	
Incremental Delay (d_2), s/veh	16.4		0.6	22.0	27.7	4.3	2.5	19.2	1.5		0.6	
Initial Queue Delay (d_3), s/veh	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	
Control Delay (*d*), s/veh	64.7		41.9	67.9	74.9	49.4	14.7	40.1	12.6		11.1	0.0
Level of Service (LOS)	E		D	E	E	D	B	D	B		B	A
Approach Delay, s/veh / LOS	54.2		D	67.1		E	33.8		C	10.1		B
Intersection Delay, s/veh / LOS	33.7						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.75	C	2.50	B	2.31	B	2.09	B
Bicycle LOS Score / LOS		F	1.79	B	2.80	C	1.08	A

HCS7 Signalized Intersection Results Summary

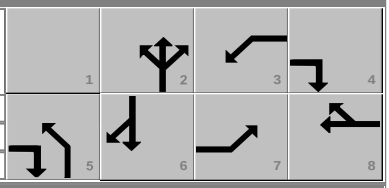
General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 1, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2050	Analysis Period	1> 16:30
Intersection	41st St/SB I-229	File Name	14-16 Alt-1 Cliff Avenue 2050 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	180		250	580	195	135	145	860	185		1570	190

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	62	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	8.2	51.1	14.4	2.4	7.9	0.0
Yellow	3.6	3.6	3.6	3.6	3.6	0.0
Red	1.0	2.5	1.5	1.5	1.5	0.0



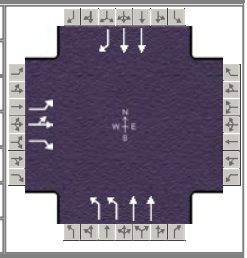
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2		6
Case Number	2.0	3.0	2.0	3.0	1.0	3.0		7.3
Phase Duration, s	19.5	13.0	27.0	20.5	12.8	70.0		57.2
Change Period, ($Y+R_c$), s	5.1	5.1	5.1	5.1	4.6	6.1		6.1
Max Allow Headway (*MAH*), s	3.1	5.3	3.2	5.3	5.2	0.0		0.0
Queue Clearance Time (g_s), s	14.5	9.9	22.8	14.8	7.5			
Green Extension Time (g_e), s	0.0	0.0	0.0	0.2	0.8	0.0		0.0
Phase Call Probability	1.00	1.00	1.00	1.00	0.99			
Max Out Probability	1.00	1.00	1.00	1.00	0.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14	3	8	18	5	2	12		6	16
Adjusted Flow Rate (*v*), veh/h	200		278	644	217	111	161	956	150		2245	272
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734		1366	1684	1821	1568	1734	1734	1610		1654	
Queue Service Time (g_s), s	12.5		7.9	20.8	12.8	7.2	5.5	17.5	4.7		47.7	
Cycle Queue Clearance Time (g_c), s	12.5		7.9	20.8	12.8	7.2	5.5	17.5	4.7		47.7	
Green Ratio (*g/C*)	0.13		0.15	0.20	0.14	0.14	0.56	0.58	0.58		0.46	
Capacity (*c*), veh/h	228		401	671	254	219	201	2014	935		2302	
Volume-to-Capacity Ratio (*X*)	0.878		0.693	0.961	0.852	0.508	0.803	0.474	0.160		0.975	
Back of Queue (*Q*), ft/ln (95 th percentile)	289.5		176.4	416.2	302.6	133.3	123.2	280.7	78		475.5	
Back of Queue (*Q*), veh/ln (95 th percentile)	11.4		6.9	16.4	11.9	5.3	4.9	11.1	3.1		18.7	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00		0.35	0.83	0.00	0.44	0.25	0.00	0.26		0.00	
Uniform Delay (d_1), s/veh	46.9		44.6	43.6	46.2	43.8	27.0	13.3	10.7		19.7	
Incremental Delay (d_2), s/veh	27.6		5.6	25.2	23.9	2.7	10.1	0.8	0.4		5.4	
Initial Queue Delay (d_3), s/veh	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	
Control Delay (*d*), s/veh	74.5		50.2	68.8	70.1	46.5	37.2	14.1	11.0		25.1	0.0
Level of Service (LOS)	E		D	E	E	D	D	B	B		C	A
Approach Delay, s/veh / LOS	60.3		E	66.6		E	16.7		B	22.4		C
Intersection Delay, s/veh / LOS	32.7						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.68	C	2.46	B	2.30	B	2.10	B
Bicycle LOS Score / LOS		F	2.09	B	1.53	B	1.56	B

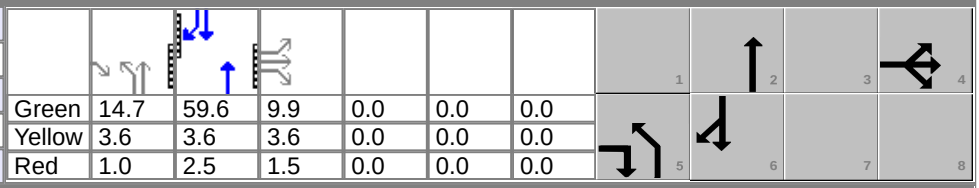
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 1, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2050	Analysis Period	1> 7:15
Intersection	41st St	File Name	14-16 Alt-6 Cliff Avenue 2050 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	140	0	120				370	2080			890	110

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	84	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	14.7	59.6	9.9	0.0	0.0	0.0			
Yellow	3.6	3.6	3.6	0.0	0.0	0.0			
Red	1.0	2.5	1.5	0.0	0.0	0.0			

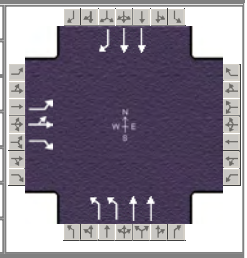
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			5	2		6
Case Number		9.0			2.0	4.0		7.3
Phase Duration, s		15.0			19.3	85.0		65.7
Change Period, ($Y+R_c$), s		5.1			4.6	6.1		6.1
Max Allow Headway (*MAH*), s		5.3			5.2	0.0		0.0
Queue Clearance Time (g_s), s		10.6			13.9			
Green Extension Time (g_e), s		0.0			0.9	0.0		0.0
Phase Call Probability		1.00			1.00			
Max Out Probability		1.00			1.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14				5	2			6	16
Adjusted Flow Rate (*v*), veh/h	78	0	167				411	2311			1258	120
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1850	1633				1684	1734			1734	1568
Queue Service Time (g_s), s	4.2	0.0	8.6				11.9	42.2			6.6	0.4
Cycle Queue Clearance Time (g_c), s	4.2	0.0	8.6				11.9	42.2			6.6	0.4
Green Ratio (*g/C*)	0.10	0.10	0.25				0.94	0.79			0.60	0.60
Capacity (*c*), veh/h	172	183	389				496	2736			2066	934
Volume-to-Capacity Ratio (*X*)	0.453	0.000	0.429				0.830	0.845			0.609	0.129
Back of Queue (*Q*), ft/ln (95 th percentile)	87.5	0	156.4				237.7	435.5			65.7	7.7
Back of Queue (*Q*), veh/ln (95 th percentile)	3.4	0.0	6.2				9.4	17.1			2.6	0.3
Queue Storage Ratio (*RQ*) (95 th percentile)	0.44	0.00	0.45				0.79	0.00			0.00	0.08
Uniform Delay (d_1), s/veh	42.5	0.0	31.6				41.4	6.7			1.9	0.9
Incremental Delay (d_2), s/veh	2.6	0.0	1.1				9.3	3.4			1.1	0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0				0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	45.1	0.0	32.7				50.7	10.1			3.0	1.1
Level of Service (LOS)	D		C				D	B			A	A
Approach Delay, s/veh / LOS	36.7	D		0.0			16.2	B		2.8	A	
Intersection Delay, s/veh / LOS	13.1						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.61	C	2.35	B	1.38	A	2.30	B
Bicycle LOS Score / LOS	0.89	A		A	2.64	C	1.38	A

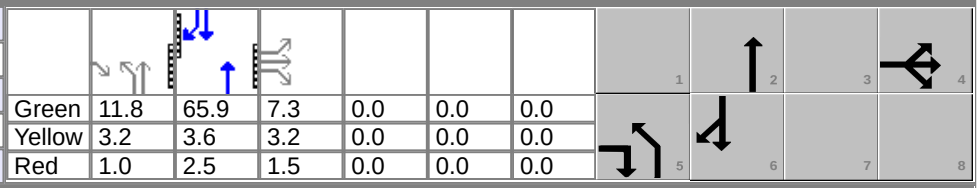
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 1, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2050	Analysis Period	1> 16:30
Intersection	41st St	File Name	14-16 Alt-6 Cliff Avenue 2050 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	180	0	250				340	995			1570	190

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	80	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	11.8	65.9	7.3	0.0	0.0	0.0						
Yellow	3.2	3.6	3.2	0.0	0.0	0.0						
Red	1.0	2.5	1.5	0.0	0.0	0.0						

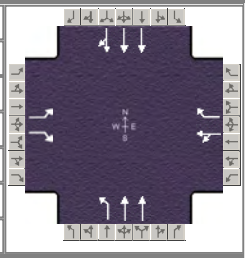
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			5	2		6
Case Number		9.0			2.0	4.0		7.3
Phase Duration, s		12.0			16.0	88.0		72.0
Change Period, ($Y+R_c$), s		4.7			4.2	6.1		6.1
Max Allow Headway (*MAH*), s		5.3			5.2	0.0		0.0
Queue Clearance Time (g_s), s		9.3			13.1			
Green Extension Time (g_e), s		0.0			0.0	0.0		0.0
Phase Call Probability		1.00			1.00			
Max Out Probability		1.00			1.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14				5	2			6	16
Adjusted Flow Rate (*v*), veh/h	100	0	267				378	1106			2252	237
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1850	1615				1684	1734			1734	1568
Queue Service Time (g_s), s	5.7	0.0	7.3				11.1	8.5			59.0	1.2
Cycle Queue Clearance Time (g_c), s	5.7	0.0	7.3				11.1	8.5			59.0	1.2
Green Ratio (*g/C*)	0.07	0.07	0.19				0.12	0.82			0.66	0.66
Capacity (*c*), veh/h	127	135	300				397	2840			2285	1033
Volume-to-Capacity Ratio (*X*)	0.790	0.000	0.889				0.950	0.389			0.986	0.229
Back of Queue (*Q*), ft/ln (95 th percentile)	156.5	0	334.7				268.3	86.6			287.7	17.9
Back of Queue (*Q*), veh/ln (95 th percentile)	6.2	0.0	13.2				10.6	3.4			11.3	0.7
Queue Storage Ratio (*RQ*) (95 th percentile)	0.78	0.00	0.96				0.89	0.00			0.00	0.18
Uniform Delay (d_1), s/veh	45.6	0.0	39.3				43.8	2.4			5.8	1.1
Incremental Delay (d_2), s/veh	29.0	0.0	26.5				32.8	0.4			12.6	0.4
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0				0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	74.6	0.0	65.8				76.6	2.8			18.4	1.5
Level of Service (LOS)	E		E				E	A			B	A
Approach Delay, s/veh / LOS	68.2	E		0.0			21.6	C		16.8	B	
Intersection Delay, s/veh / LOS	22.8						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.61	C	2.35	B	1.37	A	2.37	B
Bicycle LOS Score / LOS	1.09	A		A	1.62	B	2.08	B

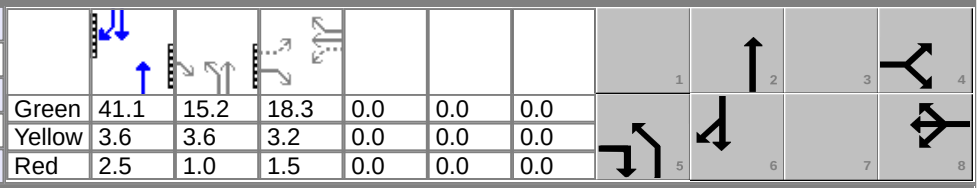
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 1, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2050	Analysis Period	1> 7:15
Intersection	41st St/SB I-229	File Name	14-16 Alt-7 Cliff Avenue 2050 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	140		120	0	180	150	190	1930			890	110

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	22	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	41.1	15.2	18.3	0.0	0.0	0.0
Yellow	3.6	3.6	3.2	0.0	0.0	0.0
Red	2.5	1.0	1.5	0.0	0.0	0.0

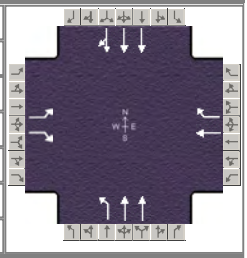
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2		6
Case Number		5.0		7.0	2.0	4.0		8.3
Phase Duration, s		23.0		23.0	19.8	67.0		47.2
Change Period, ($Y+R_c$), s		4.7		4.7	6.1	6.1		6.1
Max Allow Headway (*MAH*), s		4.1		4.1	5.2	0.0		0.0
Queue Clearance Time (g_s), s		20.3		10.8	12.6			
Green Extension Time (g_e), s		0.0		1.4	1.2	0.0		0.0
Phase Call Probability		1.00		1.00	0.99			
Max Out Probability		1.00		0.33	1.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14	3	8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h	156		89		0	167	211	2144			933	445
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1182		1543		0	1568	1734	1734			1821	1737
Queue Service Time (g_s), s	9.5		3.5		0.0	8.5	10.6	47.2			12.6	6.8
Cycle Queue Clearance Time (g_c), s	18.3		3.5		0.0	8.5	10.6	47.2			12.6	6.8
Green Ratio (*g/C*)	0.20		0.36			0.20	0.60	0.68			0.46	0.46
Capacity (*c*), veh/h	204		551			319	266	2346			1659	791
Volume-to-Capacity Ratio (*X*)	0.762		0.161		0.000	0.523	0.793	0.914			0.562	0.562
Back of Queue (*Q*), ft/ln (95 th percentile)	196.7		57.1		0	146.1	239.3	598.9			83	89.5
Back of Queue (*Q*), veh/ln (95 th percentile)	7.7		2.2		0.0	5.8	9.4	23.6			3.3	3.6
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00		0.16		0.00	0.49	0.80	0.00			0.00	0.00
Uniform Delay (d_1), s/veh	41.2		19.8			32.0	36.7	12.3			4.4	4.3
Incremental Delay (d_2), s/veh	16.4		0.2		0.0	0.8	15.8	6.9			1.1	2.4
Initial Queue Delay (d_3), s/veh	0.0		0.0		0.0	0.0	0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	57.6		20.0			32.7	52.5	19.2			5.5	6.7
Level of Service (LOS)	E		B			C	D	B			A	A
Approach Delay, s/veh / LOS	43.9	D		32.8	C		22.2	C		5.9	A	
Intersection Delay, s/veh / LOS	19.2						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.59	C	2.33	B	1.63	B	1.99	B
Bicycle LOS Score / LOS		F	1.09	A	2.34	B	1.08	A

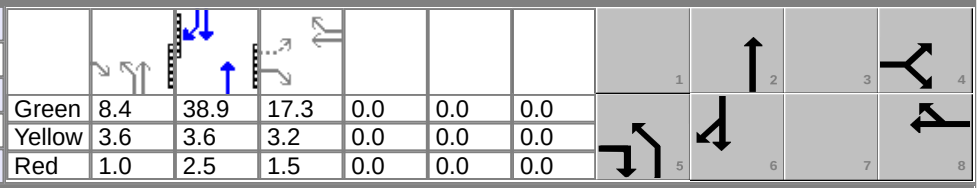
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 1, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2050	Analysis Period	1> 16:30
Intersection	41st St/SB I-229	File Name	14-16 Alt-7 Cliff Avenue 2050 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	180		250		195	135	145	860			1570	190

Signal Information			
Cycle, s	80.0	Reference Phase	2
Offset, s	65	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	8.4	38.9	17.3	0.0	0.0	0.0
Yellow	3.6	3.6	3.2	0.0	0.0	0.0
Red	1.0	2.5	1.5	0.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2		6
Case Number		5.0		7.0	2.0	4.0		8.3
Phase Duration, s		22.0		22.0	13.0	58.0		45.0
Change Period, ($Y+R_c$), s		4.7		4.7	4.6	6.1		6.1
Max Allow Headway (*MAH*), s		3.4		3.4	3.2	0.0		0.0
Queue Clearance Time (g_s), s		19.3		10.5	9.3			
Green Extension Time (g_e), s		0.0		1.3	0.0	0.0		0.0
Phase Call Probability		1.00		1.00	0.97			
Max Out Probability		1.00		0.27	1.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14		8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h	200		233		217	150	161	956			1674	815
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1165		1543		1821	1568	1734	1734			1821	1731
Queue Service Time (g_s), s	8.8		9.7		8.5	6.6	7.3	10.7			22.9	36.3
Cycle Queue Clearance Time (g_c), s	17.3		9.7		8.5	6.6	7.3	10.7			22.9	36.3
Green Ratio (*g/C*)	0.22		0.32		0.22	0.22	0.11	0.65			0.49	0.49
Capacity (*c*), veh/h	219		496		394	339	182	2250			1771	842
Volume-to-Capacity Ratio (*X*)	0.915		0.471		0.550	0.442	0.885	0.425			0.945	0.969
Back of Queue (*Q*), ft/ln (95 th percentile)	258		151.9		168	109.8	213.7	156.5			431.3	510.4
Back of Queue (*Q*), veh/ln (95 th percentile)	10.2		6.0		6.6	4.4	8.4	6.2			17.0	20.4
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00		0.43		0.00	0.37	0.71	0.00			0.00	0.00
Uniform Delay (d_1), s/veh	37.2		21.7		27.9	27.2	35.3	6.8			15.9	17.7
Incremental Delay (d_2), s/veh	37.7		0.3		1.0	0.3	35.5	0.6			7.0	16.1
Initial Queue Delay (d_3), s/veh	0.0		0.0		0.0	0.0	0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	74.8		22.0		28.8	27.5	70.8	7.4			23.0	33.8
Level of Service (LOS)	E		C		C	C	E	A			C	C
Approach Delay, s/veh / LOS	46.4	D		28.3	C		16.5	B		26.5	C	
Intersection Delay, s/veh / LOS	26.1						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.58	C	2.32	B	1.64	B	1.95	B
Bicycle LOS Score / LOS		F	1.09	A	1.32	A	1.55	B

HCS7 Two-Way Stop-Control Report

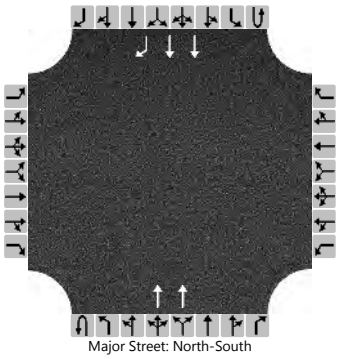
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/1/19
Analysis Year	2050
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at SB I-229 Ent
Jurisdiction	Sioux Falls, SD
East/West Street	SB I-229 Entrance Ramp
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	0	2	0	0	0	2	1
Configuration											T				T	R
Volume (veh/h)											2625				1185	255
Percent Heavy Vehicles (%)																
Proportion Time Blocked																
Percent Grade (%)																
Right Turn Channelized														No		
Median Type | Storage	Left Only								1							

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)																
Capacity, c (veh/h)																
v/c Ratio																
95% Queue Length, Q_{95} (veh)																
Control Delay (s/veh)																
Level of Service (LOS)																
Approach Delay (s/veh)																
Approach LOS																

HCS7 Two-Way Stop-Control Report

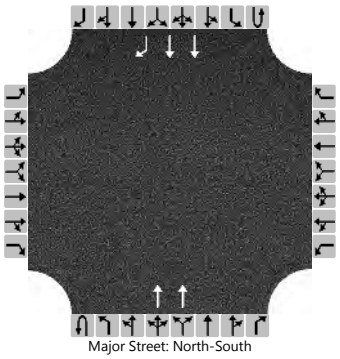
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/1/19
Analysis Year	2050
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at SB I-229 Ent
Jurisdiction	Sioux Falls, SD
East/West Street	SB I-229 Entrance Ramp
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	0	2	0	0	0	2	1
Configuration											T				T	R
Volume (veh/h)											1190				1745	655
Percent Heavy Vehicles (%)																
Proportion Time Blocked																
Percent Grade (%)																
Right Turn Channelized														No		
Median Type | Storage	Left Only								1							

Critical and Follow-up Headways

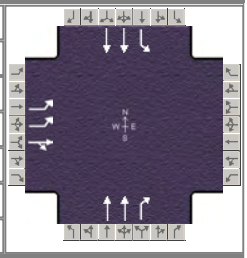
Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)																
Capacity, c (veh/h)																
v/c Ratio																
95% Queue Length, Q_{95} (veh)																
Control Delay (s/veh)																
Level of Service (LOS)																
Approach Delay (s/veh)																
Approach LOS																

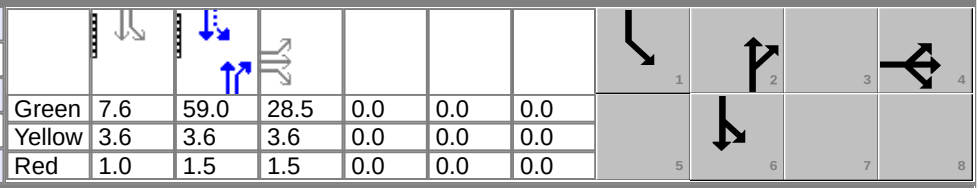
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 1, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2050	Analysis Period	1> 7:15
Intersection	I-229 South Ramp	File Name	14-16 Alt-1 Cliff Avenue 2050 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	705	0	225					1920	470	145	1040	

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	73	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	7.6	59.0	28.5	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.0	1.5	1.5	0.0	0.0	0.0

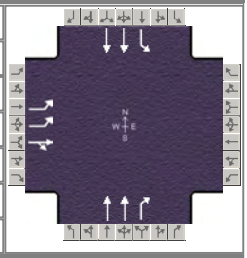
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4				2	1	6
Case Number		10.0				7.3	1.0	4.0
Phase Duration, s		33.6				64.1	12.2	76.4
Change Period, ($Y+R_c$), s		5.1				5.1	4.6	5.1
Max Allow Headway (*MAH*), s		5.2				0.0	5.2	0.0
Queue Clearance Time (g_s), s		26.7					7.4	
Green Extension Time (g_e), s		1.9				0.0	0.3	0.0
Phase Call Probability		1.00					0.99	
Max Out Probability		1.00					1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14					2	12	1	6	
Adjusted Flow Rate (*v*), veh/h	783	194						1977	407	161	1156	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1482						1876	1529	1734	1762	
Queue Service Time (g_s), s	24.7	12.3						55.5	10.3	5.4	18.9	
Cycle Queue Clearance Time (g_c), s	24.7	12.3						55.5	10.3	5.4	18.9	
Green Ratio (*g/C*)	0.26	0.26						0.54	0.54	0.62	0.65	
Capacity (*c*), veh/h	874	385						2012	820	193	2282	
Volume-to-Capacity Ratio (*X*)	0.896	0.505						0.982	0.496	0.834	0.506	
Back of Queue (*Q*), ft/ln (95 th percentile)	432.1	205.3						512.7	90.8	230	289	
Back of Queue (*Q*), veh/ln (95 th percentile)	17.0	8.1						20.2	3.6	9.1	11.4	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.79	0.00						0.00	0.36	0.77	0.00	
Uniform Delay (d_1), s/veh	39.3	34.7						15.1	6.6	30.3	10.2	
Incremental Delay (d_2), s/veh	11.4	1.5						5.0	0.4	18.2	0.8	
Initial Queue Delay (d_3), s/veh	0.0	0.0						0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	50.7	36.2						20.1	7.0	48.5	11.0	
Level of Service (LOS)	D	D						C	A	D	B	
Approach Delay, s/veh / LOS	47.8	D		0.0			17.8	B		15.6	B	
Intersection Delay, s/veh / LOS	23.5						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.43	B	2.32	B	1.38	A	1.95	B
Bicycle LOS Score / LOS	2.10	B			2.61	C	1.57	B

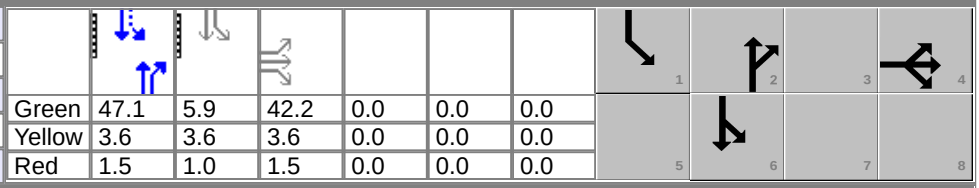
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 1, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2050	Analysis Period	1> 16:30
Intersection	I-229 South Ramp	File Name	14-16 Alt-1 Cliff Avenue 2050 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	270	0	650					920	285	130	1615	

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	37	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	47.1	5.9	42.2	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.5	1.0	1.5	0.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4				2	1	6
Case Number		10.0				7.3	1.0	4.0
Phase Duration, s		47.3				52.2	10.5	62.7
Change Period, ($Y+R_c$), s		5.1				5.1	5.1	5.1
Max Allow Headway (*MAH*), s		5.4				0.0	5.2	0.0
Queue Clearance Time (g_s), s		39.4					2.0	
Green Extension Time (g_e), s		2.9				0.0	3.5	0.0
Phase Call Probability		1.00					0.99	
Max Out Probability		0.91					1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14					2	12	1	6	
Adjusted Flow Rate (*v*), veh/h	300	556						995	243	144	1794	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1563						1741	1493	1734	1851	
Queue Service Time (g_s), s	6.6	37.4						22.4	9.4	0.0	49.3	
Cycle Queue Clearance Time (g_c), s	6.6	37.4						22.4	9.4	0.0	49.3	
Green Ratio (*g/C*)	0.38	0.38						0.43	0.43	0.46	0.52	
Capacity (*c*), veh/h	1293	600						1490	639	267	1937	
Volume-to-Capacity Ratio (*X*)	0.232	0.926						0.668	0.381	0.541	0.926	
Back of Queue (*Q*), ft/ln (95 th percentile)	121.1	601.5						320.3	141	182.1	778.8	
Back of Queue (*Q*), veh/ln (95 th percentile)	4.8	23.7						12.6	5.6	7.2	30.7	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.22	0.00						0.00	0.56	0.61	0.00	
Uniform Delay (d_1), s/veh	22.9	32.4						19.2	14.6	40.6	24.3	
Incremental Delay (d_2), s/veh	0.1	19.2						2.0	1.4	2.7	9.2	
Initial Queue Delay (d_3), s/veh	0.0	0.0						0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	23.0	51.6						21.2	16.0	43.3	33.4	
Level of Service (LOS)	C	D						C	B	D	C	
Approach Delay, s/veh / LOS	41.6	D		0.0			20.2	C		34.2	C	
Intersection Delay, s/veh / LOS	31.4						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.41	B	2.32	B	1.44	A	2.11	B
Bicycle LOS Score / LOS	1.90	B			1.54	B	2.09	B

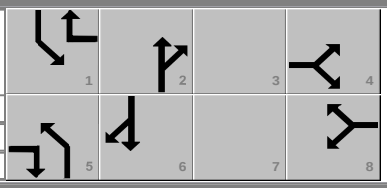
HCS7 Interchanges Results Summary

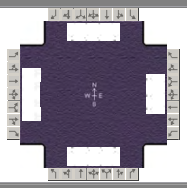
General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	SPUI
Analyst	Graham Johnson	Analysis Date	Apr 1, 2019	Segment Distance, ft	
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 SPUI	PHF	0.90	Arterial Direction	North-South
File Name	14-16 Alt-6 Cliff Avenue 2050 AM.xus				
Project Description	BUILD - I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection Demand (v), veh/h	705		225	430		330	505	1415	470	145	610	255

Signal Information	
Cycle, s	100.0
Offset, s	33
Uncoordinated	No
Force Mode	Fixed

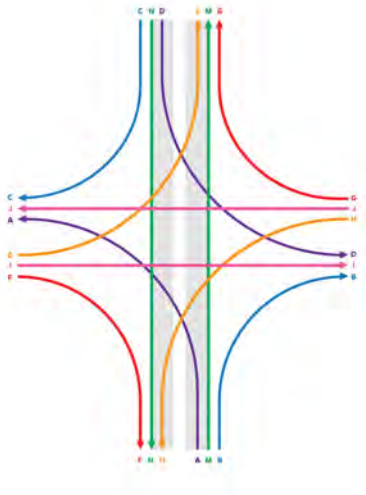
Green	11.4	15.7	26.9	26.7	0.0	0.0
Yellow	3.6	3.6	3.6	3.6	0.0	0.0
Red	1.0	1.0	1.5	1.5	0.0	0.0





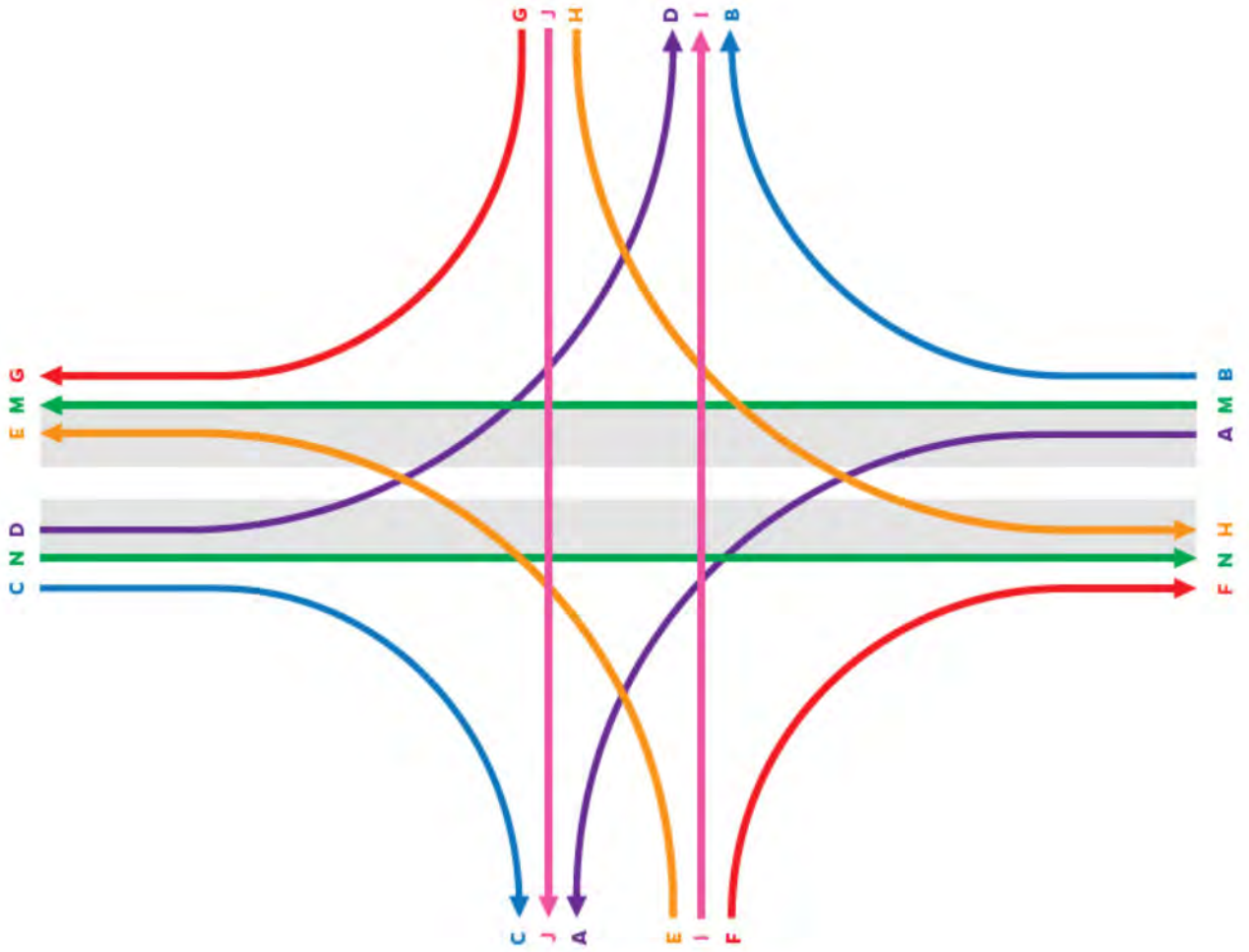
Interchange Results

O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	478	31.3	0.0	31.3	No	No	C
B	367	27.0	0.0	27.0	No	No	B
C	250	9.7	0.0	9.7	No	No	A
D	783	37.9	0.0	37.9	No	No	C
E	533	52.3	0.0	52.3	No	No	C
F	496	0.0	0.0	0.0	No	No	A
G	283	0.0	0.0	0.0	No	No	A
H	161	54.3	0.0	54.3	No	No	C
I	1493	34.0	0.0	34.0	No	No	C
J	678	38.9	0.0	38.9	No	No	C
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	37.9		9.7	31.3		27.0	52.3	34.0	0.0	54.3	38.9	0.0
Level of Service (LOS)	D		A	C		C	D	C	A	D	D	A
Approach Delay, s/veh / LOS	31.1	C		29.4	C		31.2	C		31.3	C	
Intersection Delay, s/veh / LOS	30.9						C					

Interchange Graphic



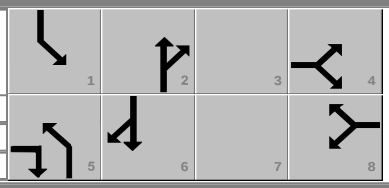
HCS7 Interchanges Results Summary

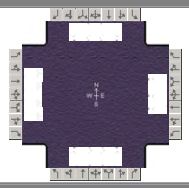
General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	SPUI
Analyst	Graham Johnson	Analysis Date	Apr 1, 2019	Segment Distance, ft	
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 SPUI	PHF	0.90	Arterial Direction	North-South
File Name	14-16 Alt-6 Cliff Avenue 2050 PM.xus				
Project Description	BUILD - I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection Demand (v), veh/h	270		650	580		330	185	735	285	130	1035	655

Signal Information	
Cycle, s	100.0
Offset, s	33
Uncoordinated	No
Force Mode	Fixed

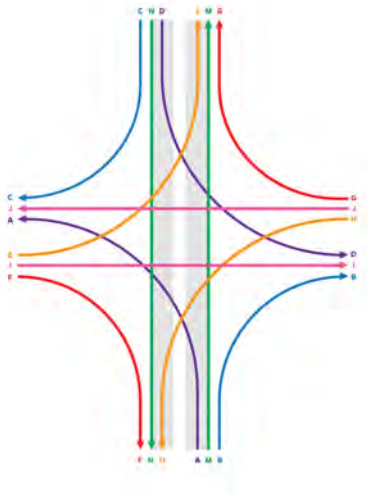
Green	10.6	2.8	37.9	34.0	0.0	0.0
Yellow	3.6	0.0	3.6	3.6	0.0	0.0
Red	1.0	0.0	1.5	1.5	0.0	0.0





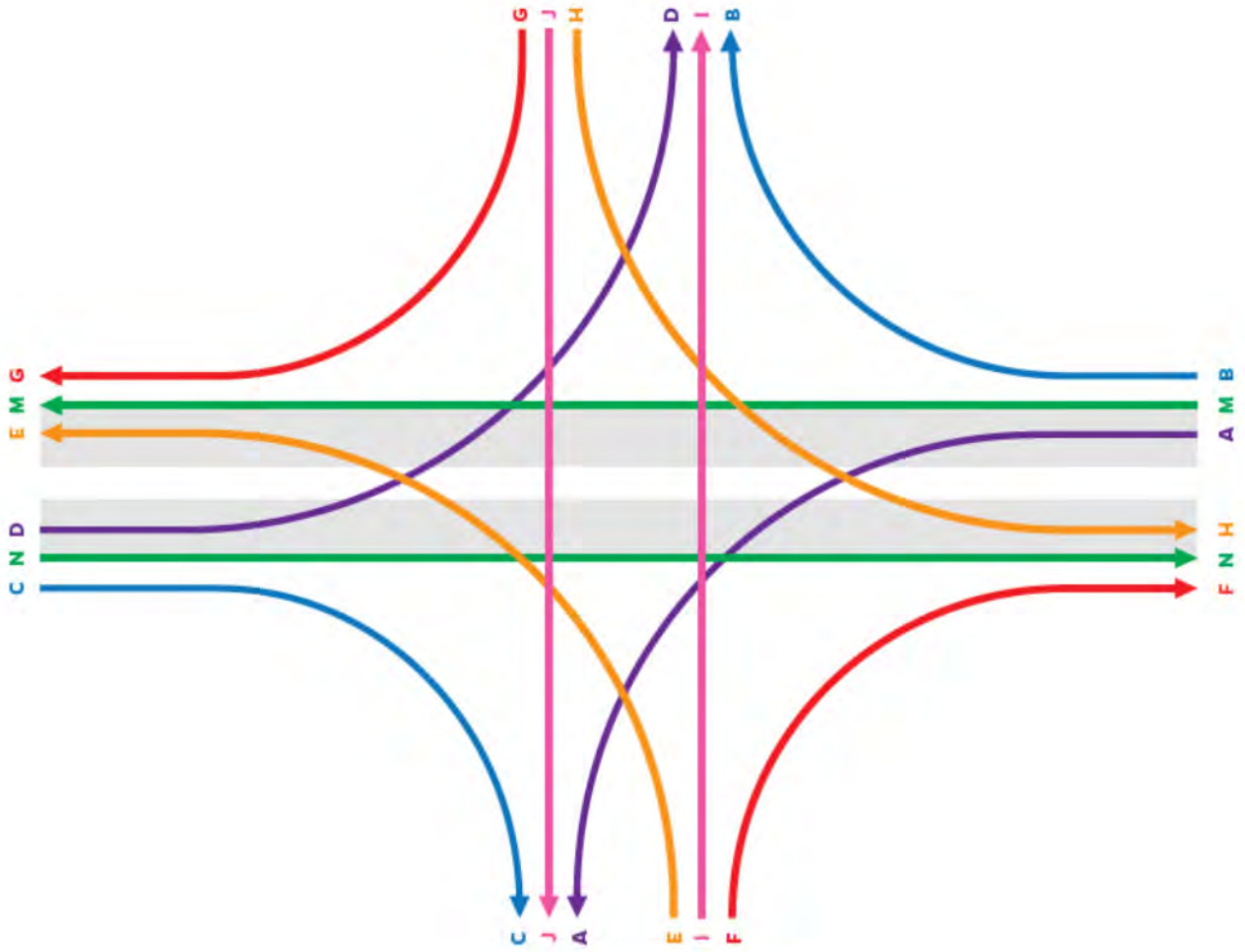
Interchange Results

O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	644	26.9	0.0	26.9	No	No	B
B	367	29.9	0.0	29.9	No	No	B
C	722	19.6	0.0	19.6	No	No	B
D	300	24.0	0.0	24.0	No	No	B
E	198	45.1	0.0	45.1	No	No	C
F	305	0.0	0.0	0.0	No	No	A
G	728	0.0	0.0	0.0	Yes	No	F
H	144	53.7	0.0	53.7	No	No	C
I	785	20.8	0.0	20.8	No	No	B
J	1150	36.7	0.0	36.7	No	No	C
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	24.0		19.6	26.9		29.9	45.1	20.8	0.0	53.7	36.7	0.0
Level of Service (LOS)	C		B	C		C	D	C	A	D	D	A
Approach Delay, s/veh / LOS	20.9	C		28.0	C		19.6	B		24.7	C	
Intersection Delay, s/veh / LOS	23.4						C					

Interchange Graphic



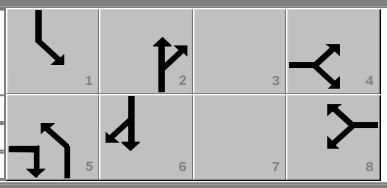
HCS7 Interchanges Results Summary

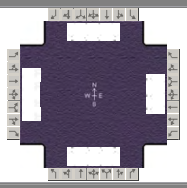
General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	SPUI
Analyst	Graham Johnson	Analysis Date	Apr 1, 2019	Segment Distance, ft	
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 SPUI	PHF	0.90	Arterial Direction	North-South
File Name	14-16 Alt-7 Cliff Avenue 2050 AM.xus				
Project Description	BUILD - I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection Demand (v), veh/h	705		225	430		0	505	1415	470	145	610	255

Signal Information	
Cycle, s	90.0
Offset, s	33
Uncoordinated	No
Force Mode	Fixed

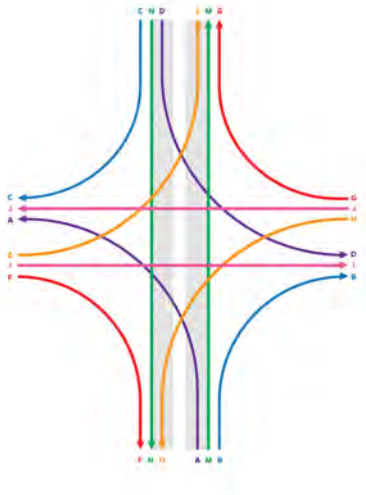
Green	10.0	12.9	28.8	18.9	0.0	0.0
Yellow	3.6	3.6	3.6	3.6	0.0	0.0
Red	1.0	1.5	1.0	1.5	0.0	0.0





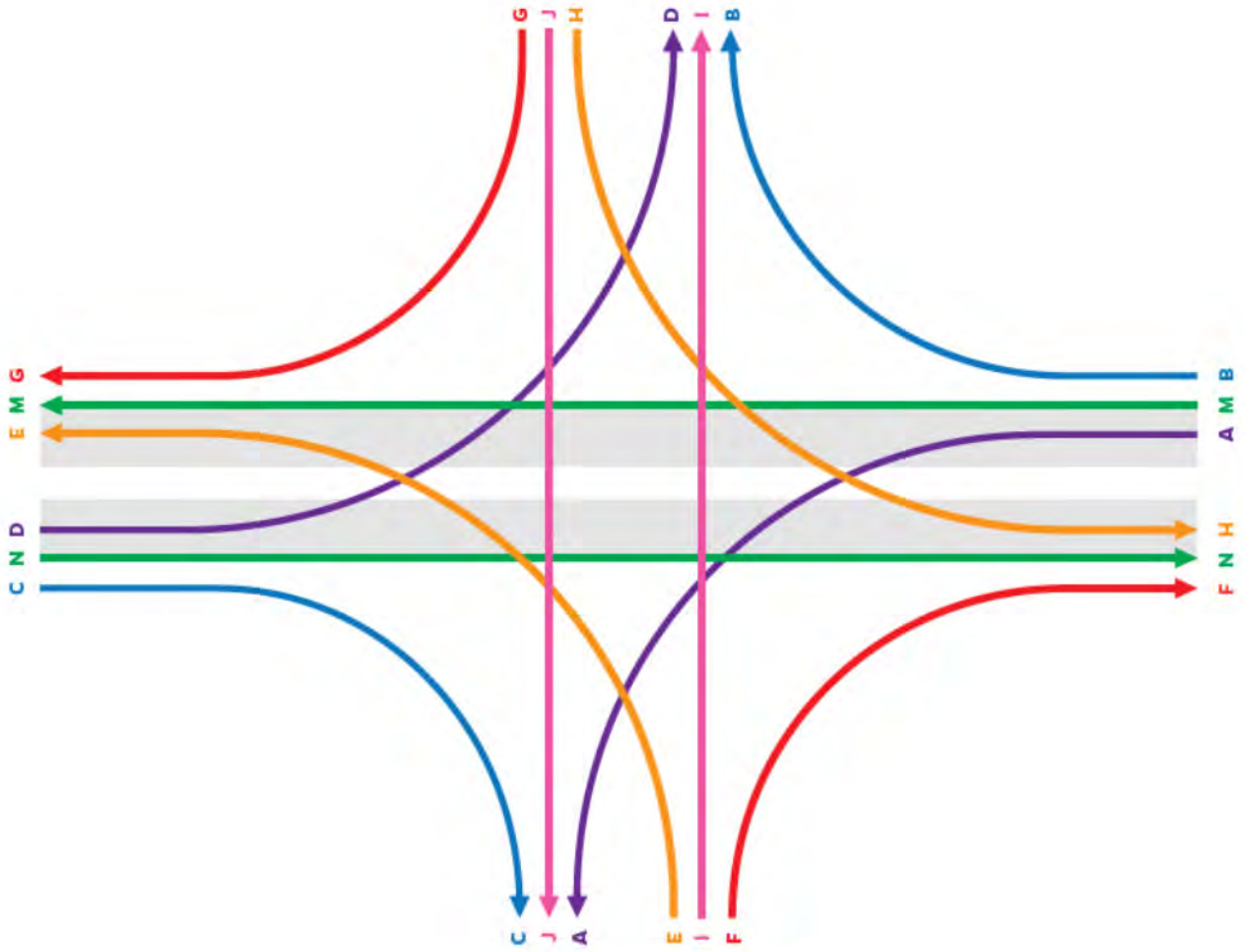
Interchange Results

O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	478	33.0	0.0	33.0	No	No	C
B	0	0.0	0.0	0.0	No	No	A
C	250	11.3	0.0	11.3	No	No	A
D	783	49.1	0.0	49.1	No	No	C
E	521	38.8	0.0	38.8	No	No	C
F	485	0.0	0.0	0.0	No	No	A
G	283	0.0	0.0	0.0	No	No	A
H	161	64.6	0.0	64.6	No	No	D
I	1460	12.2	0.0	12.2	No	No	A
J	678	30.5	0.0	30.5	No	No	C
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	49.1		11.3	33.0		0.0	38.8	12.2	0.0	64.6	30.5	0.0
Level of Service (LOS)	D		B	C			D	B	A	E	C	A
Approach Delay, s/veh / LOS	40.0	D		33.0	C		15.4	B		27.7	C	
Intersection Delay, s/veh / LOS	24.7						C					

Interchange Graphic



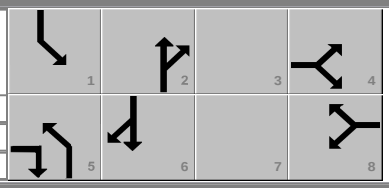
HCS7 Interchanges Results Summary

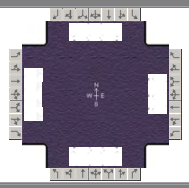
General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	SPUI
Analyst	Graham Johnson	Analysis Date	Apr 1, 2019	Segment Distance, ft	
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 SPUI	PHF	0.90	Arterial Direction	North-South
File Name	14-16 Alt-7 Cliff Avenue 2050 PM.xus				
Project Description	BUILD - I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection Demand (v), veh/h	270		650	580		0	185	735	285	130	1035	655

Signal Information	
Cycle, s	80.0
Offset, s	33
Uncoordinated	No
Force Mode	Fixed

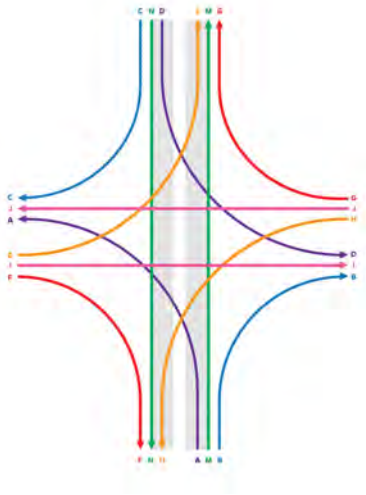
Green	8.5	2.6	39.3	14.9	0.0	0.0
Yellow	3.6	0.0	3.6	3.6	0.0	0.0
Red	1.0	0.0	1.5	1.5	0.0	0.0





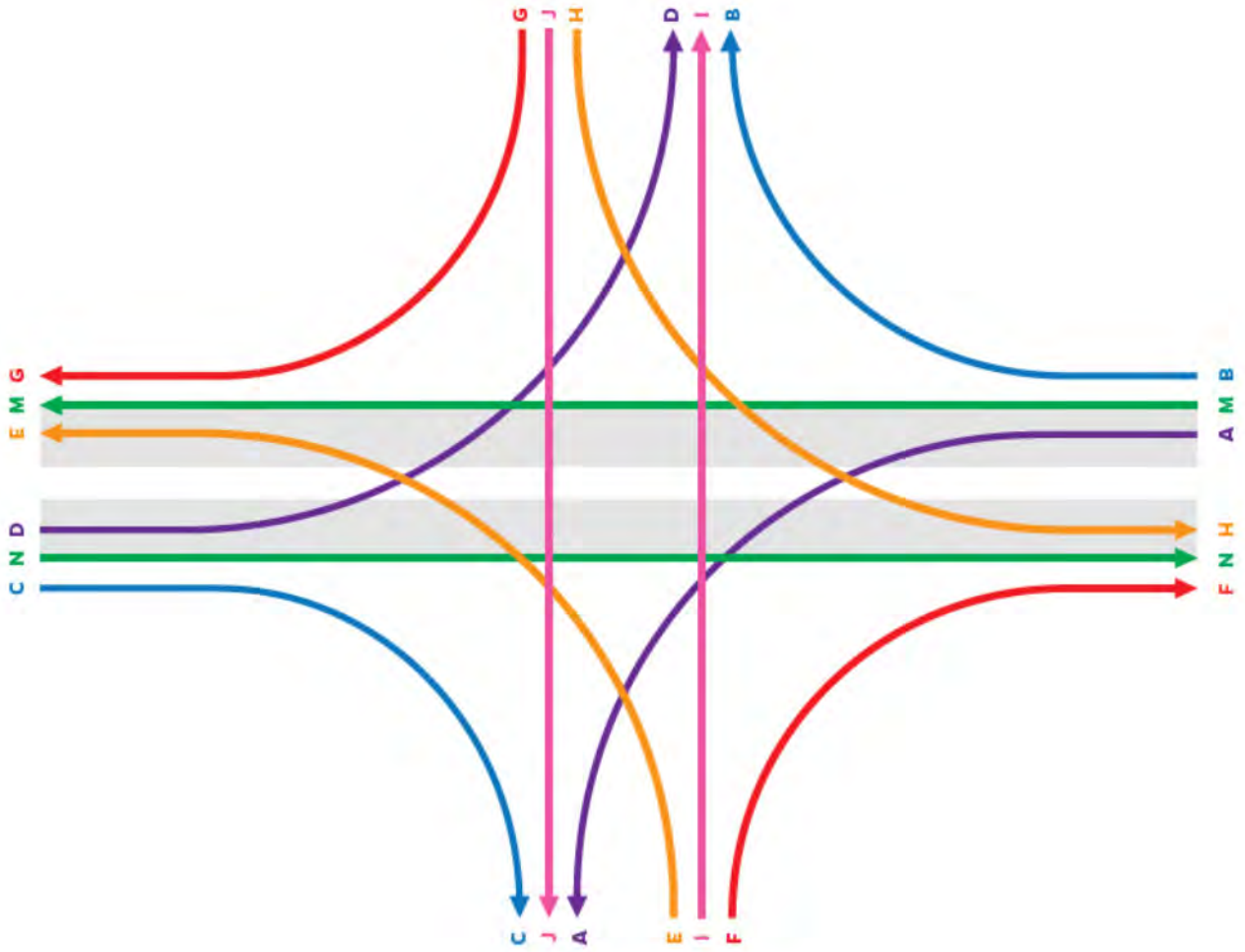
Interchange Results

O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	644	37.8	0.0	37.8	No	No	C
B	0	0.0	0.0	0.0	No	No	A
C	722	33.3	0.0	33.3	No	No	C
D	300	29.4	0.0	29.4	No	No	B
E	200	41.9	0.0	41.9	No	No	C
F	309	0.0	0.0	0.0	No	No	A
G	728	0.0	0.0	0.0	No	No	A
H	144	44.9	0.0	44.9	No	No	C
I	796	13.8	0.0	13.8	No	No	A
J	1150	17.8	0.0	17.8	No	No	B
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	29.4		33.3	37.8		0.0	41.9	13.8	0.0	44.9	17.8	0.0
Level of Service (LOS)	C		C	D			D	B	A	D	B	A
Approach Delay, s/veh / LOS	32.1	C		37.8	D		14.9	B		13.3	B	
Intersection Delay, s/veh / LOS	20.7						C					

Interchange Graphic



HCS7 Two-Way Stop-Control Report

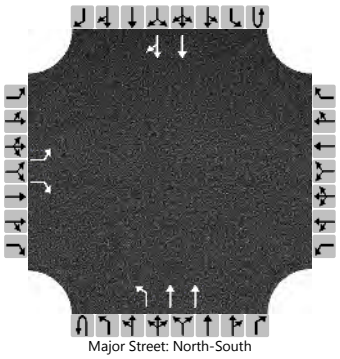
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/1/19
Analysis Year	2050
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at Spencer Park
Jurisdiction	Sioux Falls, SD
East/West Street	Spencer Park Road
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration		L		R						L	T				T	TR
Volume (veh/h)		5		5					0	5	2385				1260	5
Percent Heavy Vehicles (%)		2		2					2	2						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized		No														
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5		6.9						4.1						
Critical Headway (sec)		6.84		6.94						4.14						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.52		3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		6		6						6						
Capacity, c (veh/h)		99		380						482						
v/c Ratio		0.06		0.01						0.01						
95% Queue Length, Q_{95} (veh)		0.2		0.0						0.0						
Control Delay (s/veh)		43.7		14.6						12.6						
Level of Service (LOS)		E		B						B						
Approach Delay (s/veh)		29.2								0.0						
Approach LOS		D														

HCS7 Two-Way Stop-Control Report

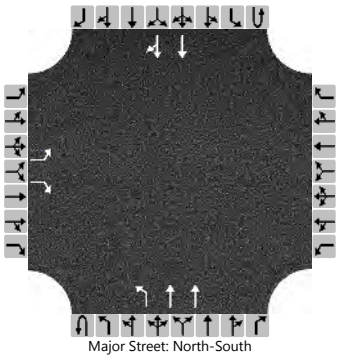
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/1/19
Analysis Year	2050
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at Spencer Park
Jurisdiction	Sioux Falls, SD
East/West Street	Spencer Park Road
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration		L		R						L	T				T	TR
Volume (veh/h)		5		20					0	20	1200				2235	30
Percent Heavy Vehicles (%)		2		2					2	2						
Proportion Time Blocked																
Percent Grade (%)	0															
Right Turn Channelized	No															
Median Type | Storage	Left Only								1							

Critical and Follow-up Headways

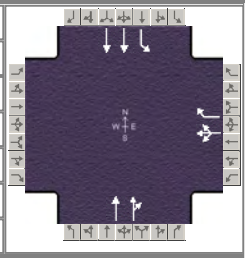
Base Critical Headway (sec)		7.5		6.9						4.1						
Critical Headway (sec)		6.84		6.94						4.14						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.52		3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		6		22						22						
Capacity, c (veh/h)		40		162						177						
v/c Ratio		0.14		0.14						0.13						
95% Queue Length, Q_{95} (veh)		0.4		0.5						0.4						
Control Delay (s/veh)		109.9		30.7						28.3						
Level of Service (LOS)		F		D						D						
Approach Delay (s/veh)	46.6								0.5							
Approach LOS	E															

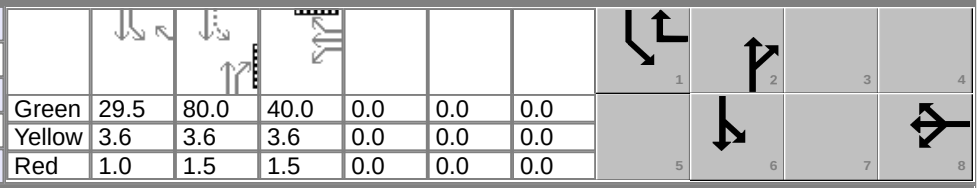
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 1, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2050	Analysis Period	1> 7:15
Intersection	49th Street	File Name	18 Cliff at 49th 2050 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				40	0	900		1615	15	300	1170	

Signal Information			
Cycle, s	164.3	Reference Phase	2
Offset, s	109	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	29.5	80.0	40.0	0.0	0.0	0.0						
Yellow	3.6	3.6	3.6	0.0	0.0	0.0						
Red	1.0	1.5	1.5	0.0	0.0	0.0						

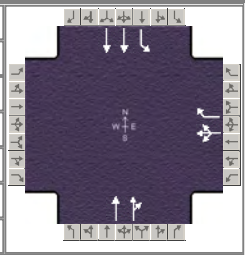
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase				8		2	1	6
Case Number				11.0		8.3	1.0	4.0
Phase Duration, s				45.1		85.1	34.1	119.2
Change Period, (*Y+R c*), s				5.1		5.1	4.6	5.1
Max Allow Headway (*MAH*), s				5.3		3.0	5.1	3.0
Queue Clearance Time (*g s*), s				41.6		91.3	28.1	30.9
Green Extension Time (*g e*), s				0.0		0.0	1.5	12.1
Phase Call Probability				1.00		1.00	1.00	1.00
Max Out Probability				1.00		1.00	0.08	0.08

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement				3	8	18		2	12	1	6	
Adjusted Flow Rate (*v*), veh/h					244	467		906	905	333	1300	
Adjusted Saturation Flow Rate (*s*), veh/h/ln					1626	1585		1870	1864	1781	1781	
Queue Service Time (*g s*), s					24.3	39.6		89.3	79.6	26.1	28.9	
Cycle Queue Clearance Time (*g c*), s					24.3	39.6		89.3	79.6	26.1	28.9	
Green Ratio (*g/C*)					0.24	0.42		0.49	0.49	0.68	0.69	
Capacity (*c*), veh/h					396	671		911	908	364	2473	
Volume-to-Capacity Ratio (*X*)					0.618	0.696		0.995	0.997	0.916	0.526	
Back of Queue (*Q*), ft/ln (95 th percentile)					417.2	572.9		1362.8	1346.8	563.1	422	
Back of Queue (*Q*), veh/ln (95 th percentile)					16.7	22.6		53.7	53.9	22.2	16.6	
Queue Storage Ratio (*RQ*) (95 th percentile)					0.00	2.55		0.00	0.00	1.44	0.00	
Uniform Delay (*d 1*), s/veh					71.0	38.8		42.0	42.1	57.3	12.1	
Incremental Delay (*d 2*), s/veh					3.4	3.5		28.5	29.2	20.4	0.1	
Initial Queue Delay (*d 3*), s/veh					0.0	0.0		0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh					74.4	42.2		70.4	71.2	77.8	12.2	
Level of Service (LOS)					E	D		E	E	E	B	
Approach Delay, s/veh / LOS	0.0			53.3		D	70.8		E	25.6		C
Intersection Delay, s/veh / LOS	50.0						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.17	B	2.34	B	2.35	B	1.36	A
Bicycle LOS Score / LOS			1.66	B	1.98	B	1.84	B

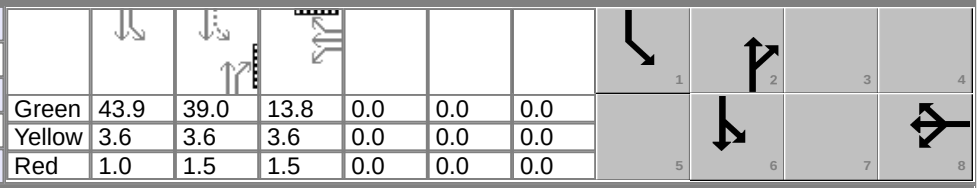
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 1, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2050	Analysis Period	1> 16:30
Intersection	49th Street	File Name	18 Cliff at 49th 2050 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				50	0	250		905	60	640	2230	

Signal Information			
Cycle, s	111.5	Reference Phase	2
Offset, s	6	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	43.9	39.0	13.8	0.0	0.0	0.0		
Yellow	3.6	3.6	3.6	0.0	0.0	0.0		
Red	1.0	1.5	1.5	0.0	0.0	0.0		

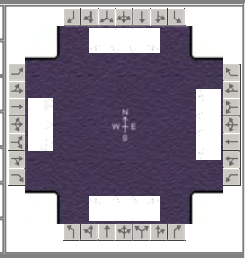
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase				8		2	1	6
Case Number				11.0		8.3	1.0	4.0
Phase Duration, s				18.9		44.1	48.5	92.6
Change Period, ($Y+R_c$), s				5.1		5.1	4.6	5.1
Max Allow Headway (*MAH*), s				5.2		3.0	5.1	3.0
Queue Clearance Time (g_s), s				13.5		38.6	39.0	56.9
Green Extension Time (g_e), s				0.3		0.3	4.9	2.8
Phase Call Probability				1.00		1.00	1.00	1.00
Max Out Probability				1.00		1.00	0.07	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement				3	8	18		2	12	1	6	
Adjusted Flow Rate (*v*), veh/h					167	167		542	530	711	2478	
Adjusted Saturation Flow Rate (*s*), veh/h/ln					1660	1585		1870	1829	1781	1781	
Queue Service Time (g_s), s					11.1	11.5		36.6	29.6	37.0	54.9	
Cycle Queue Clearance Time (g_c), s					11.1	11.5		36.6	29.6	37.0	54.9	
Green Ratio (*g/C*)					0.12	0.12		0.35	0.35	0.76	0.78	
Capacity (*c*), veh/h					205	196		653	639	778	2795	
Volume-to-Capacity Ratio (*X*)					0.812	0.851		0.829	0.830	0.914	0.886	
Back of Queue (*Q*), ft/ln (95 th percentile)					252.4	251.1		524.9	508	674.5	569.8	
Back of Queue (*Q*), veh/ln (95 th percentile)					10.1	9.9		20.7	20.3	26.6	22.4	
Queue Storage Ratio (*RQ*) (95 th percentile)					0.00	1.12		0.00	0.00	1.73	0.00	
Uniform Delay (d_1), s/veh					52.2	47.9		33.2	33.2	26.9	8.5	
Incremental Delay (d_2), s/veh					19.9	26.3		7.9	8.0	10.9	3.7	
Initial Queue Delay (d_3), s/veh					0.0	0.0		0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh					72.1	74.1		41.1	41.3	37.8	12.2	
Level of Service (LOS)					E	E		D	D	D	B	
Approach Delay, s/veh / LOS	0.0			73.1		E	41.2		D	17.9		B
Intersection Delay, s/veh / LOS	27.3						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.15	B	2.32	B	1.92	B	1.32	A
Bicycle LOS Score / LOS			1.04	A	1.37	A	3.12	C

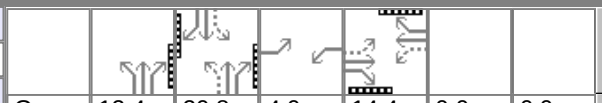
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 2, 2019	Area Type	Other
Jurisdiction	Sioux Falls	Time Period	AM	PHF	0.90
Urban Street	Western Avenue	Analysis Year	2050	Analysis Period	1> 7:15
Intersection	49th Street	File Name	19-20-21-22 Western 2050 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				

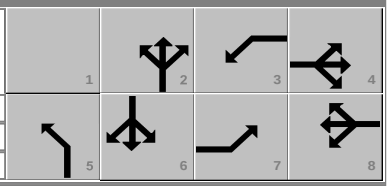


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	130	240	110	115	445	295	315	845	200	65	420	60

Signal Information			
Cycle, s	73.4	Reference Phase	2
Offset, s	21	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	12.4	20.8	4.0	14.4	0.0	0.0
Yellow	4.0	3.9	3.6	3.6	0.0	0.0
Red	2.0	2.0	1.4	1.4	0.0	0.0



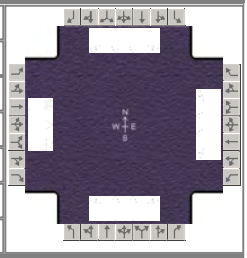
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2		6
Case Number	1.1	4.0	1.1	3.0	1.0	3.0		5.3
Phase Duration, s	9.0	19.4	9.0	19.3	18.4	45.1		26.7
Change Period, ($Y+R_c$), s	5.0	5.0	5.0	5.0	6.0	5.9		5.9
Max Allow Headway (*MAH*), s	3.1	5.1	3.1	5.1	3.1	5.3		5.3
Queue Clearance Time (g_s), s	6.0	8.8	6.0	11.8	11.7	14.7		19.0
Green Extension Time (g_e), s	0.0	5.5	0.0	0.7	0.7	24.9		0.0
Phase Call Probability	0.95	1.00	0.93	1.00	1.00	1.00		1.00
Max Out Probability	1.00	0.00	1.00	1.00	0.00	0.06		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	144	183	173	128	494	217	350	939	167	131	848	91
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1667	1734	1734	1543	1734	1734	1543	597	1734	1543
Queue Service Time (g_s), s	4.0	6.6	6.8	4.0	9.8	9.7	9.7	12.7	4.1	14.8	17.0	3.3
Cycle Queue Clearance Time (g_c), s	4.0	6.6	6.8	4.0	9.8	9.7	9.7	12.7	4.1	14.8	17.0	3.3
Green Ratio (*g/C*)	0.25	0.20	0.20	0.25	0.20	0.20	0.48	0.53	0.53	0.28	0.28	0.28
Capacity (*c*), veh/h	223	356	326	270	678	302	423	1850	824	267	983	438
Volume-to-Capacity Ratio (*X*)	0.647	0.513	0.531	0.474	0.730	0.718	0.827	0.507	0.202	0.491	0.862	0.208
Back of Queue (*Q*), ft/ln (95 th percentile)	101.8	130.9	125.4	78.2	193.7	186.9	158.4	192	56.2	93.9	288.7	52.1
Back of Queue (*Q*), veh/ln (95 th percentile)	4.0	5.2	4.9	3.1	7.6	7.4	6.2	7.6	2.2	3.7	11.4	2.1
Queue Storage Ratio (*RQ*) (95 th percentile)	0.41	0.00	0.00	0.26	0.00	0.75	0.63	0.00	0.47	0.38	0.00	0.21
Uniform Delay (d_1), s/veh	25.8	26.4	26.5	23.6	27.7	27.7	15.9	11.0	9.0	24.2	25.0	20.0
Incremental Delay (d_2), s/veh	5.0	1.6	1.9	0.5	4.3	8.7	1.6	0.3	0.2	1.6	6.7	0.3
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	30.8	28.1	28.4	24.1	32.1	36.4	17.4	11.3	9.1	25.8	31.7	20.3
Level of Service (LOS)	C	C	C	C	C	D	B	B	A	C	C	C
Approach Delay, s/veh / LOS	29.0	C		32.0	C		12.5	B		30.0	C	
Intersection Delay, s/veh / LOS	23.7						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.51	C	2.46	B	2.54	C	2.32	B
Bicycle LOS Score / LOS	0.90	A	1.18	A	1.69	B	0.97	A

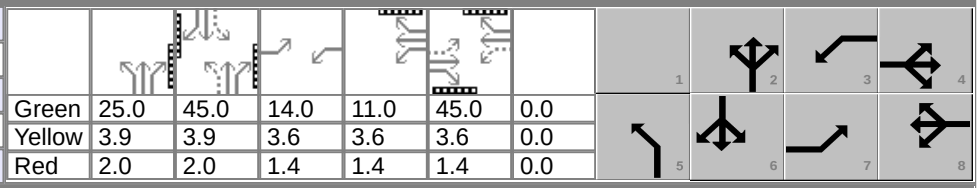
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 2, 2019	Area Type	Other
Jurisdiction	Sioux Falls	Time Period	PM	PHF	0.90
Urban Street	Western Avenue	Analysis Year	2050	Analysis Period	1> 16:30
Intersection	49th Street	File Name	19-20-21-22 Western 2050 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	155	540	380	355	760	240	320	790	125	80	1115	65

Signal Information			
Cycle, s	166.8	Reference Phase	2
Offset, s	21	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	25.0	45.0	14.0	11.0	45.0	0.0
Yellow	3.9	3.9	3.6	3.6	3.6	0.0
Red	2.0	2.0	1.4	1.4	1.4	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2		6
Case Number	1.1	4.0	1.1	3.0	1.0	3.0		5.3
Phase Duration, s	19.0	50.0	35.0	66.0	30.9	81.8		50.9
Change Period, ($Y+R_c$), s	5.0	5.0	5.0	5.0	5.9	5.9		5.9
Max Allow Headway (*MAH*), s	3.1	5.1	3.1	5.1	3.1	5.2		5.2
Queue Clearance Time (g_s), s	13.9	46.0	32.0	36.1	27.0	32.8		47.0
Green Extension Time (g_e), s	0.1	0.0	0.0	19.2	0.0	27.8		0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00	1.00		1.00
Max Out Probability	0.04	1.00	1.00	0.25	1.00	0.17		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	172	483	428	394	844	178	356	878	106	72	1008	45
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1610	1734	1734	1543	1734	1734	1543	632	1734	1543
Queue Service Time (g_s), s	11.9	44.0	44.0	30.0	34.1	13.8	25.0	30.8	6.7	15.7	45.0	3.7
Cycle Queue Clearance Time (g_c), s	11.9	44.0	44.0	30.0	34.1	13.8	25.0	30.8	6.7	15.7	45.0	3.7
Green Ratio (*g/C*)	0.35	0.27	0.27	0.46	0.37	0.37	0.43	0.46	0.46	0.27	0.27	0.27
Capacity (*c*), veh/h	286	491	434	359	1268	564	303	1578	702	214	935	416
Volume-to-Capacity Ratio (*X*)	0.601	0.984	0.984	1.100	0.666	0.315	1.173	0.556	0.150	0.339	1.078	0.109
Back of Queue (*Q*), ft/ln (95 th percentile)	226.3	849.3	772.4	821.4	537.1	232.4	810.7	484	115.9	113.5	846.4	65.9
Back of Queue (*Q*), veh/ln (95 th percentile)	8.9	33.4	30.4	32.3	21.1	9.1	31.9	19.1	4.6	4.5	33.3	2.6
Queue Storage Ratio (*RQ*) (95 th percentile)	0.91	0.00	0.00	2.74	0.00	0.93	3.24	0.00	0.97	0.45	0.00	0.26
Uniform Delay (d_1), s/veh	40.3	60.5	60.6	54.8	44.4	37.9	55.6	33.2	26.6	50.2	60.9	45.8
Incremental Delay (d_2), s/veh	0.8	36.4	39.0	77.2	0.9	0.5	107.1	0.4	0.1	0.7	45.8	0.1
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	41.1	96.9	99.6	132.0	45.3	38.4	162.7	33.6	26.7	50.9	106.7	45.9
Level of Service (LOS)	D	F	F	F	D	D	F	C	C	D	F	D
Approach Delay, s/veh / LOS	89.1	F		68.6	E		67.3	E		100.7	F	
Intersection Delay, s/veh / LOS	80.0						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.51	C	2.47	B	2.55	C	2.45	B
Bicycle LOS Score / LOS	1.38	A	1.66	B	1.59	B	1.63	B

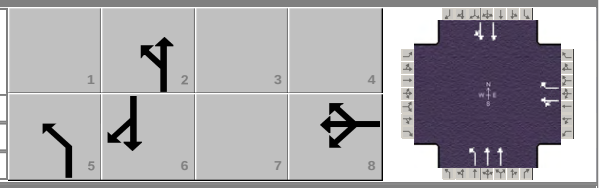
HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc.			Interchange Type	Diamond
Analyst	Graham Johnson	Analysis Date	Jan 2, 2019	Segment Distance, ft	700
Jurisdiction	Sioux Falls	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 North Ramp	PHF	0.90	Arterial Direction	North-South
File Name	19-20-21-22 Western 2050 AM.xus				
Project Description	BUILD - I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h				300	0	490	130	1130			595	140
Intersection Two Demand (*v*), veh/h	390	0	160					870	310	165	730	

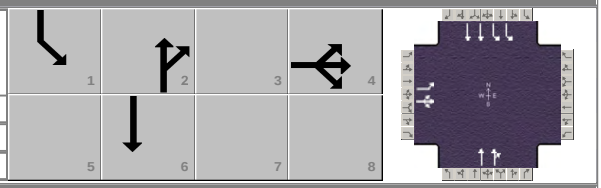
Signal One Information	
Cycle, s	110.0
Offset, s	66
Uncoordinated	No
Force Mode	Fixed

Green	7.1	52.5	32.4	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0



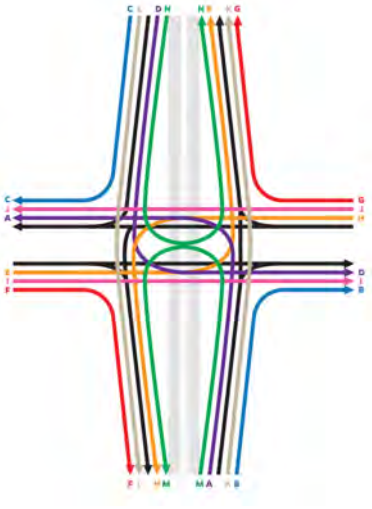
Signal Two Information	
Cycle, s	110.0
Offset, s	66
Uncoordinated	No
Force Mode	Fixed

Green	7.6	61.5	24.0	0.0	0.0	0.0
Yellow	3.9	3.9	3.6	0.0	0.0	0.0
Red	1.8	1.8	1.9	0.0	0.0	0.0



Interchange Results

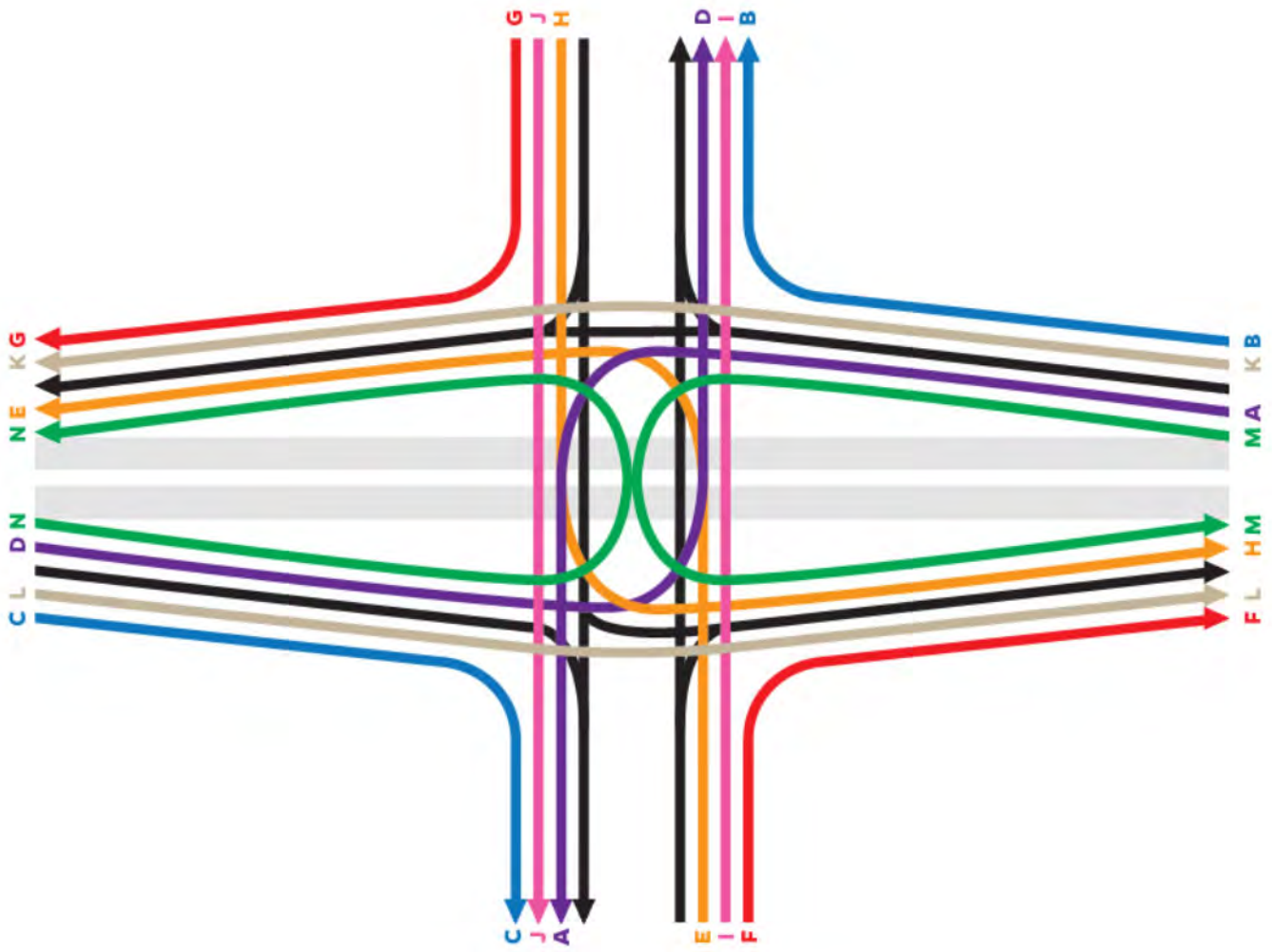
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	0	19.8	0.0	19.8	No	No	B
B	0	0.0	0.0	0.0	No	No	A
C	0	0.0	0.0	0.0	No	No	A
D	0	20.8	0.0	20.8	No	No	B
E	0	14.4	0.0	14.4	No	No	A
F	0	14.4	0.0	14.4	No	No	A
G	0	0.0	0.0	0.0	No	No	A
H	0	0.3	0.0	0.3	No	No	A
I	1351	35.3	0.0	35.3	No	No	C
J	753	20.1	0.0	20.1	No	No	B
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh					35.9	42.7	16.4	14.4			19.8	18.3
Level of Service (LOS)					D	D	B	B			B	B
Approach Delay, s/veh / LOS	0.0			39.5		D	14.6		B	19.1		B
Intersection Delay, s/veh / LOS	21.8						C					

Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	47.2	46.9						20.8	20.0	42.9	0.3	
Level of Service (LOS)	D	D						C	C	D	A	
Approach Delay, s/veh / LOS	47.0		D	0.0			20.4		C	8.2		A
Intersection Delay, s/veh / LOS	21.5						C					

Interchange Graphic



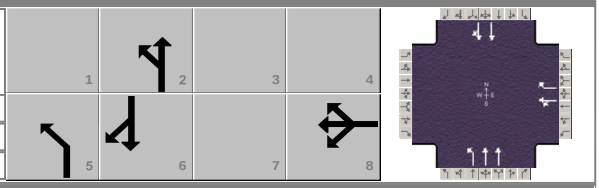
HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc.			Interchange Type	Diamond
Analyst	Graham Johnson	Analysis Date	Jan 2, 2019	Segment Distance, ft	700
Jurisdiction	Sioux Falls	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 North Ramp	PHF	0.90	Arterial Direction	North-South
File Name	19-20-21-22 Western 2050 PM.xus				
Project Description	BUILD - I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h				325	5	500	285	845			1380	420
Intersection Two Demand (*v*), veh/h	240	5	115					890	340	550	1155	

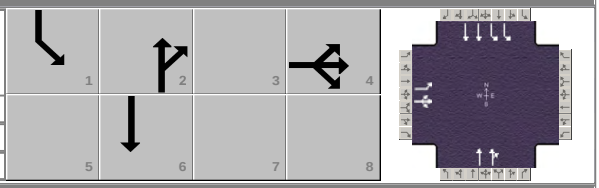
Signal One Information	
Cycle, s	100.0
Offset, s	7
Uncoordinated	No
Force Mode	Fixed

Green	18.0	33.5	30.4	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0



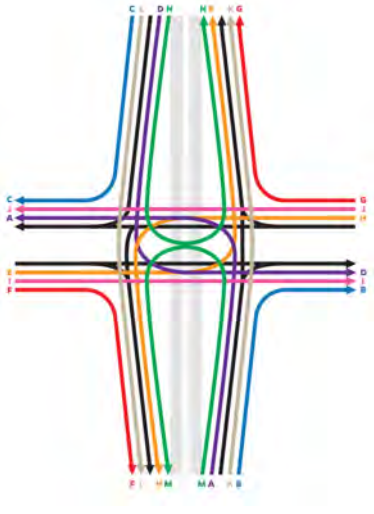
Signal Two Information	
Cycle, s	100.0
Offset, s	7
Uncoordinated	No
Force Mode	Fixed

Green	51.0	16.1	16.0	0.0	0.0	0.0
Yellow	3.9	3.9	3.6	0.0	0.0	0.0
Red	1.8	1.8	1.9	0.0	0.0	0.0



Interchange Results

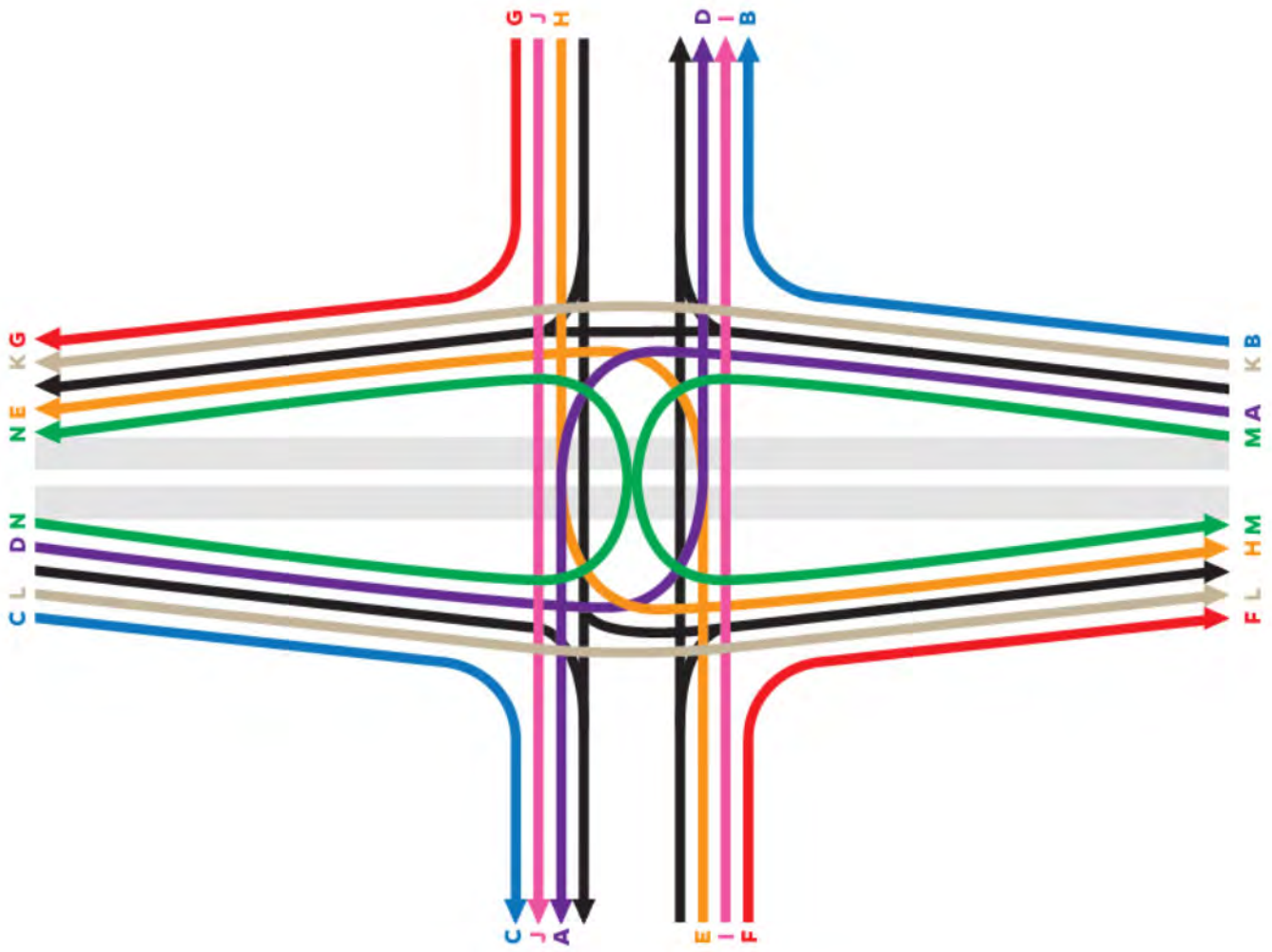
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	0	38.8	0.0	38.8	No	No	C
B	0	0.0	0.0	0.0	No	No	A
C	0	0.0	0.0	0.0	No	No	A
D	0	21.9	0.0	21.9	No	No	B
E	0	13.0	0.0	13.0	No	No	A
F	0	13.0	0.0	13.0	No	No	A
G	0	0.0	0.0	0.0	No	No	A
H	0	0.7	0.0	0.7	No	No	A
I	1128	34.9	0.0	34.9	No	No	C
J	786	39.6	0.0	39.6	No	No	C
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh					33.0	40.8	34.7	13.0			38.8	38.7
Level of Service (LOS)					C	D	C	B			D	D
Approach Delay, s/veh / LOS	0.0			37.0		D	18.5		B	38.8		D
Intersection Delay, s/veh / LOS	29.5						C					

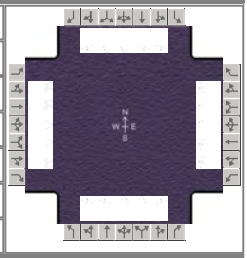
Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	44.7	42.8						21.9	19.0	32.8	0.7	
Level of Service (LOS)	D	D						C	B	C	A	
Approach Delay, s/veh / LOS	43.9		D	0.0			20.5		C	11.1		B
Intersection Delay, s/veh / LOS	19.2						B					

Interchange Graphic



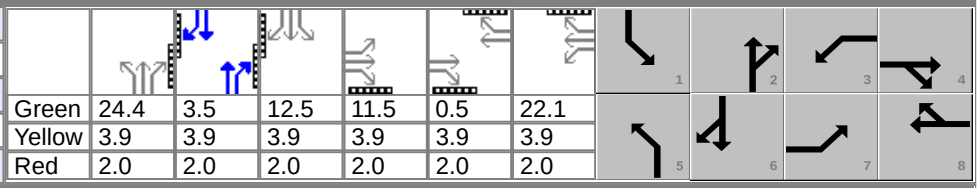
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 2, 2019	Area Type	Other
Jurisdiction	Sioux Falls	Time Period	AM	PHF	0.90
Urban Street	Western Avenue	Analysis Year	2050	Analysis Period	1> 7:15
Intersection	57th Street	File Name	19-20-21-22 Western 2050 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	255	380	135	170	715	250	470	675	50	130	520	240

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	95	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	24.4	3.5	12.5	11.5	0.5	22.1
Yellow	3.9	3.9	3.9	3.9	3.9	3.9
Red	2.0	2.0	2.0	2.0	2.0	2.0

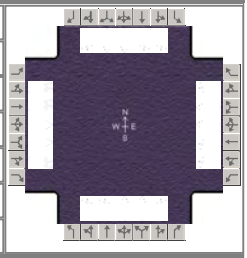
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	17.4	23.8	28.0	34.4	30.3	39.8	18.4	27.9
Change Period, ($Y+R_c$), s	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9
Max Allow Headway (*MAH*), s	2.6	5.0	4.6	4.6	2.6	0.0	5.0	0.0
Queue Clearance Time (g_s), s	11.0	14.8	7.2	26.2	23.2		6.4	
Green Extension Time (g_e), s	0.4	3.2	6.0	2.3	1.2	0.0	6.3	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		0.99	
Max Out Probability	0.00	0.01	0.20	1.00	0.00		0.01	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	283	422	106	189	794	183	682	979	51	144	578	167
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1734	1543	1684	1734	1543	1684	1734	1543	1684	1734	1543
Queue Service Time (g_s), s	9.0	12.8	6.8	5.2	24.2	11.0	21.2	30.0	2.4	4.4	17.6	10.7
Cycle Queue Clearance Time (g_c), s	9.0	12.8	6.8	5.2	24.2	11.0	21.2	30.0	2.4	4.4	17.6	10.7
Green Ratio (*g/C*)	0.10	0.16	0.16	0.20	0.26	0.26	0.22	0.31	0.31	0.11	0.20	0.20
Capacity (*c*), veh/h	352	565	252	676	899	400	748	1067	475	383	692	308
Volume-to-Capacity Ratio (*X*)	0.806	0.747	0.420	0.279	0.883	0.458	0.912	0.918	0.107	0.377	0.835	0.541
Back of Queue (*Q*), ft/ln (95 th percentile)	175.4	241.3	118.3	97.9	426.1	139.8	252.5	413	40.9	84.7	337.2	204.8
Back of Queue (*Q*), veh/ln (95 th percentile)	6.9	9.5	4.7	3.9	16.8	5.5	9.9	16.3	1.6	3.3	13.3	8.1
Queue Storage Ratio (*RQ*) (95 th percentile)	0.57	0.00	0.47	0.38	0.00	0.54	0.72	0.00	0.31	0.68	0.00	1.64
Uniform Delay (d_1), s/veh	48.2	43.9	19.4	37.2	39.1	19.8	34.6	36.8	25.4	45.1	42.3	39.5
Incremental Delay (d_2), s/veh	1.7	2.7	1.5	0.1	9.8	1.1	0.6	4.9	0.1	0.8	11.4	6.7
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	49.8	46.6	20.9	37.3	48.9	21.0	35.1	41.7	25.5	46.0	53.7	46.2
Level of Service (LOS)	D	D	C	D	D	C	D	D	C	D	D	D
Approach Delay, s/veh / LOS	44.4	D		42.6	D		38.6	D		51.0	D	
Intersection Delay, s/veh / LOS	43.1						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.62	C	2.72	C	2.72	C	2.65	C
Bicycle LOS Score / LOS	1.16	A	1.45	A	1.57	B	1.22	A

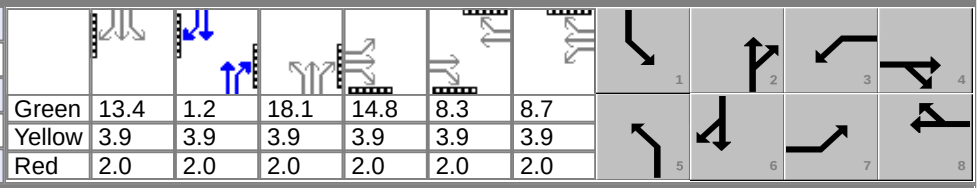
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 2, 2019	Area Type	Other
Jurisdiction	Sioux Falls	Time Period	PM	PHF	0.90
Urban Street	Western Avenue	Analysis Year	2050	Analysis Period	1> 16:30
Intersection	57th Street	File Name	19-20-21-22 Western 2050 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	380	810	465	150	585	205	610	645	125	320	695	255

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	34	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	13.4	1.2	18.1	14.8	8.3	8.7						
Yellow	3.9	3.9	3.9	3.9	3.9	3.9						
Red	2.0	2.0	2.0	2.0	2.0	2.0						

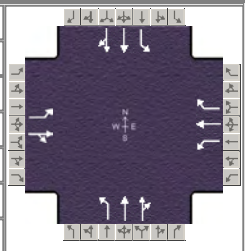
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	20.7	34.9	14.6	28.8	24.0	31.1	19.3	26.5
Change Period, ($Y+R_c$), s	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9
Max Allow Headway (*MAH*), s	2.6	5.0	4.6	4.6	2.6	0.0	5.0	0.0
Queue Clearance Time (g_s), s	14.2	26.9	6.8	19.8	20.1		12.2	
Green Extension Time (g_e), s	0.6	2.2	2.0	2.5	0.0	0.0	1.2	0.0
Phase Call Probability	1.00	1.00	0.99	1.00	1.00		1.00	
Max Out Probability	0.00	1.00	1.00	0.83	1.00		0.41	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	422	900	350	167	650	133	612	648	90	356	772	183
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1734	1543	1684	1734	1543	1684	1734	1543	1684	1734	1543
Queue Service Time (g_s), s	12.2	24.9	20.8	4.8	17.8	7.3	18.1	17.4	4.5	10.2	20.6	10.7
Cycle Queue Clearance Time (g_c), s	12.2	24.9	20.8	4.8	17.8	7.3	18.1	17.4	4.5	10.2	20.6	10.7
Green Ratio (*g/C*)	0.15	0.29	0.29	0.09	0.23	0.23	0.18	0.25	0.25	0.13	0.21	0.21
Capacity (*c*), veh/h	499	1007	448	293	795	354	610	875	389	452	713	317
Volume-to-Capacity Ratio (*X*)	0.846	0.894	0.781	0.568	0.817	0.377	1.005	0.740	0.232	0.786	1.084	0.578
Back of Queue (*Q*), ft/ln (95 th percentile)	222.5	433.1	340.1	90.3	320.4	126.1	327.6	273.4	75.7	201.5	543.3	194.7
Back of Queue (*Q*), veh/ln (95 th percentile)	8.8	17.1	13.4	3.6	12.6	5.0	12.9	10.8	3.0	7.9	21.4	7.7
Queue Storage Ratio (*RQ*) (95 th percentile)	0.72	0.00	1.36	0.35	0.00	0.49	0.94	0.00	0.58	1.61	0.00	1.56
Uniform Delay (d_1), s/veh	41.5	34.0	32.6	43.8	36.5	32.5	40.6	36.1	8.7	41.9	39.7	5.8
Incremental Delay (d_2), s/veh	1.6	10.0	8.6	0.6	6.0	0.9	25.8	2.6	0.6	4.9	58.6	7.5
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	43.0	44.0	41.2	44.5	42.5	33.4	66.5	38.8	9.3	46.8	98.3	13.3
Level of Service (LOS)	D	D	D	D	D	C	F	D	A	D	F	B
Approach Delay, s/veh / LOS	43.2	D		41.6	D		49.4	D		72.5	E	
Intersection Delay, s/veh / LOS	51.7						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.65	C	2.72	C	2.71	C	2.81	C
Bicycle LOS Score / LOS	1.87	B	1.27	A	1.72	B	1.57	B

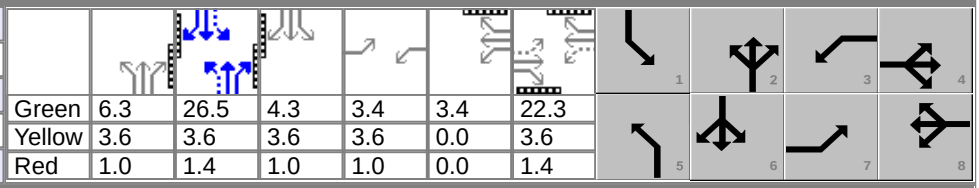
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 2, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	26th Street	Analysis Year	2050	Analysis Period	1> 7:15
Intersection	Cliff Avenue	File Name	23 26th at Cliff 2050 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	55	205	40	120	365	360	115	910	95	125	330	35

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	6.3	26.5	4.3	3.4	3.4	22.3
Yellow	3.6	3.6	3.6	3.6	0.0	3.6
Red	1.0	1.4	1.0	1.0	0.0	1.4

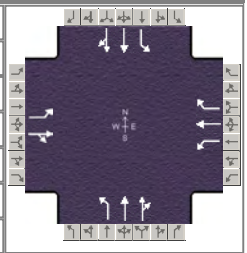
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	3.0	1.2	4.0	1.3	4.0
Phase Duration, s	8.0	27.3	11.4	30.7	10.9	42.4	8.9	40.4
Change Period, ($Y+R_c$), s	4.6	5.0	4.6	5.0	4.6	5.0	5.0	5.0
Max Allow Headway (*MAH*), s	4.2	6.2	4.2	6.2	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	4.3	13.6	7.0	20.4	6.4		2.0	
Green Extension Time (g_e), s	0.0	6.5	0.1	5.2	0.2	0.0	1.0	0.0
Phase Call Probability	0.78	1.00	0.96	1.00	0.96		0.97	
Max Out Probability	1.00	0.58	1.00	0.76	0.34		0.74	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	61	261		133	406	311	128	564	547	139	199	196
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1780		1734	1821	1543	1734	1821	1763	1734	1821	1776
Queue Service Time (g_s), s	2.3	11.6		5.0	18.4	16.2	4.4	23.6	23.6	0.0	6.7	6.8
Cycle Queue Clearance Time (g_c), s	2.3	11.6		5.0	18.4	16.2	4.4	23.6	23.6	0.0	6.7	6.8
Green Ratio (*g/C*)	0.29	0.25		0.33	0.29	0.29	0.39	0.42	0.42	0.32	0.39	0.39
Capacity (*c*), veh/h	203	441		344	519	440	419	757	733	221	717	699
Volume-to-Capacity Ratio (*X*)	0.301	0.592		0.388	0.781	0.707	0.305	0.745	0.746	0.628	0.277	0.280
Back of Queue (*Q*), ft/ln (95 th percentile)	45.3	227.2		94.1	349.7	186.4	80.4	416.4	400.5	141.9	134	130
Back of Queue (*Q*), veh/ln (95 th percentile)	1.8	8.9		3.7	13.8	7.3	3.2	16.4	16.0	5.6	5.3	5.2
Queue Storage Ratio (*RQ*) (95 th percentile)	0.35	0.00		0.82	0.00	1.62	0.46	0.00	0.00	0.95	0.00	0.00
Uniform Delay (d_1), s/veh	25.5	29.8		22.7	29.6	12.3	18.7	22.3	22.3	38.4	18.6	18.6
Incremental Delay (d_2), s/veh	0.8	2.7		0.7	7.4	5.4	0.4	6.6	6.8	2.9	1.0	1.0
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	26.3	32.6		23.4	37.0	17.7	19.2	28.8	29.1	41.3	19.5	19.6
Level of Service (LOS)	C	C		C	D	B	B	C	C	D	B	B
Approach Delay, s/veh / LOS	31.4	C		27.8	C		27.9	C		25.2	C	
Intersection Delay, s/veh / LOS	27.8						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.29	B	2.30	B	2.25	B	1.92	B
Bicycle LOS Score / LOS	1.02	A	1.89	B	1.51	B	0.93	A

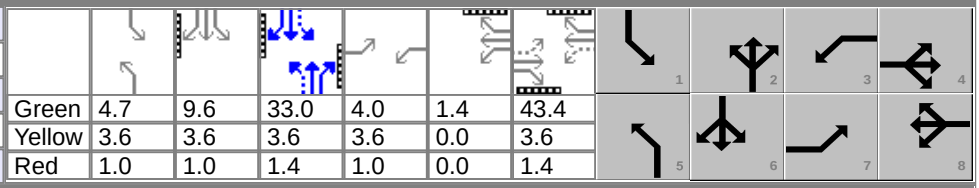
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 2, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	26th Street	Analysis Year	2050	Analysis Period	1> 16:30
Intersection	Cliff Avenue	File Name	23 26th at Cliff 2050 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	55	440	100	110	340	105	60	535	130	300	1080	70

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	4.7	9.6	33.0	4.0	1.4	43.4
Yellow	3.6	3.6	3.6	3.6	0.0	3.6
Red	1.0	1.0	1.4	1.0	0.0	1.4

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	8.6	48.4	10.0	49.8	9.3	38.0	23.6	52.2
Change Period, ($Y+R_c$), s	4.6	5.0	4.6	5.0	4.6	5.0	4.6	5.0
Max Allow Headway (*MAH*), s	4.2	6.2	4.2	6.2	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	4.6	40.3	7.4	21.7	5.3		17.7	
Green Extension Time (g_e), s	0.0	3.2	0.0	10.4	0.0	0.0	1.2	0.0
Phase Call Probability	0.87	1.00	0.98	1.00	0.89		1.00	
Max Out Probability	1.00	1.00	1.00	0.30	1.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	61	589		122	378	100	67	375	353	333	639	628
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1767		1734	1821	1543	1734	1821	1705	1734	1821	1787
Queue Service Time (g_s), s	2.6	38.3		5.4	19.7	5.2	3.3	22.6	22.7	15.7	39.3	39.4
Cycle Queue Clearance Time (g_c), s	2.6	38.3		5.4	19.7	5.2	3.3	22.6	22.7	15.7	39.3	39.4
Green Ratio (*g/C*)	0.40	0.36		0.41	0.37	0.37	0.31	0.28	0.28	0.45	0.39	0.39
Capacity (*c*), veh/h	312	640		174	680	576	150	501	469	396	717	703
Volume-to-Capacity Ratio (*X*)	0.196	0.920		0.703	0.556	0.174	0.446	0.749	0.752	0.841	0.891	0.893
Back of Queue (*Q*), ft/ln (95 th percentile)	51	681.3		128	350.2	90.1	67.1	431.1	406.2	284.8	699.1	680.6
Back of Queue (*Q*), veh/ln (95 th percentile)	2.0	26.8		5.0	13.8	3.5	2.6	17.0	16.2	11.2	27.5	27.2
Queue Storage Ratio (*RQ*) (95 th percentile)	0.39	0.00		1.11	0.00	0.78	0.38	0.00	0.00	1.90	0.00	0.00
Uniform Delay (d_1), s/veh	24.5	36.6		29.8	29.7	25.2	33.0	39.7	39.8	26.6	34.0	34.0
Incremental Delay (d_2), s/veh	0.3	18.8		12.1	1.6	0.3	2.1	9.9	10.6	4.9	15.6	16.0
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	24.8	55.4		41.9	31.4	25.5	35.0	49.6	50.4	31.5	49.6	50.0
Level of Service (LOS)	C	E		D	C	C	D	D	D	C	D	D
Approach Delay, s/veh / LOS	52.5	D		32.5	C		48.7	D		46.0	D	
Intersection Delay, s/veh / LOS	45.5						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.30	B	2.30	B	2.15	B	1.94	B
Bicycle LOS Score / LOS	1.56	B	1.48	A	1.14	A	1.81	B

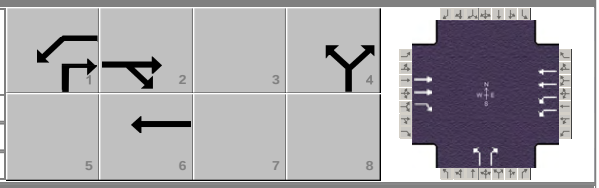
HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	Parclo AB-2Q
Analyst	Graham Johnson	Analysis Date	Jan 2, 2019	Segment Distance, ft	1097
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	North-South
Intersection	SB I-229 Ramp	PHF	0.90	Arterial Direction	East-West
File Name	24-25-26 26th Street 2050 AM.xus				
Project Description	BUILD - I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h		415	65	685	1230		160		300			
Intersection Two Demand (*v*), veh/h		595	120	155	1435		195	0	500			

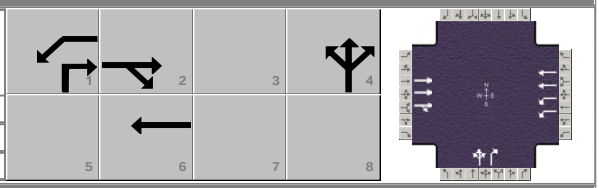
Signal One Information	
Cycle, s	120.0
Offset, s	0
Uncoordinated	No
Force Mode	Fixed

Green	43.4	41.5	19.2	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.9	1.9	1.3	0.0	0.0	0.0



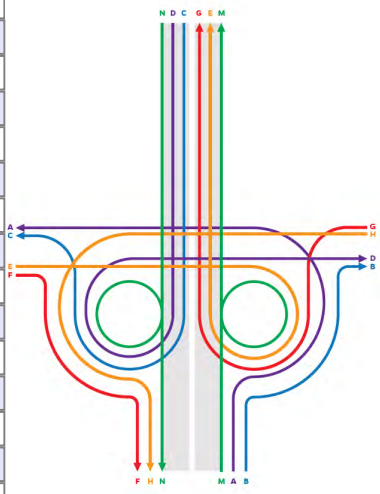
Signal Two Information	
Cycle, s	120.0
Offset, s	0
Uncoordinated	No
Force Mode	Fixed

Green	10.3	67.6	27.1	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.0	1.9	1.3	0.0	0.0	0.0



Interchange Results

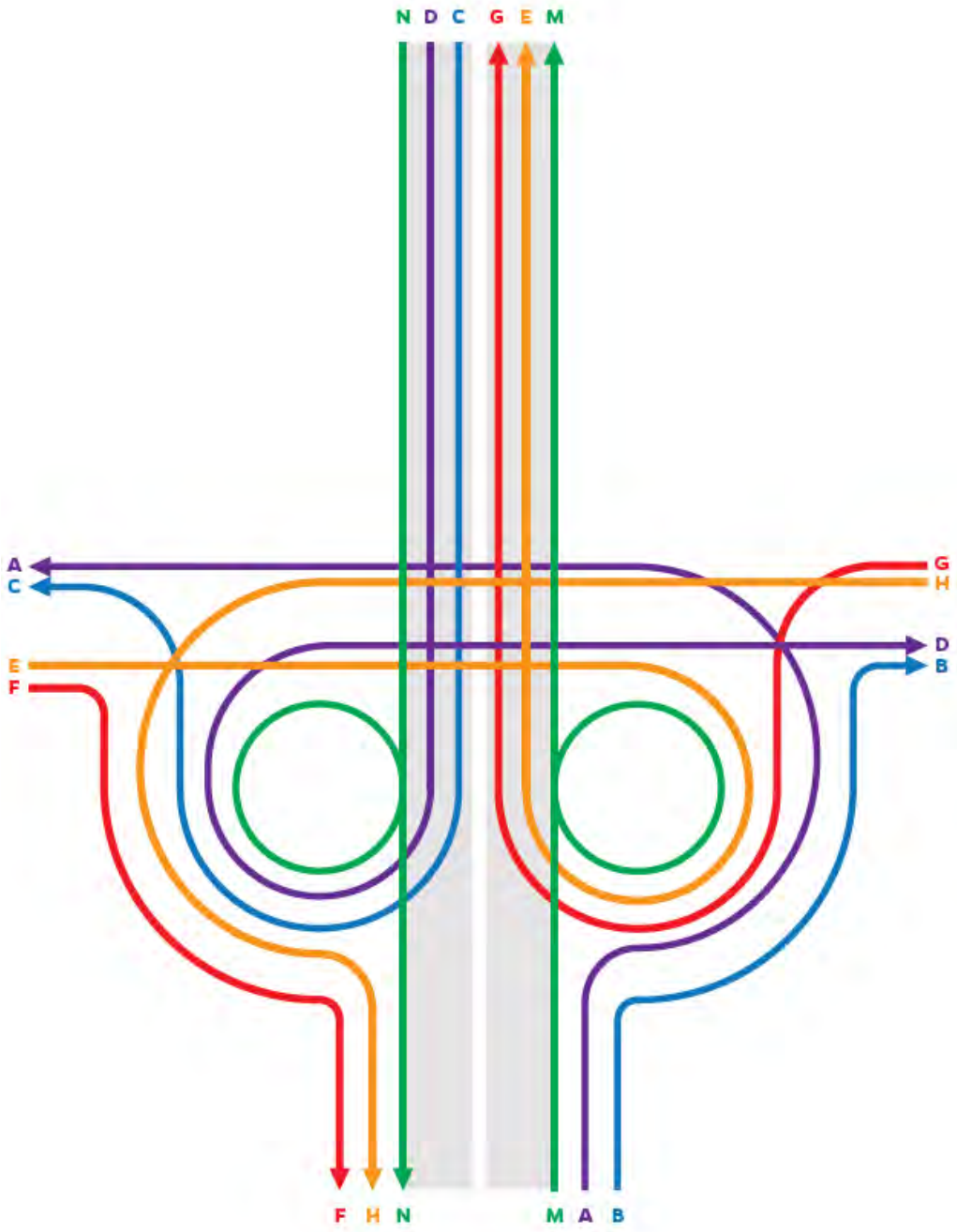
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	217	59.2	0.0	59.2	No	No	D
B	389	35.1	0.0	35.1	No	No	C
C	178	50.3	5.0	55.3	No	No	D
D	333	1.9	5.0	6.9	No	No	A
E	133	49.5	5.0	54.5	No	No	C
F	67	30.8	0.0	30.8	No	No	C
G	219	49.7	5.0	54.7	No	No	C
H	802	29.5	0.0	29.5	No	No	B
I	328	43.6	0.0	43.6	No	No	C
J	1224	8.3	0.0	8.3	No	No	A
K	-	-	0.0	-	-	-	-
L	-	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh		30.8	27.4	27.6	6.4		50.3		0.0			
Level of Service (LOS)		C	C	C	A		D		A			
Approach Delay, s/veh / LOS	30.3	C		14.0	B		17.5	B		0.0		
Intersection Delay, s/veh / LOS	17.2						B					

Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh		12.8	18.8	49.7	1.9			52.8	35.1			
Level of Service (LOS)		B	B	D	A			D	D			
Approach Delay, s/veh / LOS	14.7	B		6.6	A		44.9	D		0.0		
Intersection Delay, s/veh / LOS	14.7						B					

Interchange Graphic



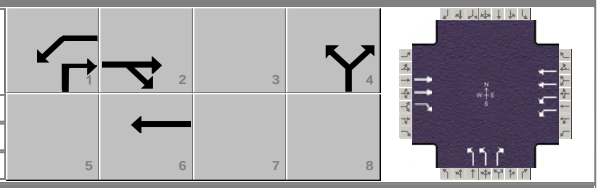
HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	Parclo AB-2Q
Analyst	Graham Johnson	Analysis Date	Jan 2, 2019	Segment Distance, ft	1097
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	North-South
Intersection	SB I-229 Ramp	PHF	0.90	Arterial Direction	East-West
File Name	24-25-26 26th Street 2050 PM.xus				
Project Description	BUILD - I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h		1390	75	540	970		160		785			
Intersection Two Demand (*v*), veh/h		1930	245	155	1435		75	0	920			

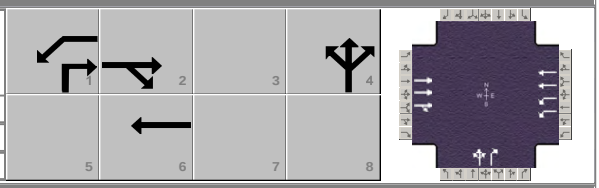
Signal One Information	
Cycle, s	140.0
Offset, s	0
Uncoordinated	No
Force Mode	Fixed

Green	32.5	76.5	15.1	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.9	1.9	1.3	0.0	0.0	0.0



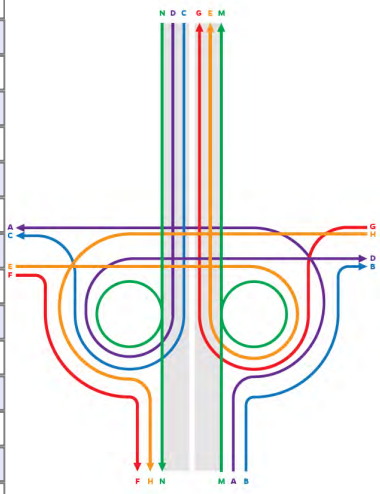
Signal Two Information	
Cycle, s	140.0
Offset, s	0
Uncoordinated	No
Force Mode	Fixed

Green	74.0	11.2	39.8	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.9	1.0	1.3	0.0	0.0	0.0



Interchange Results

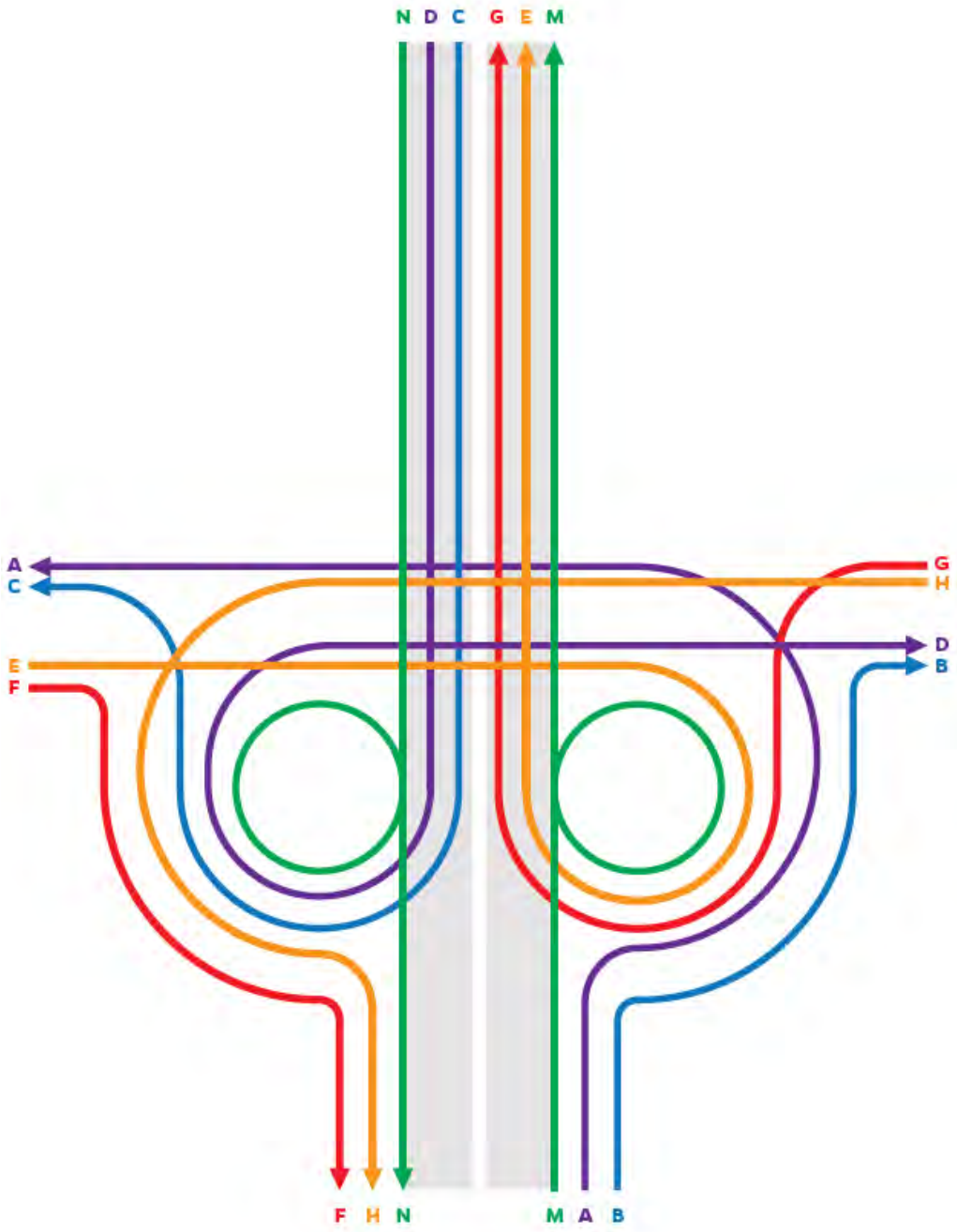
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	83	63.9	0.0	63.9	No	No	D
B	689	42.0	0.0	42.0	No	No	C
C	178	59.8	5.0	64.8	No	No	D
D	872	4.0	5.0	9.0	No	No	A
E	231	65.3	5.0	70.3	No	No	D
F	78	27.1	0.0	27.1	No	No	B
G	172	68.0	5.0	73.0	No	No	D
H	600	60.2	0.0	60.2	No	No	D
I	950	60.5	0.0	60.5	No	No	D
J	994	7.9	0.0	7.9	No	No	A
K	-	-	0.0	-	-	-	-
L	-	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh		27.1	15.5	56.2	3.9		59.8		0.0			
Level of Service (LOS)		C	B	E	A		E		A			
Approach Delay, s/veh / LOS	26.5	C		22.6	C		10.1	B		0.0		
Intersection Delay, s/veh / LOS	21.1						C					

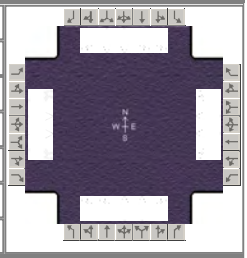
Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh		33.4	38.2	68.0	4.0			60.0	42.0			
Level of Service (LOS)		C	D	E	A			E	D			
Approach Delay, s/veh / LOS	35.0	C		10.2	B		49.5	D		0.0		
Intersection Delay, s/veh / LOS	27.9						C					

Interchange Graphic



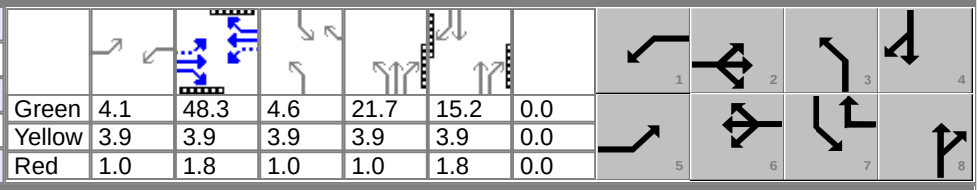
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 2, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	26th Street	Analysis Year	2050	Analysis Period	1> 7:15
Intersection	Southeastern Ave	File Name	24-25-26 26th Street 2050 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	150	715	230	70	1345	485	690	1210	60	75	255	75

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	15	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	4.1	48.3	4.6	21.7	15.2	0.0
Yellow	3.9	3.9	3.9	3.9	3.9	0.0
Red	1.0	1.8	1.0	1.0	1.8	0.0

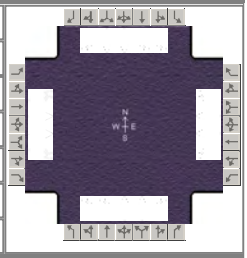
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6	3	8	7	4
Case Number	1.1	3.0	1.1	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	9.0	54.0	9.0	54.0	36.1	47.5	9.5	20.9
Change Period, ($Y+R_c$), s	4.9	5.7	4.9	5.7	4.9	5.7	4.9	5.7
Max Allow Headway (*MAH*), s	4.2	0.0	4.2	0.0	4.2	4.1	4.2	4.1
Queue Clearance Time (g_s), s	6.1		5.2		28.2	43.8	4.9	11.3
Green Extension Time (g_e), s	0.0	0.0	0.0	0.0	3.0	0.0	0.0	2.7
Phase Call Probability	1.00		0.93		1.00	1.00	0.94	1.00
Max Out Probability	1.00		1.00		0.09	1.00	1.00	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	167	794	256	78	1494	372	767	1344	44	83	283	61
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1734		1734	1734	1543	1684	1734	1568	1684	1734	1568
Queue Service Time (g_s), s	4.1	19.7		3.2	48.3	21.3	26.2	41.8	2.3	2.9	9.3	4.3
Cycle Queue Clearance Time (g_c), s	4.1	19.7		3.2	48.3	21.3	26.2	41.8	2.3	2.9	9.3	4.3
Green Ratio (*g/C*)	0.44	0.40		0.44	0.40	0.44	0.26	0.35	0.35	0.04	0.13	0.13
Capacity (*c*), veh/h	119	1396		271	1396	681	876	1207	546	130	439	199
Volume-to-Capacity Ratio (*X*)	1.397	0.569		0.287	1.071	0.547	0.876	1.114	0.081	0.642	0.645	0.308
Back of Queue (*Q*), ft/ln (95 th percentile)	372.5	313.8		61	1001.3	331.3	435.6	1001.4	39.2	63.7	193.6	77.1
Back of Queue (*Q*), veh/ln (95 th percentile)	14.7	12.4		2.4	39.4	13.0	17.1	39.4	1.6	2.5	7.6	3.1
Queue Storage Ratio (*RQ*) (95 th percentile)	0.83	0.00		0.24	0.00	1.33	1.02	0.00	0.16	0.17	0.00	0.39
Uniform Delay (d_1), s/veh	34.7	23.9		22.2	35.9	24.7	42.5	39.1	26.2	56.9	49.8	47.6
Incremental Delay (d_2), s/veh	218.4	1.5		0.6	45.5	3.1	6.2	63.0	0.1	8.2	3.2	0.9
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	253.2	25.4	0.0	22.7	81.4	27.8	48.7	102.2	26.3	65.0	53.1	48.5
Level of Service (LOS)	F	C	A	C	F	C	D	F	C	E	D	D
Approach Delay, s/veh / LOS	51.3	D		68.8	E		81.6	F		54.7	D	
Intersection Delay, s/veh / LOS	68.8						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.60	C	2.60	C	2.65	C	2.46	B
Bicycle LOS Score / LOS	1.49	A	2.09	B	2.27	B	0.84	A

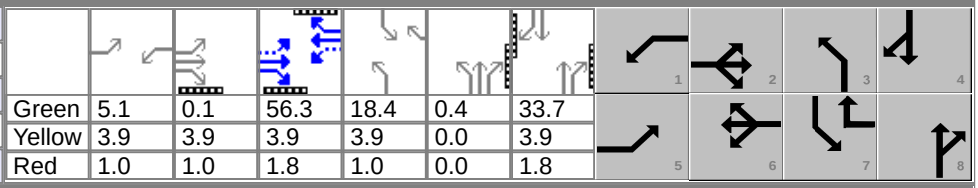
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 2, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	26th Street	Analysis Year	2050	Analysis Period	1> 4:30
Intersection	Southeastern Ave	File Name	24-25-26 26th Street 2050 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	230	1775	845	100	1105	215	345	450	105	330	890	140

Signal Information			
Cycle, s	140.0	Reference Phase	2
Offset, s	64	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	5.1	0.1	56.3	18.4	0.4	33.7
Yellow	3.9	3.9	3.9	3.9	0.0	3.9
Red	1.0	1.0	1.8	1.0	0.0	1.8

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6	3	8	7	4
Case Number	1.1	3.0	1.1	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	15.0	67.0	10.0	62.0	23.6	39.7	23.3	39.4
Change Period, ($Y+R_c$), s	4.9	5.7	4.9	5.7	4.9	5.7	4.9	5.7
Max Allow Headway (*MAH*), s	4.2	0.0	4.2	0.0	4.2	4.1	4.2	4.1
Queue Clearance Time (g_s), s	12.1		7.1		17.6	19.9	16.9	35.7
Green Extension Time (g_e), s	0.0	0.0	0.0	0.0	1.2	6.9	1.5	0.0
Phase Call Probability	1.00		0.99		1.00	1.00	1.00	1.00
Max Out Probability	1.00		1.00		0.07	0.38	0.00	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	230	1771	843	111	1228	183	383	500	89	367	989	122
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1734		1734	1734	1543	1684	1734	1568	1684	1734	1568
Queue Service Time (g_s), s	10.1	61.3		5.1	45.9	8.8	15.6	17.9	6.4	14.9	33.7	9.0
Cycle Queue Clearance Time (g_c), s	10.1	61.3		5.1	45.9	8.8	15.6	17.9	6.4	14.9	33.7	9.0
Green Ratio (*g/C*)	0.49	0.44		0.44	0.40	0.53	0.13	0.24	0.24	0.13	0.24	0.24
Capacity (*c*), veh/h	210	1517		115	1393	823	451	842	381	442	834	377
Volume-to-Capacity Ratio (*X*)	1.091	1.167		0.965	0.881	0.223	0.851	0.593	0.233	0.829	1.186	0.324
Back of Queue (*Q*), ft/ln (95 th percentile)	351	1357.8		205	723.6	151.7	291.8	317.4	114	274.8	950	161.3
Back of Queue (*Q*), veh/ln (95 th percentile)	13.8	53.5		8.1	28.5	6.0	11.5	12.5	4.6	10.8	37.4	6.5
Queue Storage Ratio (*RQ*) (95 th percentile)	0.78	0.00		0.82	0.00	0.61	0.69	0.00	0.46	0.73	0.00	0.81
Uniform Delay (d_1), s/veh	37.6	28.8		36.3	38.8	17.3	59.3	46.9	42.5	59.3	53.2	43.8
Incremental Delay (d_2), s/veh	77.2	80.5		72.6	8.3	0.6	7.3	1.1	0.3	4.1	95.8	0.5
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	114.9	109.3	0.0	108.9	47.1	17.9	66.5	48.0	42.8	63.3	148.9	44.3
Level of Service (LOS)	F	F	A	F	D	B	E	D	D	E	F	D
Approach Delay, s/veh / LOS	77.3	E		48.1	D		54.8	D		119.0	F	
Intersection Delay, s/veh / LOS	76.6						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.61	C	2.62	C	2.53	C	2.46	B
Bicycle LOS Score / LOS	3.10	C	1.74	B	1.29	A	1.71	B

HCS7 Two-Way Stop-Control Report

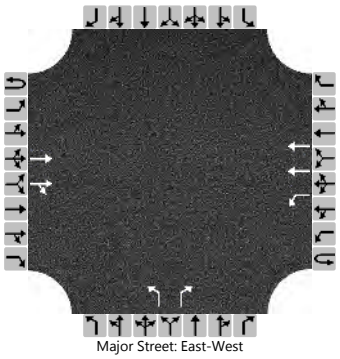
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/1/19
Analysis Year	2050
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	26th St at Yeager Rd
Jurisdiction	Sioux Falls, SD
East/West Street	26th Street
North/South Street	Yeager Road
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	2	0	0	1	2	0		1	0	1		0	0	0
Configuration			T	TR		L	T			L		R				
Volume (veh/h)			430	5	0	200	1190			25		50				
Percent Heavy Vehicles (%)					3	2				2		2				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized										No						
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.5		6.9				
Critical Headway (sec)						4.14				6.84		6.94				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.22				3.52		3.32				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						222				28		56				
Capacity, c (veh/h)						1076				78		759				
v/c Ratio						0.21				0.35		0.07				
95% Queue Length, Q_{95} (veh)						0.8				1.4		0.2				
Control Delay (s/veh)						9.2				74.2		10.1				
Level of Service (LOS)						A				F		B				
Approach Delay (s/veh)					1.3				31.5							
Approach LOS									D							

HCS7 Two-Way Stop-Control Report

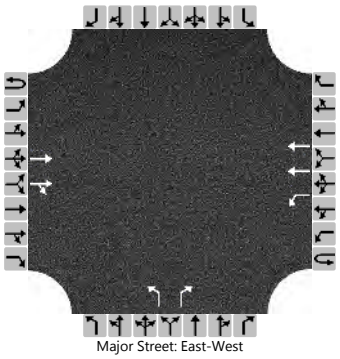
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/1/19
Analysis Year	2050
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	26th St at Yeager Rd
Jurisdiction	Sioux Falls, SD
East/West Street	26th Street
North/South Street	Yeager Road
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	2	0	0	1	2	0		1	0	1		0	0	0
Configuration			T	TR		L	T			L		R				
Volume (veh/h)			1315	10	0	265	865			25		150				
Percent Heavy Vehicles (%)					3	2				2		2				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized										No						
Median Type | Storage			Undivided													

Critical and Follow-up Headways

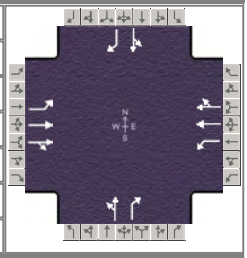
Base Critical Headway (sec)						4.1				7.5		6.9				
Critical Headway (sec)						4.14				6.84		6.94				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.22				3.52		3.32				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						294				28		167				
Capacity, c (veh/h)						454				8		361				
v/c Ratio						0.65				3.54		0.46				
95% Queue Length, Q_{95} (veh)						4.5				4.7		2.3				
Control Delay (s/veh)						26.4				2060.8		23.2				
Level of Service (LOS)						D				F		C				
Approach Delay (s/veh)						6.2				314.3						
Approach LOS										F						

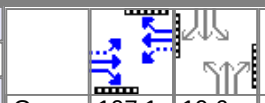
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 1, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	41st Street	Analysis Year	2050	Analysis Period	1> 7:15
Intersection	Norton Ave	File Name	28 41st at Norton 2050 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	20	540	30	10	320	10	15	10	5	10	10	10

Signal Information			
Cycle, s	150.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



							1	2	3	4
Green	107.1	19.6	7.5	0.0	0.0	0.0	5	6	7	8
Yellow	3.6	3.6	3.6	0.0	0.0	0.0				
Red	1.4	1.8	1.8	0.0	0.0	0.0				

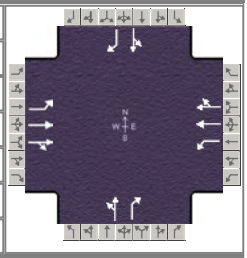
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		6.0		6.0		11.0		11.0
Phase Duration, s		112.1		112.1		12.9		25.0
Change Period, ($Y+R_c$), s		5.0		5.0		5.4		5.4
Max Allow Headway (*MAH*), s		0.0		0.0		5.2		5.2
Queue Clearance Time (g_s), s						4.3		3.7
Green Extension Time (g_e), s		0.0		0.0		0.1		0.1
Phase Call Probability						0.75		1.00
Max Out Probability						0.00		0.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	22	319	314	11	184	183		28	6		22	11
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1015	1821	1787	794	1821	1801		1768	1543		1777	1543
Queue Service Time (g_s), s	1.1	9.1	9.1	0.7	4.8	4.8		2.3	0.5		1.7	0.9
Cycle Queue Clearance Time (g_c), s	5.9	9.1	9.1	9.9	4.8	4.8		2.3	0.5		1.7	0.9
Green Ratio (*g/C*)	0.71	0.71	0.71	0.71	0.71	0.71		0.05	0.05		0.13	0.13
Capacity (*c*), veh/h	740	1300	1276	566	1300	1286		88	77		232	202
Volume-to-Capacity Ratio (*X*)	0.030	0.246	0.246	0.020	0.141	0.142		0.314	0.072		0.096	0.055
Back of Queue (*Q*), ft/ln (95 th percentile)	11.5	167.6	165	6.4	88.3	87.8		50.5	9.9		35.1	17.5
Back of Queue (*Q*), veh/ln (95 th percentile)	0.5	6.6	6.5	0.3	3.5	3.5		2.0	0.4		1.4	0.7
Queue Storage Ratio (*RQ*) (95 th percentile)	0.11	0.00	0.00	0.06	0.00	0.00		0.00	0.13		0.00	0.23
Uniform Delay (d_1), s/veh	7.8	7.4	7.4	9.2	6.8	6.8		68.8	67.9		57.4	57.1
Incremental Delay (d_2), s/veh	0.1	0.5	0.5	0.1	0.2	0.2		2.8	0.6		0.3	0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Control Delay (*d*), s/veh	7.8	7.9	7.9	9.2	7.1	7.1		71.6	68.5		57.7	57.3
Level of Service (LOS)	A	A	A	A	A	A		E	E		E	E
Approach Delay, s/veh / LOS	7.9	A		7.1	A		71.1	E		57.5	E	
Intersection Delay, s/veh / LOS	11.0						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.87	B	1.87	B	2.33	B	2.33	B
Bicycle LOS Score / LOS	1.03	A	0.80	A	0.54	A	0.54	A

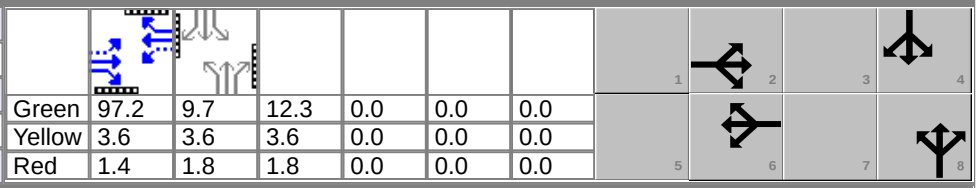
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 1, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	41st Street	Analysis Year	2050	Analysis Period	1> 16:30
Intersection	Norton Ave	File Name	28 41st at Norton 2050 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	35	945	65	25	845	30	80	35	40	20	30	45

Signal Information			
Cycle, s	135.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	97.2	9.7	12.3	0.0	0.0	0.0						
Yellow	3.6	3.6	3.6	0.0	0.0	0.0						
Red	1.4	1.8	1.8	0.0	0.0	0.0						

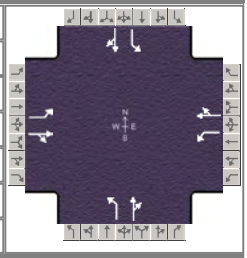
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		6.0		6.0		11.0		11.0
Phase Duration, s		102.2		102.2		17.7		15.1
Change Period, ($Y+R_c$), s		5.0		5.0		5.4		5.4
Max Allow Headway (*MAH*), s		0.0		0.0		5.2		5.3
Queue Clearance Time (g_s), s						11.6		6.0
Green Extension Time (g_e), s		0.0		0.0		0.7		0.3
Phase Call Probability						1.00		0.97
Max Out Probability						0.00		0.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	39	567	555	28	489	483		128	33		56	39
Adjusted Saturation Flow Rate (*s*), veh/h/ln	578	1821	1779	502	1821	1799		1760	1543		1785	1543
Queue Service Time (g_s), s	3.7	17.1	17.1	3.2	13.9	13.9		9.6	2.7		4.0	3.2
Cycle Queue Clearance Time (g_c), s	17.6	17.1	17.1	20.4	13.9	13.9		9.6	2.7		4.0	3.2
Green Ratio (*g/C*)	0.72	0.72	0.72	0.72	0.72	0.72		0.09	0.09		0.07	0.07
Capacity (*c*), veh/h	410	1311	1281	351	1311	1295		160	141		128	111
Volume-to-Capacity Ratio (*X*)	0.095	0.433	0.433	0.079	0.373	0.373		0.797	0.237		0.433	0.350
Back of Queue (*Q*), ft/ln (95 th percentile)	24.3	277	272.3	18.6	233.7	231.5		214.2	50.7		88.9	61.9
Back of Queue (*Q*), veh/ln (95 th percentile)	1.0	10.9	10.7	0.7	9.2	9.1		8.4	2.0		3.5	2.4
Queue Storage Ratio (*RQ*) (95 th percentile)	0.24	0.00	0.00	0.19	0.00	0.00		0.00	0.68		0.00	0.83
Uniform Delay (d_1), s/veh	10.6	7.7	7.7	11.8	7.2	7.2		60.1	57.0		60.0	59.6
Incremental Delay (d_2), s/veh	0.5	1.0	1.1	0.4	0.8	0.8		12.0	1.2		3.2	2.7
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Control Delay (*d*), s/veh	11.1	8.7	8.8	12.3	8.1	8.1		72.1	58.2		63.3	62.3
Level of Service (LOS)	B	A	A	B	A	A		E	E		E	E
Approach Delay, s/veh / LOS	8.8	A		8.2	A		69.2	E		62.9	E	
Intersection Delay, s/veh / LOS	14.7						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.88	B	1.88	B	2.33	B	2.32	B
Bicycle LOS Score / LOS	1.45	A	1.31	A	0.75	A	0.64	A

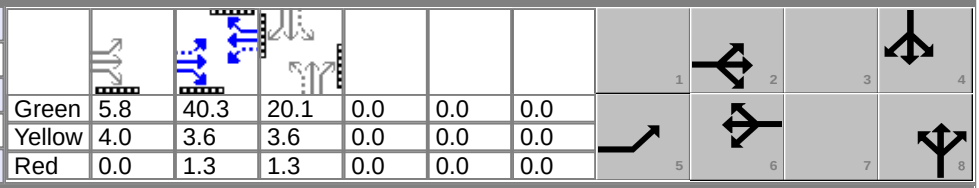
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 1, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	41st Street	Analysis Year	2050	Analysis Period	1> 7:15
Intersection	Phillips Ave	File Name	29 41st at Phillips 2050 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	170	265	10	30	260	200	10	130	55	170	20	170

Signal Information			
Cycle, s	80.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	5.8	40.3	20.1	0.0	0.0	0.0
Yellow	4.0	3.6	3.6	0.0	0.0	0.0
Red	0.0	1.3	1.3	0.0	0.0	0.0

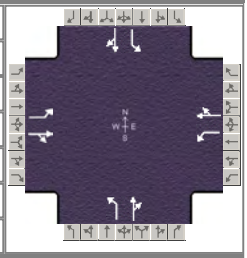
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		4
Case Number	1.0	4.0		6.3		6.0		6.0
Phase Duration, s	9.8	55.0		45.2		25.0		25.0
Change Period, ($Y+R_c$), s	4.0	4.9		4.9		4.9		4.9
Max Allow Headway (*MAH*), s	4.2	0.0		0.0		5.4		5.4
Queue Clearance Time (g_s), s	5.9					10.3		22.1
Green Extension Time (g_e), s	0.0	0.0		0.0		2.6		0.0
Phase Call Probability	0.98					1.00		1.00
Max Out Probability	1.00					0.39		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	189	306		33	511		11	206		189	178	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1809		1074	1689		1207	1729		1176	1573	
Queue Service Time (g_s), s	3.9	6.1		1.3	17.2		0.6	8.1		12.0	7.6	
Cycle Queue Clearance Time (g_c), s	3.9	6.1		1.3	17.2		8.3	8.1		20.1	7.6	
Green Ratio (*g/C*)	0.60	0.63		0.50	0.50		0.25	0.25		0.25	0.25	
Capacity (*c*), veh/h	472	1133		631	850		278	434		267	395	
Volume-to-Capacity Ratio (*X*)	0.400	0.270		0.053	0.601		0.040	0.473		0.708	0.450	
Back of Queue (*Q*), ft/ln (95 th percentile)	60.9	99.6		14.1	278.6		8.4	152.7		194.7	131.7	
Back of Queue (*Q*), veh/ln (95 th percentile)	2.4	3.9		0.6	11.0		0.3	6.0		7.7	5.2	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.47	0.00		0.24	0.00		0.14	0.00		0.97	0.00	
Uniform Delay (d_1), s/veh	10.1	6.7		10.2	14.1		28.8	25.5		34.4	25.3	
Incremental Delay (d_2), s/veh	0.5	0.6		0.2	3.1		0.1	1.1		9.1	1.1	
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh	10.6	7.3		10.3	17.3		28.9	26.6		43.5	26.4	
Level of Service (LOS)	B	A		B	B		C	C		D	C	
Approach Delay, s/veh / LOS	8.6	A		16.8	B		26.7	C		35.2	D	
Intersection Delay, s/veh / LOS	19.8						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.87	B	1.93	B	1.92	B	1.92	B
Bicycle LOS Score / LOS	1.30	A	1.39	A	0.85	A	1.09	A

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 1, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	41st Street	Analysis Year	2050	Analysis Period	1> 16:30
Intersection	Phillips Ave	File Name	29 41st at Phillips 2050 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	125	275	5	20	320	205	30	60	70	140	25	245

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4
Green	4.9	50.2	21.1	0.0	0.0	0.0	5	6	7	8
Yellow	4.0	3.6	3.6	0.0	0.0	0.0				
Red	0.0	1.3	1.3	0.0	0.0	0.0				

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		4
Case Number	1.0	4.0		6.3		6.0		6.0
Phase Duration, s	8.9	64.0		55.1		26.0		26.0
Change Period, ($Y+R_c$), s	4.0	4.9		4.9		4.9		4.9
Max Allow Headway (*MAH*), s	4.2	0.0		0.0		5.4		5.4
Queue Clearance Time (g_s), s	4.9					17.1		19.3
Green Extension Time (g_e), s	0.2	0.0		0.0		2.2		1.8
Phase Call Probability	0.97					1.00		1.00
Max Out Probability	0.46					0.58		0.93

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	139	311		22	583		33	144		156	244	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1815		1068	1702		1135	1660		1244	1571	
Queue Service Time (g_s), s	2.9	6.4		0.8	20.8		2.5	6.6		10.8	12.7	
Cycle Queue Clearance Time (g_c), s	2.9	6.4		0.9	20.8		15.1	6.6		17.3	12.7	
Green Ratio (*g/C*)	0.63	0.66		0.56	0.56		0.23	0.23		0.23	0.23	
Capacity (*c*), veh/h	446	1192		676	949		186	389		281	368	
Volume-to-Capacity Ratio (*X*)	0.311	0.261		0.033	0.614		0.179	0.371		0.553	0.664	
Back of Queue (*Q*), ft/ln (95 th percentile)	45.1	106		9.3	321.9		32.6	121.5		155.6	222.7	
Back of Queue (*Q*), veh/ln (95 th percentile)	1.8	4.2		0.4	12.7		1.3	4.8		6.1	8.8	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.35	0.00		0.15	0.00		0.54	0.00		0.78	0.00	
Uniform Delay (d_1), s/veh	10.0	6.4		9.0	13.4		38.1	28.9		36.1	31.2	
Incremental Delay (d_2), s/veh	0.4	0.5		0.1	3.0		0.6	0.8		2.4	3.7	
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh	10.4	6.9		9.1	16.4		38.7	29.7		38.5	34.9	
Level of Service (LOS)	B	A		A	B		D	C		D	C	
Approach Delay, s/veh / LOS	8.0	A		16.1	B		31.4	C		36.3	D	
Intersection Delay, s/veh / LOS	20.5						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.86	B	1.96	B	1.93	B	1.93	B
Bicycle LOS Score / LOS	1.23	A	1.49	A	0.78	A	1.15	A

Appendix E

HCS Analysis Summary – Forecast 2035 No Build Conditions

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - west of Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3230	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1269
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.55
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	20.5
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - west of Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2545	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	980
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.42
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	15.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - between Western Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2725	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1606
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.69
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.7
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	26.0
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - between Western Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2190	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1264
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.55
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	20.5
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - between Western and Minnesota		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3185	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1251
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.54
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	20.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - between Western and Minnesota		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3045	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1172
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.51
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.0
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - Western to Minnesota		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2860	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2347	368	92	378
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	6.00	6.00	6.00	6.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.943	0.943	0.943	0.943
Flow Rate (v_i), pc/h	2765	434	108	445
Weaving Flow Rate (v_w), pc/h	879	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2873	Density-Based Capacity (c_{IWL}), pc/h/ln		2195
Total Flow Rate (v), pc/h	3752	Demand Flow-Based Capacity (c_{IW}), pc/h		10256
Volume Ratio (VR)	0.234	Weaving Segment Capacity (c_W), veh/h		6210
Minimum Lane Change Rate (LC_{MIN}), lc/h	879	Adjusted Weaving Area Capacity, pc/h		6585
Maximum Weaving Length (L_{MAX}), ft	4887	Volume-to-Capacity Ratio (v/c)		0.57

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	822	Average Weaving Speed (S_W),mi/h	56.0
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1564	Average Non-Weaving Speed (S_{NW}), mi/h	52.7
Weaving Lane Change Rate (LC_W), lc/h	1188	Average Speed (S), mi/h	53.4
Weaving Lane Change Rate (LC_{All}), lc/h	2752	Density (D), pc/mi/ln	23.4
Weaving Intensity Factor (W)	0.219	Level of Service (LOS)	C

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - Western to Minnesota		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2860	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1889	701	154	301
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	4.00	4.00	4.00	4.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.962	0.962	0.962	0.962
Flow Rate (v_i), pc/h	2182	810	178	348
Weaving Flow Rate (v_w), pc/h	1158	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2360	Density-Based Capacity (c_{IWL}), pc/h/ln		2118
Total Flow Rate (v), pc/h	3518	Demand Flow-Based Capacity (c_{IW}), pc/h		7295
Volume Ratio (VR)	0.329	Weaving Segment Capacity (c_W), veh/h		6113
Minimum Lane Change Rate (LC_{MIN}), lc/h	1158	Adjusted Weaving Area Capacity, pc/h		6354
Maximum Weaving Length (L_{MAX}), ft	5897	Volume-to-Capacity Ratio (v/c)		0.55

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	675	Average Weaving Speed (S_W),mi/h	55.7
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1458	Average Non-Weaving Speed (S_{NW}), mi/h	51.0
Weaving Lane Change Rate (LC_W), lc/h	1467	Average Speed (S), mi/h	52.5
Weaving Lane Change Rate (LC_{All}), lc/h	2925	Density (D), pc/mi/ln	22.3
Weaving Intensity Factor (W)	0.230	Level of Service (LOS)	C

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - between Minnesota Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2715	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1600
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.69
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.7
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	25.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - between Minnesota Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2590	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1496
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.65
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	24.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - between Minnesota and Cliff		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3070	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1206
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.52
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.5
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - between Minnesota and Cliff		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3260	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1255
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.54
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	20.3
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - Minnesota to Cliff		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	3120	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1981	284	71	734
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	6.00	6.00	6.00	6.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.943	0.943	0.943	0.943
Flow Rate (v_i), pc/h	2334	335	84	865
Weaving Flow Rate (v_w), pc/h	1200	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2418	Density-Based Capacity (c_{IWL}), pc/h/ln		2135
Total Flow Rate (v), pc/h	3618	Demand Flow-Based Capacity (c_{IW}), pc/h		7229
Volume Ratio (VR)	0.332	Weaving Segment Capacity (c_W), veh/h		6040
Minimum Lane Change Rate (LC_{MIN}), lc/h	1200	Adjusted Weaving Area Capacity, pc/h		6405
Maximum Weaving Length (L_{MAX}), ft	5930	Volume-to-Capacity Ratio (v/c)		0.56

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	754	Average Weaving Speed (S_W),mi/h	55.7
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1611	Average Non-Weaving Speed (S_{NW}), mi/h	50.6
Weaving Lane Change Rate (LC_W), lc/h	1525	Average Speed (S), mi/h	52.2
Weaving Lane Change Rate (LC_{All}), lc/h	3136	Density (D), pc/mi/ln	23.1
Weaving Intensity Factor (W)	0.227	Level of Service (LOS)	C

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - Minnesota to Cliff		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	3120	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1921	549	121	669
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	4.00	4.00	4.00	4.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.962	0.962	0.962	0.962
Flow Rate (v_i), pc/h	2219	634	140	773
Weaving Flow Rate (v_W), pc/h	1407	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2359	Density-Based Capacity (c_{IWL}), pc/h/ln		2100
Total Flow Rate (v), pc/h	3766	Demand Flow-Based Capacity (c_{IW}), pc/h		6417
Volume Ratio (VR)	0.374	Weaving Segment Capacity (c_W), veh/h		6061
Minimum Lane Change Rate (LC_{MIN}), lc/h	1407	Adjusted Weaving Area Capacity, pc/h		6300
Maximum Weaving Length (L_{MAX}), ft	6391	Volume-to-Capacity Ratio (v/c)		0.60

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	736	Average Weaving Speed (S_W),mi/h	55.4
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1599	Average Non-Weaving Speed (S_{NW}), mi/h	48.8
Weaving Lane Change Rate (LC_W), lc/h	1732	Average Speed (S), mi/h	51.1
Weaving Lane Change Rate (LC_{All}), lc/h	3331	Density (D), pc/mi/ln	24.6
Weaving Intensity Factor (W)	0.238	Level of Service (LOS)	C

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - between Cliff Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2265	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1334
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.58
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	21.6
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - between Cliff Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2470	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1426
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.62
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	23.1
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - between Cliff and 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2835	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1113
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.48
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	18.0
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - between Cliff and 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2830	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1090
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.47
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	17.6
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - Cliff to 26th		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2750	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1718	507	63	547
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	6.00	6.00	6.00	6.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.943	0.943	0.943	0.943
Flow Rate (v_i), pc/h	2024	597	74	645
Weaving Flow Rate (v_w), pc/h	1242	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2098	Density-Based Capacity (c_{IWL}), pc/h/ln		2073
Total Flow Rate (v), pc/h	3340	Demand Flow-Based Capacity (c_{IW}), pc/h		6452
Volume Ratio (VR)	0.372	Weaving Segment Capacity (c_W), veh/h		5865
Minimum Lane Change Rate (LC_{MIN}), lc/h	1242	Adjusted Weaving Area Capacity, pc/h		6220
Maximum Weaving Length (L_{MAX}), ft	6369	Volume-to-Capacity Ratio (v/c)		0.54

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	577	Average Weaving Speed (S_W),mi/h	55.5
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1345	Average Non-Weaving Speed (S_{NW}), mi/h	50.7
Weaving Lane Change Rate (LC_W), lc/h	1544	Average Speed (S), mi/h	52.4
Weaving Lane Change Rate (LC_{All}), lc/h	2889	Density (D), pc/mi/ln	21.2
Weaving Intensity Factor (W)	0.235	Level of Service (LOS)	C

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
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Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - Cliff to 26th		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2750	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1672	263	97	798
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	4.00	4.00	4.00	4.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.962	0.962	0.962	0.962
Flow Rate (v_i), pc/h	1931	304	112	922
Weaving Flow Rate (v_w), pc/h	1226	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2043	Density-Based Capacity (c_{IWL}), pc/h/ln		2071
Total Flow Rate (v), pc/h	3269	Demand Flow-Based Capacity (c_{IW}), pc/h		6400
Volume Ratio (VR)	0.375	Weaving Segment Capacity (c_W), veh/h		5977
Minimum Lane Change Rate (LC_{MIN}), lc/h	1226	Adjusted Weaving Area Capacity, pc/h		6213
Maximum Weaving Length (L_{MAX}), ft	6402	Volume-to-Capacity Ratio (v/c)		0.53

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	562	Average Weaving Speed (S_W),mi/h	55.6
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1334	Average Non-Weaving Speed (S_{NW}), mi/h	50.9
Weaving Lane Change Rate (LC_W), lc/h	1528	Average Speed (S), mi/h	52.6
Weaving Lane Change Rate (LC_{All}), lc/h	2862	Density (D), pc/mi/ln	20.7
Weaving Intensity Factor (W)	0.233	Level of Service (LOS)	C

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - between 26th Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2225	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1311
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.57
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	21.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - between 26th Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	1935	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1118
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.48
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	18.1
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - north of 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2690	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1057
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.46
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	17.1
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - north of 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2245	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	864
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.37
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	14.0
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - north of 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3010	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1171
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.51
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	18.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - north of 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3710	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1415
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.61
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	22.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - between 26th Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2610	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1523
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.66
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	24.6
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - between 26th Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2940	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1682
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.73
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.4
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	27.4
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - between 26th and Cliff		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3345	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1301
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.56
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	21.1
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - between 26th and Cliff		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3545	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1352
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.58
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	21.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - 26th to Cliff		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2670	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2160	625	110	450
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	5.00	5.00	5.00	5.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.952	0.952	0.952	0.952
Flow Rate (v_i), pc/h	2521	729	128	525
Weaving Flow Rate (v_w), pc/h	1254	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2649	Density-Based Capacity (c_{IWL}), pc/h/ln		2110
Total Flow Rate (v), pc/h	3903	Demand Flow-Based Capacity (c_{IW}), pc/h		7477
Volume Ratio (VR)	0.321	Weaving Segment Capacity (c_W), veh/h		6026
Minimum Lane Change Rate (LC_{MIN}), lc/h	1254	Adjusted Weaving Area Capacity, pc/h		6330
Maximum Weaving Length (L_{MAX}), ft	5810	Volume-to-Capacity Ratio (v/c)		0.62

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	707	Average Weaving Speed (S_W),mi/h	55.1
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1415	Average Non-Weaving Speed (S_{NW}), mi/h	49.7
Weaving Lane Change Rate (LC_W), lc/h	1552	Average Speed (S), mi/h	51.3
Weaving Lane Change Rate (LC_{All}), lc/h	2967	Density (D), pc/mi/ln	25.4
Weaving Intensity Factor (W)	0.246	Level of Service (LOS)	C

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Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2670	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2335	490	115	605
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	3.00	3.00	3.00	3.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.971	0.971	0.971	0.971
Flow Rate (v_i), pc/h	2672	561	132	692
Weaving Flow Rate (v_w), pc/h	1253	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2804	Density-Based Capacity (c_{IWL}), pc/h/ln		2120
Total Flow Rate (v), pc/h	4057	Demand Flow-Based Capacity (c_{IW}), pc/h		7767
Volume Ratio (VR)	0.309	Weaving Segment Capacity (c_W), veh/h		6176
Minimum Lane Change Rate (LC_{MIN}), lc/h	1253	Adjusted Weaving Area Capacity, pc/h		6360
Maximum Weaving Length (L_{MAX}), ft	5681	Volume-to-Capacity Ratio (v/c)		0.64

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	749	Average Weaving Speed (S_W),mi/h	55.1
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1447	Average Non-Weaving Speed (S_{NW}), mi/h	49.5
Weaving Lane Change Rate (LC_W), lc/h	1551	Average Speed (S), mi/h	51.1
Weaving Lane Change Rate (LC_{All}), lc/h	2998	Density (D), pc/mi/ln	26.5
Weaving Intensity Factor (W)	0.248	Level of Service (LOS)	C

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - between Cliff Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2785	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1625
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.70
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.6
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	26.4
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

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Project Description	SB I-229 - between Cliff Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2825	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1616
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.70
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.7
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	26.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

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Project Information

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Project Description	SB I-229 - between Cliff and Minnesota		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3470	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1350
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.58
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	21.8
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

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Project Description	SB I-229 - between Cliff and Minnesota		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3580	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1366
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.59
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	22.1
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

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Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
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Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - Cliff to Minnesota		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	3100	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2537	548	137	248
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	5.00	5.00	5.00	5.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.952	0.952	0.952	0.952
Flow Rate (v_i), pc/h	2961	640	160	289
Weaving Flow Rate (v_w), pc/h	929	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	3121	Density-Based Capacity (c_{IWL}), pc/h/ln		2217
Total Flow Rate (v), pc/h	4050	Demand Flow-Based Capacity (c_{IW}), pc/h		10480
Volume Ratio (VR)	0.229	Weaving Segment Capacity (c_W), veh/h		6332
Minimum Lane Change Rate (LC_{MIN}), lc/h	929	Adjusted Weaving Area Capacity, pc/h		6651
Maximum Weaving Length (L_{MAX}), ft	4835	Volume-to-Capacity Ratio (v/c)		0.61

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	968	Average Weaving Speed (S_W),mi/h	56.0
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1745	Average Non-Weaving Speed (S_{NW}), mi/h	51.8
Weaving Lane Change Rate (LC_W), lc/h	1252	Average Speed (S), mi/h	52.7
Weaving Lane Change Rate (LC_{All}), lc/h	2997	Density (D), pc/mi/ln	25.6
Weaving Intensity Factor (W)	0.220	Level of Service (LOS)	C

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Project Description	SB I-229 - Cliff to Minnesota		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	3100	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2516	574	181	309
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	3.00	3.00	3.00	3.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.971	0.971	0.971	0.971
Flow Rate (v_i), pc/h	2879	657	207	354
Weaving Flow Rate (v_w), pc/h	1011	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	3086	Density-Based Capacity (c_{IWL}), pc/h/ln		2203
Total Flow Rate (v), pc/h	4097	Demand Flow-Based Capacity (c_{IW}), pc/h		9717
Volume Ratio (VR)	0.247	Weaving Segment Capacity (c_W), veh/h		6417
Minimum Lane Change Rate (LC_{MIN}), lc/h	1011	Adjusted Weaving Area Capacity, pc/h		6609
Maximum Weaving Length (L_{MAX}), ft	5022	Volume-to-Capacity Ratio (v/c)		0.62

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	957	Average Weaving Speed (S_W),mi/h	55.8
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1738	Average Non-Weaving Speed (S_{NW}), mi/h	51.2
Weaving Lane Change Rate (LC_W), lc/h	1334	Average Speed (S), mi/h	52.3
Weaving Lane Change Rate (LC_{All}), lc/h	3072	Density (D), pc/mi/ln	26.1
Weaving Intensity Factor (W)	0.224	Level of Service (LOS)	C

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
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Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - between Minnesota Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3085	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1800
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.78
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	60.6
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	29.7
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

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Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3090	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1768
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.76
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	60.9
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	29.0
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

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Project Information

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Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - between Minnesota and Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3480	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1354
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.58
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	21.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

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Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - between Minnesota and Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3765	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1436
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.62
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	23.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

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Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - Minnesota to Western		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	3220	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2436	269	126	649
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	5.00	5.00	5.00	5.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.952	0.952	0.952	0.952
Flow Rate (v_i), pc/h	2843	314	147	757
Weaving Flow Rate (v_w), pc/h	1071	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2990	Density-Based Capacity (c_{IWL}), pc/h/ln		2198
Total Flow Rate (v), pc/h	4061	Demand Flow-Based Capacity (c_{IW}), pc/h		9091
Volume Ratio (VR)	0.264	Weaving Segment Capacity (c_W), veh/h		6277
Minimum Lane Change Rate (LC_{MIN}), lc/h	1071	Adjusted Weaving Area Capacity, pc/h		6593
Maximum Weaving Length (L_{MAX}), ft	5201	Volume-to-Capacity Ratio (v/c)		0.62

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	963	Average Weaving Speed (S_W),mi/h	55.8
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1783	Average Non-Weaving Speed (S_{NW}), mi/h	50.8
Weaving Lane Change Rate (LC_W), lc/h	1401	Average Speed (S), mi/h	52.0
Weaving Lane Change Rate (LC_{All}), lc/h	3184	Density (D), pc/mi/ln	26.0
Weaving Intensity Factor (W)	0.224	Level of Service (LOS)	C

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - Minnesota to Western		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	3220	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2436	422	253	557
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	3.00	3.00	3.00	3.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.971	0.971	0.971	0.971
Flow Rate (v_i), pc/h	2788	483	290	637
Weaving Flow Rate (v_w), pc/h	1120	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	3078	Density-Based Capacity (c_{IWL}), pc/h/ln		2196
Total Flow Rate (v), pc/h	4198	Demand Flow-Based Capacity (c_{IW}), pc/h		8989
Volume Ratio (VR)	0.267	Weaving Segment Capacity (c_W), veh/h		6397
Minimum Lane Change Rate (LC_{MIN}), lc/h	1120	Adjusted Weaving Area Capacity, pc/h		6588
Maximum Weaving Length (L_{MAX}), ft	5233	Volume-to-Capacity Ratio (v/c)		0.64

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	991	Average Weaving Speed (S_W),mi/h	55.7
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1802	Average Non-Weaving Speed (S_{NW}), mi/h	50.2
Weaving Lane Change Rate (LC_W), lc/h	1450	Average Speed (S), mi/h	51.6
Weaving Lane Change Rate (LC_{All}), lc/h	3252	Density (D), pc/mi/ln	27.1
Weaving Intensity Factor (W)	0.228	Level of Service (LOS)	C

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - between Western Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2705	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1578
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.68
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	25.5
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - between Western Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2955	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1690
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.73
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.4
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	27.5
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - west of Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2950	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1148
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.50
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	18.6
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - west of Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

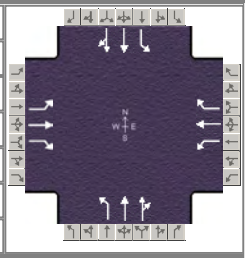
Demand Volume veh/h	3555	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1356
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.58
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	21.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

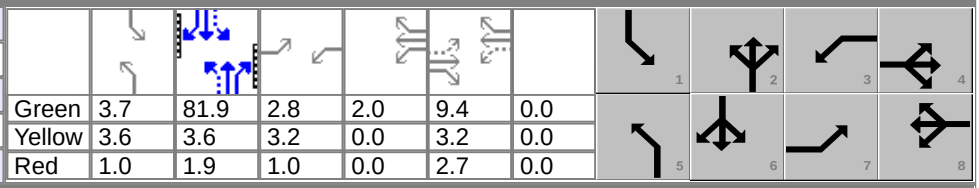
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 23, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	37th Street	File Name	01-02-04-05 Minnesota Avenue 2035 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	30	70	50	105	70	100	70	1585	100	90	800	15

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	71	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	3.7	81.9	2.8	2.0	9.4	0.0
Yellow	3.6	3.6	3.2	0.0	3.2	0.0
Red	1.0	1.9	1.0	0.0	2.7	0.0

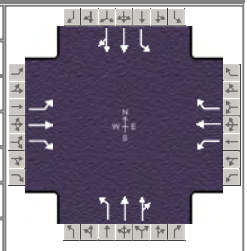
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	3.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	7.0	15.3	9.0	17.4	8.3	87.4	8.3	87.4
Change Period, ($Y+R_c$), s	4.2	5.9	4.2	5.9	4.6	5.5	4.6	5.5
Max Allow Headway (*MAH*), s	4.3	4.3	4.3	4.3	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	4.1	6.9	6.8	10.3	3.6		3.6	
Green Extension Time (g_e), s	0.0	1.2	0.0	1.2	0.3	0.0	0.3	0.0
Phase Call Probability	0.67	1.00	0.98	1.00	0.93		0.93	
Max Out Probability	1.00	0.00	1.00	0.00	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	33	78	56	117	78	111	78	938	935	78	356	354
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1543	1734	1821	1568	1734	1821	1783	1734	1821	1809
Queue Service Time (g_s), s	2.1	4.9	4.1	4.8	4.8	8.3	1.6	40.5	42.0	1.6	6.5	6.6
Cycle Queue Clearance Time (g_c), s	2.1	4.9	4.1	4.8	4.8	8.3	1.6	40.5	42.0	1.6	6.5	6.6
Green Ratio (*g/C*)	0.10	0.08	0.08	0.12	0.10	0.10	0.71	0.68	0.68	0.71	0.68	0.68
Capacity (*c*), veh/h	151	143	121	179	174	150	564	1242	1216	194	1242	1234
Volume-to-Capacity Ratio (*X*)	0.221	0.543	0.458	0.651	0.446	0.741	0.138	0.755	0.769	0.404	0.287	0.287
Back of Queue (*Q*), ft/ln (95 th percentile)	43.7	110	77.9	74.6	106.1	160.9	25.5	584.6	586.6	50.6	106.8	105.8
Back of Queue (*Q*), veh/ln (95 th percentile)	1.7	4.3	3.1	2.9	4.2	6.4	1.0	23.0	23.5	2.0	4.2	4.2
Queue Storage Ratio (*RQ*) (95 th percentile)	0.29	0.00	0.39	0.50	0.00	0.80	0.17	0.00	0.00	0.34	0.00	0.00
Uniform Delay (d_1), s/veh	49.5	53.2	52.8	52.0	51.3	52.8	5.5	12.5	12.7	16.4	4.8	4.9
Incremental Delay (d_2), s/veh	0.7	3.2	2.7	8.1	1.8	7.0	0.1	4.3	4.7	1.3	0.5	0.5
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	50.2	56.4	55.5	60.1	53.0	59.8	5.6	16.8	17.4	17.6	5.4	5.4
Level of Service (LOS)	D	E	E	E	D	E	A	B	B	B	A	A
Approach Delay, s/veh / LOS	54.9	D		58.2	E		16.7	B		6.6	A	
Intersection Delay, s/veh / LOS	20.1						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.31	B	2.31	B	2.06	B	2.06	B
Bicycle LOS Score / LOS	0.76	A	0.99	A	2.10	B	1.32	A

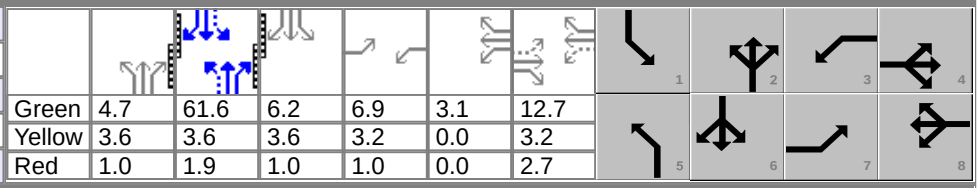
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 23, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2035	Analysis Period	1> 16:30
Intersection	37th Street	File Name	01-02-04-05 Minnesota Avenue 2035 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	70	135	120	170	125	105	80	1035	70	160	1590	50

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	71	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	4.7	61.6	6.2	6.9	3.1	12.7
Yellow	3.6	3.6	3.6	3.2	0.0	3.2
Red	1.0	1.9	1.0	1.0	0.0	2.7

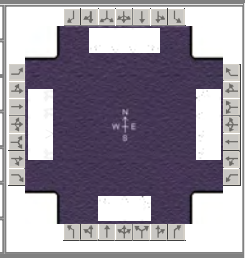
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	3.0	1.1	3.0	1.2	4.0	1.3	4.0
Phase Duration, s	11.1	18.6	14.2	21.7	9.3	76.4	10.8	78.0
Change Period, ($Y+R_c$), s	4.2	5.9	4.2	5.9	4.6	5.5	5.5	5.5
Max Allow Headway (*MAH*), s	4.3	4.3	4.3	4.3	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	6.7	11.6	12.0	10.6	4.8		2.0	
Green Extension Time (g_e), s	0.2	1.1	0.0	1.4	0.1	0.0	3.4	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	0.95		1.00	
Max Out Probability	0.00	0.28	1.00	0.05	0.06		0.98	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	78	150	78	189	139	83	89	620	607	171	879	876
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1543	1734	1821	1543	1734	1821	1780	1734	1821	1801
Queue Service Time (g_s), s	4.7	9.6	5.7	10.0	8.6	5.9	2.8	25.4	25.4	0.0	32.5	32.6
Cycle Queue Clearance Time (g_c), s	4.7	9.6	5.7	10.0	8.6	5.9	2.8	25.4	25.4	0.0	32.5	32.6
Green Ratio (*g/C*)	0.16	0.11	0.11	0.20	0.13	0.13	0.57	0.59	0.59	0.54	0.60	0.60
Capacity (*c*), veh/h	213	193	163	236	239	203	193	1076	1052	302	1100	1088
Volume-to-Capacity Ratio (*X*)	0.364	0.778	0.476	0.802	0.580	0.411	0.460	0.577	0.578	0.568	0.799	0.805
Back of Queue (*Q*), ft/ln (95 th percentile)	96.6	214.3	106	97.9	187.6	104.3	53.2	411.4	398.3	160.4	246.7	232.4
Back of Queue (*Q*), veh/ln (95 th percentile)	3.8	8.4	4.2	3.9	7.4	4.1	2.1	16.2	15.9	6.3	9.7	9.3
Queue Storage Ratio (*RQ*) (95 th percentile)	0.64	0.00	0.53	0.65	0.00	0.52	0.35	0.00	0.00	0.80	0.00	0.00
Uniform Delay (d_1), s/veh	44.2	52.3	50.5	45.6	49.0	2.3	19.1	15.2	15.2	34.0	8.2	7.9
Incremental Delay (d_2), s/veh	1.0	7.4	2.1	17.7	2.2	1.3	1.7	2.3	2.3	0.4	1.3	1.4
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	45.3	59.7	52.7	63.4	51.2	3.7	20.8	17.5	17.6	34.5	9.5	9.3
Level of Service (LOS)	D	E	D	E	D	A	C	B	B	C	A	A
Approach Delay, s/veh / LOS	54.2	D		47.2	D		17.7	B		11.6	B	
Intersection Delay, s/veh / LOS	20.6						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.31	B	2.31	B	2.19	B	2.15	B
Bicycle LOS Score / LOS	0.99	A	1.17	A	1.57	B	2.14	B

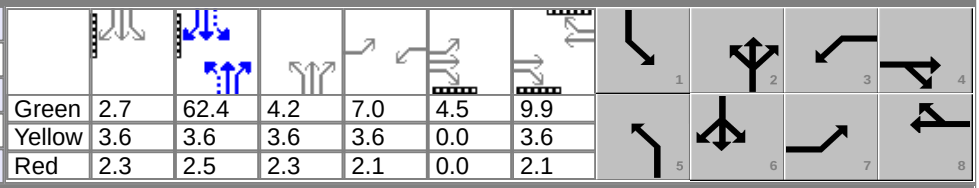
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 23, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	41st Street	File Name	01-02-04-05 Minnesota Avenue 2035 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	240	150	90	130	145	50	130	1160	65	35	570	150

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	88	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	2.7	62.4	4.2	7.0	4.5	9.9	
Yellow	3.6	3.6	3.6	3.6	0.0	3.6	
Red	2.3	2.5	2.3	2.1	0.0	2.1	

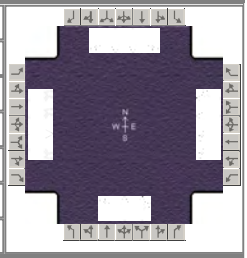
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	4.0	1.3	4.0	1.2	3.0
Phase Duration, s	17.2	20.2	12.7	15.6	10.1	78.6	8.6	77.1
Change Period, ($Y+R_c$), s	5.7	5.7	5.7	5.7	6.1	6.1	5.9	6.1
Max Allow Headway (*MAH*), s	3.1	4.3	3.2	4.3	3.2	0.0	5.2	0.0
Queue Clearance Time (g_s), s	11.3	12.6	7.0	9.4	2.0		3.0	
Green Extension Time (g_e), s	0.2	0.7	0.1	0.5	1.3	0.0	0.1	0.0
Phase Call Probability	1.00	1.00	0.99	1.00	1.00		0.67	
Max Out Probability	1.00	1.00	1.00	1.00	1.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	267	167	100	144	110	106	183	865	858	33	545	105
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1821	1568	1711	1850	1691	1762	1821	1787	1734	1734	1568
Queue Service Time (g_s), s	9.3	10.6	7.2	5.0	7.0	7.4	0.0	29.6	29.9	1.0	6.7	2.9
Cycle Queue Clearance Time (g_c), s	9.3	10.6	7.2	5.0	7.0	7.4	0.0	29.6	29.9	1.0	6.7	2.9
Green Ratio (*g/C*)	0.10	0.12	0.12	0.06	0.08	0.08	0.54	0.60	0.60	0.56	0.59	0.59
Capacity (*c*), veh/h	323	219	189	199	153	140	559	1100	1079	175	2050	927
Volume-to-Capacity Ratio (*X*)	0.825	0.759	0.529	0.725	0.720	0.760	0.327	0.786	0.795	0.191	0.266	0.113
Back of Queue (*Q*), ft/ln (95 th percentile)	196.1	239.5	128.7	101.5	159.9	161.2	126.3	252	239.5	19.7	108.9	43.9
Back of Queue (*Q*), veh/ln (95 th percentile)	7.7	9.4	5.1	4.1	6.4	6.4	5.1	9.9	9.4	0.8	4.3	1.8
Queue Storage Ratio (*RQ*) (95 th percentile)	0.78	0.00	0.00	0.41	0.00	0.00	0.84	0.00	0.00	0.13	0.00	0.44
Uniform Delay (d_1), s/veh	53.3	51.1	10.3	55.6	53.7	53.9	16.3	7.2	7.0	16.5	8.0	1.4
Incremental Delay (d_2), s/veh	9.0	12.3	3.2	3.8	7.2	11.4	0.1	3.4	3.6	0.7	0.3	0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	62.3	63.4	13.5	59.3	60.8	65.2	16.4	10.6	10.6	17.2	8.3	1.7
Level of Service (LOS)	E	E	B	E	E	E	B	B	B	B	A	A
Approach Delay, s/veh / LOS	53.5	D		61.5	E		11.2	B		7.7	A	
Intersection Delay, s/veh / LOS	22.2						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.31	B	2.52	C	2.25	B	2.47	B
Bicycle LOS Score / LOS	1.37	A	0.79	A	1.73	B	1.14	A

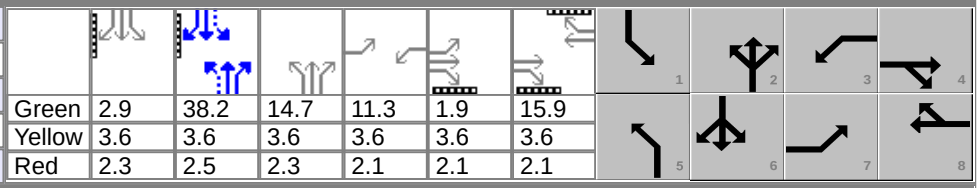
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 23, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2035	Analysis Period	1> 16:30
Intersection	41st Street	File Name	01-02-04-05 Minnesota Avenue 2035 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	420	275	280	230	320	50	240	805	95	40	1435	370

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	74	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	2.9	38.2	14.7	11.3	1.9	15.9						
Yellow	3.6	3.6	3.6	3.6	3.6	3.6						
Red	2.3	2.5	2.3	2.1	2.1	2.1						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	4.0	1.3	4.0	1.2	3.0
Phase Duration, s	24.6	29.2	17.0	21.6	20.6	64.9	8.8	53.1
Change Period, ($Y+R_c$), s	5.7	5.7	5.7	5.7	6.1	6.1	5.9	6.1
Max Allow Headway (*MAH*), s	3.1	4.3	3.2	4.3	3.2	0.0	5.2	0.0
Queue Clearance Time (g_s), s	18.3	21.4	10.8	14.8	16.5		3.8	
Green Extension Time (g_e), s	0.7	1.5	0.5	1.2	0.0	0.0	0.1	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		0.73	
Max Out Probability	0.13	1.00	0.00	1.00	1.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	467	306	200	256	199	195	283	541	521	39	1390	261
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1821	1568	1711	1850	1786	1762	1821	1753	1734	1734	1568
Queue Service Time (g_s), s	16.3	19.4	14.1	8.8	12.6	12.8	14.5	19.5	18.8	1.8	47.0	11.2
Cycle Queue Clearance Time (g_c), s	16.3	19.4	14.1	8.8	12.6	12.8	14.5	19.5	18.8	1.8	47.0	11.2
Green Ratio (*g/C*)	0.16	0.20	0.20	0.09	0.13	0.13	0.42	0.49	0.49	0.36	0.39	0.39
Capacity (*c*), veh/h	532	357	308	323	245	237	273	893	860	185	1359	615
Volume-to-Capacity Ratio (*X*)	0.878	0.855	0.650	0.792	0.813	0.823	1.037	0.605	0.606	0.210	1.022	0.425
Back of Queue (*Q*), ft/ln (95 th percentile)	301.6	397.7	230.8	173	275.8	274	453	272.4	248.6	33.7	677.3	129
Back of Queue (*Q*), veh/ln (95 th percentile)	11.9	15.7	9.2	6.9	11.0	11.0	18.1	10.7	9.8	1.3	26.7	5.2
Queue Storage Ratio (*RQ*) (95 th percentile)	1.21	0.00	0.00	0.69	0.00	0.00	3.02	0.00	0.00	0.22	0.00	1.29
Uniform Delay (d_1), s/veh	49.4	46.6	9.7	53.2	50.6	50.7	50.8	13.1	12.3	26.9	29.3	3.0
Incremental Delay (d_2), s/veh	8.8	17.0	4.8	1.7	13.9	15.5	59.1	2.5	2.6	0.3	21.3	0.9
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	58.2	63.5	14.5	54.9	64.5	66.2	109.8	15.6	14.8	27.3	50.6	3.8
Level of Service (LOS)	E	E	B	D	E	E	F	B	B	C	F	A
Approach Delay, s/veh / LOS	50.9	D		61.2	E		35.1	D		42.8	D	
Intersection Delay, s/veh / LOS	44.9						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.30	B	2.61	C	2.29	B	2.61	C
Bicycle LOS Score / LOS	2.09	B	1.02	A	1.53	B	2.09	B

HCS7 Two-Way Stop-Control Report

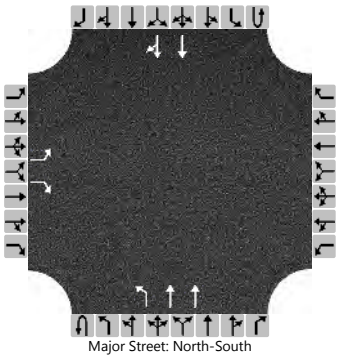
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/23/19
Analysis Year	2035
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at 49th Ave
Jurisdiction	Sioux Falls, SD
East/West Street	49th Avenue
North/South Street	Minnesota Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration		L		R						L	T				T	TR
Volume (veh/h)		70		140					0	235	1805				805	85
Percent Heavy Vehicles (%)		2		2					2	2						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized		No														
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5		6.9						4.1						
Critical Headway (sec)		6.84		6.94						4.14						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.52		3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		78		156						261						
Capacity, c (veh/h)		16		521						695						
v/c Ratio		4.99		0.30						0.38						
95% Queue Length, Q_{95} (veh)		10.5		1.2						1.8						
Control Delay (s/veh)		2284.5		14.8						13.3						
Level of Service (LOS)		F		B						B						
Approach Delay (s/veh)		771.4								1.5						
Approach LOS		F														

HCS7 Two-Way Stop-Control Report

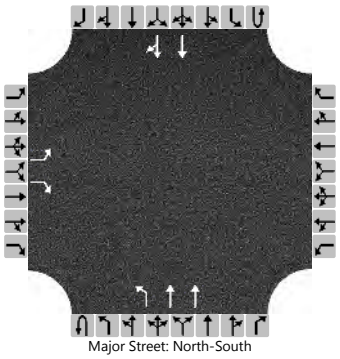
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/23/19
Analysis Year	2035
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at 49th Ave
Jurisdiction	Sioux Falls, SD
East/West Street	49th Avenue
North/South Street	Minnesota Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration		L		R						L	T				T	TR
Volume (veh/h)		100		285					0	220	1165				2100	60
Percent Heavy Vehicles (%)		2		2					2	2						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized		No														
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5		6.9						4.1						
Critical Headway (sec)		6.84		6.94						4.14						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.52		3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		111		317						244						
Capacity, c (veh/h)				177						197						
v/c Ratio				1.79						1.24						
95% Queue Length, Q_{95} (veh)				22.7						13.0						
Control Delay (s/veh)				420.0						193.0						
Level of Service (LOS)				F						F						
Approach Delay (s/veh)										30.7						
Approach LOS																

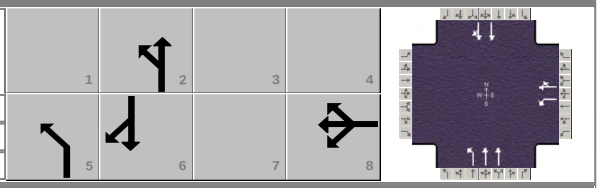
HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	Diamond
Analyst	Graham Johnson	Analysis Date	Apr 23, 2019	Segment Distance, ft	683
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 North Ramp	PHF	0.90	Arterial Direction	North-South
File Name	01-02-04-05 Minnesota Avenue 2035 AM.xus				
Project Description	I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h				135	0	250	105	1790			655	290
Intersection Two Demand (*v*), veh/h	400	0	70					1495	245	110	680	

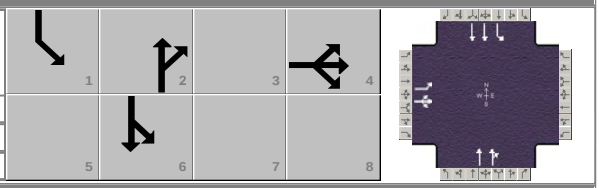
Signal One Information	
Cycle, s	120.0
Offset, s	30
Uncoordinated	No
Force Mode	Fixed

Green	4.3	80.8	18.5	0.0	0.0	0.0
Yellow	3.6	3.6	4.0	0.0	0.0	0.0
Red	1.0	2.2	2.0	0.0	0.0	0.0



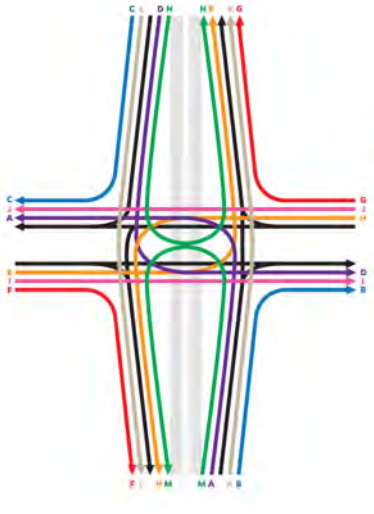
Signal Two Information	
Cycle, s	120.0
Offset, s	30
Uncoordinated	No
Force Mode	Fixed

Green	5.2	73.6	24.4	0.0	0.0	0.0
Yellow	4.3	4.3	4.0	0.0	0.0	0.0
Red	1.0	1.6	1.6	0.0	0.0	0.0



Interchange Results

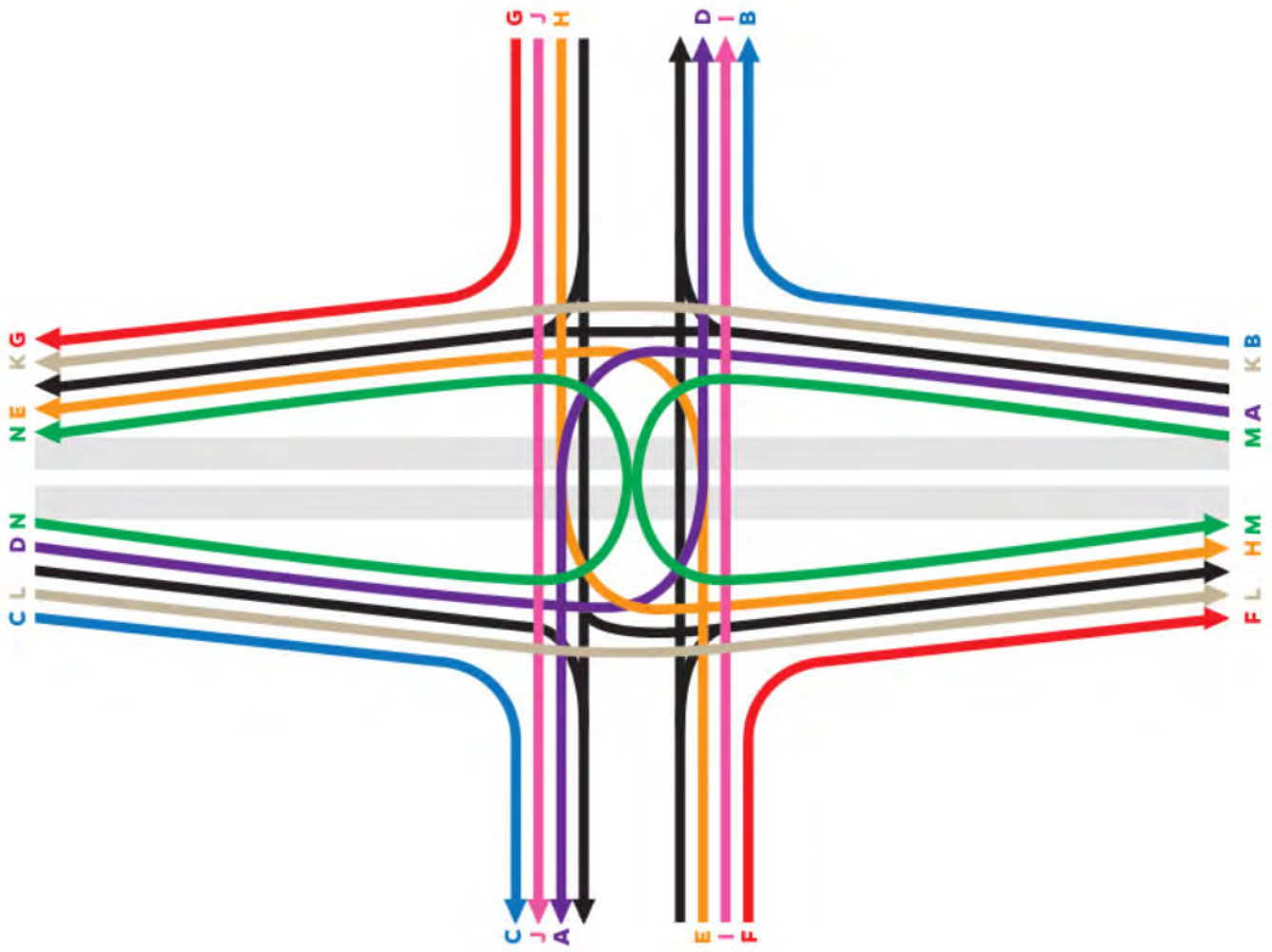
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	0	9.7	0.0	9.7	No	No	A
B	0	0.0	0.0	0.0	No	No	A
C	0	0.0	0.0	0.0	No	No	A
D	0	16.7	0.0	16.7	No	No	B
E	0	6.9	0.0	6.9	No	No	A
F	0	6.9	0.0	6.9	No	No	A
G	0	0.0	0.0	0.0	No	No	A
H	0	7.1	0.0	7.1	No	No	A
I	1829	23.6	0.0	23.6	No	No	B
J	578	16.8	0.0	16.8	No	No	B
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh				49.6	59.2		7.8	6.9			9.7	6.8
Level of Service (LOS)				D	E		A	A			A	A
Approach Delay, s/veh / LOS	0.0			54.9	D		6.9	A		8.3	A	
Intersection Delay, s/veh / LOS	12.5						B					

Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	59.2	52.6						16.7	18.5	40.0	7.1	
Level of Service (LOS)	E	D						B	B	D	A	
Approach Delay, s/veh / LOS	56.7	E		0.0			17.6	B		11.7	B	
Intersection Delay, s/veh / LOS	21.8						C					

Interchange Graphic



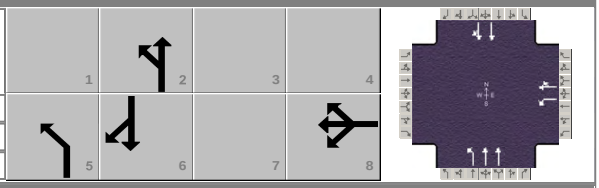
HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	Diamond
Analyst	Graham Johnson	Analysis Date	Apr 23, 2019	Segment Distance, ft	683
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 North Ramp	PHF	0.90	Arterial Direction	North-South
File Name	01-02-04-05 Minnesota Avenue 2035 PM.xus				
Project Description	I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h				240	0	250	135	1135			1845	540
Intersection Two Demand (*v*), veh/h	305	0	150					965	220	450	1635	

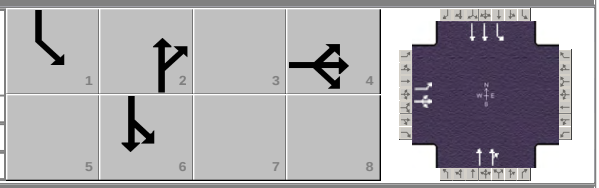
Signal One Information	
Cycle, s	120.0
Offset, s	60
Uncoordinated	No
Force Mode	Fixed

Green	71.7	9.3	22.6	0.0	0.0	0.0
Yellow	3.6	3.6	4.0	0.0	0.0	0.0
Red	2.2	1.0	2.0	0.0	0.0	0.0



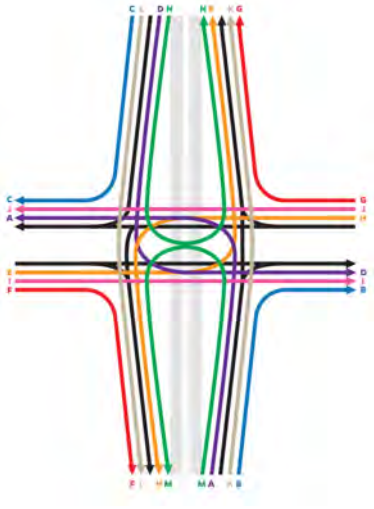
Signal Two Information	
Cycle, s	120.0
Offset, s	60
Uncoordinated	No
Force Mode	Fixed

Green	31.8	50.3	21.0	0.0	0.0	0.0
Yellow	4.3	4.3	4.0	0.0	0.0	0.0
Red	1.0	1.6	1.6	0.0	0.0	0.0



Interchange Results

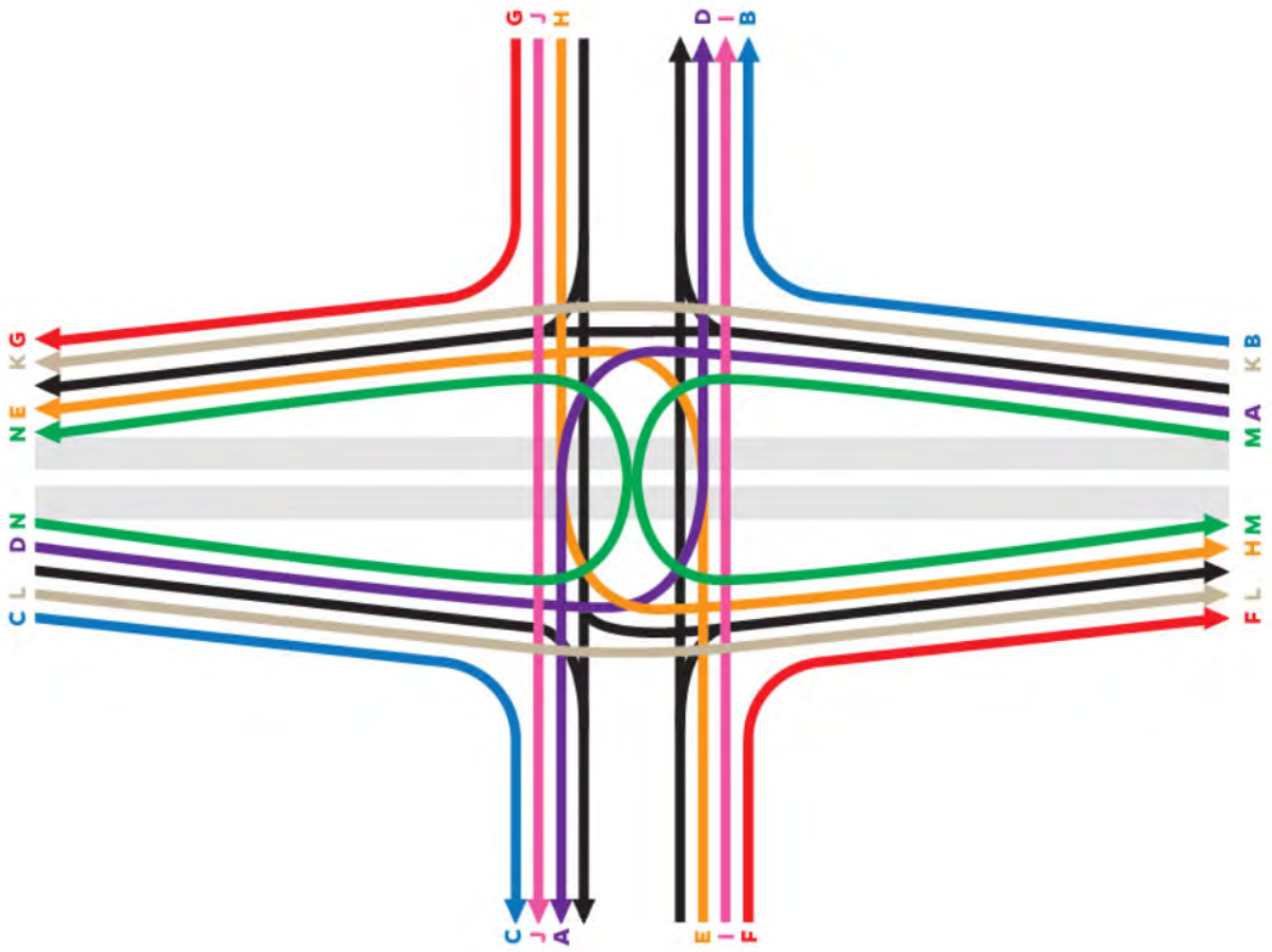
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	0	17.0	0.0	17.0	No	No	B
B	0	0.0	0.0	0.0	No	No	A
C	0	0.0	0.0	0.0	No	No	A
D	0	52.5	0.0	52.5	No	No	C
E	0	8.1	0.0	8.1	No	No	A
F	0	8.1	0.0	8.1	No	No	A
G	0	0.0	0.0	0.0	No	No	A
H	0	9.3	0.0	9.3	No	No	A
I	1307	60.6	0.0	60.6	No	No	D
J	1534	26.3	0.0	26.3	No	No	B
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh				53.7	49.3		72.4	8.1			17.0	20.3
Level of Service (LOS)				D	D		E	A			B	C
Approach Delay, s/veh / LOS	0.0			51.9		D	14.9		B	18.7		B
Intersection Delay, s/veh / LOS	21.1						C					

Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	69.9	55.1						52.5	57.3	64.0	9.3	
Level of Service (LOS)	E	E						D	E	E	A	
Approach Delay, s/veh / LOS	63.8		E	0.0			54.9		D	21.1		C
Intersection Delay, s/veh / LOS	37.7						D					

Interchange Graphic



HCS7 Two-Way Stop-Control Report

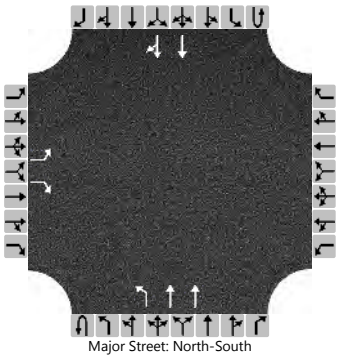
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/23/19
Analysis Year	2035
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at Yankton
Jurisdiction	Sioux Falls, SD
East/West Street	Yankton Trail
North/South Street	Minnesota Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration		L		R						L	T				T	TR
Volume (veh/h)		0		5					0	5	1740				745	5
Percent Heavy Vehicles (%)		2		2					2	2						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized		No														
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5		6.9						4.1						
Critical Headway (sec)		6.84		6.94						4.14						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.52		3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		0		6						6						
Capacity, c (veh/h)		70		585						795						
v/c Ratio		0.00		0.01						0.01						
95% Queue Length, Q_{95} (veh)		0.0		0.0						0.0						
Control Delay (s/veh)		56.6		11.2						9.6						
Level of Service (LOS)		F		B						A						
Approach Delay (s/veh)		11.2								0.0						
Approach LOS		B														

HCS7 Two-Way Stop-Control Report

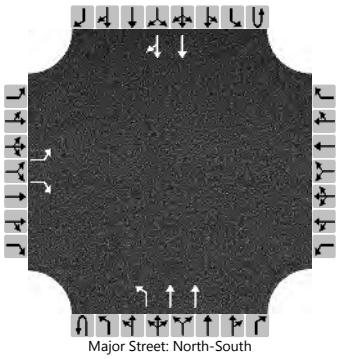
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/23/19
Analysis Year	2035
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at Yankton
Jurisdiction	Sioux Falls, SD
East/West Street	Yankton Trail
North/South Street	Minnesota Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration		L		R						L	T				T	TR
Volume (veh/h)		5		15					0	50	1180				1660	125
Percent Heavy Vehicles (%)		2		2					2	2						
Proportion Time Blocked																
Percent Grade (%)	0															
Right Turn Channelized	No															
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5		6.9						4.1						
Critical Headway (sec)		6.84		6.94						4.14						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.52		3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		6		17						56						
Capacity, c (veh/h)		14		245						287						
v/c Ratio		0.39		0.07						0.19						
95% Queue Length, Q_{95} (veh)		1.0		0.2						0.7						
Control Delay (s/veh)		369.6		20.8						20.5						
Level of Service (LOS)		F		C						C						
Approach Delay (s/veh)	108.0								0.8							
Approach LOS	F															

HCS7 Two-Way Stop-Control Report

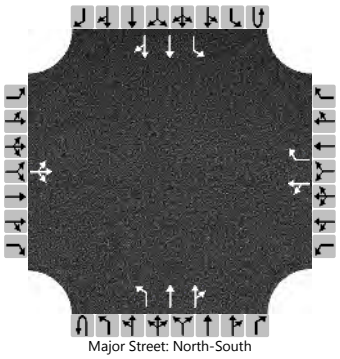
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/23/19
Analysis Year	2035
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at Lotta St
Jurisdiction	Sioux Falls, SD
East/West Street	Lotta St
North/South Street	Minnesota Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	1	0	1	2	0	0	1	2	0
Configuration			LTR			LT		R		L	T	TR		L	T	TR
Volume (veh/h)		0	0	5		30	0	285	0	10	1460	10	0	40	700	10
Percent Heavy Vehicles (%)		2	2	2		3	3	2	2	2			2	2		
Proportion Time Blocked																
Percent Grade (%)		0				0										
Right Turn Channelized						No										
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5	6.5	6.9		7.5	6.5	6.9		4.1				4.1		
Critical Headway (sec)		7.54	6.54	6.94		7.56	6.56	6.94		4.14				4.14		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.52	4.02	3.32		3.53	4.03	3.32		2.22				2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			6			33		317		11				44		
Capacity, c (veh/h)			605			25		320		827				393		
v/c Ratio			0.01			1.34		0.99		0.01				0.11		
95% Queue Length, Q_{95} (veh)			0.0			4.1		10.7		0.0				0.4		
Control Delay (s/veh)			11.0			528.7		85.0		9.4				15.3		
Level of Service (LOS)			B			F		F		A				C		
Approach Delay (s/veh)		11.0				127.3				0.1				0.8		
Approach LOS		B				F										

HCS7 Two-Way Stop-Control Report

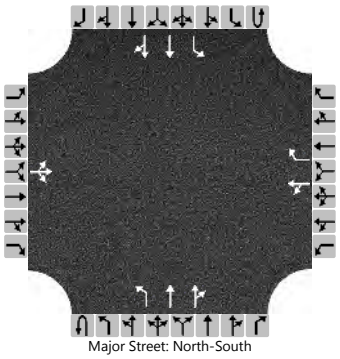
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/23/19
Analysis Year	2035
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at Lotta St
Jurisdiction	Sioux Falls, SD
East/West Street	Lotta St
North/South Street	Minnesota Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	1	0	1	2	0	0	1	2	0
Configuration			LTR			LT		R		L	T	TR		L	T	TR
Volume (veh/h)		0	0	5		15	0	115	0	5	1115	35	0	200	1475	0
Percent Heavy Vehicles (%)		2	2	2		3	3	2	2	2			2	2		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized					No											
Median Type | Storage	Undivided															

Critical and Follow-up Headways

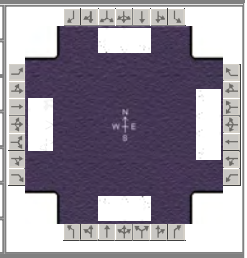
Base Critical Headway (sec)		7.5	6.5	6.9		7.5	6.5	6.9		4.1				4.1		
Critical Headway (sec)		7.54	6.54	6.94		7.56	6.56	6.94		4.14				4.14		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.52	4.02	3.32		3.53	4.03	3.32		2.22				2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			6			17		128		6				222		
Capacity, c (veh/h)			318			9		419		391				539		
v/c Ratio			0.02			1.87		0.31		0.01				0.41		
95% Queue Length, Q_{95} (veh)			0.1			3.0		1.3		0.0				2.0		
Control Delay (s/veh)			16.5			1218.0		17.3		14.3				16.3		
Level of Service (LOS)			C			F		C		B				C		
Approach Delay (s/veh)	16.5				155.9				0.1				1.9			
Approach LOS	C				F											

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	57th Street	File Name	08 Minnesota at 57th 2035 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	130	270	105	70	665	250	130	790	30	100	490	70

Signal Information			
Cycle, s	87.3	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	5.5	1.5	26.1	4.0	2.8	25.6
Yellow	4.0	0.0	4.3	4.0	0.0	3.9
Red	1.0	0.0	1.6	1.0	0.0	1.9

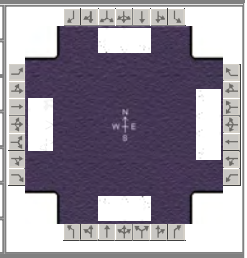
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	11.9	34.2	9.0	31.4	12.1	33.5	10.5	32.0
Change Period, ($Y+R_c$), s	5.0	5.8	5.0	5.8	5.0	5.9	5.0	5.9
Max Allow Headway (*MAH*), s	3.7	5.7	3.7	5.7	3.7	5.6	3.7	5.6
Queue Clearance Time (g_s), s	7.0	9.8	4.7	18.7	6.9	21.9	5.8	14.7
Green Extension Time (g_e), s	0.1	10.1	0.1	6.9	0.3	5.7	0.1	9.3
Phase Call Probability	0.97	1.00	0.85	1.00	0.97	1.00	0.93	1.00
Max Out Probability	1.00	0.40	0.14	0.70	0.00	0.89	0.59	0.64

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	144	206	194	78	739	183	144	455	450	111	311	300
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1667	1734	1734	1543	1734	1821	1801	1734	1821	1751
Queue Service Time (g_s), s	5.0	7.5	7.8	2.7	16.7	8.3	4.9	19.9	19.9	3.8	12.6	12.7
Cycle Queue Clearance Time (g_c), s	5.0	7.5	7.8	2.7	16.7	8.3	4.9	19.9	19.9	3.8	12.6	12.7
Green Ratio (*g/C*)	0.37	0.33	0.33	0.34	0.29	0.29	0.38	0.32	0.32	0.36	0.30	0.30
Capacity (*c*), veh/h	292	593	543	374	1017	453	347	576	570	232	544	523
Volume-to-Capacity Ratio (*X*)	0.494	0.347	0.358	0.208	0.727	0.405	0.416	0.790	0.790	0.479	0.571	0.574
Back of Queue (*Q*), ft/ln (95 th percentile)	92.2	147.3	137.6	49.7	289.4	141.2	89.9	368.3	359.6	71.6	238.6	229.3
Back of Queue (*Q*), veh/ln (95 th percentile)	3.6	5.8	5.5	2.0	11.4	5.6	3.5	14.5	14.4	2.8	9.4	9.2
Queue Storage Ratio (*RQ*) (95 th percentile)	0.74	0.00	0.00	0.20	0.00	0.94	0.90	0.00	0.00	0.24	0.00	0.00
Uniform Delay (d_1), s/veh	20.8	22.4	22.5	20.2	27.7	24.7	19.5	27.2	27.2	21.9	25.9	25.9
Incremental Delay (d_2), s/veh	1.0	0.6	0.7	0.2	2.4	1.0	0.6	7.2	7.2	1.1	1.6	1.7
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	21.7	23.0	23.2	20.4	30.1	25.7	20.0	34.4	34.4	23.0	27.5	27.6
Level of Service (LOS)	C	C	C	C	C	C	C	C	C	C	C	C
Approach Delay, s/veh / LOS	22.7	C		28.6	C		32.4	C		26.9	C	
Intersection Delay, s/veh / LOS	28.5						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.28	B	2.29	B	2.55	C	2.30	B
Bicycle LOS Score / LOS	0.94	A	1.31	A	1.35	A	1.08	A

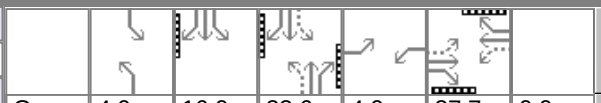
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2035	Analysis Period	1> 16:30
Intersection	57th Street	File Name	08 Minnesota at 57th 2035 PM.xus		
Project Description	I-229 Exits 3 and 4				

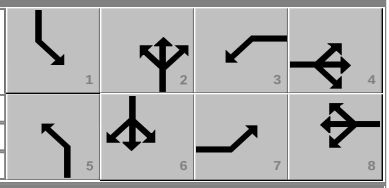


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	155	830	135	70	505	170	130	630	160	405	980	70

Signal Information			
Cycle, s	122.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	4.0	16.0	33.6	4.0	37.7	0.0
Yellow	4.0	4.0	4.3	4.0	3.9	0.0
Red	1.0	1.0	1.6	1.0	1.9	0.0



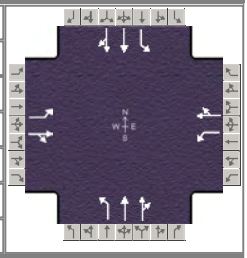
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	9.0	43.5	9.0	43.5	9.0	39.5	30.0	60.5
Change Period, (*Y+R c*), s	5.0	5.8	5.0	5.8	5.0	5.9	5.0	5.9
Max Allow Headway (*MAH*), s	3.7	5.6	3.7	5.6	3.7	5.6	3.7	5.6
Queue Clearance Time (*g s*), s	6.0	37.2	5.8	18.3	6.0	28.7	26.8	34.1
Green Extension Time (*g e*), s	0.0	0.4	0.0	0.0	0.0	4.9	0.0	0.0
Phase Call Probability	1.00	1.00	0.93	1.00	0.99	1.00	1.00	1.00
Max Out Probability	1.00	1.00	1.00	1.00	1.00	0.79	1.00	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	172	536	514	78	561	122	144	422	400	450	587	574
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1743	1734	1734	1543	1734	1821	1726	1734	1821	1781
Queue Service Time (*g s*), s	4.0	35.2	35.2	3.8	16.3	7.3	4.0	26.6	26.7	24.8	32.0	32.1
Cycle Queue Clearance Time (*g c*), s	4.0	35.2	35.2	3.8	16.3	7.3	4.0	26.6	26.7	24.8	32.0	32.1
Green Ratio (*g/C*)	0.34	0.31	0.31	0.34	0.31	0.31	0.31	0.28	0.28	0.50	0.45	0.45
Capacity (*c*), veh/h	251	562	538	118	1070	476	197	502	476	452	815	797
Volume-to-Capacity Ratio (*X*)	0.687	0.954	0.954	0.660	0.524	0.257	0.732	0.840	0.841	0.995	0.720	0.720
Back of Queue (*Q*), ft/ln (95 th percentile)	165.2	688.9	657	89.8	287.5	127.5	143.8	484.7	458.6	551.3	526.9	510.3
Back of Queue (*Q*), veh/ln (95 th percentile)	6.5	27.1	26.3	3.5	11.3	5.0	5.7	19.1	18.3	21.7	20.7	20.4
Queue Storage Ratio (*RQ*) (95 th percentile)	1.32	0.00	0.00	0.36	0.00	0.85	1.44	0.00	0.00	2.76	0.00	0.00
Uniform Delay (*d 1*), s/veh	40.5	41.3	41.3	33.5	34.8	31.7	41.2	41.6	41.7	32.2	27.4	27.5
Incremental Delay (*d 2*), s/veh	7.1	26.9	27.7	11.8	0.7	0.5	12.4	8.9	9.4	40.8	3.6	3.7
Initial Queue Delay (*d 3*), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	47.6	68.2	69.1	45.3	35.5	32.1	53.6	50.6	51.1	73.0	31.0	31.1
Level of Service (LOS)	D	E	E	D	D	C	D	D	D	E	C	C
Approach Delay, s/veh / LOS	65.7	E		36.0	D		51.2	D		42.8	D	
Intersection Delay, s/veh / LOS	49.6						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.36	B	2.30	B	2.53	C	2.30	B
Bicycle LOS Score / LOS	1.50	A	1.12	A	1.29	A	1.82	B

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	33rd Street	File Name	09 Cliff at 33rd 2035 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	80	85	40	65	160	15	100	1060	15	5	345	60

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	0.6	4.1	56.2	4.8	1.0	13.5
Yellow	3.6	0.0	3.6	3.6	0.0	3.6
Red	1.0	0.0	1.5	1.0	0.0	1.9

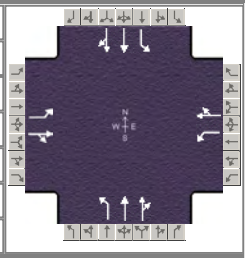
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	4.0	1.1	4.0	1.1	4.0
Phase Duration, s	10.5	20.0	9.4	19.0	9.2	65.4	5.2	61.3
Change Period, ($Y+R_c$), s	4.6	5.5	4.6	5.5	4.6	5.1	4.6	5.1
Max Allow Headway (*MAH*), s	4.2	4.2	4.2	4.2	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	6.4	9.5	5.5	12.5	4.6		2.1	
Green Extension Time (g_e), s	0.0	1.1	0.0	1.0	0.3	0.0	0.0	0.0
Phase Call Probability	0.92	1.00	0.87	1.00	0.95		0.14	
Max Out Probability	1.00	0.00	1.00	0.01	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	89	139		72	194		111	599	596	6	229	221
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1722		1734	1793		1734	1821	1812	1734	1821	1727
Queue Service Time (g_s), s	4.4	7.5		3.5	10.5		2.6	19.5	19.5	0.1	6.3	6.4
Cycle Queue Clearance Time (g_c), s	4.4	7.5		3.5	10.5		2.6	19.5	19.5	0.1	6.3	6.4
Green Ratio (*g/C*)	0.19	0.15		0.18	0.13		0.62	0.60	0.60	0.57	0.56	0.56
Capacity (*c*), veh/h	209	250		219	242		621	1098	1092	264	1024	971
Volume-to-Capacity Ratio (*X*)	0.425	0.556		0.330	0.803		0.179	0.545	0.545	0.021	0.224	0.227
Back of Queue (*Q*), ft/ln (95 th percentile)	87.1	150.1		70.5	221		42	316.5	310.9	2.4	117.8	112
Back of Queue (*Q*), veh/ln (95 th percentile)	3.4	5.9		2.8	8.7		1.7	12.5	12.4	0.1	4.6	4.5
Queue Storage Ratio (*RQ*) (95 th percentile)	0.40	0.00		0.50	0.00		0.24	0.00	0.00	0.02	0.00	0.00
Uniform Delay (d_1), s/veh	34.9	39.7		35.2	42.0		7.9	11.8	11.8	10.9	11.0	11.0
Incremental Delay (d_2), s/veh	1.4	1.9		0.9	6.1		0.1	1.9	2.0	0.0	0.5	0.5
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	36.2	41.7		36.1	48.1		8.1	13.7	13.7	10.9	11.5	11.5
Level of Service (LOS)	D	D		D	D		A	B	B	B	B	B
Approach Delay, s/veh / LOS	39.6	D		44.8	D		13.2	B		11.5	B	
Intersection Delay, s/veh / LOS	19.3						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.30	B	2.30	B	1.88	B	1.89	B
Bicycle LOS Score / LOS	0.86	A	0.93	A	1.56	B	0.86	A

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2035	Analysis Period	1> 16:30
Intersection	33rd Street	File Name	09 Cliff at 33rd 2035 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	100	185	80	95	130	30	65	560	140	20	1180	85

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	1.8	1.7	50.6	6.5	0.3	19.3
Yellow	3.6	0.0	3.6	3.6	0.0	3.6
Red	1.0	0.0	1.5	1.0	0.0	1.9

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	4.0	1.1	4.0	1.1	4.0
Phase Duration, s	11.4	25.1	11.1	24.8	8.2	57.4	6.4	55.7
Change Period, ($Y+R_c$), s	4.6	5.5	4.6	5.5	4.6	5.1	4.6	5.1
Max Allow Headway (*MAH*), s	4.2	4.2	4.2	4.2	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	7.1	18.5	6.8	11.1	4.0		2.6	
Green Extension Time (g_e), s	0.0	1.1	0.0	1.5	0.1	0.0	0.0	0.0
Phase Call Probability	0.95	1.00	0.95	1.00	0.87		0.46	
Max Out Probability	1.00	0.34	1.00	0.02	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	111	294		106	178		72	402	375	22	710	696
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1727		1734	1762		1734	1821	1695	1734	1821	1778
Queue Service Time (g_s), s	5.1	16.5		4.8	9.1		2.0	13.5	13.6	0.6	31.6	31.8
Cycle Queue Clearance Time (g_c), s	5.1	16.5		4.8	9.1		2.0	13.5	13.6	0.6	31.6	31.8
Green Ratio (*g/C*)	0.26	0.20		0.26	0.19		0.54	0.52	0.52	0.52	0.51	0.51
Capacity (*c*), veh/h	313	338		196	340		206	952	886	359	921	899
Volume-to-Capacity Ratio (*X*)	0.355	0.870		0.539	0.523		0.351	0.423	0.424	0.062	0.770	0.774
Back of Queue (*Q*), ft/ln (95 th percentile)	98.4	328.2		96.7	182.2		36.5	245.2	229.3	10.9	517.6	504.1
Back of Queue (*Q*), veh/ln (95 th percentile)	3.9	12.9		3.8	7.2		1.4	9.7	9.2	0.4	20.4	20.2
Queue Storage Ratio (*RQ*) (95 th percentile)	0.46	0.00		0.69	0.00		0.21	0.00	0.00	0.09	0.00	0.00
Uniform Delay (d_1), s/veh	29.6	39.0		31.1	36.2		17.2	14.6	14.6	12.5	20.0	20.1
Incremental Delay (d_2), s/veh	0.7	13.9		2.3	1.2		1.0	1.4	1.5	0.1	6.2	6.4
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	30.3	52.9		33.4	37.5		18.2	16.0	16.1	12.5	26.2	26.5
Level of Service (LOS)	C	D		C	D		B	B	B	B	C	C
Approach Delay, s/veh / LOS	46.7	D		36.0	D		16.2	B		26.1	C	
Intersection Delay, s/veh / LOS	27.1						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.30	B	2.30	B	1.90	B	1.90	B
Bicycle LOS Score / LOS	1.16	A	0.96	A	1.19	A	1.67	B

HCS7 Two-Way Stop-Control Report

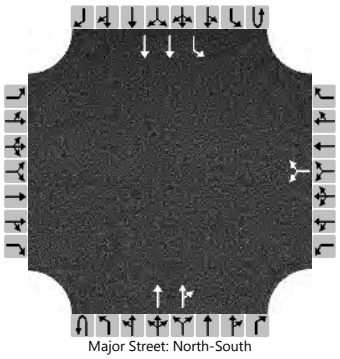
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/23/19
Analysis Year	2035
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at 36th St
Jurisdiction	Sioux Falls, SD
East/West Street	36th Street
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	2	0	0	1	2	0
Configuration							LR				T	TR		L	T	
Volume (veh/h)						40		45			1230	70	0	55	560	
Percent Heavy Vehicles (%)						2		2					2	2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized																
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)						7.5		6.9						4.1		
Critical Headway (sec)						6.84		6.94						4.14		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.52		3.32						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							94							61		
Capacity, c (veh/h)							218							465		
v/c Ratio							0.43							0.13		
95% Queue Length, Q_{95} (veh)							2.0							0.4		
Control Delay (s/veh)							33.6							13.9		
Level of Service (LOS)							D							B		
Approach Delay (s/veh)						33.6								1.2		
Approach LOS						D										

HCS7 Two-Way Stop-Control Report

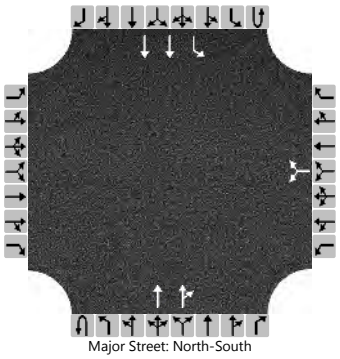
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/23/19
Analysis Year	2035
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at 36th St
Jurisdiction	Sioux Falls, SD
East/West Street	36th Street
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	2	0	0	1	2	0
Configuration							LR				T	TR		L	T	
Volume (veh/h)						30		5			755	30	0	5	1355	
Percent Heavy Vehicles (%)						2		2					2	2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized																
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)						7.5		6.9						4.1		
Critical Headway (sec)						6.84		6.94						4.14		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.52		3.32						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							39							6		
Capacity, c (veh/h)							244							769		
v/c Ratio							0.16							0.01		
95% Queue Length, Q_{95} (veh)							0.6							0.0		
Control Delay (s/veh)							22.5							9.7		
Level of Service (LOS)							C							A		
Approach Delay (s/veh)						22.5								0.0		
Approach LOS						C										

HCS7 Two-Way Stop-Control Report

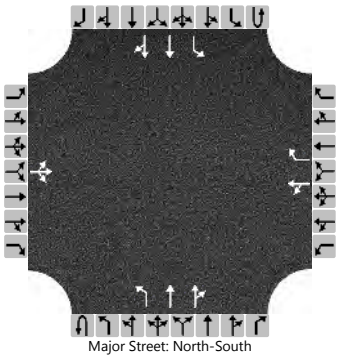
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/23/19
Analysis Year	2035
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at 38th/HS #1
Jurisdiction	Sioux Falls, SD
East/West Street	38th Street/HS #1
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	1	0	1	2	0	0	1	2	0
Configuration			LTR			LT		R		L	T	TR		L	T	TR
Volume (veh/h)		10	5	90		90	10	90	0	60	1225	160	0	15	805	45
Percent Heavy Vehicles (%)		2	2	2		2	2	2	2	2			2	2		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized					No											
Median Type | Storage	Left Only								1							

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5	6.5	6.9		7.5	6.5	6.9		4.1				4.1		
Critical Headway (sec)		7.54	6.54	6.94		7.54	6.54	6.94		4.14				4.14		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.52	4.02	3.32		3.52	4.02	3.32		2.22				2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			117			111		100		67				17		
Capacity, c (veh/h)			190			59		344		722				428		
v/c Ratio			0.61			1.87		0.29		0.09				0.04		
95% Queue Length, Q_{95} (veh)			3.5			10.5		1.2		0.3				0.1		
Control Delay (s/veh)			50.3			561.3		19.7		10.5				13.8		
Level of Service (LOS)			F			F		C		B				B		
Approach Delay (s/veh)	50.3				304.8				0.4				0.2			
Approach LOS	F				F											

HCS7 Two-Way Stop-Control Report

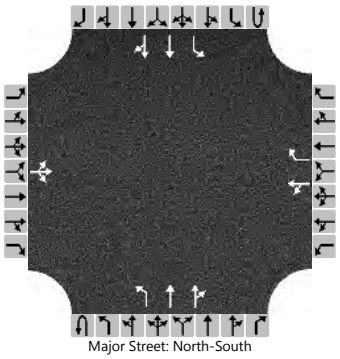
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/23/19
Analysis Year	2035
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at 38th/HS #1
Jurisdiction	Sioux Falls, SD
East/West Street	38th Street/HS #1
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	1	0	1	2	0	0	1	2	0
Configuration			LTR			LT		R		L	T	TR		L	T	TR
Volume (veh/h)		15	0	85		55	5	20	0	45	875	15	0	5	1445	30
Percent Heavy Vehicles (%)		2	2	2		2	2	2	2	2			2	2		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized					No											
Median Type | Storage	Left Only								1							

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5	6.5	6.9		7.5	6.5	6.9		4.1				4.1		
Critical Headway (sec)		7.54	6.54	6.94		7.54	6.54	6.94		4.14				4.14		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.52	4.02	3.32		3.52	4.02	3.32		2.22				2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			111			67		22		50				6		
Capacity, c (veh/h)			212			72		521		391				695		
v/c Ratio			0.52			0.93		0.04		0.13				0.01		
95% Queue Length, Q_{95} (veh)			2.7			4.7		0.1		0.4				0.0		
Control Delay (s/veh)			39.2			183.7		12.2		15.5				10.2		
Level of Service (LOS)			E			F		B		C				B		
Approach Delay (s/veh)	39.2				140.8				0.7				0.0			
Approach LOS	E				F											

HCS7 Two-Way Stop-Control Report

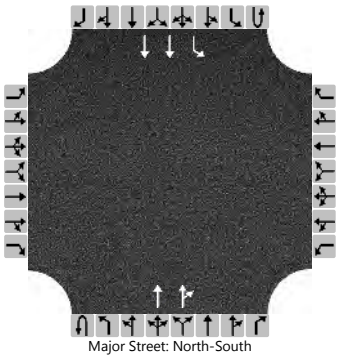
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/23/19
Analysis Year	2035
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at HS #2
Jurisdiction	Sioux Falls, SD
East/West Street	HS #2 Entrance
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	0	2	0	0	1	2	0
Configuration											T	TR		L	T	
Volume (veh/h)											1445	170	0	120	865	
Percent Heavy Vehicles (%)													2	2		
Proportion Time Blocked																
Percent Grade (%)																
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)														4.1		
Critical Headway (sec)														4.14		
Base Follow-Up Headway (sec)														2.2		
Follow-Up Headway (sec)														2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)														133		
Capacity, c (veh/h)														340		
v/c Ratio														0.39		
95% Queue Length, Q_{95} (veh)														1.8		
Control Delay (s/veh)														22.2		
Level of Service (LOS)														C		
Approach Delay (s/veh)													2.7			
Approach LOS																

HCS7 Two-Way Stop-Control Report

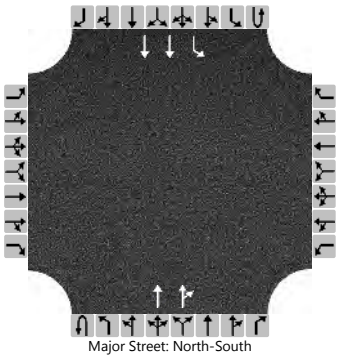
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/23/19
Analysis Year	2035
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at HS #2
Jurisdiction	Sioux Falls, SD
East/West Street	HS #2 Entrance
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	0	2	0	0	1	2	0
Configuration											T	TR		L	T	
Volume (veh/h)											935	30	0	15	1570	
Percent Heavy Vehicles (%)													2	2		
Proportion Time Blocked																
Percent Grade (%)																
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)														4.1		
Critical Headway (sec)														4.14		
Base Follow-Up Headway (sec)														2.2		
Follow-Up Headway (sec)														2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)														17		
Capacity, c (veh/h)														646		
v/c Ratio														0.03		
95% Queue Length, Q_{95} (veh)														0.1		
Control Delay (s/veh)														10.7		
Level of Service (LOS)														B		
Approach Delay (s/veh)													0.1			
Approach LOS																

HCS7 Two-Way Stop-Control Report

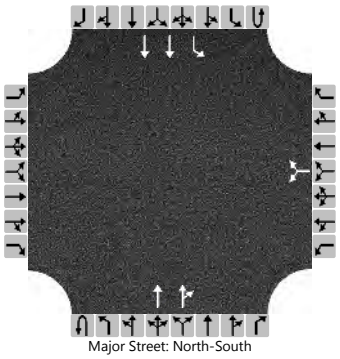
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/23/19
Analysis Year	2035
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at HS #1
Jurisdiction	Sioux Falls, SD
East/West Street	HS #1
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	2	0	0	1	2	0
Configuration							LR				T	TR		L	T	
Volume (veh/h)						30		60			1555	380	0	50	815	
Percent Heavy Vehicles (%)						2		2					2	2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized																
Median Type | Storage						Undivided										

Critical and Follow-up Headways

Base Critical Headway (sec)						7.5		6.9						4.1		
Critical Headway (sec)						6.84		6.94						4.14		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.52		3.32						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							100							56		
Capacity, c (veh/h)							47							247		
v/c Ratio							2.13							0.22		
95% Queue Length, Q_{95} (veh)							10.3							0.8		
Control Delay (s/veh)							709.5							23.8		
Level of Service (LOS)							F							C		
Approach Delay (s/veh)						709.5								1.4		
Approach LOS						F										

HCS7 Two-Way Stop-Control Report

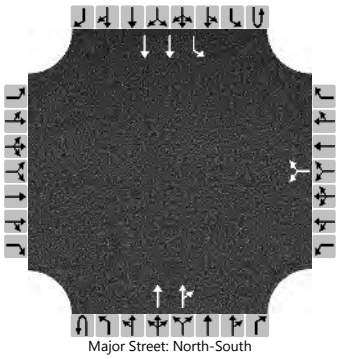
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/23/19
Analysis Year	2035
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at HS #1
Jurisdiction	Sioux Falls, SD
East/West Street	HS #1
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	2	0	0	1	2	0
Configuration							LR				T	TR		L	T	
Volume (veh/h)						30		10			955	15	0	0	1570	
Percent Heavy Vehicles (%)						2		2					2	2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized																
Median Type | Storage						Undivided										

Critical and Follow-up Headways

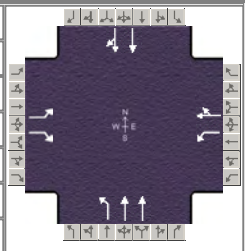
Base Critical Headway (sec)						7.5		6.9						4.1		
Critical Headway (sec)						6.84		6.94						4.14		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.52		3.32						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							44							0		
Capacity, c (veh/h)							73							643		
v/c Ratio							0.61							0.00		
95% Queue Length, Q_{95} (veh)							2.7							0.0		
Control Delay (s/veh)							111.5							10.6		
Level of Service (LOS)							F							B		
Approach Delay (s/veh)						111.5								0.0		
Approach LOS						F										

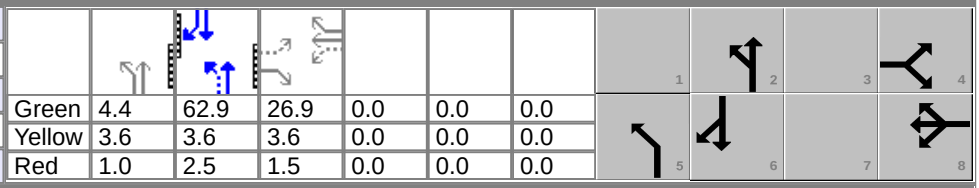
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	41st St/SB I-229	File Name	14-16-18 Cliff Avenue 2035 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	120		110	325	140	95	180	1720			745	100

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	71	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	4.4	62.9	26.9	0.0	0.0	0.0			
Yellow	3.6	3.6	3.6	0.0	0.0	0.0			
Red	1.0	2.5	1.5	0.0	0.0	0.0			

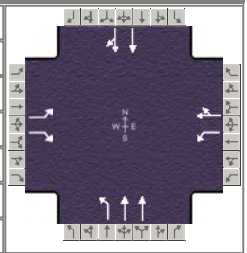
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2		6
Case Number		5.0		6.0	1.0	4.0		8.3
Phase Duration, s		32.0		32.0	9.0	78.0		69.0
Change Period, (*Y+R c*), s		5.1		5.1	4.6	6.1		6.1
Max Allow Headway (*MAH*), s		5.3		5.3	5.2	0.0		0.0
Queue Clearance Time (*g s*), s		28.9		23.9	6.4			
Green Extension Time (*g e*), s		0.0		1.5	0.0	0.0		0.0
Phase Call Probability		1.00		1.00	1.00			
Max Out Probability		1.00		1.00	1.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14	3	8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h	133		122	361	261		200	1911			544	527
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1118		1543	1734	1698		1734	1734			1821	1762
Queue Service Time (*g s*), s	11.8		7.1	21.9	15.1		4.4	46.8			16.0	16.3
Cycle Queue Clearance Time (*g c*), s	26.9		7.1	21.9	15.1		4.4	46.8			16.0	16.3
Green Ratio (*g/C*)	0.24		0.24	0.24	0.24		0.63	0.65			0.57	0.57
Capacity (*c*), veh/h	185		377	490	415		358	2266			1041	1008
Volume-to-Capacity Ratio (*X*)	0.719		0.324	0.738	0.629		0.558	0.843			0.523	0.523
Back of Queue (*Q*), ft/ln (95 th percentile)	197.8		124.4	387.9	276		97.9	624.9			276.3	235
Back of Queue (*Q*), veh/ln (95 th percentile)	7.8		4.9	15.3	10.9		3.9	24.6			10.9	9.4
Queue Storage Ratio (*RQ*) (95 th percentile)	0.88		0.00	2.59	0.00		0.56	0.00			0.00	0.00
Uniform Delay (*d 1*), s/veh	49.7		34.1	39.6	37.1		12.9	14.7			11.5	10.1
Incremental Delay (*d 2*), s/veh	13.7		0.7	6.2	3.5		2.4	4.0			1.7	1.8
Initial Queue Delay (*d 3*), s/veh	0.0		0.0	0.0	0.0		0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	63.4		34.8	45.9	40.6		15.3	18.7			13.3	11.9
Level of Service (LOS)	E		C	D	D		B	B			B	B
Approach Delay, s/veh / LOS	49.7		D	43.7		D	18.4		B	12.6		B
Intersection Delay, s/veh / LOS	22.7						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.30	B	2.16	B	1.65	B	1.89	B
Bicycle LOS Score / LOS		F	1.51	B	2.23	B	1.24	A

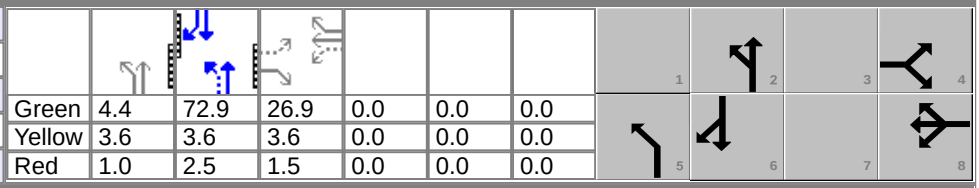
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2035	Analysis Period	1> 16:30
Intersection	41st St/SB I-229	File Name	14-16-18 Cliff Avenue 2035 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	170		240	485	145	90	135	710			1435	165

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	62	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	4.4	72.9	26.9	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.0	2.5	1.5	0.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2		6
Case Number		5.0		6.0	1.0	4.0		8.3
Phase Duration, s		32.0		32.0	9.0	88.0		79.0
Change Period, ($Y+R_c$), s		5.1		5.1	4.6	6.1		6.1
Max Allow Headway (*MAH*), s		5.3		5.3	5.2	0.0		0.0
Queue Clearance Time (g_s), s		28.9		28.9	6.4			
Green Extension Time (g_e), s		0.0		0.0	0.0	0.0		0.0
Phase Call Probability		1.00		1.00	0.99			
Max Out Probability		1.00		1.00	1.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14	3	8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h	189		267	539	261		150	789			1224	1224
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1118		1543	1734	1704		1734	1734			1821	1756
Queue Service Time (g_s), s	10.0		19.4	26.9	16.9		4.4	11.2			46.3	72.9
Cycle Queue Clearance Time (g_c), s	26.9		19.4	26.9	16.9		4.4	11.2			46.3	72.9
Green Ratio (*g/C*)	0.22		0.22	0.22	0.22		0.66	0.68			0.61	0.61
Capacity (*c*), veh/h	154		346	449	382		124	2367			1106	1067
Volume-to-Capacity Ratio (*X*)	1.229		0.771	1.201	0.684		1.214	0.333			1.107	1.148
Back of Queue (*Q*), ft/ln (95 th percentile)	457.2		333.2	1007.9	310.2		367	185.5			1189.6	1208.7
Back of Queue (*Q*), veh/ln (95 th percentile)	18.0		13.1	39.7	12.2		14.5	7.3			46.8	48.3
Queue Storage Ratio (*RQ*) (95 th percentile)	2.03		0.00	6.72	0.00		2.10	0.00			0.00	0.00
Uniform Delay (d_1), s/veh	56.9		43.7	48.3	42.7		37.0	7.8			15.1	12.7
Incremental Delay (d_2), s/veh	147.2		10.8	110.0	5.5		149.4	0.4			52.4	70.0
Initial Queue Delay (d_3), s/veh	0.0		0.0	0.0	0.0		0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	204.2		54.5	158.4	48.2		186.3	8.2			67.5	82.7
Level of Service (LOS)	F		D	F	D		F	A			F	F
Approach Delay, s/veh / LOS	116.5	F		122.4	F		36.7	D		75.1	E	
Intersection Delay, s/veh / LOS	79.5						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.30	B	2.13	B	1.64	B	1.89	B
Bicycle LOS Score / LOS		F	1.81	B	1.26	A	1.95	B

HCS7 Two-Way Stop-Control Report

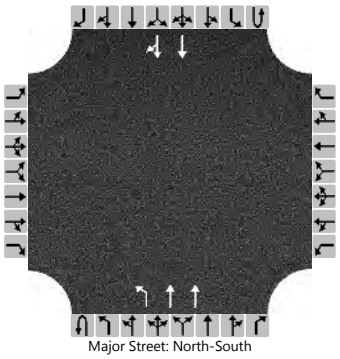
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/23/19
Analysis Year	2035
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at SB I-229 Ent
Jurisdiction	Sioux Falls, SD
East/West Street	SB I-229 Entrance Ramp
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	1	2	0	0	0	2	0
Configuration										L	T				T	TR
Volume (veh/h)									0	440	1900				935	245
Percent Heavy Vehicles (%)									2	2						
Proportion Time Blocked																
Percent Grade (%)																
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)										4.1						
Critical Headway (sec)										4.14						
Base Follow-Up Headway (sec)										2.2						
Follow-Up Headway (sec)										2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)										489						
Capacity, c (veh/h)										524						
v/c Ratio										0.93						
95% Queue Length, Q_{95} (veh)										11.5						
Control Delay (s/veh)										52.8						
Level of Service (LOS)										F						
Approach Delay (s/veh)									9.9							
Approach LOS																

HCS7 Two-Way Stop-Control Report

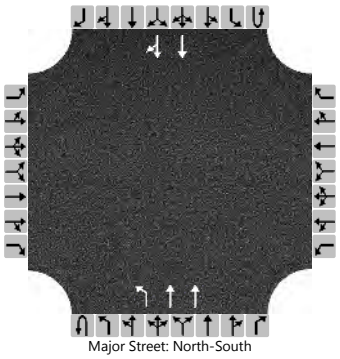
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/23/19
Analysis Year	2035
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at SB I-229 Ent
Jurisdiction	Sioux Falls, SD
East/West Street	SB I-229 Entrance Ramp
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	1	2	0	0	0	2	0
Configuration										L	T				T	TR
Volume (veh/h)									0	170	845				1575	585
Percent Heavy Vehicles (%)									2	2						
Proportion Time Blocked																
Percent Grade (%)																
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

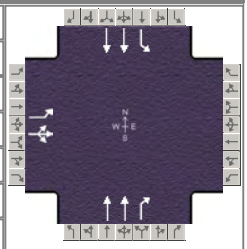
Base Critical Headway (sec)										4.1						
Critical Headway (sec)										4.14						
Base Follow-Up Headway (sec)										2.2						
Follow-Up Headway (sec)										2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)										189						
Capacity, c (veh/h)										197						
v/c Ratio										0.96						
95% Queue Length, Q_{95} (veh)										7.9						
Control Delay (s/veh)										103.8						
Level of Service (LOS)										F						
Approach Delay (s/veh)									17.4							
Approach LOS																

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	I-229 South Ramp	File Name	14-16-18 Cliff Avenue 2035 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	605	0	200					1735	450	120	815	

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	55	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

								1	2	3	4	
Green	55.9	6.1	33.1	0.0	0.0	0.0						
Yellow	3.6	3.6	3.6	0.0	0.0	0.0		5	6	7	8	
Red	1.5	1.0	1.5	0.0	0.0	0.0						

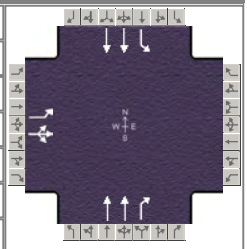
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4				2	1	6
Case Number		10.0				7.3	1.0	4.0
Phase Duration, s		38.2				61.0	10.7	71.8
Change Period, ($Y+R_c$), s		5.1				5.1	5.1	5.1
Max Allow Headway (*MAH*), s		5.3				0.0	5.2	0.0
Queue Clearance Time (g_s), s		30.6					4.0	
Green Extension Time (g_e), s		2.5				0.0	1.7	0.0
Phase Call Probability		1.00					0.98	
Max Out Probability		0.96					1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14					2	12	1	6	
Adjusted Flow Rate (*v*), veh/h	471	368						1699	367	129	877	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1637						1837	1520	1734	1725	
Queue Service Time (g_s), s	28.6	23.8						43.3	12.4	2.0	11.4	
Cycle Queue Clearance Time (g_c), s	28.6	23.8						43.3	12.4	2.0	11.4	
Green Ratio (*g/C*)	0.30	0.30						0.51	0.51	0.54	0.61	
Capacity (*c*), veh/h	523	493						1868	773	182	2091	
Volume-to-Capacity Ratio (*X*)	0.901	0.747						0.910	0.475	0.708	0.419	
Back of Queue (*Q*), ft/ln (95 th percentile)	523.9	420.1						492.7	143.4	179.8	171.4	
Back of Queue (*Q*), veh/ln (95 th percentile)	20.6	16.5						19.4	5.6	7.1	6.7	
Queue Storage Ratio (*RQ*) (95 th percentile)	1.31	0.00						0.00	0.57	0.90	0.00	
Uniform Delay (d_1), s/veh	36.8	43.5						16.5	10.4	48.6	7.9	
Incremental Delay (d_2), s/veh	17.1	5.8						4.0	1.0	10.4	0.6	
Initial Queue Delay (d_3), s/veh	0.0	0.0						0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	54.0	49.2						20.5	11.3	58.9	8.4	
Level of Service (LOS)	D	D						C	B	E	A	
Approach Delay, s/veh / LOS	51.9	D		0.0			18.9	B		14.9	B	
Intersection Delay, s/veh / LOS	24.9						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.43	B	2.32	B	1.44	A	1.73	B
Bicycle LOS Score / LOS	1.87	B			2.42	B	1.34	A

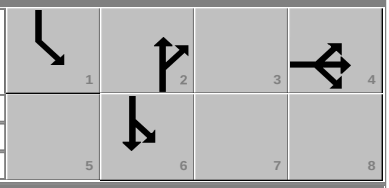
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2035	Analysis Period	1> 16:30
Intersection	I-229 South Ramp	File Name	14-16-18 Cliff Avenue 2035 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	240	0	550					775	240	120	1455	

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	37	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	54.9	5.1	45.2	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.5	1.0	1.5	0.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4				2	1	6
Case Number		10.0				7.3	1.0	4.0
Phase Duration, s		50.3				60.0	9.7	69.7
Change Period, ($Y+R_c$), s		5.1				5.1	5.1	5.1
Max Allow Headway (*MAH*), s		5.4				0.0	5.2	0.0
Queue Clearance Time (g_s), s		46.6					2.0	
Green Extension Time (g_e), s		0.0				0.0	2.6	0.0
Phase Call Probability		1.00					0.99	
Max Out Probability		1.00					1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14					2	12	1	6	
Adjusted Flow Rate (*v*), veh/h	227	596						792	184	152	1837	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1595						1724	1484	1734	1876	
Queue Service Time (g_s), s	11.2	44.6						15.8	6.1	0.0	53.2	
Cycle Queue Clearance Time (g_c), s	11.2	44.6						15.8	6.1	0.0	53.2	
Green Ratio (*g/C*)	0.38	0.38						0.46	0.46	0.48	0.54	
Capacity (*c*), veh/h	653	601						1577	679	338	2020	
Volume-to-Capacity Ratio (*X*)	0.347	0.991						0.502	0.271	0.448	0.910	
Back of Queue (*Q*), ft/ln (95 th percentile)	211.1	784.6						234.1	93	158.9	768.4	
Back of Queue (*Q*), veh/ln (95 th percentile)	8.3	30.9						9.2	3.7	6.3	30.3	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.53	0.00						0.00	0.37	0.79	0.00	
Uniform Delay (d_1), s/veh	26.8	38.7						16.2	12.0	32.8	25.1	
Incremental Delay (d_2), s/veh	0.4	34.3						1.0	0.8	0.8	5.0	
Initial Queue Delay (d_3), s/veh	0.0	0.0						0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	27.3	73.0						17.2	12.8	33.7	30.0	
Level of Service (LOS)	C	E						B	B	C	C	
Approach Delay, s/veh / LOS	60.4	E		0.0			16.4	B		30.3	C	
Intersection Delay, s/veh / LOS	33.3						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.41	B	2.32	B	1.44	A	1.75	B
Bicycle LOS Score / LOS	1.84	B			1.36	A	1.93	B

HCS7 Two-Way Stop-Control Report

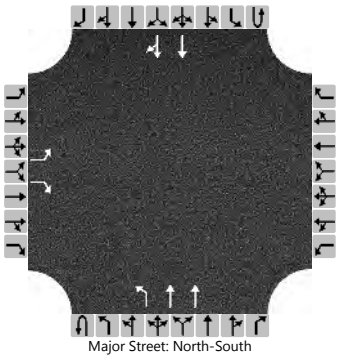
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/23/19
Analysis Year	2035
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at Spencer Park
Jurisdiction	Sioux Falls, SD
East/West Street	Spencer Park Road
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration		L		R						L	T				T	TR
Volume (veh/h)		5		5					0	5	2180				1010	5
Percent Heavy Vehicles (%)		2		2					2	2						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized		No														
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5		6.9						4.1						
Critical Headway (sec)		6.84		6.94						4.14						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.52		3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		6		6						6						
Capacity, c (veh/h)		130		469						615						
v/c Ratio		0.04		0.01						0.01						
95% Queue Length, Q_{95} (veh)		0.1		0.0						0.0						
Control Delay (s/veh)		34.0		12.8						10.9						
Level of Service (LOS)		D		B						B						
Approach Delay (s/veh)		23.4								0.0						
Approach LOS		C														

HCS7 Two-Way Stop-Control Report

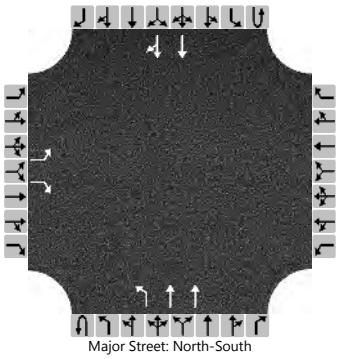
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/23/19
Analysis Year	2035
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at Spencer Park
Jurisdiction	Sioux Falls, SD
East/West Street	Spencer Park Road
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration		L		R						L	T				T	TR
Volume (veh/h)		5		20					0	20	1010				1975	30
Percent Heavy Vehicles (%)		2		2					2	2						
Proportion Time Blocked																
Percent Grade (%)	0															
Right Turn Channelized	No															
Median Type | Storage	Left Only								1							

Critical and Follow-up Headways

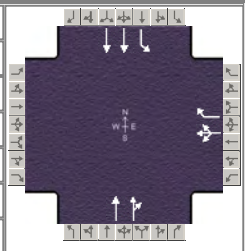
Base Critical Headway (sec)		7.5		6.9						4.1						
Critical Headway (sec)		6.84		6.94						4.14						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.52		3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		6		22						22						
Capacity, c (veh/h)		57		203						230						
v/c Ratio		0.10		0.11						0.10						
95% Queue Length, Q_{95} (veh)		0.3		0.4						0.3						
Control Delay (s/veh)		74.4		24.9						22.3						
Level of Service (LOS)		F		C						C						
Approach Delay (s/veh)	34.8								0.4							
Approach LOS	D															

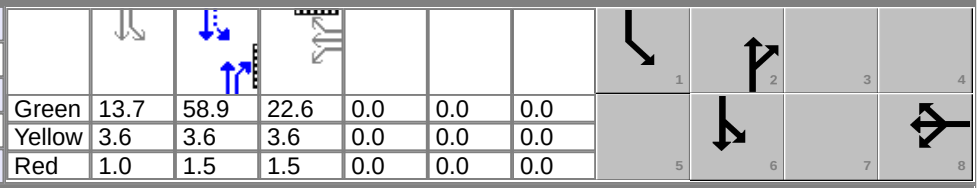
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	49th Street	File Name	14-16-18 Cliff Avenue 2035 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				40	0	760		1455	15	245	865	

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	77	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	13.7	58.9	22.6	0.0	0.0	0.0						
Yellow	3.6	3.6	3.6	0.0	0.0	0.0						
Red	1.0	1.5	1.5	0.0	0.0	0.0						

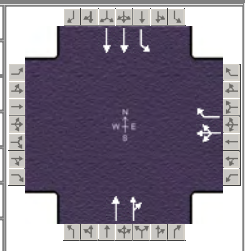
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase				8		2	1	6
Case Number				11.0		8.3	1.0	4.0
Phase Duration, s				27.7		64.0	18.3	82.3
Change Period, (*Y+R c*), s				5.1		5.1	4.6	5.1
Max Allow Headway (*MAH*), s				5.2		0.0	5.1	0.0
Queue Clearance Time (*g s*), s				20.9			14.6	
Green Extension Time (*g e*), s				1.7		0.0	0.0	0.0
Phase Call Probability				1.00			1.00	
Max Out Probability				0.83			1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement				3	8	18		2	12	1	6	
Adjusted Flow Rate (*v*), veh/h					274	281		1111	1111	272	961	
Adjusted Saturation Flow Rate (*s*), veh/h/ln					1621	1585		1870	1864	1781	1781	
Queue Service Time (*g s*), s					18.5	18.9		39.7	58.9	12.6	12.1	
Cycle Queue Clearance Time (*g c*), s					18.5	18.9		39.7	58.9	12.6	12.1	
Green Ratio (*g/C*)					0.21	0.21		0.54	0.54	0.68	0.70	
Capacity (*c*), veh/h					333	325		1002	998	288	2500	
Volume-to-Capacity Ratio (*X*)					0.825	0.865		1.109	1.113	0.946	0.384	
Back of Queue (*Q*), ft/ln (95 th percentile)					359.6	346.4		971.3	965.3	396.5	187.2	
Back of Queue (*Q*), veh/ln (95 th percentile)					14.4	13.6		38.2	38.6	15.6	7.4	
Queue Storage Ratio (*RQ*) (95 th percentile)					1.60	1.52		0.00	0.00	1.02	0.00	
Uniform Delay (*d 1*), s/veh					51.2	42.2		17.3	17.1	37.6	6.7	
Incremental Delay (*d 2*), s/veh					12.6	17.1		50.7	52.5	38.9	0.4	
Initial Queue Delay (*d 3*), s/veh					0.0	0.0		0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh					63.8	59.3		68.0	69.7	76.5	7.1	
Level of Service (LOS)					E	E		F	F	E	A	
Approach Delay, s/veh / LOS	0.0			61.6		E	68.9		E	22.4		C
Intersection Delay, s/veh / LOS	53.6						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.15	B	2.32	B	2.32	B	1.34	A
Bicycle LOS Score / LOS			1.40	A	1.84	B	1.51	B

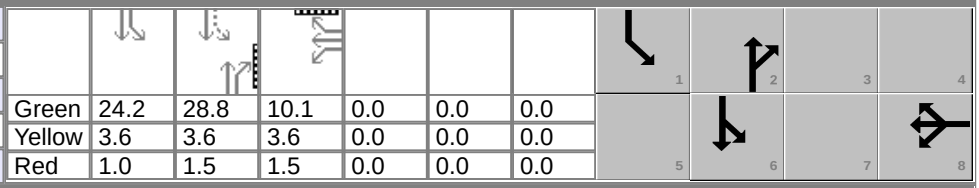
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2035	Analysis Period	1> 16:30
Intersection	49th Street	File Name	14-16-18 Cliff Avenue 2035 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				50	0	225		740	60	560	1740	

Signal Information			
Cycle, s	77.9	Reference Phase	2
Offset, s	48	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	24.2	28.8	10.1	0.0	0.0	0.0			
Yellow	3.6	3.6	3.6	0.0	0.0	0.0			
Red	1.0	1.5	1.5	0.0	0.0	0.0			

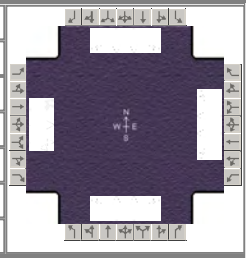
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase				8		2	1	6
Case Number				11.0		8.3	1.0	4.0
Phase Duration, s				15.2		33.9	28.8	62.7
Change Period, ($Y+R_c$), s				5.1		5.1	4.6	5.1
Max Allow Headway (*MAH*), s				5.3		3.0	5.1	3.0
Queue Clearance Time (g_s), s				9.8		21.8	20.6	26.2
Green Extension Time (g_e), s				0.4		6.3	3.5	11.1
Phase Call Probability				1.00		1.00	1.00	1.00
Max Out Probability				1.00		0.11	0.16	0.20

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement				3	8	18		2	12	1	6	
Adjusted Flow Rate (*v*), veh/h					143	163		536	522	622	1933	
Adjusted Saturation Flow Rate (*s*), veh/h/ln					1672	1585		1870	1821	1781	1781	
Queue Service Time (g_s), s					6.6	7.8		19.6	19.8	18.6	24.2	
Cycle Queue Clearance Time (g_c), s					6.6	7.8		19.6	19.8	18.6	24.2	
Green Ratio (*g/C*)					0.13	0.13		0.37	0.37	0.71	0.74	
Capacity (*c*), veh/h					217	206		689	671	707	2632	
Volume-to-Capacity Ratio (*X*)					0.658	0.789		0.778	0.778	0.880	0.734	
Back of Queue (*Q*), ft/ln (95 th percentile)					138.1	169.7		315.9	304.2	423.2	245.9	
Back of Queue (*Q*), veh/ln (95 th percentile)					5.5	6.7		12.4	12.2	16.7	9.7	
Queue Storage Ratio (*RQ*) (95 th percentile)					0.61	0.74		0.00	0.00	1.06	0.00	
Uniform Delay (d_1), s/veh					35.3	32.9		21.8	21.8	16.6	5.8	
Incremental Delay (d_2), s/veh					5.9	15.1		0.6	0.7	8.4	1.0	
Initial Queue Delay (d_3), s/veh					0.0	0.0		0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh					41.3	48.0		22.4	22.5	25.0	6.8	
Level of Service (LOS)					D	D		C	C	C	A	
Approach Delay, s/veh / LOS	0.0			44.9		D	22.5		C	11.2		B
Intersection Delay, s/veh / LOS	16.9						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.14	B	2.31	B	1.91	B	1.32	A
Bicycle LOS Score / LOS			0.99	A	1.22	A	2.60	C

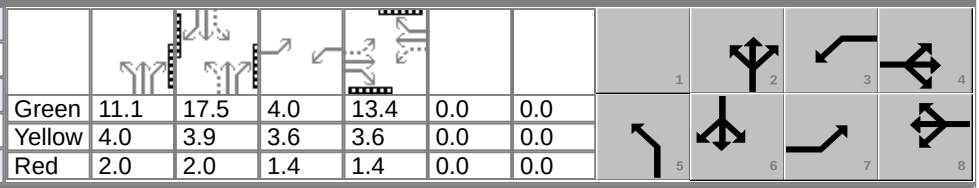
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls	Time Period	AM	PHF	0.90
Urban Street	Western Avenue	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	49th Street	File Name	19-20-21-22 Western 2035 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	120	220	105	95	365	240	290	780	185	65	410	60

Signal Information			
Cycle, s	68.0	Reference Phase	2
Offset, s	21	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	11.1	17.5	4.0	13.4	0.0	0.0
Yellow	4.0	3.9	3.6	3.6	0.0	0.0
Red	2.0	2.0	1.4	1.4	0.0	0.0

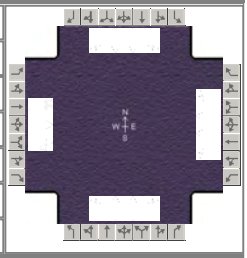
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2		6
Case Number	1.1	4.0	1.1	3.0	1.0	3.0		5.3
Phase Duration, s	9.0	18.4	9.0	18.4	17.1	40.6		23.4
Change Period, ($Y+R_c$), s	5.0	5.0	5.0	5.0	6.0	5.9		5.9
Max Allow Headway (*MAH*), s	3.1	5.1	3.1	5.1	3.1	5.3		5.3
Queue Clearance Time (g_s), s	6.0	7.8	5.3	9.2	10.5	13.1		16.8
Green Extension Time (g_e), s	0.0	5.6	0.0	1.8	0.6	22.0		0.0
Phase Call Probability	0.92	1.00	0.86	1.00	1.00	1.00		1.00
Max Out Probability	1.00	0.00	1.00	1.00	0.00	0.03		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	133	168	160	106	406	156	322	867	150	124	785	86
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1665	1734	1734	1543	1734	1734	1543	639	1734	1543
Queue Service Time (g_s), s	4.0	5.6	5.8	3.3	7.2	6.1	8.5	11.1	3.6	12.2	14.8	3.0
Cycle Queue Clearance Time (g_c), s	4.0	5.6	5.8	3.3	7.2	6.1	8.5	11.1	3.6	12.2	14.8	3.0
Green Ratio (*g/C*)	0.26	0.20	0.20	0.26	0.20	0.20	0.45	0.51	0.51	0.26	0.26	0.26
Capacity (*c*), veh/h	268	360	329	296	685	305	418	1768	787	270	894	398
Volume-to-Capacity Ratio (*X*)	0.497	0.467	0.485	0.357	0.592	0.510	0.771	0.490	0.191	0.460	0.878	0.216
Back of Queue (*Q*), ft/ln (95 th percentile)	73.8	108.2	103.9	57.1	133.6	102.8	136.7	165.7	48.1	82	265.3	47
Back of Queue (*Q*), veh/ln (95 th percentile)	2.9	4.3	4.1	2.2	5.3	4.0	5.4	6.5	1.9	3.2	10.4	1.9
Queue Storage Ratio (*RQ*) (95 th percentile)	0.30	0.00	0.00	0.19	0.00	0.41	0.55	0.00	0.40	0.33	0.00	0.19
Uniform Delay (d_1), s/veh	21.5	24.1	24.2	20.5	24.8	24.4	15.3	10.9	9.1	23.3	24.2	19.8
Incremental Delay (d_2), s/veh	0.5	1.3	1.6	0.3	1.6	2.0	1.2	0.3	0.2	1.4	8.7	0.3
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	22.0	25.5	25.8	20.8	26.4	26.3	16.4	11.2	9.2	24.7	32.9	20.2
Level of Service (LOS)	C	C	C	C	C	C	B	B	A	C	C	C
Approach Delay, s/veh / LOS	24.6	C		25.5	C		12.2	B		30.8	C	
Intersection Delay, s/veh / LOS	21.8						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.51	C	2.46	B	2.54	C	2.32	B
Bicycle LOS Score / LOS	0.87	A	1.04	A	1.59	B	0.96	A

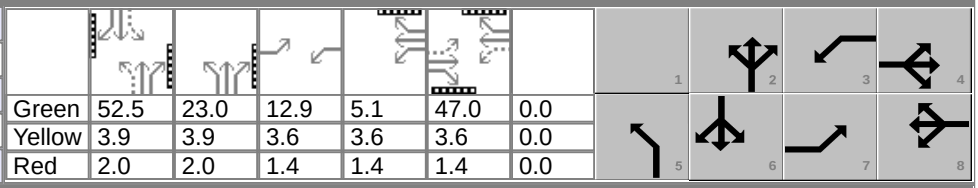
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls	Time Period	PM	PHF	0.90
Urban Street	Western Avenue	Analysis Year	2035	Analysis Period	1> 16:30
Intersection	49th Street	File Name	19-20-21-22 Western 2035 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	140	495	350	290	625	200	320	785	125	80	1095	65

Signal Information			
Cycle, s	167.3	Reference Phase	2
Offset, s	21	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	52.5	23.0	12.9	5.1	47.0	0.0
Yellow	3.9	3.9	3.6	3.6	3.6	0.0
Red	2.0	2.0	1.4	1.4	1.4	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2		6
Case Number	1.1	4.0	1.1	3.0	1.0	3.0		5.3
Phase Duration, s	17.9	52.0	28.0	62.1	28.9	87.3		58.4
Change Period, ($Y+R_c$), s	5.0	5.0	5.0	5.0	5.9	5.9		5.9
Max Allow Headway (*MAH*), s	3.1	5.1	3.1	5.1	4.5	4.5		5.2
Queue Clearance Time (g_s), s	12.6	40.3	25.0	29.6	25.0	30.9		48.3
Green Extension Time (g_e), s	0.3	6.6	0.0	16.8	0.0	0.0		4.1
Phase Call Probability	1.00	1.00	1.00	1.00	1.00	1.00		1.00
Max Out Probability	0.00	0.80	1.00	0.05	1.00	1.00		0.76

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	156	438	389	322	694	167	356	872	111	69	948	30
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1614	1734	1734	1543	1734	1734	1543	635	1734	1543
Queue Service Time (g_s), s	10.6	38.2	38.3	23.0	27.6	13.4	23.0	28.9	6.7	17.6	43.2	2.3
Cycle Queue Clearance Time (g_c), s	10.6	38.2	38.3	23.0	27.6	13.4	23.0	28.9	6.7	46.3	43.2	2.3
Green Ratio (*g/C*)	0.36	0.28	0.28	0.43	0.34	0.34	0.44	0.49	0.49	0.31	0.31	0.31
Capacity (*c*), veh/h	299	511	453	315	1183	526	308	1688	751	134	1089	485
Volume-to-Capacity Ratio (*X*)	0.519	0.857	0.859	1.022	0.587	0.317	1.155	0.517	0.148	0.518	0.871	0.063
Back of Queue (*Q*), ft/ln (95 th percentile)	206.2	674.3	615.4	542.7	451.3	227.7	796.8	455.1	114.7	134.7	649.4	41.4
Back of Queue (*Q*), veh/ln (95 th percentile)	8.1	26.5	24.2	21.4	17.8	9.0	31.4	17.9	4.5	5.3	25.6	1.6
Queue Storage Ratio (*RQ*) (95 th percentile)	0.82	0.00	0.00	1.81	0.00	0.91	2.66	0.00	0.96	0.54	0.00	0.17
Uniform Delay (d_1), s/veh	39.3	57.0	57.1	45.6	45.4	40.7	69.3	29.5	23.8	69.1	54.2	85.0
Incremental Delay (d_2), s/veh	0.5	12.9	14.5	56.4	0.7	0.5	99.9	0.4	0.1	3.0	5.2	0.1
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	39.9	69.9	71.5	102.0	46.1	41.2	169.2	29.8	23.9	72.1	59.4	85.0
Level of Service (LOS)	D	E	E	F	D	D	F	C	C	E	E	F
Approach Delay, s/veh / LOS	65.8	E		60.6	E		66.4	E		61.0	E	
Intersection Delay, s/veh / LOS	63.5						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.50	B	2.50	B	2.51	C	2.47	B
Bicycle LOS Score / LOS	1.30	A	1.46	A	1.59	B	1.60	B

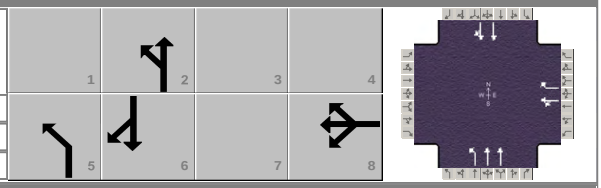
HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc.			Interchange Type	Diamond
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Segment Distance, ft	700
Jurisdiction	Sioux Falls	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 North Ramp	PHF	0.90	Arterial Direction	North-South
File Name	19-20-21-22 Western 2035 AM.xus				
Project Description	I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h				295	0	480	110	1045			550	135
Intersection Two Demand (*v*), veh/h	350	0	155					805	300	160	685	

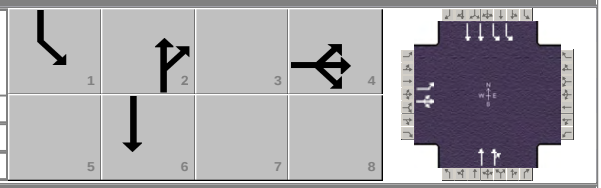
Signal One Information	
Cycle, s	110.0
Offset, s	66
Uncoordinated	No
Force Mode	Fixed

Green	6.0	54.4	31.6	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0



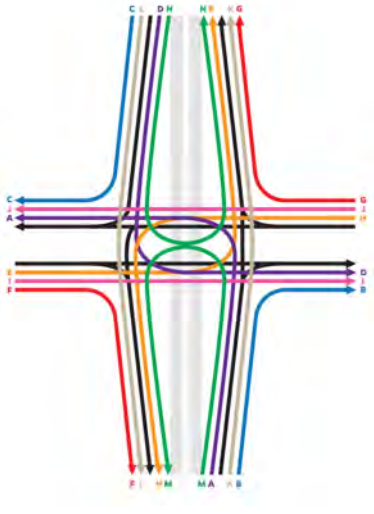
Signal Two Information	
Cycle, s	110.0
Offset, s	66
Uncoordinated	No
Force Mode	Fixed

Green	7.1	64.3	21.8	0.0	0.0	0.0
Yellow	3.9	3.9	3.6	0.0	0.0	0.0
Red	1.8	1.8	1.9	0.0	0.0	0.0



Interchange Results

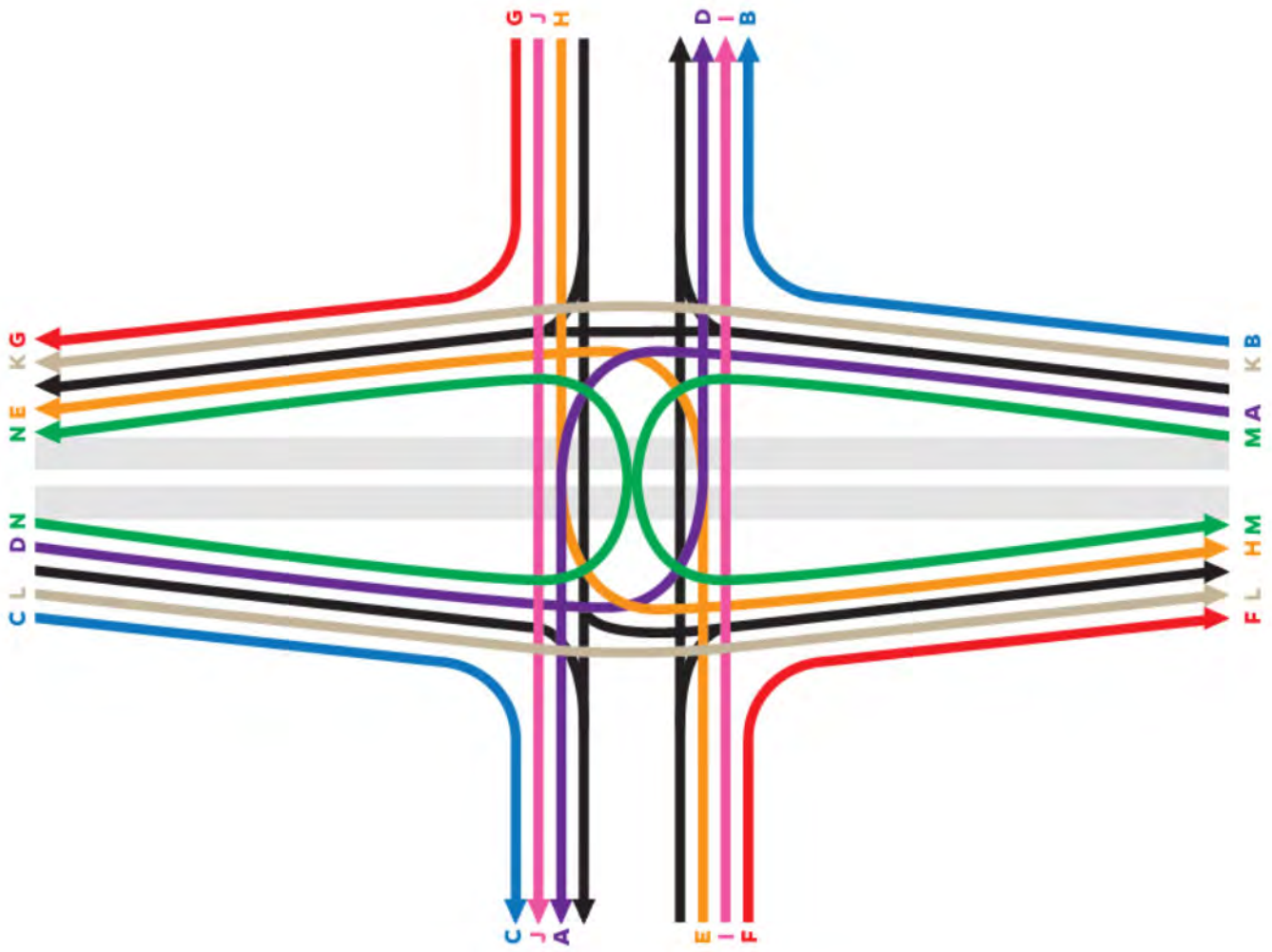
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	0	19.7	0.0	19.7	No	No	B
B	0	0.0	0.0	0.0	No	No	A
C	0	0.0	0.0	0.0	No	No	A
D	0	17.6	0.0	17.6	No	No	B
E	0	13.2	0.0	13.2	No	No	A
F	0	13.2	0.0	13.2	No	No	A
G	0	0.0	0.0	0.0	No	No	A
H	0	2.2	0.0	2.2	No	No	A
I	1239	30.9	0.0	30.9	No	No	C
J	684	21.9	0.0	21.9	No	No	B
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh					36.6	43.0	14.7	13.2			19.7	18.3
Level of Service (LOS)					D	D	B	B			B	B
Approach Delay, s/veh / LOS	0.0			40.0		D	13.4		B	19.0		B
Intersection Delay, s/veh / LOS	21.7						C					

Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	48.4	48.2						17.6	15.1	40.2	2.2	
Level of Service (LOS)	D	D						B	B	D	A	
Approach Delay, s/veh / LOS	48.3		D	0.0			16.4		B	9.4		A
Intersection Delay, s/veh / LOS	19.9						B					

Interchange Graphic



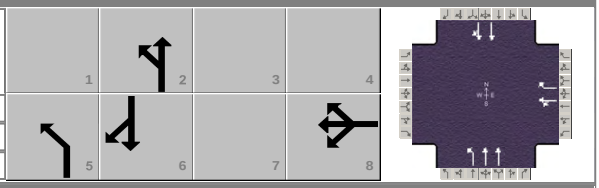
HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc.			Interchange Type	Diamond
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Segment Distance, ft	700
Jurisdiction	Sioux Falls	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 North Ramp	PHF	0.90	Arterial Direction	North-South
File Name	19-20-21-22 Western 2035 PM.xus				
Project Description	I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h				315	5	490	225	850			1320	370
Intersection Two Demand (*v*), veh/h	235	5	115					840	330	520	1115	

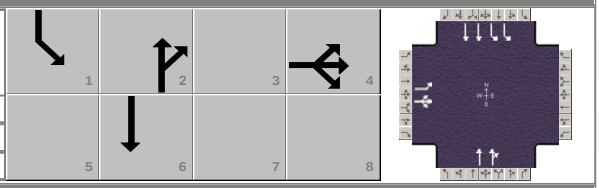
Signal One Information	
Cycle, s	90.0
Offset, s	2
Uncoordinated	No
Force Mode	Fixed

Green	11.3	34.1	26.6	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0



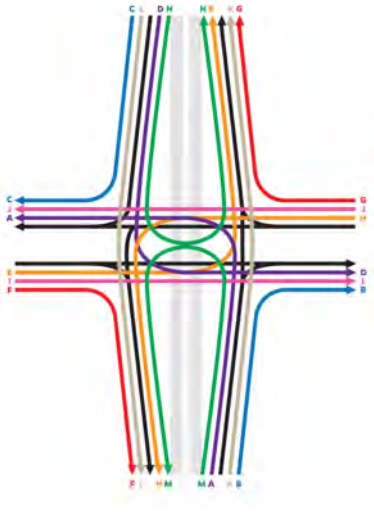
Signal Two Information	
Cycle, s	90.0
Offset, s	2
Uncoordinated	No
Force Mode	Fixed

Green	43.9	13.2	16.0	0.0	0.0	0.0
Yellow	3.9	3.9	3.6	0.0	0.0	0.0
Red	1.8	1.8	1.9	0.0	0.0	0.0



Interchange Results

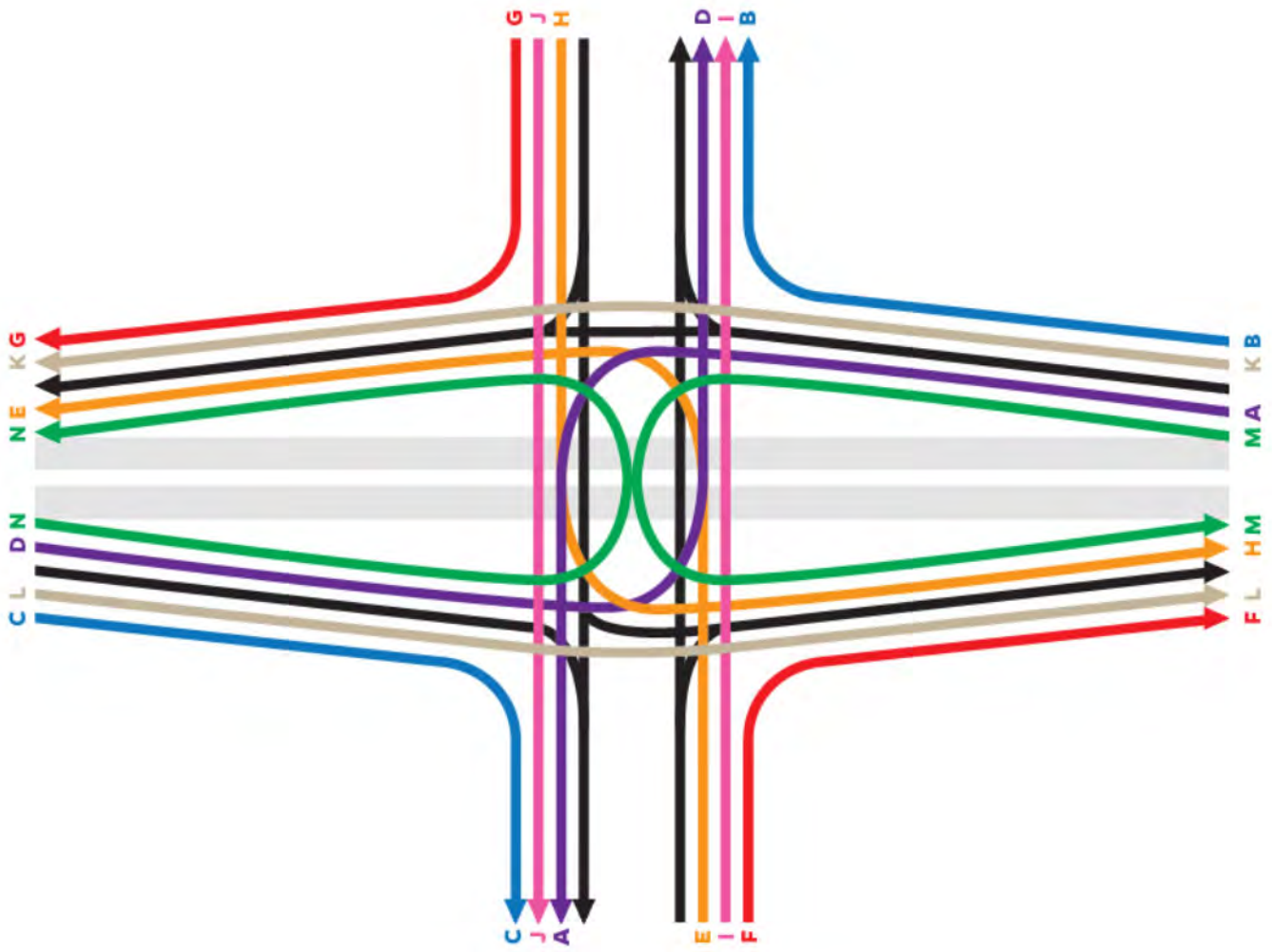
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	0	29.5	0.0	29.5	No	No	B
B	0	0.0	0.0	0.0	No	No	A
C	0	0.0	0.0	0.0	No	No	A
D	0	21.7	0.0	21.7	No	No	B
E	0	12.1	0.0	12.1	No	No	A
F	0	12.1	0.0	12.1	No	No	A
G	0	0.0	0.0	0.0	No	No	A
H	0	1.1	0.0	1.1	No	No	A
I	1117	33.8	0.0	33.8	No	No	C
J	736	30.6	0.0	30.6	No	No	C
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh					30.9	40.2	45.0	12.1			29.5	30.0
Level of Service (LOS)					C	D	D	B			C	C
Approach Delay, s/veh / LOS	0.0			35.7		D	19.0		B	29.8		C
Intersection Delay, s/veh / LOS	26.6						C					

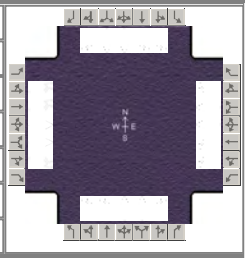
Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	37.2	36.3						21.7	19.6	30.8	1.1	
Level of Service (LOS)	D	D						C	B	C	A	
Approach Delay, s/veh / LOS	36.8		D	0.0			20.7		C	10.5		B
Intersection Delay, s/veh / LOS	18.5						B					

Interchange Graphic



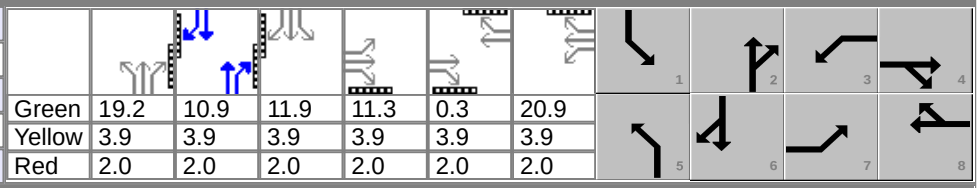
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls	Time Period	AM	PHF	0.90
Urban Street	Western Avenue	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	57th Street	File Name	19-20-21-22 Western 2035 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	250	370	130	135	650	245	320	610	45	125	485	230

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	95	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	19.2	10.9	11.9	11.3	0.3	20.9
Yellow	3.9	3.9	3.9	3.9	3.9	3.9
Red	2.0	2.0	2.0	2.0	2.0	2.0

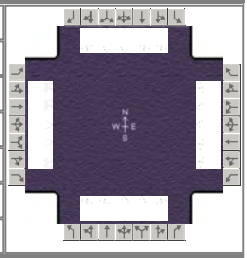
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	17.2	23.4	26.8	33.1	25.1	42.0	17.8	34.6
Change Period, ($Y+R_c$), s	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9
Max Allow Headway (*MAH*), s	2.6	5.0	4.7	4.7	2.6	0.0	5.0	0.0
Queue Clearance Time (g_s), s	10.9	14.4	6.2	23.8	18.4		6.2	
Green Extension Time (g_e), s	0.4	3.1	5.7	3.4	0.9	0.0	5.8	0.0
Phase Call Probability	1.00	1.00	0.99	1.00	1.00		0.99	
Max Out Probability	0.00	0.00	0.12	0.67	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	278	411	100	150	722	178	522	995	49	139	539	156
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1734	1543	1684	1734	1543	1684	1734	1543	1684	1734	1543
Queue Service Time (g_s), s	8.9	12.4	6.4	4.2	21.8	10.8	16.4	29.7	2.3	4.2	15.0	9.1
Cycle Queue Clearance Time (g_c), s	8.9	12.4	6.4	4.2	21.8	10.8	16.4	29.7	2.3	4.2	15.0	9.1
Green Ratio (*g/C*)	0.10	0.16	0.16	0.19	0.25	0.25	0.17	0.33	0.33	0.11	0.26	0.26
Capacity (*c*), veh/h	346	552	246	641	856	381	589	1137	506	364	905	403
Volume-to-Capacity Ratio (*X*)	0.803	0.744	0.407	0.234	0.844	0.467	0.886	0.875	0.097	0.382	0.596	0.386
Back of Queue (*Q*), ft/ln (95 th percentile)	171.8	236.6	112.2	77.9	381.1	135.5	221.1	422.9	38.2	82.1	273.6	168.1
Back of Queue (*Q*), veh/ln (95 th percentile)	6.8	9.3	4.4	3.1	15.0	5.3	8.7	16.6	1.5	3.2	10.8	6.6
Queue Storage Ratio (*RQ*) (95 th percentile)	0.55	0.00	0.45	0.30	0.00	0.52	0.63	0.00	0.29	0.66	0.00	1.35
Uniform Delay (d_1), s/veh	48.3	44.1	19.3	37.7	39.4	19.7	39.1	34.7	23.7	45.6	35.6	33.4
Incremental Delay (d_2), s/veh	1.7	2.8	1.5	0.1	6.5	1.2	0.8	4.4	0.2	0.9	2.9	2.8
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	49.9	46.9	20.8	37.8	45.9	21.0	39.9	39.1	23.9	46.6	38.5	36.2
Level of Service (LOS)	D	D	C	D	D	C	D	D	C	D	D	D
Approach Delay, s/veh / LOS	44.6	D		40.5	D		38.9	D		39.4	D	
Intersection Delay, s/veh / LOS	40.5						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.62	C	2.72	C	2.72	C	2.64	C
Bicycle LOS Score / LOS	1.14	A	1.35	A	1.37	A	1.18	A

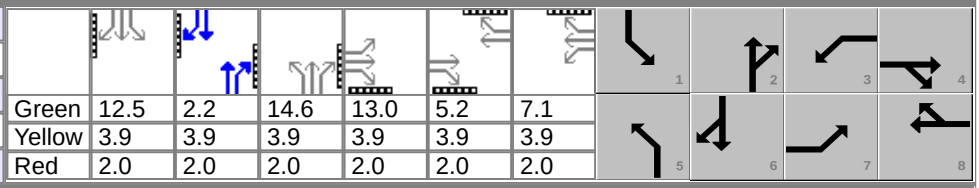
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls	Time Period	PM	PHF	0.90
Urban Street	Western Avenue	Analysis Year	2035	Analysis Period	1> 16:30
Intersection	57th Street	File Name	19-20-21-22 Western 2035 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	370	795	330	140	570	200	455	600	120	310	670	250

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	32	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	12.5	2.2	14.6	13.0	5.2	7.1
Yellow	3.9	3.9	3.9	3.9	3.9	3.9
Red	2.0	2.0	2.0	2.0	2.0	2.0

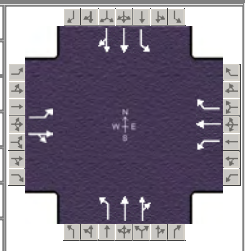
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	18.9	30.0	13.0	24.0	20.5	28.6	18.4	26.5
Change Period, ($Y+R_c$), s	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9
Max Allow Headway (*MAH*), s	2.6	5.0	4.6	4.6	2.6	0.0	5.0	0.0
Queue Clearance Time (g_s), s	12.7	24.5	6.0	18.1	16.1		10.8	
Green Extension Time (g_e), s	0.3	0.0	0.6	0.1	0.0	0.0	1.7	0.0
Phase Call Probability	1.00	1.00	0.98	1.00	1.00		1.00	
Max Out Probability	0.17	1.00	1.00	1.00	1.00		0.04	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	411	883	256	156	633	167	532	702	99	344	744	194
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1734	1543	1684	1734	1543	1684	1734	1543	1684	1734	1543
Queue Service Time (g_s), s	10.7	22.5	13.1	4.0	16.1	8.7	14.1	17.0	4.2	8.8	19.0	10.0
Cycle Queue Clearance Time (g_c), s	10.7	22.5	13.1	4.0	16.1	8.7	14.1	17.0	4.2	8.8	19.0	10.0
Green Ratio (*g/C*)	0.14	0.27	0.27	0.08	0.20	0.20	0.16	0.25	0.25	0.14	0.23	0.23
Capacity (*c*), veh/h	488	929	413	264	698	311	547	876	390	467	795	354
Volume-to-Capacity Ratio (*X*)	0.842	0.951	0.618	0.589	0.907	0.537	0.974	0.801	0.255	0.737	0.936	0.549
Back of Queue (*Q*), ft/ln (95 th percentile)	209.5	431.3	220.8	78.1	323.2	153	241.8	254.2	66.8	170.9	380.6	174.7
Back of Queue (*Q*), veh/ln (95 th percentile)	8.2	17.0	8.7	3.1	12.7	6.0	9.5	10.0	2.6	6.7	15.0	6.9
Queue Storage Ratio (*RQ*) (95 th percentile)	0.68	0.00	0.88	0.30	0.00	0.59	0.69	0.00	0.51	0.85	0.00	1.40
Uniform Delay (d_1), s/veh	37.5	32.4	28.9	40.1	35.1	32.2	35.1	30.7	4.7	37.2	34.0	3.4
Incremental Delay (d_2), s/veh	6.2	18.9	3.2	2.3	15.9	2.3	19.5	3.5	0.7	3.1	19.7	6.0
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	43.7	51.3	32.1	42.4	51.0	34.5	54.7	34.2	5.4	40.3	53.8	9.4
Level of Service (LOS)	D	D	C	D	D	C	D	C	A	D	D	A
Approach Delay, s/veh / LOS	46.1	D		46.7	D		40.2	D		43.4	D	
Intersection Delay, s/veh / LOS	44.0						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.65	C	2.69	C	2.65	C	2.73	C
Bicycle LOS Score / LOS	1.77	B	1.28	A	1.53	B	1.55	B

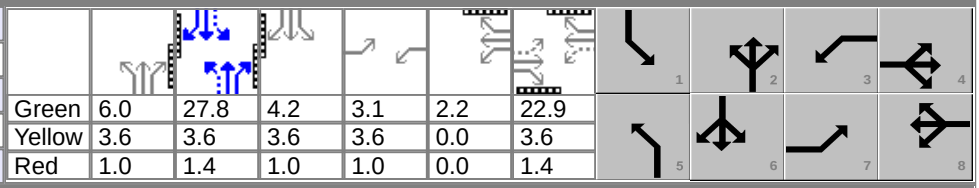
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	26th Street	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Cliff Avenue	File Name	23 26th at Cliff 2035 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	50	200	40	90	355	305	110	890	60	100	325	35

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	6.0	27.8	4.2	3.1	2.2	22.9
Yellow	3.6	3.6	3.6	3.6	0.0	3.6
Red	1.0	1.4	1.0	1.0	0.0	1.4

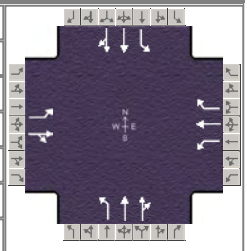
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	3.0	1.2	4.0	1.3	4.0
Phase Duration, s	7.7	27.9	10.0	30.1	10.6	43.4	8.8	41.6
Change Period, ($Y+R_c$), s	4.6	5.0	4.6	5.0	4.6	5.0	5.0	5.0
Max Allow Headway (*MAH*), s	4.2	6.2	4.2	6.2	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	4.1	13.3	5.8	19.9	6.1		2.0	
Green Extension Time (g_e), s	0.0	6.5	0.1	5.2	0.2	0.0	0.9	0.0
Phase Call Probability	0.75	1.00	0.92	1.00	0.95		0.94	
Max Out Probability	0.67	0.45	1.00	0.67	0.11		0.73	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	56	256		100	394	250	122	530	520	111	196	193
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1779		1734	1821	1543	1734	1821	1783	1734	1821	1775
Queue Service Time (g_s), s	2.1	11.3		3.8	17.9	12.5	4.1	21.2	21.2	0.0	6.4	6.5
Cycle Queue Clearance Time (g_c), s	2.1	11.3		3.8	17.9	12.5	4.1	21.2	21.2	0.0	6.4	6.5
Green Ratio (*g/C*)	0.29	0.25		0.31	0.28	0.28	0.40	0.43	0.43	0.33	0.41	0.41
Capacity (*c*), veh/h	197	452		328	508	431	431	777	761	243	740	722
Volume-to-Capacity Ratio (*X*)	0.282	0.565		0.305	0.776	0.581	0.284	0.682	0.682	0.457	0.265	0.267
Back of Queue (*Q*), ft/ln (95 th percentile)	40.9	220.3		71.2	340.8	134.1	74.9	372.9	361.4	111.2	128.2	124.6
Back of Queue (*Q*), veh/ln (95 th percentile)	1.6	8.7		2.8	13.4	5.3	2.9	14.7	14.5	4.4	5.0	5.0
Queue Storage Ratio (*RQ*) (95 th percentile)	0.31	0.00		0.62	0.00	1.17	0.43	0.00	0.00	0.74	0.00	0.00
Uniform Delay (d_1), s/veh	25.4	29.2		23.3	29.9	11.7	18.0	20.9	20.9	35.1	17.8	17.8
Incremental Delay (d_2), s/veh	0.8	2.4		0.5	7.0	2.6	0.4	4.8	4.9	1.3	0.9	0.9
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	26.1	31.6		23.8	36.9	14.3	18.4	25.7	25.8	36.4	18.6	18.7
Level of Service (LOS)	C	C		C	D	B	B	C	C	D	B	B
Approach Delay, s/veh / LOS	30.6	C		27.6	C		25.0	C		22.6	C	
Intersection Delay, s/veh / LOS	25.9						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.29	B	2.30	B	2.25	B	1.92	B
Bicycle LOS Score / LOS	1.00	A	1.72	B	1.45	A	0.90	A

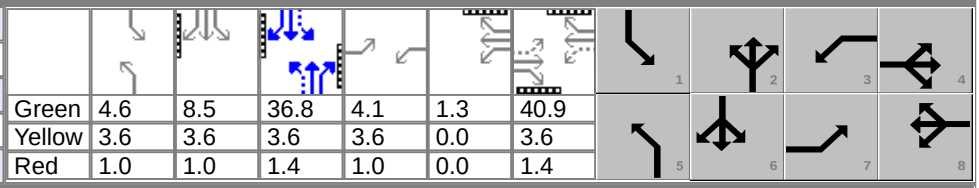
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	26th Street	Analysis Year	2035	Analysis Period	1> 16:30
Intersection	Cliff Avenue	File Name	23 26th at Cliff 2035 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	55	385	100	100	315	90	60	525	110	290	1060	70

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	4.6	8.5	36.8	4.1	1.3	40.9
Yellow	3.6	3.6	3.6	3.6	0.0	3.6
Red	1.0	1.0	1.4	1.0	0.0	1.4

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	8.7	45.9	10.0	47.1	9.2	41.8	22.3	54.9
Change Period, ($Y+R_c$), s	4.6	5.0	4.6	5.0	4.6	5.0	4.6	5.0
Max Allow Headway (*MAH*), s	4.2	6.2	4.2	6.2	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	4.7	35.9	7.0	20.5	5.1		16.5	
Green Extension Time (g_e), s	0.0	5.0	0.0	9.3	0.0	0.0	1.2	0.0
Phase Call Probability	0.87	1.00	0.98	1.00	0.89		1.00	
Max Out Probability	1.00	0.79	1.00	0.21	0.80		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	61	528		111	350	83	67	356	338	322	628	617
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1761		1734	1821	1543	1734	1821	1719	1734	1821	1786
Queue Service Time (g_s), s	2.7	33.9		5.0	18.5	4.4	3.1	20.2	20.4	14.5	36.9	37.0
Cycle Queue Clearance Time (g_c), s	2.7	33.9		5.0	18.5	4.4	3.1	20.2	20.4	14.5	36.9	37.0
Green Ratio (*g/C*)	0.37	0.34		0.39	0.35	0.35	0.35	0.31	0.31	0.47	0.42	0.42
Capacity (*c*), veh/h	305	600		189	640	542	168	559	528	419	757	743
Volume-to-Capacity Ratio (*X*)	0.200	0.880		0.587	0.547	0.154	0.398	0.638	0.641	0.769	0.829	0.830
Back of Queue (*Q*), ft/ln (95 th percentile)	53.1	594		106.6	333.9	77.3	63.1	379.7	359.7	259.8	634.7	616.6
Back of Queue (*Q*), veh/ln (95 th percentile)	2.1	23.4		4.2	13.1	3.0	2.5	14.9	14.4	10.2	25.0	24.7
Queue Storage Ratio (*RQ*) (95 th percentile)	0.41	0.00		0.93	0.00	0.67	0.36	0.00	0.00	1.73	0.00	0.00
Uniform Delay (d_1), s/veh	25.9	37.3		29.7	31.3	26.7	30.0	35.8	35.9	24.3	31.2	31.3
Incremental Delay (d_2), s/veh	0.3	13.8		4.7	1.6	0.3	1.5	5.5	5.9	3.0	10.2	10.4
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	26.3	51.0		34.3	32.8	27.0	31.5	41.3	41.7	27.3	41.4	41.7
Level of Service (LOS)	C	D		C	C	C	C	D	D	C	D	D
Approach Delay, s/veh / LOS	48.4	D		32.2	C		40.7	D		38.6	D	
Intersection Delay, s/veh / LOS	39.7						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.30	B	2.30	B	2.14	B	1.93	B
Bicycle LOS Score / LOS	1.46	A	1.39	A	1.12	A	1.78	B

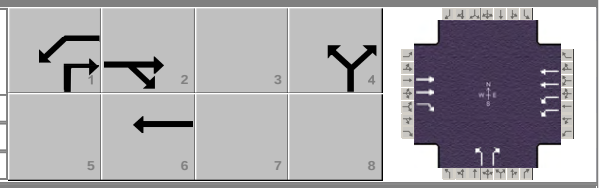
HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	Parclo AB-2Q
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Segment Distance, ft	1097
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	North-South
Intersection	SB I-229 Ramp	PHF	0.90	Arterial Direction	East-West
File Name	24-25-26 26th Street 2035 AM.xus				
Project Description	I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h		355	65	670	970		160		240			
Intersection Two Demand (*v*), veh/h		490	105	360	1480		160	0	450			

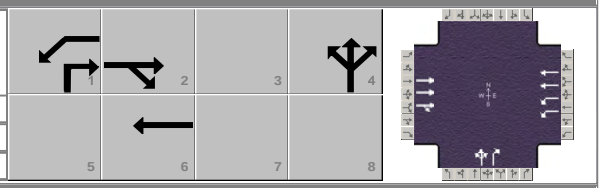
Signal One Information	
Cycle, s	90.0
Offset, s	0
Uncoordinated	No
Force Mode	Fixed

Green	43.5	18.5	12.1	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.9	1.9	1.3	0.0	0.0	0.0



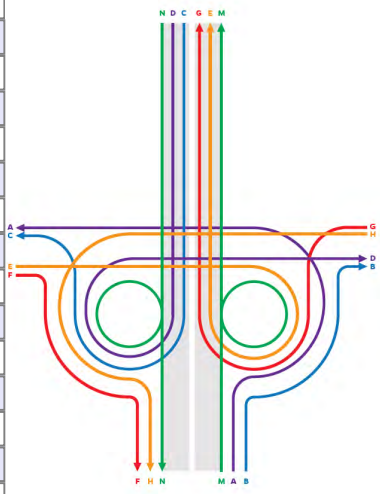
Signal Two Information	
Cycle, s	90.0
Offset, s	0
Uncoordinated	No
Force Mode	Fixed

Green	13.4	43.7	17.9	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.0	1.9	1.3	0.0	0.0	0.0



Interchange Results

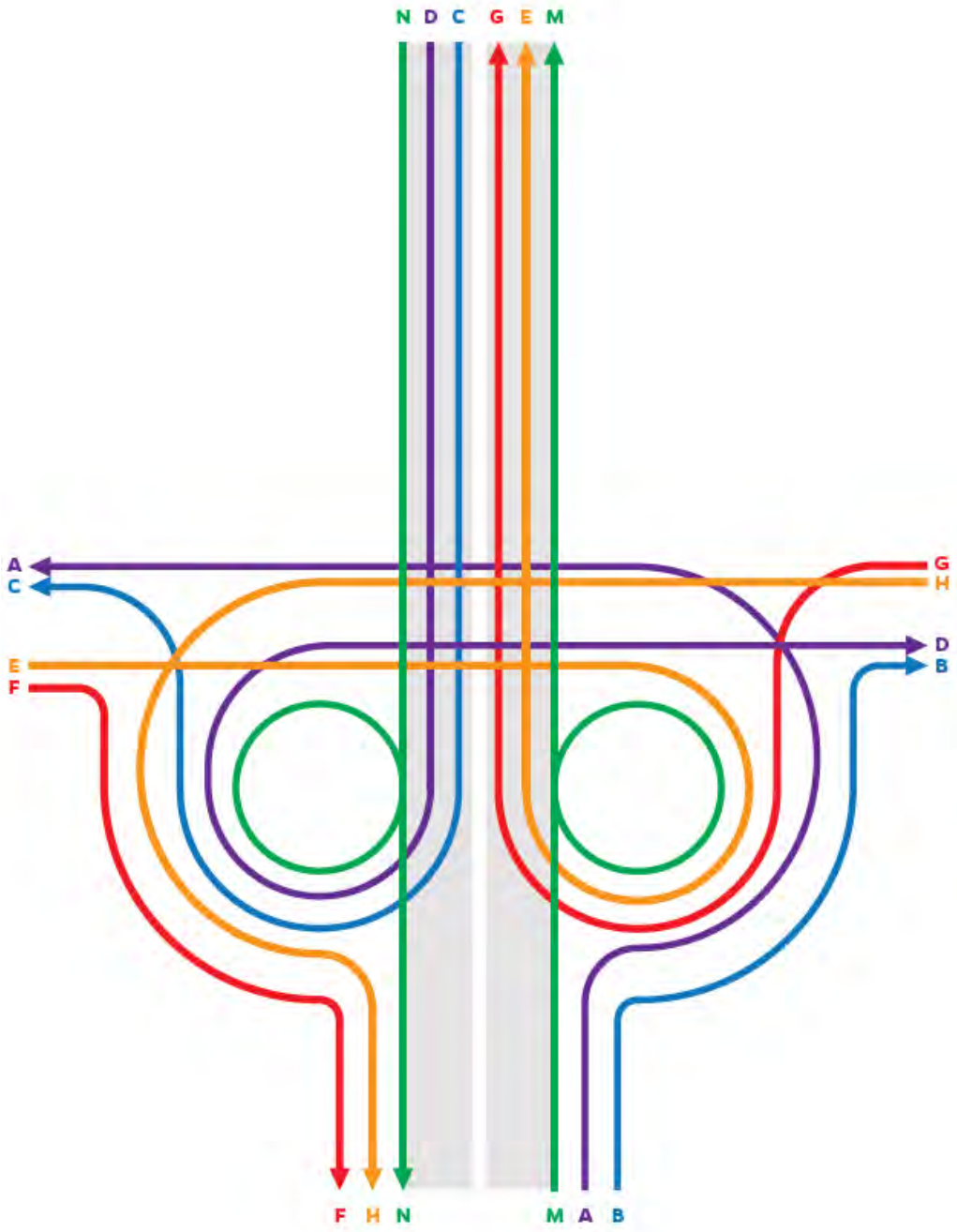
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	178	44.1	0.0	44.1	No	No	C
B	333	22.9	0.0	22.9	No	No	B
C	178	42.7	5.0	47.7	No	No	C
D	267	1.1	5.0	6.1	No	No	A
E	117	52.7	5.0	57.7	No	No	D
F	67	35.8	0.0	35.8	No	No	C
G	398	31.4	5.0	36.4	No	No	C
H	740	11.5	0.0	11.5	No	No	A
I	278	49.9	0.0	49.9	No	No	C
J	894	4.9	0.0	4.9	No	No	A
K	-	-	0.0	-	-	-	-
L	-	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh		35.8	31.5	10.3	3.8		42.7		0.0			
Level of Service (LOS)		D	C	B	A		D		A			
Approach Delay, s/veh / LOS	35.2	D		6.5	A		17.1	B		0.0		
Intersection Delay, s/veh / LOS	13.1						B					

Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh		14.1	16.9	31.4	1.1			40.3	22.9			
Level of Service (LOS)		B	B	C	A			D	C			
Approach Delay, s/veh / LOS	15.0	B		7.1	A		32.4	C		0.0		
Intersection Delay, s/veh / LOS	12.7						B					

Interchange Graphic



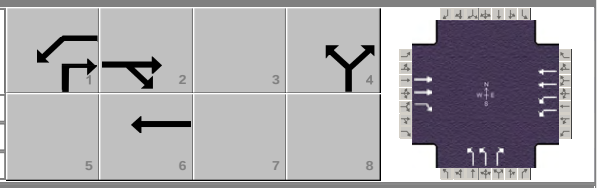
HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	Parclo AB-2Q
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Segment Distance, ft	1097
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	North-South
Intersection	SB I-229 Ramp	PHF	0.90	Arterial Direction	East-West
File Name	24-25-26 26th Street 2035 PM.xus				
Project Description	I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h		1095	75	530	775		160		610			
Intersection Two Demand (*v*), veh/h		1525	180	130	1240		65	0	830			

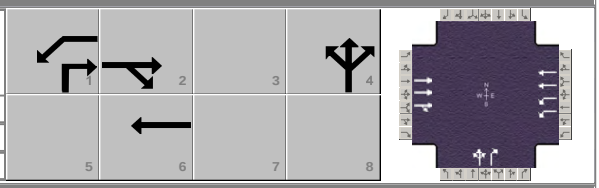
Signal One Information	
Cycle, s	130.0
Offset, s	0
Uncoordinated	No
Force Mode	Fixed

Green	34.5	69.5	10.1	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.9	1.9	1.3	0.0	0.0	0.0



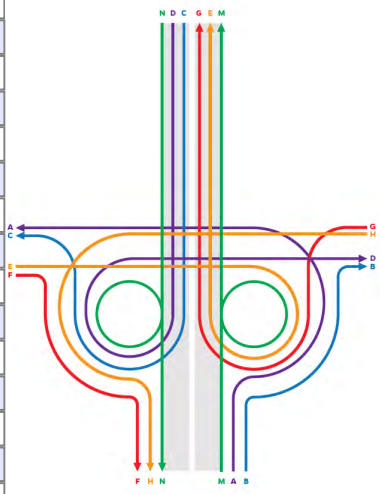
Signal Two Information	
Cycle, s	130.0
Offset, s	0
Uncoordinated	No
Force Mode	Fixed

Green	72.8	9.3	32.9	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.9	1.0	1.3	0.0	0.0	0.0



Interchange Results

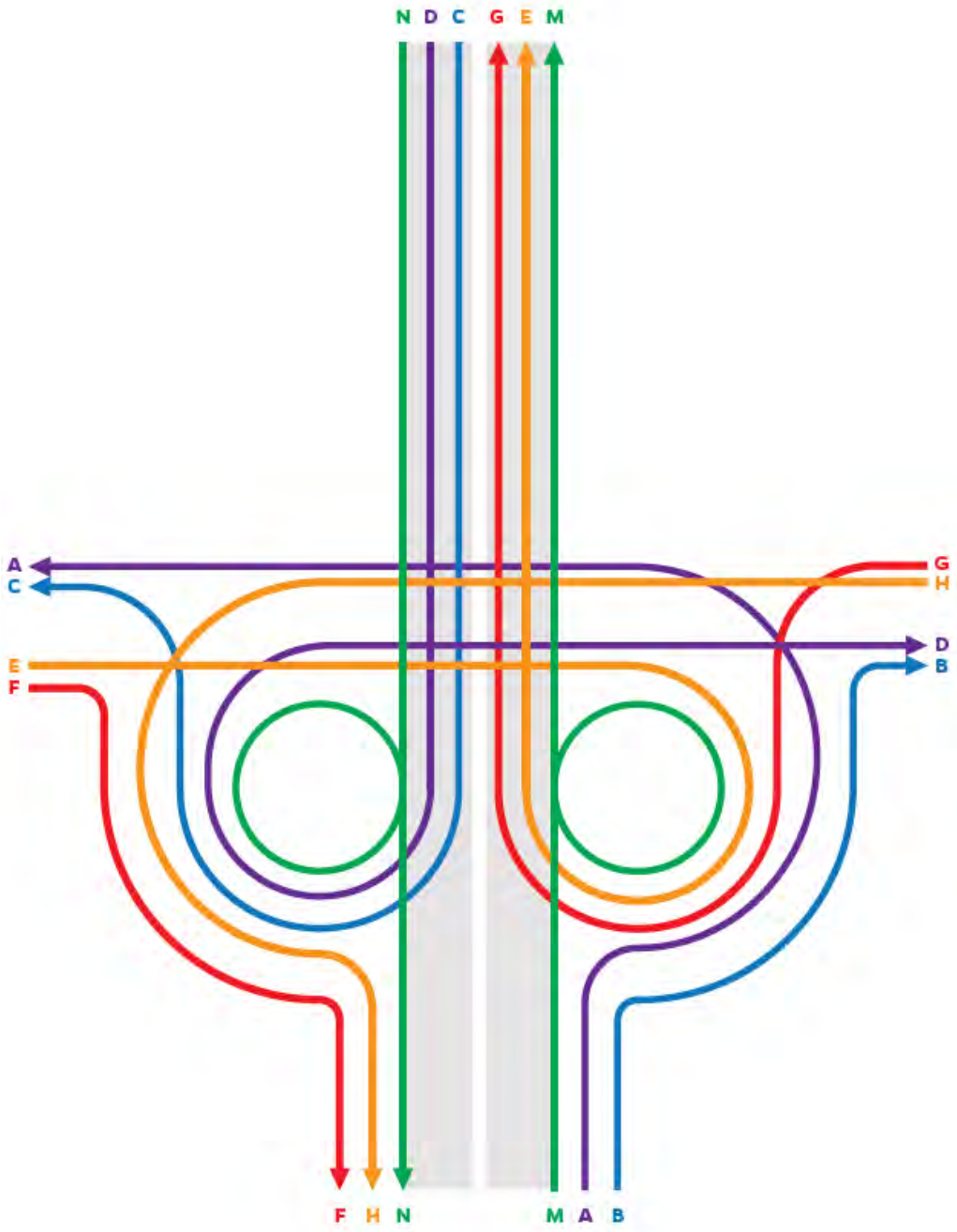
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	72	58.2	0.0	58.2	No	No	D
B	589	41.7	0.0	41.7	No	No	C
C	178	65.3	5.0	70.3	No	No	D
D	678	8.4	5.0	13.4	No	No	A
E	182	47.6	5.0	52.6	No	No	C
F	78	22.9	0.0	22.9	No	No	B
G	144	64.2	5.0	69.2	No	No	D
H	589	40.9	0.0	40.9	No	No	C
I	867	44.4	0.0	44.4	No	No	C
J	789	9.9	0.0	9.9	No	No	A
K	-	-	0.0	-	-	-	-
L	-	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh		22.9	15.1	32.5	1.6		65.3		0.0			
Level of Service (LOS)		C	B	C	A		E		A			
Approach Delay, s/veh / LOS	22.4		C	14.2		B	13.6		B	0.0		
Intersection Delay, s/veh / LOS	17.0						B					

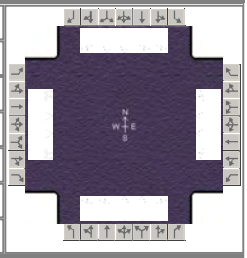
Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh		21.5	24.8	64.2	8.4			56.6	41.7			
Level of Service (LOS)		C	C	E	A			E	D			
Approach Delay, s/veh / LOS	22.6		C	13.6		B	48.0		D	0.0		
Intersection Delay, s/veh / LOS	23.4						C					

Interchange Graphic



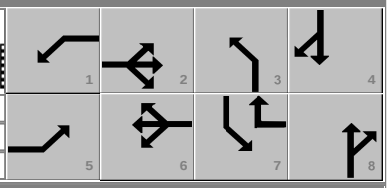
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	26th Street	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Southeastern Ave	File Name	24-25-26 26th Street 2035 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	110	650	180	55	1200	370	585	920	55	65	180	55

Signal Information					EB			WB			NB		
Cycle, s	90.0	Reference Phase	2										
Offset, s	6	Reference Point	End	Green	3.1	1.0		34.3	3.3		12.2	9.9	
Uncoordinated	No	Simult. Gap E/W	On	Yellow	3.9	0.0		3.9	3.9		3.9	3.9	
Force Mode	Fixed	Simult. Gap N/S	On	Red	1.0	0.0		1.8	1.0		1.0	1.8	



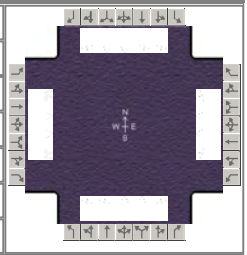
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6	3	8	7	4
Case Number	1.1	3.0	1.1	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	9.0	41.0	8.0	40.0	25.4	32.8	8.2	15.6
Change Period, ($Y+R_c$), s	4.9	5.7	4.9	5.7	4.9	5.7	4.9	5.7
Max Allow Headway (*MAH*), s	4.2	0.0	4.2	0.0	4.2	4.1	4.2	4.1
Queue Clearance Time (g_s), s	6.0		3.9		18.6	28.3	3.9	6.9
Green Extension Time (g_e), s	0.0	0.0	0.0	0.0	1.9	0.0	0.0	1.8
Phase Call Probability	0.95		0.78		1.00	1.00	0.84	1.00
Max Out Probability	1.00		1.00		0.34	1.00	1.00	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	122	722	200	61	1333	244	650	1022	39	72	200	39
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1734		1734	1734	1543	1684	1734	1568	1684	1734	1568
Queue Service Time (g_s), s	4.0	11.8		1.9	34.3	9.9	16.6	26.3	1.6	1.9	4.9	2.0
Cycle Queue Clearance Time (g_c), s	4.0	11.8		1.9	34.3	9.9	16.6	26.3	1.6	1.9	4.9	2.0
Green Ratio (*g/C*)	0.43	0.39		0.42	0.38	0.42	0.23	0.30	0.30	0.04	0.11	0.11
Capacity (*c*), veh/h	159	1359		315	1321	645	767	1042	471	125	382	173
Volume-to-Capacity Ratio (*X*)	0.767	0.532		0.194	1.009	0.379	0.848	0.981	0.083	0.577	0.524	0.225
Back of Queue (*Q*), ft/ln (95 th percentile)	104.2	183.8		35	650.6	168.3	295.6	509.4	26.6	39	97	36.1
Back of Queue (*Q*), veh/ln (95 th percentile)	4.1	7.2		1.4	25.6	6.6	11.6	20.1	1.1	1.5	3.8	1.4
Queue Storage Ratio (*RQ*) (95 th percentile)	0.23	0.00		0.14	0.00	0.67	0.70	0.00	0.11	0.10	0.00	0.18
Uniform Delay (d_1), s/veh	21.8	14.6		16.9	27.9	18.1	33.3	31.2	22.6	42.6	37.8	36.5
Incremental Delay (d_2), s/veh	18.7	1.4		0.3	27.0	1.7	5.7	23.2	0.1	4.2	1.3	0.7
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	40.5	16.0	0.0	17.2	54.9	19.8	39.0	54.4	22.6	46.8	39.1	37.2
Level of Service (LOS)	D	B	A	B	F	B	D	D	C	D	D	D
Approach Delay, s/veh / LOS	15.8	B		48.2	D		47.8	D		40.7	D	
Intersection Delay, s/veh / LOS	40.4						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.59	C	2.59	C	2.65	C	2.45	B
Bicycle LOS Score / LOS	1.35	A	1.84	B	1.90	B	0.74	A

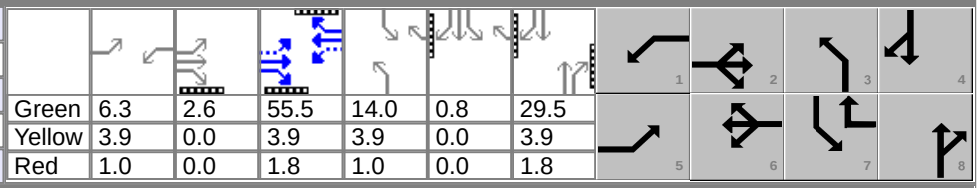
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	26th Street	Analysis Year	2035	Analysis Period	1> 4:30
Intersection	Southeastern Ave	File Name	24-25-26 26th Street 2035 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	150	1520	685	95	1000	175	270	335	100	290	715	100

Signal Information			
Cycle, s	130.0	Reference Phase	2
Offset, s	58	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	6.3	2.6	55.5	14.0	0.8	29.5
Yellow	3.9	0.0	3.9	3.9	0.0	3.9
Red	1.0	0.0	1.8	1.0	0.0	1.8

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6	3	8	7	4
Case Number	1.1	3.0	1.1	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	13.8	63.8	11.2	61.2	18.9	35.2	19.8	36.1
Change Period, ($Y+R_c$), s	4.9	5.7	4.9	5.7	4.9	5.7	4.9	5.7
Max Allow Headway (*MAH*), s	4.2	0.0	4.2	0.0	4.2	4.1	4.2	4.1
Queue Clearance Time (g_s), s	8.5		6.4		13.3	14.1	14.2	31.6
Green Extension Time (g_e), s	0.4	0.0	0.0	0.0	0.7	5.5	0.7	0.0
Phase Call Probability	1.00		0.98		1.00	1.00	1.00	1.00
Max Out Probability	0.00		1.00		0.22	0.19	0.37	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	157	1592	718	106	1111	139	300	372	83	322	794	78
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1734		1734	1734	1543	1684	1734	1568	1684	1734	1568
Queue Service Time (g_s), s	6.5	58.1		4.4	35.1	5.9	11.3	12.1	5.6	12.2	29.6	5.2
Cycle Queue Clearance Time (g_c), s	6.5	58.1		4.4	35.1	5.9	11.3	12.1	5.6	12.2	29.6	5.2
Green Ratio (*g/C*)	0.50	0.45		0.48	0.43	0.54	0.11	0.23	0.23	0.11	0.23	0.23
Capacity (*c*), veh/h	254	1550		139	1480	835	363	788	356	385	810	366
Volume-to-Capacity Ratio (*X*)	0.619	1.027		0.757	0.751	0.166	0.825	0.473	0.234	0.837	0.981	0.212
Back of Queue (*Q*), ft/ln (95 th percentile)	129.2	947.5		114.9	551	99.8	226.8	229.3	100.4	242.3	566.7	92.5
Back of Queue (*Q*), veh/ln (95 th percentile)	5.1	37.3		4.5	21.7	3.9	8.9	9.0	4.0	9.5	22.3	3.7
Queue Storage Ratio (*RQ*) (95 th percentile)	0.29	0.00		0.46	0.00	0.40	0.53	0.00	0.40	0.65	0.00	0.46
Uniform Delay (d_1), s/veh	25.6	31.8		30.9	31.4	15.0	56.8	43.5	41.0	56.4	49.5	40.2
Incremental Delay (d_2), s/veh	1.9	27.7		18.4	3.5	0.4	7.2	0.4	0.3	8.6	26.8	0.3
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	27.5	59.5	0.0	49.3	35.0	15.5	64.0	43.9	41.3	65.0	76.3	40.5
Level of Service (LOS)	C	F	A	D	C	B	E	D	D	E	E	D
Approach Delay, s/veh / LOS	40.1	D		34.1	C		51.6	D		70.9	E	
Intersection Delay, s/veh / LOS	46.6						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.61	C	2.62	C	2.53	C	2.46	B
Bicycle LOS Score / LOS	2.65	C	1.61	B	1.11	A	1.47	A

HCS7 Two-Way Stop-Control Report

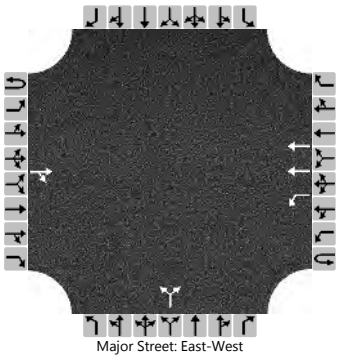
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/23/19
Analysis Year	2035
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	26th St at Yeager Rd
Jurisdiction	Sioux Falls, SD
East/West Street	26th Street
North/South Street	Yeager Road
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	1	2	0		0	1	0		0	0	0
Configuration				TR		L	T				LR					
Volume (veh/h)			375	5		155	975			25		45				
Percent Heavy Vehicles (%)						2				2		2				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.5		6.9				
Critical Headway (sec)						4.14				6.84		6.94				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.22				3.52		3.32				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						172					78					
Capacity, c (veh/h)						1133					258					
v/c Ratio						0.15					0.30					
95% Queue Length, Q_{95} (veh)						0.5					1.2					
Control Delay (s/veh)						8.7					24.9					
Level of Service (LOS)						A					C					
Approach Delay (s/veh)					1.2				24.9							
Approach LOS					C											

HCS7 Two-Way Stop-Control Report

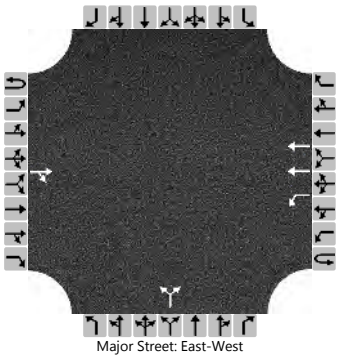
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/23/19
Analysis Year	2035
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	26th St at Yeager Rd
Jurisdiction	Sioux Falls, SD
East/West Street	26th Street
North/South Street	Yeager Road
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	1	2	0		0	1	0		0	0	0
Configuration				TR		L	T				LR					
Volume (veh/h)			1035	10		210	725			25		135				
Percent Heavy Vehicles (%)						2				2		2				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

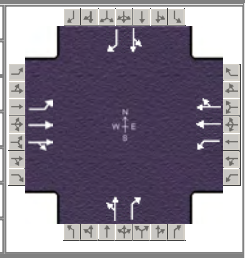
Base Critical Headway (sec)						4.1				7.5		6.9				
Critical Headway (sec)						4.14				6.84		6.94				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.22				3.52		3.32				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						233					178					
Capacity, c (veh/h)						597					105					
v/c Ratio						0.39					1.70					
95% Queue Length, Q_{95} (veh)						1.8					13.9					
Control Delay (s/veh)						14.8					422.5					
Level of Service (LOS)						B					F					
Approach Delay (s/veh)					3.3				422.5							
Approach LOS									F							

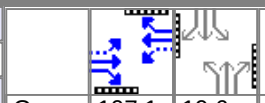
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	41st Street	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Norton Ave	File Name	28 41st at Norton 2035 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	20	520	30	10	310	10	15	10	5	10	10	10

Signal Information			
Cycle, s	150.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



							1	2	3	4
Green	107.1	19.6	7.5	0.0	0.0	0.0	5	6	7	8
Yellow	3.6	3.6	3.6	0.0	0.0	0.0				
Red	1.4	1.8	1.8	0.0	0.0	0.0				

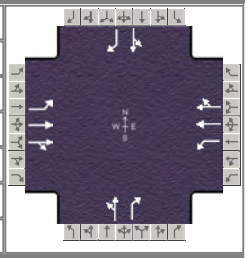
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		6.0		6.0		11.0		11.0
Phase Duration, s		112.1		112.1		12.9		25.0
Change Period, ($Y+R_c$), s		5.0		5.0		5.4		5.4
Max Allow Headway (*MAH*), s		0.0		0.0		5.2		5.2
Queue Clearance Time (g_s), s						4.3		3.7
Green Extension Time (g_e), s		0.0		0.0		0.1		0.1
Phase Call Probability						0.75		1.00
Max Out Probability						0.00		0.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	22	308	303	11	178	177		28	6		22	11
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1026	1821	1786	810	1821	1801		1768	1543		1777	1543
Queue Service Time (g_s), s	1.1	8.7	8.8	0.7	4.7	4.7		2.3	0.5		1.7	0.9
Cycle Queue Clearance Time (g_c), s	5.7	8.7	8.8	9.5	4.7	4.7		2.3	0.5		1.7	0.9
Green Ratio (*g/C*)	0.71	0.71	0.71	0.71	0.71	0.71		0.05	0.05		0.13	0.13
Capacity (*c*), veh/h	748	1300	1275	579	1300	1286		88	77		232	202
Volume-to-Capacity Ratio (*X*)	0.030	0.237	0.238	0.019	0.137	0.138		0.314	0.072		0.096	0.055
Back of Queue (*Q*), ft/ln (95 th percentile)	11.4	160.5	157.9	6.3	85.4	84.9		50.5	9.9		35.1	17.5
Back of Queue (*Q*), veh/ln (95 th percentile)	0.4	6.3	6.2	0.2	3.4	3.3		2.0	0.4		1.4	0.7
Queue Storage Ratio (*RQ*) (95 th percentile)	0.11	0.00	0.00	0.06	0.00	0.00		0.00	0.13		0.00	0.23
Uniform Delay (d_1), s/veh	7.7	7.4	7.4	9.0	6.8	6.8		68.8	67.9		57.4	57.1
Incremental Delay (d_2), s/veh	0.1	0.4	0.4	0.1	0.2	0.2		2.8	0.6		0.3	0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Control Delay (*d*), s/veh	7.8	7.8	7.8	9.1	7.0	7.0		71.6	68.5		57.7	57.3
Level of Service (LOS)	A	A	A	A	A	A		E	E		E	E
Approach Delay, s/veh / LOS	7.8	A		7.1	A		71.1	E		57.5	E	
Intersection Delay, s/veh / LOS	11.1						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.87	B	1.87	B	2.33	B	2.33	B
Bicycle LOS Score / LOS	1.01	A	0.79	A	0.54	A	0.54	A

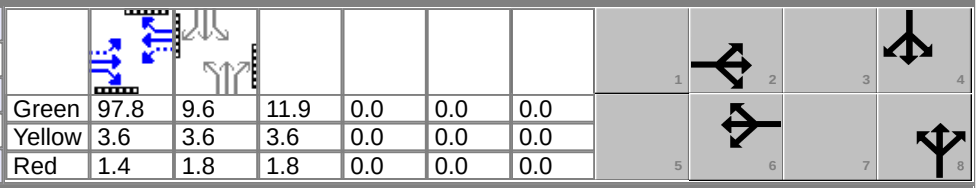
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	41st Street	Analysis Year	2035	Analysis Period	1> 16:30
Intersection	Norton Ave	File Name	28 41st at Norton 2035 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	35	925	65	25	825	30	80	30	40	20	25	40

Signal Information			
Cycle, s	135.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	97.8	9.6	11.9	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.4	1.8	1.8	0.0	0.0	0.0

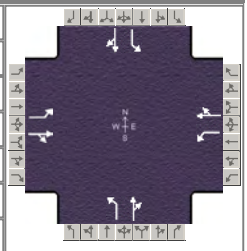
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		6.0		6.0		11.0		11.0
Phase Duration, s		102.8		102.8		17.3		15.0
Change Period, ($Y+R_c$), s		5.0		5.0		5.4		5.4
Max Allow Headway (*MAH*), s		0.0		0.0		5.2		5.3
Queue Clearance Time (g_s), s						11.2		5.6
Green Extension Time (g_e), s		0.0		0.0		0.7		0.3
Phase Call Probability						1.00		0.96
Max Out Probability						0.00		0.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	39	556	544	28	478	472		122	33		50	33
Adjusted Saturation Flow Rate (*s*), veh/h/ln	590	1821	1779	513	1821	1798		1757	1543		1782	1543
Queue Service Time (g_s), s	3.6	16.4	16.4	3.1	13.3	13.3		9.2	2.7		3.6	2.8
Cycle Queue Clearance Time (g_c), s	16.8	16.4	16.4	19.5	13.3	13.3		9.2	2.7		3.6	2.8
Green Ratio (*g/C*)	0.72	0.72	0.72	0.72	0.72	0.72		0.09	0.09		0.07	0.07
Capacity (*c*), veh/h	423	1319	1288	362	1319	1302		155	136		126	109
Volume-to-Capacity Ratio (*X*)	0.092	0.422	0.422	0.077	0.362	0.362		0.791	0.246		0.396	0.305
Back of Queue (*Q*), ft/ln (95 th percentile)	23.5	266.1	261.5	18	224.2	222.1		207.3	51		79.8	52.9
Back of Queue (*Q*), veh/ln (95 th percentile)	0.9	10.5	10.3	0.7	8.8	8.7		8.2	2.0		3.1	2.1
Queue Storage Ratio (*RQ*) (95 th percentile)	0.23	0.00	0.00	0.18	0.00	0.00		0.00	0.68		0.00	0.70
Uniform Delay (d_1), s/veh	10.1	7.4	7.4	11.3	7.0	7.0		60.3	57.4		60.0	59.6
Incremental Delay (d_2), s/veh	0.4	1.0	1.0	0.4	0.8	0.8		12.0	1.3		2.9	2.2
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Control Delay (*d*), s/veh	10.5	8.4	8.4	11.7	7.7	7.7		72.4	58.7		62.8	61.8
Level of Service (LOS)	B	A	A	B	A	A		E	E		E	E
Approach Delay, s/veh / LOS	8.5	A		7.9	A		69.4	E		62.4	E	
Intersection Delay, s/veh / LOS	14.1						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.88	B	1.88	B	2.33	B	2.32	B
Bicycle LOS Score / LOS	1.43	A	1.29	A	0.74	A	0.63	A

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	41st Street	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Phillips Ave	File Name	29 41st at Phillips 2035 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	140	260	10	30	255	155	10	130	55	135	20	165

Signal Information			
Cycle, s	80.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4
Green	5.0	41.1	20.1	0.0	0.0	0.0	5	6	7	8
Yellow	4.0	3.6	3.6	0.0	0.0	0.0				
Red	0.0	1.3	1.3	0.0	0.0	0.0				

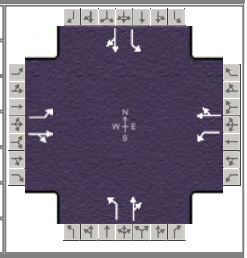
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		4
Case Number	1.0	4.0		6.3		6.0		6.0
Phase Duration, s	9.0	55.0		46.0		25.0		25.0
Change Period, ($Y+R_c$), s	4.0	4.9		4.9		4.9		4.9
Max Allow Headway (*MAH*), s	4.2	0.0		0.0		5.4		5.4
Queue Clearance Time (g_s), s	5.1					10.1		20.0
Green Extension Time (g_e), s	0.0	0.0		0.0		2.4		0.0
Phase Call Probability	0.97					1.00		1.00
Max Out Probability	1.00					0.34		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	156	300		33	456		11	206		150	172	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1809		1079	1705		1213	1729		1176	1574	
Queue Service Time (g_s), s	3.1	5.9		1.2	14.2		0.6	8.1		9.9	7.4	
Cycle Queue Clearance Time (g_c), s	3.1	5.9		1.2	14.2		8.0	8.1		18.0	7.4	
Green Ratio (*g/C*)	0.60	0.63		0.51	0.51		0.25	0.25		0.25	0.25	
Capacity (*c*), veh/h	514	1134		645	877		282	433		266	395	
Volume-to-Capacity Ratio (*X*)	0.303	0.265		0.052	0.520		0.039	0.474		0.564	0.436	
Back of Queue (*Q*), ft/ln (95 th percentile)	48.2	97		13.7	235.5		8.4	153		137.4	127	
Back of Queue (*Q*), veh/ln (95 th percentile)	1.9	3.8		0.5	9.3		0.3	6.0		5.4	5.0	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.37	0.00		0.23	0.00		0.14	0.00		1.25	0.00	
Uniform Delay (d_1), s/veh	8.9	6.7		9.7	12.9		28.6	25.5		33.2	25.2	
Incremental Delay (d_2), s/veh	0.3	0.6		0.2	2.2		0.1	1.1		3.4	1.1	
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh	9.3	7.2		9.9	15.1		28.7	26.6		36.6	26.3	
Level of Service (LOS)	A	A		A	B		C	C		D	C	
Approach Delay, s/veh / LOS	7.9	A		14.7	B		26.7	C		31.1	C	
Intersection Delay, s/veh / LOS	17.9						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.87	B	1.93	B	1.92	B	1.92	B
Bicycle LOS Score / LOS	1.24	A	1.29	A	0.85	A	1.02	A

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	41st Street	Analysis Year	2035	Analysis Period	1> 16:30
Intersection	Phillips Ave	File Name	29 41st at Phillips 2035 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	120	270	5	20	315	140	30	55	70	130	25	240

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4
Green	4.9	50.1	21.2	0.0	0.0	0.0	5	6	7	8
Yellow	4.0	3.6	3.6	0.0	0.0	0.0				
Red	0.0	1.3	1.3	0.0	0.0	0.0				

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		4
Case Number	1.0	4.0		6.3		6.0		6.0
Phase Duration, s	8.9	63.9		55.0		26.1		26.1
Change Period, ($Y+R_c$), s	4.0	4.9		4.9		4.9		4.9
Max Allow Headway (*MAH*), s	4.2	0.0		0.0		5.4		5.4
Queue Clearance Time (g_s), s	4.8					16.7		18.0
Green Extension Time (g_e), s	0.3	0.0		0.0		3.3		3.2
Phase Call Probability	0.96					1.00		1.00
Max Out Probability	0.00					0.06		0.07

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	133	306		22	506		33	139		144	239	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1815		1074	1726		1141	1654		1250	1571	
Queue Service Time (g_s), s	2.8	6.3		0.8	16.6		2.4	6.3		9.8	12.3	
Cycle Queue Clearance Time (g_c), s	2.8	6.3		0.9	16.6		14.7	6.3		16.0	12.3	
Green Ratio (*g/C*)	0.63	0.66		0.56	0.56		0.24	0.24		0.24	0.24	
Capacity (*c*), veh/h	506	1189		676	959		195	391		289	371	
Volume-to-Capacity Ratio (*X*)	0.264	0.257		0.033	0.527		0.171	0.355		0.500	0.644	
Back of Queue (*Q*), ft/ln (95 th percentile)	42.9	104.1		9.3	268.7		32.2	116.2		140.9	214.5	
Back of Queue (*Q*), veh/ln (95 th percentile)	1.7	4.1		0.4	10.6		1.3	4.6		5.5	8.4	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.33	0.00		0.16	0.00		0.54	0.00		1.28	0.00	
Uniform Delay (d_1), s/veh	8.9	6.4		9.1	12.6		37.5	28.7		35.3	31.0	
Incremental Delay (d_2), s/veh	0.3	0.5		0.1	2.1		0.6	0.8		1.9	2.7	
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh	9.1	7.0		9.2	14.6		38.1	29.4		37.2	33.6	
Level of Service (LOS)	A	A		A	B		D	C		D	C	
Approach Delay, s/veh / LOS	7.6	A		14.4	B		31.1	C		35.0	C	
Intersection Delay, s/veh / LOS	19.5						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.86	B	1.96	B	1.93	B	1.93	B
Bicycle LOS Score / LOS	1.21	A	1.36	A	0.77	A	1.12	A

Appendix F

HCS Analysis Summary – Forecast 2035 Build Conditions

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - west of Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3230	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1269
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.55
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	20.5
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - west of Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2545	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	980
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.42
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	15.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - between Western Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2725	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1606
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.69
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.7
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	26.0
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - between Western Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2190	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1264
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.55
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	20.5
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - between Western and Minnesota		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3185	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1251
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.54
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	20.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - between Western and Minnesota		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3045	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1172
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.51
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.0
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - Western to Minnesota		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2860	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2347	368	92	378
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	6.00	6.00	6.00	6.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.943	0.943	0.943	0.943
Flow Rate (v_i), pc/h	2765	434	108	445
Weaving Flow Rate (v_w), pc/h	879	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2873	Density-Based Capacity (c_{IWL}), pc/h/ln		2195
Total Flow Rate (v), pc/h	3752	Demand Flow-Based Capacity (c_{IW}), pc/h		10256
Volume Ratio (VR)	0.234	Weaving Segment Capacity (c_W), veh/h		6210
Minimum Lane Change Rate (LC_{MIN}), lc/h	879	Adjusted Weaving Area Capacity, pc/h		6585
Maximum Weaving Length (L_{MAX}), ft	4887	Volume-to-Capacity Ratio (v/c)		0.57

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	822	Average Weaving Speed (S_W),mi/h	56.0
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1564	Average Non-Weaving Speed (S_{NW}), mi/h	52.7
Weaving Lane Change Rate (LC_W), lc/h	1188	Average Speed (S), mi/h	53.4
Weaving Lane Change Rate (LC_{All}), lc/h	2752	Density (D), pc/mi/ln	23.4
Weaving Intensity Factor (W)	0.219	Level of Service (LOS)	C

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - Western to Minnesota		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2860	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1889	701	154	301
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	4.00	4.00	4.00	4.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.962	0.962	0.962	0.962
Flow Rate (v_i), pc/h	2182	810	178	348
Weaving Flow Rate (v_w), pc/h	1158	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2360	Density-Based Capacity (c_{IWL}), pc/h/ln		2118
Total Flow Rate (v), pc/h	3518	Demand Flow-Based Capacity (c_{IW}), pc/h		7295
Volume Ratio (VR)	0.329	Weaving Segment Capacity (c_W), veh/h		6113
Minimum Lane Change Rate (LC_{MIN}), lc/h	1158	Adjusted Weaving Area Capacity, pc/h		6354
Maximum Weaving Length (L_{MAX}), ft	5897	Volume-to-Capacity Ratio (v/c)		0.55

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	675	Average Weaving Speed (S_W),mi/h	55.7
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1458	Average Non-Weaving Speed (S_{NW}), mi/h	51.0
Weaving Lane Change Rate (LC_W), lc/h	1467	Average Speed (S), mi/h	52.5
Weaving Lane Change Rate (LC_{All}), lc/h	2925	Density (D), pc/mi/ln	22.3
Weaving Intensity Factor (W)	0.230	Level of Service (LOS)	C

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - between Minnesota Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2715	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1600
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.69
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.7
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	25.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - between Minnesota Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2590	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1496
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.65
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	24.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - between Minnesota and Cliff		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3070	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1206
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.52
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.5
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - between Minnesota and Cliff		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3260	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1255
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.54
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	20.3
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - Minnesota to Cliff		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	3120	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1981	284	71	734
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	6.00	6.00	6.00	6.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.943	0.943	0.943	0.943
Flow Rate (v_i), pc/h	2334	335	84	865
Weaving Flow Rate (v_w), pc/h	1200	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2418	Density-Based Capacity (c_{IWL}), pc/h/ln		2135
Total Flow Rate (v), pc/h	3618	Demand Flow-Based Capacity (c_{IW}), pc/h		7229
Volume Ratio (VR)	0.332	Weaving Segment Capacity (c_W), veh/h		6040
Minimum Lane Change Rate (LC_{MIN}), lc/h	1200	Adjusted Weaving Area Capacity, pc/h		6405
Maximum Weaving Length (L_{MAX}), ft	5930	Volume-to-Capacity Ratio (v/c)		0.56

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	754	Average Weaving Speed (S_W),mi/h	55.7
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1611	Average Non-Weaving Speed (S_{NW}), mi/h	50.6
Weaving Lane Change Rate (LC_W), lc/h	1525	Average Speed (S), mi/h	52.2
Weaving Lane Change Rate (LC_{All}), lc/h	3136	Density (D), pc/mi/ln	23.1
Weaving Intensity Factor (W)	0.227	Level of Service (LOS)	C

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - Minnesota to Cliff		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	3120	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1921	549	121	669
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	4.00	4.00	4.00	4.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.962	0.962	0.962	0.962
Flow Rate (v_i), pc/h	2219	634	140	773
Weaving Flow Rate (v_w), pc/h	1407	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2359	Density-Based Capacity (c_{IWL}), pc/h/ln		2100
Total Flow Rate (v), pc/h	3766	Demand Flow-Based Capacity (c_{IW}), pc/h		6417
Volume Ratio (VR)	0.374	Weaving Segment Capacity (c_W), veh/h		6061
Minimum Lane Change Rate (LC_{MIN}), lc/h	1407	Adjusted Weaving Area Capacity, pc/h		6300
Maximum Weaving Length (L_{MAX}), ft	6391	Volume-to-Capacity Ratio (v/c)		0.60

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	736	Average Weaving Speed (S_W),mi/h	55.4
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1599	Average Non-Weaving Speed (S_{NW}), mi/h	48.8
Weaving Lane Change Rate (LC_W), lc/h	1732	Average Speed (S), mi/h	51.1
Weaving Lane Change Rate (LC_{All}), lc/h	3331	Density (D), pc/mi/ln	24.6
Weaving Intensity Factor (W)	0.238	Level of Service (LOS)	C

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - between Cliff Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2265	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1334
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.58
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	21.6
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - between Cliff Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2470	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1426
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.62
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	23.1
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - between Cliff and 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2835	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1113
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.48
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	18.0
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - between Cliff and 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2830	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1090
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.47
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	17.6
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - Cliff to 26th		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2750	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1718	507	63	547
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	6.00	6.00	6.00	6.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.943	0.943	0.943	0.943
Flow Rate (v_i), pc/h	2024	597	74	645
Weaving Flow Rate (v_w), pc/h	1242	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2098	Density-Based Capacity (c_{IWL}), pc/h/ln		2073
Total Flow Rate (v), pc/h	3340	Demand Flow-Based Capacity (c_{IW}), pc/h		6452
Volume Ratio (VR)	0.372	Weaving Segment Capacity (c_W), veh/h		5865
Minimum Lane Change Rate (LC_{MIN}), lc/h	1242	Adjusted Weaving Area Capacity, pc/h		6220
Maximum Weaving Length (L_{MAX}), ft	6369	Volume-to-Capacity Ratio (v/c)		0.54

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	577	Average Weaving Speed (S_W),mi/h	55.5
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1345	Average Non-Weaving Speed (S_{NW}), mi/h	50.7
Weaving Lane Change Rate (LC_W), lc/h	1544	Average Speed (S), mi/h	52.4
Weaving Lane Change Rate (LC_{All}), lc/h	2889	Density (D), pc/mi/ln	21.2
Weaving Intensity Factor (W)	0.235	Level of Service (LOS)	C

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - Cliff to 26th		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2750	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1672	263	97	798
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	4.00	4.00	4.00	4.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.962	0.962	0.962	0.962
Flow Rate (v_i), pc/h	1931	304	112	922
Weaving Flow Rate (v_w), pc/h	1226	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2043	Density-Based Capacity (c_{IWL}), pc/h/ln		2071
Total Flow Rate (v), pc/h	3269	Demand Flow-Based Capacity (c_{IW}), pc/h		6400
Volume Ratio (VR)	0.375	Weaving Segment Capacity (c_W), veh/h		5977
Minimum Lane Change Rate (LC_{MIN}), lc/h	1226	Adjusted Weaving Area Capacity, pc/h		6213
Maximum Weaving Length (L_{MAX}), ft	6402	Volume-to-Capacity Ratio (v/c)		0.53

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	562	Average Weaving Speed (S_W),mi/h	55.6
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1334	Average Non-Weaving Speed (S_{NW}), mi/h	50.9
Weaving Lane Change Rate (LC_W), lc/h	1528	Average Speed (S), mi/h	52.6
Weaving Lane Change Rate (LC_{All}), lc/h	2862	Density (D), pc/mi/ln	20.7
Weaving Intensity Factor (W)	0.233	Level of Service (LOS)	C

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - between 26th Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2225	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1311
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.57
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	21.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - between 26th Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	1935	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1118
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.48
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	18.1
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - north of 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2690	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1057
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.46
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	17.1
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - north of 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2245	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	864
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.37
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	14.0
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - north of 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3010	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1171
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.51
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	18.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - north of 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3710	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1415
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.61
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	22.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - between 26th Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2610	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1523
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.66
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	24.6
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - between 26th Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2940	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1682
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.73
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.4
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	27.4
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - between 26th and Cliff		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3345	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1301
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.56
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	21.1
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - between 26th and Cliff		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3545	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1352
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.58
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	21.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - 26th to Cliff		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2670	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	0
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2160	625	110	450
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	5.00	5.00	5.00	5.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.952	0.952	0.952	0.952
Flow Rate (v_i), pc/h	2521	729	128	525
Weaving Flow Rate (v_w), pc/h	1254	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2649	Density-Based Capacity (c_{IWL}), pc/h/ln		2110
Total Flow Rate (v), pc/h	3903	Demand Flow-Based Capacity (c_{IW}), pc/h		7477
Volume Ratio (VR)	0.321	Weaving Segment Capacity (c_W), veh/h		6026
Minimum Lane Change Rate (LC_{MIN}), lc/h	525	Adjusted Weaving Area Capacity, pc/h		6330
Maximum Weaving Length (L_{MAX}), ft	5810	Volume-to-Capacity Ratio (v/c)		0.62

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	707	Average Weaving Speed (S_W),mi/h	56.8
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1415	Average Non-Weaving Speed (S_{NW}), mi/h	55.0
Weaving Lane Change Rate (LC_W), lc/h	823	Average Speed (S), mi/h	55.6
Weaving Lane Change Rate (LC_{All}), lc/h	2238	Density (D), pc/mi/ln	23.4
Weaving Intensity Factor (W)	0.197	Level of Service (LOS)	C

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - 26th to Cliff		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2670	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	0
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2335	490	115	605
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	3.00	3.00	3.00	3.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.971	0.971	0.971	0.971
Flow Rate (v_i), pc/h	2672	561	132	692
Weaving Flow Rate (v_w), pc/h	1253	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2804	Density-Based Capacity (c_{IWL}), pc/h/ln		2120
Total Flow Rate (v), pc/h	4057	Demand Flow-Based Capacity (c_{IW}), pc/h		7767
Volume Ratio (VR)	0.309	Weaving Segment Capacity (c_W), veh/h		6176
Minimum Lane Change Rate (LC_{MIN}), lc/h	692	Adjusted Weaving Area Capacity, pc/h		6360
Maximum Weaving Length (L_{MAX}), ft	5681	Volume-to-Capacity Ratio (v/c)		0.64

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	749	Average Weaving Speed (S_W),mi/h	56.3
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1447	Average Non-Weaving Speed (S_{NW}), mi/h	53.5
Weaving Lane Change Rate (LC_W), lc/h	990	Average Speed (S), mi/h	54.3
Weaving Lane Change Rate (LC_{All}), lc/h	2437	Density (D), pc/mi/ln	24.9
Weaving Intensity Factor (W)	0.210	Level of Service (LOS)	C

HCS7 Freeway Diverge Report

Project Information			
Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - Exit 4		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	3345	560
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	5.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.952
Flow Rate (vi),pc/h	3904	654
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.55	0.31

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.357
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1196
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influenece Area Speed (SR), mi/h	56.8
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.632	Outer Lanes Freeway Speed (SO), mi/h	70.5
Flow in Lanes 1 and 2 (v12), pc/h	2708	Ramp Junction Speed (S), mi/h	60.4
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	21.5
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	23.0

HCS7 Freeway Diverge Report

Project Information			
Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - Exit 4		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	3545	720
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	4057	824
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.58	0.39

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.372
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1225
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influenece Area Speed (SR), mi/h	56.4
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.621	Outer Lanes Freeway Speed (SO), mi/h	70.4
Flow in Lanes 1 and 2 (v12), pc/h	2832	Ramp Junction Speed (S), mi/h	60.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	22.5
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	24.1

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - between Cliff Ramps		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2785	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1083
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.47
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	17.5
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - between Cliff Ramps		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2825	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1078
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.46
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	17.4
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - Exit 4 Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	2785	685
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	5.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.952
Flow Rate (vi),pc/h	3250	799
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.57	0.38

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.276
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1264
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	58.7
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	62.2
Flow in Lanes 1 and 2 (v12), pc/h	1986	Ramp Junction Speed (S), mi/h	59.7
Flow Entering Ramp-Infl. Area (vR12), pc/h	2785	Average Density (D), pc/mi/ln	22.6
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	19.4

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - Exit 4 Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	2825	755
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3233	864
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.58	0.41

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.280
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1258
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	58.6
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	62.3
Flow in Lanes 1 and 2 (v12), pc/h	1975	Ramp Junction Speed (S), mi/h	59.7
Flow Entering Ramp-Infl. Area (vR12), pc/h	2839	Average Density (D), pc/mi/ln	22.9
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	19.8

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD Cliff Alt 1- SB I-229 - Exit 4 NB Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	2785	440
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	5.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.952
Flow Rate (vi),pc/h	3250	514
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.53	0.24

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.261
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1264
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	59.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	62.2
Flow in Lanes 1 and 2 (v12), pc/h	1986	Ramp Junction Speed (S), mi/h	60.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	2500	Average Density (D), pc/mi/ln	20.9
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	17.3

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD Cliff Alt 1- SB I-229 - Exit 4 NB Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	2825	170
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3233	195
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.49	0.09

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.247
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1258
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	59.3
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	62.3
Flow in Lanes 1 and 2 (v12), pc/h	1975	Ramp Junction Speed (S), mi/h	60.4
Flow Entering Ramp-Infl. Area (vR12), pc/h	2170	Average Density (D), pc/mi/ln	18.9
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	14.9

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD Cliff Alt1- SB I-229 - between Cliff Entrance Ramps		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3225	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1255
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.54
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	20.3
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD Cliff Alt1- SB I-229 - between Cliff Entrance Ramps		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2995	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1142
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.49
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	18.5
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD Cliff Alt 1- SB I-229 - Exit 4 SB Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	3225	245
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	5.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.952
Flow Rate (vi),pc/h	3764	286
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.57	0.14

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.265
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1464
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	58.9
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	61.5
Flow in Lanes 1 and 2 (v12), pc/h	2300	Ramp Junction Speed (S), mi/h	59.8
Flow Entering Ramp-Infl. Area (vR12), pc/h	2586	Average Density (D), pc/mi/ln	22.6
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	18.1

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD Cliff Alt 1- SB I-229 - Exit 4 SB Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	2995	585
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3427	669
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.58	0.32

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.275
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1333
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	58.7
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	62.0
Flow in Lanes 1 and 2 (v12), pc/h	2094	Ramp Junction Speed (S), mi/h	59.7
Flow Entering Ramp-Infl. Area (vR12), pc/h	2763	Average Density (D), pc/mi/ln	22.9
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	19.3

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - between Cliff and Minnesota		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3470	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1350
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.58
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	21.8
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - between Cliff and Minnesota		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3580	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1366
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.59
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	22.1
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Diverge Report

Project Information			
Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - Exit 3		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	3470	385
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	5.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.952
Flow Rate (vi),pc/h	4050	449
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.57	0.21

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.338
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1304
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influenece Area Speed (SR), mi/h	57.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.638	Outer Lanes Freeway Speed (SO), mi/h	70.1
Flow in Lanes 1 and 2 (v12), pc/h	2746	Ramp Junction Speed (S), mi/h	60.8
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	22.2
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	23.4

HCS7 Freeway Diverge Report

Project Information			
Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - Exit 3		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	3580	490
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	4097	561
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.58	0.27

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.348
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1301
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influenece Area Speed (SR), mi/h	57.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.632	Outer Lanes Freeway Speed (SO), mi/h	70.1
Flow in Lanes 1 and 2 (v12), pc/h	2796	Ramp Junction Speed (S), mi/h	60.6
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	22.5
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	23.8

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - between Minnesota Ramps		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3085	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1200
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.52
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.4
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - between Minnesota Ramps		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3090	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1179
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.51
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.1
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - Exit 3 Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	3085	395
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	5.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.952
Flow Rate (vi),pc/h	3601	461
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.58	0.22

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.269
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1401
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	58.8
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	61.8
Flow in Lanes 1 and 2 (v12), pc/h	2200	Ramp Junction Speed (S), mi/h	59.8
Flow Entering Ramp-Infl. Area (vR12), pc/h	2661	Average Density (D), pc/mi/ln	22.6
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	18.6

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - Exit 3 Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	3090	675
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3536	772
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.61	0.37

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.286
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1376
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	58.4
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	61.8
Flow in Lanes 1 and 2 (v12), pc/h	2160	Ramp Junction Speed (S), mi/h	59.4
Flow Entering Ramp-Infl. Area (vR12), pc/h	2932	Average Density (D), pc/mi/ln	24.2
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	20.5

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD Minnesota Alt 2C/2D - SB I-229 - Exit 3 NB Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	3085	105
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	5.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.952
Flow Rate (vi),pc/h	3601	123
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.53	0.06

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.253
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1401
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	59.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	61.8
Flow in Lanes 1 and 2 (v12), pc/h	2200	Ramp Junction Speed (S), mi/h	60.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	2323	Average Density (D), pc/mi/ln	20.6
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	16.1

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD Minnesota Alt 2C/2D - Exit 3 NB Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	3090	135
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3536	154
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.52	0.07

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.252
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1376
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	59.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	61.8
Flow in Lanes 1 and 2 (v12), pc/h	2160	Ramp Junction Speed (S), mi/h	60.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	2314	Average Density (D), pc/mi/ln	20.5
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	16.0

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD Minnesota Alt 2C/2D - between Minnesota Entrance Ramps		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3190	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1241
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.54
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	20.1
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD Minnesota Alt 2C/2D - SB I-229 - between Minnesota Entrance Ramps		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3225	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1230
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.53
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD Minnesota Alt 2C/2D - Exit 3 SB Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	3190	290
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	5.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.952
Flow Rate (vi),pc/h	3723	338
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.58	0.16

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.266
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1448
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	58.9
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	61.6
Flow in Lanes 1 and 2 (v12), pc/h	2275	Ramp Junction Speed (S), mi/h	59.8
Flow Entering Ramp-Infl. Area (vR12), pc/h	2613	Average Density (D), pc/mi/ln	22.6
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	18.2

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD Minnesota Alt 2C/2D - SB I-229 - Exit 3 SB Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	3225	540
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3690	618
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.61	0.29

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.282
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1435
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	58.5
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	61.6
Flow in Lanes 1 and 2 (v12), pc/h	2255	Ramp Junction Speed (S), mi/h	59.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	2873	Average Density (D), pc/mi/ln	24.1
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	20.1

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - between Minnesota and Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3480	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1354
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.58
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	21.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - between Minnesota and Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3765	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1436
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.62
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	23.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - Minnesota to Western		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	3220	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	0
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2436	269	126	649
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	5.00	5.00	5.00	5.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.952	0.952	0.952	0.952
Flow Rate (v_i), pc/h	2843	314	147	757
Weaving Flow Rate (v_w), pc/h	1071	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2990	Density-Based Capacity (c_{IWL}), pc/h/ln		2198
Total Flow Rate (v), pc/h	4061	Demand Flow-Based Capacity (c_{IW}), pc/h		9091
Volume Ratio (VR)	0.264	Weaving Segment Capacity (c_W), veh/h		6277
Minimum Lane Change Rate (LC_{MIN}), lc/h	314	Adjusted Weaving Area Capacity, pc/h		6593
Maximum Weaving Length (L_{MAX}), ft	5201	Volume-to-Capacity Ratio (v/c)		0.62

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	963	Average Weaving Speed (S_W),mi/h	57.3
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1783	Average Non-Weaving Speed (S_{NW}), mi/h	56.2
Weaving Lane Change Rate (LC_W), lc/h	644	Average Speed (S), mi/h	56.5
Weaving Lane Change Rate (LC_{All}), lc/h	2427	Density (D), pc/mi/ln	24.0
Weaving Intensity Factor (W)	0.181	Level of Service (LOS)	C

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - Minnesota to Western		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	3220	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	0
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2436	422	253	557
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	3.00	3.00	3.00	3.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.971	0.971	0.971	0.971
Flow Rate (v_i), pc/h	2788	483	290	637
Weaving Flow Rate (v_w), pc/h	1120	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	3078	Density-Based Capacity (c_{IWL}), pc/h/ln		2196
Total Flow Rate (v), pc/h	4198	Demand Flow-Based Capacity (c_{IW}), pc/h		8989
Volume Ratio (VR)	0.267	Weaving Segment Capacity (c_W), veh/h		6397
Minimum Lane Change Rate (LC_{MIN}), lc/h	483	Adjusted Weaving Area Capacity, pc/h		6588
Maximum Weaving Length (L_{MAX}), ft	5233	Volume-to-Capacity Ratio (v/c)		0.64

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	991	Average Weaving Speed (S_W),mi/h	56.9
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1802	Average Non-Weaving Speed (S_{NW}), mi/h	54.8
Weaving Lane Change Rate (LC_W), lc/h	813	Average Speed (S), mi/h	55.3
Weaving Lane Change Rate (LC_{All}), lc/h	2615	Density (D), pc/mi/ln	25.3
Weaving Intensity Factor (W)	0.192	Level of Service (LOS)	C

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - between Western Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2705	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1578
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.68
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	25.5
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - between Western Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2955	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1690
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.73
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.4
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	27.5
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - west of Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2950	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1148
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.50
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	18.6
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	4/18/19
Agency	SEH Inc.	Analysis Year	2035
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - west of Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

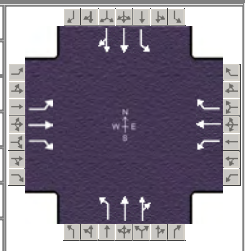
Demand Volume veh/h	3555	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1356
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.58
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	21.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

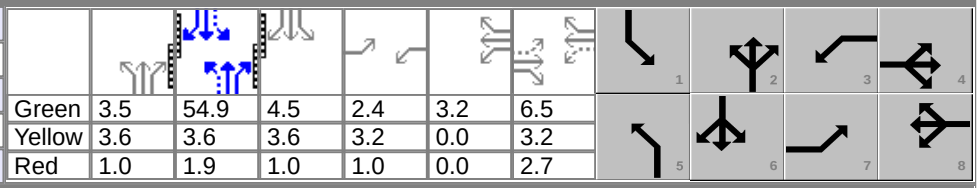
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 23, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	37th Street	File Name	01-02 Minnesota Avenue 2035 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	30	70	50	105	70	100	70	1585	100	90	800	15

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	71	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	3.5	54.9	4.5	2.4	3.2	6.5
Yellow	3.6	3.6	3.6	3.2	0.0	3.2
Red	1.0	1.9	1.0	1.0	0.0	2.7

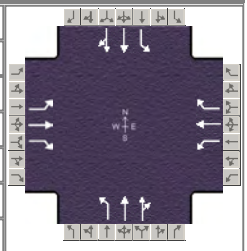
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	3.0	1.1	3.0	1.2	4.0	1.3	4.0
Phase Duration, s	6.6	12.4	9.9	15.7	8.1	68.6	9.1	69.6
Change Period, ($Y+R_c$), s	4.2	5.9	4.2	5.9	4.6	5.5	5.5	5.5
Max Allow Headway (*MAH*), s	4.3	4.3	4.3	4.3	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	3.8	6.2	7.7	8.9	3.9		2.0	
Green Extension Time (g_e), s	0.0	0.4	0.0	0.4	0.0	0.0	0.8	0.0
Phase Call Probability	0.60	1.00	0.96	1.00	0.88		0.91	
Max Out Probability	1.00	1.00	1.00	1.00	1.00		1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	33	78	56	117	78	111	78	938	935	87	397	394
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1543	1734	1821	1568	1734	1821	1783	1734	1821	1809
Queue Service Time (g_s), s	1.8	4.2	3.5	5.7	4.0	6.9	1.9	39.2	40.7	0.0	4.2	4.2
Cycle Queue Clearance Time (g_c), s	1.8	4.2	3.5	5.7	4.0	6.9	1.9	39.2	40.7	0.0	4.2	4.2
Green Ratio (*g/C*)	0.09	0.07	0.07	0.13	0.10	0.10	0.60	0.63	0.63	0.57	0.64	0.64
Capacity (*c*), veh/h	163	119	101	201	178	153	481	1149	1125	185	1167	1159
Volume-to-Capacity Ratio (*X*)	0.204	0.654	0.551	0.580	0.437	0.725	0.162	0.816	0.831	0.472	0.340	0.340
Back of Queue (*Q*), ft/ln (95 th percentile)	36.3	95.5	67.2	132.9	87.1	131.7	30.9	583.2	586.9	100.4	63.9	63.3
Back of Queue (*Q*), veh/ln (95 th percentile)	1.4	3.8	2.6	5.2	3.4	5.3	1.2	23.0	23.5	4.0	2.5	2.5
Queue Storage Ratio (*RQ*) (95 th percentile)	0.24	0.00	0.34	0.89	0.00	0.66	0.21	0.00	0.00	0.67	0.00	0.00
Uniform Delay (d_1), s/veh	42.3	45.6	45.3	41.0	42.5	3.1	8.4	14.1	14.3	41.1	2.7	2.8
Incremental Delay (d_2), s/veh	0.6	6.0	4.6	4.1	1.7	9.6	0.2	6.5	7.2	1.7	0.7	0.7
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	42.9	51.6	49.9	45.1	44.2	12.7	8.6	20.5	21.5	42.8	3.5	3.5
Level of Service (LOS)	D	D	D	D	D	B	A	C	C	D	A	A
Approach Delay, s/veh / LOS	49.3	D		33.1	C		20.5	C		7.4	A	
Intersection Delay, s/veh / LOS	19.6						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.31	B	2.31	B	2.14	B	2.06	B
Bicycle LOS Score / LOS	0.76	A	0.99	A	2.10	B	1.32	A

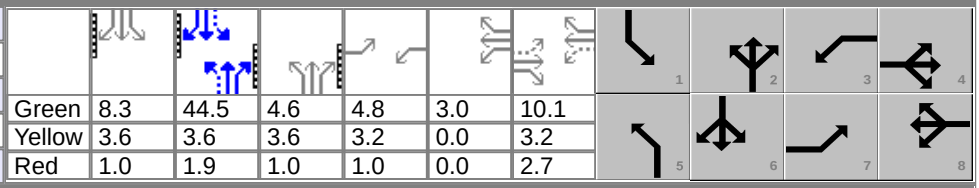
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 23, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2035	Analysis Period	1> 16:30
Intersection	37th Street	File Name	01-02 Minnesota Avenue 2035 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	70	135	120	170	125	105	80	1035	70	160	1590	50

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	71	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	8.3	44.5	4.6	4.8	3.0	10.1
Yellow	3.6	3.6	3.6	3.2	0.0	3.2
Red	1.0	1.9	1.0	1.0	0.0	2.7

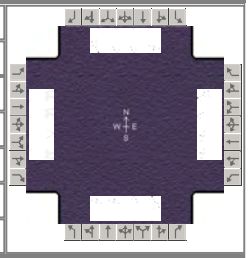
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	3.0	1.1	3.0	1.3	4.0	1.2	4.0
Phase Duration, s	9.0	16.0	12.0	19.0	9.2	59.1	12.9	62.9
Change Period, ($Y+R_c$), s	4.2	5.9	4.2	5.9	5.5	5.5	4.6	5.5
Max Allow Headway (*MAH*), s	4.3	4.3	4.3	4.3	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	6.0	10.1	9.8	9.2	2.0		8.1	
Green Extension Time (g_e), s	0.0	0.0	0.0	0.7	1.2	0.0	0.3	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	0.92		1.00	
Max Out Probability	1.00	1.00	1.00	1.00	1.00		0.44	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	78	150	78	189	139	83	89	620	607	192	979	979
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1543	1734	1821	1543	1734	1821	1780	1734	1821	1805
Queue Service Time (g_s), s	4.0	8.1	4.8	7.8	7.2	5.0	0.0	24.0	24.0	6.1	44.3	45.7
Cycle Queue Clearance Time (g_c), s	4.0	8.1	4.8	7.8	7.2	5.0	0.0	24.0	24.0	6.1	44.3	45.7
Green Ratio (*g/C*)	0.15	0.10	0.10	0.19	0.13	0.13	0.46	0.54	0.54	0.55	0.57	0.57
Capacity (*c*), veh/h	204	184	156	232	238	202	157	977	955	309	1045	1035
Volume-to-Capacity Ratio (*X*)	0.381	0.817	0.500	0.814	0.583	0.413	0.566	0.635	0.636	0.622	0.937	0.945
Back of Queue (*Q*), ft/ln (95 th percentile)	81.1	215.9	85	102.5	158.5	89.9	105.4	394.2	381.8	77.2	344.9	351.3
Back of Queue (*Q*), veh/ln (95 th percentile)	3.2	8.5	3.3	4.0	6.2	3.5	4.2	15.5	15.3	3.0	13.6	14.1
Queue Storage Ratio (*RQ*) (95 th percentile)	0.54	0.00	0.42	0.68	0.00	0.45	0.70	0.00	0.00	0.39	0.00	0.00
Uniform Delay (d_1), s/veh	38.1	44.1	3.3	39.3	40.9	39.9	45.2	16.3	16.3	14.2	9.9	10.0
Incremental Delay (d_2), s/veh	1.2	24.1	2.5	19.5	3.6	1.3	4.2	3.2	3.2	0.7	6.8	7.5
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	39.3	68.2	5.8	58.8	44.5	41.3	49.4	19.5	19.6	14.9	16.7	17.6
Level of Service (LOS)	D	E	A	E	D	D	D	B	B	B	B	B
Approach Delay, s/veh / LOS	44.9	D		50.4	D		21.5	C		16.9	B	
Intersection Delay, s/veh / LOS	23.7						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.31	B	2.32	B	2.13	B	2.21	B
Bicycle LOS Score / LOS	0.99	A	1.17	A	1.57	B	2.13	B

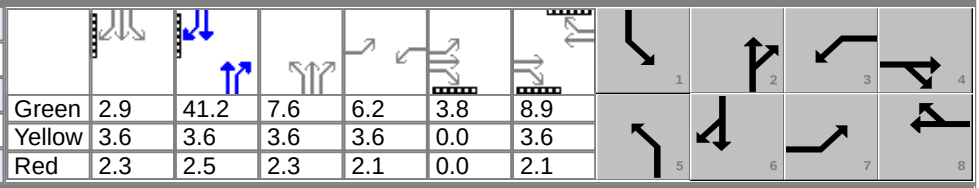
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 23, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	41st Street	File Name	01-02 Minnesota Avenue 2035 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	240	150	90	130	145	50	130	1160	65	35	570	150

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	88	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	2.9	41.2	7.6	6.2	3.8	8.9	1	2	3	4		
Yellow	3.6	3.6	3.6	3.6	0.0	3.6	5	6	7	8		
Red	2.3	2.5	2.3	2.1	0.0	2.1						

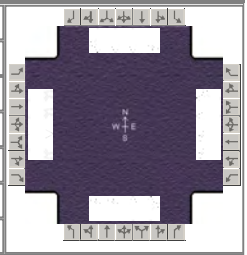
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	4.0	2.0	4.0	2.0	4.0
Phase Duration, s	15.8	18.5	11.9	14.6	13.5	60.8	8.8	56.1
Change Period, ($Y+R_c$), s	5.7	5.7	5.7	5.7	6.1	6.1	5.9	6.1
Max Allow Headway (*MAH*), s	3.1	4.3	3.2	4.3	3.2	0.0	5.2	0.0
Queue Clearance Time (g_s), s	9.7	10.8	6.1	8.1	7.2		4.2	
Green Extension Time (g_e), s	0.3	1.0	0.2	0.8	0.2	0.0	0.2	0.0
Phase Call Probability	1.00	1.00	0.98	1.00	0.99		0.66	
Max Out Probability	0.03	0.61	0.00	0.95	1.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	267	167	100	144	110	106	183	865	858	39	515	241
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1821	1568	1711	1850	1691	1711	1821	1787	1734	1821	1669
Queue Service Time (g_s), s	7.7	8.8	5.9	4.1	5.8	6.1	5.2	29.6	30.4	2.2	8.2	8.4
Cycle Queue Clearance Time (g_c), s	7.7	8.8	5.9	4.1	5.8	6.1	5.2	29.6	30.4	2.2	8.2	8.4
Green Ratio (*g/C*)	0.10	0.13	0.13	0.06	0.09	0.09	0.07	0.55	0.55	0.03	0.50	0.50
Capacity (*c*), veh/h	339	232	200	213	165	151	257	996	978	50	1818	833
Volume-to-Capacity Ratio (*X*)	0.786	0.717	0.500	0.677	0.668	0.705	0.713	0.868	0.878	0.774	0.283	0.289
Back of Queue (*Q*), ft/ln (95 th percentile)	148.1	197.1	103.8	80.4	121.9	118.9	102.6	209.6	207.7	62.5	155.6	148.4
Back of Queue (*Q*), veh/ln (95 th percentile)	5.8	7.8	4.2	3.2	4.9	4.8	4.1	8.3	8.2	2.5	6.1	5.9
Queue Storage Ratio (*RQ*) (95 th percentile)	0.49	0.00	0.00	0.32	0.00	0.00	0.68	0.00	0.00	0.42	0.00	0.00
Uniform Delay (d_1), s/veh	43.9	41.9	6.5	45.9	44.1	44.3	45.4	6.7	6.6	48.2	14.6	14.7
Incremental Delay (d_2), s/veh	1.5	7.3	2.7	1.4	1.7	2.4	3.8	5.3	5.8	29.4	0.4	0.9
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	45.4	49.1	9.3	47.3	45.8	46.6	49.2	12.0	12.4	77.6	15.0	15.5
Level of Service (LOS)	D	D	A	D	D	D	D	B	B	E	B	B
Approach Delay, s/veh / LOS	39.8	D		46.7	D		15.8	B		18.2	B	
Intersection Delay, s/veh / LOS	23.0						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.60	C	2.52	C	2.25	B	2.46	B
Bicycle LOS Score / LOS	1.37	A	0.79	A	1.73	B	0.92	A

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 23, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2035	Analysis Period	1> 16:30
Intersection	41st Street	File Name	01-02 Minnesota Avenue 2035 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	420	275	280	230	320	50	240	805	95	40	1435	370

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	6	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	3.2	0.7	37.9	9.5	0.4	13.2			
Yellow	3.6	3.6	3.6	3.6	3.6	3.6			
Red	2.3	2.3	2.5	2.1	2.1	2.1			

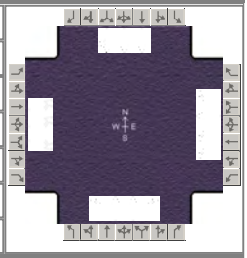
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	4.0	2.0	4.0	2.0	4.0
Phase Duration, s	21.4	25.0	15.2	18.9	15.7	50.6	9.1	44.0
Change Period, ($Y+R_c$), s	5.7	5.7	5.7	5.7	5.9	6.1	5.9	6.1
Max Allow Headway (*MAH*), s	3.1	4.3	3.2	4.3	3.2	0.0	5.2	0.0
Queue Clearance Time (g_s), s	15.6	18.3	9.3	12.6	9.8		4.5	
Green Extension Time (g_e), s	0.1	0.8	0.2	0.6	0.0	0.0	0.0	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		0.71	
Max Out Probability	1.00	1.00	0.45	1.00	1.00		1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	467	306	200	256	199	195	283	541	521	44	1296	599
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1821	1568	1711	1850	1786	1711	1821	1753	1734	1821	1670
Queue Service Time (g_s), s	13.6	16.3	11.8	7.3	10.5	10.6	7.8	23.2	23.2	2.5	34.3	34.7
Cycle Queue Clearance Time (g_c), s	13.6	16.3	11.8	7.3	10.5	10.6	7.8	23.2	23.2	2.5	34.3	34.7
Green Ratio (*g/C*)	0.16	0.19	0.19	0.10	0.13	0.13	0.10	0.44	0.44	0.03	0.38	0.38
Capacity (*c*), veh/h	528	352	303	326	244	236	336	810	780	56	1380	633
Volume-to-Capacity Ratio (*X*)	0.884	0.867	0.659	0.784	0.817	0.827	0.843	0.667	0.668	0.792	0.939	0.946
Back of Queue (*Q*), ft/ln (95 th percentile)	273.9	353.3	212.7	145.7	244.9	244.2	149	374.7	362.3	70.5	603.8	615.5
Back of Queue (*Q*), veh/ln (95 th percentile)	10.8	13.9	8.5	5.8	9.8	9.8	6.0	14.8	14.3	2.8	23.8	24.6
Queue Storage Ratio (*RQ*) (95 th percentile)	0.91	0.00	0.00	0.58	0.00	0.00	0.37	0.00	0.00	0.47	0.00	0.00
Uniform Delay (d_1), s/veh	41.3	39.1	37.3	44.2	42.2	42.3	35.9	21.4	21.3	48.0	29.9	30.1
Incremental Delay (d_2), s/veh	14.6	19.4	5.5	3.7	16.1	17.9	13.1	3.3	3.5	28.7	13.4	24.6
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	55.9	58.5	42.8	47.9	58.3	60.2	49.0	24.7	24.7	76.8	43.4	54.7
Level of Service (LOS)	E	E	D	D	E	E	D	C	C	E	D	D
Approach Delay, s/veh / LOS	54.0	D		54.8	D		29.8	C		47.6	D	
Intersection Delay, s/veh / LOS	45.0						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.59	C	2.60	C	2.29	B	2.57	C
Bicycle LOS Score / LOS	2.09	B	1.02	A	1.53	B	1.55	B

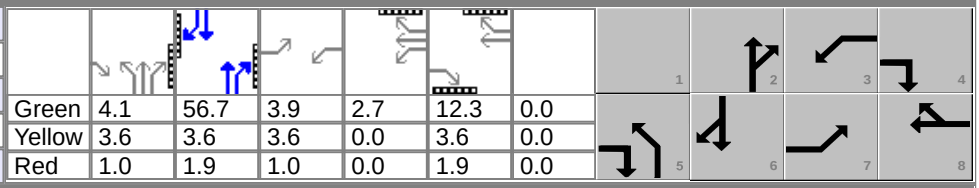
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	49th St/I-229 SB	File Name	03-05-07 Alt 2CD Minnesota Avenue 2035 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	70		140	135	185	65	50	1740	105		805	85

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	71	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	4.1	56.7	3.9	2.7	12.3	0.0
Yellow	3.6	3.6	3.6	0.0	3.6	0.0
Red	1.0	1.9	1.0	0.0	1.9	0.0

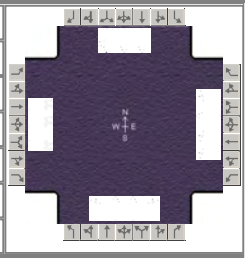
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2		6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0		8.3
Phase Duration, s	8.5	17.8	11.2	20.6	8.7	71.0		62.2
Change Period, ($Y+R_c$), s	4.6	5.5	4.6	5.5	4.6	5.5		5.5
Max Allow Headway (*MAH*), s	4.2	4.3	4.2	4.3	4.2	0.0		0.0
Queue Clearance Time (g_s), s	4.3	11.4	6.4	12.8	5.2			
Green Extension Time (g_e), s	0.1	1.0	0.3	1.1	0.1	0.0		0.0
Phase Call Probability	0.88	1.00	0.98	1.00	0.79			
Max Out Probability	0.11	0.33	0.01	0.19	0.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14	3	8	18	5	2	12		6	16
Adjusted Flow Rate (*v*), veh/h	78		156	150	206	72	56	1933	117		253	415
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684		1543	1684	1821	1543	1734	1734			543	1772
Queue Service Time (g_s), s	2.3		9.4	4.4	10.8	4.2	3.2	43.5			18.3	11.3
Cycle Queue Clearance Time (g_c), s	2.3		9.4	4.4	10.8	4.2	3.2	43.5			18.3	11.3
Green Ratio (*g/C*)	0.04		0.16	0.07	0.15	0.15	0.04	0.65			0.57	0.57
Capacity (*c*), veh/h	130		254	222	274	233	72	2270			616	1005
Volume-to-Capacity Ratio (*X*)	0.598		0.612	0.676	0.749	0.311	0.776	0.852			0.410	0.413
Back of Queue (*Q*), ft/ln (95 th percentile)	46.9		168.1	87.8	226.6	73.9	77	573.3			61.5	188.6
Back of Queue (*Q*), veh/ln (95 th percentile)	1.8		6.6	3.5	8.9	2.9	3.0	22.6			2.4	7.4
Queue Storage Ratio (*RQ*) (95 th percentile)	0.23		0.34	0.35	0.00	0.37	0.26	0.00			0.00	0.00
Uniform Delay (d_1), s/veh	47.3		38.8	45.7	40.7	37.8	47.5	13.5			9.7	9.6
Incremental Delay (d_2), s/veh	4.3		2.4	3.6	5.1	0.8	16.2	4.3			1.9	1.2
Initial Queue Delay (d_3), s/veh	0.0		0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	51.6		41.2	49.2	45.8	38.6	63.6	17.8	30.0		11.7	10.8
Level of Service (LOS)	D		D	D	D	D	E	B	C		B	B
Approach Delay, s/veh / LOS	44.7	D		45.8	D		19.6	B		11.1	B	
Intersection Delay, s/veh / LOS	22.9						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.60	C	2.30	B	2.23	B	2.08	B
Bicycle LOS Score / LOS		F	1.19	A	2.22	B	1.03	A

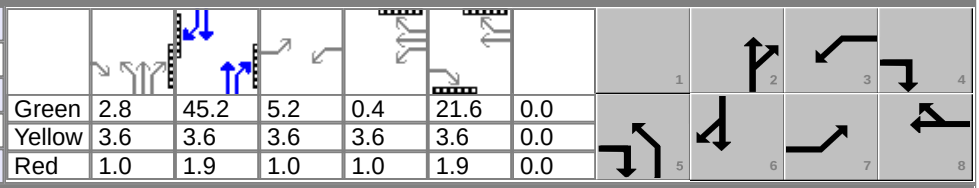
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2035	Analysis Period	1> 16:30
Intersection	49th St/I-229 SB	File Name	03-05-07 Alt 2CD Minnesota Avenue 2035 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	100		285	240	185	65	35	1100	135		2100	60

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	71	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	2.8	45.2	5.2	0.4	21.6	0.0
Yellow	3.6	3.6	3.6	3.6	3.6	0.0
Red	1.0	1.9	1.0	1.0	1.9	0.0

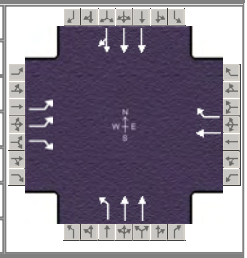
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2		6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0		8.3
Phase Duration, s	9.8	27.1	14.8	32.1	7.4	58.1		50.7
Change Period, ($Y+R_c$), s	4.6	5.5	4.6	5.5	4.6	5.5		5.5
Max Allow Headway (*MAH*), s	4.2	4.3	4.2	4.3	4.2	0.0		0.0
Queue Clearance Time (g_s), s	5.2	21.5	9.7	11.3	4.2			
Green Extension Time (g_e), s	0.2	0.0	0.5	2.2	0.1	0.0		0.0
Phase Call Probability	0.95	1.00	1.00	1.00	0.66			
Max Out Probability	0.00	1.00	0.38	0.03	0.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14	3	8	18	5	2	12		6	16
Adjusted Flow Rate (*v*), veh/h	111		317	267	206	72	39	1222	150		735	467
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684		1543	1684	1821	1543	1734	1734			1416	1798
Queue Service Time (g_s), s	3.2		19.5	7.7	9.3	3.6	2.2	25.8			66.4	19.9
Cycle Queue Clearance Time (g_c), s	3.2		19.5	7.7	9.3	3.6	2.2	25.8			66.4	19.9
Green Ratio (*g/C*)	0.05		0.24	0.10	0.27	0.27	0.03	0.53			0.45	0.45
Capacity (*c*), veh/h	176		377	345	484	410	49	1824			1280	812
Volume-to-Capacity Ratio (*X*)	0.632		0.841	0.774	0.425	0.176	0.791	0.670			0.575	0.575
Back of Queue (*Q*), ft/ln (95 th percentile)	65.7		348.2	154.9	189.2	61.7	58.7	391.9			273	340.8
Back of Queue (*Q*), veh/ln (95 th percentile)	2.6		13.7	6.1	7.5	2.4	2.3	15.4			10.7	13.4
Queue Storage Ratio (*RQ*) (95 th percentile)	0.33		0.70	0.62	0.00	0.31	0.20	0.00			0.00	0.00
Uniform Delay (d_1), s/veh	46.4		36.0	43.8	30.4	28.3	48.3	17.3			21.7	21.9
Incremental Delay (d_2), s/veh	3.7		15.5	4.1	0.6	0.2	23.9	2.0			1.6	2.5
Initial Queue Delay (d_3), s/veh	0.0		0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	50.2		51.4	47.8	31.0	28.5	72.2	19.3	30.0		23.3	24.4
Level of Service (LOS)	D		D	D	C	C	E	B	C		C	C
Approach Delay, s/veh / LOS	51.1	D		38.9	D		21.9	C		23.7	C	
Intersection Delay, s/veh / LOS	28.6						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.59	C	2.29	B	2.25	B	2.10	B
Bicycle LOS Score / LOS		F	1.39	A	1.65	B	1.81	B

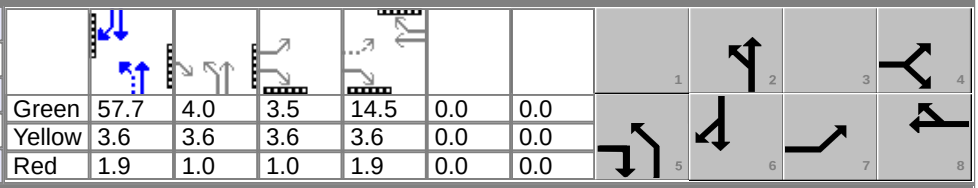
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	49th St/I-229 SB	File Name	03-05-07 Alt 9D Minnesota Avenue 2035 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	70		140		185	65	50	1740			805	85

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	71	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	57.7	4.0	3.5	14.5	0.0	0.0
Yellow	3.6	3.6	3.6	3.6	0.0	0.0
Red	1.9	1.0	1.0	1.9	0.0	0.0

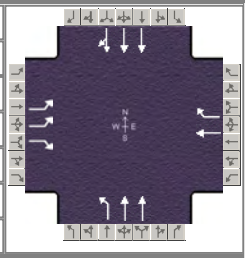
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4		8	5	2		6
Case Number	1.0	3.0		7.3	1.0	4.0		8.3
Phase Duration, s	8.1	28.1		20.0	8.6	71.9		63.2
Change Period, ($Y+R_c$), s	4.6	5.5		5.5	5.5	5.5		5.5
Max Allow Headway (*MAH*), s	4.2	4.3		4.3	4.2	0.0		0.0
Queue Clearance Time (g_s), s	3.9	10.3		12.9	2.0			
Green Extension Time (g_e), s	0.0	1.7		1.6	1.7	0.0		0.0
Phase Call Probability	0.88	1.00		1.00	0.79			
Max Out Probability	1.00	0.00		0.00	1.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14		8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h	78		156		206	72	56	1933			223	367
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684		1543		1821	1543	1734	1734			543	1772
Queue Service Time (g_s), s	1.9		8.3		10.9	4.2	0.0	42.4			23.3	8.4
Cycle Queue Clearance Time (g_c), s	1.9		8.3		10.9	4.2	0.0	42.4			23.3	8.4
Green Ratio (*g/C*)	0.20		0.26		0.14	0.14	0.59	0.66			0.58	0.58
Capacity (*c*), veh/h	348		397		263	223	394	2302			627	1023
Volume-to-Capacity Ratio (*X*)	0.224		0.391		0.780	0.323	0.141	0.840			0.355	0.359
Back of Queue (*Q*), ft/ln (95 th percentile)	35.8		143.2		227.1	74.6	41.7	553.6			42.3	138.9
Back of Queue (*Q*), veh/ln (95 th percentile)	1.4		5.6		8.9	2.9	1.6	21.8			1.7	5.5
Queue Storage Ratio (*RQ*) (95 th percentile)	0.18		0.29		0.00	0.37	0.14	0.00			0.00	0.00
Uniform Delay (d_1), s/veh	33.6		30.7		41.2	38.4	22.3	12.8			7.3	7.7
Incremental Delay (d_2), s/veh	0.3		0.6		5.0	0.8	0.2	3.9			1.5	1.0
Initial Queue Delay (d_3), s/veh	0.0		0.0		0.0	0.0	0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	33.9		31.3		46.2	39.2	22.4	16.7			8.9	8.7
Level of Service (LOS)	C		C		D	D	C	B			A	A
Approach Delay, s/veh / LOS	32.2		C	44.4		D	16.8		B	8.8		A
Intersection Delay, s/veh / LOS	18.9						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.45	B	2.30	B	1.64	B	2.14	B
Bicycle LOS Score / LOS		F	0.95	A	2.13	B	1.03	A

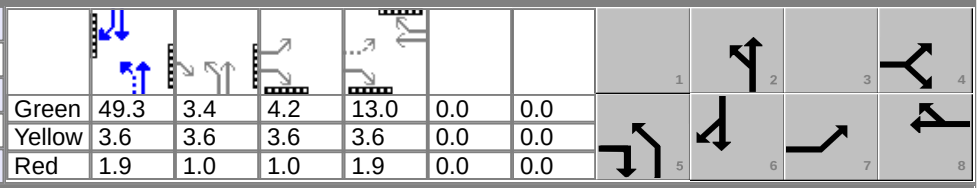
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2035	Analysis Period	1> 16:30
Intersection	49th St/I-229 SB	File Name	03-05-07 Alt 9D Minnesota Avenue 2035 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	100		285		185	65	35	1100			2100	60

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	71	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	49.3	3.4	4.2	13.0	0.0	0.0
Yellow	3.6	3.6	3.6	3.6	0.0	0.0
Red	1.9	1.0	1.0	1.9	0.0	0.0

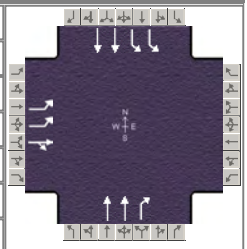
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4		8	5	2		6
Case Number	1.0	3.0		7.3	1.0	4.0		8.3
Phase Duration, s	8.8	27.2		18.5	8.0	62.8		54.8
Change Period, ($Y+R_c$), s	4.6	5.5		5.5	5.5	5.5		5.5
Max Allow Headway (*MAH*), s	4.2	4.3		4.3	4.2	0.0		0.0
Queue Clearance Time (g_s), s	4.4	19.0		11.8	2.0			
Green Extension Time (g_e), s	0.0	1.4		1.2	1.3	0.0		0.0
Phase Call Probability	0.94	1.00		1.00	0.62			
Max Out Probability	1.00	0.50		0.83	1.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14		8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h	111		317		206	72	39	1222			702	446
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684		1543		1821	1543	1734	1734			1416	1798
Queue Service Time (g_s), s	2.4		17.0		9.8	3.8	0.0	17.8			72.8	11.1
Cycle Queue Clearance Time (g_c), s	2.4		17.0		9.8	3.8	0.0	17.8			72.8	11.1
Green Ratio (*g/C*)	0.21		0.27		0.14	0.14	0.55	0.64			0.55	0.55
Capacity (*c*), veh/h	399		415		262	222	128	2206			1551	984
Volume-to-Capacity Ratio (*X*)	0.279		0.762		0.784	0.325	0.304	0.554			0.452	0.453
Back of Queue (*Q*), ft/ln (95 th percentile)	45		246.5		217.6	66.5	40.3	260			137.2	179.2
Back of Queue (*Q*), veh/ln (95 th percentile)	1.8		9.7		8.6	2.6	1.6	10.2			5.4	7.1
Queue Storage Ratio (*RQ*) (95 th percentile)	0.22		0.49		0.00	0.33	0.13	0.00			0.00	0.00
Uniform Delay (d_1), s/veh	29.7		30.2		37.2	34.6	42.5	9.2			9.0	9.1
Incremental Delay (d_2), s/veh	0.4		6.1		8.8	0.8	1.3	1.0			0.8	1.3
Initial Queue Delay (d_3), s/veh	0.0		0.0		0.0	0.0	0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	30.0		36.4		45.9	35.4	43.9	10.2			9.9	10.5
Level of Service (LOS)	C		D		D	D	D	B			A	B
Approach Delay, s/veh / LOS	34.7		C	43.2		D	11.2		B	10.1		B
Intersection Delay, s/veh / LOS	16.9						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.44	B	2.30	B	1.64	B	2.14	B
Bicycle LOS Score / LOS		F	0.95	A	1.53	B	1.81	B

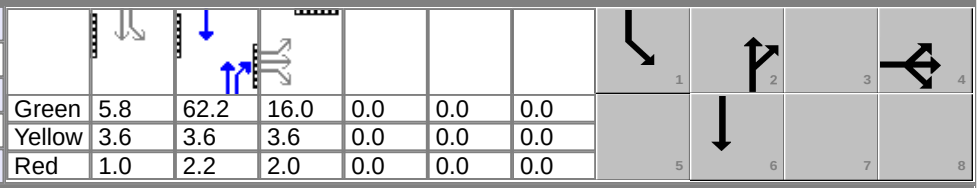
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	I-229 NB Ramp	File Name	03-05-07 Alt 2CD Minnesota Avenue 2035 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	400	0	70					1495	245	110	680	

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	84	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	5.8	62.2	16.0	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.0	2.2	2.0	0.0	0.0	0.0

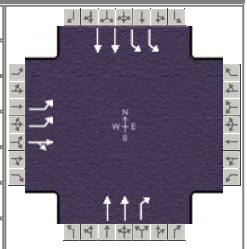
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4				2	1	6
Case Number		10.0				7.3	2.0	4.0
Phase Duration, s		21.6				68.0	10.4	78.4
Change Period, ($Y+R_c$), s		5.6				5.8	4.6	5.8
Max Allow Headway (*MAH*), s		3.2				0.0	3.1	0.0
Queue Clearance Time (g_s), s		14.8					5.5	
Green Extension Time (g_e), s		1.2				0.0	0.3	0.0
Phase Call Probability		1.00					0.96	
Max Out Probability		0.00					0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14					2	12	1	6	
Adjusted Flow Rate (*v*), veh/h	444	56						1796	204	121	746	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1453						1827	1481	1684	1700	
Queue Service Time (g_s), s	12.8	3.3						20.1	1.4	3.5	7.4	
Cycle Queue Clearance Time (g_c), s	12.8	3.3						20.1	1.4	3.5	7.4	
Green Ratio (*g/C*)	0.16	0.16						0.62	0.62	0.06	0.73	
Capacity (*c*), veh/h	539	232						2274	921	195	2469	
Volume-to-Capacity Ratio (*X*)	0.825	0.239						0.790	0.222	0.619	0.302	
Back of Queue (*Q*), ft/ln (95 th percentile)	229.6	54						159	21	66.6	92.9	
Back of Queue (*Q*), veh/ln (95 th percentile)	9.0	2.1						6.3	0.8	2.6	3.7	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.66	0.00						0.00	0.11	0.22	0.00	
Uniform Delay (d_1), s/veh	40.7	36.7						3.7	1.6	46.0	4.6	
Incremental Delay (d_2), s/veh	1.2	0.2						2.9	0.6	1.1	0.3	
Initial Queue Delay (d_3), s/veh	0.0	0.0						0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	41.9	36.9						6.5	2.1	47.1	4.9	
Level of Service (LOS)	D	D						A	A	D	A	
Approach Delay, s/veh / LOS	41.3	D		0.0			6.1	A		10.8	B	
Intersection Delay, s/veh / LOS	12.5						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.43	B	2.47	B	1.76	B	1.88	B
Bicycle LOS Score / LOS	1.31	A		A	2.01	B	1.21	A

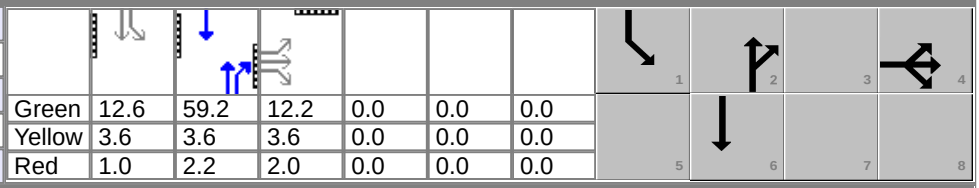
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2035	Analysis Period	1> 16:30
Intersection	I-229 NB Ramp	File Name	03-05-07 Alt 2CD Minnesota Avenue 2035 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	305	0	150					965	220	450	1635	

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	34	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	12.6	59.2	12.2	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.0	2.2	2.0	0.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4				2	1	6
Case Number		10.0				7.3	2.0	4.0
Phase Duration, s		17.8				65.0	17.2	82.2
Change Period, ($Y+R_c$), s		5.6				5.8	4.6	5.8
Max Allow Headway (*MAH*), s		3.2				0.0	3.1	0.0
Queue Clearance Time (g_s), s		11.8					12.3	
Green Extension Time (g_e), s		0.4				0.0	0.3	0.0
Phase Call Probability		1.00					1.00	
Max Out Probability		1.00					0.84	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14					2	12	1	6	
Adjusted Flow Rate (*v*), veh/h	339	133						1149	173	362	1316	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1467						1747	1475	1684	1767	
Queue Service Time (g_s), s	9.8	8.8						28.4	9.9	10.3	1.7	
Cycle Queue Clearance Time (g_c), s	9.8	8.8						28.4	9.9	10.3	1.7	
Green Ratio (*g/C*)	0.12	0.12						0.59	0.59	0.13	0.76	
Capacity (*c*), veh/h	410	179						2067	872	426	2700	
Volume-to-Capacity Ratio (*X*)	0.826	0.746						0.556	0.198	0.850	0.487	
Back of Queue (*Q*), ft/ln (95 th percentile)	202.2	162.8						483.3	170.4	181.5	18.3	
Back of Queue (*Q*), veh/ln (95 th percentile)	8.0	6.4						19.0	6.7	7.1	0.7	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.58	0.00						0.00	0.83	0.61	0.00	
Uniform Delay (d_1), s/veh	42.9	42.4						25.4	20.6	38.6	0.3	
Incremental Delay (d_2), s/veh	8.4	8.8						1.1	0.5	7.1	0.5	
Initial Queue Delay (d_3), s/veh	0.0	0.0						0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	51.2	51.2						26.5	21.1	45.6	0.8	
Level of Service (LOS)	D	D						C	C	D	A	
Approach Delay, s/veh / LOS	51.2	D		0.0			25.8	C		10.5	B	
Intersection Delay, s/veh / LOS	21.9						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.43	B	2.47	B	1.77	B	1.88	B
Bicycle LOS Score / LOS	1.27	A		A	1.51	B	2.40	B

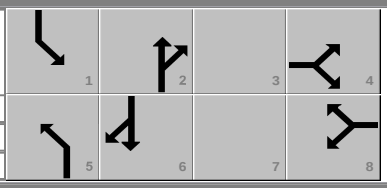
HCS7 Interchanges Results Summary

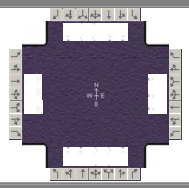
General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	SPUI
Analyst	Graham Johnson	Analysis Date	Apr 3, 2019	Segment Distance, ft	
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 SPUI	PHF	0.90	Arterial Direction	North-South
File Name	03-05-07 Alt 9D Minnesota Avenue 2035 AM.xus				
Project Description	BUILD - I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection Demand (v), veh/h	400		70	135		0	105	1390	245	110	545	290

Signal Information	
Cycle, s	100.0
Offset, s	83
Uncoordinated	No
Force Mode	Fixed

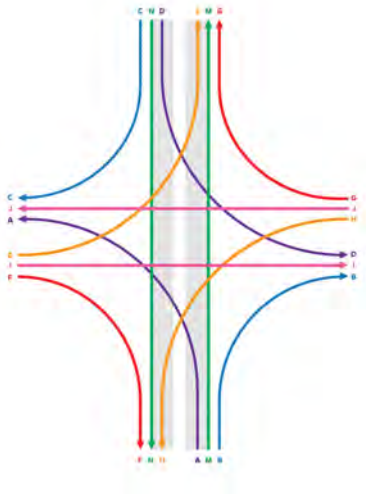
Green	5.8	51.1	6.8	14.6	0.0	0.0
Yellow	3.6	3.6	3.6	3.6	0.0	0.0
Red	2.0	2.2	1.0	2.0	0.0	0.0





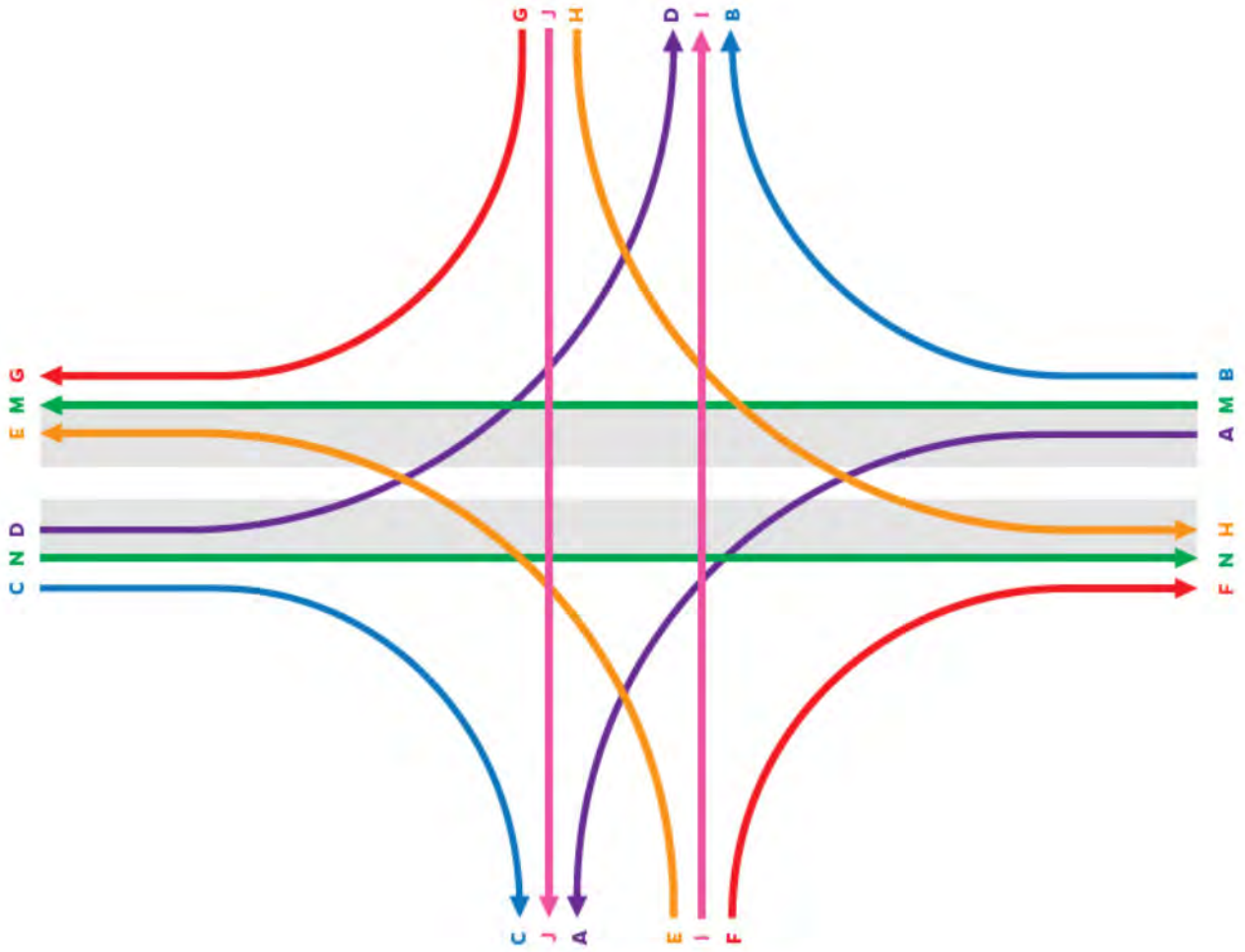
Interchange Results

O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	150	38.1	0.0	38.1	No	No	C
B	0	0.0	0.0	0.0	No	No	A
C	78	38.9	0.0	38.9	No	No	C
D	444	44.5	0.0	44.5	No	No	C
E	126	46.9	0.0	46.9	No	No	C
F	293	1.7	0.0	1.7	No	No	A
G	266	0.0	0.0	0.0	No	No	A
H	101	47.0	0.0	47.0	No	No	C
I	1664	3.1	0.0	3.1	No	No	A
J	500	8.2	0.0	8.2	No	No	A
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	44.5		38.9	38.1		0.0	46.9	3.1	1.7	47.0	8.2	0.0
Level of Service (LOS)	D		D	D			D	A	A	D	A	A
Approach Delay, s/veh / LOS	43.6	D		38.1	D		5.6	A		10.2	B	
Intersection Delay, s/veh / LOS	13.5						B					

Interchange Graphic



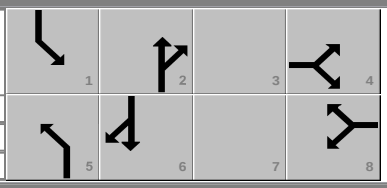
HCS7 Interchanges Results Summary

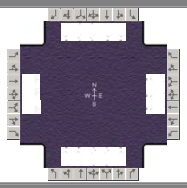
General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	SPUI
Analyst	Graham Johnson	Analysis Date	Apr 3, 2019	Segment Distance, ft	
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 SPUI	PHF	0.90	Arterial Direction	North-South
File Name	03-05-07 Alt 9D Minnesota Avenue 2035 PM.xus				
Project Description	BUILD - I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection Demand (v), veh/h	305		150	240		0	135	830	220	450	1395	540

Signal Information	
Cycle, s	90.0
Offset, s	63
Uncoordinated	No
Force Mode	Fixed

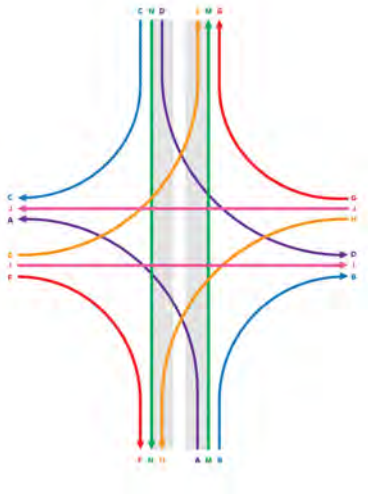
Green	6.5	33.0	15.3	13.5	0.0	0.0
Yellow	3.6	3.6	3.6	3.6	0.0	0.0
Red	2.0	2.2	1.0	2.0	0.0	0.0





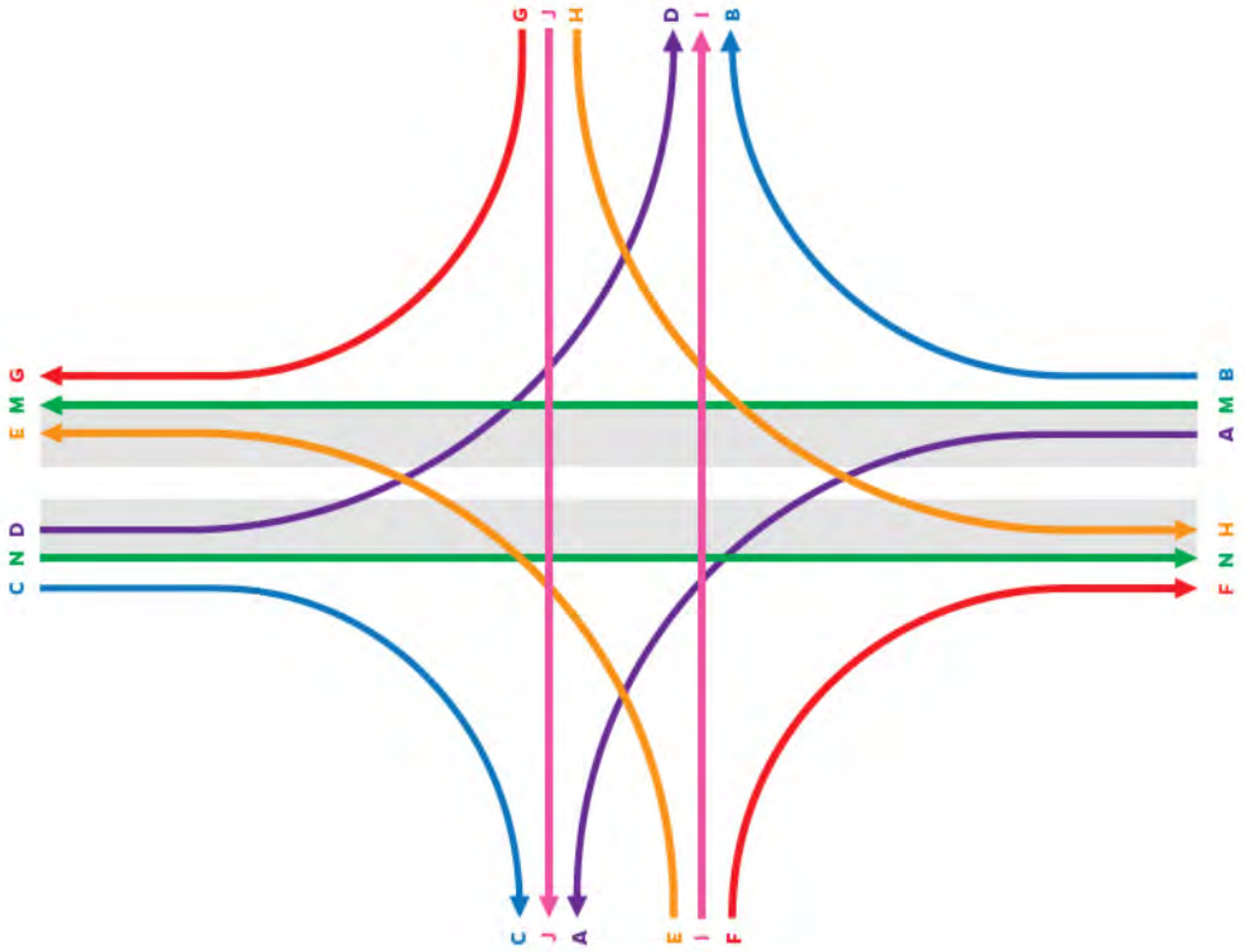
Interchange Results

O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	267	35.4	0.0	35.4	No	No	C
B	0	0.0	0.0	0.0	No	No	A
C	167	38.6	0.0	38.6	No	No	C
D	339	36.2	0.0	36.2	No	No	C
E	161	44.9	0.0	44.9	No	No	C
F	202	7.1	0.0	7.1	No	No	A
G	380	0.0	0.0	0.0	No	No	A
H	317	33.9	0.0	33.9	No	No	C
I	987	9.7	0.0	9.7	No	No	A
J	981	9.5	0.0	9.5	No	No	A
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	36.2		38.6	35.4		0.0	44.9	9.7	7.1	33.9	9.5	0.0
Level of Service (LOS)	D		D	D			D	A	A	C	A	A
Approach Delay, s/veh / LOS	37.0	D		35.4	D		13.5	B		11.9	B	
Intersection Delay, s/veh / LOS	17.5						B					

Interchange Graphic



HCS7 Two-Way Stop-Control Report

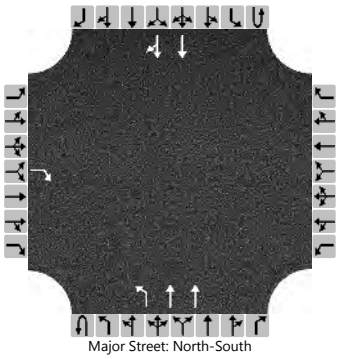
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/23/19
Analysis Year	2035
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at Yankton
Jurisdiction	Sioux Falls, SD
East/West Street	Yankton Trail
North/South Street	Minnesota Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration				R						L	T				T	TR
Volume (veh/h)				5					0	5	1740				745	5
Percent Heavy Vehicles (%)				2					2	2						
Proportion Time Blocked																
Percent Grade (%)	0															
Right Turn Channelized	No															
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)				6.9						4.1						
Critical Headway (sec)				6.94						4.14						
Base Follow-Up Headway (sec)				3.3						2.2						
Follow-Up Headway (sec)				3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)				6						6						
Capacity, c (veh/h)				585						795						
v/c Ratio				0.01						0.01						
95% Queue Length, Q_{95} (veh)				0.0						0.0						
Control Delay (s/veh)				11.2						9.6						
Level of Service (LOS)				B						A						
Approach Delay (s/veh)	11.2								0.0							
Approach LOS	B															

HCS7 Two-Way Stop-Control Report

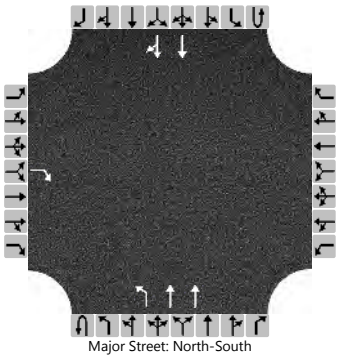
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/23/19
Analysis Year	2035
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at Yankton
Jurisdiction	Sioux Falls, SD
East/West Street	Yankton Trail
North/South Street	Minnesota Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration				R						L	T				T	TR
Volume (veh/h)				20					0	50	1180				1660	125
Percent Heavy Vehicles (%)				2					2	2						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized		No														
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)				6.9						4.1						
Critical Headway (sec)				6.94						4.14						
Base Follow-Up Headway (sec)				3.3						2.2						
Follow-Up Headway (sec)				3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)				22						56						
Capacity, c (veh/h)				245						287						
v/c Ratio				0.09						0.19						
95% Queue Length, Q_{95} (veh)				0.3						0.7						
Control Delay (s/veh)				21.2						20.5						
Level of Service (LOS)				C						C						
Approach Delay (s/veh)		21.2								0.8						
Approach LOS		C														

HCS7 Two-Way Stop-Control Report

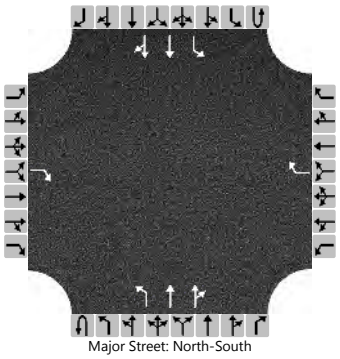
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/23/19
Analysis Year	2035
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at Lotta St
Jurisdiction	Sioux Falls, SD
East/West Street	Lotta St
North/South Street	Minnesota Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	1		0	0	1	0	1	2	0	0	1	2	0
Configuration				R				R		L	T	TR		L	T	TR
Volume (veh/h)				5				315	0	10	1460	10	0	40	700	10
Percent Heavy Vehicles (%)				2				2	2	2			2	2		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized	No				No											
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)				6.9				6.9		4.1				4.1		
Critical Headway (sec)				6.94				6.94		4.14				4.14		
Base Follow-Up Headway (sec)				3.3				3.3		2.2				2.2		
Follow-Up Headway (sec)				3.32				3.32		2.22				2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)				6				350		11				44		
Capacity, c (veh/h)				605				320		827				393		
v/c Ratio				0.01				1.09		0.01				0.11		
95% Queue Length, Q_{95} (veh)				0.0				13.5		0.0				0.4		
Control Delay (s/veh)				11.0				115.0		9.4				15.3		
Level of Service (LOS)				B				F		A				C		
Approach Delay (s/veh)	11.0				115.0				0.1				0.8			
Approach LOS	B				F											

HCS7 Two-Way Stop-Control Report

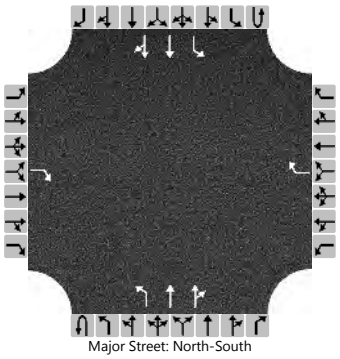
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/23/19
Analysis Year	2035
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at Lotta St
Jurisdiction	Sioux Falls, SD
East/West Street	Lotta St
North/South Street	Minnesota Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	1		0	0	1	0	1	2	0	0	1	2	0
Configuration				R				R		L	T	TR		L	T	TR
Volume (veh/h)				5				130	0	5	1115	35	0	200	1475	0
Percent Heavy Vehicles (%)				2				2	2	2			2	2		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized	No				No											
Median Type | Storage	Undivided															

Critical and Follow-up Headways

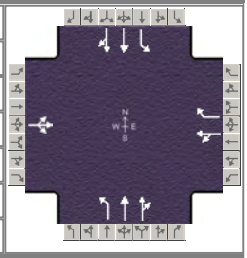
Base Critical Headway (sec)				6.9				6.9		4.1				4.1		
Critical Headway (sec)				6.94				6.94		4.14				4.14		
Base Follow-Up Headway (sec)				3.3				3.3		2.2				2.2		
Follow-Up Headway (sec)				3.32				3.32		2.22				2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)				6				144		6				222		
Capacity, c (veh/h)				318				419		391				539		
v/c Ratio				0.02				0.34		0.01				0.41		
95% Queue Length, Q_{95} (veh)				0.1				1.5		0.0				2.0		
Control Delay (s/veh)				16.5				18.1		14.3				16.3		
Level of Service (LOS)				C				C		B				C		
Approach Delay (s/veh)	16.5				18.1				0.1				1.9			
Approach LOS	C				C											

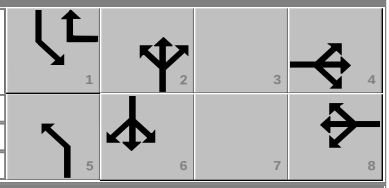
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Lotta St	File Name	03-05-07 Alt 2CD Minnesota Avenue 2035 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	45	25	5	75	25	240	10	1460	10	40	700	10

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	119	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	1.4	1.4	70.3	10.5	0.0	0.0
Yellow	4.3	0.0	4.3	3.6	0.0	0.0
Red	1.0	0.0	1.6	1.6	0.0	0.0

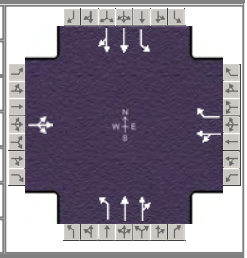
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		8.0		7.0	1.1	4.0	1.1	4.0
Phase Duration, s		15.7		15.7	6.7	76.2	8.1	77.6
Change Period, ($Y+R_c$), s		5.2		5.2	5.3	5.9	5.3	5.9
Max Allow Headway (*MAH*), s		3.5		3.5	3.1	0.0	4.1	0.0
Queue Clearance Time (g_s), s		6.9		10.2	2.3		2.7	
Green Extension Time (g_e), s		0.5		0.3	0.0	0.0	0.0	0.0
Phase Call Probability		1.00		1.00	0.35		0.71	
Max Out Probability		0.10		0.94	0.00		0.20	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h		83			111	133	16	1157	1157	44	395	393
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1559			1468	1543	1734	1821	1817	1734	1821	1812
Queue Service Time (g_s), s		0.0			2.4	8.2	0.3	43.7	44.1	0.7	7.9	7.9
Cycle Queue Clearance Time (g_c), s		4.9			7.3	8.2	0.3	43.7	44.1	0.7	7.9	7.9
Green Ratio (*g/C*)		0.10			0.10	0.13	0.72	0.70	0.70	0.73	0.72	0.72
Capacity (*c*), veh/h		221			217	206	521	1280	1277	163	1306	1299
Volume-to-Capacity Ratio (*X*)		0.377			0.512	0.648	0.030	0.904	0.906	0.273	0.303	0.303
Back of Queue (*Q*), ft/ln (95 th percentile)		91.3			122.7	146.2	3.3	270.2	270.9	27	114.4	114.4
Back of Queue (*Q*), veh/ln (95 th percentile)		3.6			4.8	5.8	0.1	10.6	10.7	1.1	4.5	4.5
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00			0.00	0.42	0.00	0.00	0.00	0.08	0.00	0.00
Uniform Delay (d_1), s/veh		42.2			43.3	41.1	4.5	6.4	6.5	17.2	5.1	5.1
Incremental Delay (d_2), s/veh		1.1			0.7	1.8	0.0	5.9	6.0	0.9	0.6	0.6
Initial Queue Delay (d_3), s/veh		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh		43.2			44.0	42.9	4.5	12.3	12.5	18.1	5.7	5.7
Level of Service (LOS)		D			D	D	A	B	B	B	A	A
Approach Delay, s/veh / LOS	43.2	D		43.4	D		12.3	B		6.4	A	
Intersection Delay, s/veh / LOS	13.8						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.31	B	2.31	B	2.03	B	1.63	B
Bicycle LOS Score / LOS	0.63	A	0.89	A	1.84	B	1.18	A

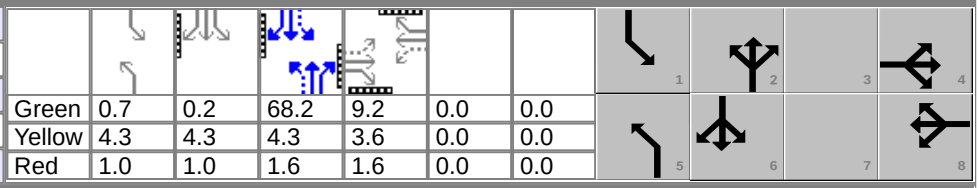
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2035	Analysis Period	1> 16:30
Intersection	Lotta St	File Name	03-05-07 Alt 2CD Minnesota Avenue 2035 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	15	25	5	30	25	100	5	1115	35	200	1475	5

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	13	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	0.7	0.2	68.2	9.2	0.0	0.0
Yellow	4.3	4.3	4.3	3.6	0.0	0.0
Red	1.0	1.0	1.6	1.6	0.0	0.0

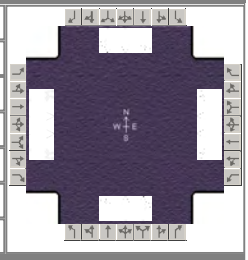
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		8.0		7.0	1.1	4.0	1.1	4.0
Phase Duration, s		14.4		14.4	6.0	74.1	11.5	79.6
Change Period, ($Y+R_c$), s		5.2		5.2	5.3	5.9	5.3	5.9
Max Allow Headway (*MAH*), s		3.5		3.5	3.1	0.0	4.1	0.0
Queue Clearance Time (g_s), s		4.6		9.0	2.1		5.5	
Green Extension Time (g_e), s		0.3		0.2	0.0	0.0	0.8	0.0
Phase Call Probability		1.00		1.00	0.17		1.00	
Max Out Probability		0.02		0.82	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h		50			61	111	7	788	783	222	822	822
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1679			1596	1543	1734	1821	1801	1734	1821	1819
Queue Service Time (g_s), s		0.0			0.8	7.0	0.1	20.5	21.0	3.5	21.7	21.7
Cycle Queue Clearance Time (g_c), s		2.6			3.4	7.0	0.1	20.5	21.0	3.5	21.7	21.7
Green Ratio (*g/C*)		0.09			0.09	0.09	0.69	0.68	0.68	0.76	0.74	0.74
Capacity (*c*), veh/h		203			203	142	236	1241	1228	334	1342	1341
Volume-to-Capacity Ratio (*X*)		0.247			0.302	0.782	0.029	0.635	0.637	0.665	0.613	0.613
Back of Queue (*Q*), ft/ln (95 th percentile)		54.1			65.4	137	1.7	230.9	237.4	107	278	278.7
Back of Queue (*Q*), veh/ln (95 th percentile)		2.1			2.6	5.4	0.1	9.1	9.3	4.2	10.9	11.0
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00			0.00	0.39	0.00	0.00	0.00	0.31	0.00	0.00
Uniform Delay (d_1), s/veh		42.4			42.7	44.4	6.5	6.5	6.7	11.5	6.3	6.3
Incremental Delay (d_2), s/veh		0.6			0.3	8.2	0.0	1.9	1.9	2.3	2.1	2.1
Initial Queue Delay (d_3), s/veh		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh		43.0			43.0	52.6	6.5	8.3	8.6	13.8	8.4	8.4
Level of Service (LOS)		D			D	D	A	A	A	B	A	A
Approach Delay, s/veh / LOS	43.0	D		49.2	D		8.5	A		9.0	A	
Intersection Delay, s/veh / LOS	11.1						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.31	B	2.31	B	1.86	B	1.62	B
Bicycle LOS Score / LOS	0.57	A	0.77	A	1.55	B	2.03	B

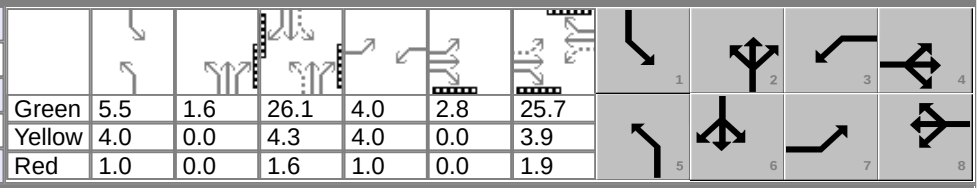
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	57th Street	File Name	08 Minnesota at 57th 2035 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	130	270	105	70	665	250	130	790	30	100	490	70

Signal Information			
Cycle, s	87.4	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	5.5	1.6	26.1	4.0	2.8	25.7
Yellow	4.0	0.0	4.3	4.0	0.0	3.9
Red	1.0	0.0	1.6	1.0	0.0	1.9

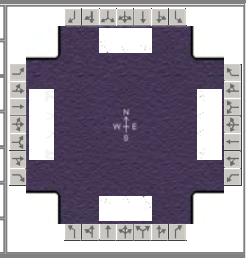
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	3.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	11.9	34.3	9.0	31.5	12.1	33.5	10.5	32.0
Change Period, ($Y+R_c$), s	5.0	5.8	5.0	5.8	5.0	5.9	5.0	5.9
Max Allow Headway (*MAH*), s	3.7	5.7	3.7	5.7	3.7	5.6	3.7	5.6
Queue Clearance Time (g_s), s	7.0	7.6	4.7	18.7	6.9	21.9	5.8	14.7
Green Extension Time (g_e), s	0.1	10.8	0.1	7.0	0.3	5.7	0.1	9.3
Phase Call Probability	0.97	1.00	0.85	1.00	0.97	1.00	0.93	1.00
Max Out Probability	1.00	0.34	0.14	0.70	0.00	0.89	0.59	0.64

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	144	300	100	78	739	183	144	455	450	111	311	300
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1734	1568	1734	1734	1543	1734	1821	1801	1734	1821	1751
Queue Service Time (g_s), s	5.0	5.6	4.0	2.7	16.7	8.3	4.9	19.9	19.9	3.8	12.6	12.7
Cycle Queue Clearance Time (g_c), s	5.0	5.6	4.0	2.7	16.7	8.3	4.9	19.9	19.9	3.8	12.6	12.7
Green Ratio (*g/C*)	0.37	0.33	0.33	0.34	0.29	0.29	0.38	0.32	0.32	0.36	0.30	0.30
Capacity (*c*), veh/h	293	1131	511	421	1019	454	347	576	570	232	544	523
Volume-to-Capacity Ratio (*X*)	0.494	0.265	0.196	0.185	0.725	0.404	0.417	0.791	0.791	0.479	0.572	0.575
Back of Queue (*Q*), ft/ln (95 th percentile)	92.3	102.9	66.7	49.6	289.3	141.3	90.1	368.9	360.2	71.8	238.9	229.6
Back of Queue (*Q*), veh/ln (95 th percentile)	3.6	4.1	2.7	2.0	11.4	5.6	3.5	14.5	14.4	2.8	9.4	9.2
Queue Storage Ratio (*RQ*) (95 th percentile)	0.46	0.00	0.33	0.20	0.00	0.94	0.60	0.00	0.00	0.18	0.00	0.00
Uniform Delay (d_1), s/veh	20.8	21.7	21.2	20.1	27.7	24.7	19.5	27.2	27.2	21.9	25.9	26.0
Incremental Delay (d_2), s/veh	1.0	0.2	0.3	0.2	2.4	1.0	0.6	7.2	7.3	1.1	1.6	1.7
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	21.7	21.9	21.5	20.2	30.1	25.7	20.1	34.5	34.5	23.1	27.6	27.7
Level of Service (LOS)	C	C	C	C	C	C	C	C	C	C	C	C
Approach Delay, s/veh / LOS	21.8	C		28.5	C		32.5	C		26.9	C	
Intersection Delay, s/veh / LOS	28.3						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.28	B	2.29	B	2.55	C	2.45	B
Bicycle LOS Score / LOS	0.94	A	1.31	A	1.35	A	1.08	A

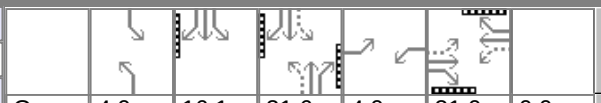
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2035	Analysis Period	1> 16:30
Intersection	57th Street	File Name	08 Minnesota at 57th 2035 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				

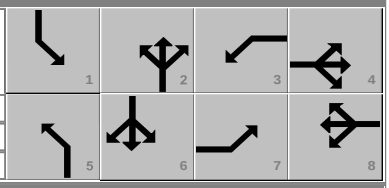


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	155	830	135	70	505	170	130	630	160	405	980	70

Signal Information			
Cycle, s	113.4	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	4.0	16.1	31.6	4.0	31.0	0.0
Yellow	4.0	4.0	4.3	4.0	3.9	0.0
Red	1.0	1.0	1.6	1.0	1.9	0.0



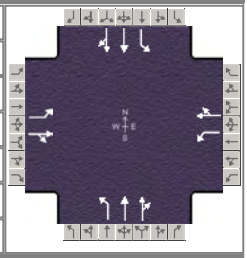
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	3.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	9.0	36.8	9.0	36.8	9.0	37.5	30.1	58.6
Change Period, ($Y+R_c$), s	5.0	5.8	5.0	5.8	5.0	5.9	5.0	5.9
Max Allow Headway (*MAH*), s	3.7	5.6	3.7	5.6	3.7	5.6	3.7	5.6
Queue Clearance Time (g_s), s	6.0	31.9	5.7	17.9	6.0	26.7	23.7	30.9
Green Extension Time (g_e), s	0.0	0.0	0.0	0.0	0.0	4.9	1.4	0.0
Phase Call Probability	1.00	1.00	0.91	1.00	0.99	1.00	1.00	1.00
Max Out Probability	1.00	1.00	1.00	1.00	1.00	0.79	0.00	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	172	922	128	78	561	122	144	422	400	450	587	574
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1734	1568	1734	1734	1543	1734	1821	1726	1734	1821	1781
Queue Service Time (g_s), s	4.0	29.9	7.3	3.7	15.9	7.1	4.0	24.7	24.7	21.7	28.9	28.9
Cycle Queue Clearance Time (g_c), s	4.0	29.9	7.3	3.7	15.9	7.1	4.0	24.7	24.7	21.7	28.9	28.9
Green Ratio (*g/C*)	0.31	0.27	0.27	0.31	0.27	0.27	0.31	0.28	0.28	0.52	0.46	0.46
Capacity (*c*), veh/h	222	948	429	125	948	422	218	508	482	488	846	828
Volume-to-Capacity Ratio (*X*)	0.775	0.973	0.298	0.624	0.592	0.290	0.664	0.830	0.831	0.922	0.693	0.694
Back of Queue (*Q*), ft/ln (95 th percentile)	178.9	560.7	128.6	83.5	283.9	124.7	105.6	449.6	425.5	370.2	473.9	458.5
Back of Queue (*Q*), veh/ln (95 th percentile)	7.0	22.1	5.1	3.3	11.2	4.9	4.2	17.7	17.0	14.6	18.7	18.3
Queue Storage Ratio (*RQ*) (95 th percentile)	0.89	0.00	0.64	0.33	0.00	0.83	0.70	0.00	0.00	0.93	0.00	0.00
Uniform Delay (d_1), s/veh	41.3	40.8	32.6	32.6	35.7	32.5	35.5	38.4	38.4	27.3	24.0	24.0
Incremental Delay (d_2), s/veh	15.1	22.9	0.7	8.4	1.3	0.6	6.8	8.0	8.5	6.0	2.9	3.0
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	56.3	63.7	33.3	41.0	37.1	33.2	42.3	46.4	46.9	33.4	26.9	26.9
Level of Service (LOS)	E	E	C	D	D	C	D	D	D	C	C	C
Approach Delay, s/veh / LOS	59.5	E		36.8	D		46.0	D		28.7	C	
Intersection Delay, s/veh / LOS	42.0						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.36	B	2.30	B	2.53	C	2.45	B
Bicycle LOS Score / LOS	1.50	A	1.12	A	1.29	A	1.82	B

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	33rd Street	File Name	09 Cliff at 33rd 2035 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	80	85	40	65	160	15	100	1060	15	5	345	60

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	0.6	4.1	56.2	4.8	1.0	13.5
Yellow	3.6	0.0	3.6	3.6	0.0	3.6
Red	1.0	0.0	1.5	1.0	0.0	1.9

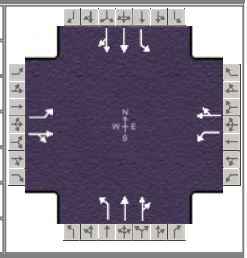
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	4.0	1.1	4.0	1.1	4.0
Phase Duration, s	10.5	20.0	9.4	19.0	9.2	65.4	5.2	61.3
Change Period, ($Y+R_c$), s	4.6	5.5	4.6	5.5	4.6	5.1	4.6	5.1
Max Allow Headway (*MAH*), s	4.2	4.2	4.2	4.2	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	6.4	9.5	5.5	12.5	4.6		2.1	
Green Extension Time (g_e), s	0.0	1.1	0.0	1.0	0.3	0.0	0.0	0.0
Phase Call Probability	0.92	1.00	0.87	1.00	0.95		0.14	
Max Out Probability	1.00	0.00	1.00	0.01	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	89	139		72	194		111	599	596	6	229	221
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1722		1734	1793		1734	1821	1812	1734	1821	1727
Queue Service Time (g_s), s	4.4	7.5		3.5	10.5		2.6	19.5	19.5	0.1	6.3	6.4
Cycle Queue Clearance Time (g_c), s	4.4	7.5		3.5	10.5		2.6	19.5	19.5	0.1	6.3	6.4
Green Ratio (*g/C*)	0.19	0.15		0.18	0.13		0.62	0.60	0.60	0.57	0.56	0.56
Capacity (*c*), veh/h	209	250		219	242		621	1098	1092	264	1024	971
Volume-to-Capacity Ratio (*X*)	0.425	0.556		0.330	0.803		0.179	0.545	0.545	0.021	0.224	0.227
Back of Queue (*Q*), ft/ln (95 th percentile)	87.1	150.1		70.5	221		42	316.5	310.9	2.4	117.8	112
Back of Queue (*Q*), veh/ln (95 th percentile)	3.4	5.9		2.8	8.7		1.7	12.5	12.4	0.1	4.6	4.5
Queue Storage Ratio (*RQ*) (95 th percentile)	0.40	0.00		0.50	0.00		0.24	0.00	0.00	0.02	0.00	0.00
Uniform Delay (d_1), s/veh	34.9	39.7		35.2	42.0		7.9	11.8	11.8	10.9	11.0	11.0
Incremental Delay (d_2), s/veh	1.4	1.9		0.9	6.1		0.1	1.9	2.0	0.0	0.5	0.5
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	36.2	41.7		36.1	48.1		8.1	13.7	13.7	10.9	11.5	11.5
Level of Service (LOS)	D	D		D	D		A	B	B	B	B	B
Approach Delay, s/veh / LOS	39.6	D		44.8	D		13.2	B		11.5	B	
Intersection Delay, s/veh / LOS	19.3						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.30	B	2.30	B	1.88	B	1.89	B
Bicycle LOS Score / LOS	0.86	A	0.93	A	1.56	B	0.86	A

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2035	Analysis Period	1> 16:30
Intersection	33rd Street	File Name	09 Cliff at 33rd 2035 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	100	185	80	95	130	30	65	560	140	20	1180	85

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	1.8	1.7	50.6	6.5	0.3	19.3
Yellow	3.6	0.0	3.6	3.6	0.0	3.6
Red	1.0	0.0	1.5	1.0	0.0	1.9

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	4.0	1.1	4.0	1.1	4.0
Phase Duration, s	11.4	25.1	11.1	24.8	8.2	57.4	6.4	55.7
Change Period, ($Y+R_c$), s	4.6	5.5	4.6	5.5	4.6	5.1	4.6	5.1
Max Allow Headway (*MAH*), s	4.2	4.2	4.2	4.2	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	7.1	18.5	6.8	11.1	4.0		2.6	
Green Extension Time (g_e), s	0.0	1.1	0.0	1.5	0.1	0.0	0.0	0.0
Phase Call Probability	0.95	1.00	0.95	1.00	0.87		0.46	
Max Out Probability	1.00	0.34	1.00	0.02	0.00		0.00	

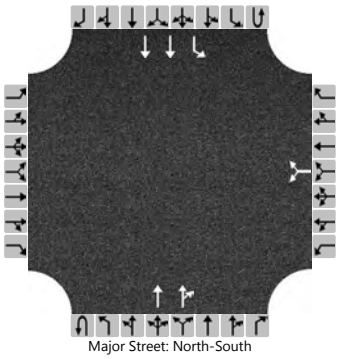
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	111	294		106	178		72	402	375	22	710	696
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1727		1734	1762		1734	1821	1695	1734	1821	1778
Queue Service Time (g_s), s	5.1	16.5		4.8	9.1		2.0	13.5	13.6	0.6	31.6	31.8
Cycle Queue Clearance Time (g_c), s	5.1	16.5		4.8	9.1		2.0	13.5	13.6	0.6	31.6	31.8
Green Ratio (*g/C*)	0.26	0.20		0.26	0.19		0.54	0.52	0.52	0.52	0.51	0.51
Capacity (*c*), veh/h	313	338		196	340		206	952	886	359	921	899
Volume-to-Capacity Ratio (*X*)	0.355	0.870		0.539	0.523		0.351	0.423	0.424	0.062	0.770	0.774
Back of Queue (*Q*), ft/ln (95 th percentile)	98.4	328.2		96.7	182.2		36.5	245.2	229.3	10.9	517.6	504.1
Back of Queue (*Q*), veh/ln (95 th percentile)	3.9	12.9		3.8	7.2		1.4	9.7	9.2	0.4	20.4	20.2
Queue Storage Ratio (*RQ*) (95 th percentile)	0.46	0.00		0.69	0.00		0.21	0.00	0.00	0.09	0.00	0.00
Uniform Delay (d_1), s/veh	29.6	39.0		31.1	36.2		17.2	14.6	14.6	12.5	20.0	20.1
Incremental Delay (d_2), s/veh	0.7	13.9		2.3	1.2		1.0	1.4	1.5	0.1	6.2	6.4
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	30.3	52.9		33.4	37.5		18.2	16.0	16.1	12.5	26.2	26.5
Level of Service (LOS)	C	D		C	D		B	B	B	B	C	C
Approach Delay, s/veh / LOS	46.7	D		36.0	D		16.2	B		26.1	C	
Intersection Delay, s/veh / LOS	27.1						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.30	B	2.30	B	1.90	B	1.90	B
Bicycle LOS Score / LOS	1.16	A	0.96	A	1.19	A	1.67	B

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Graham Johnson	Intersection	Cliff Ave at 36th St
Agency/Co.	SEH Inc.	Jurisdiction	Sioux Falls, SD
Date Performed	4/23/19	East/West Street	36th Street
Analysis Year	2035	North/South Street	Cliff Avenue
Time Analyzed	AM	Peak Hour Factor	0.90
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	BUILD - I-229 Exits 3 and 4		

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	2	0	0	1	2	0
Configuration							LR				T	TR		L	T	
Volume (veh/h)						40		45			1230	70	0	55	560	
Percent Heavy Vehicles (%)						2		2					2	2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized																
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)						7.5		6.9						4.1		
Critical Headway (sec)						6.84		6.94						4.14		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.52		3.32						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							94							61		
Capacity, c (veh/h)							218							465		
v/c Ratio							0.43							0.13		
95% Queue Length, Q_{95} (veh)							2.0							0.4		
Control Delay (s/veh)							33.6							13.9		
Level of Service (LOS)							D							B		
Approach Delay (s/veh)						33.6								1.2		
Approach LOS						D										

HCS7 Two-Way Stop-Control Report

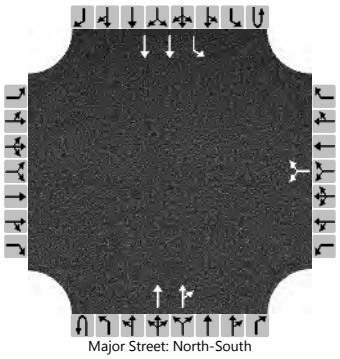
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/23/19
Analysis Year	2035
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at 36th St
Jurisdiction	Sioux Falls, SD
East/West Street	36th Street
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	2	0	0	1	2	0
Configuration							LR				T	TR		L	T	
Volume (veh/h)						30		5			755	30	0	5	1355	
Percent Heavy Vehicles (%)						2		2					2	2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized																
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)						7.5		6.9						4.1		
Critical Headway (sec)						6.84		6.94						4.14		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.52		3.32						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							39							6		
Capacity, c (veh/h)							244							769		
v/c Ratio							0.16							0.01		
95% Queue Length, Q_{95} (veh)							0.6							0.0		
Control Delay (s/veh)							22.5							9.7		
Level of Service (LOS)							C							A		
Approach Delay (s/veh)						22.5								0.0		
Approach LOS						C										

HCS7 Two-Way Stop-Control Report

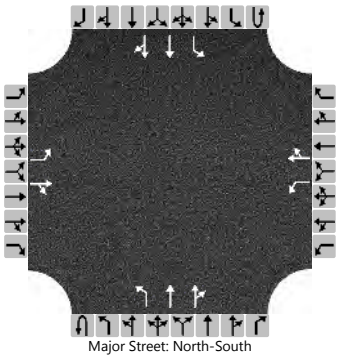
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/23/19
Analysis Year	2035
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at 38th/HS #1
Jurisdiction	Sioux Falls, SD
East/West Street	38th Street/HS #1
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	1	0		1	1	0	0	1	2	0	0	1	2	0
Configuration		L		TR		L		TR		L	T	TR		L	T	TR
Volume (veh/h)		10	5	90		120	10	90	0	60	1225	160	0	15	805	45
Percent Heavy Vehicles (%)		2	2	2		2	2	2	2	2			2	2		
Proportion Time Blocked																
Percent Grade (%)		0				0										
Right Turn Channelized																
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5	6.5	6.9		7.5	6.5	6.9		4.1				4.1		
Critical Headway (sec)		7.54	6.54	6.94		7.54	6.54	6.94		4.14				4.14		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.52	4.02	3.32		3.52	4.02	3.32		2.22				2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		11		106		133		111		67				17		
Capacity, c (veh/h)		70		231		72		142		722				428		
v/c Ratio		0.16		0.46		1.84		0.78		0.09				0.04		
95% Queue Length, Q_{95} (veh)		0.5		2.2		11.8		4.8		0.3				0.1		
Control Delay (s/veh)		65.9		33.0		521.4		87.9		10.5				13.8		
Level of Service (LOS)		F		D		F		F		B				B		
Approach Delay (s/veh)		36.1				324.3				0.4				0.2		
Approach LOS		E				F										

HCS7 Two-Way Stop-Control Report

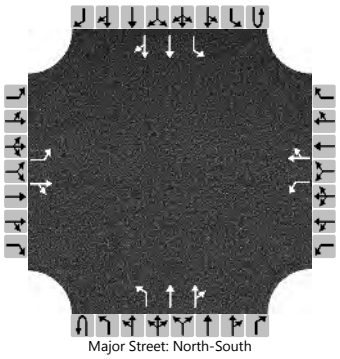
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/23/19
Analysis Year	2035
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	BUILD -I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at 38th/HS #1
Jurisdiction	Sioux Falls, SD
East/West Street	38th Street/HS #1
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	1	0		1	1	0	0	1	2	0	0	1	2	0
Configuration		L		TR		L		TR		L	T	TR		L	T	TR
Volume (veh/h)		15	0	85		85	5	20	0	45	875	15	0	55	1445	30
Percent Heavy Vehicles (%)		2	2	2		2	2	2	2	2			2	2		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type | Storage	Left Only								1							

Critical and Follow-up Headways

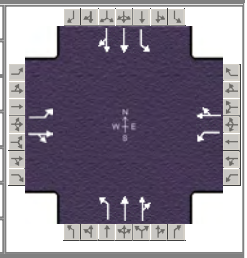
Base Critical Headway (sec)		7.5	6.5	6.9		7.5	6.5	6.9		4.1				4.1		
Critical Headway (sec)		7.54	6.54	6.94		7.54	6.54	6.94		4.14				4.14		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.52	4.02	3.32		3.52	4.02	3.32		2.22				2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		17		94		94		28		50				61		
Capacity, c (veh/h)		54		318		83		61		391				695		
v/c Ratio		0.31		0.30		1.13		0.45		0.13				0.09		
95% Queue Length, Q_{95} (veh)		1.1		1.2		6.7		1.8		0.4				0.3		
Control Delay (s/veh)		98.3		21.0		230.0		105.6		15.5				10.7		
Level of Service (LOS)		F		C		F		F		C				B		
Approach Delay (s/veh)	32.6				201.8				0.7				0.4			
Approach LOS	D				F											

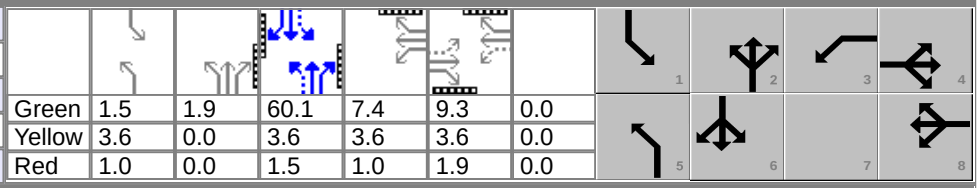
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 4, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	38th Street/LHS Access	File Name	11 Cliff at 38th Signal 2035 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	10	5	90	120	10	90	60	1225	160	15	805	45

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	1.5	1.9	60.1	7.4	9.3	0.0
Yellow	3.6	0.0	3.6	3.6	3.6	0.0
Red	1.0	0.0	1.5	1.0	1.9	0.0

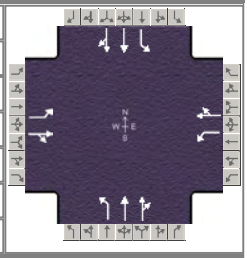
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4	3	8	5	2	1	6
Case Number		6.3	1.0	4.0	1.1	4.0	1.1	4.0
Phase Duration, s		14.8	12.0	26.8	8.0	67.1	6.1	65.2
Change Period, ($Y+R_c$), s		5.5	4.6	5.5	4.6	5.1	4.6	5.1
Max Allow Headway (*MAH*), s		4.4	3.2	4.4	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s		8.6	8.8	8.0	3.5		2.4	
Green Extension Time (g_e), s		0.7	0.0	0.9	0.1	0.0	0.0	0.0
Phase Call Probability		1.00	0.98	1.00	0.84		0.37	
Max Out Probability		0.00	1.00	0.00	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	11	106		133	111		67	780	759	17	477	468
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1282	1556		1734	1567		1734	1821	1747	1734	1821	1787
Queue Service Time (g_s), s	0.8	6.6		6.8	6.0		1.5	28.4	29.1	0.4	14.1	14.1
Cycle Queue Clearance Time (g_c), s	0.8	6.6		6.8	6.0		1.5	28.4	29.1	0.4	14.1	14.1
Green Ratio (*g/C*)	0.09	0.09		0.19	0.21		0.64	0.62	0.62	0.62	0.60	0.60
Capacity (*c*), veh/h	191	145		235	334		404	1130	1084	202	1095	1075
Volume-to-Capacity Ratio (*X*)	0.058	0.730		0.567	0.333		0.165	0.691	0.700	0.083	0.435	0.435
Back of Queue (*Q*), ft/ln (95 th percentile)	11.7	128.2		136.1	106.3		23.8	434.4	423.5	6.4	243.1	235.9
Back of Queue (*Q*), veh/ln (95 th percentile)	0.5	5.0		5.4	4.2		0.9	17.1	16.9	0.3	9.6	9.4
Queue Storage Ratio (*RQ*) (95 th percentile)	0.06	0.00		0.68	0.00		0.12	0.00	0.00	0.03	0.00	0.00
Uniform Delay (d_1), s/veh	41.5	44.1		36.2	33.3		8.0	12.6	12.7	11.9	10.8	10.8
Incremental Delay (d_2), s/veh	0.1	6.9		2.0	0.6		0.2	3.5	3.8	0.2	1.3	1.3
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	41.6	51.0		38.3	33.9		8.2	16.1	16.5	12.1	12.0	12.0
Level of Service (LOS)	D	D		D	C		A	B	B	B	B	B
Approach Delay, s/veh / LOS	50.1	D		36.3	D		16.0	B		12.0	B	
Intersection Delay, s/veh / LOS	17.7						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.31	B	2.29	B	1.88	B	1.88	B
Bicycle LOS Score / LOS	0.68	A	0.89	A	1.81	B	1.28	A

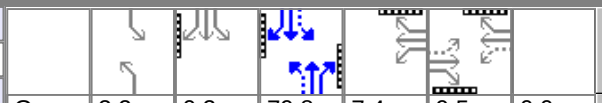
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 4, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2035	Analysis Period	1> 16:30
Intersection	38th Street/LHS Access	File Name	11 Cliff at 38th Signal 2035 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				

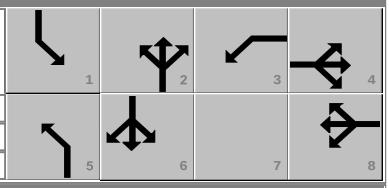


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	15	0	85	85	5	20	45	875	15	55	1445	30

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	3.2	0.2	79.8	7.4	9.5	0.0
Yellow	3.6	0.0	3.6	3.6	3.6	0.0
Red	1.0	0.0	1.5	1.0	1.9	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4	3	8	5	2	1	6
Case Number		6.3	1.0	4.0	1.1	4.0	1.1	4.0
Phase Duration, s		15.0	12.0	27.0	7.8	84.9	8.1	85.2
Change Period, ($Y+R_c$), s		5.5	4.6	5.5	4.6	5.1	4.6	5.1
Max Allow Headway (*MAH*), s		4.4	3.2	4.4	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s		9.2	7.8	3.7	3.1		3.3	
Green Extension Time (g_e), s		0.4	0.0	0.5	0.1	0.0	0.1	0.0
Phase Call Probability		0.99	0.96	1.00	0.81		0.87	
Max Out Probability		0.00	1.00	0.00	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	17	94		94	28		50	496	493	61	821	818
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1382	1543		1734	1592		1734	1821	1810	1734	1821	1808
Queue Service Time (g_s), s	1.3	7.2		5.8	1.7		1.1	15.0	15.0	1.3	32.8	33.0
Cycle Queue Clearance Time (g_c), s	1.3	7.2		5.8	1.7		1.1	15.0	15.0	1.3	32.8	33.0
Green Ratio (*g/C*)	0.08	0.08		0.16	0.18		0.69	0.67	0.67	0.69	0.67	0.67
Capacity (*c*), veh/h	169	122		192	285		222	1212	1204	418	1215	1206
Volume-to-Capacity Ratio (*X*)	0.099	0.775		0.493	0.098		0.225	0.409	0.409	0.146	0.676	0.678
Back of Queue (*Q*), ft/ln (95 th percentile)	22	143.5		116.8	32.2		19.9	253.7	248.6	21.9	490.1	482
Back of Queue (*Q*), veh/ln (95 th percentile)	0.9	5.6		4.6	1.3		0.8	10.0	9.9	0.9	19.3	19.3
Queue Storage Ratio (*RQ*) (95 th percentile)	0.11	0.00		0.58	0.00		0.10	0.00	0.00	0.11	0.00	0.00
Uniform Delay (d_1), s/veh	51.5	54.2		45.4	41.2		11.9	9.2	9.2	6.9	12.1	12.1
Incremental Delay (d_2), s/veh	0.3	10.0		0.7	0.1		0.5	1.0	1.0	0.2	3.0	3.1
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	51.8	64.2		46.2	41.3		12.4	10.3	10.3	7.0	15.1	15.2
Level of Service (LOS)	D	E		D	D		B	B	B	A	B	B
Approach Delay, s/veh / LOS	62.4	E		45.1	D		10.4	B		14.9	B	
Intersection Delay, s/veh / LOS	16.3						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.31	B	2.31	B	1.87	B	1.87	B
Bicycle LOS Score / LOS	0.67	A	0.69	A	1.34	A	1.89	B

HCS7 Two-Way Stop-Control Report

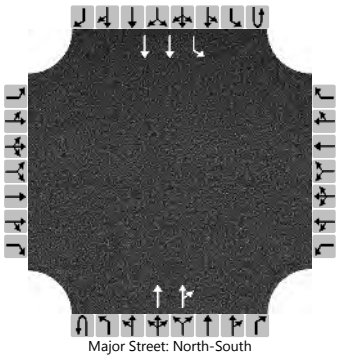
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/23/19
Analysis Year	2035
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at HS #2
Jurisdiction	Sioux Falls, SD
East/West Street	HS #2 Entrance
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	0	2	0	0	1	2	0
Configuration											T	TR		L	T	
Volume (veh/h)											1445	170	0	120	865	
Percent Heavy Vehicles (%)													2	2		
Proportion Time Blocked																
Percent Grade (%)																
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)														4.1		
Critical Headway (sec)														4.14		
Base Follow-Up Headway (sec)														2.2		
Follow-Up Headway (sec)														2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)														133		
Capacity, c (veh/h)														340		
v/c Ratio														0.39		
95% Queue Length, Q_{95} (veh)														1.8		
Control Delay (s/veh)														22.2		
Level of Service (LOS)														C		
Approach Delay (s/veh)													2.7			
Approach LOS																

HCS7 Two-Way Stop-Control Report

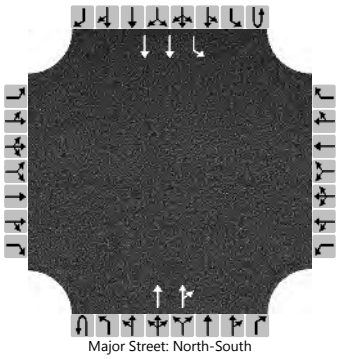
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/23/19
Analysis Year	2035
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at HS #2
Jurisdiction	Sioux Falls, SD
East/West Street	HS #2 Entrance
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	0	2	0	0	1	2	0
Configuration											T	TR		L	T	
Volume (veh/h)											935	30	0	15	1570	
Percent Heavy Vehicles (%)													2	2		
Proportion Time Blocked																
Percent Grade (%)																
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)														4.1		
Critical Headway (sec)														4.14		
Base Follow-Up Headway (sec)														2.2		
Follow-Up Headway (sec)														2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)														17		
Capacity, c (veh/h)														646		
v/c Ratio														0.03		
95% Queue Length, Q_{95} (veh)														0.1		
Control Delay (s/veh)														10.7		
Level of Service (LOS)														B		
Approach Delay (s/veh)													0.1			
Approach LOS																

HCS7 Two-Way Stop-Control Report

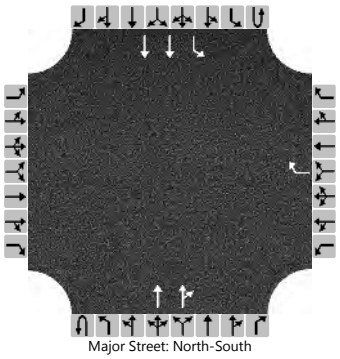
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/23/19
Analysis Year	2035
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at HS #1
Jurisdiction	Sioux Falls, SD
East/West Street	HS #1
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	1	0	0	2	0	0	1	2	0
Configuration								R			T	TR		L	T	
Volume (veh/h)								60			1555	380	0	0	815	
Percent Heavy Vehicles (%)								2					2	2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized						No										
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)								6.9						4.1		
Critical Headway (sec)								6.94						4.14		
Base Follow-Up Headway (sec)								3.3						2.2		
Follow-Up Headway (sec)								3.32						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)								67						0		
Capacity, c (veh/h)								215						247		
v/c Ratio								0.31						0.00		
95% Queue Length, Q_{95} (veh)								1.3						0.0		
Control Delay (s/veh)								29.1						19.6		
Level of Service (LOS)								D						C		
Approach Delay (s/veh)						29.1								0.0		
Approach LOS						D										

HCS7 Two-Way Stop-Control Report

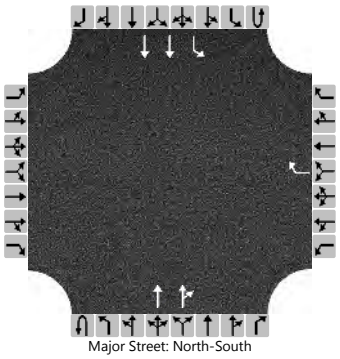
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/23/19
Analysis Year	2035
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at HS #1
Jurisdiction	Sioux Falls, SD
East/West Street	HS #1
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	1	0	0	2	0	0	1	2	0
Configuration								R			T	TR		L	T	
Volume (veh/h)								10			955	15	0	0	1570	
Percent Heavy Vehicles (%)								2					2	2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized						No										
Median Type | Storage						Undivided										

Critical and Follow-up Headways

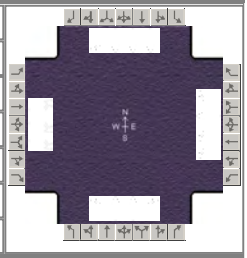
Base Critical Headway (sec)								6.9						4.1		
Critical Headway (sec)								6.94						4.14		
Base Follow-Up Headway (sec)								3.3						2.2		
Follow-Up Headway (sec)								3.32						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)								11						0		
Capacity, c (veh/h)								487						643		
v/c Ratio								0.02						0.00		
95% Queue Length, Q_{95} (veh)								0.1						0.0		
Control Delay (s/veh)								12.6						10.6		
Level of Service (LOS)								B						B		
Approach Delay (s/veh)						12.6								0.0		
Approach LOS						B										

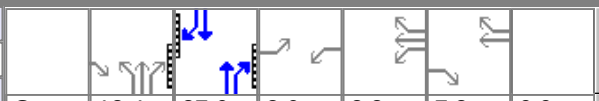
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 1, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	41st St/SB I-229	File Name	14-16 Alt-1 Cliff Avenue 2035 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				

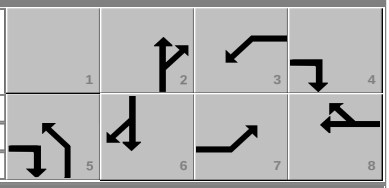


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	120		110	325	140	95	180	1720	440		745	100

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	71	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	12.4	37.6	8.6	3.3	7.3	0.0
Yellow	3.6	3.6	3.6	0.0	3.6	0.0
Red	1.0	2.5	1.5	0.0	1.5	0.0



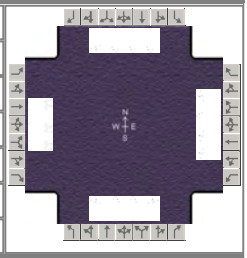
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2		6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0		7.3
Phase Duration, s	13.7	12.4	17.0	15.7	17.0	60.7		43.7
Change Period, ($Y+R_c$), s	5.1	5.1	5.1	5.1	4.6	6.1		6.1
Max Allow Headway (*MAH*), s	3.1	5.2	3.2	5.2	5.2	0.0		0.0
Queue Clearance Time (g_s), s	8.8	5.3	11.4	9.4	12.1			
Green Extension Time (g_e), s	0.1	1.2	0.5	1.1	0.3	0.0		0.0
Phase Call Probability	0.96	1.00	1.00	1.00	0.99			
Max Out Probability	0.03	0.28	0.15	0.38	1.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14	3	8	18	5	2	12		6	16
Adjusted Flow Rate (*v*), veh/h	133		122	361	156	50	200	1911	378		999	101
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734		1366	1684	1821	1568	1734	1734	1610		1654	
Queue Service Time (g_s), s	6.8		3.3	9.4	7.4	2.6	10.1	43.5	10.9		11.0	
Cycle Queue Clearance Time (g_c), s	6.8		3.3	9.4	7.4	2.6	10.1	43.5	10.9		11.0	
Green Ratio (*g/C*)	0.10		0.22	0.13	0.12	0.12	0.14	0.61	0.61		0.42	
Capacity (*c*), veh/h	165		596	444	213	184	239	2103	977		2073	
Volume-to-Capacity Ratio (*X*)	0.808		0.205	0.813	0.729	0.272	0.838	0.909	0.387		0.482	
Back of Queue (*Q*), ft/ln (95 th percentile)	136.3		48.9	184.1	167.1	47.1	230.6	602.2	168.2		166.8	
Back of Queue (*Q*), veh/ln (95 th percentile)	5.4		1.9	7.2	6.6	1.9	9.1	23.7	6.7		6.6	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00		0.10	0.37	0.00	0.16	0.46	0.00	0.56		0.00	
Uniform Delay (d_1), s/veh	39.9		28.8	38.0	38.3	36.2	37.8	15.5	9.1		14.1	
Incremental Delay (d_2), s/veh	3.5		0.2	3.6	6.6	1.1	16.3	7.2	1.2		0.7	
Initial Queue Delay (d_3), s/veh	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	
Control Delay (*d*), s/veh	43.4		29.0	41.6	45.0	37.3	54.1	22.8	10.3		14.8	0.0
Level of Service (LOS)	D		C	D	D	D	D	C	B		B	A
Approach Delay, s/veh / LOS	36.6		D	42.1		D	23.4		C	13.5		B
Intersection Delay, s/veh / LOS	24.1						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.74	C	2.49	B	2.31	B	2.10	B
Bicycle LOS Score / LOS		F	1.42	A	2.54	C	0.99	A

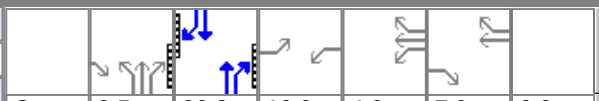
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 1, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2035	Analysis Period	1> 16:30
Intersection	41st St/SB I-229	File Name	14-16 Alt-1 Cliff Avenue 2035 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				

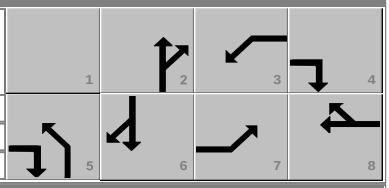


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	170		240	485	145	90	135	710	170		1435	165

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	62	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	9.5	36.8	10.9	4.0	7.9	0.0
Yellow	3.6	3.6	3.6	0.0	3.6	0.0
Red	1.0	2.5	1.5	0.0	1.5	0.0



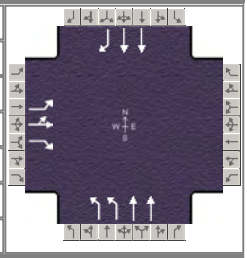
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2		6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0		7.3
Phase Duration, s	16.0	13.0	20.0	17.0	14.1	57.0		42.9
Change Period, ($Y+R_c$), s	5.1	5.1	5.1	5.1	4.6	6.1		6.1
Max Allow Headway (*MAH*), s	3.1	5.3	3.2	5.3	5.2	0.0		0.0
Queue Clearance Time (g_s), s	11.7	9.9	16.3	9.6	9.6			
Green Extension Time (g_e), s	0.0	0.0	0.0	0.7	0.1	0.0		0.0
Phase Call Probability	0.99	1.00	1.00	1.00	0.98			
Max Out Probability	1.00	1.00	1.00	1.00	1.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14	3	8	18	5	2	12		6	16
Adjusted Flow Rate (*v*), veh/h	189		267	539	161	61	150	789	133		1998	230
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734		1366	1684	1821	1568	1734	1734	1610		1654	
Queue Service Time (g_s), s	9.7		7.9	14.3	7.6	3.2	7.6	11.5	3.5		35.5	
Cycle Queue Clearance Time (g_c), s	9.7		7.9	14.3	7.6	3.2	7.6	11.5	3.5		35.5	
Green Ratio (*g/C*)	0.12		0.19	0.17	0.13	0.13	0.53	0.57	0.57		0.41	
Capacity (*c*), veh/h	210		528	558	241	207	183	1961	911		2028	
Volume-to-Capacity Ratio (*X*)	0.899		0.505	0.966	0.669	0.295	0.819	0.402	0.146		0.985	
Back of Queue (*Q*), ft/ln (95 th percentile)	256.2		118.8	322.9	175.8	56.7	192.6	193.6	55.9		388	
Back of Queue (*Q*), veh/ln (95 th percentile)	10.1		4.7	12.7	6.9	2.3	7.6	7.6	2.2		15.3	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00		0.24	0.65	0.00	0.19	0.39	0.00	0.19		0.00	
Uniform Delay (d_1), s/veh	39.0		32.4	37.3	37.2	35.3	39.4	11.0	9.3		18.2	
Incremental Delay (d_2), s/veh	35.1		1.1	29.5	7.8	1.1	20.0	0.6	0.3		10.1	
Initial Queue Delay (d_3), s/veh	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	
Control Delay (*d*), s/veh	74.1		33.5	66.8	45.0	36.4	59.4	11.6	9.6		28.3	0.0
Level of Service (LOS)	E		C	E	D	D	E	B	A		C	A
Approach Delay, s/veh / LOS	50.4		D	59.7		E	18.1		B	25.4		C
Intersection Delay, s/veh / LOS	32.0						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.67	C	2.45	B	2.29	B	2.10	B
Bicycle LOS Score / LOS		F	1.74	B	1.37	A	1.47	A

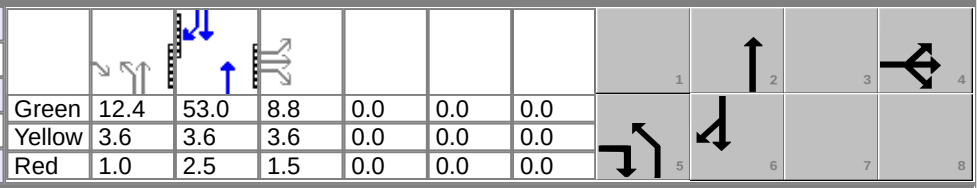
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 1, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	41st St	File Name	14-16 Alt-6 Cliff Avenue 2035 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	120	0	110				320	1815			745	100

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	84	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	12.4	53.0	8.8	0.0	0.0	0.0		
Yellow	3.6	3.6	3.6	0.0	0.0	0.0		
Red	1.0	2.5	1.5	0.0	0.0	0.0		

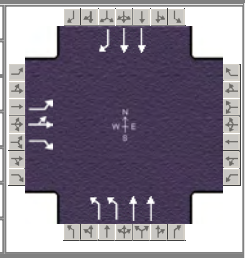
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			5	2		6
Case Number		9.0			2.0	4.0		7.3
Phase Duration, s		13.9			17.0	76.1		59.1
Change Period, ($Y+R_c$), s		5.1			4.6	6.1		6.1
Max Allow Headway (*MAH*), s		5.3			5.2	0.0		0.0
Queue Clearance Time (g_s), s		8.7			11.2			
Green Extension Time (g_e), s		0.1			1.3	0.0		0.0
Phase Call Probability		0.99			1.00			
Max Out Probability		1.00			0.44			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14				5	2			6	16
Adjusted Flow Rate (*v*), veh/h	67	0	144				356	2017			999	101
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1850	1632				1684	1734			1734	1568
Queue Service Time (g_s), s	3.2	0.0	6.7				9.2	27.8			13.7	3.0
Cycle Queue Clearance Time (g_c), s	3.2	0.0	6.7				9.2	27.8			13.7	3.0
Green Ratio (*g/C*)	0.10	0.10	0.24				0.14	0.78			0.59	0.59
Capacity (*c*), veh/h	169	180	372				465	2698			2042	923
Volume-to-Capacity Ratio (*X*)	0.395	0.000	0.388				0.765	0.747			0.489	0.109
Back of Queue (*Q*), ft/ln (95 th percentile)	66.3	0	120.2				181.2	292.7			203.3	46.5
Back of Queue (*Q*), veh/ln (95 th percentile)	2.6	0.0	4.7				7.1	11.5			8.0	1.9
Queue Storage Ratio (*RQ*) (95 th percentile)	0.33	0.00	0.34				0.60	0.00			0.00	0.46
Uniform Delay (d_1), s/veh	38.1	0.0	28.9				37.4	5.3			9.3	10.0
Incremental Delay (d_2), s/veh	2.1	0.0	0.9				3.9	1.9			0.8	0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0				0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	40.2	0.0	29.8				41.3	7.2			10.0	10.2
Level of Service (LOS)	D		C				D	A			B	B
Approach Delay, s/veh / LOS	33.1	C		0.0			12.3	B		10.0	B	
Intersection Delay, s/veh / LOS	12.8						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.61	C	2.35	B	1.38	A	2.30	B
Bicycle LOS Score / LOS	0.84	A		A	2.35	B	1.24	A

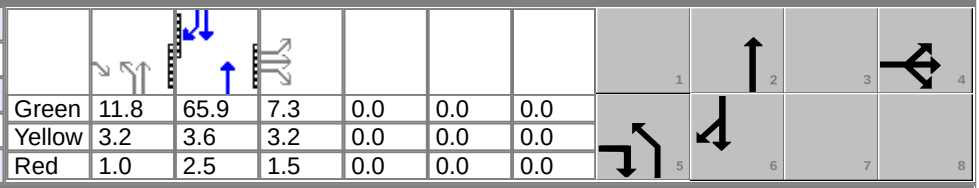
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 1, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2035	Analysis Period	1> 16:30
Intersection	41st St	File Name	14-16 Alt-6 Cliff Avenue 2035 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	180	0	250				340	995			1570	190

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	80	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	11.8	65.9	7.3	0.0	0.0	0.0						
Yellow	3.2	3.6	3.2	0.0	0.0	0.0						
Red	1.0	2.5	1.5	0.0	0.0	0.0						

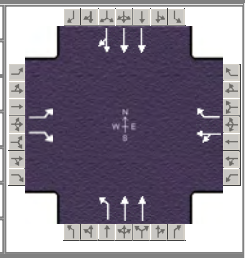
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			5	2		6
Case Number		9.0			2.0	4.0		7.3
Phase Duration, s		12.0			16.0	88.0		72.0
Change Period, ($Y+R_c$), s		4.7			4.2	6.1		6.1
Max Allow Headway (*MAH*), s		5.3			5.2	0.0		0.0
Queue Clearance Time (g_s), s		9.3			13.1			
Green Extension Time (g_e), s		0.0			0.0	0.0		0.0
Phase Call Probability		1.00			1.00			
Max Out Probability		1.00			1.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14				5	2			6	16
Adjusted Flow Rate (*v*), veh/h	100	0	267				378	1106			2252	237
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1850	1615				1684	1734			1734	1568
Queue Service Time (g_s), s	5.7	0.0	7.3				11.1	8.5			59.2	1.4
Cycle Queue Clearance Time (g_c), s	5.7	0.0	7.3				11.1	8.5			59.2	1.4
Green Ratio (*g/C*)	0.07	0.07	0.19				0.76	0.82			0.66	0.66
Capacity (*c*), veh/h	127	135	300				397	2840			2285	1033
Volume-to-Capacity Ratio (*X*)	0.790	0.000	0.889				0.950	0.389			0.986	0.229
Back of Queue (*Q*), ft/ln (95 th percentile)	156.5	0	334.7				268.3	86.6			291	20.1
Back of Queue (*Q*), veh/ln (95 th percentile)	6.2	0.0	13.2				10.6	3.4			11.5	0.8
Queue Storage Ratio (*RQ*) (95 th percentile)	0.78	0.00	0.96				0.89	0.00			0.00	0.20
Uniform Delay (d_1), s/veh	45.6	0.0	39.3				43.8	2.4			6.0	1.3
Incremental Delay (d_2), s/veh	29.0	0.0	26.5				32.8	0.4			12.5	0.4
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0				0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	74.6	0.0	65.8				76.6	2.8			18.5	1.7
Level of Service (LOS)	E		E				E	A			B	A
Approach Delay, s/veh / LOS	68.2	E		0.0			21.6	C		16.9	B	
Intersection Delay, s/veh / LOS	22.9						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.61	C	2.35	B	1.37	A	2.37	B
Bicycle LOS Score / LOS	1.09	A		A	1.62	B	2.08	B

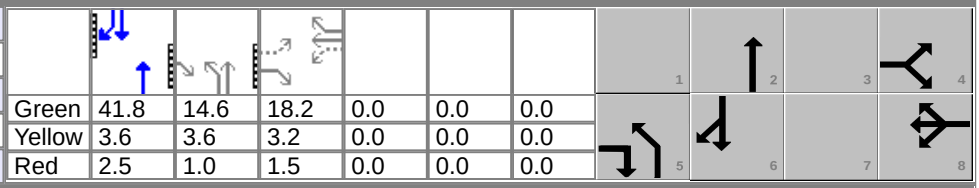
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 1, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	41st St/SB I-229	File Name	14-16 Alt-7 Cliff Avenue 2035 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	120		110	0	140	95	180	1720			745	100

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	22	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	41.8	14.6	18.2	0.0	0.0	0.0		
Yellow	3.6	3.6	3.2	0.0	0.0	0.0		
Red	2.5	1.0	1.5	0.0	0.0	0.0		

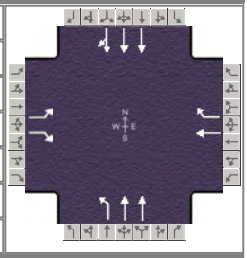
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2		6
Case Number		5.0		7.0	2.0	4.0		8.3
Phase Duration, s		22.9		22.9	19.2	67.1		47.9
Change Period, ($Y+R_c$), s		4.7		4.7	6.1	6.1		6.1
Max Allow Headway (*MAH*), s		4.2		4.2	5.2	0.0		0.0
Queue Clearance Time (g_s), s		18.2		8.7	12.0			
Green Extension Time (g_e), s		0.0		1.3	1.1	0.0		0.0
Phase Call Probability		1.00		1.00	0.99			
Max Out Probability		1.00		0.12	1.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14	3	8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h	133		78		0	106	200	1911			745	355
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1231		1543		0	1568	1734	1734			1821	1733
Queue Service Time (g_s), s	9.5		3.1		0.0	5.2	10.0	35.7			10.2	4.6
Cycle Queue Clearance Time (g_c), s	16.2		3.1		0.0	5.2	10.0	35.7			10.2	4.6
Green Ratio (*g/C*)	0.20		0.35			0.20	0.15	0.68			0.46	0.46
Capacity (*c*), veh/h	238		539			318	254	2348			1687	802
Volume-to-Capacity Ratio (*X*)	0.560		0.144		0.000	0.332	0.787	0.814			0.442	0.443
Back of Queue (*Q*), ft/ln (95 th percentile)	138.8		50.5		0	87.7	230	452.1			63.6	68
Back of Queue (*Q*), veh/ln (95 th percentile)	5.5		2.0		0.0	3.5	9.1	17.8			2.5	2.7
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00		0.14		0.00	0.29	0.77	0.00			0.00	0.00
Uniform Delay (d_1), s/veh	38.4		20.1			30.7	37.1	10.4			4.1	4.1
Incremental Delay (d_2), s/veh	3.7		0.2		0.0	0.2	15.8	3.2			0.8	1.6
Initial Queue Delay (d_3), s/veh	0.0		0.0		0.0	0.0	0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	42.0		20.2			30.9	52.8	13.7			4.9	5.7
Level of Service (LOS)	D		C			C	D	B			A	A
Approach Delay, s/veh / LOS	34.0		C	31.3		C	17.4		B	5.2		A
Intersection Delay, s/veh / LOS	15.7						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.59	C	2.33	B	1.63	B	1.99	B
Bicycle LOS Score / LOS		F	0.92	A	2.14	B	0.99	A

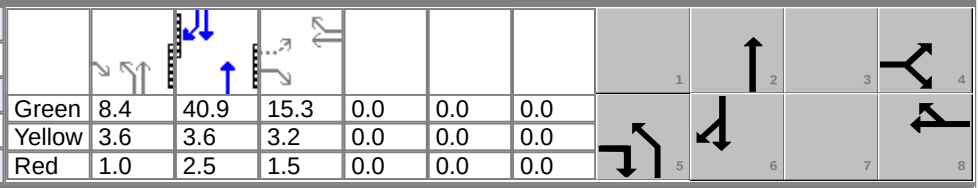
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 1, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2035	Analysis Period	1> 16:30
Intersection	41st St/SB I-229	File Name	14-16 Alt-7 Cliff Avenue 2035 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	170		240		145	90	135	710			1435	165

Signal Information			
Cycle, s	80.0	Reference Phase	2
Offset, s	65	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	8.4	40.9	15.3	0.0	0.0	0.0
Yellow	3.6	3.6	3.2	0.0	0.0	0.0
Red	1.0	2.5	1.5	0.0	0.0	0.0

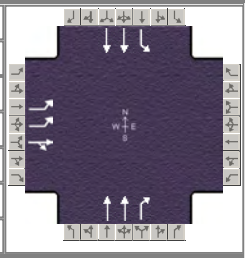
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2		6
Case Number		5.0		7.0	2.0	4.0		8.3
Phase Duration, s		20.0		20.0	13.0	60.0		47.0
Change Period, ($Y+R_c$), s		4.7		4.7	4.6	6.1		6.1
Max Allow Headway (*MAH*), s		3.3		3.3	3.2	0.0		0.0
Queue Clearance Time (g_s), s		17.3		8.3	8.8			
Green Extension Time (g_e), s		0.0		1.0	0.0	0.0		0.0
Phase Call Probability		1.00		1.00	0.96			
Max Out Probability		1.00		0.20	1.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14		8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h	189		222		161	100	150	789			1484	716
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1225		1543		1821	1568	1734	1734			1821	1736
Queue Service Time (g_s), s	9.0		9.5		6.3	4.4	6.8	7.7			18.8	26.4
Cycle Queue Clearance Time (g_c), s	15.3		9.5		6.3	4.4	6.8	7.7			18.8	26.4
Green Ratio (*g/C*)	0.19		0.30		0.19	0.19	0.11	0.67			0.51	0.51
Capacity (*c*), veh/h	228		457		348	300	182	2336			1862	887
Volume-to-Capacity Ratio (*X*)	0.828		0.486		0.463	0.334	0.824	0.338			0.797	0.807
Back of Queue (*Q*), ft/ln (95 th percentile)	216.8		150.2		123.5	73.5	183.2	107.5			316.5	353.3
Back of Queue (*Q*), veh/ln (95 th percentile)	8.5		5.9		4.9	2.9	7.2	4.2			12.5	14.1
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00		0.43		0.00	0.25	0.61	0.00			0.00	0.00
Uniform Delay (d_1), s/veh	36.7		23.1		28.7	27.9	35.1	5.5			12.9	14.3
Incremental Delay (d_2), s/veh	20.5		0.3		0.4	0.2	24.0	0.4			2.5	5.3
Initial Queue Delay (d_3), s/veh	0.0		0.0		0.0	0.0	0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	57.2		23.4		29.1	28.2	59.0	5.9			15.4	19.7
Level of Service (LOS)	E		C		C	C	E	A			B	B
Approach Delay, s/veh / LOS	39.0	D		28.7	C		14.4	B		16.8	B	
Intersection Delay, s/veh / LOS	19.4						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.58	C	2.32	B	1.63	B	1.94	B
Bicycle LOS Score / LOS		F	0.92	A	1.17	A	1.45	A

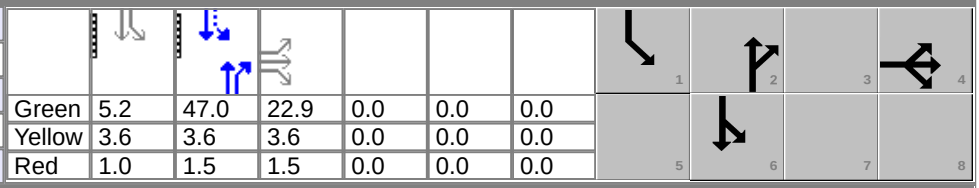
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 1, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	I-229 South Ramp	File Name	14-16 Alt-1 Cliff Avenue 2035 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	605	0	200					1735	450	120	815	

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	73	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	5.2	47.0	22.9	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.0	1.5	1.5	0.0	0.0	0.0

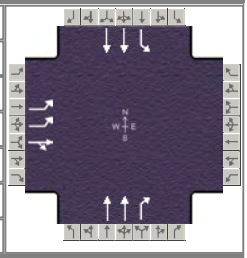
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4				2	1	6
Case Number		10.0				7.3	1.0	4.0
Phase Duration, s		28.0				52.1	9.8	62.0
Change Period, ($Y+R_c$), s		5.1				5.1	4.6	5.1
Max Allow Headway (*MAH*), s		5.2				0.0	5.2	0.0
Queue Clearance Time (g_s), s		18.7					5.0	
Green Extension Time (g_e), s		4.2				0.0	0.5	0.0
Phase Call Probability		1.00					0.96	
Max Out Probability		0.40					0.01	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14					2	12	1	6	
Adjusted Flow Rate (*v*), veh/h	672	167						1699	367	133	906	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1470						1793	1505	1734	1708	
Queue Service Time (g_s), s	16.7	8.6						32.7	6.4	3.0	11.9	
Cycle Queue Clearance Time (g_c), s	16.7	8.6						32.7	6.4	3.0	11.9	
Green Ratio (*g/C*)	0.25	0.25						0.52	0.52	0.60	0.63	
Capacity (*c*), veh/h	858	375						1874	786	227	2159	
Volume-to-Capacity Ratio (*X*)	0.783	0.445						0.907	0.467	0.588	0.420	
Back of Queue (*Q*), ft/ln (95 th percentile)	288.1	140.9						202.9	69	75.4	186.5	
Back of Queue (*Q*), veh/ln (95 th percentile)	11.3	5.5						8.0	2.7	3.0	7.3	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.52	0.00						0.00	0.28	0.25	0.00	
Uniform Delay (d_1), s/veh	31.2	28.2						8.9	4.5	18.6	8.3	
Incremental Delay (d_2), s/veh	3.3	1.2						3.0	0.7	3.4	0.6	
Initial Queue Delay (d_3), s/veh	0.0	0.0						0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	34.5	29.4						11.9	5.1	22.0	8.9	
Level of Service (LOS)	C	C						B	A	C	A	
Approach Delay, s/veh / LOS	33.5	C		0.0			10.7	B		10.6	B	
Intersection Delay, s/veh / LOS	15.5						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.42	B	2.31	B	1.37	A	1.94	B
Bicycle LOS Score / LOS	1.87	B			2.42	B	1.34	A

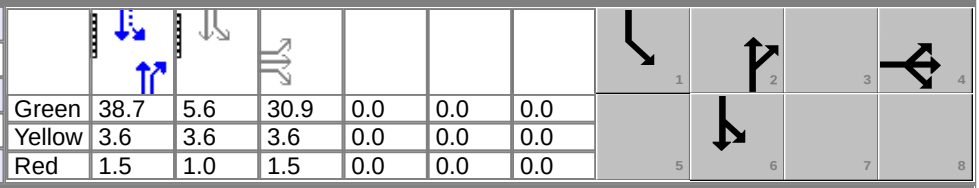
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 1, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2035	Analysis Period	1> 16:30
Intersection	I-229 South Ramp	File Name	14-16 Alt-1 Cliff Avenue 2035 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	240	0	550					775	240	120	1455	

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	44	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	38.7	5.6	30.9	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.5	1.0	1.5	0.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4				2	1	6
Case Number		10.0				7.3	1.0	4.0
Phase Duration, s		36.0				43.8	10.2	54.0
Change Period, ($Y+R_c$), s		5.1				5.1	5.1	5.1
Max Allow Headway (*MAH*), s		5.3				0.0	5.2	0.0
Queue Clearance Time (g_s), s		26.4					2.0	
Green Extension Time (g_e), s		4.5				0.0	3.3	0.0
Phase Call Probability		1.00					0.96	
Max Out Probability		0.13					1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14					2	12	1	6	
Adjusted Flow Rate (*v*), veh/h	267	444						821	191	133	1617	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1519						1699	1474	1734	1784	
Queue Service Time (g_s), s	5.1	24.4						14.4	5.8	0.0	34.1	
Cycle Queue Clearance Time (g_c), s	5.1	24.4						14.4	5.8	0.0	34.1	
Green Ratio (*g/C*)	0.34	0.34						0.43	0.43	0.46	0.54	
Capacity (*c*), veh/h	1157	522						1461	634	344	1938	
Volume-to-Capacity Ratio (*X*)	0.231	0.852						0.562	0.301	0.388	0.834	
Back of Queue (*Q*), ft/ln (95 th percentile)	90.5	374.5						213.1	86.3	115	506.1	
Back of Queue (*Q*), veh/ln (95 th percentile)	3.6	14.7						8.4	3.4	4.5	19.9	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.16	0.00						0.00	0.35	0.38	0.00	
Uniform Delay (d_1), s/veh	21.1	27.4						15.2	11.6	27.2	17.2	
Incremental Delay (d_2), s/veh	0.1	8.0						1.4	1.1	1.0	4.4	
Initial Queue Delay (d_3), s/veh	0.0	0.0						0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	21.2	35.4						16.6	12.7	28.2	21.6	
Level of Service (LOS)	C	D						B	B	C	C	
Approach Delay, s/veh / LOS	30.1	C		0.0			15.8	B		22.1	C	
Intersection Delay, s/veh / LOS	21.9						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.40	B	2.31	B	1.43	A	2.10	B
Bicycle LOS Score / LOS	1.66	B			1.36	A	1.93	B

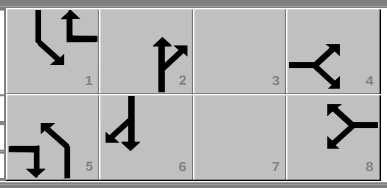
HCS7 Interchanges Results Summary

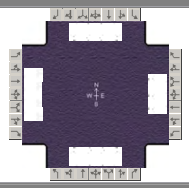
General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	SPUI
Analyst	Graham Johnson	Analysis Date	Apr 1, 2019	Segment Distance, ft	
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 SPUI	PHF	0.90	Arterial Direction	North-South
File Name	14-16 Alt-6 Cliff Avenue 2035 AM.xus				
Project Description	BUILD - I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection Demand (v), veh/h	605		200	325		235	440	1295	450	120	490	245

Signal Information	
Cycle, s	90.0
Offset, s	33
Uncoordinated	No
Force Mode	Fixed

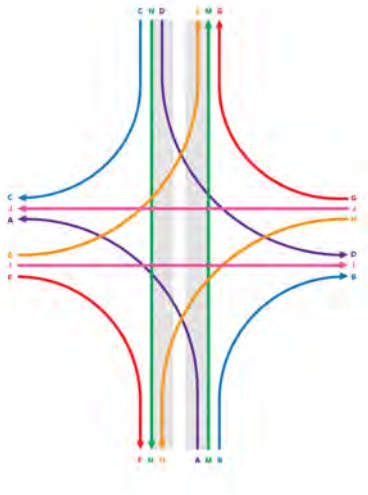
Green	8.8	11.6	30.6	19.6	0.0	0.0
Yellow	3.6	3.6	3.6	3.6	0.0	0.0
Red	1.0	1.0	1.5	1.5	0.0	0.0





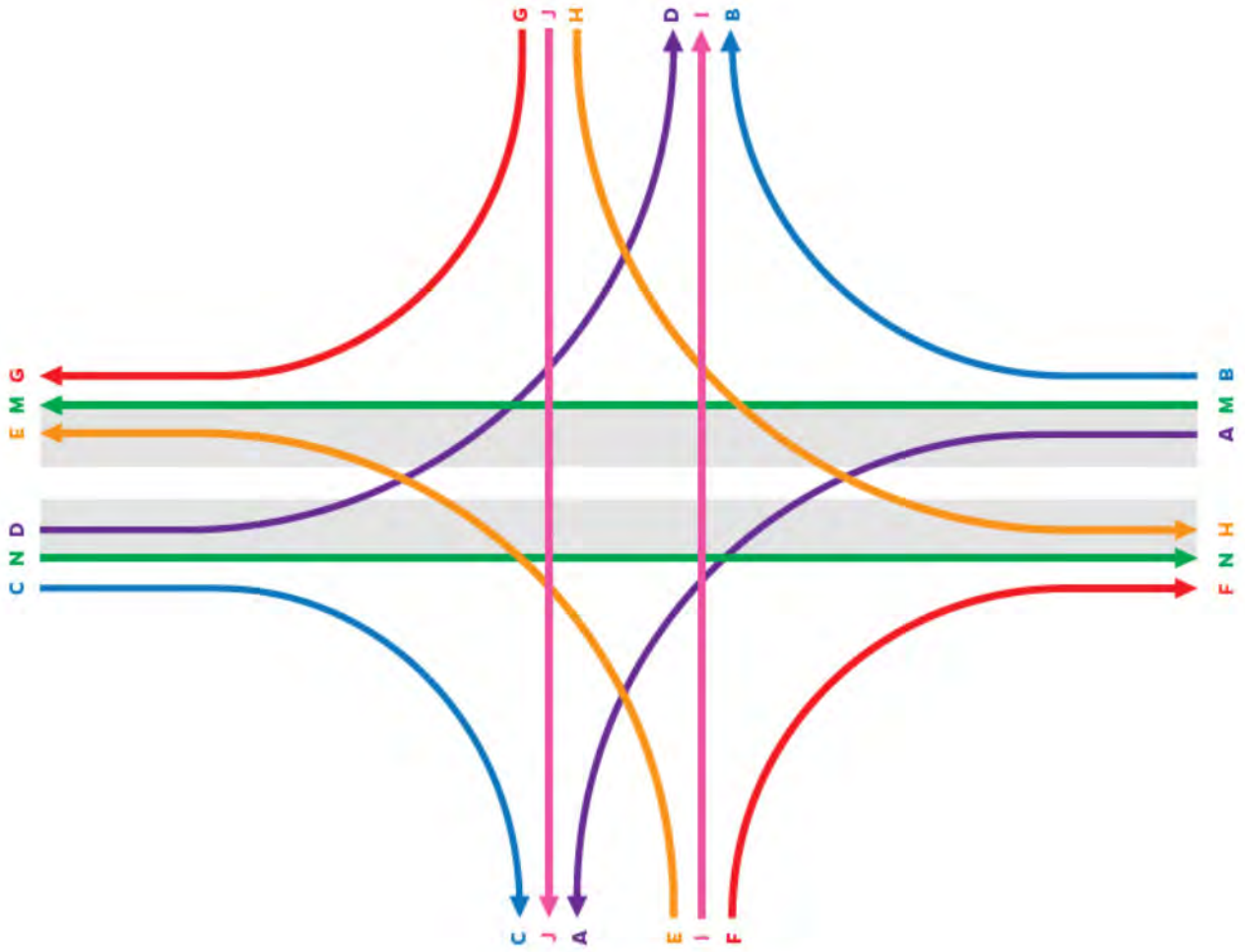
Interchange Results

O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	361	30.8	0.0	30.8	No	No	C
B	261	26.4	0.0	26.4	No	No	B
C	222	12.6	0.0	12.6	No	No	A
D	672	37.9	0.0	37.9	No	No	C
E	444	42.4	0.0	42.4	No	No	C
F	454	0.0	0.0	0.0	No	No	A
G	272	0.0	0.0	0.0	No	No	A
H	133	50.5	0.0	50.5	No	No	C
I	1307	25.0	0.0	25.0	No	No	B
J	544	24.9	0.0	24.9	No	No	B
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	37.9		12.6	30.8		26.4	42.4	25.0	0.0	50.5	24.9	0.0
Level of Service (LOS)	D		B	C		C	D	C	A	D	C	A
Approach Delay, s/veh / LOS	31.6	C		29.0	C		23.4	C		21.3	C	
Intersection Delay, s/veh / LOS	25.3						C					

Interchange Graphic



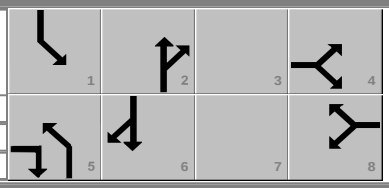
HCS7 Interchanges Results Summary

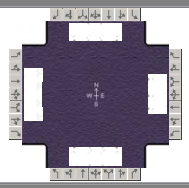
General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	SPUI
Analyst	Graham Johnson	Analysis Date	Apr 1, 2019	Segment Distance, ft	
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 SPUI	PHF	0.90	Arterial Direction	North-South
File Name	14-16 Alt-6 Cliff Avenue 2035 PM.xus				
Project Description	BUILD - I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection Demand (v), veh/h	270		650	580		330	185	735	285	130	1035	655

Signal Information	
Cycle, s	100.0
Offset, s	33
Uncoordinated	No
Force Mode	Fixed

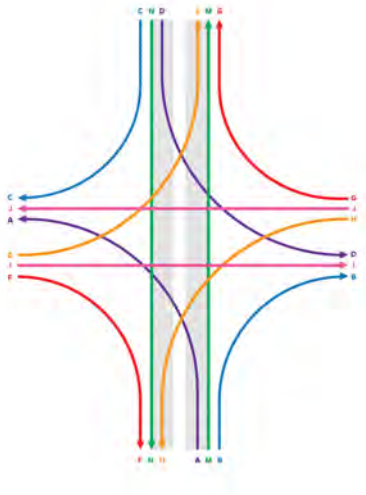
Green	10.5	2.8	38.7	33.1	0.0	0.0
Yellow	3.6	0.0	3.6	3.6	0.0	0.0
Red	1.0	0.0	1.5	1.5	0.0	0.0





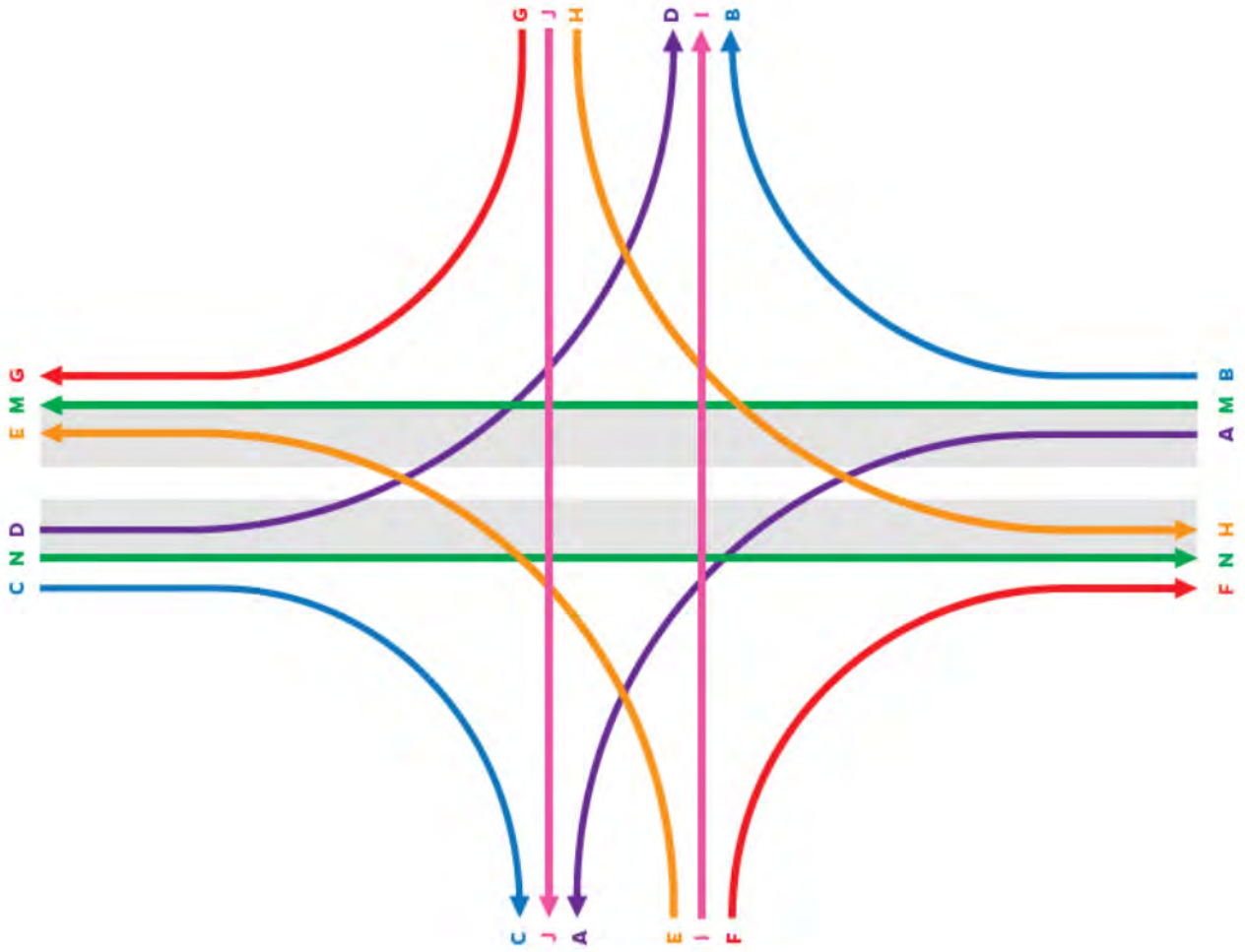
Interchange Results

O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	644	27.6	0.0	27.6	No	No	B
B	367	31.7	0.0	31.7	No	No	C
C	722	20.3	0.0	20.3	No	No	B
D	300	24.6	0.0	24.6	No	No	B
E	198	46.0	0.0	46.0	No	No	C
F	305	0.0	0.0	0.0	No	No	A
G	728	0.0	0.0	0.0	Yes	No	F
H	144	54.0	0.0	54.0	No	No	C
I	785	20.1	0.0	20.1	No	No	B
J	1150	34.8	0.0	34.8	No	No	C
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	24.6		20.3	27.6		31.7	46.0	20.1	0.0	54.0	34.8	0.0
Level of Service (LOS)	C		C	C		C	D	C	A	D	C	A
Approach Delay, s/veh / LOS	21.5	C		29.1	C		19.3	B		23.6	C	
Intersection Delay, s/veh / LOS	23.2						C					

Interchange Graphic



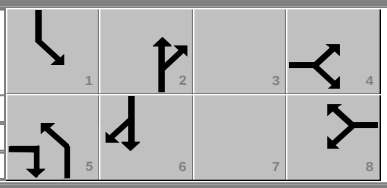
HCS7 Interchanges Results Summary

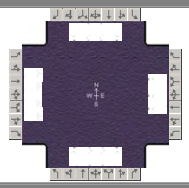
General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	SPUI
Analyst	Graham Johnson	Analysis Date	Apr 1, 2019	Segment Distance, ft	
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 SPUI	PHF	0.90	Arterial Direction	North-South
File Name	14-16 Alt-7 Cliff Avenue 2035 AM.xus				
Project Description	BUILD - I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection Demand (v), veh/h	605		200	325		0	440	1295	450	120	490	245

Signal Information	
Cycle, s	90.0
Offset, s	33
Uncoordinated	No
Force Mode	Fixed

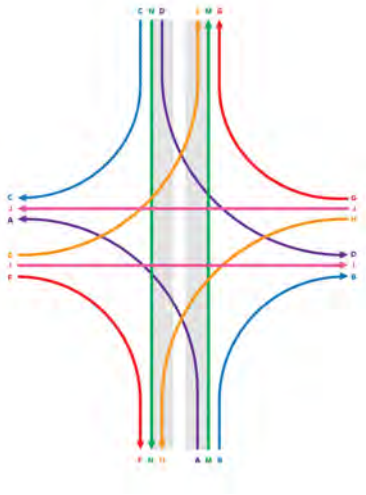
Green	8.6	18.5	24.6	18.9	0.0	0.0
Yellow	3.6	3.6	3.6	3.6	0.0	0.0
Red	1.0	1.5	1.0	1.5	0.0	0.0





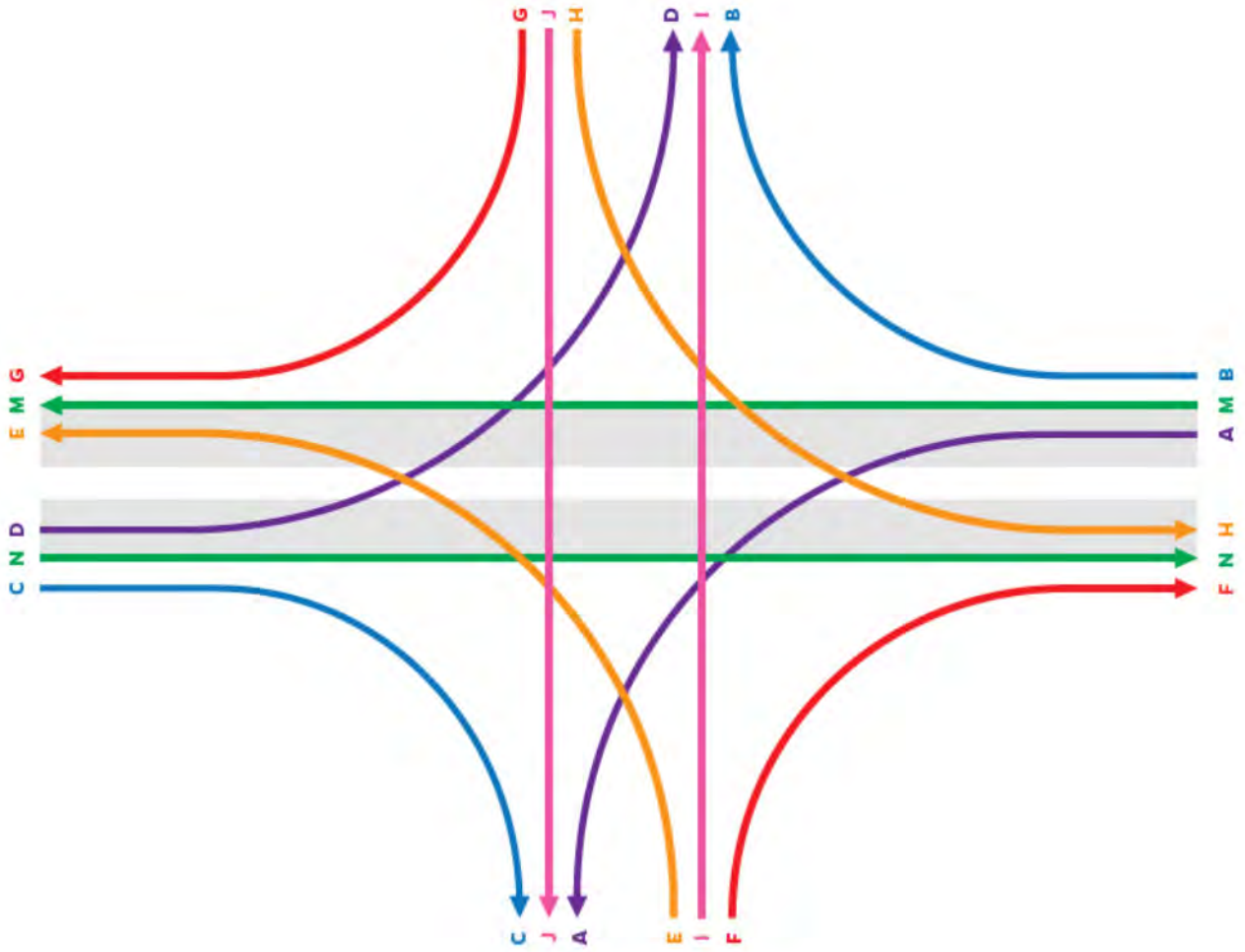
Interchange Results

O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	361	31.5	0.0	31.5	No	No	C
B	0	0.0	0.0	0.0	No	No	A
C	222	13.4	0.0	13.4	No	No	A
D	672	39.5	0.0	39.5	No	No	C
E	433	47.8	0.0	47.8	No	No	C
F	443	0.0	0.0	0.0	No	No	A
G	272	0.0	0.0	0.0	No	No	A
H	133	60.1	0.0	60.1	No	No	D
I	1274	10.6	0.0	10.6	No	No	A
J	544	23.9	0.0	23.9	No	No	B
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	39.5		13.4	31.5		0.0	47.8	10.6	0.0	60.1	23.9	0.0
Level of Service (LOS)	D		B	C			D	B	A	E	C	A
Approach Delay, s/veh / LOS	33.1	C		31.5	C		15.9	B		22.1	C	
Intersection Delay, s/veh / LOS	22.1						C					

Interchange Graphic



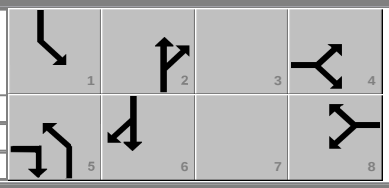
HCS7 Interchanges Results Summary

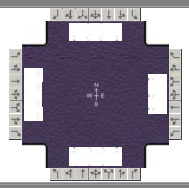
General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	SPUI
Analyst	Graham Johnson	Analysis Date	Apr 1, 2019	Segment Distance, ft	
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 SPUI	PHF	0.90	Arterial Direction	North-South
File Name	14-16 Alt-7 Cliff Avenue 2035 PM.xus				
Project Description	BUILD - I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection Demand (v), veh/h	240		550	485		0	170	605	240	120	970	585

Signal Information	
Cycle, s	80.0
Offset, s	33
Uncoordinated	No
Force Mode	Fixed

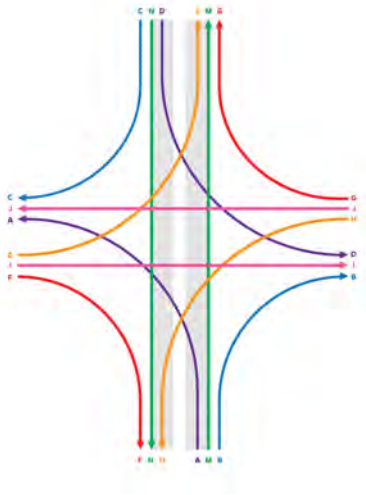
Green	7.9	2.2	40.2	14.9	0.0	0.0
Yellow	3.6	0.0	3.6	3.6	0.0	0.0
Red	1.0	0.0	1.5	1.5	0.0	0.0





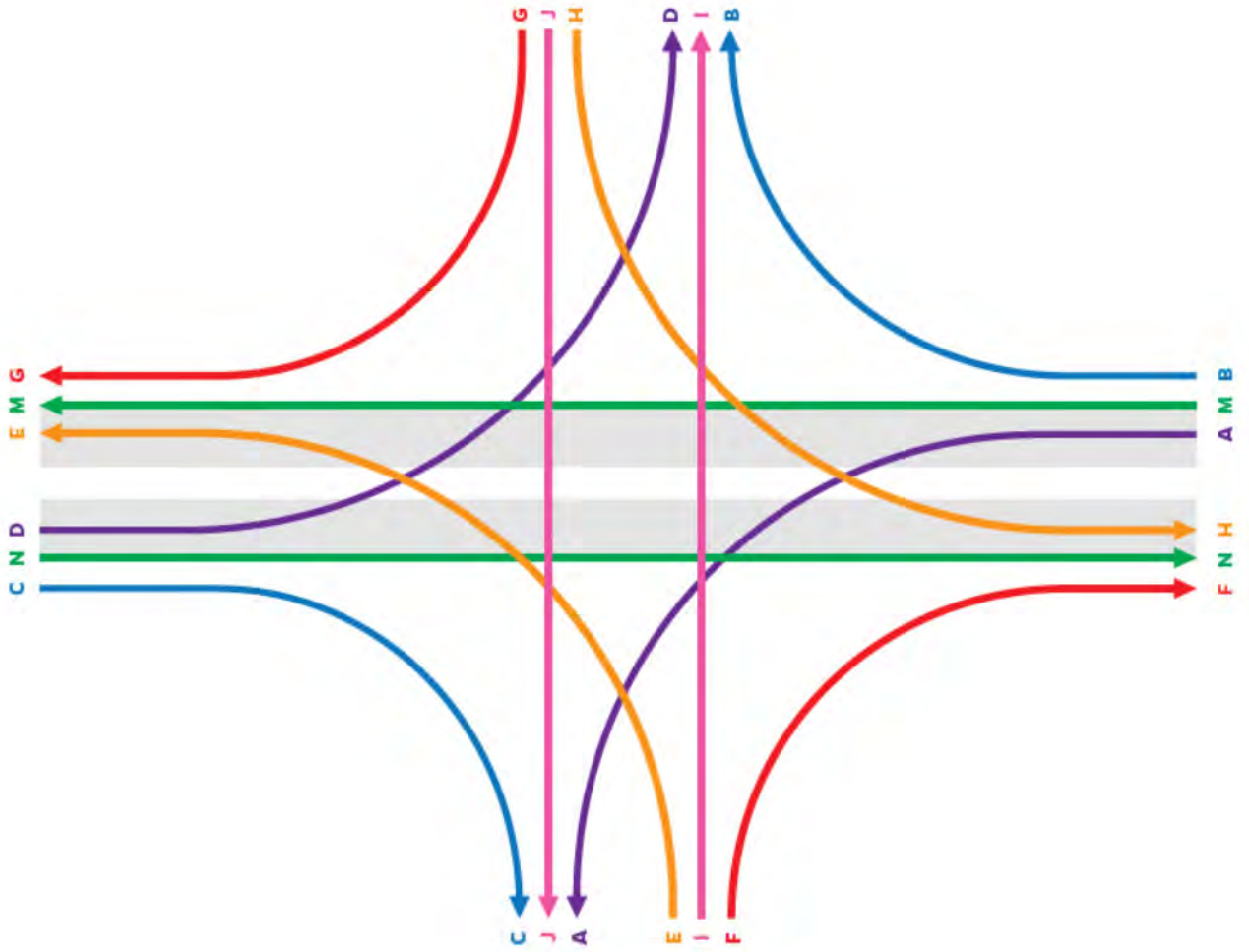
Interchange Results

O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	539	33.1	0.0	33.1	No	No	C
B	0	0.0	0.0	0.0	No	No	A
C	611	28.7	0.0	28.7	No	No	B
D	267	29.0	0.0	29.0	No	No	B
E	181	39.6	0.0	39.6	No	No	C
F	255	0.0	0.0	0.0	No	No	A
G	650	0.0	0.0	0.0	No	No	A
H	133	45.5	0.0	45.5	No	No	C
I	642	9.4	0.0	9.4	No	No	A
J	1078	16.2	0.0	16.2	No	No	B
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	29.0		28.7	33.1		0.0	39.6	9.4	0.0	45.5	16.2	0.0
Level of Service (LOS)	C		C	C			D	A	A	D	B	A
Approach Delay, s/veh / LOS	28.8	C		33.1	C		12.3	B		12.6	B	
Intersection Delay, s/veh / LOS	18.3						B					

Interchange Graphic



HCS7 Two-Way Stop-Control Report

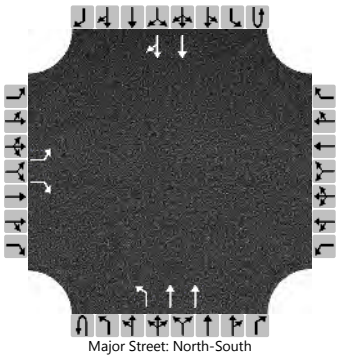
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/23/19
Analysis Year	2035
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at Spencer Park
Jurisdiction	Sioux Falls, SD
East/West Street	Spencer Park Road
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration		L		R						L	T				T	TR
Volume (veh/h)		5		5					0	5	2180				1010	5
Percent Heavy Vehicles (%)		2		2					2	2						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized		No														
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5		6.9						4.1						
Critical Headway (sec)		6.84		6.94						4.14						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.52		3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		6		6						6						
Capacity, c (veh/h)		130		469						615						
v/c Ratio		0.04		0.01						0.01						
95% Queue Length, Q_{95} (veh)		0.1		0.0						0.0						
Control Delay (s/veh)		34.0		12.8						10.9						
Level of Service (LOS)		D		B						B						
Approach Delay (s/veh)		23.4								0.0						
Approach LOS		C														

HCS7 Two-Way Stop-Control Report

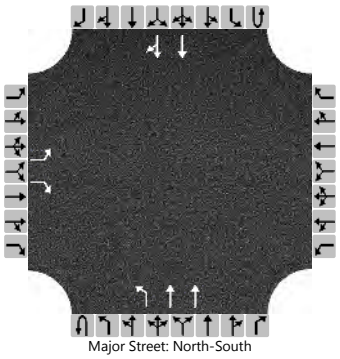
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/23/19
Analysis Year	2035
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at Spencer Park
Jurisdiction	Sioux Falls, SD
East/West Street	Spencer Park Road
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration		L		R						L	T				T	TR
Volume (veh/h)		5		20					0	20	1010				1975	30
Percent Heavy Vehicles (%)		2		2					2	2						
Proportion Time Blocked																
Percent Grade (%)	0															
Right Turn Channelized	No															
Median Type | Storage	Left Only								1							

Critical and Follow-up Headways

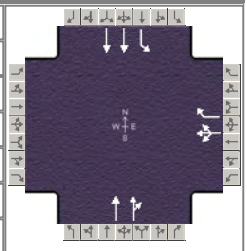
Base Critical Headway (sec)		7.5		6.9						4.1						
Critical Headway (sec)		6.84		6.94						4.14						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.52		3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		6		22						22						
Capacity, c (veh/h)		57		203						230						
v/c Ratio		0.10		0.11						0.10						
95% Queue Length, Q_{95} (veh)		0.3		0.4						0.3						
Control Delay (s/veh)		74.4		24.9						22.3						
Level of Service (LOS)		F		C						C						
Approach Delay (s/veh)	34.8								0.4							
Approach LOS	D															

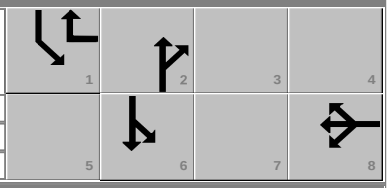
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	49th Street	File Name	18 Cliff at 49th 2035 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				40	0	760		1455	15	245	865	

Signal Information			
Cycle, s	123.5	Reference Phase	2
Offset, s	109	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	17.8	60.0	30.9	0.0	0.0	0.0						
Yellow	3.6	3.6	3.6	0.0	0.0	0.0						
Red	1.0	1.5	1.5	0.0	0.0	0.0						

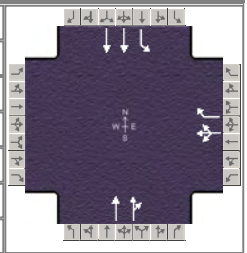
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase				8		2	1	6
Case Number				11.0		8.3	1.0	4.0
Phase Duration, s				36.0		65.1	22.4	87.5
Change Period, (*Y+R c*), s				5.1		5.1	4.6	5.1
Max Allow Headway (*MAH*), s				5.3		3.0	5.1	3.0
Queue Clearance Time (*g s*), s				27.0		83.5	16.3	17.2
Green Extension Time (*g e*), s				3.9		0.0	1.5	8.2
Phase Call Probability				1.00		1.00	1.00	1.00
Max Out Probability				0.03		1.00	0.00	0.03

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement				3	8	18		2	12	1	6	
Adjusted Flow Rate (*v*), veh/h					214	397		817	816	272	961	
Adjusted Saturation Flow Rate (*s*), veh/h/ln					1632	1585		1870	1864	1781	1781	
Queue Service Time (*g s*), s					15.8	25.0		81.5	49.4	14.3	15.2	
Cycle Queue Clearance Time (*g c*), s					15.8	25.0		81.5	49.4	14.3	15.2	
Green Ratio (*g/C*)					0.25	0.39		0.49	0.49	0.65	0.67	
Capacity (*c*), veh/h					408	625		909	905	315	2376	
Volume-to-Capacity Ratio (*X*)					0.525	0.635		0.900	0.901	0.864	0.404	
Back of Queue (*Q*), ft/ln (95 th percentile)					290.2	373.2		813.8	801.6	350.8	236.5	
Back of Queue (*Q*), veh/ln (95 th percentile)					11.6	14.7		32.0	32.1	13.8	9.3	
Queue Storage Ratio (*RQ*) (95 th percentile)					0.00	1.66		0.00	0.00	0.90	0.00	
Uniform Delay (*d 1*), s/veh					51.4	30.2		29.0	29.0	40.5	9.4	
Incremental Delay (*d 2*), s/veh					1.5	1.5		11.5	11.7	9.7	0.0	
Initial Queue Delay (*d 3*), s/veh					0.0	0.0		0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh					52.9	31.7		40.5	40.8	50.1	9.4	
Level of Service (LOS)					D	C		D	D	D	A	
Approach Delay, s/veh / LOS	0.0			39.2		D	40.6		D	18.4		B
Intersection Delay, s/veh / LOS	32.5						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.16	B	2.33	B	2.27	B	1.36	A
Bicycle LOS Score / LOS			1.50	A	1.84	B	1.51	B

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2035	Analysis Period	1> 16:30
Intersection	49th Street	File Name	18 Cliff at 49th 2035 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				50	0	225		740	60	560	1740	

Signal Information			
Cycle, s	82.6	Reference Phase	2
Offset, s	6	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4
Green	27.3	30.1	10.4	0.0	0.0	0.0	5	6	7	8
Yellow	3.6	3.6	3.6	0.0	0.0	0.0				
Red	1.0	1.5	1.5	0.0	0.0	0.0				

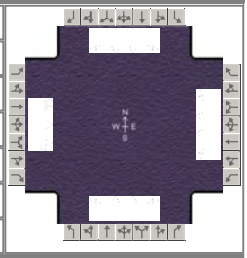
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase				8		2	1	6
Case Number				11.0		8.3	1.0	4.0
Phase Duration, s				15.5		35.2	31.9	67.1
Change Period, ($Y+R_c$), s				5.1		5.1	4.6	5.1
Max Allow Headway (*MAH*), s				5.2		3.0	5.1	3.0
Queue Clearance Time (g_s), s				9.6		27.3	22.9	26.5
Green Extension Time (g_e), s				0.8		2.8	4.4	9.6
Phase Call Probability				1.00		1.00	1.00	1.00
Max Out Probability				0.95		0.24	0.01	0.23

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement				3	8	18		2	12	1	6	
Adjusted Flow Rate (*v*), veh/h					156	150		450	438	622	1933	
Adjusted Saturation Flow Rate (*s*), veh/h/ln					1665	1585		1870	1821	1781	1781	
Queue Service Time (g_s), s					7.6	7.6		25.3	16.7	20.9	24.5	
Cycle Queue Clearance Time (g_c), s					7.6	7.6		25.3	16.7	20.9	24.5	
Green Ratio (*g/C*)					0.13	0.13		0.36	0.36	0.72	0.75	
Capacity (*c*), veh/h					210	200		681	663	713	2673	
Volume-to-Capacity Ratio (*X*)					0.741	0.751		0.661	0.662	0.873	0.723	
Back of Queue (*Q*), ft/ln (95 th percentile)					164.3	150		284.6	274.2	425.8	250.3	
Back of Queue (*Q*), veh/ln (95 th percentile)					6.6	5.9		11.2	11.0	16.8	9.9	
Queue Storage Ratio (*RQ*) (95 th percentile)					0.00	0.67		0.00	0.00	1.09	0.00	
Uniform Delay (d_1), s/veh					38.1	34.9		22.0	22.0	18.7	5.6	
Incremental Delay (d_2), s/veh					7.6	8.5		0.4	0.4	5.3	0.9	
Initial Queue Delay (d_3), s/veh					0.0	0.0		0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh					45.7	43.4		22.4	22.4	24.0	6.5	
Level of Service (LOS)					D	D		C	C	C	A	
Approach Delay, s/veh / LOS	0.0			44.6		D	22.4		C	10.7		B
Intersection Delay, s/veh / LOS	16.3						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.14	B	2.31	B	1.91	B	1.32	A
Bicycle LOS Score / LOS			0.99	A	1.22	A	2.60	C

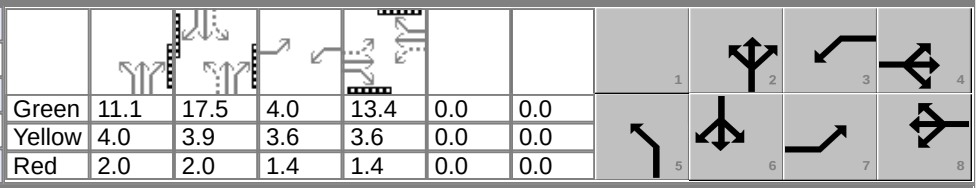
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls	Time Period	AM	PHF	0.90
Urban Street	Western Avenue	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	49th Street	File Name	19-20-21-22 Western 2035 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	120	220	105	95	365	240	290	780	185	65	410	60

Signal Information			
Cycle, s	68.0	Reference Phase	2
Offset, s	21	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	11.1	17.5	4.0	13.4	0.0	0.0
Yellow	4.0	3.9	3.6	3.6	0.0	0.0
Red	2.0	2.0	1.4	1.4	0.0	0.0

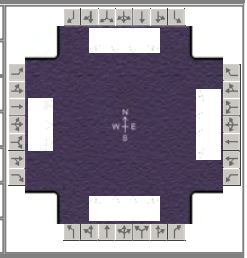
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2		6
Case Number	1.1	4.0	1.1	3.0	1.0	3.0		5.3
Phase Duration, s	9.0	18.4	9.0	18.4	17.1	40.6		23.4
Change Period, ($Y+R_c$), s	5.0	5.0	5.0	5.0	6.0	5.9		5.9
Max Allow Headway (*MAH*), s	3.1	5.1	3.1	5.1	3.1	5.3		5.3
Queue Clearance Time (g_s), s	6.0	7.8	5.3	9.2	10.5	13.1		16.8
Green Extension Time (g_e), s	0.0	5.6	0.0	1.8	0.6	22.0		0.0
Phase Call Probability	0.92	1.00	0.86	1.00	1.00	1.00		1.00
Max Out Probability	1.00	0.00	1.00	1.00	0.00	0.03		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	133	168	160	106	406	156	322	867	150	124	785	86
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1665	1734	1734	1543	1734	1734	1543	639	1734	1543
Queue Service Time (g_s), s	4.0	5.6	5.8	3.3	7.2	6.1	8.5	11.1	3.6	12.2	14.8	3.0
Cycle Queue Clearance Time (g_c), s	4.0	5.6	5.8	3.3	7.2	6.1	8.5	11.1	3.6	12.2	14.8	3.0
Green Ratio (*g/C*)	0.26	0.20	0.20	0.26	0.20	0.20	0.45	0.51	0.51	0.26	0.26	0.26
Capacity (*c*), veh/h	268	360	329	296	685	305	418	1768	787	270	894	398
Volume-to-Capacity Ratio (*X*)	0.497	0.467	0.485	0.357	0.592	0.510	0.771	0.490	0.191	0.460	0.878	0.216
Back of Queue (*Q*), ft/ln (95 th percentile)	73.8	108.2	103.9	57.1	133.6	102.8	136.7	165.7	48.1	82	265.3	47
Back of Queue (*Q*), veh/ln (95 th percentile)	2.9	4.3	4.1	2.2	5.3	4.0	5.4	6.5	1.9	3.2	10.4	1.9
Queue Storage Ratio (*RQ*) (95 th percentile)	0.30	0.00	0.00	0.19	0.00	0.41	0.55	0.00	0.40	0.33	0.00	0.19
Uniform Delay (d_1), s/veh	21.5	24.1	24.2	20.5	24.8	24.4	15.3	10.9	9.1	23.3	24.2	19.8
Incremental Delay (d_2), s/veh	0.5	1.3	1.6	0.3	1.6	2.0	1.2	0.3	0.2	1.4	8.7	0.3
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	22.0	25.5	25.8	20.8	26.4	26.3	16.4	11.2	9.2	24.7	32.9	20.2
Level of Service (LOS)	C	C	C	C	C	C	B	B	A	C	C	C
Approach Delay, s/veh / LOS	24.6	C		25.5	C		12.2	B		30.8	C	
Intersection Delay, s/veh / LOS	21.8						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.51	C	2.46	B	2.54	C	2.32	B
Bicycle LOS Score / LOS	0.87	A	1.04	A	1.59	B	0.96	A

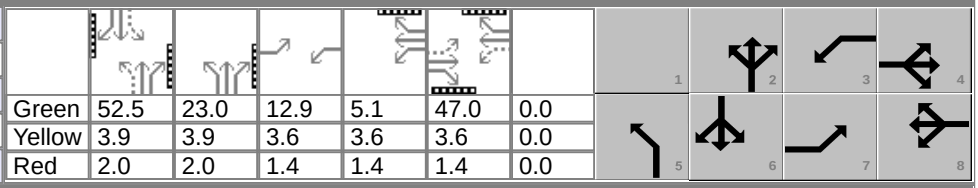
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls	Time Period	PM	PHF	0.90
Urban Street	Western Avenue	Analysis Year	2035	Analysis Period	1> 16:30
Intersection	49th Street	File Name	19-20-21-22 Western 2035 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	140	495	350	290	625	200	320	785	125	80	1095	65

Signal Information			
Cycle, s	167.3	Reference Phase	2
Offset, s	21	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	52.5	23.0	12.9	5.1	47.0	0.0
Yellow	3.9	3.9	3.6	3.6	3.6	0.0
Red	2.0	2.0	1.4	1.4	1.4	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2		6
Case Number	1.1	4.0	1.1	3.0	1.0	3.0		5.3
Phase Duration, s	17.9	52.0	28.0	62.1	28.9	87.3		58.4
Change Period, ($Y+R_c$), s	5.0	5.0	5.0	5.0	5.9	5.9		5.9
Max Allow Headway (*MAH*), s	3.1	5.1	3.1	5.1	4.5	4.5		5.2
Queue Clearance Time (g_s), s	12.6	40.3	25.0	29.6	25.0	30.9		48.3
Green Extension Time (g_e), s	0.3	6.6	0.0	16.8	0.0	0.0		4.1
Phase Call Probability	1.00	1.00	1.00	1.00	1.00	1.00		1.00
Max Out Probability	0.00	0.80	1.00	0.05	1.00	1.00		0.76

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	156	438	389	322	694	167	356	872	111	69	948	30
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1614	1734	1734	1543	1734	1734	1543	635	1734	1543
Queue Service Time (g_s), s	10.6	38.2	38.3	23.0	27.6	13.4	23.0	28.9	6.7	17.6	43.2	2.3
Cycle Queue Clearance Time (g_c), s	10.6	38.2	38.3	23.0	27.6	13.4	23.0	28.9	6.7	46.3	43.2	2.3
Green Ratio (*g/C*)	0.36	0.28	0.28	0.43	0.34	0.34	0.44	0.49	0.49	0.31	0.31	0.31
Capacity (*c*), veh/h	299	511	453	315	1183	526	308	1688	751	134	1089	485
Volume-to-Capacity Ratio (*X*)	0.519	0.857	0.859	1.022	0.587	0.317	1.155	0.517	0.148	0.518	0.871	0.063
Back of Queue (*Q*), ft/ln (95 th percentile)	206.2	674.3	615.4	542.7	451.3	227.7	796.8	455.1	114.7	134.7	649.4	41.4
Back of Queue (*Q*), veh/ln (95 th percentile)	8.1	26.5	24.2	21.4	17.8	9.0	31.4	17.9	4.5	5.3	25.6	1.6
Queue Storage Ratio (*RQ*) (95 th percentile)	0.82	0.00	0.00	1.81	0.00	0.91	2.66	0.00	0.96	0.54	0.00	0.17
Uniform Delay (d_1), s/veh	39.3	57.0	57.1	45.6	45.4	40.7	69.3	29.5	23.8	69.1	54.2	85.0
Incremental Delay (d_2), s/veh	0.5	12.9	14.5	56.4	0.7	0.5	99.9	0.4	0.1	3.0	5.2	0.1
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	39.9	69.9	71.5	102.0	46.1	41.2	169.2	29.8	23.9	72.1	59.4	85.0
Level of Service (LOS)	D	E	E	F	D	D	F	C	C	E	E	F
Approach Delay, s/veh / LOS	65.8	E		60.6	E		66.4	E		61.0	E	
Intersection Delay, s/veh / LOS	63.5						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.50	B	2.50	B	2.51	C	2.47	B
Bicycle LOS Score / LOS	1.30	A	1.46	A	1.59	B	1.60	B

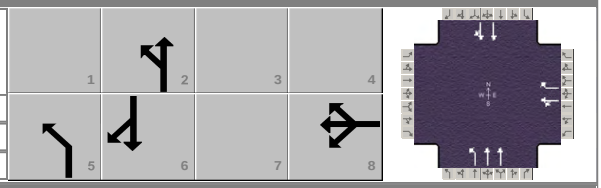
HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc.			Interchange Type	Diamond
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Segment Distance, ft	700
Jurisdiction	Sioux Falls	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 North Ramp	PHF	0.90	Arterial Direction	North-South
File Name	19-20-21-22 Western 2035 AM.xus				
Project Description	BUILD - I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h				295	0	480	110	1045			550	135
Intersection Two Demand (*v*), veh/h	350	0	155					805	300	160	685	

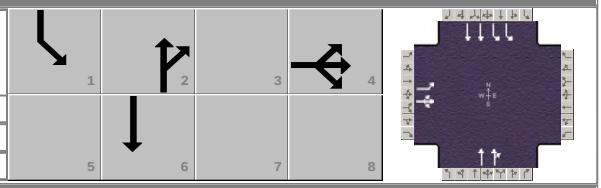
Signal One Information	
Cycle, s	110.0
Offset, s	66
Uncoordinated	No
Force Mode	Fixed

Green	6.0	54.4	31.6	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0



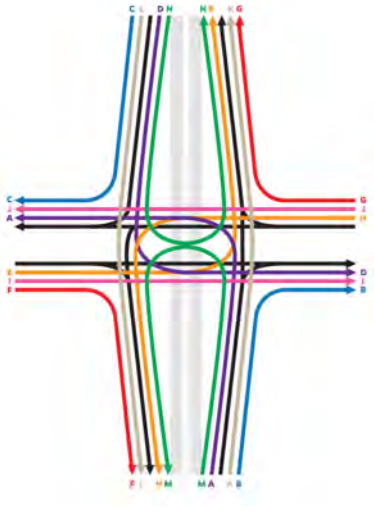
Signal Two Information	
Cycle, s	110.0
Offset, s	66
Uncoordinated	No
Force Mode	Fixed

Green	7.1	64.3	21.8	0.0	0.0	0.0
Yellow	3.9	3.9	3.6	0.0	0.0	0.0
Red	1.8	1.8	1.9	0.0	0.0	0.0



Interchange Results

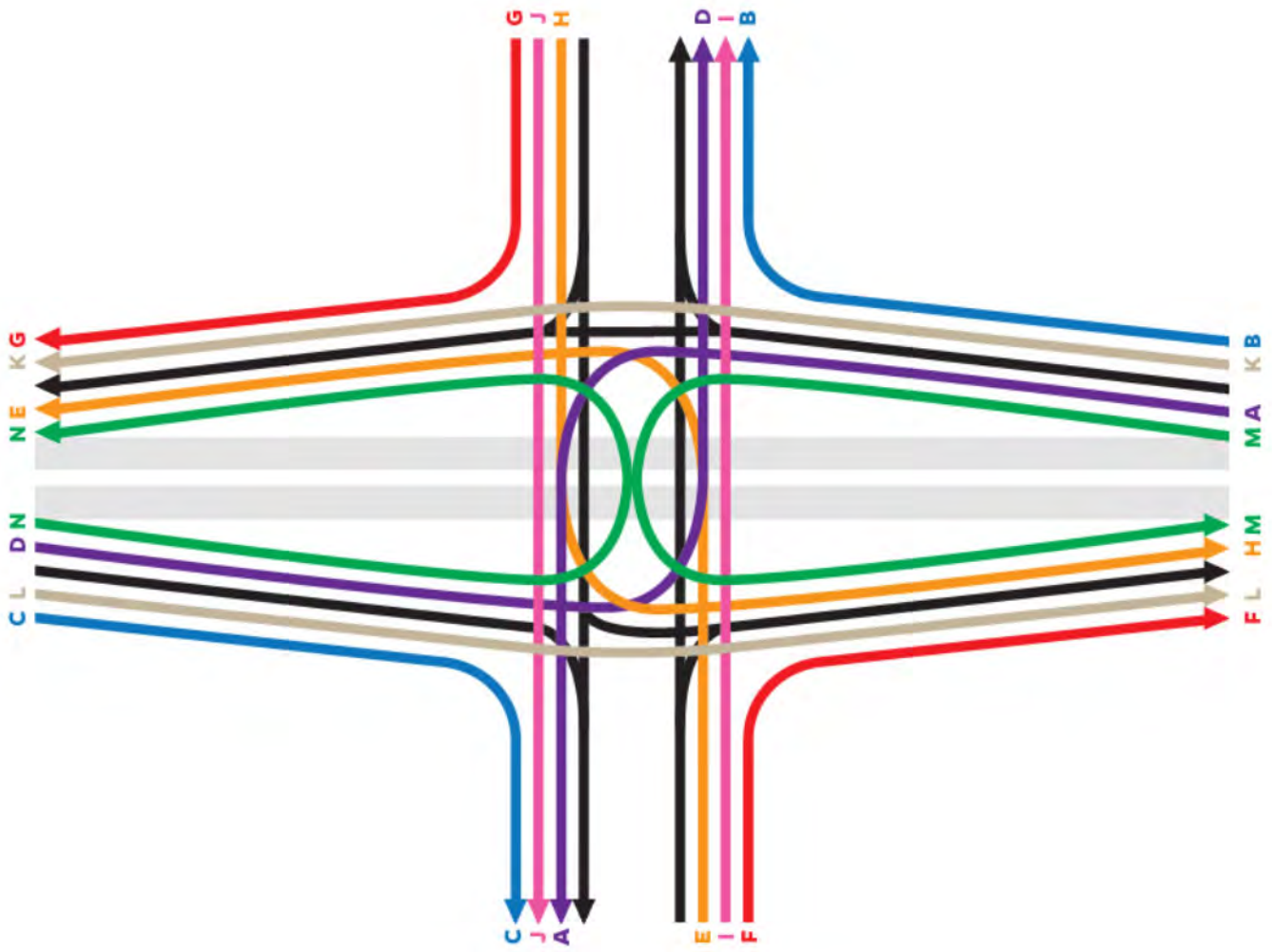
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	0	19.7	0.0	19.7	No	No	B
B	0	0.0	0.0	0.0	No	No	A
C	0	0.0	0.0	0.0	No	No	A
D	0	17.6	0.0	17.6	No	No	B
E	0	13.2	0.0	13.2	No	No	A
F	0	13.2	0.0	13.2	No	No	A
G	0	0.0	0.0	0.0	No	No	A
H	0	2.2	0.0	2.2	No	No	A
I	1239	30.9	0.0	30.9	No	No	C
J	684	21.9	0.0	21.9	No	No	B
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh					36.6	43.0	14.7	13.2			19.7	18.3
Level of Service (LOS)					D	D	B	B			B	B
Approach Delay, s/veh / LOS	0.0			40.0		D	13.4		B	19.0		B
Intersection Delay, s/veh / LOS	21.7						C					

Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	48.4	48.2						17.6	15.1	40.2	2.2	
Level of Service (LOS)	D	D						B	B	D	A	
Approach Delay, s/veh / LOS	48.3		D	0.0			16.4		B	9.4		A
Intersection Delay, s/veh / LOS	19.9						B					

Interchange Graphic



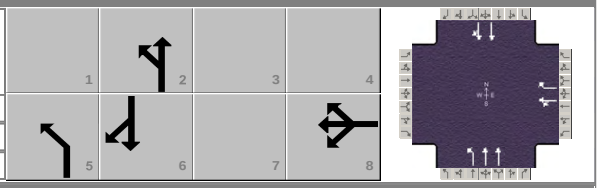
HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc.			Interchange Type	Diamond
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Segment Distance, ft	700
Jurisdiction	Sioux Falls	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 North Ramp	PHF	0.90	Arterial Direction	North-South
File Name	19-20-21-22 Western 2035 PM.xus				
Project Description	BUILD - I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h				315	5	490	225	850			1320	370
Intersection Two Demand (*v*), veh/h	235	5	115					840	330	520	1115	

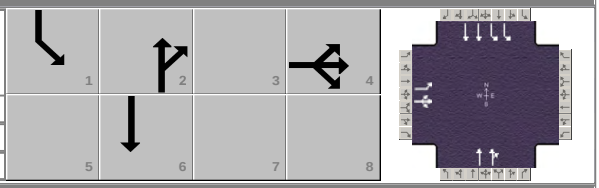
Signal One Information	
Cycle, s	90.0
Offset, s	2
Uncoordinated	No
Force Mode	Fixed

Green	11.3	34.1	26.6	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0



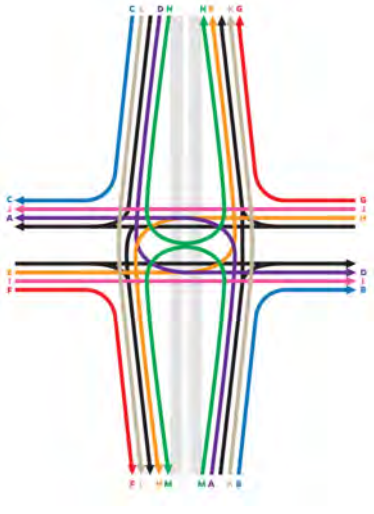
Signal Two Information	
Cycle, s	90.0
Offset, s	2
Uncoordinated	No
Force Mode	Fixed

Green	43.9	13.2	16.0	0.0	0.0	0.0
Yellow	3.9	3.9	3.6	0.0	0.0	0.0
Red	1.8	1.8	1.9	0.0	0.0	0.0



Interchange Results

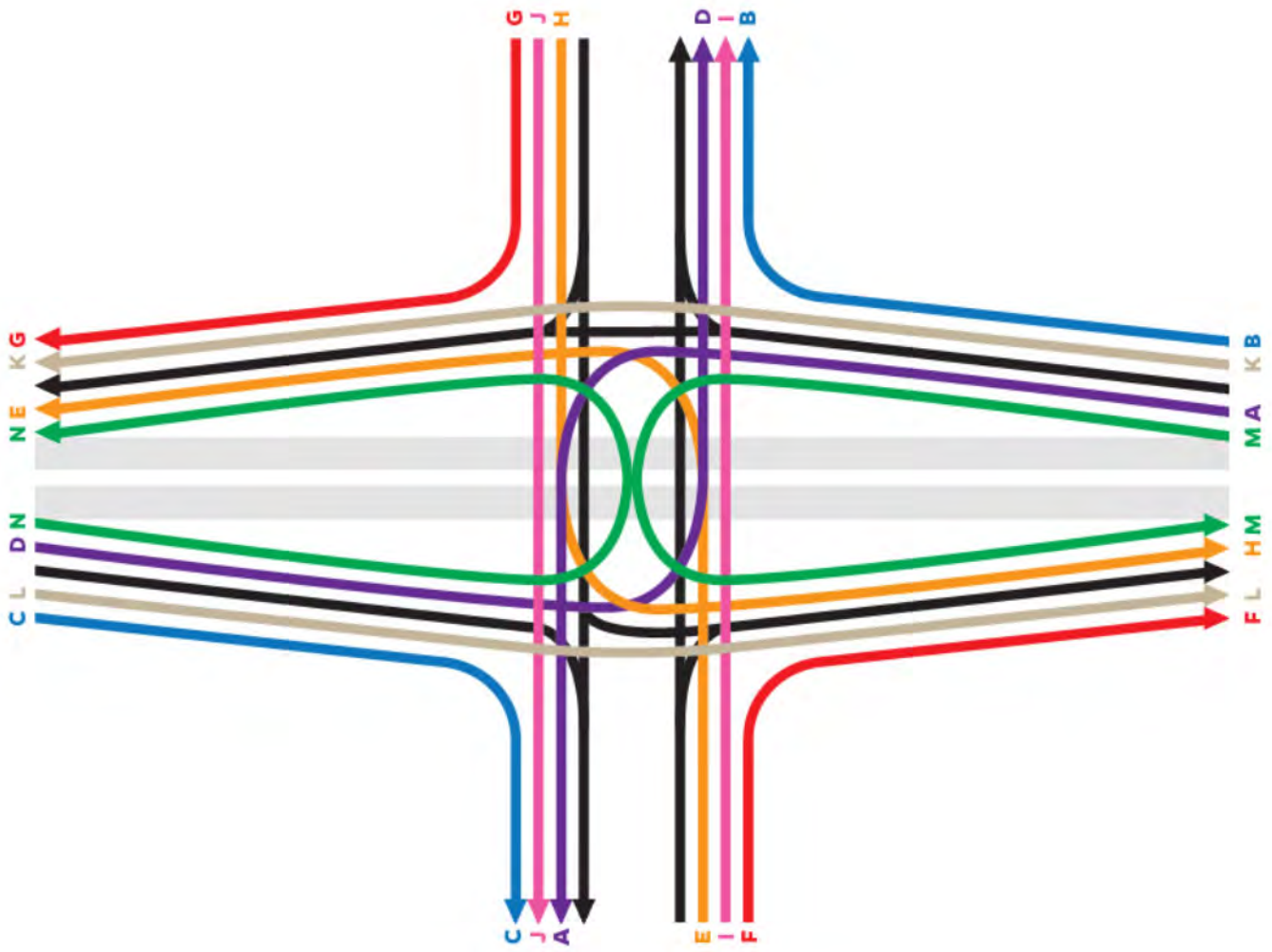
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	0	29.5	0.0	29.5	No	No	B
B	0	0.0	0.0	0.0	No	No	A
C	0	0.0	0.0	0.0	No	No	A
D	0	21.7	0.0	21.7	No	No	B
E	0	12.1	0.0	12.1	No	No	A
F	0	12.1	0.0	12.1	No	No	A
G	0	0.0	0.0	0.0	No	No	A
H	0	1.1	0.0	1.1	No	No	A
I	1117	33.8	0.0	33.8	No	No	C
J	736	30.6	0.0	30.6	No	No	C
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh					30.9	40.2	45.0	12.1			29.5	30.0
Level of Service (LOS)					C	D	D	B			C	C
Approach Delay, s/veh / LOS	0.0			35.7	D		19.0	B		29.8	C	
Intersection Delay, s/veh / LOS	26.6						C					

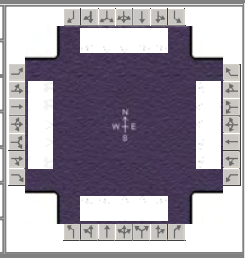
Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	37.2	36.3						21.7	19.6	30.8	1.1	
Level of Service (LOS)	D	D						C	B	C	A	
Approach Delay, s/veh / LOS	36.8	D		0.0			20.7	C		10.5	B	
Intersection Delay, s/veh / LOS	18.5						B					

Interchange Graphic



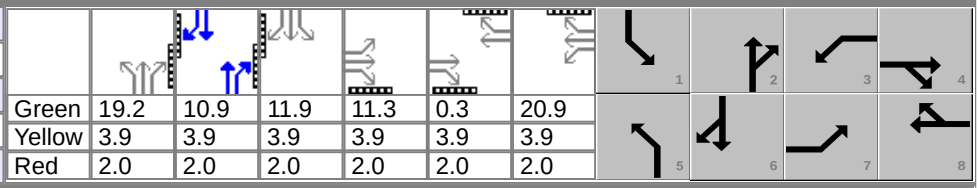
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls	Time Period	AM	PHF	0.90
Urban Street	Western Avenue	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	57th Street	File Name	19-20-21-22 Western 2035 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	250	370	130	135	650	245	320	610	45	125	485	230

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	95	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	19.2	10.9	11.9	11.3	0.3	20.9
Yellow	3.9	3.9	3.9	3.9	3.9	3.9
Red	2.0	2.0	2.0	2.0	2.0	2.0

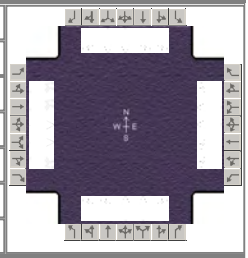
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	17.2	23.4	26.8	33.1	25.1	42.0	17.8	34.6
Change Period, ($Y+R_c$), s	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9
Max Allow Headway (*MAH*), s	2.6	5.0	4.7	4.7	2.6	0.0	5.0	0.0
Queue Clearance Time (g_s), s	10.9	14.4	6.2	23.8	18.4		6.2	
Green Extension Time (g_e), s	0.4	3.1	5.7	3.4	0.9	0.0	5.8	0.0
Phase Call Probability	1.00	1.00	0.99	1.00	1.00		0.99	
Max Out Probability	0.00	0.00	0.12	0.67	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	278	411	100	150	722	178	522	995	49	139	539	156
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1734	1543	1684	1734	1543	1684	1734	1543	1684	1734	1543
Queue Service Time (g_s), s	8.9	12.4	6.4	4.2	21.8	10.8	16.4	29.7	2.3	4.2	15.0	9.1
Cycle Queue Clearance Time (g_c), s	8.9	12.4	6.4	4.2	21.8	10.8	16.4	29.7	2.3	4.2	15.0	9.1
Green Ratio (*g/C*)	0.10	0.16	0.16	0.19	0.25	0.25	0.17	0.33	0.33	0.11	0.26	0.26
Capacity (*c*), veh/h	346	552	246	641	856	381	589	1137	506	364	905	403
Volume-to-Capacity Ratio (*X*)	0.803	0.744	0.407	0.234	0.844	0.467	0.886	0.875	0.097	0.382	0.596	0.386
Back of Queue (*Q*), ft/ln (95 th percentile)	171.8	236.6	112.2	77.9	381.1	135.5	221.1	422.9	38.2	82.1	273.6	168.1
Back of Queue (*Q*), veh/ln (95 th percentile)	6.8	9.3	4.4	3.1	15.0	5.3	8.7	16.6	1.5	3.2	10.8	6.6
Queue Storage Ratio (*RQ*) (95 th percentile)	0.55	0.00	0.45	0.30	0.00	0.52	0.63	0.00	0.29	0.66	0.00	1.35
Uniform Delay (d_1), s/veh	48.3	44.1	19.3	37.7	39.4	19.7	39.1	34.7	23.7	45.6	35.6	33.4
Incremental Delay (d_2), s/veh	1.7	2.8	1.5	0.1	6.5	1.2	0.8	4.4	0.2	0.9	2.9	2.8
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	49.9	46.9	20.8	37.8	45.9	21.0	39.9	39.1	23.9	46.6	38.5	36.2
Level of Service (LOS)	D	D	C	D	D	C	D	D	C	D	D	D
Approach Delay, s/veh / LOS	44.6	D		40.5	D		38.9	D		39.4	D	
Intersection Delay, s/veh / LOS	40.5						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.62	C	2.72	C	2.72	C	2.64	C
Bicycle LOS Score / LOS	1.14	A	1.35	A	1.37	A	1.18	A

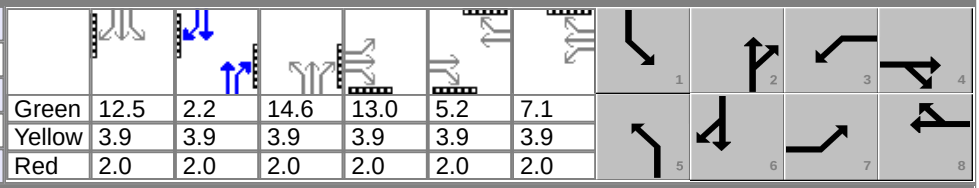
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls	Time Period	PM	PHF	0.90
Urban Street	Western Avenue	Analysis Year	2035	Analysis Period	1> 16:30
Intersection	57th Street	File Name	19-20-21-22 Western 2035 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	370	795	330	140	570	200	455	600	120	310	670	250

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	32	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	12.5	2.2	14.6	13.0	5.2	7.1
Yellow	3.9	3.9	3.9	3.9	3.9	3.9
Red	2.0	2.0	2.0	2.0	2.0	2.0

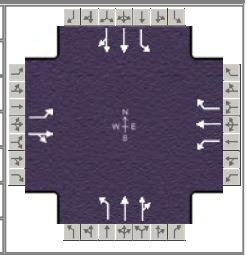
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	18.9	30.0	13.0	24.0	20.5	28.6	18.4	26.5
Change Period, ($Y+R_c$), s	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9
Max Allow Headway (*MAH*), s	2.6	5.0	4.6	4.6	2.6	0.0	5.0	0.0
Queue Clearance Time (g_s), s	12.7	24.5	6.0	18.1	16.1		10.8	
Green Extension Time (g_e), s	0.3	0.0	0.6	0.1	0.0	0.0	1.7	0.0
Phase Call Probability	1.00	1.00	0.98	1.00	1.00		1.00	
Max Out Probability	0.17	1.00	1.00	1.00	1.00		0.04	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	411	883	256	156	633	167	532	702	99	344	744	194
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1734	1543	1684	1734	1543	1684	1734	1543	1684	1734	1543
Queue Service Time (g_s), s	10.7	22.5	13.1	4.0	16.1	8.7	14.1	17.0	4.2	8.8	19.0	10.0
Cycle Queue Clearance Time (g_c), s	10.7	22.5	13.1	4.0	16.1	8.7	14.1	17.0	4.2	8.8	19.0	10.0
Green Ratio (*g/C*)	0.14	0.27	0.27	0.08	0.20	0.20	0.16	0.25	0.25	0.14	0.23	0.23
Capacity (*c*), veh/h	488	929	413	264	698	311	547	876	390	467	795	354
Volume-to-Capacity Ratio (*X*)	0.842	0.951	0.618	0.589	0.907	0.537	0.974	0.801	0.255	0.737	0.936	0.549
Back of Queue (*Q*), ft/ln (95 th percentile)	209.5	431.3	220.8	78.1	323.2	153	241.8	254.2	66.8	170.9	380.6	174.7
Back of Queue (*Q*), veh/ln (95 th percentile)	8.2	17.0	8.7	3.1	12.7	6.0	9.5	10.0	2.6	6.7	15.0	6.9
Queue Storage Ratio (*RQ*) (95 th percentile)	0.68	0.00	0.88	0.30	0.00	0.59	0.69	0.00	0.51	0.85	0.00	1.40
Uniform Delay (d_1), s/veh	37.5	32.4	28.9	40.1	35.1	32.2	35.1	30.7	4.7	37.2	34.0	3.4
Incremental Delay (d_2), s/veh	6.2	18.9	3.2	2.3	15.9	2.3	19.5	3.5	0.7	3.1	19.7	6.0
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	43.7	51.3	32.1	42.4	51.0	34.5	54.7	34.2	5.4	40.3	53.8	9.4
Level of Service (LOS)	D	D	C	D	D	C	D	C	A	D	D	A
Approach Delay, s/veh / LOS	46.1	D		46.7	D		40.2	D		43.4	D	
Intersection Delay, s/veh / LOS	44.0						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.65	C	2.69	C	2.65	C	2.73	C
Bicycle LOS Score / LOS	1.77	B	1.28	A	1.53	B	1.55	B

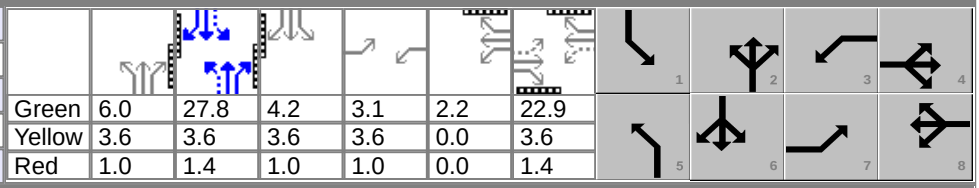
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	26th Street	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Cliff Avenue	File Name	23 26th at Cliff 2035 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	50	200	40	90	355	305	110	890	60	100	325	35

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	6.0	27.8	4.2	3.1	2.2	22.9
Yellow	3.6	3.6	3.6	3.6	0.0	3.6
Red	1.0	1.4	1.0	1.0	0.0	1.4

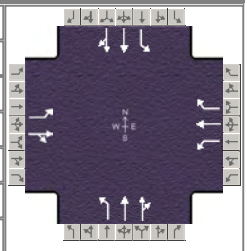
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	3.0	1.2	4.0	1.3	4.0
Phase Duration, s	7.7	27.9	10.0	30.1	10.6	43.4	8.8	41.6
Change Period, ($Y+R_c$), s	4.6	5.0	4.6	5.0	4.6	5.0	5.0	5.0
Max Allow Headway (*MAH*), s	4.2	6.2	4.2	6.2	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	4.1	13.3	5.8	19.9	6.1		2.0	
Green Extension Time (g_e), s	0.0	6.5	0.1	5.2	0.2	0.0	0.9	0.0
Phase Call Probability	0.75	1.00	0.92	1.00	0.95		0.94	
Max Out Probability	0.67	0.45	1.00	0.67	0.11		0.73	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	56	256		100	394	250	122	530	520	111	196	193
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1779		1734	1821	1543	1734	1821	1783	1734	1821	1775
Queue Service Time (g_s), s	2.1	11.3		3.8	17.9	12.5	4.1	21.2	21.2	0.0	6.4	6.5
Cycle Queue Clearance Time (g_c), s	2.1	11.3		3.8	17.9	12.5	4.1	21.2	21.2	0.0	6.4	6.5
Green Ratio (*g/C*)	0.29	0.25		0.31	0.28	0.28	0.40	0.43	0.43	0.33	0.41	0.41
Capacity (*c*), veh/h	197	452		328	508	431	431	777	761	243	740	722
Volume-to-Capacity Ratio (*X*)	0.282	0.565		0.305	0.776	0.581	0.284	0.682	0.682	0.457	0.265	0.267
Back of Queue (*Q*), ft/ln (95 th percentile)	40.9	220.3		71.2	340.8	134.1	74.9	372.9	361.4	111.2	128.2	124.6
Back of Queue (*Q*), veh/ln (95 th percentile)	1.6	8.7		2.8	13.4	5.3	2.9	14.7	14.5	4.4	5.0	5.0
Queue Storage Ratio (*RQ*) (95 th percentile)	0.31	0.00		0.62	0.00	1.17	0.43	0.00	0.00	0.74	0.00	0.00
Uniform Delay (d_1), s/veh	25.4	29.2		23.3	29.9	11.7	18.0	20.9	20.9	35.1	17.8	17.8
Incremental Delay (d_2), s/veh	0.8	2.4		0.5	7.0	2.6	0.4	4.8	4.9	1.3	0.9	0.9
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	26.1	31.6		23.8	36.9	14.3	18.4	25.7	25.8	36.4	18.6	18.7
Level of Service (LOS)	C	C		C	D	B	B	C	C	D	B	B
Approach Delay, s/veh / LOS	30.6	C		27.6	C		25.0	C		22.6	C	
Intersection Delay, s/veh / LOS	25.9						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.29	B	2.30	B	2.25	B	1.92	B
Bicycle LOS Score / LOS	1.00	A	1.72	B	1.45	A	0.90	A

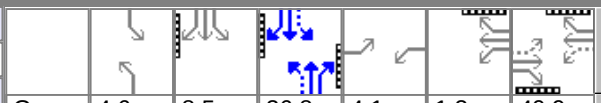
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	26th Street	Analysis Year	2035	Analysis Period	1> 16:30
Intersection	Cliff Avenue	File Name	23 26th at Cliff 2035 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				

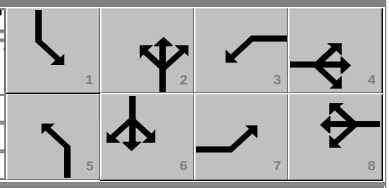


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	55	385	100	100	315	90	60	525	110	290	1060	70

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	4.6	8.5	36.8	4.1	1.3	40.9						
Yellow	3.6	3.6	3.6	3.6	0.0	3.6						
Red	1.0	1.0	1.4	1.0	0.0	1.4						



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	8.7	45.9	10.0	47.1	9.2	41.8	22.3	54.9
Change Period, ($Y+R_c$), s	4.6	5.0	4.6	5.0	4.6	5.0	4.6	5.0
Max Allow Headway (*MAH*), s	4.2	6.2	4.2	6.2	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	4.7	35.9	7.0	20.5	5.1		16.5	
Green Extension Time (g_e), s	0.0	5.0	0.0	9.3	0.0	0.0	1.2	0.0
Phase Call Probability	0.87	1.00	0.98	1.00	0.89		1.00	
Max Out Probability	1.00	0.79	1.00	0.21	0.80		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	61	528		111	350	83	67	356	338	322	628	617
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1761		1734	1821	1543	1734	1821	1719	1734	1821	1786
Queue Service Time (g_s), s	2.7	33.9		5.0	18.5	4.4	3.1	20.2	20.4	14.5	36.9	37.0
Cycle Queue Clearance Time (g_c), s	2.7	33.9		5.0	18.5	4.4	3.1	20.2	20.4	14.5	36.9	37.0
Green Ratio (*g/C*)	0.37	0.34		0.39	0.35	0.35	0.35	0.31	0.31	0.47	0.42	0.42
Capacity (*c*), veh/h	305	600		189	640	542	168	559	528	419	757	743
Volume-to-Capacity Ratio (*X*)	0.200	0.880		0.587	0.547	0.154	0.398	0.638	0.641	0.769	0.829	0.830
Back of Queue (*Q*), ft/ln (95 th percentile)	53.1	594		106.6	333.9	77.3	63.1	379.7	359.7	259.8	634.7	616.6
Back of Queue (*Q*), veh/ln (95 th percentile)	2.1	23.4		4.2	13.1	3.0	2.5	14.9	14.4	10.2	25.0	24.7
Queue Storage Ratio (*RQ*) (95 th percentile)	0.41	0.00		0.93	0.00	0.67	0.36	0.00	0.00	1.73	0.00	0.00
Uniform Delay (d_1), s/veh	25.9	37.3		29.7	31.3	26.7	30.0	35.8	35.9	24.3	31.2	31.3
Incremental Delay (d_2), s/veh	0.3	13.8		4.7	1.6	0.3	1.5	5.5	5.9	3.0	10.2	10.4
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	26.3	51.0		34.3	32.8	27.0	31.5	41.3	41.7	27.3	41.4	41.7
Level of Service (LOS)	C	D		C	C	C	C	D	D	C	D	D
Approach Delay, s/veh / LOS	48.4	D		32.2	C		40.7	D		38.6	D	
Intersection Delay, s/veh / LOS	39.7						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.30	B	2.30	B	2.14	B	1.93	B
Bicycle LOS Score / LOS	1.46	A	1.39	A	1.12	A	1.78	B

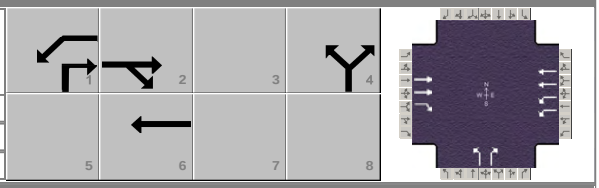
HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	Parclo AB-2Q
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Segment Distance, ft	1097
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	North-South
Intersection	SB I-229 Ramp	PHF	0.90	Arterial Direction	East-West
File Name	24-25-26 26th Street 2035 AM.xus				
Project Description	BUILD - I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h		355	65	670	970		160		240			
Intersection Two Demand (*v*), veh/h		490	105	360	1480		160	0	450			

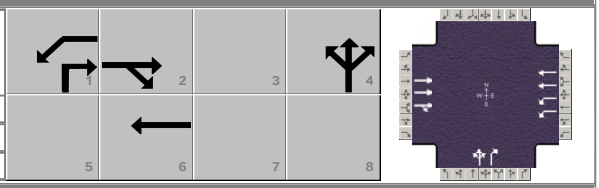
Signal One Information	
Cycle, s	90.0
Offset, s	0
Uncoordinated	No
Force Mode	Fixed

Green	43.5	18.5	12.1	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.9	1.9	1.3	0.0	0.0	0.0



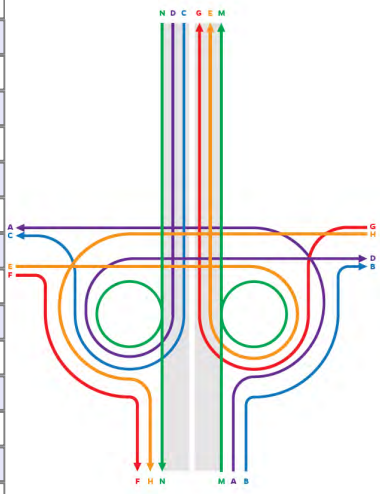
Signal Two Information	
Cycle, s	90.0
Offset, s	0
Uncoordinated	No
Force Mode	Fixed

Green	13.4	43.7	17.9	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.0	1.9	1.3	0.0	0.0	0.0



Interchange Results

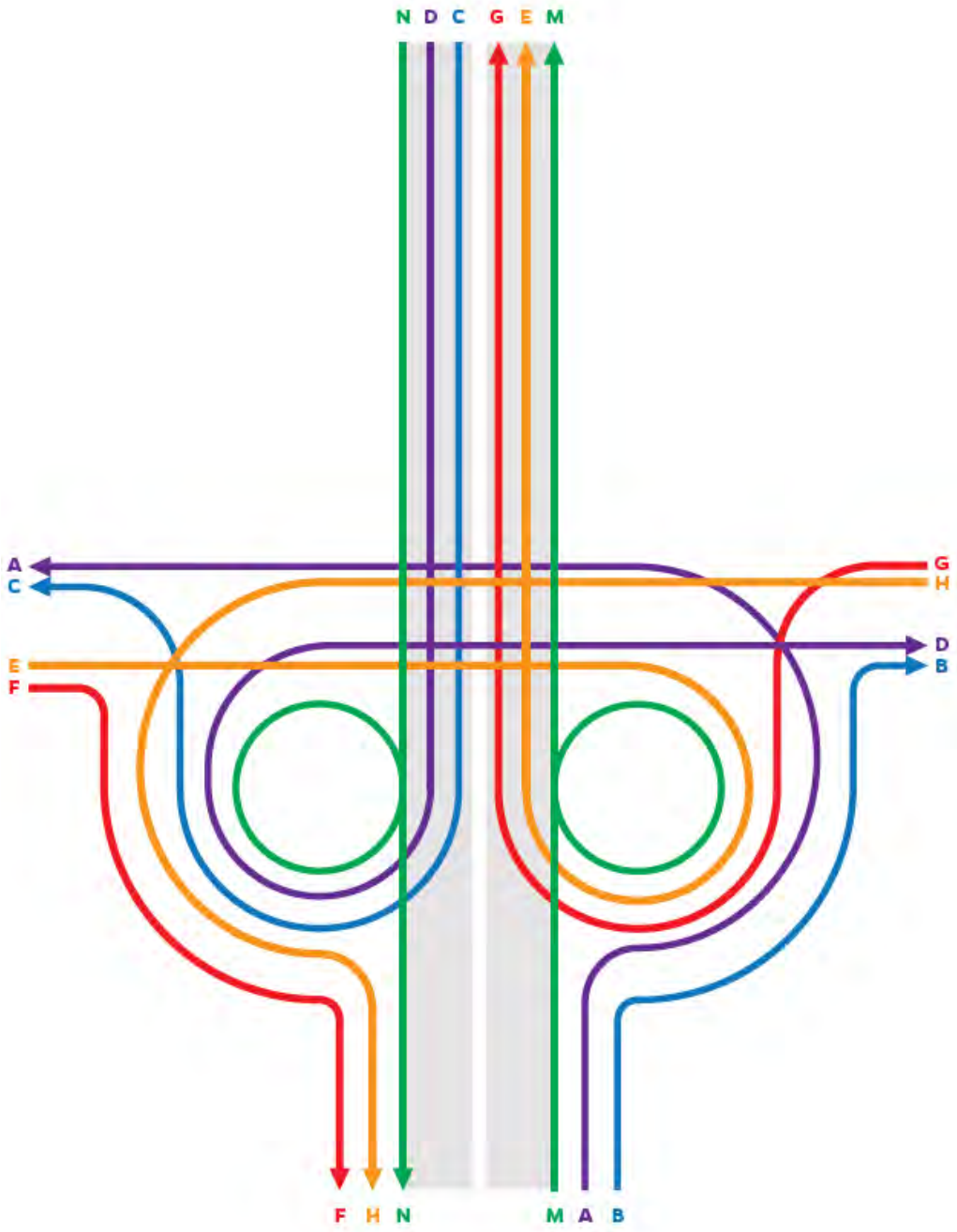
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	178	44.1	0.0	44.1	No	No	C
B	333	22.9	0.0	22.9	No	No	B
C	178	42.7	5.0	47.7	No	No	C
D	267	1.1	5.0	6.1	No	No	A
E	117	52.7	5.0	57.7	No	No	D
F	67	35.8	0.0	35.8	No	No	C
G	398	31.4	5.0	36.4	No	No	C
H	740	11.5	0.0	11.5	No	No	A
I	278	49.9	0.0	49.9	No	No	C
J	894	4.9	0.0	4.9	No	No	A
K	-	-	0.0	-	-	-	-
L	-	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh		35.8	31.5	10.3	3.8		42.7		0.0			
Level of Service (LOS)		D	C	B	A		D		A			
Approach Delay, s/veh / LOS	35.2	D		6.5	A		17.1	B		0.0		
Intersection Delay, s/veh / LOS	13.1						B					

Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh		14.1	16.9	31.4	1.1			40.3	22.9			
Level of Service (LOS)		B	B	C	A			D	C			
Approach Delay, s/veh / LOS	15.0	B		7.1	A		32.4	C		0.0		
Intersection Delay, s/veh / LOS	12.7						B					

Interchange Graphic



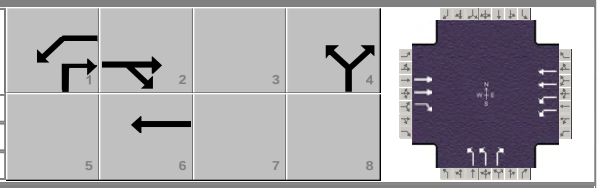
HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	Parclo AB-2Q
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Segment Distance, ft	1097
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	North-South
Intersection	SB I-229 Ramp	PHF	0.90	Arterial Direction	East-West
File Name	24-25-26 26th Street 2035 PM.xus				
Project Description	BUILD - I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h		1095	75	530	775		160		610			
Intersection Two Demand (*v*), veh/h		1525	180	130	1240		65	0	830			

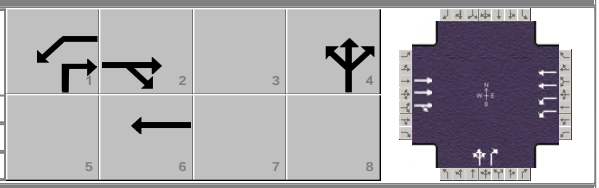
Signal One Information	
Cycle, s	130.0
Offset, s	0
Uncoordinated	No
Force Mode	Fixed

Green	34.5	69.5	10.1	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.9	1.9	1.3	0.0	0.0	0.0



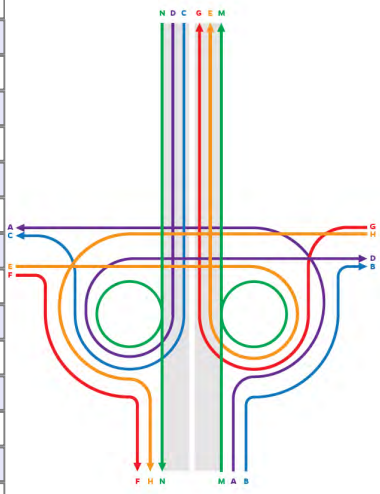
Signal Two Information	
Cycle, s	130.0
Offset, s	0
Uncoordinated	No
Force Mode	Fixed

Green	72.8	9.3	32.9	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.9	1.0	1.3	0.0	0.0	0.0



Interchange Results

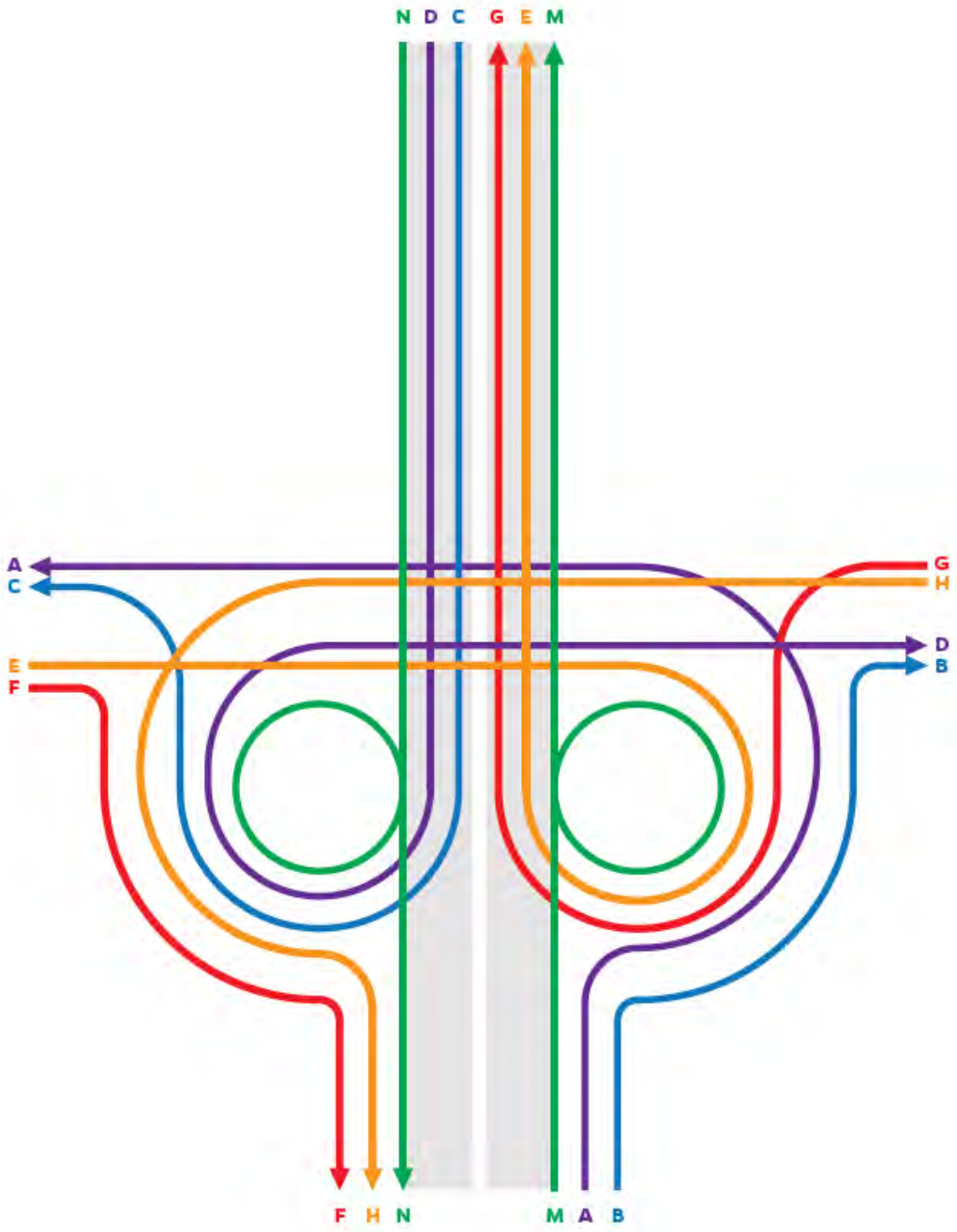
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	72	58.2	0.0	58.2	No	No	D
B	589	41.7	0.0	41.7	No	No	C
C	178	65.3	5.0	70.3	No	No	D
D	678	8.4	5.0	13.4	No	No	A
E	182	47.6	5.0	52.6	No	No	C
F	78	22.9	0.0	22.9	No	No	B
G	144	64.2	5.0	69.2	No	No	D
H	589	40.9	0.0	40.9	No	No	C
I	867	44.4	0.0	44.4	No	No	C
J	789	9.9	0.0	9.9	No	No	A
K	-	-	0.0	-	-	-	-
L	-	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh		22.9	15.1	32.5	1.6		65.3		0.0			
Level of Service (LOS)		C	B	C	A		E		A			
Approach Delay, s/veh / LOS	22.4	C		14.2	B		13.6	B		0.0		
Intersection Delay, s/veh / LOS	17.0						B					

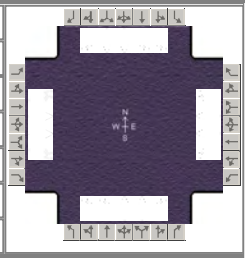
Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh		21.5	24.8	64.2	8.4			56.6	41.7			
Level of Service (LOS)		C	C	E	A			E	D			
Approach Delay, s/veh / LOS	22.6	C		13.6	B		48.0	D		0.0		
Intersection Delay, s/veh / LOS	23.4						C					

Interchange Graphic



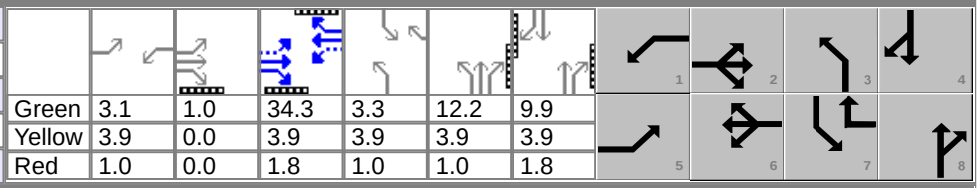
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	26th Street	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Southeastern Ave	File Name	24-25-26 26th Street 2035 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	110	650	180	55	1200	370	585	920	55	65	180	55

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	6	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	3.1	1.0	34.3	3.3	12.2	9.9
Yellow	3.9	0.0	3.9	3.9	3.9	3.9
Red	1.0	0.0	1.8	1.0	1.0	1.8

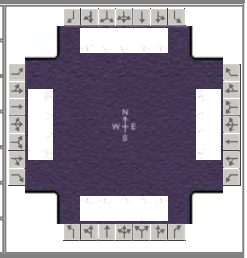
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6	3	8	7	4
Case Number	1.1	3.0	1.1	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	9.0	41.0	8.0	40.0	25.4	32.8	8.2	15.6
Change Period, ($Y+R_c$), s	4.9	5.7	4.9	5.7	4.9	5.7	4.9	5.7
Max Allow Headway (*MAH*), s	4.2	0.0	4.2	0.0	4.2	4.1	4.2	4.1
Queue Clearance Time (g_s), s	6.0		3.9		18.6	28.3	3.9	6.9
Green Extension Time (g_e), s	0.0	0.0	0.0	0.0	1.9	0.0	0.0	1.8
Phase Call Probability	0.95		0.78		1.00	1.00	0.84	1.00
Max Out Probability	1.00		1.00		0.34	1.00	1.00	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	122	722	200	61	1333	244	650	1022	39	72	200	39
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1734		1734	1734	1543	1684	1734	1568	1684	1734	1568
Queue Service Time (g_s), s	4.0	11.8		1.9	34.3	9.9	16.6	26.3	1.6	1.9	4.9	2.0
Cycle Queue Clearance Time (g_c), s	4.0	11.8		1.9	34.3	9.9	16.6	26.3	1.6	1.9	4.9	2.0
Green Ratio (*g/C*)	0.43	0.39		0.42	0.38	0.42	0.23	0.30	0.30	0.04	0.11	0.11
Capacity (*c*), veh/h	159	1359		315	1321	645	767	1042	471	125	382	173
Volume-to-Capacity Ratio (*X*)	0.767	0.532		0.194	1.009	0.379	0.848	0.981	0.083	0.577	0.524	0.225
Back of Queue (*Q*), ft/ln (95 th percentile)	104.2	183.8		35	650.6	168.3	295.6	509.4	26.6	39	97	36.1
Back of Queue (*Q*), veh/ln (95 th percentile)	4.1	7.2		1.4	25.6	6.6	11.6	20.1	1.1	1.5	3.8	1.4
Queue Storage Ratio (*RQ*) (95 th percentile)	0.23	0.00		0.14	0.00	0.67	0.70	0.00	0.11	0.10	0.00	0.18
Uniform Delay (d_1), s/veh	21.8	14.6		16.9	27.9	18.1	33.3	31.2	22.6	42.6	37.8	36.5
Incremental Delay (d_2), s/veh	18.7	1.4		0.3	27.0	1.7	5.7	23.2	0.1	4.2	1.3	0.7
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	40.5	16.0	0.0	17.2	54.9	19.8	39.0	54.4	22.6	46.8	39.1	37.2
Level of Service (LOS)	D	B	A	B	F	B	D	D	C	D	D	D
Approach Delay, s/veh / LOS	15.8	B		48.2	D		47.8	D		40.7	D	
Intersection Delay, s/veh / LOS	40.4						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.59	C	2.59	C	2.65	C	2.45	B
Bicycle LOS Score / LOS	1.35	A	1.84	B	1.90	B	0.74	A

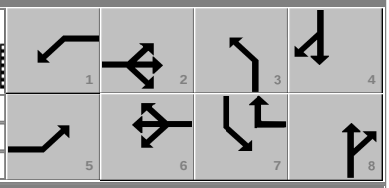
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	26th Street	Analysis Year	2035	Analysis Period	1> 4:30
Intersection	Southeastern Ave	File Name	24-25-26 26th Street 2035 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	150	1520	685	95	1000	175	270	335	100	290	715	100

Signal Information					EB			WB			NB		
Cycle, s	130.0	Reference Phase	2										
Offset, s	58	Reference Point	End	Green	6.3	2.6		55.5	14.0	0.8	29.5		
Uncoordinated	No	Simult. Gap E/W	On	Yellow	3.9	0.0		3.9	3.9	0.0	3.9		
Force Mode	Fixed	Simult. Gap N/S	On	Red	1.0	0.0		1.8	1.0	0.0	1.8		



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6	3	8	7	4
Case Number	1.1	3.0	1.1	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	13.8	63.8	11.2	61.2	18.9	35.2	19.8	36.1
Change Period, ($Y+R_c$), s	4.9	5.7	4.9	5.7	4.9	5.7	4.9	5.7
Max Allow Headway (*MAH*), s	4.2	0.0	4.2	0.0	4.2	4.1	4.2	4.1
Queue Clearance Time (g_s), s	8.5		6.4		13.3	14.1	14.2	31.6
Green Extension Time (g_e), s	0.4	0.0	0.0	0.0	0.7	5.5	0.7	0.0
Phase Call Probability	1.00		0.98		1.00	1.00	1.00	1.00
Max Out Probability	0.00		1.00		0.22	0.19	0.37	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	157	1592	718	106	1111	139	300	372	83	322	794	78
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1734		1734	1734	1543	1684	1734	1568	1684	1734	1568
Queue Service Time (g_s), s	6.5	58.1		4.4	35.1	5.9	11.3	12.1	5.6	12.2	29.6	5.2
Cycle Queue Clearance Time (g_c), s	6.5	58.1		4.4	35.1	5.9	11.3	12.1	5.6	12.2	29.6	5.2
Green Ratio (*g/C*)	0.50	0.45		0.48	0.43	0.54	0.11	0.23	0.23	0.11	0.23	0.23
Capacity (*c*), veh/h	254	1550		139	1480	835	363	788	356	385	810	366
Volume-to-Capacity Ratio (*X*)	0.619	1.027		0.757	0.751	0.166	0.825	0.473	0.234	0.837	0.981	0.212
Back of Queue (*Q*), ft/ln (95 th percentile)	129.2	947.5		114.9	551	99.8	226.8	229.3	100.4	242.3	566.7	92.5
Back of Queue (*Q*), veh/ln (95 th percentile)	5.1	37.3		4.5	21.7	3.9	8.9	9.0	4.0	9.5	22.3	3.7
Queue Storage Ratio (*RQ*) (95 th percentile)	0.29	0.00		0.46	0.00	0.40	0.53	0.00	0.40	0.65	0.00	0.46
Uniform Delay (d_1), s/veh	25.6	31.8		30.9	31.4	15.0	56.8	43.5	41.0	56.4	49.5	40.2
Incremental Delay (d_2), s/veh	1.9	27.7		18.4	3.5	0.4	7.2	0.4	0.3	8.6	26.8	0.3
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	27.5	59.5	0.0	49.3	35.0	15.5	64.0	43.9	41.3	65.0	76.3	40.5
Level of Service (LOS)	C	F	A	D	C	B	E	D	D	E	E	D
Approach Delay, s/veh / LOS	40.1	D		34.1	C		51.6	D		70.9	E	
Intersection Delay, s/veh / LOS	46.6						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.61	C	2.62	C	2.53	C	2.46	B
Bicycle LOS Score / LOS	2.65	C	1.61	B	1.11	A	1.47	A

HCS7 Two-Way Stop-Control Report

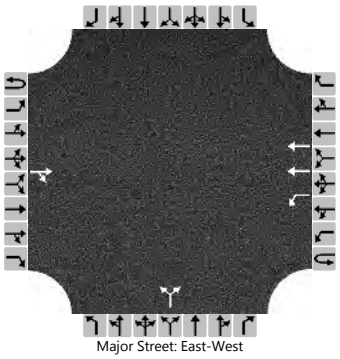
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/23/19
Analysis Year	2035
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	26th St at Yeager Rd
Jurisdiction	Sioux Falls, SD
East/West Street	26th Street
North/South Street	Yeager Road
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	1	2	0		0	1	0		0	0	0
Configuration				TR		L	T				LR					
Volume (veh/h)			375	5		155	975			25		45				
Percent Heavy Vehicles (%)						2				2		2				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized																
Median Type | Storage						Undivided										

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.5		6.9				
Critical Headway (sec)						4.14				6.84		6.94				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.22				3.52		3.32				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						172					78					
Capacity, c (veh/h)						1133					258					
v/c Ratio						0.15					0.30					
95% Queue Length, Q_{95} (veh)						0.5					1.2					
Control Delay (s/veh)						8.7					24.9					
Level of Service (LOS)						A					C					
Approach Delay (s/veh)						1.2				24.9						
Approach LOS										C						

HCS7 Two-Way Stop-Control Report

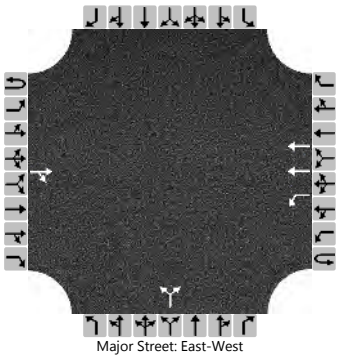
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	4/23/19
Analysis Year	2035
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	26th St at Yeager Rd
Jurisdiction	Sioux Falls, SD
East/West Street	26th Street
North/South Street	Yeager Road
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	1	2	0		0	1	0		0	0	0
Configuration				TR		L	T				LR					
Volume (veh/h)			1035	10		210	725			25		135				
Percent Heavy Vehicles (%)						2				2		2				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized																
Median Type | Storage						Undivided										

Critical and Follow-up Headways

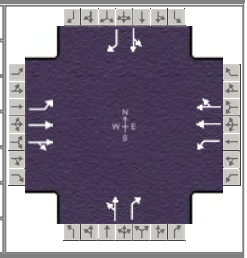
Base Critical Headway (sec)						4.1				7.5		6.9				
Critical Headway (sec)						4.14				6.84		6.94				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.22				3.52		3.32				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						233					178					
Capacity, c (veh/h)						597					105					
v/c Ratio						0.39					1.70					
95% Queue Length, Q_{95} (veh)						1.8					13.9					
Control Delay (s/veh)						14.8					422.5					
Level of Service (LOS)						B					F					
Approach Delay (s/veh)						3.3				422.5						
Approach LOS										F						

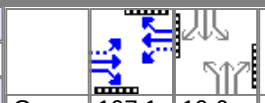
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	41st Street	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Norton Ave	File Name	28 41st at Norton 2035 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				

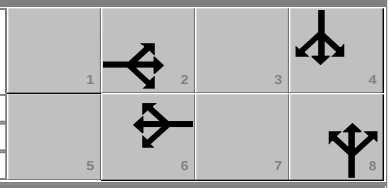


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	20	520	30	10	310	10	15	10	5	10	10	10

Signal Information			
Cycle, s	150.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	107.1	19.6	7.5	0.0	0.0	0.0						
Yellow	3.6	3.6	3.6	0.0	0.0	0.0						
Red	1.4	1.8	1.8	0.0	0.0	0.0						



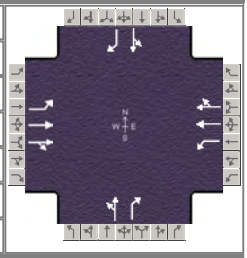
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		6.0		6.0		11.0		11.0
Phase Duration, s		112.1		112.1		12.9		25.0
Change Period, ($Y+R_c$), s		5.0		5.0		5.4		5.4
Max Allow Headway (*MAH*), s		0.0		0.0		5.2		5.2
Queue Clearance Time (g_s), s						4.3		3.7
Green Extension Time (g_e), s		0.0		0.0		0.1		0.1
Phase Call Probability						0.75		1.00
Max Out Probability						0.00		0.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	22	308	303	11	178	177		28	6		22	11
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1026	1821	1786	810	1821	1801		1768	1543		1777	1543
Queue Service Time (g_s), s	1.1	8.7	8.8	0.7	4.7	4.7		2.3	0.5		1.7	0.9
Cycle Queue Clearance Time (g_c), s	5.7	8.7	8.8	9.5	4.7	4.7		2.3	0.5		1.7	0.9
Green Ratio (*g/C*)	0.71	0.71	0.71	0.71	0.71	0.71		0.05	0.05		0.13	0.13
Capacity (*c*), veh/h	748	1300	1275	579	1300	1286		88	77		232	202
Volume-to-Capacity Ratio (*X*)	0.030	0.237	0.238	0.019	0.137	0.138		0.314	0.072		0.096	0.055
Back of Queue (*Q*), ft/ln (95 th percentile)	11.4	160.5	157.9	6.3	85.4	84.9		50.5	9.9		35.1	17.5
Back of Queue (*Q*), veh/ln (95 th percentile)	0.4	6.3	6.2	0.2	3.4	3.3		2.0	0.4		1.4	0.7
Queue Storage Ratio (*RQ*) (95 th percentile)	0.11	0.00	0.00	0.06	0.00	0.00		0.00	0.13		0.00	0.23
Uniform Delay (d_1), s/veh	7.7	7.4	7.4	9.0	6.8	6.8		68.8	67.9		57.4	57.1
Incremental Delay (d_2), s/veh	0.1	0.4	0.4	0.1	0.2	0.2		2.8	0.6		0.3	0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Control Delay (*d*), s/veh	7.8	7.8	7.8	9.1	7.0	7.0		71.6	68.5		57.7	57.3
Level of Service (LOS)	A	A	A	A	A	A		E	E		E	E
Approach Delay, s/veh / LOS	7.8	A		7.1	A		71.1	E		57.5	E	
Intersection Delay, s/veh / LOS	11.1						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.87	B	1.87	B	2.33	B	2.33	B
Bicycle LOS Score / LOS	1.01	A	0.79	A	0.54	A	0.54	A

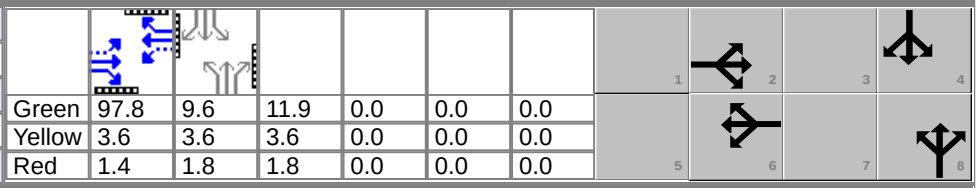
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	41st Street	Analysis Year	2035	Analysis Period	1> 16:30
Intersection	Norton Ave	File Name	28 41st at Norton 2035 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	35	925	65	25	825	30	80	30	40	20	25	40

Signal Information			
Cycle, s	135.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	97.8	9.6	11.9	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.4	1.8	1.8	0.0	0.0	0.0

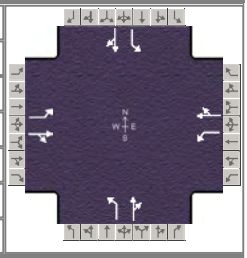
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		6.0		6.0		11.0		11.0
Phase Duration, s		102.8		102.8		17.3		15.0
Change Period, ($Y+R_c$), s		5.0		5.0		5.4		5.4
Max Allow Headway (*MAH*), s		0.0		0.0		5.2		5.3
Queue Clearance Time (g_s), s						11.2		5.6
Green Extension Time (g_e), s		0.0		0.0		0.7		0.3
Phase Call Probability						1.00		0.96
Max Out Probability						0.00		0.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	39	556	544	28	478	472		122	33		50	33
Adjusted Saturation Flow Rate (*s*), veh/h/ln	590	1821	1779	513	1821	1798		1757	1543		1782	1543
Queue Service Time (g_s), s	3.6	16.4	16.4	3.1	13.3	13.3		9.2	2.7		3.6	2.8
Cycle Queue Clearance Time (g_c), s	16.8	16.4	16.4	19.5	13.3	13.3		9.2	2.7		3.6	2.8
Green Ratio (*g/C*)	0.72	0.72	0.72	0.72	0.72	0.72		0.09	0.09		0.07	0.07
Capacity (*c*), veh/h	423	1319	1288	362	1319	1302		155	136		126	109
Volume-to-Capacity Ratio (*X*)	0.092	0.422	0.422	0.077	0.362	0.362		0.791	0.246		0.396	0.305
Back of Queue (*Q*), ft/ln (95 th percentile)	23.5	266.1	261.5	18	224.2	222.1		207.3	51		79.8	52.9
Back of Queue (*Q*), veh/ln (95 th percentile)	0.9	10.5	10.3	0.7	8.8	8.7		8.2	2.0		3.1	2.1
Queue Storage Ratio (*RQ*) (95 th percentile)	0.23	0.00	0.00	0.18	0.00	0.00		0.00	0.68		0.00	0.70
Uniform Delay (d_1), s/veh	10.1	7.4	7.4	11.3	7.0	7.0		60.3	57.4		60.0	59.6
Incremental Delay (d_2), s/veh	0.4	1.0	1.0	0.4	0.8	0.8		12.0	1.3		2.9	2.2
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Control Delay (*d*), s/veh	10.5	8.4	8.4	11.7	7.7	7.7		72.4	58.7		62.8	61.8
Level of Service (LOS)	B	A	A	B	A	A		E	E		E	E
Approach Delay, s/veh / LOS	8.5	A		7.9	A		69.4	E		62.4	E	
Intersection Delay, s/veh / LOS	14.1						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.88	B	1.88	B	2.33	B	2.32	B
Bicycle LOS Score / LOS	1.43	A	1.29	A	0.74	A	0.63	A

HCS7 Signalized Intersection Results Summary

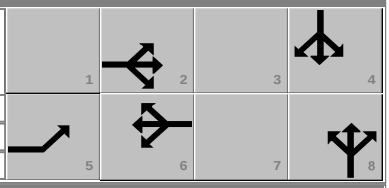
General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	41st Street	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Phillips Ave	File Name	29 41st at Phillips 2035 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	140	260	10	30	255	155	10	130	55	135	20	165

Signal Information			
Cycle, s	80.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	5.0	41.1	20.1	0.0	0.0	0.0
Yellow	4.0	3.6	3.6	0.0	0.0	0.0
Red	0.0	1.3	1.3	0.0	0.0	0.0



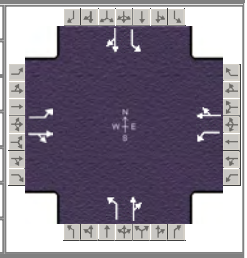
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		4
Case Number	1.0	4.0		6.3		6.0		6.0
Phase Duration, s	9.0	55.0		46.0		25.0		25.0
Change Period, ($Y+R_c$), s	4.0	4.9		4.9		4.9		4.9
Max Allow Headway (*MAH*), s	4.2	0.0		0.0		5.4		5.4
Queue Clearance Time (g_s), s	5.1					10.1		20.0
Green Extension Time (g_e), s	0.0	0.0		0.0		2.4		0.0
Phase Call Probability	0.97					1.00		1.00
Max Out Probability	1.00					0.34		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	156	300		33	456		11	206		150	172	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1809		1079	1705		1213	1729		1176	1574	
Queue Service Time (g_s), s	3.1	5.9		1.2	14.2		0.6	8.1		9.9	7.4	
Cycle Queue Clearance Time (g_c), s	3.1	5.9		1.2	14.2		8.0	8.1		18.0	7.4	
Green Ratio (*g/C*)	0.60	0.63		0.51	0.51		0.25	0.25		0.25	0.25	
Capacity (*c*), veh/h	514	1134		645	877		282	433		266	395	
Volume-to-Capacity Ratio (*X*)	0.303	0.265		0.052	0.520		0.039	0.474		0.564	0.436	
Back of Queue (*Q*), ft/ln (95 th percentile)	48.2	97		13.7	235.5		8.4	153		137.4	127	
Back of Queue (*Q*), veh/ln (95 th percentile)	1.9	3.8		0.5	9.3		0.3	6.0		5.4	5.0	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.37	0.00		0.23	0.00		0.14	0.00		0.92	0.00	
Uniform Delay (d_1), s/veh	8.9	6.7		9.7	12.9		28.6	25.5		33.2	25.2	
Incremental Delay (d_2), s/veh	0.3	0.6		0.2	2.2		0.1	1.1		3.4	1.1	
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh	9.3	7.2		9.9	15.1		28.7	26.6		36.6	26.3	
Level of Service (LOS)	A	A		A	B		C	C		D	C	
Approach Delay, s/veh / LOS	7.9	A		14.7	B		26.7	C		31.1	C	
Intersection Delay, s/veh / LOS	17.9						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.87	B	1.93	B	1.92	B	1.92	B
Bicycle LOS Score / LOS	1.24	A	1.29	A	0.85	A	1.02	A

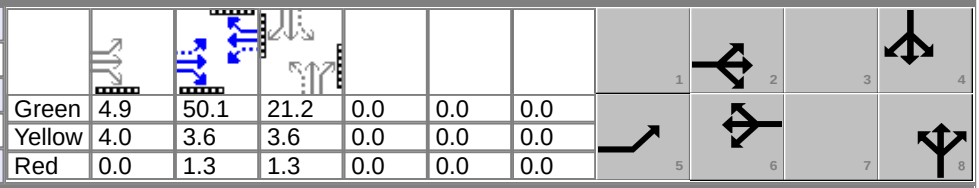
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	41st Street	Analysis Year	2035	Analysis Period	1> 16:30
Intersection	Phillips Ave	File Name	29 41st at Phillips 2035 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	120	270	5	20	315	140	30	55	70	130	25	240

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	4.9	50.1	21.2	0.0	0.0	0.0
Yellow	4.0	3.6	3.6	0.0	0.0	0.0
Red	0.0	1.3	1.3	0.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		4
Case Number	1.0	4.0		6.3		6.0		6.0
Phase Duration, s	8.9	63.9		55.0		26.1		26.1
Change Period, ($Y+R_c$), s	4.0	4.9		4.9		4.9		4.9
Max Allow Headway (*MAH*), s	4.2	0.0		0.0		5.4		5.4
Queue Clearance Time (g_s), s	4.8					16.7		18.0
Green Extension Time (g_e), s	0.3	0.0		0.0		3.3		3.2
Phase Call Probability	0.96					1.00		1.00
Max Out Probability	0.00					0.06		0.07

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	133	306		22	506		33	139		144	239	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1815		1074	1726		1141	1654		1250	1571	
Queue Service Time (g_s), s	2.8	6.3		0.8	16.6		2.4	6.3		9.8	12.3	
Cycle Queue Clearance Time (g_c), s	2.8	6.3		0.9	16.6		14.7	6.3		16.0	12.3	
Green Ratio (*g/C*)	0.63	0.66		0.56	0.56		0.24	0.24		0.24	0.24	
Capacity (*c*), veh/h	506	1189		676	959		195	391		289	371	
Volume-to-Capacity Ratio (*X*)	0.264	0.257		0.033	0.527		0.171	0.355		0.500	0.644	
Back of Queue (*Q*), ft/ln (95 th percentile)	42.9	104.1		9.3	268.7		32.2	116.2		140.9	214.5	
Back of Queue (*Q*), veh/ln (95 th percentile)	1.7	4.1		0.4	10.6		1.3	4.6		5.5	8.4	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.33	0.00		0.16	0.00		0.54	0.00		0.94	0.00	
Uniform Delay (d_1), s/veh	8.9	6.4		9.1	12.6		37.5	28.7		35.3	31.0	
Incremental Delay (d_2), s/veh	0.3	0.5		0.1	2.1		0.6	0.8		1.9	2.7	
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh	9.1	7.0		9.2	14.6		38.1	29.4		37.2	33.6	
Level of Service (LOS)	A	A		A	B		D	C		D	C	
Approach Delay, s/veh / LOS	7.6	A		14.4	B		31.1	C		35.0	C	
Intersection Delay, s/veh / LOS	19.5						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.86	B	1.96	B	1.93	B	1.93	B
Bicycle LOS Score / LOS	1.21	A	1.36	A	0.77	A	1.12	A

Appendix G

HCS Analysis Summary – Forecast 2024 No Build Conditions

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - west of Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2950	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1159
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.50
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	18.8
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - west of Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2315	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	891
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.38
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	14.4
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - between Western Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2480	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1461
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.63
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	23.6
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - between Western Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	1970	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1138
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.49
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	18.4
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - between Western and Minnesota		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2930	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1151
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.50
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	18.6
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - between Western and Minnesota		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2795	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1076
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.46
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	17.4
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - Western to Minnesota		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2860	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2100	360	90	380
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	6.00	6.00	6.00	6.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.943	0.943	0.943	0.943
Flow Rate (v_i), pc/h	2474	424	106	448
Weaving Flow Rate (v_w), pc/h	872	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2580	Density-Based Capacity (c_{IWL}), pc/h/ln		2180
Total Flow Rate (v), pc/h	3452	Demand Flow-Based Capacity (c_{IW}), pc/h		9486
Volume Ratio (VR)	0.253	Weaving Segment Capacity (c_W), veh/h		6167
Minimum Lane Change Rate (LC_{MIN}), lc/h	872	Adjusted Weaving Area Capacity, pc/h		6540
Maximum Weaving Length (L_{MAX}), ft	5085	Volume-to-Capacity Ratio (v/c)		0.53

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	738	Average Weaving Speed (S_W),mi/h	56.2
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1504	Average Non-Weaving Speed (S_{NW}), mi/h	53.2
Weaving Lane Change Rate (LC_W), lc/h	1181	Average Speed (S), mi/h	53.9
Weaving Lane Change Rate (LC_{All}), lc/h	2685	Density (D), pc/mi/ln	21.3
Weaving Intensity Factor (W)	0.215	Level of Service (LOS)	C

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - Western to Minnesota		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2860	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1669	676	149	301
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	4.00	4.00	4.00	4.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.962	0.962	0.962	0.962
Flow Rate (v_i), pc/h	1928	781	172	348
Weaving Flow Rate (v_w), pc/h	1129	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2100	Density-Based Capacity (c_{IWL}), pc/h/ln		2100
Total Flow Rate (v), pc/h	3229	Demand Flow-Based Capacity (c_{IW}), pc/h		6857
Volume Ratio (VR)	0.350	Weaving Segment Capacity (c_W), veh/h		6061
Minimum Lane Change Rate (LC_{MIN}), lc/h	1129	Adjusted Weaving Area Capacity, pc/h		6300
Maximum Weaving Length (L_{MAX}), ft	6126	Volume-to-Capacity Ratio (v/c)		0.51

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	601	Average Weaving Speed (S_W),mi/h	55.8
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1405	Average Non-Weaving Speed (S_{NW}), mi/h	51.7
Weaving Lane Change Rate (LC_W), lc/h	1438	Average Speed (S), mi/h	53.1
Weaving Lane Change Rate (LC_{All}), lc/h	2843	Density (D), pc/mi/ln	20.3
Weaving Intensity Factor (W)	0.225	Level of Service (LOS)	C

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - between Minnesota Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2460	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1450
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.63
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	23.5
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - between Minnesota Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2345	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1354
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.58
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	21.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - between Minnesota and Cliff		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2800	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1100
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.47
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	17.8
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - between Minnesota and Cliff		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2920	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1124
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.49
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	18.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - Minnesota to Cliff		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	3120	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1813	272	68	647
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	6.00	6.00	6.00	6.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.943	0.943	0.943	0.943
Flow Rate (v_i), pc/h	2136	320	80	762
Weaving Flow Rate (v_w), pc/h	1082	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2216	Density-Based Capacity (c_{IWL}), pc/h/ln		2138
Total Flow Rate (v), pc/h	3298	Demand Flow-Based Capacity (c_{IW}), pc/h		7317
Volume Ratio (VR)	0.328	Weaving Segment Capacity (c_W), veh/h		6048
Minimum Lane Change Rate (LC_{MIN}), lc/h	1082	Adjusted Weaving Area Capacity, pc/h		6414
Maximum Weaving Length (L_{MAX}), ft	5886	Volume-to-Capacity Ratio (v/c)		0.51

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	691	Average Weaving Speed (S_W),mi/h	56.1
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1570	Average Non-Weaving Speed (S_{NW}), mi/h	51.9
Weaving Lane Change Rate (LC_W), lc/h	1407	Average Speed (S), mi/h	53.2
Weaving Lane Change Rate (LC_{All}), lc/h	2977	Density (D), pc/mi/ln	20.7
Weaving Intensity Factor (W)	0.218	Level of Service (LOS)	C

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - Minnesota to Cliff		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	3120	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1754	471	104	591
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	4.00	4.00	4.00	4.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.962	0.962	0.962	0.962
Flow Rate (v_i), pc/h	2026	544	120	683
Weaving Flow Rate (v_w), pc/h	1227	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2146	Density-Based Capacity (c_{IWL}), pc/h/ln		2108
Total Flow Rate (v), pc/h	3373	Demand Flow-Based Capacity (c_{IW}), pc/h		6593
Volume Ratio (VR)	0.364	Weaving Segment Capacity (c_W), veh/h		6084
Minimum Lane Change Rate (LC_{MIN}), lc/h	1227	Adjusted Weaving Area Capacity, pc/h		6324
Maximum Weaving Length (L_{MAX}), ft	6281	Volume-to-Capacity Ratio (v/c)		0.53

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	670	Average Weaving Speed (S_W),mi/h	55.8
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1555	Average Non-Weaving Speed (S_{NW}), mi/h	50.8
Weaving Lane Change Rate (LC_W), lc/h	1552	Average Speed (S), mi/h	52.5
Weaving Lane Change Rate (LC_{All}), lc/h	3107	Density (D), pc/mi/ln	21.4
Weaving Intensity Factor (W)	0.225	Level of Service (LOS)	C

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - between Cliff Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2085	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1228
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.53
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - between Cliff Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2225	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1285
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.55
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	20.8
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - between Cliff and 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2620	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1029
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.44
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	16.7
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - between Cliff and 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2550	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	982
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.42
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	15.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - Cliff to 26th		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2750	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1599	476	59	486
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	6.00	6.00	6.00	6.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.943	0.943	0.943	0.943
Flow Rate (v_i), pc/h	1884	561	70	573
Weaving Flow Rate (v_w), pc/h	1134	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	1954	Density-Based Capacity (c_{IWL}), pc/h/ln		2077
Total Flow Rate (v), pc/h	3088	Demand Flow-Based Capacity (c_{IW}), pc/h		6540
Volume Ratio (VR)	0.367	Weaving Segment Capacity (c_W), veh/h		5876
Minimum Lane Change Rate (LC_{MIN}), lc/h	1134	Adjusted Weaving Area Capacity, pc/h		6231
Maximum Weaving Length (L_{MAX}), ft	6314	Volume-to-Capacity Ratio (v/c)		0.50

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	537	Average Weaving Speed (S_W),mi/h	55.8
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1315	Average Non-Weaving Speed (S_{NW}), mi/h	51.9
Weaving Lane Change Rate (LC_W), lc/h	1436	Average Speed (S), mi/h	53.3
Weaving Lane Change Rate (LC_{All}), lc/h	2751	Density (D), pc/mi/ln	19.3
Weaving Intensity Factor (W)	0.226	Level of Service (LOS)	B

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - Cliff to 26th		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2750	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1488	237	88	737
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	4.00	4.00	4.00	4.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.962	0.962	0.962	0.962
Flow Rate (v_i), pc/h	1719	274	102	851
Weaving Flow Rate (v_w), pc/h	1125	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	1821	Density-Based Capacity (c_{IWL}), pc/h/ln		2065
Total Flow Rate (v), pc/h	2946	Demand Flow-Based Capacity (c_{IW}), pc/h		6283
Volume Ratio (VR)	0.382	Weaving Segment Capacity (c_W), veh/h		5960
Minimum Lane Change Rate (LC_{MIN}), lc/h	1125	Adjusted Weaving Area Capacity, pc/h		6195
Maximum Weaving Length (L_{MAX}), ft	6480	Volume-to-Capacity Ratio (v/c)		0.48

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	501	Average Weaving Speed (S_W),mi/h	55.8
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1288	Average Non-Weaving Speed (S_{NW}), mi/h	52.2
Weaving Lane Change Rate (LC_W), lc/h	1427	Average Speed (S), mi/h	53.5
Weaving Lane Change Rate (LC_{All}), lc/h	2715	Density (D), pc/mi/ln	18.4
Weaving Intensity Factor (W)	0.224	Level of Service (LOS)	B

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - between 26th Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2075	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1222
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.53
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.8
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - between 26th Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	1725	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	996
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.43
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	16.1
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	NB I-229 - north of 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2505	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	984
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.42
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	15.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	NB I-229 - north of 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	1965	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	757
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.33
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	12.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - north of 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2465	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	959
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.41
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	15.5
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - north of 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3140	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1198
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.52
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.4
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - between 26th Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2115	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1234
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.53
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	20.0
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - between 26th Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2495	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1428
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.62
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	23.1
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - between 26th and Cliff		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2840	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1105
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.48
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	17.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - between 26th and Cliff		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3085	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1177
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.51
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.0
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - 26th to Cliff		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2670	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1804	616	109	311
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	5.00	5.00	5.00	5.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.952	0.952	0.952	0.952
Flow Rate (v_i), pc/h	2106	719	127	363
Weaving Flow Rate (v_w), pc/h	1082	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2233	Density-Based Capacity (c_{IWL}), pc/h/ln		2106
Total Flow Rate (v), pc/h	3315	Demand Flow-Based Capacity (c_{IW}), pc/h		7362
Volume Ratio (VR)	0.326	Weaving Segment Capacity (c_W), veh/h		6015
Minimum Lane Change Rate (LC_{MIN}), lc/h	1082	Adjusted Weaving Area Capacity, pc/h		6318
Maximum Weaving Length (L_{MAX}), ft	5864	Volume-to-Capacity Ratio (v/c)		0.52

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	596	Average Weaving Speed (S_W),mi/h	55.7
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1329	Average Non-Weaving Speed (S_{NW}), mi/h	51.9
Weaving Lane Change Rate (LC_W), lc/h	1380	Average Speed (S), mi/h	53.1
Weaving Lane Change Rate (LC_{All}), lc/h	2709	Density (D), pc/mi/ln	20.8
Weaving Intensity Factor (W)	0.229	Level of Service (LOS)	C

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - 26th to Cliff		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2670	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2022	478	112	473
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	3.00	3.00	3.00	3.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.971	0.971	0.971	0.971
Flow Rate (v_i), pc/h	2314	547	128	541
Weaving Flow Rate (v_w), pc/h	1088	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2442	Density-Based Capacity (c_{IWL}), pc/h/ln		2120
Total Flow Rate (v), pc/h	3530	Demand Flow-Based Capacity (c_{IW}), pc/h		7792
Volume Ratio (VR)	0.308	Weaving Segment Capacity (c_W), veh/h		6176
Minimum Lane Change Rate (LC_{MIN}), lc/h	1088	Adjusted Weaving Area Capacity, pc/h		6360
Maximum Weaving Length (L_{MAX}), ft	5670	Volume-to-Capacity Ratio (v/c)		0.56

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	652	Average Weaving Speed (S_W),mi/h	55.6
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1372	Average Non-Weaving Speed (S_{NW}), mi/h	51.5
Weaving Lane Change Rate (LC_W), lc/h	1386	Average Speed (S), mi/h	52.7
Weaving Lane Change Rate (LC_{All}), lc/h	2758	Density (D), pc/mi/ln	22.3
Weaving Intensity Factor (W)	0.232	Level of Service (LOS)	C

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - between Cliff Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2500	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1459
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.63
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	23.6
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - between Cliff Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2500	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1430
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.62
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	23.1
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - between Cliff and Minnesota		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3050	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1187
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.51
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - between Cliff and Minnesota		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3190	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1217
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.52
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.7
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - Cliff to Minnesota		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	3100	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2166	504	126	254
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	5.00	5.00	5.00	5.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.952	0.952	0.952	0.952
Flow Rate (v_i), pc/h	2528	588	147	296
Weaving Flow Rate (v_w), pc/h	884	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2675	Density-Based Capacity (c_{IWL}), pc/h/ln		2202
Total Flow Rate (v), pc/h	3559	Demand Flow-Based Capacity (c_{IW}), pc/h		9677
Volume Ratio (VR)	0.248	Weaving Segment Capacity (c_W), veh/h		6289
Minimum Lane Change Rate (LC_{MIN}), lc/h	884	Adjusted Weaving Area Capacity, pc/h		6606
Maximum Weaving Length (L_{MAX}), ft	5033	Volume-to-Capacity Ratio (v/c)		0.54

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	829	Average Weaving Speed (S_W),mi/h	56.3
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1653	Average Non-Weaving Speed (S_{NW}), mi/h	52.9
Weaving Lane Change Rate (LC_W), lc/h	1207	Average Speed (S), mi/h	53.7
Weaving Lane Change Rate (LC_{All}), lc/h	2860	Density (D), pc/mi/ln	22.1
Weaving Intensity Factor (W)	0.212	Level of Service (LOS)	C

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - Cliff to Minnesota		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	3100	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2191	524	166	309
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	3.00	3.00	3.00	3.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.971	0.971	0.971	0.971
Flow Rate (v_i), pc/h	2507	600	190	354
Weaving Flow Rate (v_w), pc/h	954	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2697	Density-Based Capacity (c_{IWL}), pc/h/ln		2192
Total Flow Rate (v), pc/h	3651	Demand Flow-Based Capacity (c_{IW}), pc/h		9195
Volume Ratio (VR)	0.261	Weaving Segment Capacity (c_W), veh/h		6385
Minimum Lane Change Rate (LC_{MIN}), lc/h	954	Adjusted Weaving Area Capacity, pc/h		6576
Maximum Weaving Length (L_{MAX}), ft	5169	Volume-to-Capacity Ratio (v/c)		0.56

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	836	Average Weaving Speed (S_W),mi/h	56.1
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1658	Average Non-Weaving Speed (S_{NW}), mi/h	52.3
Weaving Lane Change Rate (LC_W), lc/h	1277	Average Speed (S), mi/h	53.2
Weaving Lane Change Rate (LC_{All}), lc/h	2935	Density (D), pc/mi/ln	22.9
Weaving Intensity Factor (W)	0.216	Level of Service (LOS)	C

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - between Minnesota Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2670	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1558
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.67
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	25.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - between Minnesota Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2715	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1554
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.67
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	25.1
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - between Minnesota and Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3050	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1187
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.51
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - between Minnesota and Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3375	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1287
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.56
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	20.8
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - Minnesota to Western		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	3220	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2032	258	122	638
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	5.00	5.00	5.00	5.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.952	0.952	0.952	0.952
Flow Rate (v_i), pc/h	2372	301	142	745
Weaving Flow Rate (v_W), pc/h	1046	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2514	Density-Based Capacity (c_{IWL}), pc/h/ln		2174
Total Flow Rate (v), pc/h	3560	Demand Flow-Based Capacity (c_{IW}), pc/h		8163
Volume Ratio (VR)	0.294	Weaving Segment Capacity (c_W), veh/h		6209
Minimum Lane Change Rate (LC_{MIN}), lc/h	1046	Adjusted Weaving Area Capacity, pc/h		6522
Maximum Weaving Length (L_{MAX}), ft	5520	Volume-to-Capacity Ratio (v/c)		0.55

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	810	Average Weaving Speed (S_W),mi/h	56.1
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1685	Average Non-Weaving Speed (S_{NW}), mi/h	51.8
Weaving Lane Change Rate (LC_W), lc/h	1376	Average Speed (S), mi/h	53.0
Weaving Lane Change Rate (LC_{All}), lc/h	3061	Density (D), pc/mi/ln	22.4
Weaving Intensity Factor (W)	0.217	Level of Service (LOS)	C

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - Minnesota to Western		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	3220	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2168	412	248	547
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	3.00	3.00	3.00	3.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.971	0.971	0.971	0.971
Flow Rate (v_i), pc/h	2481	471	284	626
Weaving Flow Rate (v_w), pc/h	1097	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2765	Density-Based Capacity (c_{IWL}), pc/h/ln		2182
Total Flow Rate (v), pc/h	3862	Demand Flow-Based Capacity (c_{IW}), pc/h		8451
Volume Ratio (VR)	0.284	Weaving Segment Capacity (c_W), veh/h		6356
Minimum Lane Change Rate (LC_{MIN}), lc/h	1097	Adjusted Weaving Area Capacity, pc/h		6546
Maximum Weaving Length (L_{MAX}), ft	5413	Volume-to-Capacity Ratio (v/c)		0.59

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	890	Average Weaving Speed (S_W),mi/h	55.9
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1737	Average Non-Weaving Speed (S_{NW}), mi/h	50.9
Weaving Lane Change Rate (LC_W), lc/h	1427	Average Speed (S), mi/h	52.2
Weaving Lane Change Rate (LC_{All}), lc/h	3164	Density (D), pc/mi/ln	24.7
Weaving Intensity Factor (W)	0.223	Level of Service (LOS)	C

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - between Western Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2290	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1336
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.58
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	21.6
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - between Western Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2580	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1476
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.64
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	23.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	SB I-229 - west of Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2520	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	980
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.42
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	15.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	SB I-229 - west of Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

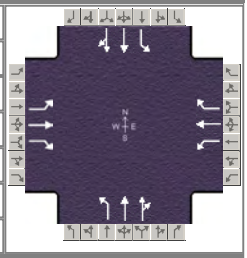
Demand Volume veh/h	3100	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1182
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.51
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.1
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

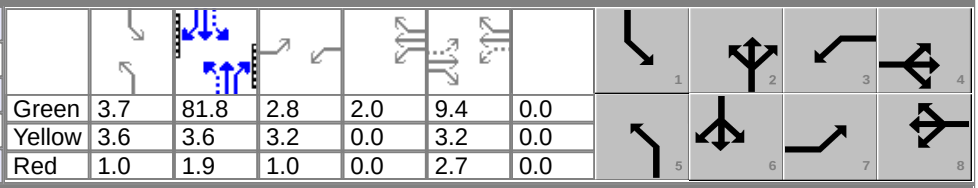
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 23, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2024	Analysis Period	1> 7:15
Intersection	37th Street	File Name	01-02-04-05 Minnesota Avenue 2024 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	30	70	50	100	70	100	70	1505	90	90	770	10

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	71	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	3.7	81.8	2.8	2.0	9.4	0.0
Yellow	3.6	3.6	3.2	0.0	3.2	0.0
Red	1.0	1.9	1.0	0.0	2.7	0.0

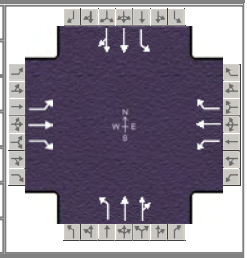
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	3.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	7.0	15.3	9.0	17.4	8.3	87.3	8.3	87.4
Change Period, ($Y+R_c$), s	4.2	5.9	4.2	5.9	4.6	5.5	4.6	5.5
Max Allow Headway (*MAH*), s	4.3	4.3	4.3	4.3	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	4.1	6.9	6.8	10.3	3.6		3.6	
Green Extension Time (g_e), s	0.0	1.2	0.0	1.2	0.3	0.0	0.3	0.0
Phase Call Probability	0.67	1.00	0.98	1.00	0.93		0.93	
Max Out Probability	1.00	0.00	1.00	0.00	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	33	78	56	111	78	111	78	889	883	79	342	340
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1543	1734	1821	1568	1734	1821	1785	1734	1821	1813
Queue Service Time (g_s), s	2.1	4.9	4.1	4.8	4.8	8.3	1.6	36.4	37.4	1.6	6.2	6.2
Cycle Queue Clearance Time (g_c), s	2.1	4.9	4.1	4.8	4.8	8.3	1.6	36.4	37.4	1.6	6.2	6.2
Green Ratio (*g/C*)	0.10	0.08	0.08	0.12	0.10	0.10	0.71	0.68	0.68	0.71	0.68	0.68
Capacity (*c*), veh/h	151	143	121	179	174	150	579	1242	1217	213	1242	1237
Volume-to-Capacity Ratio (*X*)	0.221	0.543	0.458	0.620	0.446	0.741	0.134	0.716	0.726	0.369	0.275	0.275
Back of Queue (*Q*), ft/ln (95 th percentile)	43.7	110	77.9	62.3	106.1	160.9	25.5	531.1	527	41.7	101.5	100.2
Back of Queue (*Q*), veh/ln (95 th percentile)	1.7	4.3	3.1	2.5	4.2	6.4	1.0	20.9	21.1	1.6	4.0	4.0
Queue Storage Ratio (*RQ*) (95 th percentile)	0.29	0.00	0.39	0.42	0.00	0.80	0.17	0.00	0.00	0.28	0.00	0.00
Uniform Delay (d_1), s/veh	49.5	53.2	52.8	51.6	51.3	52.8	5.5	11.8	12.0	13.7	4.8	4.8
Incremental Delay (d_2), s/veh	0.7	3.2	2.7	6.4	1.8	7.0	0.1	3.6	3.8	1.0	0.5	0.5
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	50.2	56.4	55.5	58.0	53.0	59.8	5.6	15.4	15.8	14.7	5.3	5.3
Level of Service (LOS)	D	E	E	E	D	E	A	B	B	B	A	A
Approach Delay, s/veh / LOS	54.9	D		57.4	E		15.2	B		6.3	A	
Intersection Delay, s/veh / LOS	19.2						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.31	B	2.31	B	2.06	B	2.06	B
Bicycle LOS Score / LOS	0.76	A	0.98	A	2.01	B	1.29	A

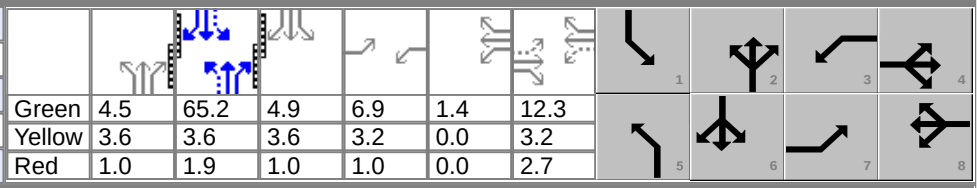
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 23, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2024	Analysis Period	1> 16:30
Intersection	37th Street	File Name	01-02-04-05 Minnesota Avenue 2024 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	70	130	110	155	125	105	80	985	60	155	1510	50

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	71	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	4.5	65.2	4.9	6.9	1.4	12.3
Yellow	3.6	3.6	3.6	3.2	0.0	3.2
Red	1.0	1.9	1.0	1.0	0.0	2.7

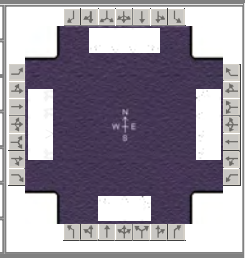
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	3.0	1.1	3.0	1.2	4.0	1.3	4.0
Phase Duration, s	11.1	18.2	12.5	19.7	9.1	79.8	9.5	80.2
Change Period, ($Y+R_c$), s	4.2	5.9	4.2	5.9	4.6	5.5	5.5	5.5
Max Allow Headway (*MAH*), s	4.3	4.3	4.3	4.3	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	6.7	11.3	10.3	10.8	4.6		2.0	
Green Extension Time (g_e), s	0.2	1.1	0.0	1.2	0.1	0.0	1.5	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	0.95		1.00	
Max Out Probability	0.00	0.23	1.00	0.10	0.10		1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	78	144	67	172	139	83	89	586	575	163	823	818
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1543	1734	1821	1543	1734	1821	1784	1734	1821	1800
Queue Service Time (g_s), s	4.7	9.3	4.9	8.3	8.8	6.1	2.6	21.7	21.7	0.0	25.3	25.2
Cycle Queue Clearance Time (g_c), s	4.7	9.3	4.9	8.3	8.8	6.1	2.6	21.7	21.7	0.0	25.3	25.2
Green Ratio (*g/C*)	0.16	0.10	0.10	0.17	0.11	0.11	0.60	0.62	0.62	0.56	0.62	0.62
Capacity (*c*), veh/h	191	187	159	212	209	177	226	1127	1104	321	1133	1120
Volume-to-Capacity Ratio (*X*)	0.408	0.772	0.420	0.813	0.665	0.471	0.393	0.520	0.521	0.507	0.726	0.730
Back of Queue (*Q*), ft/ln (95 th percentile)	97.5	206.8	90.3	114.6	193.7	107.3	48.2	354.8	343.9	146	206.8	196.2
Back of Queue (*Q*), veh/ln (95 th percentile)	3.8	8.1	3.6	4.5	7.6	4.2	1.9	14.0	13.8	5.7	8.1	7.8
Queue Storage Ratio (*RQ*) (95 th percentile)	0.65	0.00	0.45	0.76	0.00	0.54	0.32	0.00	0.00	0.73	0.00	0.00
Uniform Delay (d_1), s/veh	44.7	52.5	50.5	48.2	50.9	2.1	14.6	12.8	12.9	27.4	6.8	6.6
Incremental Delay (d_2), s/veh	1.4	6.6	1.8	20.9	3.6	1.9	1.1	1.7	1.8	0.4	1.4	1.5
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	46.1	59.1	52.3	69.1	54.5	4.1	15.7	14.6	14.6	27.8	8.3	8.1
Level of Service (LOS)	D	E	D	E	D	A	B	B	B	C	A	A
Approach Delay, s/veh / LOS	54.0	D		50.2	D		14.7	B		10.0	A	
Intersection Delay, s/veh / LOS	19.2						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.31	B	2.31	B	2.19	B	2.15	B
Bicycle LOS Score / LOS	0.96	A	1.14	A	1.52	B	2.06	B

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 23, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2024	Analysis Period	1> 7:15
Intersection	41st Street	File Name	01-02-04-05 Minnesota Avenue 2024 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	225	145	90	130	145	50	125	1100	65	30	535	150

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	88	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	2.5	63.1	4.2	7.0	4.0	10.0						
Yellow	3.6	3.6	3.6	3.6	0.0	3.6						
Red	2.3	2.5	2.3	2.1	0.0	2.1						

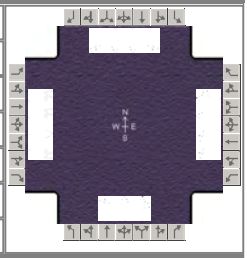
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	4.0	1.3	4.0	1.2	3.0
Phase Duration, s	16.6	19.7	12.7	15.7	10.1	79.3	8.4	77.6
Change Period, ($Y+R_c$), s	5.7	5.7	5.7	5.7	6.1	6.1	5.9	6.1
Max Allow Headway (*MAH*), s	3.1	4.3	3.2	4.3	3.2	0.0	5.2	0.0
Queue Clearance Time (g_s), s	10.7	12.3	7.0	9.4	2.0		2.9	
Green Extension Time (g_e), s	0.2	0.8	0.1	0.6	1.2	0.0	0.1	0.0
Phase Call Probability	1.00	1.00	0.99	1.00	1.00		0.62	
Max Out Probability	0.64	0.98	1.00	1.00	1.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	250	161	100	144	110	106	176	825	816	29	516	106
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1821	1568	1711	1850	1691	1762	1821	1785	1734	1734	1568
Queue Service Time (g_s), s	8.7	10.3	7.2	5.0	7.0	7.4	0.0	25.3	25.3	0.9	6.0	2.8
Cycle Queue Clearance Time (g_c), s	8.7	10.3	7.2	5.0	7.0	7.4	0.0	25.3	25.3	0.9	6.0	2.8
Green Ratio (*g/C*)	0.09	0.12	0.12	0.06	0.08	0.08	0.54	0.61	0.61	0.56	0.60	0.60
Capacity (*c*), veh/h	307	212	182	199	154	141	576	1110	1088	192	2065	934
Volume-to-Capacity Ratio (*X*)	0.814	0.760	0.548	0.725	0.715	0.754	0.306	0.743	0.750	0.151	0.250	0.114
Back of Queue (*Q*), ft/ln (95 th percentile)	181.9	233	129.9	101.5	156.9	157.5	121.9	229.3	221.2	16.6	97.4	42.6
Back of Queue (*Q*), veh/ln (95 th percentile)	7.2	9.2	5.2	4.1	6.3	6.3	4.9	9.0	8.7	0.7	3.8	1.7
Queue Storage Ratio (*RQ*) (95 th percentile)	0.73	0.00	0.00	0.41	0.00	0.00	0.81	0.00	0.00	0.11	0.00	0.43
Uniform Delay (d_1), s/veh	53.5	51.4	10.3	55.6	53.6	53.8	15.7	6.6	6.3	14.9	7.4	1.4
Incremental Delay (d_2), s/veh	7.2	12.1	3.6	3.8	5.6	9.3	0.1	2.9	3.1	0.5	0.3	0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	60.7	63.5	13.9	59.3	59.2	63.1	15.7	9.5	9.4	15.3	7.7	1.6
Level of Service (LOS)	E	E	B	E	E	E	B	A	A	B	A	A
Approach Delay, s/veh / LOS	52.4	D		60.4	E		10.1	B		7.1	A	
Intersection Delay, s/veh / LOS	21.4						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.31	B	2.52	C	2.25	B	2.47	B
Bicycle LOS Score / LOS	1.33	A	0.79	A	1.67	B	1.11	A

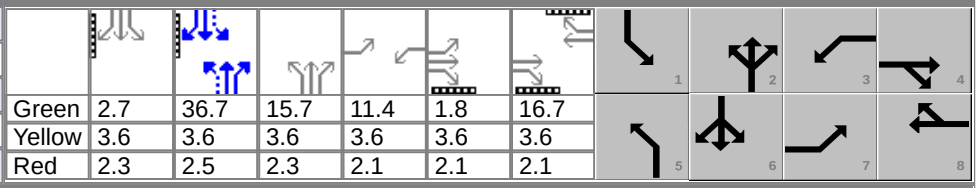
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 23, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2024	Analysis Period	1> 16:30
Intersection	41st Street	File Name	01-02-04-05 Minnesota Avenue 2024 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	410	270	275	230	315	50	235	745	90	35	1270	365

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	75	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	2.7	36.7	15.7	11.4	1.8	16.7						
Yellow	3.6	3.6	3.6	3.6	3.6	3.6						
Red	2.3	2.5	2.3	2.1	2.1	2.1						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	4.0	1.3	4.0	1.2	3.0
Phase Duration, s	24.6	29.9	17.1	22.4	21.6	64.4	8.6	51.5
Change Period, ($Y+R_c$), s	5.7	5.7	5.7	5.7	6.1	6.1	5.9	6.1
Max Allow Headway (*MAH*), s	3.1	4.3	3.2	4.3	3.2	0.0	5.2	0.0
Queue Clearance Time (g_s), s	17.8	20.9	10.8	14.5	16.4		3.6	
Green Extension Time (g_e), s	1.0	2.4	0.6	2.2	0.0	0.0	0.0	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		0.68	
Max Out Probability	0.00	0.42	0.00	0.52	1.00		0.23	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	456	300	194	256	197	192	283	513	493	34	1242	259
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1821	1568	1711	1850	1785	1762	1821	1752	1734	1734	1568
Queue Service Time (g_s), s	15.8	18.9	13.6	8.8	12.3	12.5	14.4	18.1	17.3	1.6	41.1	12.0
Cycle Queue Clearance Time (g_c), s	15.8	18.9	13.6	8.8	12.3	12.5	14.4	18.1	17.3	1.6	41.1	12.0
Green Ratio (*g/C*)	0.16	0.20	0.20	0.09	0.14	0.14	0.42	0.49	0.49	0.35	0.38	0.38
Capacity (*c*), veh/h	529	367	316	324	258	249	296	885	851	187	1311	593
Volume-to-Capacity Ratio (*X*)	0.861	0.817	0.615	0.789	0.764	0.773	0.956	0.579	0.579	0.183	0.948	0.437
Back of Queue (*Q*), ft/ln (95 th percentile)	278	371	218	172.9	252	249.3	413.4	257.9	233.6	30.5	566.1	147.4
Back of Queue (*Q*), veh/ln (95 th percentile)	10.9	14.6	8.7	6.9	10.1	10.0	16.5	10.2	9.2	1.2	22.3	5.9
Queue Storage Ratio (*RQ*) (95 th percentile)	1.11	0.00	0.00	0.69	0.00	0.00	2.76	0.00	0.00	0.20	0.00	1.47
Uniform Delay (d_1), s/veh	49.3	45.8	7.6	53.1	49.7	49.8	50.3	13.0	12.1	27.6	30.6	6.0
Incremental Delay (d_2), s/veh	1.6	10.7	2.9	1.6	5.2	5.9	36.5	2.4	2.4	0.3	9.1	1.2
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	50.9	56.5	10.5	54.8	54.9	55.7	86.8	15.3	14.6	27.9	39.7	7.2
Level of Service (LOS)	D	E	B	D	D	E	F	B	B	C	D	A
Approach Delay, s/veh / LOS	44.4	D		55.1	E		30.7	C		33.9	C	
Intersection Delay, s/veh / LOS	38.3						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.30	B	2.60	C	2.29	B	2.61	C
Bicycle LOS Score / LOS	2.06	B	1.02	A	1.47	A	1.93	B

HCS7 Two-Way Stop-Control Report

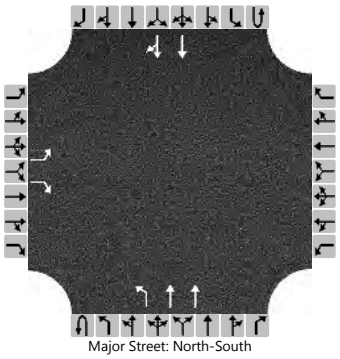
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at 49th Ave
Jurisdiction	Sioux Falls, SD
East/West Street	49th Avenue
North/South Street	Minnesota Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration		L		R						L	T				T	TR
Volume (veh/h)		30		115					0	170	1785				780	50
Percent Heavy Vehicles (%)		2		2					2	2						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized		No														
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5		6.9						4.1						
Critical Headway (sec)		6.84		6.94						4.14						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.52		3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		33		128						189						
Capacity, c (veh/h)		26		547						736						
v/c Ratio		1.30		0.23						0.26						
95% Queue Length, Q_{95} (veh)		4.1		0.9						1.0						
Control Delay (s/veh)		508.5		13.6						11.6						
Level of Service (LOS)		F		B						B						
Approach Delay (s/veh)		116.0								1.0						
Approach LOS		F														

HCS7 Two-Way Stop-Control Report

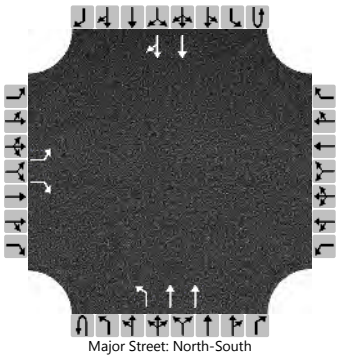
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at 49th Ave
Jurisdiction	Sioux Falls, SD
East/West Street	49th Avenue
North/South Street	Minnesota Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration		L		R						L	T				T	TR
Volume (veh/h)		45		220					0	150	1155				1950	35
Percent Heavy Vehicles (%)		2		2					2	2						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized		No														
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5		6.9						4.1						
Critical Headway (sec)		6.84		6.94						4.14						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.52		3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		50		244						167						
Capacity, c (veh/h)		2		206						235						
v/c Ratio		21.11		1.19						0.71						
95% Queue Length, Q_{95} (veh)		8.2		12.3						4.7						
Control Delay (s/veh)		11958.3		169.5						50.7						
Level of Service (LOS)		F		F						F						
Approach Delay (s/veh)		2171.3								5.8						
Approach LOS		F														

HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	Diamond
Analyst	Graham Johnson	Analysis Date	Apr 23, 2019	Segment Distance, ft	683
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 North Ramp	PHF	0.90	Arterial Direction	North-South
File Name	01-02-04-05 Minnesota Avenue 2024 AM.xus				
Project Description	I-229 Exits 3 and 4				

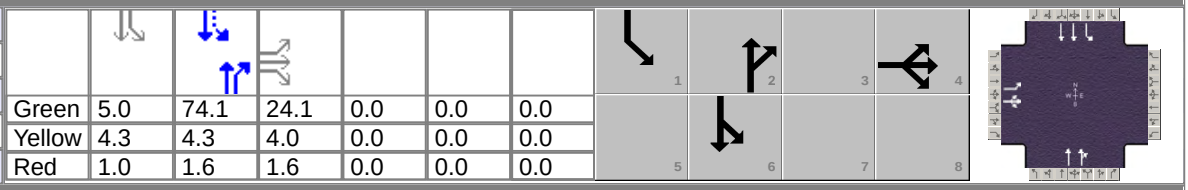
Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h				135	0	245	100	1710			615	280
Intersection Two Demand (*v*), veh/h	395	5	70					1415	230	105	645	

Signal One Information	
Cycle, s	120.0
Offset, s	30
Uncoordinated	No
Force Mode	Fixed

Green	4.1	81.4	18.1	0.0	0.0	0.0
Yellow	3.6	3.6	4.0	0.0	0.0	0.0
Red	1.0	2.2	2.0	0.0	0.0	0.0

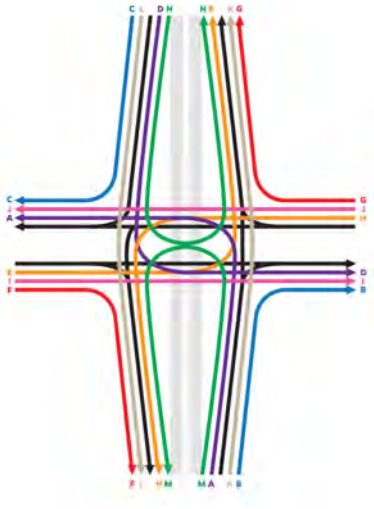
Signal Two Information	
Cycle, s	120.0
Offset, s	30
Uncoordinated	No
Force Mode	Fixed

Green	5.0	74.1	24.1	0.0	0.0	0.0
Yellow	4.3	4.3	4.0	0.0	0.0	0.0
Red	1.0	1.6	1.6	0.0	0.0	0.0



Interchange Results

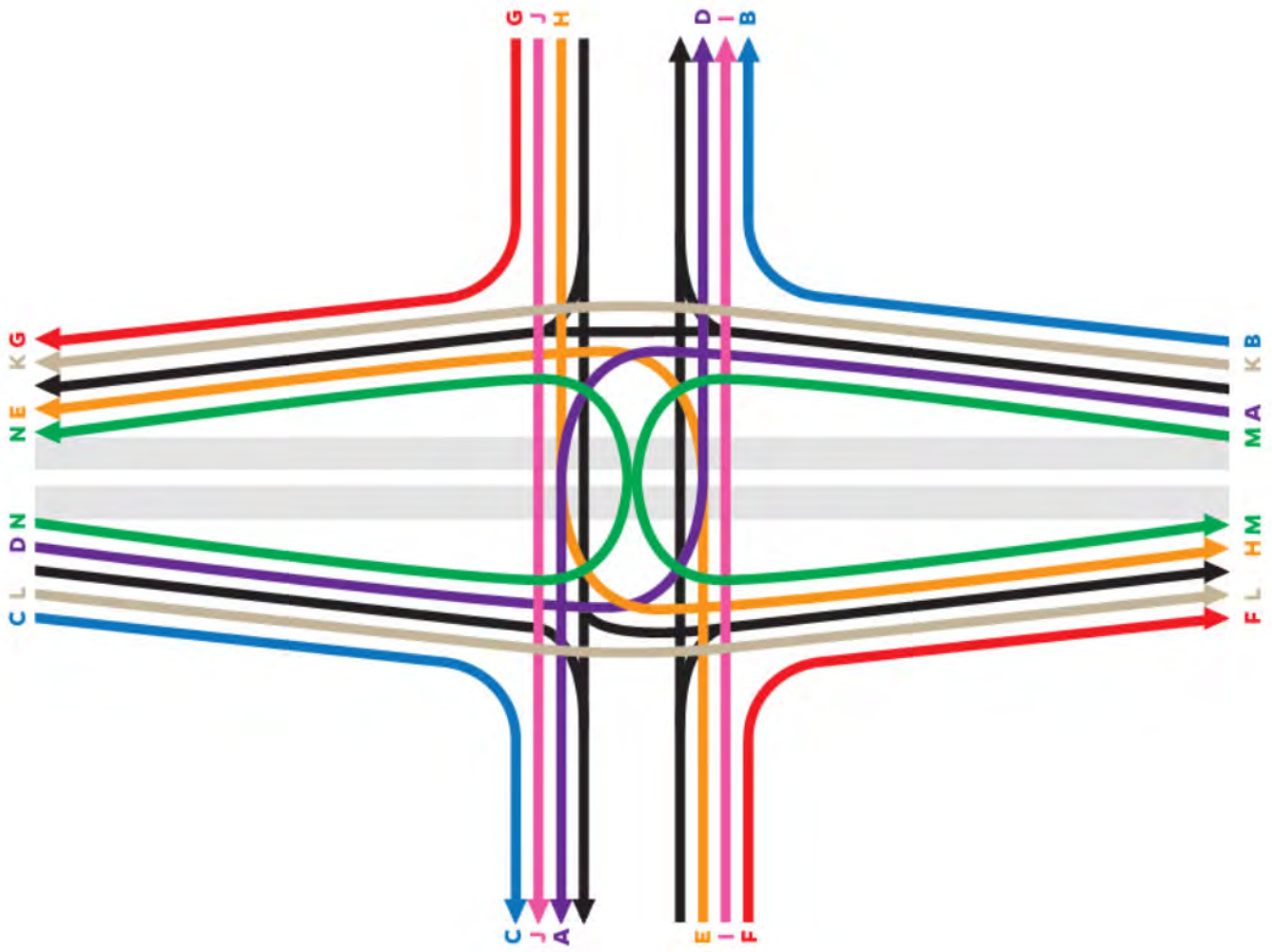
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	0	9.3	0.0	9.3	No	No	A
B	0	0.0	0.0	0.0	No	No	A
C	0	0.0	0.0	0.0	No	No	A
D	0	14.5	0.0	14.5	No	No	A
E	0	7.4	0.0	7.4	No	No	A
F	0	7.4	0.0	7.4	No	No	A
G	0	0.0	0.0	0.0	No	No	A
H	0	6.9	0.0	6.9	No	No	A
I	1752	21.9	0.0	21.9	No	No	B
J	546	16.2	0.0	16.2	No	No	B
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh				50.2	59.4		7.3	7.4			9.3	6.5
Level of Service (LOS)				D	E		A	A			A	A
Approach Delay, s/veh / LOS	0.0			55.3	E		7.4	A		8.0	A	
Intersection Delay, s/veh / LOS	12.9						B					

Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	58.9	44.9						14.5	15.4	34.2	6.9	
Level of Service (LOS)	E	D						B	B	C	A	
Approach Delay, s/veh / LOS	53.5	D		0.0			15.0	B		10.7	B	
Intersection Delay, s/veh / LOS	19.7						B					

Interchange Graphic



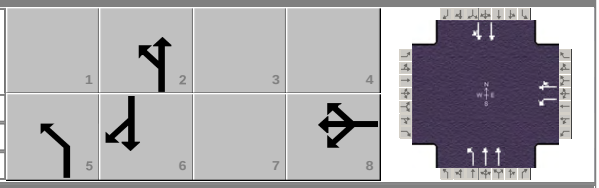
HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	Diamond
Analyst	Graham Johnson	Analysis Date	Apr 23, 2019	Segment Distance, ft	683
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 North Ramp	PHF	0.90	Arterial Direction	North-South
File Name	01-02-04-05 Minnesota Avenue 2024 PM.xus				
Project Description	I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h				235	0	240	130	1065			1640	530
Intersection Two Demand (*v*), veh/h	300	0	150					895	200	375	1500	

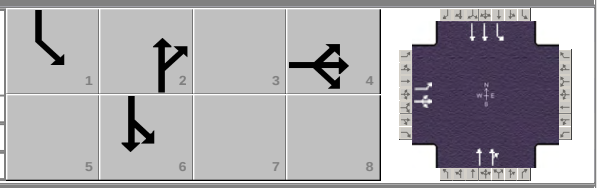
Signal One Information	
Cycle, s	120.0
Offset, s	61
Uncoordinated	No
Force Mode	Fixed

Green	73.9	9.1	20.6	0.0	0.0	0.0
Yellow	3.6	3.6	4.0	0.0	0.0	0.0
Red	2.2	1.0	2.0	0.0	0.0	0.0



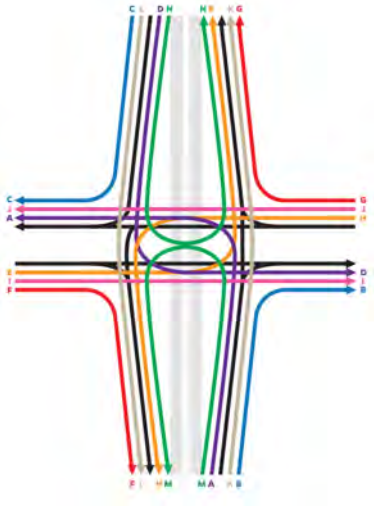
Signal Two Information	
Cycle, s	120.0
Offset, s	61
Uncoordinated	No
Force Mode	Fixed

Green	21.4	60.8	21.0	0.0	0.0	0.0
Yellow	4.3	4.3	4.0	0.0	0.0	0.0
Red	1.0	1.6	1.6	0.0	0.0	0.0



Interchange Results

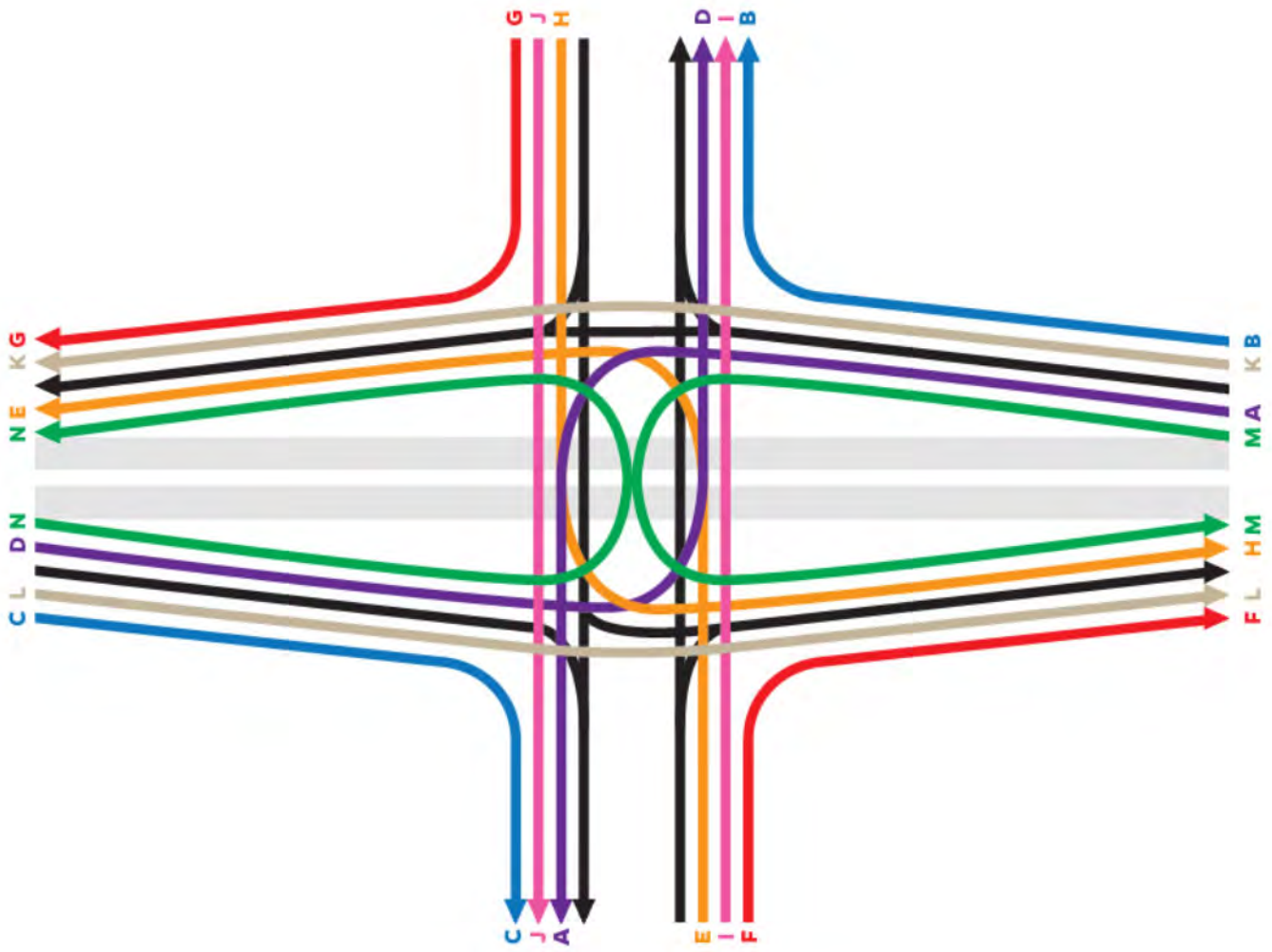
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	0	13.6	0.0	13.6	No	No	A
B	0	0.0	0.0	0.0	No	No	A
C	0	0.0	0.0	0.0	No	No	A
D	0	21.7	0.0	21.7	No	No	B
E	0	6.9	0.0	6.9	No	No	A
F	0	6.9	0.0	6.9	No	No	A
G	0	0.0	0.0	0.0	No	No	A
H	0	8.6	0.0	8.6	No	No	A
I	1256	28.6	0.0	28.6	No	No	B
J	1386	22.2	0.0	22.2	No	No	B
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh				69.0	53.7		73.1	6.9			13.6	13.6
Level of Service (LOS)				E	D		E	A			B	B
Approach Delay, s/veh / LOS	0.0			62.8		E	14.1		B	13.6		B
Intersection Delay, s/veh / LOS	19.7						B					

Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	65.7	54.1						21.7	21.3	46.6	8.6	
Level of Service (LOS)	E	D						C	C	D	A	
Approach Delay, s/veh / LOS	60.9		E	0.0			21.5		C	16.2		B
Intersection Delay, s/veh / LOS	23.2						C					

Interchange Graphic



HCS7 Two-Way Stop-Control Report

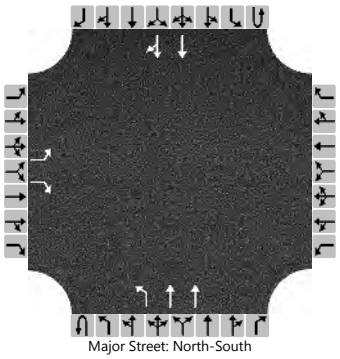
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at Yankton
Jurisdiction	Sioux Falls, SD
East/West Street	Yankton Trail
North/South Street	Minnesota Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration		L		R						L	T				T	TR
Volume (veh/h)		0		5					0	5	1645				710	5
Percent Heavy Vehicles (%)		2		2					2	2						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized		No														
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5		6.9						4.1						
Critical Headway (sec)		6.84		6.94						4.14						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.52		3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		0		6						6						
Capacity, c (veh/h)		80		602						823						
v/c Ratio		0.00		0.01						0.01						
95% Queue Length, Q_{95} (veh)		0.0		0.0						0.0						
Control Delay (s/veh)		49.8		11.0						9.4						
Level of Service (LOS)		E		B						A						
Approach Delay (s/veh)		11.0								0.0						
Approach LOS		B														

HCS7 Two-Way Stop-Control Report

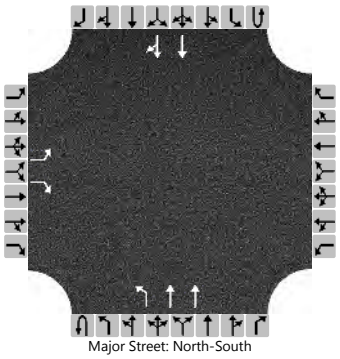
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at Yankton
Jurisdiction	Sioux Falls, SD
East/West Street	Yankton Trail
North/South Street	Minnesota Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration		L		R						L	T				T	TR
Volume (veh/h)		5		10					0	50	1090				1530	120
Percent Heavy Vehicles (%)		2		2					2	2						
Proportion Time Blocked																
Percent Grade (%)	0															
Right Turn Channelized	No															
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5		6.9						4.1						
Critical Headway (sec)		6.84		6.94						4.14						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.52		3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		6		11						56						
Capacity, c (veh/h)		20		274						329						
v/c Ratio		0.27		0.04						0.17						
95% Queue Length, Q_{95} (veh)		0.8		0.1						0.6						
Control Delay (s/veh)		240.5		18.7						18.2						
Level of Service (LOS)		F		C						C						
Approach Delay (s/veh)	92.6								0.8							
Approach LOS	F															

HCS7 Two-Way Stop-Control Report

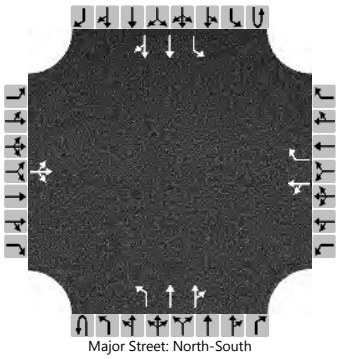
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at Lotta St
Jurisdiction	Sioux Falls, SD
East/West Street	Lotta St
North/South Street	Minnesota Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	1	0	1	2	0	0	1	2	0
Configuration			LTR			LT		R		L	T	TR		L	T	TR
Volume (veh/h)		0	0	5		20	0	215	0	10	1435	10	0	40	665	10
Percent Heavy Vehicles (%)		2	2	2		3	3	2	2	2			2	2		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized					No											
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5	6.5	6.9		7.5	6.5	6.9		4.1				4.1		
Critical Headway (sec)		7.54	6.54	6.94		7.56	6.56	6.94		4.14				4.14		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.52	4.02	3.32		3.53	4.03	3.32		2.22				2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			6			22		239		11				44		
Capacity, c (veh/h)			623			27		327		855				403		
v/c Ratio			0.01			0.82		0.73		0.01				0.11		
95% Queue Length, Q_{95} (veh)			0.0			2.6		5.5		0.0				0.4		
Control Delay (s/veh)			10.8			320.4		40.9		9.3				15.0		
Level of Service (LOS)			B			F		E		A				C		
Approach Delay (s/veh)	10.8				64.7				0.1				0.8			
Approach LOS	B				F											

HCS7 Two-Way Stop-Control Report

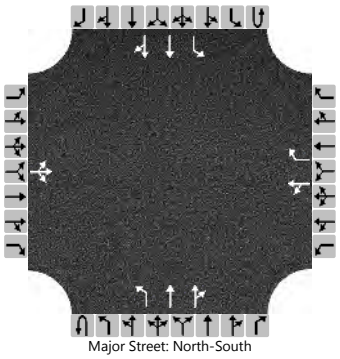
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at Lotta St
Jurisdiction	Sioux Falls, SD
East/West Street	Lotta St
North/South Street	Minnesota Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	1	0	1	2	0	0	1	2	0
Configuration			LTR			LT		R		L	T	TR		L	T	TR
Volume (veh/h)		0	0	5		15	0	95	0	5	1045	30	0	170	1370	0
Percent Heavy Vehicles (%)		2	2	2		3	3	2	2	2			2	2		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized					No											
Median Type | Storage	Undivided															

Critical and Follow-up Headways

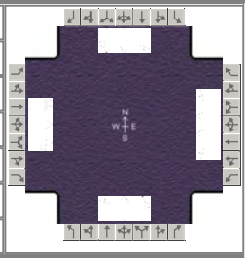
Base Critical Headway (sec)		7.5	6.5	6.9		7.5	6.5	6.9		4.1				4.1		
Critical Headway (sec)		7.54	6.54	6.94		7.56	6.56	6.94		4.14				4.14		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.52	4.02	3.32		3.53	4.03	3.32		2.22				2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			6			17		106		6				189		
Capacity, c (veh/h)			348			14		446		434				580		
v/c Ratio			0.02			1.17		0.24		0.01				0.33		
95% Queue Length, Q_{95} (veh)			0.0			2.7		0.9		0.0				1.4		
Control Delay (s/veh)			15.5			663.3		15.6		13.4				14.2		
Level of Service (LOS)			C			F		C		B				B		
Approach Delay (s/veh)	15.5				103.9				0.1				1.6			
Approach LOS	C				F											

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2024	Analysis Period	1> 7:15
Intersection	57th Street	File Name	08 Minnesota at 57th 2024 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	125	255	95	65	635	240	125	745	30	95	450	65

Signal Information			
Cycle, s	84.2	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	5.1	1.5	24.8	3.7	2.8	24.5
Yellow	4.0	0.0	4.3	4.0	0.0	3.9
Red	1.0	0.0	1.6	1.0	0.0	1.9

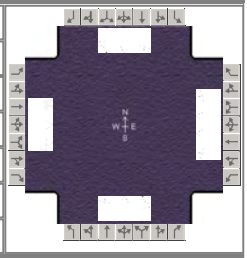
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	11.5	33.1	8.7	30.3	11.7	32.3	10.1	30.7
Change Period, ($Y+R_c$), s	5.0	5.8	5.0	5.8	5.0	5.9	5.0	5.9
Max Allow Headway (*MAH*), s	3.7	5.7	3.7	5.7	3.7	5.6	3.7	5.6
Queue Clearance Time (g_s), s	6.6	8.9	4.4	17.3	6.6	19.9	5.5	13.1
Green Extension Time (g_e), s	0.1	9.9	0.1	7.3	0.3	6.5	0.1	9.3
Phase Call Probability	0.96	1.00	0.82	1.00	0.96	1.00	0.92	1.00
Max Out Probability	1.00	0.35	0.10	0.62	0.00	0.79	0.42	0.55

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	139	191	181	72	706	194	139	430	425	106	285	276
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1673	1734	1734	1543	1734	1821	1800	1734	1821	1751
Queue Service Time (g_s), s	4.6	6.7	6.9	2.4	15.3	8.6	4.6	17.9	17.9	3.5	11.0	11.1
Cycle Queue Clearance Time (g_c), s	4.6	6.7	6.9	2.4	15.3	8.6	4.6	17.9	17.9	3.5	11.0	11.1
Green Ratio (*g/C*)	0.37	0.32	0.32	0.33	0.29	0.29	0.37	0.31	0.31	0.36	0.30	0.30
Capacity (*c*), veh/h	301	591	543	382	1010	449	361	571	564	241	538	517
Volume-to-Capacity Ratio (*X*)	0.462	0.323	0.334	0.189	0.699	0.433	0.384	0.754	0.754	0.438	0.530	0.534
Back of Queue (*Q*), ft/ln (95 th percentile)	85	130	122.1	44.3	265.2	145.6	83.1	329.7	321.8	65.2	213.2	205.2
Back of Queue (*Q*), veh/ln (95 th percentile)	3.3	5.1	4.9	1.7	10.4	5.7	3.3	13.0	12.9	2.6	8.4	8.2
Queue Storage Ratio (*RQ*) (95 th percentile)	0.68	0.00	0.00	0.18	0.00	0.97	0.83	0.00	0.00	0.22	0.00	0.00
Uniform Delay (d_1), s/veh	20.0	21.5	21.5	19.7	26.6	24.2	18.8	26.0	26.0	21.0	24.8	24.8
Incremental Delay (d_2), s/veh	0.8	0.5	0.6	0.2	1.9	1.1	0.5	5.3	5.4	0.9	1.4	1.5
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	20.8	22.0	22.2	19.9	28.4	25.3	19.3	31.3	31.4	21.9	26.2	26.3
Level of Service (LOS)	C	C	C	B	C	C	B	C	C	C	C	C
Approach Delay, s/veh / LOS	21.7	C		27.2	C		29.7	C		25.6	C	
Intersection Delay, s/veh / LOS	26.7						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.28	B	2.29	B	2.52	C	2.30	B
Bicycle LOS Score / LOS	0.91	A	1.29	A	1.31	A	1.04	A

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2024	Analysis Period	1> 16:30
Intersection	57th Street	File Name	08 Minnesota at 57th 2024 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	150	820	130	65	495	160	130	575	120	355	920	70

Signal Information			
Cycle, s	111.4	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	4.0	11.9	28.2	4.0	1.0	35.6
Yellow	4.0	4.0	4.3	4.0	0.0	3.9
Red	1.0	1.0	1.6	1.0	0.0	1.9

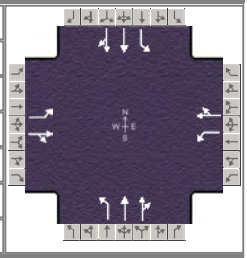
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	10.0	42.4	9.0	41.4	9.0	34.1	25.9	51.0
Change Period, ($Y+R_c$), s	5.0	5.8	5.0	5.8	5.0	5.9	5.0	5.9
Max Allow Headway (*MAH*), s	3.7	5.6	3.7	5.6	3.7	5.6	3.7	5.6
Queue Clearance Time (g_s), s	7.0	32.5	5.1	16.3	6.0	22.9	19.8	31.0
Green Extension Time (g_e), s	0.0	4.1	0.0	0.0	0.0	5.3	1.1	0.0
Phase Call Probability	0.99	1.00	0.89	1.00	0.99	1.00	1.00	1.00
Max Out Probability	1.00	0.91	1.00	1.00	1.00	0.64	0.00	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	167	528	506	72	550	111	144	365	352	394	554	541
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1745	1734	1734	1543	1734	1821	1751	1734	1821	1778
Queue Service Time (g_s), s	5.0	30.5	30.5	3.1	14.3	5.9	4.0	20.9	20.9	17.8	29.0	29.0
Cycle Queue Clearance Time (g_c), s	5.0	30.5	30.5	3.1	14.3	5.9	4.0	20.9	20.9	17.8	29.0	29.0
Green Ratio (*g/C*)	0.36	0.33	0.33	0.36	0.32	0.32	0.29	0.25	0.25	0.46	0.40	0.40
Capacity (*c*), veh/h	307	599	574	147	1109	494	192	461	444	438	737	720
Volume-to-Capacity Ratio (*X*)	0.543	0.881	0.881	0.492	0.496	0.225	0.752	0.791	0.793	0.901	0.751	0.751
Back of Queue (*Q*), ft/ln (95 th percentile)	78.9	557.4	531.5	62.2	255.6	101.8	133.2	383	367.2	318.9	491.5	475
Back of Queue (*Q*), veh/ln (95 th percentile)	3.1	21.9	21.3	2.4	10.1	4.0	5.2	15.1	14.7	12.6	19.3	19.0
Queue Storage Ratio (*RQ*) (95 th percentile)	0.63	0.00	0.00	0.25	0.00	0.68	1.33	0.00	0.00	1.59	0.00	0.00
Uniform Delay (d_1), s/veh	30.2	35.4	35.4	29.3	30.7	27.8	39.5	38.9	38.9	24.8	28.4	28.4
Incremental Delay (d_2), s/veh	1.6	13.1	13.6	1.9	0.6	0.4	14.6	5.3	5.6	7.1	4.8	5.0
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	31.8	48.5	49.0	31.2	31.3	28.2	54.2	44.2	44.5	31.9	33.2	33.3
Level of Service (LOS)	C	D	D	C	C	C	D	D	D	C	C	C
Approach Delay, s/veh / LOS	46.4	D		30.8	C		46.0	D		32.9	C	
Intersection Delay, s/veh / LOS	39.0						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.36	B	2.29	B	2.53	C	2.31	B
Bicycle LOS Score / LOS	1.48	A	1.09	A	1.20	A	1.72	B

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2024	Analysis Period	1> 7:15
Intersection	33rd Street	File Name	09 Cliff at 33rd 2024 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	70	85	30	50	130	10	90	970	15	5	330	60

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	0.5	3.5	51.0	3.4	1.3	10.4
Yellow	3.6	0.0	3.6	3.6	0.0	3.6
Red	1.0	0.0	1.5	1.0	0.0	1.9

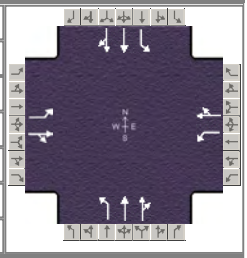
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	4.0	1.1	4.0	1.1	4.0
Phase Duration, s	9.4	17.3	8.0	15.9	8.6	59.6	5.1	56.1
Change Period, ($Y+R_c$), s	4.6	5.5	4.6	5.5	4.6	5.1	4.6	5.1
Max Allow Headway (*MAH*), s	4.2	4.1	4.2	4.1	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	5.5	8.2	4.5	9.5	4.1		2.1	
Green Extension Time (g_e), s	0.0	0.9	0.0	0.9	0.3	0.0	0.0	0.0
Phase Call Probability	0.86	1.00	0.75	1.00	0.92		0.13	
Max Out Probability	1.00	0.00	1.00	0.00	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	78	128		56	156		100	549	546	6	221	213
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1739		1734	1798		1734	1821	1811	1734	1821	1724
Queue Service Time (g_s), s	3.5	6.2		2.5	7.5		2.1	15.3	15.3	0.1	5.4	5.5
Cycle Queue Clearance Time (g_c), s	3.5	6.2		2.5	7.5		2.1	15.3	15.3	0.1	5.4	5.5
Green Ratio (*g/C*)	0.17	0.13		0.15	0.12		0.62	0.61	0.61	0.57	0.57	0.57
Capacity (*c*), veh/h	211	227		196	208		640	1103	1097	303	1032	977
Volume-to-Capacity Ratio (*X*)	0.368	0.562		0.284	0.747		0.156	0.498	0.498	0.018	0.214	0.217
Back of Queue (*Q*), ft/ln (95 th percentile)	69.3	125.1		49.7	163.5		32.5	253.2	248.2	2.1	97.4	92.8
Back of Queue (*Q*), veh/ln (95 th percentile)	2.7	4.9		2.0	6.4		1.3	10.0	9.9	0.1	3.8	3.7
Queue Storage Ratio (*RQ*) (95 th percentile)	0.32	0.00		0.36	0.00		0.19	0.00	0.00	0.02	0.00	0.00
Uniform Delay (d_1), s/veh	32.9	36.7		33.6	38.5		7.1	10.0	10.0	9.3	9.6	9.6
Incremental Delay (d_2), s/veh	1.1	2.2		0.8	5.3		0.1	1.6	1.6	0.0	0.5	0.5
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	34.0	38.9		34.4	43.8		7.2	11.6	11.6	9.3	10.1	10.1
Level of Service (LOS)	C	D		C	D		A	B	B	A	B	B
Approach Delay, s/veh / LOS	37.0	D		41.3	D		11.3	B		10.1	B	
Intersection Delay, s/veh / LOS	16.7						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.30	B	2.30	B	1.88	B	1.88	B
Bicycle LOS Score / LOS	0.83	A	0.84	A	1.47	A	0.85	A

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2024	Analysis Period	1> 16:30
Intersection	33rd Street	File Name	09 Cliff at 33rd 2024 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	100	175	80	80	120	20	60	510	95	20	1160	85

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	1.7	1.5	44.3	5.1	1.1	16.4
Yellow	3.6	0.0	3.6	3.6	0.0	3.6
Red	1.0	0.0	1.5	1.0	0.0	1.9

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	4.0	1.1	4.0	1.1	4.0
Phase Duration, s	10.8	23.0	9.7	21.9	7.8	51.0	6.3	49.4
Change Period, ($Y+R_c$), s	4.6	5.5	4.6	5.5	4.6	5.1	4.6	5.1
Max Allow Headway (*MAH*), s	4.2	4.2	4.2	4.2	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	6.6	16.3	5.7	9.1	3.7		2.6	
Green Extension Time (g_e), s	0.0	1.2	0.0	1.5	0.1	0.0	0.0	0.0
Phase Call Probability	0.94	1.00	0.89	1.00	0.81		0.43	
Max Out Probability	1.00	0.07	1.00	0.01	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	111	283		89	156		67	345	328	22	699	685
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1724		1734	1775		1734	1821	1721	1734	1821	1777
Queue Service Time (g_s), s	4.6	14.3		3.7	7.1		1.7	10.3	10.4	0.6	28.4	28.6
Cycle Queue Clearance Time (g_c), s	4.6	14.3		3.7	7.1		1.7	10.3	10.4	0.6	28.4	28.6
Green Ratio (*g/C*)	0.25	0.19		0.24	0.18		0.53	0.51	0.51	0.51	0.49	0.49
Capacity (*c*), veh/h	328	335		194	323		211	928	877	398	897	875
Volume-to-Capacity Ratio (*X*)	0.339	0.845		0.459	0.481		0.316	0.371	0.373	0.056	0.779	0.782
Back of Queue (*Q*), ft/ln (95 th percentile)	88.2	274.3		73.1	141.5		30.3	194.8	184.1	9.8	472.6	460.4
Back of Queue (*Q*), veh/ln (95 th percentile)	3.5	10.8		2.9	5.6		1.2	7.7	7.4	0.4	18.6	18.4
Queue Storage Ratio (*RQ*) (95 th percentile)	0.41	0.00		0.52	0.00		0.17	0.00	0.00	0.09	0.00	0.00
Uniform Delay (d_1), s/veh	27.3	34.9		28.9	33.0		15.9	13.3	13.4	11.5	18.8	18.8
Incremental Delay (d_2), s/veh	0.6	7.9		1.7	1.1		0.9	1.1	1.2	0.1	6.6	6.9
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	27.9	42.8		30.5	34.1		16.7	14.5	14.6	11.6	25.4	25.7
Level of Service (LOS)	C	D		C	C		B	B	B	B	C	C
Approach Delay, s/veh / LOS	38.6	D		32.8	C		14.7	B		25.4	C	
Intersection Delay, s/veh / LOS	25.1						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.29	B	2.29	B	1.89	B	1.90	B
Bicycle LOS Score / LOS	1.14	A	0.89	A	1.10	A	1.65	B

HCS7 Two-Way Stop-Control Report

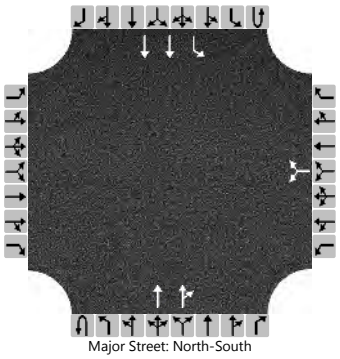
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at 36th St
Jurisdiction	Sioux Falls, SD
East/West Street	36th Street
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	2	0	0	1	2	0
Configuration							LR				T	TR		L	T	
Volume (veh/h)						30		40			1120	55	0	55	515	
Percent Heavy Vehicles (%)						2		2					2	2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized																
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)						7.5		6.9						4.1		
Critical Headway (sec)						6.84		6.94						4.14		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.52		3.32						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							78							61		
Capacity, c (veh/h)							259							526		
v/c Ratio							0.30							0.12		
95% Queue Length, Q_{95} (veh)							1.2							0.4		
Control Delay (s/veh)							24.7							12.7		
Level of Service (LOS)							C							B		
Approach Delay (s/veh)						24.7								1.2		
Approach LOS						C										

HCS7 Two-Way Stop-Control Report

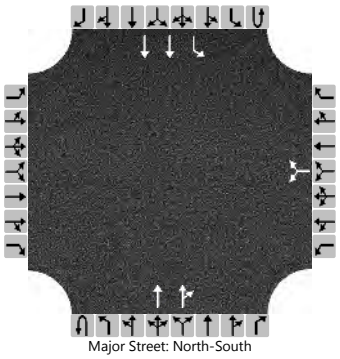
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at 36th St
Jurisdiction	Sioux Falls, SD
East/West Street	36th Street
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	2	0	0	1	2	0
Configuration							LR				T	TR		L	T	
Volume (veh/h)						25		5			655	25	0	5	1310	
Percent Heavy Vehicles (%)						2		2					2	2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized																
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)						7.5		6.9						4.1		
Critical Headway (sec)						6.84		6.94						4.14		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.52		3.32						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							33							6		
Capacity, c (veh/h)							277							851		
v/c Ratio							0.12							0.01		
95% Queue Length, Q_{95} (veh)							0.4							0.0		
Control Delay (s/veh)							19.8							9.3		
Level of Service (LOS)							C							A		
Approach Delay (s/veh)						19.8								0.0		
Approach LOS						C										

HCS7 Two-Way Stop-Control Report

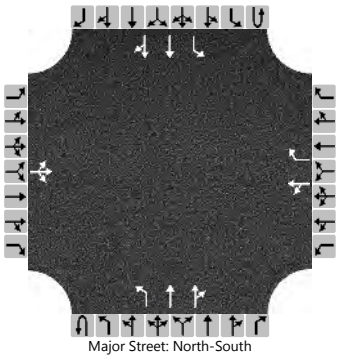
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at 38th/HS #1
Jurisdiction	Sioux Falls, SD
East/West Street	38th Street/HS #1
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	1	0	1	2	0	0	1	2	0
Configuration			LTR			LT		R		L	T	TR		L	T	TR
Volume (veh/h)		10	5	80		75	10	90	0	50	1145	130	0	15	705	40
Percent Heavy Vehicles (%)		2	2	2		2	2	2	2	2			2	2		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized					No											
Median Type | Storage	Left Only								1							

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5	6.5	6.9		7.5	6.5	6.9		4.1				4.1		
Critical Headway (sec)		7.54	6.54	6.94		7.54	6.54	6.94		4.14				4.14		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.52	4.02	3.32		3.52	4.02	3.32		2.22				2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			106			94		100		56				17		
Capacity, c (veh/h)			243			78		377		799				477		
v/c Ratio			0.43			1.22		0.27		0.07				0.03		
95% Queue Length, Q_{95} (veh)			2.1			7.1		1.1		0.2				0.1		
Control Delay (s/veh)			30.6			267.6		18.0		9.8				12.8		
Level of Service (LOS)			D			F		C		A				B		
Approach Delay (s/veh)	30.6				139.2				0.4				0.3			
Approach LOS	D				F											

HCS7 Two-Way Stop-Control Report

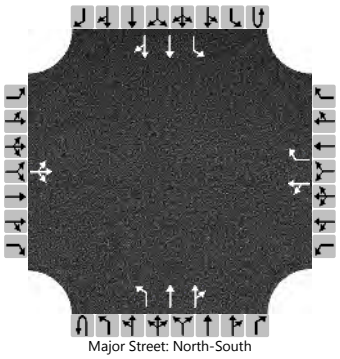
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at 38th/HS #1
Jurisdiction	Sioux Falls, SD
East/West Street	38th Street/HS #1
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	1	0	1	2	0	0	1	2	0
Configuration			LTR			LT		R		L	T	TR		L	T	TR
Volume (veh/h)		15	0	75		45	5	20	0	40	745	10	0	5	1345	30
Percent Heavy Vehicles (%)		2	2	2		2	2	2	2	2			2	2		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized					No											
Median Type | Storage	Left Only								1							

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5	6.5	6.9		7.5	6.5	6.9		4.1				4.1		
Critical Headway (sec)		7.54	6.54	6.94		7.54	6.54	6.94		4.14				4.14		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.52	4.02	3.32		3.52	4.02	3.32		2.22				2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			100			56		22		44				6		
Capacity, c (veh/h)			236			94		582		432				792		
v/c Ratio			0.42			0.59		0.04		0.10				0.01		
95% Queue Length, Q_{95} (veh)			2.0			2.7		0.1		0.3				0.0		
Control Delay (s/veh)			30.9			87.1		11.4		14.3				9.6		
Level of Service (LOS)			D			F		B		B				A		
Approach Delay (s/veh)	30.9				65.5				0.7				0.0			
Approach LOS	D				F											

HCS7 Two-Way Stop-Control Report

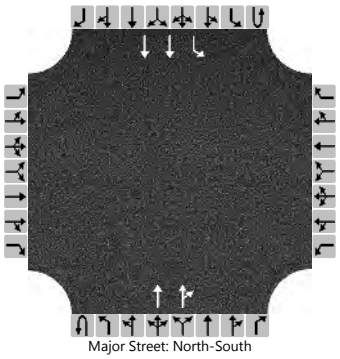
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at HS #2
Jurisdiction	Sioux Falls, SD
East/West Street	HS #2 Entrance
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	0	2	0	0	1	2	0
Configuration											T	TR		L	T	
Volume (veh/h)											1325	130	0	115	745	
Percent Heavy Vehicles (%)													2	2		
Proportion Time Blocked																
Percent Grade (%)																
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)														4.1		
Critical Headway (sec)														4.14		
Base Follow-Up Headway (sec)														2.2		
Follow-Up Headway (sec)														2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)														128		
Capacity, c (veh/h)														399		
v/c Ratio														0.32		
95% Queue Length, Q_{95} (veh)														1.4		
Control Delay (s/veh)														18.2		
Level of Service (LOS)														C		
Approach Delay (s/veh)													2.4			
Approach LOS																

HCS7 Two-Way Stop-Control Report

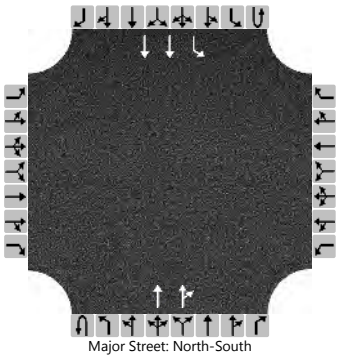
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at HS #2
Jurisdiction	Sioux Falls, SD
East/West Street	HS #2 Entrance
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	0	2	0	0	1	2	0
Configuration											T	TR		L	T	
Volume (veh/h)											795	20	0	15	1450	
Percent Heavy Vehicles (%)													2	2		
Proportion Time Blocked																
Percent Grade (%)																
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)														4.1		
Critical Headway (sec)														4.14		
Base Follow-Up Headway (sec)														2.2		
Follow-Up Headway (sec)														2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)														17		
Capacity, c (veh/h)														747		
v/c Ratio														0.02		
95% Queue Length, Q_{95} (veh)														0.1		
Control Delay (s/veh)														9.9		
Level of Service (LOS)														A		
Approach Delay (s/veh)													0.1			
Approach LOS																

HCS7 Two-Way Stop-Control Report

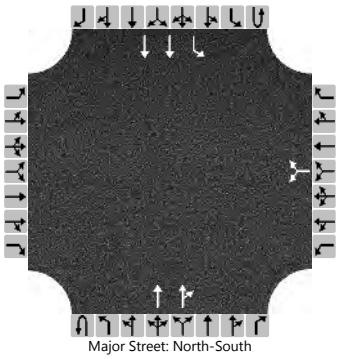
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at HS #1
Jurisdiction	Sioux Falls, SD
East/West Street	HS #1
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	2	0	0	1	2	0
Configuration							LR				T	TR		L	T	
Volume (veh/h)						25		55			1400	320	0	50	695	
Percent Heavy Vehicles (%)						2		2					2	2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized																
Median Type | Storage						Undivided										

Critical and Follow-up Headways

Base Critical Headway (sec)						7.5		6.9						4.1		
Critical Headway (sec)						6.84		6.94						4.14		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.52		3.32						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							89							56		
Capacity, c (veh/h)							76							307		
v/c Ratio							1.17							0.18		
95% Queue Length, Q_{95} (veh)							6.6							0.7		
Control Delay (s/veh)							253.6							19.3		
Level of Service (LOS)							F							C		
Approach Delay (s/veh)						253.6							1.3			
Approach LOS						F										

HCS7 Two-Way Stop-Control Report

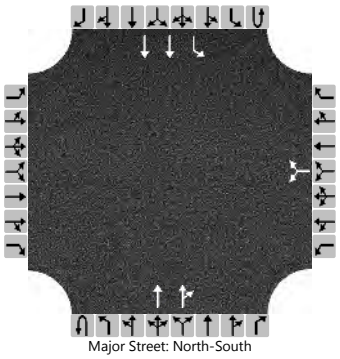
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at HS #1
Jurisdiction	Sioux Falls, SD
East/West Street	HS #1
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	2	0	0	1	2	0
Configuration							LR				T	TR		L	T	
Volume (veh/h)						20		10			805	10	0	0	1450	
Percent Heavy Vehicles (%)						2		2					2	2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized																
Median Type | Storage						Undivided										

Critical and Follow-up Headways

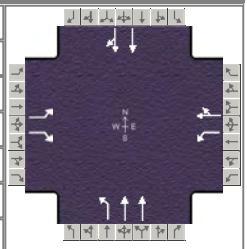
Base Critical Headway (sec)						7.5		6.9						4.1		
Critical Headway (sec)						6.84		6.94						4.14		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.52		3.32						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							33							0		
Capacity, c (veh/h)							115							747		
v/c Ratio							0.29							0.00		
95% Queue Length, Q_{95} (veh)							1.1							0.0		
Control Delay (s/veh)							48.7							9.8		
Level of Service (LOS)							E							A		
Approach Delay (s/veh)						48.7							0.0			
Approach LOS						E										

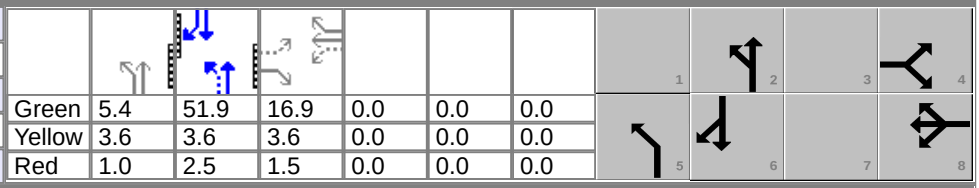
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2024	Analysis Period	1> 7:15
Intersection	41st St/SB I-229	File Name	14-16-18 Cliff Avenue 2024 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	100		105	250	115	55	180	1565			630	90

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	71	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	5.4	51.9	16.9	0.0	0.0	0.0		
Yellow	3.6	3.6	3.6	0.0	0.0	0.0		
Red	1.0	2.5	1.5	0.0	0.0	0.0		

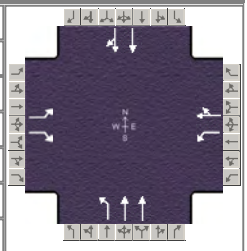
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2		6
Case Number		5.0		6.0	1.0	4.0		8.3
Phase Duration, s		22.0		22.0	10.0	68.0		58.0
Change Period, ($Y+R_c$), s		5.1		5.1	4.6	6.1		6.1
Max Allow Headway (*MAH*), s		5.2		5.2	5.2	0.0		0.0
Queue Clearance Time (g_s), s		18.9		15.9	6.0			
Green Extension Time (g_e), s		0.0		0.4	0.0	0.0		0.0
Phase Call Probability		1.00		1.00	0.99			
Max Out Probability		1.00		1.00	1.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14	3	8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h	111		117	278	189		200	1739			425	411
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1194		1543	1734	1721		1734	1734			1821	1761
Queue Service Time (g_s), s	7.9		6.0	13.9	9.0		4.0	28.3			10.4	9.9
Cycle Queue Clearance Time (g_c), s	16.9		6.0	13.9	9.0		4.0	28.3			10.4	9.9
Green Ratio (*g/C*)	0.19		0.19	0.19	0.19		0.66	0.69			0.58	0.58
Capacity (*c*), veh/h	185		290	406	323		487	2385			1050	1015
Volume-to-Capacity Ratio (*X*)	0.602		0.403	0.685	0.585		0.411	0.729			0.405	0.405
Back of Queue (*Q*), ft/ln (95 th percentile)	125.3		103.7	266.4	182.6		63.1	361.2			186.5	158.1
Back of Queue (*Q*), veh/ln (95 th percentile)	4.9		4.1	10.5	7.2		2.5	14.2			7.3	6.3
Queue Storage Ratio (*RQ*) (95 th percentile)	0.56		0.00	1.78	0.00		0.36	0.00			0.00	0.00
Uniform Delay (d_1), s/veh	41.3		32.1	35.3	33.3		7.2	8.8			9.4	8.3
Incremental Delay (d_2), s/veh	6.4		1.3	5.2	3.3		0.8	2.0			1.1	1.1
Initial Queue Delay (d_3), s/veh	0.0		0.0	0.0	0.0		0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	47.7		33.4	40.6	36.6		7.9	10.8			10.5	9.4
Level of Service (LOS)	D		C	D	D		A	B			B	A
Approach Delay, s/veh / LOS	40.4		D	39.0		D	10.5		B	10.0		A
Intersection Delay, s/veh / LOS	16.2						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.29	B	2.16	B	1.63	B	1.88	B
Bicycle LOS Score / LOS		F	1.26	A	2.09	B	1.12	A

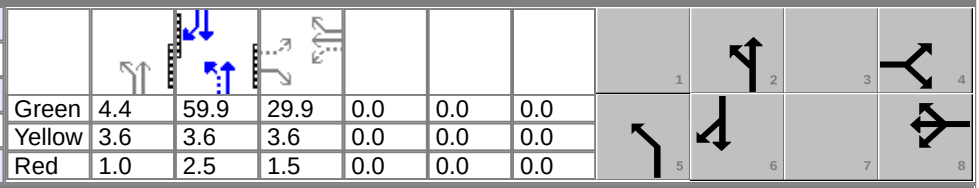
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2024	Analysis Period	1> 16:30
Intersection	41st St/SB I-229	File Name	14-16-18 Cliff Avenue 2024 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	160		235	415	110	60	125	595			1320	150

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	62	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	4.4	59.9	29.9	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.0	2.5	1.5	0.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2		6
Case Number		5.0		6.0	1.0	4.0		8.3
Phase Duration, s		35.0		35.0	9.0	75.0		66.0
Change Period, (*Y+R c*), s		5.1		5.1	4.6	6.1		6.1
Max Allow Headway (*MAH*), s		5.2		5.2	5.2	0.0		0.0
Queue Clearance Time (*g s*), s		27.7		31.0	6.4			
Green Extension Time (*g e*), s		1.4		0.0	0.0	0.0		0.0
Phase Call Probability		1.00		1.00	0.99			
Max Out Probability		1.00		1.00	1.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14	3	8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h	178		261	461	189		139	661			1000	1000
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1194		1543	1734	1712		1734	1734			1821	1757
Queue Service Time (*g s*), s	15.7		16.3	29.0	9.9		4.4	9.7			41.9	59.9
Cycle Queue Clearance Time (*g c*), s	25.7		16.3	29.0	9.9		4.4	9.7			41.9	59.9
Green Ratio (*g/C*)	0.27		0.27	0.27	0.27		0.60	0.63			0.54	0.54
Capacity (*c*), veh/h	282		420	537	465		135	2172			992	957
Volume-to-Capacity Ratio (*X*)	0.630		0.622	0.859	0.406		1.030	0.304			1.009	1.046
Back of Queue (*Q*), ft/ln (95 th percentile)	219.3		267.9	517.2	192.7		226.7	164.5			823.7	845.4
Back of Queue (*Q*), veh/ln (95 th percentile)	8.6		10.5	20.4	7.6		8.9	6.5			32.4	33.8
Queue Storage Ratio (*RQ*) (95 th percentile)	0.97		0.00	3.45	0.00		1.30	0.00			0.00	0.00
Uniform Delay (*d 1*), s/veh	43.3		35.1	39.7	32.8		30.5	9.5			18.2	16.3
Incremental Delay (*d 2*), s/veh	5.1		3.3	13.5	0.8		85.7	0.4			23.1	34.4
Initial Queue Delay (*d 3*), s/veh	0.0		0.0	0.0	0.0		0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	48.4		38.4	53.3	33.6		116.2	9.8			41.3	50.7
Level of Service (LOS)	D		D	D	C		F	A			F	F
Approach Delay, s/veh / LOS	42.5		D	47.5		D	28.3		C	46.0		D
Intersection Delay, s/veh / LOS	42.2						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.29	B	2.12	B	1.65	B	1.90	B
Bicycle LOS Score / LOS		F	1.56	B	1.15	A	1.84	B

HCS7 Two-Way Stop-Control Report

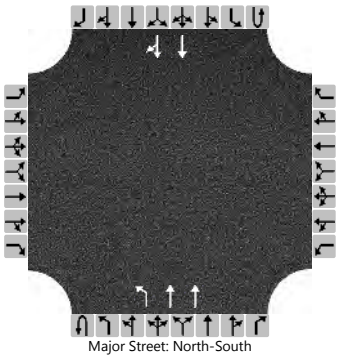
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at SB I-229 Ent
Jurisdiction	Sioux Falls, SD
East/West Street	SB I-229 Entrance Ramp
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	1	2	0	0	0	2	0
Configuration										L	T				T	TR
Volume (veh/h)									0	390	1745				745	240
Percent Heavy Vehicles (%)									2	2						
Proportion Time Blocked																
Percent Grade (%)																
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)										4.1						
Critical Headway (sec)										4.14						
Base Follow-Up Headway (sec)										2.2						
Follow-Up Headway (sec)										2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)										433						
Capacity, c (veh/h)										633						
v/c Ratio										0.68						
95% Queue Length, Q_{95} (veh)										5.4						
Control Delay (s/veh)										22.1						
Level of Service (LOS)										C						
Approach Delay (s/veh)									4.0							
Approach LOS																

HCS7 Two-Way Stop-Control Report

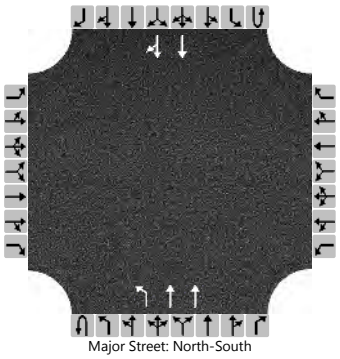
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at SB I-229 Ent
Jurisdiction	Sioux Falls, SD
East/West Street	SB I-229 Entrance Ramp
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	1	2	0	0	0	2	0
Configuration										L	T				T	TR
Volume (veh/h)									0	160	720				1440	530
Percent Heavy Vehicles (%)									2	2						
Proportion Time Blocked																
Percent Grade (%)																
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

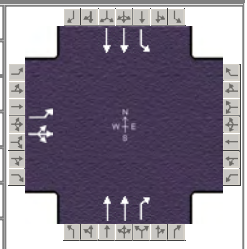
Base Critical Headway (sec)										4.1						
Critical Headway (sec)										4.14						
Base Follow-Up Headway (sec)										2.2						
Follow-Up Headway (sec)										2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)										178						
Capacity, c (veh/h)										238						
v/c Ratio										0.75						
95% Queue Length, Q_{95} (veh)										5.2						
Control Delay (s/veh)										54.2						
Level of Service (LOS)										F						
Approach Delay (s/veh)									9.9							
Approach LOS																

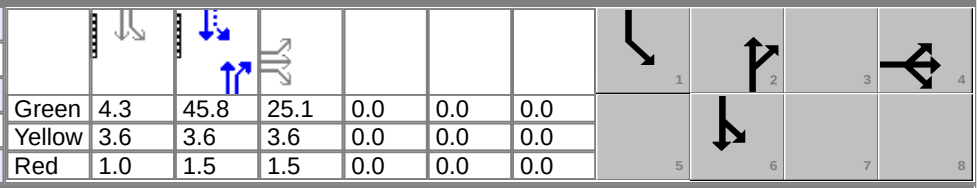
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2024	Analysis Period	1> 7:15
Intersection	I-229 South Ramp	File Name	14-16-18 Cliff Avenue 2024 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	530	0	185					1605	435	100	645	

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	66	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	4.3	45.8	25.1	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.0	1.5	1.5	0.0	0.0	0.0

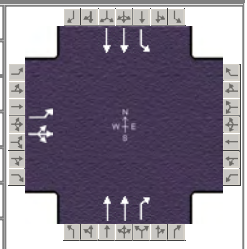
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4				2	1	6
Case Number		10.0				7.3	1.0	4.0
Phase Duration, s		30.2				50.9	8.9	59.8
Change Period, ($Y+R_c$), s		5.1				5.1	4.6	5.1
Max Allow Headway (*MAH*), s		5.3				0.0	5.2	0.0
Queue Clearance Time (g_s), s		22.2					4.4	
Green Extension Time (g_e), s		2.8				0.0	0.3	0.0
Phase Call Probability		1.00					0.92	
Max Out Probability		0.68					0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14					2	12	1	6	
Adjusted Flow Rate (*v*), veh/h	412	327						1493	335	102	659	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1626						1770	1499	1734	1683	
Queue Service Time (g_s), s	20.2	17.4						26.1	6.9	2.4	6.5	
Cycle Queue Clearance Time (g_c), s	20.2	17.4						26.1	6.9	2.4	6.5	
Green Ratio (*g/C*)	0.28	0.28						0.51	0.51	0.58	0.61	
Capacity (*c*), veh/h	483	453						1802	763	241	2048	
Volume-to-Capacity Ratio (*X*)	0.854	0.722						0.829	0.439	0.424	0.322	
Back of Queue (*Q*), ft/ln (95 th percentile)	376.4	319.1						230.2	84.8	42.7	93	
Back of Queue (*Q*), veh/ln (95 th percentile)	14.8	12.6						9.1	3.3	1.7	3.7	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.94	0.00						0.00	0.34	0.21	0.00	
Uniform Delay (d_1), s/veh	30.7	35.9						9.7	5.8	14.6	5.9	
Incremental Delay (d_2), s/veh	11.3	4.5						2.9	1.2	1.6	0.4	
Initial Queue Delay (d_3), s/veh	0.0	0.0						0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	42.0	40.4						12.6	6.9	16.3	6.3	
Level of Service (LOS)	D	D						B	A	B	A	
Approach Delay, s/veh / LOS	41.3	D		0.0			11.6	B		7.7	A	
Intersection Delay, s/veh / LOS	17.3						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.42	B	2.31	B	1.38	A	1.72	B
Bicycle LOS Score / LOS	1.71	B			2.29	B	1.17	A

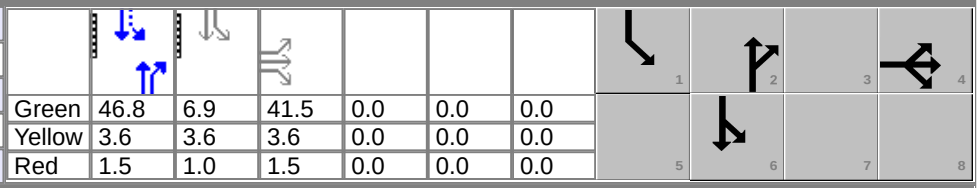
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2024	Analysis Period	1> 16:30
Intersection	I-229 South Ramp	File Name	14-16-18 Cliff Avenue 2024 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	210	0	485					670	210	115	1325	

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	31	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	46.8	6.9	41.5	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.5	1.0	1.5	0.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4				2	1	6
Case Number		10.0				7.3	1.0	4.0
Phase Duration, s		46.6				51.9	11.5	63.4
Change Period, ($Y+R_c$), s		5.1				5.1	5.1	5.1
Max Allow Headway (*MAH*), s		5.4				0.0	5.2	0.0
Queue Clearance Time (g_s), s		36.1					2.0	
Green Extension Time (g_e), s		5.4				0.0	4.6	0.0
Phase Call Probability		1.00					0.98	
Max Out Probability		0.02					0.96	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14					2	12	1	6	
Adjusted Flow Rate (*v*), veh/h	198	518						685	153	127	1462	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1566						1701	1474	1734	1803	
Queue Service Time (g_s), s	8.8	34.1						12.2	5.1	0.0	30.3	
Cycle Queue Clearance Time (g_c), s	8.8	34.1						12.2	5.1	0.0	30.3	
Green Ratio (*g/C*)	0.38	0.38						0.43	0.43	0.47	0.53	
Capacity (*c*), veh/h	655	591						1446	627	391	1911	
Volume-to-Capacity Ratio (*X*)	0.303	0.877						0.474	0.245	0.325	0.765	
Back of Queue (*Q*), ft/ln (95 th percentile)	168.3	510.4						187.3	79.1	119.5	387.6	
Back of Queue (*Q*), veh/ln (95 th percentile)	6.6	20.1						7.4	3.1	4.7	15.3	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.42	0.00						0.00	0.32	0.60	0.00	
Uniform Delay (d_1), s/veh	24.1	33.2						14.7	12.9	27.4	13.7	
Incremental Delay (d_2), s/veh	0.4	7.0						1.0	0.9	0.6	2.5	
Initial Queue Delay (d_3), s/veh	0.0	0.0						0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	24.4	40.2						15.7	13.7	28.0	16.2	
Level of Service (LOS)	C	D						B	B	C	B	
Approach Delay, s/veh / LOS	35.9	D		0.0			15.4	B		17.1	B	
Intersection Delay, s/veh / LOS	20.9						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.41	B	2.32	B	1.44	A	1.74	B
Bicycle LOS Score / LOS	1.67	B			1.24	A	1.81	B

HCS7 Two-Way Stop-Control Report

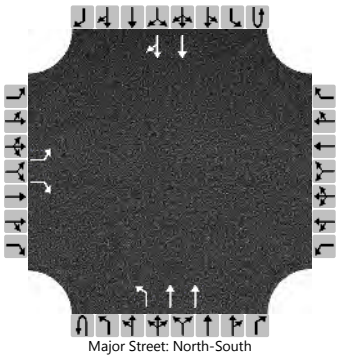
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at Spencer Park
Jurisdiction	Sioux Falls, SD
East/West Street	Spencer Park Road
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration		L		R						L	T				T	TR
Volume (veh/h)		5		5					0	5	2035				825	5
Percent Heavy Vehicles (%)		2		2					2	2						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized		No														
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5		6.9						4.1						
Critical Headway (sec)		6.84		6.94						4.14						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.52		3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		6		6						6						
Capacity, c (veh/h)		158		547						736						
v/c Ratio		0.04		0.01						0.01						
95% Queue Length, Q_{95} (veh)		0.1		0.0						0.0						
Control Delay (s/veh)		28.6		11.6						9.9						
Level of Service (LOS)		D		B						A						
Approach Delay (s/veh)		20.1								0.0						
Approach LOS		C														

HCS7 Two-Way Stop-Control Report

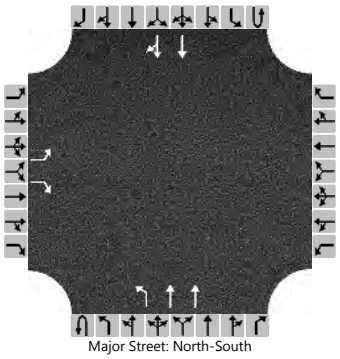
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at Spencer Park
Jurisdiction	Sioux Falls, SD
East/West Street	Spencer Park Road
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration		L		R						L	T				T	TR
Volume (veh/h)		5		20					0	20	875				1785	25
Percent Heavy Vehicles (%)		2		2					2	2						
Proportion Time Blocked																
Percent Grade (%)	0															
Right Turn Channelized	No															
Median Type | Storage	Left Only								1							

Critical and Follow-up Headways

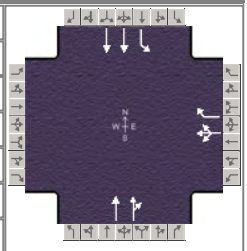
Base Critical Headway (sec)		7.5		6.9						4.1						
Critical Headway (sec)		6.84		6.94						4.14						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.52		3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		6		22						22						
Capacity, c (veh/h)		75		239						280						
v/c Ratio		0.07		0.09						0.08						
95% Queue Length, Q_{95} (veh)		0.2		0.3						0.3						
Control Delay (s/veh)		56.7		21.6						19.0						
Level of Service (LOS)		F		C						C						
Approach Delay (s/veh)	28.6								0.4							
Approach LOS	D															

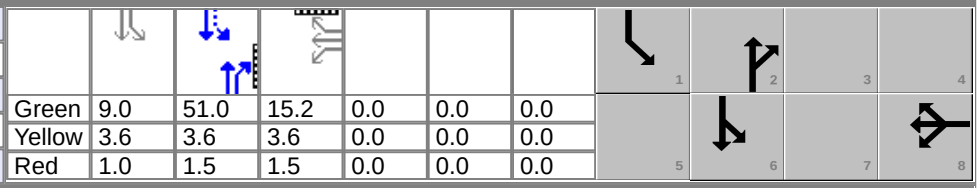
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2024	Analysis Period	1> 7:15
Intersection	49th Street	File Name	14-16-18 Cliff Avenue 2024 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				40	0	660		1335	15	200	645	

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	90	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	9.0	51.0	15.2	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.0	1.5	1.5	0.0	0.0	0.0

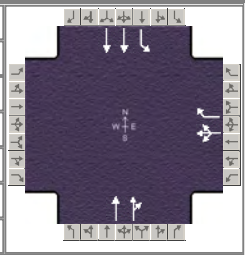
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase				8		2	1	6
Case Number				11.0		8.3	1.0	4.0
Phase Duration, s				20.3		56.1	13.6	69.7
Change Period, (*Y+R c*), s				5.1		5.1	4.6	5.1
Max Allow Headway (*MAH*), s				5.2		0.0	5.1	0.0
Queue Clearance Time (*g s*), s				14.3			7.8	
Green Extension Time (*g e*), s				0.9		0.0	1.2	0.0
Phase Call Probability				1.00			1.00	
Max Out Probability				1.00			0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement				3	8	18		2	12	1	6	
Adjusted Flow Rate (*v*), veh/h					224	220		988	988	222	717	
Adjusted Saturation Flow Rate (*s*), veh/h/ln					1630	1585		1870	1863	1781	1781	
Queue Service Time (*g s*), s					12.3	12.1		43.1	41.3	5.8	6.4	
Cycle Queue Clearance Time (*g c*), s					12.3	12.1		43.1	41.3	5.8	6.4	
Green Ratio (*g/C*)					0.17	0.17		0.57	0.57	0.69	0.72	
Capacity (*c*), veh/h					275	268		1060	1056	278	2556	
Volume-to-Capacity Ratio (*X*)					0.816	0.822		0.932	0.936	0.801	0.280	
Back of Queue (*Q*), ft/ln (95 th percentile)					267.9	242.2		360.2	353.6	225.2	85	
Back of Queue (*Q*), veh/ln (95 th percentile)					10.7	9.5		14.2	14.1	8.9	3.3	
Queue Storage Ratio (*RQ*) (95 th percentile)					1.19	1.06		0.00	0.00	0.58	0.00	
Uniform Delay (*d 1*), s/veh					42.1	36.1		11.8	11.8	24.9	4.5	
Incremental Delay (*d 2*), s/veh					14.2	15.2		4.7	4.9	7.4	0.3	
Initial Queue Delay (*d 3*), s/veh					0.0	0.0		0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh					56.3	51.3		16.5	16.7	32.3	4.8	
Level of Service (LOS)					E	D		B	B	C	A	
Approach Delay, s/veh / LOS	0.0			53.8		D	16.6		B	11.3		B
Intersection Delay, s/veh / LOS	20.0						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.15	B	2.32	B	2.31	B	1.33	A
Bicycle LOS Score / LOS			1.22	A	1.73	B	1.26	A

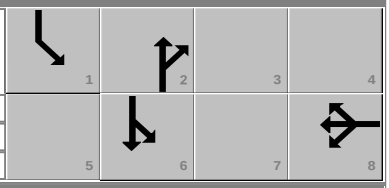
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2024	Analysis Period	1> 16:30
Intersection	49th Street	File Name	14-16-18 Cliff Avenue 2024 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				50	0	205		620	55	500	1380	

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	48	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	18.1	63.5	13.6	0.0	0.0	0.0						
Yellow	3.6	3.6	3.6	0.0	0.0	0.0						
Red	1.0	1.5	1.5	0.0	0.0	0.0						

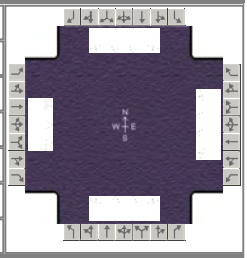
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase				8		2	1	6
Case Number				11.0		8.3	1.0	4.0
Phase Duration, s				18.7		68.6	22.7	91.3
Change Period, (*Y+R* $_c$), s				5.1		5.1	4.6	5.1
Max Allow Headway (*MAH*), s				5.3		0.0	5.1	0.0
Queue Clearance Time (g_s), s				11.9			14.5	
Green Extension Time (g_e), s				1.7		0.0	3.6	0.0
Phase Call Probability				1.00			1.00	
Max Out Probability				0.00			0.02	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement				3	8	18		2	12	1	6	
Adjusted Flow Rate (*v*), veh/h					135	148		466	453	556	1533	
Adjusted Saturation Flow Rate (*s*), veh/h/ln					1677	1585		1870	1816	1781	1781	
Queue Service Time (g_s), s					8.7	9.9		16.6	12.6	12.5	18.0	
Cycle Queue Clearance Time (g_c), s					8.7	9.9		16.6	12.6	12.5	18.0	
Green Ratio (*g/C*)					0.12	0.12		0.58	0.58	0.76	0.78	
Capacity (*c*), veh/h					208	196		1080	1049	618	2790	
Volume-to-Capacity Ratio (*X*)					0.652	0.755		0.432	0.432	0.899	0.550	
Back of Queue (*Q*), ft/ln (95 th percentile)					183.5	195.7		215.3	197.7	387.7	222	
Back of Queue (*Q*), veh/ln (95 th percentile)					7.3	7.7		8.5	7.9	15.3	8.7	
Queue Storage Ratio (*RQ*) (95 th percentile)					0.82	0.86		0.00	0.00	0.97	0.00	
Uniform Delay (d_1), s/veh					49.9	46.6		10.3	9.7	13.6	4.5	
Incremental Delay (d_2), s/veh					4.9	8.1		1.1	1.2	9.7	0.8	
Initial Queue Delay (d_3), s/veh					0.0	0.0		0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh					54.7	54.7		11.4	10.8	23.3	5.3	
Level of Service (LOS)					D	D		B	B	C	A	
Approach Delay, s/veh / LOS	0.0			54.7		D	11.1		B	10.1		B
Intersection Delay, s/veh / LOS	14.2						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.15	B	2.32	B	1.89	B	1.32	A
Bicycle LOS Score / LOS			0.96	A	1.11	A	2.21	B

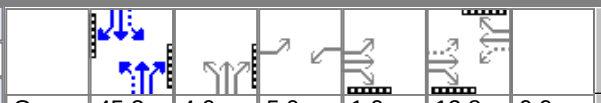
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls	Time Period	AM	PHF	0.90
Urban Street	Western Avenue	Analysis Year	2024	Analysis Period	1> 7:15
Intersection	49th Street	File Name	19-20-21-22 Western 2024 AM.xus		
Project Description	I-229 Exits 3 and 4				

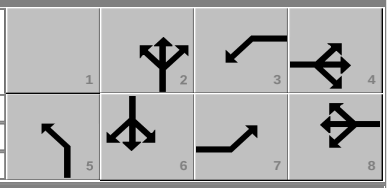


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	110	205	95	75	280	185	265	710	165	60	400	60

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	21	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	45.3	4.0	5.0	1.0	12.8	0.0
Yellow	3.9	4.0	3.6	0.0	3.6	0.0
Red	2.0	2.0	1.4	0.0	1.4	0.0



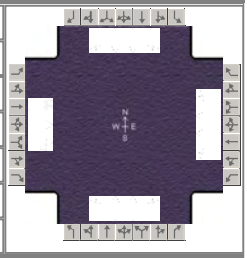
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2		6
Case Number	1.1	4.0	1.1	3.0	1.0	3.0		5.3
Phase Duration, s	11.0	18.8	10.0	17.8	10.0	61.2		51.2
Change Period, ($Y+R_c$), s	5.0	5.0	5.0	5.0	6.0	6.0		5.9
Max Allow Headway (*MAH*), s	3.1	5.1	3.1	5.1	3.1	0.0		0.0
Queue Clearance Time (g_s), s	7.4	9.3	5.6	9.6	2.0			
Green Extension Time (g_e), s	0.0	3.4	0.1	3.2	0.8	0.0		0.0
Phase Call Probability	0.95	1.00	0.88	1.00	1.00			
Max Out Probability	1.00	0.28	0.00	0.36	1.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	122	153	147	83	311	122	294	789	128	112	745	84
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1673	1734	1734	1543	1734	1734	1543	687	1734	1543
Queue Service Time (g_s), s	5.4	7.0	7.3	3.6	7.6	6.6	0.0	10.2	3.1	9.2	7.8	1.8
Cycle Queue Clearance Time (g_c), s	5.4	7.0	7.3	3.6	7.6	6.6	0.0	10.2	3.1	20.1	7.8	1.8
Green Ratio (*g/C*)	0.21	0.15	0.15	0.20	0.14	0.14	0.53	0.61	0.61	0.50	0.50	0.50
Capacity (*c*), veh/h	257	279	256	230	493	219	439	2127	947	348	1746	777
Volume-to-Capacity Ratio (*X*)	0.475	0.550	0.572	0.362	0.632	0.557	0.671	0.371	0.135	0.322	0.427	0.108
Back of Queue (*Q*), ft/ln (95 th percentile)	101.6	146.8	142	68.7	149.4	120	249.8	159.5	45.1	72.3	108.7	27.5
Back of Queue (*Q*), veh/ln (95 th percentile)	4.0	5.8	5.6	2.7	5.9	4.7	9.8	6.3	1.8	2.8	4.3	1.1
Queue Storage Ratio (*RQ*) (95 th percentile)	0.41	0.00	0.00	0.23	0.00	0.48	1.00	0.00	0.38	0.29	0.00	0.11
Uniform Delay (d_1), s/veh	30.7	35.2	35.4	30.8	36.4	36.0	24.1	8.7	7.3	16.9	7.3	0.5
Incremental Delay (d_2), s/veh	0.5	2.4	2.9	0.4	1.9	3.1	3.2	0.5	0.3	2.0	0.6	0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	31.2	37.6	38.2	31.2	38.3	39.1	27.3	9.2	7.6	18.9	8.0	0.7
Level of Service (LOS)	C	D	D	C	D	D	C	A	A	B	A	A
Approach Delay, s/veh / LOS	36.0	D		37.3	D		13.4	B		8.6	A	
Intersection Delay, s/veh / LOS	19.0						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.52	C	2.47	B	2.49	B	2.35	B
Bicycle LOS Score / LOS	0.84	A	0.91	A	1.49	A	0.95	A

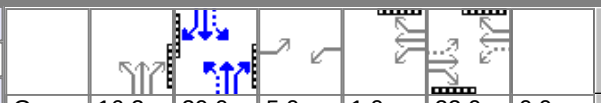
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls	Time Period	PM	PHF	0.90
Urban Street	Western Avenue	Analysis Year	2024	Analysis Period	1> 16:30
Intersection	49th Street	File Name	19-20-21-22 Western 2024 PM.xus		
Project Description	I-229 Exits 3 and 4				

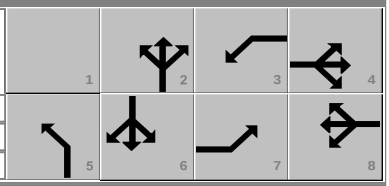


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	130	445	320	225	475	150	315	785	125	80	1075	65

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	21	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	16.2	29.0	5.0	1.0	22.0	0.0
Yellow	3.9	3.9	3.6	3.6	3.6	0.0
Red	2.0	2.0	1.4	1.4	1.4	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2		6
Case Number	1.1	4.0	1.1	3.0	1.0	3.0		5.3
Phase Duration, s	10.0	27.0	16.0	33.0	22.1	57.0		34.9
Change Period, ($Y+R_c$), s	5.0	5.0	5.0	5.0	5.9	5.9		5.9
Max Allow Headway (*MAH*), s	3.1	5.1	3.1	5.1	3.1	0.0		0.0
Queue Clearance Time (g_s), s	7.0	22.5	12.9	14.9	15.8			
Green Extension Time (g_e), s	0.0	0.0	0.0	6.8	0.4	0.0		0.0
Phase Call Probability	0.98	1.00	1.00	1.00	1.00			
Max Out Probability	1.00	1.00	1.00	0.54	0.20			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	144	377	340	250	528	111	350	872	111	66	881	29
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1629	1734	1734	1543	1734	1734	1543	635	1734	1543
Queue Service Time (g_s), s	5.0	20.4	20.5	10.9	12.9	5.6	13.8	16.4	3.8	5.7	24.3	1.1
Cycle Queue Clearance Time (g_c), s	5.0	20.4	20.5	10.9	12.9	5.6	13.8	16.4	3.8	5.7	24.3	1.1
Green Ratio (*g/C*)	0.27	0.22	0.22	0.35	0.28	0.28	0.47	0.51	0.51	0.29	0.29	0.29
Capacity (*c*), veh/h	273	401	358	273	971	432	382	1772	789	256	1007	448
Volume-to-Capacity Ratio (*X*)	0.529	0.941	0.948	0.914	0.544	0.257	0.915	0.492	0.141	0.256	0.875	0.064
Back of Queue (*Q*), ft/ln (95 th percentile)	38	455.9	429.4	281.4	232.8	94.9	295.6	265.7	60.9	39.6	406.2	19.2
Back of Queue (*Q*), veh/ln (95 th percentile)	1.5	17.9	16.9	11.1	9.2	3.7	11.6	10.5	2.4	1.6	16.0	0.8
Queue Storage Ratio (*RQ*) (95 th percentile)	0.15	0.00	0.00	0.94	0.00	0.38	0.99	0.00	0.51	0.16	0.00	0.08
Uniform Delay (d_1), s/veh	31.6	38.4	38.4	27.5	30.6	27.9	23.3	16.0	12.9	17.2	34.6	20.9
Incremental Delay (d_2), s/veh	1.0	30.5	34.3	32.2	0.8	0.4	18.4	1.0	0.4	1.9	8.4	0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	32.6	68.9	72.8	59.7	31.4	28.4	41.7	17.0	13.3	19.0	43.0	21.1
Level of Service (LOS)	C	E	E	E	C	C	D	B	B	B	D	C
Approach Delay, s/veh / LOS	64.3	E		39.0	D		23.1	C		40.8	D	
Intersection Delay, s/veh / LOS	39.6						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.48	B	2.48	B	2.48	B	2.46	B
Bicycle LOS Score / LOS	1.20	A	1.22	A	1.59	B	1.58	B

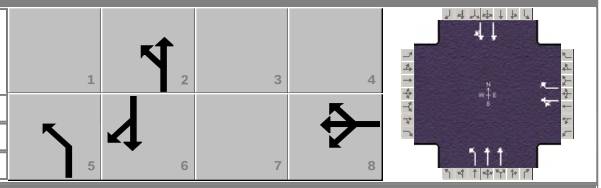
HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc.			Interchange Type	Diamond
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Segment Distance, ft	700
Jurisdiction	Sioux Falls	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 North Ramp	PHF	0.90	Arterial Direction	North-South
File Name	19-20-21-22 Western 2024 AM.xus				
Project Description	I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h				290	0	470	100	970			520	130
Intersection Two Demand (*v*), veh/h	320	0	150					750	295	155	655	

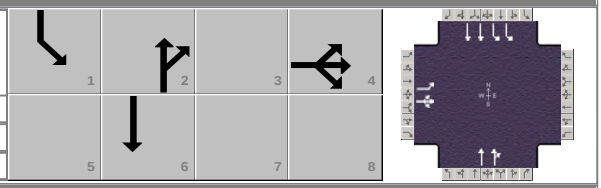
Signal One Information	
Cycle, s	90.0
Offset, s	48
Uncoordinated	No
Force Mode	Fixed

Green	4.9	40.8	26.3	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0



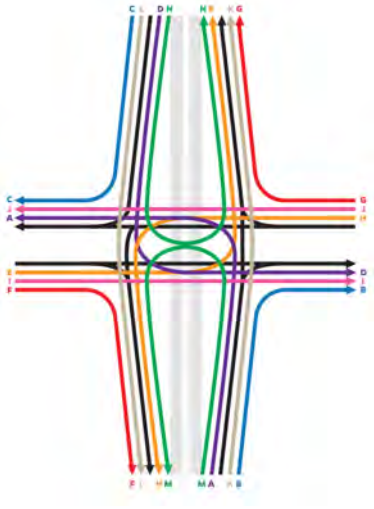
Signal Two Information	
Cycle, s	90.0
Offset, s	48
Uncoordinated	No
Force Mode	Fixed

Green	5.9	50.5	16.8	0.0	0.0	0.0
Yellow	3.9	3.9	3.6	0.0	0.0	0.0
Red	1.8	1.8	1.9	0.0	0.0	0.0



Interchange Results

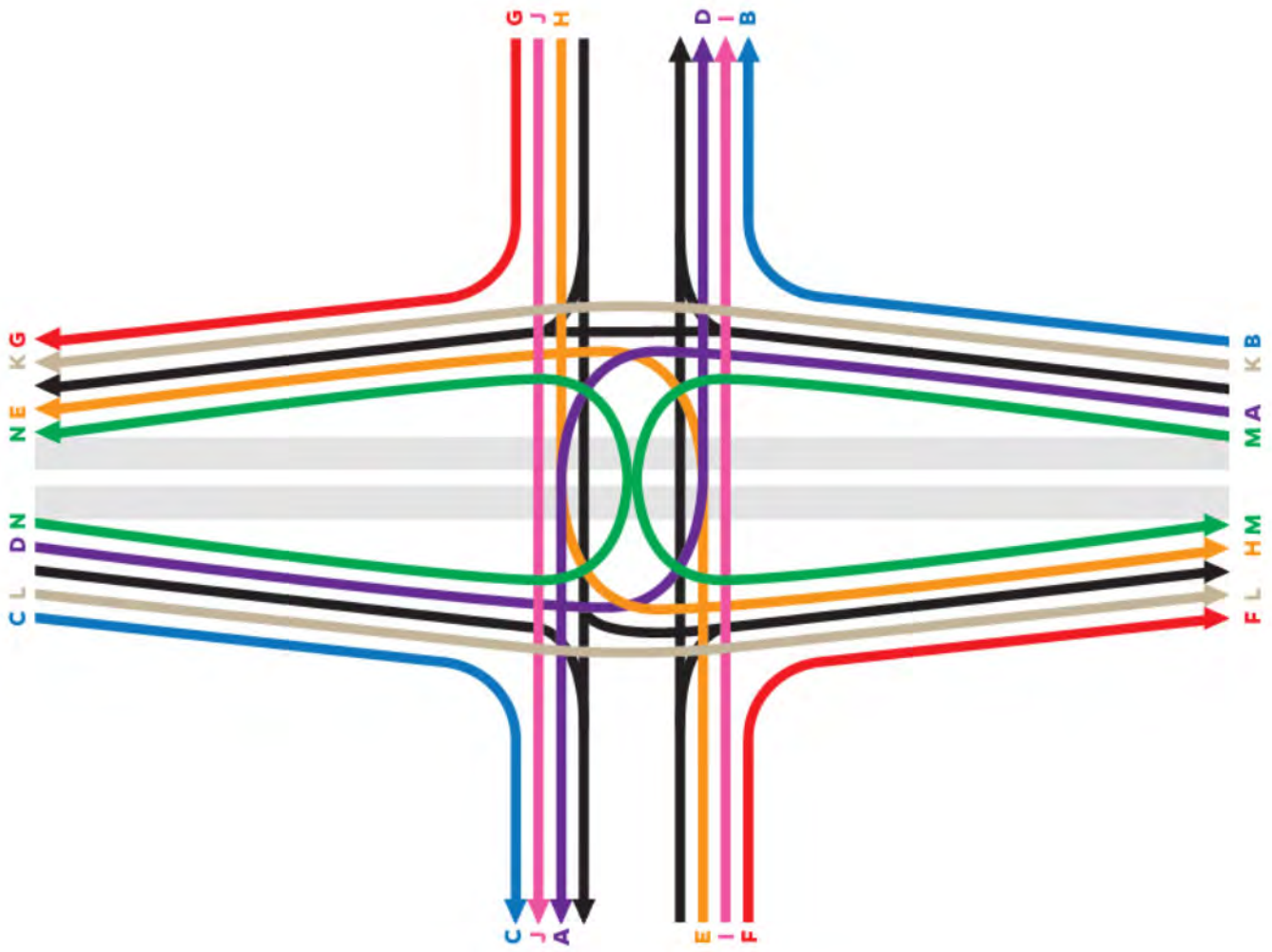
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	0	19.2	0.0	19.2	No	No	B
B	0	0.0	0.0	0.0	No	No	A
C	0	0.0	0.0	0.0	No	No	A
D	0	14.7	0.0	14.7	No	No	A
E	0	9.1	0.0	9.1	No	No	A
F	0	9.1	0.0	9.1	No	No	A
G	0	0.0	0.0	0.0	No	No	A
H	0	1.4	0.0	1.4	No	No	A
I	1115	23.8	0.0	23.8	No	No	B
J	636	20.6	0.0	20.6	No	No	B
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh					29.5	34.5	12.1	9.1			19.2	18.0
Level of Service (LOS)					C	C	B	A			B	B
Approach Delay, s/veh / LOS	0.0			32.2		C	9.4		A	18.6		B
Intersection Delay, s/veh / LOS	18.2						B					

Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	40.7	40.4						14.7	12.0	31.8	1.4	
Level of Service (LOS)	D	D						B	B	C	A	
Approach Delay, s/veh / LOS	40.6		D	0.0			13.4		B	7.2		A
Intersection Delay, s/veh / LOS	16.3						B					

Interchange Graphic



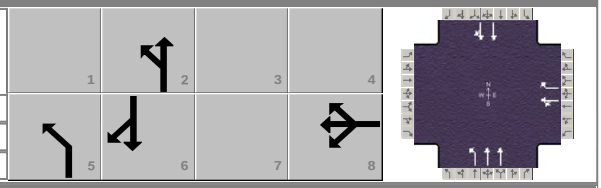
HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc.			Interchange Type	Diamond
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Segment Distance, ft	700
Jurisdiction	Sioux Falls	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 North Ramp	PHF	0.90	Arterial Direction	North-South
File Name	19-20-21-22 Western 2024 PM.xus				
Project Description	I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h				310	5	480	180	860			1275	335
Intersection Two Demand (*v*), veh/h	230	5	110					810	325	495	1090	

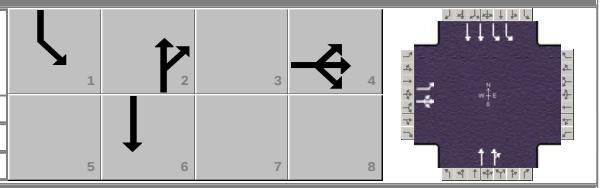
Signal One Information	
Cycle, s	100.0
Offset, s	2
Uncoordinated	No
Force Mode	Fixed

Green	10.6	38.3	33.2	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0



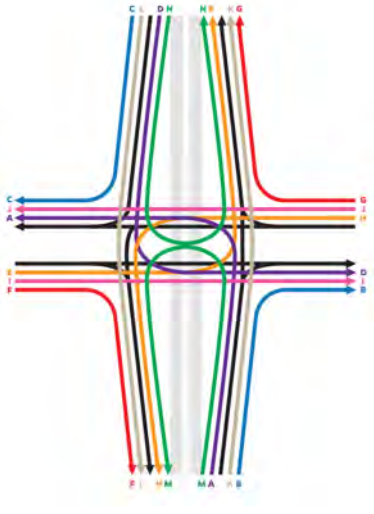
Signal Two Information	
Cycle, s	100.0
Offset, s	2
Uncoordinated	No
Force Mode	Fixed

Green	53.9	13.2	16.0	0.0	0.0	0.0
Yellow	3.9	3.9	3.6	0.0	0.0	0.0
Red	1.8	1.8	1.9	0.0	0.0	0.0



Interchange Results

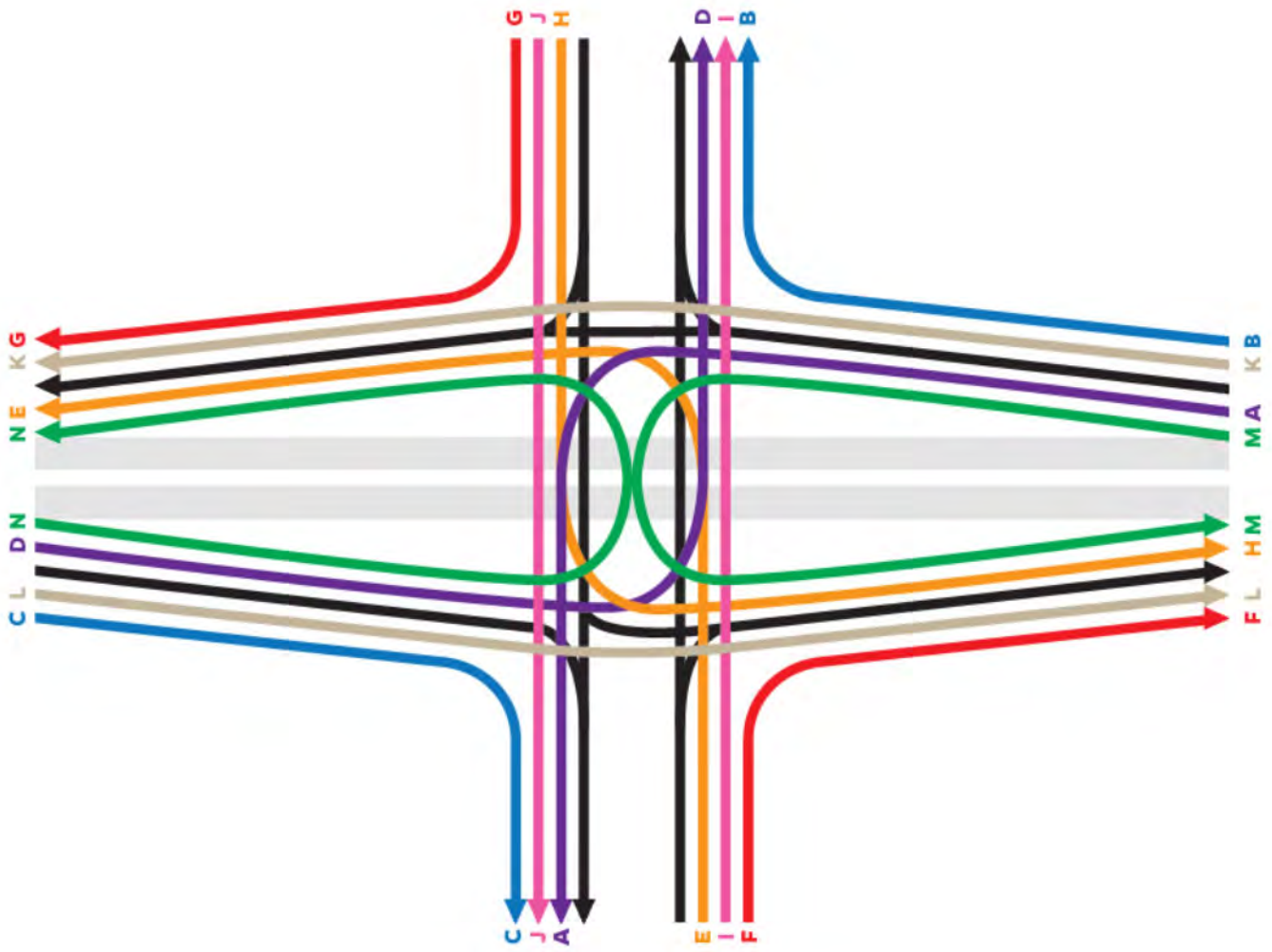
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	0	28.7	0.0	28.7	No	No	B
B	0	0.0	0.0	0.0	No	No	A
C	0	0.0	0.0	0.0	No	No	A
D	0	17.8	0.0	17.8	No	No	B
E	0	21.1	0.0	21.1	No	No	B
F	0	21.1	0.0	21.1	No	No	B
G	0	0.0	0.0	0.0	No	No	A
H	0	1.0	0.0	1.0	No	No	A
I	1097	38.9	0.0	38.9	No	No	C
J	669	29.7	0.0	29.7	No	No	B
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh					29.5	36.1	35.0	21.1			28.7	28.3
Level of Service (LOS)					C	D	D	C			C	C
Approach Delay, s/veh / LOS	0.0			33.1		C	23.5		C	28.5		C
Intersection Delay, s/veh / LOS	27.7						C					

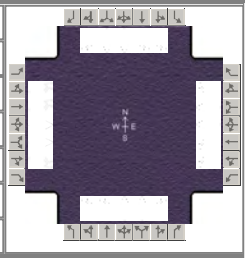
Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	43.8	42.2						17.8	13.9	42.4	1.0	
Level of Service (LOS)	D	D						B	B	D	A	
Approach Delay, s/veh / LOS	43.1		D	0.0			15.9		B	13.9		B
Intersection Delay, s/veh / LOS	18.5						B					

Interchange Graphic



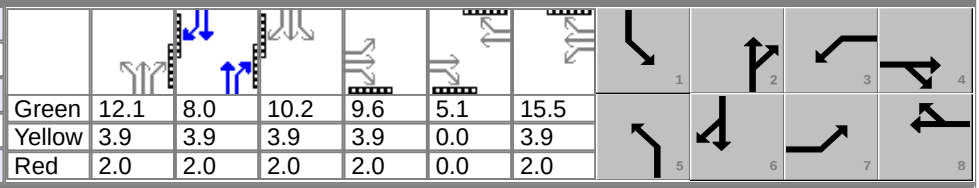
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls	Time Period	AM	PHF	0.90
Urban Street	Western Avenue	Analysis Year	2024	Analysis Period	1> 7:15
Intersection	57th Street	File Name	19-20-21-22 Western 2024 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	250	365	130	110	605	240	210	555	45	125	455	225

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	78	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	12.1	8.0	10.2	9.6	5.1	15.5
Yellow	3.9	3.9	3.9	3.9	0.0	3.9
Red	2.0	2.0	2.0	2.0	0.0	2.0

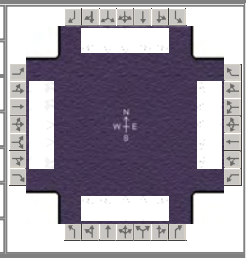
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	15.5	20.6	21.4	26.5	18.0	31.9	16.1	30.0
Change Period, ($Y+R_c$), s	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9
Max Allow Headway (*MAH*), s	2.6	5.0	4.7	4.7	2.6	0.0	5.0	0.0
Queue Clearance Time (g_s), s	9.2	12.0	4.8	18.7	11.6		5.4	
Green Extension Time (g_e), s	0.4	2.7	4.4	1.9	0.5	0.0	5.1	0.0
Phase Call Probability	1.00	1.00	0.95	1.00	1.00		0.97	
Max Out Probability	0.00	0.04	0.28	1.00	0.00		0.03	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	278	406	100	122	672	183	375	992	54	139	506	150
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1734	1543	1684	1734	1543	1684	1734	1543	1684	1734	1543
Queue Service Time (g_s), s	7.2	10.0	5.2	2.8	16.7	9.4	9.6	25.7	2.0	3.4	11.2	7.1
Cycle Queue Clearance Time (g_c), s	7.2	10.0	5.2	2.8	16.7	9.4	9.6	25.7	2.0	3.4	11.2	7.1
Green Ratio (*g/C*)	0.11	0.16	0.16	0.17	0.23	0.23	0.13	0.29	0.29	0.11	0.27	0.27
Capacity (*c*), veh/h	360	565	251	582	794	353	452	1001	445	382	929	413
Volume-to-Capacity Ratio (*X*)	0.773	0.718	0.398	0.210	0.847	0.519	0.830	0.991	0.120	0.363	0.544	0.363
Back of Queue (*Q*), ft/ln (95 th percentile)	136.1	194.9	88	51.2	308	154.9	142.4	413.9	33.5	65	212.8	128.1
Back of Queue (*Q*), veh/ln (95 th percentile)	5.4	7.7	3.5	2.0	12.1	6.1	5.6	16.3	1.3	2.6	8.4	5.0
Queue Storage Ratio (*RQ*) (95 th percentile)	0.44	0.00	0.35	0.20	0.00	0.60	0.41	0.00	0.26	0.52	0.00	1.03
Uniform Delay (d_1), s/veh	39.1	35.7	8.1	32.0	33.2	15.8	34.1	31.0	20.5	36.9	28.2	26.7
Incremental Delay (d_2), s/veh	1.3	2.4	1.4	0.1	7.7	1.6	0.7	17.3	0.3	0.8	2.3	2.5
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	40.5	38.1	9.5	32.0	40.9	17.4	34.8	48.3	20.7	37.7	30.5	29.2
Level of Service (LOS)	D	D	A	C	D	B	C	D	C	D	C	C
Approach Delay, s/veh / LOS	35.3	D		35.4	D		43.7	D		31.5	C	
Intersection Delay, s/veh / LOS	37.6						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.61	C	2.71	C	2.70	C	2.64	C
Bicycle LOS Score / LOS	1.13	A	1.29	A	1.22	A	1.14	A

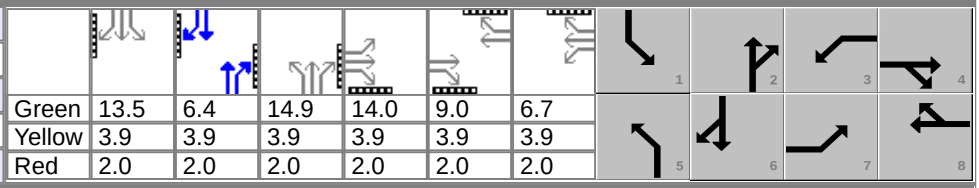
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls	Time Period	PM	PHF	0.90
Urban Street	Western Avenue	Analysis Year	2024	Analysis Period	1> 16:30
Intersection	57th Street	File Name	19-20-21-22 Western 2024 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	365	780	230	135	565	200	340	570	120	305	650	245

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	32	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	13.5	6.4	14.9	14.0	9.0	6.7
Yellow	3.9	3.9	3.9	3.9	3.9	3.9
Red	2.0	2.0	2.0	2.0	2.0	2.0

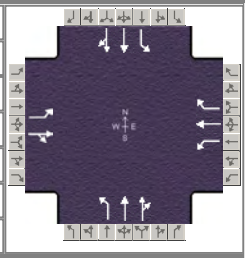
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	19.9	34.8	12.6	27.5	20.8	33.1	19.4	31.7
Change Period, ($Y+R_c$), s	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9
Max Allow Headway (*MAH*), s	2.6	5.0	4.6	4.6	2.6	0.0	5.0	0.0
Queue Clearance Time (g_s), s	13.8	25.7	6.3	19.3	15.0		11.7	
Green Extension Time (g_e), s	0.3	3.3	0.5	1.4	0.0	0.0	1.9	0.0
Phase Call Probability	1.00	1.00	0.98	1.00	1.00		1.00	
Max Out Probability	0.49	0.82	1.00	1.00	1.00		0.01	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	406	867	144	150	628	167	447	749	112	339	722	189
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1734	1543	1684	1734	1543	1684	1734	1543	1684	1734	1543
Queue Service Time (g_s), s	11.8	23.7	7.3	4.3	17.3	9.5	13.0	20.0	5.2	9.7	19.5	10.3
Cycle Queue Clearance Time (g_c), s	11.8	23.7	7.3	4.3	17.3	9.5	13.0	20.0	5.2	9.7	19.5	10.3
Green Ratio (*g/C*)	0.14	0.29	0.29	0.07	0.22	0.22	0.15	0.27	0.27	0.14	0.26	0.26
Capacity (*c*), veh/h	473	1003	447	227	750	334	502	943	420	456	895	398
Volume-to-Capacity Ratio (*X*)	0.857	0.864	0.323	0.661	0.837	0.499	0.890	0.795	0.266	0.743	0.807	0.474
Back of Queue (*Q*), ft/ln (95 th percentile)	233.5	404.4	124.2	88.1	321.3	166.1	222.2	309.5	84.1	189.7	351.5	175
Back of Queue (*Q*), veh/ln (95 th percentile)	9.2	15.9	4.9	3.5	12.6	6.5	8.7	12.2	3.3	7.5	13.8	6.9
Queue Storage Ratio (*RQ*) (95 th percentile)	0.75	0.00	0.50	0.34	0.00	0.64	0.63	0.00	0.65	0.95	0.00	1.40
Uniform Delay (d_1), s/veh	42.0	33.7	27.9	45.5	37.5	34.4	40.4	33.5	3.5	41.6	34.8	3.0
Incremental Delay (d_2), s/veh	9.1	7.0	0.6	4.3	8.2	1.6	10.5	3.9	0.9	3.3	7.7	4.0
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	51.1	40.7	28.4	49.8	45.7	36.0	50.8	37.4	4.4	44.9	42.5	7.0
Level of Service (LOS)	D	D	C	D	D	D	D	D	A	D	D	A
Approach Delay, s/veh / LOS	42.4	D		44.7	D		39.1	D		37.8	D	
Intersection Delay, s/veh / LOS	40.8						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.65	C	2.70	C	2.65	C	2.74	C
Bicycle LOS Score / LOS	1.66	B	1.27	A	1.40	A	1.52	B

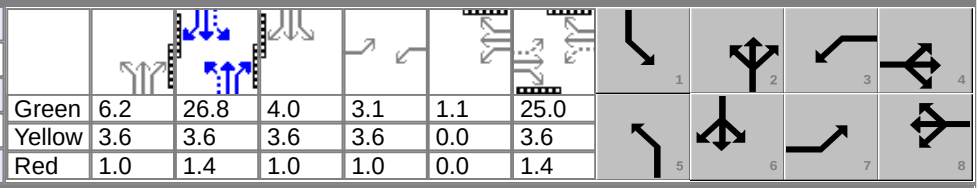
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	26th Street	Analysis Year	2024	Analysis Period	1> 7:15
Intersection	Cliff Avenue	File Name	23 26th at Cliff 2024 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	50	195	40	70	345	265	110	880	40	85	320	35

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	6.2	26.8	4.0	3.1	1.1	25.0
Yellow	3.6	3.6	3.6	3.6	0.0	3.6
Red	1.0	1.4	1.0	1.0	0.0	1.4

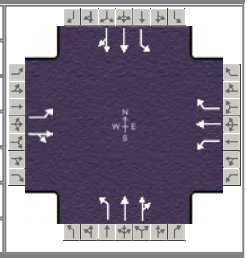
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	3.0	1.2	4.0	1.3	4.0
Phase Duration, s	7.7	30.0	8.8	31.1	10.8	42.6	8.6	40.4
Change Period, ($Y+R_c$), s	4.6	5.0	4.6	5.0	4.6	5.0	5.0	5.0
Max Allow Headway (*MAH*), s	4.2	6.2	4.2	6.2	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	4.0	12.6	4.9	19.0	6.2		2.0	
Green Extension Time (g_e), s	0.0	7.8	0.0	7.1	0.3	0.0	0.9	0.0
Phase Call Probability	0.75	1.00	0.86	1.00	0.95		0.91	
Max Out Probability	1.00	0.14	1.00	0.23	0.00		0.72	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	56	250		78	383	206	122	512	505	94	193	190
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1778		1734	1821	1543	1734	1821	1796	1734	1821	1774
Queue Service Time (g_s), s	2.0	10.6		2.9	17.0	9.8	4.2	20.5	20.5	0.0	6.5	6.5
Cycle Queue Clearance Time (g_c), s	2.0	10.6		2.9	17.0	9.8	4.2	20.5	20.5	0.0	6.5	6.5
Green Ratio (*g/C*)	0.31	0.28		0.32	0.29	0.29	0.39	0.42	0.42	0.32	0.39	0.39
Capacity (*c*), veh/h	218	494		341	529	448	424	761	750	243	717	699
Volume-to-Capacity Ratio (*X*)	0.255	0.506		0.228	0.725	0.459	0.288	0.673	0.673	0.389	0.269	0.272
Back of Queue (*Q*), ft/ln (95 th percentile)	39.2	208		53.5	314.4	134	76.2	363.7	354.4	91.2	129.6	126
Back of Queue (*Q*), veh/ln (95 th percentile)	1.5	8.2		2.1	12.4	5.3	3.0	14.3	14.2	3.6	5.1	5.0
Queue Storage Ratio (*RQ*) (95 th percentile)	0.30	0.00		0.47	0.00	1.16	0.44	0.00	0.00	0.61	0.00	0.00
Uniform Delay (d_1), s/veh	23.9	27.3		22.2	28.7	17.3	18.5	21.2	21.2	34.0	18.5	18.5
Incremental Delay (d_2), s/veh	0.6	1.7		0.3	4.0	1.6	0.4	4.7	4.8	1.0	0.9	1.0
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	24.5	29.0		22.5	32.7	18.9	18.9	25.9	26.0	35.0	19.4	19.5
Level of Service (LOS)	C	C		C	C	B	B	C	C	D	B	B
Approach Delay, s/veh / LOS	28.2	C		27.3	C		25.2	C		22.5	C	
Intersection Delay, s/veh / LOS	25.6						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.29	B	2.30	B	2.25	B	1.92	B
Bicycle LOS Score / LOS	0.99	A	1.59	B	1.43	A	0.88	A

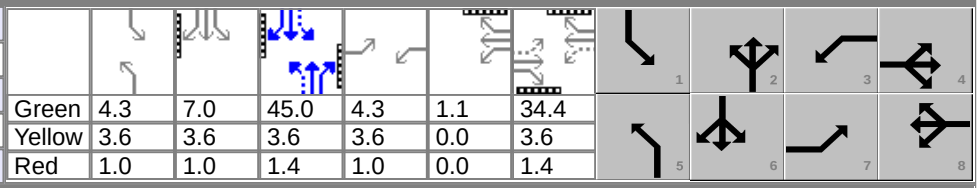
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	26th Street	Analysis Year	2024	Analysis Period	1> 16:30
Intersection	Cliff Avenue	File Name	23 26th at Cliff 2024 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	55	340	95	90	300	80	60	515	100	285	1040	70

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	4.3	7.0	45.0	4.3	1.1	34.4
Yellow	3.6	3.6	3.6	3.6	0.0	3.6
Red	1.0	1.0	1.4	1.0	0.0	1.4

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	8.9	39.4	10.0	40.5	8.9	50.0	20.5	61.7
Change Period, ($Y+R_c$), s	4.6	5.0	4.6	5.0	4.6	5.0	4.6	5.0
Max Allow Headway (*MAH*), s	4.2	6.2	4.2	6.2	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	5.0	33.4	6.9	20.9	4.8		14.7	
Green Extension Time (g_e), s	0.0	1.0	0.0	6.4	0.0	0.0	1.2	0.0
Phase Call Probability	0.87	1.00	0.96	1.00	0.89		1.00	
Max Out Probability	1.00	1.00	1.00	0.43	1.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	61	472		100	333	72	67	344	328	317	617	606
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1758		1734	1821	1543	1734	1821	1726	1734	1821	1786
Queue Service Time (g_s), s	3.0	31.4		4.9	18.9	4.1	2.8	17.5	17.6	12.7	32.4	32.5
Cycle Queue Clearance Time (g_c), s	3.0	31.4		4.9	18.9	4.1	2.8	17.5	17.6	12.7	32.4	32.5
Green Ratio (*g/C*)	0.32	0.29		0.33	0.30	0.30	0.41	0.38	0.38	0.52	0.47	0.47
Capacity (*c*), veh/h	250	504		161	539	457	207	684	648	465	860	843
Volume-to-Capacity Ratio (*X*)	0.245	0.936		0.621	0.619	0.158	0.323	0.504	0.506	0.680	0.717	0.718
Back of Queue (*Q*), ft/ln (95 th percentile)	58.4	605		108.4	349	73.2	55.3	324.7	308.4	227.9	540.5	524.6
Back of Queue (*Q*), veh/ln (95 th percentile)	2.3	23.8		4.3	13.7	2.9	2.2	12.8	12.3	9.0	21.3	21.0
Queue Storage Ratio (*RQ*) (95 th percentile)	0.45	0.00		0.94	0.00	0.64	0.32	0.00	0.00	1.52	0.00	0.00
Uniform Delay (d_1), s/veh	30.3	41.7		33.0	36.4	31.2	24.2	28.9	28.9	19.3	25.3	25.3
Incremental Delay (d_2), s/veh	0.5	25.4		7.1	3.1	0.3	0.9	2.6	2.8	1.8	5.1	5.2
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	30.8	67.2		40.1	39.5	31.6	25.1	31.5	31.7	21.1	30.4	30.5
Level of Service (LOS)	C	E		D	D	C	C	C	C	C	C	C
Approach Delay, s/veh / LOS	63.0	E		38.5	D		31.0	C		28.5	C	
Intersection Delay, s/veh / LOS	36.1						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.31	B	2.31	B	2.14	B	1.92	B
Bicycle LOS Score / LOS	1.37	A	1.32	A	1.10	A	1.76	B

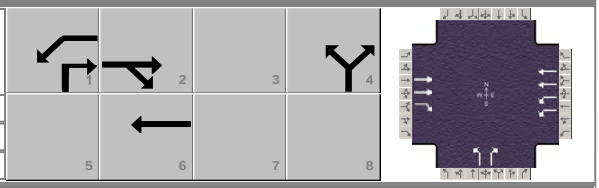
HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	Parclo AB-2Q
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Segment Distance, ft	1097
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	North-South
Intersection	SB I-229 Ramp	PHF	0.90	Arterial Direction	East-West
File Name	24-25-26 26th Street 2024 AM.xus				
Project Description	I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h		315	65	660	780		155		195			
Intersection Two Demand (*v*), veh/h		415	95	335	1305		135	0	410			

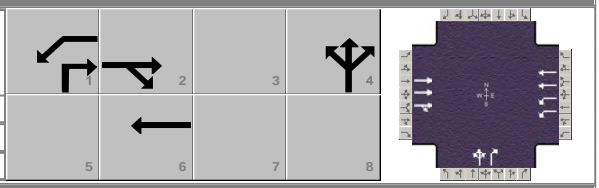
Signal One Information	
Cycle, s	90.0
Offset, s	0
Uncoordinated	No
Force Mode	Fixed

Green	44.0	18.5	11.6	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.9	1.9	1.3	0.0	0.0	0.0



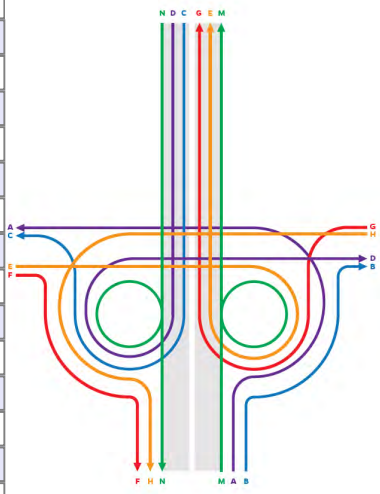
Signal Two Information	
Cycle, s	90.0
Offset, s	0
Uncoordinated	No
Force Mode	Fixed

Green	12.6	46.8	15.6	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.0	1.9	1.3	0.0	0.0	0.0



Interchange Results

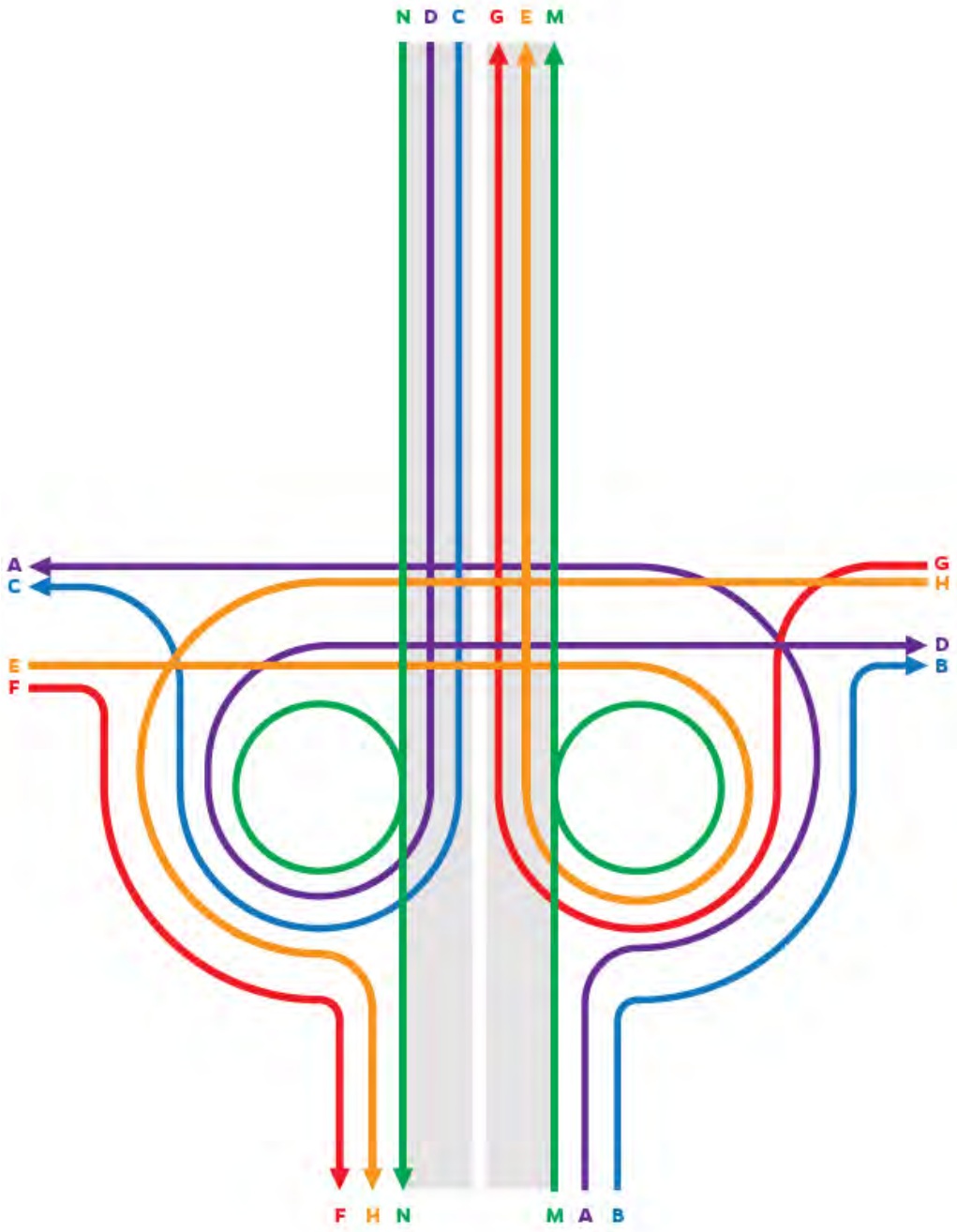
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	150	45.1	0.0	45.1	No	No	C
B	289	24.8	0.0	24.8	No	No	B
C	172	43.3	5.0	48.3	No	No	C
D	217	1.3	5.0	6.3	No	No	A
E	106	50.6	5.0	55.6	No	No	D
F	67	34.5	0.0	34.5	No	No	C
G	372	30.4	5.0	35.4	No	No	C
H	733	12.6	0.0	12.6	No	No	A
I	244	49.4	0.0	49.4	No	No	C
J	717	5.3	0.0	5.3	No	No	A
K	-	-	0.0	-	-	-	-
L	-	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh		34.5	31.5	11.3	4.0		43.3		0.0			
Level of Service (LOS)		C	C	B	A		D		A			
Approach Delay, s/veh / LOS	34.0	C		7.3	A		19.2	B		0.0		
Intersection Delay, s/veh / LOS	13.9						B					

Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh		14.9	16.1	30.4	1.3			41.2	24.8			
Level of Service (LOS)		B	B	C	A			D	C			
Approach Delay, s/veh / LOS	15.3	B		7.3	A		33.6	C		0.0		
Intersection Delay, s/veh / LOS	13.0						B					

Interchange Graphic



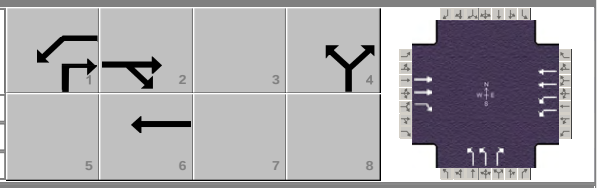
HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	Parclo AB-2Q
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Segment Distance, ft	1097
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	North-South
Intersection	SB I-229 Ramp	PHF	0.90	Arterial Direction	East-West
File Name	24-25-26 26th Street 2024 PM.xus				
Project Description	I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h		880	70	520	630		155		490			
Intersection Two Demand (*v*), veh/h		1240	130	110	1090		60	0	765			

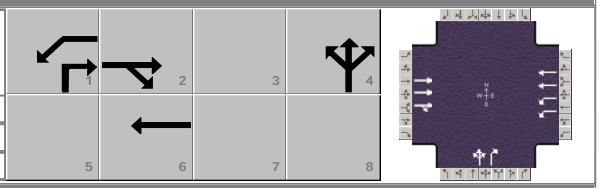
Signal One Information	
Cycle, s	110.0
Offset, s	0
Uncoordinated	No
Force Mode	Fixed

Green	52.5	32.5	9.1	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.9	1.9	1.3	0.0	0.0	0.0



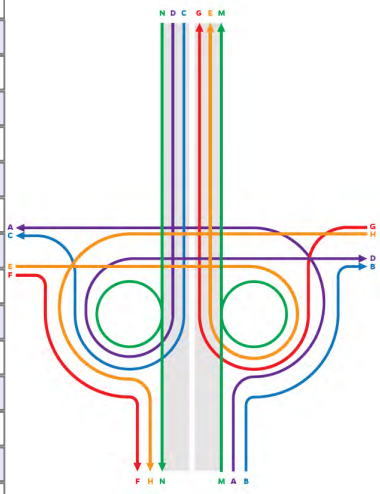
Signal Two Information	
Cycle, s	110.0
Offset, s	0
Uncoordinated	No
Force Mode	Fixed

Green	5.9	64.4	24.7	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.0	1.9	1.3	0.0	0.0	0.0



Interchange Results

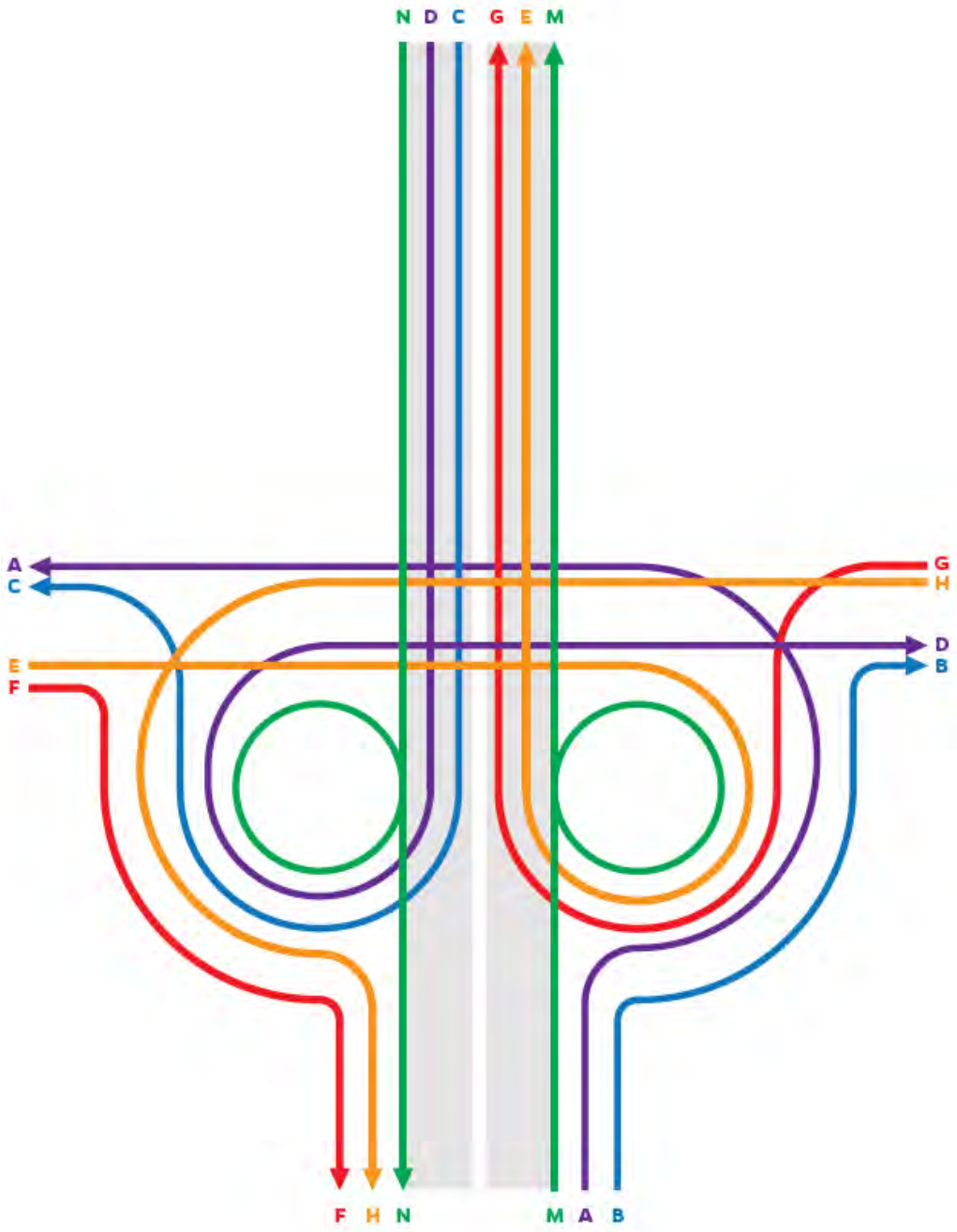
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	67	55.3	0.0	55.3	No	No	D
B	517	46.6	0.0	46.6	No	No	C
C	172	52.9	5.0	57.9	No	No	D
D	544	1.4	5.0	6.4	No	No	A
E	144	30.3	5.0	35.3	No	No	C
F	72	22.5	0.0	22.5	No	No	B
G	122	50.4	5.0	55.4	No	No	D
H	578	31.9	0.0	31.9	No	No	C
I	833	31.7	0.0	31.7	No	No	C
J	633	3.8	0.0	3.8	No	No	A
K	-	-	0.0	-	-	-	-
L	-	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh		22.5	16.1	30.5	2.3		52.9		0.0			
Level of Service (LOS)		C	B	C	A		D		A			
Approach Delay, s/veh / LOS	22.0	C		15.1	B		12.7	B		0.0		
Intersection Delay, s/veh / LOS	16.9						B					

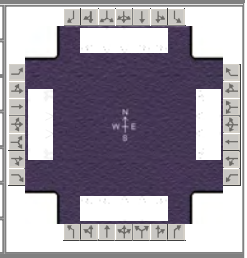
Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh		9.3	7.8	50.4	1.4			52.9	46.6			
Level of Service (LOS)		A	A	D	A			D	D			
Approach Delay, s/veh / LOS	8.8	A		5.9	A		49.3	D		0.0		
Intersection Delay, s/veh / LOS	14.5						B					

Interchange Graphic



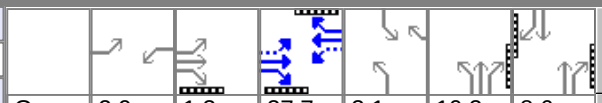
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	26th Street	Analysis Year	2024	Analysis Period	1> 7:15
Intersection	Southeastern Ave	File Name	24-25-26 26th Street 2024 AM.xus		
Project Description	I-229 Exits 3 and 4				

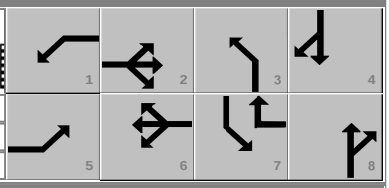


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	80	600	145	45	1090	280	510	710	50	55	130	40

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	6	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	2.9	1.3	37.7	3.1	10.3	8.6
Yellow	3.9	0.0	3.9	3.9	3.9	3.9
Red	1.0	0.0	1.8	1.0	1.0	1.8



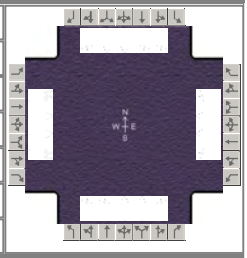
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6	3	8	7	4
Case Number	1.1	3.0	1.1	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	9.1	44.7	7.8	43.4	23.2	29.5	8.0	14.3
Change Period, ($Y+R_c$), s	4.9	5.7	4.9	5.7	4.9	5.7	4.9	5.7
Max Allow Headway (*MAH*), s	4.2	0.0	4.2	0.0	4.2	4.1	4.2	4.1
Queue Clearance Time (g_s), s	4.6		3.5		16.5	21.5	3.6	5.5
Green Extension Time (g_e), s	0.1	0.0	0.0	0.0	1.8	2.3	0.0	2.5
Phase Call Probability	0.89		0.71		1.00	1.00	0.78	1.00
Max Out Probability	1.00		0.34		0.14	0.70	1.00	0.59

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	89	667	161	50	1211	200	567	789	33	61	144	22
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1734		1734	1734	1543	1684	1734	1568	1684	1734	1568
Queue Service Time (g_s), s	2.6	9.0		1.5	28.1	7.3	14.5	19.5	1.4	1.6	3.5	1.2
Cycle Queue Clearance Time (g_c), s	2.6	9.0		1.5	28.1	7.3	14.5	19.5	1.4	1.6	3.5	1.2
Green Ratio (*g/C*)	0.47	0.43		0.45	0.42	0.45	0.20	0.26	0.26	0.03	0.10	0.10
Capacity (*c*), veh/h	209	1503		375	1453	700	686	917	415	117	332	150
Volume-to-Capacity Ratio (*X*)	0.425	0.444		0.133	0.834	0.286	0.826	0.860	0.080	0.521	0.436	0.148
Back of Queue (*Q*), ft/ln (95 th percentile)	48	138.1		26.2	448.5	122	260.4	345.7	24.1	32.9	69.8	20.8
Back of Queue (*Q*), veh/ln (95 th percentile)	1.9	5.4		1.0	17.7	4.8	10.3	13.6	1.0	1.3	2.7	0.8
Queue Storage Ratio (*RQ*) (95 th percentile)	0.11	0.00		0.10	0.00	0.49	0.61	0.00	0.10	0.09	0.00	0.10
Uniform Delay (d_1), s/veh	18.9	11.2		14.5	23.3	15.4	34.3	31.5	24.9	42.7	38.4	37.3
Incremental Delay (d_2), s/veh	1.3	0.9		0.2	5.8	1.0	4.0	6.6	0.1	3.6	0.9	0.5
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	20.2	12.1	0.0	14.7	29.1	16.5	38.3	38.1	24.9	46.3	39.3	37.8
Level of Service (LOS)	C	B	A	B	C	B	D	D	C	D	D	D
Approach Delay, s/veh / LOS	10.8	B		26.9	C		37.9	D		41.0	D	
Intersection Delay, s/veh / LOS	27.8						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.59	C	2.59	C	2.58	C	2.45	B
Bicycle LOS Score / LOS	1.24	A	1.69	B	1.63	B	0.68	A

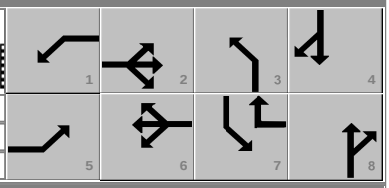
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	26th Street	Analysis Year	2024	Analysis Period	1> 16:30
Intersection	Southeastern Ave	File Name	24-25-26 26th Street 2024 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	90	1350	565	90	915	150	220	250	95	260	585	65

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	83	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	5.0	0.2	51.1	10.2	1.9	20.2
Yellow	3.9	0.0	3.9	3.9	0.0	3.9
Red	1.0	0.0	1.8	1.0	0.0	1.8

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6	3	8	7	4
Case Number	1.1	3.0	1.1	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	9.9	56.8	10.2	57.1	15.1	25.9	17.1	27.9
Change Period, ($Y+R_c$), s	4.9	5.7	4.9	5.7	4.9	5.7	4.9	5.7
Max Allow Headway (*MAH*), s	4.2	0.0	4.2	0.0	4.2	4.1	4.2	4.1
Queue Clearance Time (g_s), s	5.2		5.3		9.8	9.8	11.2	22.3
Green Extension Time (g_e), s	0.1	0.0	0.2	0.0	0.4	3.5	1.0	0.0
Phase Call Probability	0.95		0.95		1.00	1.00	1.00	1.00
Max Out Probability	0.51		0.00		0.48	0.28	0.00	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	97	1455	609	100	1017	111	244	278	78	289	650	39
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1734		1734	1734	1543	1684	1734	1568	1684	1734	1568
Queue Service Time (g_s), s	3.2	42.4		3.3	24.3	3.6	7.8	7.8	4.7	9.2	20.3	2.2
Cycle Queue Clearance Time (g_c), s	3.2	42.4		3.3	24.3	3.6	7.8	7.8	4.7	9.2	20.3	2.2
Green Ratio (*g/C*)	0.51	0.46		0.51	0.47	0.58	0.09	0.18	0.18	0.11	0.20	0.20
Capacity (*c*), veh/h	271	1612		177	1619	892	314	638	288	373	698	316
Volume-to-Capacity Ratio (*X*)	0.358	0.903		0.564	0.628	0.125	0.779	0.436	0.270	0.775	0.931	0.123
Back of Queue (*Q*), ft/ln (95 th percentile)	57.2	607.2		64.3	387.7	57.9	159.5	154.1	82.9	183.8	400.4	39.2
Back of Queue (*Q*), veh/ln (95 th percentile)	2.3	23.9		2.5	15.3	2.3	6.3	6.1	3.3	7.2	15.8	1.6
Queue Storage Ratio (*RQ*) (95 th percentile)	0.13	0.00		0.26	0.00	0.23	0.38	0.00	0.33	0.49	0.00	0.20
Uniform Delay (d_1), s/veh	17.3	26.5		24.5	22.1	10.6	48.8	39.8	38.5	47.6	43.2	36.0
Incremental Delay (d_2), s/veh	0.6	6.3		2.8	1.9	0.3	5.0	0.5	0.5	3.5	19.1	0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	17.9	32.8	0.0	27.3	24.0	10.9	53.8	40.3	39.0	51.1	62.3	36.1
Level of Service (LOS)	B	C	A	C	C	B	D	D	D	D	E	D
Approach Delay, s/veh / LOS	22.9	C		23.0	C		45.6	D		57.9	E	
Intersection Delay, s/veh / LOS	32.6						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.60	C	2.60	C	2.53	C	2.45	B
Bicycle LOS Score / LOS	2.33	B	1.50	B	0.98	A	1.29	A

HCS7 Two-Way Stop-Control Report

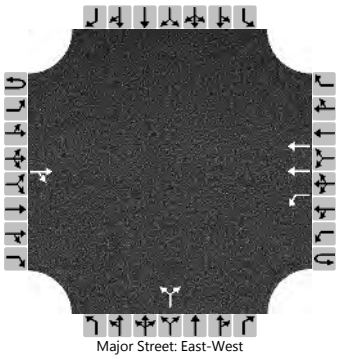
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	26th St at Yeager Rd
Jurisdiction	Sioux Falls, SD
East/West Street	26th Street
North/South Street	Yeager Road
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	1	2	0		0	1	0		0	0	0
Configuration				TR		L	T				LR					
Volume (veh/h)			335	5		120	815			25		45				
Percent Heavy Vehicles (%)						2				2		2				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized																
Median Type | Storage						Undivided										

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.5		6.9				
Critical Headway (sec)						4.14				6.84		6.94				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.22				3.52		3.32				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						133					78					
Capacity, c (veh/h)						1177					337					
v/c Ratio						0.11					0.23					
95% Queue Length, Q_{95} (veh)						0.4					0.9					
Control Delay (s/veh)						8.4					18.9					
Level of Service (LOS)						A					C					
Approach Delay (s/veh)						1.1				18.9						
Approach LOS										C						

HCS7 Two-Way Stop-Control Report

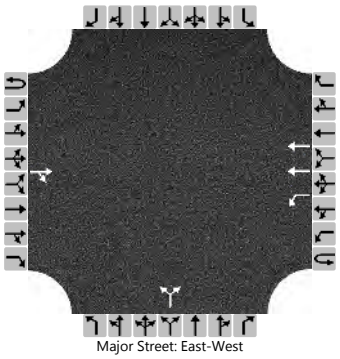
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-229 Exits 3 and 4

Site Information

Intersection	26th St at Yeager Rd
Jurisdiction	Sioux Falls, SD
East/West Street	26th Street
North/South Street	Yeager Road
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	1	2	0		0	1	0		0	0	0
Configuration				TR		L	T				LR					
Volume (veh/h)			830	10		170	615			25		120				
Percent Heavy Vehicles (%)						2				2		2				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized																
Median Type | Storage						Undivided										

Critical and Follow-up Headways

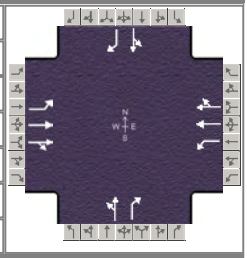
Base Critical Headway (sec)						4.1				7.5		6.9				
Critical Headway (sec)						4.14				6.84		6.94				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.22				3.52		3.32				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						189					161					
Capacity, c (veh/h)						729					177					
v/c Ratio						0.26					0.91					
95% Queue Length, Q_{95} (veh)						1.0					6.8					
Control Delay (s/veh)						11.7					98.8					
Level of Service (LOS)						B					F					
Approach Delay (s/veh)						2.5				98.8						
Approach LOS										F						

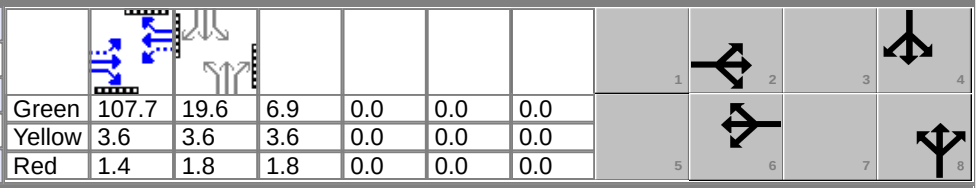
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	41st Street	Analysis Year	2024	Analysis Period	1> 7:15
Intersection	Norton Ave	File Name	28 41st at Norton 2024 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	20	505	30	10	605	10	10	10	5	5	10	10

Signal Information			
Cycle, s	150.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	107.7	19.6	6.9	0.0	0.0	0.0						
Yellow	3.6	3.6	3.6	0.0	0.0	0.0						
Red	1.4	1.8	1.8	0.0	0.0	0.0						

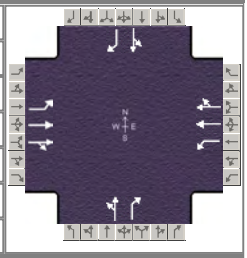
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		6.0		6.0		11.0		11.0
Phase Duration, s		112.7		112.7		12.3		25.0
Change Period, ($Y+R_c$), s		5.0		5.0		5.4		5.4
Max Allow Headway (*MAH*), s		0.0		0.0		5.2		5.2
Queue Clearance Time (g_s), s						3.8		3.2
Green Extension Time (g_e), s		0.0		0.0		0.1		0.1
Phase Call Probability						0.69		1.00
Max Out Probability						0.00		0.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	22	300	295	11	343	341		22	6		17	11
Adjusted Saturation Flow Rate (*s*), veh/h/ln	758	1821	1785	823	1821	1811		1777	1543		1791	1543
Queue Service Time (g_s), s	1.6	8.3	8.4	0.7	9.8	9.8		1.8	0.5		1.2	0.9
Cycle Queue Clearance Time (g_c), s	11.4	8.3	8.4	9.1	9.8	9.8		1.8	0.5		1.2	0.9
Green Ratio (*g/C*)	0.72	0.72	0.72	0.72	0.72	0.72		0.05	0.05		0.13	0.13
Capacity (*c*), veh/h	543	1308	1282	593	1308	1300		81	71		234	202
Volume-to-Capacity Ratio (*X*)	0.041	0.229	0.230	0.019	0.262	0.262		0.274	0.079		0.071	0.055
Back of Queue (*Q*), ft/ln (95 th percentile)	13.1	151.8	149.8	6.2	178.6	177.7		40.6	10		26.2	17.5
Back of Queue (*Q*), veh/ln (95 th percentile)	0.5	6.0	5.9	0.2	7.0	7.0		1.6	0.4		1.0	0.7
Queue Storage Ratio (*RQ*) (95 th percentile)	0.13	0.00	0.00	0.06	0.00	0.00		0.00	0.13		0.00	0.23
Uniform Delay (d_1), s/veh	9.3	7.1	7.1	8.7	7.3	7.3		69.2	68.5		57.2	57.1
Incremental Delay (d_2), s/veh	0.1	0.4	0.4	0.1	0.5	0.5		2.5	0.7		0.2	0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Control Delay (*d*), s/veh	9.4	7.5	7.5	8.7	7.8	7.8		71.7	69.2		57.4	57.3
Level of Service (LOS)	A	A	A	A	A	A		E	E		E	E
Approach Delay, s/veh / LOS	7.6	A		7.8	A		71.2	E		57.3	E	
Intersection Delay, s/veh / LOS	10.0						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.87	B	1.87	B	2.33	B	2.33	B
Bicycle LOS Score / LOS	1.00	A	1.06	A	0.53	A	0.53	A

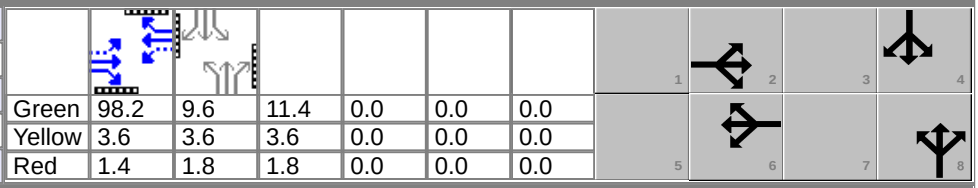
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	41st Street	Analysis Year	2024	Analysis Period	1> 16:30
Intersection	Norton Ave	File Name	28 41st at Norton 2024 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	35	910	60	20	810	25	75	30	40	20	25	40

Signal Information			
Cycle, s	135.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	98.2	9.6	11.4	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.4	1.8	1.8	0.0	0.0	0.0

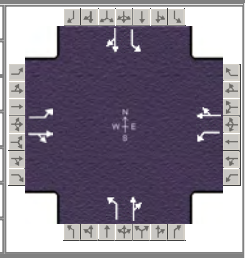
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		6.0		6.0		11.0		11.0
Phase Duration, s		103.2		103.2		16.8		15.0
Change Period, ($Y+R_c$), s		5.0		5.0		5.4		5.4
Max Allow Headway (*MAH*), s		0.0		0.0		5.2		5.3
Queue Clearance Time (g_s), s						10.8		5.6
Green Extension Time (g_e), s		0.0		0.0		0.7		0.3
Phase Call Probability						1.00		0.96
Max Out Probability						0.00		0.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	39	545	533	22	466	461		117	33		50	33
Adjusted Saturation Flow Rate (*s*), veh/h/ln	603	1821	1781	523	1821	1802		1758	1543		1782	1543
Queue Service Time (g_s), s	3.4	15.7	15.7	2.3	12.7	12.7		8.8	2.7		3.6	2.8
Cycle Queue Clearance Time (g_c), s	16.1	15.7	15.7	18.0	12.7	12.7		8.8	2.7		3.6	2.8
Green Ratio (*g/C*)	0.73	0.73	0.73	0.73	0.73	0.73		0.08	0.08		0.07	0.07
Capacity (*c*), veh/h	435	1325	1296	373	1325	1311		149	131		126	109
Volume-to-Capacity Ratio (*X*)	0.089	0.411	0.411	0.060	0.352	0.352		0.784	0.255		0.396	0.305
Back of Queue (*Q*), ft/ln (95 th percentile)	22.8	255.7	251.5	13.9	215.2	213.5		200	51.3		79.8	52.9
Back of Queue (*Q*), veh/ln (95 th percentile)	0.9	10.1	9.9	0.5	8.5	8.4		7.9	2.0		3.1	2.1
Queue Storage Ratio (*RQ*) (95 th percentile)	0.23	0.00	0.00	0.14	0.00	0.00		0.00	0.68		0.00	0.70
Uniform Delay (d_1), s/veh	9.7	7.2	7.2	10.7	6.7	6.7		60.6	57.8		60.0	59.6
Incremental Delay (d_2), s/veh	0.4	0.9	1.0	0.3	0.7	0.7		12.0	1.4		2.9	2.2
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Control Delay (*d*), s/veh	10.1	8.1	8.1	11.0	7.5	7.5		72.6	59.3		62.8	61.8
Level of Service (LOS)	B	A	A	B	A	A		E	E		E	E
Approach Delay, s/veh / LOS	8.2	A		7.6	A		69.7	E		62.4	E	
Intersection Delay, s/veh / LOS	13.9						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.88	B	1.88	B	2.33	B	2.32	B
Bicycle LOS Score / LOS	1.41	A	1.27	A	0.74	A	0.63	A

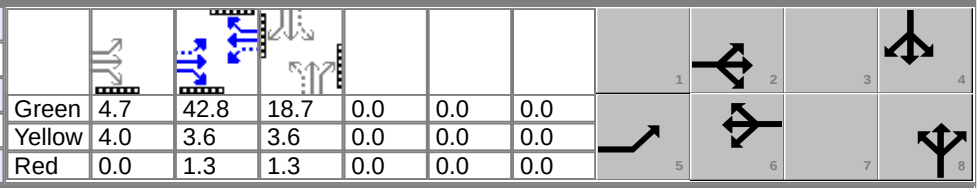
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	41st Street	Analysis Year	2024	Analysis Period	1> 7:15
Intersection	Phillips Ave	File Name	29 41st at Phillips 2024 AM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	120	250	10	30	250	125	10	125	55	110	20	165

Signal Information			
Cycle, s	80.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	4.7	42.8	18.7	0.0	0.0	0.0
Yellow	4.0	3.6	3.6	0.0	0.0	0.0
Red	0.0	1.3	1.3	0.0	0.0	0.0

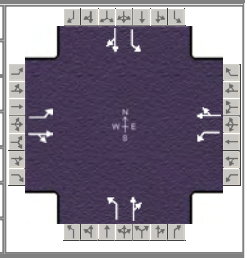
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		4
Case Number	1.0	4.0		6.3		6.0		6.0
Phase Duration, s	8.7	56.4		47.7		23.6		23.6
Change Period, ($Y+R_c$), s	4.0	4.9		4.9		4.9		4.9
Max Allow Headway (*MAH*), s	4.2	0.0		0.0		5.4		5.4
Queue Clearance Time (g_s), s	4.5					10.2		18.0
Green Extension Time (g_e), s	0.1	0.0		0.0		2.2		0.6
Phase Call Probability	0.95					1.00		1.00
Max Out Probability	1.00					0.33		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	133	289		33	417		11	200		122	172	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1809		1090	1718		1213	1726		1182	1574	
Queue Service Time (g_s), s	2.5	5.4		1.2	11.9		0.6	8.0		8.0	7.5	
Cycle Queue Clearance Time (g_c), s	2.5	5.4		1.2	11.9		8.2	8.0		16.0	7.5	
Green Ratio (*g/C*)	0.62	0.64		0.53	0.53		0.23	0.23		0.23	0.23	
Capacity (*c*), veh/h	567	1165		673	919		259	403		247	367	
Volume-to-Capacity Ratio (*X*)	0.235	0.248		0.050	0.453		0.043	0.496		0.494	0.469	
Back of Queue (*Q*), ft/ln (95 th percentile)	38.1	86.4		12.9	203.4		8.6	153.2		108.9	131.3	
Back of Queue (*Q*), veh/ln (95 th percentile)	1.5	3.4		0.5	8.0		0.3	6.0		4.3	5.2	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.29	0.00		0.22	0.00		0.14	0.00		0.99	0.00	
Uniform Delay (d_1), s/veh	7.7	6.0		8.9	11.4		29.9	26.6		33.5	26.4	
Incremental Delay (d_2), s/veh	0.2	0.5		0.1	1.6		0.1	1.3		2.2	1.3	
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh	7.9	6.5		9.1	13.0		30.0	27.9		35.7	27.7	
Level of Service (LOS)	A	A		A	B		C	C		D	C	
Approach Delay, s/veh / LOS	7.0	A		12.7	B		28.0	C		31.0	C	
Intersection Delay, s/veh / LOS	17.2						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.86	B	1.93	B	1.92	B	1.92	B
Bicycle LOS Score / LOS	1.18	A	1.23	A	0.84	A	0.97	A

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	41st Street	Analysis Year	2024	Analysis Period	1> 16:30
Intersection	Phillips Ave	File Name	29 41st at Phillips 2024 PM.xus		
Project Description	I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	120	265	5	20	310	90	30	55	65	120	25	235

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4
Green	4.8	51.2	20.2	0.0	0.0	0.0	5	6	7	8
Yellow	4.0	3.6	3.6	0.0	0.0	0.0				
Red	0.0	1.3	1.3	0.0	0.0	0.0				

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		4
Case Number	1.0	4.0		6.3		6.0		6.0
Phase Duration, s	8.8	64.9		56.1		25.1		25.1
Change Period, ($Y+R_c$), s	4.0	4.9		4.9		4.9		4.9
Max Allow Headway (*MAH*), s	4.2	0.0		0.0		5.4		5.4
Queue Clearance Time (g_s), s	4.7					16.5		17.0
Green Extension Time (g_e), s	0.4	0.0		0.0		3.1		3.1
Phase Call Probability	0.96					1.00		1.00
Max Out Probability	0.00					0.05		0.05

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	133	300		22	444		33	133		133	233	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1815		1079	1750		1147	1659		1256	1572	
Queue Service Time (g_s), s	2.7	5.9		0.8	13.2		2.5	6.1		9.0	12.2	
Cycle Queue Clearance Time (g_c), s	2.7	5.9		0.9	13.2		14.5	6.1		15.0	12.2	
Green Ratio (*g/C*)	0.64	0.67		0.57	0.57		0.22	0.22		0.22	0.22	
Capacity (*c*), veh/h	570	1210		692	994		184	373		278	353	
Volume-to-Capacity Ratio (*X*)	0.234	0.248		0.032	0.447		0.181	0.358		0.479	0.661	
Back of Queue (*Q*), ft/ln (95 th percentile)	40.8	97.4		9	224.2		32.7	113.1		130.4	213.6	
Back of Queue (*Q*), veh/ln (95 th percentile)	1.6	3.8		0.4	8.8		1.3	4.5		5.1	8.4	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.31	0.00		0.15	0.00		0.55	0.00		1.19	0.00	
Uniform Delay (d_1), s/veh	7.7	6.0		8.6	11.2		38.3	29.4		35.7	31.8	
Incremental Delay (d_2), s/veh	0.2	0.5		0.1	1.5		0.7	0.8		1.8	3.0	
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh	7.9	6.5		8.7	12.7		39.0	30.2		37.5	34.8	
Level of Service (LOS)	A	A		A	B		D	C		D	C	
Approach Delay, s/veh / LOS	6.9	A		12.5	B		32.0	C		35.8	D	
Intersection Delay, s/veh / LOS	19.0						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.86	B	1.95	B	1.93	B	1.93	B
Bicycle LOS Score / LOS	1.20	A	1.26	A	0.76	A	1.09	A

Appendix H

HCS Analysis Summary – Forecast 2024 Build Conditions

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - west of Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2950	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1159
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.50
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	18.8
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - west of Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2315	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	891
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.38
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	14.4
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - between Western Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2480	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1461
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.63
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	23.6
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - between Western Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	1970	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1138
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.49
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	18.4
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - between Western and Minnesota		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2930	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1151
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.50
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	18.6
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - between Western and Minnesota		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2795	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1076
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.46
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	17.4
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - Western to Minnesota		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2860	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2100	360	90	380
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	6.00	6.00	6.00	6.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.943	0.943	0.943	0.943
Flow Rate (v_i), pc/h	2474	424	106	448
Weaving Flow Rate (v_w), pc/h	872	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2580	Density-Based Capacity (c_{IWL}), pc/h/ln		2180
Total Flow Rate (v), pc/h	3452	Demand Flow-Based Capacity (c_{IW}), pc/h		9486
Volume Ratio (VR)	0.253	Weaving Segment Capacity (c_W), veh/h		6167
Minimum Lane Change Rate (LC_{MIN}), lc/h	872	Adjusted Weaving Area Capacity, pc/h		6540
Maximum Weaving Length (L_{MAX}), ft	5085	Volume-to-Capacity Ratio (v/c)		0.53

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	738	Average Weaving Speed (S_W),mi/h	56.2
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1504	Average Non-Weaving Speed (S_{NW}), mi/h	53.2
Weaving Lane Change Rate (LC_W), lc/h	1181	Average Speed (S), mi/h	53.9
Weaving Lane Change Rate (LC_{All}), lc/h	2685	Density (D), pc/mi/ln	21.3
Weaving Intensity Factor (W)	0.215	Level of Service (LOS)	C

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - Western to Minnesota		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2860	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1669	676	149	301
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	4.00	4.00	4.00	4.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.962	0.962	0.962	0.962
Flow Rate (v_i), pc/h	1928	781	172	348
Weaving Flow Rate (v_w), pc/h	1129	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2100	Density-Based Capacity (c_{IWL}), pc/h/ln		2100
Total Flow Rate (v), pc/h	3229	Demand Flow-Based Capacity (c_{IW}), pc/h		6857
Volume Ratio (VR)	0.350	Weaving Segment Capacity (c_W), veh/h		6061
Minimum Lane Change Rate (LC_{MIN}), lc/h	1129	Adjusted Weaving Area Capacity, pc/h		6300
Maximum Weaving Length (L_{MAX}), ft	6126	Volume-to-Capacity Ratio (v/c)		0.51

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	601	Average Weaving Speed (S_W),mi/h	55.8
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1405	Average Non-Weaving Speed (S_{NW}), mi/h	51.7
Weaving Lane Change Rate (LC_W), lc/h	1438	Average Speed (S), mi/h	53.1
Weaving Lane Change Rate (LC_{All}), lc/h	2843	Density (D), pc/mi/ln	20.3
Weaving Intensity Factor (W)	0.225	Level of Service (LOS)	C

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - between Minnesota Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2460	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1450
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.63
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	23.5
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - between Minnesota Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2345	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1354
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.58
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	21.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - between Minnesota and Cliff		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2800	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1100
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.47
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	17.8
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - between Minnesota and Cliff		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2920	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1124
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.49
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	18.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - Minnesota to Cliff		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	3120	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1813	272	68	647
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	6.00	6.00	6.00	6.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.943	0.943	0.943	0.943
Flow Rate (v_i), pc/h	2136	320	80	762
Weaving Flow Rate (v_w), pc/h	1082	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2216	Density-Based Capacity (c_{IWL}), pc/h/ln		2138
Total Flow Rate (v), pc/h	3298	Demand Flow-Based Capacity (c_{IW}), pc/h		7317
Volume Ratio (VR)	0.328	Weaving Segment Capacity (c_W), veh/h		6048
Minimum Lane Change Rate (LC_{MIN}), lc/h	1082	Adjusted Weaving Area Capacity, pc/h		6414
Maximum Weaving Length (L_{MAX}), ft	5886	Volume-to-Capacity Ratio (v/c)		0.51

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	691	Average Weaving Speed (S_W),mi/h	56.1
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1570	Average Non-Weaving Speed (S_{NW}), mi/h	51.9
Weaving Lane Change Rate (LC_W), lc/h	1407	Average Speed (S), mi/h	53.2
Weaving Lane Change Rate (LC_{All}), lc/h	2977	Density (D), pc/mi/ln	20.7
Weaving Intensity Factor (W)	0.218	Level of Service (LOS)	C

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - Minnesota to Cliff		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	3120	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1754	471	104	591
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	4.00	4.00	4.00	4.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.962	0.962	0.962	0.962
Flow Rate (v_i), pc/h	2026	544	120	683
Weaving Flow Rate (v_w), pc/h	1227	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2146	Density-Based Capacity (c_{IWL}), pc/h/ln		2108
Total Flow Rate (v), pc/h	3373	Demand Flow-Based Capacity (c_{IW}), pc/h		6593
Volume Ratio (VR)	0.364	Weaving Segment Capacity (c_W), veh/h		6084
Minimum Lane Change Rate (LC_{MIN}), lc/h	1227	Adjusted Weaving Area Capacity, pc/h		6324
Maximum Weaving Length (L_{MAX}), ft	6281	Volume-to-Capacity Ratio (v/c)		0.53

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	670	Average Weaving Speed (S_W),mi/h	55.8
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1555	Average Non-Weaving Speed (S_{NW}), mi/h	50.8
Weaving Lane Change Rate (LC_W), lc/h	1552	Average Speed (S), mi/h	52.5
Weaving Lane Change Rate (LC_{All}), lc/h	3107	Density (D), pc/mi/ln	21.4
Weaving Intensity Factor (W)	0.225	Level of Service (LOS)	C

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - between Cliff Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2085	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1228
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.53
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - between Cliff Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2225	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1285
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.55
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	20.8
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - between Cliff and 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2620	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1029
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.44
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	16.7
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - between Cliff and 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2550	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	982
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.42
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	15.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - Cliff to 26th		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2750	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1599	476	59	486
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	6.00	6.00	6.00	6.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.943	0.943	0.943	0.943
Flow Rate (v_i), pc/h	1884	561	70	573
Weaving Flow Rate (v_w), pc/h	1134	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	1954	Density-Based Capacity (c_{IWL}), pc/h/ln		2077
Total Flow Rate (v), pc/h	3088	Demand Flow-Based Capacity (c_{IW}), pc/h		6540
Volume Ratio (VR)	0.367	Weaving Segment Capacity (c_W), veh/h		5876
Minimum Lane Change Rate (LC_{MIN}), lc/h	1134	Adjusted Weaving Area Capacity, pc/h		6231
Maximum Weaving Length (L_{MAX}), ft	6314	Volume-to-Capacity Ratio (v/c)		0.50

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	537	Average Weaving Speed (S_W),mi/h	55.8
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1315	Average Non-Weaving Speed (S_{NW}), mi/h	51.9
Weaving Lane Change Rate (LC_W), lc/h	1436	Average Speed (S), mi/h	53.3
Weaving Lane Change Rate (LC_{All}), lc/h	2751	Density (D), pc/mi/ln	19.3
Weaving Intensity Factor (W)	0.226	Level of Service (LOS)	B

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - Cliff to 26th		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2750	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1488	237	88	737
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	4.00	4.00	4.00	4.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.962	0.962	0.962	0.962
Flow Rate (v_i), pc/h	1719	274	102	851
Weaving Flow Rate (v_w), pc/h	1125	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	1821	Density-Based Capacity (c_{IWL}), pc/h/ln		2065
Total Flow Rate (v), pc/h	2946	Demand Flow-Based Capacity (c_{IW}), pc/h		6283
Volume Ratio (VR)	0.382	Weaving Segment Capacity (c_W), veh/h		5960
Minimum Lane Change Rate (LC_{MIN}), lc/h	1125	Adjusted Weaving Area Capacity, pc/h		6195
Maximum Weaving Length (L_{MAX}), ft	6480	Volume-to-Capacity Ratio (v/c)		0.48

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	501	Average Weaving Speed (S_W),mi/h	55.8
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1288	Average Non-Weaving Speed (S_{NW}), mi/h	52.2
Weaving Lane Change Rate (LC_W), lc/h	1427	Average Speed (S), mi/h	53.5
Weaving Lane Change Rate (LC_{All}), lc/h	2715	Density (D), pc/mi/ln	18.4
Weaving Intensity Factor (W)	0.224	Level of Service (LOS)	B

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - between 26th Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2075	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1222
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.53
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.8
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - between 26th Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	1725	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	996
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.43
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	16.1
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - NB I-229 - north of 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2505	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	984
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.42
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	15.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - NB I-229 - north of 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	1965	Heavy Vehicle Adjustment Factor (f_{HV})	0.962
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	757
Total Trucks, %	4.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.33
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	12.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - north of 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2465	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	959
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.41
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	15.5
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - north of 26th		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3140	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1198
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.52
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.4
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - between 26th Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2115	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1234
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.53
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	20.0
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - between 26th Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2495	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1428
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.62
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	23.1
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - between 26th and Cliff		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2840	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1105
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.48
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	17.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - between 26th and Cliff		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3085	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1177
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.51
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.0
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - 26th to Cliff		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2670	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	0
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1804	616	109	311
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	5.00	5.00	5.00	5.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.952	0.952	0.952	0.952
Flow Rate (v_i), pc/h	2106	719	127	363
Weaving Flow Rate (v_w), pc/h	1082	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2233	Density-Based Capacity (c_{IWL}), pc/h/ln		2106
Total Flow Rate (v), pc/h	3315	Demand Flow-Based Capacity (c_{IW}), pc/h		7362
Volume Ratio (VR)	0.326	Weaving Segment Capacity (c_W), veh/h		6015
Minimum Lane Change Rate (LC_{MIN}), lc/h	363	Adjusted Weaving Area Capacity, pc/h		6318
Maximum Weaving Length (L_{MAX}), ft	5864	Volume-to-Capacity Ratio (v/c)		0.52

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	596	Average Weaving Speed (S_W),mi/h	57.4
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1329	Average Non-Weaving Speed (S_{NW}), mi/h	57.1
Weaving Lane Change Rate (LC_W), lc/h	661	Average Speed (S), mi/h	57.2
Weaving Lane Change Rate (LC_{All}), lc/h	1990	Density (D), pc/mi/ln	19.3
Weaving Intensity Factor (W)	0.179	Level of Service (LOS)	B

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - 26th to Cliff		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	2670	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	0
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2022	478	112	473
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	3.00	3.00	3.00	3.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.971	0.971	0.971	0.971
Flow Rate (v_i), pc/h	2314	547	128	541
Weaving Flow Rate (v_w), pc/h	1088	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2442	Density-Based Capacity (c_{IWL}), pc/h/ln		2120
Total Flow Rate (v), pc/h	3530	Demand Flow-Based Capacity (c_{IW}), pc/h		7792
Volume Ratio (VR)	0.308	Weaving Segment Capacity (c_W), veh/h		6176
Minimum Lane Change Rate (LC_{MIN}), lc/h	541	Adjusted Weaving Area Capacity, pc/h		6360
Maximum Weaving Length (L_{MAX}), ft	5670	Volume-to-Capacity Ratio (v/c)		0.56

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	652	Average Weaving Speed (S_W),mi/h	56.8
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1372	Average Non-Weaving Speed (S_{NW}), mi/h	55.5
Weaving Lane Change Rate (LC_W), lc/h	839	Average Speed (S), mi/h	55.9
Weaving Lane Change Rate (LC_{All}), lc/h	2211	Density (D), pc/mi/ln	21.0
Weaving Intensity Factor (W)	0.195	Level of Service (LOS)	C

HCS7 Freeway Diverge Report

Project Information			
Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - Exit 4		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	2840	420
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	5.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.952
Flow Rate (vi),pc/h	3315	490
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.47	0.23

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.342
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	975
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influenece Area Speed (SR), mi/h	57.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.655	Outer Lanes Freeway Speed (SO), mi/h	71.3
Flow in Lanes 1 and 2 (v12), pc/h	2340	Ramp Junction Speed (S), mi/h	60.7
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	18.2
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	19.9

HCS7 Freeway Diverge Report

Project Information			
Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - Exit 4		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	3085	585
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3530	669
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.50	0.32

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.358
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1027
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influenece Area Speed (SR), mi/h	56.8
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.641	Outer Lanes Freeway Speed (SO), mi/h	71.2
Flow in Lanes 1 and 2 (v12), pc/h	2503	Ramp Junction Speed (S), mi/h	60.4
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	19.5
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	21.3

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - between Cliff Ramps		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2500	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	973
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.42
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	15.7
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - between Cliff Ramps		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2500	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	954
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.41
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	15.4
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - Exit 4 Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	2420	630
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	5.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.952
Flow Rate (vi),pc/h	2824	735
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.50	0.35

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.259
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1099
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	59.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	62.8
Flow in Lanes 1 and 2 (v12), pc/h	1725	Ramp Junction Speed (S), mi/h	60.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	2460	Average Density (D), pc/mi/ln	19.7
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	16.9

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - Exit 4 Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	2500	690
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	2861	790
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.52	0.38

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.262
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1113
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	59.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	62.8
Flow in Lanes 1 and 2 (v12), pc/h	1748	Ramp Junction Speed (S), mi/h	60.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	2538	Average Density (D), pc/mi/ln	20.2
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	17.5

HCS7 Freeway Merge Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD Cliff Alt 1- SB I-229 - Exit 4 NB Entrance		

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity

Demand Volume (Vi)	2420	390
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	5.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.952
Flow Rate (vi),pc/h	2824	455
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.47	0.22

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.248
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1099
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	59.3
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	62.8
Flow in Lanes 1 and 2 (v12), pc/h	1725	Ramp Junction Speed (S), mi/h	60.4
Flow Entering Ramp-Infl. Area (vR12), pc/h	2180	Average Density (D), pc/mi/ln	18.1
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	14.8

HCS7 Freeway Merge Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD Cliff Alt 1- SB I-229 - Exit 4 NB Entrance		

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity

Demand Volume (Vi)	2500	160
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	2861	183
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.43	0.09

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.240
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1113
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	59.5
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	62.8
Flow in Lanes 1 and 2 (v12), pc/h	1748	Ramp Junction Speed (S), mi/h	60.7
Flow Entering Ramp-Infl. Area (vR12), pc/h	1931	Average Density (D), pc/mi/ln	16.7
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	13.0

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD Cliff Alt1- SB I-229 - between Cliff Entrance Ramps		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2810	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1093
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.47
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	17.7
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD Cliff Alt1- SB I-229 - between Cliff Entrance Ramps		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2660	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1015
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.44
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	16.4
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD Cliff Alt 1- SB I-229 - Exit 4 SB Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	2810	240
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	5.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.952
Flow Rate (vi),pc/h	3280	280
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.50	0.13

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.251
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1276
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	59.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	62.2
Flow in Lanes 1 and 2 (v12), pc/h	2004	Ramp Junction Speed (S), mi/h	60.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	2284	Average Density (D), pc/mi/ln	19.7
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	15.7

HCS7 Freeway Merge Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD Cliff Alt 1- SB I-229 - Exit 4 SB Entrance		

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity

Demand Volume (Vi)	2660	530
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3044	606
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.52	0.29

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.259
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1184
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	59.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	62.5
Flow in Lanes 1 and 2 (v12), pc/h	1860	Ramp Junction Speed (S), mi/h	60.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	2466	Average Density (D), pc/mi/ln	20.2
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	17.0

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - between Cliff and Minnesota		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3050	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1187
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.51
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - between Cliff and Minnesota		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3190	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1217
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.52
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.7
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Diverge Report

Project Information			
Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - Exit 3		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	3050	380
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	5.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.952
Flow Rate (vi),pc/h	3560	444
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.50	0.21

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.338
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1087
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influenece Area Speed (SR), mi/h	57.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.651	Outer Lanes Freeway Speed (SO), mi/h	71.0
Flow in Lanes 1 and 2 (v12), pc/h	2473	Ramp Junction Speed (S), mi/h	60.8
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	19.5
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	21.0

HCS7 Freeway Diverge Report

Project Information			
Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - Exit 3		

Geometric Data	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	3190	475
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3650	544
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.52	0.26

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.347
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1106
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influenece Area Speed (SR), mi/h	57.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.644	Outer Lanes Freeway Speed (SO), mi/h	70.9
Flow in Lanes 1 and 2 (v12), pc/h	2544	Ramp Junction Speed (S), mi/h	60.6
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	20.1
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	21.6

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - between Minnesota Ramps		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2670	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1039
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.45
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	16.8
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - between Minnesota Ramps		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2715	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1036
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.45
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	16.8
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - Exit 3 Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	2670	380
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	5.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.952
Flow Rate (vi),pc/h	3116	444
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.50	0.21

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.254
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1212
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	59.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	62.4
Flow in Lanes 1 and 2 (v12), pc/h	1904	Ramp Junction Speed (S), mi/h	60.3
Flow Entering Ramp-Infl. Area (vR12), pc/h	2348	Average Density (D), pc/mi/ln	19.7
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	16.1

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - Exit 3 Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	2715	660
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3107	755
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.55	0.36

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.268
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1209
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	58.8
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	62.4
Flow in Lanes 1 and 2 (v12), pc/h	1898	Ramp Junction Speed (S), mi/h	59.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	2653	Average Density (D), pc/mi/ln	21.5
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	18.4

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD Minnesota Alt 2C/2D - SB I-229 - Exit 3 NB Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	2670	100
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	5.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.952
Flow Rate (vi),pc/h	3116	117
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.46	0.06

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.242
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1212
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	59.4
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	62.4
Flow in Lanes 1 and 2 (v12), pc/h	1904	Ramp Junction Speed (S), mi/h	60.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	2021	Average Density (D), pc/mi/ln	17.8
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	13.7

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD Minnesota Alt 2C/2D - Exit 3 NB Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	2715	130
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3107	149
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.46	0.07

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.243
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1209
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	59.4
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	62.4
Flow in Lanes 1 and 2 (v12), pc/h	1898	Ramp Junction Speed (S), mi/h	60.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	2047	Average Density (D), pc/mi/ln	17.9
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	13.9

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD Minnesota Alt 2C/2D - between Minnesota Entrance Ramps		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2770	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1078
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.46
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	17.4
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD Minnesota Alt 2C/2D - SB I-229 - between Minnesota Entrance Ramps		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2845	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1085
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.47
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	17.6
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD Minnesota Alt 2C/2D - Exit 3 SB Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	2770	280
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	5.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.952	0.952
Flow Rate (vi),pc/h	3233	327
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.50	0.16

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.252
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1258
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	59.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	62.3
Flow in Lanes 1 and 2 (v12), pc/h	1975	Ramp Junction Speed (S), mi/h	60.3
Flow Entering Ramp-Infl. Area (vR12), pc/h	2302	Average Density (D), pc/mi/ln	19.7
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	15.8

HCS7 Freeway Merge Report

Project Information			
Analyst	Graham Johnson, PE	Date	3/19/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD Minnesota Alt 2C/2D - SB I-229 - Exit 3 SB Entrance		

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	1200
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	2845	530
Peak Hour Factor (PHF)	0.90	0.90
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3256	606
Capacity (c), pc/h	7050	2100
Volume-to-Capacity Ratio (v/c)	0.55	0.29

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.265
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/mi/ln	1267
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influenece Area Speed (SR), mi/h	58.9
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.611	Outer Lanes Freeway Speed (SO), mi/h	62.2
Flow in Lanes 1 and 2 (v12), pc/h	1989	Ramp Junction Speed (S), mi/h	59.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	2595	Average Density (D), pc/mi/ln	21.5
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	18.0

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - between Minnesota and Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3050	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1187
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.51
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.2
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - between Minnesota and Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	3375	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1287
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.56
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	20.8
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - Minnesota to Western		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	3220	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	0
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2032	258	122	638
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	5.00	5.00	5.00	5.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.952	0.952	0.952	0.952
Flow Rate (v_i), pc/h	2372	301	142	745
Weaving Flow Rate (v_w), pc/h	1046	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2514	Density-Based Capacity (c_{IWL}), pc/h/ln		2174
Total Flow Rate (v), pc/h	3560	Demand Flow-Based Capacity (c_{IW}), pc/h		8163
Volume Ratio (VR)	0.294	Weaving Segment Capacity (c_W), veh/h		6209
Minimum Lane Change Rate (LC_{MIN}), lc/h	301	Adjusted Weaving Area Capacity, pc/h		6522
Maximum Weaving Length (L_{MAX}), ft	5520	Volume-to-Capacity Ratio (v/c)		0.55

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	810	Average Weaving Speed (S_W),mi/h	57.6
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1685	Average Non-Weaving Speed (S_{NW}), mi/h	57.1
Weaving Lane Change Rate (LC_W), lc/h	631	Average Speed (S), mi/h	57.2
Weaving Lane Change Rate (LC_{All}), lc/h	2316	Density (D), pc/mi/ln	20.7
Weaving Intensity Factor (W)	0.174	Level of Service (LOS)	C

HCS7 Freeway Weaving Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - Minnesota to Western		

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	3220	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	0
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	1.00	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	2168	412	248	547
Peak Hour Factor (PHF)	0.90	0.90	0.90	0.90
Total Trucks, %	3.00	3.00	3.00	3.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.971	0.971	0.971	0.971
Flow Rate (v_i), pc/h	2481	471	284	626
Weaving Flow Rate (v_w), pc/h	1097	Freeway Max Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	2765	Density-Based Capacity (c_{IWL}), pc/h/ln		2182
Total Flow Rate (v), pc/h	3862	Demand Flow-Based Capacity (c_{IW}), pc/h		8451
Volume Ratio (VR)	0.284	Weaving Segment Capacity (c_W), veh/h		6356
Minimum Lane Change Rate (LC_{MIN}), lc/h	471	Adjusted Weaving Area Capacity, pc/h		6546
Maximum Weaving Length (L_{MAX}), ft	5413	Volume-to-Capacity Ratio (v/c)		0.59

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	890	Average Weaving Speed (S_W),mi/h	57.1
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1737	Average Non-Weaving Speed (S_{NW}), mi/h	55.4
Weaving Lane Change Rate (LC_W), lc/h	801	Average Speed (S), mi/h	55.9
Weaving Lane Change Rate (LC_{All}), lc/h	2538	Density (D), pc/mi/ln	23.0
Weaving Intensity Factor (W)	0.187	Level of Service (LOS)	C

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - between Western Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2290	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1336
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.58
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	21.6
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - between Western Ramps		

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2580	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1476
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.64
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	23.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	AM
Project Description	BUILD - SB I-229 - west of Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	2520	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	980
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.42
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	15.9
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

HCS7 Basic Freeway Report

Project Information

Analyst	Graham Johnson, PE	Date	5/6/19
Agency	SEH Inc.	Analysis Year	2024
Jurisdiction	SDDOT Interstate	Time Period Analyzed	PM
Project Description	BUILD - SB I-229 - west of Western		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	1.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	61.8
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	1.000
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

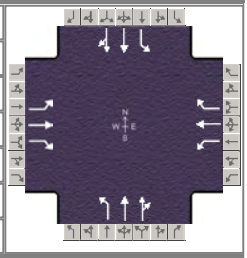
Demand Volume veh/h	3100	Heavy Vehicle Adjustment Factor (f_{HV})	0.971
Peak Hour Factor	0.90	Flow Rate (V_p), pc/h/ln	1182
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2318
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2318
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.51
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.1
Total Ramp Density Adjustment	3.2	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	61.8		

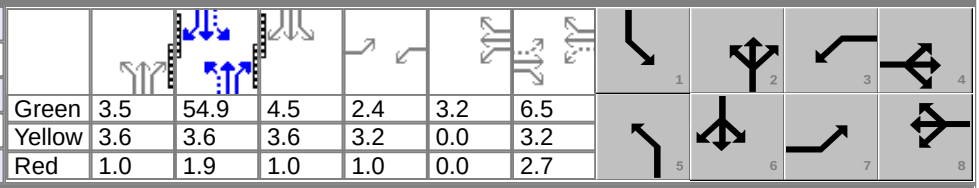
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 23, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2024	Analysis Period	1> 7:15
Intersection	37th Street	File Name	01-02 Minnesota Avenue 2024 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	30	70	50	100	70	100	70	1505	90	90	770	10

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	71	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	3.5	54.9	4.5	2.4	3.2	6.5
Yellow	3.6	3.6	3.6	3.2	0.0	3.2
Red	1.0	1.9	1.0	1.0	0.0	2.7

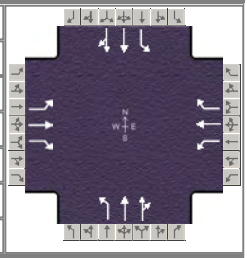
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	3.0	1.1	3.0	1.2	4.0	1.3	4.0
Phase Duration, s	6.6	12.4	9.9	15.7	8.1	68.6	9.1	69.6
Change Period, ($Y+R_c$), s	4.2	5.9	4.2	5.9	4.6	5.5	5.5	5.5
Max Allow Headway (*MAH*), s	4.3	4.3	4.3	4.3	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	3.8	6.2	7.7	8.9	3.9		2.0	
Green Extension Time (g_e), s	0.0	0.4	0.0	0.4	0.0	0.0	0.8	0.0
Phase Call Probability	0.60	1.00	0.95	1.00	0.88		0.91	
Max Out Probability	1.00	1.00	1.00	1.00	1.00		1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	33	78	56	111	78	111	78	889	883	87	377	375
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1543	1734	1821	1568	1734	1821	1785	1734	1821	1813
Queue Service Time (g_s), s	1.8	4.2	3.5	5.7	4.0	6.9	1.9	35.2	36.2	0.0	9.9	10.0
Cycle Queue Clearance Time (g_c), s	1.8	4.2	3.5	5.7	4.0	6.9	1.9	35.2	36.2	0.0	9.9	10.0
Green Ratio (*g/C*)	0.09	0.07	0.07	0.13	0.10	0.10	0.60	0.63	0.63	0.57	0.64	0.64
Capacity (*c*), veh/h	163	119	101	201	178	153	453	1149	1126	202	1167	1161
Volume-to-Capacity Ratio (*X*)	0.204	0.654	0.551	0.552	0.437	0.725	0.172	0.774	0.785	0.429	0.323	0.323
Back of Queue (*Q*), ft/ln (95 th percentile)	36.3	95.5	67.2	124.4	87.1	131.6	31	525.3	522.5	85.8	178.5	176.6
Back of Queue (*Q*), veh/ln (95 th percentile)	1.4	3.8	2.6	4.9	3.4	5.3	1.2	20.7	20.9	3.4	7.0	7.1
Queue Storage Ratio (*RQ*) (95 th percentile)	0.24	0.00	0.34	0.83	0.00	0.66	0.21	0.00	0.00	0.57	0.00	0.00
Uniform Delay (d_1), s/veh	42.3	45.6	45.3	40.6	42.5	3.1	9.0	13.3	13.5	31.1	8.8	8.9
Incremental Delay (d_2), s/veh	0.6	6.0	4.6	3.2	1.7	9.6	0.2	5.1	5.5	1.4	0.7	0.7
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	42.9	51.6	49.9	43.8	44.2	12.7	9.2	18.4	19.0	32.5	9.5	9.6
Level of Service (LOS)	D	D	D	D	D	B	A	B	B	C	A	A
Approach Delay, s/veh / LOS	49.3	D		32.4	C		18.3	B		11.9	B	
Intersection Delay, s/veh / LOS	19.6						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.31	B	2.31	B	2.14	B	2.06	B
Bicycle LOS Score / LOS	0.76	A	0.98	A	2.01	B	1.29	A

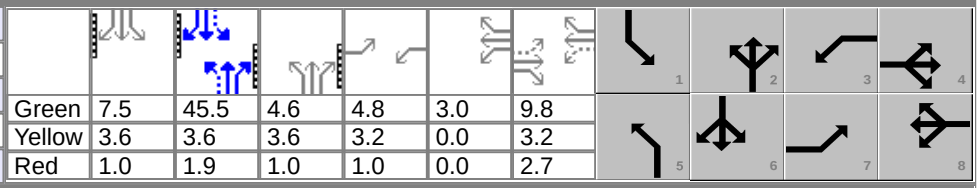
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 23, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2024	Analysis Period	1> 16:30
Intersection	37th Street	File Name	01-02 Minnesota Avenue 2024 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	70	130	110	155	125	105	80	985	60	155	1510	50

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	71	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	7.5	45.5	4.6	4.8	3.0	9.8
Yellow	3.6	3.6	3.6	3.2	0.0	3.2
Red	1.0	1.9	1.0	1.0	0.0	2.7

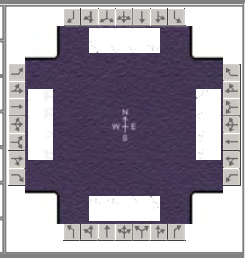
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	3.0	1.1	3.0	1.3	4.0	1.2	4.0
Phase Duration, s	9.0	15.7	12.0	18.7	9.2	60.2	12.1	63.1
Change Period, ($Y+R_c$), s	4.2	5.9	4.2	5.9	5.5	5.5	4.6	5.5
Max Allow Headway (*MAH*), s	4.3	4.3	4.3	4.3	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	6.0	9.8	9.8	9.2	2.0		7.2	
Green Extension Time (g_e), s	0.0	0.1	0.0	0.6	1.2	0.0	0.3	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	0.92		0.99	
Max Out Probability	1.00	1.00	1.00	1.00	1.00		0.20	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	78	144	67	172	139	83	89	586	575	178	893	890
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1543	1734	1821	1543	1734	1821	1784	1734	1821	1804
Queue Service Time (g_s), s	4.0	7.8	4.1	7.8	7.2	5.0	0.0	21.5	21.5	5.2	25.1	25.2
Cycle Queue Clearance Time (g_c), s	4.0	7.8	4.1	7.8	7.2	5.0	0.0	21.5	21.5	5.2	25.1	25.2
Green Ratio (*g/C*)	0.15	0.10	0.10	0.18	0.13	0.13	0.47	0.55	0.55	0.55	0.58	0.58
Capacity (*c*), veh/h	201	179	152	233	234	198	217	996	976	318	1049	1039
Volume-to-Capacity Ratio (*X*)	0.387	0.806	0.439	0.739	0.594	0.421	0.410	0.589	0.589	0.561	0.851	0.856
Back of Queue (*Q*), ft/ln (95 th percentile)	81.3	206.6	72.5	59.5	159.5	90.2	97.5	357.1	346.3	86.3	163.3	157.7
Back of Queue (*Q*), veh/ln (95 th percentile)	3.2	8.1	2.9	2.3	6.3	3.6	3.8	14.1	13.9	3.4	6.4	6.3
Queue Storage Ratio (*RQ*) (95 th percentile)	0.54	0.00	0.36	0.40	0.00	0.45	0.65	0.00	0.00	0.43	0.00	0.00
Uniform Delay (d_1), s/veh	38.4	44.1	3.3	38.4	41.1	40.2	32.5	15.1	15.1	15.1	4.6	4.4
Incremental Delay (d_2), s/veh	1.2	22.1	2.0	11.8	3.8	1.4	1.2	2.6	2.6	0.7	4.1	4.3
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	39.6	66.3	5.3	50.2	44.9	41.6	33.8	17.7	17.8	15.8	8.7	8.7
Level of Service (LOS)	D	E	A	D	D	D	C	B	B	B	A	A
Approach Delay, s/veh / LOS	45.0	D		46.5	D		18.9	B		9.3	A	
Intersection Delay, s/veh / LOS	18.8						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.31	B	2.32	B	2.12	B	2.21	B
Bicycle LOS Score / LOS	0.96	A	1.14	A	1.52	B	2.05	B

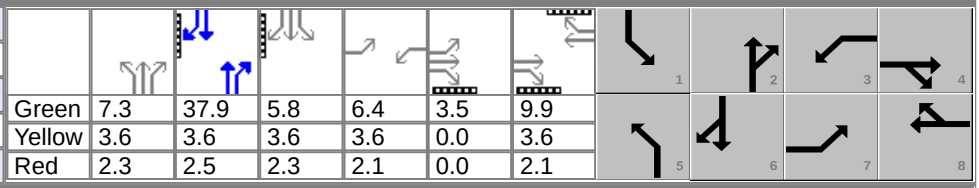
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 23, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2024	Analysis Period	1> 7:15
Intersection	41st Street	File Name	01-02 Minnesota Avenue 2024 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	225	145	90	130	145	50	125	1100	65	30	535	150

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	88	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	7.3	37.9	5.8	6.4	3.5	9.9						
Yellow	3.6	3.6	3.6	3.6	0.0	3.6						
Red	2.3	2.5	2.3	2.1	0.0	2.1						

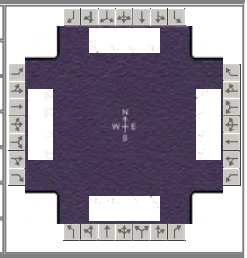
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	4.0	2.0	4.0	2.0	4.0
Phase Duration, s	15.5	19.1	12.1	15.6	13.2	57.2	11.7	55.7
Change Period, ($Y+R_c$), s	5.7	5.7	5.7	5.7	5.9	6.1	6.1	6.1
Max Allow Headway (*MAH*), s	3.1	4.3	3.2	4.3	3.2	0.0	5.2	0.0
Queue Clearance Time (g_s), s	9.2	10.4	6.1	8.0	6.9		3.8	
Green Extension Time (g_e), s	0.6	1.9	0.3	1.9	0.4	0.0	5.4	0.0
Phase Call Probability	1.00	1.00	0.98	1.00	0.99		0.60	
Max Out Probability	0.00	0.00	0.00	0.00	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	250	161	100	144	110	106	176	825	816	33	489	228
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1821	1568	1711	1850	1691	1711	1821	1785	1734	1821	1661
Queue Service Time (g_s), s	7.2	8.4	5.9	4.1	5.7	6.0	4.9	32.8	33.5	1.8	7.8	8.0
Cycle Queue Clearance Time (g_c), s	7.2	8.4	5.9	4.1	5.7	6.0	4.9	32.8	33.5	1.8	7.8	8.0
Green Ratio (*g/C*)	0.10	0.13	0.13	0.06	0.10	0.10	0.07	0.51	0.51	0.06	0.50	0.50
Capacity (*c*), veh/h	330	243	209	217	183	167	250	931	912	97	1806	824
Volume-to-Capacity Ratio (*X*)	0.757	0.662	0.478	0.664	0.602	0.635	0.704	0.886	0.894	0.344	0.271	0.277
Back of Queue (*Q*), ft/ln (95 th percentile)	138.2	182.8	106.9	80.2	119.5	116.1	91.3	266.8	263.1	39.9	147.9	140.8
Back of Queue (*Q*), veh/ln (95 th percentile)	5.4	7.2	4.3	3.2	4.8	4.6	3.7	10.5	10.4	1.6	5.8	5.6
Queue Storage Ratio (*RQ*) (95 th percentile)	0.46	0.00	0.00	0.32	0.00	0.00	0.61	0.00	0.00	0.27	0.00	0.00
Uniform Delay (d_1), s/veh	43.9	41.2	40.1	45.8	43.2	43.3	42.8	9.4	9.3	45.4	14.7	14.7
Incremental Delay (d_2), s/veh	1.3	4.3	2.4	1.3	1.2	1.5	0.8	7.3	8.0	3.0	0.4	0.8
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	45.3	45.5	42.5	47.1	44.3	44.8	43.6	16.8	17.2	48.4	15.0	15.6
Level of Service (LOS)	D	D	D	D	D	D	D	B	B	D	B	B
Approach Delay, s/veh / LOS	44.8	D		45.6	D		19.6	B		16.7	B	
Intersection Delay, s/veh / LOS	25.4						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.60	C	2.52	C	2.31	B	2.41	B
Bicycle LOS Score / LOS	1.33	A	0.79	A	1.67	B	0.90	A

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 23, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2024	Analysis Period	1> 16:30
Intersection	41st Street	File Name	01-02 Minnesota Avenue 2024 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	410	270	275	230	315	50	235	745	90	35	1270	365

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	6	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	10.2	24.2	6.9	9.7	0.3	13.8						
Yellow	3.6	3.6	3.6	3.6	3.6	3.6						
Red	2.3	2.5	2.3	2.1	2.1	2.1						

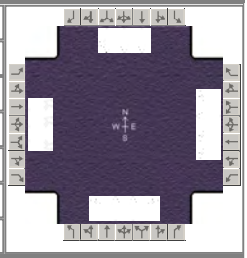
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	4.0	2.0	4.0	2.0	4.0
Phase Duration, s	21.4	25.5	15.4	19.5	16.1	46.3	12.8	43.0
Change Period, ($Y+R_c$), s	5.7	5.7	5.7	5.7	5.9	6.1	6.1	6.1
Max Allow Headway (*MAH*), s	3.1	4.3	3.2	4.3	3.2	0.0	5.2	0.0
Queue Clearance Time (g_s), s	15.2	17.8	9.3	12.4	10.1		4.1	
Green Extension Time (g_e), s	0.5	1.6	0.4	1.4	0.1	0.0	5.9	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		0.66	
Max Out Probability	0.41	0.98	0.01	1.00	1.00		0.90	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	456	300	194	256	197	192	283	513	493	39	1171	534
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1821	1568	1711	1850	1785	1711	1821	1752	1734	1821	1657
Queue Service Time (g_s), s	13.2	15.8	11.3	7.3	10.3	10.4	8.1	24.1	24.2	2.1	29.9	30.0
Cycle Queue Clearance Time (g_c), s	13.2	15.8	11.3	7.3	10.3	10.4	8.1	24.1	24.2	2.1	29.9	30.0
Green Ratio (*g/C*)	0.16	0.20	0.20	0.10	0.14	0.14	0.10	0.40	0.40	0.07	0.37	0.37
Capacity (*c*), veh/h	529	361	311	331	255	246	348	733	705	115	1344	612
Volume-to-Capacity Ratio (*X*)	0.861	0.830	0.625	0.772	0.770	0.780	0.813	0.700	0.700	0.337	0.871	0.873
Back of Queue (*Q*), ft/ln (95 th percentile)	252.4	328.4	201.8	141	224.1	222.4	164	414.5	403	45.5	514.9	510.4
Back of Queue (*Q*), veh/ln (95 th percentile)	9.9	12.9	8.1	5.6	9.0	8.9	6.6	16.3	15.9	1.8	20.3	20.4
Queue Storage Ratio (*RQ*) (95 th percentile)	0.84	0.00	0.00	0.56	0.00	0.00	0.41	0.00	0.00	0.30	0.00	0.00
Uniform Delay (d_1), s/veh	41.1	38.5	36.7	44.1	41.6	41.6	43.1	27.0	27.1	44.6	29.3	29.4
Incremental Delay (d_2), s/veh	8.1	13.4	3.7	1.5	8.2	9.2	8.1	4.4	4.6	2.4	8.0	15.9
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	49.1	51.8	40.4	45.5	49.7	50.9	51.2	31.5	31.7	47.0	37.3	45.3
Level of Service (LOS)	D	D	D	D	D	D	D	C	C	D	D	D
Approach Delay, s/veh / LOS	48.2	D		48.4	D		35.9	D		40.0	D	
Intersection Delay, s/veh / LOS	41.7						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.59	C	2.60	C	2.33	B	2.57	C
Bicycle LOS Score / LOS	2.06	B	1.02	A	1.47	A	1.45	A

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	May 7, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2024	Analysis Period	1> 7:15
Intersection	49th St/I-229 SB	File Name	03-05-07 Alt 2CD Minnesota Avenue 2024 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	30		115	135	120	125	50	1660	100		780	50

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	71	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	4.1	59.2	2.4	4.0	10.0	0.0
Yellow	3.6	3.6	3.6	0.0	3.6	0.0
Red	1.0	1.9	1.0	0.0	1.9	0.0

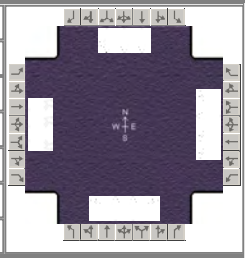
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2		6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0		8.3
Phase Duration, s	7.0	15.5	11.0	19.6	8.7	73.4		64.7
Change Period, ($Y+R_c$), s	4.6	5.5	4.6	5.5	4.6	5.5		5.5
Max Allow Headway (*MAH*), s	4.2	4.3	4.2	4.3	4.2	0.0		0.0
Queue Clearance Time (g_s), s	3.0	9.8	6.4	10.5	5.2			
Green Extension Time (g_e), s	0.0	0.3	0.2	0.7	0.0	0.0		0.0
Phase Call Probability	0.60	1.00	0.98	1.00	0.79			
Max Out Probability	0.70	1.00	1.00	0.75	1.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14	3	8	18	5	2	12		6	16
Adjusted Flow Rate (*v*), veh/h	33		128	150	133	139	56	1844	111		229	392
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684		1543	1684	1821	1543	1734	1734			526	1790
Queue Service Time (g_s), s	1.0		7.8	4.4	6.8	8.5	3.2	36.5			12.9	11.3
Cycle Queue Clearance Time (g_c), s	1.0		7.8	4.4	6.8	8.5	3.2	36.5			12.9	11.3
Green Ratio (*g/C*)	0.02		0.14	0.06	0.14	0.14	0.04	0.68			0.59	0.59
Capacity (*c*), veh/h	81		218	217	256	217	71	2355			623	1061
Volume-to-Capacity Ratio (*X*)	0.410		0.586	0.692	0.520	0.640	0.785	0.783			0.368	0.370
Back of Queue (*Q*), ft/ln (95 th percentile)	20.3		142	88.3	143.3	159.9	77.7	472.3			61.9	200.3
Back of Queue (*Q*), veh/ln (95 th percentile)	0.8		5.6	3.5	5.6	6.3	3.1	18.6			2.4	7.9
Queue Storage Ratio (*RQ*) (95 th percentile)	0.10		0.28	0.35	0.00	0.80	0.26	0.00			0.00	0.00
Uniform Delay (d_1), s/veh	48.1		40.2	45.8	39.8	40.6	47.5	11.0			10.5	10.5
Incremental Delay (d_2), s/veh	3.3		3.1	3.9	1.6	4.9	17.1	2.7			1.6	1.0
Initial Queue Delay (d_3), s/veh	0.0		0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	51.4		43.3	49.7	41.5	45.5	64.6	13.7	30.0		12.1	11.5
Level of Service (LOS)	D		D	D	D	D	E	B	C		B	B
Approach Delay, s/veh / LOS	44.9		D	45.7		D	16.0		B	11.7		B
Intersection Delay, s/veh / LOS	20.5						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.60	C	2.30	B	2.22	B	2.07	B
Bicycle LOS Score / LOS		F	1.18	A	2.15	B	0.99	A

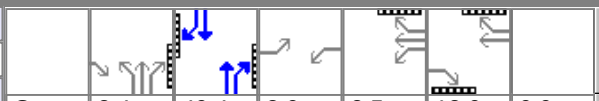
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	May 7, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2024	Analysis Period	1> 16:30
Intersection	49th St/I-229 SB	File Name	03-05-07 Alt 2CD Minnesota Avenue 2024 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				

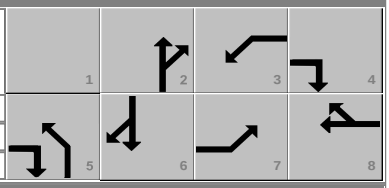


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	45		220	235	120	120	30	1035	130		1950	35

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	71	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	2.4	49.4	3.0	2.5	18.0	0.0
Yellow	3.6	3.6	3.6	3.6	3.6	0.0
Red	1.0	1.9	1.0	1.0	1.9	0.0



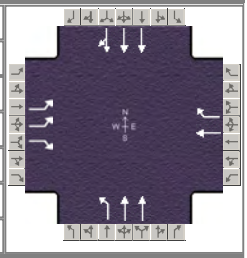
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2		6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0		8.3
Phase Duration, s	7.6	23.5	14.7	30.5	7.0	61.9		54.9
Change Period, ($Y+R_c$), s	4.6	5.5	4.6	5.5	4.6	5.5		5.5
Max Allow Headway (*MAH*), s	4.2	4.3	4.2	4.3	4.2	0.0		0.0
Queue Clearance Time (g_s), s	3.5	17.0	9.6	9.1	3.9			
Green Extension Time (g_e), s	0.1	1.0	0.5	2.0	0.1	0.0		0.0
Phase Call Probability	0.75	1.00	1.00	1.00	0.60			
Max Out Probability	0.00	0.84	0.34	0.00	0.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14	3	8	18	5	2	12		6	16
Adjusted Flow Rate (*v*), veh/h	50		244	261	133	133	33	1150	144		680	468
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684		1543	1684	1821	1543	1734	1734			1315	1807
Queue Service Time (g_s), s	1.5		15.0	7.6	5.9	7.1	1.9	21.6			58.7	18.5
Cycle Queue Clearance Time (g_c), s	1.5		15.0	7.6	5.9	7.1	1.9	21.6			58.7	18.5
Green Ratio (*g/C*)	0.03		0.20	0.10	0.25	0.25	0.02	0.56			0.49	0.49
Capacity (*c*), veh/h	101		314	339	456	386	42	1955			1299	892
Volume-to-Capacity Ratio (*X*)	0.494		0.778	0.770	0.293	0.345	0.795	0.588			0.524	0.524
Back of Queue (*Q*), ft/ln (95 th percentile)	30.3		265.2	151.1	120.1	122.3	52.4	331.1			240.6	317.7
Back of Queue (*Q*), veh/ln (95 th percentile)	1.2		10.4	5.9	4.7	4.8	2.1	13.0			9.5	12.5
Queue Storage Ratio (*RQ*) (95 th percentile)	0.15		0.53	0.60	0.00	0.61	0.17	0.00			0.00	0.00
Uniform Delay (d_1), s/veh	47.8		37.7	43.8	30.3	30.8	48.5	14.2			18.8	18.9
Incremental Delay (d_2), s/veh	3.7		8.4	3.8	0.4	0.5	27.7	1.3			1.3	1.9
Initial Queue Delay (d_3), s/veh	0.0		0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	51.4		46.1	47.6	30.7	31.3	76.3	15.5	30.0		20.1	20.8
Level of Service (LOS)	D		D	D	C	C	E	B	C		C	C
Approach Delay, s/veh / LOS	47.0	D		39.2	D		18.6	B		20.4	C	
Intersection Delay, s/veh / LOS	25.1						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.59	C	2.29	B	2.25	B	2.09	B
Bicycle LOS Score / LOS		F	1.36	A	1.58	B	1.70	B

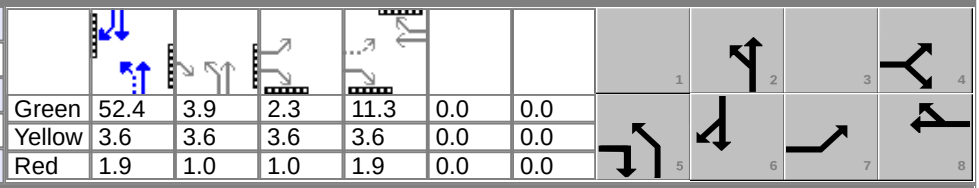
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	May 7, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2024	Analysis Period	1> 7:15
Intersection	49th St/I-229 SB	File Name	03-05-07 Alt 9D Minnesota Avenue 2024 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	30		115		120	125	50	1660			780	50

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	71	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	52.4	3.9	2.3	11.3	0.0	0.0
Yellow	3.6	3.6	3.6	3.6	0.0	0.0
Red	1.9	1.0	1.0	1.9	0.0	0.0

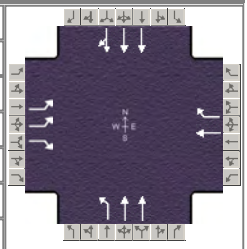
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4		8	5	2		6
Case Number	1.0	3.0		7.3	1.0	4.0		8.3
Phase Duration, s	6.9	23.6		16.8	8.5	66.4		57.9
Change Period, ($Y+R_c$), s	4.6	5.5		5.5	5.5	5.5		5.5
Max Allow Headway (*MAH*), s	4.2	4.3		4.3	4.2	0.0		0.0
Queue Clearance Time (g_s), s	2.7	8.2		9.8	2.0			
Green Extension Time (g_e), s	0.1	1.6		1.5	1.7	0.0		0.0
Phase Call Probability	0.57	1.00		1.00	0.75			
Max Out Probability	0.00	0.00		0.00	1.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14		8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h	33		128		133	139	56	1844			204	350
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684		1543		1821	1543	1734	1734			526	1790
Queue Service Time (g_s), s	0.7		6.2		6.2	7.8	0.0	33.1			17.6	7.0
Cycle Queue Clearance Time (g_c), s	0.7		6.2		6.2	7.8	0.0	33.1			17.6	7.0
Green Ratio (*g/C*)	0.17		0.23		0.13	0.13	0.59	0.68			0.58	0.58
Capacity (*c*), veh/h	386		363		228	193	448	2345			612	1041
Volume-to-Capacity Ratio (*X*)	0.086		0.352		0.584	0.718	0.124	0.787			0.334	0.336
Back of Queue (*Q*), ft/ln (95 th percentile)	13.9		105.9		131.8	144.6	33.8	422.9			34.5	114.2
Back of Queue (*Q*), veh/ln (95 th percentile)	0.5		4.2		5.2	5.7	1.3	16.6			1.4	4.5
Queue Storage Ratio (*RQ*) (95 th percentile)	0.07		0.21		0.00	0.72	0.11	0.00			0.00	0.00
Uniform Delay (d_1), s/veh	31.5		28.7		37.1	37.8	17.5	10.1			6.6	6.8
Incremental Delay (d_2), s/veh	0.1		0.6		2.4	4.9	0.1	2.8			1.4	0.8
Initial Queue Delay (d_3), s/veh	0.0		0.0		0.0	0.0	0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	31.6		29.3		39.5	42.8	17.6	12.8			8.0	7.6
Level of Service (LOS)	C		C		D	D	B	B			A	A
Approach Delay, s/veh / LOS	29.8		C	41.2		D	13.0		B	7.8		A
Intersection Delay, s/veh / LOS	15.6						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.44	B	2.30	B	1.63	B	2.14	B
Bicycle LOS Score / LOS		F	0.94	A	2.06	B	0.99	A

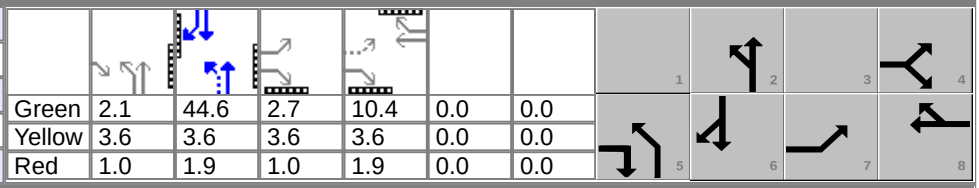
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	May 7, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2024	Analysis Period	1> 16:30
Intersection	49th St/I-229 SB	File Name	03-05-07 Alt 9D Minnesota Avenue 2024 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	45		220		120	120	30	1035			1950	35

Signal Information			
Cycle, s	80.0	Reference Phase	2
Offset, s	71	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	2.1	44.6	2.7	10.4	0.0	0.0
Yellow	3.6	3.6	3.6	3.6	0.0	0.0
Red	1.0	1.9	1.0	1.9	0.0	0.0

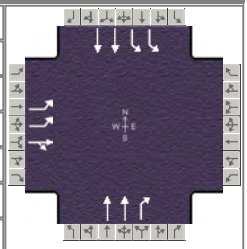
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4		8	5	2		6
Case Number	1.0	3.0		7.3	1.0	4.0		8.3
Phase Duration, s	7.3	23.2		15.9	6.7	56.8		50.1
Change Period, ($Y+R_c$), s	4.6	5.5		5.5	4.6	5.5		5.5
Max Allow Headway (*MAH*), s	4.2	4.3		4.3	4.2	0.0		0.0
Queue Clearance Time (g_s), s	3.0	13.3		8.6	2.6			
Green Extension Time (g_e), s	0.1	1.9		1.8	0.1	0.0		0.0
Phase Call Probability	0.67	1.00		1.00	0.52			
Max Out Probability	0.01	0.01		0.02	0.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14		8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h	50		244		133	133	33	1150			622	428
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684		1543		1821	1543	1734	1734			1315	1807
Queue Service Time (g_s), s	1.0		11.3		5.5	6.6	0.6	14.2			43.3	8.4
Cycle Queue Clearance Time (g_c), s	1.0		11.3		5.5	6.6	0.6	14.2			43.3	8.4
Green Ratio (*g/C*)	0.19		0.25		0.13	0.13	0.61	0.64			0.56	0.56
Capacity (*c*), veh/h	448		382		237	201	144	2223			1467	1008
Volume-to-Capacity Ratio (*X*)	0.112		0.640		0.562	0.663	0.231	0.517			0.424	0.424
Back of Queue (*Q*), ft/ln (95 th percentile)	17.8		192.2		114.3	119.1	16.8	208.3			89.8	129.4
Back of Queue (*Q*), veh/ln (95 th percentile)	0.7		7.6		4.5	4.7	0.7	8.2			3.5	5.1
Queue Storage Ratio (*RQ*) (95 th percentile)	0.09		0.38		0.00	0.60	0.06	0.00			0.00	0.00
Uniform Delay (d_1), s/veh	27.1		26.9		32.6	33.1	19.6	7.7			6.8	6.9
Incremental Delay (d_2), s/veh	0.1		1.8		2.1	3.7	0.8	0.9			0.7	1.1
Initial Queue Delay (d_3), s/veh	0.0		0.0		0.0	0.0	0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	27.2		28.7		34.7	36.8	20.5	8.6			7.5	7.9
Level of Service (LOS)	C		C		C	D	C	A			A	A
Approach Delay, s/veh / LOS	28.4	C		35.8	D		8.9	A		7.7	A	
Intersection Delay, s/veh / LOS	13.1						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.44	B	2.29	B	1.64	B	2.07	B
Bicycle LOS Score / LOS		F	0.93	A	1.46	A	1.70	B

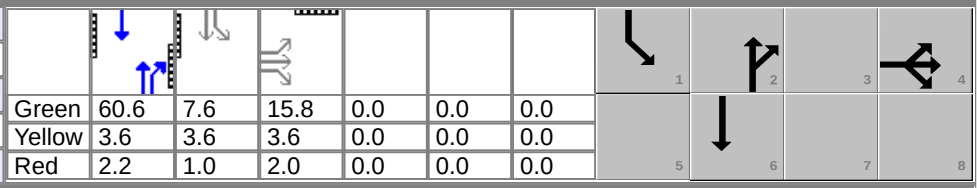
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	May 7, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2024	Analysis Period	1> 7:15
Intersection	I-229 NB Ramp	File Name	03-05-07 Alt 2CD Minnesota Avenue 2024 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	395	5	70					1415	230	105	645	

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	82	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	60.6	7.6	15.8	0.0	0.0	0.0			
Yellow	3.6	3.6	3.6	0.0	0.0	0.0			
Red	2.2	1.0	2.0	0.0	0.0	0.0			

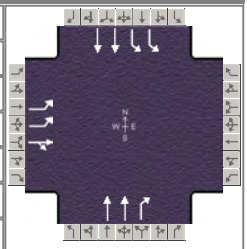
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4				2	1	6
Case Number		10.0				7.3	2.0	4.0
Phase Duration, s		21.4				66.4	12.2	78.6
Change Period, ($Y+R_c$), s		5.6				5.8	5.8	5.8
Max Allow Headway (*MAH*), s		3.2				0.0	3.1	0.0
Queue Clearance Time (g_s), s		14.6					5.2	
Green Extension Time (g_e), s		1.2				0.0	1.5	0.0
Phase Call Probability		1.00					0.96	
Max Out Probability		0.00					0.09	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14					2	12	1	6	
Adjusted Flow Rate (*v*), veh/h	439	61						1742	191	112	688	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1474						1820	1478	1684	1694	
Queue Service Time (g_s), s	12.6	3.6						22.4	1.6	3.2	5.1	
Cycle Queue Clearance Time (g_c), s	12.6	3.6						22.4	1.6	3.2	5.1	
Green Ratio (*g/C*)	0.16	0.16						0.61	0.61	0.06	0.73	
Capacity (*c*), veh/h	533	233						2206	896	215	2465	
Volume-to-Capacity Ratio (*X*)	0.823	0.262						0.790	0.213	0.521	0.279	
Back of Queue (*Q*), ft/ln (95 th percentile)	227.3	59.7						155.6	21.4	61.3	60.4	
Back of Queue (*Q*), veh/ln (95 th percentile)	8.9	2.4						6.1	0.8	2.4	2.4	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.65	0.00						0.00	0.11	0.20	0.00	
Uniform Delay (d_1), s/veh	40.7	37.0						4.8	2.1	45.5	3.2	
Incremental Delay (d_2), s/veh	1.2	0.2						1.7	0.3	0.7	0.3	
Initial Queue Delay (d_3), s/veh	0.0	0.0						0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	42.0	37.2						6.5	2.4	46.2	3.5	
Level of Service (LOS)	D	D						A	A	D	A	
Approach Delay, s/veh / LOS	41.4	D		0.0			6.1	A		9.4	A	
Intersection Delay, s/veh / LOS	12.4						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.43	B	2.47	B	1.84	B	1.88	B
Bicycle LOS Score / LOS	1.31	A		A	1.93	B	1.18	A

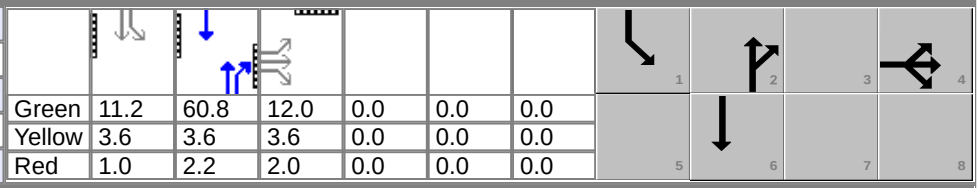
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	May 7, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2024	Analysis Period	1> 16:30
Intersection	I-229 NB Ramp	File Name	03-05-07 Alt 2CD Minnesota Avenue 2024 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	300	0	150					895	200	375	1500	

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	34	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	11.2	60.8	12.0	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.0	2.2	2.0	0.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4				2	1	6
Case Number		10.0				7.3	2.0	4.0
Phase Duration, s		17.6				66.6	15.8	82.4
Change Period, ($Y+R_c$), s		5.6				5.8	4.6	5.8
Max Allow Headway (*MAH*), s		3.2				0.0	3.1	0.0
Queue Clearance Time (g_s), s		11.7					10.8	
Green Extension Time (g_e), s		0.4				0.0	0.3	0.0
Phase Call Probability		1.00					1.00	
Max Out Probability		1.00					0.17	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14					2	12	1	6	
Adjusted Flow Rate (*v*), veh/h	333	133						1097	153	312	1249	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1467						1741	1471	1684	1759	
Queue Service Time (g_s), s	9.7	8.8						25.4	8.2	8.8	1.6	
Cycle Queue Clearance Time (g_c), s	9.7	8.8						25.4	8.2	8.8	1.6	
Green Ratio (*g/C*)	0.12	0.12						0.61	0.61	0.11	0.77	
Capacity (*c*), veh/h	405	177						2117	894	376	2693	
Volume-to-Capacity Ratio (*X*)	0.822	0.755						0.518	0.171	0.830	0.464	
Back of Queue (*Q*), ft/ln (95 th percentile)	198.8	163.8						429.1	131.2	154.1	17.8	
Back of Queue (*Q*), veh/ln (95 th percentile)	7.8	6.4						16.9	5.2	6.1	0.7	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.57	0.00						0.00	0.64	0.51	0.00	
Uniform Delay (d_1), s/veh	42.9	42.6						21.6	17.8	37.7	0.3	
Incremental Delay (d_2), s/veh	7.9	9.3						0.9	0.4	4.4	0.5	
Initial Queue Delay (d_3), s/veh	0.0	0.0						0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	50.9	51.9						22.5	18.2	42.0	0.8	
Level of Service (LOS)	D	D						C	B	D	A	
Approach Delay, s/veh / LOS	51.2	D		0.0			21.9	C		9.0	A	
Intersection Delay, s/veh / LOS	19.9						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.43	B	2.47	B	1.77	B	1.88	B
Bicycle LOS Score / LOS	1.26	A		A	1.42	A	2.21	B

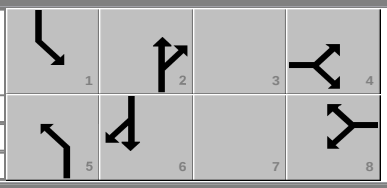
HCS7 Interchanges Results Summary

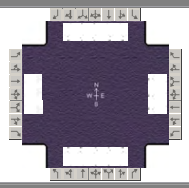
General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	SPUI
Analyst	Graham Johnson	Analysis Date	May 7, 2019	Segment Distance, ft	
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 SPUI	PHF	0.90	Arterial Direction	North-South
File Name	03-05-07 Alt 9D Minnesota Avenue 2024 AM.xus				
Project Description	BUILD - I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection Demand (v), veh/h	395		70	135		0	100	1315	230	105	510	280

Signal Information	
Cycle, s	90.0
Offset, s	77
Uncoordinated	No
Force Mode	Fixed

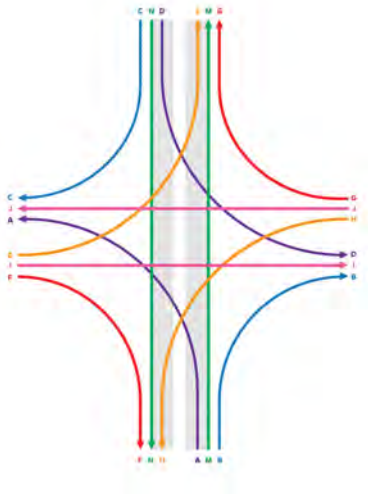
Green	5.7	41.4	6.8	14.5	0.0	0.0
Yellow	3.6	3.6	3.6	3.6	0.0	0.0
Red	2.0	2.2	1.0	2.0	0.0	0.0





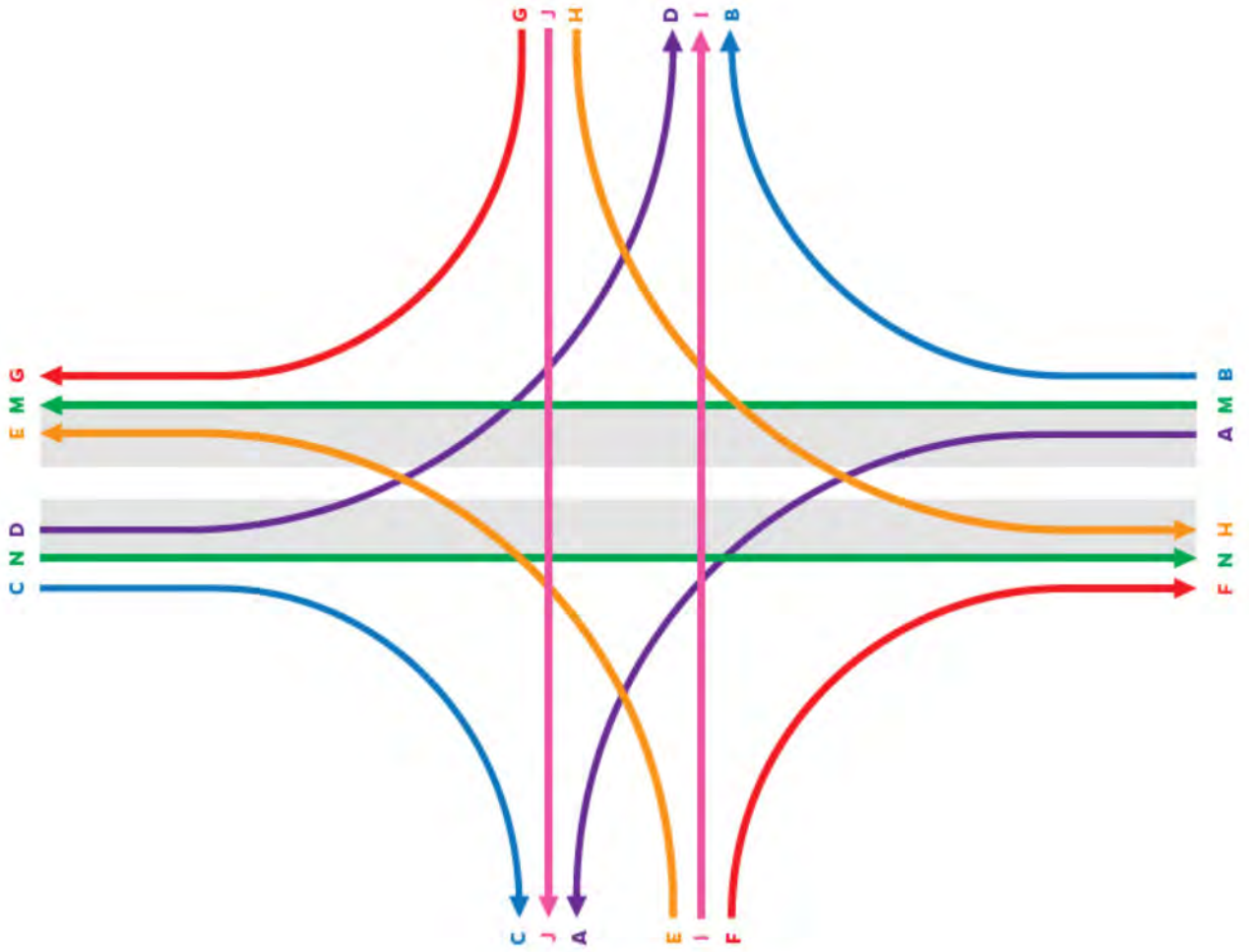
Interchange Results

O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	150	33.2	0.0	33.2	No	No	C
B	0	0.0	0.0	0.0	No	No	A
C	78	33.8	0.0	33.8	No	No	C
D	439	36.6	0.0	36.6	No	No	C
E	123	39.6	0.0	39.6	No	No	C
F	282	2.8	0.0	2.8	No	No	A
G	250	0.0	0.0	0.0	No	No	A
H	94	41.3	0.0	41.3	No	No	C
I	1612	4.8	0.0	4.8	No	No	A
J	456	7.9	0.0	7.9	No	No	A
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	36.6		33.8	33.2		0.0	39.6	4.8	2.8	41.3	7.9	0.0
Level of Service (LOS)	D		C	C			D	A	A	D	A	A
Approach Delay, s/veh / LOS	36.2	D		33.2	C		6.6	A		9.4	A	
Intersection Delay, s/veh / LOS	12.8						B					

Interchange Graphic



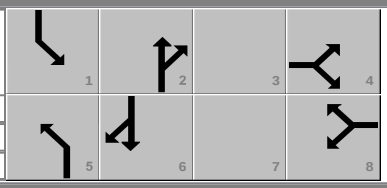
HCS7 Interchanges Results Summary

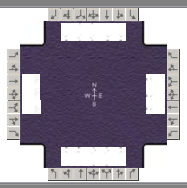
General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	SPUI
Analyst	Graham Johnson	Analysis Date	May 7, 2019	Segment Distance, ft	
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 SPUI	PHF	0.90	Arterial Direction	North-South
File Name	03-05-07 Alt 9D Minnesota Avenue 2024 PM.xus				
Project Description	BUILD - I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection Demand (v), veh/h	300		150	235		0	130	765	200	375	1265	530

Signal Information	
Cycle, s	80.0
Offset, s	70
Uncoordinated	No
Force Mode	Fixed

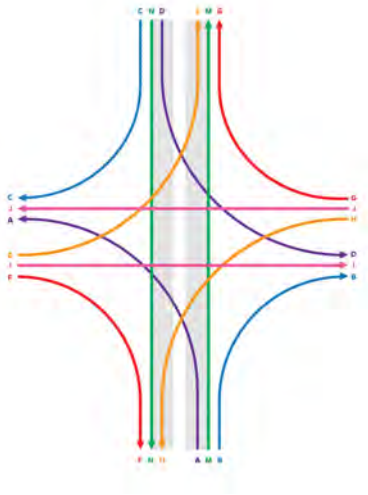
Green	5.8	27.1	13.1	12.4	0.0	0.0
Yellow	3.6	3.6	3.6	3.6	0.0	0.0
Red	2.0	2.2	1.0	2.0	0.0	0.0





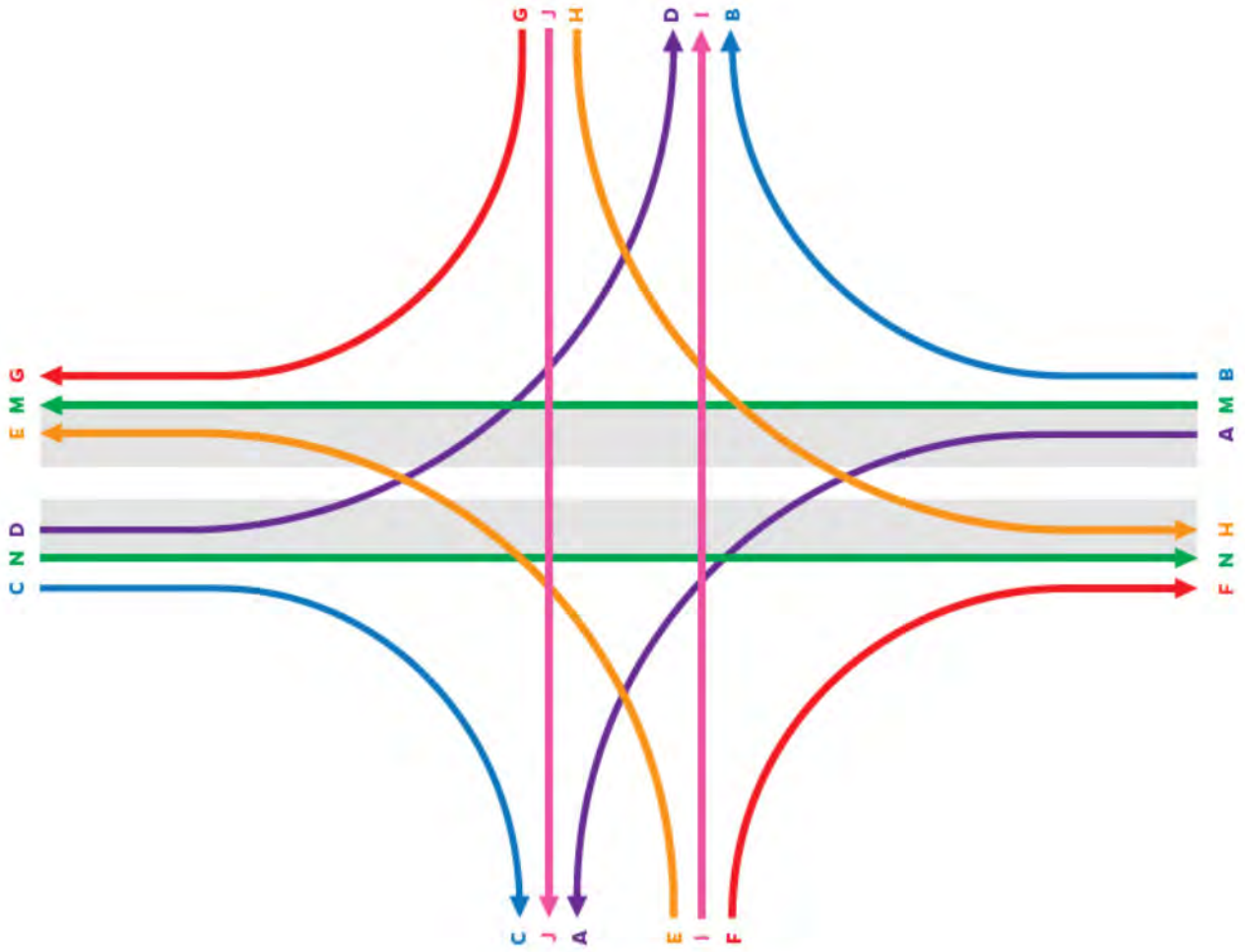
Interchange Results

O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	261	31.0	0.0	31.0	No	No	C
B	0	0.0	0.0	0.0	No	No	A
C	167	34.0	0.0	34.0	No	No	C
D	333	31.8	0.0	31.8	No	No	C
E	159	33.8	0.0	33.8	No	No	C
F	183	4.7	0.0	4.7	No	No	A
G	381	0.0	0.0	0.0	No	No	A
H	270	30.6	0.0	30.6	No	No	C
I	935	6.0	0.0	6.0	No	No	A
J	910	8.9	0.0	8.9	No	No	A
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	31.8		34.0	31.0		0.0	33.8	6.0	4.7	30.6	8.9	0.0
Level of Service (LOS)	C		C	C			C	A	A	C	A	A
Approach Delay, s/veh / LOS	32.5	C		31.0	C		9.3	A		10.5	B	
Intersection Delay, s/veh / LOS	14.6						B					

Interchange Graphic



HCS7 Two-Way Stop-Control Report

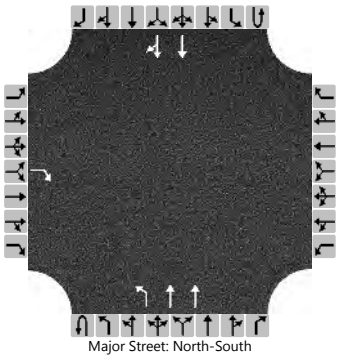
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at Yankton
Jurisdiction	Sioux Falls, SD
East/West Street	Yankton Trail
North/South Street	Minnesota Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration				R						L	T				T	TR
Volume (veh/h)				5					0	5	1645				710	5
Percent Heavy Vehicles (%)				2					2	2						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized		No														
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)				6.9						4.1						
Critical Headway (sec)				6.94						4.14						
Base Follow-Up Headway (sec)				3.3						2.2						
Follow-Up Headway (sec)				3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)				6						6						
Capacity, c (veh/h)				602						823						
v/c Ratio				0.01						0.01						
95% Queue Length, Q_{95} (veh)				0.0						0.0						
Control Delay (s/veh)				11.0						9.4						
Level of Service (LOS)				B						A						
Approach Delay (s/veh)		11.0								0.0						
Approach LOS		B														

HCS7 Two-Way Stop-Control Report

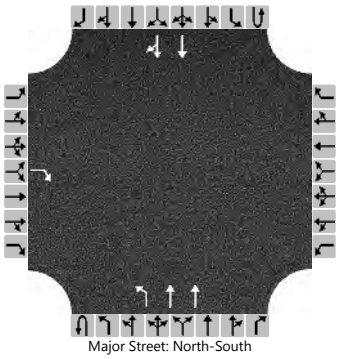
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at Yankton
Jurisdiction	Sioux Falls, SD
East/West Street	Yankton Trail
North/South Street	Minnesota Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration				R						L	T				T	TR
Volume (veh/h)				15					0	50	1090				1530	120
Percent Heavy Vehicles (%)				2					2	2						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized		No														
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)				6.9						4.1						
Critical Headway (sec)				6.94						4.14						
Base Follow-Up Headway (sec)				3.3						2.2						
Follow-Up Headway (sec)				3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)				17						56						
Capacity, c (veh/h)				274						329						
v/c Ratio				0.06						0.17						
95% Queue Length, Q_{95} (veh)				0.2						0.6						
Control Delay (s/veh)				19.0						18.2						
Level of Service (LOS)				C						C						
Approach Delay (s/veh)		19.0								0.8						
Approach LOS		C														

HCS7 Two-Way Stop-Control Report

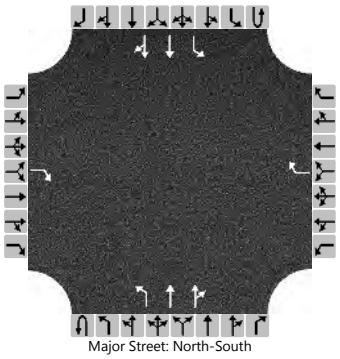
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at Lotta St
Jurisdiction	Sioux Falls, SD
East/West Street	Lotta St
North/South Street	Minnesota Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	1		0	0	1	0	1	2	0	0	1	2	0
Configuration				R				R		L	T	TR		L	T	TR
Volume (veh/h)				5				235	0	10	1435	10	0	40	665	10
Percent Heavy Vehicles (%)				2				2	2	2			2	2		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized	No				No											
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)				6.9				6.9		4.1				4.1		
Critical Headway (sec)				6.94				6.94		4.14				4.14		
Base Follow-Up Headway (sec)				3.3				3.3		2.2				2.2		
Follow-Up Headway (sec)				3.32				3.32		2.22				2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)				6				261		11				44		
Capacity, c (veh/h)				623				327		855				403		
v/c Ratio				0.01				0.80		0.01				0.11		
95% Queue Length, Q_{95} (veh)				0.0				6.6		0.0				0.4		
Control Delay (s/veh)				10.8				48.4		9.3				15.0		
Level of Service (LOS)				B				E		A				C		
Approach Delay (s/veh)	10.8				48.4				0.1				0.8			
Approach LOS	B				E											

HCS7 Two-Way Stop-Control Report

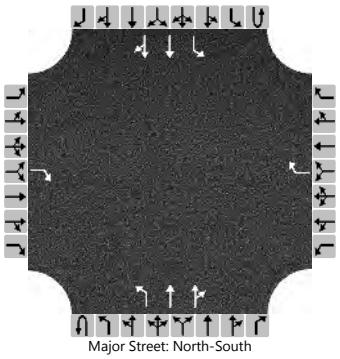
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Minnesota Ave at Lotta St
Jurisdiction	Sioux Falls, SD
East/West Street	Lotta St
North/South Street	Minnesota Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	1		0	0	1	0	1	2	0	0	1	2	0
Configuration				R				R		L	T	TR		L	T	TR
Volume (veh/h)				5				110	0	5	1045	30	0	170	1370	0
Percent Heavy Vehicles (%)				2				2	2	2			2	2		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized	No				No											
Median Type | Storage	Undivided															

Critical and Follow-up Headways

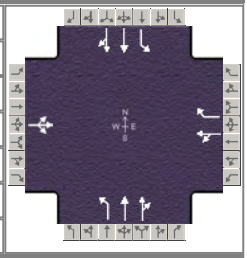
Base Critical Headway (sec)				6.9				6.9		4.1				4.1		
Critical Headway (sec)				6.94				6.94		4.14				4.14		
Base Follow-Up Headway (sec)				3.3				3.3		2.2				2.2		
Follow-Up Headway (sec)				3.32				3.32		2.22				2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)				6				122		6				189		
Capacity, c (veh/h)				348				446		434				580		
v/c Ratio				0.02				0.27		0.01				0.33		
95% Queue Length, Q_{95} (veh)				0.0				1.1		0.0				1.4		
Control Delay (s/veh)				15.5				16.1		13.4				14.2		
Level of Service (LOS)				C				C		B				B		
Approach Delay (s/veh)	15.5				16.1				0.1				1.6			
Approach LOS	C				C											

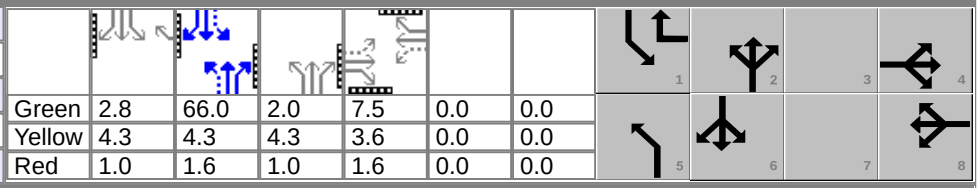
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	May 7, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2024	Analysis Period	1> 7:15
Intersection	Lotta St	File Name	03-05-07 Alt 2CD Minnesota Avenue 2024 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	30	25	5	50	25	185	10	1435	10	40	665	10

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	100	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	2.8	66.0	2.0	7.5	0.0	0.0
Yellow	4.3	4.3	4.3	3.6	0.0	0.0
Red	1.0	1.6	1.0	1.6	0.0	0.0

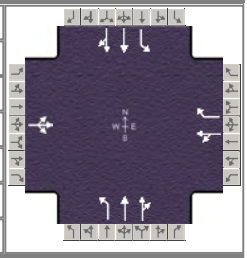
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		8.0		7.0	1.3	4.0	1.2	4.0
Phase Duration, s		12.7		12.7	7.3	79.2	8.1	80.0
Change Period, ($Y+R_c$), s		5.2		5.2	5.9	5.9	5.3	5.9
Max Allow Headway (*MAH*), s		3.5		3.5	3.1	0.0	4.1	0.0
Queue Clearance Time (g_s), s		5.9		7.4	2.0		2.8	
Green Extension Time (g_e), s		0.2		0.1	1.5	0.0	0.1	0.0
Phase Call Probability		1.00		1.00	0.35		0.71	
Max Out Probability		0.75		1.00	1.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h		67			83	72	16	1127	1127	44	376	374
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1605			1508	1543	1734	1821	1817	1734	1821	1811
Queue Service Time (g_s), s		0.0			1.5	4.4	0.0	32.4	32.6	0.8	6.7	6.7
Cycle Queue Clearance Time (g_c), s		3.9			5.4	4.4	0.0	32.4	32.6	0.8	6.7	6.7
Green Ratio (*g/C*)		0.08			0.08	0.10	0.65	0.73	0.73	0.71	0.74	0.74
Capacity (*c*), veh/h		174			173	160	552	1334	1331	177	1349	1342
Volume-to-Capacity Ratio (*X*)		0.382			0.481	0.452	0.028	0.845	0.847	0.251	0.279	0.279
Back of Queue (*Q*), ft/ln (95 th percentile)		75.4			93.6	77.6	4.6	195.5	195.7	19.1	92.4	92.4
Back of Queue (*Q*), veh/ln (95 th percentile)		3.0			3.7	3.1	0.2	7.7	7.7	0.8	3.6	3.6
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00			0.00	0.22	0.00	0.00	0.00	0.05	0.00	0.00
Uniform Delay (d_1), s/veh		44.5			45.2	42.2	6.1	4.3	4.3	12.6	4.2	4.2
Incremental Delay (d_2), s/veh		1.4			0.8	0.7	0.0	3.5	3.6	0.7	0.5	0.5
Initial Queue Delay (d_3), s/veh		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh		45.9			46.0	42.9	6.1	7.8	7.9	13.3	4.7	4.7
Level of Service (LOS)		D			D	D	A	A	A	B	A	A
Approach Delay, s/veh / LOS	45.9	D		44.6	D		7.9	A		5.2	A	
Intersection Delay, s/veh / LOS	9.7						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.31	B	2.31	B	2.02	B	1.73	B
Bicycle LOS Score / LOS	0.60	A	0.74	A	1.82	B	1.14	A

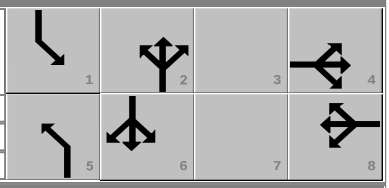
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	May 7, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2024	Analysis Period	1> 16:30
Intersection	Lotta St	File Name	03-05-07 Alt 2CD Minnesota Avenue 2024 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	15	25	5	30	25	80	5	1045	30	170	1370	5

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	13	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	0.7	4.7	70.4	7.8	0.0	0.0
Yellow	4.3	0.0	4.3	3.6	0.0	0.0
Red	1.0	0.0	1.6	1.6	0.0	0.0

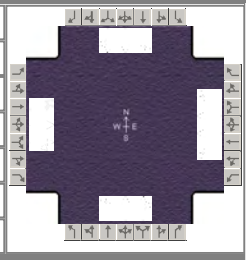
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		8.0		7.0	1.1	4.0	1.1	4.0
Phase Duration, s		13.0		13.0	6.0	76.3	10.7	81.0
Change Period, ($Y+R_c$), s		5.2		5.2	5.3	5.9	5.3	5.9
Max Allow Headway (*MAH*), s		3.5		3.5	3.1	0.0	4.1	0.0
Queue Clearance Time (g_s), s		4.7		7.6	2.1		4.8	
Green Extension Time (g_e), s		0.3		0.2	0.0	0.0	0.7	0.0
Phase Call Probability		1.00		1.00	0.18		0.99	
Max Out Probability		0.02		0.24	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h		50			61	89	7	759	753	189	764	764
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1677			1596	1543	1734	1821	1803	1734	1821	1819
Queue Service Time (g_s), s		0.0			0.9	5.6	0.1	19.2	19.6	2.8	18.0	18.0
Cycle Queue Clearance Time (g_c), s		2.7			3.5	5.6	0.1	19.2	19.6	2.8	18.0	18.0
Green Ratio (*g/C*)		0.08			0.08	0.08	0.71	0.70	0.70	0.77	0.75	0.75
Capacity (*c*), veh/h		179			180	120	272	1282	1269	341	1367	1366
Volume-to-Capacity Ratio (*X*)		0.279			0.339	0.738	0.026	0.592	0.594	0.553	0.559	0.559
Back of Queue (*Q*), ft/ln (95 th percentile)		55.3			66.8	102.8	1.5	231.2	236.1	53.8	232.7	233.3
Back of Queue (*Q*), veh/ln (95 th percentile)		2.2			2.6	4.0	0.1	9.1	9.3	2.1	9.2	9.2
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00			0.00	0.29	0.00	0.00	0.00	0.15	0.00	0.00
Uniform Delay (d_1), s/veh		43.7			44.1	45.1	5.4	6.3	6.5	7.8	5.3	5.4
Incremental Delay (d_2), s/veh		0.8			0.4	3.3	0.0	1.6	1.6	1.4	1.7	1.7
Initial Queue Delay (d_3), s/veh		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh		44.6			44.5	48.4	5.4	7.9	8.1	9.2	7.0	7.0
Level of Service (LOS)		D			D	D	A	A	A	A	A	A
Approach Delay, s/veh / LOS	44.6	D		46.8	D		8.0	A		7.2	A	
Intersection Delay, s/veh / LOS	9.8						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.31	B	2.31	B	1.86	B	1.62	B
Bicycle LOS Score / LOS	0.57	A	0.74	A	1.48	A	1.90	B

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Jan 3, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2024	Analysis Period	1> 7:15
Intersection	57th Street	File Name	08 Minnesota at 57th 2024 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	125	255	95	65	635	240	125	745	30	95	450	65

Signal Information			
Cycle, s	84.2	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	5.1	1.5	24.8	3.7	2.8	24.5
Yellow	4.0	0.0	4.3	4.0	0.0	3.9
Red	1.0	0.0	1.6	1.0	0.0	1.9

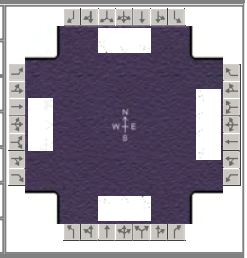
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	11.5	33.1	8.7	30.3	11.7	32.3	10.1	30.7
Change Period, ($Y+R_c$), s	5.0	5.8	5.0	5.8	5.0	5.9	5.0	5.9
Max Allow Headway (*MAH*), s	3.7	5.7	3.7	5.7	3.7	5.6	3.7	5.6
Queue Clearance Time (g_s), s	6.6	8.9	4.4	17.3	6.6	19.9	5.5	13.1
Green Extension Time (g_e), s	0.1	9.9	0.1	7.3	0.3	6.5	0.1	9.3
Phase Call Probability	0.96	1.00	0.82	1.00	0.96	1.00	0.92	1.00
Max Out Probability	1.00	0.35	0.10	0.62	0.00	0.79	0.42	0.55

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	139	191	181	72	706	194	139	430	425	106	285	276
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1673	1734	1734	1543	1734	1821	1800	1734	1821	1751
Queue Service Time (g_s), s	4.6	6.7	6.9	2.4	15.3	8.6	4.6	17.9	17.9	3.5	11.0	11.1
Cycle Queue Clearance Time (g_c), s	4.6	6.7	6.9	2.4	15.3	8.6	4.6	17.9	17.9	3.5	11.0	11.1
Green Ratio (*g/C*)	0.37	0.32	0.32	0.33	0.29	0.29	0.37	0.31	0.31	0.36	0.30	0.30
Capacity (*c*), veh/h	301	591	543	382	1010	449	361	571	564	241	538	517
Volume-to-Capacity Ratio (*X*)	0.462	0.323	0.334	0.189	0.699	0.433	0.384	0.754	0.754	0.438	0.530	0.534
Back of Queue (*Q*), ft/ln (95 th percentile)	85	130	122.1	44.3	265.2	145.6	83.1	329.7	321.8	65.2	213.2	205.2
Back of Queue (*Q*), veh/ln (95 th percentile)	3.3	5.1	4.9	1.7	10.4	5.7	3.3	13.0	12.9	2.6	8.4	8.2
Queue Storage Ratio (*RQ*) (95 th percentile)	0.68	0.00	0.00	0.18	0.00	0.97	0.55	0.00	0.00	0.16	0.00	0.00
Uniform Delay (d_1), s/veh	20.0	21.5	21.5	19.7	26.6	24.2	18.8	26.0	26.0	21.0	24.8	24.8
Incremental Delay (d_2), s/veh	0.8	0.5	0.6	0.2	1.9	1.1	0.5	5.3	5.4	0.9	1.4	1.5
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	20.8	22.0	22.2	19.9	28.4	25.3	19.3	31.3	31.4	21.9	26.2	26.3
Level of Service (LOS)	C	C	C	B	C	C	B	C	C	C	C	C
Approach Delay, s/veh / LOS	21.7	C		27.2	C		29.7	C		25.6	C	
Intersection Delay, s/veh / LOS	26.7						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.28	B	2.29	B	2.52	C	2.30	B
Bicycle LOS Score / LOS	0.91	A	1.29	A	1.31	A	1.04	A

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Minnesota Avenue	Analysis Year	2024	Analysis Period	1> 16:30
Intersection	57th Street	File Name	08 Minnesota at 57th 2024 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	150	820	130	65	495	160	130	575	120	355	920	70

Signal Information			
Cycle, s	111.4	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	4.0	11.9	28.2	4.0	1.0	35.6
Yellow	4.0	4.0	4.3	4.0	0.0	3.9
Red	1.0	1.0	1.6	1.0	0.0	1.9

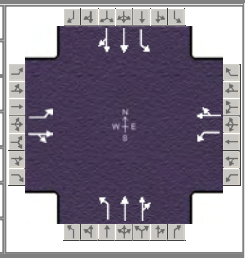
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	10.0	42.4	9.0	41.4	9.0	34.1	25.9	51.0
Change Period, ($Y+R_c$), s	5.0	5.8	5.0	5.8	5.0	5.9	5.0	5.9
Max Allow Headway (*MAH*), s	3.7	5.6	3.7	5.6	3.7	5.6	3.7	5.6
Queue Clearance Time (g_s), s	7.0	32.5	5.1	16.3	6.0	22.9	19.8	31.0
Green Extension Time (g_e), s	0.0	4.1	0.0	0.0	0.0	5.3	1.1	0.0
Phase Call Probability	0.99	1.00	0.89	1.00	0.99	1.00	1.00	1.00
Max Out Probability	1.00	0.91	1.00	1.00	1.00	0.64	0.00	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	167	528	506	72	550	111	144	365	352	394	554	541
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1745	1734	1734	1543	1734	1821	1751	1734	1821	1778
Queue Service Time (g_s), s	5.0	30.5	30.5	3.1	14.3	5.9	4.0	20.9	20.9	17.8	29.0	29.0
Cycle Queue Clearance Time (g_c), s	5.0	30.5	30.5	3.1	14.3	5.9	4.0	20.9	20.9	17.8	29.0	29.0
Green Ratio (*g/C*)	0.36	0.33	0.33	0.36	0.32	0.32	0.29	0.25	0.25	0.46	0.40	0.40
Capacity (*c*), veh/h	307	599	574	147	1109	494	192	461	444	438	737	720
Volume-to-Capacity Ratio (*X*)	0.543	0.881	0.881	0.492	0.496	0.225	0.752	0.791	0.793	0.901	0.751	0.751
Back of Queue (*Q*), ft/ln (95 th percentile)	78.9	557.4	531.5	62.2	255.6	101.8	133.2	383	367.2	318.9	491.5	475
Back of Queue (*Q*), veh/ln (95 th percentile)	3.1	21.9	21.3	2.4	10.1	4.0	5.2	15.1	14.7	12.6	19.3	19.0
Queue Storage Ratio (*RQ*) (95 th percentile)	0.63	0.00	0.00	0.25	0.00	0.68	0.89	0.00	0.00	0.80	0.00	0.00
Uniform Delay (d_1), s/veh	30.2	35.4	35.4	29.3	30.7	27.8	39.5	38.9	38.9	24.8	28.4	28.4
Incremental Delay (d_2), s/veh	1.6	13.1	13.6	1.9	0.6	0.4	14.6	5.3	5.6	7.1	4.8	5.0
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	31.8	48.5	49.0	31.2	31.3	28.2	54.2	44.2	44.5	31.9	33.2	33.3
Level of Service (LOS)	C	D	D	C	C	C	D	D	D	C	C	C
Approach Delay, s/veh / LOS	46.4	D		30.8	C		46.0	D		32.9	C	
Intersection Delay, s/veh / LOS	39.0						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.36	B	2.29	B	2.53	C	2.31	B
Bicycle LOS Score / LOS	1.48	A	1.09	A	1.20	A	1.72	B

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2024	Analysis Period	1> 7:15
Intersection	33rd Street	File Name	09 Cliff at 33rd 2024 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	70	85	30	50	130	10	90	970	15	5	330	60

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	0.5	3.5	51.0	3.4	1.3	10.4
Yellow	3.6	0.0	3.6	3.6	0.0	3.6
Red	1.0	0.0	1.5	1.0	0.0	1.9

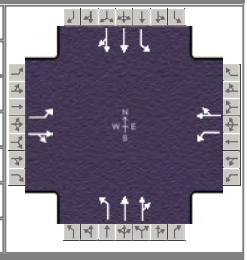
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	4.0	1.1	4.0	1.1	4.0
Phase Duration, s	9.4	17.3	8.0	15.9	8.6	59.6	5.1	56.1
Change Period, ($Y+R_c$), s	4.6	5.5	4.6	5.5	4.6	5.1	4.6	5.1
Max Allow Headway (*MAH*), s	4.2	4.1	4.2	4.1	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	5.5	8.2	4.5	9.5	4.1		2.1	
Green Extension Time (g_e), s	0.0	0.9	0.0	0.9	0.3	0.0	0.0	0.0
Phase Call Probability	0.86	1.00	0.75	1.00	0.92		0.13	
Max Out Probability	1.00	0.00	1.00	0.00	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	78	128		56	156		100	549	546	6	221	213
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1739		1734	1798		1734	1821	1811	1734	1821	1724
Queue Service Time (g_s), s	3.5	6.2		2.5	7.5		2.1	15.3	15.3	0.1	5.4	5.5
Cycle Queue Clearance Time (g_c), s	3.5	6.2		2.5	7.5		2.1	15.3	15.3	0.1	5.4	5.5
Green Ratio (*g/C*)	0.17	0.13		0.15	0.12		0.62	0.61	0.61	0.57	0.57	0.57
Capacity (*c*), veh/h	211	227		196	208		640	1103	1097	303	1032	977
Volume-to-Capacity Ratio (*X*)	0.368	0.562		0.284	0.747		0.156	0.498	0.498	0.018	0.214	0.217
Back of Queue (*Q*), ft/ln (95 th percentile)	69.3	125.1		49.7	163.5		32.5	253.2	248.2	2.1	97.4	92.8
Back of Queue (*Q*), veh/ln (95 th percentile)	2.7	4.9		2.0	6.4		1.3	10.0	9.9	0.1	3.8	3.7
Queue Storage Ratio (*RQ*) (95 th percentile)	0.32	0.00		0.36	0.00		0.19	0.00	0.00	0.02	0.00	0.00
Uniform Delay (d_1), s/veh	32.9	36.7		33.6	38.5		7.1	10.0	10.0	9.3	9.6	9.6
Incremental Delay (d_2), s/veh	1.1	2.2		0.8	5.3		0.1	1.6	1.6	0.0	0.5	0.5
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	34.0	38.9		34.4	43.8		7.2	11.6	11.6	9.3	10.1	10.1
Level of Service (LOS)	C	D		C	D		A	B	B	A	B	B
Approach Delay, s/veh / LOS	37.0	D		41.3	D		11.3	B		10.1	B	
Intersection Delay, s/veh / LOS	16.7						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.30	B	2.30	B	1.88	B	1.88	B
Bicycle LOS Score / LOS	0.83	A	0.84	A	1.47	A	0.85	A

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2024	Analysis Period	1> 16:30
Intersection	33rd Street	File Name	09 Cliff at 33rd 2024 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	100	175	80	80	120	20	60	510	95	20	1160	85

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	1.7	1.5	44.3	5.1	1.1	16.4
Yellow	3.6	0.0	3.6	3.6	0.0	3.6
Red	1.0	0.0	1.5	1.0	0.0	1.9

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	4.0	1.1	4.0	1.1	4.0
Phase Duration, s	10.8	23.0	9.7	21.9	7.8	51.0	6.3	49.4
Change Period, ($Y+R_c$), s	4.6	5.5	4.6	5.5	4.6	5.1	4.6	5.1
Max Allow Headway (*MAH*), s	4.2	4.2	4.2	4.2	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	6.6	16.3	5.7	9.1	3.7		2.6	
Green Extension Time (g_e), s	0.0	1.2	0.0	1.5	0.1	0.0	0.0	0.0
Phase Call Probability	0.94	1.00	0.89	1.00	0.81		0.43	
Max Out Probability	1.00	0.07	1.00	0.01	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	111	283		89	156		67	345	328	22	699	685
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1724		1734	1775		1734	1821	1721	1734	1821	1777
Queue Service Time (g_s), s	4.6	14.3		3.7	7.1		1.7	10.3	10.4	0.6	28.4	28.6
Cycle Queue Clearance Time (g_c), s	4.6	14.3		3.7	7.1		1.7	10.3	10.4	0.6	28.4	28.6
Green Ratio (*g/C*)	0.25	0.19		0.24	0.18		0.53	0.51	0.51	0.51	0.49	0.49
Capacity (*c*), veh/h	328	335		194	323		211	928	877	398	897	875
Volume-to-Capacity Ratio (*X*)	0.339	0.845		0.459	0.481		0.316	0.371	0.373	0.056	0.779	0.782
Back of Queue (*Q*), ft/ln (95 th percentile)	88.2	274.3		73.1	141.5		30.3	194.8	184.1	9.8	472.6	460.4
Back of Queue (*Q*), veh/ln (95 th percentile)	3.5	10.8		2.9	5.6		1.2	7.7	7.4	0.4	18.6	18.4
Queue Storage Ratio (*RQ*) (95 th percentile)	0.41	0.00		0.52	0.00		0.17	0.00	0.00	0.09	0.00	0.00
Uniform Delay (d_1), s/veh	27.3	34.9		28.9	33.0		15.9	13.3	13.4	11.5	18.8	18.8
Incremental Delay (d_2), s/veh	0.6	7.9		1.7	1.1		0.9	1.1	1.2	0.1	6.6	6.9
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	27.9	42.8		30.5	34.1		16.7	14.5	14.6	11.6	25.4	25.7
Level of Service (LOS)	C	D		C	C		B	B	B	B	C	C
Approach Delay, s/veh / LOS	38.6	D		32.8	C		14.7	B		25.4	C	
Intersection Delay, s/veh / LOS	25.1						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.29	B	2.29	B	1.89	B	1.90	B
Bicycle LOS Score / LOS	1.14	A	0.89	A	1.10	A	1.65	B

HCS7 Two-Way Stop-Control Report

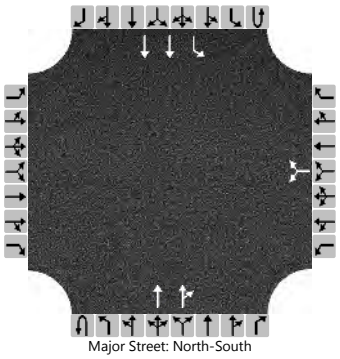
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at 36th St
Jurisdiction	Sioux Falls, SD
East/West Street	36th Street
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	2	0	0	1	2	0
Configuration							LR				T	TR		L	T	
Volume (veh/h)						30		40			1120	55	0	55	515	
Percent Heavy Vehicles (%)						2		2					2	2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized																
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)						7.5		6.9						4.1		
Critical Headway (sec)						6.84		6.94						4.14		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.52		3.32						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							78							61		
Capacity, c (veh/h)							259							526		
v/c Ratio							0.30							0.12		
95% Queue Length, Q_{95} (veh)							1.2							0.4		
Control Delay (s/veh)							24.7							12.7		
Level of Service (LOS)							C							B		
Approach Delay (s/veh)						24.7							1.2			
Approach LOS						C										

HCS7 Two-Way Stop-Control Report

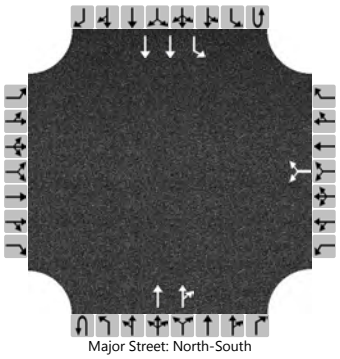
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at 36th St
Jurisdiction	Sioux Falls, SD
East/West Street	36th Street
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	2	0	0	1	2	0
Configuration							LR				T	TR		L	T	
Volume (veh/h)						25		5			655	25	0	5	1310	
Percent Heavy Vehicles (%)						2		2					2	2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized																
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)						7.5		6.9						4.1		
Critical Headway (sec)						6.84		6.94						4.14		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.52		3.32						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							33							6		
Capacity, c (veh/h)							277							851		
v/c Ratio							0.12							0.01		
95% Queue Length, Q_{95} (veh)							0.4							0.0		
Control Delay (s/veh)							19.8							9.3		
Level of Service (LOS)							C							A		
Approach Delay (s/veh)						19.8								0.0		
Approach LOS						C										

HCS7 Two-Way Stop-Control Report

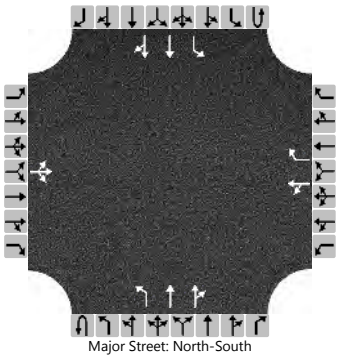
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at 38th/HS #1
Jurisdiction	Sioux Falls, SD
East/West Street	38th Street/HS #1
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	1	0	1	2	0	0	1	2	0
Configuration			LTR			LT		R		L	T	TR		L	T	TR
Volume (veh/h)		10	5	80		100	10	90	0	50	1145	130	0	65	705	40
Percent Heavy Vehicles (%)		2	2	2		2	2	2	2	2			2	2		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized					No											
Median Type | Storage	Left Only								1							

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5	6.5	6.9		7.5	6.5	6.9		4.1				4.1		
Critical Headway (sec)		7.54	6.54	6.94		7.54	6.54	6.94		4.14				4.14		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.52	4.02	3.32		3.52	4.02	3.32		2.22				2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			106			122		100		56				72		
Capacity, c (veh/h)			178			68		377		799				477		
v/c Ratio			0.59			1.81		0.27		0.07				0.15		
95% Queue Length, Q_{95} (veh)			3.2			11.0		1.1		0.2				0.5		
Control Delay (s/veh)			51.2			516.0		18.0		9.8				13.9		
Level of Service (LOS)			F			F		C		A				B		
Approach Delay (s/veh)	51.2				291.9				0.4				1.1			
Approach LOS	F				F											

HCS7 Two-Way Stop-Control Report

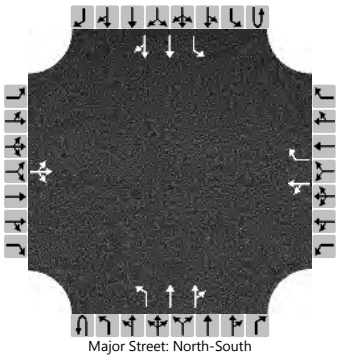
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at 38th/HS #1
Jurisdiction	Sioux Falls, SD
East/West Street	38th Street/HS #1
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	1	0	1	2	0	0	1	2	0
Configuration			LTR			LT		R		L	T	TR		L	T	TR
Volume (veh/h)		15	0	75		65	5	20	0	40	745	10	0	5	1345	30
Percent Heavy Vehicles (%)		2	2	2		2	2	2	2	2			2	2		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized					No											
Median Type | Storage	Left Only								1							

Critical and Follow-up Headways

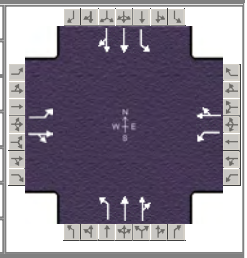
Base Critical Headway (sec)		7.5	6.5	6.9		7.5	6.5	6.9		4.1				4.1		
Critical Headway (sec)		7.54	6.54	6.94		7.54	6.54	6.94		4.14				4.14		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.52	4.02	3.32		3.52	4.02	3.32		2.22				2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			100			78		22		44				6		
Capacity, c (veh/h)			236			103		582		432				792		
v/c Ratio			0.42			0.76		0.04		0.10				0.01		
95% Queue Length, Q_{95} (veh)			2.0			4.1		0.1		0.3				0.0		
Control Delay (s/veh)			30.9			107.7		11.4		14.3				9.6		
Level of Service (LOS)			D			F		B		B				A		
Approach Delay (s/veh)	30.9				86.3				0.7				0.0			
Approach LOS	D				F											

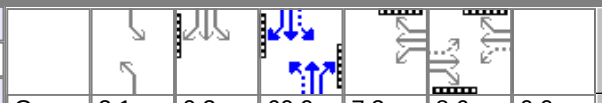
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 4, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2024	Analysis Period	1> 7:15
Intersection	38th Street/LHS Access	File Name	11 Cliff at 38th Signal 2024 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				

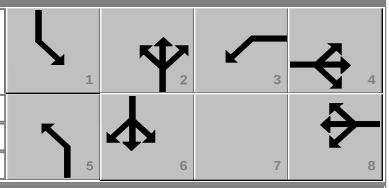


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	10	5	80	100	10	90	50	1145	330	65	705	40

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	3.1	0.3	60.9	7.3	8.6	0.0
Yellow	3.6	0.0	3.6	3.6	3.6	0.0
Red	1.0	0.0	1.5	1.0	1.9	0.0



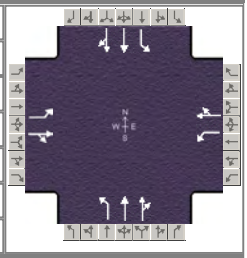
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4	3	8	5	2	1	6
Case Number		6.3	1.0	4.0	1.1	4.0	1.1	4.0
Phase Duration, s		14.1	11.9	25.9	7.7	66.0	8.1	66.3
Change Period, ($Y+R_c$), s		5.5	4.6	5.5	4.6	5.1	4.6	5.1
Max Allow Headway (*MAH*), s		4.4	3.2	4.4	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s		7.9	7.6	8.1	3.2		3.5	
Green Extension Time (g_e), s		0.7	0.0	0.8	0.1	0.0	0.2	0.0
Phase Call Probability		1.00	0.95	1.00	0.79		0.87	
Max Out Probability		0.00	1.00	0.00	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	11	94		111	111		56	837	802	72	418	410
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1282	1557		1734	1567		1734	1821	1683	1734	1821	1786
Queue Service Time (g_s), s	0.8	5.9		5.6	6.1		1.2	33.3	35.6	1.5	11.5	11.6
Cycle Queue Clearance Time (g_c), s	0.8	5.9		5.6	6.1		1.2	33.3	35.6	1.5	11.5	11.6
Green Ratio (*g/C*)	0.09	0.09		0.18	0.20		0.64	0.61	0.61	0.64	0.61	0.61
Capacity (*c*), veh/h	182	133		233	320		442	1109	1025	209	1115	1094
Volume-to-Capacity Ratio (*X*)	0.061	0.708		0.477	0.347		0.126	0.755	0.783	0.345	0.375	0.375
Back of Queue (*Q*), ft/ln (95 th percentile)	11.9	114.9		109.8	107.6		19.2	505.9	500.4	33	205.1	199.1
Back of Queue (*Q*), veh/ln (95 th percentile)	0.5	4.5		4.3	4.2		0.8	19.9	20.0	1.3	8.1	8.0
Queue Storage Ratio (*RQ*) (95 th percentile)	0.06	0.00		0.55	0.00		0.10	0.00	0.00	0.16	0.00	0.00
Uniform Delay (d_1), s/veh	42.2	44.5		36.4	34.1		7.6	14.1	14.6	14.9	9.8	9.8
Incremental Delay (d_2), s/veh	0.1	6.7		0.6	0.6		0.1	4.8	6.0	1.0	1.0	1.0
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	42.3	51.2		37.0	34.7		7.8	18.9	20.6	15.9	10.7	10.7
Level of Service (LOS)	D	D		D	C		A	B	C	B	B	B
Approach Delay, s/veh / LOS	50.3	D		35.8	D		19.3	B		11.1	B	
Intersection Delay, s/veh / LOS	19.2						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.31	B	2.30	B	1.88	B	1.88	B
Bicycle LOS Score / LOS	0.66	A	0.85	A	1.89	B	1.23	A

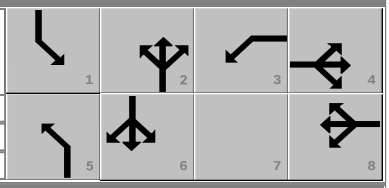
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 4, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2024	Analysis Period	1> 16:30
Intersection	38th Street/LHS Access	File Name	11 Cliff at 38th Signal 2024 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	15	0	75	65	5	20	40	745	20	5	1345	30

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	0.5	2.2	56.2	4.5	6.8	0.0
Yellow	3.6	0.0	3.6	3.6	3.6	0.0
Red	1.0	0.0	1.5	1.0	1.9	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4	3	8	5	2	1	6
Case Number		6.3	1.0	4.0	1.1	4.0	1.1	4.0
Phase Duration, s		12.3	9.1	21.4	7.3	63.5	5.1	61.3
Change Period, ($Y+R_c$), s		5.5	4.6	5.5	4.6	5.1	4.6	5.1
Max Allow Headway (*MAH*), s		4.4	3.2	4.4	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s		6.7	5.3	3.3	2.8		2.1	
Green Extension Time (g_e), s		0.4	0.0	0.5	0.1	0.0	0.0	0.0
Phase Call Probability		0.96	0.84	0.99	0.67		0.13	
Max Out Probability		0.00	1.00	0.00	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	17	83		72	28		44	427	423	6	766	762
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1382	1543		1734	1592		1734	1821	1804	1734	1821	1807
Queue Service Time (g_s), s	1.0	4.7		3.3	1.3		0.8	9.7	9.7	0.1	24.5	24.6
Cycle Queue Clearance Time (g_c), s	1.0	4.7		3.3	1.3		0.8	9.7	9.7	0.1	24.5	24.6
Green Ratio (*g/C*)	0.08	0.08		0.15	0.18		0.65	0.65	0.65	0.63	0.62	0.62
Capacity (*c*), veh/h	185	117		197	281		251	1181	1170	426	1137	1128
Volume-to-Capacity Ratio (*X*)	0.090	0.710		0.367	0.099		0.177	0.361	0.362	0.013	0.673	0.675
Back of Queue (*Q*), ft/ln (95 th percentile)	16.1	92.8		64.4	23.4		13	163.6	159.7	1.7	372.4	366
Back of Queue (*Q*), veh/ln (95 th percentile)	0.6	3.7		2.5	0.9		0.5	6.4	6.4	0.1	14.7	14.6
Queue Storage Ratio (*RQ*) (95 th percentile)	0.08	0.00		0.32	0.00		0.06	0.00	0.00	0.01	0.00	0.00
Uniform Delay (d_1), s/veh	38.9	40.6		34.4	31.0		9.4	7.3	7.3	6.7	10.9	11.0
Incremental Delay (d_2), s/veh	0.2	7.7		0.4	0.2		0.3	0.9	0.9	0.0	3.2	3.2
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	39.1	48.3		34.8	31.2		9.7	8.1	8.1	6.7	14.1	14.2
Level of Service (LOS)	D	D		C	C		A	A	A	A	B	B
Approach Delay, s/veh / LOS	46.8	D		33.8	C		8.2	A		14.2	B	
Intersection Delay, s/veh / LOS	14.1						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.30	B	2.29	B	1.87	B	1.87	B
Bicycle LOS Score / LOS	0.65	A	0.65	A	1.23	A	1.75	B

HCS7 Two-Way Stop-Control Report

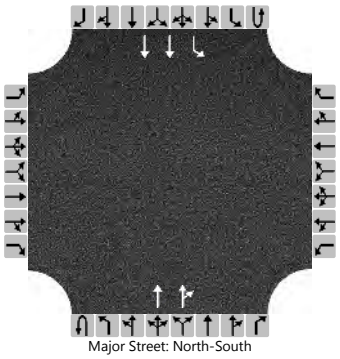
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at HS #2
Jurisdiction	Sioux Falls, SD
East/West Street	HS #2 Entrance
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	0	2	0	0	1	2	0
Configuration											T	TR		L	T	
Volume (veh/h)											1325	130	0	115	745	
Percent Heavy Vehicles (%)													2	2		
Proportion Time Blocked																
Percent Grade (%)																
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)														4.1		
Critical Headway (sec)														4.14		
Base Follow-Up Headway (sec)														2.2		
Follow-Up Headway (sec)														2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)														128		
Capacity, c (veh/h)														399		
v/c Ratio														0.32		
95% Queue Length, Q_{95} (veh)														1.4		
Control Delay (s/veh)														18.2		
Level of Service (LOS)														C		
Approach Delay (s/veh)													2.4			
Approach LOS																

HCS7 Two-Way Stop-Control Report

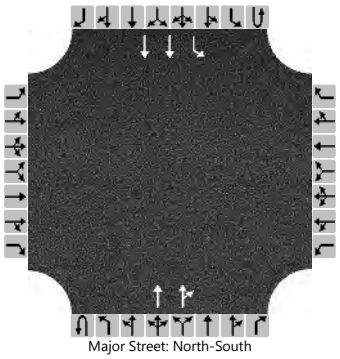
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at HS #2
Jurisdiction	Sioux Falls, SD
East/West Street	HS #2 Entrance
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	0	2	0	0	1	2	0
Configuration											T	TR		L	T	
Volume (veh/h)											795	20	0	15	1450	
Percent Heavy Vehicles (%)													2	2		
Proportion Time Blocked																
Percent Grade (%)																
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)														4.1		
Critical Headway (sec)														4.14		
Base Follow-Up Headway (sec)														2.2		
Follow-Up Headway (sec)														2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)														17		
Capacity, c (veh/h)														747		
v/c Ratio														0.02		
95% Queue Length, Q_{95} (veh)														0.1		
Control Delay (s/veh)														9.9		
Level of Service (LOS)														A		
Approach Delay (s/veh)													0.1			
Approach LOS																

HCS7 Two-Way Stop-Control Report

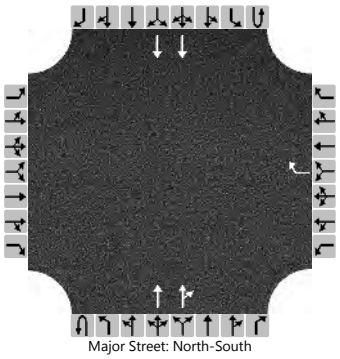
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at HS #1
Jurisdiction	Sioux Falls, SD
East/West Street	HS #1
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	1	0	0	2	0	0	0	2	0
Configuration								R			T	TR			T	
Volume (veh/h)								55			1400	320			695	
Percent Heavy Vehicles (%)								2								
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized						No										
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)								6.9								
Critical Headway (sec)								6.94								
Base Follow-Up Headway (sec)								3.3								
Follow-Up Headway (sec)								3.32								

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)								61								
Capacity, c (veh/h)								259								
v/c Ratio								0.24								
95% Queue Length, Q_{95} (veh)								0.9								
Control Delay (s/veh)								23.2								
Level of Service (LOS)								C								
Approach Delay (s/veh)						23.2										
Approach LOS						C										

HCS7 Two-Way Stop-Control Report

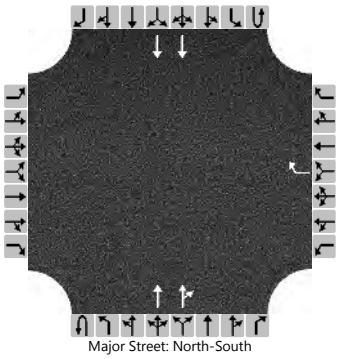
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at HS #1
Jurisdiction	Sioux Falls, SD
East/West Street	HS #1
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	1	0	0	2	0	0	0	2	0
Configuration								R			T	TR			T	
Volume (veh/h)								10			805	10			1450	
Percent Heavy Vehicles (%)								2								
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized						No										
Median Type | Storage						Undivided										

Critical and Follow-up Headways

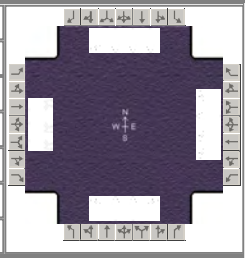
Base Critical Headway (sec)								6.9								
Critical Headway (sec)								6.94								
Base Follow-Up Headway (sec)								3.3								
Follow-Up Headway (sec)								3.32								

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)								11								
Capacity, c (veh/h)								554								
v/c Ratio								0.02								
95% Queue Length, Q_{95} (veh)								0.1								
Control Delay (s/veh)								11.6								
Level of Service (LOS)								B								
Approach Delay (s/veh)						11.6										
Approach LOS						B										

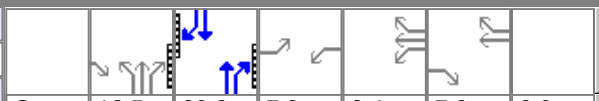
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	May 7, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2024	Analysis Period	1> 7:15
Intersection	41st St/SB I-229	File Name	14-16 Alt-1 Cliff Avenue 2024 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				

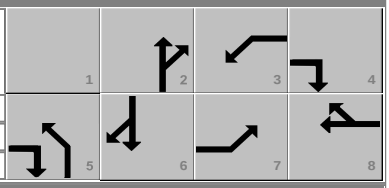


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	100		105	250	115	55	180	1565	390		630	90

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	71	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	12.5	39.9	7.3	2.4	7.0	0.0
Yellow	3.6	3.6	3.6	0.0	3.6	0.0
Red	1.0	2.5	1.5	0.0	1.5	0.0



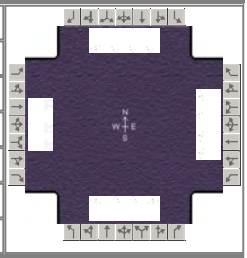
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2		6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0		7.3
Phase Duration, s	12.4	12.1	14.7	14.5	17.1	63.2		46.0
Change Period, ($Y+R_c$), s	5.1	5.1	5.1	5.1	4.6	6.1		6.1
Max Allow Headway (*MAH*), s	3.1	5.2	3.2	5.2	5.2	0.0		0.0
Queue Clearance Time (g_s), s	7.7	5.1	9.2	8.1	12.1			
Green Extension Time (g_e), s	0.1	1.0	0.4	1.0	0.5	0.0		0.0
Phase Call Probability	0.94	1.00	1.00	1.00	0.99			
Max Out Probability	0.01	0.07	0.01	0.09	0.52			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14	3	8	18	5	2	12		6	16
Adjusted Flow Rate (*v*), veh/h	111		117	278	128	6	200	1739	378		811	84
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734		1366	1684	1821	1568	1734	1734	1610		1654	
Queue Service Time (g_s), s	5.7		3.1	7.2	6.1	0.3	10.1	33.1	10.1		8.8	
Cycle Queue Clearance Time (g_c), s	5.7		3.1	7.2	6.1	0.3	10.1	33.1	10.1		8.8	
Green Ratio (*g/C*)	0.08		0.22	0.11	0.10	0.10	0.14	0.63	0.63		0.44	
Capacity (*c*), veh/h	140		593	361	190	163	241	2199	1021		2202	
Volume-to-Capacity Ratio (*X*)	0.793		0.197	0.770	0.674	0.034	0.829	0.791	0.370		0.368	
Back of Queue (*Q*), ft/ln (95 th percentile)	114.7		46.6	137.4	136.7	5.1	221	444.6	152.2		142.2	
Back of Queue (*Q*), veh/ln (95 th percentile)	4.5		1.8	5.4	5.4	0.2	8.7	17.5	6.1		5.6	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00		0.09	0.27	0.00	0.02	0.44	0.00	0.51		0.00	
Uniform Delay (d_1), s/veh	40.6		28.8	39.1	38.8	36.3	37.7	12.1	7.9		14.2	
Incremental Delay (d_2), s/veh	3.8		0.2	1.3	5.8	0.1	12.1	3.0	1.0		0.5	
Initial Queue Delay (d_3), s/veh	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	
Control Delay (*d*), s/veh	44.4		29.1	40.4	44.7	36.4	49.8	15.1	8.9		14.7	0.0
Level of Service (LOS)	D		C	D	D	D	D	B	A		B	A
Approach Delay, s/veh / LOS	36.6	D		41.7	D		17.1	B		13.3	B	
Intersection Delay, s/veh / LOS	20.0						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.67	C	2.49	B	2.30	B	2.09	B
Bicycle LOS Score / LOS		F	1.17	A	2.40	B	0.91	A

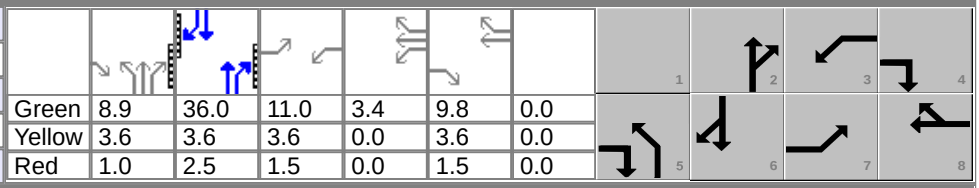
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	May 7, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2024	Analysis Period	1> 16:30
Intersection	41st St/SB I-229	File Name	14-16 Alt-1 Cliff Avenue 2024 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	160		235	415	110	60	125	595	160		1320	150

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	62	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	8.9	36.0	11.0	3.4	9.8	0.0
Yellow	3.6	3.6	3.6	0.0	3.6	0.0
Red	1.0	2.5	1.5	0.0	1.5	0.0

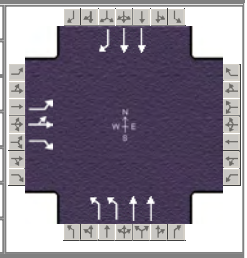
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2		6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0		7.3
Phase Duration, s	16.1	14.9	19.5	18.3	13.5	55.6		42.1
Change Period, ($Y+R_c$), s	5.1	5.1	5.1	5.1	4.6	6.1		6.1
Max Allow Headway (*MAH*), s	3.1	5.3	3.2	5.3	5.2	0.0		0.0
Queue Clearance Time (g_s), s	11.0	9.5	14.0	7.5	9.1			
Green Extension Time (g_e), s	0.1	0.2	0.4	1.3	0.2	0.0		0.0
Phase Call Probability	0.99	1.00	1.00	1.00	0.97			
Max Out Probability	1.00	1.00	1.00	0.72	1.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14	3	8	18	5	2	12		6	16
Adjusted Flow Rate (*v*), veh/h	178		261	461	122	28	139	661	122		1806	205
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734		1366	1684	1821	1568	1734	1734	1610		1654	
Queue Service Time (g_s), s	9.0		7.5	12.0	5.5	1.4	7.1	9.5	3.3		30.0	
Cycle Queue Clearance Time (g_c), s	9.0		7.5	12.0	5.5	1.4	7.1	9.5	3.3		30.0	
Green Ratio (*g/C*)	0.12		0.21	0.16	0.15	0.15	0.10	0.55	0.55		0.40	
Capacity (*c*), veh/h	211		567	539	267	230	172	1908	886		1984	
Volume-to-Capacity Ratio (*X*)	0.842		0.460	0.856	0.457	0.121	0.807	0.346	0.138		0.910	
Back of Queue (*Q*), ft/ln (95 th percentile)	211.5		113.1	237	116.2	24.4	171.3	161.8	53.1		377.9	
Back of Queue (*Q*), veh/ln (95 th percentile)	8.3		4.5	9.3	4.6	1.0	6.7	6.4	2.1		14.9	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00		0.23	0.47	0.00	0.08	0.34	0.00	0.18		0.00	
Uniform Delay (d_1), s/veh	38.7		31.2	36.8	35.1	33.3	39.7	11.2	9.8		21.0	
Incremental Delay (d_2), s/veh	17.4		0.8	8.7	1.7	0.3	16.4	0.5	0.3		5.0	
Initial Queue Delay (d_3), s/veh	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	
Control Delay (*d*), s/veh	56.1		32.1	45.5	36.8	33.7	56.1	11.7	10.2		25.9	0.0
Level of Service (LOS)	E		C	D	D	C	E	B	B		C	A
Approach Delay, s/veh / LOS	41.8		D	43.3		D	18.2		B	23.3		C
Intersection Delay, s/veh / LOS	27.2						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.67	C	2.45	B	2.30	B	2.10	B
Bicycle LOS Score / LOS		F	1.50	A	1.25	A	1.39	A

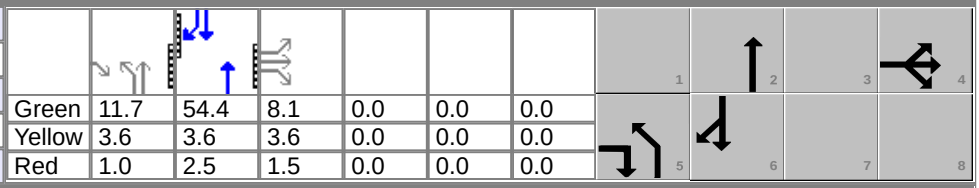
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	May 7, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2024	Analysis Period	1> 7:15
Intersection	41st St	File Name	14-16 Alt-6 Cliff Avenue 2024 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	100	0	105				295	1620			630	90

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	84	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	11.7	54.4	8.1	0.0	0.0	0.0		
Yellow	3.6	3.6	3.6	0.0	0.0	0.0		
Red	1.0	2.5	1.5	0.0	0.0	0.0		

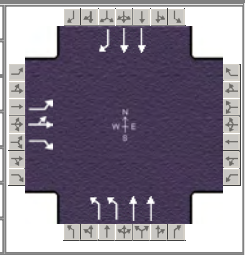
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			5	2		6
Case Number		9.0			2.0	4.0		7.3
Phase Duration, s		13.2			16.3	76.8		60.5
Change Period, ($Y+R_c$), s		5.1			4.6	6.1		6.1
Max Allow Headway (*MAH*), s		5.3			5.2	0.0		0.0
Queue Clearance Time (g_s), s		8.0			10.4			
Green Extension Time (g_e), s		0.2			1.3	0.0		0.0
Phase Call Probability		0.99			1.00			
Max Out Probability		1.00			0.24			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14				5	2			6	16
Adjusted Flow Rate (*v*), veh/h	56	0	128				328	1800			811	84
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1850	1626				1684	1734			1734	1568
Queue Service Time (g_s), s	2.7	0.0	6.0				8.4	20.8			10.5	2.7
Cycle Queue Clearance Time (g_c), s	2.7	0.0	6.0				8.4	20.8			10.5	2.7
Green Ratio (*g/C*)	0.09	0.09	0.22				0.13	0.79			0.60	0.60
Capacity (*c*), veh/h	155	166	347				439	2725			2096	948
Volume-to-Capacity Ratio (*X*)	0.357	0.000	0.368				0.746	0.660			0.387	0.088
Back of Queue (*Q*), ft/ln (95 th percentile)	55.5	0	107.9				166.6	223.9			167.1	41
Back of Queue (*Q*), veh/ln (95 th percentile)	2.2	0.0	4.2				6.6	8.8			6.6	1.6
Queue Storage Ratio (*RQ*) (95 th percentile)	0.28	0.00	0.31				0.56	0.00			0.00	0.41
Uniform Delay (d_1), s/veh	38.5	0.0	29.7				37.7	4.3			8.8	10.4
Incremental Delay (d_2), s/veh	2.0	0.0	0.9				3.6	1.3			0.5	0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0				0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	40.5	0.0	30.6				41.3	5.6			9.3	10.6
Level of Service (LOS)	D		C				D	A			A	B
Approach Delay, s/veh / LOS	33.6	C		0.0			11.1	B		9.4	A	
Intersection Delay, s/veh / LOS	11.9						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.61	C	2.35	B	1.38	A	2.29	B
Bicycle LOS Score / LOS	0.79	A		A	2.15	B	1.12	A

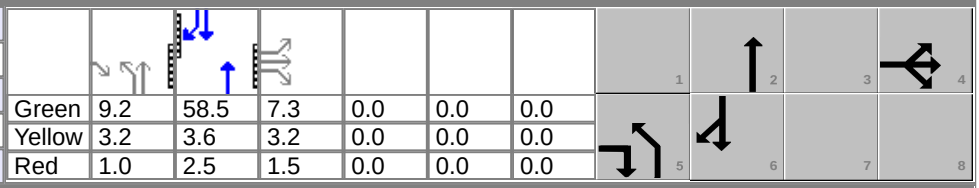
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	May 7, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2024	Analysis Period	1> 16:30
Intersection	41st St	File Name	14-16 Alt-6 Cliff Avenue 2024 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	160	0	235				235	655			1320	150

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	80	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	9.2	58.5	7.3	0.0	0.0	0.0
Yellow	3.2	3.6	3.2	0.0	0.0	0.0
Red	1.0	2.5	1.5	0.0	0.0	0.0

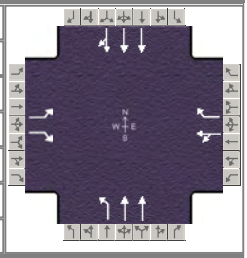
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			5	2		6
Case Number		9.0			2.0	4.0		7.3
Phase Duration, s		12.0			13.4	78.0		64.6
Change Period, ($Y+R_c$), s		4.7			4.2	6.1		6.1
Max Allow Headway (*MAH*), s		5.3			5.2	0.0		0.0
Queue Clearance Time (g_s), s		9.3			8.8			
Green Extension Time (g_e), s		0.0			0.4	0.0		0.0
Phase Call Probability		1.00			1.00			
Max Out Probability		1.00			1.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14				5	2			6	16
Adjusted Flow Rate (*v*), veh/h	89	0	239				261	728			1812	172
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1850	1614				1684	1734			1734	1568
Queue Service Time (g_s), s	4.5	0.0	7.3				6.8	4.8			29.1	3.7
Cycle Queue Clearance Time (g_c), s	4.5	0.0	7.3				6.8	4.8			29.1	3.7
Green Ratio (*g/C*)	0.08	0.08	0.18				0.10	0.80			0.65	0.65
Capacity (*c*), veh/h	141	150	289				344	2770			2254	1019
Volume-to-Capacity Ratio (*X*)	0.632	0.000	0.827				0.758	0.263			0.804	0.168
Back of Queue (*Q*), ft/ln (95 th percentile)	103.2	0	265.9				141.4	48.9			276.9	51.7
Back of Queue (*Q*), veh/ln (95 th percentile)	4.1	0.0	10.5				5.6	1.9			10.9	2.1
Queue Storage Ratio (*RQ*) (95 th percentile)	0.52	0.00	0.76				0.47	0.00			0.00	0.52
Uniform Delay (d_1), s/veh	40.0	0.0	35.3				39.3	2.3			7.3	5.9
Incremental Delay (d_2), s/veh	10.1	0.0	18.4				6.7	0.2			2.6	0.3
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0				0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	50.2	0.0	53.7				46.0	2.5			9.9	6.2
Level of Service (LOS)	D		D				D	A			A	A
Approach Delay, s/veh / LOS	52.7	D		0.0			14.0	B		9.6	A	
Intersection Delay, s/veh / LOS	15.2						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.61	C	2.35	B	1.38	A	2.37	B
Bicycle LOS Score / LOS	1.03	A		A	1.21	A	1.81	B

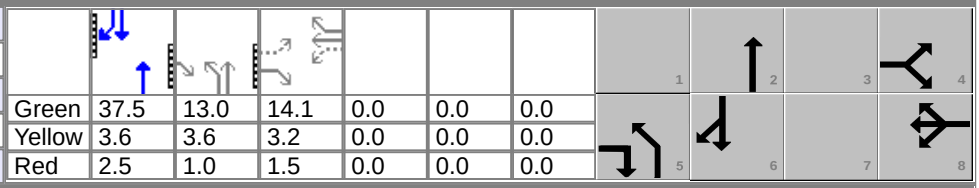
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	May 7, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2024	Analysis Period	1> 7:15
Intersection	41st St/SB I-229	File Name	14-16 Alt-7 Cliff Avenue 2024 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	100		105	0	115	55	180	1565			630	90

Signal Information			
Cycle, s	80.0	Reference Phase	2
Offset, s	20	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	37.5	13.0	14.1	0.0	0.0	0.0		
Yellow	3.6	3.6	3.2	0.0	0.0	0.0		
Red	2.5	1.0	1.5	0.0	0.0	0.0		

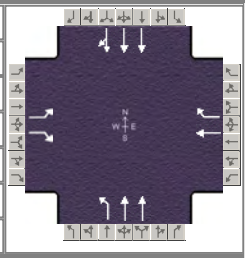
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2		6
Case Number		5.0		7.0	2.0	4.0		8.3
Phase Duration, s		18.8		18.8	17.6	61.2		43.6
Change Period, ($Y+R_c$), s		4.7		4.7	6.1	6.1		6.1
Max Allow Headway (*MAH*), s		4.3		4.3	5.2	0.0		0.0
Queue Clearance Time (g_s), s		13.8		7.0	10.9			
Green Extension Time (g_e), s		0.2		0.9	0.6	0.0		0.0
Phase Call Probability		1.00		1.00	0.99			
Max Out Probability		1.00		0.15	1.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14	3	8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h	111		72		0	61	200	1739			605	290
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1263		1543		0	1568	1734	1734			1821	1731
Queue Service Time (g_s), s	6.8		2.7		0.0	2.7	8.9	25.0			7.7	3.6
Cycle Queue Clearance Time (g_c), s	11.8		2.7		0.0	2.7	8.9	25.0			7.7	3.6
Green Ratio (*g/C*)	0.18		0.32			0.18	0.39	0.69			0.47	0.47
Capacity (*c*), veh/h	233		495			275	251	2390			1705	810
Volume-to-Capacity Ratio (*X*)	0.476		0.146		0.000	0.222	0.795	0.728			0.355	0.357
Back of Queue (*Q*), ft/ln (95 th percentile)	98.8		42.8		0	44.7	213.5	309.9			50.4	56.8
Back of Queue (*Q*), veh/ln (95 th percentile)	3.9		1.7		0.0	1.8	8.4	12.2			2.0	2.3
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00		0.12		0.00	0.15	0.71	0.00			0.00	0.00
Uniform Delay (d_1), s/veh	34.5		19.4			28.3	33.1	7.7			4.1	4.4
Incremental Delay (d_2), s/veh	2.1		0.2		0.0	0.1	16.7	2.0			0.6	1.2
Initial Queue Delay (d_3), s/veh	0.0		0.0		0.0	0.0	0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	36.6		19.6			28.4	49.7	9.7			4.7	5.6
Level of Service (LOS)	D		B			C	D	A			A	A
Approach Delay, s/veh / LOS	29.9		C	29.2		C	13.8		B	5.0		A
Intersection Delay, s/veh / LOS	13.2						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.58	C	2.33	B	1.63	B	1.99	B
Bicycle LOS Score / LOS		F	0.80	A	2.00	B	0.91	A

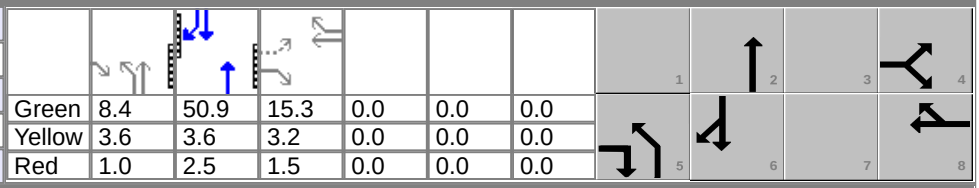
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	May 7, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2024	Analysis Period	1> 16:30
Intersection	41st St/SB I-229	File Name	14-16 Alt-7 Cliff Avenue 2024 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	160		235		110	60	125	595			1320	150

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	65	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	8.4	50.9	15.3	0.0	0.0	0.0
Yellow	3.6	3.6	3.2	0.0	0.0	0.0
Red	1.0	2.5	1.5	0.0	0.0	0.0

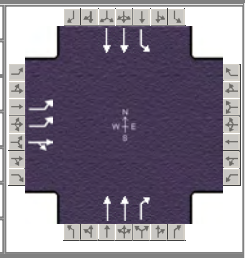
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2		6
Case Number		5.0		7.0	2.0	4.0		8.3
Phase Duration, s		20.0		20.0	13.0	70.0		57.0
Change Period, ($Y+R_c$), s		4.7		4.7	4.6	6.1		6.1
Max Allow Headway (*MAH*), s		3.3		3.3	3.2	0.0		0.0
Queue Clearance Time (g_s), s		17.3		7.4	9.1			
Green Extension Time (g_e), s		0.0		0.9	0.0	0.0		0.0
Phase Call Probability		1.00		1.00	0.97			
Max Out Probability		1.00		0.10	1.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14		8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h	178		217		122	67	139	661			1340	643
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1269		1543		1821	1568	1734	1734			1821	1738
Queue Service Time (g_s), s	9.9		10.8		5.4	3.3	7.1	6.1			16.6	22.3
Cycle Queue Clearance Time (g_c), s	15.3		10.8		5.4	3.3	7.1	6.1			16.6	22.3
Green Ratio (*g/C*)	0.17		0.26		0.17	0.17	0.09	0.71			0.57	0.57
Capacity (*c*), veh/h	220		406		310	267	162	2462			2060	983
Volume-to-Capacity Ratio (*X*)	0.808		0.533		0.395	0.250	0.858	0.269			0.651	0.654
Back of Queue (*Q*), ft/ln (95 th percentile)	220.5		179.8		108.3	56.6	201.4	85.2			287.9	308.7
Back of Queue (*Q*), veh/ln (95 th percentile)	8.7		7.1		4.3	2.3	7.9	3.4			11.3	12.3
Queue Storage Ratio (*RQ*) (95 th percentile)	0.00		0.51		0.00	0.19	0.67	0.00			0.00	0.00
Uniform Delay (d_1), s/veh	41.1		28.4		33.2	32.4	40.2	4.7			11.4	12.6
Incremental Delay (d_2), s/veh	18.4		0.7		0.3	0.2	32.8	0.3			1.2	2.5
Initial Queue Delay (d_3), s/veh	0.0		0.0		0.0	0.0	0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	59.5		29.1		33.5	32.6	73.0	4.9			12.6	15.1
Level of Service (LOS)	E		C		C	C	E	A			B	B
Approach Delay, s/veh / LOS	42.8	D		33.2	C		16.8	B		13.4	B	
Intersection Delay, s/veh / LOS	18.8						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.59	C	2.33	B	1.63	B	1.94	B
Bicycle LOS Score / LOS		F	0.80	A	1.06	A	1.37	A

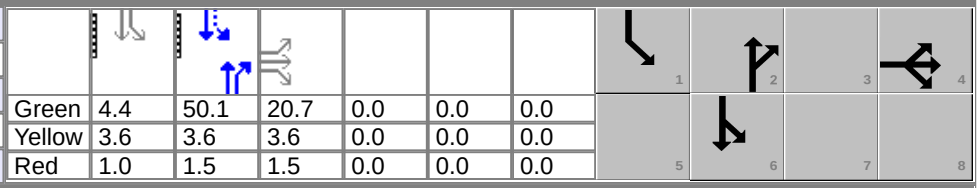
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	May 7, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2024	Analysis Period	1> 7:15
Intersection	I-229 South Ramp	File Name	14-16 Alt-1 Cliff Avenue 2024 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	530	0	185					1605	435	100	645	

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	73	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	4.4	50.1	20.7	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.0	1.5	1.5	0.0	0.0	0.0

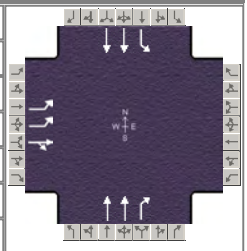
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4				2	1	6
Case Number		10.0				7.3	1.0	4.0
Phase Duration, s		25.8				55.2	9.0	64.2
Change Period, ($Y+R_c$), s		5.1				5.1	4.6	5.1
Max Allow Headway (*MAH*), s		5.2				0.0	5.2	0.0
Queue Clearance Time (g_s), s		16.7					4.3	
Green Extension Time (g_e), s		4.0				0.0	0.4	0.0
Phase Call Probability		1.00					0.94	
Max Out Probability		0.24					0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14					2	12	1	6	
Adjusted Flow Rate (*v*), veh/h	589	150						1493	335	111	717	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1467						1770	1499	1734	1689	
Queue Service Time (g_s), s	14.7	7.9						19.3	4.7	2.3	8.3	
Cycle Queue Clearance Time (g_c), s	14.7	7.9						19.3	4.7	2.3	8.3	
Green Ratio (*g/C*)	0.23	0.23						0.56	0.56	0.63	0.66	
Capacity (*c*), veh/h	776	338						1970	834	285	2217	
Volume-to-Capacity Ratio (*X*)	0.759	0.444						0.758	0.401	0.389	0.323	
Back of Queue (*Q*), ft/ln (95 th percentile)	257.7	130.6						155.5	55.3	39	124.2	
Back of Queue (*Q*), veh/ln (95 th percentile)	10.1	5.1						6.1	2.2	1.5	4.9	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.47	0.00						0.00	0.22	0.13	0.00	
Uniform Delay (d_1), s/veh	32.3	29.7						5.9	3.4	10.4	6.7	
Incremental Delay (d_2), s/veh	2.5	1.3						1.5	0.7	1.2	0.4	
Initial Queue Delay (d_3), s/veh	0.0	0.0						0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	34.8	31.0						7.4	4.2	11.6	7.1	
Level of Service (LOS)	C	C						A	A	B	A	
Approach Delay, s/veh / LOS	34.0	C		0.0			6.8	A		7.7	A	
Intersection Delay, s/veh / LOS	13.0						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.42	B	2.31	B	1.37	A	1.94	B
Bicycle LOS Score / LOS	1.71	B			2.29	B	1.17	A

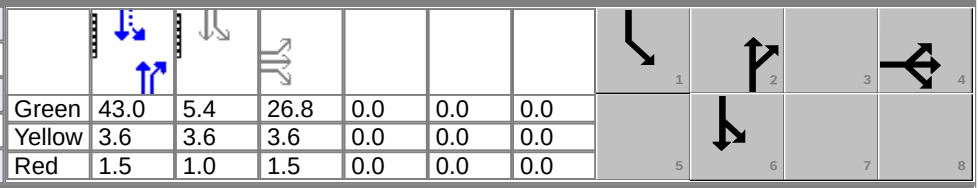
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	May 7, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2024	Analysis Period	1> 16:30
Intersection	I-229 South Ramp	File Name	14-16 Alt-1 Cliff Avenue 2024 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	210	0	485					670	210	115	1325	

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	44	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	43.0	5.4	26.8	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.5	1.0	1.5	0.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4				2	1	6
Case Number		10.0				7.3	1.0	4.0
Phase Duration, s		31.9				48.1	10.0	58.1
Change Period, ($Y+R_c$), s		5.1				5.1	5.1	5.1
Max Allow Headway (*MAH*), s		5.3				0.0	5.2	0.0
Queue Clearance Time (g_s), s		22.8					2.0	
Green Extension Time (g_e), s		4.0				0.0	3.1	0.0
Phase Call Probability		1.00					0.96	
Max Out Probability		0.04					1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14					2	12	1	6	
Adjusted Flow Rate (*v*), veh/h	233	372						685	153	128	1472	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1506						1686	1468	1734	1768	
Queue Service Time (g_s), s	4.7	20.8						10.9	4.4	0.0	26.4	
Cycle Queue Clearance Time (g_c), s	4.7	20.8						10.9	4.4	0.0	26.4	
Green Ratio (*g/C*)	0.30	0.30						0.48	0.48	0.51	0.59	
Capacity (*c*), veh/h	1001	448						1611	702	428	2084	
Volume-to-Capacity Ratio (*X*)	0.233	0.831						0.425	0.219	0.298	0.706	
Back of Queue (*Q*), ft/ln (95 th percentile)	85.2	320.6						176.4	65.5	90	382.4	
Back of Queue (*Q*), veh/ln (95 th percentile)	3.4	12.6						6.9	2.6	3.5	15.1	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.15	0.00						0.00	0.26	0.30	0.00	
Uniform Delay (d_1), s/veh	23.9	29.5						13.3	10.3	20.2	13.0	
Incremental Delay (d_2), s/veh	0.2	5.9						0.7	0.6	0.5	2.0	
Initial Queue Delay (d_3), s/veh	0.0	0.0						0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	24.0	35.4						14.0	11.0	20.7	15.0	
Level of Service (LOS)	C	D						B	B	C	B	
Approach Delay, s/veh / LOS	31.0	C		0.0			13.4	B		15.5	B	
Intersection Delay, s/veh / LOS	18.0						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.40	B	2.31	B	1.43	A	2.09	B
Bicycle LOS Score / LOS	1.49	A			1.24	A	1.81	B

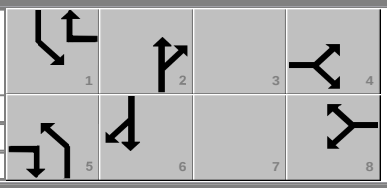
HCS7 Interchanges Results Summary

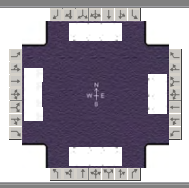
General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	SPUI
Analyst	Graham Johnson	Analysis Date	May 7, 2019	Segment Distance, ft	
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 SPUI	PHF	0.90	Arterial Direction	North-South
File Name	14-16 Alt-6 Cliff Avenue 2024 AM.xus				
Project Description	BUILD - I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection Demand (v), veh/h	530		185	250		170	390	1215	435	100	395	240

Signal Information	
Cycle, s	90.0
Offset, s	33
Uncoordinated	No
Force Mode	Fixed

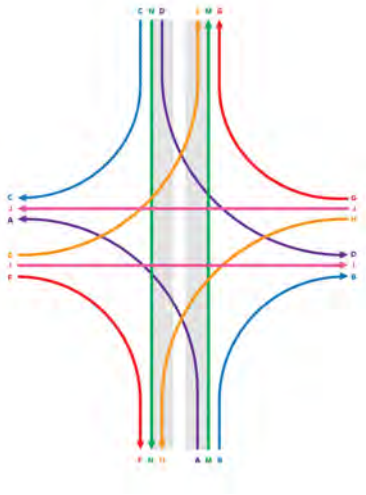
Green	7.5	9.5	35.1	18.6	0.0	0.0
Yellow	3.6	3.6	3.6	3.6	0.0	0.0
Red	1.0	1.0	1.5	1.5	0.0	0.0





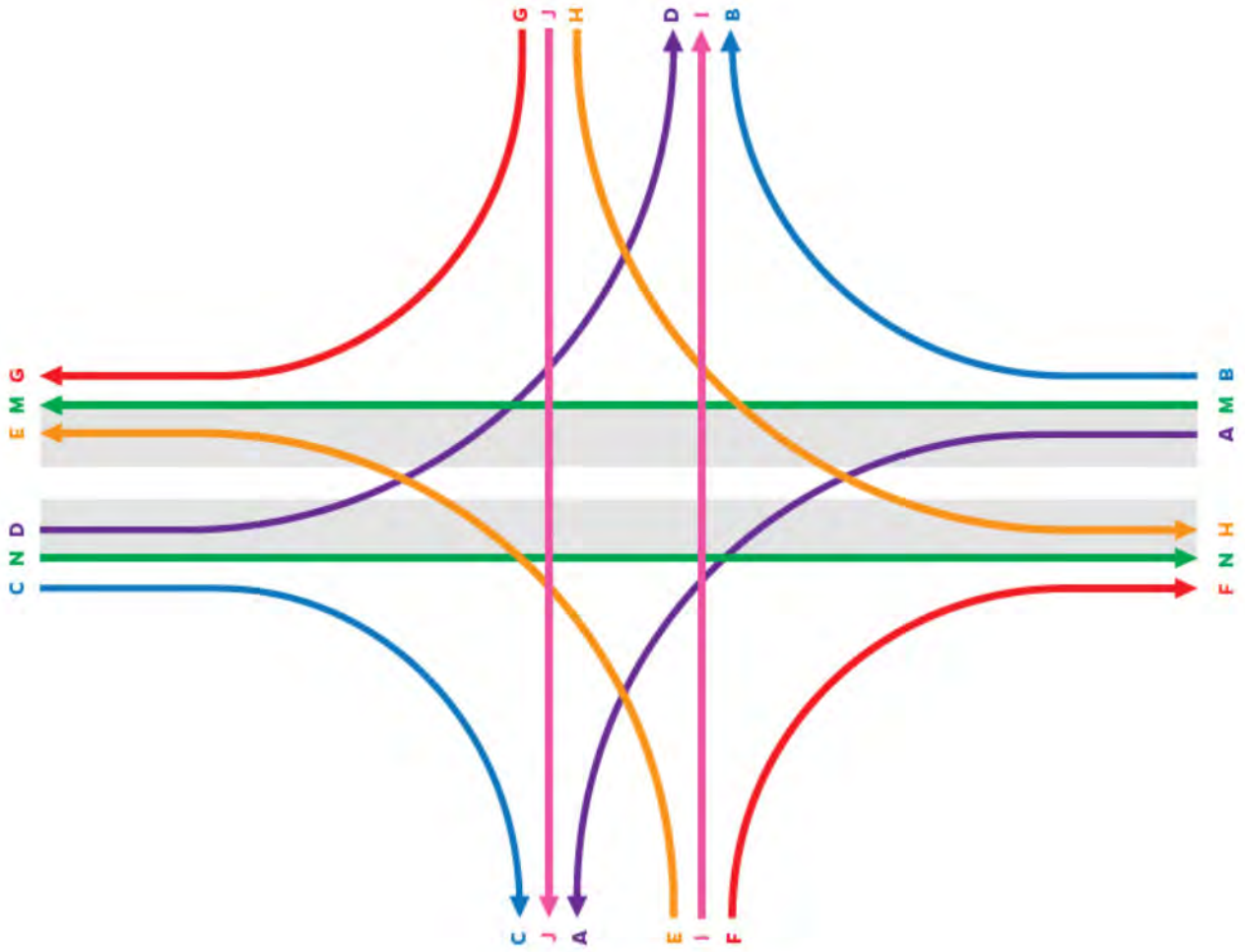
Interchange Results

O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	278	30.9	0.0	30.9	No	No	C
B	189	26.3	0.0	26.3	No	No	B
C	206	15.1	0.0	15.1	No	No	B
D	589	36.5	0.0	36.5	No	No	C
E	376	40.8	0.0	40.8	No	No	C
F	419	0.0	0.0	0.0	No	No	A
G	267	0.0	0.0	0.0	No	No	A
H	111	52.0	0.0	52.0	No	No	C
I	1171	21.0	0.0	21.0	No	No	B
J	439	20.0	0.0	20.0	No	No	B
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	36.5		15.1	30.9		26.3	40.8	21.0	0.0	52.0	20.0	0.0
Level of Service (LOS)	D		B	C		C	D	C	A	D	C	A
Approach Delay, s/veh / LOS	31.0	C		29.1	C		20.3	C		17.8	B	
Intersection Delay, s/veh / LOS	22.9						C					

Interchange Graphic



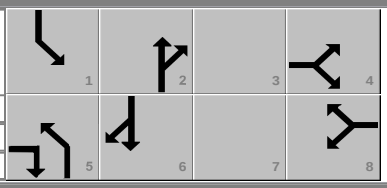
HCS7 Interchanges Results Summary

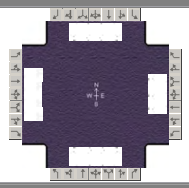
General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	SPUI
Analyst	Graham Johnson	Analysis Date	May 7, 2019	Segment Distance, ft	
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 SPUI	PHF	0.90	Arterial Direction	North-South
File Name	14-16 Alt-6 Cliff Avenue 2024 PM.xus				
Project Description	BUILD - I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection Demand (v), veh/h	210		485	415		170	160	510	210	115	910	530

Signal Information	
Cycle, s	90.0
Offset, s	33
Uncoordinated	No
Force Mode	Fixed

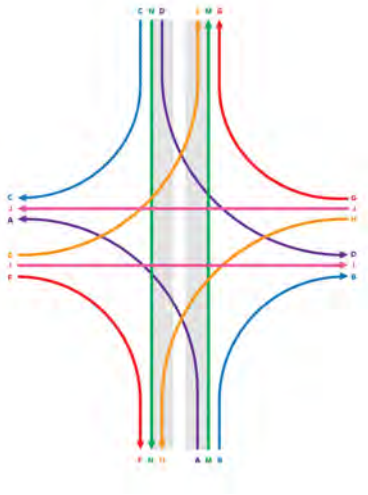
Green	8.6	2.0	42.2	22.4	0.0	0.0
Yellow	3.6	0.0	3.6	3.6	0.0	0.0
Red	1.0	0.0	1.5	1.5	0.0	0.0





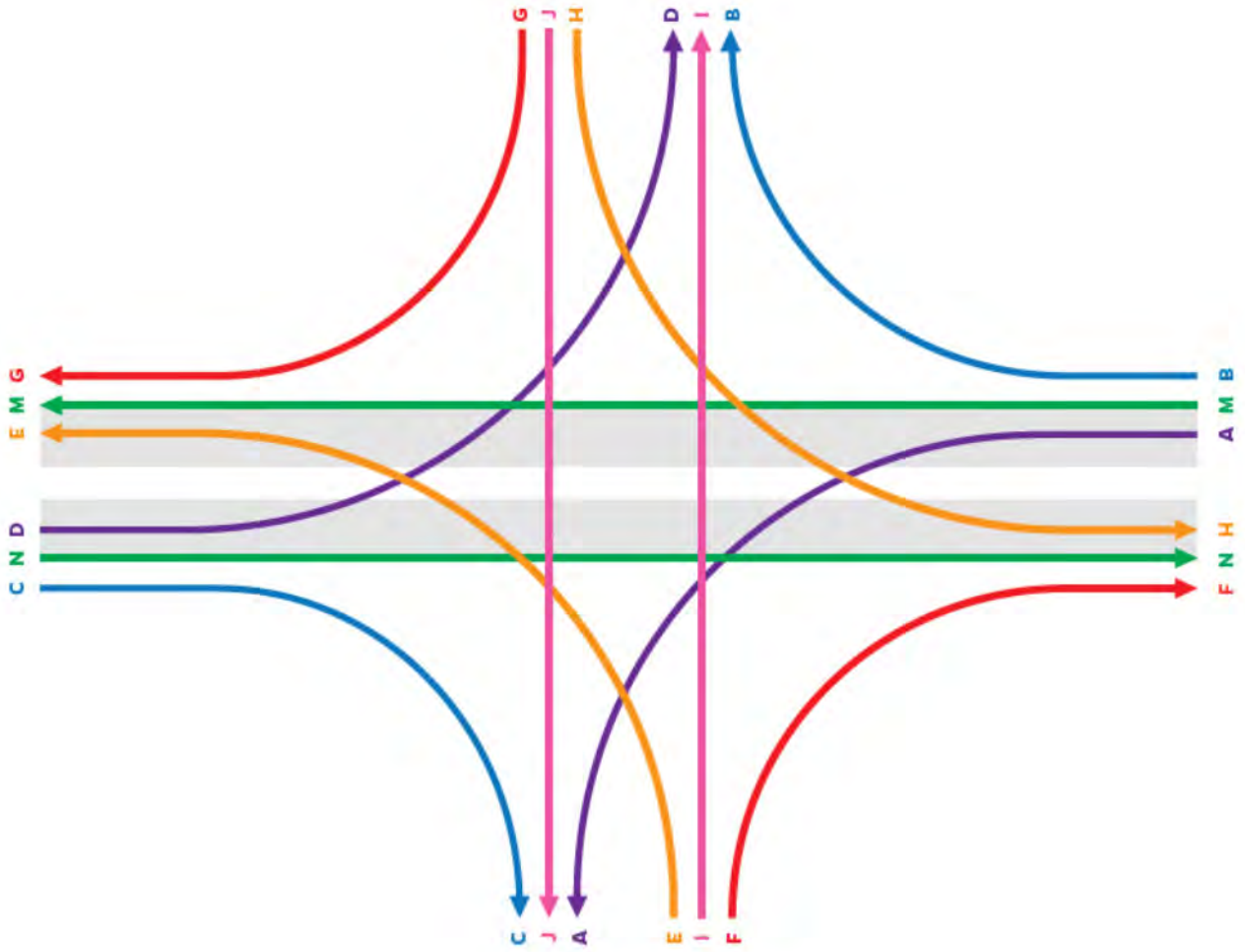
Interchange Results

O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	461	29.4	0.0	29.4	No	No	B
B	189	29.5	0.0	29.5	No	No	B
C	539	23.4	0.0	23.4	No	No	B
D	233	27.4	0.0	27.4	No	No	B
E	168	42.1	0.0	42.1	No	No	C
F	221	0.0	0.0	0.0	No	No	A
G	589	0.0	0.0	0.0	No	No	A
H	128	49.8	0.0	49.8	No	No	C
I	536	12.3	0.0	12.3	No	No	A
J	1011	19.8	0.0	19.8	No	No	B
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	27.4		23.4	29.4		29.5	42.1	12.3	0.0	49.8	19.8	0.0
Level of Service (LOS)	C		C	C		C	D	B	A	D	B	A
Approach Delay, s/veh / LOS	24.6	C		29.4	C		14.8	B		15.3	B	
Intersection Delay, s/veh / LOS	19.2						B					

Interchange Graphic



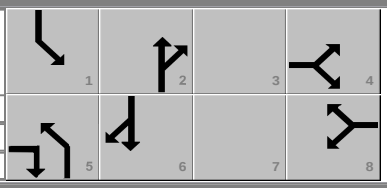
HCS7 Interchanges Results Summary

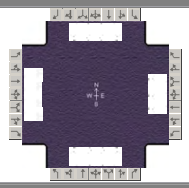
General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	SPUI
Analyst	Graham Johnson	Analysis Date	May 7, 2019	Segment Distance, ft	
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 SPUI	PHF	0.90	Arterial Direction	North-South
File Name	14-16 Alt-7 Cliff Avenue 2024 AM.xus				
Project Description	BUILD - I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection Demand (v), veh/h	530		185	250		0	390	1215	435	100	395	240

Signal Information	
Cycle, s	80.0
Offset, s	33
Uncoordinated	No
Force Mode	Fixed

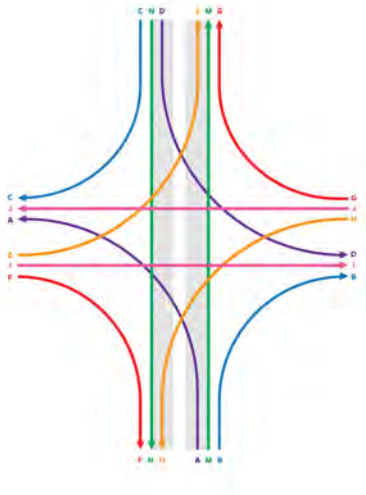
Green	6.6	20.0	19.1	14.9	0.0	0.0
Yellow	3.6	3.6	3.6	3.6	0.0	0.0
Red	1.0	1.5	1.0	1.5	0.0	0.0





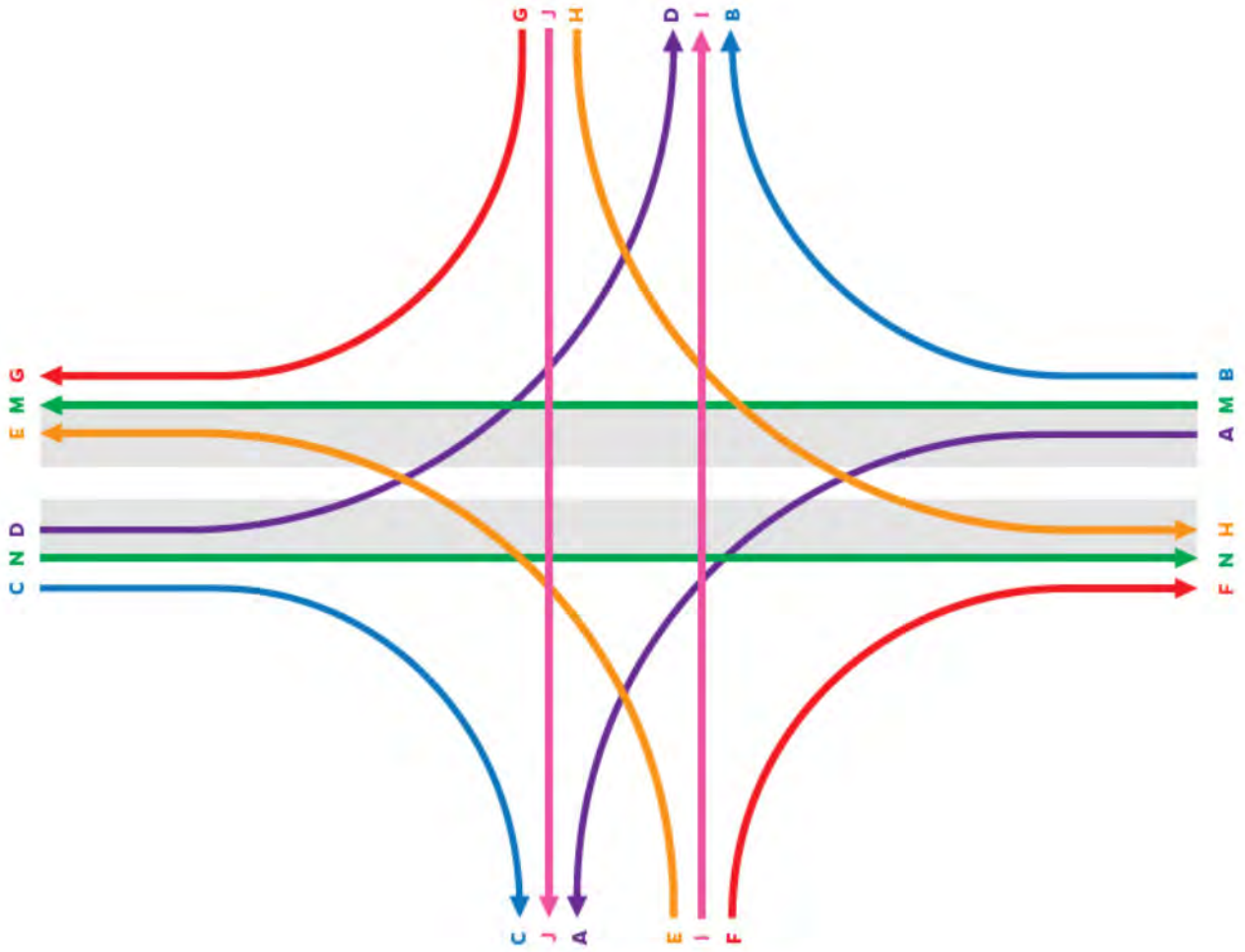
Interchange Results

O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	278	28.9	0.0	28.9	No	No	B
B	0	0.0	0.0	0.0	No	No	A
C	206	14.7	0.0	14.7	No	No	A
D	589	35.6	0.0	35.6	No	No	C
E	365	46.4	0.0	46.4	No	No	C
F	408	0.0	0.0	0.0	No	No	A
G	267	0.0	0.0	0.0	No	No	A
H	111	48.0	0.0	48.0	No	No	C
I	1138	9.4	0.0	9.4	No	No	A
J	439	17.9	0.0	17.9	No	No	B
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	35.6		14.7	28.9		0.0	46.4	9.4	0.0	48.0	17.9	0.0
Level of Service (LOS)	D		B	C			D	A	A	D	B	A
Approach Delay, s/veh / LOS	30.2	C		28.9	C		14.5	B		16.1	B	
Intersection Delay, s/veh / LOS	19.2						B					

Interchange Graphic



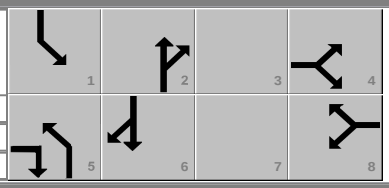
HCS7 Interchanges Results Summary

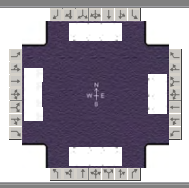
General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	SPUI
Analyst	Graham Johnson	Analysis Date	May 7, 2019	Segment Distance, ft	
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 SPUI	PHF	0.90	Arterial Direction	North-South
File Name	14-16 Alt-7 Cliff Avenue 2024 PM.xus				
Project Description	BUILD - I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection Demand (v), veh/h	210		485	415		0	160	510	210	115	910	530

Signal Information	
Cycle, s	90.0
Offset, s	33
Uncoordinated	No
Force Mode	Fixed

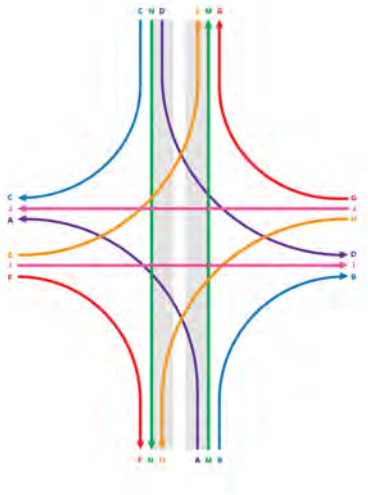
Green	8.4	1.9	50.0	14.9	0.0	0.0
Yellow	3.6	0.0	3.6	3.6	0.0	0.0
Red	1.0	0.0	1.5	1.5	0.0	0.0





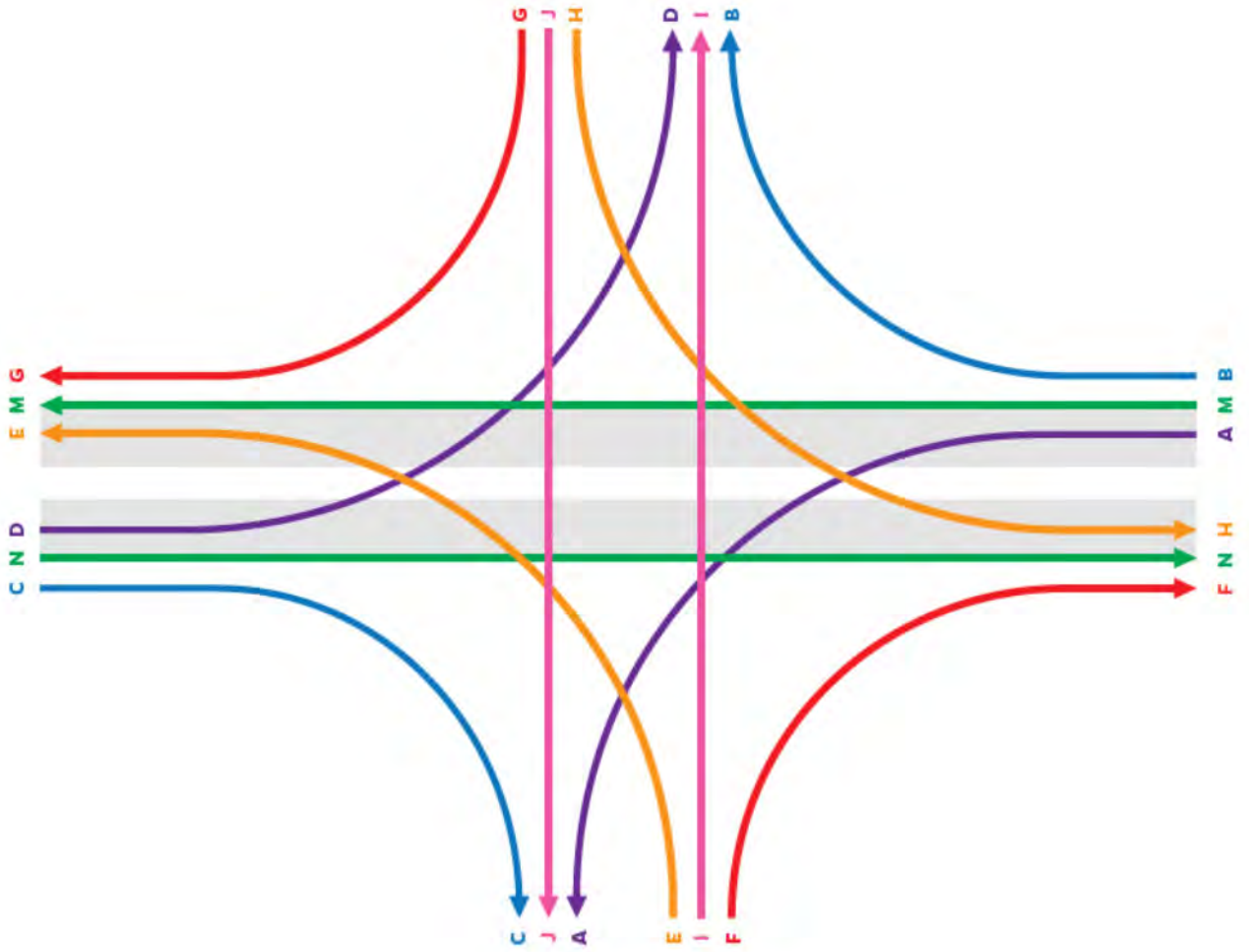
Interchange Results

O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	461	37.7	0.0	37.7	No	No	C
B	0	0.0	0.0	0.0	No	No	A
C	539	33.4	0.0	33.4	No	No	C
D	233	34.0	0.0	34.0	No	No	C
E	165	46.2	0.0	46.2	No	No	C
F	216	0.0	0.0	0.0	No	No	A
G	589	0.0	0.0	0.0	No	No	A
H	128	51.3	0.0	51.3	No	No	C
I	525	7.1	0.0	7.1	No	No	A
J	1011	13.7	0.0	13.7	No	No	A
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	34.0		33.4	37.7		0.0	46.2	7.1	0.0	51.3	13.7	0.0
Level of Service (LOS)	C		C	D			D	A	A	D	B	A
Approach Delay, s/veh / LOS	33.6	C		37.7	D		12.5	B		11.8	B	
Intersection Delay, s/veh / LOS	19.4						B					

Interchange Graphic



HCS7 Two-Way Stop-Control Report

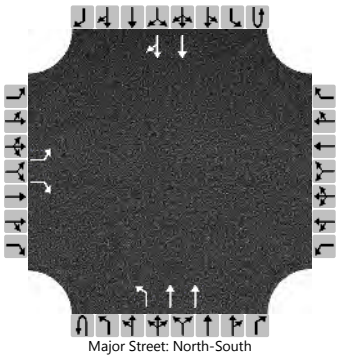
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at Spencer Park
Jurisdiction	Sioux Falls, SD
East/West Street	Spencer Park Road
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration		L		R						L	T				T	TR
Volume (veh/h)		5		5					0	5	2035				825	5
Percent Heavy Vehicles (%)		2		2					2	2						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized		No														
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)		7.5		6.9						4.1						
Critical Headway (sec)		6.84		6.94						4.14						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.52		3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		6		6						6						
Capacity, c (veh/h)		158		547						736						
v/c Ratio		0.04		0.01						0.01						
95% Queue Length, Q_{95} (veh)		0.1		0.0						0.0						
Control Delay (s/veh)		28.6		11.6						9.9						
Level of Service (LOS)		D		B						A						
Approach Delay (s/veh)		20.1								0.0						
Approach LOS		C														

HCS7 Two-Way Stop-Control Report

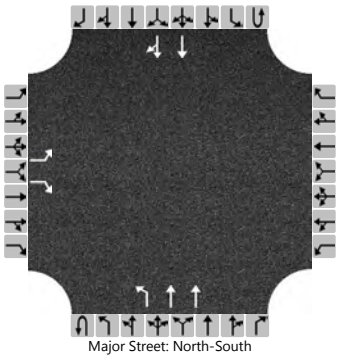
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	Cliff Ave at Spencer Park
Jurisdiction	Sioux Falls, SD
East/West Street	Spencer Park Road
North/South Street	Cliff Avenue
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	0	1		0	0	0	0	1	2	0	0	0	2	0
Configuration		L		R						L	T				T	TR
Volume (veh/h)		5		20					0	20	875				1785	25
Percent Heavy Vehicles (%)		2		2					2	2						
Proportion Time Blocked																
Percent Grade (%)	0															
Right Turn Channelized	No															
Median Type | Storage	Left Only								1							

Critical and Follow-up Headways

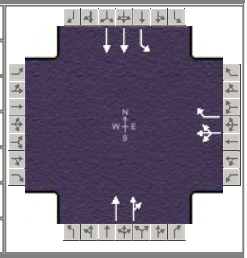
Base Critical Headway (sec)		7.5		6.9						4.1						
Critical Headway (sec)		6.84		6.94						4.14						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.52		3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		6		22						22						
Capacity, c (veh/h)		75		239						280						
v/c Ratio		0.07		0.09						0.08						
95% Queue Length, Q_{95} (veh)		0.2		0.3						0.3						
Control Delay (s/veh)		56.7		21.6						19.0						
Level of Service (LOS)		F		C						C						
Approach Delay (s/veh)	28.6								0.4							
Approach LOS	D															

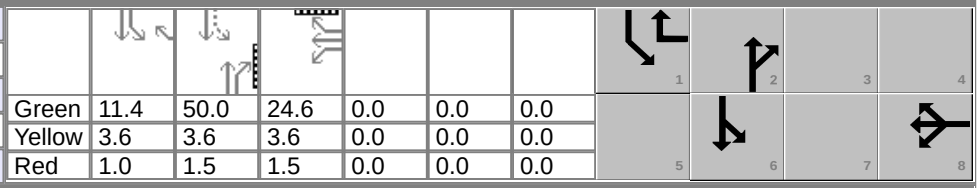
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2024	Analysis Period	1> 7:15
Intersection	49th Street	File Name	18 Cliff at 49th 2024 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				40	0	660		1335	15	200	645	

Signal Information			
Cycle, s	100.7	Reference Phase	2
Offset, s	109	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	11.4	50.0	24.6	0.0	0.0	0.0						
Yellow	3.6	3.6	3.6	0.0	0.0	0.0						
Red	1.0	1.5	1.5	0.0	0.0	0.0						

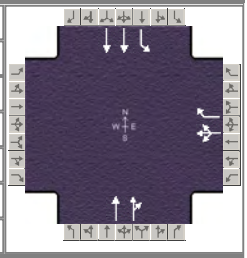
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase				8		2	1	6
Case Number				11.0		8.3	1.0	4.0
Phase Duration, s				29.7		55.1	16.0	71.1
Change Period, (*Y+R c*), s				5.1		5.1	4.6	5.1
Max Allow Headway (*MAH*), s				5.3		3.0	5.1	3.0
Queue Clearance Time (*g s*), s				20.9		72.4	10.1	10.8
Green Extension Time (*g e*), s				3.7		0.0	1.3	6.1
Phase Call Probability				1.00		1.00	1.00	1.00
Max Out Probability				0.00		1.00	0.00	0.01

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement				3	8	18		2	12	1	6	
Adjusted Flow Rate (*v*), veh/h					198	358		751	749	222	717	
Adjusted Saturation Flow Rate (*s*), veh/h/ln					1635	1585		1870	1863	1781	1781	
Queue Service Time (*g s*), s					11.8	18.9		70.4	34.1	8.1	8.8	
Cycle Queue Clearance Time (*g c*), s					11.8	18.9		70.4	34.1	8.1	8.8	
Green Ratio (*g/C*)					0.24	0.36		0.50	0.50	0.63	0.65	
Capacity (*c*), veh/h					399	565		928	925	272	2332	
Volume-to-Capacity Ratio (*X*)					0.496	0.633		0.809	0.810	0.816	0.307	
Back of Queue (*Q*), ft/ln (95 th percentile)					229.8	292.7		545	536.2	249.3	134.7	
Back of Queue (*Q*), veh/ln (95 th percentile)					9.2	11.5		21.5	21.4	9.8	5.3	
Queue Storage Ratio (*RQ*) (95 th percentile)					0.00	1.30		0.00	0.00	0.64	0.00	
Uniform Delay (*d 1*), s/veh					41.6	26.9		21.3	21.4	29.9	7.5	
Incremental Delay (*d 2*), s/veh					1.4	1.7		5.0	5.1	8.2	0.0	
Initial Queue Delay (*d 3*), s/veh					0.0	0.0		0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh					42.9	28.6		26.4	26.5	38.1	7.5	
Level of Service (LOS)					D	C		C	C	D	A	
Approach Delay, s/veh / LOS	0.0			33.7		C	26.4		C	14.8		B
Intersection Delay, s/veh / LOS	24.1						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.15	B	2.32	B	2.18	B	1.35	A
Bicycle LOS Score / LOS			1.40	A	1.73	B	1.26	A

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	Cliff Avenue	Analysis Year	2024	Analysis Period	1> 16:30
Intersection	49th Street	File Name	18 Cliff at 49th 2024 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				50	0	205		620	55	500	1380	

Signal Information			
Cycle, s	70.1	Reference Phase	2
Offset, s	6	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4
Green	19.3	27.1	8.9	0.0	0.0	0.0	5	6	7	8
Yellow	3.6	3.6	3.6	0.0	0.0	0.0				
Red	1.0	1.5	1.5	0.0	0.0	0.0				

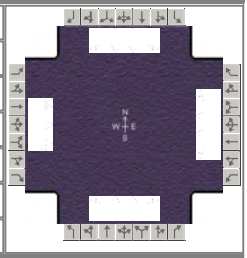
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase				8		2	1	6
Case Number				11.0		8.3	1.0	4.0
Phase Duration, s				14.0		32.2	23.9	56.1
Change Period, ($Y+R_c$), s				5.1		5.1	4.6	5.1
Max Allow Headway (*MAH*), s				5.2		3.0	5.1	3.0
Queue Clearance Time (g_s), s				8.1		22.3	15.3	16.4
Green Extension Time (g_e), s				0.8		4.2	3.9	7.1
Phase Call Probability				1.00		1.00	1.00	1.00
Max Out Probability				0.50		0.05	0.00	0.03

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement				3	8	18		2	12	1	6	
Adjusted Flow Rate (*v*), veh/h					147	137		380	370	556	1533	
Adjusted Saturation Flow Rate (*s*), veh/h/ln					1670	1585		1870	1816	1781	1781	
Queue Service Time (g_s), s					6.1	5.8		20.3	11.0	13.3	14.4	
Cycle Queue Clearance Time (g_c), s					6.1	5.8		20.3	11.0	13.3	14.4	
Green Ratio (*g/C*)					0.13	0.13		0.39	0.39	0.69	0.73	
Capacity (*c*), veh/h					212	201		723	702	661	2592	
Volume-to-Capacity Ratio (*X*)					0.693	0.680		0.526	0.527	0.840	0.592	
Back of Queue (*Q*), ft/ln (95 th percentile)					125.7	109.4		194.5	186.9	214	138.5	
Back of Queue (*Q*), veh/ln (95 th percentile)					5.0	4.3		7.7	7.5	8.4	5.5	
Queue Storage Ratio (*RQ*) (95 th percentile)					0.00	0.49		0.00	0.00	0.55	0.00	
Uniform Delay (d_1), s/veh					32.0	29.3		16.6	16.6	14.1	4.6	
Incremental Delay (d_2), s/veh					5.7	5.6		0.2	0.2	4.2	0.3	
Initial Queue Delay (d_3), s/veh					0.0	0.0		0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh					37.7	34.9		16.8	16.8	18.3	4.8	
Level of Service (LOS)					D	C		B	B	B	A	
Approach Delay, s/veh / LOS	0.0			36.4		D	16.8		B	8.4		A
Intersection Delay, s/veh / LOS	12.9						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.14	B	2.31	B	1.90	B	1.32	A
Bicycle LOS Score / LOS			0.96	A	1.11	A	2.21	B

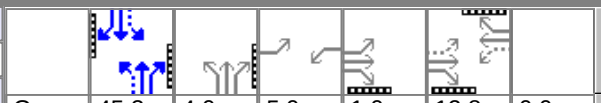
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls	Time Period	AM	PHF	0.90
Urban Street	Western Avenue	Analysis Year	2024	Analysis Period	1> 7:15
Intersection	49th Street	File Name	19-20-21-22 Western 2024 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				

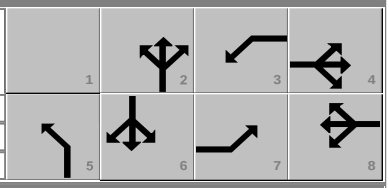


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	110	205	95	75	280	185	265	710	165	60	400	60

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	21	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	45.3	4.0	5.0	1.0	12.8	0.0
Yellow	3.9	4.0	3.6	0.0	3.6	0.0
Red	2.0	2.0	1.4	0.0	1.4	0.0



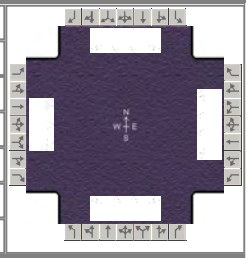
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2		6
Case Number	1.1	4.0	1.1	3.0	1.0	3.0		5.3
Phase Duration, s	11.0	18.8	10.0	17.8	10.0	61.2		51.2
Change Period, ($Y+R_c$), s	5.0	5.0	5.0	5.0	6.0	6.0		5.9
Max Allow Headway (*MAH*), s	3.1	5.1	3.1	5.1	3.1	0.0		0.0
Queue Clearance Time (g_s), s	7.4	9.3	5.6	9.6	2.0			
Green Extension Time (g_e), s	0.0	3.4	0.1	3.2	0.8	0.0		0.0
Phase Call Probability	0.95	1.00	0.88	1.00	1.00			
Max Out Probability	1.00	0.28	0.00	0.36	1.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	122	153	147	83	311	122	294	789	128	112	745	84
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1673	1734	1734	1543	1734	1734	1543	687	1734	1543
Queue Service Time (g_s), s	5.4	7.0	7.3	3.6	7.6	6.6	0.0	10.2	3.1	9.2	7.8	1.8
Cycle Queue Clearance Time (g_c), s	5.4	7.0	7.3	3.6	7.6	6.6	0.0	10.2	3.1	20.1	7.8	1.8
Green Ratio (*g/C*)	0.21	0.15	0.15	0.20	0.14	0.14	0.53	0.61	0.61	0.50	0.50	0.50
Capacity (*c*), veh/h	257	279	256	230	493	219	439	2127	947	348	1746	777
Volume-to-Capacity Ratio (*X*)	0.475	0.550	0.572	0.362	0.632	0.557	0.671	0.371	0.135	0.322	0.427	0.108
Back of Queue (*Q*), ft/ln (95 th percentile)	101.6	146.8	142	68.7	149.4	120	249.8	159.5	45.1	72.3	108.7	27.5
Back of Queue (*Q*), veh/ln (95 th percentile)	4.0	5.8	5.6	2.7	5.9	4.7	9.8	6.3	1.8	2.8	4.3	1.1
Queue Storage Ratio (*RQ*) (95 th percentile)	0.41	0.00	0.00	0.23	0.00	0.48	1.00	0.00	0.38	0.29	0.00	0.11
Uniform Delay (d_1), s/veh	30.7	35.2	35.4	30.8	36.4	36.0	24.1	8.7	7.3	16.9	7.3	0.5
Incremental Delay (d_2), s/veh	0.5	2.4	2.9	0.4	1.9	3.1	3.2	0.5	0.3	2.0	0.6	0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	31.2	37.6	38.2	31.2	38.3	39.1	27.3	9.2	7.6	18.9	8.0	0.7
Level of Service (LOS)	C	D	D	C	D	D	C	A	A	B	A	A
Approach Delay, s/veh / LOS	36.0	D		37.3	D		13.4	B		8.6	A	
Intersection Delay, s/veh / LOS	19.0						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.52	C	2.47	B	2.49	B	2.35	B
Bicycle LOS Score / LOS	0.84	A	0.91	A	1.49	A	0.95	A

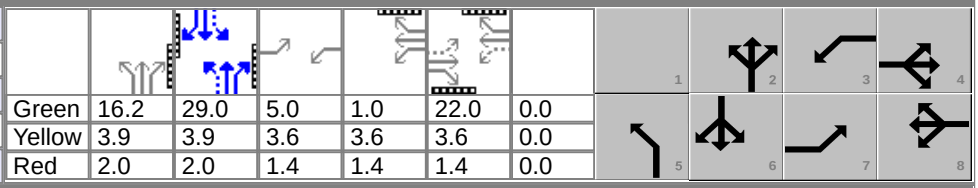
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls	Time Period	PM	PHF	0.90
Urban Street	Western Avenue	Analysis Year	2024	Analysis Period	1> 16:30
Intersection	49th Street	File Name	19-20-21-22 Western 2024 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	130	445	320	225	475	150	315	785	125	80	1075	65

Signal Information					EB			WB			NB			SB		
Cycle, s	100.0	Reference Phase	2		L	T	R	L	T	R	L	T	R	L	T	R
Offset, s	21	Reference Point	End	Green	16.2	29.0	5.0	1.0	22.0	0.0						
Uncoordinated	No	Simult. Gap E/W	On	Yellow	3.9	3.9	3.6	3.6	3.6	0.0						
Force Mode	Fixed	Simult. Gap N/S	On	Red	2.0	2.0	1.4	1.4	1.4	0.0						



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2		6
Case Number	1.1	4.0	1.1	3.0	1.0	3.0		5.3
Phase Duration, s	10.0	27.0	16.0	33.0	22.1	57.0		34.9
Change Period, ($Y+R_c$), s	5.0	5.0	5.0	5.0	5.9	5.9		5.9
Max Allow Headway (*MAH*), s	3.1	5.1	3.1	5.1	3.1	0.0		0.0
Queue Clearance Time (g_s), s	7.0	22.5	12.9	14.9	15.8			
Green Extension Time (g_e), s	0.0	0.0	0.0	6.8	0.4	0.0		0.0
Phase Call Probability	0.98	1.00	1.00	1.00	1.00			
Max Out Probability	1.00	1.00	1.00	0.54	0.20			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	144	377	340	250	528	111	350	872	111	66	881	29
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1821	1629	1734	1734	1543	1734	1734	1543	635	1734	1543
Queue Service Time (g_s), s	5.0	20.4	20.5	10.9	12.9	5.6	13.8	16.4	3.8	5.7	24.3	1.1
Cycle Queue Clearance Time (g_c), s	5.0	20.4	20.5	10.9	12.9	5.6	13.8	16.4	3.8	5.7	24.3	1.1
Green Ratio (*g/C*)	0.27	0.22	0.22	0.35	0.28	0.28	0.47	0.51	0.51	0.29	0.29	0.29
Capacity (*c*), veh/h	273	401	358	273	971	432	382	1772	789	256	1007	448
Volume-to-Capacity Ratio (*X*)	0.529	0.941	0.948	0.914	0.544	0.257	0.915	0.492	0.141	0.256	0.875	0.064
Back of Queue (*Q*), ft/ln (95 th percentile)	38	455.9	429.4	281.4	232.8	94.9	295.6	265.7	60.9	39.6	406.2	19.2
Back of Queue (*Q*), veh/ln (95 th percentile)	1.5	17.9	16.9	11.1	9.2	3.7	11.6	10.5	2.4	1.6	16.0	0.8
Queue Storage Ratio (*RQ*) (95 th percentile)	0.15	0.00	0.00	0.94	0.00	0.38	0.99	0.00	0.51	0.16	0.00	0.08
Uniform Delay (d_1), s/veh	31.6	38.4	38.4	27.5	30.6	27.9	23.3	16.0	12.9	17.2	34.6	20.9
Incremental Delay (d_2), s/veh	1.0	30.5	34.3	32.2	0.8	0.4	18.4	1.0	0.4	1.9	8.4	0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	32.6	68.9	72.8	59.7	31.4	28.4	41.7	17.0	13.3	19.0	43.0	21.1
Level of Service (LOS)	C	E	E	E	C	C	D	B	B	B	D	C
Approach Delay, s/veh / LOS	64.3	E		39.0	D		23.1	C		40.8	D	
Intersection Delay, s/veh / LOS	39.6						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.48	B	2.48	B	2.48	B	2.46	B
Bicycle LOS Score / LOS	1.20	A	1.22	A	1.59	B	1.58	B

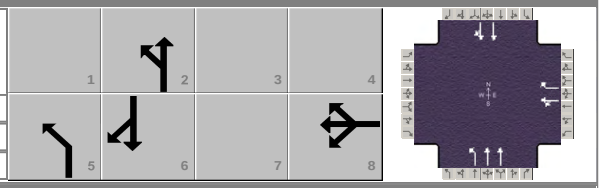
HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc.			Interchange Type	Diamond
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Segment Distance, ft	700
Jurisdiction	Sioux Falls	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 North Ramp	PHF	0.90	Arterial Direction	North-South
File Name	19-20-21-22 Western 2024 AM.xus				
Project Description	BUILD - I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h				290	0	470	100	970			520	130
Intersection Two Demand (*v*), veh/h	320	0	150					750	295	155	655	

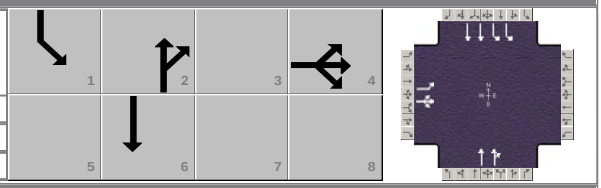
Signal One Information	
Cycle, s	90.0
Offset, s	48
Uncoordinated	No
Force Mode	Fixed

Green	4.9	40.8	26.3	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0



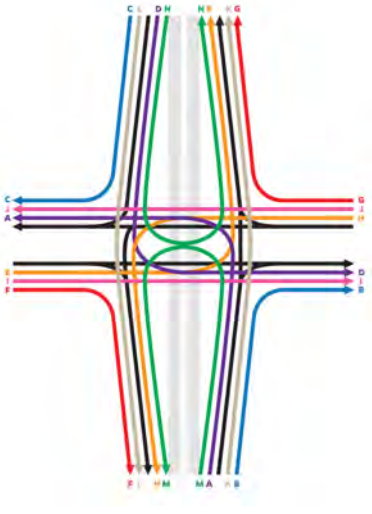
Signal Two Information	
Cycle, s	90.0
Offset, s	48
Uncoordinated	No
Force Mode	Fixed

Green	5.9	50.5	16.8	0.0	0.0	0.0
Yellow	3.9	3.9	3.6	0.0	0.0	0.0
Red	1.8	1.8	1.9	0.0	0.0	0.0



Interchange Results

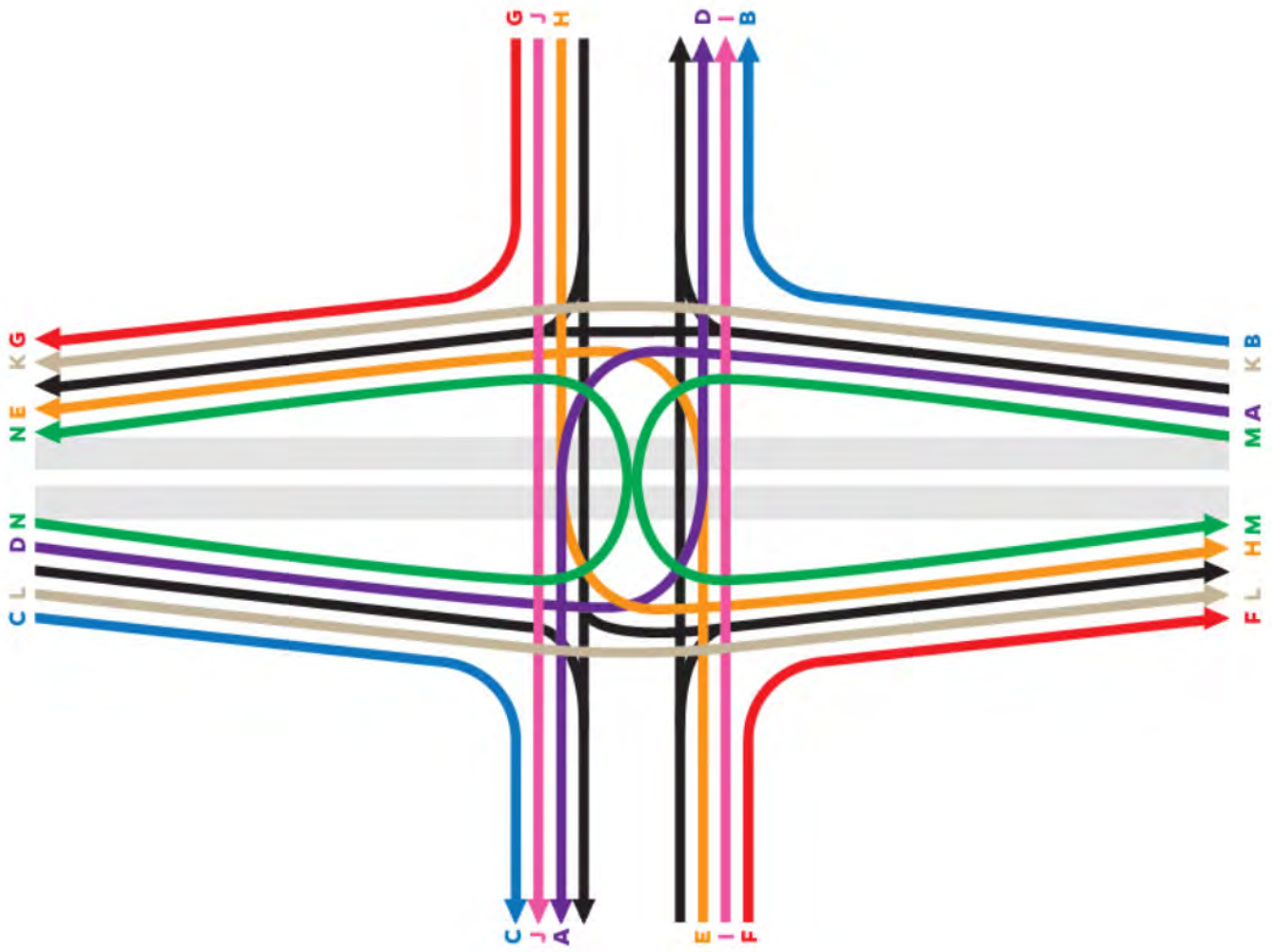
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	0	19.2	0.0	19.2	No	No	B
B	0	0.0	0.0	0.0	No	No	A
C	0	0.0	0.0	0.0	No	No	A
D	0	14.7	0.0	14.7	No	No	A
E	0	9.1	0.0	9.1	No	No	A
F	0	9.1	0.0	9.1	No	No	A
G	0	0.0	0.0	0.0	No	No	A
H	0	1.4	0.0	1.4	No	No	A
I	1115	23.8	0.0	23.8	No	No	B
J	636	20.6	0.0	20.6	No	No	B
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh					29.5	34.5	12.1	9.1			19.2	18.0
Level of Service (LOS)					C	C	B	A			B	B
Approach Delay, s/veh / LOS	0.0			32.2		C	9.4		A	18.6		B
Intersection Delay, s/veh / LOS	18.2						B					

Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	40.7	40.4						14.7	12.0	31.8	1.4	
Level of Service (LOS)	D	D						B	B	C	A	
Approach Delay, s/veh / LOS	40.6		D	0.0			13.4		B	7.2		A
Intersection Delay, s/veh / LOS	16.3						B					

Interchange Graphic



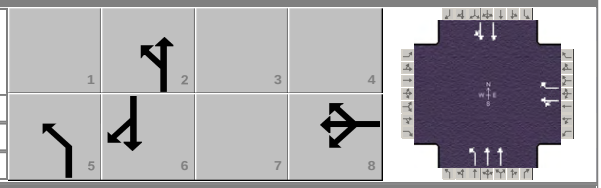
HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc.			Interchange Type	Diamond
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Segment Distance, ft	700
Jurisdiction	Sioux Falls	Duration, h	0.25	Freeway Direction	East-West
Intersection	I-229 North Ramp	PHF	0.90	Arterial Direction	North-South
File Name	19-20-21-22 Western 2024 PM.xus				
Project Description	BUILD - I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h				310	5	480	180	860			1275	335
Intersection Two Demand (*v*), veh/h	230	5	110					810	325	495	1090	

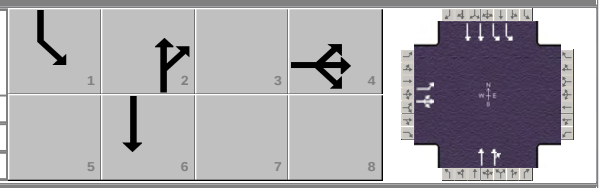
Signal One Information	
Cycle, s	100.0
Offset, s	2
Uncoordinated	No
Force Mode	Fixed

Green	10.6	38.3	33.2	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0



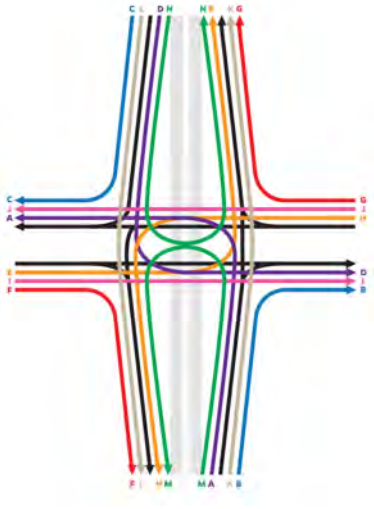
Signal Two Information	
Cycle, s	100.0
Offset, s	2
Uncoordinated	No
Force Mode	Fixed

Green	53.9	13.2	16.0	0.0	0.0	0.0
Yellow	3.9	3.9	3.6	0.0	0.0	0.0
Red	1.8	1.8	1.9	0.0	0.0	0.0



Interchange Results

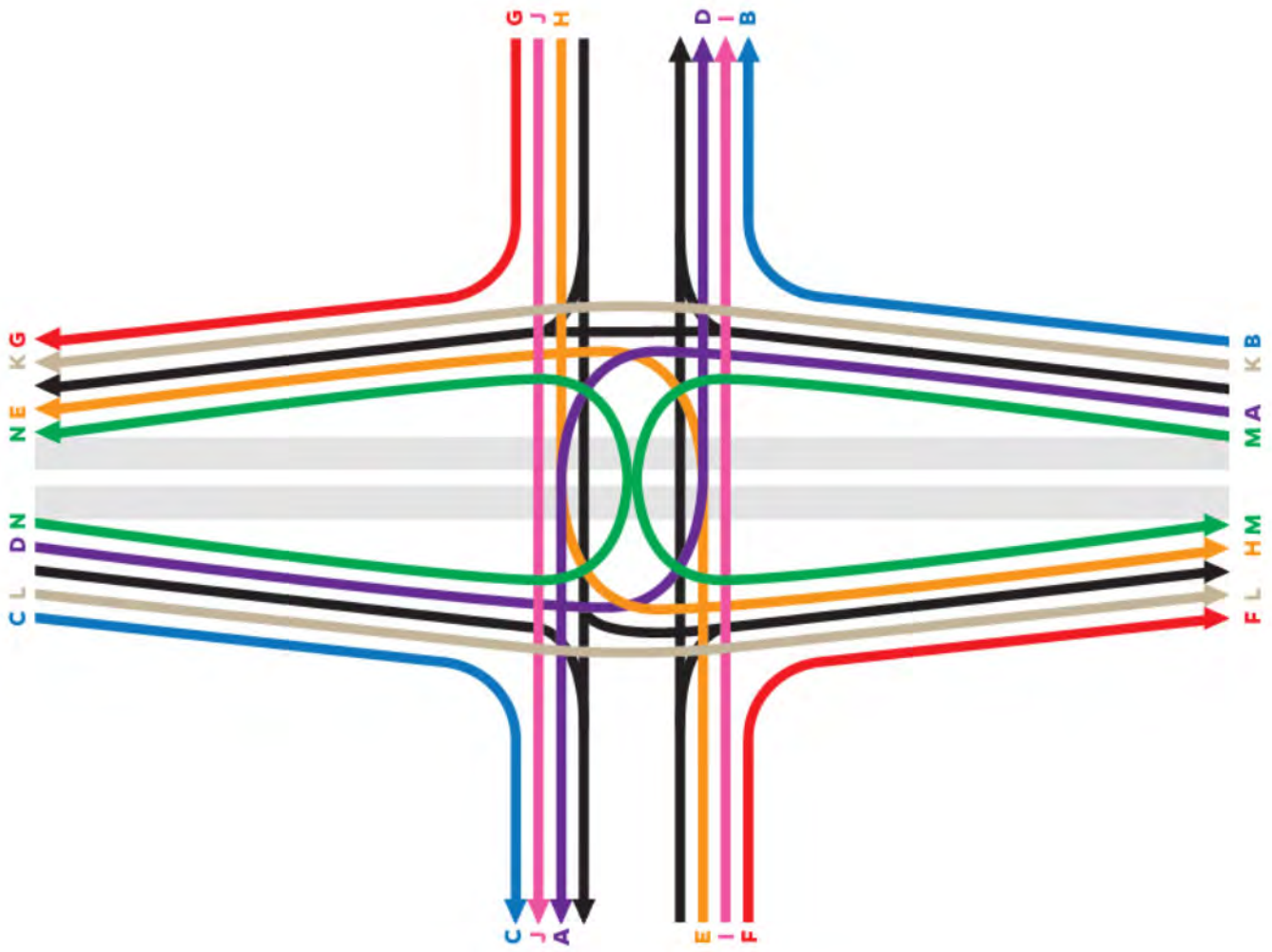
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	0	28.7	0.0	28.7	No	No	B
B	0	0.0	0.0	0.0	No	No	A
C	0	0.0	0.0	0.0	No	No	A
D	0	17.8	0.0	17.8	No	No	B
E	0	21.1	0.0	21.1	No	No	B
F	0	21.1	0.0	21.1	No	No	B
G	0	0.0	0.0	0.0	No	No	A
H	0	1.0	0.0	1.0	No	No	A
I	1097	38.9	0.0	38.9	No	No	C
J	669	29.7	0.0	29.7	No	No	B
K	0	-	0.0	-	-	-	-
L	0	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh					29.5	36.1	35.0	21.1			28.7	28.3
Level of Service (LOS)					C	D	D	C			C	C
Approach Delay, s/veh / LOS	0.0			33.1		C	23.5		C	28.5		C
Intersection Delay, s/veh / LOS	27.7						C					

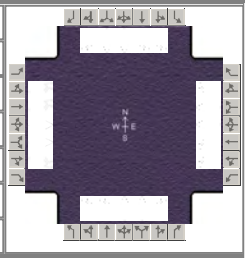
Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh	43.8	42.2						17.8	13.9	42.4	1.0	
Level of Service (LOS)	D	D						B	B	D	A	
Approach Delay, s/veh / LOS	43.1		D	0.0			15.9		B	13.9		B
Intersection Delay, s/veh / LOS	18.5						B					

Interchange Graphic



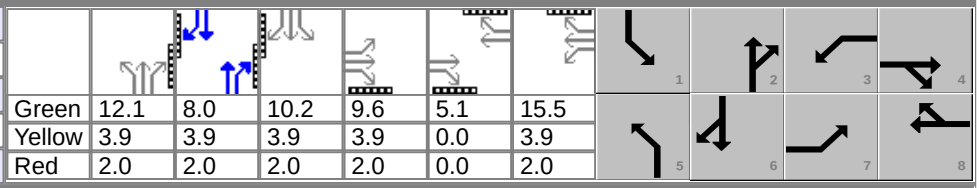
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls	Time Period	AM	PHF	0.90
Urban Street	Western Avenue	Analysis Year	2024	Analysis Period	1> 7:15
Intersection	57th Street	File Name	19-20-21-22 Western 2024 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	250	365	130	110	605	240	210	555	45	125	455	225

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	78	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	12.1	8.0	10.2	9.6	5.1	15.5
Yellow	3.9	3.9	3.9	3.9	0.0	3.9
Red	2.0	2.0	2.0	2.0	0.0	2.0

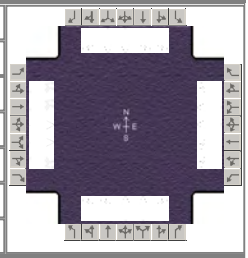
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	15.5	20.6	21.4	26.5	18.0	31.9	16.1	30.0
Change Period, ($Y+R_c$), s	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9
Max Allow Headway (*MAH*), s	2.6	5.0	4.7	4.7	2.6	0.0	5.0	0.0
Queue Clearance Time (g_s), s	9.2	12.0	4.8	18.7	11.6		5.4	
Green Extension Time (g_e), s	0.4	2.7	4.4	1.9	0.5	0.0	5.1	0.0
Phase Call Probability	1.00	1.00	0.95	1.00	1.00		0.97	
Max Out Probability	0.00	0.04	0.28	1.00	0.00		0.03	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	278	406	100	122	672	183	375	992	54	139	506	150
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1734	1543	1684	1734	1543	1684	1734	1543	1684	1734	1543
Queue Service Time (g_s), s	7.2	10.0	5.2	2.8	16.7	9.4	9.6	25.7	2.0	3.4	11.2	7.1
Cycle Queue Clearance Time (g_c), s	7.2	10.0	5.2	2.8	16.7	9.4	9.6	25.7	2.0	3.4	11.2	7.1
Green Ratio (*g/C*)	0.11	0.16	0.16	0.17	0.23	0.23	0.13	0.29	0.29	0.11	0.27	0.27
Capacity (*c*), veh/h	360	565	251	582	794	353	452	1001	445	382	929	413
Volume-to-Capacity Ratio (*X*)	0.773	0.718	0.398	0.210	0.847	0.519	0.830	0.991	0.120	0.363	0.544	0.363
Back of Queue (*Q*), ft/ln (95 th percentile)	136.1	194.9	88	51.2	308	154.9	142.4	413.9	33.5	65	212.8	128.1
Back of Queue (*Q*), veh/ln (95 th percentile)	5.4	7.7	3.5	2.0	12.1	6.1	5.6	16.3	1.3	2.6	8.4	5.0
Queue Storage Ratio (*RQ*) (95 th percentile)	0.44	0.00	0.35	0.20	0.00	0.60	0.41	0.00	0.26	0.52	0.00	1.03
Uniform Delay (d_1), s/veh	39.1	35.7	8.1	32.0	33.2	15.8	34.1	31.0	20.5	36.9	28.2	26.7
Incremental Delay (d_2), s/veh	1.3	2.4	1.4	0.1	7.7	1.6	0.7	17.3	0.3	0.8	2.3	2.5
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	40.5	38.1	9.5	32.0	40.9	17.4	34.8	48.3	20.7	37.7	30.5	29.2
Level of Service (LOS)	D	D	A	C	D	B	C	D	C	D	C	C
Approach Delay, s/veh / LOS	35.3	D		35.4	D		43.7	D		31.5	C	
Intersection Delay, s/veh / LOS	37.6						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.61	C	2.71	C	2.70	C	2.64	C
Bicycle LOS Score / LOS	1.13	A	1.29	A	1.22	A	1.14	A

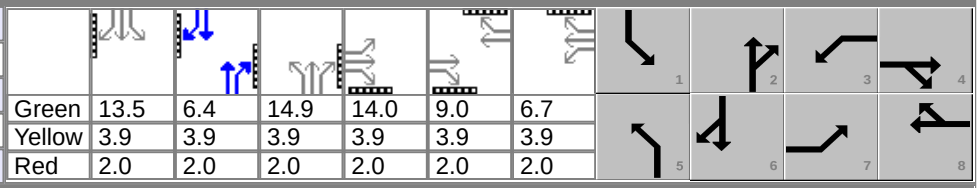
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls	Time Period	PM	PHF	0.90
Urban Street	Western Avenue	Analysis Year	2024	Analysis Period	1> 16:30
Intersection	57th Street	File Name	19-20-21-22 Western 2024 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	365	780	230	135	565	200	340	570	120	305	650	245

Signal Information			
Cycle, s	100.0	Reference Phase	2
Offset, s	32	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	13.5	6.4	14.9	14.0	9.0	6.7
Yellow	3.9	3.9	3.9	3.9	3.9	3.9
Red	2.0	2.0	2.0	2.0	2.0	2.0

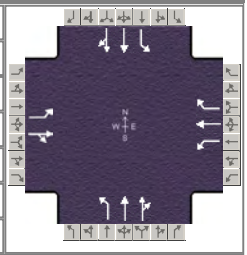
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	19.9	34.8	12.6	27.5	20.8	33.1	19.4	31.7
Change Period, ($Y+R_c$), s	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9
Max Allow Headway (*MAH*), s	2.6	5.0	4.6	4.6	2.6	0.0	5.0	0.0
Queue Clearance Time (g_s), s	13.8	25.7	6.3	19.3	15.0		11.7	
Green Extension Time (g_e), s	0.3	3.3	0.5	1.4	0.0	0.0	1.9	0.0
Phase Call Probability	1.00	1.00	0.98	1.00	1.00		1.00	
Max Out Probability	0.49	0.82	1.00	1.00	1.00		0.01	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	406	867	144	150	628	167	447	749	112	339	722	189
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1684	1734	1543	1684	1734	1543	1684	1734	1543	1684	1734	1543
Queue Service Time (g_s), s	11.8	23.7	7.3	4.3	17.3	9.5	13.0	20.0	5.2	9.7	19.5	10.3
Cycle Queue Clearance Time (g_c), s	11.8	23.7	7.3	4.3	17.3	9.5	13.0	20.0	5.2	9.7	19.5	10.3
Green Ratio (*g/C*)	0.14	0.29	0.29	0.07	0.22	0.22	0.15	0.27	0.27	0.14	0.26	0.26
Capacity (*c*), veh/h	473	1003	447	227	750	334	502	943	420	456	895	398
Volume-to-Capacity Ratio (*X*)	0.857	0.864	0.323	0.661	0.837	0.499	0.890	0.795	0.266	0.743	0.807	0.474
Back of Queue (*Q*), ft/ln (95 th percentile)	233.5	404.4	124.2	88.1	321.3	166.1	222.2	309.5	84.1	189.7	351.5	175
Back of Queue (*Q*), veh/ln (95 th percentile)	9.2	15.9	4.9	3.5	12.6	6.5	8.7	12.2	3.3	7.5	13.8	6.9
Queue Storage Ratio (*RQ*) (95 th percentile)	0.75	0.00	0.50	0.34	0.00	0.64	0.63	0.00	0.65	0.95	0.00	1.40
Uniform Delay (d_1), s/veh	42.0	33.7	27.9	45.5	37.5	34.4	40.4	33.5	3.5	41.6	34.8	3.0
Incremental Delay (d_2), s/veh	9.1	7.0	0.6	4.3	8.2	1.6	10.5	3.9	0.9	3.3	7.7	4.0
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	51.1	40.7	28.4	49.8	45.7	36.0	50.8	37.4	4.4	44.9	42.5	7.0
Level of Service (LOS)	D	D	C	D	D	D	D	D	A	D	D	A
Approach Delay, s/veh / LOS	42.4	D		44.7	D		39.1	D		37.8	D	
Intersection Delay, s/veh / LOS	40.8						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.65	C	2.70	C	2.65	C	2.74	C
Bicycle LOS Score / LOS	1.66	B	1.27	A	1.40	A	1.52	B

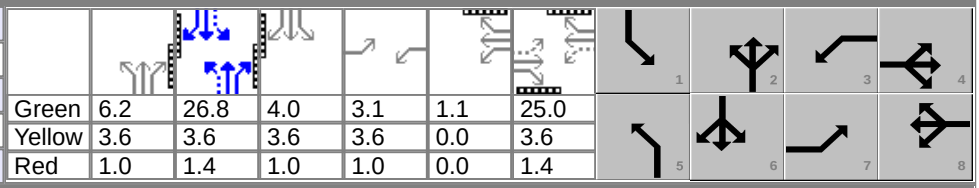
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	26th Street	Analysis Year	2024	Analysis Period	1> 7:15
Intersection	Cliff Avenue	File Name	23 26th at Cliff 2024 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	50	195	40	70	345	265	110	880	40	85	320	35

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	6.2	26.8	4.0	3.1	1.1	25.0
Yellow	3.6	3.6	3.6	3.6	0.0	3.6
Red	1.0	1.4	1.0	1.0	0.0	1.4

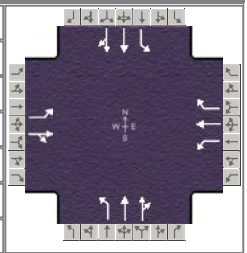
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	3.0	1.2	4.0	1.3	4.0
Phase Duration, s	7.7	30.0	8.8	31.1	10.8	42.6	8.6	40.4
Change Period, ($Y+R_c$), s	4.6	5.0	4.6	5.0	4.6	5.0	5.0	5.0
Max Allow Headway (*MAH*), s	4.2	6.2	4.2	6.2	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	4.0	12.6	4.9	19.0	6.2		2.0	
Green Extension Time (g_e), s	0.0	7.8	0.0	7.1	0.3	0.0	0.9	0.0
Phase Call Probability	0.75	1.00	0.86	1.00	0.95		0.91	
Max Out Probability	1.00	0.14	1.00	0.23	0.00		0.72	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	56	250		78	383	206	122	512	505	94	193	190
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1778		1734	1821	1543	1734	1821	1796	1734	1821	1774
Queue Service Time (g_s), s	2.0	10.6		2.9	17.0	9.8	4.2	20.5	20.5	0.0	6.5	6.5
Cycle Queue Clearance Time (g_c), s	2.0	10.6		2.9	17.0	9.8	4.2	20.5	20.5	0.0	6.5	6.5
Green Ratio (*g/C*)	0.31	0.28		0.32	0.29	0.29	0.39	0.42	0.42	0.32	0.39	0.39
Capacity (*c*), veh/h	218	494		341	529	448	424	761	750	243	717	699
Volume-to-Capacity Ratio (*X*)	0.255	0.506		0.228	0.725	0.459	0.288	0.673	0.673	0.389	0.269	0.272
Back of Queue (*Q*), ft/ln (95 th percentile)	39.2	208		53.5	314.4	134	76.2	363.7	354.4	91.2	129.6	126
Back of Queue (*Q*), veh/ln (95 th percentile)	1.5	8.2		2.1	12.4	5.3	3.0	14.3	14.2	3.6	5.1	5.0
Queue Storage Ratio (*RQ*) (95 th percentile)	0.30	0.00		0.47	0.00	1.16	0.44	0.00	0.00	0.61	0.00	0.00
Uniform Delay (d_1), s/veh	23.9	27.3		22.2	28.7	17.3	18.5	21.2	21.2	34.0	18.5	18.5
Incremental Delay (d_2), s/veh	0.6	1.7		0.3	4.0	1.6	0.4	4.7	4.8	1.0	0.9	1.0
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	24.5	29.0		22.5	32.7	18.9	18.9	25.9	26.0	35.0	19.4	19.5
Level of Service (LOS)	C	C		C	C	B	B	C	C	D	B	B
Approach Delay, s/veh / LOS	28.2	C		27.3	C		25.2	C		22.5	C	
Intersection Delay, s/veh / LOS	25.6						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.29	B	2.30	B	2.25	B	1.92	B
Bicycle LOS Score / LOS	0.99	A	1.59	B	1.43	A	0.88	A

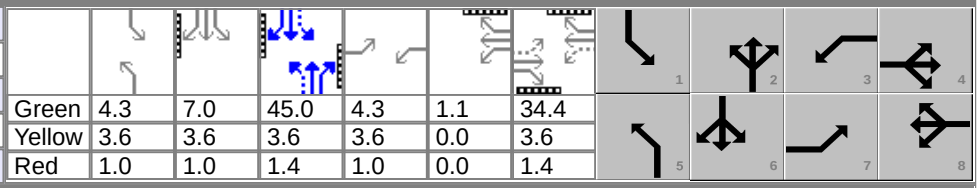
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	26th Street	Analysis Year	2024	Analysis Period	1> 16:30
Intersection	Cliff Avenue	File Name	23 26th at Cliff 2024 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	55	340	95	90	300	80	60	515	100	285	1040	70

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	4.3	7.0	45.0	4.3	1.1	34.4
Yellow	3.6	3.6	3.6	3.6	0.0	3.6
Red	1.0	1.0	1.4	1.0	0.0	1.4

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	8.9	39.4	10.0	40.5	8.9	50.0	20.5	61.7
Change Period, ($Y+R_c$), s	4.6	5.0	4.6	5.0	4.6	5.0	4.6	5.0
Max Allow Headway (*MAH*), s	4.2	6.2	4.2	6.2	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	5.0	33.4	6.9	20.9	4.8		14.7	
Green Extension Time (g_e), s	0.0	1.0	0.0	6.4	0.0	0.0	1.2	0.0
Phase Call Probability	0.87	1.00	0.96	1.00	0.89		1.00	
Max Out Probability	1.00	1.00	1.00	0.43	1.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	61	472		100	333	72	67	344	328	317	617	606
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1758		1734	1821	1543	1734	1821	1726	1734	1821	1786
Queue Service Time (g_s), s	3.0	31.4		4.9	18.9	4.1	2.8	17.5	17.6	12.7	32.4	32.5
Cycle Queue Clearance Time (g_c), s	3.0	31.4		4.9	18.9	4.1	2.8	17.5	17.6	12.7	32.4	32.5
Green Ratio (*g/C*)	0.32	0.29		0.33	0.30	0.30	0.41	0.38	0.38	0.52	0.47	0.47
Capacity (*c*), veh/h	250	504		161	539	457	207	684	648	465	860	843
Volume-to-Capacity Ratio (*X*)	0.245	0.936		0.621	0.619	0.158	0.323	0.504	0.506	0.680	0.717	0.718
Back of Queue (*Q*), ft/ln (95 th percentile)	58.4	605		108.4	349	73.2	55.3	324.7	308.4	227.9	540.5	524.6
Back of Queue (*Q*), veh/ln (95 th percentile)	2.3	23.8		4.3	13.7	2.9	2.2	12.8	12.3	9.0	21.3	21.0
Queue Storage Ratio (*RQ*) (95 th percentile)	0.45	0.00		0.94	0.00	0.64	0.32	0.00	0.00	1.52	0.00	0.00
Uniform Delay (d_1), s/veh	30.3	41.7		33.0	36.4	31.2	24.2	28.9	28.9	19.3	25.3	25.3
Incremental Delay (d_2), s/veh	0.5	25.4		7.1	3.1	0.3	0.9	2.6	2.8	1.8	5.1	5.2
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	30.8	67.2		40.1	39.5	31.6	25.1	31.5	31.7	21.1	30.4	30.5
Level of Service (LOS)	C	E		D	D	C	C	C	C	C	C	C
Approach Delay, s/veh / LOS	63.0	E		38.5	D		31.0	C		28.5	C	
Intersection Delay, s/veh / LOS	36.1						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.31	B	2.31	B	2.14	B	1.92	B
Bicycle LOS Score / LOS	1.37	A	1.32	A	1.10	A	1.76	B

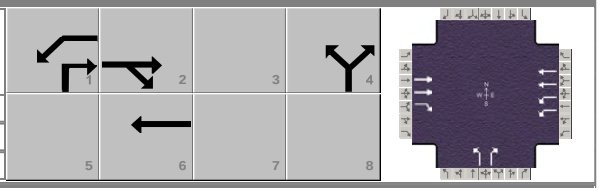
HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	Parclo AB-2Q
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Segment Distance, ft	1097
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	North-South
Intersection	SB I-229 Ramp	PHF	0.90	Arterial Direction	East-West
File Name	24-25-26 26th Street 2024 AM.xus				
Project Description	BUILD - I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h		315	65	660	780		155		195			
Intersection Two Demand (*v*), veh/h		415	95	335	1305		135	0	410			

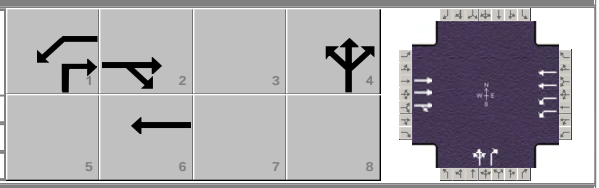
Signal One Information	
Cycle, s	90.0
Offset, s	0
Uncoordinated	No
Force Mode	Fixed

Green	44.0	18.5	11.6	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.9	1.9	1.3	0.0	0.0	0.0



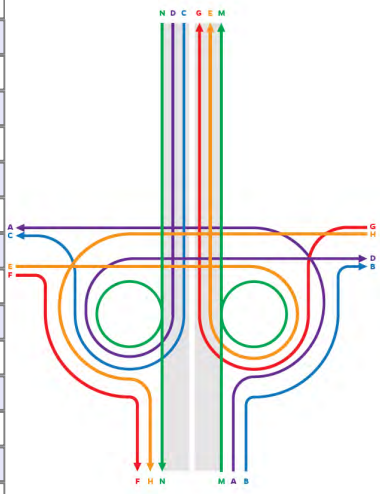
Signal Two Information	
Cycle, s	90.0
Offset, s	0
Uncoordinated	No
Force Mode	Fixed

Green	12.6	46.8	15.6	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.0	1.9	1.3	0.0	0.0	0.0



Interchange Results

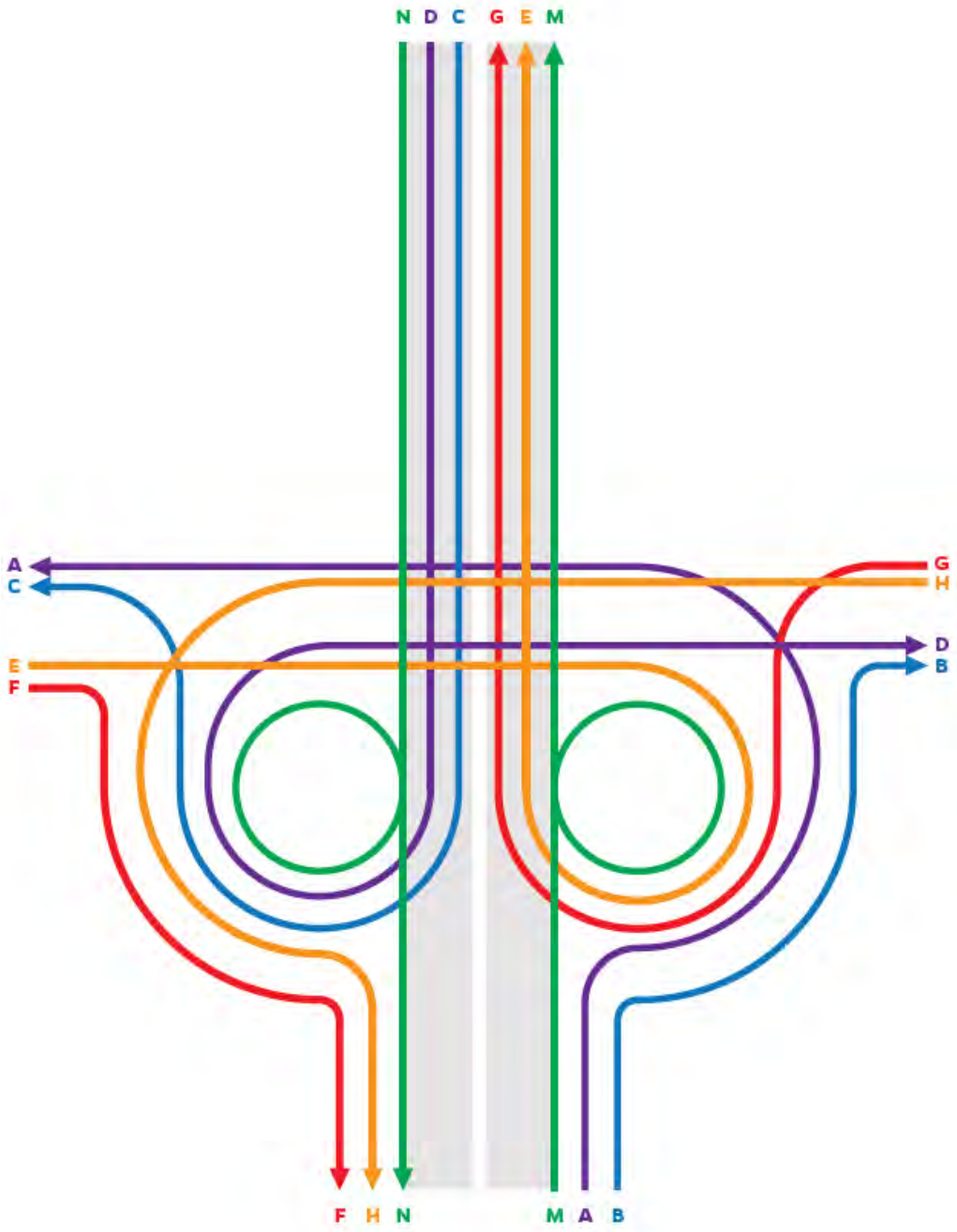
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	150	45.1	0.0	45.1	No	No	C
B	289	24.8	0.0	24.8	No	No	B
C	172	43.3	5.0	48.3	No	No	C
D	217	1.3	5.0	6.3	No	No	A
E	106	50.6	5.0	55.6	No	No	D
F	67	34.5	0.0	34.5	No	No	C
G	372	30.4	5.0	35.4	No	No	C
H	733	12.6	0.0	12.6	No	No	A
I	244	49.4	0.0	49.4	No	No	C
J	717	5.3	0.0	5.3	No	No	A
K	-	-	0.0	-	-	-	-
L	-	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh		34.5	31.5	11.3	4.0		43.3		0.0			
Level of Service (LOS)		C	C	B	A		D		A			
Approach Delay, s/veh / LOS	34.0	C		7.3	A		19.2	B		0.0		
Intersection Delay, s/veh / LOS	13.9						B					

Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh		14.9	16.1	30.4	1.3			41.2	24.8			
Level of Service (LOS)		B	B	C	A			D	C			
Approach Delay, s/veh / LOS	15.3	B		7.3	A		33.6	C		0.0		
Intersection Delay, s/veh / LOS	13.0						B					

Interchange Graphic



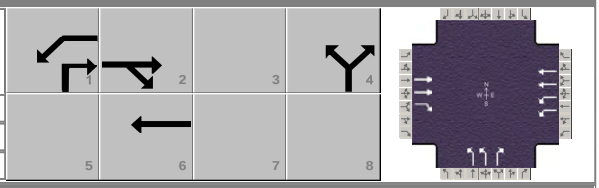
HCS7 Interchanges Results Summary

General Information				Interchange Information	
Agency	SEH Inc			Interchange Type	Parclo AB-2Q
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Segment Distance, ft	1097
Jurisdiction	Sioux Falls, SD	Duration, h	0.25	Freeway Direction	North-South
Intersection	SB I-229 Ramp	PHF	0.90	Arterial Direction	East-West
File Name	24-25-26 26th Street 2024 PM.xus				
Project Description	BUILD - I-229 Exits 3 and 4				

Demand	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Intersection One Demand (*v*), veh/h		880	70	520	630		155		490			
Intersection Two Demand (*v*), veh/h		1240	130	110	1090		60	0	765			

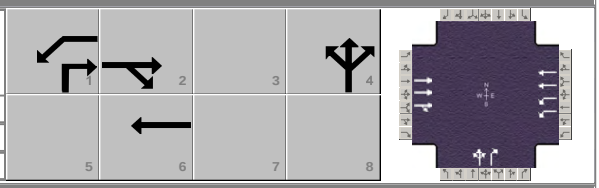
Signal One Information	
Cycle, s	110.0
Offset, s	0
Uncoordinated	No
Force Mode	Fixed

Green	52.5	32.5	9.1	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.9	1.9	1.3	0.0	0.0	0.0



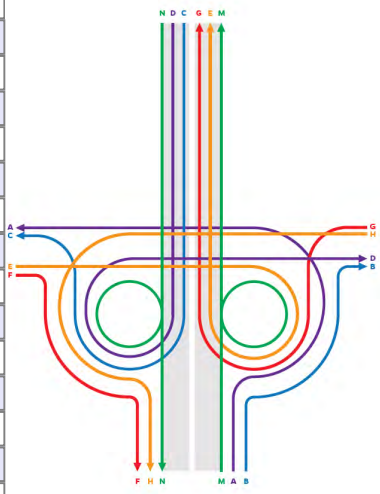
Signal Two Information	
Cycle, s	110.0
Offset, s	0
Uncoordinated	No
Force Mode	Fixed

Green	5.9	64.4	24.7	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.0	1.9	1.3	0.0	0.0	0.0



Interchange Results

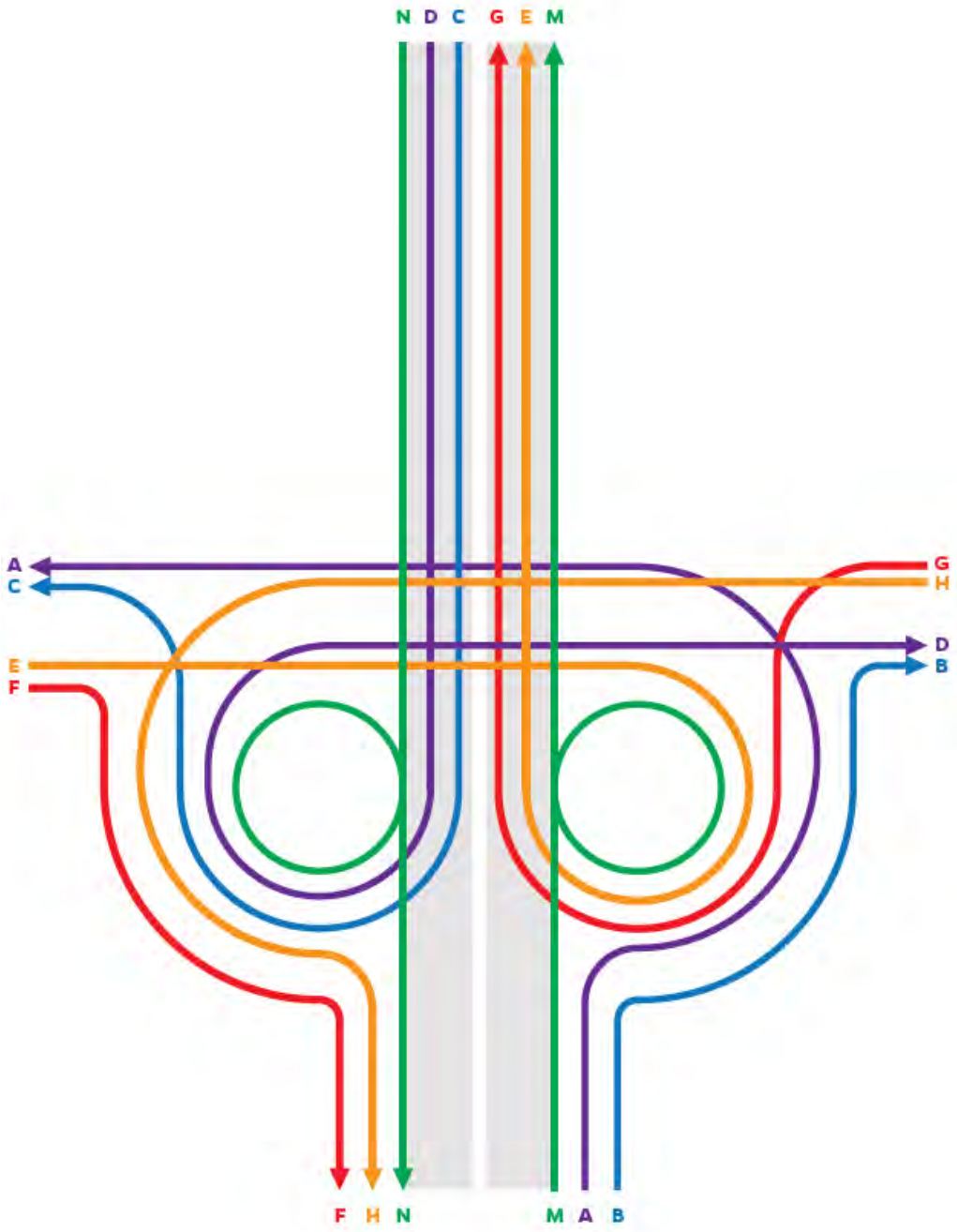
O-D	Demand (veh/h)	Delay (s)	EDTT	ETT	v/c > 1 ?	R_Q > 1 ?	LOS
A	67	55.3	0.0	55.3	No	No	D
B	517	46.6	0.0	46.6	No	No	C
C	172	52.9	5.0	57.9	No	No	D
D	544	1.4	5.0	6.4	No	No	A
E	144	30.3	5.0	35.3	No	No	C
F	72	22.5	0.0	22.5	No	No	B
G	122	50.4	5.0	55.4	No	No	D
H	578	31.9	0.0	31.9	No	No	C
I	833	31.7	0.0	31.7	No	No	C
J	633	3.8	0.0	3.8	No	No	A
K	-	-	0.0	-	-	-	-
L	-	-	0.0	-	-	-	-
M	0	-	0.0	-	-	-	-
N	0	-	0.0	-	-	-	-



Signalized Intersection One Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh		22.5	16.1	30.5	2.3		52.9		0.0			
Level of Service (LOS)		C	B	C	A		D		A			
Approach Delay, s/veh / LOS	22.0	C		15.1	B		12.7	B		0.0		
Intersection Delay, s/veh / LOS	16.9						B					

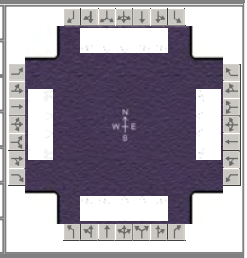
Signalized Intersection Two Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Control Delay (*d*) , s/veh		9.3	7.8	50.4	1.4			52.9	46.6			
Level of Service (LOS)		A	A	D	A			D	D			
Approach Delay, s/veh / LOS	8.8	A		5.9	A		49.3	D		0.0		
Intersection Delay, s/veh / LOS	14.5						B					

Interchange Graphic



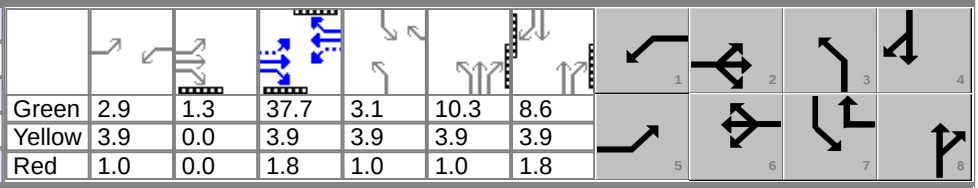
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	26th Street	Analysis Year	2024	Analysis Period	1> 7:15
Intersection	Southeastern Ave	File Name	24-25-26 26th Street 2024 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	80	600	145	45	1090	280	510	710	50	55	130	40

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	6	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	2.9	1.3	37.7	3.1	10.3	8.6
Yellow	3.9	0.0	3.9	3.9	3.9	3.9
Red	1.0	0.0	1.8	1.0	1.0	1.8

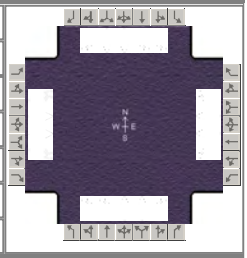
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6	3	8	7	4
Case Number	1.1	3.0	1.1	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	9.1	44.7	7.8	43.4	23.2	29.5	8.0	14.3
Change Period, ($Y+R_c$), s	4.9	5.7	4.9	5.7	4.9	5.7	4.9	5.7
Max Allow Headway (*MAH*), s	4.2	0.0	4.2	0.0	4.2	4.1	4.2	4.1
Queue Clearance Time (g_s), s	4.6		3.5		16.5	21.5	3.6	5.5
Green Extension Time (g_e), s	0.1	0.0	0.0	0.0	1.8	2.3	0.0	2.5
Phase Call Probability	0.89		0.71		1.00	1.00	0.78	1.00
Max Out Probability	1.00		0.34		0.14	0.70	1.00	0.59

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	89	667	161	50	1211	200	567	789	33	61	144	22
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1734		1734	1734	1543	1684	1734	1568	1684	1734	1568
Queue Service Time (g_s), s	2.6	9.0		1.5	28.1	7.3	14.5	19.5	1.4	1.6	3.5	1.2
Cycle Queue Clearance Time (g_c), s	2.6	9.0		1.5	28.1	7.3	14.5	19.5	1.4	1.6	3.5	1.2
Green Ratio (*g/C*)	0.47	0.43		0.45	0.42	0.45	0.20	0.26	0.26	0.03	0.10	0.10
Capacity (*c*), veh/h	209	1503		375	1453	700	686	917	415	117	332	150
Volume-to-Capacity Ratio (*X*)	0.425	0.444		0.133	0.834	0.286	0.826	0.860	0.080	0.521	0.436	0.148
Back of Queue (*Q*), ft/ln (95 th percentile)	48	138.1		26.2	448.5	122	260.4	345.7	24.1	32.9	69.8	20.8
Back of Queue (*Q*), veh/ln (95 th percentile)	1.9	5.4		1.0	17.7	4.8	10.3	13.6	1.0	1.3	2.7	0.8
Queue Storage Ratio (*RQ*) (95 th percentile)	0.11	0.00		0.10	0.00	0.49	0.61	0.00	0.10	0.09	0.00	0.10
Uniform Delay (d_1), s/veh	18.9	11.2		14.5	23.3	15.4	34.3	31.5	24.9	42.7	38.4	37.3
Incremental Delay (d_2), s/veh	1.3	0.9		0.2	5.8	1.0	4.0	6.6	0.1	3.6	0.9	0.5
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	20.2	12.1	0.0	14.7	29.1	16.5	38.3	38.1	24.9	46.3	39.3	37.8
Level of Service (LOS)	C	B	A	B	C	B	D	D	C	D	D	D
Approach Delay, s/veh / LOS	10.8	B		26.9	C		37.9	D		41.0	D	
Intersection Delay, s/veh / LOS	27.8						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.59	C	2.59	C	2.58	C	2.45	B
Bicycle LOS Score / LOS	1.24	A	1.69	B	1.63	B	0.68	A

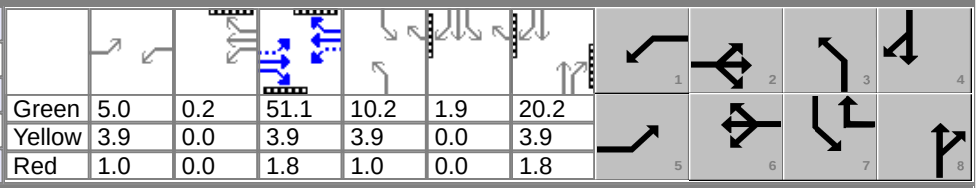
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	26th Street	Analysis Year	2024	Analysis Period	1> 16:30
Intersection	Southeastern Ave	File Name	24-25-26 26th Street 2024 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	90	1350	565	90	915	150	220	250	95	260	585	65

Signal Information			
Cycle, s	110.0	Reference Phase	2
Offset, s	83	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	5.0	0.2	51.1	10.2	1.9	20.2
Yellow	3.9	0.0	3.9	3.9	0.0	3.9
Red	1.0	0.0	1.8	1.0	0.0	1.8

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6	3	8	7	4
Case Number	1.1	3.0	1.1	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	9.9	56.8	10.2	57.1	15.1	25.9	17.1	27.9
Change Period, ($Y+R_c$), s	4.9	5.7	4.9	5.7	4.9	5.7	4.9	5.7
Max Allow Headway (*MAH*), s	4.2	0.0	4.2	0.0	4.2	4.1	4.2	4.1
Queue Clearance Time (g_s), s	5.2		5.3		9.8	9.8	11.2	22.3
Green Extension Time (g_e), s	0.1	0.0	0.2	0.0	0.4	3.5	1.0	0.0
Phase Call Probability	0.95		0.95		1.00	1.00	1.00	1.00
Max Out Probability	0.51		0.00		0.48	0.28	0.00	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	97	1455	609	100	1017	111	244	278	78	289	650	39
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1734		1734	1734	1543	1684	1734	1568	1684	1734	1568
Queue Service Time (g_s), s	3.2	42.4		3.3	24.3	3.6	7.8	7.8	4.7	9.2	20.3	2.2
Cycle Queue Clearance Time (g_c), s	3.2	42.4		3.3	24.3	3.6	7.8	7.8	4.7	9.2	20.3	2.2
Green Ratio (*g/C*)	0.51	0.46		0.51	0.47	0.58	0.09	0.18	0.18	0.11	0.20	0.20
Capacity (*c*), veh/h	271	1612		177	1619	892	314	638	288	373	698	316
Volume-to-Capacity Ratio (*X*)	0.358	0.903		0.564	0.628	0.125	0.779	0.436	0.270	0.775	0.931	0.123
Back of Queue (*Q*), ft/ln (95 th percentile)	57.2	607.2		64.3	387.7	57.9	159.5	154.1	82.9	183.8	400.4	39.2
Back of Queue (*Q*), veh/ln (95 th percentile)	2.3	23.9		2.5	15.3	2.3	6.3	6.1	3.3	7.2	15.8	1.6
Queue Storage Ratio (*RQ*) (95 th percentile)	0.13	0.00		0.26	0.00	0.23	0.38	0.00	0.33	0.49	0.00	0.20
Uniform Delay (d_1), s/veh	17.3	26.5		24.5	22.1	10.6	48.8	39.8	38.5	47.6	43.2	36.0
Incremental Delay (d_2), s/veh	0.6	6.3		2.8	1.9	0.3	5.0	0.5	0.5	3.5	19.1	0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	17.9	32.8	0.0	27.3	24.0	10.9	53.8	40.3	39.0	51.1	62.3	36.1
Level of Service (LOS)	B	C	A	C	C	B	D	D	D	D	E	D
Approach Delay, s/veh / LOS	22.9	C		23.0	C		45.6	D		57.9	E	
Intersection Delay, s/veh / LOS	32.6						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.60	C	2.60	C	2.53	C	2.45	B
Bicycle LOS Score / LOS	2.33	B	1.50	B	0.98	A	1.29	A

HCS7 Two-Way Stop-Control Report

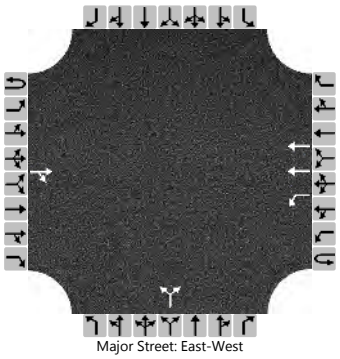
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	26th St at Yeager Rd
Jurisdiction	Sioux Falls, SD
East/West Street	26th Street
North/South Street	Yeager Road
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	1	2	0		0	1	0		0	0	0
Configuration				TR		L	T				LR					
Volume (veh/h)			335	5		120	815			25		45				
Percent Heavy Vehicles (%)						2				2		2				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized																
Median Type | Storage						Undivided										

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.5		6.9				
Critical Headway (sec)						4.14				6.84		6.94				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.22				3.52		3.32				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						133					78					
Capacity, c (veh/h)						1177					337					
v/c Ratio						0.11					0.23					
95% Queue Length, Q_{95} (veh)						0.4					0.9					
Control Delay (s/veh)						8.4					18.9					
Level of Service (LOS)						A					C					
Approach Delay (s/veh)						1.1				18.9						
Approach LOS										C						

HCS7 Two-Way Stop-Control Report

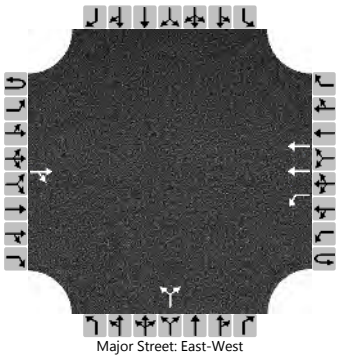
General Information

Analyst	Graham Johnson
Agency/Co.	SEH Inc.
Date Performed	5/6/19
Analysis Year	2024
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	BUILD - I-229 Exits 3 and 4

Site Information

Intersection	26th St at Yeager Rd
Jurisdiction	Sioux Falls, SD
East/West Street	26th Street
North/South Street	Yeager Road
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes


Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	1	2	0		0	1	0		0	0	0
Configuration				TR		L	T				LR					
Volume (veh/h)			830	10		170	615			25		120				
Percent Heavy Vehicles (%)						2				2		2				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized																
Median Type | Storage						Undivided										

Critical and Follow-up Headways

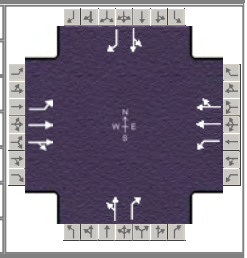
Base Critical Headway (sec)						4.1				7.5		6.9				
Critical Headway (sec)						4.14				6.84		6.94				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.22				3.52		3.32				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						189					161					
Capacity, c (veh/h)						729					177					
v/c Ratio						0.26					0.91					
95% Queue Length, Q_{95} (veh)						1.0					6.8					
Control Delay (s/veh)						11.7					98.8					
Level of Service (LOS)						B					F					
Approach Delay (s/veh)						2.5				98.8						
Approach LOS										F						

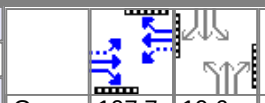
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	41st Street	Analysis Year	2024	Analysis Period	1> 7:15
Intersection	Norton Ave	File Name	28 41st at Norton 2024 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				

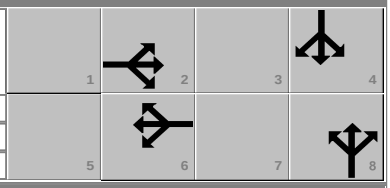


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	20	505	30	10	605	10	10	10	5	5	10	10

Signal Information			
Cycle, s	150.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	107.7	19.6	6.9	0.0	0.0	0.0						
Yellow	3.6	3.6	3.6	0.0	0.0	0.0						
Red	1.4	1.8	1.8	0.0	0.0	0.0						



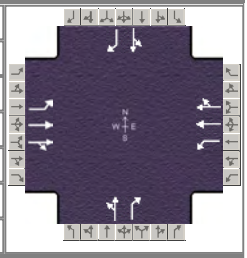
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		6.0		6.0		11.0		11.0
Phase Duration, s		112.7		112.7		12.3		25.0
Change Period, ($Y+R_c$), s		5.0		5.0		5.4		5.4
Max Allow Headway (*MAH*), s		0.0		0.0		5.2		5.2
Queue Clearance Time (g_s), s						3.8		3.2
Green Extension Time (g_e), s		0.0		0.0		0.1		0.1
Phase Call Probability						0.69		1.00
Max Out Probability						0.00		0.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	22	300	295	11	343	341		22	6		17	11
Adjusted Saturation Flow Rate (*s*), veh/h/ln	758	1821	1785	823	1821	1811		1777	1543		1791	1543
Queue Service Time (g_s), s	1.6	8.3	8.4	0.7	9.8	9.8		1.8	0.5		1.2	0.9
Cycle Queue Clearance Time (g_c), s	11.4	8.3	8.4	9.1	9.8	9.8		1.8	0.5		1.2	0.9
Green Ratio (*g/C*)	0.72	0.72	0.72	0.72	0.72	0.72		0.05	0.05		0.13	0.13
Capacity (*c*), veh/h	543	1308	1282	593	1308	1300		81	71		234	202
Volume-to-Capacity Ratio (*X*)	0.041	0.229	0.230	0.019	0.262	0.262		0.274	0.079		0.071	0.055
Back of Queue (*Q*), ft/ln (95 th percentile)	13.1	151.8	149.8	6.2	178.6	177.7		40.6	10		26.2	17.5
Back of Queue (*Q*), veh/ln (95 th percentile)	0.5	6.0	5.9	0.2	7.0	7.0		1.6	0.4		1.0	0.7
Queue Storage Ratio (*RQ*) (95 th percentile)	0.13	0.00	0.00	0.06	0.00	0.00		0.00	0.13		0.00	0.23
Uniform Delay (d_1), s/veh	9.3	7.1	7.1	8.7	7.3	7.3		69.2	68.5		57.2	57.1
Incremental Delay (d_2), s/veh	0.1	0.4	0.4	0.1	0.5	0.5		2.5	0.7		0.2	0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Control Delay (*d*), s/veh	9.4	7.5	7.5	8.7	7.8	7.8		71.7	69.2		57.4	57.3
Level of Service (LOS)	A	A	A	A	A	A		E	E		E	E
Approach Delay, s/veh / LOS	7.6	A		7.8	A		71.2	E		57.3	E	
Intersection Delay, s/veh / LOS	10.0						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.87	B	1.87	B	2.33	B	2.33	B
Bicycle LOS Score / LOS	1.00	A	1.06	A	0.53	A	0.53	A

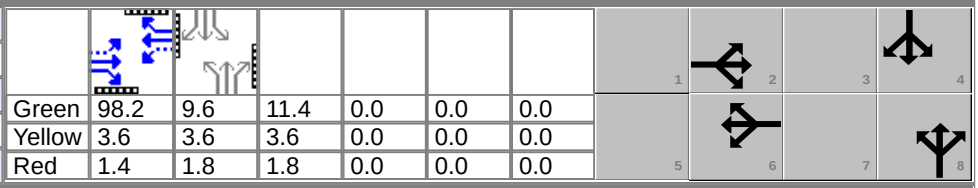
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	41st Street	Analysis Year	2024	Analysis Period	1> 16:30
Intersection	Norton Ave	File Name	28 41st at Norton 2024 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	35	910	60	20	810	25	75	30	40	20	25	40

Signal Information			
Cycle, s	135.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	98.2	9.6	11.4	0.0	0.0	0.0
Yellow	3.6	3.6	3.6	0.0	0.0	0.0
Red	1.4	1.8	1.8	0.0	0.0	0.0

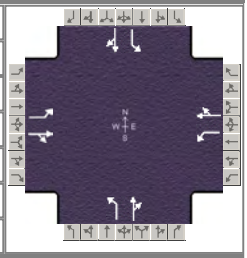
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		6.0		6.0		11.0		11.0
Phase Duration, s		103.2		103.2		16.8		15.0
Change Period, ($Y+R_c$), s		5.0		5.0		5.4		5.4
Max Allow Headway (*MAH*), s		0.0		0.0		5.2		5.3
Queue Clearance Time (g_s), s						10.8		5.6
Green Extension Time (g_e), s		0.0		0.0		0.7		0.3
Phase Call Probability						1.00		0.96
Max Out Probability						0.00		0.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	39	545	533	22	466	461		117	33		50	33
Adjusted Saturation Flow Rate (*s*), veh/h/ln	603	1821	1781	523	1821	1802		1758	1543		1782	1543
Queue Service Time (g_s), s	3.4	15.7	15.7	2.3	12.7	12.7		8.8	2.7		3.6	2.8
Cycle Queue Clearance Time (g_c), s	16.1	15.7	15.7	18.0	12.7	12.7		8.8	2.7		3.6	2.8
Green Ratio (*g/C*)	0.73	0.73	0.73	0.73	0.73	0.73		0.08	0.08		0.07	0.07
Capacity (*c*), veh/h	435	1325	1296	373	1325	1311		149	131		126	109
Volume-to-Capacity Ratio (*X*)	0.089	0.411	0.411	0.060	0.352	0.352		0.784	0.255		0.396	0.305
Back of Queue (*Q*), ft/ln (95 th percentile)	22.8	255.7	251.5	13.9	215.2	213.5		200	51.3		79.8	52.9
Back of Queue (*Q*), veh/ln (95 th percentile)	0.9	10.1	9.9	0.5	8.5	8.4		7.9	2.0		3.1	2.1
Queue Storage Ratio (*RQ*) (95 th percentile)	0.23	0.00	0.00	0.14	0.00	0.00		0.00	0.68		0.00	0.70
Uniform Delay (d_1), s/veh	9.7	7.2	7.2	10.7	6.7	6.7		60.6	57.8		60.0	59.6
Incremental Delay (d_2), s/veh	0.4	0.9	1.0	0.3	0.7	0.7		12.0	1.4		2.9	2.2
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Control Delay (*d*), s/veh	10.1	8.1	8.1	11.0	7.5	7.5		72.6	59.3		62.8	61.8
Level of Service (LOS)	B	A	A	B	A	A		E	E		E	E
Approach Delay, s/veh / LOS	8.2	A		7.6	A		69.7	E		62.4	E	
Intersection Delay, s/veh / LOS	13.9						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.88	B	1.88	B	2.33	B	2.32	B
Bicycle LOS Score / LOS	1.41	A	1.27	A	0.74	A	0.63	A

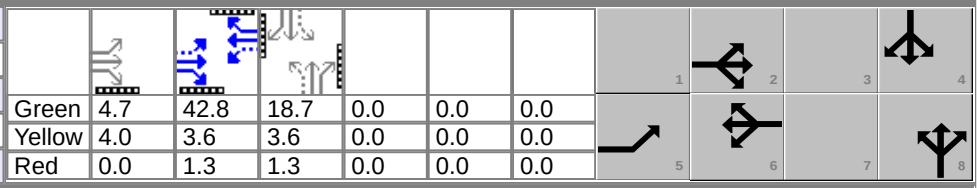
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM	PHF	0.90
Urban Street	41st Street	Analysis Year	2024	Analysis Period	1> 7:15
Intersection	Phillips Ave	File Name	29 41st at Phillips 2024 AM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	120	250	10	30	250	125	10	125	55	110	20	165

Signal Information			
Cycle, s	80.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	4.7	42.8	18.7	0.0	0.0	0.0
Yellow	4.0	3.6	3.6	0.0	0.0	0.0
Red	0.0	1.3	1.3	0.0	0.0	0.0

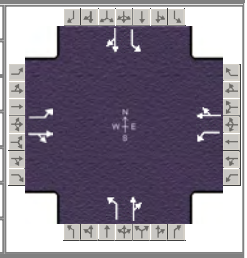
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		4
Case Number	1.0	4.0		6.3		6.0		6.0
Phase Duration, s	8.7	56.4		47.7		23.6		23.6
Change Period, ($Y+R_c$), s	4.0	4.9		4.9		4.9		4.9
Max Allow Headway (*MAH*), s	4.2	0.0		0.0		5.4		5.4
Queue Clearance Time (g_s), s	4.5					10.2		18.0
Green Extension Time (g_e), s	0.1	0.0		0.0		2.2		0.6
Phase Call Probability	0.95					1.00		1.00
Max Out Probability	1.00					0.33		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	133	289		33	417		11	200		122	172	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1809		1090	1718		1213	1726		1182	1574	
Queue Service Time (g_s), s	2.5	5.4		1.2	11.9		0.6	8.0		8.0	7.5	
Cycle Queue Clearance Time (g_c), s	2.5	5.4		1.2	11.9		8.2	8.0		16.0	7.5	
Green Ratio (*g/C*)	0.62	0.64		0.53	0.53		0.23	0.23		0.23	0.23	
Capacity (*c*), veh/h	567	1165		673	919		259	403		247	367	
Volume-to-Capacity Ratio (*X*)	0.235	0.248		0.050	0.453		0.043	0.496		0.494	0.469	
Back of Queue (*Q*), ft/ln (95 th percentile)	38.1	86.4		12.9	203.4		8.6	153.2		108.9	131.3	
Back of Queue (*Q*), veh/ln (95 th percentile)	1.5	3.4		0.5	8.0		0.3	6.0		4.3	5.2	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.29	0.00		0.22	0.00		0.14	0.00		0.73	0.00	
Uniform Delay (d_1), s/veh	7.7	6.0		8.9	11.4		29.9	26.6		33.5	26.4	
Incremental Delay (d_2), s/veh	0.2	0.5		0.1	1.6		0.1	1.3		2.2	1.3	
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh	7.9	6.5		9.1	13.0		30.0	27.9		35.7	27.7	
Level of Service (LOS)	A	A		A	B		C	C		D	C	
Approach Delay, s/veh / LOS	7.0	A		12.7	B		28.0	C		31.0	C	
Intersection Delay, s/veh / LOS	17.2						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.86	B	1.93	B	1.92	B	1.92	B
Bicycle LOS Score / LOS	1.18	A	1.23	A	0.84	A	0.97	A

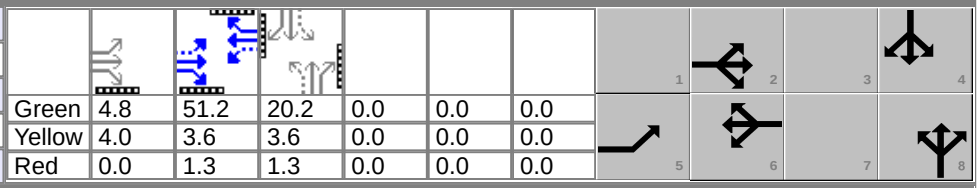
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SEH Inc.			Duration, h	0.25
Analyst	Graham Johnson	Analysis Date	Apr 22, 2019	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM	PHF	0.90
Urban Street	41st Street	Analysis Year	2024	Analysis Period	1> 16:30
Intersection	Phillips Ave	File Name	29 41st at Phillips 2024 PM.xus		
Project Description	BUILD - I-229 Exits 3 and 4				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	120	265	5	20	310	90	30	55	65	120	25	235

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	4.8	51.2	20.2	0.0	0.0	0.0
Yellow	4.0	3.6	3.6	0.0	0.0	0.0
Red	0.0	1.3	1.3	0.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		4
Case Number	1.0	4.0		6.3		6.0		6.0
Phase Duration, s	8.8	64.9		56.1		25.1		25.1
Change Period, ($Y+R_c$), s	4.0	4.9		4.9		4.9		4.9
Max Allow Headway (*MAH*), s	4.2	0.0		0.0		5.4		5.4
Queue Clearance Time (g_s), s	4.7					16.5		17.0
Green Extension Time (g_e), s	0.4	0.0		0.0		3.1		3.1
Phase Call Probability	0.96					1.00		1.00
Max Out Probability	0.00					0.05		0.05

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	133	300		22	444		33	133		133	233	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1734	1815		1079	1750		1147	1659		1256	1572	
Queue Service Time (g_s), s	2.7	5.9		0.8	13.2		2.5	6.1		9.0	12.2	
Cycle Queue Clearance Time (g_c), s	2.7	5.9		0.9	13.2		14.5	6.1		15.0	12.2	
Green Ratio (*g/C*)	0.64	0.67		0.57	0.57		0.22	0.22		0.22	0.22	
Capacity (*c*), veh/h	570	1210		692	994		184	373		278	353	
Volume-to-Capacity Ratio (*X*)	0.234	0.248		0.032	0.447		0.181	0.358		0.479	0.661	
Back of Queue (*Q*), ft/ln (95 th percentile)	40.8	97.4		9	224.2		32.7	113.1		130.4	213.6	
Back of Queue (*Q*), veh/ln (95 th percentile)	1.6	3.8		0.4	8.8		1.3	4.5		5.1	8.4	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.31	0.00		0.15	0.00		0.55	0.00		0.87	0.00	
Uniform Delay (d_1), s/veh	7.7	6.0		8.6	11.2		38.3	29.4		35.7	31.8	
Incremental Delay (d_2), s/veh	0.2	0.5		0.1	1.5		0.7	0.8		1.8	3.0	
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay (*d*), s/veh	7.9	6.5		8.7	12.7		39.0	30.2		37.5	34.8	
Level of Service (LOS)	A	A		A	B		D	C		D	C	
Approach Delay, s/veh / LOS	6.9	A		12.5	B		32.0	C		35.8	D	
Intersection Delay, s/veh / LOS	19.0						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.86	B	1.95	B	1.93	B	1.93	B
Bicycle LOS Score / LOS	1.20	A	1.26	A	0.76	A	1.09	A

Appendix I

Traffic Forecasting Memorandum

To: Alan V. Murra, PE
SEH Inc

Cc: Graham Johnson, PE, PTOE, SEH Inc
Mark Dierling, PE, SEH Inc

From: Haifeng Xiao, PE, PTOE
HFTE, Inc

Date: June 3, 2019

Subject: Interchange and Environmental Study for I-229 Exits 3 (Minnesota Avenue) and 4 (Cliff Avenue)
Traffic Forecasts Memorandum

INTRODUCTION

The South Dakota Department of Transportation (SDDOT), in conjunction with the City of Sioux Falls, the Sioux Falls Metropolitan Organization (SF MPO) and the Federal Highway Administration (FHWA), is conducting the Interchange and Environmental Study for I-229 Exits 3 (Minnesota Avenue) & 4 (Cliff Avenue) in the City of Sioux Falls. **Figure1** illustrates the study location in the SF MPO area. Different interchange modification designs have been proposed for this study. Traffic forecasts and subsequent operations analysis are one of the major tasks to determine how the modified interchanges accommodate current and future travel demands.

The development of traffic forecasts was conducted largely based on the utilization of the latest SF MPO travel demand model. This memorandum summarizes the traffic forecast methodology, assumptions and results using the model.

STUDY LIMITS AND FORECAST SCENARIOS

To adequately identify the traffic impacts of the study interchanges modifications, their adjacent interchanges & ramps, arterial corridors and major intersections were included for analysis. **Figure 1** illustrates the study arterial roadway segments and intersections. They are listed as below:

- I-229 interchange ramps between Exit 2 and Exit 5 (~3.7 miles)
    - Exit 2 (Western Avenue) Interchange
    - Exit 3 (Minnesota Avenue) Interchange
    - Exit 4 (Cliff Avenue) Interchange
    - Exit 5 (26th Street) Interchange

- Minnesota Avenue between 37th Street and 57th Street (~1.25 miles)
    - 37th Street intersection

  - 41st Street intersection
  - 49th Street intersection
  - I-229 southbound ramps intersection
  - I-229 northbound ramps intersection
  - Yankton Trail Park Entrance intersection
  - Lotta Street intersection
  - 57th Street intersection

- Cliff Avenue between 33rd Street and 49th Street (~1.00 miles)
  - 33rd Street intersection
  - 36th Street intersection
  - 38th Street intersection
  - Lincoln High School Entrance #1
  - Lincoln High School Entrance #2
  - 41st Street/I-229 southbound exit ramp intersection
  - I-229 southbound entrance ramp intersection
  - I-229 northbound ramps intersection
  - Spencer Park Entrance intersection
  - 49th Street intersection

- Western Avenue between 49th Street and 57th Street (~0.60 miles)
  - 49th Street intersection
  - I-229 southbound ramps intersection
  - I-229 northbound ramps intersection
  - 57th Street intersection

- 26th Avenue between Cliff Avenue and Southeastern Avenue (~0.90 miles)
  - Cliff Avenue intersection
  - Yeager Road intersection
  - I-229 northbound ramps intersection
  - Southeastern Avenue intersection

- Yeager Road between I-229 Exit 5 ramp terminal and 26th Street (~0.10 miles)
  - I-229 southbound ramps intersection

- 41st Street between Norton Avenue and Southeastern Avenue (~1.20 miles)
  - Norton Avenue intersection
  - Philips Avenue intersection

    SD 100 is expected to facilitate commercial and residential growth in the eastern section of the city of Sioux Falls. It will also serve as a second eastern bypass of the city, running roughly parallel to I-229 and about 2.5 miles (4.0 km) outside of it.

The SDDOT has been planning to build the SD 100 corridor between I-90 and I-229 for a long time. The SD 100, located about 2.5 miles outside of I-229, is expected to facilitate commercial and residential growth in the eastern section of the city of Sioux Falls. It would have significant impacts on the roadways in this study area and thus should be included for the analysis. A high-level travel demand modeling analysis was conducted to identify the traffic impacts of the SD 100 on the roadways in the study area.

These two 2050 analysis scenarios assume No Build conditions for this project and they are described as:

- No Build Without SD 100 Scenario
- No Build With SD 100 Scenario

Based on the analysis, it was determined that the SD 100 project, along with other Capital Improvement Projects (CIPs) in the SF MPO model, should be included in the subsequent analysis for all the future scenarios for this study.

Daily and peak hour traffic forecasts were prepared for major roadway segments and study intersections respectively for the project design, interim and opening years under No Build and Build conditions. The traffic forecast scenarios include:

- Design Year 2050 (assuming completion of SD 100)
    - Build Scenario
    - No Build Scenario

- Interim Year 2035
    - Build Scenario
    - No Build Scenario

- Opening Year 2024
    - Build Scenario
    - No Build Scenario

TRAFFIC FORECAST METHODOLOGY AND STEPS

Daily traffic forecasts were developed for the major roadway segments and peak hour traffic forecasts were developed for the study ramps, freeway segments and intersections in the study area. The development of the traffic forecasts was largely based on the existing traffic counts and the traffic changes on the roadways in the latest SF MPO regional travel demand model from the existing to horizon year. The existing peak hour turning movements (TMs) were available from different years from 2015-2018. Those TMs were reconciled and compiled into one final base dataset for this study. The traffic forecasts were developed following the steps below:

1) The latest SF regional travel model obtained from the MPO was reviewed. The model horizon year is 2045 and the base year is 2013.

2) The existing model was validated in the study area based on the screen lines analysis. The screen lines analysis compared actual daily counts and the base model traffic assignment results for the roadways crossing the pre-defined north-south and east-west screen lines in the study area. All the screen lines were matched to within 10%, a threshold commonly used for travel demand model validation.

3) To align with the design year of this project, a 2050 model was developed using the existing and 2045 data in the current SF MPO model based on two major assumptions. First, the 2045 model network, which had incorporated all the CIPs, would be used for the 2050 model. Second, the

2050 land uses data were estimated based on the linear growth trend from the existing to 2045 in the current SF MPO model.

4) The 2050 model was used to conduct high level daily traffic impacts analysis for the scenarios without and with SD 100 assuming No Build conditions in this study area. The 2050 model daily outputs for major roadway segments were adjusted to develop final daily traffic forecasts based on the differences between the existing counts and the base model daily outputs to account for modeling errors. After the analysis, it was determined that the scenario with SD 100 should be included for this interchange modification study.

5) The 2050 No Build daily traffic forecast results on major roadway segments were used to develop peak hour TM traffic forecasts for the corresponding intersections. The traffic growth and changes at segment levels were adjusted and balanced in the process to account for different growth rates in different approaches.

6) The 2050 No Build TM traffic forecasts were rerouted in the study interchanges areas to develop 2050 Build traffic forecasts to reflect the new interchanges configurations. No travel demand modeling analysis was conducted for the Build Scenario since there were only limited capacity changes to the study interchanges. Selected links analyses were conducted at selected locations and the results were used to refine the turning movements forecasts due to new roadway connections in the study area.

7) There were no travel demand models for the opening and interim years. Based on the discussions with the project management team and previous project practice, the traffic forecasts for those two years were estimated assuming linear growth between existing and corresponding 2050 traffic forecasts.

8) The daily and peak hour TM traffic forecasts were reviewed and checked for reasonableness.

EXISTING MODEL VALIDATION AND 2050 TRAFFIC MODEL DEVELOPMENT

Existing Model Validation

The SF MPO base model year is 2013. The existing model outputs in the study area were validated based on the screen lines analysis. The screen lines analysis compared actual daily counts and the base model traffic assignment results for the roadways crossing the pre-defined north-south and east-west screen lines in the study area.

Table 1.1 and **Table 1.2** respectively summarize the screen lines analysis results for the east-west and north-south roadways in the study area. The tables show that all the screen lines in the study area were matched to within 10%, a threshold commonly used for travel demand model validation. The validation made us confident to use the SF MPO model for travel demand analysis and forecasts for this study.

2050 Land Uses Data

The existing and 2045 land uses data for all the traffic analysis zones (TAZs) in the SF MPO area were used to estimate the land uses data for year 2050 based on the linear growth trend. **Figure 2.0** illustrates the TAZs in the study area in the SF MPO model. **Table 2** summarizes the estimated land uses data for those TAZs and the entire MPO area. **Figures 2.1, 2.2 and 2.3** respectively illustrate the land uses data for households, retail and total jobs for the TAZs in the study area. The table and figures show that there is not much growth projected in the study area from existing to 2050 while the projected growth in the

entire MPO is significant. The population growth and total employment growth are about 6% in the study area while they are over 70% in the MPO area.

2050 Roadway Networks

The base 2045 network was used as the 2050 network. The original 2045 highway network and thus the 2050 network have incorporated all the current Capital Improvement Projects (CIPs).

The CIPs in the study area are illustrated in **Figure 2.0**. They are listed as follows:

- I-229 Expansion from 4-lane to 6-lane between E 26th Street and E 10th Street.
- I-229/E 26th Street Interchange Modification
- Southeastern Avenue Expansion from 2-lane to 4-lane between E 26th Street to E 18th Street
- Cliff Avenue Expansion from 3-lane to 4-lane between E. 49th Street and E. 56th Street
- 49th Street Extension/Connection between Western Avenue and Minnesota Avenue.

It is noted that the I-229/85th Street full access interchange (not shown in the figure) is included in the 2050 model as well.

Based on the inputs from SF MPO, the planned SD 100 project was added to the base 2050 network to develop the network for the 2050 SD 100 Scenario for this study.

2050 Traffic Forecast Results

2050 With/Without SD 100 Analysis

Following the previously described methodology and steps, the daily traffic forecasts were developed for the 2050 With/Without SD 100 scenarios assuming No Build conditions for this study (all other CIPs were included for analysis in both scenarios). The differences in percentages were calculated to identify the traffic impacts of the SD 100 on the roadways in the study area.

Figure 3 illustrates the traffic forecasts and comparison results. The figure shows that:

- A noticeable amount of traffic will be diverted from I-229 if the nearby parallel SD 100 is built. The daily traffic volumes on I-229 in the study interchanges area are lower by about 5% under the SD 100 Build conditions than those under the SD 100 No Build conditions.
- The traffic impacts of the SD 100 on the arterial roadways are twofold. On the one hand, the construction of SD 100 provides additional capacity thus it draws and shares a certain amount of traffic currently using the roadways in the study area, resulting in lower traffic volumes on some existing roadways. On the other hand, the SD 100 would draw some trips that are currently on other routes to use the roadways in the study area due to capacity addition, resulting in higher traffic on some other existing roadways. The phenomena are reflected in the figure:
    - The traffic volumes on the local arterials located in the immediate west side of I-229 and between I-229 and SD 100 are generally lower under SD 100 Build conditions than those under SD 100 No Build conditions, primarily due to the traffic diversion to SD 100 and the new routes. The percentile changes vary greatly from less than 1% to over 10% on different roadway segments.
    - The traffic volumes on the arterials located farther west of I-229 are higher under SD 100 Build conditions than the No Build conditions, primarily due to additional traffic attracted to use the roadways in the study area.

2050 No Build & Build Traffic Forecasts (With SD 100)

The daily traffic forecasts and peak period model outputs from the 2050 SD 100 Scenario under No Build conditions were used to develop the peak hour TMs for the study intersections and freeways in the study area based on the methodology and steps described in the previous section (The SD 100 is included in the 2050 No Build and Build scenarios in the subsequent sections).

Figure 4.0 illustrates the existing daily traffic counts, the 2050 No Build daily traffic forecasts and the average annual growth rates.

Figure 4.1 illustrates the existing freeway and intersection peak hour TMs.

Figure 4.2 illustrates the 2050 No Build freeway and intersection peak hour TM forecasts.

No regional model analysis was conducted for the Build Scenario since there are limited capacity improvements proposed for the study interchanges. Instead, the No Build peak hour TM traffic forecasts in the study interchanges areas were rerouted to develop peak hour TM traffic forecasts for the proposed different interchange design configurations. **Figure 4.3** illustrates the 2050 Build peak hour TM forecasts for the Single-Point-Urban-Interchanges (SPUIs) proposed for the I-229 interchanges at Minnesota Avenue and Cliff Avenue. The TMs rerouted for other interchange designs are not included in the memorandum. The traffic forecasts for all other intersections under interchanges build conditions are the same as those under no build conditions.

A selected link analysis was conducted using the SF MPO model on Minnesota Ave and Cliff Avenue at I-229 to identify where the increased traffic volumes come from and where they go via the study interchanges.

Figure 5.1 illustrates the selected link analysis results on the Minnesota Avenue.

Figure 5.2 illustrates the selected link analysis results on the Cliff Avenue.

The traffic forecasts and selected links figures show that:

- The daily traffic figure shows that the freeway I-229, as one of the major corridors carrying regional trips, has higher annual growth rates than the local arterials where there are no planned CIPs. This is consistent with the planned land uses growth in the study area (~ 6%) and the entire MPO area (~70%).
- The peak hour TM traffic forecasts and their growth are generally consistent with the daily traffic forecasts and their growth.
- It is noted that the existing peak hour directional splits between southbound and northbound on I-229 are relatively even while the forecasted peak hour traffic volumes indicate noticeably higher directional splits in southbound than northbound, especially during AM peak hour. The model review revealed that the directional splits and the changes were consistent with the SF MPO model results due to land uses changes from the existing to 2050.
- The selected links figures show that the increased traffic volumes using the Minnesota Avenue and Cliff Avenue disperse much more quickly in west/north side of I-229 than east/south side. The figures show that a substantial amount of new traffic volumes generated from the suburban area will use the study interchanges even those there is not much land uses development growth expected within the enclosed I-229/I-29/I-90 area.

Interim 2035 and Opening Year 2024 Traffic Forecast Results

There were no travel demand models for the interim year 2035 and opening year 2024. The daily and peak hour traffic forecasts for the 2035 & 2024 No Build and Build scenarios were estimated assuming linear growth between existing and corresponding 2050 traffic forecasts.

Figure 6.1 illustrates the 2035 No Build freeway and intersection peak hour TM forecasts.

Figure 6.2 illustrates the 2035 Build peak hour TM forecasts for the SPUIs proposed for the I-229 interchanges at Minnesota Avenue and Cliff Avenue.

Figure 7.1 illustrates the 2024 No Build freeway and intersection peak hour TM forecasts.

Figure 7.2 illustrates the 2024 Build peak hour TM forecasts for the SPUIs proposed for the I-229 interchanges at Minnesota Avenue and Cliff Avenue.

Date: 6/3/2019
Author: HXiao

Study Interchanges Location in the SF MPO Area and Study Corridor Segments and Intersections

Figure 1

Interchange EA Study for I-229 Exits 3 (Minnesota Avenue) & 4 (Cliff Avenue)
Sioux Falls, South Dakota

Table 1.1

6/3/2019

2013 SF MPO Base Model Scree Lines Analysis (East-West Roadways)

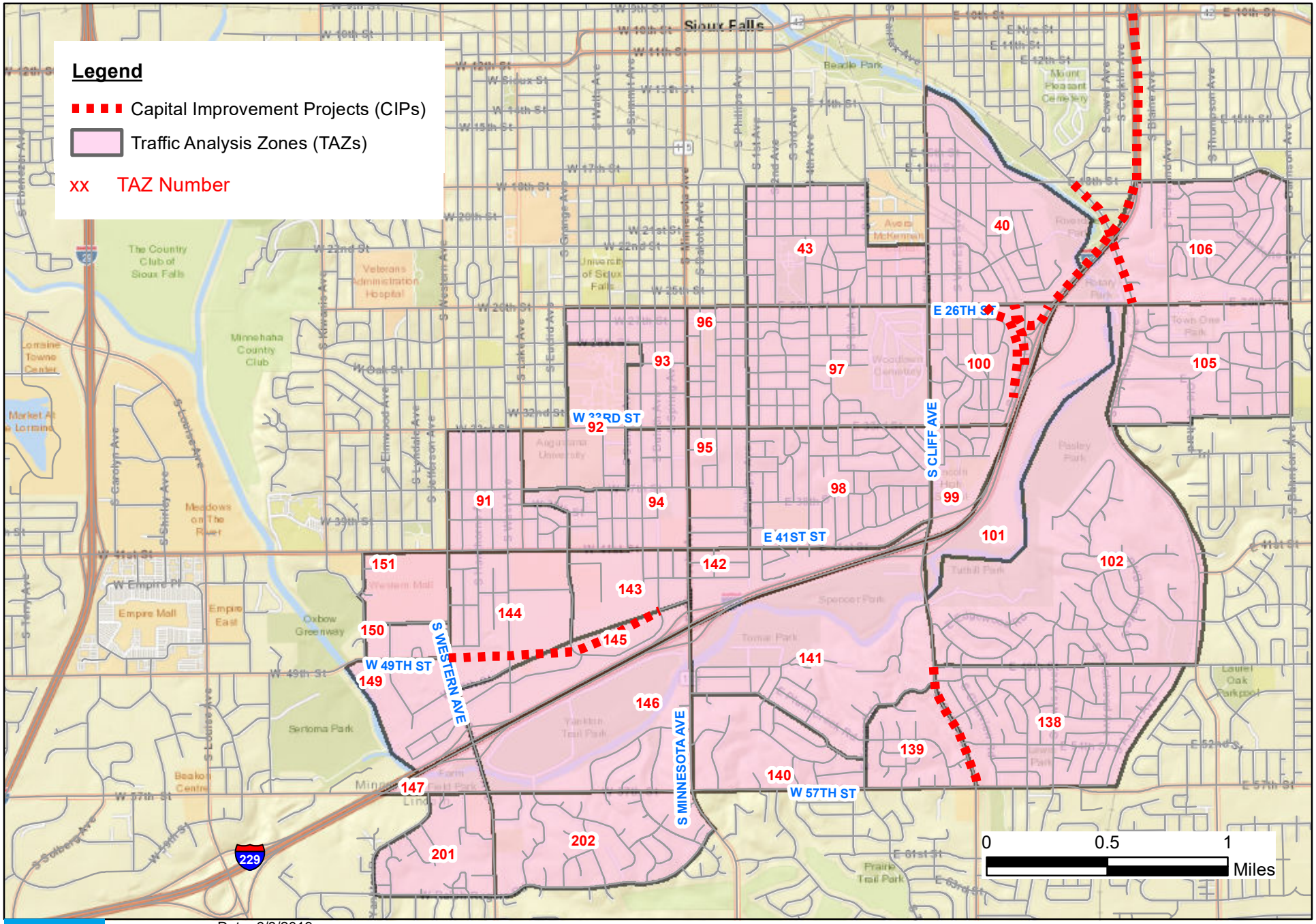
Screen Line Location		Major Roadways	Traffic Counts	Model Outputs	Diff in %
East-West Roadways	West of Southeastern Ave	E 26th St	27,500	26,599	-3%
		E 49th St	6,500	7,772	20%
		E 57th St	12,600	12,769	1%
		E 69th St	3,500	3,933	12%
		Cutline Total	**50,100**	**51,073**	**2%**
	West of Cliff Ave	E 26th St	12,500	11,042	-12%
		E 33rd St	6,700	7,018	5%
		E 41st St	6,000	6,983	16%
		E Tomar Rd	1,300	3,150	142%
		E 57th St	12,600	11,411	-9%
		E 69th St	9,600	9,199	-4%
		Cutline Total	**48,700**	**48,803**	**0%**
	West of Minnesota Ave	E 26th St	10,300	9,189	-11%
		E 33rd St	10,600	10,323	-3%
		E 41st St	22,200	21,740	-2%
		E 57th St	16,800	17,435	4%
		W Ralph Rogers Rd	1,600	971	-39%
		E 69th St	11,600	11,385	-2%
		Cutline Total	**73,100**	**71,043**	**-3%**
	West of Western Ave	E 26th St	5,100	6,560	29%
		E 33rd St	6,300	7,437	18%
		E 41st St	25,800	24,098	-7%
		E 49th St	14,400	16,519	15%
		E 57th St	22,000	20,919	-5%
		W Ralph Rogers Rd	2,000	1,433	-28%
		E 69th St	10,100	9,674	-4%
		Cutline Total	**85,700**	**86,640**	**1%**

Table 1.2

6/3/2019

2013 SF MPO Base Model Scree Lines Analysis (North-South Roadways)

Screen Line Location		Major Roadways	Traffic Counts	Model Outputs	Diff in %
North-South Roadways	North of 26th St	S Kiwanis Ave	20,000	16,882	-16%
		S Western Ave	12,900	12,854	0%
		S Grange Ave	5,100	7,917	55%
		S Minnesota Ave	25,800	23,820	-8%
		S Phillips Ave	4,300	5,865	36%
		S Cliff Ave	13,800	14,369	4%
		I-229	39,217	38,893	-1%
		S Southeastern Ave	7,800	18,610	139%
		S Cleveland Ave	5,600	5,423	-3%
		S Bahnson Ave	4,200	3,641	-13%
		Cutline Total	**138,717**	**148,274**	**7%**
	North of 41st St	S Louise Ave	22,200	22,050	-1%
		S Kiwanis Ave	17,500	19,009	9%
		S Western Ave	10,700	10,383	-3%
		S Minnesota Ave	28,200	27,866	-1%
		S Phillips Ave	5,100	4,966	-3%
		S Cliff Ave	14,600	14,903	2%
		I-229	47,671	45,882	-4%
		S Southeastern Ave	9,900	8,594	-13%
		S Bahnson Ave	3,800	4,369	15%
		Cutline Total	**159,671**	**158,022**	**-1%**
	North of 57th St	S Louise Ave	24,600	23,231	-6%
		S Oxbow Ave	5,400	6,493	20%
		S Western Ave	22,800	20,245	-11%
		I-229	53,523	50,116	-6%
		S Minnesota Ave	21,700	22,779	5%
		S Cliff Ave	13,400	14,392	7%
		S Southeastern Ave	5,000	7,243	45%
		S Bahnson Ave	4,800	4,536	-6%
		Cutline Total	**151,223**	**149,035**	**-1%**
	South of 57th St	S Louise Ave	33,300	33,511	1%
		I-229	42,656	39,396	-8%
		S Western Ave	14,200	13,376	-6%
		S Minnesota Ave	17,400	17,406	0%
		S Tomar Rd	1,300	1,593	23%
		S Cliff Ave	12,500	12,489	0%
		S Lewis Ave	1,900	2,353	24%
		S Southeastern Ave	7,300	6,610	-9%
		Cutline Total	**130,556**	**126,734**	**-3%**
	South of 69th St	S Louise Ave	16,500	15,376	-7%
		S Western Ave	5,500	5,777	5%
		S Heatheridge Ave	1,200	1,670	39%
		S Minnesota Ave	6,600	7,909	20%
		S Cliff Ave	7,500	7,292	-3%
		S Southeastern Ave	400	1,065	166%
		Cutline Total	**37,700**	**39,089**	**4%**



Date: 6/3/2019
Author: HXiao

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TAZs and CIPs in the Study Area
In the Sioux Falls Travel Demand Model

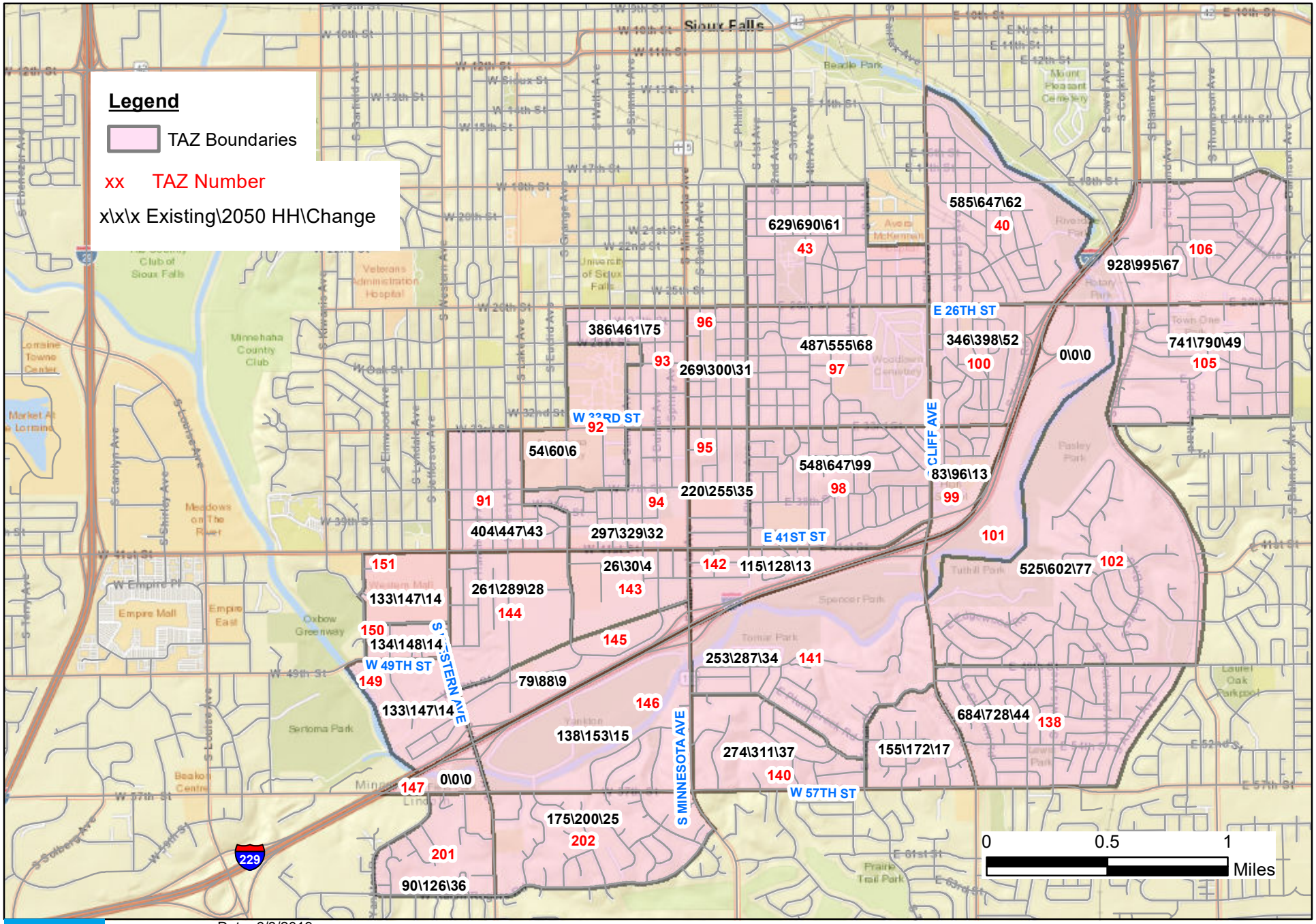
Figure 2.0

Interchange EA Study for I-229 Exits 3 (Minnesota Avenue) & 4 (Cliff Avenue)
Sioux Falls, South Dakota

Table 2
Estimated 2050 Land Uses Data for the SF MPO Model

TAZ	2013					2050					Change					Change (%)				
	HH	Pop	Retail	NRetail	TotalEmp	HH	Pop	Retail	NRetail	TotalEmp	HH	Pop	Retail	NRetail	TotalEmp	HH	Pop	Retail	NRetail	TotalEmp
40	585	1,356	76	169	245	647	1,371	83	179	262	62	15	7	10	17	11%	1%	9%	6%	7%
43	629	1,440	11	918	929	690	1,517	11	1,160	1,171	61	77	0	242	242	10%	5%	0%	26%	26%
91	404	888	132	78	210	447	988	136	78	214	43	100	4	0	4	11%	11%	3%	0%	2%
92	54	101	33	543	576	60	114	34	548	582	6	13	1	5	6	11%	13%	3%	1%	1%
93	386	984	242	560	802	461	972	250	571	821	75	-12	8	11	19	19%	-1%	3%	2%	2%
94	297	787	520	377	897	329	774	537	386	923	32	-13	17	9	26	11%	-2%	3%	2%	3%
95	220	492	1,006	332	1,338	255	489	1,037	336	1,373	35	-3	31	4	35	16%	-1%	3%	1%	3%
96	269	645	184	112	296	300	678	190	114	304	31	33	6	2	8	12%	5%	3%	2%	3%
97	487	1,186	31	187	218	555	1,271	32	189	221	68	85	1	2	3	14%	7%	3%	1%	1%
98	548	1,385	74	425	499	647	1,488	83	439	522	99	103	9	14	23	18%	7%	12%	3%	5%
99	83	203	0	117	117	96	209	0	117	117	13	6	0	0	0	16%	3%	N/A	0%	0%
100	346	800	15	126	141	398	859	15	127	142	52	59	0	1	1	15%	7%	0%	1%	1%
101	0	0	55	0	55	0	0	56	0	56	0	0	1	0	1	N/A	N/A	2%	N/A	2%
102	525	1,470	15	214	229	602	1,669	15	217	232	77	199	0	3	3	15%	14%	0%	1%	1%
105	741	1,699	99	149	248	790	1,815	102	155	257	49	116	3	6	9	7%	7%	3%	4%	4%
106	928	2,157	133	479	612	995	2,197	144	490	634	67	40	11	11	22	7%	2%	8%	2%	4%
138	684	1,868	11	39	50	728	1,915	12	40	52	44	47	1	1	2	6%	3%	9%	3%	4%
139	155	400	43	24	67	172	445	44	24	68	17	45	1	0	1	11%	11%	2%	0%	1%
140	274	617	15	28	43	311	707	15	28	43	37	90	0	0	0	14%	15%	0%	0%	0%
141	253	548	5	33	38	287	613	4	34	38	34	65	-1	1	0	13%	12%	-20%	3%	0%
142	115	266	141	606	747	128	299	146	631	777	13	33	5	25	30	11%	12%	4%	4%	4%
143	26	40	507	334	841	30	47	556	375	931	4	7	49	41	90	15%	18%	10%	12%	11%
144	261	449	661	413	1,074	289	452	697	438	1,135	28	3	36	25	61	11%	1%	5%	6%	6%
145	79	158	302	615	917	88	176	369	659	1,028	9	18	67	44	111	11%	11%	22%	7%	12%
146	138	286	0	179	179	153	310	0	190	190	15	24	0	11	11	11%	8%	N/A	6%	6%
147	0	0	0	1	1	0	0	0	1	1	0	0	0	0	0	N/A	N/A	N/A	0%	0%
149	133	263	25	385	410	147	289	42	407	449	14	26	17	22	39	11%	10%	68%	6%	10%
150	134	159	178	716	894	148	176	190	720	910	14	17	12	4	16	10%	11%	7%	1%	2%
151	133	146	801	363	1,164	147	161	833	370	1,203	14	15	32	7	39	11%	10%	4%	2%	3%
201	90	206	292	426	718	126	291	331	435	766	36	85	39	9	48	40%	41%	13%	2%	7%
202	175	559	57	345	402	200	640	59	365	424	25	81	2	20	22	14%	14%	4%	6%	5%
Sub Total	**9,152**	**21,558**	**5,664**	**9,293**	**14,957**	**10,226**	**22,932**	**6,023**	**9,823**	**15,846**	**1,074**	**1,374**	**359**	**530**	**889**	**12%**	**6%**	**6%**	**6%**	**6%**
MPO Area	**87,238**	**215,944**	**37,659**	**98,424**	**136,083**	**154,069**	**371,016**	**67,048**	**163,762**	**230,810**	**66,831**	**155,072**	**29,389**	**65,338**	**94,727**	**77%**	**72%**	**78%**	**66%**	**70%**

Note: TAZs in the study area are illustrated in Figures 2.

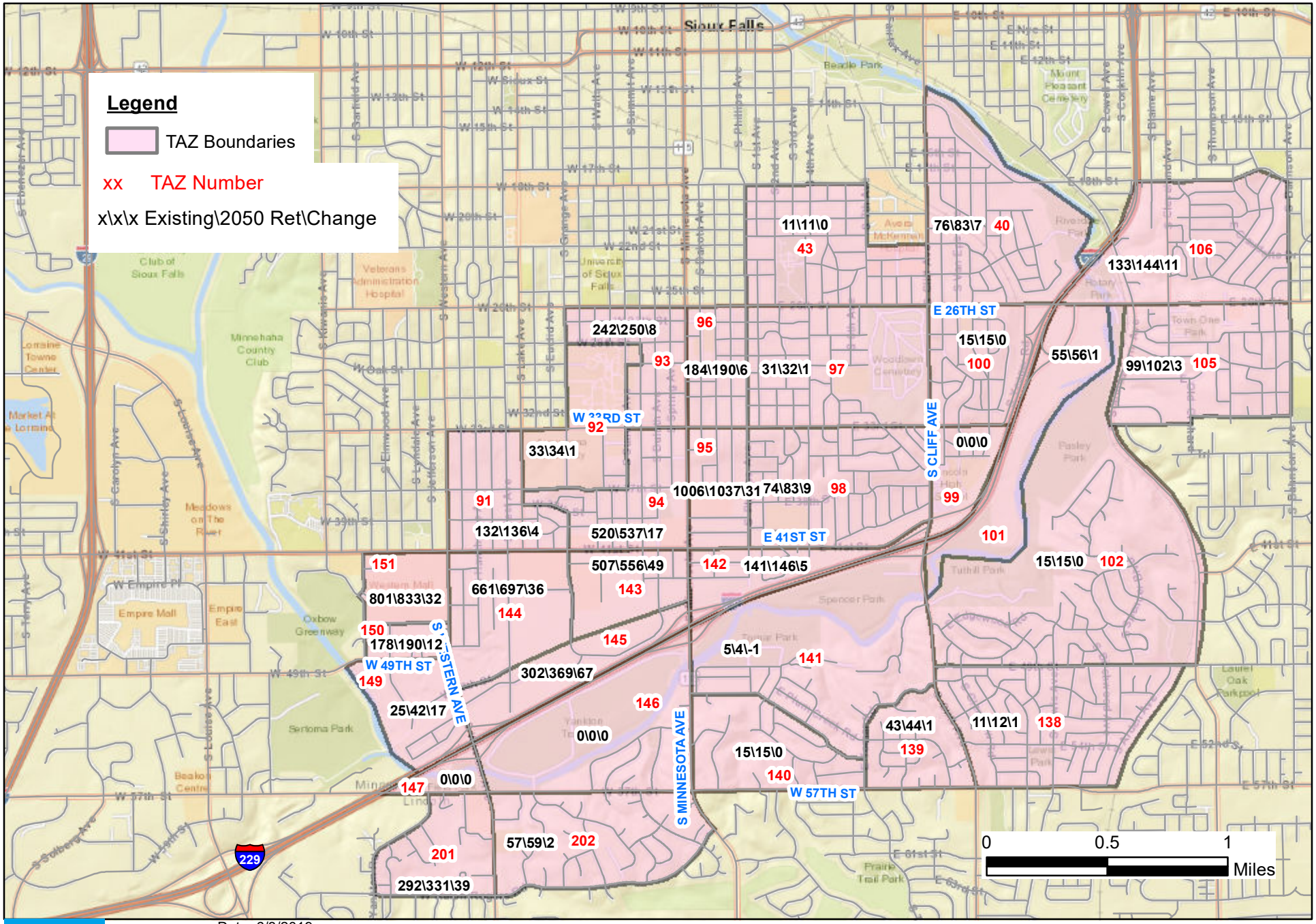


Date: 6/3/2019
Author: HXiao

TAZs and Existing/2050 Land Use Data in the Study Area (Household) In the Sioux Falls Travel Demand Model

Figure 2.1

Interchange EA Study for I-229 Exits 3 (Minnesota Avenue) & 4 (Cliff Avenue)
Sioux Falls, South Dakota

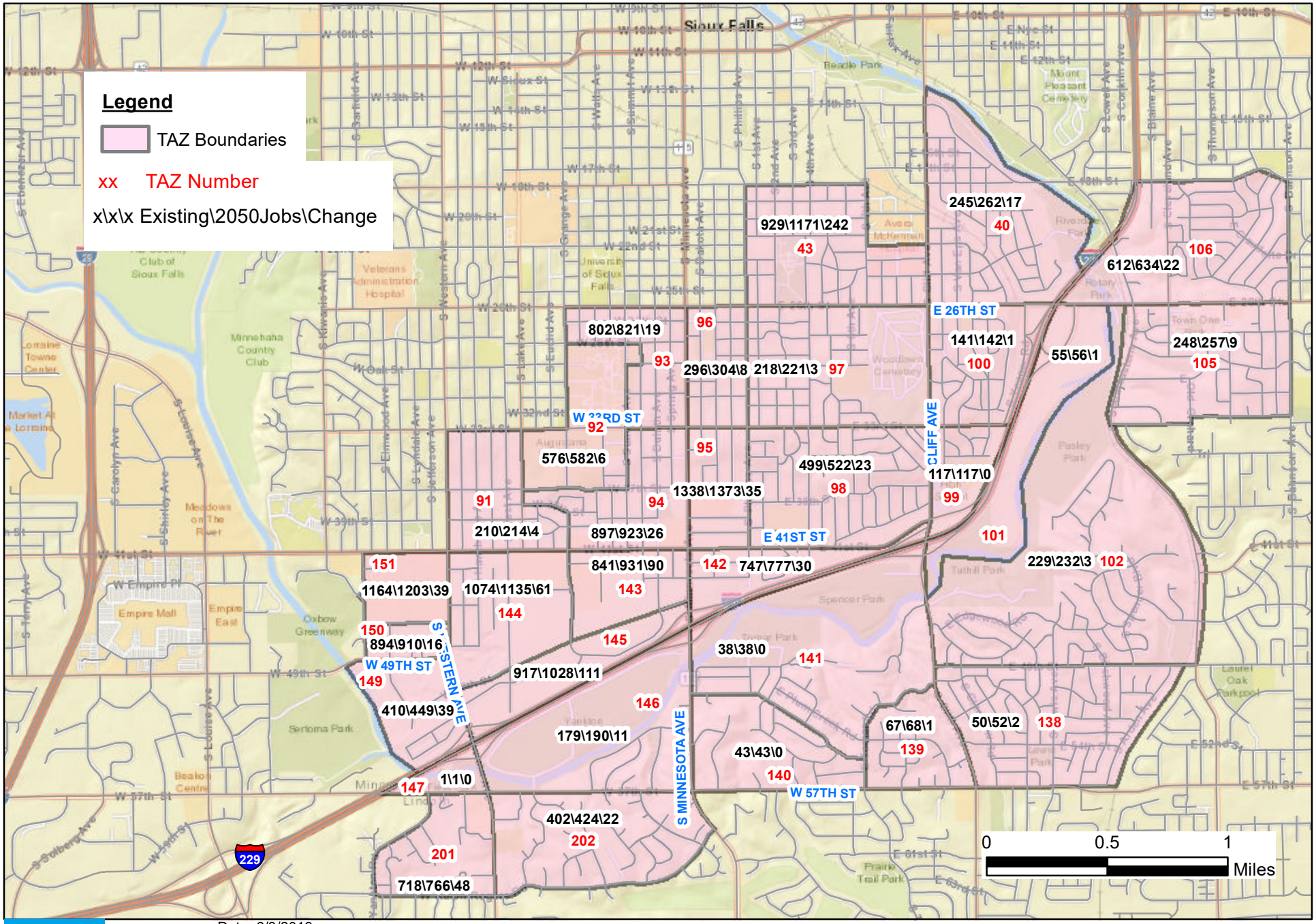


Date: 6/3/2019
Author: HXiao

TAZs and Existing/2050 Land Use Data in the Study Area (Retail Jobs) In the Sioux Falls Travel Demand Model

Figure 2.2

Interchange EA Study for I-229 Exits 3 (Minnesota Avenue) & 4 (Cliff Avenue)
Sioux Falls, South Dakota

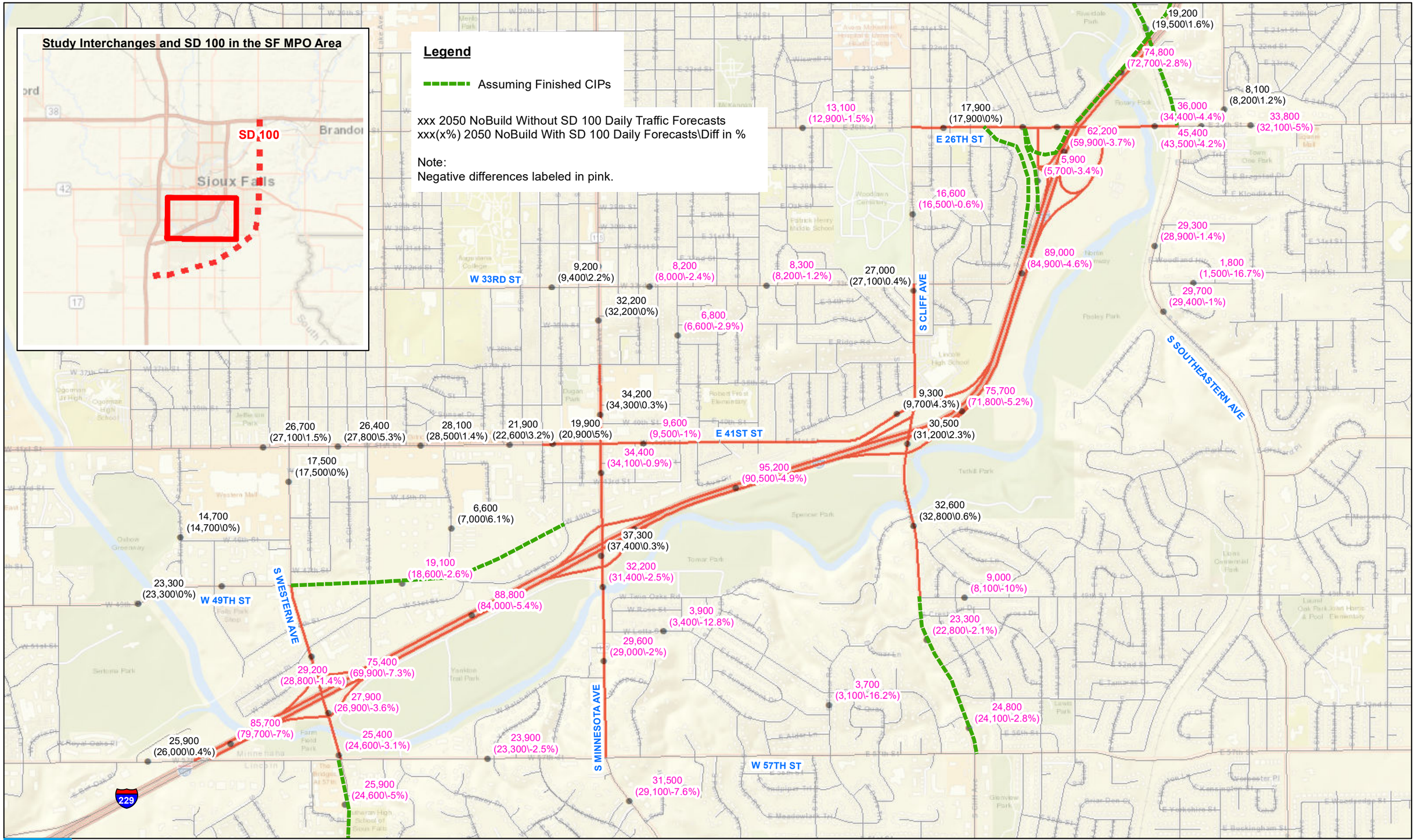


Date: 6/3/2019
Author: HXiao

TAZs and Existing/2050 Land Use Data in the Study Area (Total Jobs) In the Sioux Falls Travel Demand Model

Figure 2.3

Interchange EA Study for I-229 Exits 3 (Minnesota Avenue) & 4 (Cliff Avenue)
Sioux Falls, South Dakota



Date: 6/3/2019
Author: HXiao

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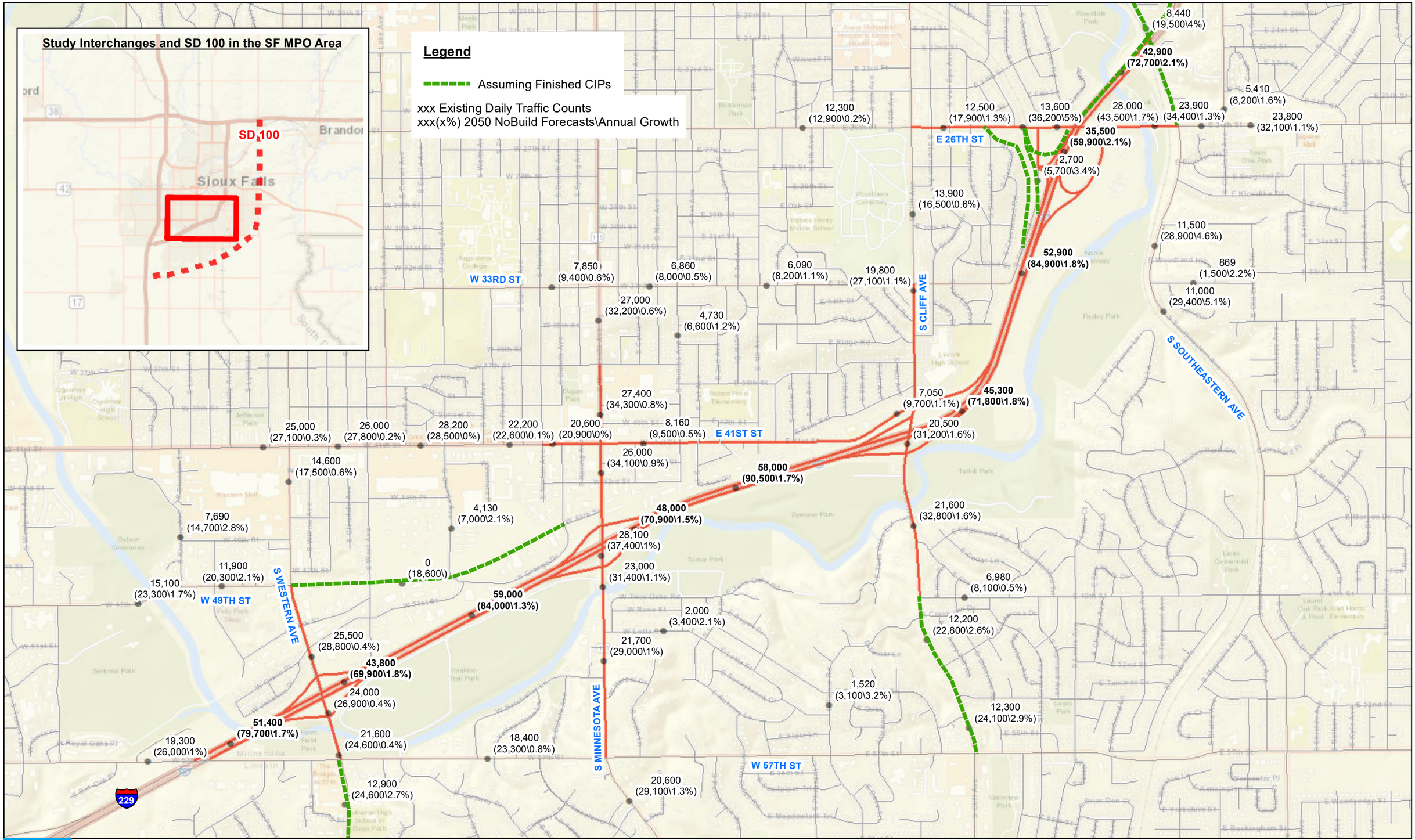
2050 No-Build Daily Traffic Forecasts Comparison
Without/With SD 100 between I-90 and I-29

Interchange EA Study for I-229 Exits 3 (Minnesota Avenue) & 4 (Cliff Avenue)
Sioux Falls, South Dakota

Figure 3



Date: 6/3/2019
Author: HXiao

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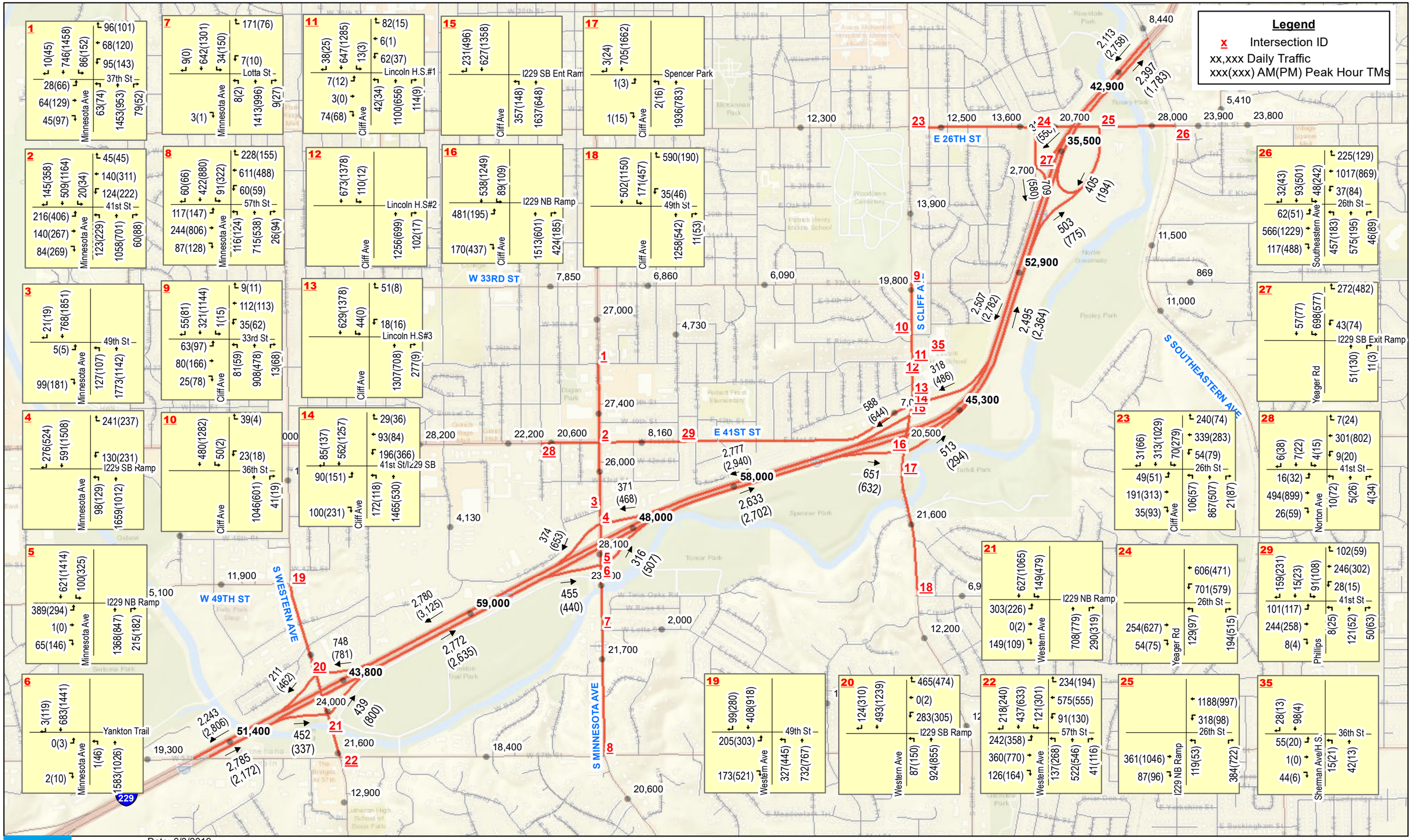
Existing and 2050 No-Build Daily Traffic Forecasts
(Assuming Completion of SD 100)

Interchange EA Study for I-229 Exits 3 (Minnesota Avenue) & 4 (Cliff Avenue)
Sioux Falls, South Dakota

Figure 4.0



Date: 6/3/2019
Author: HXiao

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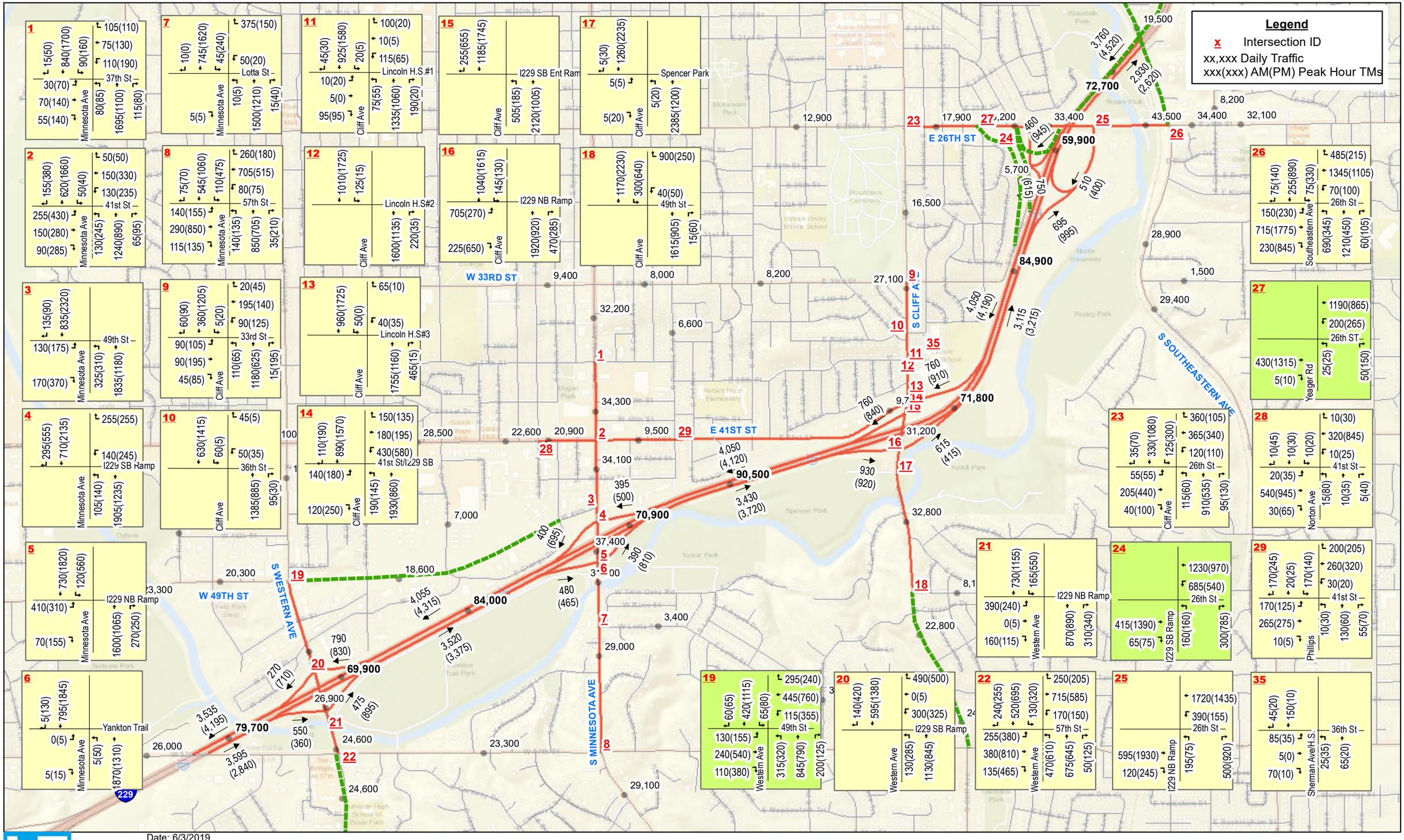
Existing Freeway and Intersection Peak Hour Turning Movements

Figure 4.1

Interchange EA Study for I-229 Exits 3 (Minnesota Avenue) & 4 (Cliff Avenue)
Sioux Falls, South Dakota

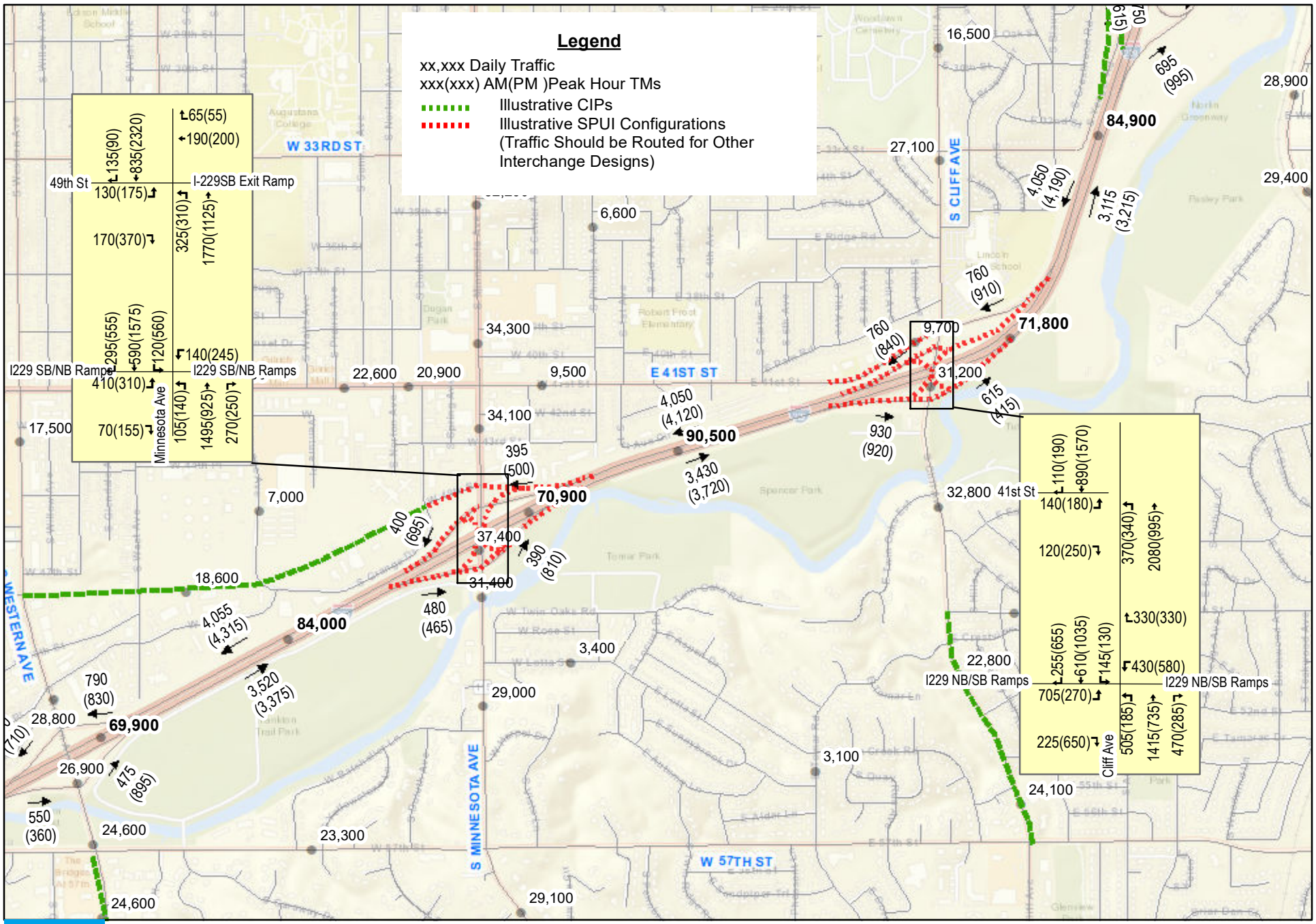


Date: 6/3/2019
Author: HXiao

2050 NoBuild Peak Hour Freeway and Intersection TM Forecasts
(Assuming Completion of SD 100)

Figure 4.2

Interchange EA Study for I-229 Exits 3 (Minnesota Avenue) & 4 (Cliff Avenue)
Sioux Falls, South Dakota



Date: 6/3/2019
Author: HXiao

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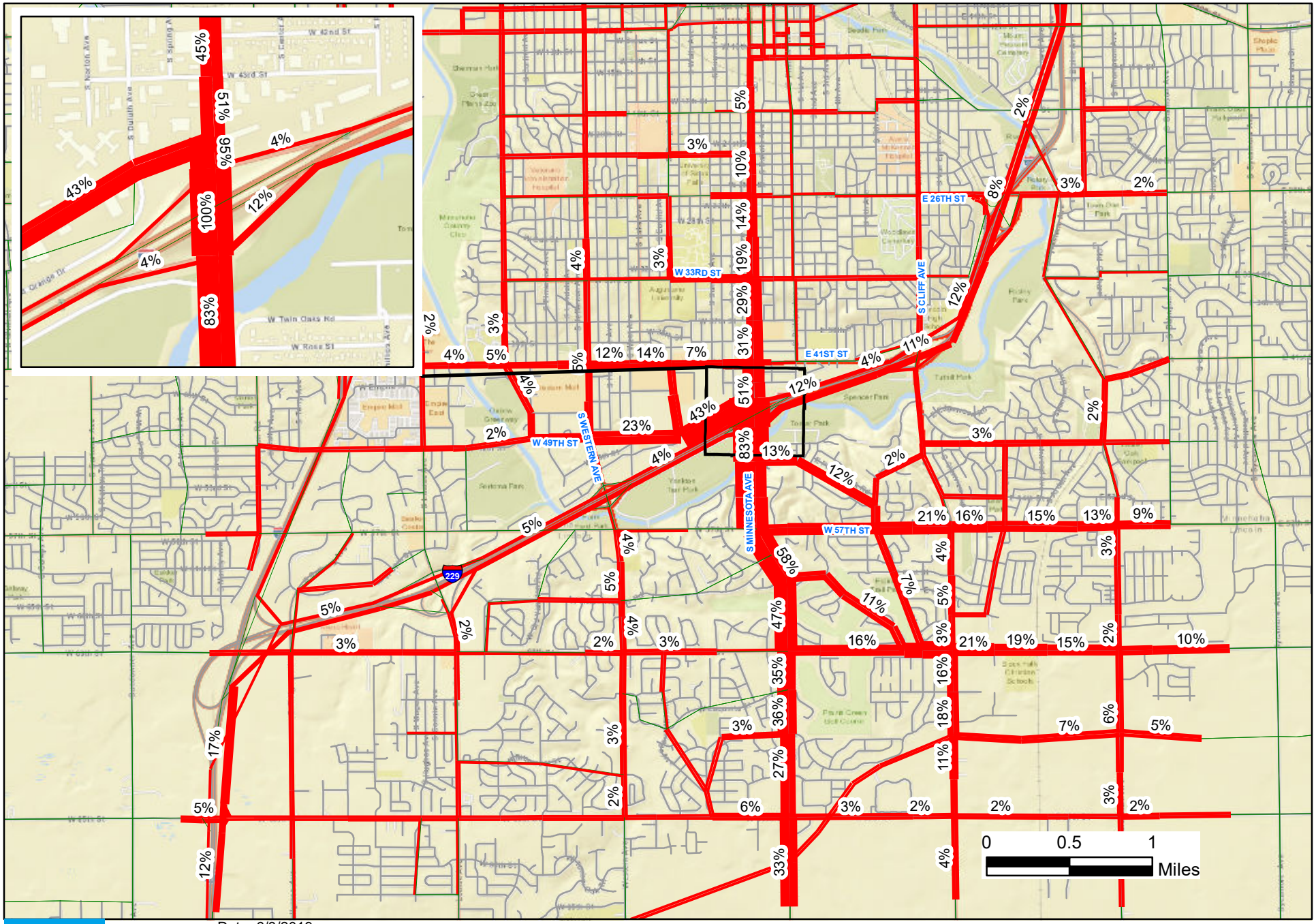
2050 Build Peak Hour I-229 Ramp Intersection TM Forecasts at Minnesota Avenue and Cliff Avenue

Figure 4.3

Interchange EA Study for I-229 Exits 3 (Minnesota Avenue) & 4 (Cliff Avenue)
Sioux Falls, South Dakota



Date: 6/3/2019
Author: HXiao

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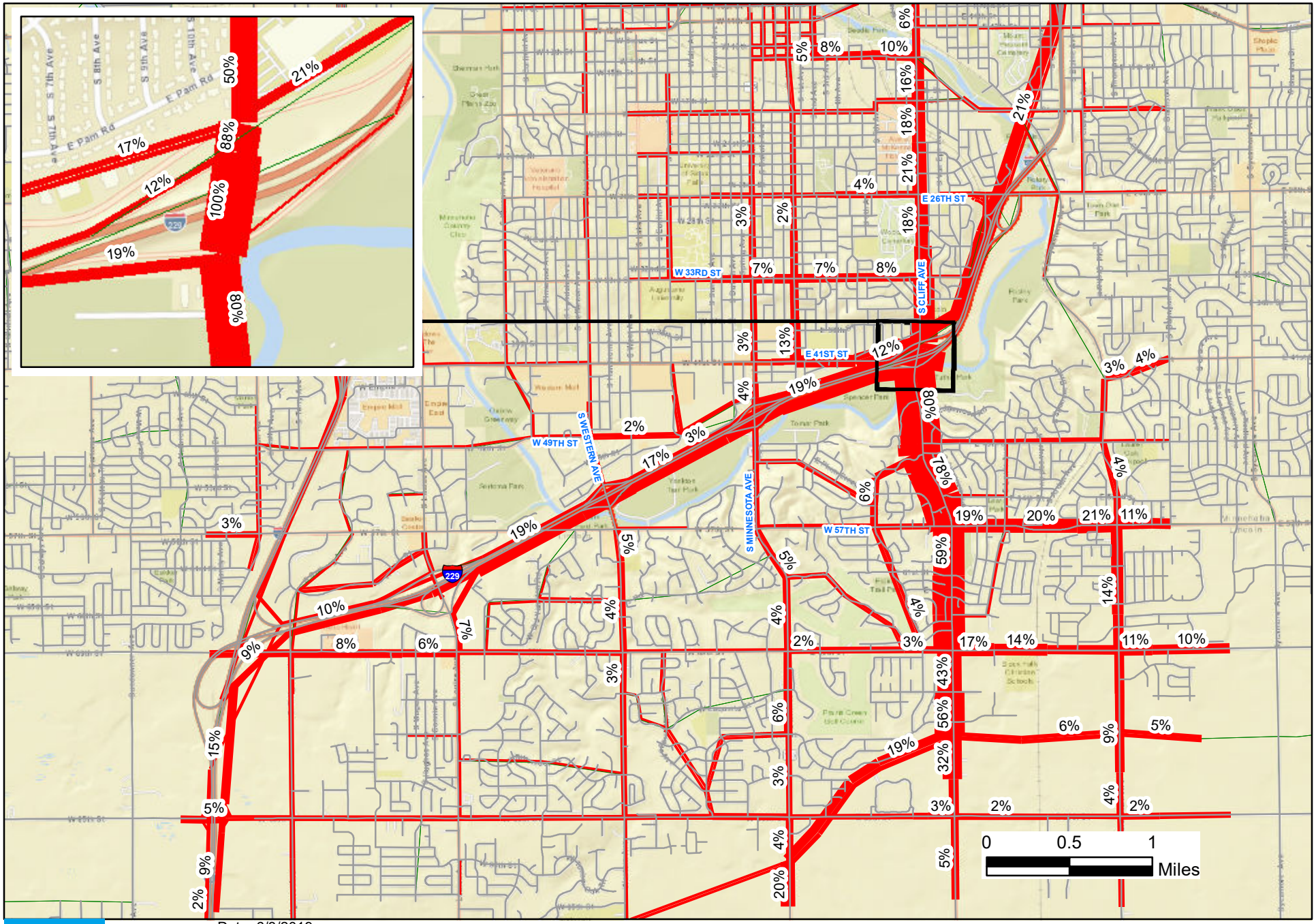
The Directional Distributions of the Inreased Daily Traffic Volumes (9,300) from Existing to 2050 on Minnesota Ave at I-229

Figure 5.1

Interchange EA Study for I-229 Exits 3 (Minnesota Avenue) & 4 (Cliff Avenue)
Sioux Falls, South Dakota

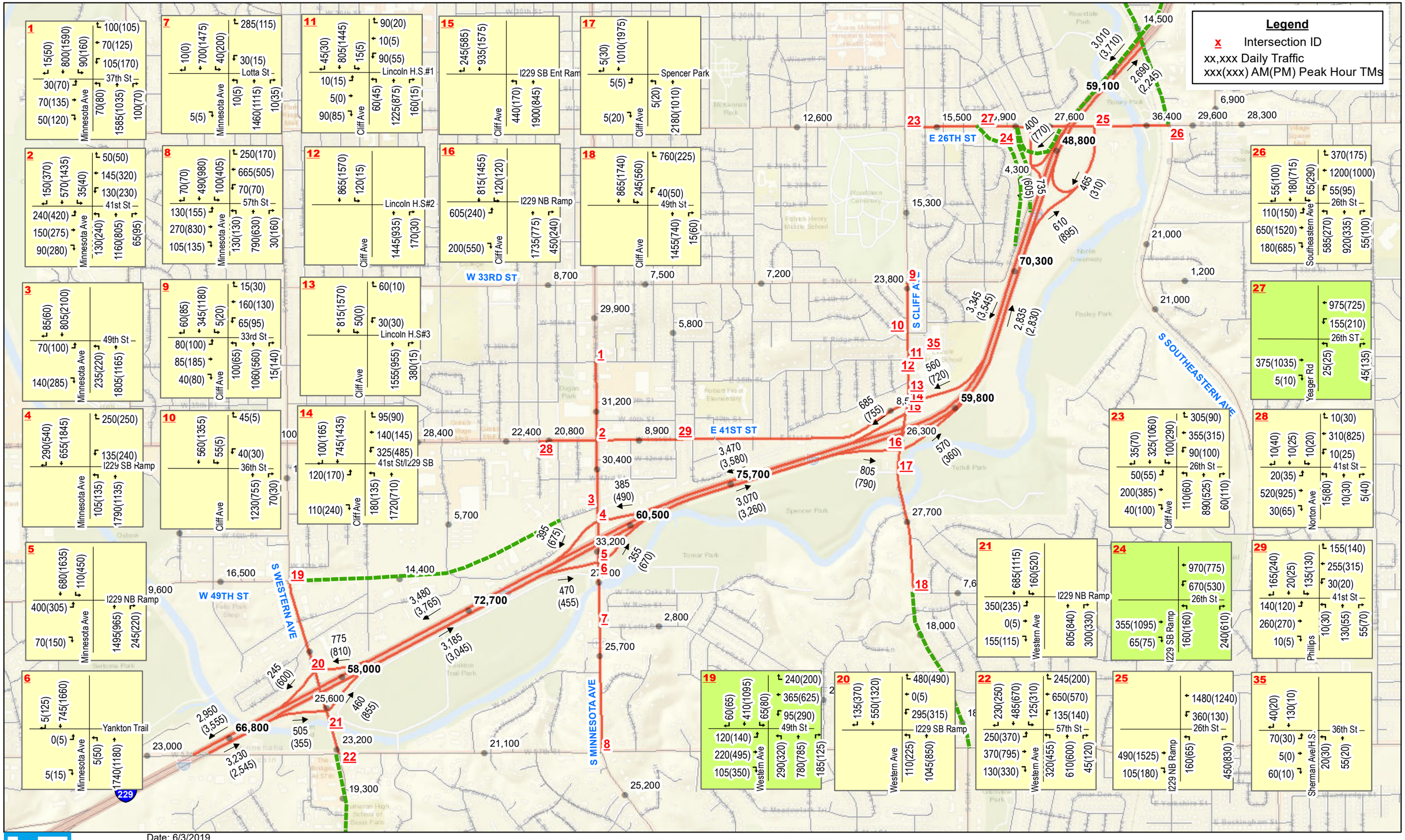


Date: 6/3/2019
Author: HXiao

The Directional Distributions of the Inreased Daily Traffic Volumes (10,700) from Existing to 2050 on Cliff Ave at I-229

Figure 5.2

Interchange EA Study for I-229 Exits 3 (Minnesota Avenue) & 4 (Cliff Avenue)
Sioux Falls, South Dakota

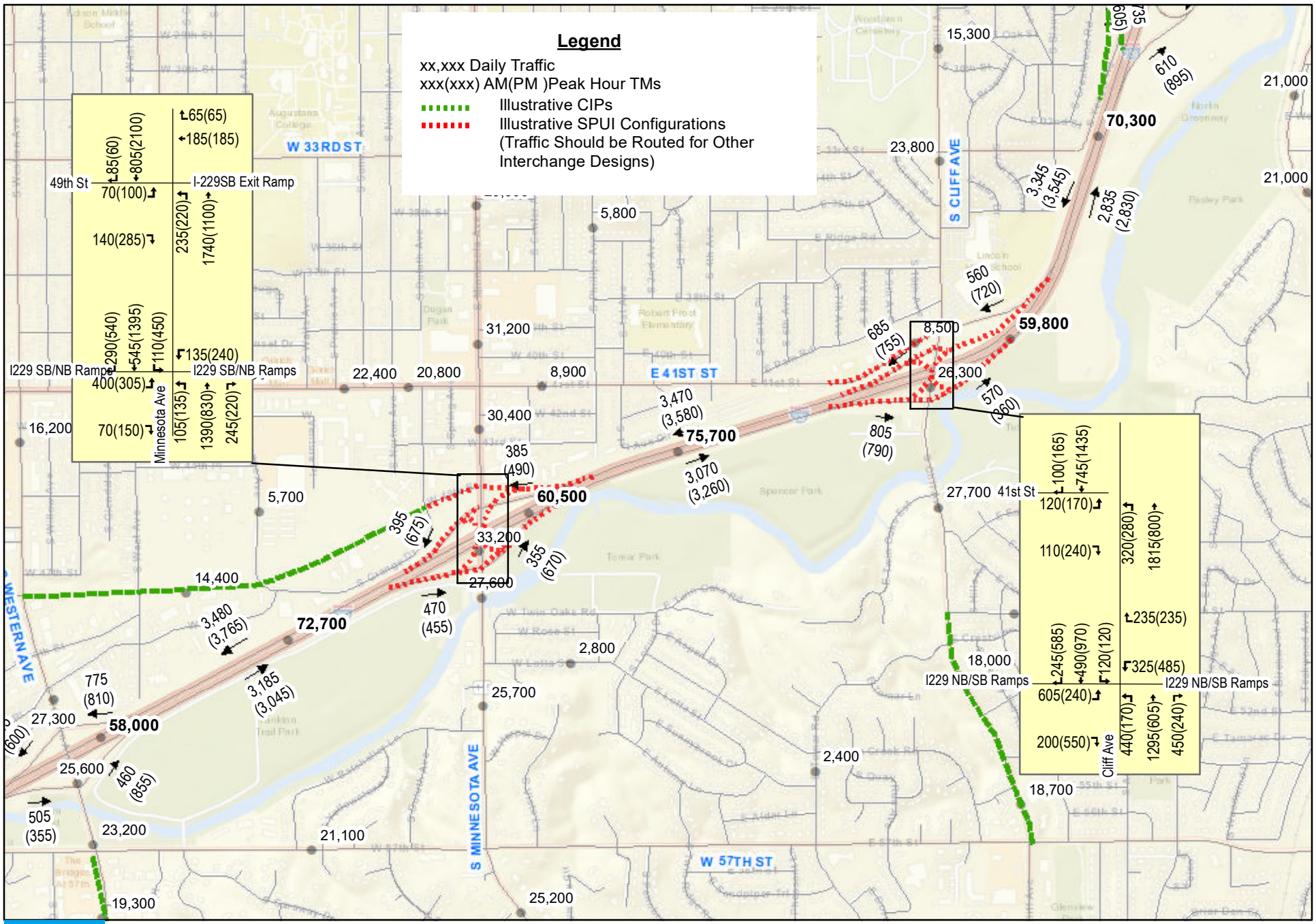


Date: 6/3/2019
Author: HXiao

2035 NoBuild Peak Hour Freeway and Intersection TM Forecasts
(Assuming Completion of SD 100)

Figure 6.1

Interchange EA Study for I-229 Exits 3 (Minnesota Avenue) & 4 (Cliff Avenue)
Sioux Falls, South Dakota



Date: 6/3/2019
Author: HXiao

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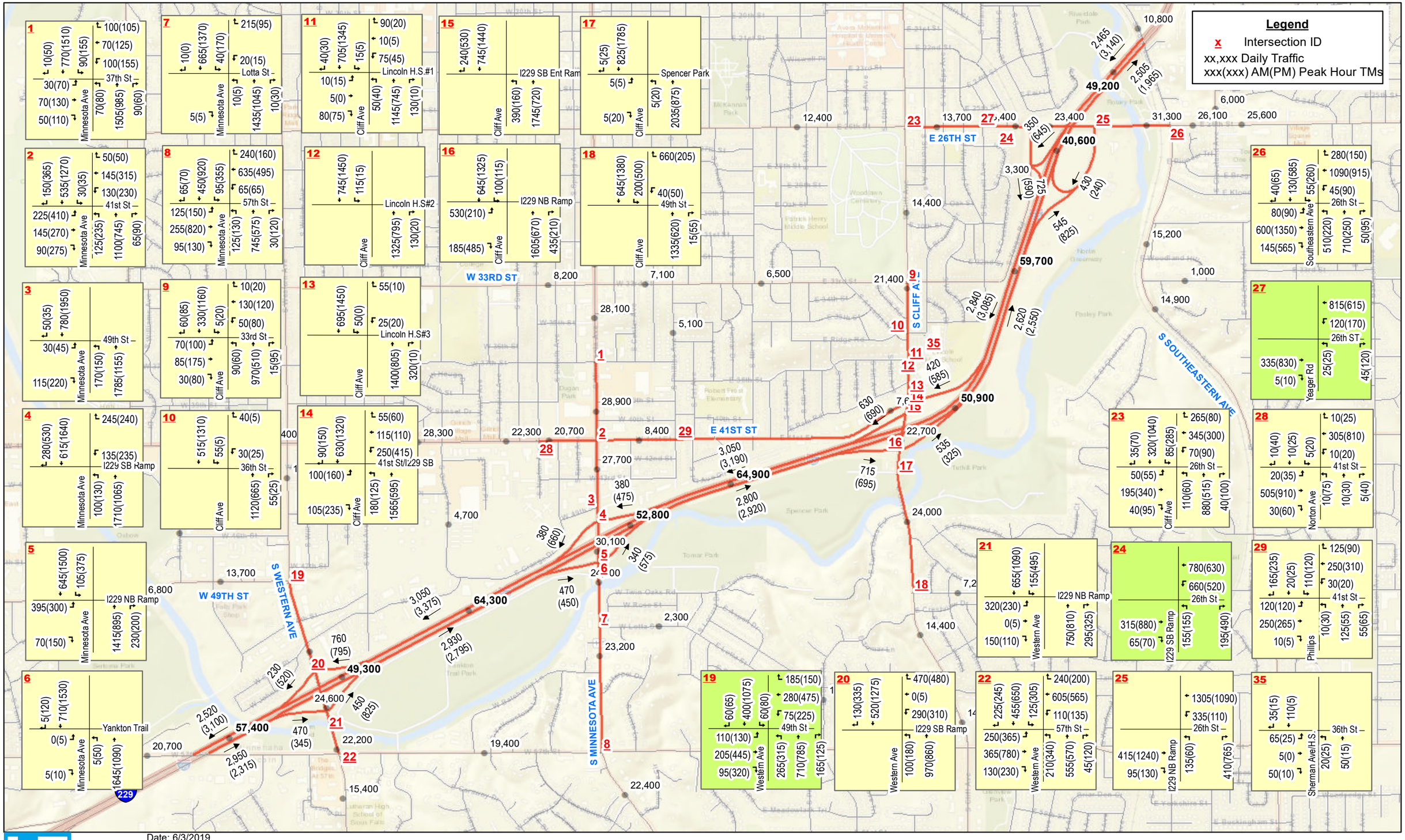
2035 Build Peak Hour I-229 Ramp Intersection TM Forecasts at Minnesota Avenue and Cliff Avenue

Figure 6.2

Interchange EA Study for I-229 Exits 3 (Minnesota Avenue) & 4 (Cliff Avenue)
Sioux Falls, South Dakota

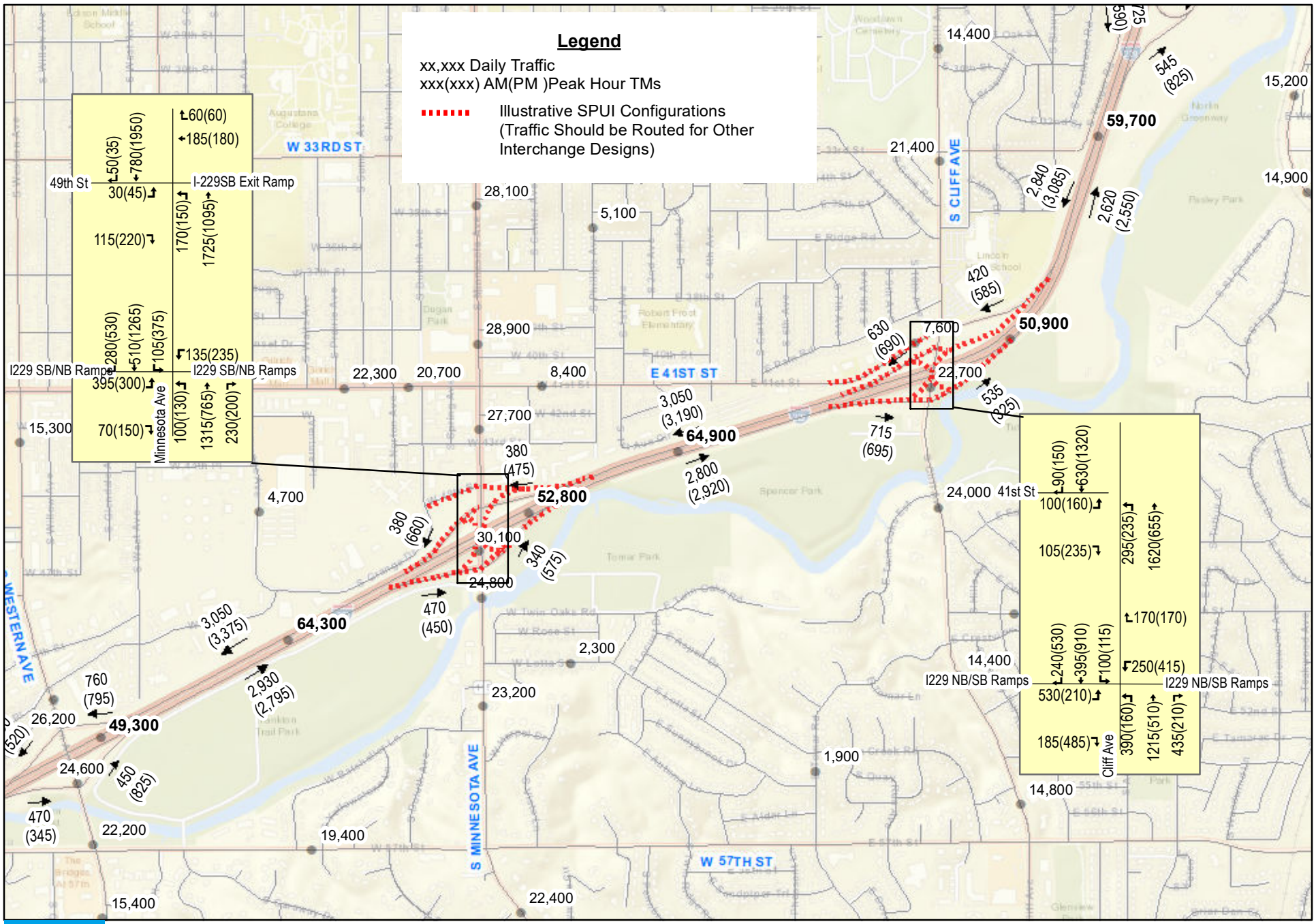


Date: 6/3/2019
Author: HXiao

2024 NoBuild Peak Hour Freeway and Intersection TM Forecasts

Figure 7.1

Interchange EA Study for I-229 Exits 3 (Minnesota Avenue) & 4 (Cliff Avenue)
Sioux Falls, South Dakota



Date: 6/3/2019
Author: HXiao

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2024 Build Peak Hour I-229 Ramp Intersection TM Forecasts at Minnesota Avenue and Cliff Avenue

Figure 7.2

Interchange EA Study for I-229 Exits 3 (Minnesota Avenue) & 4 (Cliff Avenue)
Sioux Falls, South Dakota

Appendix J

Origin-Destination Memorandum

Building a Better World for All of Us®

MEMORANDUM

TO: Steve Gramm, PE
SDDOT Planning Engineer

FROM: Graham Johnson, PE, PTOE

DATE: January 4, 2019

RE: I-229 Exits 3 &4 Interchange Study: Origin-Destination Study
SEH No. SDDOT 147016

This memorandum summarizes the methodology and findings of an Origin and Destination (OD) Study for the I-229 Exit 3 and Exit 4 Interchange Study in the City of Sioux Falls, South Dakota. The OD study relies on the use of the StreetLight Data software-platform.

StreetLight Data is a private company that compiles mobile device information from two sources of data for the information it provides. Cell phone data can provide Location-Based Service (LBS) data from smartphone applications that track the devices location during use. Global Positioning System (GPS) information is obtained from devices that help people navigate, including connected cars/trucks and commercial fleet management systems.

PROJECT BACKGROUND AND INFORMATION

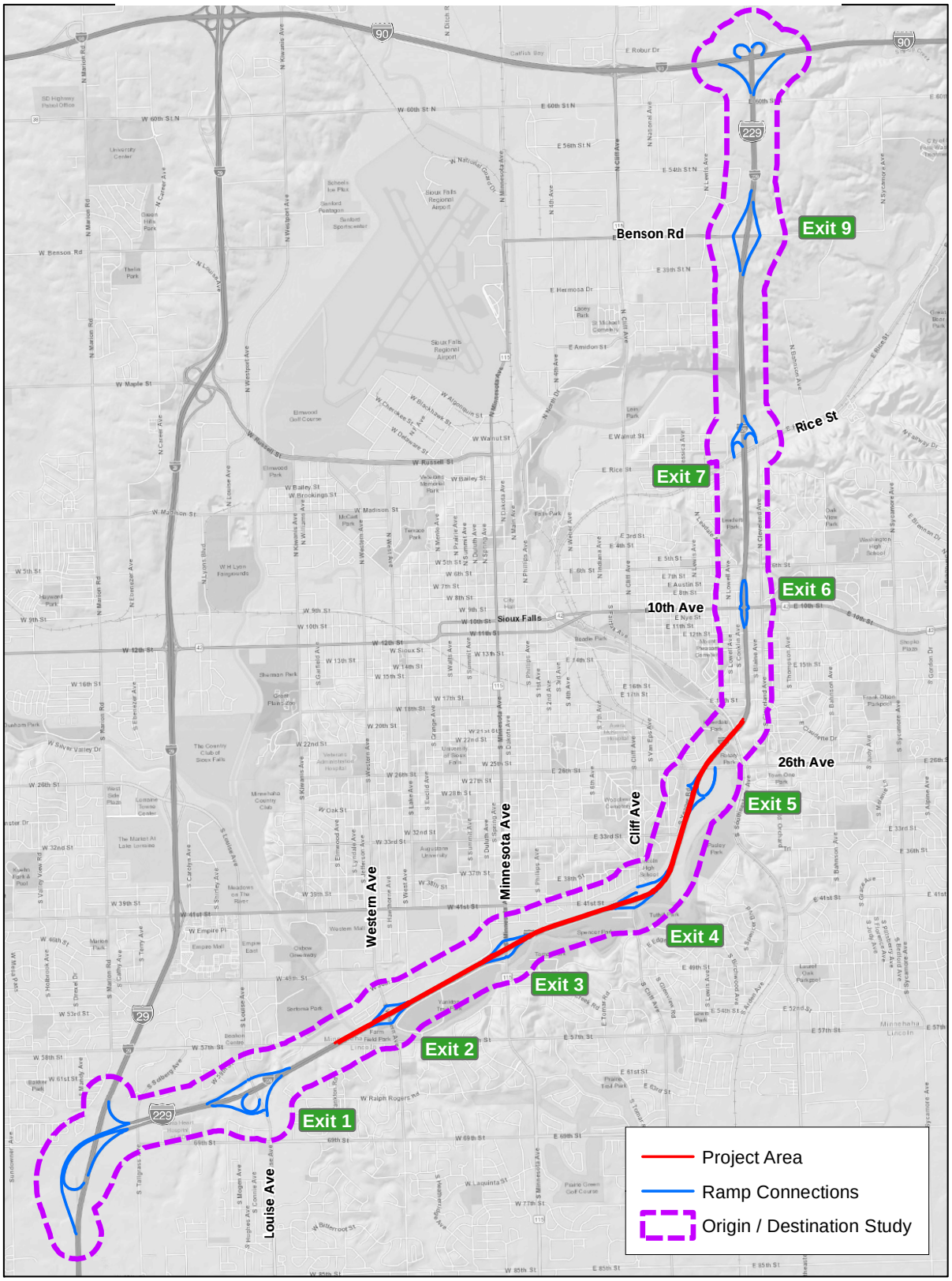
As part of the recently completed I-229 Major Investment Corridor Study, it was determined that the interchanges at Exit 3 (Minnesota Avenue) and Exit 4 (Cliff Avenue) would need modification to better serve existing and future traffic demands at each interchange.

The existing I-229 corridor has auxiliary lanes between each entrance and exit ramp connection between Exits 2, 3, 4, and 5 in both the northbound and southbound directions of I-229. The auxiliary lanes between each ramp connection create a weaving condition that requires special analysis using the Highway Capacity Manual methodology. The weaving analysis requires a traffic volume to be entered for the ramp to ramp connection of the entrance volumes and exit volumes. This value is typically an assumed percentage or in the most conservative analysis, no traffic is assumed to make the ramp to ramp connection which prompts the highest weaving demands. However, assumed weaving demands may result in an evaluation that is not truly representative of the existing or future operations.

An origin and destination study of the ramp to ramp connection demands along I-229 between Exits 2, 3, 4, and 5 was proposed as part of the study to understand the traffic patterns along the I-229 corridor traffic to aide in the operations analysis of the freeway system.

Due to the breadth of readily available data through the StreetLight platform, a more comprehensive OD study was completed along the I-229 corridor between I-90 and I-29. The project location and OD study area are shown in **Figure 1**.

Figure 1 I-229 Project Area and OD Study Area



STREETLIGHT DATA

As mentioned previously, StreetLight Data is a private company that compiles mobile device and GPS information from two sources of data for the data analytics information it provides to consumers. More information about StreetLight can be found at the company's website: https://www.streetlightdata.com.

It should be noted that the StreetLight data is a relatively new source of information for many transportation projects and is continually being modified to better apply the information to real world transportation problems. The information also relies heavily on the number of devices within the study or project area to provide the information. To ensure the subsequent information is more clearly understood, the following is a glossary of typical terms used within the StreetLight process:

- **GPS Data**: Global Positioning System; created by connected cars/trucks and commercial fleet management systems (commercial and personal trips).
- **LBS Data**: Location-Based Service data; created by smart phone and mobile device applications that use location-based services (personal trips).
- **Zones**: a geospatial shape or polygon that represents an area to be analyzed, can range in size from small to very large.
- **Roadway Gate**: a small zone on a roadway segment to obtain trips crossing the "gate" by direction.
- **Origin Zone**: A zone in which a trip starts or initially passes through.
- **Destination Zone**: A zone in which a trip ends or lastly passes through.
- **Calibration Zone**: A zone, which can be separate from project specific zones, set up as a roadway gate that includes an estimated ADT or other type of existing traffic count data
- **Trip (GPS)**: A trip is required to be at least 3 minutes of time and 500 meters in length; a trip is considered stopped when the device does not move 5 meters within 5 minutes or when a device is turned off.
- **Trip (LBS)**: Incoming data is more variable than GPS. A trip is considered stopped if pinging data is 100m+ from the prior location and stays virtually still for 5 minutes. For continuous pinging devices, a trip is considered stopped if the device slows down to walking speeds and speeds up or stays virtually still for 5 minutes.
- **Pass-Through Trip**: If a zone or gate is coded with "Pass Through", then all trips that cross each pass through zone are tracked as they pass through an origin zone and subsequently pass through a destination zone.
- **Personal Trip**: Any trip from a connected vehicle (GPS) or smart phone/mobile device (LBS).
- **Commercial Trip**: Any trip from a commercial fleet management system data (GPS).
- **StreetLight Index (StL Index)**: A normalized number of trips based on all available data. StreetLight normalizes the data as their sample size and data increases every month and the normalization allows capture of monthly and seasonal variations.
- **Calibrated Daily Volume**: A set of calibration zones can be input with user entered existing average daily traffic (ADT) throughout the project area and/or beyond the area. This information allows StreetLight to compare the daily traffic information to their device capture rates for each of the calibration zones and then scale the StreetLight Index values for each zone to estimate a daily value for the project zones. Fundamentally, StreetLight is comparing each entered ADT value, for each calibration zone, to the total device capture for those zones in order to develop a ratio to adjust their device counts and index value, which account for only a portion of all roadway users, to a daily estimate.

ORIGIN-DESTINATION PROJECT DATA

As mentioned previously, determining the weaving demands along I-229 between Exits 2, 3, 4, and 5 is the primary purpose of this OD study. However, due to the breadth of data available, ease of the platform, and the allowable number of zones, the project extents were significantly increased to capture all of the I-229 corridor.

Roadway gates were coded at a total of 43 locations and captured the directional movements along each segment of freeway for this study. The roadway gates are coded to capture all pass-through traffic crossing each origin or destination zone. For this project, a total of 22 origin zones were used and a total of 21 destination zones.

The following is a list of the locations (**Zone ID's**) used to assess general traffic patterns along both northbound and southbound I-229:

Northbound ORIGIN ZONES (Total of 11):

- **291**: Northbound I-29
- **294**: Southbound I-29
- **12**: Southbound Louise Avenue
- **15**: Northbound Louise Avenue
- **22**: Western Avenue
- **32**: Minnesota Avenue
- **42**: Cliff Avenue
- **52**: 26th Street
- **62**: 10th Street
- **72**: Rice Street
- **92**: Benson Road

Northbound DESTINATION ZONES (Total of 11):

- **11**: Exit 1 – Louise Avenue
- **21**: Exit 2 – Western Avenue
- **31**: Exit 3 – Minnesota Avenue
- **41**: Exit 4 – Cliff Avenue
- **51**: Exit 5 – 26th Street
- **61**: Exit 6 – 10th Street
- **71**: Exit 7 – Rice Street
- **91**: Exit 9 – Benson Road
- **903**: Exit 10A – Eastbound I-90
- **902**: Exit 10B – Westbound I-90
- **905**: CR 125/476th Avenue

Southbound ORIGIN ZONES (Total of 11):

- **901**: Eastbound I-90
- **902**: Westbound I-90
- **906**: CR 125/476th Avenue
- **94**: Benson Road
- **74**: Rice Street
- **64**: 10th Street
- **54**: 26th Street
- **44**: Cliff Avenue
- **34**: Minnesota Avenue
- **24**: Western Avenue
- **14**: Louise Avenue

Southbound DESTINATION ZONES (Total of 10):

- **93**: Exit 9 – Benson Road
- **73**: Exit 7 – Rice Street
- **63**: Exit 6 – 10th Street
- **53**: Exit 5 – 26th Street
- **43**: Exit 4 – Cliff Avenue
- **33**: Exit 3 – Minnesota Avenue
- **23**: Exit 2 – Western Avenue
- **13**: Exit 1C – Louise Avenue
- **293**: Exit 1B – Northbound I-29
- **292**: Exit 1AB – Southbound I-29

StreetLight allows the use of both LBS data and GPS data for pass-through trip identification; both options were evaluated in this study. The evaluation of a full year of data is available for both data sets; in this evaluation the data was evaluated from July 2017 through June 2018. Weather events and traffic incidents are not able to be removed from the yearlong analysis time period; however, it should be noted that these events represent a small fraction of the entire 365 day evaluation and have a minimal impact on the overall average values.

While each data source is normalized with the StreetLight Index or scaled to a calibrated daily value for each OD pair, each data source also provides a total sample size of unique trips that occurred during the study period.

For the entire I-229 project area, here are the following data sources and corresponding number of unique trips:

- **LBS Data (Personal) 375,000 unique trips**
- **GPS Data (Commercial) 265,000 unique trips**
- **GPS Data (Personal) 42,000 unique trips**

Based on the low capture rate of personal GPS data for this project area, the personal GPS information will not be evaluated further in the following summary of OD estimates.

Each data source can be parsed out for different days of the week and different times of the day; however it is very dependent on the amount of available data for each particular project. With the relatively high capture rates for both the LBS data and commercial GPS data, detailed information from these sources were captured with this project.

This project included the following daily data breakdowns:

- **Average Day Monday through Sunday**
- **Average Weekday Monday through Thursday; Friday not included**
- **Average Weekend Saturday and Sunday only**

This project included the following hourly data breakdowns:

- **All Day 12AM to 12AM (24 Hours)**
- **Early AM 12AM to 6AM (6 Hours)**
- **Peak AM 6AM to 9AM (3 Hours)**
- **Mid-Day 9AM to 3PM (6 Hours)**
- **Peak PM 3PM to 7PM (4 Hours)**
- **Late PM 7PM to 12AM (5 Hours)**

A series of tables will be presented in this memorandum for northbound I-229 and southbound I-229; these will include the 24-hour weekday trips as well as the peak AM and peak PM weekday trip tables for both the personal and commercial trips. The tables include the percentages based on the calibrated demand for each OD pair.

In the attached appendix tables, information for the following trip tables will be included for both northbound I-229 and southbound I-229; these tables include the percentages and calibrated demands for each OD pair:

- **Average Daily 7-days/week; 24 Hours**
- **Average Weekday Mon-Thurs; 24 Hours**
- **Average Weekend Sat-Sun: 24 Hours**
- **Average Weekday Mon-Thurs Peak AM; (3 Hours)**
- **Average Weekday Mon-Thurs Mid-Day; (6 Hours)**
- **Average Weekday Mon-Thurs Peak PM; (4 Hours)**

It should be noted that the StreetLight calibration process does not result in a perfect match of the existing ADT demands entered at the calibration zones and the estimated daily count provided by StreetLight. Rather, all of the calibration zones are used to develop the estimated daily count information from the StreetLight Index values; a total of over 50 calibration zones were input with 2017 AADT data and the recent 2018 ramp counts. Therefore, relying on the OD pair percentages for each ramp to ramp connection is a more reasonable assessment instead of relying on the calibrated demands themselves.

Northbound I-229 Origin Destination Results

The following **Tables 1 through 7** represent the full years' worth of origin-destination data for the northbound I-229 entrance and exit ramps.

- **Table 1** **NB I-229 Exit 3 & 4 Project Summary**
- **Table 2** **Weekday 24-Hour - Personal**
- **Table 3** **Weekday 24-Hour - Commercial**
- **Table 4** **Weekday AM Peak Period - Personal**
- **Table 5** **Weekday AM Peak Period - Commercial**
- **Table 6** **Weekday PM Peak Period - Personal**
- **Table 7** **Weekday PM Peak Period - Commercial**

I-229 Exits 3 and 4 Interchange Project Area:

Based on the mobile device and GPS device data, the ramp to ramp demands between each ramp to ramp connection can vary from as low as 9% to upwards of 28%. The following table shows the three northbound I-229 weaving sections and the corresponding ramp to ramp percentages for the personal devices (LBS), the commercial vehicles (GPS), and then a weighted average between the two data sources. As the commercial trips are significantly lower than the personal trips counts, the weighted average is typically very close to the personal trip percentages.

Table 1 Northbound I-229 OD Percentages (Exits 2, 3, 4, & 5)

NB I-229 Ramp Weaving	Weekday 24-hr			Weekday AM Period			Weekday PM Period		
	P	C	Avg	P	C	Avg	P	C	Avg
Western to Minnesota	20%	18%	20%	21%	14%	20%	18%	13%	18%
Minnesota to Cliff	18%	8%	17%	21%	9%	20%	19%	6%	18%
Cliff to 26th	24%	15%	24%	10%	16%	11%	28%	12%	27%

Notes: P = Personal (LBS); C = Commercial (GPS); Avg = Weighted Average Percentage

Between Western Avenue (Exit 2) and Minnesota Avenue (Exit 3) the average weekday ramp to ramp demands are approximately 20% of the entrance demands from Western Avenue. The daily percentage is essentially echoed during the peak periods with the AM peak having 20% as well and the PM peak a slight reduction to 18%.

Between Minnesota Avenue (Exit 3) and Cliff Avenue (Exit 4) the average weekday ramp to ramp demands are approximately 17% of the entrance demands from Minnesota Avenue. The daily percentage is slightly lower than the peak periods with the AM peak having 20% and the PM peak a slight reduction to 18%.

Between Cliff Avenue (Exit 4) and 26th Street (Exit 5) the average weekday ramp to ramp demands are approximately 24% of the entrance demands from Cliff Avenue. In the AM peak period there is only a small portion of trips making the ramp to ramp maneuver with only approximately 11%. The PM peak period has a significantly higher percentage with 27% of the demands making the ramp to ramp connection; this is likely used as a shortcut route during the peak period to avoid local street congestion.

I-229 Corridor:

Based on the data results for the entire northbound I-229 corridor, this freeway corridor serves a majority of local service trips and is not used by longer, regional trips. The following description of results is based on the average 24-hour weekday trips unless otherwise directly noted.

Traffic entering northbound I-229 from both directions of I-29 is mostly dispersed within the first four service interchanges along the corridor. At Cliff Avenue (Exit 4), approximately 70% or more of the I-29 traffic has left the corridor and less than approximately 3% of the I-29 traffic reaches I-90 to the north. The only exception to this is

the northbound I-29 commercial traffic which has a high demand of approximately 25% of trips destined to the Benson Road (Exit 9) and additionally approximately 17% of trips destined to either direction of I-90.

For all of the service interchange entrance ramps, the demand of personal trips destined to I-90 does not exceed 10% until the Cliff Avenue (Exit 4) entrance ramp and then all the subsequent entrance ramps. The demand of commercial trips destined to I-90 reaches or exceeds 25% as early as Minnesota Avenue (Exit 3) and all the subsequent entrance ramps.

On average, approximately 18% of the traffic entering northbound I-229 from a service interchange will exit at the next available exit ramp along the corridor; this does not include Benson Road due to the proximity to I-90. By the 2nd available exit ramp, approximately 42% of the traffic will have exited the freeway and approximately 62% depart by the 3rd available exit ramp. By the 4th available exit, approximately 78% of the traffic from each entrance ramp will have departed the I-229 freeway; this relates back the I-229 corridor being used primarily for short distance trips.

Based on the OD matrices developed from the Streetlight information, an estimated average trip distance was developed. Each entrance and exit ramp distance was correlated to the exit ramp numbering system to develop trip distances. For example, traffic that entered the corridor from Western Avenue, Exit 2, and exited at Benson Road, Exit 9, was assumed to travel 7 miles along I-229. This was done for every entrance ramp origin location and exit ramp destination location and a weighted average of all the trips was created. The results showed that the average personal trip along the northbound I-229 corridor was approximately 3.3 miles and the average commercial trip along the corridor was approximately 4.3 miles.

The following **Tables 2 through 4** represent the origin destination percentages for both the personal and commercial data for an average weekday and both the AM and PM peak periods. Each entrance ramp has a bar graph to represent the scale of each percentage based on the trip type; personal trips and commercial trips are scaled separately.

The attached **Figure 2** represents the 24-hour weekday average in a graphical form, and the attached **Tables A1-A8** represent all of the OD data separately by all-days, weekdays, weekends, AM peak, Mid-day, and PM peak information.

*Table 2 Northbound I-229 OD Percentages (**Weekday 24-Hr**)*

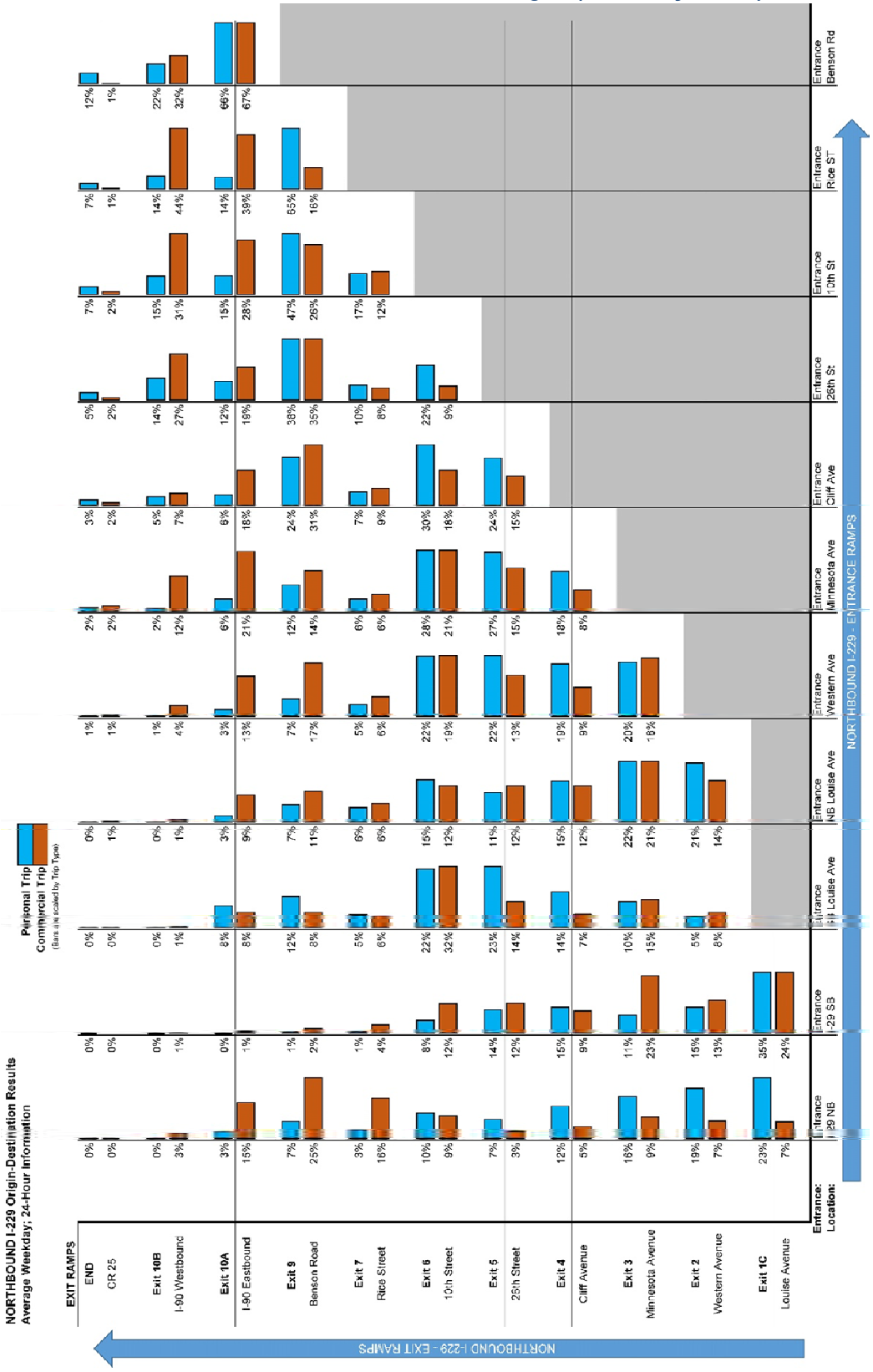


*Table 3 Northbound I-229 OD Percentages (Weekday **AM Peak 6am to 9am**)*

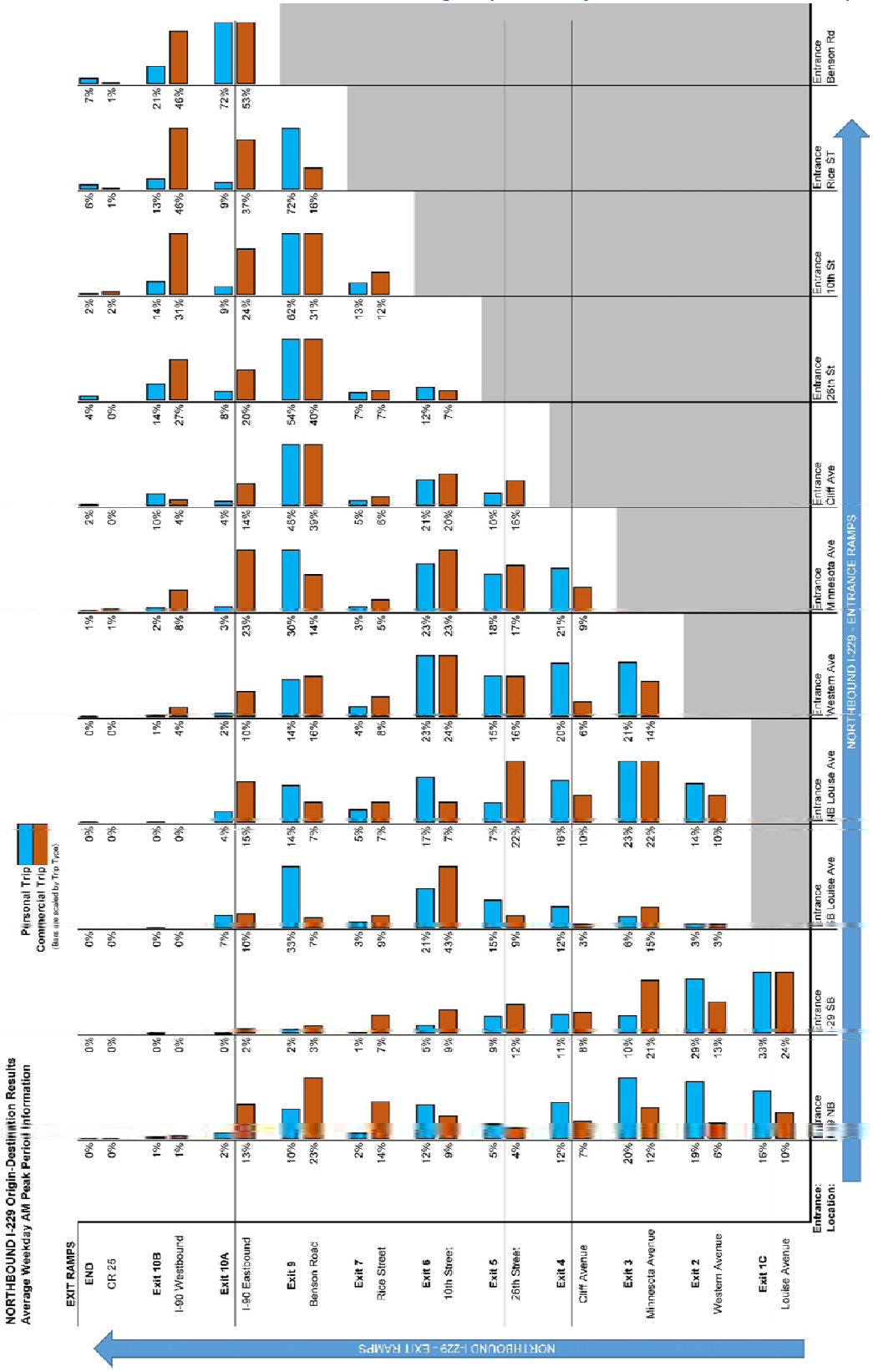
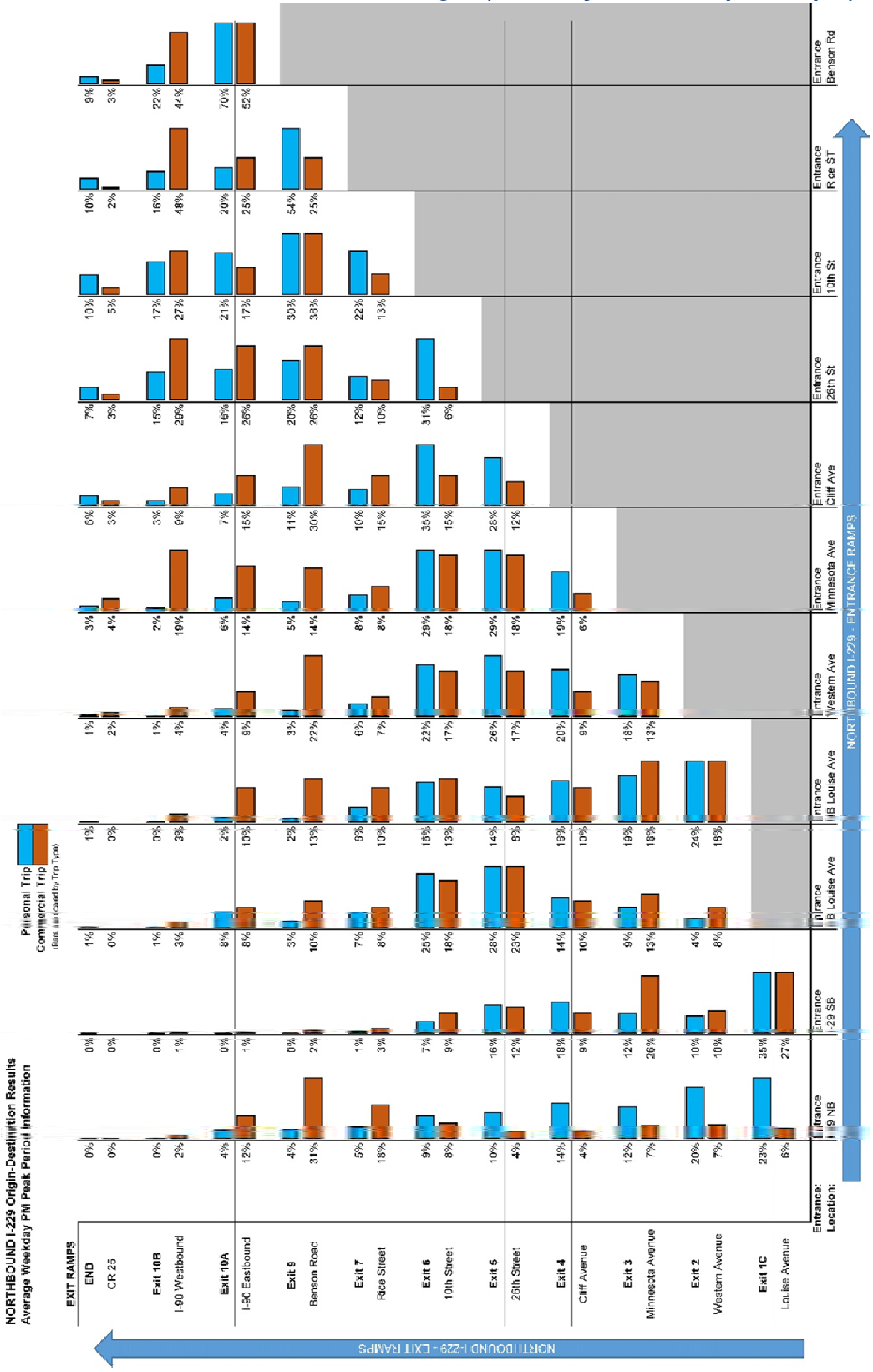


*Table 4 Northbound I-229 OD Percentages (**Weekday PM Peak 3pm to 7pm**)*



Southbound I-229 Origin Destination Results

The following **Tables 8 through 14** represent the full years' worth of origin-destination data for the southbound I-229 entrance and exit ramps.

- **Table 8 SB I-229 Exit 3 & 4 Project Summary**
- **Table 9 Weekday 24-Hour - Personal**
- **Table 10 Weekday 24-Hour - Commercial**
- **Table 11 Weekday AM Peak Period - Personal**
- **Table 12 Weekday AM Peak Period - Commercial**
- **Table 13 Weekday PM Peak Period - Personal**
- **Table 14 Weekday PM Peak Period - Commercial**

I-229 Exits 3 and 4 Interchange Project Area:

Based on the mobile device and GPS device data, the weaving demands between each ramp to ramp connection can vary from as low as 9% to upwards of 32%. The following table shows the three southbound I-229 weaving sections and the corresponding ramp to ramp percentages for the personal devices (LBS), the commercial vehicles (GPS), and then a weighted average between the two data sources. As the commercial trips are significantly lower than the personal trips counts, the weighted average is typically very close to the personal trip percentages.

Table 5 Southbound I-229 OD Percentages (Exits 2, 3, 4, & 5)

SB I-229 Ramp Weaving	Weekday 24-hr			Weekday AM Period			Weekday PM Period		
	P	C	Avg	P	C	Avg	P	C	Avg
26th to Cliff	18%	11%	18%	15%	9%	15%	19%	10%	19%
Cliff to Minnesota	23%	16%	23%	20%	24%	20%	25%	13%	24%
Minnesota to Western	34%	11%	32%	34%	10%	32%	32%	6%	30%

Notes: P = Personal (LBS); C = Commercial (GPS); Avg = Weighted Average Percentage

Between 26th Street (Exit 5) and Cliff Avenue (Exit 4) the average weekday ramp to ramp demands are approximately 18% of the entrance demands from 26th Street. The daily percentage is essentially echoed during the peak periods with the AM peak having a slight reduction to 15% and the PM peak at 19%.

Between Cliff Avenue (Exit 4) and Minnesota Avenue (Exit 3) the average weekday ramp to ramp demands are approximately 23% of the entrance demands from Cliff Avenue. The daily percentage is essentially echoed during the peak periods with the AM peak having a slight reduction to 20% and the PM peak at 24%.

Between Minnesota Avenue (Exit 3) and Western Avenue (Exit 2) the average weekday ramp to ramp demands are approximately 32% of the entrance demands from Minnesota Avenue. The daily percentage is essentially echoed during the peak periods with the AM peak having 32% as well and the PM peak a slight reduction to 30%.

I-229 Corridor:

Based on the data results for the entire southbound I-229 corridor, this freeway corridor again serves a majority of local service trips and is not used by longer, regional trips. The following description of results is based on the average 24-hour weekday trips unless otherwise directly noted.

Traffic entering southbound I-229 from both directions of I-90 is mostly dispersed within the first six service interchanges along the corridor. At Minnesota Avenue (Exit 3), approximately 70% or more of the I-90 traffic has left the corridor. There is a substantial demand from I-90 that exits at 10th Street (Exit 6) with approximately 22% of the westbound I-90 traffic and 36% of eastbound I-90 traffic using this exit.

Less than approximately 6% of the I-90 traffic continues along southbound I-29 and a very insignificant amount continues to northbound I-29. The only exception to this is for commercial trips, where approximately 23% of the trips from either eastbound I-90 or westbound I-90 continue along southbound I-229 and exit to southbound I-29.

For all of the service interchange entrance ramps, the demand of personal trips destined to I-29 does not exceed 15% until the 26th Street (Exit 5) entrance ramp and then all the subsequent entrance ramps. The demand of commercial trips destined to either direction of I-29 exceeds 50% as early as Benson Road (Exit 9) and all the subsequent entrance ramps; the commercial demand for northbound I-29 does exceed 20% at 26th Street (Exit 5).

On average, approximately 19% of the traffic entering southbound I-229 from a service interchange will exit at the next available exit ramp along the corridor; this does not include Louise Avenue due to the proximity to I-29. By the 2nd available exit ramp, approximately 45% of the traffic will have exited the freeway and approximately 60% depart by the 3rd available exit ramp. By the 4th available exit, approximately 74% of the traffic from each entrance ramp will have departed the I-229 freeway; this relates back the I-229 corridor being used primarily for short distance trips.

Based on the OD matrices developed from the Streetlight information, an estimated average trip distance was developed. Each entrance and exit ramp distance was correlated to the exit ramp numbering system to develop trip distances. For example, traffic that entered the corridor from Benson Road, Exit 9, and exited at Western Avenue, Exit 2, was assumed to travel 7 miles along I-229. This was done for every entrance ramp origin location and exit ramp destination location and a weighted average of all the trips was created. The results showed that the average personal trip along the southbound I-229 corridor was approximately 3.2 miles and the average commercial trip along the corridor was approximately 4.7 miles.

The following **Tables 6 through 8** represent the origin destination percentages for both the personal and commercial data for an average weekday and both the AM and PM peak periods. Each entrance ramp has a bar graph to represent the scale of each percentage based on the trip type; personal trips and commercial trips are scaled separately.

The attached **Figure 3** represents the 24-hour weekday average in a graphical form, and the attached **Tables A1-A8** represent all of the OD data separately by all-days, weekdays, weekends, AM peak, Mid-day, and PM peak information.

*Table 6 Southbound I-229 OD Percentages (**Weekday 24-Hr**)*

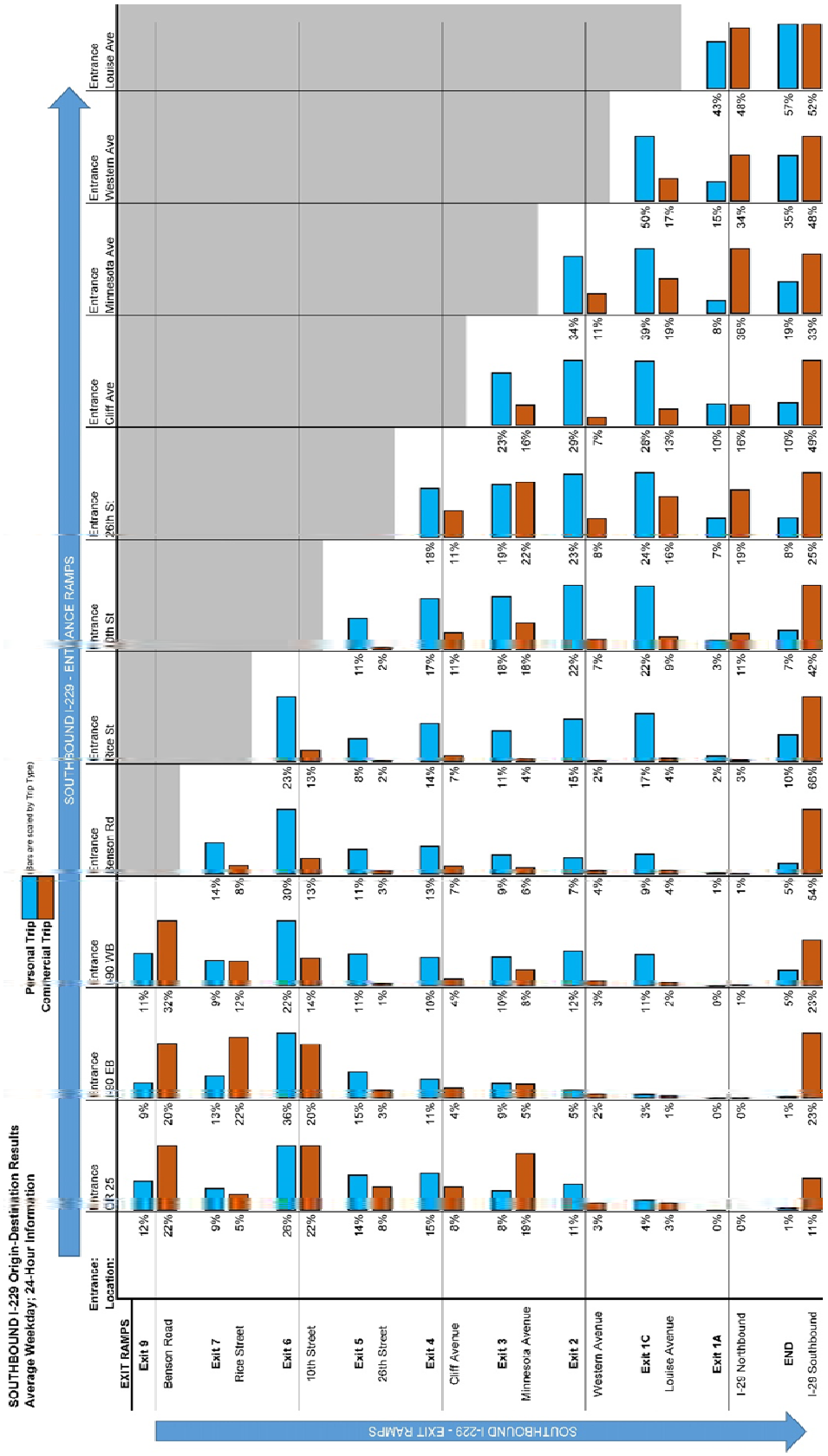


*Table 7 Southbound I-229 OD Percentages (**Weekday AM Peak 6am to 9am**)*

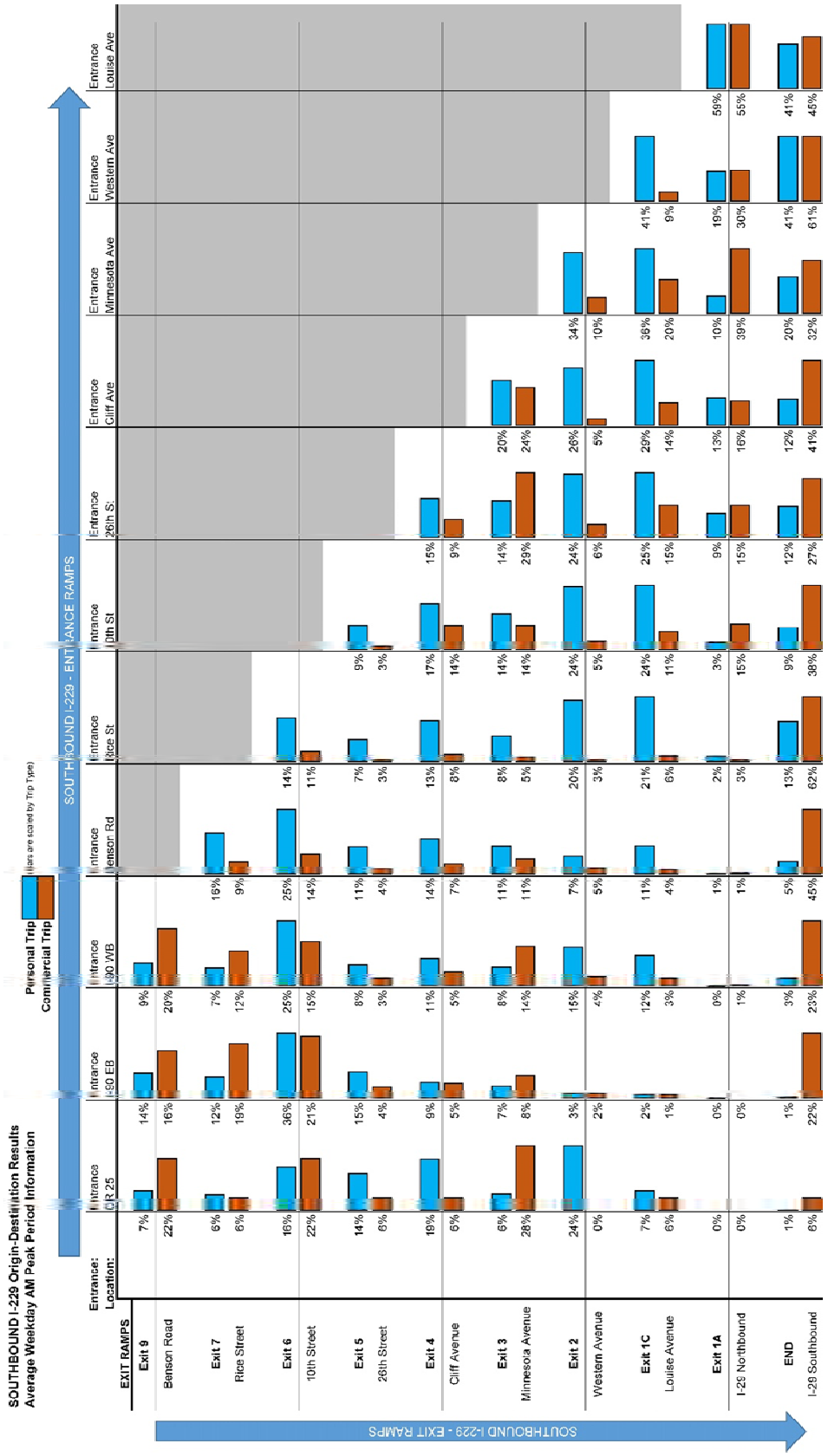
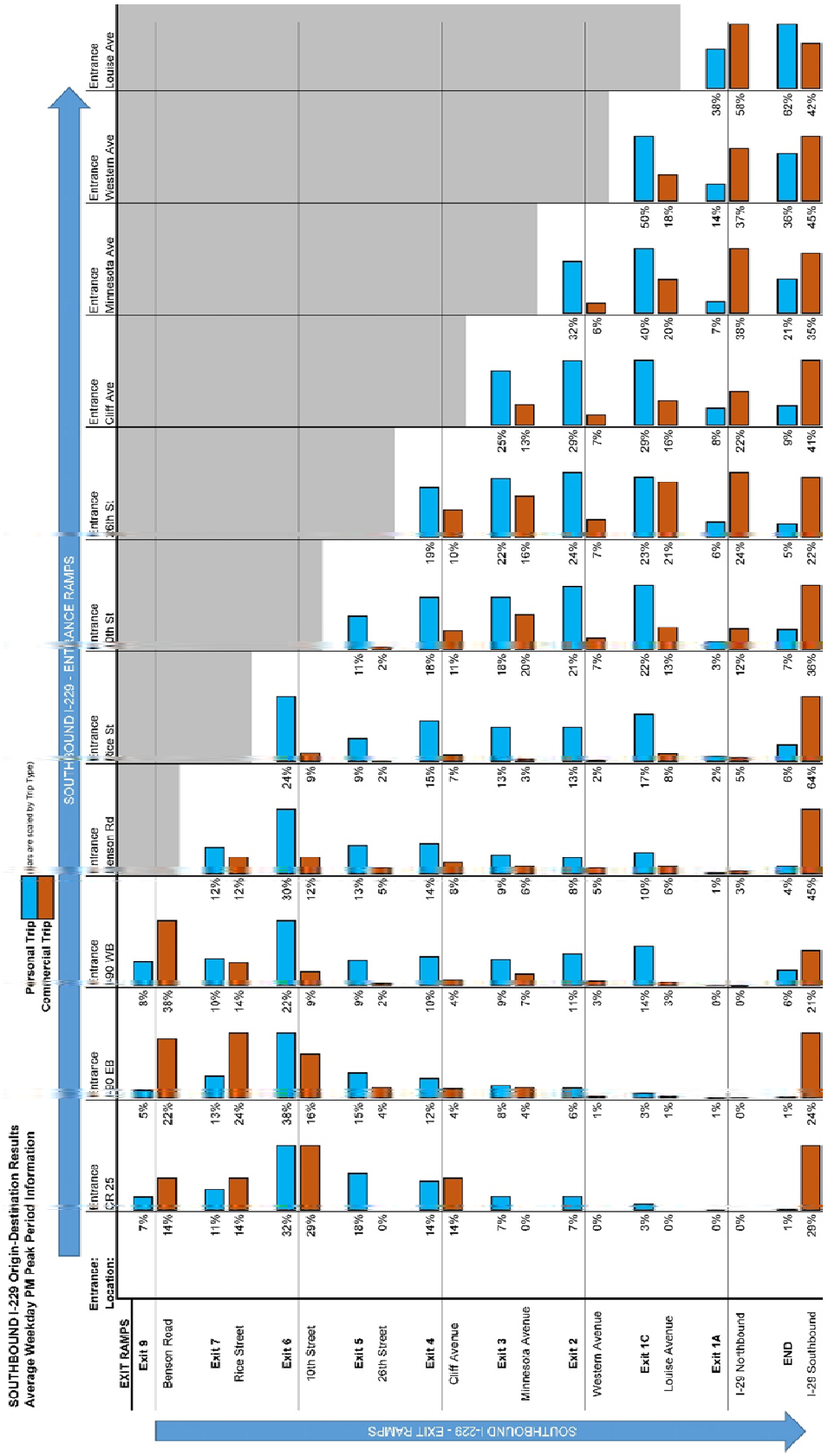


*Table 8 Southbound I-229 OD Percentages (**Weekday PM Peak 3pm to 7pm**)*



CONCLUSIONS AND SUMMARY

SDDOT and the City of Sioux Falls have a desire to better understand the traffic patterns along I-229, in particular the weaving demands between Exits 2, 3, 4, and 5. Using "big data" provided through StreetLight, an Origin-Destination study was conducted based on route tracking of personal and commercial mobile devices.

A full years' worth of device data, from July 2017 through June 2018, was analyzed through the platform and an Origin Destination matrix was completed for the entire corridor. The data tracking system is able to capture personal trips via LBS data and commercial trips via GPS data; personal GPS data was not used due to low capture rate.

Due to the breadth of readily available data through the StreetLight platform, a more comprehensive OD study was completed along the I-229 corridor between I-90 and I-29. The project specific Streetlight subscription allowed for a total of up to 50 zones, which allowed for all entrance and exit ramps along I-229 to be included in the study.

I-229 Corridor

Analyzing the entire I-229 corridor for both directions, the majority of trips are of relatively short duration. An estimated, average freeway trip length was calculated for both personal and commercial trips. The average trip length along the freeway was:

- Personal Trips: 3.3 miles / 3.2 miles for northbound / southbound I-229.
- Commercial Trips: 4.3 miles / 4.7 miles for northbound / southbound I-229

For northbound I-229, the majority of traffic that initially enters the corridor will exit within the first 4 exit opportunities; approximately 70% of each entrance ramp volume will depart within these first opportunities. The majority of personal trips from northbound I-29 that enter I-229 will not continue to I-90, only approximately 3% of the trips used the entire corridor.

Commercial trips along northbound I-229 have a distinct pattern with the highest volumes destined to either the Benson Road interchange or along I-90 in either direction. The commercial trips include the highest percent of longer route trips, such as the northbound I-29 commercial traffic which has a high destination of approximately 25% of trips destined to the Benson Road (Exit 9) and additionally approximately 17% of trips destined to either direction of I-90.

Southbound I-229 has similar patterns compared to northbound. The majority of traffic that enters the corridor will exit within the first 6 exit opportunities, approximately 70% of each entrance ramp will depart within these opportunities. The majority of personal trips from I-90 that enter I-229 will not continue down to I-29, only approximately 6% of the trips used the entire corridor.

Commercial trips along southbound I-229 have a distinct pattern with the majority destined to I-29 in either direction; northbound I-29 isn't a destination until the traffic enters from 26th Street or further south. The commercial trips include the highest percent of longer route trips, such as the I-90 commercial traffic which has a high destination of approximately 23% of trips destined to southbound I-29; only approximately 1% are destined to northbound I-29.

I-229 Exits 3 and 4 Interchange Project

The I-229 Exits 3 and 4 project specific OD evaluation results can be narrowed down to show what will be incorporated into the freeway weaving analysis. The ramp to ramp demands range from as low as 11% and as high as 32%.

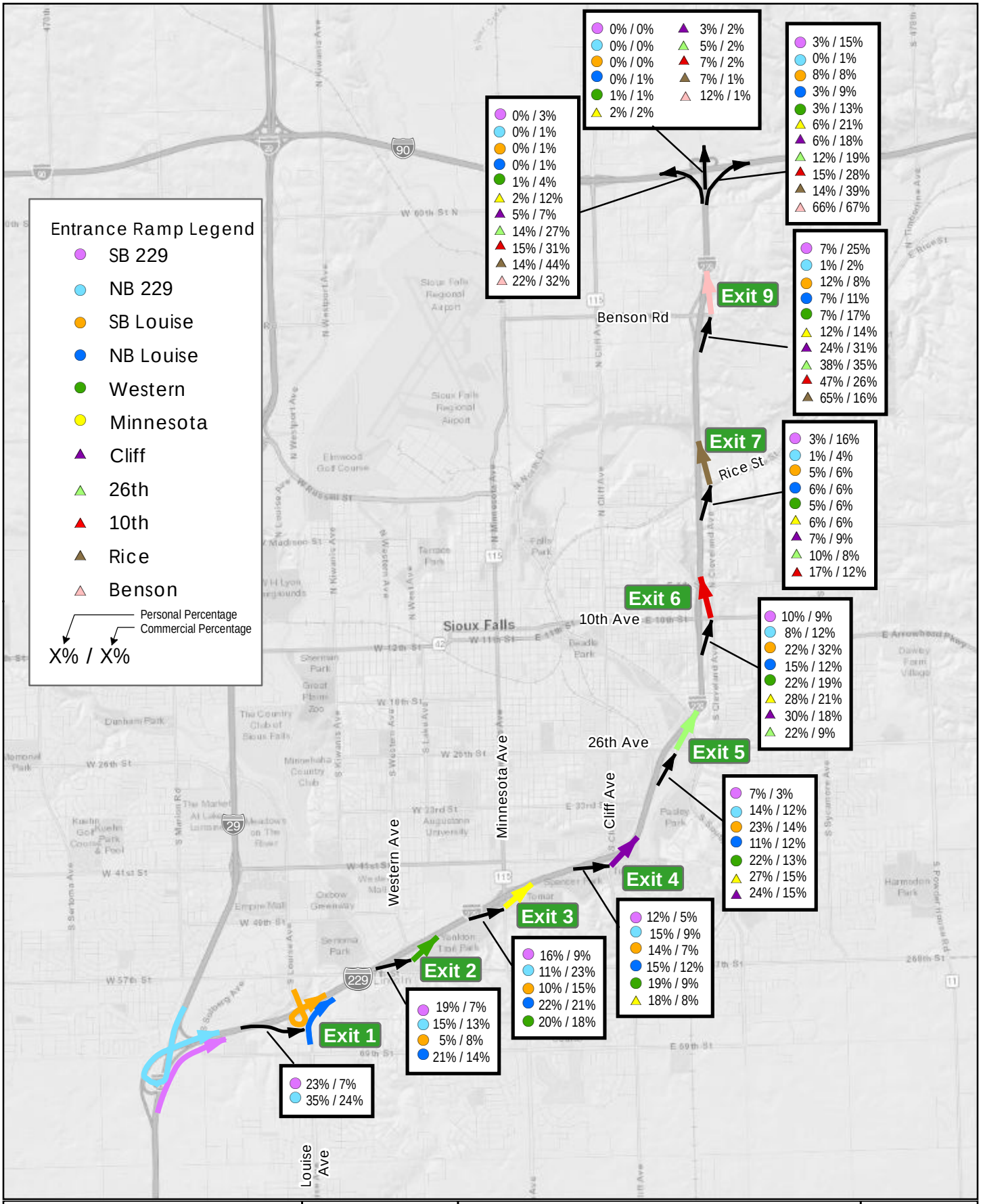
Some of the PM peak period percentages are much higher than the AM peak period, this is likely due to traffic avoiding the arterial roadway congestion and using the freeway to reduce their trip time.

The resulting ramp to ramp percentages for the project are shown in **Table 9**.

Table 9 Summary I-229 OD Percentages (Exits 2, 3, 4, & 5)

Ramp Weaving Sections		Weekday 24-hr	Weekday AM Period	Weekday PM Period
		Avg	Avg	Avg
NB I-229	Western to Minnesota	20%	20%	18%
NB I-229	Minnesota to Cliff	17%	20%	18%
NB I-229	Cliff to 26th	24%	11%	27%
SB I-229	26th to Cliff	18%	15%	19%
SB I-229	Cliff to Minnesota	23%	20%	24%
SB I-229	Minnesota to Western	32%	32%	30%

gtj
Attached Figures 2 & 3
Attached Tables A1-A8
c: Shannon Ausen (City of Sioux Falls)
c:\tsis6 projects\i-229 ex3&4\streetlight data\memo\od memo i229 exits3&4 streetlight 010419.docx



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SEH

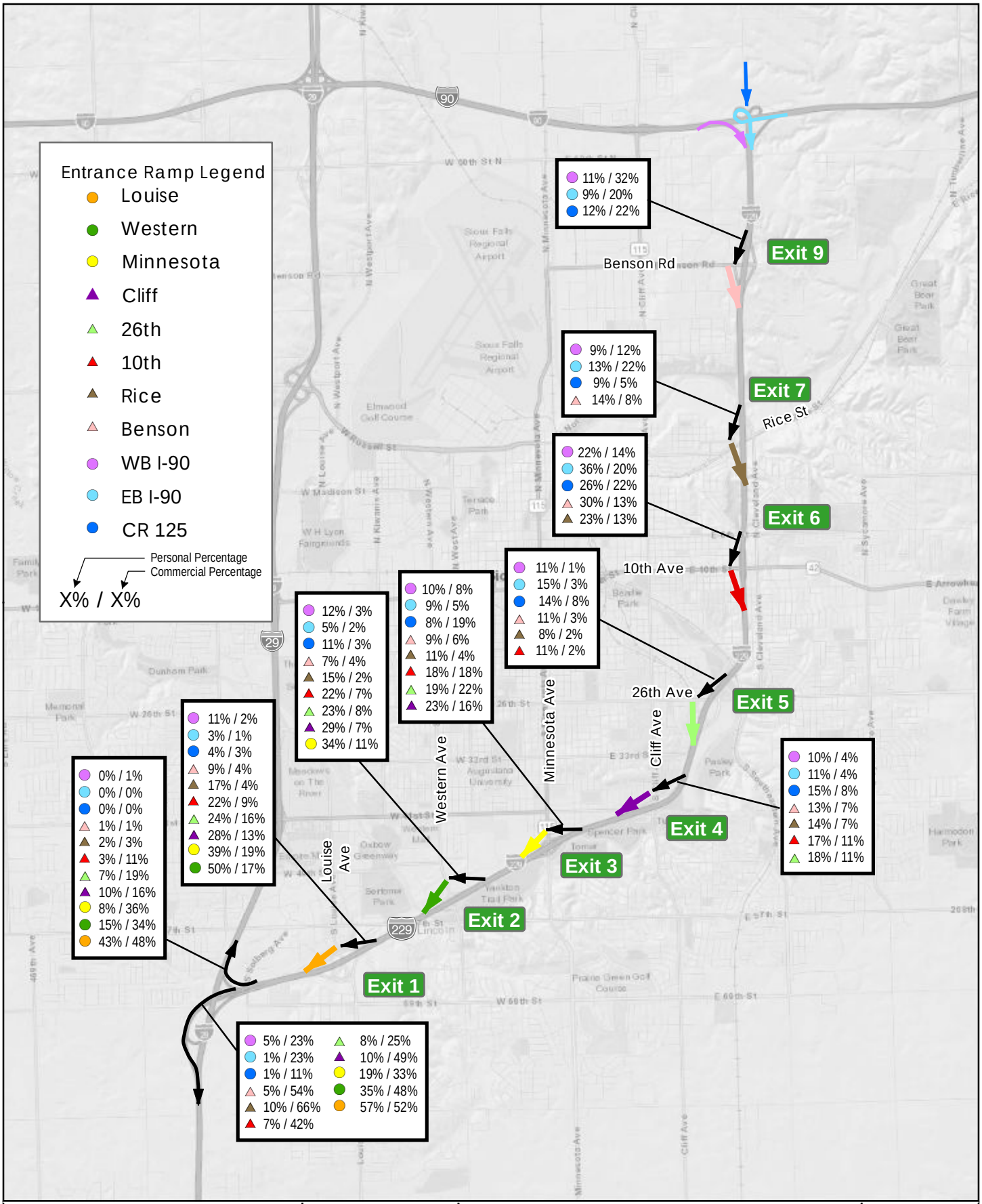
0 0.25 0.5 1 Miles

Project: SDDOT 147016
Print Date: 1/4/2019

Map by: msteuernagel
Projection: UTM Zone 14N
Source: SEH, ESRI

NB I-229 OD Summary; 24 Hr Weekday Avg.
I-229 Exits 3 and 4 Interchange Study
Sioux Falls, SD

Figure 2



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SEH

0 0.25 0.5 1 Miles

Project: SDDOT 147016
Print Date: 1/4/2019

Map by: msteuernagel
Projection: UTM Zone 14N
Source: SEH, ESRI

SB I-229 OD Summary; 24 Hr Weekday Avg.

I-229 Exits 3 and 4 Interchange Study
Sioux Falls, SD

Figure 3

STREETLIGHT DATA
I-229 OD Study Information
July 2017 to June 2018

Table A1a
NORTHBOUND I-229 ORIGIN & DESTINTATION
I-229 EXITS 3 & 4 STUDY
PERCENTAGE INFORMATION

Type: **PV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 0 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 0 24-Hr (0), other based on inputs (notes below).

7 Day Avg - 24-Hr

NB I-229				DESTINATION ZONES											
7 Day Avg - 24-Hr				Exit 1C Louise	Exit 2 Western	Exit 3 Minn.	Exit 4 Cliff	Exit 5 26th	Exit 6 10th	Exit 7 Rice	Exit 9 Benson	Exit 10A EB I-90	Exit 10B WB I-90	CR 125	
			Zone #	11	21	31	41	51	61	71	91	903	902	905	**Total**
			ADT	6160	3925	4930	6000	8040	6810	3990	8430	--	--	1200	**49485**
Entrance	Zone #	ADT	**Calibrated**	**3,213**	**3,590**	**5,665**	**6,147**	**8,371**	**9,097**	**3,156**	**8,074**	**3,770**	**2,298**	**1,260**	**54,641**
NB I-29	291	--	**7,479**	23%	19%	16%	12%	8%	9%	3%	6%	3%	0%	0%	**100%**
SB I-29	294	--	**4,128**	35%	14%	11%	15%	14%	8%	2%	1%	0%	0%	0%	**100%**
SB Louise	12	6360	**2,486**		5%	10%	13%	24%	23%	6%	10%	9%	1%	0%	**100%**
NB Louise	15	5185	**6,645**		22%	22%	14%	12%	15%	5%	6%	3%	0%	0%	**100%**
Western	22	7290	**11,747**			**20%**	19%	23%	23%	5%	6%	3%	1%	1%	**100%**
Minnesota	32	5180	**6,580**				**17%**	29%	28%	6%	10%	7%	2%	2%	**100%**
Cliff	42	3870	**4,577**					**26%**	31%	7%	21%	6%	5%	3%	**100%**
26th	52	3110	**2,198**						22%	10%	34%	13%	15%	6%	**100%**
10th	62	5650	**5,236**							17%	43%	16%	17%	8%	**100%**
Rice	72	3500	**2,811**								62%	15%	16%	8%	**100%**
Benson	92	1320	**754**									67%	20%	12%	**100%**
	Total	**41465**	**54,641**												

ORIGIN ZONES

Type: **PV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 1 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 0 24-Hr (0), other based on inputs (notes below).

Avg Wkdy - 24-Hr

NB I-229				DESTINATION ZONES											
Avg Wkdy - 24-Hr				Exit 1C Louise	Exit 2 Western	Exit 3 Minn.	Exit 4 Cliff	Exit 5 26th	Exit 6 10th	Exit 7 Rice	Exit 9 Benson	Exit 10A EB I-90	Exit 10B WB I-90	CR 125	
			Zone #	11	21	31	41	51	61	71	91	903	902	905	**Total**
			ADT	6160	3925	4930	6000	8040	6810	3990	8430	--	--	1200	**49485**
Entrance	Zone #	ADT	**Calibrated**	**3,329**	**3,834**	**6,135**	**6,757**	**8,370**	**9,511**	**3,408**	**9,920**	**3,859**	**2,361**	**1,281**	**58,765**
NB I-29	291	--	**8,299**	23%	19%	16%	12%	7%	10%	3%	7%	3%	0%	0%	**100%**
SB I-29	294	--	**4,155**	35%	15%	11%	15%	14%	8%	1%	1%	0%	0%	0%	**100%**
SB Louise	12	6360	**2,608**		5%	10%	14%	23%	22%	5%	12%	8%	0%	0%	**100%**
NB Louise	15	5185	**7,204**		21%	22%	15%	11%	15%	6%	7%	3%	0%	0%	**100%**
Western	22	7290	**12,566**			**20%**	19%	22%	22%	5%	7%	3%	1%	1%	**100%**
Minnesota	32	5180	**6,771**				**18%**	27%	28%	6%	12%	6%	2%	2%	**100%**
Cliff	42	3870	**4,892**					**24%**	30%	7%	24%	6%	5%	3%	**100%**
26th	52	3110	**2,444**						22%	10%	38%	12%	14%	5%	**100%**
10th	62	5650	**5,731**							17%	47%	15%	15%	7%	**100%**
Rice	72	3500	**3,188**								65%	14%	14%	7%	**100%**
Benson	92	1320	**907**									66%	22%	12%	**100%**
	Total	**41465**	**58,765**												

ORIGIN ZONES

Type: **PV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 2 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 0 24-Hr (0), other based on inputs (notes below).

Avg Wknd - 24-Hr

NB I-229				DESTINATION ZONES											
Avg Wknd - 24-Hr				Exit 1C Louise	Exit 2 Western	Exit 3 Minn.	Exit 4 Cliff	Exit 5 26th	Exit 6 10th	Exit 7 Rice	Exit 9 Benson	Exit 10A EB I-90	Exit 10B WB I-90	CR 125	
			Zone #	11	21	31	41	51	61	71	91	903	902	905	**Total**
			ADT	6160	3925	4930	6000	8040	6810	3990	8430	--	--	1200	**49485**
Entrance	Zone #	ADT	**Calibrated**	**2,691**	**2,824**	**4,226**	**4,453**	**7,958**	**7,438**	**2,448**	**3,378**	**3,233**	**1,934**	**1,161**	**41,744**
NB I-29	291	--	**5,281**	26%	20%	15%	11%	9%	9%	3%	2%	4%	0%	0%	**100%**
SB I-29	294	--	**3,665**	36%	11%	11%	15%	17%	7%	2%	0%	1%	0%	0%	**100%**
SB Louise	12	6360	**1,994**		5%	10%	12%	27%	25%	8%	3%	9%	1%	1%	**100%**
NB Louise	15	5185	**5,053**		26%	24%	11%	14%	14%	5%	2%	3%	1%	0%	**100%**
Western	22	7290	**9,071**			**18%**	18%	27%	25%	5%	3%	4%	0%	1%	**100%**
Minnesota	32	5180	**5,722**				**15%**	34%	29%	6%	4%	8%	1%	2%	**100%**
Cliff	42	3870	**3,592**					**34%**	34%	6%	11%	8%	4%	3%	**100%**
26th	52	3110	**1,502**						24%	11%	20%	17%	21%	7%	**100%**
10th	62	5650	**3,776**							18%	29%	19%	22%	12%	**100%**
Rice	72	3500	**1,732**							0%	47%	20%	21%	12%	**100%**
Benson	92	1320	**356**							0%		70%	16%	14%	**100%**
	Total	**41465**	**41,744**												

ORIGIN ZONES

Ramp to Ramp Demand between Study Interchanges

Notes:

Demand: Streetlight Index is a representative of the relative amount of Trips; Calibrated is a representative Daily Value.

Day Type: Average Day (Mon-Sun), Weekdays (Mon-Thurs), or Weekends (Sat-Sun)

Day Part: [0] 24-hour, [1] Early AM (12am-6am), [2] Peak AM (6am-9am), [3] Mid-Day (9am-3pm), [4] Peak PM (3pm-7pm), [5] Late PM (7pm-12am)

Some Day Types or Day Parts might not have resulted in sufficient data for Streetlight to provide values.

Trips: For GPS Trips, a trip is considered when the device does not move 5 meters in 5 minutes or when device is turned off.

Trips are required to be at least 3 minutes and 500 meters in length.

STREETLIGHT DATA
I-229 OD Study Information
July 2017 to June 2018

Table A1b
NORTHBOUND I-229 ORIGIN & DESTINTATION
I-229 EXITS 3 & 4 STUDY
ESTIMATED COUNT INFORMATION

Type: **PV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 0 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 0 24-Hr (0), other based on inputs (notes below).

7 Day Avg - 24-Hr

NB I-229				DESTINATION ZONES											
7 Day Avg - 24-Hr				Exit 1C Louise	Exit 2 Western	Exit 3 Minn.	Exit 4 Cliff	Exit 5 26th	Exit 6 10th	Exit 7 Rice	Exit 9 Benson	Exit 10A EB I-90	Exit 10B WB I-90	CR 125	
			Zone #	11	21	31	41	51	61	71	91	903	902	905	Total
			ADT	6160	3925	4930	6000	8040	6810	3990	8430	--	--	1200	49485
Entrance	Zone #	ADT	Calibrated	3,213	3,590	5,665	6,147	8,371	9,097	3,156	8,074	3,770	2,298	1,260	54,641
ORIGIN ZONES															
NB I-29	291	--	7,479	1,757	1,408	1,169	893	569	700	252	433	247	31	20	7,479
SB I-29	294	--	4,128	1,456	569	445	618	591	325	62	36	16	6	4	4,128
SB Louise	12	6360	2,486		119	242	335	596	567	145	246	212	13	11	2,486
NB Louise	15	5185	6,645		1,494	1,493	924	774	1,001	350	370	182	28	29	6,645
Western	22	7290	11,747			**2,316**	2,228	2,738	2,716	547	687	362	69	84	11,747
Minnesota	32	5180	6,580				**1,149**	1,891	1,870	374	648	432	102	114	6,580
Cliff	42	3870	4,577					**1,212**	1,430	326	945	293	226	145	4,577
26th	52	3110	2,198						488	218	746	285	339	122	2,198
10th	62	5650	5,236							882	2,230	823	884	417	5,236
Rice	72	3500	2,811								1,733	412	446	220	2,811
Benson	92	1320	754									506	154	94	754
	Total	**41465**	**54,641**	**3,213**	**3,590**	**5,665**	**6,147**	**8,371**	**9,097**	**3,156**	**8,074**	**3,770**	**2,298**	**1,260**	**54,641**

Type: **PV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 1 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 0 24-Hr (0), other based on inputs (notes below).

Avg Wkdy - 24-Hr

NB I-229				DESTINATION ZONES											
Avg Wkdy - 24-Hr				Exit 1C Louise	Exit 2 Western	Exit 3 Minn.	Exit 4 Cliff	Exit 5 26th	Exit 6 10th	Exit 7 Rice	Exit 9 Benson	Exit 10A EB I-90	Exit 10B WB I-90	CR 125	
			Zone #	11	21	31	41	51	61	71	91	903	902	905	Total
			ADT	6160	3925	4930	6000	8040	6810	3990	8430	--	--	1200	49485
Entrance	Zone #	ADT	Calibrated	3,329	3,834	6,135	6,757	8,370	9,511	3,408	9,920	3,859	2,361	1,281	58,765
ORIGIN ZONES															
NB I-29	291	--	8,299	1,874	1,553	1,305	1,010	611	805	289	551	237	39	25	8,299
SB I-29	294	--	4,155	1,455	624	447	624	568	319	57	45	8	6	2	4,155
SB Louise	12	6360	2,608		118	261	358	602	580	135	313	221	10	10	2,608
NB Louise	15	5185	7,204		1,539	1,587	1,081	781	1,108	398	469	186	24	31	7,204
Western	22	7290	12,566			**2,535**	2,448	2,824	2,800	592	850	358	78	81	12,566
Minnesota	32	5180	6,771				**1,236**	1,815	1,877	394	826	392	106	125	6,771
Cliff	42	3870	4,892					**1,169**	1,491	355	1,193	280	243	161	4,892
26th	52	3110	2,444						531	235	919	292	340	127	2,444
10th	62	5650	5,731							953	2,684	856	853	385	5,731
Rice	72	3500	3,188								2,070	433	462	223	3,188
Benson	92	1320	907									596	200	111	907
	Total	**41465**	**58,765**	**3,329**	**3,834**	**6,135**	**6,757**	**8,370**	**9,511**	**3,408**	**9,920**	**3,859**	**2,361**	**1,281**	**58,765**

Type: **PV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 2 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 0 24-Hr (0), other based on inputs (notes below).

Avg Wknd - 24-Hr

NB I-229				DESTINATION ZONES											
Avg Wknd - 24-Hr				Exit 1C Louise	Exit 2 Western	Exit 3 Minn.	Exit 4 Cliff	Exit 5 26th	Exit 6 10th	Exit 7 Rice	Exit 9 Benson	Exit 10A EB I-90	Exit 10B WB I-90	CR 125	
			Zone #	11	21	31	41	51	61	71	91	903	902	905	Total
			ADT	6160	3925	4930	6000	8040	6810	3990	8430	--	--	1200	49485
Entrance	Zone #	ADT	Calibrated	2,691	2,824	4,226	4,453	7,958	7,438	2,448	3,378	3,233	1,934	1,161	41,744
ORIGIN ZONES															
NB I-29	291	--	5,281	1,376	1,031	807	587	472	458	165	121	234	17	13	5,281
SB I-29	294	--	3,665	1,315	397	396	552	615	271	68	8	31	6	6	3,665
SB Louise	12	6360	1,994		102	198	247	541	490	157	54	174	19	12	1,994
NB Louise	15	5185	5,053		1,294	1,198	540	728	727	234	125	151	32	24	5,053
Western	22	7290	9,071			**1,627**	1,645	2,421	2,254	410	258	324	44	88	9,071
Minnesota	32	5180	5,722				**882**	1,959	1,676	322	218	486	81	98	5,722
Cliff	42	3870	3,592					**1,222**	1,208	233	383	287	158	101	3,592
26th	52	3110	1,502						354	168	302	257	315	106	1,502
10th	62	5650	3,776							691	1,089	699	842	455	3,776
Rice	72	3500	1,732								820	340	364	208	1,732
Benson	92	1320	356									250	56	50	356
	Total	**41465**	**41,744**	**2,691**	**2,824**	**4,226**	**4,453**	**7,958**	**7,438**	**2,448**	**3,378**	**3,233**	**1,934**	**1,161**	**41,744**

Ramp to Ramp Demand between Study Interchanges

Notes:

Demand: Streetlight Index is a representative of the relative amount of Trips; Calibrated is a representative Daily Value.

Day Type: Average Day (Mon-Sun), Weekdays (Mon-Thurs), or Weekends (Sat-Sun)

Day Part: [0] 24-hour, [1] Early AM (12am-6am), [2] Peak AM (6am-9am), [3] Mid-Day (9am-3pm), [4] Peak PM (3pm-7pm), [5] Late PM (7pm-12am)

Some Day Types or Day Parts might not have resulted in sufficient data for Streetlight to provide values.

Trips: For GPS Trips, a trip is considered when the device does not move 5 meters in 5 minutes or when device is turned off.
Trips are required to be at least 3 minutes and 500 meters in length.

STREETLIGHT DATA
I-229 OD Study Information
July 2017 to June 2018

Table A2a
NORTHBOUND I-229 ORIGIN & DESTINTATION
I-229 EXITS 3 & 4 STUDY
PERCENTAGE INFORMATION

Type: **PV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 1 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 2 24-Hr (0), other based on inputs (notes below).

Avg Wkdy - 6am-9am

NB I-229 Avg Wkdy - 6am-9am				DESTINATION ZONES											
				Exit 1C Louise	Exit 2 Western	Exit 3 Minn.	Exit 4 Cliff	Exit 5 26th	Exit 6 10th	Exit 7 Rice	Exit 9 Benson	Exit 10A EB I-90	Exit 10B WB I-90	CR 125	
		Zone #		11	21	31	41	51	61	71	91	903	902	905	**Total**
			ADT	6160	3925	4930	6000	8040	6810	3990	8430	--	--	1200	**49485**
Entrance	Zone #	ADT	**Calibrated**	**697**	**1,046**	**1,555**	**1,505**	**1,162**	**1,983**	**646**	**4,290**	**695**	**714**	**182**	**14,475**
ORIGIN ZONES															
NB I-29	291	--	**2,555**	16%	19%	20%	12%	5%	12%	2%	10%	2%	1%	0%	**100%**
SB I-29	294	--	**868**	33%	29%	10%	11%	9%	5%	1%	2%	0%	0%	0%	**100%**
SB Louise	12	6360	**626**		3%	6%	12%	15%	21%	3%	33%	7%	0%	0%	**100%**
NB Louise	15	5185	**1,978**		14%	23%	16%	7%	17%	5%	14%	4%	0%	0%	**100%**
Western	22	7290	**2,245**			**21%**	20%	15%	23%	4%	14%	2%	1%	0%	**100%**
Minnesota	32	5180	**1,259**				**21%**	18%	23%	3%	30%	3%	2%	1%	**100%**
Cliff	42	3870	**1,280**					**10%**	21%	5%	48%	4%	10%	2%	**100%**
26th	52	3110	**905**						12%	7%	54%	8%	14%	4%	**100%**
10th	62	5650	**1,739**							13%	62%	9%	14%	2%	**100%**
Rice	72	3500	**906**								72%	9%	13%	6%	**100%**
Benson	92	1320	**114**									72%	21%	7%	**100%**
	Total	**41465**	**14,475**												

Type: **PV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 1 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 3 24-Hr (0), other based on inputs (notes below).

Avg Wkdy - 9am-3pm

NB I-229 Avg Wkdy - 9am-3pm				DESTINATION ZONES											
				Exit 1C Louise	Exit 2 Western	Exit 3 Minn.	Exit 4 Cliff	Exit 5 26th	Exit 6 10th	Exit 7 Rice	Exit 9 Benson	Exit 10A EB I-90	Exit 10B WB I-90	CR 125	
		Zone #		11	21	31	41	51	61	71	91	903	902	905	**Total**
			ADT	6160	3925	4930	6000	8040	6810	3990	8430	--	--	1200	**49485**
Entrance	Zone #	ADT	**Calibrated**	**1,306**	**1,439**	**2,312**	**2,340**	**2,938**	**3,434**	**1,091**	**3,125**	**1,283**	**771**	**425**	**20,464**
ORIGIN ZONES															
NB I-29	291	--	**2,814**	27%	20%	15%	11%	7%	9%	3%	5%	3%	0%	0%	**100%**
SB I-29	294	--	**1,583**	35%	13%	12%	14%	13%	10%	2%	1%	0%	0%	0%	**100%**
SB Louise	12	6360	**838**		7%	13%	14%	24%	23%	5%	8%	6%	0%	0%	**100%**
NB Louise	15	5185	**2,363**		26%	23%	14%	10%	14%	4%	5%	2%	0%	1%	**100%**
Western	22	7290	**4,631**			**23%**	19%	20%	22%	5%	7%	3%	1%	1%	**100%**
Minnesota	32	5180	**2,537**				**18%**	27%	29%	6%	10%	7%	2%	1%	**100%**
Cliff	42	3870	**1,628**					**29%**	33%	7%	20%	5%	3%	3%	**100%**
26th	52	3110	**735**						26%	10%	33%	14%	12%	4%	**100%**
10th	62	5650	**1,833**							16%	47%	15%	15%	7%	**100%**
Rice	72	3500	**1,147**								65%	14%	15%	5%	**100%**
Benson	92	1320	**355**									56%	25%	18%	**100%**
	Total	**41465**	**20,464**												

Type: **PV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 1 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 4 24-Hr (0), other based on inputs (notes below).

Avg Wkdy - 3pm-7pm

NB I-229 Avg Wkdy - 3pm-7pm				DESTINATION ZONES											
				Exit 1C Louise	Exit 2 Western	Exit 3 Minn.	Exit 4 Cliff	Exit 5 26th	Exit 6 10th	Exit 7 Rice	Exit 9 Benson	Exit 10A EB I-90	Exit 10B WB I-90	CR 125	
		Zone #		11	21	31	41	51	61	71	91	903	902	905	**Total**
			ADT	6160	3925	4930	6000	8040	6810	3990	8430	--	--	1200	**49485**
Entrance	Zone #	ADT	**Calibrated**	**902**	**1,052**	**1,540**	**2,075**	**2,820**	**2,795**	**1,136**	**1,349**	**1,241**	**582**	**456**	**15,948**
ORIGIN ZONES															
NB I-29	291	--	**2,071**	23%	20%	12%	14%	10%	9%	5%	4%	4%	0%	0%	**100%**
SB I-29	294	--	**1,217**	35%	10%	12%	18%	16%	7%	1%	0%	0%	0%	0%	**100%**
SB Louise	12	6360	**748**		4%	9%	14%	28%	25%	7%	3%	8%	1%	1%	**100%**
NB Louise	15	5185	**2,021**		24%	19%	16%	14%	16%	6%	2%	2%	0%	1%	**100%**
Western	22	7290	**3,903**			**18%**	20%	26%	22%	6%	3%	4%	1%	1%	**100%**
Minnesota	32	5180	**1,893**				**19%**	29%	29%	8%	5%	6%	2%	3%	**100%**
Cliff	42	3870	**1,297**					**28%**	35%	10%	11%	7%	3%	6%	**100%**
26th	52	3110	**524**						31%	12%	20%	16%	15%	7%	**100%**
10th	62	5650	**1,284**							22%	30%	21%	17%	10%	**100%**
Rice	72	3500	**668**								54%	20%	16%	10%	**100%**
Benson	92	1320	**322**									70%	22%	9%	**100%**
	Total	**41465**	**15,948**												

Ramp to Ramp Demand between Study Interchanges

Notes:

Demand: Streetlight Index is a representative of the relative amount of Trips; Calibrated is a representative Daily Value.

Day Type: Average Day (Mon-Sun), Weekdays (Mon-Thurs), or Weekends (Sat-Sun)

Day Part: [0] 24-hour, [1] Early AM (12am-6am), [2] Peak AM (6am-9am), [3] Mid-Day (9am-3pm), [4] Peak PM (3pm-7pm), [5] Late PM (7pm-12am)

Some Day Types or Day Parts might not have resulted in sufficient data for Streetlight to provide values.

Trips: For GPS Trips, a trip is considered when the device does not move 5 meters in 5 minutes or when device is turned off.
Trips are required to be at least 3 minutes and 500 meters in length.

STREETLIGHT DATA
I-229 OD Study Information
July 2017 to June 2018

Table A2b
NORTHBOUND I-229 ORIGIN & DESTINTATION
I-229 EXITS 3 & 4 STUDY
ESTIMATED COUNT INFORMATION

Type: **PV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 1 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 2 24-Hr (0), other based on inputs (notes below).

Avg Wkdy - 6am-9am

NB I-229 Avg Wkdy - 6am-9am				DESTINATION ZONES											
				Exit 1C Louise	Exit 2 Western	Exit 3 Minn.	Exit 4 Cliff	Exit 5 26th	Exit 6 10th	Exit 7 Rice	Exit 9 Benson	Exit 10A EB I-90	Exit 10B WB I-90	CR 125	
		Zone #		11	21	31	41	51	61	71	91	903	902	905	**Total**
		ADT	ADT	6160	3925	4930	6000	8040	6810	3990	8430	--	--	1200	**49485**
Entrance	Zone #	ADT	**Calibrated**	**697**	**1,046**	**1,555**	**1,505**	**1,162**	**1,983**	**646**	**4,290**	**695**	**714**	**182**	**14,475**
NB I-29	291	--	**2,555**	411	490	523	314	130	296	53	257	54	20	7	**2,555**
SB I-29	294	--	**868**	286	255	84	92	82	40	5	20	2	2	0	**868**
SB Louise	12	6360	**626**		16	40	72	94	132	21	205	44	2	0	**626**
NB Louise	15	5185	**1,978**		285	447	309	147	332	96	270	84	5	3	**1,978**
Western	22	7290	**2,245**			**461**	454	347	517	90	318	37	16	5	**2,245**
Minnesota	32	5180	**1,259**				**264**	229	292	33	375	33	25	8	**1,259**
Cliff	42	3870	**1,280**					**133**	267	59	620	52	127	22	**1,280**
26th	52	3110	**905**						107	67	486	74	131	40	**905**
10th	62	5650	**1,739**							222	1,084	155	244	34	**1,739**
Rice	72	3500	**906**								655	78	118	55	**906**
Benson	92	1320	**114**									82	24	8	**114**
	Total	**41465**	**14,475**	**697**	**1,046**	**1,555**	**1,505**	**1,162**	**1,983**	**646**	**4,290**	**695**	**714**	**182**	**14,475**

ORIGIN ZONES

Type: **PV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 1 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 3 24-Hr (0), other based on inputs (notes below).

Avg Wkdy - 9am-3pm

NB I-229 Avg Wkdy - 9am-3pm				DESTINATION ZONES											
				Exit 1C Louise	Exit 2 Western	Exit 3 Minn.	Exit 4 Cliff	Exit 5 26th	Exit 6 10th	Exit 7 Rice	Exit 9 Benson	Exit 10A EB I-90	Exit 10B WB I-90	CR 125	
		Zone #		11	21	31	41	51	61	71	91	903	902	905	**Total**
		ADT	ADT	6160	3925	4930	6000	8040	6810	3990	8430	--	--	1200	**49485**
Entrance	Zone #	ADT	**Calibrated**	**1,306**	**1,439**	**2,312**	**2,340**	**2,938**	**3,434**	**1,091**	**3,125**	**1,283**	**771**	**425**	**20,464**
NB I-29	291	--	**2,814**	752	554	413	315	196	255	91	140	81	8	9	**2,814**
SB I-29	294	--	**1,583**	554	213	188	225	201	155	24	17	2	3	1	**1,583**
SB Louise	12	6360	**838**		57	113	116	198	191	39	63	53	4	4	**838**
NB Louise	15	5185	**2,363**		615	547	338	241	340	86	128	42	10	16	**2,363**
Western	22	7290	**4,631**			**1,051**	884	949	1,024	210	336	124	29	24	**4,631**
Minnesota	32	5180	**2,537**				**462**	679	745	144	263	166	40	38	**2,537**
Cliff	42	3870	**1,628**					**474**	532	122	323	85	50	42	**1,628**
26th	52	3110	**735**						192	74	246	104	88	31	**735**
10th	62	5650	**1,833**							301	858	267	275	132	**1,833**
Rice	72	3500	**1,147**								751	159	174	63	**1,147**
Benson	92	1320	**355**									200	90	65	**355**
	Total	**41465**	**20,464**	**1,306**	**1,439**	**2,312**	**2,340**	**2,938**	**3,434**	**1,091**	**3,125**	**1,283**	**771**	**425**	**20,464**

ORIGIN ZONES

Type: **PV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 1 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 4 24-Hr (0), other based on inputs (notes below).

Avg Wkdy - 3pm-7pm

NB I-229 Avg Wkdy - 3pm-7pm				DESTINATION ZONES											
				Exit 1C Louise	Exit 2 Western	Exit 3 Minn.	Exit 4 Cliff	Exit 5 26th	Exit 6 10th	Exit 7 Rice	Exit 9 Benson	Exit 10A EB I-90	Exit 10B WB I-90	CR 125	
		Zone #		11	21	31	41	51	61	71	91	903	902	905	**Total**
		ADT	ADT	6160	3925	4930	6000	8040	6810	3990	8430	--	--	1200	**49485**
Entrance	Zone #	ADT	**Calibrated**	**902**	**1,052**	**1,540**	**2,075**	**2,820**	**2,795**	**1,136**	**1,349**	**1,241**	**582**	**456**	**15,948**
NB I-29	291	--	**2,071**	479	406	253	280	209	183	98	77	74	7	5	**2,071**
SB I-29	294	--	**1,217**	423	123	141	219	198	85	17	6	3	1	1	**1,217**
SB Louise	12	6360	**748**		33	71	103	209	185	55	25	57	4	6	**748**
NB Louise	15	5185	**2,021**		490	374	333	286	323	122	37	41	4	11	**2,021**
Western	22	7290	**3,903**			**701**	785	1,014	860	224	113	145	22	39	**3,903**
Minnesota	32	5180	**1,893**				**355**	546	545	150	91	122	32	52	**1,893**
Cliff	42	3870	**1,297**					**358**	453	126	142	94	45	79	**1,297**
26th	52	3110	**524**						161	64	105	82	76	36	**524**
10th	62	5650	**1,284**							280	391	268	214	131	**1,284**
Rice	72	3500	**668**								362	131	107	68	**668**
Benson	92	1320	**322**									224	70	28	**322**
	Total	**41465**	**15,948**	**902**	**1,052**	**1,540**	**2,075**	**2,820**	**2,795**	**1,136**	**1,349**	**1,241**	**582**	**456**	**15,948**

ORIGIN ZONES

Ramp to Ramp Demand between Study Interchanges

Notes:

Demand: Streetlight Index is a representative of the relative amount of Trips; Calibrated is a representative Daily Value.

Day Type: Average Day (Mon-Sun), Weekdays (Mon-Thurs), or Weekends (Sat-Sun)

Day Part: [0] 24-hour, [1] Early AM (12am-6am), [2] Peak AM (6am-9am), [3] Mid-Day (9am-3pm), [4] Peak PM (3pm-7pm), [5] Late PM (7pm-12am)

Some Day Types or Day Parts might not have resulted in sufficient data for Streetlight to provide values.

Trips: For GPS Trips, a trip is considered when the device does not move 5 meters in 5 minutes or when device is turned off.
Trips are required to be at least 3 minutes and 500 meters in length.

STREETLIGHT DATA
I-229 OD Study Information
July 2017 to June 2018

Table A3a
SOUTHBOUND I-229 ORIGIN & DESTINTATION
I-229 EXITS 3 & 4 STUDY
PERCENTAGE INFORMATION

Type: **PV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 0 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 0 24-Hr (0), other based on inputs (notes below).

7 Day Avg - 24-Hr

SB I-229				DESTINATION ZONES										
7 Day Avg - 24-Hr				Exit 9 Benson	Exit 7 Rice	Exit 6 10th	Exit 5 26th	Exit 4 Cliff	Exit 3 Minn.	Exit 2 Western	Exit 1C Louise	Exit 1B NB I-29	Exit 1A SB I-29	
			Zone #	93	73	63	53	43	33	23	13	293	292	**Total**
			ADT	1360	3535	5450	4550	3570	4910	7950	10515	--	--	**41840**
Entrance	Zone #	ADT	**Calibrated**	**733**	**1,989**	**5,647**	**3,352**	**5,901**	**8,038**	**11,074**	**13,322**	**5,303**	**8,094**	**63,453**
WB I-90	904	--	**3,592**	10%	9%	22%	10%	11%	10%	12%	11%	0%	6%	**100%**
EB I-90	901	--	**3,391**	8%	13%	37%	15%	10%	8%	5%	3%	0%	1%	**100%**
CR 125	906	1200	**1,250**	10%	10%	30%	13%	14%	9%	9%	4%	0%	1%	**100%**
Benson	94	7940	**7,832**		14%	31%	11%	13%	9%	7%	9%	1%	5%	**100%**
Rice	74	4050	**3,611**			23%	8%	14%	12%	15%	17%	2%	9%	**100%**
10th	64	7030	**10,653**				11%	17%	19%	22%	22%	4%	6%	**100%**
26th	54	9950	**9,071**					**18%**	20%	23%	23%	8%	7%	**100%**
Cliff	44	6330	**9,460**						**24%**	28%	27%	11%	10%	**100%**
Minnesota	34	6150	**6,619**							**34%**	39%	8%	19%	**100%**
Western	24	3675	**3,697**								50%	17%	33%	**100%**
Louise	14	4710	**4,277**									43%	57%	**100%**
	Total	**51035**	**63,453**											

ORIGIN ZONES

Type: **PV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 1 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 0 24-Hr (0), other based on inputs (notes below).

Avg Wkdy - 24-Hr

SB I-229				DESTINATION ZONES										
Avg Wkdy - 24-Hr				Exit 9 Benson	Exit 7 Rice	Exit 6 10th	Exit 5 26th	Exit 4 Cliff	Exit 3 Minn.	Exit 2 Western	Exit 1C Louise	Exit 1B NB I-29	Exit 1A SB I-29	
			Zone #	93	73	63	53	43	33	23	13	293	292	**Total**
			ADT	1360	3535	5450	4550	3570	4910	7950	10515	--	--	**41840**
Entrance	Zone #	ADT	**Calibrated**	**881**	**2,263**	**6,132**	**3,711**	**6,259**	**8,160**	**11,846**	**14,149**	**5,235**	**8,765**	**67,401**
WB I-90	904	--	**3,753**	11%	9%	22%	11%	10%	10%	12%	11%	0%	5%	**100%**
EB I-90	901	--	**3,613**	9%	13%	36%	15%	11%	9%	5%	3%	0%	1%	**100%**
CR 125	906	1200	**1,273**	12%	9%	26%	14%	15%	8%	11%	4%	0%	1%	**100%**
Benson	94	7940	**9,552**		14%	30%	11%	13%	9%	7%	9%	1%	5%	**100%**
Rice	74	4050	**3,881**			23%	8%	14%	11%	15%	17%	2%	10%	**100%**
10th	64	7030	**10,957**				11%	17%	18%	22%	22%	3%	7%	**100%**
26th	54	9950	**9,072**					**18%**	19%	23%	24%	7%	8%	**100%**
Cliff	44	6330	**10,019**						**23%**	29%	28%	10%	10%	**100%**
Minnesota	34	6150	**7,033**							**34%**	39%	8%	19%	**100%**
Western	24	3675	**3,920**								50%	15%	35%	**100%**
Louise	14	4710	**4,328**									43%	57%	**100%**
	Total	**51035**	**67,401**											

ORIGIN ZONES

Type: **PV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 2 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 0 24-Hr (0), other based on inputs (notes below).

Avg Wknd - 24-Hr

SB I-229				DESTINATION ZONES										
Avg Wknd - 24-Hr				Exit 9 Benson	Exit 7 Rice	Exit 6 10th	Exit 5 26th	Exit 4 Cliff	Exit 3 Minn.	Exit 2 Western	Exit 1C Louise	Exit 1B NB I-29	Exit 1A SB I-29	
			Zone #	93	73	63	53	43	33	23	13	293	292	**Total**
			ADT	1360	3535	5450	4550	3570	4910	7950	10515	--	--	**41840**
Entrance	Zone #	ADT	**Calibrated**	**361**	**1,220**	**4,177**	**2,360**	**4,726**	**7,228**	**8,667**	**10,764**	**4,868**	**6,080**	**50,451**
WB I-90	904	--	**2,996**	6%	9%	21%	9%	13%	13%	12%	11%	1%	7%	**100%**
EB I-90	901	--	**2,697**	5%	13%	41%	17%	10%	6%	4%	3%	1%	1%	**100%**
CR 125	906	1200	**1,149**	6%	9%	41%	11%	10%	12%	7%	3%	0%	1%	**100%**
Benson	94	7940	**3,380**		15%	37%	11%	11%	8%	7%	7%	1%	3%	**100%**
Rice	74	4050	**2,813**			26%	7%	14%	14%	13%	17%	3%	6%	**100%**
10th	64	7030	**9,267**				10%	17%	21%	20%	22%	4%	5%	**100%**
26th	54	9950	**8,501**					**19%**	22%	23%	23%	8%	5%	**100%**
Cliff	44	6330	**7,634**						**27%**	26%	26%	12%	9%	**100%**
Minnesota	34	6150	**5,290**							**32%**	41%	9%	18%	**100%**
Western	24	3675	**2,924**								51%	19%	30%	**100%**
Louise	14	4710	**3,800**									45%	55%	**100%**
	Total	**51035**	**50,451**											

ORIGIN ZONES

Ramp to Ramp Demand between Study Interchanges

Notes:

Demand: Streetlight Index is a representative of the relative amount of Trips; Calibrated is a representative Daily Value.

Day Type: Average Day (Mon-Sun), Weekdays (Mon-Thurs), or Weekends (Sat-Sun)

Day Part: [0] 24-hour, [1] Early AM (12am-6am), [2] Peak AM (6am-9am), [3] Mid-Day (9am-3pm), [4] Peak PM (3pm-7pm), [5] Late PM (7pm-12am)

Some Day Types or Day Parts might not have resulted in sufficient data for Streetlight to provide values.

Trips: For GPS Trips, a trip is considered when the device does not move 5 meters in 5 minutes or when device is turned off.
Trips are required to be at least 3 minutes and 500 meters in length.

STREETLIGHT DATA
I-229 OD Study Information
July 2017 to June 2018

Table A3b
SOUTHBOUND I-229 ORIGIN & DESTINTATION
I-229 EXITS 3 & 4 STUDY
PERCENTAGE INFORMATION

Type: **PV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 0 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 0 24-Hr (0), other based on inputs (notes below).

7 Day Avg - 24-Hr

SB I-229				DESTINATION ZONES										
7 Day Avg - 24-Hr				Exit 9 Benson	Exit 7 Rice	Exit 6 10th	Exit 5 26th	Exit 4 Cliff	Exit 3 Minn.	Exit 2 Western	Exit 1C Louise	Exit 1B NB I-29	Exit 1A SB I-29	
			Zone #	93	73	63	53	43	33	23	13	293	292	**Total**
			ADT	1360	3535	5450	4550	3570	4910	7950	10515	--	--	**41840**
Entrance	Zone #	ADT	**Calibrated**	**733**	**1,989**	**5,647**	**3,352**	**5,901**	**8,038**	**11,074**	**13,322**	**5,303**	**8,094**	**63,453**
WB I-90	904	--	**3,592**	346	309	778	370	383	375	421	382	15	213	**3,592**
EB I-90	901	--	**3,391**	264	439	1,256	514	355	265	155	87	15	41	**3,391**
CR 125	906	1200	**1,250**	123	119	373	164	172	114	117	49	4	15	**1,250**
Benson	94	7940	**7,832**		1,122	2,392	888	985	701	587	709	70	378	**7,832**
Rice	74	4050	**3,611**			848	295	494	427	532	614	88	313	**3,611**
10th	64	7030	**10,653**				1,121	1,838	2,000	2,302	2,331	390	671	**10,653**
26th	54	9950	**9,071**					**1,674**	1,855	2,102	2,118	700	622	**9,071**
Cliff	44	6330	**9,460**						**2,301**	2,628	2,601	998	932	**9,460**
Minnesota	34	6150	**6,619**							**2,230**	2,582	555	1,252	**6,619**
Western	24	3675	**3,697**								1,849	613	1,235	**3,697**
Louise	14	4710	**4,277**									1,855	2,422	**4,277**
	Total	**51035**	**63,453**	**733**	**1,989**	**5,647**	**3,352**	**5,901**	**8,038**	**11,074**	**13,322**	**5,303**	**8,094**	**63,453**

ORIGIN ZONES

Type: **PV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 1 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 0 24-Hr (0), other based on inputs (notes below).

Avg Wkdy - 24-Hr

SB I-229				DESTINATION ZONES										
Avg Wkdy - 24-Hr				Exit 9 Benson	Exit 7 Rice	Exit 6 10th	Exit 5 26th	Exit 4 Cliff	Exit 3 Minn.	Exit 2 Western	Exit 1C Louise	Exit 1B NB I-29	Exit 1A SB I-29	
			Zone #	93	73	63	53	43	33	23	13	293	292	**Total**
			ADT	1360	3535	5450	4550	3570	4910	7950	10515	--	--	**41840**
Entrance	Zone #	ADT	**Calibrated**	**881**	**2,263**	**6,132**	**3,711**	**6,259**	**8,160**	**11,846**	**14,149**	**5,235**	**8,765**	**67,401**
WB I-90	904	--	**3,753**	413	327	810	407	368	370	442	402	10	204	**3,753**
EB I-90	901	--	**3,613**	318	454	1,287	528	390	312	171	92	16	45	**3,613**
CR 125	906	1200	**1,273**	150	115	329	179	189	100	136	55	4	16	**1,273**
Benson	94	7940	**9,552**		1,367	2,818	1,096	1,226	859	713	903	85	485	**9,552**
Rice	74	4050	**3,881**			888	322	532	436	585	661	86	371	**3,881**
10th	64	7030	**10,957**				1,179	1,908	1,975	2,413	2,368	382	732	**10,957**
26th	54	9950	**9,072**					**1,646**	1,768	2,124	2,169	679	686	**9,072**
Cliff	44	6330	**10,019**						**2,340**	2,866	2,825	968	1,020	**10,019**
Minnesota	34	6150	**7,033**							**2,396**	2,732	560	1,345	**7,033**
Western	24	3675	**3,920**								1,942	605	1,373	**3,920**
Louise	14	4710	**4,328**									1,840	2,488	**4,328**
	Total	**51035**	**67,401**	**881**	**2,263**	**6,132**	**3,711**	**6,259**	**8,160**	**11,846**	**14,149**	**5,235**	**8,765**	**67,401**

ORIGIN ZONES

Type: **PV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 2 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 0 24-Hr (0), other based on inputs (notes below).

Avg Wknd - 24-Hr

SB I-229				DESTINATION ZONES										
Avg Wknd - 24-Hr				Exit 9 Benson	Exit 7 Rice	Exit 6 10th	Exit 5 26th	Exit 4 Cliff	Exit 3 Minn.	Exit 2 Western	Exit 1C Louise	Exit 1B NB I-29	Exit 1A SB I-29	
			Zone #	93	73	63	53	43	33	23	13	293	292	**Total**
			ADT	1360	3535	5450	4550	3570	4910	7950	10515	--	--	**41840**
Entrance	Zone #	ADT	**Calibrated**	**361**	**1,220**	**4,177**	**2,360**	**4,726**	**7,228**	**8,667**	**10,764**	**4,868**	**6,080**	**50,451**
WB I-90	904	--	**2,996**	174	256	625	259	385	379	357	335	18	208	**2,996**
EB I-90	901	--	**2,697**	123	352	1,093	467	274	155	111	72	16	34	**2,697**
CR 125	906	1200	**1,149**	64	108	470	126	118	141	75	31	4	12	**1,149**
Benson	94	7940	**3,380**		504	1,251	358	387	269	240	232	22	117	**3,380**
Rice	74	4050	**2,813**			738	209	386	385	365	466	87	177	**2,813**
10th	64	7030	**9,267**				941	1,556	1,933	1,897	2,043	392	505	**9,267**
26th	54	9950	**8,501**					**1,620**	1,893	1,922	1,961	675	430	**8,501**
Cliff	44	6330	**7,634**						**2,073**	1,998	1,969	926	668	**7,634**
Minnesota	34	6150	**5,290**							**1,702**	2,155	465	968	**5,290**
Western	24	3675	**2,924**								1,500	559	865	**2,924**
Louise	14	4710	**3,800**									1,704	2,096	**3,800**
	Total	**51035**	**50,451**	**361**	**1,220**	**4,177**	**2,360**	**4,726**	**7,228**	**8,667**	**10,764**	**4,868**	**6,080**	**50,451**

ORIGIN ZONES

Ramp to Ramp Demand between Study Interchanges

Notes:

Demand: Streetlight Index is a representative of the relative amount of Trips; Calibrated is a representative Daily Value.

Day Type: Average Day (Mon-Sun), Weekdays (Mon-Thurs), or Weekends (Sat-Sun)

Day Part: [0] 24-hour, [1] Early AM (12am-6am), [2] Peak AM (6am-9am), [3] Mid-Day (9am-3pm), [4] Peak PM (3pm-7pm), [5] Late PM (7pm-12am)

Some Day Types or Day Parts might not have resulted in sufficient data for Streetlight to provide values.

Trips: For GPS Trips, a trip is considered when the device does not move 5 meters in 5 minutes or when device is turned off.
Trips are required to be at least 3 minutes and 500 meters in length.

STREETLIGHT DATA
I-229 OD Study Information
July 2017 to June 2018

Table A4a
SOUTHBOUND I-229 ORIGIN & DESTINTATION
I-229 EXITS 3 & 4 STUDY
PERCENTAGE INFORMATION

Type: **PV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 1 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 2 24-Hr (0), other based on inputs (notes below).

Avg Wkdy - 6am-9am

SB I-229				DESTINATION ZONES										
Avg Wkdy - 6am-9am				Exit 9 Benson	Exit 7 Rice	Exit 6 10th	Exit 5 26th	Exit 4 Cliff	Exit 3 Minn.	Exit 2 Western	Exit 1C Louise	Exit 1B NB I-29	Exit 1A SB I-29	
			Zone #	93	73	63	53	43	33	23	13	293	292	**Total**
			ADT	1360	3535	5450	4550	3570	4910	7950	10515	--	--	**41840**
Entrance	Zone #	ADT	**Calibrated**	**232**	**363**	**1,023**	**677**	**1,338**	**1,493**	**2,703**	**3,045**	**1,396**	**1,889**	**14,159**
WB I-90	904	--	**1,177**	9%	7%	25%	8%	11%	8%	15%	12%	0%	3%	**100%**
EB I-90	901	--	**702**	14%	12%	36%	15%	9%	7%	3%	2%	0%	1%	**100%**
CR 125	906	1200	**358**	7%	6%	16%	14%	19%	6%	24%	7%	0%	1%	**100%**
Benson	94	7940	**1,078**		16%	25%	11%	14%	11%	7%	11%	1%	5%	**100%**
Rice	74	4050	**1,004**			14%	7%	13%	8%	20%	21%	2%	13%	**100%**
10th	64	7030	**2,515**				9%	17%	14%	24%	24%	3%	9%	**100%**
26th	54	9950	**2,359**					**15%**	14%	24%	25%	9%	12%	**100%**
Cliff	44	6330	**2,225**						**20%**	26%	29%	13%	12%	**100%**
Minnesota	34	6150	**1,163**							**34%**	36%	10%	20%	**100%**
Western	24	3675	**643**								41%	19%	41%	**100%**
Louise	14	4710	**935**									59%	41%	**100%**
	Total	**51035**	**14,159**											

ORIGIN ZONES

Type: **PV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 1 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 3 24-Hr (0), other based on inputs (notes below).

Avg Wkdy - 9am-3pm

SB I-229				DESTINATION ZONES										
Avg Wkdy - 9am-3pm				Exit 9 Benson	Exit 7 Rice	Exit 6 10th	Exit 5 26th	Exit 4 Cliff	Exit 3 Minn.	Exit 2 Western	Exit 1C Louise	Exit 1B NB I-29	Exit 1A SB I-29	
			Zone #	93	73	63	53	43	33	23	13	293	292	**Total**
			ADT	1360	3535	5450	4550	3570	4910	7950	10515	--	--	**41840**
Entrance	Zone #	ADT	**Calibrated**	**412**	**710**	**1,964**	**1,223**	**2,067**	**3,049**	**4,500**	**4,640**	**1,962**	**3,019**	**23,546**
WB I-90	904	--	**1,361**	14%	8%	18%	14%	9%	13%	11%	8%	0%	6%	**100%**
EB I-90	901	--	**1,267**	10%	12%	34%	14%	10%	11%	5%	2%	1%	2%	**100%**
CR 125	906	1200	**426**	22%	10%	24%	13%	12%	9%	5%	3%	1%	2%	**100%**
Benson	94	7940	**2,955**		14%	31%	9%	12%	10%	8%	8%	1%	7%	**100%**
Rice	74	4050	**1,259**			22%	10%	14%	13%	17%	13%	3%	9%	**100%**
10th	64	7030	**3,908**				10%	17%	19%	24%	19%	4%	6%	**100%**
26th	54	9950	**2,925**					**19%**	22%	25%	22%	8%	5%	**100%**
Cliff	44	6330	**3,640**						**24%**	32%	26%	10%	9%	**100%**
Minnesota	34	6150	**2,783**							**37%**	38%	9%	17%	**100%**
Western	24	3675	**1,487**								48%	18%	34%	**100%**
Louise	14	4710	**1,535**									41%	59%	**100%**
	Total	**51035**	**23,546**											

ORIGIN ZONES

Type: **PV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 1 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 4 24-Hr (0), other based on inputs (notes below).

Avg Wkdy - 3pm-7pm

SB I-229				DESTINATION ZONES										
Avg Wkdy - 3pm-7pm				Exit 9 Benson	Exit 7 Rice	Exit 6 10th	Exit 5 26th	Exit 4 Cliff	Exit 3 Minn.	Exit 2 Western	Exit 1C Louise	Exit 1B NB I-29	Exit 1A SB I-29	
			Zone #	93	73	63	53	43	33	23	13	293	292	**Total**
			ADT	1360	3535	5450	4550	3570	4910	7950	10515	--	--	**41840**
Entrance	Zone #	ADT	**Calibrated**	**154**	**800**	**2,287**	**1,335**	**2,063**	**2,564**	**3,483**	**4,397**	**1,370**	**2,601**	**21,054**
WB I-90	904	--	**880**	8%	10%	22%	9%	10%	9%	11%	14%	0%	6%	**100%**
EB I-90	901	--	**1,194**	5%	13%	38%	15%	12%	8%	6%	3%	1%	1%	**100%**
CR 125	906	1200	**360**	7%	11%	32%	18%	14%	7%	7%	3%	0%	1%	**100%**
Benson	94	7940	**4,284**		12%	30%	13%	14%	9%	8%	10%	1%	4%	**100%**
Rice	74	4050	**1,087**			24%	9%	15%	13%	13%	17%	2%	6%	**100%**
10th	64	7030	**3,173**				11%	18%	18%	21%	22%	3%	7%	**100%**
26th	54	9950	**2,445**					**19%**	22%	24%	23%	6%	5%	**100%**
Cliff	44	6330	**2,974**						**25%**	29%	29%	8%	9%	**100%**
Minnesota	34	6150	**2,120**							**32%**	40%	7%	21%	**100%**
Western	24	3675	**1,294**								50%	14%	36%	**100%**
Louise	14	4710	**1,243**									38%	62%	**100%**
	Total	**51035**	**21,054**											

ORIGIN ZONES

Ramp to Ramp Demand between Study Interchanges

Notes:

Demand: Streetlight Index is a representative of the relative amount of Trips; Calibrated is a representative Daily Value.

Day Type: Average Day (Mon-Sun), Weekdays (Mon-Thurs), or Weekends (Sat-Sun)

Day Part: [0] 24-hour, [1] Early AM (12am-6am), [2] Peak AM (6am-9am), [3] Mid-Day (9am-3pm), [4] Peak PM (3pm-7pm), [5] Late PM (7pm-12am)

Some Day Types or Day Parts might not have resulted in sufficient data for Streetlight to provide values.

Trips: For GPS Trips, a trip is considered when the device does not move 5 meters in 5 minutes or when device is turned off.
Trips are required to be at least 3 minutes and 500 meters in length.

STREETLIGHT DATA
I-229 OD Study Information
July 2017 to June 2018

Table A4b
SOUTHBOUND I-229 ORIGIN & DESTINTATION
I-229 EXITS 3 & 4 STUDY
PERCENTAGE INFORMATION

Type: **PV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 1 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 2 24-Hr (0), other based on inputs (notes below).

Avg Wkdy - 6am-9am

SB I-229				DESTINATION ZONES										
Avg Wkdy - 6am-9am				Exit 9 Benson	Exit 7 Rice	Exit 6 10th	Exit 5 26th	Exit 4 Cliff	Exit 3 Minn.	Exit 2 Western	Exit 1C Louise	Exit 1B NB I-29	Exit 1A SB I-29	
		Zone #		93	73	63	53	43	33	23	13	293	292	**Total**
		ADT		1360	3535	5450	4550	3570	4910	7950	10515	--	--	**41840**
Entrance	Zone #	ADT	**Calibrated**	**232**	**363**	**1,023**	**677**	**1,338**	**1,493**	**2,703**	**3,045**	**1,396**	**1,889**	**14,159**
WB I-90	904	--	**1,177**	107	85	299	100	130	90	180	144	1	41	**1,177**
EB I-90	901	--	**702**	99	85	252	103	65	50	22	17	2	7	**702**
CR 125	906	1200	**358**	26	21	58	49	68	22	86	26	0	2	**358**
Benson	94	7940	**1,078**		172	270	115	146	118	78	119	6	54	**1,078**
Rice	74	4050	**1,004**			144	74	135	85	201	212	20	133	**1,004**
10th	64	7030	**2,515**				236	437	341	593	612	79	217	**2,515**
26th	54	9950	**2,359**					**357**	338	573	585	222	284	**2,359**
Cliff	44	6330	**2,225**						**449**	577	649	283	267	**2,225**
Minnesota	34	6150	**1,163**							**393**	420	113	237	**1,163**
Western	24	3675	**643**								261	121	261	**643**
Louise	14	4710	**935**									549	386	**935**
	Total	**51035**	**14,159**	**232**	**363**	**1,023**	**677**	**1,338**	**1,493**	**2,703**	**3,045**	**1,396**	**1,889**	**14,159**

ORIGIN ZONES

Type: **PV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 1 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 3 24-Hr (0), other based on inputs (notes below).

Avg Wkdy - 9am-3pm

SB I-229				DESTINATION ZONES										
Avg Wkdy - 9am-3pm				Exit 9 Benson	Exit 7 Rice	Exit 6 10th	Exit 5 26th	Exit 4 Cliff	Exit 3 Minn.	Exit 2 Western	Exit 1C Louise	Exit 1B NB I-29	Exit 1A SB I-29	
		Zone #		93	73	63	53	43	33	23	13	293	292	**Total**
		ADT		1360	3535	5450	4550	3570	4910	7950	10515	--	--	**41840**
Entrance	Zone #	ADT	**Calibrated**	**412**	**710**	**1,964**	**1,223**	**2,067**	**3,049**	**4,500**	**4,640**	**1,962**	**3,019**	**23,546**
WB I-90	904	--	**1,361**	196	110	239	191	117	171	146	106	3	82	**1,361**
EB I-90	901	--	**1,267**	124	151	425	172	131	141	66	28	7	22	**1,267**
CR 125	906	1200	**426**	92	41	102	55	52	37	23	14	3	7	**426**
Benson	94	7940	**2,955**		408	923	279	366	284	234	226	33	202	**2,955**
Rice	74	4050	**1,259**			275	124	172	164	209	168	36	111	**1,259**
10th	64	7030	**3,908**				402	666	759	927	759	170	225	**3,908**
26th	54	9950	**2,925**					**563**	635	717	634	220	156	**2,925**
Cliff	44	6330	**3,640**						**858**	1,150	945	346	341	**3,640**
Minnesota	34	6150	**2,783**							**1,028**	1,044	239	472	**2,783**
Western	24	3675	**1,487**								716	268	503	**1,487**
Louise	14	4710	**1,535**									637	898	**1,535**
	Total	**51035**	**23,546**	**412**	**710**	**1,964**	**1,223**	**2,067**	**3,049**	**4,500**	**4,640**	**1,962**	**3,019**	**23,546**

ORIGIN ZONES

Type: **PV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 1 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 4 24-Hr (0), other based on inputs (notes below).

Avg Wkdy - 3pm-7pm

SB I-229				DESTINATION ZONES										
Avg Wkdy - 3pm-7pm				Exit 9 Benson	Exit 7 Rice	Exit 6 10th	Exit 5 26th	Exit 4 Cliff	Exit 3 Minn.	Exit 2 Western	Exit 1C Louise	Exit 1B NB I-29	Exit 1A SB I-29	
		Zone #		93	73	63	53	43	33	23	13	293	292	**Total**
		ADT		1360	3535	5450	4550	3570	4910	7950	10515	--	--	**41840**
Entrance	Zone #	ADT	**Calibrated**	**154**	**800**	**2,287**	**1,335**	**2,063**	**2,564**	**3,483**	**4,397**	**1,370**	**2,601**	**21,054**
WB I-90	904	--	**880**	74	85	197	80	90	82	99	121	3	49	**880**
EB I-90	901	--	**1,194**	56	154	448	175	140	92	72	38	6	13	**1,194**
CR 125	906	1200	**360**	24	38	115	65	52	25	25	12	1	3	**360**
Benson	94	7940	**4,284**		523	1,266	559	592	380	333	427	43	161	**4,284**
Rice	74	4050	**1,087**			261	95	165	141	141	190	24	70	**1,087**
10th	64	7030	**3,173**				361	563	565	676	696	94	218	**3,173**
26th	54	9950	**2,445**					**461**	547	599	558	151	129	**2,445**
Cliff	44	6330	**2,974**						**732**	865	869	238	270	**2,974**
Minnesota	34	6150	**2,120**							**673**	842	157	448	**2,120**
Western	24	3675	**1,294**								644	178	472	**1,294**
Louise	14	4710	**1,243**									475	768	**1,243**
	Total	**51035**	**21,054**	**154**	**800**	**2,287**	**1,335**	**2,063**	**2,564**	**3,483**	**4,397**	**1,370**	**2,601**	**21,054**

ORIGIN ZONES

Ramp to Ramp Demand between Study Interchanges

Notes:

Demand: Streetlight Index is a representative of the relative amount of Trips; Calibrated is a representative Daily Value.

Day Type: Average Day (Mon-Sun), Weekdays (Mon-Thurs), or Weekends (Sat-Sun)

Day Part: [0] 24-hour, [1] Early AM (12am-6am), [2] Peak AM (6am-9am), [3] Mid-Day (9am-3pm), [4] Peak PM (3pm-7pm), [5] Late PM (7pm-12am)

Some Day Types or Day Parts might not have resulted in sufficient data for Streetlight to provide values.

Trips: For GPS Trips, a trip is considered when the device does not move 5 meters in 5 minutes or when device is turned off.
Trips are required to be at least 3 minutes and 500 meters in length.

STREETLIGHT DATA
I-229 OD Study Information
July 2017 to June 2018

Table A5a
NORTHBOUND I-229 ORIGIN & DESTINTATION
I-229 EXITS 3 & 4 STUDY
PERCENTAGE INFORMATION

Type: **HV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 0 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 0 24-Hr (0), other based on inputs (notes below).

7 Day Avg - 24-Hr

NB I-229				DESTINATION ZONES											
7 Day Avg - 24-Hr				Exit 1C Louise	Exit 2 Western	Exit 3 Minn.	Exit 4 Cliff	Exit 5 26th	Exit 6 10th	Exit 7 Rice	Exit 9 Benson	Exit 10A EB I-90	Exit 10B WB I-90	CR 125	
			Zone #	11	21	31	41	51	61	71	91	903	902	905	**Total**
			HCADT	--	--	--	--	--	--	--	--	--	--	--	**0**
Entrance	Zone #	HCADT	**Calibrated**	**227**	**228**	**343**	**209**	**250**	**474**	**488**	**861**	**1,309**	**771**	**39**	**5,199**
ORIGIN ZONES	NB I-29	291	--	**1,865**	7%	8%	9%	5%	3%	9%	17%	25%	14%	3%	0%	**100%**
	SB I-29	294	--	**397**	23%	14%	23%	9%	12%	12%	3%	2%	1%	1%	0%	**100%**
	SB Louise	12	--	**183**		8%	13%	7%	14%	33%	7%	8%	9%	1%	1%	**100%**
	NB Louise	15	--	**131**		14%	20%	11%	11%	15%	7%	11%	9%	2%	1%	**100%**
	Western	22	--	**213**			**17%**	8%	14%	22%	6%	16%	12%	4%	0%	**100%**
	Minnesota	32	--	**423**				**7%**	14%	22%	6%	14%	22%	13%	2%	**100%**
	Cliff	42	--	**127**					**15%**	20%	9%	30%	17%	8%	2%	**100%**
	26th	52	--	**74**						9%	8%	35%	18%	27%	3%	**100%**
	10th	62	--	**588**							13%	24%	30%	32%	2%	**100%**
	Rice	72	--	**464**								15%	39%	45%	1%	**100%**
	Benson	92	--	**734**									68%	31%	1%	**100%**
		Total	**0**	**5,199**												

Type: **HV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 1 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 0 24-Hr (0), other based on inputs (notes below).

Avg Wkdy - 24-Hr

NB I-229				DESTINATION ZONES											
Avg Wkdy - 24-Hr				Exit 1C Louise	Exit 2 Western	Exit 3 Minn.	Exit 4 Cliff	Exit 5 26th	Exit 6 10th	Exit 7 Rice	Exit 9 Benson	Exit 10A EB I-90	Exit 10B WB I-90	CR 125	
			Zone #	11	21	31	41	51	61	71	91	903	902	905	**Total**
			HCADT	--	--	--	--	--	--	--	--	--	--	--	**0**
Entrance	Zone #	HCADT	**Calibrated**	**284**	**277**	**434**	**266**	**326**	**565**	**577**	**1,087**	**1,631**	**945**	**57**	**6,449**
ORIGIN ZONES	NB I-29	291	--	**2,287**	7%	7%	9%	5%	3%	9%	16%	25%	15%	3%	0%	**100%**
	SB I-29	294	--	**502**	24%	13%	23%	9%	12%	12%	4%	2%	1%	1%	0%	**100%**
	SB Louise	12	--	**218**		8%	15%	7%	14%	32%	6%	8%	8%	1%	0%	**100%**
	NB Louise	15	--	**170**		14%	21%	12%	12%	12%	6%	11%	9%	1%	1%	**100%**
	Western	22	--	**268**			**18%**	9%	13%	19%	6%	17%	13%	4%	1%	**100%**
	Minnesota	32	--	**525**				**8%**	15%	21%	6%	14%	21%	12%	2%	**100%**
	Cliff	42	--	**165**					**15%**	18%	9%	31%	18%	7%	2%	**100%**
	26th	52	--	**93**						9%	8%	35%	19%	27%	2%	**100%**
	10th	62	--	**702**							12%	26%	28%	31%	2%	**100%**
	Rice	72	--	**562**								16%	39%	44%	1%	**100%**
	Benson	92	--	**957**									67%	32%	1%	**100%**
		Total	**0**	**6,449**												

Type: **HV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 2 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 0 24-Hr (0), other based on inputs (notes below).

Avg Wknd - 24-Hr

NB I-229				DESTINATION ZONES											
Avg Wknd - 24-Hr				Exit 1C Louise	Exit 2 Western	Exit 3 Minn.	Exit 4 Cliff	Exit 5 26th	Exit 6 10th	Exit 7 Rice	Exit 9 Benson	Exit 10A EB I-90	Exit 10B WB I-90	CR 125	
			Zone #	11	21	31	41	51	61	71	91	903	902	905	**Total**
			HCADT	--	--	--	--	--	--	--	--	--	--	--	**0**
Entrance	Zone #	HCADT	**Calibrated**	**81**	**90**	**126**	**72**	**86**	**229**	**232**	**284**	**558**	**351**	**5**	**2,114**
ORIGIN ZONES	NB I-29	291	--	**799**	7%	8%	7%	5%	1%	11%	20%	25%	13%	5%	0%	**100%**
	SB I-29	294	--	**151**	18%	13%	33%	10%	11%	11%	2%	1%	1%	1%	0%	**100%**
	SB Louise	12	--	**79**		8%	10%	4%	11%	51%	6%	3%	8%	0%	0%	**100%**
	NB Louise	15	--	**32**		13%	9%	9%	13%	13%	25%	9%	6%	3%	0%	**100%**
	Western	22	--	**73**			**12%**	5%	27%	30%	7%	8%	7%	3%	0%	**100%**
	Minnesota	32	--	**181**				**5%**	9%	28%	4%	9%	24%	20%	0%	**100%**
	Cliff	42	--	**43**					**21%**	21%	7%	14%	21%	14%	2%	**100%**
	26th	52	--	**19**						11%	11%	37%	5%	37%	0%	**100%**
	10th	62	--	**302**							13%	11%	39%	37%	0%	**100%**
	Rice	72	--	**252**								5%	50%	44%	0%	**100%**
	Benson	92	--	**183**									80%	19%	1%	**100%**
		Total	**0**	**2,114**												

Ramp to Ramp Demand between Study Interchanges

Notes:

Demand: Streetlight Index is a representative of the relative amount of Trips; Calibrated is a representative Daily Value.

Day Type: Average Day (Mon-Sun), Weekdays (Mon-Thurs), or Weekends (Sat-Sun)

Day Part: [0] 24-hour, [1] Early AM (12am-6am), [2] Peak AM (6am-9am), [3] Mid-Day (9am-3pm), [4] Peak PM (3pm-7pm), [5] Late PM (7pm-12am)

Some Day Types or Day Parts might not have resulted in sufficient data for Streetlight to provide values.

Trips: For GPS Trips, a trip is considered when the device does not move 5 meters in 5 minutes or when device is turned off.
Trips are required to be at least 3 minutes and 500 meters in length.

STREETLIGHT DATA
I-229 OD Study Information
July 2017 to June 2018

Table A5b
NORTHBOUND I-229 ORIGIN & DESTINTATION
I-229 EXITS 3 & 4 STUDY
ESTIMATED COUNT INFORMATION

Type: **HV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 0 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 0 24-Hr (0), other based on inputs (notes below).

7 Day Avg - 24-Hr

NB I-229				DESTINATION ZONES											
7 Day Avg - 24-Hr				Exit 1C Louise	Exit 2 Western	Exit 3 Minn.	Exit 4 Cliff	Exit 5 26th	Exit 6 10th	Exit 7 Rice	Exit 9 Benson	Exit 10A EB I-90	Exit 10B WB I-90	CR 125	
		Zone #		11	21	31	41	51	61	71	91	903	902	905	**Total**
		HCADT		--	--	--	--	--	--	--	--	--	--	--	**0**
Entrance	Zone #	HCADT	**Calibrated**	**227**	**228**	**343**	**209**	**250**	**474**	**488**	**861**	**1,309**	**771**	**39**	**5,199**
NB I-29	291	--	**1,865**	135	141	163	96	54	177	323	459	263	51	3	**1,865**
SB I-29	294	--	**397**	92	54	93	37	46	47	13	8	4	3	0	**397**
SB Louise	12	--	**183**		15	24	12	25	61	13	14	16	2	1	**183**
NB Louise	15	--	**131**		18	26	15	15	19	9	14	12	2	1	**131**
Western	22	--	**213**			**37**	18	30	46	13	34	26	8	1	**213**
Minnesota	32	--	**423**				**31**	61	92	26	58	93	55	7	**423**
Cliff	42	--	**127**					**19**	25	11	38	22	10	2	**127**
26th	52	--	**74**						7	6	26	13	20	2	**74**
10th	62	--	**588**							74	142	176	187	9	**588**
Rice	72	--	**464**								68	182	209	5	**464**
Benson	92	--	**734**									502	224	8	**734**
	Total	**0**	**5,199**	**227**	**228**	**343**	**209**	**250**	**474**	**488**	**861**	**1,309**	**771**	**39**	**5,199**

ORIGIN ZONES

Type: **HV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 1 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 0 24-Hr (0), other based on inputs (notes below).

Avg Wkdy - 24-Hr

NB I-229				DESTINATION ZONES											
Avg Wkdy - 24-Hr				Exit 1C Louise	Exit 2 Western	Exit 3 Minn.	Exit 4 Cliff	Exit 5 26th	Exit 6 10th	Exit 7 Rice	Exit 9 Benson	Exit 10A EB I-90	Exit 10B WB I-90	CR 125	
		Zone #		11	21	31	41	51	61	71	91	903	902	905	**Total**
		HCADT		--	--	--	--	--	--	--	--	--	--	--	**0**
Entrance	Zone #	HCADT	**Calibrated**	**284**	**277**	**434**	**266**	**326**	**565**	**577**	**1,087**	**1,631**	**945**	**57**	**6,449**
NB I-29	291	--	**2,287**	163	169	204	119	75	215	377	565	337	58	5	**2,287**
SB I-29	294	--	**502**	121	66	114	45	60	59	18	11	5	3	0	**502**
SB Louise	12	--	**218**		18	32	16	30	69	14	18	18	2	1	**218**
NB Louise	15	--	**170**		24	35	21	21	21	11	18	16	2	1	**170**
Western	22	--	**268**			**49**	25	35	51	17	45	34	10	2	**268**
Minnesota	32	--	**525**				**40**	80	112	32	75	110	65	11	**525**
Cliff	42	--	**165**					**25**	30	15	51	30	11	3	**165**
26th	52	--	**93**						8	7	33	18	25	2	**93**
10th	62	--	**702**							86	182	199	221	14	**702**
Rice	72	--	**562**								89	220	246	7	**562**
Benson	92	--	**957**									644	302	11	**957**
	Total	**0**	**6,449**	**284**	**277**	**434**	**266**	**326**	**565**	**577**	**1,087**	**1,631**	**945**	**57**	**6,449**

ORIGIN ZONES

Type: **HV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 2 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 0 24-Hr (0), other based on inputs (notes below).

Avg Wknd - 24-Hr

NB I-229				DESTINATION ZONES											
Avg Wknd - 24-Hr				Exit 1C Louise	Exit 2 Western	Exit 3 Minn.	Exit 4 Cliff	Exit 5 26th	Exit 6 10th	Exit 7 Rice	Exit 9 Benson	Exit 10A EB I-90	Exit 10B WB I-90	CR 125	
		Zone #		11	21	31	41	51	61	71	91	903	902	905	**Total**
		HCADT		--	--	--	--	--	--	--	--	--	--	--	**0**
Entrance	Zone #	HCADT	**Calibrated**	**81**	**90**	**126**	**72**	**86**	**229**	**232**	**284**	**558**	**351**	**5**	**2,114**
NB I-29	291	--	**799**	54	61	56	38	10	86	158	197	100	38	1	**799**
SB I-29	294	--	**151**	27	19	50	15	17	16	3	1	2	1	0	**151**
SB Louise	12	--	**79**		6	8	3	9	40	5	2	6	0	0	**79**
NB Louise	15	--	**32**		4	3	3	4	4	8	3	2	1	0	**32**
Western	22	--	**73**			**9**	4	20	22	5	6	5	2	0	**73**
Minnesota	32	--	**181**				**9**	17	50	8	17	43	37	0	**181**
Cliff	42	--	**43**					**9**	9	3	6	9	6	1	**43**
26th	52	--	**19**						2	2	7	1	7	0	**19**
10th	62	--	**302**							40	32	117	112	1	**302**
Rice	72	--	**252**								13	126	112	1	**252**
Benson	92	--	**183**									147	35	1	**183**
	Total	**0**	**2,114**	**81**	**90**	**126**	**72**	**86**	**229**	**232**	**284**	**558**	**351**	**5**	**2,114**

ORIGIN ZONES

Ramp to Ramp Demand between Study Interchanges

Notes:

Demand: Streetlight Index is a representative of the relative amount of Trips; Calibrated is a representative Daily Value.

Day Type: Average Day (Mon-Sun), Weekdays (Mon-Thurs), or Weekends (Sat-Sun)

Day Part: [0] 24-hour, [1] Early AM (12am-6am), [2] Peak AM (6am-9am), [3] Mid-Day (9am-3pm), [4] Peak PM (3pm-7pm), [5] Late PM (7pm-12am)

Some Day Types or Day Parts might not have resulted in sufficient data for Streetlight to provide values.

Trips: For GPS Trips, a trip is considered when the device does not move 5 meters in 5 minutes or when device is turned off.
Trips are required to be at least 3 minutes and 500 meters in length.

STREETLIGHT DATA
I-229 OD Study Information
July 2017 to June 2018

Table A6a
NORTHBOUND I-229 ORIGIN & DESTINTATION
I-229 EXITS 3 & 4 STUDY
PERCENTAGE INFORMATION

Type: **HV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 1 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 2 24-Hr (0), other based on inputs (notes below).

Avg Wkdy - 6am-9am

NB I-229				DESTINATION ZONES											
Avg Wkdy - 6am-9am				Exit 1C Louise	Exit 2 Western	Exit 3 Minn.	Exit 4 Cliff	Exit 5 26th	Exit 6 10th	Exit 7 Rice	Exit 9 Benson	Exit 10A EB I-90	Exit 10B WB I-90	CR 125	
			Zone #	11	21	31	41	51	61	71	91	903	902	905	**Total**
			HCADT	--	--	--	--	--	--	--	--	--	--	--	**0**
Entrance	Zone #	HCADT	**Calibrated**	**64**	**43**	**95**	**53**	**75**	**120**	**98**	**198**	**235**	**158**	**7**	**1,146**
ORIGIN ZONES	NB I-29	291	--	**411**	10%	6%	12%	7%	4%	9%	14%	23%	13%	1%	0%	**100%**
	SB I-29	294	--	**95**	24%	13%	21%	8%	12%	9%	7%	3%	2%	0%	0%	**100%**
	SB Louise	12	--	**67**		3%	15%	3%	9%	43%	9%	7%	10%	0%	0%	**100%**
	NB Louise	15	--	**41**		10%	22%	10%	22%	7%	7%	7%	15%	0%	0%	**100%**
	Western	22	--	**49**			**14%**	6%	16%	24%	8%	16%	10%	4%	0%	**100%**
	Minnesota	32	--	**87**				**9%**	17%	23%	5%	14%	23%	8%	1%	**100%**
	Cliff	42	--	**49**					**16%**	20%	6%	39%	14%	4%	0%	**100%**
	26th	52	--	**15**						7%	7%	40%	20%	27%	0%	**100%**
	10th	62	--	**102**							12%	31%	24%	31%	2%	**100%**
	Rice	72	--	**92**								16%	37%	46%	1%	**100%**
	Benson	92	--	**138**									53%	46%	1%	**100%**
		Total	**0**	**1,146**												

Type: **HV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 1 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 3 24-Hr (0), other based on inputs (notes below).

Avg Wkdy - 9am-3pm

NB I-229				DESTINATION ZONES											
Avg Wkdy - 9am-3pm				Exit 1C Louise	Exit 2 Western	Exit 3 Minn.	Exit 4 Cliff	Exit 5 26th	Exit 6 10th	Exit 7 Rice	Exit 9 Benson	Exit 10A EB I-90	Exit 10B WB I-90	CR 125	
			Zone #	11	21	31	41	51	61	71	91	903	902	905	**Total**
			HCADT	--	--	--	--	--	--	--	--	--	--	--	**0**
Entrance	Zone #	HCADT	**Calibrated**	**109**	**120**	**201**	**145**	**127**	**247**	**267**	**437**	**690**	**418**	**22**	**2,783**
ORIGIN ZONES	NB I-29	291	--	**943**	6%	6%	9%	7%	3%	10%	19%	21%	16%	3%	0%	**100%**
	SB I-29	294	--	**225**	22%	16%	24%	10%	10%	12%	3%	3%	0%	0%	0%	**100%**
	SB Louise	12	--	**95**		12%	16%	9%	11%	29%	5%	9%	7%	1%	0%	**100%**
	NB Louise	15	--	**79**		16%	23%	16%	10%	14%	4%	11%	4%	1%	0%	**100%**
	Western	22	--	**138**			**22%**	11%	12%	16%	4%	17%	14%	4%	1%	**100%**
	Minnesota	32	--	**253**				**9%**	13%	21%	6%	17%	22%	10%	2%	**100%**
	Cliff	42	--	**68**					**12%**	18%	10%	31%	21%	7%	1%	**100%**
	26th	52	--	**37**						8%	8%	46%	16%	19%	3%	**100%**
	10th	62	--	**300**							14%	24%	28%	31%	2%	**100%**
	Rice	72	--	**233**								17%	35%	47%	1%	**100%**
	Benson	92	--	**412**									65%	34%	1%	**100%**
		Total	**0**	**2,783**												

Type: **HV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 1 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 4 24-Hr (0), other based on inputs (notes below).

Avg Wkdy - 3pm-7pm

NB I-229				DESTINATION ZONES											
Avg Wkdy - 3pm-7pm				Exit 1C Louise	Exit 2 Western	Exit 3 Minn.	Exit 4 Cliff	Exit 5 26th	Exit 6 10th	Exit 7 Rice	Exit 9 Benson	Exit 10A EB I-90	Exit 10B WB I-90	CR 125	
			Zone #	11	21	31	41	51	61	71	91	903	902	905	**Total**
			HCADT	--	--	--	--	--	--	--	--	--	--	--	**0**
Entrance	Zone #	HCADT	**Calibrated**	**60**	**59**	**85**	**53**	**81**	**102**	**140**	**300**	**237**	**216**	**23**	**1,356**
ORIGIN ZONES	NB I-29	291	--	**499**	6%	7%	7%	4%	4%	8%	18%	31%	12%	2%	0%	**100%**
	SB I-29	294	--	**117**	27%	10%	26%	9%	12%	9%	3%	2%	1%	1%	0%	**100%**
	SB Louise	12	--	**39**		8%	13%	10%	23%	18%	8%	10%	8%	3%	0%	**100%**
	NB Louise	15	--	**40**		18%	18%	10%	8%	13%	10%	13%	10%	3%	0%	**100%**
	Western	22	--	**54**			**13%**	9%	17%	17%	7%	22%	9%	4%	2%	**100%**
	Minnesota	32	--	**125**				**6%**	18%	18%	8%	14%	14%	19%	4%	**100%**
	Cliff	42	--	**33**					**12%**	15%	15%	30%	15%	9%	3%	**100%**
	26th	52	--	**31**						6%	10%	26%	26%	29%	3%	**100%**
	10th	62	--	**153**							13%	38%	17%	27%	5%	**100%**
	Rice	72	--	**112**								25%	25%	48%	2%	**100%**
	Benson	92	--	**153**									52%	44%	3%	**100%**
		Total	**0**	**1,356**												

Ramp to Ramp Demand between Study Interchanges

Notes:

Demand: Streetlight Index is a representative of the relative amount of Trips; Calibrated is a representative Daily Value.

Day Type: Average Day (Mon-Sun), Weekdays (Mon-Thurs), or Weekends (Sat-Sun)

Day Part: [0] 24-hour, [1] Early AM (12am-6am), [2] Peak AM (6am-9am), [3] Mid-Day (9am-3pm), [4] Peak PM (3pm-7pm), [5] Late PM (7pm-12am)

Some Day Types or Day Parts might not have resulted in sufficient data for Streetlight to provide values.

Trips: For GPS Trips, a trip is considered when the device does not move 5 meters in 5 minutes or when device is turned off.
Trips are required to be at least 3 minutes and 500 meters in length.

STREETLIGHT DATA
I-229 OD Study Information
July 2017 to June 2018

Table A6b
NORTHBOUND I-229 ORIGIN & DESTINTATION
I-229 EXITS 3 & 4 STUDY
ESTIMATED COUNT INFORMATION

Type: **HV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 1 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 2 24-Hr (0), other based on inputs (notes below).

Avg Wkdy - 6am-9am

NB I-229 Avg Wkdy - 6am-9am				DESTINATION ZONES											
				Exit 1C Louise	Exit 2 Western	Exit 3 Minn.	Exit 4 Cliff	Exit 5 26th	Exit 6 10th	Exit 7 Rice	Exit 9 Benson	Exit 10A EB I-90	Exit 10B WB I-90	CR 125	
		Zone #		11	21	31	41	51	61	71	91	903	902	905	Total
		HCADT		--	--	--	--	--	--	--	--	--	--	--	0
Entrance	Zone #	HCADT	Calibrated	64	43	95	53	75	120	98	198	235	158	7	1,146
NB I-29	291	--	411	41	25	49	28	18	36	58	95	54	6	1	411
SB I-29	294	--	95	23	12	20	8	11	9	7	3	2	0	0	95
SB Louise	12	--	67		2	10	2	6	29	6	5	7	0	0	67
NB Louise	15	--	41		4	9	4	9	3	3	3	6	0	0	41
Western	22	--	49			7	3	8	12	4	8	5	2	0	49
Minnesota	32	--	87				8	15	20	4	12	20	7	1	87
Cliff	42	--	49					8	10	3	19	7	2	0	49
26th	52	--	15						1	1	6	3	4	0	15
10th	62	--	102							12	32	24	32	2	102
Rice	72	--	92								15	34	42	1	92
Benson	92	--	138									73	63	2	138
	Total	0	1,146	64	43	95	53	75	120	98	198	235	158	7	1,146

ORIGIN ZONES

Type: **HV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 1 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 3 24-Hr (0), other based on inputs (notes below).

Avg Wkdy - 9am-3pm

NB I-229 Avg Wkdy - 9am-3pm				DESTINATION ZONES											
				Exit 1C Louise	Exit 2 Western	Exit 3 Minn.	Exit 4 Cliff	Exit 5 26th	Exit 6 10th	Exit 7 Rice	Exit 9 Benson	Exit 10A EB I-90	Exit 10B WB I-90	CR 125	
		Zone #		11	21	31	41	51	61	71	91	903	902	905	Total
		HCADT		--	--	--	--	--	--	--	--	--	--	--	0
Entrance	Zone #	HCADT	Calibrated	109	120	201	145	127	247	267	437	690	418	22	2,783
NB I-29	291	--	943	59	61	84	62	29	91	178	196	150	30	3	943
SB I-29	294	--	225	50	35	53	22	22	28	7	6	1	1	0	225
SB Louise	12	--	95		11	15	9	10	28	5	9	7	1	0	95
NB Louise	15	--	79		13	18	13	8	11	3	9	3	1	0	79
Western	22	--	138			31	15	16	22	6	23	19	5	1	138
Minnesota	32	--	253				24	34	52	15	43	56	25	4	253
Cliff	42	--	68					8	12	7	21	14	5	1	68
26th	52	--	37						3	3	17	6	7	1	37
10th	62	--	300							43	73	85	94	5	300
Rice	72	--	233								40	81	109	3	233
Benson	92	--	412									268	140	4	412
	Total	0	2,783	109	120	201	145	127	247	267	437	690	418	22	2,783

ORIGIN ZONES

Type: **HV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 1 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 4 24-Hr (0), other based on inputs (notes below).

Avg Wkdy - 3pm-7pm

NB I-229 Avg Wkdy - 3pm-7pm				DESTINATION ZONES											
				Exit 1C Louise	Exit 2 Western	Exit 3 Minn.	Exit 4 Cliff	Exit 5 26th	Exit 6 10th	Exit 7 Rice	Exit 9 Benson	Exit 10A EB I-90	Exit 10B WB I-90	CR 125	
		Zone #		11	21	31	41	51	61	71	91	903	902	905	Total
		HCADT		--	--	--	--	--	--	--	--	--	--	--	0
Entrance	Zone #	HCADT	Calibrated	60	59	85	53	81	102	140	300	237	216	23	1,356
NB I-29	291	--	499	28	37	36	22	20	41	88	156	59	11	1	499
SB I-29	294	--	117	32	12	30	11	14	11	3	2	1	1	0	117
SB Louise	12	--	39		3	5	4	9	7	3	4	3	1	0	39
NB Louise	15	--	40		7	7	4	3	5	4	5	4	1	0	40
Western	22	--	54			7	5	9	9	4	12	5	2	1	54
Minnesota	32	--	125				7	22	22	10	17	18	24	5	125
Cliff	42	--	33					4	5	5	10	5	3	1	33
26th	52	--	31						2	3	8	8	9	1	31
10th	62	--	153							20	58	26	42	7	153
Rice	72	--	112								28	28	54	2	112
Benson	92	--	153									80	68	5	153
	Total	0	1,356	60	59	85	53	81	102	140	300	237	216	23	1,356

ORIGIN ZONES

Ramp to Ramp Demand between Study Interchanges

Notes:

Demand: Streetlight Index is a representative of the relative amount of Trips; Calibrated is a representative Daily Value.

Day Type: Average Day (Mon-Sun), Weekdays (Mon-Thurs), or Weekends (Sat-Sun)

Day Part: [0] 24-hour, [1] Early AM (12am-6am), [2] Peak AM (6am-9am), [3] Mid-Day (9am-3pm), [4] Peak PM (3pm-7pm), [5] Late PM (7pm-12am)

Some Day Types or Day Parts might not have resulted in sufficient data for Streetlight to provide values.

Trips: For GPS Trips, a trip is considered when the device does not move 5 meters in 5 minutes or when device is turned off.
Trips are required to be at least 3 minutes and 500 meters in length.

STREETLIGHT DATA
I-229 OD Study Information
July 2017 to June 2018

Table A7a
SOUTHBOUND I-229 ORIGIN & DESTINTATION
I-229 EXITS 3 & 4 STUDY
PERCENTAGE INFORMATION

Type: **HV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 0 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 0 24-Hr (0), other based on inputs (notes below).

7 Day Avg - 24-Hr

SB I-229				DESTINATION ZONES										
7 Day Avg - 24-Hr				Exit 9 Benson	Exit 7 Rice	Exit 6 10th	Exit 5 26th	Exit 4 Cliff	Exit 3 Minn.	Exit 2 Western	Exit 1C Louise	Exit 1B NB I-29	Exit 1A SB I-29	
			Zone #	93	73	63	53	43	33	23	13	293	292	**Total**
			HCADT	--	--	--	--	--	--	--	--	--	--	**0**
Entrance	Zone #	HCADT	**Calibrated**	**521**	**441**	**559**	**99**	**268**	**401**	**225**	**341**	**574**	**2,328**	**5,757**
ORIGIN ZONES WB I-90	904	--	**1,102**	31%	14%	14%	1%	4%	8%	3%	2%	1%	23%	**100%**
EB I-90	901	--	**936**	18%	23%	19%	3%	4%	5%	1%	1%	0%	25%	**100%**
CR 125	906	--	**28**	18%	7%	21%	7%	11%	18%	4%	4%	0%	11%	**100%**
Benson	94	--	**1,046**		7%	14%	3%	7%	5%	3%	3%	1%	56%	**100%**
Rice	74	--	**624**			12%	2%	6%	3%	3%	4%	3%	67%	**100%**
10th	64	--	**500**				2%	11%	17%	7%	8%	11%	44%	**100%**
26th	54	--	**210**					**10%**	21%	8%	17%	20%	24%	**100%**
Cliff	44	--	**349**						**15%**	8%	13%	16%	49%	**100%**
Minnesota	34	--	**484**							**11%**	19%	38%	33%	**100%**
Western	24	--	**205**								17%	34%	49%	**100%**
Louise	14	--	**273**									48%	52%	**100%**
	Total	**0**	**5,757**											

Type: **HV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 1 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 0 24-Hr (0), other based on inputs (notes below).

Avg Wkdy - 24-Hr

SB I-229				DESTINATION ZONES										
Avg Wkdy - 24-Hr				Exit 9 Benson	Exit 7 Rice	Exit 6 10th	Exit 5 26th	Exit 4 Cliff	Exit 3 Minn.	Exit 2 Western	Exit 1C Louise	Exit 1B NB I-29	Exit 1A SB I-29	
			Zone #	93	73	63	53	43	33	23	13	293	292	**Total**
			HCADT	--	--	--	--	--	--	--	--	--	--	**0**
Entrance	Zone #	HCADT	**Calibrated**	**647**	**513**	**683**	**127**	**342**	**518**	**292**	**439**	**725**	**2,844**	**7,130**
ORIGIN ZONES WB I-90	904	--	**1,321**	32%	12%	14%	1%	4%	8%	3%	2%	1%	23%	**100%**
EB I-90	901	--	**1,120**	20%	22%	20%	3%	4%	5%	2%	1%	0%	23%	**100%**
CR 125	906	--	**37**	22%	5%	22%	8%	8%	19%	3%	3%	0%	11%	**100%**
Benson	94	--	**1,328**		8%	13%	3%	7%	6%	4%	4%	1%	54%	**100%**
Rice	74	--	**758**			13%	2%	7%	4%	2%	4%	3%	66%	**100%**
10th	64	--	**611**				2%	11%	18%	7%	9%	11%	42%	**100%**
26th	54	--	**273**					**11%**	22%	8%	16%	19%	25%	**100%**
Cliff	44	--	**441**						**16%**	7%	13%	16%	49%	**100%**
Minnesota	34	--	**615**							**11%**	19%	36%	33%	**100%**
Western	24	--	**267**								17%	34%	48%	**100%**
Louise	14	--	**359**									48%	52%	**100%**
	Total	**0**	**7,130**											

Type: **HV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 2 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 0 24-Hr (0), other based on inputs (notes below).

Avg Wknd - 24-Hr

SB I-229				DESTINATION ZONES										
Avg Wknd - 24-Hr				Exit 9 Benson	Exit 7 Rice	Exit 6 10th	Exit 5 26th	Exit 4 Cliff	Exit 3 Minn.	Exit 2 Western	Exit 1C Louise	Exit 1B NB I-29	Exit 1A SB I-29	
			Zone #	93	73	63	53	43	33	23	13	293	292	**Total**
			HCADT	--	--	--	--	--	--	--	--	--	--	**0**
Entrance	Zone #	HCADT	**Calibrated**	**197**	**200**	**249**	**30**	**95**	**166**	**53**	**84**	**189**	**1,063**	**2,326**
ORIGIN ZONES WB I-90	904	--	**538**	28%	17%	15%	1%	4%	9%	1%	1%	1%	23%	**100%**
EB I-90	901	--	**446**	10%	22%	22%	2%	4%	7%	1%	0%	0%	31%	**100%**
CR 125	906	--	**8**	0%	13%	13%	13%	25%	13%	0%	0%	0%	25%	**100%**
Benson	94	--	**345**		2%	9%	2%	5%	4%	1%	1%	1%	74%	**100%**
Rice	74	--	**302**			11%	1%	5%	1%	2%	3%	2%	75%	**100%**
10th	64	--	**239**				2%	8%	18%	5%	6%	8%	53%	**100%**
26th	54	--	**58**					**9%**	21%	9%	19%	24%	19%	**100%**
Cliff	44	--	**116**						**13%**	4%	11%	16%	56%	**100%**
Minnesota	34	--	**159**							**9%**	11%	52%	28%	**100%**
Western	24	--	**50**								12%	22%	66%	**100%**
Louise	14	--	**65**									42%	58%	**100%**
	Total	**0**	**2,326**											

Ramp to Ramp Demand between Study Interchanges

Notes:

Demand: Streetlight Index is a representative of the relative amount of Trips; Calibrated is a representative Daily Value.

Day Type: Average Day (Mon-Sun), Weekdays (Mon-Thurs), or Weekends (Sat-Sun)

Day Part: [0] 24-hour, [1] Early AM (12am-6am), [2] Peak AM (6am-9am), [3] Mid-Day (9am-3pm), [4] Peak PM (3pm-7pm), [5] Late PM (7pm-12am)

Some Day Types or Day Parts might not have resulted in sufficient data for Streetlight to provide values.

Trips: For GPS Trips, a trip is considered when the device does not move 5 meters in 5 minutes or when device is turned off.
Trips are required to be at least 3 minutes and 500 meters in length.

STREETLIGHT DATA
I-229 OD Study Information
July 2017 to June 2018

Table A7b
SOUTHBOUND I-229 ORIGIN & DESTINTATION
I-229 EXITS 3 & 4 STUDY
PERCENTAGE INFORMATION

Type: **HV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 0 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 0 24-Hr (0), other based on inputs (notes below).

7 Day Avg - 24-Hr

SB I-229				DESTINATION ZONES										
7 Day Avg - 24-Hr				Exit 9 Benson	Exit 7 Rice	Exit 6 10th	Exit 5 26th	Exit 4 Cliff	Exit 3 Minn.	Exit 2 Western	Exit 1C Louise	Exit 1B NB I-29	Exit 1A SB I-29	
			Zone #	93	73	63	53	43	33	23	13	293	292	**Total**
			HCADT	--	--	--	--	--	--	--	--	--	--	**0**
Entrance	Zone #	HCADT	**Calibrated**	**521**	**441**	**559**	**99**	**268**	**401**	**225**	**341**	**574**	**2,328**	**5,757**
ORIGIN ZONES WB I-90	904	--	**1,102**	344	151	152	15	43	88	30	23	8	248	**1,102**
EB I-90	901	--	**936**	172	213	182	26	38	49	14	9	2	231	**936**
CR 125	906	--	**28**	5	2	6	2	3	5	1	1	0	3	**28**
Benson	94	--	**1,046**		75	142	35	70	56	33	36	14	585	**1,046**
Rice	74	--	**624**			77	10	40	19	16	26	17	419	**624**
10th	64	--	**500**				11	53	86	34	42	54	220	**500**
26th	54	--	**210**					**21**	45	17	35	41	51	**210**
Cliff	44	--	**349**						**53**	27	44	55	170	**349**
Minnesota	34	--	**484**							**53**	90	183	158	**484**
Western	24	--	**205**								35	70	100	**205**
Louise	14	--	**273**									130	143	**273**
	Total	**0**	**5,757**	**521**	**441**	**559**	**99**	**268**	**401**	**225**	**341**	**574**	**2,328**	**5,757**

Type: **HV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 1 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 0 24-Hr (0), other based on inputs (notes below).

Avg Wkdy - 24-Hr

SB I-229				DESTINATION ZONES										
Avg Wkdy - 24-Hr				Exit 9 Benson	Exit 7 Rice	Exit 6 10th	Exit 5 26th	Exit 4 Cliff	Exit 3 Minn.	Exit 2 Western	Exit 1C Louise	Exit 1B NB I-29	Exit 1A SB I-29	
			Zone #	93	73	63	53	43	33	23	13	293	292	**Total**
			HCADT	--	--	--	--	--	--	--	--	--	--	**0**
Entrance	Zone #	HCADT	**Calibrated**	**647**	**513**	**683**	**127**	**342**	**518**	**292**	**439**	**725**	**2,844**	**7,130**
ORIGIN ZONES WB I-90	904	--	**1,321**	419	163	184	19	52	109	41	27	8	299	**1,321**
EB I-90	901	--	**1,120**	220	246	219	34	43	61	20	12	3	262	**1,120**
CR 125	906	--	**37**	8	2	8	3	3	7	1	1	0	4	**37**
Benson	94	--	**1,328**		102	176	45	94	77	47	49	18	720	**1,328**
Rice	74	--	**758**			96	13	52	27	18	32	20	500	**758**
10th	64	--	**611**				13	69	109	44	53	66	257	**611**
26th	54	--	**273**					**29**	59	21	44	51	69	**273**
Cliff	44	--	**441**						**69**	30	56	70	216	**441**
Minnesota	34	--	**615**							**70**	119	223	203	**615**
Western	24	--	**267**								46	92	129	**267**
Louise	14	--	**359**									174	185	**359**
	Total	**0**	**7,130**	**647**	**513**	**683**	**127**	**342**	**518**	**292**	**439**	**725**	**2,844**	**7,130**

Type: **HV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 2 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 0 24-Hr (0), other based on inputs (notes below).

Avg Wknd - 24-Hr

SB I-229				DESTINATION ZONES										
Avg Wknd - 24-Hr				Exit 9 Benson	Exit 7 Rice	Exit 6 10th	Exit 5 26th	Exit 4 Cliff	Exit 3 Minn.	Exit 2 Western	Exit 1C Louise	Exit 1B NB I-29	Exit 1A SB I-29	
			Zone #	93	73	63	53	43	33	23	13	293	292	**Total**
			HCADT	--	--	--	--	--	--	--	--	--	--	**0**
Entrance	Zone #	HCADT	**Calibrated**	**197**	**200**	**249**	**30**	**95**	**166**	**53**	**84**	**189**	**1,063**	**2,326**
ORIGIN ZONES WB I-90	904	--	**538**	152	93	83	5	19	47	4	7	6	122	**538**
EB I-90	901	--	**446**	45	98	100	8	19	30	4	2	1	139	**446**
CR 125	906	--	**8**	0	1	1	1	2	1	0	0	0	2	**8**
Benson	94	--	**345**		8	31	7	16	14	4	5	3	257	**345**
Rice	74	--	**302**			34	4	14	4	6	8	7	225	**302**
10th	64	--	**239**				5	20	43	11	14	20	126	**239**
26th	54	--	**58**					**5**	12	5	11	14	11	**58**
Cliff	44	--	**116**						**15**	5	13	18	65	**116**
Minnesota	34	--	**159**							**14**	18	82	45	**159**
Western	24	--	**50**								6	11	33	**50**
Louise	14	--	**65**									27	38	**65**
	Total	**0**	**2,326**	**197**	**200**	**249**	**30**	**95**	**166**	**53**	**84**	**189**	**1,063**	**2,326**

Ramp to Ramp Demand between Study Interchanges

Notes:

Demand: Streetlight Index is a representative of the relative amount of Trips; Calibrated is a representative Daily Value.

Day Type: Average Day (Mon-Sun), Weekdays (Mon-Thurs), or Weekends (Sat-Sun)

Day Part: [0] 24-hour, [1] Early AM (12am-6am), [2] Peak AM (6am-9am), [3] Mid-Day (9am-3pm), [4] Peak PM (3pm-7pm), [5] Late PM (7pm-12am)

Some Day Types or Day Parts might not have resulted in sufficient data for Streetlight to provide values.

Trips: For GPS Trips, a trip is considered when the device does not move 5 meters in 5 minutes or when device is turned off.
Trips are required to be at least 3 minutes and 500 meters in length.

STREETLIGHT DATA
I-229 OD Study Information
July 2017 to June 2018

Table A8a
SOUTHBOUND I-229 ORIGIN & DESTINTATION
I-229 EXITS 3 & 4 STUDY
PERCENTAGE INFORMATION

Type: **HV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 1 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 2 24-Hr (0), other based on inputs (notes below).

Avg Wkdy - 6am-9am

SB I-229				DESTINATION ZONES										
Avg Wkdy - 6am-9am				Exit 9 Benson	Exit 7 Rice	Exit 6 10th	Exit 5 26th	Exit 4 Cliff	Exit 3 Minn.	Exit 2 Western	Exit 1C Louise	Exit 1B NB I-29	Exit 1A SB I-29	
			Zone #	93	73	63	53	43	33	23	13	293	292	**Total**
			HCADT	--	--	--	--	--	--	--	--	--	--	**0**
Entrance	Zone #	HCADT	**Calibrated**	**76**	**82**	**124**	**31**	**72**	**138**	**51**	**90**	**139**	**466**	**1,269**
WB I-90	904	--	**194**	20%	12%	15%	3%	5%	14%	4%	3%	1%	23%	**100%**
EB I-90	901	--	**201**	16%	19%	21%	4%	5%	8%	2%	1%	0%	22%	**100%**
CR 125	906	--	**18**	22%	6%	22%	6%	6%	28%	0%	6%	0%	6%	**100%**
Benson	94	--	**217**		9%	14%	4%	7%	11%	5%	4%	1%	45%	**100%**
Rice	74	--	**146**			11%	3%	8%	5%	3%	6%	3%	62%	**100%**
10th	64	--	**112**				3%	14%	14%	5%	11%	15%	38%	**100%**
26th	54	--	**82**					**9%**	29%	6%	15%	15%	27%	**100%**
Cliff	44	--	**83**						**24%**	5%	14%	16%	41%	**100%**
Minnesota	34	--	**114**							**10%**	20%	39%	32%	**100%**
Western	24	--	**44**								9%	30%	61%	**100%**
Louise	14	--	**58**									55%	45%	**100%**
	Total	**0**	**1,269**											

ORIGIN ZONES

Type: **HV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 1 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 3 24-Hr (0), other based on inputs (notes below).

Avg Wkdy - 9am-3pm

SB I-229				DESTINATION ZONES										
Avg Wkdy - 9am-3pm				Exit 9 Benson	Exit 7 Rice	Exit 6 10th	Exit 5 26th	Exit 4 Cliff	Exit 3 Minn.	Exit 2 Western	Exit 1C Louise	Exit 1B NB I-29	Exit 1A SB I-29	
			Zone #	93	73	63	53	43	33	23	13	293	292	**Total**
			HCADT	--	--	--	--	--	--	--	--	--	--	**0**
Entrance	Zone #	HCADT	**Calibrated**	**236**	**228**	**282**	**56**	**155**	**220**	**162**	**202**	**333**	**1,302**	**3,176**
WB I-90	904	--	**471**	27%	15%	11%	1%	4%	8%	4%	2%	1%	28%	**100%**
EB I-90	901	--	**484**	22%	21%	21%	3%	4%	5%	2%	1%	0%	21%	**100%**
CR 125	906	--	**10**	30%	10%	20%	10%	10%	10%	0%	0%	0%	10%	**100%**
Benson	94	--	**655**		8%	14%	4%	8%	6%	4%	4%	1%	51%	**100%**
Rice	74	--	**321**			11%	2%	7%	4%	3%	3%	2%	67%	**100%**
10th	64	--	**263**				2%	11%	19%	9%	8%	8%	43%	**100%**
26th	54	--	**113**					**12%**	20%	10%	15%	19%	25%	**100%**
Cliff	44	--	**223**						**13%**	8%	12%	15%	51%	**100%**
Minnesota	34	--	**313**							**15%**	19%	33%	33%	**100%**
Western	24	--	**152**								18%	36%	47%	**100%**
Louise	14	--	**171**									46%	54%	**100%**
	Total	**0**	**3,176**											

ORIGIN ZONES

Type: **HV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 1 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 4 24-Hr (0), other based on inputs (notes below).

Avg Wkdy - 3pm-7pm

SB I-229				DESTINATION ZONES										
Avg Wkdy - 3pm-7pm				Exit 9 Benson	Exit 7 Rice	Exit 6 10th	Exit 5 26th	Exit 4 Cliff	Exit 3 Minn.	Exit 2 Western	Exit 1C Louise	Exit 1B NB I-29	Exit 1A SB I-29	
			Zone #	93	73	63	53	43	33	23	13	293	292	**Total**
			HCADT	--	--	--	--	--	--	--	--	--	--	**0**
Entrance	Zone #	HCADT	**Calibrated**	**169**	**124**	**103**	**28**	**64**	**87**	**50**	**108**	**182**	**488**	**1,403**
WB I-90	904	--	**302**	38%	14%	9%	2%	4%	7%	3%	3%	0%	21%	**100%**
EB I-90	901	--	**246**	22%	24%	16%	4%	4%	4%	1%	1%	0%	24%	**100%**
CR 125	906	--	**7**	14%	14%	29%	0%	14%	0%	0%	0%	0%	29%	**100%**
Benson	94	--	**193**		12%	12%	5%	8%	6%	5%	6%	3%	45%	**100%**
Rice	74	--	**131**			9%	2%	7%	3%	2%	8%	5%	64%	**100%**
10th	64	--	**102**				2%	11%	20%	7%	13%	12%	36%	**100%**
26th	54	--	**58**					**10%**	16%	7%	21%	24%	22%	**100%**
Cliff	44	--	**82**						**13%**	7%	16%	22%	41%	**100%**
Minnesota	34	--	**144**							**6%**	20%	38%	35%	**100%**
Western	24	--	**49**								18%	37%	45%	**100%**
Louise	14	--	**89**									58%	42%	**100%**
	Total	**0**	**1,403**											

ORIGIN ZONES

Ramp to Ramp Demand between Study Interchanges

Notes:

Demand: Streetlight Index is a representative of the relative amount of Trips; Calibrated is a representative Daily Value.

Day Type: Average Day (Mon-Sun), Weekdays (Mon-Thurs), or Weekends (Sat-Sun)

Day Part: [0] 24-hour, [1] Early AM (12am-6am), [2] Peak AM (6am-9am), [3] Mid-Day (9am-3pm), [4] Peak PM (3pm-7pm), [5] Late PM (7pm-12am)

Some Day Types or Day Parts might not have resulted in sufficient data for Streetlight to provide values.

Trips: For GPS Trips, a trip is considered when the device does not move 5 meters in 5 minutes or when device is turned off.
Trips are required to be at least 3 minutes and 500 meters in length.

STREETLIGHT DATA
I-229 OD Study Information
July 2017 to June 2018

Table A8b
SOUTHBOUND I-229 ORIGIN & DESTINTATION
I-229 EXITS 3 & 4 STUDY
PERCENTAGE INFORMATION

Type: **HV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 1 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 2 24-Hr (0), other based on inputs (notes below).

Avg Wkdy - 6am-9am

SB I-229				DESTINATION ZONES										
Avg Wkdy - 6am-9am				Exit 9 Benson	Exit 7 Rice	Exit 6 10th	Exit 5 26th	Exit 4 Cliff	Exit 3 Minn.	Exit 2 Western	Exit 1C Louise	Exit 1B NB I-29	Exit 1A SB I-29	
			Zone #	93	73	63	53	43	33	23	13	293	292	**Total**
			HCADT	--	--	--	--	--	--	--	--	--	--	**0**
Entrance	Zone #	HCADT	**Calibrated**	**76**	**82**	**124**	**31**	**72**	**138**	**51**	**90**	**139**	**466**	**1,269**
ORIGIN ZONES: WB I-90	904	--	**194**	39	24	30	6	10	27	7	6	1	44	**194**
EB I-90	901	--	**201**	33	38	43	8	11	16	4	3	0	45	**201**
CR 125	906	--	**18**	4	1	4	1	1	5	0	1	0	1	**18**
Benson	94	--	**217**		19	31	9	16	23	10	8	3	98	**217**
Rice	74	--	**146**			16	4	11	7	4	9	4	91	**146**
10th	64	--	**112**				3	16	16	6	12	17	42	**112**
26th	54	--	**82**					**7**	24	5	12	12	22	**82**
Cliff	44	--	**83**						**20**	4	12	13	34	**83**
Minnesota	34	--	**114**							**11**	23	44	36	**114**
Western	24	--	**44**								4	13	27	**44**
Louise	14	--	**58**									32	26	**58**
	Total	**0**	**1,269**	**76**	**82**	**124**	**31**	**72**	**138**	**51**	**90**	**139**	**466**	**1,269**

Type: **HV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 1 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 3 24-Hr (0), other based on inputs (notes below).

Avg Wkdy - 9am-3pm

SB I-229				DESTINATION ZONES										
Avg Wkdy - 9am-3pm				Exit 9 Benson	Exit 7 Rice	Exit 6 10th	Exit 5 26th	Exit 4 Cliff	Exit 3 Minn.	Exit 2 Western	Exit 1C Louise	Exit 1B NB I-29	Exit 1A SB I-29	
			Zone #	93	73	63	53	43	33	23	13	293	292	**Total**
			HCADT	--	--	--	--	--	--	--	--	--	--	**0**
Entrance	Zone #	HCADT	**Calibrated**	**236**	**228**	**282**	**56**	**155**	**220**	**162**	**202**	**333**	**1,302**	**3,176**
ORIGIN ZONES: WB I-90	904	--	**471**	125	70	50	6	20	39	18	10	3	130	**471**
EB I-90	901	--	**484**	108	104	100	13	17	26	8	4	1	103	**484**
CR 125	906	--	**10**	3	1	2	1	1	1	0	0	0	1	**10**
Benson	94	--	**655**		53	94	24	51	39	27	26	8	333	**655**
Rice	74	--	**321**			36	6	24	13	9	11	8	214	**321**
10th	64	--	**263**				6	29	49	24	21	22	112	**263**
26th	54	--	**113**					**13**	23	11	17	21	28	**113**
Cliff	44	--	**223**						**30**	18	27	34	114	**223**
Minnesota	34	--	**313**							**47**	59	104	103	**313**
Western	24	--	**152**								27	54	71	**152**
Louise	14	--	**171**									78	93	**171**
	Total	**0**	**3,176**	**236**	**228**	**282**	**56**	**155**	**220**	**162**	**202**	**333**	**1,302**	**3,176**

Type: **HV** Passenger Vehicles Data (PV) or Commercial Vehicle Data (HV)
Demand: 2 Streelight Index (1) or Calibrated Data (2)
Day Type: 1 Avg. Day (0), Weekday (1), or Weekend (2)
Day Part: 4 24-Hr (0), other based on inputs (notes below).

Avg Wkdy - 3pm-7pm

SB I-229				DESTINATION ZONES										
Avg Wkdy - 3pm-7pm				Exit 9 Benson	Exit 7 Rice	Exit 6 10th	Exit 5 26th	Exit 4 Cliff	Exit 3 Minn.	Exit 2 Western	Exit 1C Louise	Exit 1B NB I-29	Exit 1A SB I-29	
			Zone #	93	73	63	53	43	33	23	13	293	292	**Total**
			HCADT	--	--	--	--	--	--	--	--	--	--	**0**
Entrance	Zone #	HCADT	**Calibrated**	**169**	**124**	**103**	**28**	**64**	**87**	**50**	**108**	**182**	**488**	**1,403**
ORIGIN ZONES: WB I-90	904	--	**302**	114	41	26	5	12	22	10	8	1	63	**302**
EB I-90	901	--	**246**	54	59	40	10	9	10	2	2	1	59	**246**
CR 125	906	--	**7**	1	1	2	0	1	0	0	0	0	2	**7**
Benson	94	--	**193**		23	23	9	16	11	9	11	5	86	**193**
Rice	74	--	**131**			12	2	9	4	3	11	6	84	**131**
10th	64	--	**102**				2	11	20	7	13	12	37	**102**
26th	54	--	**58**					**6**	9	4	12	14	13	**58**
Cliff	44	--	**82**						**11**	6	13	18	34	**82**
Minnesota	34	--	**144**							**9**	29	55	51	**144**
Western	24	--	**49**								9	18	22	**49**
Louise	14	--	**89**									52	37	**89**
	Total	**0**	**1,403**	**169**	**124**	**103**	**28**	**64**	**87**	**50**	**108**	**182**	**488**	**1,403**

Ramp to Ramp Demand between Study Interchanges

Notes:

Demand: Streetlight Index is a representative of the relative amount of Trips; Calibrated is a representative Daily Value.

Day Type: Average Day (Mon-Sun), Weekdays (Mon-Thurs), or Weekends (Sat-Sun)

Day Part: [0] 24-hour, [1] Early AM (12am-6am), [2] Peak AM (6am-9am), [3] Mid-Day (9am-3pm), [4] Peak PM (3pm-7pm), [5] Late PM (7pm-12am)

Some Day Types or Day Parts might not have resulted in sufficient data for Streetlight to provide values.

Trips: For GPS Trips, a trip is considered when the device does not move 5 meters in 5 minutes or when device is turned off.
Trips are required to be at least 3 minutes and 500 meters in length.

Appendix K

Methods and Assumptions Document

METHODS & ASSUMPTIONS REPORT

Interchange Study for I-229 Exits 3 (Minnesota Avenue) and 4 (Cliff Avenue)

THE SOUTH DAKOTA DEPARTMENT OF TRANSPORTATION

IN CONJUNCTION WITH

THE FEDERAL HIGHWAY ADMINISTRATION

September 21, 2018

Methods and Assumptions Document

This Methods and Assumptions document was developed in preparation of the Methods and Assumptions Meeting held on August 9, 2018 with representatives from the South Dakota Department of Transportation (SDDOT), Federal Highway Administration (FHWA), Sioux Falls Metropolitan Planning Organization (MPO), the City of Sioux Falls, SD, and Short Elliott Hendrickson (SEH). The document is intended to serve as a historical record of the meeting, process, dates, and decisions made by the study team for the **Interchange Study for I-229 Exits 3 (Minnesota Avenue) and 4 (Cliff Avenue).**

Stakeholder Acceptance

The undersigned parties concur with the Methods and Assumptions for the **Interchange Study for I-229 Exits 3 (Minnesota Avenue) and 4 (Cliff Avenue)** as presented in this document."

SDDOT:	FHWA:
_____	_____
Signature	Signature
_____	_____
Title	Title
_____	_____
Date	Date

(1) Participation on the Study Advisory Team and/or signing of this document does not constitute approval of the ***Interchange Study for I-229 Exits 3 (Minnesota Avenue) and 4 (Cliff Avenue) Final Report*** *or conclusions.*

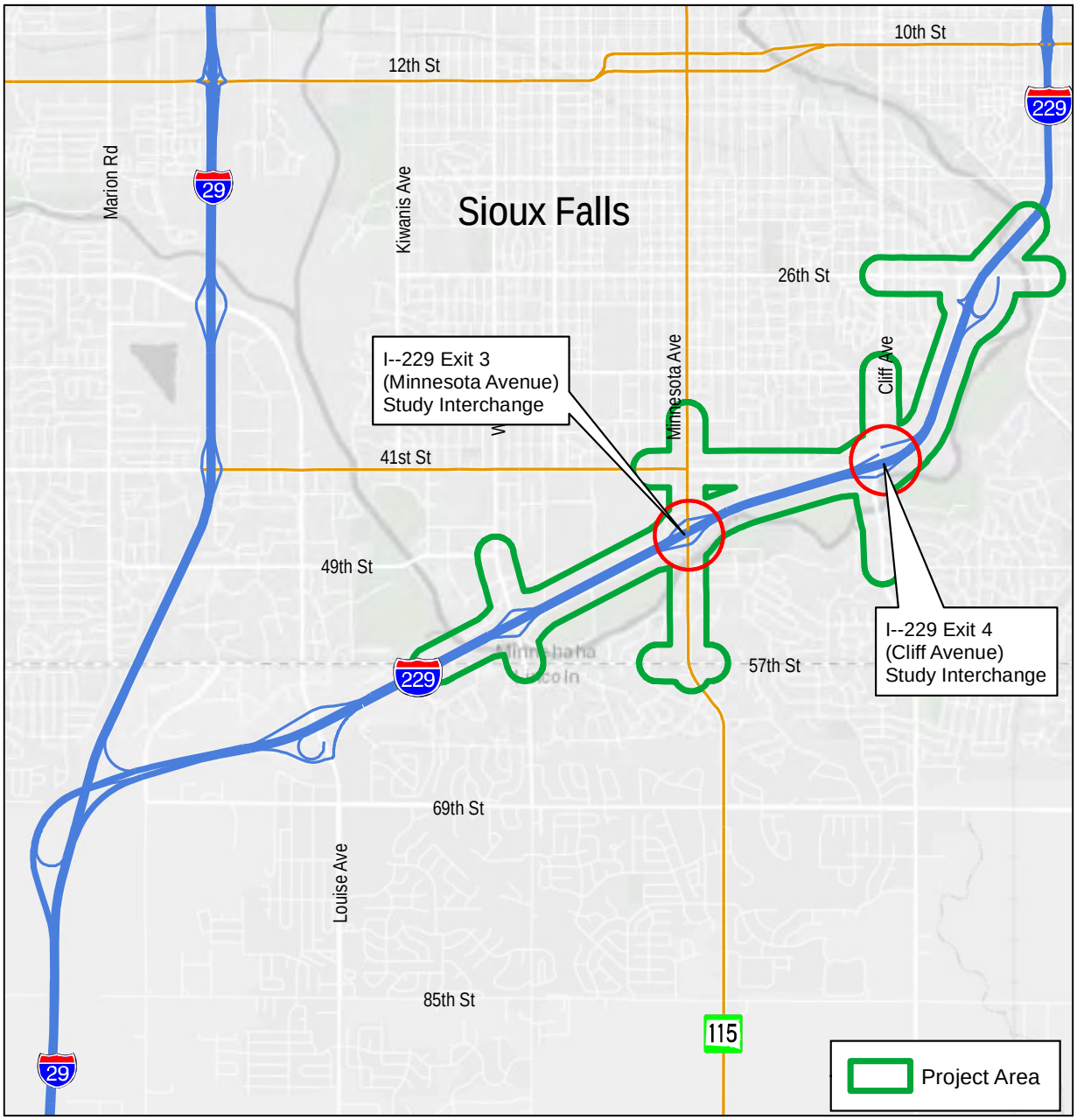
(2) All members of the Study Advisory Team will accept this document as a guide and reference as the study progresses through the various stages of development. If there are any agreed upon changes to the assumptions in this document a revision will be created, endorsed and signed by all the signatories.

1. Introduction and Project Description

Background Information

This document presents the methodology for the study of the interchanges at Interstate 229 (I-229) Exit 3 (Minnesota Avenue) and Exit 4 (Cliff Avenue). Located east of the system interchange of I-29/I-229, the project area is expected to have increased congestion as traffic growth continues. As a result, there are projected capacity deficiencies and safety issues that may warrant upgrades to the transportation system. Improvements have been recommended at each interchange in previous studies. **Figure 1** shows the interchange study locations.

Figure 1 – Study Interchanges Map



Previous Studies

The most recent study within the project area was the I-229 Major Investment Corridor Study (MIS). Five interchange sub-studies resulted from the MIS, including Exit 3 (Sub-study 2) and Exit 4 (Sub-study 6), which were completed in June 2017. Sub-study evaluations included existing and future year traffic capacity and operations analyses; preliminary concept development, analysis and recommendations for alternatives for further study; and documentation of next steps. Additional studies include the 2010 Decennial Interstate Corridor Study and 2000 Interstate Corridor Study. The *Go Sioux Falls 2040*, Metropolitan Planning Organization Long Range Plan (LRTP) also discusses the importance of improvements in the area.

Project Schedule

The Interchange Study for I-229 Exits 3 (Minnesota Avenue) and 4 (Cliff Avenue) schedule will seek to complete an Interchange Justification Report (IMJR) in the fall of 2019. The IMJR schedule is anticipated to include the following timeframes:

Sept. – Oct.:	Obtain Data/Baseline Conditions (Traffic Counts, Crash Data, Weaving Data, Available Agency Data)
Oct. – Nov.:	Existing Conditions Operational and Crash Analysis, Obtain Draft Regional Forecast Model (2040) from MPO, Review Draft Regional Forecast Model (2040) with MPO, develop project traffic forecasts
Dec. – Feb. 2019:	Future conditions operational analysis, improvement alternatives development, safety analysis for build options, traffic variables for design, constructability analysis of build options
Feb. – Apr. 2019:	Develop draft IJR
Apr. – Aug. 2019:	IJR review
End of Aug. 2019:	IJR completion and submitted for approval

Study Complexity

The study will evaluate not only the interchange configuration at Exits 3 and 4 and impacts to the I-229 corridor but will assess the adjacent local arterial roadway network. Traffic forecasting and capacity analysis will include both the freeway and the arterial roadway network and intersection controls. The local arterial roadway network will be analyzed to determine the needs for roadway capacity, intersection lane configurations and traffic controls.

Facilities Affected

The study will evaluate traffic conditions on facilities within the study area including I-229 corridor, I-229/Western Avenue Interchange I-229/Minnesota Avenue Interchange, I-229/Cliff Avenue Interchange, I-229/26th Street Interchange, Minnesota Avenue, Cliff Avenue, Western Avenue, 26th Street and surrounding local arterial roadway network will be affected by the study (see Figure 2 in Section 2).

Study Advisory Team

The Study Advisory Team will include representatives from the following agencies or parties (additional team members may be added as the study progresses):

- SDDOT
  - Steve Gramm
  - Becky Hoffman
  - Brad Remmich
  - Jeff Brosz
  - Travis Dressen
  - Cary Cleland
  - Tom Lehmkuhl
  - Steve Johnson
  - Craig Smith
  - Thomas Therkelsen
  - Brooke White
- FHWA
  - Mark Hoines
- Sioux Falls MPO
  - Jim Feeney
- City of Sioux Falls
  - Shannon Ausen
  - Heath Hoftiezer
  - Sam Trebilcock

2. Study Area

The project study area will include the Minnesota Avenue and Cliff Avenue interchanges, adjacent interchanges and interstate segments and surrounding arterial roadway network. Study area will include impacted travel segments where path diversion to the new facilities is likely to occur. The arterial network is bordered by 57th Street on the south, 26th Street on the north, Southeastern Avenue on the east and Western Avenue on the west.

Figure 1 illustrates the extents of the study area, including the freeway segments, intersections and arterial roadway segments to be analyzed.

Arterial Roadway Corridors to be studied:

- Minnesota Avenue – 37th Street to 57th Street
- Cliff Avenue – 33rd Street to 49th Street
- Western Avenue – 49th Street to 57th Street
- 26th Street – Cliff Avenue to Southeastern Avenue
- Yeager Road – 26th St to I-229 SB Ramp
- 41st Street – Norton Avenue to Cliff Avenue

Intersections along these routes to be studied:

- Minnesota Avenue – Exit 3
    - 37th Avenue
    - 41st Street
    - 49th Street
    - I-229 Interchange Ramp Intersections (2) – Exit 3
        - NB I-229 off ramp restriped with dual left turns (2018)
    - Yankton Trail Park
    - Lotta Street
    - 57th Street

- Cliff Avenue – Exit 4
    - 33rd Street
    - 36th Street
    - 38th Street/Lincoln High School. Entrance #1
    - Lincoln High School Entrance #2
    - Lincoln High School Entrance #3
    - I-229 Interchange Ramp Intersections/41st Street (3) – Exit 4
        - NB I-229 off ramp restriped with dual left turns (2018)
    - Spencer Park Entrance
    - 49th Street
        - Project in 2021 – Cliff Avenue Expansion project from 49th and 57th Street

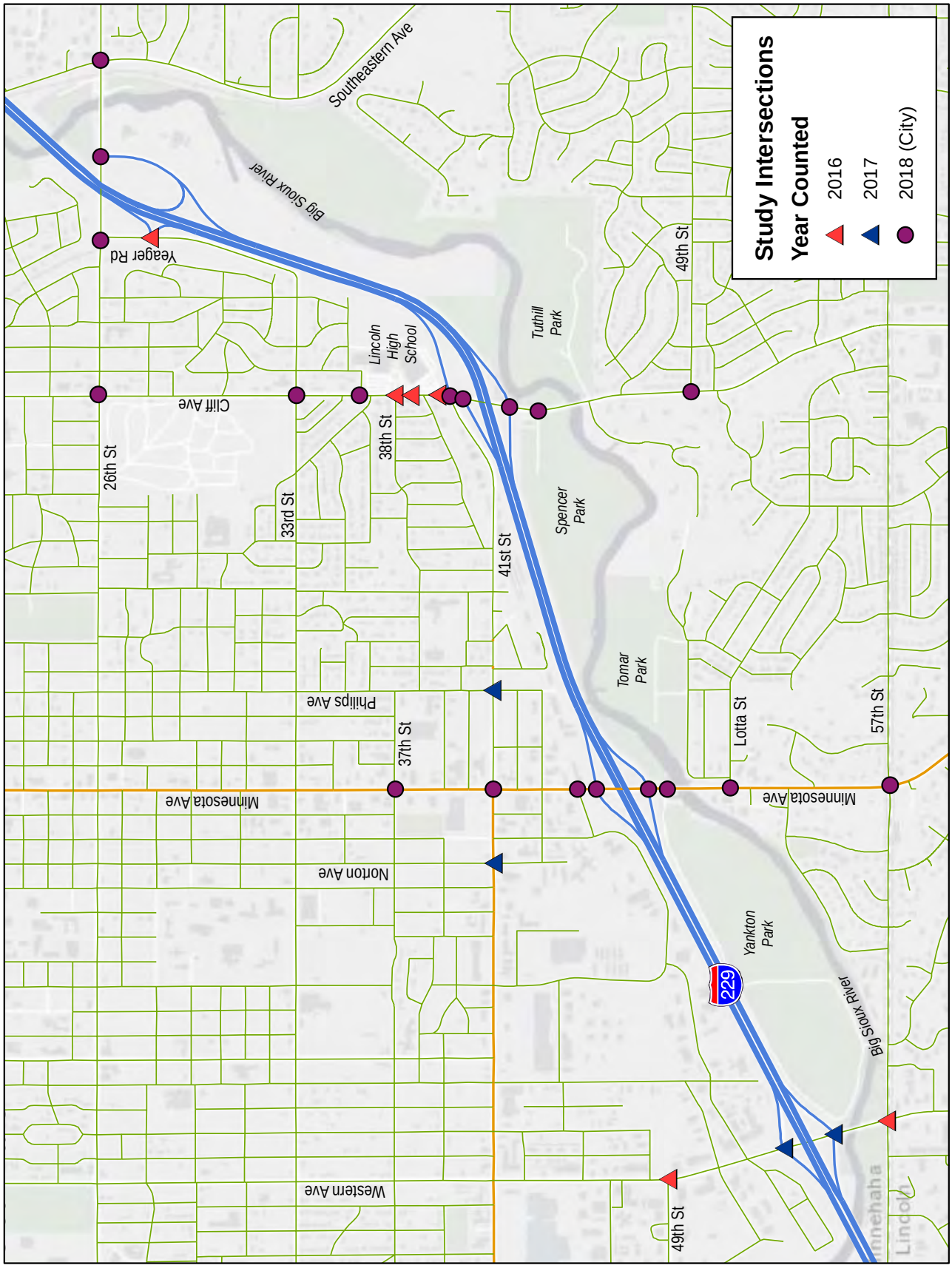
- Western Avenue – Exit 2
    - 49th Street
    - I-229 Interchange Ramp Intersections (2) – Exit 2
        - Project in 2023 – Southbound Dual Lefts to NB I-229
        - Northbound Dual Lefts may be included as part of project; currently under discussion/planning.
    - 57th Street

- 26th Street – Exit 5 (Reconstruction Project in 2019/2020)
    - Cliff Avenue
    - Yeager Road
    - I-229 Northbound Interchange Ramp Intersection (1) – Exit 5
    - I-229 Southbound Interchange Ramp Intersection (1) – Exit 5
        - Year of Opening and design year only; intersection does not exist in existing conditions.
    - Southeastern Avenue

- Yeager Road – Exit 5
    - I-229 Southbound Interchange Ramp Intersection (1) – Exit 5
        - Existing Conditions Only; Exit 5 Reconstruction Project in 2019/20 eliminates this intersection.

- 41st Street
    - Norton Avenue
    - Philips Avenue

Figure 2 – Study Area Map



3. Analysis Years/Periods

Design and Operational analysis will be conducted for the following time periods:

- Existing conditions (2018), for the AM and PM peak hours
- Year of opening conditions (2024), for the AM and PM peak hours
- Horizon year of traffic conditions (2050), for the AM and PM peak hours.
    - One Forecast without the SD 100 corridor
    - One Forecast with the SD 100 corridor between I-29 and SD 11.

4. Data Collection

Data collection is one of the most important items during any transportation planning study. The data collection efforts for this project are documented below:

Traffic volume data from the SDDOT and the City of Sioux Falls will be utilized where appropriate for data less than 3 years old. Based on available published (online) data and following the 3 year timeframe criteria it appears data collection efforts will include the following:

- Utilize SDDOT and City 2017 ADT volume data, where available.
- Utilize available (no older than 2016) existing turning movement count data for intersections, review for major traffic pattern changes to determine if additional turning movement counts are needed at these locations. Older counts with be factored to 2018 based on new count data at other locations.
    - Table 1 shows a breakdown of the most recent count data at each study intersection as well as what intersections will be counted by the City of Sioux Falls in 2018.
- For intersection data that does not correlate with adjacent intersection counts, a determination will be made between the City and SEH if the intersection should be recounted or used as is. If deemed necessary to recount, either the City or SEH will collect new turning movement counts during the months of September/October 2018.
- Peak hour data summaries will encompass two-hour durations for use with the forecast model and one-hour durations for operations analysis.
- Compare existing conditions field data collected as part of this project with the existing conditions forecast model provided by the Sioux Falls MPO. The comparisons will be used to validate the forecast model, complete reasonableness checks of the roadway capacity, directional splits, time of day distribution, and speed outputs from the model. Discrepancies found during the validation of the provided existing conditions model will be address through a cooperative effort with the Sioux Falls MPO.
- Weaving Demands: An origin-destination study will be conducted to better understand the ramp to ramp volumes and weaving demands. StreetLight Data is proposed to be used to gather weaving demands to evaluate weaving patterns for both the AM and PM peak periods.
    - The user data from StreetLight comes from two sources: Global Positioning Services (GPS) data and Location Based Services

(LBS) data. GPS data includes all connected vehicles using the existing roadways and is able to be separated by commercial vehicles and passenger vehicles dependent on the vehicle type. LBS data is derived from cell phones and other app based devices.
    - Both GPS and LBS data would be provided for the project. GPS data will include one full year (July 2017 through June 2018) of data, while LBS data will include 6-months (January 2018 through June 2018) of data due to the larger sample size.
    - The entry level project subscription to Streetlight includes up to 50 roadway zones or roadway gates. This will allow for placement of some zones on the arterial network surrounding the interchange study area to gain some understanding of the OD patterns outside of the freeway weaving areas. This information may be summarized in a separate memorandum for informational purposes outside of the weaving demand OD study.
    - SEH will work with StreetLight Data to access the information and sort through the data for the use in the operational analysis.

Additional Data supplied by SDDOT and/or City of Sioux Falls:

- Crash History Geodatabase
    - Includes crash records for the most recent five years of available data
- Existing Traffic Signal Timing and Coordination data

Summarize data collection efforts in the existing conditions analysis technical memorandum and provide all data to the City of Sioux Falls and SDDOT.

Table 1 – Existing Intersection Count Data and 2018 Updates

#	Intersection	Existing Count Data	2018 Update
1	Minnesota Ave at 37th Street	2015	City
2	Minnesota Ave at 41st Street	2015	City
3	Minnesota Ave at 49th Street	2012	City
4	Minnesota Ave at I-229 SB Ramp	2015	City
5	Minnesota Ave at I-229 NB Ramp	2015	City
6	Minnesota Ave at Yankton Trail Park	n/a	City
7	Minnesota Ave at Lotta Street	2013	City
8	Minnesota Ave at 57th Street	2015	City
9	Cliff Avenue at 33rd Street	2015	City
10	Cliff Avenue at 36th Street	n/a	City
11	Cliff Avenue at 38th Street/H.S. Ent #1	2016	-
12	Cliff Avenue at Lincoln H.S. Ent #2	2016	-
13	Cliff Avenue at Lincoln H.S. Ent #3	2016	-
14	Cliff Avenue at 41st Street/I-229 SB	2015	City
15	Cliff Avenue at I-229 SB Ramp	2015	City
16	Cliff Avenue at I-229 NB Ramp	2015	City
17	Cliff Avenue at Spencer Park Ent	n/a	City
18	Cliff Avenue at 49th Street	2017	City
19	Western Avenue at 49th Street	2016	-
20	Western Avenue at I-229 SB Ramp	2017	-
21	Western Avenue at I-229 NB Ramp	2017	-
22	Western Avenue at 57th Street	2016	-
23	26th Street at Cliff Avenue	2014	City
24	26th Street at Yeager Road	2015	City
25	26th Street at I-229 NB Ramp	2015	City
26	26th Street at Southeastern Avenue	2015	City
27	Yeager Road at I-229 SB Ramp	2016	-
28	41st Street at Norton Avenue	2017	-
29	41st Street at Philips Avenue	2017	-

5. Traffic Operations Analysis

Software

All operational analysis of both the freeway and intersections will be analyzed through the use of the most current HCS software version (Release 7.6 - HCM 6th Edition Methodology). Synchro/Simtraffic software will only be utilized, if necessary, for the development of signal timings.

Analysis Assumptions or Variables

Measures of Effectiveness (MOE) will include Level-of –Service (LOS) for signalized and unsignalized intersections.

- Minimum allowable LOS for overall intersections will be LOS "D" or better and individual intersection movements will be allowed to operate at LOS "E" (v/c ratio < 1.0).
- The Queue Storage Ratio for all movements will be considered failing at 1.0 or greater; queue storage ratio is the 95th percentile queue divided by the storage provided for each storage lane.
- Minimum allowable LOS for Freeway Segments, Weave Segments, Ramp Junctions and Terminals will be LOS "C" or better.

Peak Hour Factor (PHF) will be the calculated value for the existing conditions and 0.90 will be used for all future years.

Saturation Flow Rate will be 1,850 vph based on City of Sioux Falls determination. SDDOT Road Design allows urban areas up to 1,900 vph.

Traffic signal operational analysis along arterials will allow for both actuated and coordinated controllers. Analysis at an arterial/collector intersection will allow semi-actuation with a coordination option, as appropriate.

Left-Turn Phasing will allow permitted, protected, protected/permitted or split phasing at arterial intersections.

Right-turn-on-red (RTOR) will be evaluated based on count data and applied to the analysis.

Heavy vehicle percentages will be based on collected data for the interstate and arterial roadways and values set accordingly for each roadway type.

Phase change intervals will include the following:

- Existing signal timings will be used for the existing conditions analysis.
- Minimum All-Red clearance of 1 second or ITE procedures, greater value of the two, capped at 3.0 seconds, for all movements.
- Minimum Yellow clearances will be based on standard Institute of Transportation Engineers (ITE) procedures for determination of clearance intervals.

Vehicle speed in analysis will utilize posted speed limits for I-229 and arterial roadways.

Ramp speeds for existing ramps will be 45 mph unless the ramp configuration or posted speed warrants something other than 45 mph.

RV percentage will be assumed to be 0%.

SDDOT access control beyond an intersection for urban areas is a minimum 100 feet for an existing interchange and will need to be identified in the IMJR.

No microsimulation is anticipated to be conducted as a part of this study.

Interchange ramp terminal intersections will be analyzed under HCM Chapter 22 methodology; this includes I-229 at Western Avenue and Minnesota Avenue. The interchange intersections at I-229 at Cliff Avenue and 26th Street/Yeager Road are unique designs and unable to be evaluated with the HCM Chapter 22 methodology due to the mix of ramp and arterial approaches.

Based on discussions with McTrans, the ramp terminal analysis for I-229 at Cliff Avenue and for I-229 at 26th Street/Yeager Road will be analyzed as a standard intersections due to the non-standard interchange ramp terminal designs. However, all future design alternatives that can be evaluated using HCM Chapter 22 methodology will be analyzed accordingly; as an example, if an alternative interchange design involved a single point urban interchange or standard diamond configurations.

6. Travel Forecast

The Sioux Falls MPO Travel Demand Model (TDM) for 2045 will be utilized for the travel forecasts for this study. A review and comparison of the current TDM and the projects included in the latest LRTP will be conducted to ensure all long range projects are included in the forecast model; this would include the proposed I-29 at 85th Street interchange which is currently part of the latest LRTP.

The existing traffic data, collected as part of this project, will be smoothed and balanced between freeway locations and study intersections to eliminate source/sinks along the roadway facilities. A figure will be provided representing the existing traffic demands throughout the entire study area.

The traffic forecasts for the year of opening (2024) and the two horizon year traffic demand scenarios (2050; with/without SD 100 connection) will utilize existing traffic peak hour factors, the travel demand model growth and post-processing to develop the design year traffic demands. The 2045 TDM forecast results will be carried out to the 2050 design year via straight line growth from 2045 to 2050.

Forecasts demands will be smoothed and balanced between freeway locations and study intersections to eliminate source/sinks along the roadway facilities. Estimated volumes will be compared to observed counts for validation of forecast assumptions. Figures will be provided representing the 2024, 2050 with the SD 100 connection, and 2050 without the SD 100 connection traffic demands throughout the entire study area.

7. Safety Issues

Available SDDOT crash data for the most current five-year time frame will be utilized for the study. SDDOT critical crash rates will be utilized for the freeway segments. City of Sioux Falls critical crash rates will be utilized for arterials and intersections. Crash analysis conducted in the study, in accordance with Highway Safety Manual (latest edition), will provide the following information:

- Segment and Intersection Crash Rates
- Segment and Intersection Critical Crash Rates
- Crash trends identified
- Potential mitigation options for critical rate situations

Predictive crash analysis will be performed on the preferred concepts carried forward in the alternatives evaluations. The predictive crash analysis will be conducted for the study interchanges using the FHWA Interactive Highway Safety Design Model (IHSDM), which is a faithful software implementation of the crash prediction methods documented in Part C of the Highway Safety Manual (HSM).

8. Selection of Measures of Effectiveness (MOE)

The objective of this study will be to evaluate current and forecast traffic conditions in the study area and determine feasible alternative solutions that meet current design standards and traffic operation expectations. Solutions will seek to enhance the economic and social well-being of the area residents.

The following MOE's will be used to evaluate and compare improvement alternatives:

- Signalized Intersections: Level–of-Service (LOS) and Individual Movement Delay
- Freeway Segments, Ramp Junctions and Weave Areas: LOS, Speed and Delay
- Ramp Terminal Intersections: LOS and Individual Movement Delay
- All queue storage ratios shall be less than 1.0.

All traffic analysis and reporting will be based on the HCM 6th Edition Methodology.

9. FHWA Interstate Access Modification Policy Points

An Interchange Modification Justification Report (IMJR) for each interchange (Exit 3 and Exit 4) will be developed as a part of this project study effort. The reports will follow the most recent guidelines of the FHWA's Interstate System Access, dated May 22, 2017.

10. Environmental Studies

Environmental studies for the proposed Exit 3 and Exit 4 interchanges will be completed concurrently and begin with a thorough review and evaluation of the previously documented I-229 Major Investment Corridor Study (MIS)

environmental overview, as well as a more focused review of the results of the Environmental Scan from the respective Exit 3 and Exit 4 IMJR processes.

The NEPA path determination will be highly dependent on the potential for measurable impacts, their severity, and the anticipated public controversy. The appropriate action determination for each project is expected to be an Environmental Assessment (EA), where impacts will likely require additional study to determine the extent and potential severity of impact, and/or where public controversy may call for additional environmental study. The EA will also be used to assess whether or not an Environmental Impact Statement (EIS) would be warranted.

The following major NEPA topics and potential issues that may be expected for additional investigation in the environmental documentation process for each interchange are listed below:

- Socio-economic impacts – business impacts and private property accessibility resulting from proposed raised medians, traffic operations impacts
- Right-of-way impacts – partial or total property takings for infrastructure improvements
- Bicyclist and pedestrian Impacts – existing and proposed facilities along roadways, structures, and park properties
- Floodplain and Waters of the U.S. impacts – Big Sioux River basin and 100 year floodplain, wetlands
- Federal and/or State-listed threatened and/or endangered species – Topeka shiner, rufa red knot, western prairie fringed orchid and northern long-eared bat
- Section 4(f) impacts – potentially constructive uses within Yankton Trail, Tomar, Spencer, and/or Tuthill Parks, and the Big Sioux Trail
- Section 6(f) impacts - temporary or permanent changes to the aforementioned parks and Big Sioux Trail, which were acquired in part with Land and Water Conservation Fund grant funds
- Regulated materials impacts – former railroad corridor, old building sites and other potential acquisition areas with current and prior land use histories
- Visual impacts – a visual impact assessment to determine impacts to viewsheds to and from the proposed interchange projects (before and after construction)
- Cultural resources – former rail corridor historical significance, other locations within the Area of Potential Effect (APE) that may be on or potentially eligible for the National Register of Historic Places (NRHP).
- Noise – sensitive receptors and potential mitigation requirements

SDDOT/FHWA guidance and analysis protocol will be used to assess impacts of the alternatives that will be evaluated in the NEPA process using the SDDOT's Environmental Procedures Manual (May 2015). These will include additional topics that were not assessed in the I-229 MIS, such as impacts related to land use, environmental justice, visual, indirect and cumulative effects, and air and water quality.

11. Deviations/Justifications

No deviations from standards are currently known. Deviations required will be documented through amendments to this document prior to proceeding.

12. Conclusion

All sections contained in this document will guide the traffic and environmental data collection and traffic and environmental assessment for the study area.

13. Appendices

The study appendix includes Methods and Assumptions Study Advisory Team meeting minutes from August 9, 2018 and other applicable correspondence.

APPENDIX

Methods and Assumptions Advisory Team Meeting Minutes

Building a Better World for All of Us®

MEETING MINUTES

RE: I-229/Exit 3 & 4 IMJR-Env Study

Project Manager: Al Murra

SEH No.: 147016 16.00

Date of Meeting: 08/09/18

Time of Meeting: 10:00 AM

Location of Meeting: DOT VC Sioux Falls Large;
DOT VC Pierre Central Rm 153-(14)

Attendees: DOT VC Pierre - Steve Gramm, Becky Hoffman, Steve Johnson, Dave Hausman
DOT VC Sioux Falls – Al Murra, Jeff Rhoda, Ross Harris, Jon Jacobson, Phill Gundvaldson, Beau Koopal, Sam Trebilcock, Shannon Ausen, Heath Hoftiezer, Cary Cleland, Brad Remmich, Mark Hoines, Jim Feeney, Travis Dressen
SEH Conference Call - Kristin Petersen, Graham Johnson, Scott Hotchkin, Sam Turrentine

The following items were discussed at the above referenced meeting:

I. Introductions

II. Kick-Off Meeting
- A. Project Overview. Jeff gave an overview of the project, project limits and work that will be completed as part of this project.
- B. Review PMP (Risk Management Plan & Communication Plan).
  1. Additions to the Risk Management Plan
     - a. Taylor Oil property along the north side of the SB I-229 & Minnesota Ave off ramp
       - (1) The City has started the early acquisition process and discussions with the landowners regarding property acquisition since 4 of 5 concepts have a total property take.
       - (2) Landowners have indicated to the City there are some dead trees extending over their property from the SDDOT ROW they would like removed.
       - (3) We should survey this parcel early on to get a parcel exhibit together for the property acquisition.
     - b. 41st St and Pam Rd properties just west of Cliff Ave are within the floodplain. This could be a potential buyout and may impact the alternatives selection process.
     - c. VFW property at the northwest corner of 49th St and Minnesota Ave has indicated they are planning some type of future redevelopment. There have been no further discussions at this time.
- C. Finalize the Work Plan and Schedule.
  1. Meetings and Public Involvement.
     - a. Bi-weekly progress meetings. A meeting date and time need to set this up. Will need to know who will be included, what day and time of the week will best work to have recurring bi-weekly meetings.
     - b. Study Advisory Team (SAT) (5). We will work with Steve during our bi-weekly progress meetings to set up the next SAT meeting. Anticipating the next SAT meeting sometime in October/November 2018 prior to the Public Meeting.
     - c. Stakeholder meetings (2 per exit). These will correlate with the public meetings.
     - d. Public meetings (2-IMJR; 1-NEPA).
       - (1) We will look to hold the first public meeting sometime in November 2018.
       - (2) There may be an opportunity to have an informational booth at the September 24th 2018 High School Parent-Teacher Conferences. Shannon will reach out to Lincoln High School.

(3) A mailing list will be generated for the public involvement process. The list will be reviewed with Steve and Shannon. Attendees at public meeting may request to be included on the list.

e. MPO meetings (2). We will provide information for SDDOT staff to present at MPO meetings as needed.

f. Website. The website will be set up prior to the first public meeting which could be a booth at the Lincoln High School Open House. Once the website is set up notice will be given to Steve to share with the SAT for review.

g. SF Parks Dept. Coordination. All coordination with the SF Parks Department will happen through Shannon.

2. Data Collection.

a. Topographic survey.

(1) Preference on survey order (Exit 4 vs Exit 3). Will get started first with Exit 4 survey work prior to school being back in session.

(2) Landowner permission parcel list. IDG will develop a landowner permission parcel list for review of those properties that will require access for survey.

(3) Landowner permission form template.

(a) Travis mentioned that a separate letter could be included with the Form 238 template and that the template does not have to have the carbon copies.

(b) The permission form is more so directed towards the environmental surveys where there is potential for property impacts to collect data.

(c) Steve will check with HDR to get us the Major Investment Study (MIS) logo (vector file preferred if possible) to be used on public correspondence so we can be consistent with the previous studies which may result in more public engagement.

(4) Permit for work within the Right-of-Way. No permit will be needed for survey work along I-229 within the SDDOT ROW.

(5) IDG is not planning to do any scanning for survey work.

(6) Shannon mentioned the City is currently making ADA improvements at the 41st St and Minnesota Ave intersection.

(7) At Exit 3 we should get some topographic survey (curb shots) at the 42nd St and Center Ave intersection for potential redevelopment in the area.

(8) Should extend the Exit 3 survey limits on the north side of I-229 to cover the area at the southwest corner of 43rd St and Phillips Ave up to this intersection for a potential local access road/drive.

(9) On the south leg of Exit 3 the survey should stop north of 57th St as that won't be part of the project.

(10) At the north side of Exit 4 the survey limits will follow roads and intersection unlike the diagonal lines shown on the aerial exhibit that cut across properties.

(11) IDG is planning to survey at night along the I-229 corridor when there is less traffic.

(12) IDG will notify Travis prior to any survey work within the I-229 corridor who will then notify the South Dakota Highway Patrol.

b. Utility Coordination and Locating Phase 1 & 2 survey.

(1) Dave gave an update on the work that they will be performing which he is planning to start the first of September 2018.

(2) UMS will have an on-site utility kick-off meeting prior to getting started.

(3) Their work will include surveying all of the utilities in the project area.

(4) Dave will send Shannon a schedule of when they will be starting their work and she will let the City utility departments know.

(5) Beau will send Dave their survey limits file for use in verifying survey boundaries.

c. Environmental surveys.

(1) Ross gave an overview of the environmental surveys.

(2) Steve mentioned for SDARC's work that the cultural resources windshield survey from the I-229 MIS should be adequate.

(3) The I-90 Exit 406 (Brandon) document might be a good example to follow, will need to verify with the new FHWA person.

(4) The new environmental staff at FHWA will be starting soon; favors the Colorado DOT checklist process in NEPA documents.

d. Existing traffic volume data for Exits 2/3/4/5 (SDDOT). Shannon/Heath will work with us to get us the existing traffic data for review.

e. Existing turning movement data (City of Sioux Falls).

f. The City will collect data for the four intersections listed on the table in the RFP that do not have any data as well as provide the most recent count data available for each intersection. Most of the 2015 data has updated 2018 data.

g. The City will collect 24 hour video at the park entrances during events.

h. Other traffic count data.

(1) Origin-destination (OD) data.

(a) StreetLight data will be obtained as either 6 months or 12 months depending on what is available for this area.

(b) Include StreetLight as part of the M&A discussion.

(2) Traffic safety-crash history. Steve made the request for the crash data information and will send it out when he receives it. SDDOT crash data only includes those incidents that were reported. The City noted the SFPD data may not be very attainable so we may have to use the State data.

3. IMJR Documents (M&A discussion next).

4. Environmental (NEPA).

D. Project Deliverables (two of everything for official submittal documents).

1. Draft final reports & executive summary (electronic copy).
2. Final IMJR documents (ten hard copies).
3. Final IMJR documents (electronic in both MS Word and PDF).
4. Raw traffic data collection files (electronic copy).
5. Traffic Analysis models (HCS7 preferred).
6. Copies of all other pertinent working papers and electronic files for the project.
7. Electronic survey files including: FWD, DGN, DTM, ALG (InRoads compatible); and RAW data files in ASCII format.

III. Other Items

IV. Discuss M&A Document

A. Review Methods and Assumptions document (draft - dated July 27, 2018).

B. Jeff presented the draft M&A document and gave a review summary of the document to the group. Comments include:

1. Cover of M&A document - Remove the amendment info, remove SEH logo, remove City of Sioux Falls signature block, and add SF MPO to the list of others in conjunction with.
2. Use the term “Go Sioux Falls” rather than LRTP.
3. There are a number of current and upcoming construction projects that we should be aware of for the modeling. (I-229 & 26th St interchange, I-229 & Western Ave, Southeastern Ave from 41st St to 49th St, Cliff Ave lane addition, I-229 & Minnesota Ave and Cliff Ave off NB off ramp re-striping (2018-19).
4. The study should include analysis with and without future Hwy-100 as well as include the 85th St Interchange (85th St interchange was added to the long range transportation plan in May of 2018).
5. The City will be updating the Sioux Falls regional model in 2019.
6. Include in the M&A document that a straight-line projected forecast will be used for 2050 information.
7. StreetLight data will be obtained/used for the OD data (6 month or 12 month pending what is available) and the data collection info will be included in the M&A document.
8. The saturation flow rate should be 1850 instead of 1800.
9. SDDOT minimum access control beyond the ramp terminal is 100’.
10. Further clarification on last sentence of Page 9 of 10 that talks about future intersection design analysis.
11. Provide predictive crash analysis for the desired option for each interchange.
12. Add May 2017 FHWA policy guide update (#9 edit).

13. Add Environmental conclusions/recommendations from the I-229 MIS to the M&A document.
14. The City does not sign the M&A document but it should be noted that they were in attendance at this meeting to provide input.
15. SEH will get a revised version of the M&A document back to Steve by early next week.

V. Next SAT Meeting TBD (October/November)

SEH believes that this document accurately reflects the business transacted during the meeting. If any attendee believes that there are any inconsistencies, omissions or errors in the minutes, they should notify the writer at once. Unless objections are raised within seven (7) days, we will consider this account accurate and acceptable to all.

If there are errors contained in this document, or if relevant information has been omitted, please contact Al Murra at 605-330-7015 or by email at amurra@sehinc.com.

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Appendix L

IHSDM Output Files

Table 1
Summary Table - CLIFF AVENUE INTERCHANGE ALTERNATIVES
Predictive Crash Estimations
2024 to 2050 Total Crashes
Crash Prediction (IHSDM) Model

Summary of Results

Alternative	Description	Total Crashes	Fatal and Injury Crashes	Property Damage Only Crashes	Comment
No Build	Existing configuration of Exit 4 (Cliff Ave) Interchange	1,733	599	1,134	Base Condition
Build Alternative 1	SB I-229 Loop Ramp at 41st St/SB I-229 Intersection	1,621	576	1,045	Freeway crashes slightly reduced due to added southbound lane; negligable change from additional southbound ramp access. Arterial crashes reduced by 75 with addition of median and RI/RO at southern highschool access; interchange still has 3 intersections.
	Percent Difference from No Build	-6.4%	-3.7%	-7.9%	
Build Alternative 6	Center SPUI and realignment of 41st St	1,431	493	938	Freeway crashes slightly reduced due to added southbound lane. Arterial crashes reduced by 275 with addition of median, RI/RO at southern highschool access, and Pam Road closure; interchange intersections reduced with SPUI.
	Percent Difference from No Build	-17.4%	-17.6%	-17.4%	
Build Alternative 7	Center SPUI and with SB I-229 exit ramp split to 41st St for Thru/Right Turns	1,465	501	965	Freeway crashes slightly reduced due to added southbound lane. Arterial crashes reduced by 230 with addition of median and RI/RO at southern highschool access; interchange intersections reduced with SPUI.
	Percent Difference from No Build	-15.4%	-16.3%	-15.0%	

Notes:
I-229 Southbound has 3-continuous lanes in all Build Alternatives as it was needed in 2035, northbound is same as No Build conditions.

Model Area:
I-229 from the eastern gore area at Exit 3 (Minnesota Ave) to western gore area at Exit 5 (26th Street)
Cliff Avenue from approximately 500 feet south of 49th Street to approximately 500 feet north of 33rd Street

Table 2
No Build vs. Build Alternative 1
Predictive Crash Estimations
2024 to 2050 Total Crashes
Crash Prediction (IHSDM) Model

No Build Conditions

Facility Type / Location			Length (ft)	Length (mile)	Total Crashes	Fatal and Injury Crashes	Property Damage Only Crashes	Crash Rate (crashes/million veh-mi)	Comment
I-229	Mainline	Freeway Segment	5,257.30	1.00	349.11	124.70	224.41	0.57	
		Speed Change Areas	6,000.19	1.14	202.29	60.87	141.42	0.53	
Cliff Avenue	Arterial	Arterial Segment	6,443.71	1.22	1,112.71	378.36	734.35	3.57	
Ramps	NB Exit	Ramp Segment	1,234.99	0.23	16.18	8.26	7.92	0.88	
	NB Entrance	Ramp Segment	1,558.66	0.30	11.26	5.27	5.99	0.85	
	SB Exit	Ramp Segment	1,832.16	0.35	26.56	13.93	12.63	1.27	
	SB Entrance	Ramp Segment	1,260.86	0.24	14.91	7.16	7.75	0.84	
		Total	23,587.87	4.47	1,733.02	598.55	1,134.47		

Avg Per Year	66.7	23.0	43.6
Existing Avg	70.2	16.4	53.8

Build Alternative 1

Facility Type / Location			Length (ft)	Length (mile)	Total Crashes	Fatal and Injury Crashes	Property Damage Only Crashes	Crash Rate (crashes/million veh-mi)	Comment
I-229	Mainline	Freeway Segment	5,306.93	1.01	330.94	120.66	210.28	0.52	
		Speed Change Areas	5,899.87	1.12	182.22	54.14	128.07	0.50	
Cliff Avenue	Arterial	Arterial Segment	6,443.71	1.22	1,038.37	366.91	671.47	3.49	
Ramps	NB Exit	Ramp Segment	1,234.99	0.23	11.94	7.42	4.52	0.82	
	NB Entrance	Ramp Segment	1,558.66	0.30	11.26	5.27	5.99	0.85	
	SB Exit	Ramp Segment	1,832.16	0.35	21.73	10.64	11.09	1.04	
	SB Loop	Ramp Segment	930.34	0.18	14.92	6.58	8.34	2.72	
	SB Entrance	Ramp Segment	1,528.03	0.29	9.97	4.71	5.26	0.80	
		Total	24,734.69	4.68	1,621.35	576.33	1,045.02		

Avg Per Year	62.4	22.2	40.2
Existing Avg	70.2	16.4	53.8

No Build vs. Build Alternative 1	Length (ft)	Length (mile)	Total Crashes	Fatal and Injury Crashes	Property Damage Only Crashes	Comment
TOTAL CHANGE	1146.82	0.22	-111.67	-22.22	-89.45	

Table 3
No Build Conditions vs. Build Alternative 6
Predictive Crash Estimations
2024 to 2050 Total Crashes
Crash Prediction (IHSDM) Model

No Build Conditions

Facility Type / Location			Length (ft)	Length (mile)	Total Crashes	Fatal and Injury Crashes	Property Damage Only Crashes	Crash Rate (crashes/million veh-mi)	Comment
I-229	Mainline	Freeway Segment	5257.30	1.00	349.11	124.70	224.41	0.57	0.00
		Speed Change Areas	6000.19	1.14	202.29	60.87	141.42	0.53	0.00
Cliff Avenue	Arterial	Arterial Segment	6443.71	1.22	1112.71	378.36	734.35	3.57	0.00
Ramps	NB Exit	Ramp Segment	1234.99	0.23	16.18	8.26	7.92	0.88	0.00
	NB Entrance	Ramp Segment	1558.66	0.30	11.26	5.27	5.99	0.85	0.00
	SB Exit	Ramp Segment	1832.16	0.35	26.56	13.93	12.63	1.27	0.00
	SB Entrance	Ramp Segment	1260.86	0.24	14.91	7.16	7.75	0.84	0.00
		Total	23587.87	4.47	1733.02	598.55	1134.47		

Avg Per Year	66.7	23.0	43.6
Existing Avg	70.2	16.4	53.8

Build Alternative 6

Facility Type / Location			Length (ft)	Length (mile)	Total Crashes	Fatal and Injury Crashes	Property Damage Only Crashes	Crash Rate (crashes/million veh-mi)	Comment
I-229	Mainline	Freeway Segment	5907.26	1.12	355.91	130.32	225.59	0.51	
		Speed Change Areas	4700.26	0.89	151.22	45.83	105.39	0.51	
Cliff Avenue	Arterial	Arterial Segment	6443.71	1.22	838.69	278.93	559.76	2.85	
Ramps	NB Exit Left Turn	Ramp Segment	1323.70	0.25	10.01	4.47	5.54	0.58	
	NB Exit Right Turn	Ramp Segment	190.61	0.04	16.88	7.60	9.28	12.55	
	NB Entrance Left Turn	Ramp Segment	1411.34	0.27	8.99	4.18	4.81	0.86	
	NB Entrance Right Turn	Ramp Segment	336.86	0.06	6.78	2.97	3.81	3.24	
	SB Exit Left Turn	Ramp Segment	2088.77	0.40	12.79	5.79	7.00	0.56	
	SB Exit Right Turn	Ramp Segment	212.78	0.04	11.90	5.31	6.59	15.49	
	SB Entrance Right Turn	Ramp Segment	1157.90	0.22	14.14	6.31	7.83	0.97	
	SB Entrance Left Turn	Ramp Segment	244.99	0.05	3.47	1.57	1.90	1.73	
		Total	24018.19	4.55	1430.78	493.28	937.50		

Avg Per Year	55.0	19.0	36.1
Existing Avg	70.2	16.4	53.8

No Build vs Build Alternative 6	Length (ft)	Length (mile)	Total Crashes	Fatal and Injury Crashes	Property Damage Only Crashes	Comment
TOTAL CHANGE	430.32	0.08	-302.24	-105.27	-196.97	

Table 4
No Build Conditions vs. Build Alternative 7
Predictive Crash Estimations
2024 to 2050 Total Crashes
Crash Prediction (IHSDM) Model

No Build Conditions

Facility Type / Location			Length (ft)	Length (mile)	Total Crashes	Fatal and Injury Crashes	Property Damage Only Crashes	Crash Rate (crashes/million veh-mi)	Comment
I-229	Mainline	Freeway Segment	5257.30	1.00	349.11	124.70	224.41	0.57	0.00
		Speed Change Areas	6000.19	1.14	202.29	60.87	141.42	0.53	0.00
Cliff Avenue	Arterial	Arterial Segment	6443.71	1.22	1112.71	378.36	734.35	3.57	0.00
Ramps	NB Exit	Ramp Segment	1234.99	0.23	16.18	8.26	7.92	0.88	0.00
	NB Entrance	Ramp Segment	1558.66	0.30	11.26	5.27	5.99	0.85	0.00
	SB Exit	Ramp Segment	1832.16	0.35	26.56	13.93	12.63	1.27	0.00
	SB Entrance	Ramp Segment	1260.86	0.24	14.91	7.16	7.75	0.84	0.00
		Total	23587.87	4.47	1733.02	598.55	1134.47		

Avg Per Year	66.7	23.0	43.6
Existing Avg	70.2	16.4	53.8

Build Alternative 7

Facility Type / Location			Length (ft)	Length (mile)	Total Crashes	Fatal and Injury Crashes	Property Damage Only Crashes	Crash Rate (crashes/million veh-mi)	Comment
I-229	Mainline	Freeway Segment	5907.26	1.12	355.91	130.32	225.59	0.51	
		Speed Change Areas	4700.26	0.89	151.22	45.83	105.39	0.51	
Cliff Avenue	Arterial	Arterial Segment	6443.71	1.22	881.28	289.92	591.36	2.94	
Ramps	NB Exit Left Turn	Ramp Segment	1323.70	0.25	10.01	4.47	5.54	0.58	
	NB Exit Right Turn	Ramp Segment	190.61	0.04	16.88	7.60	9.28	12.55	
	NB Entrance Left Turn	Ramp Segment	1411.34	0.27	8.99	4.18	4.81	0.86	
	NB Entrance Right Turn	Ramp Segment	336.86	0.06	6.78	2.97	3.81	3.24	
	SB Exit Left Turn	Ramp Segment	2088.24	0.40	12.09	5.47	6.62	0.58	
	SB Exit Right Turn	Ramp Segment	609.84	0.12	2.75	1.37	1.39	1.25	
	SB Entrance Right Turn	Ramp Segment	1157.90	0.22	15.45	6.89	8.55	1.06	
	SB Entrance Left Turn	Ramp Segment	224.40	0.04	3.99	1.76	2.23	2.17	
		Total	24394.13	4.62	1465.35	500.78	964.57		

Avg Per Year	56.4	19.3	37.1
Existing Avg	70.2	16.4	53.8

No Build vs Build Alternative 7	Length (ft)	Length (mile)	Total Crashes	Fatal and Injury Crashes	Property Damage Only Crashes	Comment
TOTAL CHANGE	806.26	0.15	-267.67	-97.77	-169.90	

IHSDM Results

(2024 to 2050)

Cliff Avenue (Exit 4)

No Build Conditions

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

April 30, 2019

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Table of Contents

List of Tables

List of Figures

Report Overview

Report Generated: Apr 30, 2019 8:56 AM
Report Template: System: Single Page [System] (mlcpm3, Apr 10, 2019 1:31 PM)

Evaluation Date: Tue Apr 30 08:56:03 CDT 2019
IHSDM Version: v14.1.0 (Mar 12, 2019)
Crash Prediction Module: v9.1.0 (Mar 12, 2019)

User Name: jdanibas
Organization Name:
Phone:
E-Mail:

Project Title: I-229 Exit 4 (Cliff Ave) - No Build
Project Comment: Created Tue Apr 16 14:58:43 CDT 2019
Project Unit System: U.S. Customary

Highway Title: I-229
Highway Comment: Created Tue Apr 16 14:59:05 CDT 2019
Highway Version: 1

Evaluation Title: Evaluation 1
Evaluation Comment: Created Tue Apr 30 08:55:52 CDT 2019

Minimum Location: 10+00.000
Maximum Location: 92+57.134
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2024
Last Year of Analysis: 2050
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Section Types

Section 1 Evaluation

Section: Section 1
Evaluation Start Location: 10+00.000
Evaluation End Location: 92+57.134
Functional Class: Freeway
Type of Alignment: Divided, Multilane
Model Category: Freeway Segment
Calibration Factor: FI_EN=1.0; FI_EX=1.0; FI_MV=1.0; FI_SV=1.0; PDO_EN=1.0; PDO_EX=1.0; PDO_MV=1.0; PDO_SV=1.0;

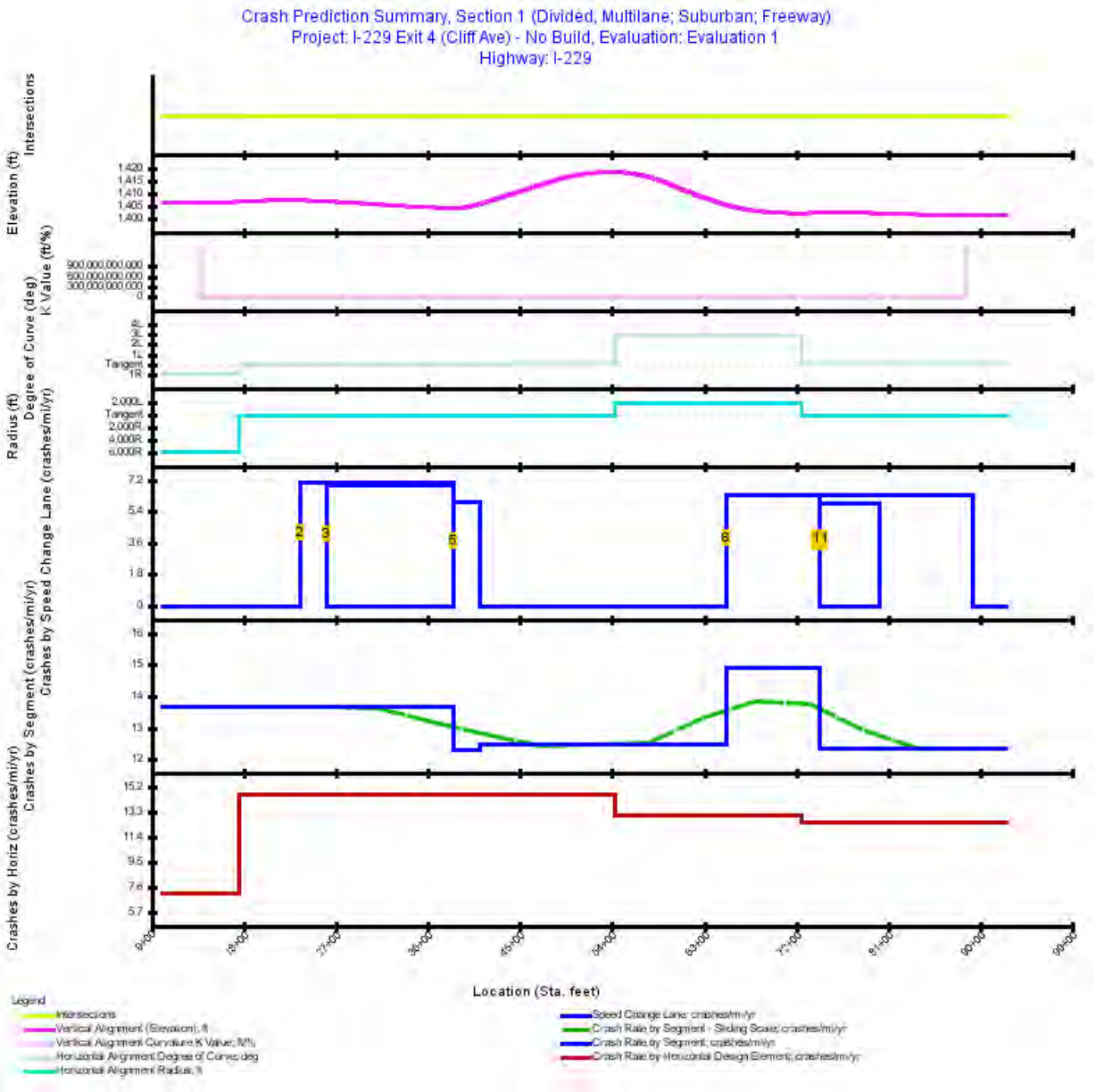

Figure 1. Crash Prediction Summary (Section 1)

Table 1. Evaluation Freeway - Homogeneous Segments (Section 1)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT	Median Width (ft)	Type	Effective Median Width (ft)
1	6F	Urban	10+00.000	38+44.179	2,844.18	0.5387	2024: 62,235; 2025: 62,933; 2026: 63,632; 2027: 64,331; 2028: 65,030; 2029: 65,729; 2030: 66,428; 2031: 67,126; 2032: 67,825; 2033: 68,524; 2034: 69,223; 2035: 69,922; 2036: 70,621; 2037: 71,320; 2038: 72,018; 2039: 72,717; 2040: 73,416; 2041: 74,115; 2042: 74,814; 2043: 75,513; 2044: 76,211; 2045: 76,910; 2046: 77,609; 2047: 78,308; 2048: 79,007; 2049: 79,706; 2050: 80,405	48.00	Non-Traversable Median	60.00
4	5F	Urban	38+44.179	41+02.826	258.65	0.0490	2024: 55,424; 2025: 56,036; 2026: 56,648; 2027: 57,260; 2028: 57,872; 2029: 58,484; 2030: 59,096; 2031: 59,708; 2032: 60,320; 2033: 60,932; 2034: 61,544; 2035: 62,155; 2036: 62,767; 2037: 63,379; 2038: 63,991; 2039: 64,603; 2040: 65,215; 2041: 65,827; 2042: 66,439; 2043: 67,051; 2044: 67,663; 2045: 68,275; 2046: 68,887; 2047: 69,499; 2048: 70,111; 2049: 70,723; 2050: 71,335	48.00	Non-Traversable Median	60.00
6	4F	Urban	41+02.826	65+13.782	2,410.96	0.4566	2024: 48,645; 2025: 49,197; 2026: 49,749; 2027: 50,301; 2028: 50,853; 2029: 51,406; 2030: 51,958; 2031: 52,510; 2032: 53,062; 2033: 53,614; 2034: 54,166; 2035: 54,718; 2036: 55,270; 2037: 55,822; 2038: 56,374; 2039: 56,926; 2040: 57,479; 2041: 58,031; 2042: 58,583; 2043: 59,135; 2044: 59,687; 2045: 60,239; 2046: 60,791; 2047: 61,343; 2048: 61,895; 2049: 62,447; 2050: 63,000	48.00	Non-Traversable Median	60.00
7	5F	Urban	65+13.782	74+33.116	919.33	0.1741	2024: 52,736; 2025: 53,325; 2026: 53,914; 2027: 54,503; 2028: 55,092; 2029: 55,681; 2030: 56,270; 2031: 56,859; 2032: 57,448; 2033: 58,037; 2034: 58,626; 2035: 59,215; 2036: 59,804; 2037: 60,393; 2038: 60,982; 2039: 61,571; 2040: 62,160; 2041: 62,749; 2042: 63,338; 2043: 63,927; 2044: 64,516; 2045: 65,105; 2046: 65,694; 2047: 66,283; 2048: 66,872; 2049: 67,461; 2050: 68,050	48.00	Non-Traversable Median	60.00
9	6F	Urban	74+33.116	92+57.134	1,824.02	0.3455	2024: 57,184; 2025: 57,902; 2026: 58,621; 2027: 59,340; 2028: 60,058; 2029: 60,777; 2030: 61,496; 2031: 62,214; 2032: 62,933; 2033: 63,652; 2034: 64,371; 2035: 65,089; 2036: 65,808; 2037: 66,527; 2038: 67,245; 2039: 67,964; 2040: 68,683; 2041: 69,401; 2042: 70,120; 2043: 70,839; 2044: 71,557; 2045: 72,276; 2046: 72,995; 2047: 73,713; 2048: 74,432; 2049: 75,151; 2050: 75,870	48.00	Non-Traversable Median	60.00

Table 2. Evaluation Freeway - Speed Change Lanes (Speed Change)

Seg. No.	Type	Ramp Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT	Median Width (ft)	Type	Effective Median Width (ft)
2	6SC	Exit	23+44.179	38+44.179	1,500.00	0.2841	2024: 62,235; 2025: 62,933; 2026: 63,632; 2027: 64,331; 2028: 65,030; 2029: 65,729; 2030: 66,428; 2031: 67,126; 2032: 67,825; 2033: 68,524; 2034: 69,223; 2035: 69,922; 2036: 70,621; 2037: 71,320; 2038: 72,018; 2039: 72,717; 2040: 73,416; 2041: 74,115; 2042: 74,814; 2043: 75,513; 2044: 76,211; 2045: 76,910; 2046: 77,609; 2047: 78,308; 2048: 79,007; 2049: 79,706; 2050: 80,405	48.00	Non-Traversable Median	60.00
3	6SC	Entrance	26+02.826	38+44.179	1,241.35	0.2351	2024: 62,235; 2025: 62,933; 2026: 63,632; 2027: 64,331; 2028: 65,030; 2029: 65,729; 2030: 66,428; 2031: 67,126; 2032: 67,825; 2033: 68,524; 2034: 69,223; 2035: 69,922; 2036: 70,621; 2037: 71,320; 2038: 72,018; 2039: 72,717; 2040: 73,416; 2041: 74,115; 2042: 74,814; 2043: 75,513; 2044: 76,211; 2045: 76,910; 2046: 77,609; 2047: 78,308; 2048: 79,007; 2049: 79,706; 2050: 80,405	48.00	Non-Traversable Median	60.00
5	5SC	Entrance	38+44.179	41+02.826	258.65	0.0490	2024: 55,424; 2025: 56,036; 2026: 56,648; 2027: 57,260; 2028: 57,872; 2029: 58,484; 2030: 59,096; 2031: 59,708; 2032: 60,320; 2033: 60,932; 2034: 61,544; 2035: 62,155; 2036: 62,767; 2037: 63,379; 2038: 63,991; 2039: 64,603; 2040: 65,215; 2041: 65,827; 2042: 66,439; 2043: 67,051; 2044: 67,663; 2045: 68,275; 2046: 68,887; 2047: 69,499; 2048: 70,111; 2049: 70,723; 2050: 71,335	48.00	Non-Traversable Median	60.00
8	5SC	Entrance	65+13.782	74+33.116	919.33	0.1741	2024: 52,736; 2025: 53,325; 2026: 53,914; 2027: 54,503; 2028: 55,092; 2029: 55,681; 2030: 56,270; 2031: 56,859; 2032: 57,448; 2033: 58,037; 2034: 58,626; 2035: 59,215; 2036: 59,804; 2037: 60,393; 2038: 60,982; 2039: 61,571; 2040: 62,160; 2041: 62,749; 2042: 63,338; 2043: 63,927; 2044: 64,516; 2045: 65,105; 2046: 65,694; 2047: 66,283; 2048: 66,872; 2049: 67,461; 2050: 68,050	48.00	Non-Traversable Median	60.00
10	6SC	Entrance	74+33.116	80+13.782	580.67	0.1100	2024: 57,184; 2025: 57,902; 2026: 58,621; 2027: 59,340; 2028: 60,058; 2029: 60,777; 2030: 61,496; 2031: 62,214; 2032: 62,933; 2033: 63,652; 2034: 64,371; 2035: 65,089; 2036: 65,808; 2037: 66,527; 2038: 67,245; 2039: 67,964; 2040: 68,683; 2041: 69,401; 2042: 70,120; 2043: 70,839; 2044: 71,557; 2045: 72,276; 2046: 72,995; 2047: 73,713; 2048: 74,432; 2049: 75,151; 2050: 75,870	48.00	Non-Traversable Median	60.00
11	6SC	Exit	74+33.116	89+33.116	1,500.00	0.2841	2024: 57,184; 2025: 57,902; 2026: 58,621; 2027: 59,340; 2028: 60,058; 2029: 60,777; 2030: 61,496; 2031: 62,214; 2032: 62,933; 2033: 63,652; 2034: 64,371; 2035: 65,089; 2036: 65,808; 2037: 66,527; 2038: 67,245; 2039: 67,964; 2040: 68,683; 2041: 69,401; 2042: 70,120; 2043: 70,839; 2044: 71,557; 2045: 72,276; 2046: 72,995; 2047: 73,713; 2048: 74,432; 2049: 75,151; 2050: 75,870	48.00	Non-Traversable Median	60.00

Table 3. Predicted Freeway Crash Rates and Frequencies Summary (Section 1)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Effective Length (mi)	**0.9957**
Average Future Road AADT (vpd)	**62,347**
Predicted Crashes	
Total Crashes	**349.11**
Fatal and Injury Crashes	**124.70**
Property-Damage-Only Crashes	**224.41**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**36**
Percent Property-Damage-Only Crashes (%)	**64**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**12.9864**
FI Crash Rate (crashes/mi/yr)	**4.6388**
PDO Crash Rate (crashes/mi/yr)	**8.3476**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**611.77**
Travel Crash Rate (crashes/million veh-mi)	**0.57**
Travel FI Crash Rate (crashes/million veh-mi)	**0.20**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.37**

Note: *Effective Length* is the *segment length* minus the length of the *speed change lanes* if present.

Table 4. Predicted Freeway Speed Change Lane Crash Rates and Frequencies Summary (Speed Change)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Evaluated Length (mi)	**1.1364**
Average Future Road AADT (vpd)	**33,820**
Predicted Crashes	
Total Crashes	**202.29**
Fatal and Injury Crashes	**60.87**
Property-Damage-Only Crashes	**141.42**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**30**
Percent Property-Damage-Only Crashes (%)	**70**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**6.5930**
FI Crash Rate (crashes/mi/yr)	**1.9839**
PDO Crash Rate (crashes/mi/yr)	**4.6092**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**378.75**
Travel Crash Rate (crashes/million veh-mi)	**0.53**
Travel FI Crash Rate (crashes/million veh-mi)	**0.16**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.37**

Note: *Total Travel and Crash Rates/Million Vehicle Miles* for *Speed Change Lanes* reflect AADTs that are **half of the Freeway Segment AADTs** based on the assumption of 50/50 directional distribution.

Table 5. Predicted Crash Frequencies and Rates by Freeway Segment/Intersection (Section 1)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Effective Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	10+00.000	38+44.179	0.2791	103.071	3.8175	1.3820	2.4355	13.6791	0.53
4	38+44.179	41+02.826	0.0245	8.136	0.3013	0.1121	0.1893	12.3027	0.53
6	41+02.826	65+13.782	0.4566	153.505	5.6854	1.9913	3.6941	12.4510	0.61
7	65+13.782	74+33.116	0.0871	35.048	1.2981	0.4737	0.8243	14.9103	0.68
9	74+33.116	92+57.134	0.1484	49.355	1.8279	0.6596	1.1683	12.3156	0.51
Total			0.9957	349.114	12.9302	4.6187	8.3114	12.9864	0.57

Note: *Effective Length* is the *segment length* minus the length of the *speed change lanes* if present.

Table 6. Predicted Crash Frequencies and Rates by Freeway Speed Change Lane (Speed Change)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
2	23+44.179	38+44.179	0.2841	54.179	2.0066	0.5705	1.4361	7.0634	0.54
3	26+02.826	38+44.179	0.2351	43.782	1.6216	0.5449	1.0767	6.8972	0.53
5	38+44.179	41+02.826	0.0490	7.917	0.2932	0.0989	0.1944	5.9855	0.52
8	65+13.782	74+33.116	0.1741	29.927	1.1084	0.3237	0.7847	6.3658	0.58
10	74+33.116	80+13.782	0.1100	17.557	0.6503	0.2035	0.4467	5.9129	0.49
11	74+33.116	89+33.116	0.2841	48.924	1.8120	0.5128	1.2991	6.3782	0.53
Total			1.1364	202.286	7.4921	2.2544	5.2377	6.5930	0.53

Note: *Travel Crash Rates/Million Vehicle Miles* for *Speed Change Lanes* reflect AADTs that are **half of the Freeway Segment AADTs** based on the assumption of 50/50 directional distribution.

Table 7. Predicted Crash Frequencies and Rates by Horizontal Design Element (Section 1)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Simple Curve 1	10+00.000	17+54.376	0.1429	27.338	1.0125	0.3666	0.6460	7.0868	0.53
Tangent	17+54.376	54+26.711	0.6955	274.039	10.1496	3.4352	6.7143	14.5928	0.99
Simple Curve 2	54+26.711	72+50.687	0.3454	121.295	4.4924	1.5371	2.9553	13.0045	0.87
Tangent	72+50.687	92+57.134	0.3800	128.729	4.7677	1.5343	3.2335	12.5464	1.11

Table 8. Predicted Crash Frequencies by Year (Section 1)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2024	17.36	5.91	34.056	11.45	65.944
2025	17.62	6.00	34.036	11.62	65.964
2026	17.88	6.08	34.016	11.80	65.984
2027	18.14	6.17	33.996	11.97	66.004
2028	18.40	6.25	33.977	12.15	66.023
2029	18.66	6.34	33.957	12.33	66.043
2030	18.93	6.42	33.937	12.51	66.063
2031	19.20	6.51	33.917	12.69	66.083
2032	19.47	6.60	33.898	12.87	66.102
2033	19.74	6.69	33.878	13.05	66.122
2034	20.02	6.78	33.858	13.24	66.142
2035	20.30	6.87	33.839	13.43	66.162
2036	20.39	6.86	33.637	13.53	66.363
2037	20.64	6.93	33.587	13.71	66.413
2038	20.89	7.01	33.538	13.89	66.462
2039	21.15	7.08	33.489	14.07	66.511
2040	21.41	7.16	33.441	14.25	66.559
2041	21.66	7.23	33.393	14.43	66.607
2042	21.92	7.31	33.345	14.61	66.655
2043	22.18	7.38	33.298	14.79	66.702
2044	22.44	7.46	33.251	14.98	66.749
2045	22.70	7.54	33.204	15.16	66.796
2046	22.96	7.61	33.158	15.35	66.842
2047	23.22	7.69	33.112	15.53	66.888
2048	23.49	7.77	33.066	15.72	66.934
2049	23.75	7.84	33.021	15.91	66.979
2050	24.02	7.92	32.976	16.10	67.024
Total	558.52	187.41	33.555	371.11	66.445
Average	20.69	6.94	33.555	13.74	66.445

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 9. Predicted Crash Severity by Freeway Segment (Section 1)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.7062	1.8273	11.5747	23.2057	65.7574
4	0.0530	0.1346	0.9029	1.9357	5.1098
6	1.0082	2.6031	16.6018	33.5517	99.7400
7	0.2771	0.7160	4.4040	7.3937	22.2570
9	0.3428	0.8615	5.7965	10.8089	31.5448
Total	2.3873	6.1424	39.2799	76.8956	224.4090

Table 10. Predicted Crash Severity by Speed Change Lane (Speed Change)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
2	0.2696	0.6851	4.5959	9.8534	38.7753
3	0.2575	0.6544	4.3896	9.4110	29.0699
5	0.0467	0.1187	0.7963	1.7073	5.2476
8	0.1893	0.4893	3.0094	5.0524	21.1862
10	0.1058	0.2658	1.7887	3.3355	12.0616
11	0.2666	0.6698	4.5067	8.4038	35.0767
Total	1.1355	2.8831	19.0867	37.7633	141.4173

Table 11. Predicted Freeway Crash Type Distribution (Section 1)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.25	0.1	2.26	0.6	2.51	0.7
Highway Segment	Collision with Fixed Object	45.81	13.0	73.51	20.9	119.32	33.9
Highway Segment	Collision with Other Object	3.24	0.9	14.27	4.1	17.51	5.0
Highway Segment	Other Single-vehicle Collision	13.20	3.8	10.98	3.1	24.18	6.9
Highway Segment	Collision with Parked Vehicle	0.95	0.3	1.64	0.5	2.59	0.7
Highway Segment	Total Single Vehicle Crashes	63.45	18.0	102.67	29.2	166.12	47.2
Highway Segment	Right-Angle Collision	1.90	0.5	2.23	0.6	4.14	1.2
Highway Segment	Head-on Collision	0.49	0.1	0.25	0.1	0.74	0.2
Highway Segment	Other Multi-vehicle Collision	1.90	0.5	2.98	0.8	4.88	1.4
Highway Segment	Rear-end Collision	46.05	13.1	85.61	24.3	131.66	37.4
Highway Segment	Sideswipe, Same Direction Collision	11.05	3.1	33.00	9.4	44.05	12.5
Highway Segment	Total Multiple Vehicle Crashes	61.40	17.5	124.07	35.3	185.47	52.8
Highway Segment	Total Highway Segment Crashes	124.85	35.5	226.74	64.5	351.58	100.0
	Total Crashes	124.85	35.5	226.74	64.5	351.58	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 12. Predicted Exit Speed Change Lane Crash Type Distribution (Speed Change)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.00	0.0	0.52	0.5	0.52	0.5
Highway Segment	Collision with Fixed Object	5.73	5.6	15.29	14.8	21.02	20.4
Highway Segment	Collision with Other Object	0.47	0.5	2.22	2.1	2.68	2.6
Highway Segment	Other Single-vehicle Collision	1.43	1.4	1.70	1.6	3.13	3.0
Highway Segment	Collision with Parked Vehicle	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Total Single Vehicle Crashes	7.63	7.4	19.72	19.1	27.35	26.5
Highway Segment	Right-Angle Collision	0.32	0.3	0.89	0.9	1.21	1.2
Highway Segment	Head-on Collision	0.15	0.1	0.15	0.1	0.29	0.3
Highway Segment	Other Multi-vehicle Collision	0.47	0.5	1.18	1.1	1.65	1.6
Highway Segment	Rear-end Collision	16.06	15.6	41.73	40.5	57.78	56.0
Highway Segment	Sideswipe, Same Direction Collision	4.62	4.5	10.19	9.9	14.81	14.4
Highway Segment	Total Multiple Vehicle Crashes	21.62	21.0	54.13	52.5	75.75	73.5
Highway Segment	Total Highway Segment Crashes	29.25	28.4	73.85	71.6	103.10	100.0
	Total Crashes	29.25	28.4	73.85	71.6	103.10	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 13. Predicted Entrance Speed Change Lane Crash Type Distribution (Speed Change)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.00	0.0	0.14	0.1	0.14	0.1
Highway Segment	Collision with Fixed Object	6.46	6.2	9.10	8.8	15.56	15.0
Highway Segment	Collision with Other Object	0.63	0.6	2.54	2.4	3.17	3.1
Highway Segment	Other Single-vehicle Collision	2.23	2.1	1.13	1.1	3.36	3.2
Highway Segment	Collision with Parked Vehicle	0.13	0.1	0.21	0.2	0.34	0.3
Highway Segment	Total Single Vehicle Crashes	9.46	9.1	13.12	12.6	22.58	21.7
Highway Segment	Right-Angle Collision	0.63	0.6	1.13	1.1	1.76	1.7
Highway Segment	Head-on Collision	0.13	0.1	0.07	0.1	0.20	0.2
Highway Segment	Other Multi-vehicle Collision	0.57	0.5	1.06	1.0	1.62	1.6
Highway Segment	Rear-end Collision	18.09	17.4	37.38	36.0	55.47	53.4
Highway Segment	Sideswipe, Same Direction Collision	4.43	4.3	17.77	17.1	22.20	21.4
Highway Segment	Total Multiple Vehicle Crashes	23.85	23.0	57.41	55.3	81.26	78.3
Highway Segment	Total Highway Segment Crashes	33.31	32.1	70.52	67.9	103.83	100.0
	Total Crashes	33.31	32.1	70.52	67.9	103.83	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 14. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
38+44.179	41+02.826	for segment #4 (38+44.179 to 41+02.826), Freeway Segment of type Five-lane Freeway is using unbalanced lane processing with types Four-lane Freeway and Six-lane Freeway
65+13.782	74+33.116	for segment #7 (65+13.782 to 74+33.116), Freeway Segment of type Five-lane Freeway is using unbalanced lane processing with types Four-lane Freeway and Six-lane Freeway
38+44.179	41+02.826	for segment #5 (38+44.179 to 41+02.826), Speed Change Segment of type Five-lane Freeway Speed Change is using unbalanced lane processing with types Four-lane Freeway Speed Change and Six-lane Freeway Speed Change
65+13.782	74+33.116	for segment #8 (65+13.782 to 74+33.116), Speed Change Segment of type Five-lane Freeway Speed Change is using unbalanced lane processing with types Four-lane Freeway Speed Change and Six-lane Freeway Speed Change

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

April 23, 2019

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Table of Contents

List of Tables

List of Figures

Report Overview

Report Generated: Apr 23, 2019 11:54 AM
Report Template: System: Single Page [System] (mlcpm3, Apr 10, 2019 1:31 PM)

Evaluation Date: Tue Apr 23 11:54:40 CDT 2019
IHSDM Version: v14.1.0 (Mar 12, 2019)
Crash Prediction Module: v9.1.0 (Mar 12, 2019)

User Name: jdanibas
Organization Name:
Phone:
E-Mail:

Project Title: I-229 Exit 4 (Cliff Ave) - No Build
Project Comment: Created Tue Apr 16 14:58:43 CDT 2019
Project Unit System: U.S. Customary

Highway Title: No Build - NB Entrance
Highway Comment: Created Thu Apr 18 09:36:04 CDT 2019
Highway Version: 1

Evaluation Title: Evaluation 1
Evaluation Comment: Created Tue Apr 23 11:54:28 CDT 2019

Minimum Location: 0.000
Maximum Location: 15+58.698
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2024
Last Year of Analysis: 2050
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Section Types

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 15+58.698
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp
Calibration Factor: ENT_RAMP_MV_FI=1.0; ENT_RAMP_MV_PDO=1.0; ENT_RAMP_SV_FI=1.0; ENT_RAMP_SV_PDO=1.0;

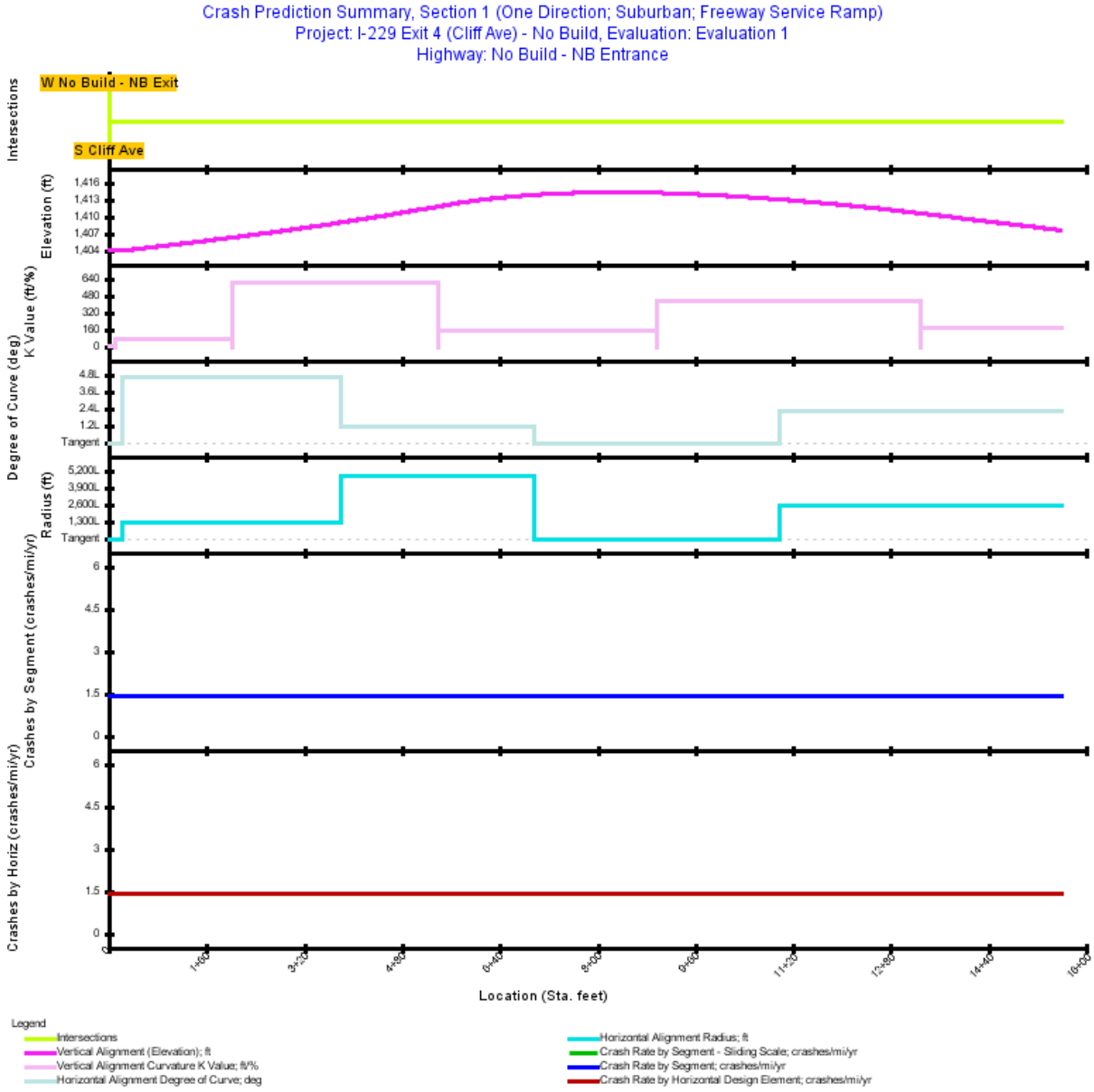

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT
1	1EN	Urban	0.000	15+58.698	1,558.70	0.2952	2024: 4,091; 2025: 4,128; 2026: 4,165; 2027: 4,201; 2028: 4,238; 2029: 4,275; 2030: 4,312; 2031: 4,349; 2032: 4,386; 2033: 4,423; 2034: 4,460; 2035: 4,496; 2036: 4,533; 2037: 4,570; 2038: 4,607; 2039: 4,644; 2040: 4,681; 2041: 4,718; 2042: 4,755; 2043: 4,791; 2044: 4,828; 2045: 4,865; 2046: 4,902; 2047: 4,939; 2048: 4,976; 2049: 5,013; 2050: 5,050

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Evaluated Length (mi)	**0.2952**
Average Future Road AADT (vpd)	**4,570**
Predicted Crashes	
Total Crashes	**11.26**
Fatal and Injury Crashes	**5.27**
Property-Damage-Only Crashes	**5.99**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**47**
Percent Property-Damage-Only Crashes (%)	**53**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**1.4125**
FI Crash Rate (crashes/mi/yr)	**0.6614**
PDO Crash Rate (crashes/mi/yr)	**0.7511**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**13.30**
Travel Crash Rate (crashes/million veh-mi)	**0.85**
Travel FI Crash Rate (crashes/million veh-mi)	**0.40**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.45**

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	15+58.698	0.2952	11.258	0.4170	0.1953	0.2217	1.4125	0.85
Total			0.2952	11.258	0.4170	0.1953	0.2217	1.4125	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	0.000	22.006	0.0042	0.159	0.0059	0.0028	0.0031	1.4125	0.85
Simple Curve 1	22.006	3+80.403	0.0679	2.589	0.0959	0.0449	0.0510	1.4125	0.85
Simple Curve 2	3+80.403	6+96.978	0.0600	2.287	0.0847	0.0397	0.0450	1.4125	0.85
Tangent	6+96.978	10+98.409	0.0760	2.900	0.1074	0.0503	0.0571	1.4125	0.85
Simple Curve 3	10+98.409	15+58.698	0.0872	3.325	0.1231	0.0577	0.0655	1.4125	0.85

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2024	0.38	0.18	47.020	0.20	52.980
2025	0.39	0.18	47.004	0.20	52.996
2026	0.39	0.18	46.989	0.21	53.011
2027	0.39	0.18	46.974	0.21	53.026
2028	0.39	0.18	46.959	0.21	53.041
2029	0.40	0.19	46.944	0.21	53.056
2030	0.40	0.19	46.929	0.21	53.071
2031	0.40	0.19	46.915	0.21	53.085
2032	0.40	0.19	46.900	0.21	53.100
2033	0.41	0.19	46.886	0.22	53.114
2034	0.41	0.19	46.871	0.22	53.129
2035	0.41	0.19	46.858	0.22	53.142
2036	0.41	0.19	46.843	0.22	53.157
2037	0.42	0.20	46.830	0.22	53.170
2038	0.42	0.20	46.816	0.22	53.184
2039	0.42	0.20	46.802	0.23	53.198
2040	0.42	0.20	46.788	0.23	53.212
2041	0.43	0.20	46.775	0.23	53.225
2042	0.43	0.20	46.761	0.23	53.239
2043	0.43	0.20	46.749	0.23	53.251
2044	0.43	0.20	46.735	0.23	53.265
2045	0.44	0.20	46.722	0.23	53.278
2046	0.44	0.21	46.709	0.23	53.291
2047	0.44	0.21	46.697	0.24	53.303
2048	0.45	0.21	46.684	0.24	53.316
2049	0.45	0.21	46.671	0.24	53.329
2050	0.45	0.21	46.659	0.24	53.341
Total	11.26	5.27	46.828	5.99	53.172
Average	0.42	0.20	46.828	0.22	53.172

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.1124	0.3409	2.1704	2.6483	5.9864

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.02	0.2	0.10	0.9	0.12	1.1
Highway Segment	Collision with Fixed Object	3.15	27.9	3.38	30.0	6.53	58.0
Highway Segment	Collision with Other Object	0.22	2.0	0.66	5.8	0.88	7.8
Highway Segment	Other Single-vehicle Collision	0.91	8.1	0.51	4.5	1.41	12.5
Highway Segment	Collision with Parked Vehicle	0.07	0.6	0.08	0.7	0.14	1.3
Highway Segment	Total Single Vehicle Crashes	4.36	38.7	4.72	41.9	9.08	80.7
Highway Segment	Right-Angle Collision	0.03	0.3	0.02	0.2	0.05	0.5
Highway Segment	Head-on Collision	0.01	0.1	0.00	0.0	0.01	0.1
Highway Segment	Other Multi-vehicle Collision	0.03	0.3	0.03	0.3	0.06	0.5
Highway Segment	Rear-end Collision	0.69	6.1	0.87	7.7	1.56	13.8
Highway Segment	Sideswipe, Same Direction Collision	0.17	1.5	0.34	3.0	0.50	4.4
Highway Segment	Total Multiple Vehicle Crashes	0.91	8.1	1.26	11.2	2.18	19.4
Highway Segment	Total Highway Segment Crashes	5.27	46.8	5.99	53.2	11.26	100.0
	Total Crashes	5.27	46.8	5.99	53.2	11.26	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
0.000	15+58.698	for segment #1 (0.000 to 15+58.698), The ramp type for Ramp No Build - NB Entrance is set at the Ramp Connection (Entrance) and in the Ramp (Entrance). The Ramp value takes precedence.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

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Table of Contents

List of Tables

List of Figures

Report Overview

Report Generated: Apr 23, 2019 11:53 AM
Report Template: System: Single Page [System] (mlcpm3, Apr 10, 2019 1:31 PM)

Evaluation Date: Tue Apr 23 11:53:35 CDT 2019
IHSDM Version: v14.1.0 (Mar 12, 2019)
Crash Prediction Module: v9.1.0 (Mar 12, 2019)

User Name: jdanibas
Organization Name:
Phone:
E-Mail:

Project Title: I-229 Exit 4 (Cliff Ave) - No Build
Project Comment: Created Tue Apr 16 14:58:43 CDT 2019
Project Unit System: U.S. Customary

Highway Title: No Build - NB Exit
Highway Comment: Created Thu Apr 18 09:26:49 CDT 2019
Highway Version: 1

Evaluation Title: Evaluation 1
Evaluation Comment: Created Tue Apr 23 11:53:15 CDT 2019

Minimum Location: 0.000
Maximum Location: 12+35.089
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2024
Last Year of Analysis: 2050
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Section Types

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 12+35.089
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp
Calibration Factor: EX_RAMP_MV_FI=1.0; EX_RAMP_MV_PDO=1.0; EX_RAMP_SV_FI=1.0; EX_RAMP_SV_PDO=1.0;

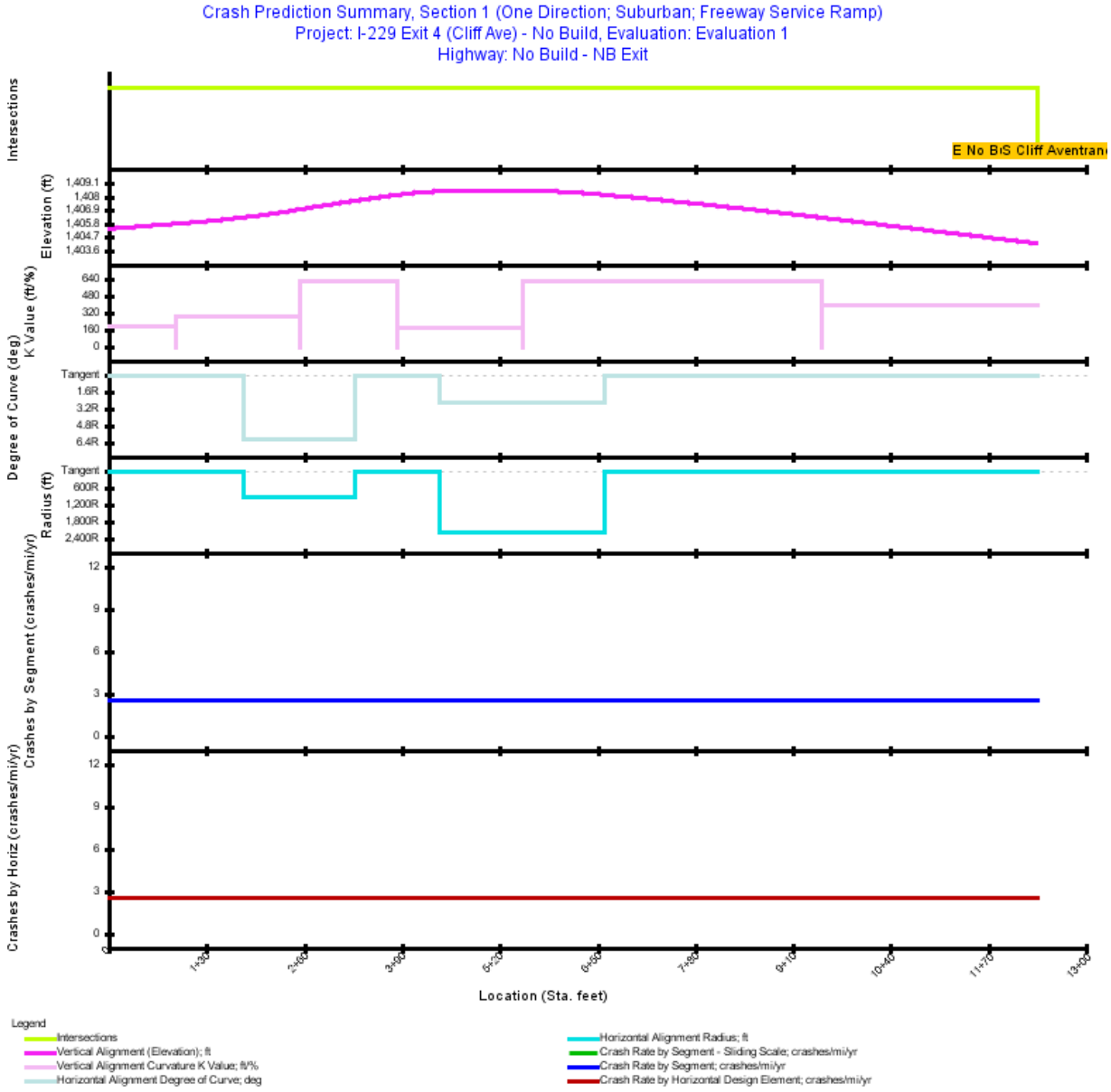

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT
1	1EX	Urban	0.000	12+35.089	1,235.09	0.2339	2024: 6,810; 2025: 6,897; 2026: 6,984; 2027: 7,071; 2028: 7,158; 2029: 7,244; 2030: 7,331; 2031: 7,418; 2032: 7,505; 2033: 7,592; 2034: 7,679; 2035: 7,766; 2036: 7,853; 2037: 7,940; 2038: 8,027; 2039: 8,114; 2040: 8,200; 2041: 8,287; 2042: 8,374; 2043: 8,461; 2044: 8,548; 2045: 8,635; 2046: 8,722; 2047: 8,809; 2048: 8,896; 2049: 8,983; 2050: 9,070

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Evaluated Length (mi)	**0.2339**
Average Future Road AADT (vpd)	**7,940**
Predicted Crashes	
Total Crashes	**16.18**
Fatal and Injury Crashes	**8.26**
Property-Damage-Only Crashes	**7.92**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**51**
Percent Property-Damage-Only Crashes (%)	**49**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**2.5612**
FI Crash Rate (crashes/mi/yr)	**1.3078**
PDO Crash Rate (crashes/mi/yr)	**1.2534**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**18.30**
Travel Crash Rate (crashes/million veh-mi)	**0.88**
Travel FI Crash Rate (crashes/million veh-mi)	**0.45**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.43**

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	12+35.089	0.2339	16.176	0.5991	0.3059	0.2932	2.5612	0.88
Total			0.2339	16.176	0.5991	0.3059	0.2932	2.5612	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	0.000	1+79.049	0.0339	2.345	0.0869	0.0444	0.0425	2.5612	0.88
Simple Curve 1	1+79.049	3+27.727	0.0282	1.947	0.0721	0.0368	0.0353	2.5612	0.88
Tangent	3+27.727	4+39.651	0.0212	1.466	0.0543	0.0277	0.0266	2.5612	0.88
Simple Curve 2	4+39.651	6+59.841	0.0417	2.884	0.1068	0.0545	0.0523	2.5612	0.88
Tangent	6+59.841	12+35.089	0.1089	7.534	0.2790	0.1425	0.1366	2.5612	0.88

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2024	0.54	0.27	51.105	0.26	48.895
2025	0.54	0.28	51.102	0.26	48.898
2026	0.55	0.28	51.099	0.27	48.901
2027	0.55	0.28	51.095	0.27	48.905
2028	0.56	0.28	51.092	0.27	48.908
2029	0.56	0.29	51.089	0.27	48.911
2030	0.56	0.29	51.086	0.28	48.914
2031	0.57	0.29	51.082	0.28	48.918
2032	0.57	0.29	51.079	0.28	48.921
2033	0.58	0.30	51.076	0.28	48.924
2034	0.58	0.30	51.073	0.29	48.927
2035	0.59	0.30	51.070	0.29	48.930
2036	0.59	0.30	51.067	0.29	48.933
2037	0.60	0.31	51.064	0.29	48.936
2038	0.60	0.31	51.060	0.30	48.940
2039	0.61	0.31	51.057	0.30	48.943
2040	0.61	0.31	51.055	0.30	48.945
2041	0.62	0.32	51.052	0.30	48.948
2042	0.62	0.32	51.049	0.30	48.951
2043	0.63	0.32	51.046	0.31	48.954
2044	0.63	0.32	51.043	0.31	48.957
2045	0.64	0.33	51.040	0.31	48.960
2046	0.64	0.33	51.037	0.32	48.963
2047	0.65	0.33	51.035	0.32	48.965
2048	0.65	0.33	51.032	0.32	48.968
2049	0.66	0.34	51.029	0.32	48.971
2050	0.66	0.34	51.026	0.32	48.974
Total	16.18	8.26	51.063	7.92	48.937
Average	0.60	0.31	51.063	0.29	48.937

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.2579	0.7821	3.2520	3.9680	7.9162

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.03	0.2	0.16	1.0	0.19	1.2
Highway Segment	Collision with Fixed Object	5.74	35.5	5.13	31.7	10.86	67.2
Highway Segment	Collision with Other Object	0.41	2.5	1.00	6.2	1.40	8.7
Highway Segment	Other Single-vehicle Collision	1.65	10.2	0.77	4.7	2.42	15.0
Highway Segment	Collision with Parked Vehicle	0.12	0.7	0.12	0.7	0.23	1.4
Highway Segment	Total Single Vehicle Crashes	7.94	49.1	7.16	44.3	15.11	93.4
Highway Segment	Right-Angle Collision	0.01	0.1	0.01	0.1	0.02	0.1
Highway Segment	Head-on Collision	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Other Multi-vehicle Collision	0.01	0.1	0.02	0.1	0.03	0.2
Highway Segment	Rear-end Collision	0.24	1.5	0.52	3.2	0.76	4.7
Highway Segment	Sideswipe, Same Direction Collision	0.06	0.4	0.20	1.2	0.26	1.6
Highway Segment	Total Multiple Vehicle Crashes	0.32	2.0	0.75	4.7	1.07	6.6
Highway Segment	Total Highway Segment Crashes	8.26	51.1	7.92	48.9	16.18	100.0
	Total Crashes	8.26	51.1	7.92	48.9	16.18	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
0.000	12+35.089	for segment #1 (0.000 to 12+35.089), The ramp type for Ramp No Build - NB Exit is set at the Ramp Connection (Exit) and in the Ramp (Exit). The Ramp value takes precedence.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

April 23, 2019

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Table of Contents

List of Tables

List of Figures

Report Overview

Report Generated: Apr 23, 2019 11:57 AM
Report Template: System: Single Page [System] (mlcpm3, Apr 10, 2019 1:31 PM)

Evaluation Date: Tue Apr 23 11:57:08 CDT 2019
IHSDM Version: v14.1.0 (Mar 12, 2019)
Crash Prediction Module: v9.1.0 (Mar 12, 2019)

User Name: jdanibas
Organization Name:
Phone:
E-Mail:

Project Title: I-229 Exit 4 (Cliff Ave) - No Build
Project Comment: Created Tue Apr 16 14:58:43 CDT 2019
Project Unit System: U.S. Customary

Highway Title: No Build - SB Entrance
Highway Comment: Created Thu Apr 18 09:54:59 CDT 2019
Highway Version: 1

Evaluation Title: Evaluation 1
Evaluation Comment: Created Tue Apr 23 11:56:59 CDT 2019

Minimum Location: 0.000
Maximum Location: 12+60.870
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2024
Last Year of Analysis: 2050
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Section Types

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 12+60.870
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp
Calibration Factor: ENT_RAMP_MV_FI=1.0; ENT_RAMP_MV_PDO=1.0; ENT_RAMP_SV_FI=1.0; ENT_RAMP_SV_PDO=1.0;

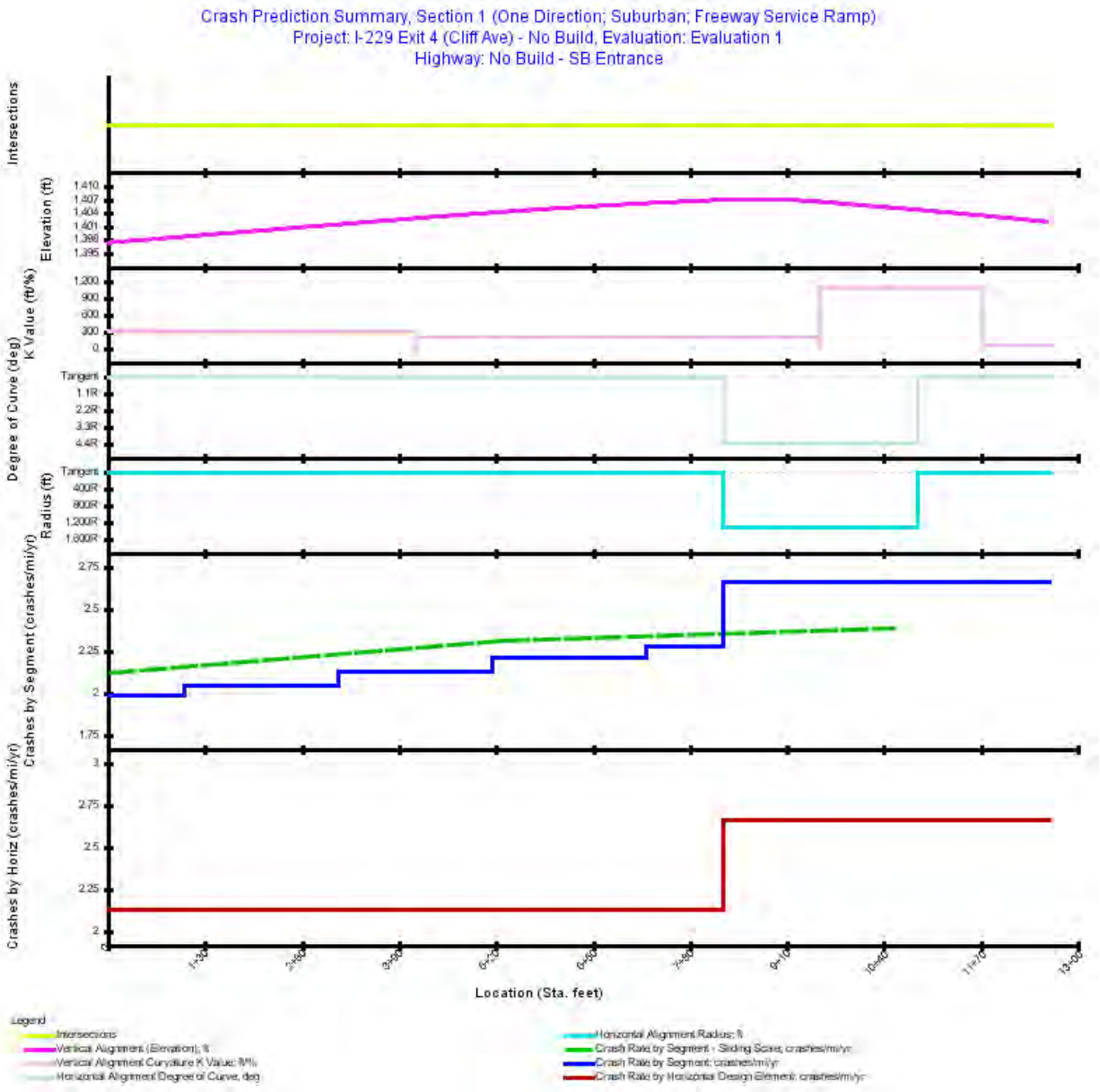

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT
1	1EN	Urban	0.000	1+03.000	103.00	0.0195	2024: 6,779; 2025: 6,838; 2026: 6,898; 2027: 6,958; 2028: 7,018; 2029: 7,078; 2030: 7,138; 2031: 7,197; 2032: 7,257; 2033: 7,317; 2034: 7,377; 2035: 7,437; 2036: 7,497; 2037: 7,557; 2038: 7,616; 2039: 7,676; 2040: 7,736; 2041: 7,796; 2042: 7,856; 2043: 7,916; 2044: 7,975; 2045: 8,035; 2046: 8,095; 2047: 8,155; 2048: 8,215; 2049: 8,275; 2050: 8,335
2	1EN	Urban	1+03.000	3+09.000	206.00	0.0390	2024: 6,779; 2025: 6,838; 2026: 6,898; 2027: 6,958; 2028: 7,018; 2029: 7,078; 2030: 7,138; 2031: 7,197; 2032: 7,257; 2033: 7,317; 2034: 7,377; 2035: 7,437; 2036: 7,497; 2037: 7,557; 2038: 7,616; 2039: 7,676; 2040: 7,736; 2041: 7,796; 2042: 7,856; 2043: 7,916; 2044: 7,975; 2045: 8,035; 2046: 8,095; 2047: 8,155; 2048: 8,215; 2049: 8,275; 2050: 8,335
3	1EN	Urban	3+09.000	5+15.000	206.00	0.0390	2024: 6,779; 2025: 6,838; 2026: 6,898; 2027: 6,958; 2028: 7,018; 2029: 7,078; 2030: 7,138; 2031: 7,197; 2032: 7,257; 2033: 7,317; 2034: 7,377; 2035: 7,437; 2036: 7,497; 2037: 7,557; 2038: 7,616; 2039: 7,676; 2040: 7,736; 2041: 7,796; 2042: 7,856; 2043: 7,916; 2044: 7,975; 2045: 8,035; 2046: 8,095; 2047: 8,155; 2048: 8,215; 2049: 8,275; 2050: 8,335
4	1EN	Urban	5+15.000	7+21.000	206.00	0.0390	2024: 6,779; 2025: 6,838; 2026: 6,898; 2027: 6,958; 2028: 7,018; 2029: 7,078; 2030: 7,138; 2031: 7,197; 2032: 7,257; 2033: 7,317; 2034: 7,377; 2035: 7,437; 2036: 7,497; 2037: 7,557; 2038: 7,616; 2039: 7,676; 2040: 7,736; 2041: 7,796; 2042: 7,856; 2043: 7,916; 2044: 7,975; 2045: 8,035; 2046: 8,095; 2047: 8,155; 2048: 8,215; 2049: 8,275; 2050: 8,335
5	1EN	Urban	7+21.000	8+23.845	102.84	0.0195	2024: 6,779; 2025: 6,838; 2026: 6,898; 2027: 6,958; 2028: 7,018; 2029: 7,078; 2030: 7,138; 2031: 7,197; 2032: 7,257; 2033: 7,317; 2034: 7,377; 2035: 7,437; 2036: 7,497; 2037: 7,557; 2038: 7,616; 2039: 7,676; 2040: 7,736; 2041: 7,796; 2042: 7,856; 2043: 7,916; 2044: 7,975; 2045: 8,035; 2046: 8,095; 2047: 8,155; 2048: 8,215; 2049: 8,275; 2050: 8,335
6	1EN	Urban	8+23.845	12+60.870	437.02	0.0828	2024: 6,779; 2025: 6,838; 2026: 6,898; 2027: 6,958; 2028: 7,018; 2029: 7,078; 2030: 7,138; 2031: 7,197; 2032: 7,257; 2033: 7,317; 2034: 7,377; 2035: 7,437; 2036: 7,497; 2037: 7,557; 2038: 7,616; 2039: 7,676; 2040: 7,736; 2041: 7,796; 2042: 7,856; 2043: 7,916; 2044: 7,975; 2045: 8,035; 2046: 8,095; 2047: 8,155; 2048: 8,215; 2049: 8,275; 2050: 8,335

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Evaluated Length (mi)	**0.2388**
Average Future Road AADT (vpd)	**7,557**
Predicted Crashes	
Total Crashes	**14.91**
Fatal and Injury Crashes	**7.16**
Property-Damage-Only Crashes	**7.75**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**48**
Percent Property-Damage-Only Crashes (%)	**52**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**2.3128**
FI Crash Rate (crashes/mi/yr)	**1.1110**
PDO Crash Rate (crashes/mi/yr)	**1.2018**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**17.78**
Travel Crash Rate (crashes/million veh-mi)	**0.84**
Travel FI Crash Rate (crashes/million veh-mi)	**0.40**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.44**

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	1+03.000	0.0195	1.046	0.0387	0.0180	0.0207	1.9854	0.72
2	1+03.000	3+09.000	0.0390	2.153	0.0798	0.0375	0.0423	2.0443	0.74
3	3+09.000	5+15.000	0.0390	2.239	0.0829	0.0395	0.0434	2.1259	0.77
4	5+15.000	7+21.000	0.0390	2.329	0.0863	0.0417	0.0446	2.2112	0.80
5	7+21.000	8+23.845	0.0195	1.198	0.0444	0.0217	0.0227	2.2777	0.83
6	8+23.845	12+60.870	0.0828	5.947	0.2202	0.1069	0.1133	2.6609	0.97
Total			0.2388	14.912	0.5523	0.2653	0.2870	2.3128	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	0.000	8+23.845	0.1560	8.966	0.3321	0.1584	0.1737	2.1282	0.77
Simple Curve 1	8+23.845	10+85.578	0.0496	3.561	0.1319	0.0640	0.0679	2.6609	0.97
Tangent	10+85.578	12+60.870	0.0332	2.385	0.0883	0.0429	0.0454	2.6609	0.97

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2024	0.51	0.24	48.198	0.26	51.802
2025	0.51	0.25	48.184	0.26	51.816
2026	0.51	0.25	48.171	0.27	51.829
2027	0.52	0.25	48.157	0.27	51.843
2028	0.52	0.25	48.144	0.27	51.856
2029	0.52	0.25	48.131	0.27	51.869
2030	0.53	0.25	48.118	0.27	51.882
2031	0.53	0.26	48.106	0.28	51.894
2032	0.54	0.26	48.094	0.28	51.906
2033	0.54	0.26	48.081	0.28	51.919
2034	0.54	0.26	48.069	0.28	51.931
2035	0.55	0.26	48.057	0.28	51.943
2036	0.55	0.26	48.046	0.28	51.954
2037	0.55	0.27	48.034	0.29	51.966
2038	0.56	0.27	48.023	0.29	51.977
2039	0.56	0.27	48.012	0.29	51.988
2040	0.56	0.27	48.001	0.29	51.999
2041	0.57	0.27	47.990	0.29	52.010
2042	0.57	0.27	47.980	0.30	52.020
2043	0.57	0.28	47.969	0.30	52.031
2044	0.58	0.28	47.959	0.30	52.041
2045	0.58	0.28	47.949	0.30	52.051
2046	0.58	0.28	47.939	0.30	52.061
2047	0.59	0.28	47.929	0.31	52.071
2048	0.59	0.28	47.920	0.31	52.080
2049	0.59	0.28	47.910	0.31	52.090
2050	0.60	0.29	47.901	0.31	52.099
Total	14.91	7.16	48.035	7.75	51.965
Average	0.55	0.27	48.035	0.29	51.965

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0104	0.0314	0.1999	0.2439	0.5601
2	0.0216	0.0654	0.4163	0.5080	1.1422
3	0.0228	0.0690	0.4394	0.5361	1.1722
4	0.0240	0.0728	0.4637	0.5658	1.2030
5	0.0125	0.0379	0.2410	0.2941	0.6124
6	0.0616	0.1867	1.1887	1.4504	3.0592
Total	0.1528	0.4632	2.9489	3.5982	7.7491

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.02	0.2	0.12	0.8	0.15	1.0
Highway Segment	Collision with Fixed Object	4.18	28.0	4.08	27.3	8.26	55.4
Highway Segment	Collision with Other Object	0.29	2.0	0.79	5.3	1.09	7.3
Highway Segment	Other Single-vehicle Collision	1.21	8.1	0.61	4.1	1.81	12.2
Highway Segment	Collision with Parked Vehicle	0.09	0.6	0.09	0.6	0.18	1.2
Highway Segment	Total Single Vehicle Crashes	5.79	38.8	5.69	38.2	11.49	77.0
Highway Segment	Right-Angle Collision	0.04	0.3	0.04	0.2	0.08	0.5
Highway Segment	Head-on Collision	0.01	0.1	0.00	0.0	0.01	0.1
Highway Segment	Other Multi-vehicle Collision	0.04	0.3	0.05	0.3	0.09	0.6
Highway Segment	Rear-end Collision	1.03	6.9	1.42	9.5	2.45	16.4
Highway Segment	Sideswipe, Same Direction Collision	0.25	1.7	0.55	3.7	0.79	5.3
Highway Segment	Total Multiple Vehicle Crashes	1.37	9.2	2.06	13.8	3.43	23.0
Highway Segment	Total Highway Segment Crashes	7.16	48.0	7.75	52.0	14.91	100.0
	Total Crashes	7.16	48.0	7.75	52.0	14.91	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
0.000	1+03.000	for segment #1 (0.000 to 1+03.000), The ramp type for Ramp No Build - SB Entrance is set at the Ramp Connection (Entrance) and in the Ramp (Entrance). The Ramp value takes precedence.
0.000	1+03.000	for segment #1 (0.000 to 1+03.000), Left shoulder width (1.0 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.
1+03.000	3+09.000	for segment #2 (1+03.000 to 3+09.000), The ramp type for Ramp No Build - SB Entrance is set at the Ramp Connection (Entrance) and in the Ramp (Entrance). The Ramp value takes precedence.
1+03.000	3+09.000	for segment #2 (1+03.000 to 3+09.000), Left shoulder width (1.0 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.
3+09.000	5+15.000	for segment #3 (3+09.000 to 5+15.000), The ramp type for Ramp No Build - SB Entrance is set at the Ramp Connection (Entrance) and in the Ramp (Entrance). The Ramp value takes precedence.
3+09.000	5+15.000	for segment #3 (3+09.000 to 5+15.000), Left shoulder width (1.0 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.
5+15.000	7+21.000	for segment #4 (5+15.000 to 7+21.000), The ramp type for Ramp No Build - SB Entrance is set at the Ramp Connection (Entrance) and in the Ramp (Entrance). The Ramp value takes precedence.
5+15.000	7+21.000	for segment #4 (5+15.000 to 7+21.000), Left shoulder width (1.0 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.
7+21.000	8+23.845	for segment #5 (7+21.000 to 8+23.845), The ramp type for Ramp No Build - SB Entrance is set at the Ramp Connection (Entrance) and in the Ramp (Entrance). The Ramp value takes precedence.
7+21.000	8+23.845	for segment #5 (7+21.000 to 8+23.845), Left shoulder width (1.0 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.
8+23.845	12+60.870	for segment #6 (8+23.845 to 12+60.870), The ramp type for Ramp No Build - SB Entrance is set at the Ramp Connection (Entrance) and in the Ramp (Entrance). The Ramp value takes precedence.
8+23.845	12+60.870	for segment #6 (8+23.845 to 12+60.870), Left shoulder width (1.0 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

April 23, 2019

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Table of Contents

List of Tables

List of Figures

Report Overview

Report Generated: Apr 23, 2019 11:56 AM
Report Template: System: Single Page [System] (mlcpm3, Apr 10, 2019 1:31 PM)

Evaluation Date: Tue Apr 23 11:56:27 CDT 2019
IHSDM Version: v14.1.0 (Mar 12, 2019)
Crash Prediction Module: v9.1.0 (Mar 12, 2019)

User Name: jdanibas
Organization Name:
Phone:
E-Mail:

Project Title: I-229 Exit 4 (Cliff Ave) - No Build
Project Comment: Created Tue Apr 16 14:58:43 CDT 2019
Project Unit System: U.S. Customary

Highway Title: No Build - SB Exit
Highway Comment: Created Thu Apr 18 09:41:36 CDT 2019
Highway Version: 2

Evaluation Title: Evaluation 1
Evaluation Comment: Created Tue Apr 23 11:56:15 CDT 2019

Minimum Location: 0.000
Maximum Location: 18+32.306
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2024
Last Year of Analysis: 2050
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Section Types

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 18+32.306
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp
Calibration Factor: EX_RAMP_MV_FI=1.0; EX_RAMP_MV_PDO=1.0; EX_RAMP_SV_FI=1.0; EX_RAMP_SV_PDO=1.0;

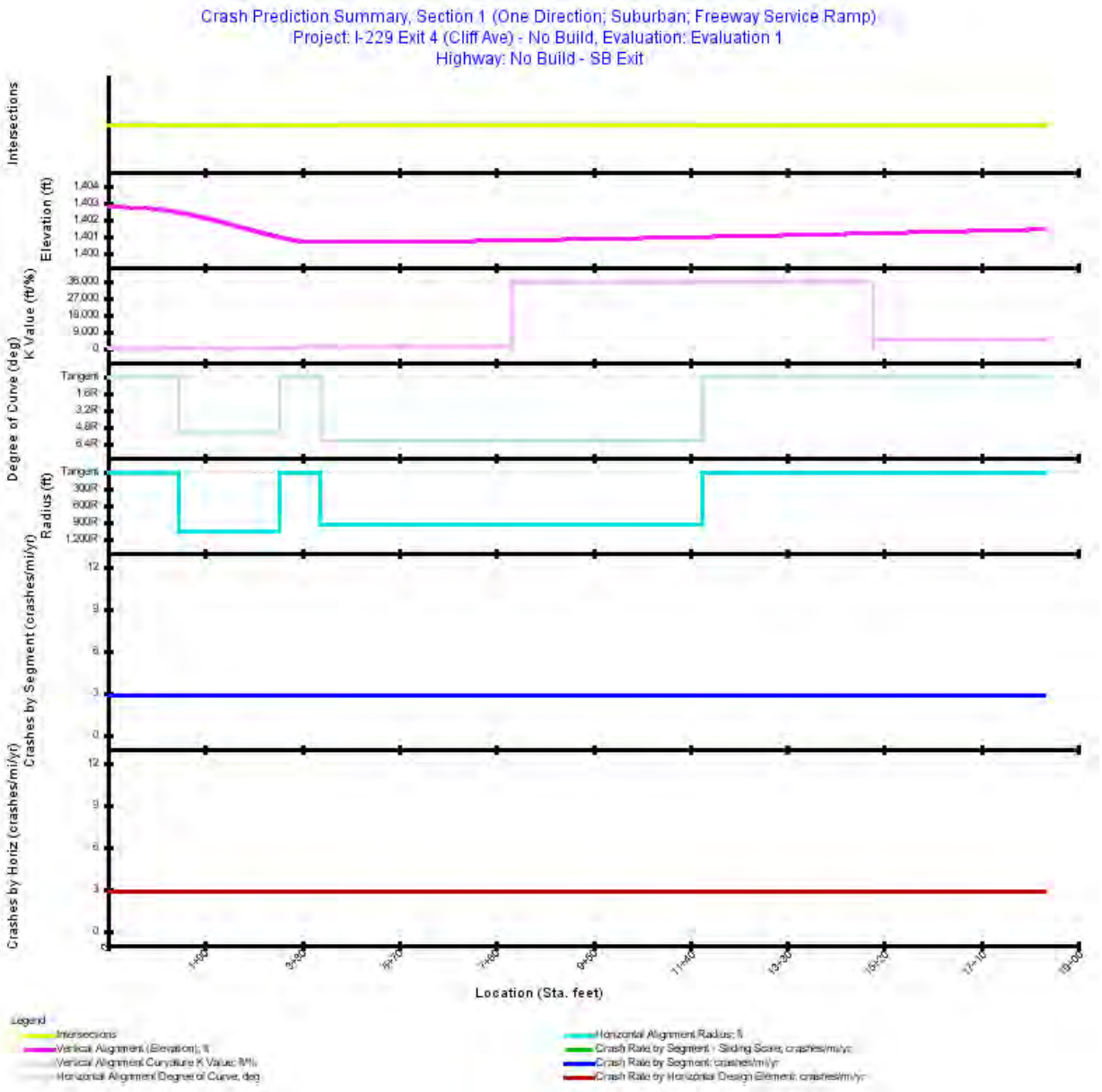

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT
1	1EX	Urban	0.000	18+32.306	1,832.31	0.3470	2024: 4,447; 2025: 4,577; 2026: 4,706; 2027: 4,836; 2028: 4,966; 2029: 5,095; 2030: 5,225; 2031: 5,355; 2032: 5,485; 2033: 5,614; 2034: 5,744; 2035: 5,874; 2036: 6,003; 2037: 6,133; 2038: 6,263; 2039: 6,393; 2040: 6,522; 2041: 6,652; 2042: 6,782; 2043: 6,911; 2044: 7,041; 2045: 7,171; 2046: 7,301; 2047: 7,430; 2048: 7,560; 2049: 7,690; 2050: 7,820

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Evaluated Length (mi)	**0.3470**
Average Future Road AADT (vpd)	**6,133**
Predicted Crashes	
Total Crashes	**26.56**
Fatal and Injury Crashes	**13.93**
Property-Damage-Only Crashes	**12.63**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**52**
Percent Property-Damage-Only Crashes (%)	**48**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**2.8345**
FI Crash Rate (crashes/mi/yr)	**1.4869**
PDO Crash Rate (crashes/mi/yr)	**1.3476**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**20.98**
Travel Crash Rate (crashes/million veh-mi)	**1.27**
Travel FI Crash Rate (crashes/million veh-mi)	**0.66**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.60**

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	18+32.306	0.3470	26.559	0.9837	0.5160	0.4677	2.8345	1.27
Total			0.3470	26.559	0.9837	0.5160	0.4677	2.8345	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	0.000	1+37.512	0.0260	1.993	0.0738	0.0387	0.0351	2.8345	1.27
Simple Curve 1	1+37.512	3+36.954	0.0378	2.891	0.1071	0.0562	0.0509	2.8345	1.27
Tangent	3+36.954	4+14.815	0.0147	1.129	0.0418	0.0219	0.0199	2.8345	1.27
Simple Curve 2	4+14.815	11+64.761	0.1420	10.870	0.4026	0.2112	0.1914	2.8345	1.27
Tangent	11+64.761	18+32.306	0.1264	9.676	0.3584	0.1880	0.1704	2.8345	1.27

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2024	0.78	0.41	52.484	0.37	47.516
2025	0.80	0.42	52.482	0.38	47.518
2026	0.81	0.43	52.481	0.39	47.519
2027	0.83	0.44	52.479	0.39	47.521
2028	0.85	0.44	52.477	0.40	47.523
2029	0.86	0.45	52.476	0.41	47.524
2030	0.88	0.46	52.474	0.42	47.526
2031	0.89	0.47	52.472	0.42	47.528
2032	0.91	0.48	52.470	0.43	47.530
2033	0.93	0.48	52.468	0.44	47.532
2034	0.94	0.49	52.465	0.45	47.535
2035	0.96	0.50	52.463	0.45	47.537
2036	0.97	0.51	52.461	0.46	47.539
2037	0.99	0.52	52.459	0.47	47.541
2038	1.00	0.53	52.457	0.48	47.543
2039	1.02	0.53	52.455	0.48	47.545
2040	1.03	0.54	52.452	0.49	47.548
2041	1.05	0.55	52.450	0.50	47.550
2042	1.06	0.56	52.448	0.51	47.552
2043	1.08	0.56	52.446	0.51	47.554
2044	1.09	0.57	52.443	0.52	47.557
2045	1.10	0.58	52.441	0.53	47.559
2046	1.12	0.59	52.439	0.53	47.561
2047	1.13	0.59	52.437	0.54	47.563
2048	1.15	0.60	52.434	0.55	47.566
2049	1.16	0.61	52.432	0.55	47.568
2050	1.18	0.62	52.430	0.56	47.570
Total	26.56	13.93	52.456	12.63	47.544
Average	0.98	0.52	52.456	0.47	47.544

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.4350	1.3192	5.4850	6.6927	12.6271

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.05	0.2	0.26	1.0	0.31	1.2
Highway Segment	Collision with Fixed Object	9.73	36.6	8.39	31.6	18.12	68.2
Highway Segment	Collision with Other Object	0.69	2.6	1.63	6.1	2.32	8.7
Highway Segment	Other Single-vehicle Collision	2.80	10.6	1.25	4.7	4.06	15.3
Highway Segment	Collision with Parked Vehicle	0.20	0.8	0.19	0.7	0.39	1.5
Highway Segment	Total Single Vehicle Crashes	13.48	50.8	11.71	44.1	25.19	94.9
Highway Segment	Right-Angle Collision	0.01	0.1	0.02	0.1	0.03	0.1
Highway Segment	Head-on Collision	0.00	0.0	0.00	0.0	0.01	0.0
Highway Segment	Other Multi-vehicle Collision	0.01	0.1	0.02	0.1	0.04	0.1
Highway Segment	Rear-end Collision	0.34	1.3	0.63	2.4	0.97	3.6
Highway Segment	Sideswipe, Same Direction Collision	0.08	0.3	0.24	0.9	0.32	1.2
Highway Segment	Total Multiple Vehicle Crashes	0.45	1.7	0.91	3.4	1.36	5.1
Highway Segment	Total Highway Segment Crashes	13.93	52.5	12.63	47.5	26.56	100.0
	Total Crashes	13.93	52.5	12.63	47.5	26.56	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
0.000	18+32.306	for segment #1 (0.000 to 18+32.306), The ramp type for Ramp No Build - SB Exit is set at the Ramp Connection (Exit) and in the Ramp (Exit). The Ramp value takes precedence.
0.000	18+32.306	for segment #1 (0.000 to 18+32.306), Left shoulder width (1.0 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.
0.000	18+32.306	for segment #1 (0.000 to 18+32.306), Right shoulder width (1.5 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

April 23, 2019

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Table of Contents

List of Tables

List of Figures

Report Overview

Report Generated: Apr 23, 2019 11:50 AM
Report Template: System: Single Page [System] (mlcpm3, Apr 10, 2019 1:31 PM)

Evaluation Date: Tue Apr 23 11:50:23 CDT 2019
IHSDM Version: v14.1.0 (Mar 12, 2019)
Crash Prediction Module: v9.1.0 (Mar 12, 2019)

User Name: jdanibas
Organization Name:
Phone:
E-Mail:

Project Title: I-229 Exit 4 (Cliff Ave) - No Build
Project Comment: Created Tue Apr 16 14:58:43 CDT 2019
Project Unit System: U.S. Customary

Highway Title: Cliff Ave
Highway Comment: Created Tue Apr 16 15:32:22 CDT 2019
Highway Version: 1

Evaluation Title: Evaluation 1
Evaluation Comment: Created Tue Apr 23 11:50:08 CDT 2019

Minimum Location: 10+00.000
Maximum Location: 74+43.703
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2024
Last Year of Analysis: 2050
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Section Types

Section 1 Evaluation

Section: Section 1
Evaluation Start Location: 10+00.000
Evaluation End Location: 74+43.703
Area Type: Urban
Functional Class: Arterial
Type of Alignment: Divided, Multilane
Model Category: Urban/Suburban Arterial
Calibration Factor: 3SG=1.0; 3ST=1.0; 4D=1.0; 4SG=1.0; 4ST=1.0; 4U=1.0; 5T=1.0; RT_SG_FI=1.0; RT_SG_PDO=1.0;

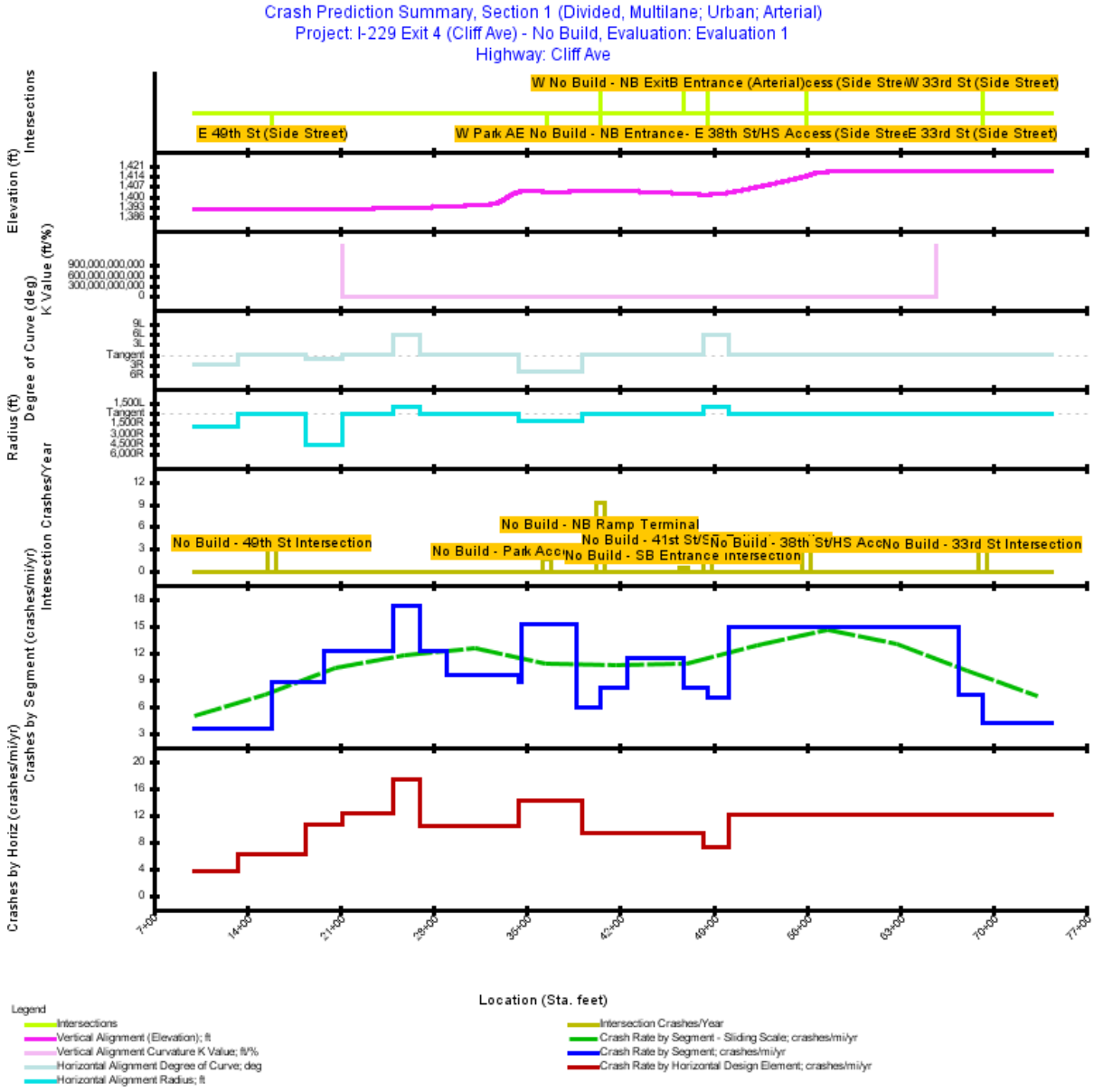

Figure 1. Crash Prediction Summary (Section 1)

Table 1. Evaluation Highway - Homogeneous Segments (Section 1)

Seg. No.	Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT	Number Major Commercial Driveways	Number Minor Commercial Driveways	Number Major Industial/Institutional	Number Minor Industial/Institutional	Number Major Residential Driveways	Number Minor Residential Driveways	Number Other Driveways	Lighting	Automated Speed Enforcement	Density (fixed objects/mi)	Median Width (ft)	Type	Effective Median Width (ft)	Speed Level	Number Rail Highway Crossings	Average Shoulder Width (ft)	Average Lane Width (ft)
1	4D	10+00.000	13+34.041	334.04	0.0633	2024: 14,262; 2025: 14,606; 2026: 14,950; 2027: 15,293; 2028: 15,637; 2029: 15,981; 2030: 16,325; 2031: 16,668; 2032: 17,012; 2033: 17,356; 2034: 17,700; 2035: 18,043; 2036: 18,387; 2037: 18,731; 2038: 19,075; 2039: 19,418; 2040: 19,762; 2041: 20,106; 2042: 20,450; 2043: 20,793; 2044: 21,137; 2045: 21,481; 2046: 21,825; 2047: 22,168; 2048: 22,512; 2049: 22,856; 2050: 23,200	0	0	0	0	0	0	0	false	false	0.0	12.00	Traversable Median	12.00	Intermediate/High	0	2.00	12.00
2	4D	13+34.041	15+86.000	251.96	0.0477	2024: 14,262; 2025: 14,606; 2026: 14,950; 2027: 15,293; 2028: 15,637; 2029: 15,981; 2030: 16,325; 2031: 16,668; 2032: 17,012; 2033: 17,356; 2034: 17,700; 2035: 18,043; 2036: 18,387; 2037: 18,731; 2038: 19,075; 2039: 19,418; 2040: 19,762; 2041: 20,106; 2042: 20,450; 2043: 20,793; 2044: 21,137; 2045: 21,481; 2046: 21,825; 2047: 22,168; 2048: 22,512; 2049: 22,856; 2050: 23,200	0	0	0	0	0	0	0	false	false	0.0	12.00	Traversable Median	12.00	Intermediate/High	0	2.00	12.00
3	4U	15+86.000	18+42.805	256.81	0.0486	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
4	4U	18+42.805	19+76.000	133.19	0.0252	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
5	5T	19+76.000	21+08.879	132.88	0.0252	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
6	5T	21+08.879	24+96.922	388.04	0.0735	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
7	5T	24+96.922	26+94.712	197.79	0.0375	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	1	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
8	5T	26+94.712	28+98.954	204.24	0.0387	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
9	4U	28+98.954	34+34.660	535.71	0.1015	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	2	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
10	4U	34+34.660	34+59.660	25.00	0.0047	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
11	5T	34+59.660	38+73.000	413.34	0.0783	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	2	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00

Seg. No.	Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT	Number Major Commercial Driveways	Number Minor Commercial Driveways	Number Major Industial/Institutional	Number Minor Industial/Institutional	Number Major Residential Driveways	Number Minor Residential Driveways	Number Other Driveways	Lighting	Automated Speed Enforcement	Density (fixed objects/mi)	Median Width (ft)	Type	Effective Median Width (ft)	Speed Level	Number Rail Highway Crossings	Average Shoulder Width (ft)	Average Lane Width (ft)
12	4D	38+73.000	39+10.280	37.28	0.0071	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	0	0	false	false	0.0	12.00	Traversable Median	12.00	Intermediate/High	0	2.00	12.00
13	4D	39+10.280	40+48.000	137.72	0.0261	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	0	0	false	false	0.0	12.00	Traversable Median	12.00	Intermediate/High	0	2.00	12.00
14	4U	40+48.000	42+48.000	200.00	0.0379	2024: 22,375; 2025: 22,687; 2026: 23,000; 2027: 23,312; 2028: 23,625; 2029: 23,937; 2030: 24,250; 2031: 24,562; 2032: 24,875; 2033: 25,187; 2034: 25,500; 2035: 25,812; 2036: 26,125; 2037: 26,437; 2038: 26,750; 2039: 27,062; 2040: 27,375; 2041: 27,687; 2042: 28,000; 2043: 28,312; 2044: 28,625; 2045: 28,937; 2046: 29,250; 2047: 29,562; 2048: 29,875; 2049: 30,187; 2050: 30,500	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
15	5T	42+48.000	44+75.544	227.54	0.0431	2024: 22,375; 2025: 22,687; 2026: 23,000; 2027: 23,312; 2028: 23,625; 2029: 23,937; 2030: 24,250; 2031: 24,562; 2032: 24,875; 2033: 25,187; 2034: 25,500; 2035: 25,812; 2036: 26,125; 2037: 26,437; 2038: 26,750; 2039: 27,062; 2040: 27,375; 2041: 27,687; 2042: 28,000; 2043: 28,312; 2044: 28,625; 2045: 28,937; 2046: 29,250; 2047: 29,562; 2048: 29,875; 2049: 30,187; 2050: 30,500	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
16	5T	44+75.544	46+78.645	203.10	0.0385	2024: 22,375; 2025: 22,687; 2026: 23,000; 2027: 23,312; 2028: 23,625; 2029: 23,937; 2030: 24,250; 2031: 24,562; 2032: 24,875; 2033: 25,187; 2034: 25,500; 2035: 25,812; 2036: 26,125; 2037: 26,437; 2038: 26,750; 2039: 27,062; 2040: 27,375; 2041: 27,687; 2042: 28,000; 2043: 28,312; 2044: 28,625; 2045: 28,937; 2046: 29,250; 2047: 29,562; 2048: 29,875; 2049: 30,187; 2050: 30,500	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
17	4U	46+78.645	48+21.477	142.83	0.0271	2024: 22,375; 2025: 22,687; 2026: 23,000; 2027: 23,312; 2028: 23,625; 2029: 23,937; 2030: 24,250; 2031: 24,562; 2032: 24,875; 2033: 25,187; 2034: 25,500; 2035: 25,812; 2036: 26,125; 2037: 26,437; 2038: 26,750; 2039: 27,062; 2040: 27,375; 2041: 27,687; 2042: 28,000; 2043: 28,312; 2044: 28,625; 2045: 28,937; 2046: 29,250; 2047: 29,562; 2048: 29,875; 2049: 30,187; 2050: 30,500	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
18	4U	48+21.477	48+54.000	32.52	0.0062	2024: 22,375; 2025: 22,687; 2026: 23,000; 2027: 23,312; 2028: 23,625; 2029: 23,937; 2030: 24,250; 2031: 24,562; 2032: 24,875; 2033: 25,187; 2034: 25,500; 2035: 25,812; 2036: 26,125; 2037: 26,437; 2038: 26,750; 2039: 27,062; 2040: 27,375; 2041: 27,687; 2042: 28,000; 2043: 28,312; 2044: 28,625; 2045: 28,937; 2046: 29,250; 2047: 29,562; 2048: 29,875; 2049: 30,187; 2050: 30,500	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
19	4D	48+54.000	50+12.172	158.17	0.0300	2024: 21,150; 2025: 21,375; 2026: 21,600; 2027: 21,825; 2028: 22,050; 2029: 22,275; 2030: 22,500; 2031: 22,725; 2032: 22,950; 2033: 23,175; 2034: 23,400; 2035: 23,625; 2036: 23,850; 2037: 24,075; 2038: 24,300; 2039: 24,525; 2040: 24,750; 2041: 24,975; 2042: 25,200; 2043: 25,425; 2044: 25,650; 2045: 25,875; 2046: 26,100; 2047: 26,325; 2048: 26,550; 2049: 26,775; 2050: 27,000	0	0	1	0	0	0	0	false	false	0.0	12.00	Traversable Median	6.00	Intermediate/High	0	2.00	12.00
20	5T	50+12.172	67+46.101	1,733.93	0.3284	2024: 21,150; 2025: 21,375; 2026: 21,600; 2027: 21,825; 2028: 22,050; 2029: 22,275; 2030: 22,500; 2031: 22,725; 2032: 22,950; 2033: 23,175; 2034: 23,400; 2035: 23,625; 2036: 23,850; 2037: 24,075; 2038: 24,300; 2039: 24,525; 2040: 24,750; 2041: 24,975; 2042: 25,200; 2043: 25,425; 2044: 25,650; 2045: 25,875; 2046: 26,100; 2047: 26,325; 2048: 26,550; 2049: 26,775; 2050: 27,000	0	0	3	0	3	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
21	4U	67+46.101	69+21.101	175.00	0.0331	2024: 21,150; 2025: 21,375; 2026: 21,600; 2027: 21,825; 2028: 22,050; 2029: 22,275; 2030: 22,500; 2031: 22,725; 2032: 22,950; 2033: 23,175; 2034: 23,400; 2035: 23,625; 2036: 23,850; 2037: 24,075; 2038: 24,300; 2039: 24,525; 2040: 24,750; 2041: 24,975; 2042: 25,200; 2043: 25,425; 2044: 25,650; 2045: 25,875; 2046: 26,100; 2047: 26,325; 2048: 26,550; 2049: 26,775; 2050: 27,000	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
22	4U	69+21.101	70+36.101	115.00	0.0218	2024: 14,406; 2025: 14,490; 2026: 14,575; 2027: 14,659; 2028: 14,743; 2029: 14,828; 2030: 14,912; 2031: 14,996; 2032: 15,081; 2033: 15,165; 2034: 15,250; 2035: 15,334; 2036: 15,418; 2037: 15,503; 2038: 15,587; 2039: 15,671; 2040: 15,756; 2041: 15,840; 2042: 15,925; 2043: 16,009; 2044: 16,093; 2045: 16,178; 2046: 16,262; 2047: 16,346; 2048: 16,431; 2049: 16,515; 2050: 16,600	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
23	4U	70+36.101	74+43.703	407.60	0.0772	2024: 14,406; 2025: 14,490; 2026: 14,575; 2027: 14,659; 2028: 14,743; 2029: 14,828; 2030: 14,912; 2031: 14,996; 2032: 15,081; 2033: 15,165; 2034: 15,250; 2035: 15,334; 2036: 15,418; 2037: 15,503; 2038: 15,587; 2039: 15,671; 2040: 15,756; 2041: 15,840; 2042: 15,925; 2043: 16,009; 2044: 16,093; 2045: 16,178; 2046: 16,262; 2047: 16,346; 2048: 16,431; 2049: 16,515; 2050: 16,600	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00

Table 2. Evaluation Intersection (Section 1)

Inter. No.	Title	Location (Sta. ft)	Major AADT	Minor AADT	Legs	Traffic Control	Intersection Type	Approaches w/Left Turn Lanes	Approaches w/Right Turn Lanes	Approaches w/o Right Turn on Red	Pedestrian Volume (crossings/day)	Lighted at Night	Red Light Camera	School Nearby	Number of Bus Stops	Number of Alcohol Sales Establishments	Max Lanes Crossed	Replaced with Roundabout
1	No Build - Park Access Intersection	36+51.824	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	2024: 360; 2025: 365; 2026: 370; 2027: 375; 2028: 380; 2029: 385; 2030: 390; 2031: 395; 2032: 400; 2033: 405; 2034: 410; 2035: 415; 2036: 420; 2037: 425; 2038: 430; 2039: 435; 2040: 440; 2041: 445; 2042: 450; 2043: 455; 2044: 460; 2045: 465; 2046: 470; 2047: 475; 2048: 480; 2049: 485; 2050: 490	3	Stop-Controlled	Three-Legged w/STOP control	0	0			true	false	false				false
2	No Build - 49th St Intersection	15+85.495	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	2024: 8,734; 2025: 8,848; 2026: 8,962; 2027: 9,076; 2028: 9,190; 2029: 9,304; 2030: 9,418; 2031: 9,532; 2032: 9,646; 2033: 9,760; 2034: 9,875; 2035: 9,989; 2036: 10,103; 2037: 10,217; 2038: 10,331; 2039: 10,445; 2040: 10,559; 2041: 10,673; 2042: 10,787; 2043: 10,901; 2044: 11,015; 2045: 11,129; 2046: 11,243; 2047: 11,357; 2048: 11,471; 2049: 11,585; 2050: 11,700	3	Signalized	Three-Legged Signalized	2	0	0	15	true	false	false	0	0	5	false

Table 3. Evaluation Intersection (Section 1)

Inter. No.	Title	Location (Sta. ft)	Major AADT	Minor AADT	Legs	Traffic Control	Intersection Type	Approaches w/Left Turn Lanes	Approaches w/Right Turn Lanes	Approaches w/o Right Turn on Red	Pedestrian Volume (crossings/day)	Lighted at Night	Red Light Camera	School Nearby	Number of Bus Stops	Number of Alcohol Sales Establishments	Max Lanes Crossed	Replaced with Roundabout
4	No Build - SB Entrance Intersection	46+75.544	2024: 6,779; 2025: 6,838; 2026: 6,898; 2027: 6,958; 2028: 7,018; 2029: 7,078; 2030: 7,138; 2031: 7,197; 2032: 7,257; 2033: 7,317; 2034: 7,377; 2035: 7,437; 2036: 7,497; 2037: 7,557; 2038: 7,616; 2039: 7,676; 2040: 7,736; 2041: 7,796; 2042: 7,856; 2043: 7,916; 2044: 7,975; 2045: 8,035; 2046: 8,095; 2047: 8,155; 2048: 8,215; 2049: 8,275; 2050: 8,335	2024: 22,375; 2025: 22,687; 2026: 23,000; 2027: 23,312; 2028: 23,625; 2029: 23,937; 2030: 24,250; 2031: 24,562; 2032: 24,875; 2033: 25,187; 2034: 25,500; 2035: 25,812; 2036: 26,125; 2037: 26,437; 2038: 26,750; 2039: 27,062; 2040: 27,375; 2041: 27,687; 2042: 28,000; 2043: 28,312; 2044: 28,625; 2045: 28,937; 2046: 29,250; 2047: 29,562; 2048: 29,875; 2049: 30,187; 2050: 30,500	3	Stop-Controlled	Three-Legged w/STOP control	0	0			true	false	true				false
5	No Build - 41st St/SB Exit Intersection	48+53.645	2024: 4,447; 2025: 4,577; 2026: 4,706; 2027: 4,836; 2028: 4,966; 2029: 5,095; 2030: 5,225; 2031: 5,355; 2032: 5,485; 2033: 5,614; 2034: 5,744; 2035: 5,874; 2036: 6,003; 2037: 6,133; 2038: 6,263; 2039: 6,393; 2040: 6,522; 2041: 6,652; 2042: 6,782; 2043: 6,911; 2044: 7,041; 2045: 7,171; 2046: 7,301; 2047: 7,430; 2048: 7,560; 2049: 7,690; 2050: 7,820	2024: 22,375; 2025: 22,687; 2026: 23,000; 2027: 23,312; 2028: 23,625; 2029: 23,937; 2030: 24,250; 2031: 24,562; 2032: 24,875; 2033: 25,187; 2034: 25,500; 2035: 25,812; 2036: 26,125; 2037: 26,437; 2038: 26,750; 2039: 27,062; 2040: 27,375; 2041: 27,687; 2042: 28,000; 2043: 28,312; 2044: 28,625; 2045: 28,937; 2046: 29,250; 2047: 29,562; 2048: 29,875; 2049: 30,187; 2050: 30,500	4	Signalized	Four-Legged Signalized	3	0	0	20	true	false	true	0	0	5	false
6	No Build - 38th St/HS Access	55+97.795	2024: 21,150; 2025: 21,375; 2026: 21,600; 2027: 21,825; 2028: 22,050; 2029: 22,275; 2030: 22,500; 2031: 22,725; 2032: 22,950; 2033: 23,175; 2034: 23,400; 2035: 23,625; 2036: 23,850; 2037: 24,075; 2038: 24,300; 2039: 24,525; 2040: 24,750; 2041: 24,975; 2042: 25,200; 2043: 25,425; 2044: 25,650; 2045: 25,875; 2046: 26,100; 2047: 26,325; 2048: 26,550; 2049: 26,775; 2050: 27,000	2024: 2,014; 2025: 2,048; 2026: 2,082; 2027: 2,116; 2028: 2,150; 2029: 2,184; 2030: 2,218; 2031: 2,252; 2032: 2,286; 2033: 2,320; 2034: 2,355; 2035: 2,389; 2036: 2,423; 2037: 2,457; 2038: 2,491; 2039: 2,525; 2040: 2,559; 2041: 2,593; 2042: 2,627; 2043: 2,661; 2044: 2,695; 2045: 2,729; 2046: 2,763; 2047: 2,797; 2048: 2,831; 2049: 2,865; 2050: 2,900	4	Stop-Controlled	Four-Legged w/STOP control	0	0			true	false	false				false
7	No Build - 33rd St Intersection	69+21.101	2024: 21,150; 2025: 21,375; 2026: 21,600; 2027: 21,825; 2028: 22,050; 2029: 22,275; 2030: 22,500; 2031: 22,725; 2032: 22,950; 2033: 23,175; 2034: 23,400; 2035: 23,625; 2036: 23,850; 2037: 24,075; 2038: 24,300; 2039: 24,525; 2040: 24,750; 2041: 24,975; 2042: 25,200; 2043: 25,425; 2044: 25,650; 2045: 25,875; 2046: 26,100; 2047: 26,325; 2048: 26,550; 2049: 26,775; 2050: 27,000	2024: 5,465; 2025: 5,507; 2026: 5,550; 2027: 5,592; 2028: 5,635; 2029: 5,677; 2030: 5,720; 2031: 5,762; 2032: 5,805; 2033: 5,847; 2034: 5,890; 2035: 5,932; 2036: 5,975; 2037: 6,017; 2038: 6,060; 2039: 6,102; 2040: 6,145; 2041: 6,187; 2042: 6,230; 2043: 6,272; 2044: 6,315; 2045: 6,357; 2046: 6,400; 2047: 6,442; 2048: 6,485; 2049: 6,527; 2050: 6,570	4	Signalized	Four-Legged Signalized	4	0	0	20	true	false	false	0	0	5	false

Table 4. Evaluation Ramp Terminal - Site (Section 1)

Inter. No.	Ramp Terminal Type	Area Type	Legs	Location (Sta. ft)	Traffic Control	AADT
3	D4-Four-Leg Ramp Terminal with Diagonal Ramps	Urban	4	40+47.883	Signalized	Inside: 2024: 22,375; 2025: 22,687; 2026: 23,000; 2027: 23,312; 2028: 23,625; 2029: 23,937; 2030: 24,250; 2031: 24,562; 2032: 24,875; 2033: 25,187; 2034: 25,500; 2035: 25,812; 2036: 26,125; 2037: 26,437; 2038: 26,750; 2039: 27,062; 2040: 27,375; 2041: 27,687; 2042: 28,000; 2043: 28,312; 2044: 28,625; 2045: 28,937; 2046: 29,250; 2047: 29,562; 2048: 29,875; 2049: 30,187; 2050: 30,500; Outside: 2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600 :: Entrance: 2024: 4,091; 2025: 4,128; 2026: 4,165; 2027: 4,201; 2028: 4,238; 2029: 4,275; 2030: 4,312; 2031: 4,349; 2032: 4,386; 2033: 4,423; 2034: 4,460; 2035: 4,496; 2036: 4,533; 2037: 4,570; 2038: 4,607; 2039: 4,644; 2040: 4,681; 2041: 4,718; 2042: 4,755; 2043: 4,791; 2044: 4,828; 2045: 4,865; 2046: 4,902; 2047: 4,939; 2048: 4,976; 2049: 5,013; 2050: 5,050; Exit: 2024: 6,810; 2025: 6,897; 2026: 6,984; 2027: 7,071; 2028: 7,158; 2029: 7,244; 2030: 7,331; 2031: 7,418; 2032: 7,505; 2033: 7,592; 2034: 7,679; 2035: 7,766; 2036: 7,853; 2037: 7,940; 2038: 8,027; 2039: 8,114; 2040: 8,200; 2041: 8,287; 2042: 8,374; 2043: 8,461; 2044: 8,548; 2045: 8,635; 2046: 8,722; 2047: 8,809; 2048: 8,896; 2049: 8,983; 2050: 9,070

Table 5. Predicted Highway Crash Rates and Frequencies Summary (Section 1)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Evaluated Length (mi)	**1.2204**
Average Future Road AADT (vpd)	**24,739**
Predicted Crashes	
Total Crashes	**1,112.71**
Fatal and Injury Crashes	**378.36**
Property-Damage-Only Crashes	**734.35**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**34**
Percent Property-Damage-Only Crashes (%)	**66**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**33.7689**
FI Crash Rate (crashes/mi/yr)	**11.4825**
PDO Crash Rate (crashes/mi/yr)	**22.2864**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**297.54**
Travel Crash Rate (crashes/million veh-mi)	**3.74**
Travel FI Crash Rate (crashes/million veh-mi)	**1.27**
Travel PDO Crash Rate (crashes/million veh-mi)	**2.47**

Table 6. Predicted Crash Frequencies and Rates by Highway Segment/Intersection (Section 1)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)	Predicted Intersection Travel Crash Rate (crashes/million veh)
1	10+00.000	13+34.041	0.0633	6.147	0.2277	0.0633	0.1644	3.5989	0.53	
2	13+34.041	15+86.000	0.0477	4.637	0.1717	0.0477	0.1240	3.5989	0.53	
No Build - 49th St Intersection	15+85.495			110.346	4.0869	1.3240	2.7629			0.39
3	15+86.000	18+42.805	0.0486	11.590	0.4292	0.1245	0.3047	8.8254	0.86	
4	18+42.805	19+76.000	0.0252	6.011	0.2226	0.0646	0.1580	8.8254	0.86	
5	19+76.000	21+08.879	0.0252	8.357	0.3095	0.0878	0.2217	12.2983	1.20	
6	21+08.879	24+96.922	0.0735	24.404	0.9038	0.2564	0.6475	12.2983	1.20	
7	24+96.922	26+94.712	0.0375	17.524	0.6490	0.1860	0.4630	17.3258	1.69	
8	26+94.712	28+98.954	0.0387	12.845	0.4757	0.1349	0.3408	12.2983	1.20	
9	28+98.954	34+34.660	0.1015	26.232	0.9715	0.2864	0.6852	9.5757	0.93	
10	34+34.660	34+59.660	0.0047	1.128	0.0418	0.0121	0.0297	8.8254	0.86	
11	34+59.660	38+73.000	0.0783	32.190	1.1922	0.3405	0.8517	15.2294	1.48	
No Build - Park Access Intersection	36+51.824			45.001	1.6667	0.7260	0.9407			0.16
12	38+73.000	39+10.280	0.0071	1.123	0.0416	0.0116	0.0300	5.8899	0.57	
13	39+10.280	40+48.000	0.0261	4.148	0.1536	0.0427	0.1109	5.8899	0.57	
No Build - NB Ramp Terminal	40+47.883			247.072	9.1508	3.9182	5.2326			0.75
14	40+48.000	42+48.000	0.0379	8.352	0.3093	0.0902	0.2191	8.1665	0.85	
15	42+48.000	44+75.544	0.0431	13.398	0.4962	0.1411	0.3551	11.5143	1.19	
16	44+75.544	46+78.645	0.0385	11.959	0.4429	0.1259	0.3170	11.5143	1.19	
No Build - SB Entrance Intersection	46+75.544			14.488	0.5366	0.1184	0.4182			0.05
17	46+78.645	48+21.477	0.0271	5.965	0.2209	0.0644	0.1565	8.1665	0.85	
18	48+21.477	48+54.000	0.0062	1.358	0.0503	0.0147	0.0356	8.1665	0.85	
No Build - 41st St/SB Exit Intersection	48+53.645			135.483	5.0179	1.2294	3.7885			0.43
19	48+54.000	50+12.172	0.0300	5.644	0.2090	0.0596	0.1494	6.9777	0.79	
20	50+12.172	67+46.101	0.3284	131.609	4.8744	1.4035	3.4709	14.8431	1.69	
No Build - 38th St/HS Access	55+97.795			105.259	3.8985	1.6329	2.2656			0.41
21	67+46.101	69+21.101	0.0331	6.501	0.2408	0.0708	0.1700	7.2643	0.83	

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)	Predicted Intersection Travel Crash Rate (crashes/million veh)
No Build - 33rd St Intersection	69+21.101			102.674	3.8028	1.3081	2.4946			0.41
22	69+21.101	70+36.101	0.0218	2.480	0.0918	0.0280	0.0638	4.2166	0.74	
23	70+36.101	74+43.703	0.0772	8.789	0.3255	0.0993	0.2262	4.2166	0.74	
All Segments			1.2204	352.388	13.0514	3.7562	9.2952	10.6944	1.18	
All Intersections				760.323	28.1601	10.2571	17.9031			0.38
Total			1.2204	1,112.711	41.2115	14.0133	27.1983	33.7689		

Table 7. Predicted Crash Frequencies and Rates by Horizontal Design Element (Section 1)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Simple Curve 1	10+00.000	13+34.041	0.0633	6.147	0.2277	0.0633	0.1644	3.5989	0.53
Tangent	13+34.041	18+42.805	0.0964	16.226	0.6010	0.1723	0.4287	6.2370	0.69
Simple Curve 2	18+42.805	21+08.879	0.0504	14.368	0.5321	0.1524	0.3797	10.5598	1.03
Tangent	21+08.879	24+96.922	0.0735	24.404	0.9038	0.2564	0.6475	12.2983	1.20
Simple Curve 3	24+96.922	26+94.712	0.0375	17.524	0.6490	0.1860	0.4630	17.3258	1.69
Tangent	26+94.712	34+34.660	0.1401	39.076	1.4473	0.4213	1.0259	10.3272	1.01
Simple Curve 4	34+34.660	39+10.280	0.0901	34.441	1.2756	0.3642	0.9114	14.1608	1.38
Tangent	39+10.280	48+21.477	0.1726	43.821	1.6230	0.4645	1.1586	9.4046	0.97
Simple Curve 5	48+21.477	50+12.172	0.0361	7.002	0.2593	0.0743	0.1851	7.1805	0.80
Tangent	50+12.172	74+43.703	0.4605	149.378	5.5325	1.6017	3.9309	12.0137	1.42

Table 8. Predicted Crash Frequencies by Year (Section 1)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2024	34.16	11.64	34.072	22.52	65.928
2025	34.70	11.82	34.064	22.88	65.936
2026	35.23	12.00	34.056	23.23	65.944
2027	35.76	12.18	34.049	23.58	65.951
2028	36.30	12.36	34.042	23.94	65.958
2029	36.83	12.54	34.035	24.30	65.965
2030	37.37	12.72	34.029	24.65	65.971
2031	37.91	12.90	34.024	25.01	65.976
2032	38.45	13.08	34.018	25.37	65.982
2033	38.99	13.26	34.014	25.73	65.987
2034	39.53	13.45	34.009	26.09	65.991
2035	40.08	13.63	34.005	26.45	65.995
2036	40.62	13.81	34.001	26.81	65.999
2037	41.17	14.00	33.997	27.17	66.003
2038	41.72	14.18	33.994	27.54	66.006
2039	42.27	14.37	33.991	27.90	66.009
2040	42.82	14.55	33.988	28.27	66.012
2041	43.37	14.74	33.986	28.63	66.014
2042	43.93	14.93	33.983	29.00	66.017
2043	44.48	15.12	33.981	29.37	66.019
2044	45.04	15.30	33.980	29.73	66.020
2045	45.60	15.49	33.978	30.10	66.022
2046	46.16	15.68	33.977	30.47	66.023
2047	46.72	15.87	33.975	30.84	66.025
2048	47.28	16.06	33.974	31.22	66.026
2049	47.84	16.25	33.974	31.59	66.026
2050	48.41	16.45	33.973	31.96	66.027
Total	1,112.71	378.36	34.003	734.35	65.997
Average	41.21	14.01	34.003	27.20	65.997

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 9. Predicted Crash Severity by Urban Arterial (Section 1)

Seg. No.	Type	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
4	USAIntersection	0.0086	0.1908	0.7847	2.2114	11.2922
5	USAIntersection	0.0701	1.4546	7.9390	23.7312	102.2886
Total		0.0787	1.6454	8.7238	25.9425	113.5808

Table 10. Predicted Five Lane or Fewer Crash Type Distribution (Section 1)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.13	0.0	1.51	0.2	1.63	0.2
Highway Segment	Collision with Bicycle	3.19	0.3	0.00	0.0	3.19	0.3
Highway Segment	Collision with Fixed Object	5.15	0.5	30.68	3.2	35.84	3.7
Highway Segment	Collision with Other Object	0.11	0.0	1.97	0.2	2.08	0.2
Highway Segment	Other Single-vehicle Collision	5.86	0.6	5.13	0.5	10.99	1.1
Highway Segment	Collision with Pedestrian	6.71	0.7	0.00	0.0	6.71	0.7
Highway Segment	Total Single Vehicle Crashes	21.15	2.2	39.28	4.1	60.43	6.3
Highway Segment	Angle Collision	5.70	0.6	13.13	1.4	18.82	2.0
Highway Segment	Driveway-related Collision	14.27	1.5	38.13	4.0	52.40	5.4
Highway Segment	Head-on Collision	2.43	0.3	0.73	0.1	3.16	0.3
Highway Segment	Other Multi-vehicle Collision	2.03	0.2	7.79	0.8	9.82	1.0
Highway Segment	Rear-end Collision	49.52	5.1	106.67	11.1	156.19	16.2
Highway Segment	Sideswipe, Opposite Direction Collision	1.75	0.2	2.45	0.3	4.19	0.4
Highway Segment	Sideswipe, Same Direction Collision	4.57	0.5	42.79	4.4	47.37	4.9
Highway Segment	Total Multiple Vehicle Crashes	80.27	8.3	211.69	22.0	291.96	30.3
Highway Segment	Total Highway Segment Crashes	101.42	10.5	250.97	26.1	352.39	36.6
Intersection	Collision with Animal	0.01	0.0	0.22	0.0	0.23	0.0
Intersection	Collision with Bicycle	5.23	0.5	0.00	0.0	5.23	0.5
Intersection	Collision with Fixed Object	4.87	0.5	15.00	1.6	19.87	2.1
Intersection	Non-Collision	1.19	0.1	0.57	0.1	1.76	0.2
Intersection	Collision with Other Object	0.60	0.1	1.26	0.1	1.86	0.2
Intersection	Other Single-vehicle Collision	0.32	0.0	0.28	0.0	0.59	0.1
Intersection	Collision with Parked Vehicle	0.01	0.0	0.02	0.0	0.03	0.0
Intersection	Collision with Pedestrian	3.77	0.4	0.00	0.0	3.77	0.4
Intersection	Total Intersection Single Vehicle Crashes	15.99	1.7	17.35	1.8	33.34	3.5
Intersection	Angle Collision	42.48	4.4	54.18	5.6	96.66	10.0
Intersection	Head-on Collision	5.10	0.5	5.48	0.6	10.57	1.1
Intersection	Other Multi-vehicle Collision	6.96	0.7	44.54	4.6	51.50	5.3
Intersection	Rear-end Collision	51.94	5.4	99.37	10.3	151.30	15.7
Intersection	Sideswipe	12.30	1.3	7.61	0.8	19.91	2.1
Intersection	Total Intersection Multiple Vehicle Crashes	118.77	12.3	211.17	21.9	329.94	34.3
Intersection	Total Intersection Crashes	134.76	14.0	228.52	23.7	363.28	37.7
Ramp Terminal	Collision with Animal	0.00	0.0	0.00	0.0	0.00	0.0
Ramp Terminal	Collision with Fixed Object	3.49	0.4	7.06	0.7	10.55	1.1
Ramp Terminal	Collision with Other Object	0.11	0.0	0.28	0.0	0.39	0.0
Ramp Terminal	Other Single-vehicle Collision	1.90	0.2	0.99	0.1	2.89	0.3
Ramp Terminal	Collision with Parked Vehicle	0.11	0.0	0.28	0.0	0.39	0.0
Ramp Terminal	Total Single Vehicle Crashes	5.61	0.6	8.62	0.9	14.22	1.5
Ramp Terminal	Right-Angle Collision	27.51	2.9	31.08	3.2	58.59	6.1
Ramp Terminal	Head-on Collision	1.16	0.1	0.99	0.1	2.15	0.2
Ramp Terminal	Other Multi-vehicle Collision	0.95	0.1	2.83	0.3	3.78	0.4
Ramp Terminal	Rear-end Collision	66.12	6.9	76.72	8.0	142.84	14.8
Ramp Terminal	Sideswipe, Same Direction Collision	4.44	0.5	21.05	2.2	25.49	2.6
Ramp Terminal	Total Multiple Vehicle Crashes	100.19	10.4	132.66	13.8	232.85	24.2
Ramp Terminal	Total Ramp Terminal Crashes	105.79	11.0	141.28	14.7	247.07	25.7
	Total Crashes	341.97	35.5	620.77	64.5	962.74	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 11. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
46+75.544	46+75.544	for intersection #4 (46+75.544 to 46+75.544), minor road traffic volume (22,375 vpd) for 2024 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
46+75.544	46+75.544	for intersection #4 (46+75.544 to 46+75.544), minor road traffic volume (22,687 vpd) for 2025 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
46+75.544	46+75.544	for intersection #4 (46+75.544 to 46+75.544), minor road traffic volume (23,000 vpd) for 2026 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
46+75.544	46+75.544	for intersection #4 (46+75.544 to 46+75.544), minor road traffic volume (23,312 vpd) for 2027 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
46+75.544	46+75.544	for intersection #4 (46+75.544 to 46+75.544), minor road traffic volume (23,625 vpd) for 2028 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
46+75.544	46+75.544	for intersection #4 (46+75.544 to 46+75.544), minor road traffic volume (23,937 vpd) for 2029 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
46+75.544	46+75.544	for intersection #4 (46+75.544 to 46+75.544), minor road traffic volume (24,250 vpd) for 2030 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
46+75.544	46+75.544	for intersection #4 (46+75.544 to 46+75.544), minor road traffic volume (24,562 vpd) for 2031 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
46+75.544	46+75.544	for intersection #4 (46+75.544 to 46+75.544), minor road traffic volume (24,875 vpd) for 2032 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
46+75.544	46+75.544	for intersection #4 (46+75.544 to 46+75.544), minor road traffic volume (25,187 vpd) for 2033 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
46+75.544	46+75.544	for intersection #4 (46+75.544 to 46+75.544), minor road traffic volume (25,500 vpd) for 2034 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
46+75.544	46+75.544	for intersection #4 (46+75.544 to 46+75.544), minor road traffic volume (25,812 vpd) for 2035 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
46+75.544	46+75.544	for intersection #4 (46+75.544 to 46+75.544), minor road traffic volume (26,125 vpd) for 2036 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
46+75.544	46+75.544	for intersection #4 (46+75.544 to 46+75.544), minor road traffic volume (26,437 vpd) for 2037 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
46+75.544	46+75.544	for intersection #4 (46+75.544 to 46+75.544), minor road traffic volume (26,750 vpd) for 2038 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
46+75.544	46+75.544	for intersection #4 (46+75.544 to 46+75.544), minor road traffic volume (27,062 vpd) for 2039 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
46+75.544	46+75.544	for intersection #4 (46+75.544 to 46+75.544), minor road traffic volume (27,375 vpd) for 2040 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
46+75.544	46+75.544	for intersection #4 (46+75.544 to 46+75.544), minor road traffic volume (27,687 vpd) for 2041 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST

Start Location (Sta. ft)	End Location (Sta. ft)	Message
46+75.544	46+75.544	for intersection #4 (46+75.544 to 46+75.544), minor road traffic volume (28,000 vpd) for 2042 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
46+75.544	46+75.544	for intersection #4 (46+75.544 to 46+75.544), minor road traffic volume (28,312 vpd) for 2043 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
46+75.544	46+75.544	for intersection #4 (46+75.544 to 46+75.544), minor road traffic volume (28,625 vpd) for 2044 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
46+75.544	46+75.544	for intersection #4 (46+75.544 to 46+75.544), minor road traffic volume (28,937 vpd) for 2045 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
46+75.544	46+75.544	for intersection #4 (46+75.544 to 46+75.544), minor road traffic volume (29,250 vpd) for 2046 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
46+75.544	46+75.544	for intersection #4 (46+75.544 to 46+75.544), minor road traffic volume (29,562 vpd) for 2047 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
46+75.544	46+75.544	for intersection #4 (46+75.544 to 46+75.544), minor road traffic volume (29,875 vpd) for 2048 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
46+75.544	46+75.544	for intersection #4 (46+75.544 to 46+75.544), minor road traffic volume (30,187 vpd) for 2049 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
46+75.544	46+75.544	for intersection #4 (46+75.544 to 46+75.544), minor road traffic volume (30,500 vpd) for 2050 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST

IHSDM Results
(2024 to 2050)

Cliff Avenue (Exit 4)

Alternative 1 Conditions

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

May 3, 2019

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Table of Contents

List of Tables

List of Figures

Report Overview

Report Generated: May 3, 2019 10:35 AM
Report Template: System: Single Page [System] (mlcpm3, Apr 10, 2019 1:31 PM)

Evaluation Date: Fri May 03 10:35:14 CDT 2019
IHSDM Version: v14.1.0 (Mar 12, 2019)
Crash Prediction Module: v9.1.0 (Mar 12, 2019)

User Name: jdanibas
Organization Name:
Phone:
E-Mail:

Project Title: I-229 Exit 4 (Cliff Ave) - Alternative 1
Project Comment: Created Tue Apr 16 14:58:43 CDT 2019
Project Unit System: U.S. Customary

Highway Title: I-229
Highway Comment: Created Tue Apr 16 14:59:05 CDT 2019
Highway Version: 1

Evaluation Title: Evaluation 1
Evaluation Comment: Created Fri May 03 10:35:03 CDT 2019

Minimum Location: 10+00.000
Maximum Location: 92+57.134
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2024
Last Year of Analysis: 2050
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Section Types

Section 1 Evaluation

Section: Section 1
Evaluation Start Location: 10+00.000
Evaluation End Location: 92+57.134
Functional Class: Freeway
Type of Alignment: Divided, Multilane
Model Category: Freeway Segment
Calibration Factor: FI_EN=1.0; FI_EX=1.0; FI_MV=1.0; FI_SV=1.0; PDO_EN=1.0; PDO_EX=1.0; PDO_MV=1.0; PDO_SV=1.0;

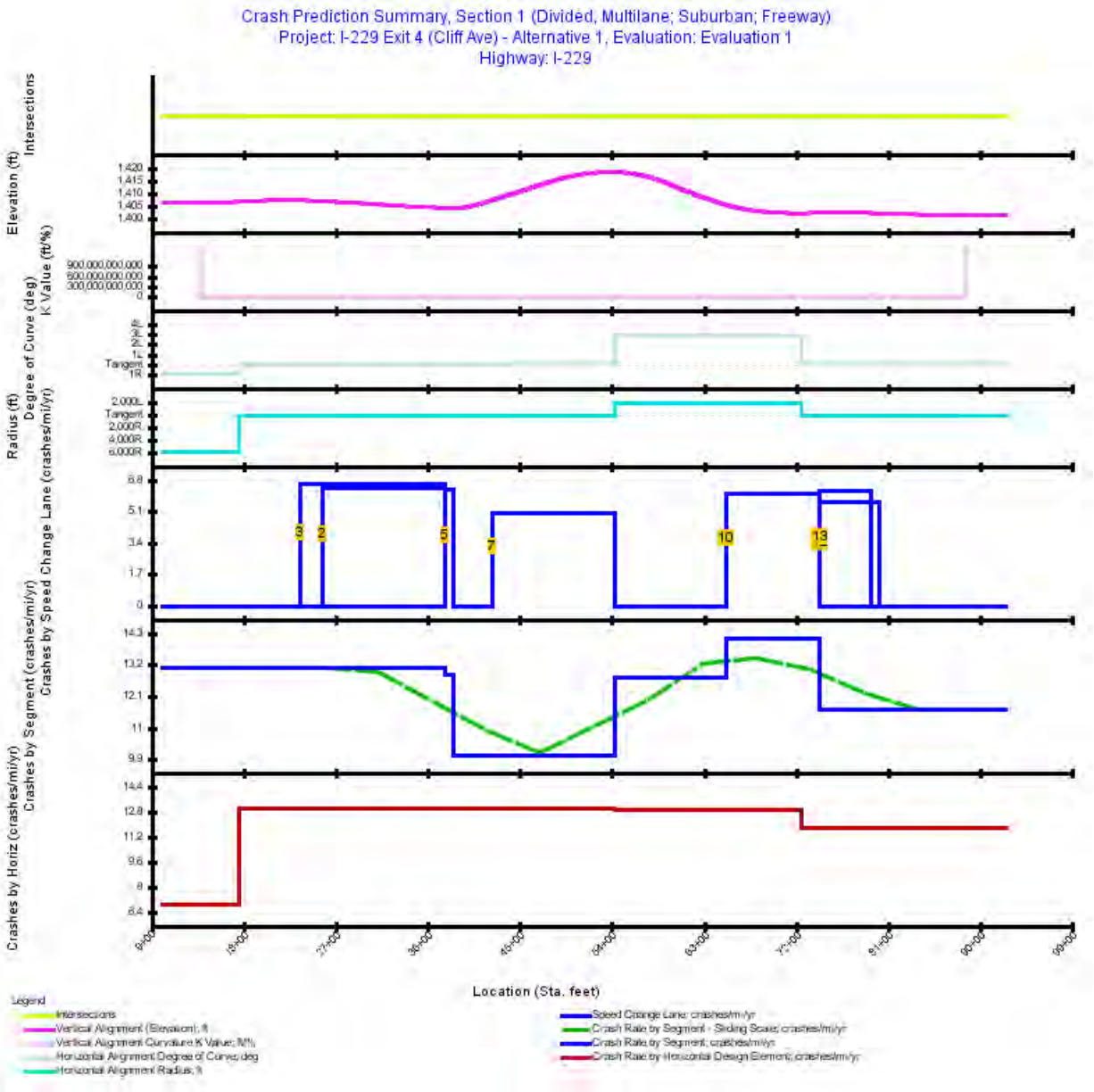

Figure 1. Crash Prediction Summary (Section 1)

Table 1. Evaluation Freeway - Homogeneous Segments (Section 1)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT	Median Width (ft)	Type	Effective Median Width (ft)
1	6F	Urban	10+00.000	37+62.826	2,762.83	0.5233	2024: 62,235; 2025: 62,933; 2026: 63,632; 2027: 64,331; 2028: 65,030; 2029: 65,729; 2030: 66,428; 2031: 67,126; 2032: 67,825; 2033: 68,524; 2034: 69,223; 2035: 69,922; 2036: 70,621; 2037: 71,320; 2038: 72,018; 2039: 72,717; 2040: 73,416; 2041: 74,115; 2042: 74,814; 2043: 75,513; 2044: 76,211; 2045: 76,910; 2046: 77,609; 2047: 78,308; 2048: 79,007; 2049: 79,706; 2050: 80,405	44.00	Non-Traversable Median	64.00
4	6F	Urban	37+62.826	38+44.179	81.35	0.0154	2024: 58,291; 2025: 58,956; 2026: 59,620; 2027: 60,284; 2028: 60,948; 2029: 61,612; 2030: 62,276; 2031: 62,941; 2032: 63,605; 2033: 64,269; 2034: 64,933; 2035: 65,597; 2036: 66,261; 2037: 66,925; 2038: 67,590; 2039: 68,254; 2040: 68,918; 2041: 69,582; 2042: 70,246; 2043: 70,910; 2044: 71,575; 2045: 72,239; 2046: 72,903; 2047: 73,567; 2048: 74,231; 2049: 74,895; 2050: 75,560	44.00	Non-Traversable Median	64.00
6	5F	Urban	38+44.179	54+27.826	1,583.65	0.2999	2024: 51,481; 2025: 52,058; 2026: 52,636; 2027: 53,213; 2028: 53,790; 2029: 54,367; 2030: 54,945; 2031: 55,522; 2032: 56,099; 2033: 56,676; 2034: 57,254; 2035: 57,831; 2036: 58,408; 2037: 58,985; 2038: 59,563; 2039: 60,140; 2040: 60,717; 2041: 61,294; 2042: 61,872; 2043: 62,449; 2044: 63,026; 2045: 63,603; 2046: 64,181; 2047: 64,758; 2048: 65,335; 2049: 65,912; 2050: 66,490	44.00	Non-Traversable Median	64.00
8	5F	Urban	54+27.826	65+13.782	1,085.96	0.2057	2024: 48,645; 2025: 49,197; 2026: 49,749; 2027: 50,301; 2028: 50,853; 2029: 51,406; 2030: 51,958; 2031: 52,510; 2032: 53,062; 2033: 53,614; 2034: 54,166; 2035: 54,718; 2036: 55,270; 2037: 55,822; 2038: 56,374; 2039: 56,926; 2040: 57,479; 2041: 58,031; 2042: 58,583; 2043: 59,135; 2044: 59,687; 2045: 60,239; 2046: 60,791; 2047: 61,343; 2048: 61,895; 2049: 62,447; 2050: 63,000	44.00	Non-Traversable Median	64.00
9	6F	Urban	65+13.782	74+33.116	919.33	0.1741	2024: 52,736; 2025: 53,325; 2026: 53,914; 2027: 54,503; 2028: 55,092; 2029: 55,681; 2030: 56,270; 2031: 56,859; 2032: 57,448; 2033: 58,037; 2034: 58,626; 2035: 59,215; 2036: 59,804; 2037: 60,393; 2038: 60,982; 2039: 61,571; 2040: 62,160; 2041: 62,749; 2042: 63,338; 2043: 63,927; 2044: 64,516; 2045: 65,105; 2046: 65,694; 2047: 66,283; 2048: 66,872; 2049: 67,461; 2050: 68,050	44.00	Non-Traversable Median	64.00
11	6F	Urban	74+33.116	92+57.134	1,824.02	0.3455	2024: 57,184; 2025: 57,902; 2026: 58,621; 2027: 59,340; 2028: 60,058; 2029: 60,777; 2030: 61,496; 2031: 62,214; 2032: 62,933; 2033: 63,652; 2034: 64,371; 2035: 65,089; 2036: 65,808; 2037: 66,527; 2038: 67,245; 2039: 67,964; 2040: 68,683; 2041: 69,401; 2042: 70,120; 2043: 70,839; 2044: 71,557; 2045: 72,276; 2046: 72,995; 2047: 73,713; 2048: 74,432; 2049: 75,151; 2050: 75,870	44.00	Non-Traversable Median	64.00

Table 2. Evaluation Freeway - Speed Change Lanes (Speed Change)

Seg. No.	Type	Ramp Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT	Median Width (ft)	Type	Effective Median Width (ft)
2	6SC	Entrance	25+62.826	37+62.826	1,200.00	0.2273	2024: 62,235; 2025: 62,933; 2026: 63,632; 2027: 64,331; 2028: 65,030; 2029: 65,729; 2030: 66,428; 2031: 67,126; 2032: 67,825; 2033: 68,524; 2034: 69,223; 2035: 69,922; 2036: 70,621; 2037: 71,320; 2038: 72,018; 2039: 72,717; 2040: 73,416; 2041: 74,115; 2042: 74,814; 2043: 75,513; 2044: 76,211; 2045: 76,910; 2046: 77,609; 2047: 78,308; 2048: 79,007; 2049: 79,706; 2050: 80,405	44.00	Non-Traversable Median	64.00
3	6SC	Exit	23+44.179	37+62.826	1,418.65	0.2687	2024: 62,235; 2025: 62,933; 2026: 63,632; 2027: 64,331; 2028: 65,030; 2029: 65,729; 2030: 66,428; 2031: 67,126; 2032: 67,825; 2033: 68,524; 2034: 69,223; 2035: 69,922; 2036: 70,621; 2037: 71,320; 2038: 72,018; 2039: 72,717; 2040: 73,416; 2041: 74,115; 2042: 74,814; 2043: 75,513; 2044: 76,211; 2045: 76,910; 2046: 77,609; 2047: 78,308; 2048: 79,007; 2049: 79,706; 2050: 80,405	44.00	Non-Traversable Median	64.00
5	6SC	Exit	37+62.826	38+44.179	81.35	0.0154	2024: 58,291; 2025: 58,956; 2026: 59,620; 2027: 60,284; 2028: 60,948; 2029: 61,612; 2030: 62,276; 2031: 62,941; 2032: 63,605; 2033: 64,269; 2034: 64,933; 2035: 65,597; 2036: 66,261; 2037: 66,925; 2038: 67,590; 2039: 68,254; 2040: 68,918; 2041: 69,582; 2042: 70,246; 2043: 70,910; 2044: 71,575; 2045: 72,239; 2046: 72,903; 2047: 73,567; 2048: 74,231; 2049: 74,895; 2050: 75,560	44.00	Non-Traversable Median	64.00
7	5SC	Entrance	42+27.826	54+27.826	1,200.00	0.2273	2024: 51,481; 2025: 52,058; 2026: 52,636; 2027: 53,213; 2028: 53,790; 2029: 54,367; 2030: 54,945; 2031: 55,522; 2032: 56,099; 2033: 56,676; 2034: 57,254; 2035: 57,831; 2036: 58,408; 2037: 58,985; 2038: 59,563; 2039: 60,140; 2040: 60,717; 2041: 61,294; 2042: 61,872; 2043: 62,449; 2044: 63,026; 2045: 63,603; 2046: 64,181; 2047: 64,758; 2048: 65,335; 2049: 65,912; 2050: 66,490	44.00	Non-Traversable Median	64.00
10	6SC	Entrance	65+13.782	74+33.116	919.33	0.1741	2024: 52,736; 2025: 53,325; 2026: 53,914; 2027: 54,503; 2028: 55,092; 2029: 55,681; 2030: 56,270; 2031: 56,859; 2032: 57,448; 2033: 58,037; 2034: 58,626; 2035: 59,215; 2036: 59,804; 2037: 60,393; 2038: 60,982; 2039: 61,571; 2040: 62,160; 2041: 62,749; 2042: 63,338; 2043: 63,927; 2044: 64,516; 2045: 65,105; 2046: 65,694; 2047: 66,283; 2048: 66,872; 2049: 67,461; 2050: 68,050	44.00	Non-Traversable Median	64.00
12	6SC	Entrance	74+33.116	80+13.782	580.67	0.1100	2024: 57,184; 2025: 57,902; 2026: 58,621; 2027: 59,340; 2028: 60,058; 2029: 60,777; 2030: 61,496; 2031: 62,214; 2032: 62,933; 2033: 63,652; 2034: 64,371; 2035: 65,089; 2036: 65,808; 2037: 66,527; 2038: 67,245; 2039: 67,964; 2040: 68,683; 2041: 69,401; 2042: 70,120; 2043: 70,839; 2044: 71,557; 2045: 72,276; 2046: 72,995; 2047: 73,713; 2048: 74,432; 2049: 75,151; 2050: 75,870	44.00	Non-Traversable Median	64.00
13	6SC	Exit	74+33.116	79+33.116	500.00	0.0947	2024: 57,184; 2025: 57,902; 2026: 58,621; 2027: 59,340; 2028: 60,058; 2029: 60,777; 2030: 61,496; 2031: 62,214; 2032: 62,933; 2033: 63,652; 2034: 64,371; 2035: 65,089; 2036: 65,808; 2037: 66,527; 2038: 67,245; 2039: 67,964; 2040: 68,683; 2041: 69,401; 2042: 70,120; 2043: 70,839; 2044: 71,557; 2045: 72,276; 2046: 72,995; 2047: 73,713; 2048: 74,432; 2049: 75,151; 2050: 75,870	44.00	Non-Traversable Median	64.00

Table 3. Predicted Freeway Crash Rates and Frequencies Summary (Section 1)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Effective Length (mi)	**1.0051**
Average Future Road AADT (vpd)	**63,723**
Predicted Crashes	
Total Crashes	**330.94**
Fatal and Injury Crashes	**120.66**
Property-Damage-Only Crashes	**210.27**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**36**
Percent Property-Damage-Only Crashes (%)	**64**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**12.1942**
FI Crash Rate (crashes/mi/yr)	**4.4461**
PDO Crash Rate (crashes/mi/yr)	**7.7481**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**631.22**
Travel Crash Rate (crashes/million veh-mi)	**0.52**
Travel FI Crash Rate (crashes/million veh-mi)	**0.19**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.33**

Note: *Effective Length* is the *segment length* minus the length of the *speed change lanes* if present.

Table 4. Predicted Freeway Speed Change Lane Crash Rates and Frequencies Summary (Speed Change)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Evaluated Length (mi)	**1.1174**
Average Future Road AADT (vpd)	**33,085**
Predicted Crashes	
Total Crashes	**182.22**
Fatal and Injury Crashes	**54.14**
Property-Damage-Only Crashes	**128.07**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**30**
Percent Property-Damage-Only Crashes (%)	**70**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**6.0395**
FI Crash Rate (crashes/mi/yr)	**1.7945**
PDO Crash Rate (crashes/mi/yr)	**4.2450**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**364.34**
Travel Crash Rate (crashes/million veh-mi)	**0.50**
Travel FI Crash Rate (crashes/million veh-mi)	**0.15**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.35**

Note: *Total Travel and Crash Rates/Million Vehicle Miles* for *Speed Change Lanes* reflect AADTs that are **half of the Freeway Segment AADTs** based on the assumption of 50/50 directional distribution.

Table 5. Predicted Crash Frequencies and Rates by Freeway Segment/Intersection (Section 1)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Effective Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	10+00.000	37+62.826	0.2753	97.409	3.6077	1.2866	2.3211	13.1054	0.50
4	37+62.826	38+44.179	0.0077	2.672	0.0990	0.0360	0.0630	12.8451	0.53
6	38+44.179	54+27.826	0.1863	50.313	1.8634	0.7000	1.1635	10.0026	0.47
8	54+27.826	65+13.782	0.2057	70.870	2.6248	0.9901	1.6347	12.7620	0.63
9	65+13.782	74+33.116	0.0871	33.154	1.2279	0.4435	0.7844	14.1048	0.64
11	74+33.116	92+57.134	0.2431	76.518	2.8340	1.0129	1.8211	11.6567	0.48
Total			1.0051	330.935	12.2568	4.4689	7.7879	12.1942	0.52

Note: *Effective Length* is the *segment length* minus the length of the *speed change lanes* if present.

Table 6. Predicted Crash Frequencies and Rates by Freeway Speed Change Lane (Speed Change)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
2	25+62.826	37+62.826	0.2273	39.396	1.4591	0.4550	1.0041	6.4201	0.49
3	23+44.179	37+62.826	0.2687	48.213	1.7857	0.5043	1.2813	6.6459	0.51
5	37+62.826	38+44.179	0.0154	2.631	0.0975	0.0276	0.0699	6.3255	0.52
7	42+27.826	54+27.826	0.2273	31.025	1.1491	0.3448	0.8043	5.0559	0.47
10	65+13.782	74+33.116	0.1741	28.420	1.0526	0.3059	0.7467	6.0454	0.55
12	74+33.116	80+13.782	0.1100	16.671	0.6174	0.1923	0.4251	5.6145	0.46
13	74+33.116	79+33.116	0.0947	15.859	0.5874	0.1753	0.4121	6.2027	0.51
Total			1.1174	182.215	6.7487	2.0052	4.7435	6.0395	0.50

Note: *Travel Crash Rates/Million Vehicle Miles* for *Speed Change Lanes* reflect AADTs that are **half of the Freeway Segment AADTs** based on the assumption of 50/50 directional distribution.

Table 7. Predicted Crash Frequencies and Rates by Horizontal Design Element (Section 1)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Simple Curve 1	10+00.000	17+54.376	0.1429	26.597	0.9851	0.3513	0.6338	6.8947	0.50
Tangent	17+54.376	54+26.711	0.6955	244.997	9.0740	3.0022	6.0718	13.0463	1.01
Simple Curve 2	54+26.711	72+50.687	0.3454	120.290	4.4552	1.5915	2.8636	12.8967	0.85
Tangent	72+50.687	92+57.134	0.3800	121.267	4.4914	1.5292	2.9622	11.8191	0.81

Table 8. Predicted Crash Frequencies by Year (Section 1)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2024	16.18	5.51	34.051	10.67	65.949
2025	16.42	5.59	34.056	10.83	65.944
2026	16.67	5.68	34.061	10.99	65.939
2027	16.91	5.76	34.065	11.15	65.935
2028	17.16	5.85	34.069	11.32	65.931
2029	17.42	5.93	34.072	11.48	65.928
2030	17.67	6.02	34.075	11.65	65.925
2031	17.93	6.11	34.077	11.82	65.923
2032	18.19	6.20	34.079	11.99	65.921
2033	18.46	6.29	34.081	12.17	65.919
2034	18.73	6.38	34.081	12.34	65.918
2035	18.99	6.47	34.082	12.52	65.918
2036	19.15	6.48	33.820	12.67	66.180
2037	19.39	6.55	33.770	12.84	66.230
2038	19.63	6.62	33.721	13.01	66.279
2039	19.87	6.69	33.672	13.18	66.328
2040	20.11	6.76	33.624	13.35	66.376
2041	20.36	6.83	33.576	13.52	66.424
2042	20.60	6.91	33.528	13.70	66.472
2043	20.85	6.98	33.480	13.87	66.520
2044	21.09	7.05	33.434	14.04	66.567
2045	21.34	7.13	33.387	14.22	66.613
2046	21.59	7.20	33.340	14.39	66.660
2047	21.84	7.27	33.294	14.57	66.706
2048	22.09	7.34	33.249	14.75	66.751
2049	22.34	7.42	33.203	14.93	66.797
2050	22.60	7.49	33.158	15.10	66.842
Total	523.60	176.53	33.714	347.08	66.286
Average	19.39	6.54	33.714	12.86	66.286

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 9. Predicted Crash Severity by Freeway Segment (Section 1)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.6582	1.7034	10.7814	21.5953	62.6701
4	0.0170	0.0432	0.2896	0.6209	1.7011
6	0.3308	0.8407	5.6390	12.0888	31.4137
8	0.5444	1.4328	8.5931	16.1611	44.1382
9	0.2594	0.6703	4.1229	6.9218	21.1799
11	0.5264	1.3228	8.9006	16.5973	49.1706
Total	2.3362	6.0132	38.3268	73.9852	210.2736

Table 10. Predicted Crash Severity by Speed Change Lane (Speed Change)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
2	0.2150	0.5464	3.6653	7.8582	27.1112
3	0.2383	0.6057	4.0629	8.7105	34.5953
5	0.0130	0.0332	0.2224	0.4768	1.8861
7	0.1629	0.4141	2.7777	5.9545	21.7153
10	0.1789	0.4623	2.8435	4.7738	20.1618
12	0.1000	0.2512	1.6901	3.1515	11.4784
13	0.0911	0.2289	1.5402	2.8720	11.1269
Total	0.9993	2.5417	16.8021	33.7974	128.0750

Table 11. Predicted Freeway Crash Type Distribution (Section 1)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.25	0.1	2.20	0.7	2.45	0.7
Highway Segment	Collision with Fixed Object	44.52	13.2	71.64	21.2	116.17	34.4
Highway Segment	Collision with Other Object	3.15	0.9	13.91	4.1	17.05	5.1
Highway Segment	Other Single-vehicle Collision	12.83	3.8	10.71	3.2	23.53	7.0
Highway Segment	Collision with Parked Vehicle	0.93	0.3	1.60	0.5	2.53	0.7
Highway Segment	Total Single Vehicle Crashes	61.67	18.3	100.06	29.6	161.73	47.9
Highway Segment	Right-Angle Collision	1.84	0.5	2.10	0.6	3.94	1.2
Highway Segment	Head-on Collision	0.47	0.1	0.23	0.1	0.71	0.2
Highway Segment	Other Multi-vehicle Collision	1.84	0.5	2.80	0.8	4.64	1.4
Highway Segment	Rear-end Collision	44.50	13.2	80.39	23.8	124.90	37.0
Highway Segment	Sideswipe, Same Direction Collision	10.68	3.2	30.99	9.2	41.67	12.3
Highway Segment	Total Multiple Vehicle Crashes	59.34	17.6	116.51	34.5	175.85	52.1
Highway Segment	Total Highway Segment Crashes	121.00	35.8	216.57	64.2	337.58	100.0
	Total Crashes	121.00	35.8	216.57	64.2	337.58	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 12. Predicted Exit Speed Change Lane Crash Type Distribution (Speed Change)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.00	0.0	0.33	0.5	0.33	0.5
Highway Segment	Collision with Fixed Object	3.74	5.6	9.86	14.8	13.60	20.4
Highway Segment	Collision with Other Object	0.31	0.5	1.43	2.1	1.73	2.6
Highway Segment	Other Single-vehicle Collision	0.94	1.4	1.09	1.6	2.03	3.0
Highway Segment	Collision with Parked Vehicle	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Total Single Vehicle Crashes	4.98	7.5	12.71	19.1	17.70	26.5
Highway Segment	Right-Angle Collision	0.21	0.3	0.57	0.9	0.78	1.2
Highway Segment	Head-on Collision	0.10	0.1	0.10	0.1	0.19	0.3
Highway Segment	Other Multi-vehicle Collision	0.31	0.5	0.76	1.1	1.07	1.6
Highway Segment	Rear-end Collision	10.48	15.7	26.90	40.3	37.38	56.0
Highway Segment	Sideswipe, Same Direction Collision	3.02	4.5	6.57	9.8	9.59	14.4
Highway Segment	Total Multiple Vehicle Crashes	14.11	21.2	34.90	52.3	49.01	73.5
Highway Segment	Total Highway Segment Crashes	19.09	28.6	47.61	71.4	66.70	100.0
	Total Crashes	19.09	28.6	47.61	71.4	66.70	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 13. Predicted Entrance Speed Change Lane Crash Type Distribution (Speed Change)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.00	0.0	0.17	0.1	0.17	0.1
Highway Segment	Collision with Fixed Object	7.07	5.9	10.69	9.0	17.76	14.9
Highway Segment	Collision with Other Object	0.69	0.6	2.98	2.5	3.68	3.1
Highway Segment	Other Single-vehicle Collision	2.44	2.0	1.33	1.1	3.77	3.2
Highway Segment	Collision with Parked Vehicle	0.15	0.1	0.25	0.2	0.39	0.3
Highway Segment	Total Single Vehicle Crashes	10.35	8.7	15.42	12.9	25.76	21.6
Highway Segment	Right-Angle Collision	0.69	0.6	1.33	1.1	2.02	1.7
Highway Segment	Head-on Collision	0.15	0.1	0.08	0.1	0.23	0.2
Highway Segment	Other Multi-vehicle Collision	0.62	0.5	1.24	1.0	1.86	1.6
Highway Segment	Rear-end Collision	19.78	16.6	43.94	36.8	63.72	53.4
Highway Segment	Sideswipe, Same Direction Collision	4.84	4.1	20.89	17.5	25.73	21.6
Highway Segment	Total Multiple Vehicle Crashes	26.08	21.9	67.48	56.5	93.56	78.4
Highway Segment	Total Highway Segment Crashes	36.43	30.5	82.90	69.5	119.33	100.0
	Total Crashes	36.43	30.5	82.90	69.5	119.33	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 14. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
38+44.179	54+27.826	for segment #6 (38+44.179 to 54+27.826), Freeway Segment of type Five-lane Freeway is using unbalanced lane processing with types Four-lane Freeway and Six-lane Freeway
54+27.826	65+13.782	for segment #8 (54+27.826 to 65+13.782), Freeway Segment of type Five-lane Freeway is using unbalanced lane processing with types Four-lane Freeway and Six-lane Freeway
42+27.826	54+27.826	for segment #7 (42+27.826 to 54+27.826), Speed Change Segment of type Five-lane Freeway Speed Change is using unbalanced lane processing with types Four-lane Freeway Speed Change and Six-lane Freeway Speed Change

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

May 2, 2019

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Table of Contents

List of Tables

List of Figures

Report Overview

Report Generated: May 2, 2019 1:55 PM
Report Template: System: Single Page [System] (mlcpm3, Apr 10, 2019 1:31 PM)

Evaluation Date: Thu May 02 13:55:34 CDT 2019
IHSDM Version: v14.1.0 (Mar 12, 2019)
Crash Prediction Module: v9.1.0 (Mar 12, 2019)

User Name: jdanibas
Organization Name:
Phone:
E-Mail:

Project Title: I-229 Exit 4 (Cliff Ave) - Alternative 1
Project Comment: Created Tue Apr 16 14:58:43 CDT 2019
Project Unit System: U.S. Customary

Highway Title: Alt 1 - NB Exit
Highway Comment: Created Thu Apr 18 09:26:49 CDT 2019
Highway Version: 1

Evaluation Title: Evaluation 1
Evaluation Comment: Created Thu May 02 13:55:23 CDT 2019

Minimum Location: 0.000
Maximum Location: 12+35.089
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2024
Last Year of Analysis: 2050
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Section Types

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 12+35.089
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp
Calibration Factor: EX_RAMP_MV_FI=1.0; EX_RAMP_MV_PDO=1.0; EX_RAMP_SV_FI=1.0; EX_RAMP_SV_PDO=1.0;

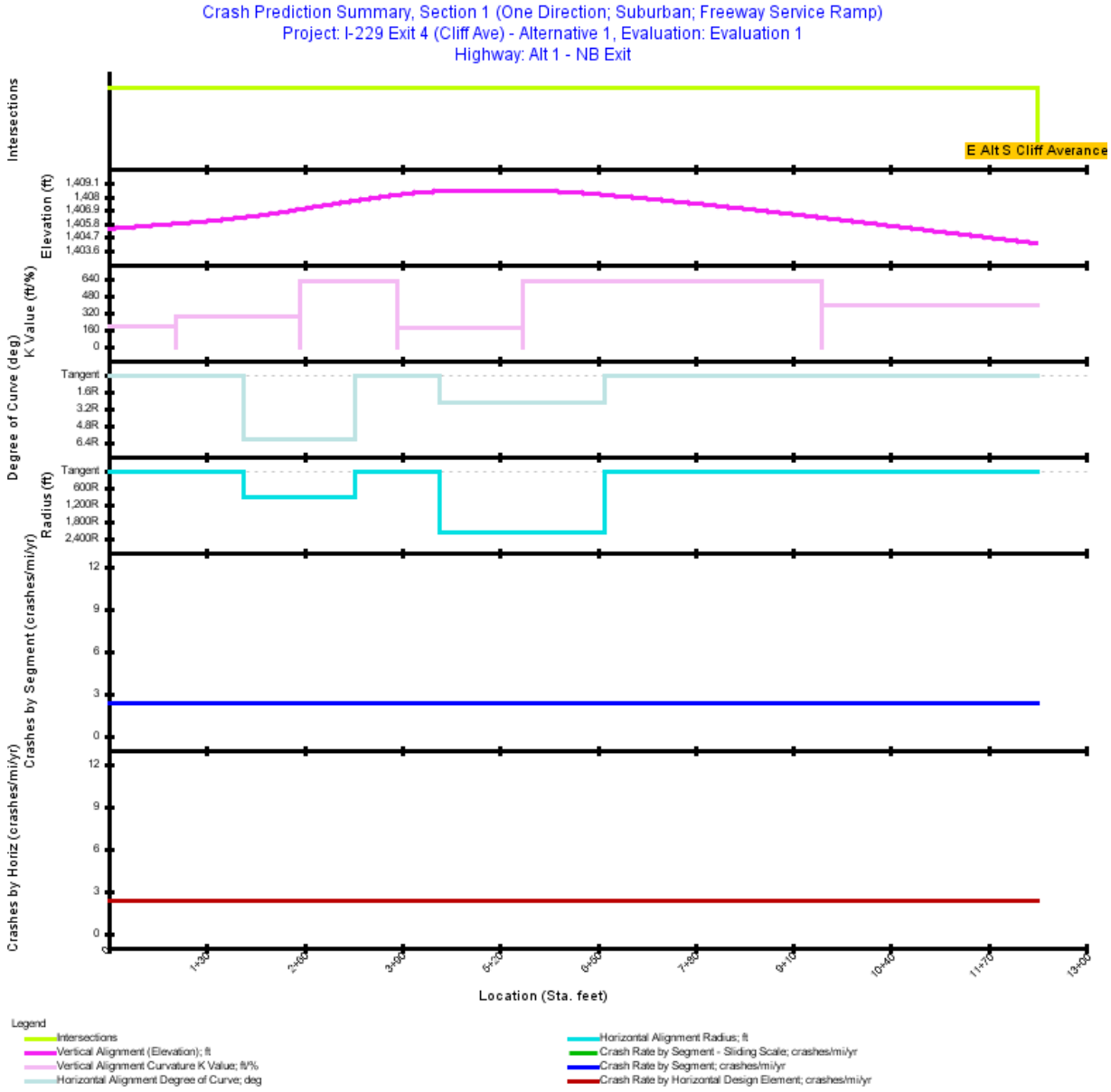

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT
1	1EX	Urban	0.000	12+35.089	1,235.09	0.2339	2024: 6,810; 2025: 6,897; 2026: 6,984; 2027: 7,071; 2028: 7,158; 2029: 7,244; 2030: 7,331; 2031: 7,418; 2032: 7,505; 2033: 7,592; 2034: 7,679; 2035: 7,766; 2036: 7,853; 2037: 7,940; 2038: 8,027; 2039: 8,114; 2040: 8,200; 2041: 8,287; 2042: 8,374; 2043: 8,461; 2044: 8,548; 2045: 8,635; 2046: 8,722; 2047: 8,809; 2048: 8,896; 2049: 8,983; 2050: 9,070

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Evaluated Length (mi)	**0.2339**
Average Future Road AADT (vpd)	**7,940**
Predicted Crashes	
Total Crashes	**14.93**
Fatal and Injury Crashes	**7.42**
Property-Damage-Only Crashes	**7.52**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**50**
Percent Property-Damage-Only Crashes (%)	**50**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**2.3643**
FI Crash Rate (crashes/mi/yr)	**1.1742**
PDO Crash Rate (crashes/mi/yr)	**1.1901**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**18.30**
Travel Crash Rate (crashes/million veh-mi)	**0.82**
Travel FI Crash Rate (crashes/million veh-mi)	**0.40**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.41**

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	12+35.089	0.2339	14.933	0.5531	0.2747	0.2784	2.3643	0.82
Total			0.2339	14.933	0.5531	0.2747	0.2784	2.3643	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	0.000	1+79.049	0.0339	2.165	0.0802	0.0398	0.0404	2.3643	0.82
Simple Curve 1	1+79.049	3+27.727	0.0282	1.798	0.0666	0.0331	0.0335	2.3643	0.82
Tangent	3+27.727	4+39.651	0.0212	1.353	0.0501	0.0249	0.0252	2.3643	0.82
Simple Curve 2	4+39.651	6+59.841	0.0417	2.662	0.0986	0.0490	0.0496	2.3643	0.82
Tangent	6+59.841	12+35.089	0.1089	6.955	0.2576	0.1279	0.1297	2.3643	0.82

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2024	0.49	0.25	49.706	0.25	50.294
2025	0.50	0.25	49.702	0.25	50.298
2026	0.50	0.25	49.699	0.25	50.301
2027	0.51	0.25	49.696	0.26	50.304
2028	0.51	0.26	49.692	0.26	50.308
2029	0.52	0.26	49.689	0.26	50.311
2030	0.52	0.26	49.686	0.26	50.314
2031	0.53	0.26	49.682	0.27	50.318
2032	0.53	0.26	49.679	0.27	50.321
2033	0.54	0.27	49.676	0.27	50.324
2034	0.54	0.27	49.673	0.27	50.327
2035	0.54	0.27	49.670	0.27	50.330
2036	0.55	0.27	49.667	0.28	50.333
2037	0.55	0.28	49.664	0.28	50.336
2038	0.56	0.28	49.661	0.28	50.339
2039	0.56	0.28	49.658	0.28	50.342
2040	0.57	0.28	49.655	0.28	50.345
2041	0.57	0.28	49.652	0.29	50.348
2042	0.58	0.29	49.649	0.29	50.351
2043	0.58	0.29	49.646	0.29	50.354
2044	0.58	0.29	49.643	0.29	50.357
2045	0.59	0.29	49.640	0.30	50.360
2046	0.59	0.29	49.638	0.30	50.362
2047	0.60	0.30	49.635	0.30	50.365
2048	0.60	0.30	49.632	0.30	50.368
2049	0.61	0.30	49.629	0.30	50.371
2050	0.61	0.30	49.627	0.31	50.373
Total	14.93	7.42	49.663	7.52	50.337
Average	0.55	0.28	49.663	0.28	50.337

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.2316	0.7022	2.9197	3.5625	7.5166

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.03	0.2	0.15	1.0	0.18	1.2
Highway Segment	Collision with Fixed Object	5.15	34.5	4.87	32.6	10.02	67.1
Highway Segment	Collision with Other Object	0.36	2.4	0.94	6.3	1.31	8.8
Highway Segment	Other Single-vehicle Collision	1.48	9.9	0.73	4.9	2.21	14.8
Highway Segment	Collision with Parked Vehicle	0.11	0.7	0.11	0.7	0.22	1.4
Highway Segment	Total Single Vehicle Crashes	7.13	47.8	6.80	45.5	13.93	93.3
Highway Segment	Right-Angle Collision	0.01	0.1	0.01	0.1	0.02	0.1
Highway Segment	Head-on Collision	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Other Multi-vehicle Collision	0.01	0.1	0.02	0.1	0.03	0.2
Highway Segment	Rear-end Collision	0.21	1.4	0.49	3.3	0.71	4.7
Highway Segment	Sideswipe, Same Direction Collision	0.05	0.3	0.19	1.3	0.24	1.6
Highway Segment	Total Multiple Vehicle Crashes	0.28	1.9	0.72	4.8	1.00	6.7
Highway Segment	Total Highway Segment Crashes	7.42	49.7	7.52	50.3	14.93	100.0
	Total Crashes	7.42	49.7	7.52	50.3	14.93	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
0.000	12+35.089	for segment #1 (0.000 to 12+35.089), The ramp type for Ramp Alt 1 - NB Exit is set at the Ramp Connection (Exit) and in the Ramp (Exit). The Ramp value takes precedence.
0.000	12+35.089	for segment #1 (0.000 to 12+35.089), Left shoulder width (1.0 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

April 25, 2019

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Table of Contents

List of Tables

List of Figures

Report Overview

Report Generated: Apr 25, 2019 10:42 AM
Report Template: System: Single Page [System] (mlcpm3, Apr 10, 2019 1:31 PM)

Evaluation Date: Thu Apr 25 10:42:00 CDT 2019
IHSDM Version: v14.1.0 (Mar 12, 2019)
Crash Prediction Module: v9.1.0 (Mar 12, 2019)

User Name: jdanibas
Organization Name:
Phone:
E-Mail:

Project Title: I-229 Exit 4 (Cliff Ave) - Alternative 1
Project Comment: Created Tue Apr 16 14:58:43 CDT 2019
Project Unit System: U.S. Customary

Highway Title: Alt 1 - SB Entrance
Highway Comment: Created Tue Apr 23 15:43:56 CDT 2019
Highway Version: 1

Evaluation Title: Evaluation 1
Evaluation Comment: Created Thu Apr 25 10:41:52 CDT 2019

Minimum Location: 0.000
Maximum Location: 15+27.898
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2024
Last Year of Analysis: 2050
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Section Types

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 15+27.898
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp
Calibration Factor: ENT_RAMP_MV_FI=1.0; ENT_RAMP_MV_PDO=1.0; ENT_RAMP_SV_FI=1.0; ENT_RAMP_SV_PDO=1.0;

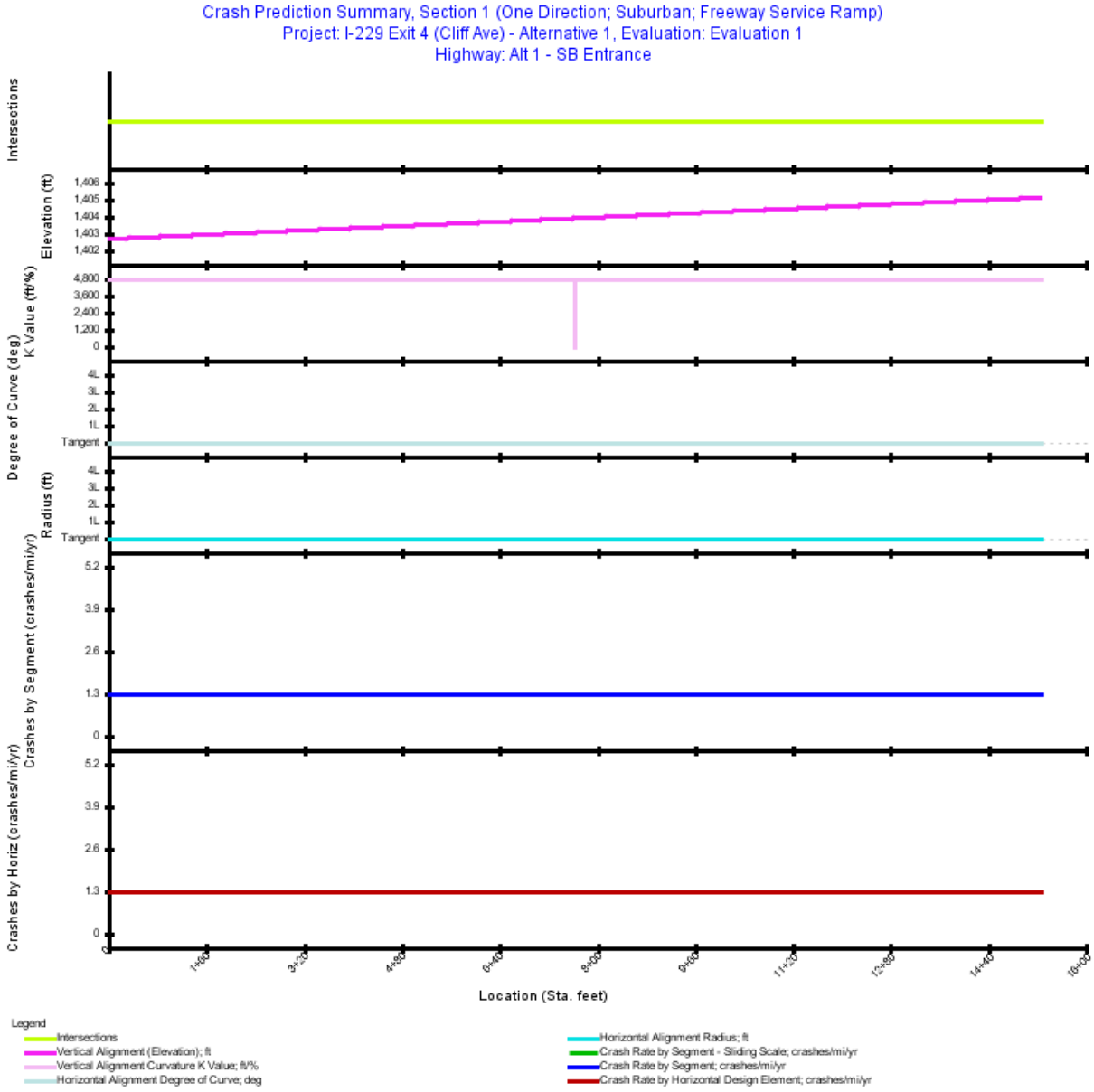

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT
1	1EN	Urban	0.000	15+27.898	1,527.90	0.2894	2024: 3,943; 2025: 3,977; 2026: 4,012; 2027: 4,047; 2028: 4,081; 2029: 4,116; 2030: 4,151; 2031: 4,185; 2032: 4,220; 2033: 4,255; 2034: 4,290; 2035: 4,324; 2036: 4,359; 2037: 4,394; 2038: 4,428; 2039: 4,463; 2040: 4,498; 2041: 4,532; 2042: 4,567; 2043: 4,602; 2044: 4,636; 2045: 4,671; 2046: 4,706; 2047: 4,740; 2048: 4,775; 2049: 4,810; 2050: 4,845

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Evaluated Length (mi)	**0.2894**
Average Future Road AADT (vpd)	**4,394**
Predicted Crashes	
Total Crashes	**9.97**
Fatal and Injury Crashes	**4.71**
Property-Damage-Only Crashes	**5.26**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**47**
Percent Property-Damage-Only Crashes (%)	**53**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**1.2766**
FI Crash Rate (crashes/mi/yr)	**0.6028**
PDO Crash Rate (crashes/mi/yr)	**0.6737**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**12.53**
Travel Crash Rate (crashes/million veh-mi)	**0.80**
Travel FI Crash Rate (crashes/million veh-mi)	**0.38**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.42**

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	15+27.898	0.2894	9.974	0.3694	0.1744	0.1950	1.2766	0.80
Total			0.2894	9.974	0.3694	0.1744	0.1950	1.2766	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	0.000	15+27.898	0.2894	9.974	0.3694	0.1744	0.1950	1.2766	0.80

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2024	0.34	0.16	47.427	0.18	52.573
2025	0.34	0.16	47.411	0.18	52.589
2026	0.34	0.16	47.395	0.18	52.605
2027	0.35	0.16	47.378	0.18	52.622
2028	0.35	0.17	47.363	0.18	52.637
2029	0.35	0.17	47.346	0.18	52.654
2030	0.35	0.17	47.331	0.19	52.669
2031	0.36	0.17	47.315	0.19	52.685
2032	0.36	0.17	47.300	0.19	52.700
2033	0.36	0.17	47.284	0.19	52.716
2034	0.36	0.17	47.269	0.19	52.731
2035	0.36	0.17	47.254	0.19	52.746
2036	0.37	0.17	47.239	0.19	52.761
2037	0.37	0.17	47.223	0.20	52.777
2038	0.37	0.17	47.209	0.20	52.791
2039	0.37	0.18	47.194	0.20	52.806
2040	0.38	0.18	47.179	0.20	52.821
2041	0.38	0.18	47.165	0.20	52.835
2042	0.38	0.18	47.151	0.20	52.849
2043	0.38	0.18	47.136	0.20	52.864
2044	0.39	0.18	47.123	0.20	52.877
2045	0.39	0.18	47.108	0.20	52.892
2046	0.39	0.18	47.094	0.21	52.906
2047	0.39	0.18	47.081	0.21	52.919
2048	0.39	0.19	47.067	0.21	52.933
2049	0.40	0.19	47.054	0.21	52.946
2050	0.40	0.19	47.040	0.21	52.960
Total	9.97	4.71	47.222	5.26	52.778
Average	0.37	0.17	47.222	0.20	52.778

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.1004	0.3046	1.9390	2.3659	5.2641

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.01	0.2	0.09	0.9	0.11	1.1
Highway Segment	Collision with Fixed Object	2.79	28.0	2.94	29.5	5.73	57.4
Highway Segment	Collision with Other Object	0.20	2.0	0.57	5.7	0.77	7.7
Highway Segment	Other Single-vehicle Collision	0.80	8.1	0.44	4.4	1.24	12.5
Highway Segment	Collision with Parked Vehicle	0.06	0.6	0.07	0.7	0.12	1.2
Highway Segment	Total Single Vehicle Crashes	3.86	38.7	4.10	41.1	7.97	79.9
Highway Segment	Right-Angle Collision	0.03	0.3	0.02	0.2	0.05	0.5
Highway Segment	Head-on Collision	0.01	0.1	0.00	0.0	0.01	0.1
Highway Segment	Other Multi-vehicle Collision	0.03	0.3	0.03	0.3	0.05	0.5
Highway Segment	Rear-end Collision	0.64	6.4	0.80	8.0	1.44	14.4
Highway Segment	Sideswipe, Same Direction Collision	0.15	1.5	0.31	3.1	0.46	4.6
Highway Segment	Total Multiple Vehicle Crashes	0.85	8.5	1.16	11.6	2.01	20.1
Highway Segment	Total Highway Segment Crashes	4.71	47.2	5.26	52.8	9.97	100.0
	Total Crashes	4.71	47.2	5.26	52.8	9.97	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
0.000	15+27.898	for segment #1 (0.000 to 15+27.898), The ramp type for Ramp Alt 1 - SB Entrance is set at the Ramp Connection (Entrance) and in the Ramp (Entrance). The Ramp value takes precedence.
0.000	15+27.898	for segment #1 (0.000 to 15+27.898), Left shoulder width (1.0 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

April 25, 2019

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Table of Contents

List of Tables

List of Figures

Report Overview

Report Generated: Apr 25, 2019 10:39 AM
Report Template: System: Single Page [System] (mlcpm3, Apr 10, 2019 1:31 PM)

Evaluation Date: Thu Apr 25 10:39:32 CDT 2019
IHSDM Version: v14.1.0 (Mar 12, 2019)
Crash Prediction Module: v9.1.0 (Mar 12, 2019)

User Name: jdanibas
Organization Name:
Phone:
E-Mail:

Project Title: I-229 Exit 4 (Cliff Ave) - Alternative 1
Project Comment: Created Tue Apr 16 14:58:43 CDT 2019
Project Unit System: U.S. Customary

Highway Title: Alt 1 - SB Exit
Highway Comment: Created Thu Apr 18 09:41:36 CDT 2019
Highway Version: 2

Evaluation Title: Evaluation 1
Evaluation Comment: Created Thu Apr 25 10:39:21 CDT 2019

Minimum Location: 0.000
Maximum Location: 18+32.306
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2024
Last Year of Analysis: 2050
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Section Types

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 18+32.306
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp
Calibration Factor: EX_RAMP_MV_FI=1.0; EX_RAMP_MV_PDO=1.0; EX_RAMP_SV_FI=1.0; EX_RAMP_SV_PDO=1.0;

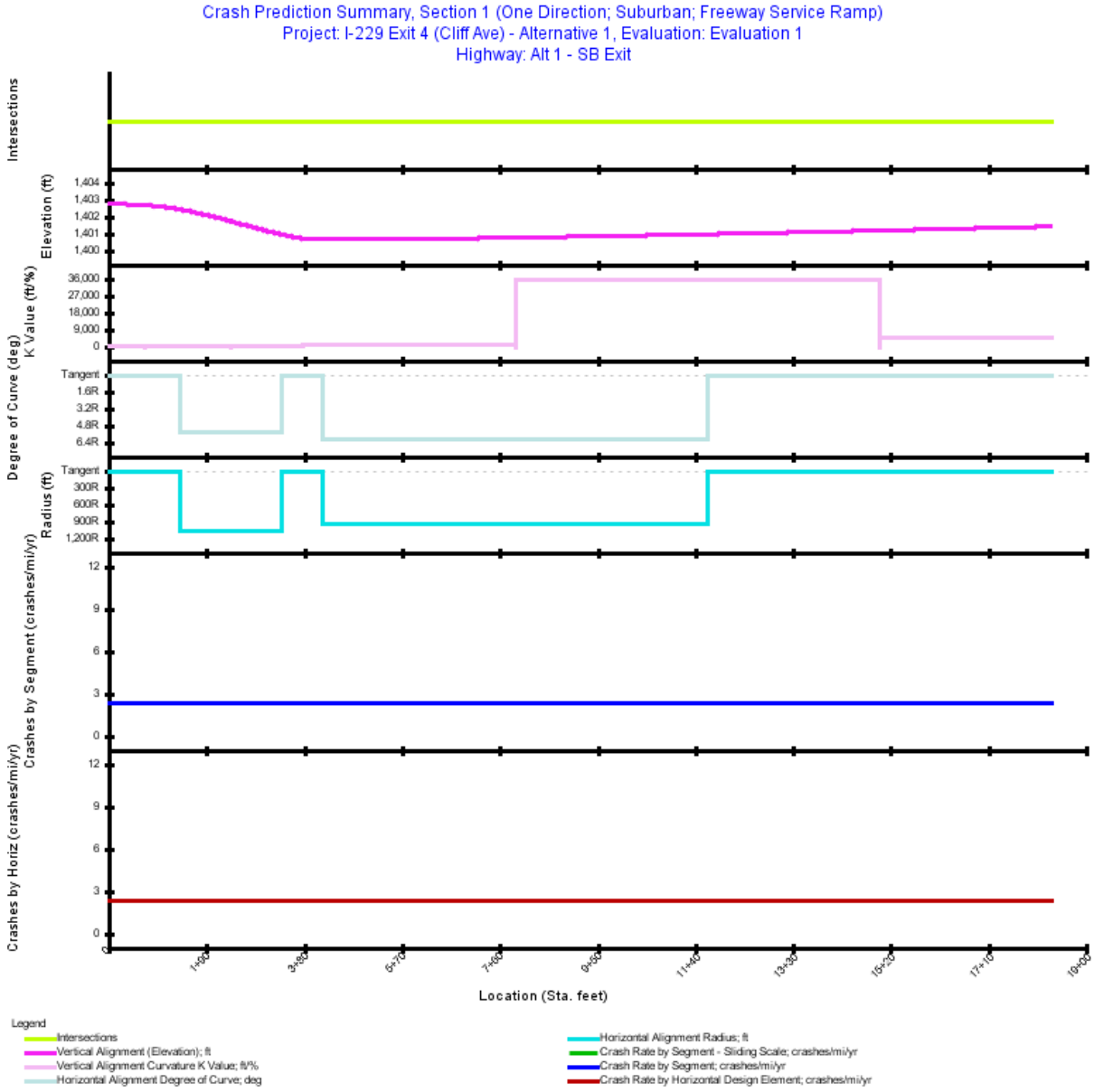

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT
1	1EX	Urban	0.000	18+32.306	1,832.31	0.3470	2024: 4,447; 2025: 4,577; 2026: 4,706; 2027: 4,836; 2028: 4,966; 2029: 5,095; 2030: 5,225; 2031: 5,355; 2032: 5,485; 2033: 5,614; 2034: 5,744; 2035: 5,874; 2036: 6,003; 2037: 6,133; 2038: 6,263; 2039: 6,393; 2040: 6,522; 2041: 6,652; 2042: 6,782; 2043: 6,911; 2044: 7,041; 2045: 7,171; 2046: 7,301; 2047: 7,430; 2048: 7,560; 2049: 7,690; 2050: 7,820

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Evaluated Length (mi)	**0.3470**
Average Future Road AADT (vpd)	**6,133**
Predicted Crashes	
Total Crashes	**21.73**
Fatal and Injury Crashes	**10.64**
Property-Damage-Only Crashes	**11.09**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**49**
Percent Property-Damage-Only Crashes (%)	**51**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**2.3196**
FI Crash Rate (crashes/mi/yr)	**1.1356**
PDO Crash Rate (crashes/mi/yr)	**1.1840**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**20.98**
Travel Crash Rate (crashes/million veh-mi)	**1.04**
Travel FI Crash Rate (crashes/million veh-mi)	**0.51**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.53**

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	18+32.306	0.3470	21.734	0.8050	0.3941	0.4109	2.3196	1.04
Total			0.3470	21.734	0.8050	0.3941	0.4109	2.3196	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	0.000	1+37.512	0.0260	1.631	0.0604	0.0296	0.0308	2.3196	1.04
Simple Curve 1	1+37.512	3+36.954	0.0378	2.366	0.0876	0.0429	0.0447	2.3196	1.04
Tangent	3+36.954	4+14.815	0.0147	0.924	0.0342	0.0167	0.0175	2.3196	1.04
Simple Curve 2	4+14.815	11+64.761	0.1420	8.896	0.3295	0.1613	0.1682	2.3196	1.04
Tangent	11+64.761	18+32.306	0.1264	7.918	0.2933	0.1436	0.1497	2.3196	1.04

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2024	0.64	0.31	48.986	0.33	51.014
2025	0.65	0.32	48.984	0.33	51.016
2026	0.67	0.33	48.983	0.34	51.017
2027	0.68	0.33	48.981	0.35	51.019
2028	0.69	0.34	48.980	0.35	51.020
2029	0.70	0.34	48.978	0.36	51.022
2030	0.72	0.35	48.976	0.37	51.024
2031	0.73	0.36	48.974	0.37	51.026
2032	0.74	0.36	48.972	0.38	51.028
2033	0.76	0.37	48.970	0.39	51.030
2034	0.77	0.38	48.968	0.39	51.032
2035	0.78	0.38	48.965	0.40	51.035
2036	0.79	0.39	48.963	0.41	51.037
2037	0.81	0.40	48.961	0.41	51.039
2038	0.82	0.40	48.959	0.42	51.041
2039	0.83	0.41	48.957	0.42	51.043
2040	0.84	0.41	48.954	0.43	51.046
2041	0.86	0.42	48.952	0.44	51.048
2042	0.87	0.42	48.950	0.44	51.050
2043	0.88	0.43	48.948	0.45	51.052
2044	0.89	0.44	48.945	0.46	51.055
2045	0.90	0.44	48.943	0.46	51.057
2046	0.92	0.45	48.941	0.47	51.059
2047	0.93	0.45	48.939	0.47	51.061
2048	0.94	0.46	48.936	0.48	51.064
2049	0.95	0.47	48.934	0.49	51.066
2050	0.96	0.47	48.932	0.49	51.068
Total	21.73	10.64	48.958	11.09	51.042
Average	0.81	0.39	48.958	0.41	51.042

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.3323	1.0075	4.1892	5.1116	11.0934

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.04	0.2	0.23	1.0	0.27	1.2
Highway Segment	Collision with Fixed Object	7.43	34.2	7.37	33.9	14.80	68.1
Highway Segment	Collision with Other Object	0.53	2.4	1.43	6.6	1.96	9.0
Highway Segment	Other Single-vehicle Collision	2.14	9.9	1.10	5.1	3.24	14.9
Highway Segment	Collision with Parked Vehicle	0.15	0.7	0.17	0.8	0.32	1.5
Highway Segment	Total Single Vehicle Crashes	10.30	47.4	10.29	47.3	20.59	94.7
Highway Segment	Right-Angle Collision	0.01	0.0	0.01	0.1	0.03	0.1
Highway Segment	Head-on Collision	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Other Multi-vehicle Collision	0.01	0.0	0.02	0.1	0.03	0.1
Highway Segment	Rear-end Collision	0.26	1.2	0.55	2.5	0.81	3.7
Highway Segment	Sideswipe, Same Direction Collision	0.06	0.3	0.21	1.0	0.28	1.3
Highway Segment	Total Multiple Vehicle Crashes	0.34	1.6	0.80	3.7	1.15	5.3
Highway Segment	Total Highway Segment Crashes	10.64	49.0	11.09	51.0	21.73	100.0
	Total Crashes	10.64	49.0	11.09	51.0	21.73	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
0.000	18+32.306	for segment #1 (0.000 to 18+32.306), The ramp type for Ramp Alt 1 - SB Exit is set at the Ramp Connection (Exit) and in the Ramp (Exit). The Ramp value takes precedence.
0.000	18+32.306	for segment #1 (0.000 to 18+32.306), Left shoulder width (1.0 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

April 25, 2019

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Table of Contents

List of Tables

List of Figures

Report Overview

Report Generated: Apr 25, 2019 10:40 AM
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Evaluation Date: Thu Apr 25 10:40:48 CDT 2019
IHSDM Version: v14.1.0 (Mar 12, 2019)
Crash Prediction Module: v9.1.0 (Mar 12, 2019)

User Name: jdanibas
Organization Name:
Phone:
E-Mail:

Project Title: I-229 Exit 4 (Cliff Ave) - Alternative 1
Project Comment: Created Tue Apr 16 14:58:43 CDT 2019
Project Unit System: U.S. Customary

Highway Title: Alt 1 - SB Loop Ramp
Highway Comment: Created Tue Apr 23 15:39:08 CDT 2019
Highway Version: 1

Evaluation Title: Evaluation 1
Evaluation Comment: Created Thu Apr 25 10:40:36 CDT 2019

Minimum Location: 0.000
Maximum Location: 9+30.464
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2024
Last Year of Analysis: 2050
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Section Types

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 9+30.464
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp
Calibration Factor: ENT_RAMP_MV_FI=1.0; ENT_RAMP_MV_PDO=1.0; ENT_RAMP_SV_FI=1.0; ENT_RAMP_SV_PDO=1.0;

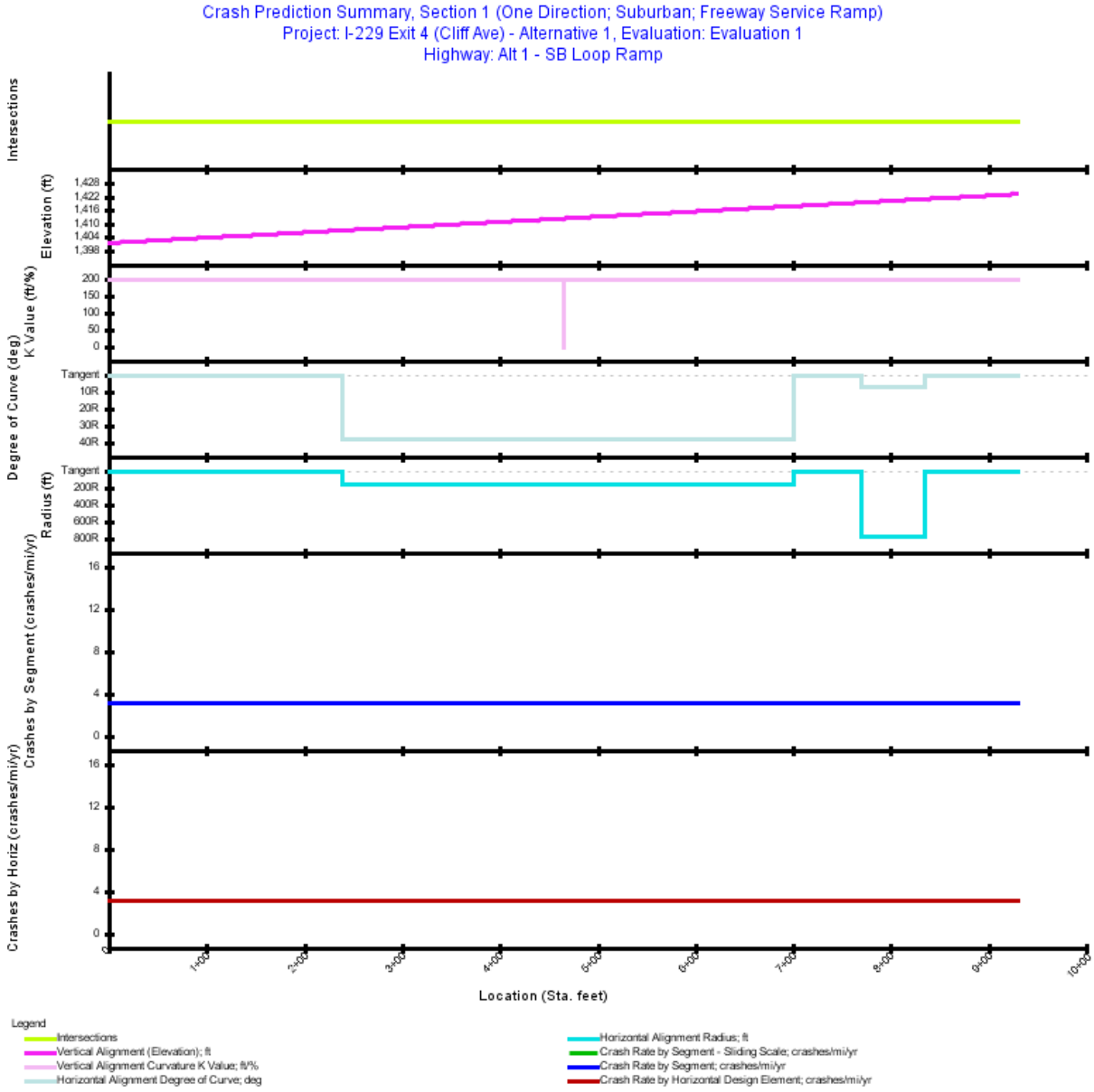

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT
1	1EN	Urban	0.000	9+30.464	930.46	0.1762	2024: 2,835; 2025: 2,861; 2026: 2,886; 2027: 2,911; 2028: 2,936; 2029: 2,961; 2030: 2,986; 2031: 3,012; 2032: 3,037; 2033: 3,062; 2034: 3,087; 2035: 3,112; 2036: 3,137; 2037: 3,162; 2038: 3,188; 2039: 3,213; 2040: 3,238; 2041: 3,263; 2042: 3,288; 2043: 3,313; 2044: 3,339; 2045: 3,364; 2046: 3,389; 2047: 3,414; 2048: 3,439; 2049: 3,464; 2050: 3,490

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Evaluated Length (mi)	**0.1762**
Average Future Road AADT (vpd)	**3,162**
Predicted Crashes	
Total Crashes	**14.92**
Fatal and Injury Crashes	**6.58**
Property-Damage-Only Crashes	**8.34**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**44**
Percent Property-Damage-Only Crashes (%)	**56**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**3.1353**
FI Crash Rate (crashes/mi/yr)	**1.3825**
PDO Crash Rate (crashes/mi/yr)	**1.7528**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**5.49**
Travel Crash Rate (crashes/million veh-mi)	**2.72**
Travel FI Crash Rate (crashes/million veh-mi)	**1.20**
Travel PDO Crash Rate (crashes/million veh-mi)	**1.52**

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	9+30.464	0.1762	14.918	0.5525	0.2436	0.3089	3.1353	2.72
Total			0.1762	14.918	0.5525	0.2436	0.3089	3.1353	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	0.000	2+39.321	0.0453	3.837	0.1421	0.0627	0.0794	3.1353	2.72
Simple Curve 1	2+39.321	7+01.066	0.0875	7.403	0.2742	0.1209	0.1533	3.1353	2.72
Tangent	7+01.066	7+70.359	0.0131	1.111	0.0411	0.0181	0.0230	3.1353	2.72
Simple Curve 2	7+70.359	8+35.251	0.0123	1.040	0.0385	0.0170	0.0215	3.1353	2.72
Tangent	8+35.251	9+30.464	0.0180	1.526	0.0565	0.0249	0.0316	3.1353	2.72

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2024	0.51	0.23	44.136	0.28	55.864
2025	0.51	0.23	44.132	0.29	55.868
2026	0.52	0.23	44.129	0.29	55.871
2027	0.52	0.23	44.126	0.29	55.874
2028	0.52	0.23	44.123	0.29	55.877
2029	0.53	0.23	44.119	0.29	55.881
2030	0.53	0.23	44.116	0.30	55.884
2031	0.53	0.23	44.113	0.30	55.887
2032	0.54	0.24	44.110	0.30	55.890
2033	0.54	0.24	44.106	0.30	55.894
2034	0.54	0.24	44.103	0.30	55.897
2035	0.55	0.24	44.100	0.30	55.900
2036	0.55	0.24	44.097	0.31	55.903
2037	0.55	0.24	44.094	0.31	55.906
2038	0.56	0.24	44.091	0.31	55.909
2039	0.56	0.25	44.088	0.31	55.912
2040	0.56	0.25	44.085	0.31	55.915
2041	0.56	0.25	44.082	0.32	55.918
2042	0.57	0.25	44.079	0.32	55.921
2043	0.57	0.25	44.076	0.32	55.924
2044	0.57	0.25	44.073	0.32	55.927
2045	0.58	0.26	44.070	0.32	55.930
2046	0.58	0.26	44.067	0.33	55.933
2047	0.58	0.26	44.065	0.33	55.935
2048	0.59	0.26	44.062	0.33	55.938
2049	0.59	0.26	44.059	0.33	55.941
2050	0.59	0.26	44.056	0.33	55.944
Total	14.92	6.58	44.094	8.34	55.906
Average	0.55	0.24	44.094	0.31	55.906

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.1403	0.4254	2.7080	3.3043	8.3401

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.02	0.2	0.17	1.1	0.19	1.3
Highway Segment	Collision with Fixed Object	4.26	28.6	5.47	36.7	9.73	65.2
Highway Segment	Collision with Other Object	0.30	2.0	1.06	7.1	1.36	9.1
Highway Segment	Other Single-vehicle Collision	1.23	8.2	0.82	5.5	2.04	13.7
Highway Segment	Collision with Parked Vehicle	0.09	0.6	0.12	0.8	0.21	1.4
Highway Segment	Total Single Vehicle Crashes	5.90	39.5	7.64	51.2	13.54	90.8
Highway Segment	Right-Angle Collision	0.02	0.1	0.01	0.1	0.03	0.2
Highway Segment	Head-on Collision	0.01	0.0	0.00	0.0	0.01	0.0
Highway Segment	Other Multi-vehicle Collision	0.02	0.1	0.02	0.1	0.04	0.3
Highway Segment	Rear-end Collision	0.51	3.4	0.48	3.2	0.99	6.6
Highway Segment	Sideswipe, Same Direction Collision	0.12	0.8	0.19	1.2	0.31	2.1
Highway Segment	Total Multiple Vehicle Crashes	0.68	4.5	0.70	4.7	1.38	9.2
Highway Segment	Total Highway Segment Crashes	6.58	44.1	8.34	55.9	14.92	100.0
	Total Crashes	6.58	44.1	8.34	55.9	14.92	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
0.000	9+30.464	for segment #1 (0.000 to 9+30.464), The ramp type for Ramp Alt 1 - SB Loop Ramp is set at the Ramp Connection (Entrance) and in the Ramp (Entrance). The Ramp value takes precedence.
0.000	9+30.464	for segment #1 (0.000 to 9+30.464), Left shoulder width (1.0 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

April 25, 2019

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Table of Contents

List of Tables

List of Figures

Report Overview

Report Generated: Apr 25, 2019 10:38 AM
Report Template: System: Single Page [System] (mlcpm3, Apr 10, 2019 1:31 PM)

Evaluation Date: Thu Apr 25 10:38:35 CDT 2019
IHSDM Version: v14.1.0 (Mar 12, 2019)
Crash Prediction Module: v9.1.0 (Mar 12, 2019)

User Name: jdanibas
Organization Name:
Phone:
E-Mail:

Project Title: I-229 Exit 4 (Cliff Ave) - Alternative 1
Project Comment: Created Tue Apr 16 14:58:43 CDT 2019
Project Unit System: U.S. Customary

Highway Title: Alt 1 - NB Entrance
Highway Comment: Created Thu Apr 18 09:36:04 CDT 2019
Highway Version: 1

Evaluation Title: Evaluation 1
Evaluation Comment: Created Thu Apr 25 10:38:24 CDT 2019

Minimum Location: 0.000
Maximum Location: 15+58.698
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2024
Last Year of Analysis: 2050
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Section Types

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 15+58.698
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp
Calibration Factor: ENT_RAMP_MV_FI=1.0; ENT_RAMP_MV_PDO=1.0; ENT_RAMP_SV_FI=1.0; ENT_RAMP_SV_PDO=1.0;

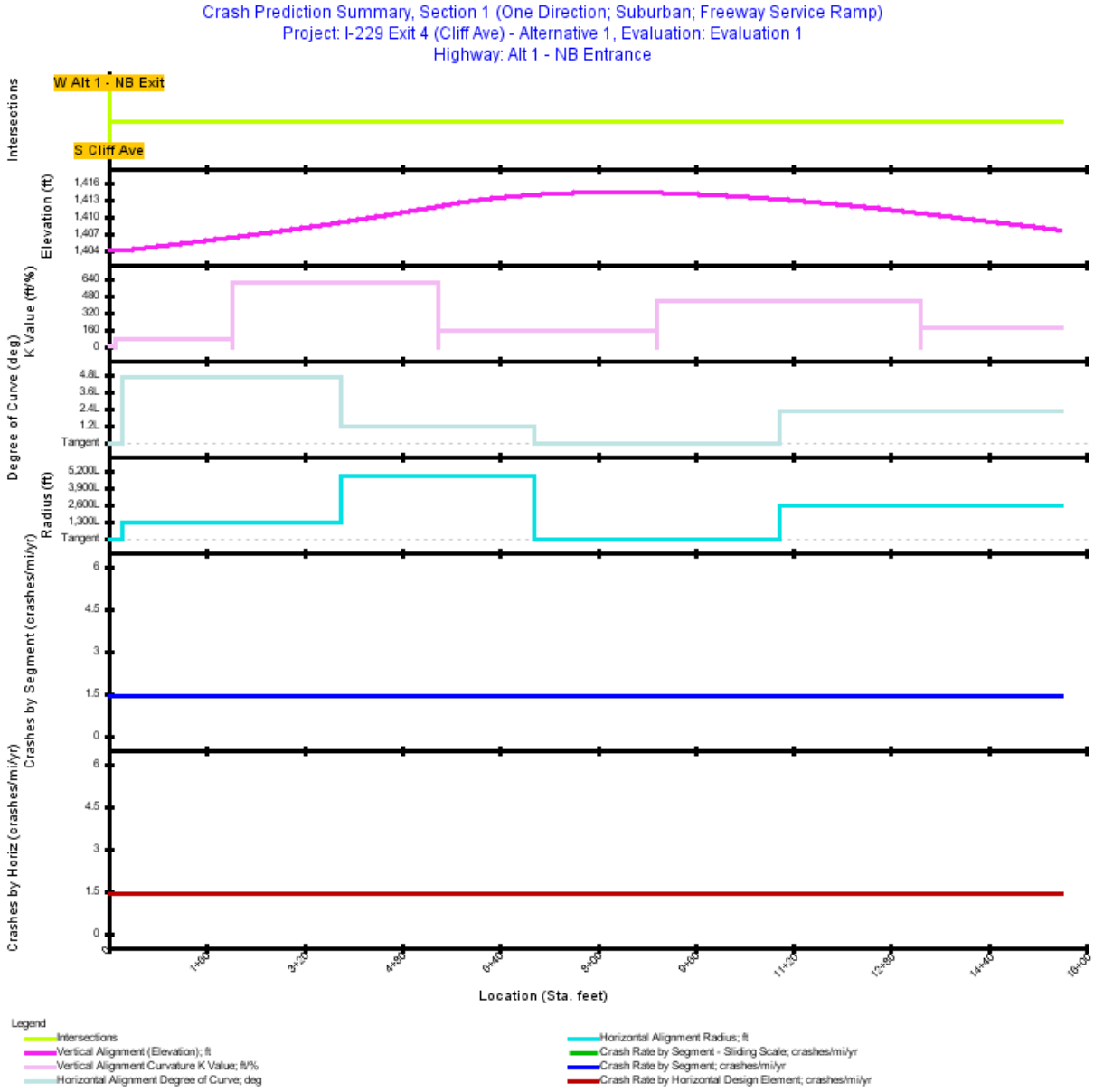

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT
1	1EN	Urban	0.000	15+58.698	1,558.70	0.2952	2024: 4,091; 2025: 4,128; 2026: 4,165; 2027: 4,201; 2028: 4,238; 2029: 4,275; 2030: 4,312; 2031: 4,349; 2032: 4,386; 2033: 4,423; 2034: 4,460; 2035: 4,496; 2036: 4,533; 2037: 4,570; 2038: 4,607; 2039: 4,644; 2040: 4,681; 2041: 4,718; 2042: 4,755; 2043: 4,791; 2044: 4,828; 2045: 4,865; 2046: 4,902; 2047: 4,939; 2048: 4,976; 2049: 5,013; 2050: 5,050

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Evaluated Length (mi)	**0.2952**
Average Future Road AADT (vpd)	**4,570**
Predicted Crashes	
Total Crashes	**11.26**
Fatal and Injury Crashes	**5.27**
Property-Damage-Only Crashes	**5.99**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**47**
Percent Property-Damage-Only Crashes (%)	**53**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**1.4125**
FI Crash Rate (crashes/mi/yr)	**0.6614**
PDO Crash Rate (crashes/mi/yr)	**0.7511**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**13.30**
Travel Crash Rate (crashes/million veh-mi)	**0.85**
Travel FI Crash Rate (crashes/million veh-mi)	**0.40**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.45**

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	15+58.698	0.2952	11.258	0.4170	0.1953	0.2217	1.4125	0.85
Total			0.2952	11.258	0.4170	0.1953	0.2217	1.4125	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	0.000	22.006	0.0042	0.159	0.0059	0.0028	0.0031	1.4125	0.85
Simple Curve 1	22.006	3+80.403	0.0679	2.589	0.0959	0.0449	0.0510	1.4125	0.85
Simple Curve 2	3+80.403	6+96.978	0.0600	2.287	0.0847	0.0397	0.0450	1.4125	0.85
Tangent	6+96.978	10+98.409	0.0760	2.900	0.1074	0.0503	0.0571	1.4125	0.85
Simple Curve 3	10+98.409	15+58.698	0.0872	3.325	0.1231	0.0577	0.0655	1.4125	0.85

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2024	0.38	0.18	47.020	0.20	52.980
2025	0.39	0.18	47.004	0.20	52.996
2026	0.39	0.18	46.989	0.21	53.011
2027	0.39	0.18	46.974	0.21	53.026
2028	0.39	0.18	46.959	0.21	53.041
2029	0.40	0.19	46.944	0.21	53.056
2030	0.40	0.19	46.929	0.21	53.071
2031	0.40	0.19	46.915	0.21	53.085
2032	0.40	0.19	46.900	0.21	53.100
2033	0.41	0.19	46.886	0.22	53.114
2034	0.41	0.19	46.871	0.22	53.129
2035	0.41	0.19	46.858	0.22	53.142
2036	0.41	0.19	46.843	0.22	53.157
2037	0.42	0.20	46.830	0.22	53.170
2038	0.42	0.20	46.816	0.22	53.184
2039	0.42	0.20	46.802	0.23	53.198
2040	0.42	0.20	46.788	0.23	53.212
2041	0.43	0.20	46.775	0.23	53.225
2042	0.43	0.20	46.761	0.23	53.239
2043	0.43	0.20	46.749	0.23	53.251
2044	0.43	0.20	46.735	0.23	53.265
2045	0.44	0.20	46.722	0.23	53.278
2046	0.44	0.21	46.709	0.23	53.291
2047	0.44	0.21	46.697	0.24	53.303
2048	0.45	0.21	46.684	0.24	53.316
2049	0.45	0.21	46.671	0.24	53.329
2050	0.45	0.21	46.659	0.24	53.341
Total	11.26	5.27	46.828	5.99	53.172
Average	0.42	0.20	46.828	0.22	53.172

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.1124	0.3409	2.1704	2.6483	5.9864

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.02	0.2	0.10	0.9	0.12	1.1
Highway Segment	Collision with Fixed Object	3.15	27.9	3.38	30.0	6.53	58.0
Highway Segment	Collision with Other Object	0.22	2.0	0.66	5.8	0.88	7.8
Highway Segment	Other Single-vehicle Collision	0.91	8.1	0.51	4.5	1.41	12.5
Highway Segment	Collision with Parked Vehicle	0.07	0.6	0.08	0.7	0.14	1.3
Highway Segment	Total Single Vehicle Crashes	4.36	38.7	4.72	41.9	9.08	80.7
Highway Segment	Right-Angle Collision	0.03	0.3	0.02	0.2	0.05	0.5
Highway Segment	Head-on Collision	0.01	0.1	0.00	0.0	0.01	0.1
Highway Segment	Other Multi-vehicle Collision	0.03	0.3	0.03	0.3	0.06	0.5
Highway Segment	Rear-end Collision	0.69	6.1	0.87	7.7	1.56	13.8
Highway Segment	Sideswipe, Same Direction Collision	0.17	1.5	0.34	3.0	0.50	4.4
Highway Segment	Total Multiple Vehicle Crashes	0.91	8.1	1.26	11.2	2.18	19.4
Highway Segment	Total Highway Segment Crashes	5.27	46.8	5.99	53.2	11.26	100.0
	Total Crashes	5.27	46.8	5.99	53.2	11.26	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
0.000	15+58.698	for segment #1 (0.000 to 15+58.698), The ramp type for Ramp Alt 1 - NB Entrance is set at the Ramp Connection (Entrance) and in the Ramp (Entrance). The Ramp value takes precedence.
0.000	15+58.698	for segment #1 (0.000 to 15+58.698), Left shoulder width (1.0 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

May 2, 2019

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Table of Contents

List of Tables

List of Figures

Report Overview

Report Generated: May 2, 2019 4:47 PM
Report Template: System: Single Page [System] (mlcpm3, Apr 10, 2019 1:31 PM)

Evaluation Date: Thu May 02 16:47:41 CDT 2019
IHSDM Version: v14.1.0 (Mar 12, 2019)
Crash Prediction Module: v9.1.0 (Mar 12, 2019)

User Name: jdanibas
Organization Name:
Phone:
E-Mail:

Project Title: I-229 Exit 4 (Cliff Ave) - Alternative 1
Project Comment: Created Tue Apr 16 14:58:43 CDT 2019
Project Unit System: U.S. Customary

Highway Title: Cliff Ave
Highway Comment: Created Tue Apr 16 15:32:22 CDT 2019
Highway Version: 1

Evaluation Title: Evaluation 1
Evaluation Comment: Created Thu May 02 16:45:59 CDT 2019

Minimum Location: 10+00.000
Maximum Location: 74+43.703
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2024
Last Year of Analysis: 2050
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Section Types

Section 1 Evaluation

Section: Section 1
Evaluation Start Location: 10+00.000
Evaluation End Location: 74+43.703
Area Type: Urban
Functional Class: Arterial
Type of Alignment: Divided, Multilane
Model Category: Urban/Suburban Arterial
Calibration Factor: 3SG=1.0; 3ST=1.0; 4D=1.0; 4SG=1.0; 4ST=1.0; 4U=1.0; 5T=1.0; RT_SG_FI=1.0; RT_SG_PDO=1.0;

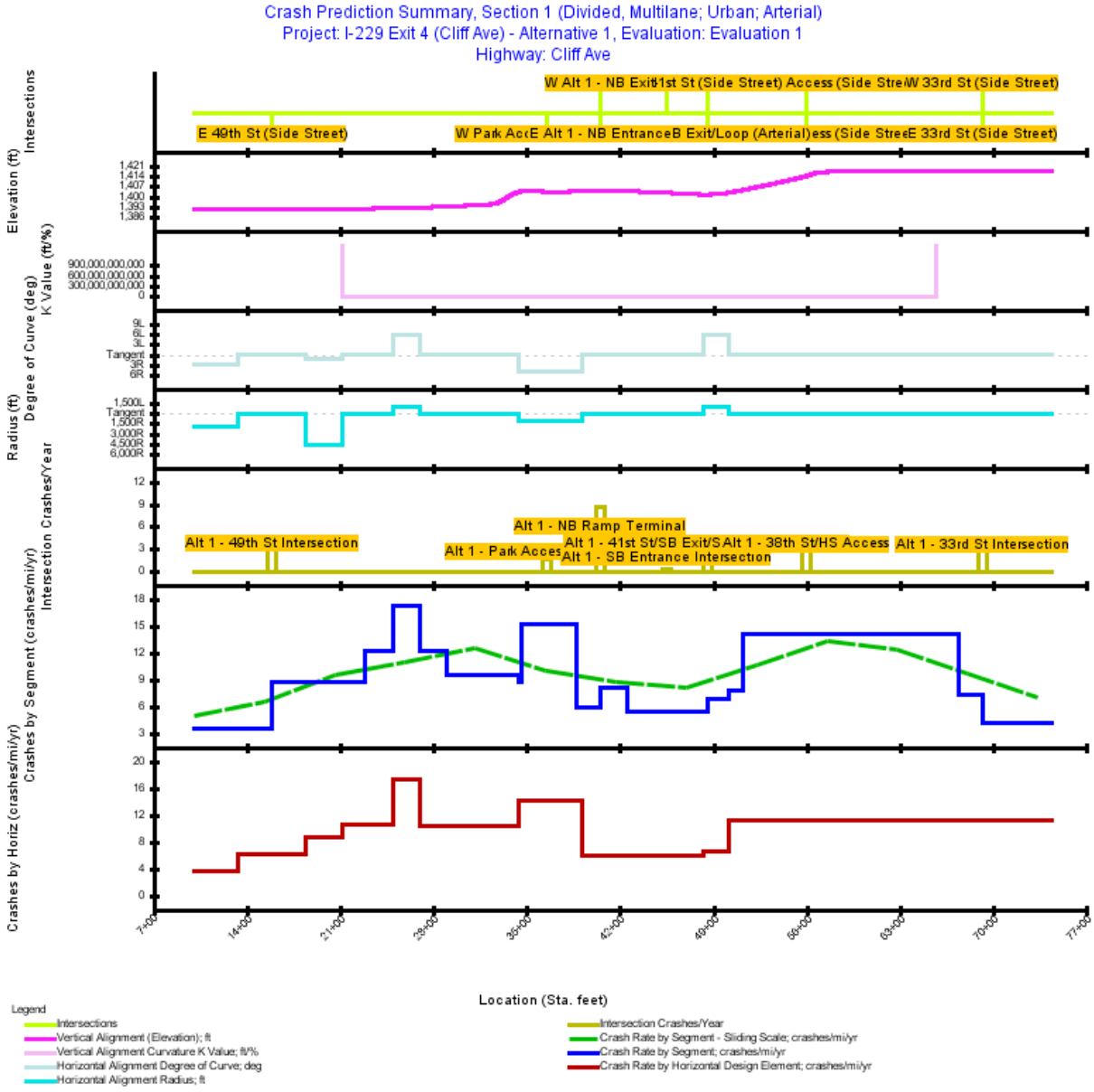

Figure 1. Crash Prediction Summary (Section 1)

Table 1. Evaluation Highway - Homogeneous Segments (Section 1)

Seg. No.	Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT	Number Major Commercial Driveways	Number Minor Commercial Driveways	Number Major Industial/Institutional	Number Minor Industial/Institutional	Number Major Residential Driveways	Number Minor Residential Driveways	Number Other Driveways	Lighting	Automated Speed Enforcement	Density (fixed objects/mi)	Median Width (ft)	Type	Effective Median Width (ft)	Speed Level	Number Rail Highway Crossings	Average Shoulder Width (ft)	Average Lane Width (ft)
1	4D	10+00.000	13+34.041	334.04	0.0633	2024: 14,262; 2025: 14,606; 2026: 14,950; 2027: 15,293; 2028: 15,637; 2029: 15,981; 2030: 16,325; 2031: 16,668; 2032: 17,012; 2033: 17,356; 2034: 17,700; 2035: 18,043; 2036: 18,387; 2037: 18,731; 2038: 19,075; 2039: 19,418; 2040: 19,762; 2041: 20,106; 2042: 20,450; 2043: 20,793; 2044: 21,137; 2045: 21,481; 2046: 21,825; 2047: 22,168; 2048: 22,512; 2049: 22,856; 2050: 23,200	0	0	0	0	0	0	0	false	false	0.0	12.00	Traversable Median	12.00	Intermediate/High	0	2.00	12.00
2	4D	13+34.041	15+86.000	251.96	0.0477	2024: 14,262; 2025: 14,606; 2026: 14,950; 2027: 15,293; 2028: 15,637; 2029: 15,981; 2030: 16,325; 2031: 16,668; 2032: 17,012; 2033: 17,356; 2034: 17,700; 2035: 18,043; 2036: 18,387; 2037: 18,731; 2038: 19,075; 2039: 19,418; 2040: 19,762; 2041: 20,106; 2042: 20,450; 2043: 20,793; 2044: 21,137; 2045: 21,481; 2046: 21,825; 2047: 22,168; 2048: 22,512; 2049: 22,856; 2050: 23,200	0	0	0	0	0	0	0	false	false	0.0	12.00	Traversable Median	12.00	Intermediate/High	0	2.00	12.00
3	4U	15+86.000	18+42.805	256.81	0.0486	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
4	4U	18+42.805	21+08.879	266.07	0.0504	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
5	4U	21+08.879	22+86.000	177.12	0.0336	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
6	5T	22+86.000	24+96.922	210.92	0.0399	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
7	5T	24+96.922	26+94.712	197.79	0.0375	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	1	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
8	5T	26+94.712	28+98.954	204.24	0.0387	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
9	4U	28+98.954	34+34.660	535.71	0.1015	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	2	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
10	4U	34+34.660	34+59.660	25.00	0.0047	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
11	5T	34+59.660	38+73.000	413.34	0.0783	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	2	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00

Seg. No.	Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT	Number Major Commercial Driveways	Number Minor Commercial Driveways	Number Major Industial/Institutional	Number Minor Industial/Institutional	Number Major Residential Driveways	Number Minor Residential Driveways	Number Other Driveways	Lighting	Automated Speed Enforcement	Density (fixed objects/mi)	Median Width (ft)	Type	Effective Median Width (ft)	Speed Level	Number Rail Highway Crossings	Average Shoulder Width (ft)	Average Lane Width (ft)
12	4D	38+73.000	39+10.280	37.28	0.0071	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	0	0	false	false	0.0	12.00	Traversable Median	12.00	Intermediate /High	0	2.00	12.00
13	4D	39+10.280	40+48.000	137.72	0.0261	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	0	0	false	false	0.0	12.00	Traversable Median	12.00	Intermediate /High	0	2.00	12.00
14	4U	40+48.000	42+48.000	200.00	0.0379	2024: 22,375; 2025: 22,687; 2026: 23,000; 2027: 23,312; 2028: 23,625; 2029: 23,937; 2030: 24,250; 2031: 24,562; 2032: 24,875; 2033: 25,187; 2034: 25,500; 2035: 25,812; 2036: 26,125; 2037: 26,437; 2038: 26,750; 2039: 27,062; 2040: 27,375; 2041: 27,687; 2042: 28,000; 2043: 28,312; 2044: 28,625; 2045: 28,937; 2046: 29,250; 2047: 29,562; 2048: 29,875; 2049: 30,187; 2050: 30,500	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate /High	0	2.00	12.00
15	4D	42+48.000	45+53.645	305.64	0.0579	2024: 22,375; 2025: 22,687; 2026: 23,000; 2027: 23,312; 2028: 23,625; 2029: 23,937; 2030: 24,250; 2031: 24,562; 2032: 24,875; 2033: 25,187; 2034: 25,500; 2035: 25,812; 2036: 26,125; 2037: 26,437; 2038: 26,750; 2039: 27,062; 2040: 27,375; 2041: 27,687; 2042: 28,000; 2043: 28,312; 2044: 28,625; 2045: 28,937; 2046: 29,250; 2047: 29,562; 2048: 29,875; 2049: 30,187; 2050: 30,500	0	0	0	0	0	0	0	false	false	0.0	9.00	Non-Traversable Median	13.00	Intermediate /High	0	2.00	12.00
16	4D	45+53.645	48+21.477	267.83	0.0507	2024: 22,375; 2025: 22,687; 2026: 23,000; 2027: 23,312; 2028: 23,625; 2029: 23,937; 2030: 24,250; 2031: 24,562; 2032: 24,875; 2033: 25,187; 2034: 25,500; 2035: 25,812; 2036: 26,125; 2037: 26,437; 2038: 26,750; 2039: 27,062; 2040: 27,375; 2041: 27,687; 2042: 28,000; 2043: 28,312; 2044: 28,625; 2045: 28,937; 2046: 29,250; 2047: 29,562; 2048: 29,875; 2049: 30,187; 2050: 30,500	0	0	0	0	0	0	0	false	false	0.0	9.00	Non-Traversable Median	25.00	Intermediate /High	0	2.00	12.00
17	4D	48+21.477	48+54.000	32.52	0.0062	2024: 22,375; 2025: 22,687; 2026: 23,000; 2027: 23,312; 2028: 23,625; 2029: 23,937; 2030: 24,250; 2031: 24,562; 2032: 24,875; 2033: 25,187; 2034: 25,500; 2035: 25,812; 2036: 26,125; 2037: 26,437; 2038: 26,750; 2039: 27,062; 2040: 27,375; 2041: 27,687; 2042: 28,000; 2043: 28,312; 2044: 28,625; 2045: 28,937; 2046: 29,250; 2047: 29,562; 2048: 29,875; 2049: 30,187; 2050: 30,500	0	0	0	0	0	0	0	false	false	0.0	9.00	Non-Traversable Median	26.00	Intermediate /High	0	2.00	12.00
18	4D	48+54.000	50+12.172	158.17	0.0300	2024: 21,150; 2025: 21,375; 2026: 21,600; 2027: 21,825; 2028: 22,050; 2029: 22,275; 2030: 22,500; 2031: 22,725; 2032: 22,950; 2033: 23,175; 2034: 23,400; 2035: 23,625; 2036: 23,850; 2037: 24,075; 2038: 24,300; 2039: 24,525; 2040: 24,750; 2041: 24,975; 2042: 25,200; 2043: 25,425; 2044: 25,650; 2045: 25,875; 2046: 26,100; 2047: 26,325; 2048: 26,550; 2049: 26,775; 2050: 27,000	0	0	1	0	0	0	0	false	false	0.0	23.00	Non-Traversable Median	27.00	Intermediate /High	0	2.00	12.00
19	4D	50+12.172	51+25.172	113.00	0.0214	2024: 21,150; 2025: 21,375; 2026: 21,600; 2027: 21,825; 2028: 22,050; 2029: 22,275; 2030: 22,500; 2031: 22,725; 2032: 22,950; 2033: 23,175; 2034: 23,400; 2035: 23,625; 2036: 23,850; 2037: 24,075; 2038: 24,300; 2039: 24,525; 2040: 24,750; 2041: 24,975; 2042: 25,200; 2043: 25,425; 2044: 25,650; 2045: 25,875; 2046: 26,100; 2047: 26,325; 2048: 26,550; 2049: 26,775; 2050: 27,000	0	0	1	0	0	0	0	false	false	0.0	23.00	Non-Traversable Median	13.50	Intermediate /High	0	2.00	12.00
20	5T	51+25.172	67+46.101	1,620.93	0.3070	2024: 21,150; 2025: 21,375; 2026: 21,600; 2027: 21,825; 2028: 22,050; 2029: 22,275; 2030: 22,500; 2031: 22,725; 2032: 22,950; 2033: 23,175; 2034: 23,400; 2035: 23,625; 2036: 23,850; 2037: 24,075; 2038: 24,300; 2039: 24,525; 2040: 24,750; 2041: 24,975; 2042: 25,200; 2043: 25,425; 2044: 25,650; 2045: 25,875; 2046: 26,100; 2047: 26,325; 2048: 26,550; 2049: 26,775; 2050: 27,000	0	0	2	0	3	0	0	false	false	0.0	0.00	None	0.00	Intermediate /High	0	2.00	12.00
21	4U	67+46.101	69+21.101	175.00	0.0331	2024: 21,150; 2025: 21,375; 2026: 21,600; 2027: 21,825; 2028: 22,050; 2029: 22,275; 2030: 22,500; 2031: 22,725; 2032: 22,950; 2033: 23,175; 2034: 23,400; 2035: 23,625; 2036: 23,850; 2037: 24,075; 2038: 24,300; 2039: 24,525; 2040: 24,750; 2041: 24,975; 2042: 25,200; 2043: 25,425; 2044: 25,650; 2045: 25,875; 2046: 26,100; 2047: 26,325; 2048: 26,550; 2049: 26,775; 2050: 27,000	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate /High	0	2.00	12.00
22	4U	69+21.101	70+36.101	115.00	0.0218	2024: 14,406; 2025: 14,490; 2026: 14,575; 2027: 14,659; 2028: 14,743; 2029: 14,828; 2030: 14,912; 2031: 14,996; 2032: 15,081; 2033: 15,165; 2034: 15,250; 2035: 15,334; 2036: 15,418; 2037: 15,503; 2038: 15,587; 2039: 15,671; 2040: 15,756; 2041: 15,840; 2042: 15,925; 2043: 16,009; 2044: 16,093; 2045: 16,178; 2046: 16,262; 2047: 16,346; 2048: 16,431; 2049: 16,515; 2050: 16,600	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate /High	0	2.00	12.00
23	4U	70+36.101	74+43.703	407.60	0.0772	2024: 14,406; 2025: 14,490; 2026: 14,575; 2027: 14,659; 2028: 14,743; 2029: 14,828; 2030: 14,912; 2031: 14,996; 2032: 15,081; 2033: 15,165; 2034: 15,250; 2035: 15,334; 2036: 15,418; 2037: 15,503; 2038: 15,587; 2039: 15,671; 2040: 15,756; 2041: 15,840; 2042: 15,925; 2043: 16,009; 2044: 16,093; 2045: 16,178; 2046: 16,262; 2047: 16,346; 2048: 16,431; 2049: 16,515; 2050: 16,600	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate /High	0	2.00	12.00

Table 2. Evaluation Intersection (Section 1)

Inter. No.	Title	Location (Sta. ft)	Major AADT	Minor AADT	Legs	Traffic Control	Intersection Type	Approaches w/Left Turn Lanes	Approaches w/Right Turn Lanes	Approaches w/o Right Turn on Red	Pedestrian Volume (crossings/day)	Lighted at Night	Red Light Camera	School Nearby	Number of Bus Stops	Number of Alcohol Sales Establishments	Max Lanes Crossed	Replaced with Roundabout
1	Alt 1 - Park Access Intersection	36+51.824	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	2024: 360; 2025: 365; 2026: 370; 2027: 375; 2028: 380; 2029: 385; 2030: 390; 2031: 395; 2032: 400; 2033: 405; 2034: 410; 2035: 415; 2036: 420; 2037: 425; 2038: 430; 2039: 435; 2040: 440; 2041: 445; 2042: 450; 2043: 455; 2044: 460; 2045: 465; 2046: 470; 2047: 475; 2048: 480; 2049: 485; 2050: 490	3	Stop-Controlled	Three-Legged w/STOP control	0	0			true	false	false				false
2	Alt 1 - 49th St Intersection	15+85.495	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	2024: 8,734; 2025: 8,848; 2026: 8,962; 2027: 9,076; 2028: 9,190; 2029: 9,304; 2030: 9,418; 2031: 9,532; 2032: 9,646; 2033: 9,760; 2034: 9,875; 2035: 9,989; 2036: 10,103; 2037: 10,217; 2038: 10,331; 2039: 10,445; 2040: 10,559; 2041: 10,673; 2042: 10,787; 2043: 10,901; 2044: 11,015; 2045: 11,129; 2046: 11,243; 2047: 11,357; 2048: 11,471; 2049: 11,585; 2050: 11,700	3	Signalized	Three-Legged Signalized	2	0	0	15	true	false	false	0	0	5	false

Table 3. Evaluation Intersection (Section 1)

Inter. No.	Title	Location (Sta. ft)	Major AADT	Minor AADT	Legs	Traffic Control	Intersection Type	Approaches w/Left Turn Lanes	Approaches w/Right Turn Lanes	Approaches w/o Right Turn on Red	Pedestrian Volume (crossings/day)	Lighted at Night	Red Light Camera	School Nearby	Number of Bus Stops	Number of Alcohol Sales Establishments	Max Lanes Crossed	Replaced with Roundabout
4	Alt 1 - SB Entrance Intersection	45+45.544	2024: 3,943; 2025: 3,977; 2026: 4,012; 2027: 4,047; 2028: 4,081; 2029: 4,116; 2030: 4,151; 2031: 4,185; 2032: 4,220; 2033: 4,255; 2034: 4,290; 2035: 4,324; 2036: 4,359; 2037: 4,394; 2038: 4,428; 2039: 4,463; 2040: 4,498; 2041: 4,532; 2042: 4,567; 2043: 4,602; 2044: 4,636; 2045: 4,671; 2046: 4,706; 2047: 4,740; 2048: 4,775; 2049: 4,810; 2050: 4,845	2024: 22,375; 2025: 22,687; 2026: 23,000; 2027: 23,312; 2028: 23,625; 2029: 23,937; 2030: 24,250; 2031: 24,562; 2032: 24,875; 2033: 25,187; 2034: 25,500; 2035: 25,812; 2036: 26,125; 2037: 26,437; 2038: 26,750; 2039: 27,062; 2040: 27,375; 2041: 27,687; 2042: 28,000; 2043: 28,312; 2044: 28,625; 2045: 28,937; 2046: 29,250; 2047: 29,562; 2048: 29,875; 2049: 30,187; 2050: 30,500	3	Stop-Controlled	Three-Legged w/STOP control	0	0			true	false	false				false
5	Alt 1 - 41st St/SB Exit/SB Loop Intersection	48+53.645	2024: 22,375; 2025: 22,687; 2026: 23,000; 2027: 23,312; 2028: 23,625; 2029: 23,937; 2030: 24,250; 2031: 24,562; 2032: 24,875; 2033: 25,187; 2034: 25,500; 2035: 25,812; 2036: 26,125; 2037: 26,437; 2038: 26,750; 2039: 27,062; 2040: 27,375; 2041: 27,687; 2042: 28,000; 2043: 28,312; 2044: 28,625; 2045: 28,937; 2046: 29,250; 2047: 29,562; 2048: 29,875; 2049: 30,187; 2050: 30,500	2024: 7,283; 2025: 7,438; 2026: 7,593; 2027: 7,747; 2028: 7,902; 2029: 8,057; 2030: 8,212; 2031: 8,367; 2032: 8,522; 2033: 8,677; 2034: 8,832; 2035: 8,986; 2036: 9,141; 2037: 9,296; 2038: 9,451; 2039: 9,606; 2040: 9,761; 2041: 9,916; 2042: 10,071; 2043: 10,225; 2044: 10,380; 2045: 10,535; 2046: 10,690; 2047: 10,845; 2048: 11,000; 2049: 11,155; 2050: 11,310	4	Signalized	Four-Legged Signalized	2	4	0	20	true	false	true	0	0	7	false
6	Alt 1 - 38th St/HS Access	55+97.795	2024: 21,150; 2025: 21,375; 2026: 21,600; 2027: 21,825; 2028: 22,050; 2029: 22,275; 2030: 22,500; 2031: 22,725; 2032: 22,950; 2033: 23,175; 2034: 23,400; 2035: 23,625; 2036: 23,850; 2037: 24,075; 2038: 24,300; 2039: 24,525; 2040: 24,750; 2041: 24,975; 2042: 25,200; 2043: 25,425; 2044: 25,650; 2045: 25,875; 2046: 26,100; 2047: 26,325; 2048: 26,550; 2049: 26,775; 2050: 27,000	2024: 2,014; 2025: 2,048; 2026: 2,082; 2027: 2,116; 2028: 2,150; 2029: 2,184; 2030: 2,218; 2031: 2,252; 2032: 2,286; 2033: 2,320; 2034: 2,355; 2035: 2,389; 2036: 2,423; 2037: 2,457; 2038: 2,491; 2039: 2,525; 2040: 2,559; 2041: 2,593; 2042: 2,627; 2043: 2,661; 2044: 2,695; 2045: 2,729; 2046: 2,763; 2047: 2,797; 2048: 2,831; 2049: 2,865; 2050: 2,900	4	Stop-Controlled	Four-Legged w/STOP control	0	0			true	false	true				false
7	Alt 1 - 33rd St Intersection	69+21.101	2024: 21,150; 2025: 21,375; 2026: 21,600; 2027: 21,825; 2028: 22,050; 2029: 22,275; 2030: 22,500; 2031: 22,725; 2032: 22,950; 2033: 23,175; 2034: 23,400; 2035: 23,625; 2036: 23,850; 2037: 24,075; 2038: 24,300; 2039: 24,525; 2040: 24,750; 2041: 24,975; 2042: 25,200; 2043: 25,425; 2044: 25,650; 2045: 25,875; 2046: 26,100; 2047: 26,325; 2048: 26,550; 2049: 26,775; 2050: 27,000	2024: 5,465; 2025: 5,507; 2026: 5,550; 2027: 5,592; 2028: 5,635; 2029: 5,677; 2030: 5,720; 2031: 5,762; 2032: 5,805; 2033: 5,847; 2034: 5,890; 2035: 5,932; 2036: 5,975; 2037: 6,017; 2038: 6,060; 2039: 6,102; 2040: 6,145; 2041: 6,187; 2042: 6,230; 2043: 6,272; 2044: 6,315; 2045: 6,357; 2046: 6,400; 2047: 6,442; 2048: 6,485; 2049: 6,527; 2050: 6,570	4	Signalized	Four-Legged Signalized	4	0	0	20	true	false	false	0	0	5	false

Table 4. Evaluation Ramp Terminal - Site (Section 1)

Inter. No.	Ramp Terminal Type	Area Type	Legs	Location (Sta. ft)	Traffic Control	AADT
3	D4-Four-Leg Ramp Terminal with Diagonal Ramps	Urban	4	40+47.883	Signalized	Inside: 2024: 22,375; 2025: 22,687; 2026: 23,000; 2027: 23,312; 2028: 23,625; 2029: 23,937; 2030: 24,250; 2031: 24,562; 2032: 24,875; 2033: 25,187; 2034: 25,500; 2035: 25,812; 2036: 26,125; 2037: 26,437; 2038: 26,750; 2039: 27,062; 2040: 27,375; 2041: 27,687; 2042: 28,000; 2043: 28,312; 2044: 28,625; 2045: 28,937; 2046: 29,250; 2047: 29,562; 2048: 29,875; 2049: 30,187; 2050: 30,500; Outside: 2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600 :: Entrance: 2024: 4,091; 2025: 4,128; 2026: 4,165; 2027: 4,201; 2028: 4,238; 2029: 4,275; 2030: 4,312; 2031: 4,349; 2032: 4,386; 2033: 4,423; 2034: 4,460; 2035: 4,496; 2036: 4,533; 2037: 4,570; 2038: 4,607; 2039: 4,644; 2040: 4,681; 2041: 4,718; 2042: 4,755; 2043: 4,791; 2044: 4,828; 2045: 4,865; 2046: 4,902; 2047: 4,939; 2048: 4,976; 2049: 5,013; 2050: 5,050; Exit: 2024: 6,810; 2025: 6,897; 2026: 6,984; 2027: 7,071; 2028: 7,158; 2029: 7,244; 2030: 7,331; 2031: 7,418; 2032: 7,505; 2033: 7,592; 2034: 7,679; 2035: 7,766; 2036: 7,853; 2037: 7,940; 2038: 8,027; 2039: 8,114; 2040: 8,200; 2041: 8,287; 2042: 8,374; 2043: 8,461; 2044: 8,548; 2045: 8,635; 2046: 8,722; 2047: 8,809; 2048: 8,896; 2049: 8,983; 2050: 9,070

Table 5. Predicted Highway Crash Rates and Frequencies Summary (Section 1)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Evaluated Length (mi)	**1.2204**
Average Future Road AADT (vpd)	**24,739**
Predicted Crashes	
Total Crashes	**1,038.37**
Fatal and Injury Crashes	**366.91**
Property-Damage-Only Crashes	**671.47**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**35**
Percent Property-Damage-Only Crashes (%)	**65**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**31.5129**
FI Crash Rate (crashes/mi/yr)	**11.1350**
PDO Crash Rate (crashes/mi/yr)	**20.3779**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**297.54**
Travel Crash Rate (crashes/million veh-mi)	**3.49**
Travel FI Crash Rate (crashes/million veh-mi)	**1.23**
Travel PDO Crash Rate (crashes/million veh-mi)	**2.26**

Table 6. Predicted Crash Frequencies and Rates by Highway Segment/Intersection (Section 1)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)	Predicted Intersection Travel Crash Rate (crashes/million veh)
1	10+00.000	13+34.041	0.0633	6.147	0.2277	0.0633	0.1644	3.5989	0.53	
2	13+34.041	15+86.000	0.0477	4.637	0.1717	0.0477	0.1240	3.5989	0.53	
Alt 1 - 49th St Intersection	15+85.495			110.346	4.0869	1.3240	2.7629			0.39
3	15+86.000	18+42.805	0.0486	11.590	0.4292	0.1245	0.3047	8.8254	0.86	
4	18+42.805	21+08.879	0.0504	12.008	0.4447	0.1290	0.3157	8.8254	0.86	
5	21+08.879	22+86.000	0.0335	7.993	0.2961	0.0859	0.2102	8.8254	0.86	
6	22+86.000	24+96.922	0.0399	13.265	0.4913	0.1394	0.3519	12.2983	1.20	
7	24+96.922	26+94.712	0.0375	17.524	0.6490	0.1860	0.4630	17.3258	1.69	
8	26+94.712	28+98.954	0.0387	12.845	0.4757	0.1349	0.3408	12.2983	1.20	
9	28+98.954	34+34.660	0.1015	26.232	0.9715	0.2864	0.6852	9.5757	0.93	
10	34+34.660	34+59.660	0.0047	1.128	0.0418	0.0121	0.0297	8.8254	0.86	
11	34+59.660	38+73.000	0.0783	32.190	1.1922	0.3405	0.8517	15.2294	1.48	
Alt 1 - Park Access Intersection	36+51.824			45.001	1.6667	0.7260	0.9407			0.16
12	38+73.000	39+10.280	0.0071	1.123	0.0416	0.0116	0.0300	5.8899	0.57	
13	39+10.280	40+48.000	0.0261	4.148	0.1536	0.0427	0.1109	5.8899	0.57	
Alt 1 - NB Ramp Terminal	40+47.883			234.090	8.6700	3.6469	5.0230			0.71
14	40+48.000	42+48.000	0.0379	8.352	0.3093	0.0902	0.2191	8.1665	0.85	
15	42+48.000	45+53.645	0.0579	8.475	0.3139	0.0874	0.2265	5.4222	0.56	
Alt 1 - SB Entrance Intersection	45+45.544			7.072	0.2619	0.0795	0.1824			0.03
16	45+53.645	48+21.477	0.0507	7.426	0.2750	0.0765	0.1985	5.4222	0.56	
17	48+21.477	48+54.000	0.0062	0.902	0.0334	0.0093	0.0241	5.4222	0.56	
Alt 1 - 41st St/SB Exit/SB Loop Intersection	48+53.645			113.347	4.1980	1.4555	2.7425			0.35
18	48+54.000	50+12.172	0.0300	5.588	0.2070	0.0590	0.1479	6.9086	0.79	
19	50+12.172	51+25.172	0.0214	4.472	0.1656	0.0475	0.1181	7.7390	0.88	
20	51+25.172	67+46.101	0.3070	116.772	4.3249	1.2440	3.0809	14.0878	1.60	
Alt 1 - 38th St/HS Access	55+97.795			105.259	3.8985	1.6329	2.2656			0.41
21	67+46.101	69+21.101	0.0331	6.501	0.2408	0.0708	0.1700	7.2643	0.83	

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)	Predicted Intersection Travel Crash Rate (crashes/million veh)
Alt 1 - 33rd St Intersection	69+21.101			102.674	3.8028	1.3081	2.4946			0.41
22	69+21.101	70+36.101	0.0218	2.480	0.0918	0.0280	0.0638	4.2166	0.74	
23	70+36.101	74+43.703	0.0772	8.789	0.3255	0.0993	0.2262	4.2166	0.74	
All Segments			1.2204	320.584	11.8735	3.4161	8.4574	9.7292	1.08	
All Intersections				717.789	26.5848	10.1731	16.4117			0.36
Total			1.2204	1,038.374	38.4583	13.5892	24.8691	31.5129		

Table 7. Predicted Crash Frequencies and Rates by Horizontal Design Element (Section 1)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Simple Curve 1	10+00.000	13+34.041	0.0633	6.147	0.2277	0.0633	0.1644	3.5989	0.53
Tangent	13+34.041	18+42.805	0.0964	16.226	0.6010	0.1723	0.4287	6.2370	0.69
Simple Curve 2	18+42.805	21+08.879	0.0504	12.008	0.4447	0.1290	0.3157	8.8254	0.86
Tangent	21+08.879	24+96.922	0.0735	21.258	0.7873	0.2253	0.5621	10.7131	1.04
Simple Curve 3	24+96.922	26+94.712	0.0375	17.524	0.6490	0.1860	0.4630	17.3258	1.69
Tangent	26+94.712	34+34.660	0.1401	39.076	1.4473	0.4213	1.0259	10.3272	1.01
Simple Curve 4	34+34.660	39+10.280	0.0901	34.441	1.2756	0.3642	0.9114	14.1608	1.38
Tangent	39+10.280	48+21.477	0.1726	28.401	1.0519	0.2969	0.7550	6.0953	0.63
Simple Curve 5	48+21.477	50+12.172	0.0361	6.490	0.2404	0.0683	0.1720	6.6551	0.75
Tangent	50+12.172	74+43.703	0.4605	139.013	5.1486	1.4896	3.6590	11.1801	1.33

Table 8. Predicted Crash Frequencies by Year (Section 1)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2024	31.57	11.15	35.311	20.42	64.689
2025	32.08	11.33	35.313	20.75	64.687
2026	32.60	11.51	35.315	21.09	64.685
2027	33.12	11.70	35.318	21.42	64.682
2028	33.64	11.88	35.320	21.76	64.680
2029	34.16	12.07	35.322	22.09	64.678
2030	34.68	12.25	35.323	22.43	64.677
2031	35.21	12.44	35.325	22.77	64.675
2032	35.74	12.62	35.327	23.11	64.673
2033	36.27	12.81	35.328	23.45	64.671
2034	36.80	13.00	35.330	23.80	64.670
2035	37.33	13.19	35.332	24.14	64.668
2036	37.87	13.38	35.333	24.49	64.667
2037	38.40	13.57	35.335	24.83	64.665
2038	38.94	13.76	35.336	25.18	64.664
2039	39.48	13.95	35.338	25.53	64.662
2040	40.02	14.14	35.339	25.88	64.661
2041	40.57	14.34	35.340	26.23	64.660
2042	41.12	14.53	35.342	26.58	64.658
2043	41.66	14.72	35.343	26.94	64.657
2044	42.21	14.92	35.344	27.29	64.656
2045	42.76	15.12	35.345	27.65	64.655
2046	43.32	15.31	35.347	28.00	64.653
2047	43.87	15.51	35.348	28.36	64.652
2048	44.43	15.70	35.349	28.72	64.651
2049	44.98	15.90	35.350	29.08	64.650
2050	45.55	16.10	35.351	29.44	64.649
Total	1,038.37	366.91	35.335	671.47	64.665
Average	38.46	13.59	35.335	24.87	64.665

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 9. Predicted Crash Severity by Urban Arterial (Section 1)

Seg. No.	Type	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
4	USAIntersection	0.0058	0.1282	0.5272	1.4857	4.9255

Table 10. Predicted Five Lane or Fewer Crash Type Distribution (Section 1)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.10	0.0	1.32	0.1	1.42	0.1
Highway Segment	Collision with Bicycle	2.61	0.3	0.00	0.0	2.61	0.3
Highway Segment	Collision with Fixed Object	4.77	0.5	28.02	2.7	32.79	3.2
Highway Segment	Collision with Other Object	0.12	0.0	1.62	0.2	1.74	0.2
Highway Segment	Other Single-vehicle Collision	5.06	0.5	4.68	0.5	9.74	0.9
Highway Segment	Collision with Pedestrian	5.83	0.6	0.00	0.0	5.83	0.6
Highway Segment	Total Single Vehicle Crashes	18.49	1.8	35.64	3.5	54.13	5.2
Highway Segment	Angle Collision	5.63	0.5	12.31	1.2	17.95	1.7
Highway Segment	Driveway-related Collision	12.44	1.2	33.07	3.2	45.52	4.4
Highway Segment	Head-on Collision	2.41	0.2	0.71	0.1	3.12	0.3
Highway Segment	Other Multi-vehicle Collision	2.15	0.2	8.09	0.8	10.23	1.0
Highway Segment	Rear-end Collision	44.94	4.4	97.16	9.4	142.10	13.8
Highway Segment	Sideswipe, Opposite Direction Collision	1.88	0.2	2.31	0.2	4.20	0.4
Highway Segment	Sideswipe, Same Direction Collision	4.29	0.4	39.05	3.8	43.34	4.2
Highway Segment	Total Multiple Vehicle Crashes	73.74	7.2	192.71	18.7	266.46	25.8
Highway Segment	Total Highway Segment Crashes	92.23	8.9	228.35	22.1	320.58	31.1
Intersection	Collision with Animal	0.01	0.0	0.23	0.0	0.24	0.0
Intersection	Collision with Bicycle	6.89	0.7	0.00	0.0	6.89	0.7
Intersection	Collision with Fixed Object	6.01	0.6	19.06	1.8	25.07	2.4
Intersection	Non-Collision	1.41	0.1	0.73	0.1	2.14	0.2
Intersection	Collision with Other Object	0.71	0.1	1.58	0.2	2.30	0.2
Intersection	Other Single-vehicle Collision	0.38	0.0	0.39	0.0	0.76	0.1
Intersection	Collision with Parked Vehicle	0.01	0.0	0.03	0.0	0.04	0.0
Intersection	Collision with Pedestrian	4.45	0.4	0.00	0.0	4.45	0.4
Intersection	Total Intersection Single Vehicle Crashes	19.87	1.9	22.01	2.1	41.88	4.1

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Intersection	Angle Collision	54.77	5.3	71.11	6.9	125.88	12.2
Intersection	Head-on Collision	6.83	0.7	7.56	0.7	14.39	1.4
Intersection	Other Multi-vehicle Collision	8.90	0.9	59.18	5.7	68.08	6.6
Intersection	Rear-end Collision	67.87	6.6	132.88	12.9	200.76	19.5
Intersection	Sideswipe	15.81	1.5	9.83	1.0	25.64	2.5
Intersection	Total Intersection Multiple Vehicle Crashes	154.19	15.0	280.56	27.2	434.75	42.2
Intersection	Total Intersection Crashes	174.06	16.9	302.57	29.3	476.63	46.2
Ramp Terminal	Collision with Animal	0.00	0.0	0.00	0.0	0.00	0.0
Ramp Terminal	Collision with Fixed Object	3.25	0.3	6.78	0.7	10.03	1.0
Ramp Terminal	Collision with Other Object	0.10	0.0	0.27	0.0	0.37	0.0
Ramp Terminal	Other Single-vehicle Collision	1.77	0.2	0.95	0.1	2.72	0.3
Ramp Terminal	Collision with Parked Vehicle	0.10	0.0	0.27	0.0	0.37	0.0
Ramp Terminal	Total Single Vehicle Crashes	5.22	0.5	8.27	0.8	13.49	1.3
Ramp Terminal	Right-Angle Collision	25.60	2.5	29.84	2.9	55.44	5.4
Ramp Terminal	Head-on Collision	1.08	0.1	0.95	0.1	2.03	0.2
Ramp Terminal	Other Multi-vehicle Collision	0.89	0.1	2.71	0.3	3.60	0.3
Ramp Terminal	Rear-end Collision	61.54	6.0	73.64	7.1	135.19	13.1
Ramp Terminal	Sideswipe, Same Direction Collision	4.14	0.4	20.21	2.0	24.34	2.4
Ramp Terminal	Total Multiple Vehicle Crashes	93.25	9.0	127.35	12.3	220.60	21.4
Ramp Terminal	Total Ramp Terminal Crashes	98.47	9.5	135.62	13.2	234.09	22.7
	Total Crashes	364.76	35.4	666.54	64.6	1,031.30	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 11. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
45+45.544	45+45.544	for intersection #4 (45+45.544 to 45+45.544), minor road traffic volume (22,375 vpd) for 2024 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
45+45.544	45+45.544	for intersection #4 (45+45.544 to 45+45.544), minor road traffic volume (22,687 vpd) for 2025 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
45+45.544	45+45.544	for intersection #4 (45+45.544 to 45+45.544), minor road traffic volume (23,000 vpd) for 2026 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
45+45.544	45+45.544	for intersection #4 (45+45.544 to 45+45.544), minor road traffic volume (23,312 vpd) for 2027 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
45+45.544	45+45.544	for intersection #4 (45+45.544 to 45+45.544), minor road traffic volume (23,625 vpd) for 2028 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
45+45.544	45+45.544	for intersection #4 (45+45.544 to 45+45.544), minor road traffic volume (23,937 vpd) for 2029 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
45+45.544	45+45.544	for intersection #4 (45+45.544 to 45+45.544), minor road traffic volume (24,250 vpd) for 2030 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
45+45.544	45+45.544	for intersection #4 (45+45.544 to 45+45.544), minor road traffic volume (24,562 vpd) for 2031 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
45+45.544	45+45.544	for intersection #4 (45+45.544 to 45+45.544), minor road traffic volume (24,875 vpd) for 2032 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
45+45.544	45+45.544	for intersection #4 (45+45.544 to 45+45.544), minor road traffic volume (25,187 vpd) for 2033 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
45+45.544	45+45.544	for intersection #4 (45+45.544 to 45+45.544), minor road traffic volume (25,500 vpd) for 2034 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
45+45.544	45+45.544	for intersection #4 (45+45.544 to 45+45.544), minor road traffic volume (25,812 vpd) for 2035 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
45+45.544	45+45.544	for intersection #4 (45+45.544 to 45+45.544), minor road traffic volume (26,125 vpd) for 2036 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
45+45.544	45+45.544	for intersection #4 (45+45.544 to 45+45.544), minor road traffic volume (26,437 vpd) for 2037 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
45+45.544	45+45.544	for intersection #4 (45+45.544 to 45+45.544), minor road traffic volume (26,750 vpd) for 2038 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
45+45.544	45+45.544	for intersection #4 (45+45.544 to 45+45.544), minor road traffic volume (27,062 vpd) for 2039 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
45+45.544	45+45.544	for intersection #4 (45+45.544 to 45+45.544), minor road traffic volume (27,375 vpd) for 2040 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
45+45.544	45+45.544	for intersection #4 (45+45.544 to 45+45.544), minor road traffic volume (27,687 vpd) for 2041 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
45+45.544	45+45.544	for intersection #4 (45+45.544 to 45+45.544), minor road traffic volume (28,000 vpd) for 2042 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
45+45.544	45+45.544	for intersection #4 (45+45.544 to 45+45.544), minor road traffic volume (28,312 vpd) for 2043 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
45+45.544	45+45.544	for intersection #4 (45+45.544 to 45+45.544), minor road traffic volume (28,625 vpd) for 2044 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
45+45.544	45+45.544	for intersection #4 (45+45.544 to 45+45.544), minor road traffic volume (28,937 vpd) for 2045 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
45+45.544	45+45.544	for intersection #4 (45+45.544 to 45+45.544), minor road traffic volume (29,250 vpd) for 2046 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
45+45.544	45+45.544	for intersection #4 (45+45.544 to 45+45.544), minor road traffic volume (29,562 vpd) for 2047 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
45+45.544	45+45.544	for intersection #4 (45+45.544 to 45+45.544), minor road traffic volume (29,875 vpd) for 2048 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST
45+45.544	45+45.544	for intersection #4 (45+45.544 to 45+45.544), minor road traffic volume (30,187 vpd) for 2049 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST

Start Location (Sta. ft)	End Location (Sta. ft)	Message
45+45.544	45+45.544	for intersection #4 (45+45.544 to 45+45.544), minor road traffic volume (30,500 vpd) for 2050 is not within the model limit (13,400 vpd) for reliable results for intersection type 3ST

IHSDM Results
(2024 to 2050)

Cliff Avenue (Exit 4)

Alternative 6 Conditions

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

May 3, 2019

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Table of Contents

List of Tables

List of Figures

Report Overview

Report Generated: May 3, 2019 10:40 AM
Report Template: System: Single Page [System] (mlcpm3, Apr 10, 2019 1:31 PM)

Evaluation Date: Fri May 03 10:40:17 CDT 2019
IHSDM Version: v14.1.0 (Mar 12, 2019)
Crash Prediction Module: v9.1.0 (Mar 12, 2019)

User Name: jdanibas
Organization Name:
Phone:
E-Mail:

Project Title: I-229 Exit 4 (Cliff Ave) - Alternative 6
Project Comment: Created Tue Apr 16 14:58:43 CDT 2019
Project Unit System: U.S. Customary

Highway Title: I-229
Highway Comment: Created Tue Apr 16 14:59:05 CDT 2019
Highway Version: 1

Evaluation Title: Evaluation 1
Evaluation Comment: Created Fri May 03 10:40:07 CDT 2019

Minimum Location: 10+00.000
Maximum Location: 92+57.134
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2024
Last Year of Analysis: 2050
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Section Types

Section 1 Evaluation

Section: Section 1
Evaluation Start Location: 10+00.000
Evaluation End Location: 92+57.134
Functional Class: Freeway
Type of Alignment: Divided, Multilane
Model Category: Freeway Segment
Calibration Factor: FI_EN=1.0; FI_EX=1.0; FI_MV=1.0; FI_SV=1.0; PDO_EN=1.0; PDO_EX=1.0; PDO_MV=1.0; PDO_SV=1.0;

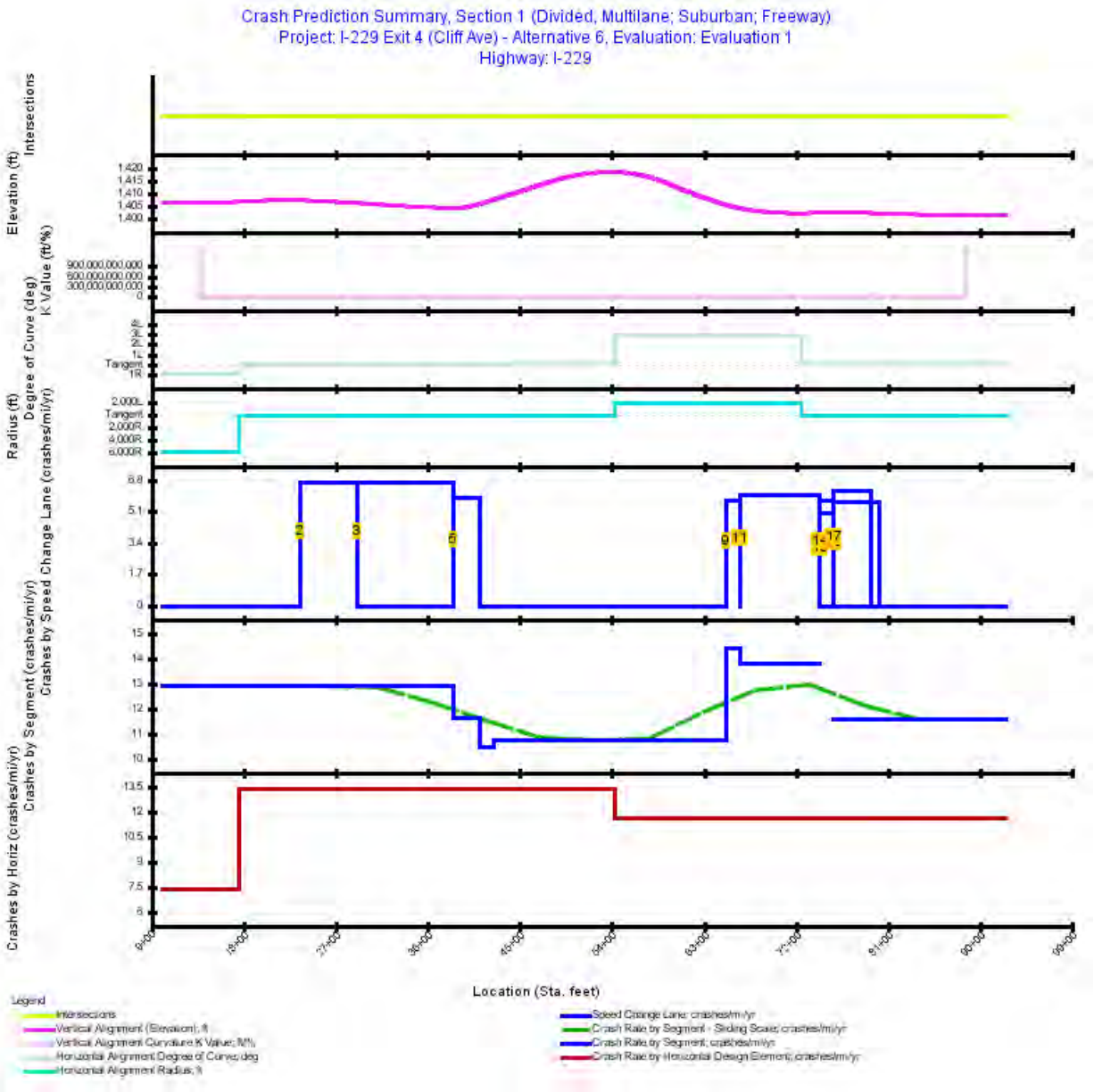

Figure 1. Crash Prediction Summary (Section 1)

Table 1. Evaluation Freeway - Homogeneous Segments (Section 1)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT	Median Width (ft)	Type	Effective Median Width (ft)
1	6F	Urban	10+00.000	38+44.179	2,844.18	0.5387	2024: 62,235; 2025: 62,933; 2026: 63,632; 2027: 64,331; 2028: 65,030; 2029: 65,729; 2030: 66,428; 2031: 67,126; 2032: 67,825; 2033: 68,524; 2034: 69,223; 2035: 69,922; 2036: 70,621; 2037: 71,320; 2038: 72,018; 2039: 72,717; 2040: 73,416; 2041: 74,115; 2042: 74,814; 2043: 75,513; 2044: 76,211; 2045: 76,910; 2046: 77,609; 2047: 78,308; 2048: 79,007; 2049: 79,706; 2050: 80,405	44.00	Non-Traversable Median	64.00
4	5F	Urban	38+44.179	41+02.826	258.65	0.0490	2024: 55,424; 2025: 56,036; 2026: 56,648; 2027: 57,260; 2028: 57,872; 2029: 58,484; 2030: 59,096; 2031: 59,708; 2032: 60,320; 2033: 60,932; 2034: 61,544; 2035: 62,155; 2036: 62,767; 2037: 63,379; 2038: 63,991; 2039: 64,603; 2040: 65,215; 2041: 65,827; 2042: 66,439; 2043: 67,051; 2044: 67,663; 2045: 68,275; 2046: 68,887; 2047: 69,499; 2048: 70,111; 2049: 70,723; 2050: 71,335	44.00	Non-Traversable Median	64.00
6	5F	Urban	41+02.826	42+36.423	133.60	0.0253	2024: 55,424; 2025: 56,036; 2026: 56,648; 2027: 57,260; 2028: 57,872; 2029: 58,484; 2030: 59,096; 2031: 59,708; 2032: 60,320; 2033: 60,932; 2034: 61,544; 2035: 62,155; 2036: 62,767; 2037: 63,379; 2038: 63,991; 2039: 64,603; 2040: 65,215; 2041: 65,827; 2042: 66,439; 2043: 67,051; 2044: 67,663; 2045: 68,275; 2046: 68,887; 2047: 69,499; 2048: 70,111; 2049: 70,723; 2050: 71,335	44.00	Non-Traversable Median	64.00
7	5F	Urban	42+36.423	65+13.782	2,277.36	0.4313	2024: 48,645; 2025: 49,197; 2026: 49,749; 2027: 50,301; 2028: 50,853; 2029: 51,406; 2030: 51,958; 2031: 52,510; 2032: 53,062; 2033: 53,614; 2034: 54,166; 2035: 54,718; 2036: 55,270; 2037: 55,822; 2038: 56,374; 2039: 56,926; 2040: 57,479; 2041: 58,031; 2042: 58,583; 2043: 59,135; 2044: 59,687; 2045: 60,239; 2046: 60,791; 2047: 61,343; 2048: 61,895; 2049: 62,447; 2050: 63,000	44.00	Non-Traversable Median	64.00
8	6F	Urban	65+13.782	66+47.379	133.60	0.0253	2024: 48,645; 2025: 49,197; 2026: 49,749; 2027: 50,301; 2028: 50,853; 2029: 51,406; 2030: 51,958; 2031: 52,510; 2032: 53,062; 2033: 53,614; 2034: 54,166; 2035: 54,718; 2036: 55,270; 2037: 55,822; 2038: 56,374; 2039: 56,926; 2040: 57,479; 2041: 58,031; 2042: 58,583; 2043: 59,135; 2044: 59,687; 2045: 60,239; 2046: 60,791; 2047: 61,343; 2048: 61,895; 2049: 62,447; 2050: 63,000	44.00	Non-Traversable Median	64.00
10	6F	Urban	66+47.379	74+33.116	785.74	0.1488	2024: 52,736; 2025: 53,325; 2026: 53,914; 2027: 54,503; 2028: 55,092; 2029: 55,681; 2030: 56,270; 2031: 56,859; 2032: 57,448; 2033: 58,037; 2034: 58,626; 2035: 59,215; 2036: 59,804; 2037: 60,393; 2038: 60,982; 2039: 61,571; 2040: 62,160; 2041: 62,749; 2042: 63,338; 2043: 63,927; 2044: 64,516; 2045: 65,105; 2046: 65,694; 2047: 66,283; 2048: 66,872; 2049: 67,461; 2050: 68,050	44.00	Non-Traversable Median	64.00
12	6F	Urban	74+33.116	75+66.713	133.60	0.0253	2024: 52,736; 2025: 53,325; 2026: 53,914; 2027: 54,503; 2028: 55,092; 2029: 55,681; 2030: 56,270; 2031: 56,859; 2032: 57,448; 2033: 58,037; 2034: 58,626; 2035: 59,215; 2036: 59,804; 2037: 60,393; 2038: 60,982; 2039: 61,571; 2040: 62,160; 2041: 62,749; 2042: 63,338; 2043: 63,927; 2044: 64,516; 2045: 65,105; 2046: 65,694; 2047: 66,283; 2048: 66,872; 2049: 67,461; 2050: 68,050	44.00	Non-Traversable Median	64.00
15	6F	Urban	75+66.713	92+57.134	1,690.42	0.3202	2024: 57,184; 2025: 57,902; 2026: 58,621; 2027: 59,340; 2028: 60,058; 2029: 60,777; 2030: 61,496; 2031: 62,214; 2032: 62,933; 2033: 63,652; 2034: 64,371; 2035: 65,089; 2036: 65,808; 2037: 66,527; 2038: 67,245; 2039: 67,964; 2040: 68,683; 2041: 69,401; 2042: 70,120; 2043: 70,839; 2044: 71,557; 2045: 72,276; 2046: 72,995; 2047: 73,713; 2048: 74,432; 2049: 75,151; 2050: 75,870	44.00	Non-Traversable Median	64.00

Table 2. Evaluation Freeway - Speed Change Lanes (Speed Change)

Seg. No.	Type	Ramp Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT	Median Width (ft)	Type	Effective Median Width (ft)
2	6SC	Exit	23+44.179	38+44.179	1,500.00	0.2841	2024: 62,235; 2025: 62,933; 2026: 63,632; 2027: 64,331; 2028: 65,030; 2029: 65,729; 2030: 66,428; 2031: 67,126; 2032: 67,825; 2033: 68,524; 2034: 69,223; 2035: 69,922; 2036: 70,621; 2037: 71,320; 2038: 72,018; 2039: 72,717; 2040: 73,416; 2041: 74,115; 2042: 74,814; 2043: 75,513; 2044: 76,211; 2045: 76,910; 2046: 77,609; 2047: 78,308; 2048: 79,007; 2049: 79,706; 2050: 80,405	44.00	Non-Traversable Median	64.00
3	6SC	Entrance	29+02.826	38+44.179	941.35	0.1783	2024: 62,235; 2025: 62,933; 2026: 63,632; 2027: 64,331; 2028: 65,030; 2029: 65,729; 2030: 66,428; 2031: 67,126; 2032: 67,825; 2033: 68,524; 2034: 69,223; 2035: 69,922; 2036: 70,621; 2037: 71,320; 2038: 72,018; 2039: 72,717; 2040: 73,416; 2041: 74,115; 2042: 74,814; 2043: 75,513; 2044: 76,211; 2045: 76,910; 2046: 77,609; 2047: 78,308; 2048: 79,007; 2049: 79,706; 2050: 80,405	44.00	Non-Traversable Median	64.00
5	5SC	Entrance	38+44.179	41+02.826	258.65	0.0490	2024: 55,424; 2025: 56,036; 2026: 56,648; 2027: 57,260; 2028: 57,872; 2029: 58,484; 2030: 59,096; 2031: 59,708; 2032: 60,320; 2033: 60,932; 2034: 61,544; 2035: 62,155; 2036: 62,767; 2037: 63,379; 2038: 63,991; 2039: 64,603; 2040: 65,215; 2041: 65,827; 2042: 66,439; 2043: 67,051; 2044: 67,663; 2045: 68,275; 2046: 68,887; 2047: 69,499; 2048: 70,111; 2049: 70,723; 2050: 71,335	44.00	Non-Traversable Median	64.00
9	6SC	Entrance	65+13.782	66+47.379	133.60	0.0253	2024: 48,645; 2025: 49,197; 2026: 49,749; 2027: 50,301; 2028: 50,853; 2029: 51,406; 2030: 51,958; 2031: 52,510; 2032: 53,062; 2033: 53,614; 2034: 54,166; 2035: 54,718; 2036: 55,270; 2037: 55,822; 2038: 56,374; 2039: 56,926; 2040: 57,479; 2041: 58,031; 2042: 58,583; 2043: 59,135; 2044: 59,687; 2045: 60,239; 2046: 60,791; 2047: 61,343; 2048: 61,895; 2049: 62,447; 2050: 63,000	44.00	Non-Traversable Median	64.00
11	6SC	Entrance	66+47.379	74+33.116	785.74	0.1488	2024: 52,736; 2025: 53,325; 2026: 53,914; 2027: 54,503; 2028: 55,092; 2029: 55,681; 2030: 56,270; 2031: 56,859; 2032: 57,448; 2033: 58,037; 2034: 58,626; 2035: 59,215; 2036: 59,804; 2037: 60,393; 2038: 60,982; 2039: 61,571; 2040: 62,160; 2041: 62,749; 2042: 63,338; 2043: 63,927; 2044: 64,516; 2045: 65,105; 2046: 65,694; 2047: 66,283; 2048: 66,872; 2049: 67,461; 2050: 68,050	44.00	Non-Traversable Median	64.00
13	6SC	Entrance	74+33.116	75+66.713	133.60	0.0253	2024: 52,736; 2025: 53,325; 2026: 53,914; 2027: 54,503; 2028: 55,092; 2029: 55,681; 2030: 56,270; 2031: 56,859; 2032: 57,448; 2033: 58,037; 2034: 58,626; 2035: 59,215; 2036: 59,804; 2037: 60,393; 2038: 60,982; 2039: 61,571; 2040: 62,160; 2041: 62,749; 2042: 63,338; 2043: 63,927; 2044: 64,516; 2045: 65,105; 2046: 65,694; 2047: 66,283; 2048: 66,872; 2049: 67,461; 2050: 68,050	44.00	Non-Traversable Median	64.00
14	6SC	Exit	74+33.116	75+66.713	133.60	0.0253	2024: 52,736; 2025: 53,325; 2026: 53,914; 2027: 54,503; 2028: 55,092; 2029: 55,681; 2030: 56,270; 2031: 56,859; 2032: 57,448; 2033: 58,037; 2034: 58,626; 2035: 59,215; 2036: 59,804; 2037: 60,393; 2038: 60,982; 2039: 61,571; 2040: 62,160; 2041: 62,749; 2042: 63,338; 2043: 63,927; 2044: 64,516; 2045: 65,105; 2046: 65,694; 2047: 66,283; 2048: 66,872; 2049: 67,461; 2050: 68,050	44.00	Non-Traversable Median	64.00
16	6SC	Entrance	75+66.713	80+13.782	447.07	0.0847	2024: 57,184; 2025: 57,902; 2026: 58,621; 2027: 59,340; 2028: 60,058; 2029: 60,777; 2030: 61,496; 2031: 62,214; 2032: 62,933; 2033: 63,652; 2034: 64,371; 2035: 65,089; 2036: 65,808; 2037: 66,527; 2038: 67,245; 2039: 67,964; 2040: 68,683; 2041: 69,401; 2042: 70,120; 2043: 70,839; 2044: 71,557; 2045: 72,276; 2046: 72,995; 2047: 73,713; 2048: 74,432; 2049: 75,151; 2050: 75,870	44.00	Non-Traversable Median	64.00
17	6SC	Exit	75+66.713	79+33.116	366.40	0.0694	2024: 57,184; 2025: 57,902; 2026: 58,621; 2027: 59,340; 2028: 60,058; 2029: 60,777; 2030: 61,496; 2031: 62,214; 2032: 62,933; 2033: 63,652; 2034: 64,371; 2035: 65,089; 2036: 65,808; 2037: 66,527; 2038: 67,245; 2039: 67,964; 2040: 68,683; 2041: 69,401; 2042: 70,120; 2043: 70,839; 2044: 71,557; 2045: 72,276; 2046: 72,995; 2047: 73,713; 2048: 74,432; 2049: 75,151; 2050: 75,870	44.00	Non-Traversable Median	64.00

Table 3. Predicted Freeway Crash Rates and Frequencies Summary (Section 1)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Effective Length (mi)	**1.1188**
Average Future Road AADT (vpd)	**63,048**
Predicted Crashes	
Total Crashes	**355.91**
Fatal and Injury Crashes	**130.32**
Property-Damage-Only Crashes	**225.59**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**37**
Percent Property-Damage-Only Crashes (%)	**63**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**11.7824**
FI Crash Rate (crashes/mi/yr)	**4.3141**
PDO Crash Rate (crashes/mi/yr)	**7.4683**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**695.14**
Travel Crash Rate (crashes/million veh-mi)	**0.51**
Travel FI Crash Rate (crashes/million veh-mi)	**0.19**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.33**

Note: *Effective Length* is the *segment length* minus the length of the *speed change lanes* if present.

Table 4. Predicted Freeway Speed Change Lane Crash Rates and Frequencies Summary (Speed Change)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Evaluated Length (mi)	**0.8902**
Average Future Road AADT (vpd)	**33,582**
Predicted Crashes	
Total Crashes	**151.22**
Fatal and Injury Crashes	**45.83**
Property-Damage-Only Crashes	**105.39**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**30**
Percent Property-Damage-Only Crashes (%)	**70**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**6.2920**
FI Crash Rate (crashes/mi/yr)	**1.9069**
PDO Crash Rate (crashes/mi/yr)	**4.3851**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**294.60**
Travel Crash Rate (crashes/million veh-mi)	**0.51**
Travel FI Crash Rate (crashes/million veh-mi)	**0.16**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.36**

Note: *Total Travel and Crash Rates/Million Vehicle Miles* for *Speed Change Lanes* reflect AADTs that are **half of the Freeway Segment AADTs** based on the assumption of 50/50 directional distribution.

Table 5. Predicted Crash Frequencies and Rates by Freeway Segment/Intersection (Section 1)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Effective Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	10+00.000	38+44.179	0.3075	107.292	3.9738	1.4252	2.5485	12.9236	0.50
4	38+44.179	41+02.826	0.0245	7.701	0.2852	0.1051	0.1801	11.6448	0.50
6	41+02.826	42+36.423	0.0253	7.172	0.2656	0.0981	0.1675	10.4975	0.45
7	42+36.423	65+13.782	0.4313	125.205	4.6372	1.7554	2.8818	10.7513	0.53
8	65+13.782	66+47.379	0.0127	4.915	0.1820	0.0665	0.1155	14.3890	0.71
10	66+47.379	74+33.116	0.0744	27.739	1.0274	0.3715	0.6559	13.8076	0.63
12	74+33.116	75+66.713	0.0000	0.000	0.0000	0.0000	0.0000		
15	75+66.713	92+57.134	0.2431	75.887	2.8106	1.0046	1.8060	11.5606	0.48
Total			1.1188	355.911	13.1819	4.8266	8.3553	11.7824	0.51

Note: *Effective Length* is the *segment length* minus the length of the *speed change lanes* if present.

Table 6. Predicted Crash Frequencies and Rates by Freeway Speed Change Lane (Speed Change)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
2	23+44.179	38+44.179	0.2841	51.455	1.9057	0.5391	1.3667	6.7082	0.52
3	29+02.826	38+44.179	0.1783	32.290	1.1959	0.4015	0.7944	6.7079	0.52
5	38+44.179	41+02.826	0.0490	7.699	0.2852	0.0961	0.1891	5.8212	0.50
9	65+13.782	66+47.379	0.0253	3.918	0.1451	0.0416	0.1035	5.7354	0.56
11	66+47.379	74+33.116	0.1488	24.113	0.8931	0.2602	0.6329	6.0013	0.54
13	74+33.116	75+66.713	0.0253	3.414	0.1264	0.0395	0.0870	4.9975	0.45
14	74+33.116	75+66.713	0.0253	3.876	0.1435	0.0429	0.1006	5.6731	0.52
16	75+66.713	80+13.782	0.0847	12.835	0.4754	0.1481	0.3273	5.6145	0.46
17	75+66.713	79+33.116	0.0694	11.622	0.4304	0.1284	0.3020	6.2027	0.51
Total			0.8902	151.222	5.6008	1.6974	3.9034	6.2920	0.51

Note: *Travel Crash Rates/Million Vehicle Miles* for *Speed Change Lanes* reflect AADTs that are **half of the Freeway Segment**

AADTs based on the assumption of 50/50 directional distribution.

Table 7. Predicted Crash Frequencies and Rates by Horizontal Design Element (Section 1)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Simple Curve 1	10+00.000	17+54.376	0.1429	28.457	1.0540	0.3780	0.6760	7.3770	0.50
Tangent	17+54.376	54+26.711	0.6955	250.591	9.2811	3.2045	6.0766	13.3442	0.88
Simple Curve 2	54+26.711	72+50.687	0.3454	108.412	4.0153	1.4312	2.5841	11.6233	0.80
Tangent	72+50.687	92+57.134	0.3800	119.673	4.4323	1.5102	2.9221	11.6638	

Table 8. Predicted Crash Frequencies by Year (Section 1)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2024	16.03	5.59	34.870	10.44	65.130
2025	16.26	5.67	34.852	10.60	65.148
2026	16.50	5.75	34.833	10.75	65.167
2027	16.73	5.83	34.814	10.91	65.186
2028	16.97	5.90	34.796	11.06	65.204
2029	17.20	5.98	34.777	11.22	65.223
2030	17.45	6.06	34.758	11.38	65.242
2031	17.69	6.14	34.739	11.54	65.261
2032	17.93	6.22	34.720	11.71	65.280
2033	18.18	6.31	34.701	11.87	65.299
2034	18.42	6.39	34.681	12.03	65.319
2035	18.67	6.47	34.662	12.20	65.338
2036	18.83	6.47	34.393	12.35	65.607
2037	19.06	6.55	34.337	12.52	65.663
2038	19.30	6.62	34.281	12.69	65.719
2039	19.54	6.69	34.225	12.85	65.775
2040	19.78	6.76	34.170	13.02	65.830
2041	20.02	6.83	34.115	13.19	65.885
2042	20.26	6.90	34.061	13.36	65.939
2043	20.50	6.97	34.007	13.53	65.993
2044	20.75	7.04	33.954	13.70	66.046
2045	20.99	7.12	33.901	13.87	66.099
2046	21.23	7.19	33.848	14.05	66.152
2047	21.48	7.26	33.796	14.22	66.204
2048	21.73	7.33	33.744	14.39	66.256
2049	21.97	7.40	33.693	14.57	66.308
2050	22.22	7.48	33.641	14.75	66.359
Total	515.69	176.92	34.308	338.77	65.692
Average	19.10	6.55	34.308	12.55	65.692

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 9. Predicted Crash Severity by Freeway Segment (Section 1)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.7231	1.8679	11.8948	23.9956	68.8101
4	0.0497	0.1262	0.8468	1.8155	4.8626
6	0.0464	0.1178	0.7902	1.6941	4.5231
7	0.8924	2.3061	14.6641	29.5332	77.8094
8	0.0400	0.1042	0.6268	1.0254	3.1186
10	0.2162	0.5581	3.4460	5.8109	17.7080
12					0.0000
15	0.5222	1.3121	8.8284	16.4627	48.7618
Total					225.5936

Table 10. Predicted Crash Severity by Speed Change Lane (Speed Change)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
2	0.2547	0.6474	4.3425	9.3101	36.9004
3	0.1897	0.4822	3.2345	6.9345	21.4491
5	0.0454	0.1153	0.7738	1.6589	5.1059
9	0.0251	0.0652	0.3924	0.6418	2.7937
11	0.1514	0.3909	2.4133	4.0696	17.0878
13	0.0205	0.0516	0.3471	0.6472	2.3477
14	0.0223	0.0561	0.3771	0.7033	2.7169
16	0.0770	0.1934	1.3012	2.4265	8.8375
17	0.0668	0.1677	1.1287	2.1046	8.1539
Total	0.8529	2.1697	14.3105	28.4964	105.3929

Table 11. Predicted Freeway Crash Type Distribution (Section 1)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.27	0.1	2.38	0.7	2.65	0.7
Highway Segment	Collision with Fixed Object	48.40	13.3	77.47	21.3	125.88	34.6
Highway Segment	Collision with Other Object	3.42	0.9	15.04	4.1	18.46	5.1
Highway Segment	Other Single-vehicle Collision	13.95	3.8	11.58	3.2	25.52	7.0
Highway Segment	Collision with Parked Vehicle	1.01	0.3	1.73	0.5	2.74	0.8
Highway Segment	Total Single Vehicle Crashes	67.04	18.4	108.20	29.8	175.24	48.2
Highway Segment	Right-Angle Collision	1.97	0.5	2.24	0.6	4.22	1.2
Highway Segment	Head-on Collision	0.51	0.1	0.25	0.1	0.76	0.2
Highway Segment	Other Multi-vehicle Collision	1.97	0.5	2.99	0.8	4.96	1.4
Highway Segment	Rear-end Collision	47.75	13.1	85.98	23.7	133.73	36.8
Highway Segment	Sideswipe, Same Direction Collision	11.46	3.2	33.15	9.1	44.60	12.3
Highway Segment	Total Multiple Vehicle Crashes	63.66	17.5	124.61	34.3	188.27	51.8
Highway Segment	Total Highway Segment Crashes	130.71	36.0	232.81	64.0	363.51	100.0
	Total Crashes	130.71	36.0	232.81	64.0	363.51	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 12. Predicted Exit Speed Change Lane Crash Type Distribution (Speed Change)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.00	0.0	0.33	0.5	0.33	0.5
Highway Segment	Collision with Fixed Object	3.76	5.6	9.89	14.8	13.65	20.4
Highway Segment	Collision with Other Object	0.31	0.5	1.43	2.1	1.74	2.6
Highway Segment	Other Single-vehicle Collision	0.94	1.4	1.10	1.6	2.04	3.0
Highway Segment	Collision with Parked Vehicle	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Total Single Vehicle Crashes	5.01	7.5	12.76	19.1	17.76	26.5
Highway Segment	Right-Angle Collision	0.21	0.3	0.57	0.9	0.78	1.2
Highway Segment	Head-on Collision	0.10	0.1	0.10	0.1	0.19	0.3
Highway Segment	Other Multi-vehicle Collision	0.31	0.5	0.76	1.1	1.07	1.6
Highway Segment	Rear-end Collision	10.53	15.7	26.99	40.3	37.52	56.0
Highway Segment	Sideswipe, Same Direction Collision	3.03	4.5	6.59	9.8	9.62	14.4
Highway Segment	Total Multiple Vehicle Crashes	14.18	21.2	35.02	52.3	49.19	73.5
Highway Segment	Total Highway Segment Crashes	19.18	28.6	47.77	71.4	66.95	100.0
	Total Crashes	19.18	28.6	47.77	71.4	66.95	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 13. Predicted Entrance Speed Change Lane Crash Type Distribution (Speed Change)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.00	0.0	0.12	0.1	0.12	0.1
Highway Segment	Collision with Fixed Object	5.24	6.2	7.51	8.8	12.75	15.0
Highway Segment	Collision with Other Object	0.51	0.6	2.10	2.5	2.61	3.1
Highway Segment	Other Single-vehicle Collision	1.81	2.1	0.93	1.1	2.74	3.2
Highway Segment	Collision with Parked Vehicle	0.11	0.1	0.17	0.2	0.28	0.3
Highway Segment	Total Single Vehicle Crashes	7.68	9.0	10.82	12.7	18.50	21.7
Highway Segment	Right-Angle Collision	0.51	0.6	0.93	1.1	1.45	1.7
Highway Segment	Head-on Collision	0.11	0.1	0.06	0.1	0.17	0.2
Highway Segment	Other Multi-vehicle Collision	0.46	0.5	0.87	1.0	1.33	1.6
Highway Segment	Rear-end Collision	14.68	17.2	30.84	36.2	45.52	53.4
Highway Segment	Sideswipe, Same Direction Collision	3.60	4.2	14.66	17.2	18.26	21.4
Highway Segment	Total Multiple Vehicle Crashes	19.36	22.7	47.37	55.6	66.72	78.3
Highway Segment	Total Highway Segment Crashes	27.03	31.7	58.19	68.3	85.23	100.0
	Total Crashes	27.03	31.7	58.19	68.3	85.23	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 14. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
38+44.179	41+02.826	for segment #4 (38+44.179 to 41+02.826), Freeway Segment of type Five-lane Freeway is using unbalanced lane processing with types Four-lane Freeway and Six-lane Freeway
41+02.826	42+36.423	for segment #6 (41+02.826 to 42+36.423), Freeway Segment of type Five-lane Freeway is using unbalanced lane processing with types Four-lane Freeway and Six-lane Freeway
42+36.423	65+13.782	for segment #7 (42+36.423 to 65+13.782), Freeway Segment of type Five-lane Freeway is using unbalanced lane processing with types Four-lane Freeway and Six-lane Freeway
38+44.179	41+02.826	for segment #5 (38+44.179 to 41+02.826), Speed Change Segment of type Five-lane Freeway Speed Change is using unbalanced lane processing with types Four-lane Freeway Speed Change and Six-lane Freeway Speed Change

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

April 29, 2019

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Table of Contents

List of Tables

List of Figures

Report Overview

Report Generated: Apr 29, 2019 5:10 PM
Report Template: System: Single Page [System] (mlcpm3, Apr 10, 2019 1:31 PM)

Evaluation Date: Mon Apr 29 17:10:09 CDT 2019
IHSDM Version: v14.1.0 (Mar 12, 2019)
Crash Prediction Module: v9.1.0 (Mar 12, 2019)

User Name: jdanibas
Organization Name:
Phone:
E-Mail:

Project Title: I-229 Exit 4 (Cliff Ave) - Alternative 6
Project Comment: Created Tue Apr 16 14:58:43 CDT 2019
Project Unit System: U.S. Customary

Highway Title: Alt 6 - NB Entrance LT Ramp
Highway Comment: Created Mon Apr 29 13:14:14 CDT 2019
Highway Version: 1

Evaluation Title: Evaluation 1
Evaluation Comment: Created Mon Apr 29 17:09:55 CDT 2019

Minimum Location: 0.000
Maximum Location: 14+11.601
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2024
Last Year of Analysis: 2050
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Section Types

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 14+11.601
Functional Class: Freeway C-D Road & System Ramp
Type of Alignment: One Direction
Model Category: C-D Road & System Ramp
Calibration Factor: CD_MV_FI=1.0; CD_MV_PDO=1.0; CD_SV_FI=1.0; CD_SV_PDO=1.0;

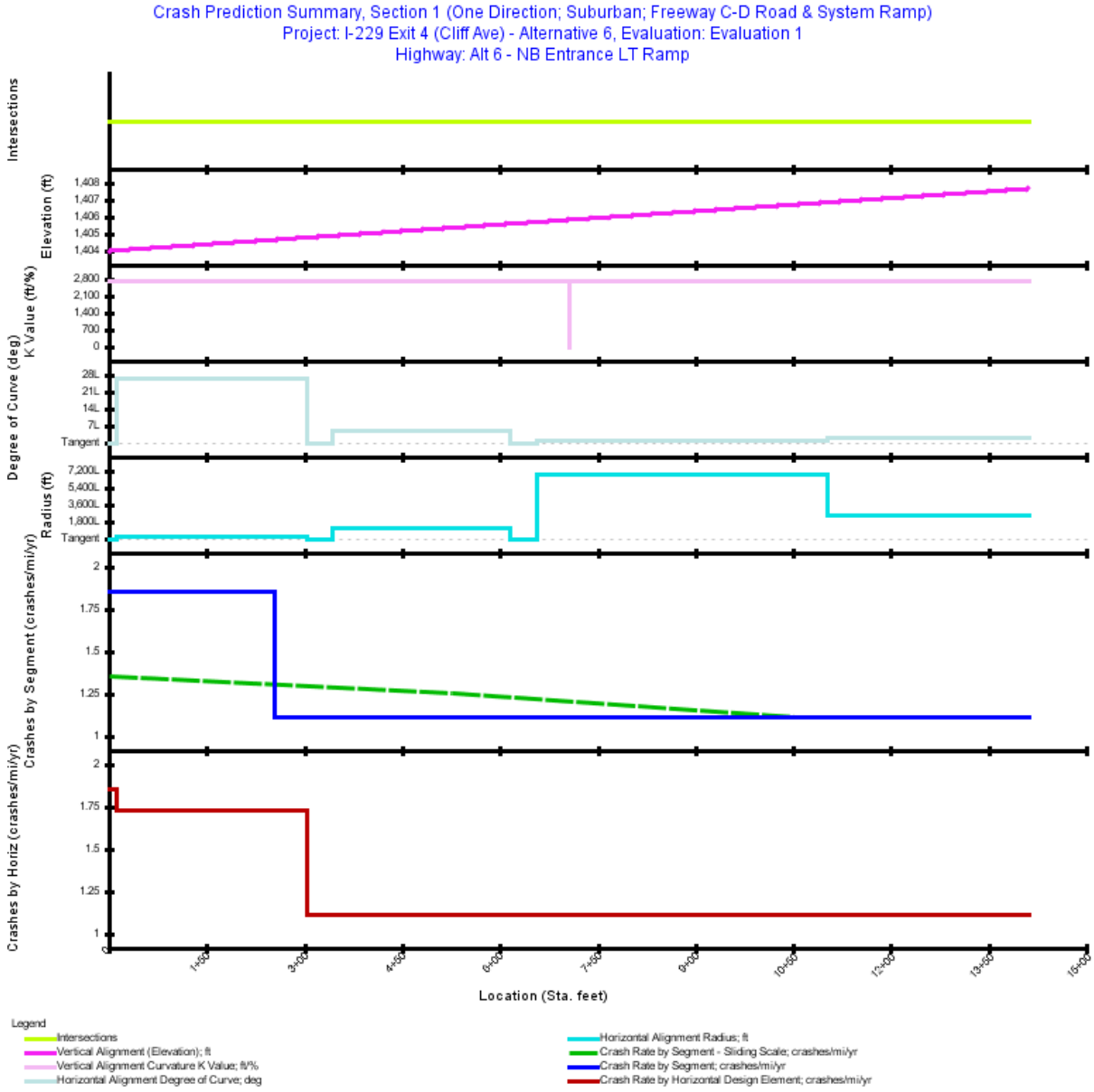

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT
1	1CD	Urban	0.000	2+53.807	253.81	0.0481	2024: 1,115; 2025: 1,125; 2026: 1,135; 2027: 1,145; 2028: 1,155; 2029: 1,165; 2030: 1,175; 2031: 1,185; 2032: 1,195; 2033: 1,205; 2034: 1,215; 2035: 1,225; 2036: 1,235; 2037: 1,245; 2038: 1,255; 2039: 1,265; 2040: 1,275; 2041: 1,285; 2042: 1,295; 2043: 1,305; 2044: 1,315; 2045: 1,325; 2046: 1,335; 2047: 1,345; 2048: 1,355; 2049: 1,365; 2050: 1,375
2	1CD	Urban	2+53.807	14+11.601	1,157.79	0.2193	2024: 4,091; 2025: 4,128; 2026: 4,165; 2027: 4,201; 2028: 4,238; 2029: 4,275; 2030: 4,312; 2031: 4,349; 2032: 4,386; 2033: 4,423; 2034: 4,460; 2035: 4,496; 2036: 4,533; 2037: 4,570; 2038: 4,607; 2039: 4,644; 2040: 4,681; 2041: 4,718; 2042: 4,755; 2043: 4,791; 2044: 4,828; 2045: 4,865; 2046: 4,902; 2047: 4,939; 2048: 4,976; 2049: 5,013; 2050: 5,050

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Evaluated Length (mi)	**0.2673**
Average Future Road AADT (vpd)	**3,972**
Predicted Crashes	
Total Crashes	**8.99**
Fatal and Injury Crashes	**4.18**
Property-Damage-Only Crashes	**4.81**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**46**
Percent Property-Damage-Only Crashes (%)	**54**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**1.2458**
FI Crash Rate (crashes/mi/yr)	**0.5793**
PDO Crash Rate (crashes/mi/yr)	**0.6666**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**10.47**
Travel Crash Rate (crashes/million veh-mi)	**0.86**
Travel FI Crash Rate (crashes/million veh-mi)	**0.40**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.46**

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	2+53.807	0.0481	2.408	0.0892	0.0424	0.0467	1.8553	4.08
2	2+53.807	14+11.601	0.2193	6.585	0.2439	0.1124	0.1315	1.1122	0.67
Total			0.2673	8.993	0.3331	0.1549	0.1782	1.2458	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	0.000	12.525	0.0024	0.119	0.0044	0.0021	0.0023	1.8553	4.08
Simple Curve 1	12.525	3+03.643	0.0551	2.573	0.0953	0.0452	0.0501	1.7281	3.50
Tangent	3+03.643	3+43.938	0.0076	0.229	0.0085	0.0039	0.0046	1.1122	0.67
Simple Curve 2	3+43.938	6+16.421	0.0516	1.550	0.0574	0.0265	0.0309	1.1122	0.67
Tangent	6+16.421	6+55.894	0.0075	0.225	0.0083	0.0038	0.0045	1.1122	0.67
Simple Curve 3	6+55.894	11+02.705	0.0846	2.541	0.0941	0.0434	0.0507	1.1122	0.67
Simple Curve 4	11+02.705	14+11.601	0.0585	1.757	0.0651	0.0300	0.0351	1.1122	0.67

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2024	0.30	0.14	46.934	0.16	53.066
2025	0.31	0.14	46.898	0.16	53.102
2026	0.31	0.14	46.863	0.16	53.137
2027	0.31	0.14	46.828	0.17	53.172
2028	0.31	0.15	46.794	0.17	53.206
2029	0.32	0.15	46.760	0.17	53.240
2030	0.32	0.15	46.726	0.17	53.274
2031	0.32	0.15	46.692	0.17	53.308
2032	0.32	0.15	46.659	0.17	53.341
2033	0.32	0.15	46.626	0.17	53.374
2034	0.33	0.15	46.593	0.17	53.407
2035	0.33	0.15	46.562	0.18	53.438
2036	0.33	0.15	46.530	0.18	53.470
2037	0.33	0.15	46.498	0.18	53.502
2038	0.34	0.16	46.467	0.18	53.533
2039	0.34	0.16	46.436	0.18	53.564
2040	0.34	0.16	46.405	0.18	53.595
2041	0.34	0.16	46.375	0.18	53.625
2042	0.34	0.16	46.345	0.18	53.655
2043	0.35	0.16	46.316	0.19	53.684
2044	0.35	0.16	46.286	0.19	53.714
2045	0.35	0.16	46.257	0.19	53.743
2046	0.35	0.16	46.228	0.19	53.772
2047	0.35	0.16	46.199	0.19	53.801
2048	0.36	0.17	46.171	0.19	53.829
2049	0.36	0.17	46.143	0.19	53.857
2050	0.36	0.17	46.115	0.20	53.885
Total	8.99	4.18	46.495	4.81	53.505
Average	0.33	0.15	46.495	0.18	53.505

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0244	0.0741	0.4717	0.5756	1.2621
2	0.0647	0.1963	1.2496	1.5247	3.5497
Total	0.0892	0.2704	1.7214	2.1004	4.8117

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.01	0.1	0.07	0.7	0.08	0.8
Highway Segment	Collision with Fixed Object	1.86	20.6	2.13	23.7	3.99	44.3
Highway Segment	Collision with Other Object	0.13	1.5	0.41	4.6	0.55	6.1
Highway Segment	Other Single-vehicle Collision	0.54	5.9	0.32	3.5	0.85	9.5
Highway Segment	Collision with Parked Vehicle	0.04	0.4	0.05	0.5	0.09	1.0
Highway Segment	Total Single Vehicle Crashes	2.57	28.6	2.97	33.1	5.55	61.7
Highway Segment	Right-Angle Collision	0.05	0.6	0.03	0.4	0.08	0.9
Highway Segment	Head-on Collision	0.01	0.1	0.00	0.0	0.02	0.2
Highway Segment	Other Multi-vehicle Collision	0.05	0.6	0.04	0.5	0.09	1.0
Highway Segment	Rear-end Collision	1.21	13.4	1.27	14.1	2.48	27.5
Highway Segment	Sideswipe, Same Direction Collision	0.29	3.2	0.49	5.4	0.78	8.7
Highway Segment	Total Multiple Vehicle Crashes	1.61	17.9	1.84	20.4	3.45	38.3
Highway Segment	Total Highway Segment Crashes	4.18	46.5	4.81	53.5	8.99	100.0
	Total Crashes	4.18	46.5	4.81	53.5	8.99	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
0.000	2+53.807	for segment #1 (0.000 to 2+53.807), Left shoulder width (1.0 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.
2+53.807	14+11.601	for segment #2 (2+53.807 to 14+11.601), Left shoulder width (1.0 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

April 29, 2019

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Table of Contents

List of Tables

List of Figures

Report Overview

Report Generated: Apr 29, 2019 5:11 PM
Report Template: System: Single Page [System] (mlcpm3, Apr 10, 2019 1:31 PM)

Evaluation Date: Mon Apr 29 17:11:17 CDT 2019
IHSDM Version: v14.1.0 (Mar 12, 2019)
Crash Prediction Module: v9.1.0 (Mar 12, 2019)

User Name: jdanibas
Organization Name:
Phone:
E-Mail:

Project Title: I-229 Exit 4 (Cliff Ave) - Alternative 6
Project Comment: Created Tue Apr 16 14:58:43 CDT 2019
Project Unit System: U.S. Customary

Highway Title: Alt 6 - NB Entrance RT Ramp
Highway Comment: Created Mon Apr 29 13:20:18 CDT 2019
Highway Version: 1

Evaluation Title: Evaluation 1
Evaluation Comment: Created Mon Apr 29 17:10:57 CDT 2019

Minimum Location: 0.000
Maximum Location: 3+36.905
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2024
Last Year of Analysis: 2050
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Section Types

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 3+36.905
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp
Calibration Factor: ENT_RAMP_MV_FI=1.0; ENT_RAMP_MV_PDO=1.0; ENT_RAMP_SV_FI=1.0; ENT_RAMP_SV_PDO=1.0;

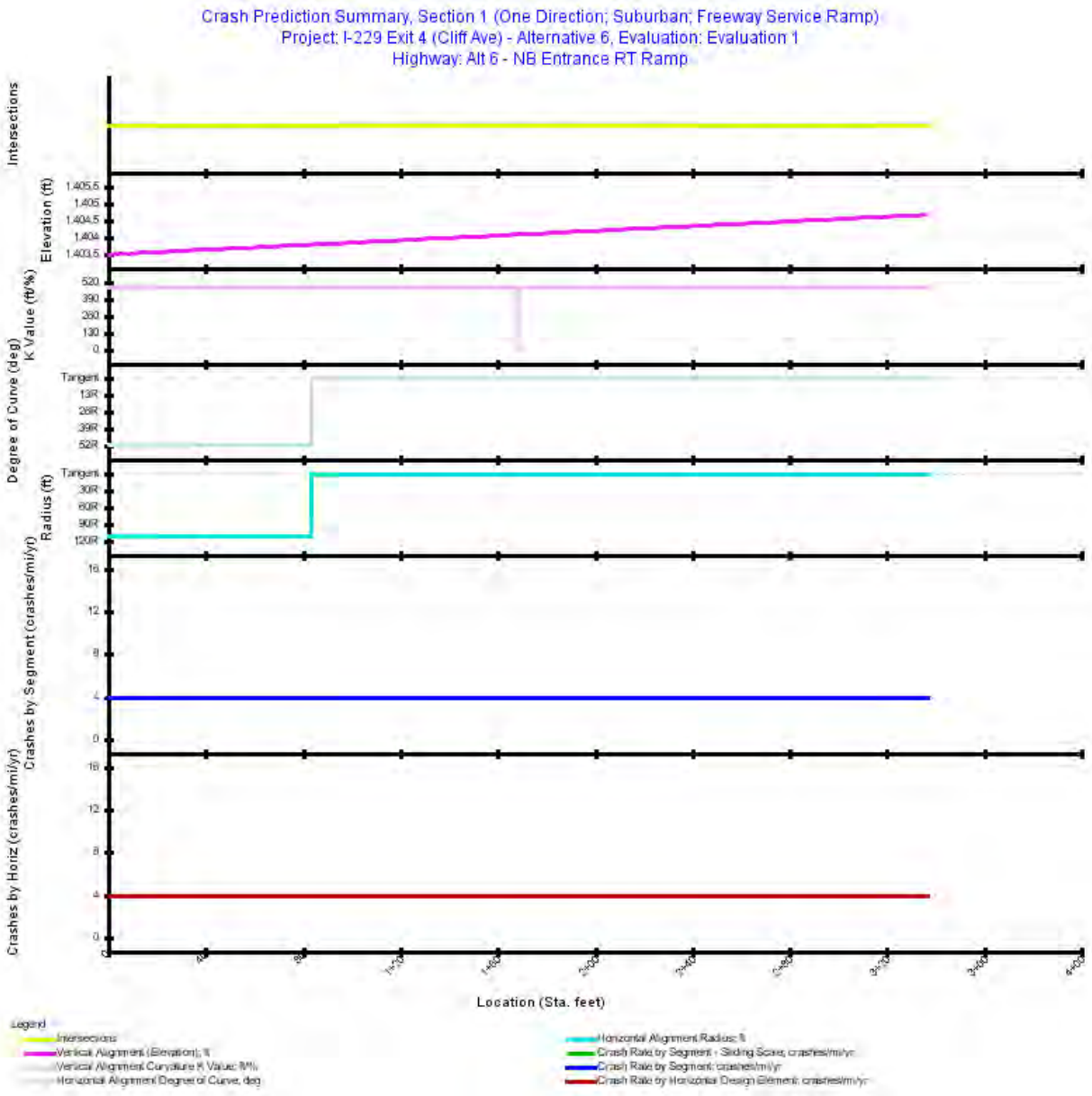

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT
1	1EN	Urban	0.000	3+36.905	336.90	0.0638	2024: 2,976; 2025: 3,003; 2026: 3,030; 2027: 3,056; 2028: 3,083; 2029: 3,110; 2030: 3,137; 2031: 3,164; 2032: 3,191; 2033: 3,218; 2034: 3,245; 2035: 3,271; 2036: 3,298; 2037: 3,325; 2038: 3,352; 2039: 3,379; 2040: 3,406; 2041: 3,433; 2042: 3,460; 2043: 3,486; 2044: 3,513; 2045: 3,540; 2046: 3,567; 2047: 3,594; 2048: 3,621; 2049: 3,648; 2050: 3,675

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Evaluated Length (mi)	**0.0638**
Average Future Road AADT (vpd)	**3,325**
Predicted Crashes	
Total Crashes	**6.78**
Fatal and Injury Crashes	**2.97**
Property-Damage-Only Crashes	**3.81**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**44**
Percent Property-Damage-Only Crashes (%)	**56**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**3.9365**
FI Crash Rate (crashes/mi/yr)	**1.7234**
PDO Crash Rate (crashes/mi/yr)	**2.2131**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**2.09**
Travel Crash Rate (crashes/million veh-mi)	**3.24**
Travel FI Crash Rate (crashes/million veh-mi)	**1.42**
Travel PDO Crash Rate (crashes/million veh-mi)	**1.82**

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	3+36.905	0.0638	6.782	0.2512	0.1100	0.1412	3.9365	3.24
Total			0.0638	6.782	0.2512	0.1100	0.1412	3.9365	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Simple Curve 1	0.000	83.155	0.0157	1.674	0.0620	0.0271	0.0349	3.9365	3.24
Tangent	83.155	3+36.905	0.0481	5.108	0.1892	0.0828	0.1064	3.9365	3.24

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2024	0.23	0.10	43.810	0.13	56.190
2025	0.23	0.10	43.807	0.13	56.193
2026	0.23	0.10	43.805	0.13	56.195
2027	0.24	0.10	43.803	0.13	56.197
2028	0.24	0.10	43.800	0.13	56.200
2029	0.24	0.10	43.798	0.14	56.202
2030	0.24	0.10	43.795	0.14	56.205
2031	0.24	0.11	43.793	0.14	56.207
2032	0.24	0.11	43.791	0.14	56.209
2033	0.24	0.11	43.788	0.14	56.212
2034	0.25	0.11	43.786	0.14	56.214
2035	0.25	0.11	43.784	0.14	56.216
2036	0.25	0.11	43.781	0.14	56.219
2037	0.25	0.11	43.779	0.14	56.221
2038	0.25	0.11	43.777	0.14	56.223
2039	0.25	0.11	43.775	0.14	56.225
2040	0.26	0.11	43.772	0.14	56.228
2041	0.26	0.11	43.770	0.14	56.230
2042	0.26	0.11	43.768	0.14	56.232
2043	0.26	0.11	43.766	0.15	56.234
2044	0.26	0.11	43.764	0.15	56.236
2045	0.26	0.12	43.762	0.15	56.238
2046	0.26	0.12	43.760	0.15	56.240
2047	0.27	0.12	43.758	0.15	56.242
2048	0.27	0.12	43.755	0.15	56.245
2049	0.27	0.12	43.753	0.15	56.247
2050	0.27	0.12	43.751	0.15	56.249
Total	6.78	2.97	43.779	3.81	56.221
Average	0.25	0.11	43.779	0.14	56.221

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0633	0.1920	1.2223	1.4914	3.8128

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.01	0.2	0.08	1.1	0.09	1.3
Highway Segment	Collision with Fixed Object	1.94	28.5	2.52	37.1	4.45	65.7
Highway Segment	Collision with Other Object	0.14	2.0	0.49	7.2	0.63	9.2
Highway Segment	Other Single-vehicle Collision	0.56	8.2	0.38	5.5	0.93	13.8
Highway Segment	Collision with Parked Vehicle	0.04	0.6	0.06	0.8	0.10	1.4
Highway Segment	Total Single Vehicle Crashes	2.68	39.5	3.52	51.9	6.20	91.4
Highway Segment	Right-Angle Collision	0.01	0.1	0.01	0.1	0.01	0.2
Highway Segment	Head-on Collision	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Other Multi-vehicle Collision	0.01	0.1	0.01	0.1	0.02	0.2
Highway Segment	Rear-end Collision	0.22	3.2	0.20	3.0	0.42	6.2
Highway Segment	Sideswipe, Same Direction Collision	0.05	0.8	0.08	1.2	0.13	1.9
Highway Segment	Total Multiple Vehicle Crashes	0.29	4.2	0.30	4.4	0.58	8.6
Highway Segment	Total Highway Segment Crashes	2.97	43.8	3.81	56.2	6.78	100.0
	Total Crashes	2.97	43.8	3.81	56.2	6.78	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
0.000	3+36.905	for segment #1 (0.000 to 3+36.905), The ramp type for Ramp Alt 6 - NB Entrance RT Ramp is set at the Ramp Connection (Entrance) and in the Ramp (Entrance). The Ramp value takes precedence.
0.000	3+36.905	for segment #1 (0.000 to 3+36.905), Left shoulder width (1.0 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

April 29, 2019

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Table of Contents

List of Tables

List of Figures

Report Overview

Report Generated: Apr 29, 2019 5:07 PM
Report Template: System: Single Page [System] (mlcpm3, Apr 10, 2019 1:31 PM)

Evaluation Date: Mon Apr 29 17:07:21 CDT 2019
IHSDM Version: v14.1.0 (Mar 12, 2019)
Crash Prediction Module: v9.1.0 (Mar 12, 2019)

User Name: jdanibas
Organization Name:
Phone:
E-Mail:

Project Title: I-229 Exit 4 (Cliff Ave) - Alternative 6
Project Comment: Created Tue Apr 16 14:58:43 CDT 2019
Project Unit System: U.S. Customary

Highway Title: Alt 6 - NB Exit LT Ramp
Highway Comment: Created Mon Apr 29 12:53:40 CDT 2019
Highway Version: 1

Evaluation Title: Evaluation 1
Evaluation Comment: Created Mon Apr 29 17:07:09 CDT 2019

Minimum Location: 0.000
Maximum Location: 13+23.882
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2024
Last Year of Analysis: 2050
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Section Types

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 13+23.882
Functional Class: Freeway C-D Road & System Ramp
Type of Alignment: One Direction
Model Category: C-D Road & System Ramp
Calibration Factor: CD_MV_FI=1.0; CD_MV_PDO=1.0; CD_SV_FI=1.0; CD_SV_PDO=1.0;

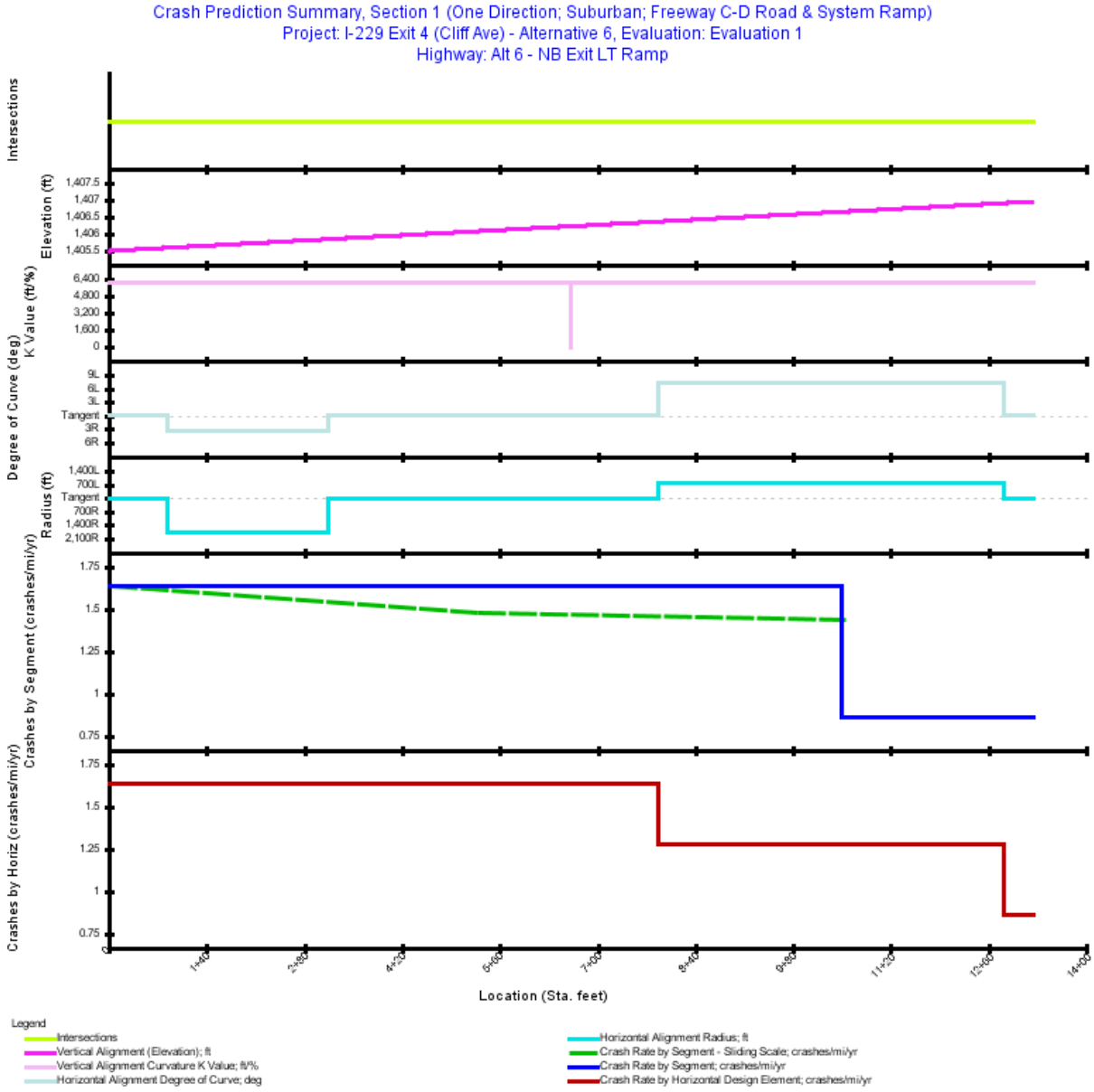

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT
1	1CD	Urban	0.000	10+49.661	1,049.66	0.1988	2024: 6,810; 2025: 6,897; 2026: 6,984; 2027: 7,071; 2028: 7,158; 2029: 7,244; 2030: 7,331; 2031: 7,418; 2032: 7,505; 2033: 7,592; 2034: 7,679; 2035: 7,766; 2036: 7,853; 2037: 7,940; 2038: 8,027; 2039: 8,114; 2040: 8,200; 2041: 8,287; 2042: 8,374; 2043: 8,461; 2044: 8,548; 2045: 8,635; 2046: 8,722; 2047: 8,809; 2048: 8,896; 2049: 8,983; 2050: 9,070
2	1CD	Urban	10+49.661	13+23.882	274.22	0.0519	2024-2050: 3,294

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Evaluated Length (mi)	**0.2507**
Average Future Road AADT (vpd)	**6,977**
Predicted Crashes	
Total Crashes	**10.01**
Fatal and Injury Crashes	**4.47**
Property-Damage-Only Crashes	**5.54**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**45**
Percent Property-Damage-Only Crashes (%)	**55**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**1.4785**
FI Crash Rate (crashes/mi/yr)	**0.6601**
PDO Crash Rate (crashes/mi/yr)	**0.8184**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**17.24**
Travel Crash Rate (crashes/million veh-mi)	**0.58**
Travel FI Crash Rate (crashes/million veh-mi)	**0.26**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.32**

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	10+49.661	0.1988	8.801	0.3260	0.1444	0.1815	1.6396	0.57
2	10+49.661	13+23.882	0.0519	1.209	0.0448	0.0211	0.0237	0.8619	0.72
Total			0.2507	10.009	0.3707	0.1655	0.2052	1.4785	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	0.000	83.041	0.0157	0.696	0.0258	0.0114	0.0144	1.6396	0.57
Simple Curve 1	83.041	3+14.449	0.0438	1.940	0.0719	0.0318	0.0400	1.6396	0.57
Tangent	3+14.449	7+87.443	0.0896	3.966	0.1469	0.0651	0.0818	1.6396	0.57
Simple Curve 2	7+87.443	12+80.974	0.0935	3.218	0.1192	0.0539	0.0653	1.2751	0.64
Tangent	12+80.974	13+23.882	0.0081	0.189	0.0070	0.0033	0.0037	0.8619	0.72

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2024	0.33	0.15	45.152	0.18	54.848
2025	0.33	0.15	45.107	0.18	54.893
2026	0.33	0.15	45.062	0.18	54.938
2027	0.34	0.15	45.019	0.18	54.981
2028	0.34	0.15	44.977	0.19	55.023
2029	0.34	0.15	44.936	0.19	55.064
2030	0.35	0.16	44.896	0.19	55.104
2031	0.35	0.16	44.856	0.19	55.144
2032	0.35	0.16	44.818	0.20	55.182
2033	0.36	0.16	44.781	0.20	55.219
2034	0.36	0.16	44.744	0.20	55.256
2035	0.36	0.16	44.709	0.20	55.291
2036	0.37	0.16	44.674	0.20	55.326
2037	0.37	0.17	44.641	0.20	55.359
2038	0.37	0.17	44.608	0.21	55.392
2039	0.38	0.17	44.576	0.21	55.424
2040	0.38	0.17	44.545	0.21	55.455
2041	0.38	0.17	44.516	0.21	55.484
2042	0.39	0.17	44.486	0.21	55.514
2043	0.39	0.17	44.458	0.22	55.542
2044	0.40	0.17	44.431	0.22	55.569
2045	0.40	0.18	44.404	0.22	55.596
2046	0.40	0.18	44.378	0.22	55.622
2047	0.41	0.18	44.353	0.23	55.647
2048	0.41	0.18	44.329	0.23	55.671
2049	0.41	0.18	44.306	0.23	55.694
2050	0.42	0.18	44.283	0.23	55.717
Total	10.01	4.47	44.650	5.54	55.350
Average	0.37	0.17	44.650	0.20	55.350

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0832	0.2522	1.6054	1.9589	4.9011
2	0.0121	0.0368	0.2344	0.2861	0.6391
Total	0.0953	0.2890	1.8398	2.2449	5.5402

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.01	0.1	0.05	0.5	0.06	0.6
Highway Segment	Collision with Fixed Object	1.66	16.6	1.71	17.0	3.37	33.6
Highway Segment	Collision with Other Object	0.12	1.2	0.33	3.3	0.45	4.5
Highway Segment	Other Single-vehicle Collision	0.48	4.8	0.26	2.5	0.73	7.3
Highway Segment	Collision with Parked Vehicle	0.04	0.3	0.04	0.4	0.07	0.7
Highway Segment	Total Single Vehicle Crashes	2.30	23.0	2.38	23.8	4.68	46.8
Highway Segment	Right-Angle Collision	0.07	0.7	0.06	0.6	0.12	1.2
Highway Segment	Head-on Collision	0.02	0.2	0.01	0.1	0.02	0.2
Highway Segment	Other Multi-vehicle Collision	0.07	0.7	0.08	0.8	0.14	1.4
Highway Segment	Rear-end Collision	1.63	16.2	2.18	21.8	3.81	38.0
Highway Segment	Sideswipe, Same Direction Collision	0.39	3.9	0.84	8.4	1.23	12.3
Highway Segment	Total Multiple Vehicle Crashes	2.17	21.7	3.16	31.5	5.33	53.2
Highway Segment	Total Highway Segment Crashes	4.47	44.6	5.54	55.4	10.01	100.0
	Total Crashes	4.47	44.6	5.54	55.4	10.01	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
0.000	10+49.661	for segment #1 (0.000 to 10+49.661), Left shoulder width (1.0 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.
10+49.661	13+23.882	for segment #2 (10+49.661 to 13+23.882), Left shoulder width (1.0 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

April 29, 2019

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Table of Contents

List of Tables

List of Figures

Report Overview

Report Generated: Apr 29, 2019 5:08 PM
Report Template: System: Single Page [System] (mlcpm3, Apr 10, 2019 1:31 PM)

Evaluation Date: Mon Apr 29 17:08:39 CDT 2019
IHSDM Version: v14.1.0 (Mar 12, 2019)
Crash Prediction Module: v9.1.0 (Mar 12, 2019)

User Name: jdanibas
Organization Name:
Phone:
E-Mail:

Project Title: I-229 Exit 4 (Cliff Ave) - Alternative 6
Project Comment: Created Tue Apr 16 14:58:43 CDT 2019
Project Unit System: U.S. Customary

Highway Title: Alt 6 - NB Exit RT Ramp
Highway Comment: Created Mon Apr 29 13:09:35 CDT 2019
Highway Version: 1

Evaluation Title: Evaluation 1
Evaluation Comment: Created Mon Apr 29 17:08:26 CDT 2019

Minimum Location: 0.000
Maximum Location: 1+90.496
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2024
Last Year of Analysis: 2050
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Section Types

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 1+90.496
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp
Calibration Factor: EX_RAMP_MV_FI=1.0; EX_RAMP_MV_PDO=1.0; EX_RAMP_SV_FI=1.0; EX_RAMP_SV_PDO=1.0;

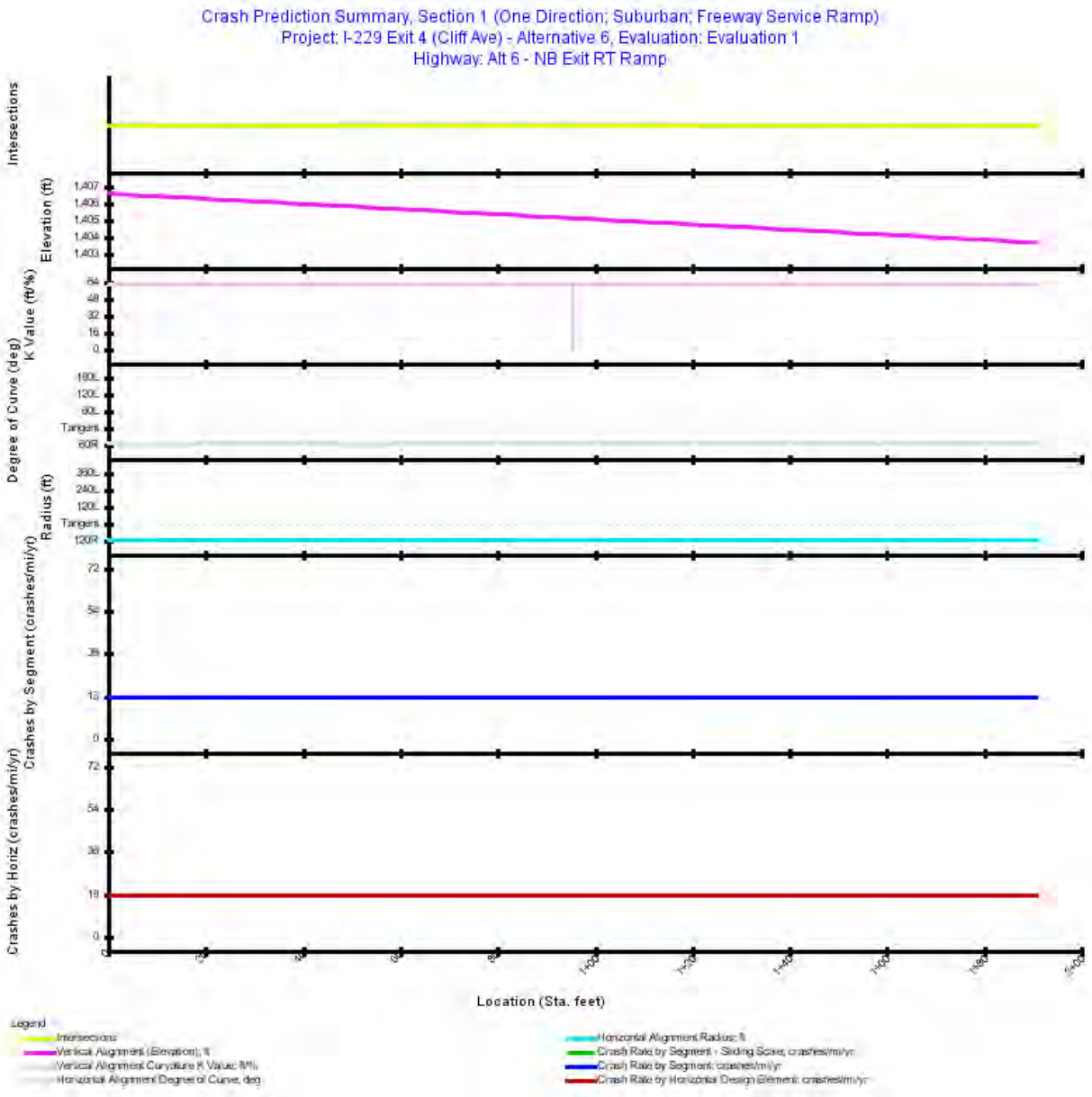

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT
1	1EX	Urban	0.000	1+90.496	190.50	0.0361	2024: 3,243; 2025: 3,284; 2026: 3,326; 2027: 3,367; 2028: 3,409; 2029: 3,450; 2030: 3,491; 2031: 3,533; 2032: 3,574; 2033: 3,616; 2034: 3,657; 2035: 3,698; 2036: 3,740; 2037: 3,781; 2038: 3,823; 2039: 3,864; 2040: 3,905; 2041: 3,947; 2042: 3,988; 2043: 4,030; 2044: 4,071; 2045: 4,112; 2046: 4,154; 2047: 4,195; 2048: 4,237; 2049: 4,278; 2050: 4,320

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Evaluated Length (mi)	**0.0361**
Average Future Road AADT (vpd)	**3,781**
Predicted Crashes	
Total Crashes	**16.88**
Fatal and Injury Crashes	**7.60**
Property-Damage-Only Crashes	**9.28**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**45**
Percent Property-Damage-Only Crashes (%)	**55**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**17.3242**
FI Crash Rate (crashes/mi/yr)	**7.7974**
PDO Crash Rate (crashes/mi/yr)	**9.5267**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**1.34**
Travel Crash Rate (crashes/million veh-mi)	**12.55**
Travel FI Crash Rate (crashes/million veh-mi)	**5.65**
Travel PDO Crash Rate (crashes/million veh-mi)	**6.90**

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	1+90.496	0.0361	16.876	0.6250	0.2813	0.3437	17.3242	12.55
Total			0.0361	16.876	0.6250	0.2813	0.3437	17.3242	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Simple Curve 1	0.000	1+90.496	0.0361	16.876	0.6250	0.2813	0.3437	17.3242	12.55

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2024	0.56	0.25	44.930	0.31	55.070
2025	0.57	0.25	44.936	0.31	55.064
2026	0.57	0.26	44.943	0.32	55.057
2027	0.58	0.26	44.949	0.32	55.051
2028	0.58	0.26	44.956	0.32	55.044
2029	0.59	0.26	44.962	0.32	55.038
2030	0.59	0.27	44.968	0.33	55.032
2031	0.60	0.27	44.974	0.33	55.026
2032	0.60	0.27	44.980	0.33	55.020
2033	0.61	0.27	44.986	0.33	55.014
2034	0.61	0.28	44.991	0.34	55.009
2035	0.62	0.28	44.997	0.34	55.003
2036	0.62	0.28	45.003	0.34	54.997
2037	0.62	0.28	45.008	0.34	54.992
2038	0.63	0.28	45.014	0.35	54.986
2039	0.64	0.29	45.019	0.35	54.981
2040	0.64	0.29	45.025	0.35	54.975
2041	0.65	0.29	45.030	0.35	54.970
2042	0.65	0.29	45.035	0.36	54.965
2043	0.65	0.29	45.041	0.36	54.959
2044	0.66	0.30	45.046	0.36	54.954
2045	0.66	0.30	45.051	0.36	54.949
2046	0.67	0.30	45.056	0.37	54.944
2047	0.67	0.30	45.061	0.37	54.939
2048	0.68	0.31	45.066	0.37	54.934
2049	0.68	0.31	45.071	0.38	54.929
2050	0.69	0.31	45.076	0.38	54.924
Total	16.88	7.60	45.009	9.28	54.991
Average	0.62	0.28	45.009	0.34	54.991

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.2372	0.7192	2.9904	3.6489	9.2802

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.03	0.2	0.20	1.2	0.23	1.4
Highway Segment	Collision with Fixed Object	5.41	32.1	6.53	38.7	11.94	70.8
Highway Segment	Collision with Other Object	0.38	2.3	1.27	7.5	1.65	9.8
Highway Segment	Other Single-vehicle Collision	1.56	9.2	0.98	5.8	2.54	15.0
Highway Segment	Collision with Parked Vehicle	0.11	0.7	0.15	0.9	0.26	1.5
Highway Segment	Total Single Vehicle Crashes	7.49	44.4	9.13	54.1	16.62	98.5
Highway Segment	Right-Angle Collision	0.00	0.0	0.00	0.0	0.01	0.0
Highway Segment	Head-on Collision	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Other Multi-vehicle Collision	0.00	0.0	0.00	0.0	0.01	0.0
Highway Segment	Rear-end Collision	0.08	0.5	0.11	0.6	0.18	1.1
Highway Segment	Sideswipe, Same Direction Collision	0.02	0.1	0.04	0.2	0.06	0.4
Highway Segment	Total Multiple Vehicle Crashes	0.10	0.6	0.15	0.9	0.26	1.5
Highway Segment	Total Highway Segment Crashes	7.60	45.0	9.28	55.0	16.88	100.0
	Total Crashes	7.60	45.0	9.28	55.0	16.88	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
0.000	1+90.496	for segment #1 (0.000 to 1+90.496), The ramp type for Ramp Alt 6 - NB Exit RT Ramp is set at the Ramp Connection (Exit) and in the Ramp (Exit). The Ramp value takes precedence.
0.000	1+90.496	for segment #1 (0.000 to 1+90.496), Left shoulder width (1.0 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

April 29, 2019

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Table of Contents

List of Tables

List of Figures

Report Overview

Report Generated: Apr 29, 2019 5:14 PM
Report Template: System: Single Page [System] (mlcpm3, Apr 10, 2019 1:31 PM)

Evaluation Date: Mon Apr 29 17:14:17 CDT 2019
IHSDM Version: v14.1.0 (Mar 12, 2019)
Crash Prediction Module: v9.1.0 (Mar 12, 2019)

User Name: jdanibas
Organization Name:
Phone:
E-Mail:

Project Title: I-229 Exit 4 (Cliff Ave) - Alternative 6
Project Comment: Created Tue Apr 16 14:58:43 CDT 2019
Project Unit System: U.S. Customary

Highway Title: Alt 6 - SB Entrance LT Ramp
Highway Comment: Created Mon Apr 29 16:33:49 CDT 2019
Highway Version: 2

Evaluation Title: Evaluation 1
Evaluation Comment: Created Mon Apr 29 17:14:08 CDT 2019

Minimum Location: 0.000
Maximum Location: 11+58.131
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2024
Last Year of Analysis: 2050
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Section Types

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 11+58.131
Functional Class: Freeway C-D Road & System Ramp
Type of Alignment: One Direction
Model Category: C-D Road & System Ramp
Calibration Factor: CD_MV_FI=1.0; CD_MV_PDO=1.0; CD_SV_FI=1.0; CD_SV_PDO=1.0;

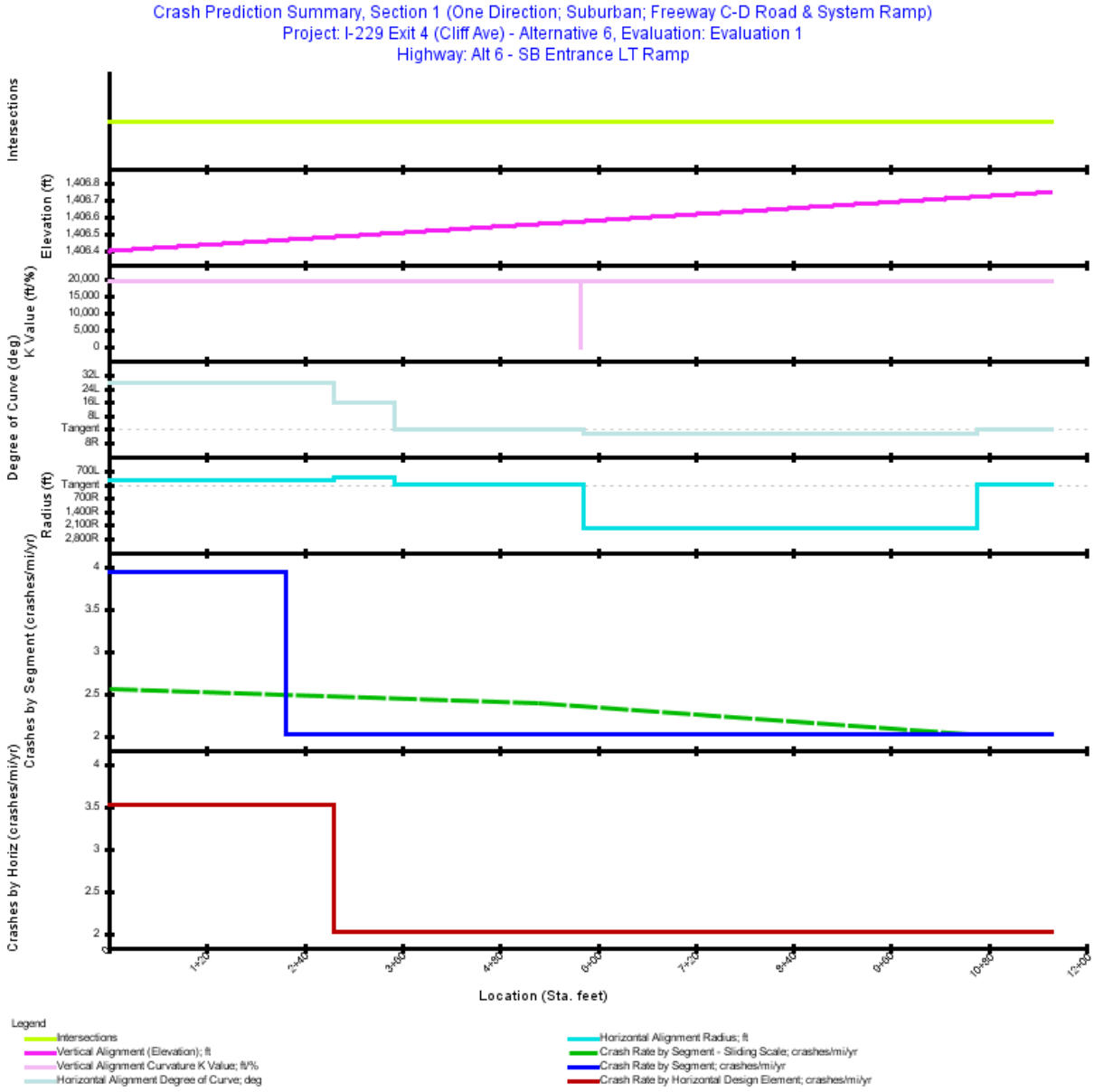

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT
1	1CD	Urban	0.000	2+16.463	216.46	0.0410	2024: 2,835; 2025: 2,861; 2026: 2,886; 2027: 2,911; 2028: 2,936; 2029: 2,961; 2030: 2,986; 2031: 3,012; 2032: 3,037; 2033: 3,062; 2034: 3,087; 2035: 3,112; 2036: 3,137; 2037: 3,162; 2038: 3,188; 2039: 3,213; 2040: 3,238; 2041: 3,263; 2042: 3,288; 2043: 3,313; 2044: 3,339; 2045: 3,364; 2046: 3,389; 2047: 3,414; 2048: 3,439; 2049: 3,464; 2050: 3,490
2	1CD	Urban	2+16.463	11+58.131	941.67	0.1784	2024: 6,779; 2025: 6,838; 2026: 6,898; 2027: 6,958; 2028: 7,018; 2029: 7,078; 2030: 7,138; 2031: 7,197; 2032: 7,257; 2033: 7,317; 2034: 7,377; 2035: 7,437; 2036: 7,497; 2037: 7,557; 2038: 7,616; 2039: 7,676; 2040: 7,736; 2041: 7,796; 2042: 7,856; 2043: 7,916; 2044: 7,975; 2045: 8,035; 2046: 8,095; 2047: 8,155; 2048: 8,215; 2049: 8,275; 2050: 8,335

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Evaluated Length (mi)	**0.2193**
Average Future Road AADT (vpd)	**6,735**
Predicted Crashes	
Total Crashes	**14.14**
Fatal and Injury Crashes	**6.31**
Property-Damage-Only Crashes	**7.83**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**45**
Percent Property-Damage-Only Crashes (%)	**55**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**2.3870**
FI Crash Rate (crashes/mi/yr)	**1.0650**
PDO Crash Rate (crashes/mi/yr)	**1.3220**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**14.56**
Travel Crash Rate (crashes/million veh-mi)	**0.97**
Travel FI Crash Rate (crashes/million veh-mi)	**0.43**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.54**

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	2+16.463	0.0410	4.369	0.1618	0.0740	0.0878	3.9466	3.42
2	2+16.463	11+58.131	0.1783	9.768	0.3618	0.1596	0.2022	2.0285	0.73
Total			0.2193	14.136	0.5236	0.2336	0.2900	2.3870	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Simple Curve 1	0.000	2+76.463	0.0524	4.991	0.1848	0.0842	0.1007	3.5303	2.84
Simple Curve 2	2+76.463	3+51.094	0.0141	0.774	0.0287	0.0126	0.0160	2.0285	0.73
Tangent	3+51.094	5+83.310	0.0440	2.409	0.0892	0.0394	0.0499	2.0285	0.73
Simple Curve 3	5+83.310	10+66.157	0.0914	5.008	0.1855	0.0818	0.1037	2.0285	0.73
Tangent	10+66.157	11+58.131	0.0174	0.954	0.0353	0.0156	0.0197	2.0285	0.73

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2024	0.48	0.21	44.907	0.26	55.093
2025	0.48	0.21	44.882	0.27	55.118
2026	0.48	0.22	44.858	0.27	55.142
2027	0.49	0.22	44.834	0.27	55.166
2028	0.49	0.22	44.810	0.27	55.190
2029	0.49	0.22	44.787	0.27	55.213
2030	0.50	0.22	44.764	0.28	55.236
2031	0.50	0.23	44.741	0.28	55.259
2032	0.51	0.23	44.719	0.28	55.281
2033	0.51	0.23	44.697	0.28	55.303
2034	0.51	0.23	44.676	0.28	55.324
2035	0.52	0.23	44.655	0.29	55.345
2036	0.52	0.23	44.634	0.29	55.366
2037	0.52	0.23	44.614	0.29	55.386
2038	0.53	0.23	44.594	0.29	55.406
2039	0.53	0.24	44.574	0.29	55.426
2040	0.53	0.24	44.554	0.30	55.446
2041	0.54	0.24	44.535	0.30	55.465
2042	0.54	0.24	44.517	0.30	55.483
2043	0.55	0.24	44.498	0.30	55.502
2044	0.55	0.24	44.480	0.30	55.520
2045	0.55	0.25	44.462	0.31	55.538
2046	0.56	0.25	44.445	0.31	55.555
2047	0.56	0.25	44.428	0.31	55.572
2048	0.56	0.25	44.411	0.31	55.589
2049	0.57	0.25	44.395	0.32	55.605
2050	0.57	0.25	44.378	0.32	55.622
Total	14.14	6.31	44.615	7.83	55.385
Average	0.52	0.23	44.615	0.29	55.385

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0426	0.1292	0.8226	1.0037	2.3705
2	0.0919	0.2786	1.7739	2.1645	5.4589
Total	0.1345	0.4078	2.5965	3.1682	7.8294

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.02	0.1	0.10	0.7	0.12	0.8
Highway Segment	Collision with Fixed Object	2.86	20.2	3.31	23.4	6.17	43.7
Highway Segment	Collision with Other Object	0.20	1.4	0.64	4.6	0.84	6.0
Highway Segment	Other Single-vehicle Collision	0.82	5.8	0.49	3.5	1.32	9.3
Highway Segment	Collision with Parked Vehicle	0.06	0.4	0.07	0.5	0.13	0.9
Highway Segment	Total Single Vehicle Crashes	3.96	28.0	4.63	32.8	8.59	60.7
Highway Segment	Right-Angle Collision	0.07	0.5	0.06	0.4	0.13	0.9
Highway Segment	Head-on Collision	0.02	0.1	0.01	0.0	0.03	0.2
Highway Segment	Other Multi-vehicle Collision	0.07	0.5	0.08	0.5	0.15	1.1
Highway Segment	Rear-end Collision	1.76	12.5	2.21	15.6	3.97	28.1
Highway Segment	Sideswipe, Same Direction Collision	0.42	3.0	0.85	6.0	1.27	9.0
Highway Segment	Total Multiple Vehicle Crashes	2.35	16.6	3.20	22.6	5.55	39.3
Highway Segment	Total Highway Segment Crashes	6.31	44.6	7.83	55.4	14.14	100.0
	Total Crashes	6.31	44.6	7.83	55.4	14.14	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
0.000	2+16.463	for segment #1 (0.000 to 2+16.463), Left shoulder width (1.0 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.
2+16.463	11+58.131	for segment #2 (2+16.463 to 11+58.131), Left shoulder width (1.0 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

April 29, 2019

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Table of Contents

List of Tables

List of Figures

Report Overview

Report Generated: Apr 29, 2019 5:15 PM
Report Template: System: Single Page [System] (mlcpm3, Apr 10, 2019 1:31 PM)

Evaluation Date: Mon Apr 29 17:15:16 CDT 2019
IHSDM Version: v14.1.0 (Mar 12, 2019)
Crash Prediction Module: v9.1.0 (Mar 12, 2019)

User Name: jdanibas
Organization Name:
Phone:
E-Mail:

Project Title: I-229 Exit 4 (Cliff Ave) - Alternative 6
Project Comment: Created Tue Apr 16 14:58:43 CDT 2019
Project Unit System: U.S. Customary

Highway Title: Alt 6 - SB Entrance RT Ramp
Highway Comment: Created Mon Apr 29 16:40:33 CDT 2019
Highway Version: 1

Evaluation Title: Evaluation 1
Evaluation Comment: Created Mon Apr 29 17:15:06 CDT 2019

Minimum Location: 0.000
Maximum Location: 2+44.773
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2024
Last Year of Analysis: 2050
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Section Types

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 2+44.773
Functional Class: Freeway C-D Road & System Ramp
Type of Alignment: One Direction
Model Category: C-D Road & System Ramp
Calibration Factor: CD_MV_FI=1.0; CD_MV_PDO=1.0; CD_SV_FI=1.0; CD_SV_PDO=1.0;

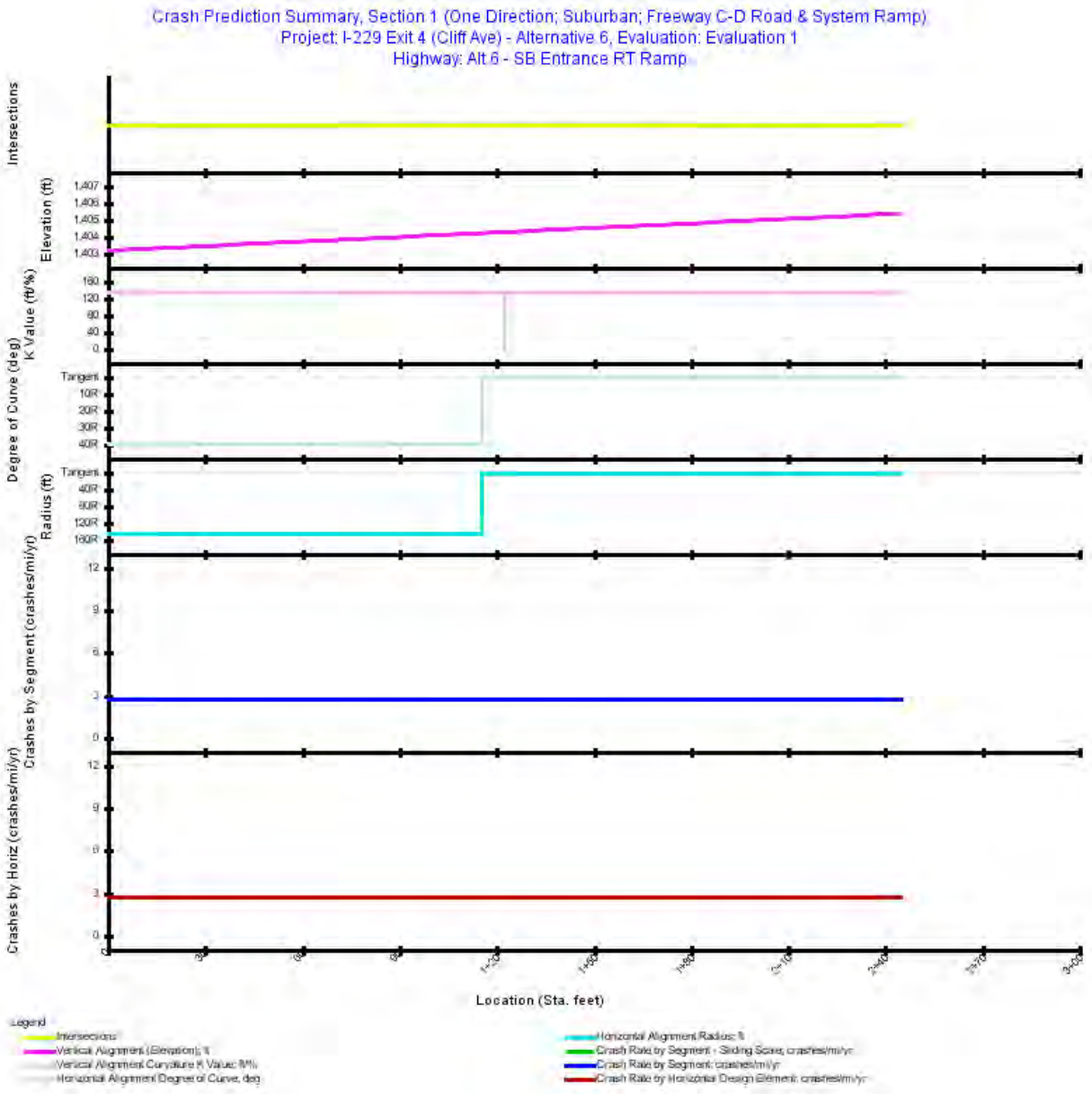

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT
1	1CD	Urban	0.000	2+44.773	244.77	0.0464	2024: 3,943; 2025: 3,977; 2026: 4,012; 2027: 4,047; 2028: 4,081; 2029: 4,116; 2030: 4,151; 2031: 4,185; 2032: 4,220; 2033: 4,255; 2034: 4,290; 2035: 4,324; 2036: 4,359; 2037: 4,394; 2038: 4,428; 2039: 4,463; 2040: 4,498; 2041: 4,532; 2042: 4,567; 2043: 4,602; 2044: 4,636; 2045: 4,671; 2046: 4,706; 2047: 4,740; 2048: 4,775; 2049: 4,810; 2050: 4,845

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Evaluated Length (mi)	**0.0464**
Average Future Road AADT (vpd)	**4,394**
Predicted Crashes	
Total Crashes	**3.47**
Fatal and Injury Crashes	**1.57**
Property-Damage-Only Crashes	**1.90**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**45**
Percent Property-Damage-Only Crashes (%)	**55**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**2.7704**
FI Crash Rate (crashes/mi/yr)	**1.2540**
PDO Crash Rate (crashes/mi/yr)	**1.5164**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**2.01**
Travel Crash Rate (crashes/million veh-mi)	**1.73**
Travel FI Crash Rate (crashes/million veh-mi)	**0.78**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.95**

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	2+44.773	0.0464	3.468	0.1284	0.0581	0.0703	2.7704	1.73
Total			0.0464	3.468	0.1284	0.0581	0.0703	2.7704	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Simple Curve 1	0.000	1+15.321	0.0218	1.634	0.0605	0.0274	0.0331	2.7704	1.73
Tangent	1+15.321	2+44.773	0.0245	1.834	0.0679	0.0307	0.0372	2.7704	1.73

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2024	0.12	0.05	45.535	0.06	54.465
2025	0.12	0.05	45.514	0.07	54.486
2026	0.12	0.05	45.492	0.07	54.508
2027	0.12	0.06	45.470	0.07	54.530
2028	0.12	0.06	45.449	0.07	54.551
2029	0.12	0.06	45.428	0.07	54.572
2030	0.12	0.06	45.407	0.07	54.593
2031	0.12	0.06	45.387	0.07	54.613
2032	0.12	0.06	45.366	0.07	54.634
2033	0.12	0.06	45.346	0.07	54.654
2034	0.13	0.06	45.325	0.07	54.675
2035	0.13	0.06	45.306	0.07	54.694
2036	0.13	0.06	45.286	0.07	54.714
2037	0.13	0.06	45.267	0.07	54.733
2038	0.13	0.06	45.248	0.07	54.752
2039	0.13	0.06	45.229	0.07	54.771
2040	0.13	0.06	45.210	0.07	54.790
2041	0.13	0.06	45.192	0.07	54.808
2042	0.13	0.06	45.173	0.07	54.827
2043	0.13	0.06	45.155	0.07	54.845
2044	0.13	0.06	45.137	0.07	54.863
2045	0.14	0.06	45.119	0.07	54.881
2046	0.14	0.06	45.101	0.07	54.899
2047	0.14	0.06	45.084	0.07	54.916
2048	0.14	0.06	45.066	0.07	54.934
2049	0.14	0.06	45.049	0.08	54.951
2050	0.14	0.06	45.032	0.08	54.968
Total	3.47	1.57	45.266	1.90	54.734
Average	0.13	0.06	45.266	0.07	54.734

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0335	0.1015	0.6462	0.7885	1.8980

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.00	0.1	0.03	0.9	0.03	1.0
Highway Segment	Collision with Fixed Object	0.80	23.0	0.97	28.0	1.77	51.0
Highway Segment	Collision with Other Object	0.06	1.6	0.19	5.4	0.24	7.1
Highway Segment	Other Single-vehicle Collision	0.23	6.6	0.14	4.2	0.38	10.8
Highway Segment	Collision with Parked Vehicle	0.02	0.5	0.02	0.6	0.04	1.1
Highway Segment	Total Single Vehicle Crashes	1.10	31.8	1.36	39.2	2.46	71.0
Highway Segment	Right-Angle Collision	0.01	0.4	0.01	0.3	0.02	0.7
Highway Segment	Head-on Collision	0.00	0.1	0.00	0.0	0.01	0.1
Highway Segment	Other Multi-vehicle Collision	0.01	0.4	0.01	0.4	0.03	0.8
Highway Segment	Rear-end Collision	0.35	10.1	0.37	10.7	0.72	20.8
Highway Segment	Sideswipe, Same Direction Collision	0.08	2.4	0.14	4.1	0.23	6.6
Highway Segment	Total Multiple Vehicle Crashes	0.47	13.5	0.54	15.6	1.01	29.0
Highway Segment	Total Highway Segment Crashes	1.57	45.3	1.90	54.7	3.47	100.0
	Total Crashes	1.57	45.3	1.90	54.7	3.47	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
0.000	2+44.773	for segment #1 (0.000 to 2+44.773), Left shoulder width (1.0 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

April 29, 2019

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Table of Contents

List of Tables

List of Figures

Report Overview

Report Generated: Apr 29, 2019 5:12 PM
Report Template: System: Single Page [System] (mlcpm3, Apr 10, 2019 1:31 PM)

Evaluation Date: Mon Apr 29 17:12:23 CDT 2019
IHSDM Version: v14.1.0 (Mar 12, 2019)
Crash Prediction Module: v9.1.0 (Mar 12, 2019)

User Name: jdanibas
Organization Name:
Phone:
E-Mail:

Project Title: I-229 Exit 4 (Cliff Ave) - Alternative 6
Project Comment: Created Tue Apr 16 14:58:43 CDT 2019
Project Unit System: U.S. Customary

Highway Title: Alt 6 - SB Exit LT Ramp
Highway Comment: Created Mon Apr 29 16:16:19 CDT 2019
Highway Version: 1

Evaluation Title: Evaluation 1
Evaluation Comment: Created Mon Apr 29 17:12:16 CDT 2019

Minimum Location: 0.000
Maximum Location: 20+88.846
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2024
Last Year of Analysis: 2050
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Section Types

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 20+88.846
Functional Class: Freeway C-D Road & System Ramp
Type of Alignment: One Direction
Model Category: C-D Road & System Ramp
Calibration Factor: CD_MV_FI=1.0; CD_MV_PDO=1.0; CD_SV_FI=1.0; CD_SV_PDO=1.0;

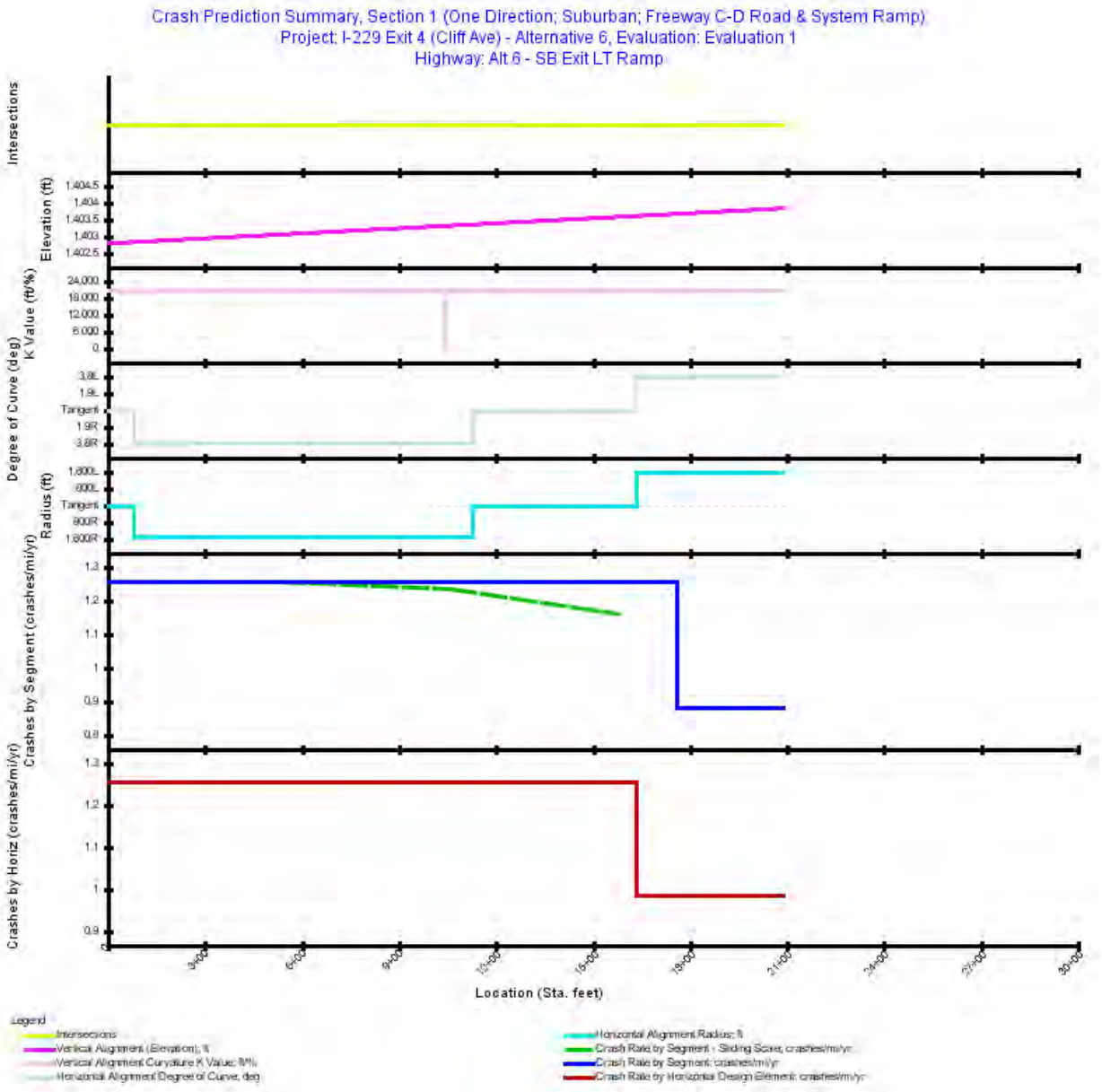

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT
1	1CD	Urban	0.000	17+60.496	1,760.50	0.3334	2024: 4,447; 2025: 4,577; 2026: 4,706; 2027: 4,836; 2028: 4,966; 2029: 5,095; 2030: 5,225; 2031: 5,355; 2032: 5,485; 2033: 5,614; 2034: 5,744; 2035: 5,874; 2036: 6,003; 2037: 6,133; 2038: 6,263; 2039: 6,393; 2040: 6,522; 2041: 6,652; 2042: 6,782; 2043: 6,911; 2044: 7,041; 2045: 7,171; 2046: 7,301; 2047: 7,430; 2048: 7,560; 2049: 7,690; 2050: 7,820
2	1CD	Urban	17+60.496	20+88.846	328.35	0.0622	2024: 3,046; 2025: 3,135; 2026: 3,224; 2027: 3,313; 2028: 3,401; 2029: 3,490; 2030: 3,579; 2031: 3,668; 2032: 3,756; 2033: 3,845; 2034: 3,934; 2035: 4,023; 2036: 4,112; 2037: 4,200; 2038: 4,289; 2039: 4,378; 2040: 4,467; 2041: 4,555; 2042: 4,644; 2043: 4,733; 2044: 4,822; 2045: 4,911; 2046: 4,999; 2047: 5,088; 2048: 5,177; 2049: 5,266; 2050: 5,355

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Evaluated Length (mi)	**0.3956**
Average Future Road AADT (vpd)	**5,829**
Predicted Crashes	
Total Crashes	**12.79**
Fatal and Injury Crashes	**5.79**
Property-Damage-Only Crashes	**7.00**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**45**
Percent Property-Damage-Only Crashes (%)	**55**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**1.1972**
FI Crash Rate (crashes/mi/yr)	**0.5419**
PDO Crash Rate (crashes/mi/yr)	**0.6554**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**22.73**
Travel Crash Rate (crashes/million veh-mi)	**0.56**
Travel FI Crash Rate (crashes/million veh-mi)	**0.26**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.31**

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	17+60.496	0.3334	11.310	0.4189	0.1891	0.2298	1.2563	0.56
2	17+60.496	20+88.846	0.0622	1.479	0.0548	0.0253	0.0295	0.8807	0.57
Total			0.3956	12.788	0.4736	0.2144	0.2593	1.1972	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	0.000	78.502	0.0149	0.504	0.0187	0.0084	0.0102	1.2563	0.56
Simple Curve 1	78.502	11+27.906	0.1988	6.742	0.2497	0.1127	0.1370	1.2563	0.56
Tangent	11+27.906	16+35.496	0.0961	3.261	0.1208	0.0545	0.0663	1.2563	0.56
Simple Curve 2	16+35.496	20+88.846	0.0859	2.282	0.0845	0.0387	0.0458	0.9843	0.57

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2024	0.35	0.17	46.847	0.19	53.153
2025	0.36	0.17	46.697	0.19	53.303
2026	0.37	0.17	46.553	0.20	53.447
2027	0.38	0.18	46.413	0.20	53.587
2028	0.39	0.18	46.278	0.21	53.722
2029	0.40	0.18	46.149	0.21	53.851
2030	0.41	0.19	46.024	0.22	53.976
2031	0.42	0.19	45.903	0.23	54.097
2032	0.43	0.20	45.787	0.23	54.213
2033	0.44	0.20	45.676	0.24	54.324
2034	0.45	0.20	45.568	0.24	54.432
2035	0.46	0.21	45.463	0.25	54.537
2036	0.46	0.21	45.364	0.25	54.636
2037	0.47	0.21	45.267	0.26	54.733
2038	0.48	0.22	45.173	0.26	54.827
2039	0.49	0.22	45.083	0.27	54.917
2040	0.50	0.23	44.997	0.28	55.003
2041	0.51	0.23	44.914	0.28	55.086
2042	0.52	0.23	44.833	0.29	55.167
2043	0.53	0.24	44.756	0.29	55.244
2044	0.54	0.24	44.681	0.30	55.319
2045	0.55	0.24	44.610	0.30	55.390
2046	0.56	0.25	44.541	0.31	55.459
2047	0.57	0.25	44.475	0.31	55.525
2048	0.58	0.26	44.411	0.32	55.589
2049	0.58	0.26	44.350	0.33	55.650
2050	0.59	0.26	44.291	0.33	55.709
Total	12.79	5.79	45.259	7.00	54.741
Average	0.47	0.21	45.259	0.26	54.741

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.1089	0.3302	2.1019	2.5647	6.2040
2	0.0146	0.0441	0.2809	0.3427	0.7965
Total	0.1234	0.3743	2.3828	2.9074	7.0005

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.01	0.1	0.07	0.5	0.08	0.6
Highway Segment	Collision with Fixed Object	2.19	17.1	2.22	17.4	4.41	34.5
Highway Segment	Collision with Other Object	0.15	1.2	0.43	3.4	0.59	4.6
Highway Segment	Other Single-vehicle Collision	0.63	4.9	0.33	2.6	0.96	7.5
Highway Segment	Collision with Parked Vehicle	0.04	0.4	0.05	0.4	0.10	0.7
Highway Segment	Total Single Vehicle Crashes	3.03	23.7	3.10	24.3	6.13	47.9
Highway Segment	Right-Angle Collision	0.09	0.7	0.07	0.5	0.16	1.2
Highway Segment	Head-on Collision	0.02	0.2	0.01	0.1	0.03	0.2
Highway Segment	Other Multi-vehicle Collision	0.09	0.7	0.09	0.7	0.18	1.4
Highway Segment	Rear-end Collision	2.07	16.2	2.69	21.0	4.76	37.2
Highway Segment	Sideswipe, Same Direction Collision	0.50	3.9	1.04	8.1	1.53	12.0
Highway Segment	Total Multiple Vehicle Crashes	2.76	21.6	3.90	30.5	6.66	52.1
Highway Segment	Total Highway Segment Crashes	5.79	45.3	7.00	54.7	12.79	100.0
	Total Crashes	5.79	45.3	7.00	54.7	12.79	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
0.000	17+60.496	for segment #1 (0.000 to 17+60.496), Left shoulder width (1.0 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.
17+60.496	20+88.846	for segment #2 (17+60.496 to 20+88.846), Left shoulder width (1.0 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

April 29, 2019

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Table of Contents

List of Tables

List of Figures

Report Overview

Report Generated: Apr 29, 2019 5:13 PM
Report Template: System: Single Page [System] (mlcpm3, Apr 10, 2019 1:31 PM)

Evaluation Date: Mon Apr 29 17:13:18 CDT 2019
IHSDM Version: v14.1.0 (Mar 12, 2019)
Crash Prediction Module: v9.1.0 (Mar 12, 2019)

User Name: jdanibas
Organization Name:
Phone:
E-Mail:

Project Title: I-229 Exit 4 (Cliff Ave) - Alternative 6
Project Comment: Created Tue Apr 16 14:58:43 CDT 2019
Project Unit System: U.S. Customary

Highway Title: Alt 6 - SB Exit RT Ramp
Highway Comment: Created Mon Apr 29 16:23:35 CDT 2019
Highway Version: 1

Evaluation Title: Evaluation 1
Evaluation Comment: Created Mon Apr 29 17:13:09 CDT 2019

Minimum Location: 0.000
Maximum Location: 2+12.935
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2024
Last Year of Analysis: 2050
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Section Types

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 2+12.935
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp
Calibration Factor: EX_RAMP_MV_FI=1.0; EX_RAMP_MV_PDO=1.0; EX_RAMP_SV_FI=1.0; EX_RAMP_SV_PDO=1.0;

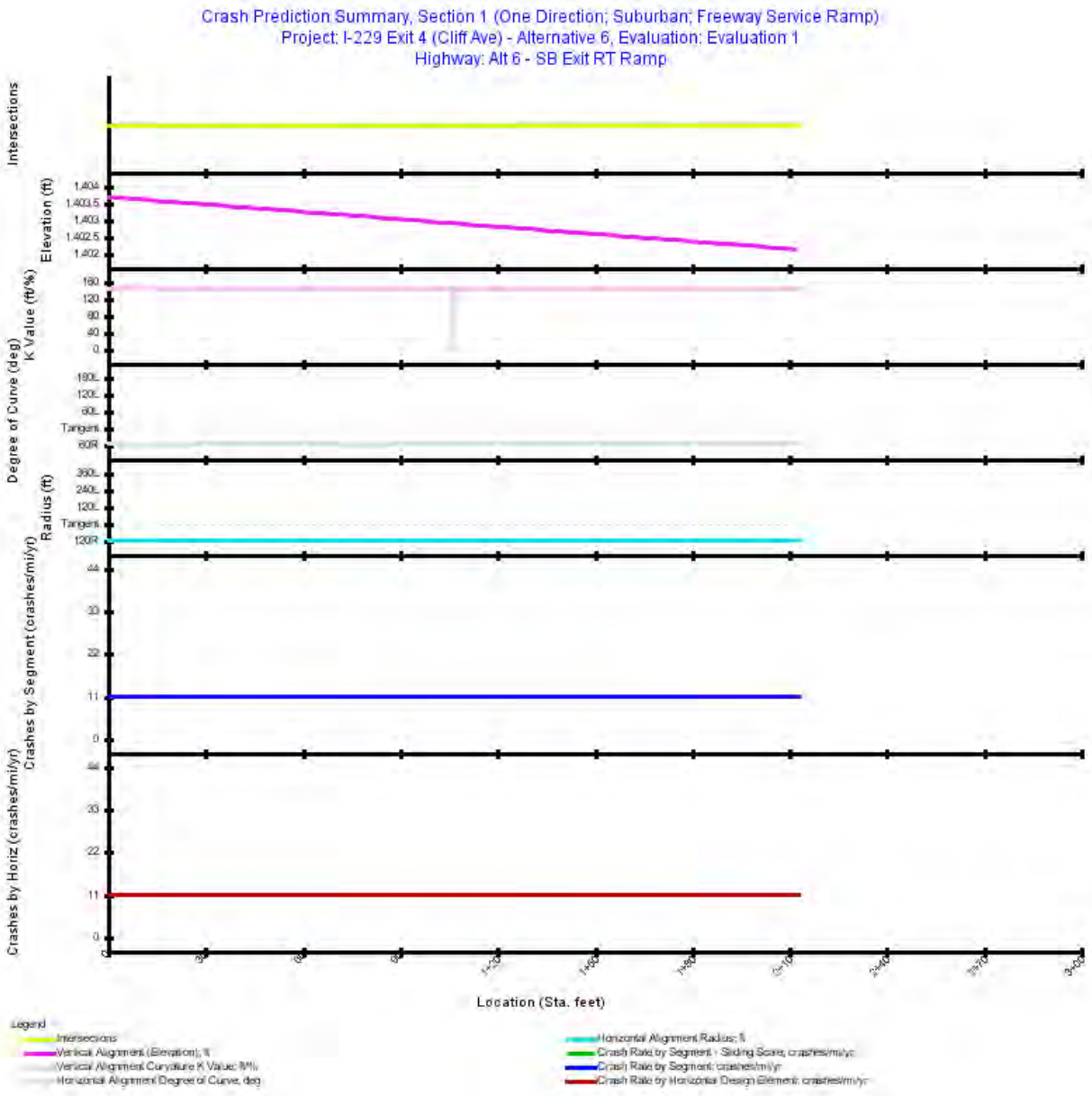

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT
1	1EX	Urban	0.000	2+12.935	212.94	0.0403	2024: 1,400; 2025: 1,441; 2026: 1,482; 2027: 1,523; 2028: 1,564; 2029: 1,605; 2030: 1,646; 2031: 1,687; 2032: 1,728; 2033: 1,769; 2034: 1,810; 2035: 1,850; 2036: 1,891; 2037: 1,932; 2038: 1,973; 2039: 2,014; 2040: 2,055; 2041: 2,096; 2042: 2,137; 2043: 2,178; 2044: 2,219; 2045: 2,260; 2046: 2,301; 2047: 2,342; 2048: 2,383; 2049: 2,424; 2050: 2,465

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Evaluated Length (mi)	**0.0403**
Average Future Road AADT (vpd)	**1,932**
Predicted Crashes	
Total Crashes	**11.90**
Fatal and Injury Crashes	**5.31**
Property-Damage-Only Crashes	**6.59**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**45**
Percent Property-Damage-Only Crashes (%)	**55**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**10.9285**
FI Crash Rate (crashes/mi/yr)	**4.8800**
PDO Crash Rate (crashes/mi/yr)	**6.0486**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**0.77**
Travel Crash Rate (crashes/million veh-mi)	**15.49**
Travel FI Crash Rate (crashes/million veh-mi)	**6.92**
Travel PDO Crash Rate (crashes/million veh-mi)	**8.58**

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	2+12.935	0.0403	11.900	0.4407	0.1968	0.2439	10.9285	15.49
Total			0.0403	11.900	0.4407	0.1968	0.2439	10.9285	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Simple Curve 1	0.000	2+12.935	0.0403	11.900	0.4407	0.1968	0.2439	10.9285	15.49

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2024	0.35	0.16	44.476	0.20	55.524
2025	0.36	0.16	44.492	0.20	55.508
2026	0.37	0.16	44.507	0.20	55.493
2027	0.37	0.17	44.522	0.21	55.478
2028	0.38	0.17	44.536	0.21	55.464
2029	0.39	0.17	44.550	0.21	55.450
2030	0.40	0.18	44.564	0.22	55.436
2031	0.40	0.18	44.578	0.22	55.422
2032	0.41	0.18	44.591	0.23	55.409
2033	0.41	0.18	44.603	0.23	55.397
2034	0.42	0.19	44.616	0.23	55.384
2035	0.43	0.19	44.627	0.24	55.373
2036	0.43	0.19	44.639	0.24	55.361
2037	0.44	0.20	44.651	0.24	55.349
2038	0.45	0.20	44.662	0.25	55.338
2039	0.46	0.20	44.673	0.25	55.327
2040	0.46	0.21	44.684	0.26	55.316
2041	0.47	0.21	44.694	0.26	55.306
2042	0.47	0.21	44.705	0.26	55.295
2043	0.48	0.21	44.715	0.27	55.285
2044	0.49	0.22	44.725	0.27	55.275
2045	0.49	0.22	44.735	0.27	55.265
2046	0.50	0.22	44.744	0.28	55.256
2047	0.51	0.23	44.754	0.28	55.246
2048	0.51	0.23	44.763	0.28	55.237
2049	0.52	0.23	44.772	0.29	55.228
2050	0.53	0.23	44.781	0.29	55.219
Total	11.90	5.31	44.653	6.59	55.347
Average	0.44	0.20	44.653	0.24	55.347

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.1659	0.5031	2.0920	2.5526	6.5861

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.02	0.2	0.14	1.2	0.16	1.4
Highway Segment	Collision with Fixed Object	3.79	31.8	4.66	39.2	8.45	71.0
Highway Segment	Collision with Other Object	0.27	2.2	0.91	7.6	1.17	9.9
Highway Segment	Other Single-vehicle Collision	1.09	9.2	0.70	5.9	1.79	15.0
Highway Segment	Collision with Parked Vehicle	0.08	0.7	0.10	0.9	0.18	1.5
Highway Segment	Total Single Vehicle Crashes	5.24	44.1	6.51	54.7	11.75	98.8
Highway Segment	Right-Angle Collision	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Head-on Collision	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Other Multi-vehicle Collision	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Rear-end Collision	0.05	0.5	0.05	0.4	0.11	0.9
Highway Segment	Sideswipe, Same Direction Collision	0.01	0.1	0.02	0.2	0.03	0.3
Highway Segment	Total Multiple Vehicle Crashes	0.07	0.6	0.08	0.6	0.15	1.2
Highway Segment	Total Highway Segment Crashes	5.31	44.7	6.59	55.3	11.90	100.0
	Total Crashes	5.31	44.7	6.59	55.3	11.90	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
0.000	2+12.935	for segment #1 (0.000 to 2+12.935), The ramp type for Ramp Alt 6 - SB Exit RT Ramp is set at the Ramp Connection (Exit) and in the Ramp (Exit). The Ramp value takes precedence.
0.000	2+12.935	for segment #1 (0.000 to 2+12.935), Left shoulder width (1.0 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

May 2, 2019

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Table of Contents

List of Tables

List of Figures

Report Overview

Report Generated: May 2, 2019 4:52 PM
Report Template: System: Single Page [System] (mlcpm3, Apr 10, 2019 1:31 PM)

Evaluation Date: Thu May 02 16:52:09 CDT 2019
IHSDM Version: v14.1.0 (Mar 12, 2019)
Crash Prediction Module: v9.1.0 (Mar 12, 2019)

User Name: jdanibas
Organization Name:
Phone:
E-Mail:

Project Title: I-229 Exit 4 (Cliff Ave) - Alternative 6
Project Comment: Created Tue Apr 16 14:58:43 CDT 2019
Project Unit System: U.S. Customary

Highway Title: Cliff Ave
Highway Comment: Created Tue Apr 16 15:32:22 CDT 2019
Highway Version: 1

Evaluation Title: Evaluation 1
Evaluation Comment: Created Thu May 02 16:51:55 CDT 2019

Minimum Location: 10+00.000
Maximum Location: 74+43.703
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2024
Last Year of Analysis: 2050
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Section Types

Section 1 Evaluation

Section: Section 1
Evaluation Start Location: 10+00.000
Evaluation End Location: 74+43.703
Area Type: Urban
Functional Class: Arterial
Type of Alignment: Divided, Multilane
Model Category: Urban/Suburban Arterial
Calibration Factor: 3SG=1.0; 3ST=1.0; 4D=1.0; 4SG=1.0; 4ST=1.0; 4U=1.0; 5T=1.0;

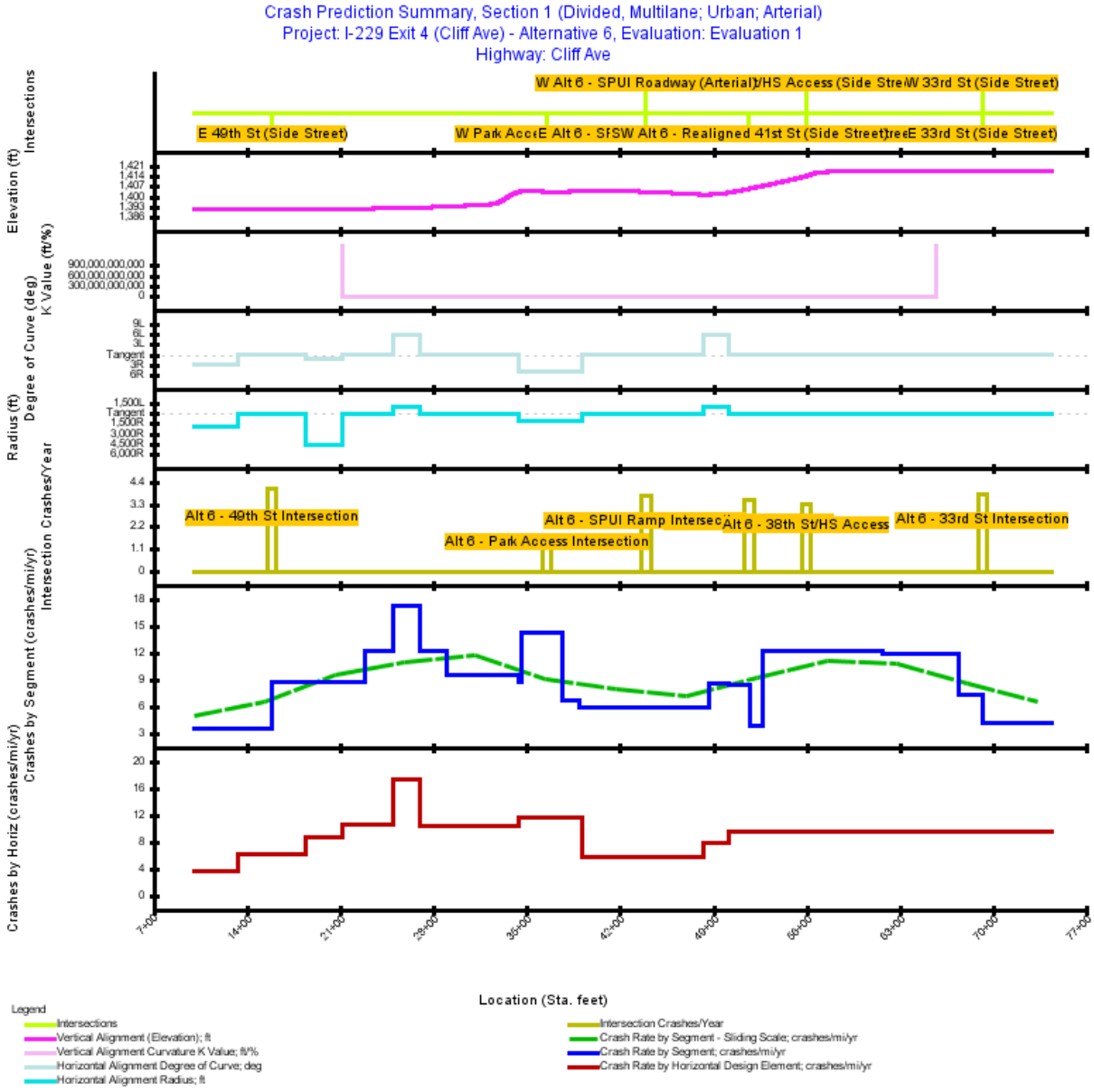

Figure 1. Crash Prediction Summary (Section 1)

Table 1. Evaluation Highway - Homogeneous Segments (Section 1)

Seg. No.	Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT	Number Major Commercial Driveways	Number Minor Commercial Driveways	Number Major Industial/Institutional	Number Minor Industial/Institutional	Number Major Residential Driveways	Number Minor Residential Driveways	Number Other Driveways	Lighting	Automated Speed Enforcement	Density (fixed objects/mi)	Median Width (ft)	Type	Effective Median Width (ft)	Speed Level	Number Rail Highway Crossings	Average Shoulder Width (ft)	Average Lane Width (ft)
1	4D	10+00.000	13+34.041	334.04	0.0633	2024: 14,262; 2025: 14,606; 2026: 14,950; 2027: 15,293; 2028: 15,637; 2029: 15,981; 2030: 16,325; 2031: 16,668; 2032: 17,012; 2033: 17,356; 2034: 17,700; 2035: 18,043; 2036: 18,387; 2037: 18,731; 2038: 19,075; 2039: 19,418; 2040: 19,762; 2041: 20,106; 2042: 20,450; 2043: 20,793; 2044: 21,137; 2045: 21,481; 2046: 21,825; 2047: 22,168; 2048: 22,512; 2049: 22,856; 2050: 23,200	0	0	0	0	0	0	0	false	false	0.0	12.00	Traversable Median	12.00	Intermediate/High	0	2.00	12.00
2	4D	13+34.041	15+86.000	251.96	0.0477	2024: 14,262; 2025: 14,606; 2026: 14,950; 2027: 15,293; 2028: 15,637; 2029: 15,981; 2030: 16,325; 2031: 16,668; 2032: 17,012; 2033: 17,356; 2034: 17,700; 2035: 18,043; 2036: 18,387; 2037: 18,731; 2038: 19,075; 2039: 19,418; 2040: 19,762; 2041: 20,106; 2042: 20,450; 2043: 20,793; 2044: 21,137; 2045: 21,481; 2046: 21,825; 2047: 22,168; 2048: 22,512; 2049: 22,856; 2050: 23,200	0	0	0	0	0	0	0	false	false	0.0	12.00	Traversable Median	12.00	Intermediate/High	0	2.00	12.00
3	4U	15+86.000	18+42.805	256.81	0.0486	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
4	4U	18+42.805	21+08.879	266.07	0.0504	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
5	4U	21+08.879	22+86.000	177.12	0.0336	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
6	5T	22+86.000	24+96.922	210.92	0.0399	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
7	5T	24+96.922	26+94.712	197.79	0.0375	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	1	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
8	5T	26+94.712	28+98.954	204.24	0.0387	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
9	4U	28+98.954	34+34.660	535.71	0.1015	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	2	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
10	4U	34+34.660	34+59.660	25.00	0.0047	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
11	5T	34+59.660	37+62.000	302.34	0.0573	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	1	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00

Seg. No.	Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT	Number Major Commercial Driveways	Number Minor Commercial Driveways	Number Major Industial/Institutional	Number Minor Industial/Institutional	Number Major Residential Driveways	Number Minor Residential Driveways	Number Other Driveways	Lighting	Automated Speed Enforcement	Density (fixed objects/mi)	Median Width (ft)	Type	Effective Median Width (ft)	Speed Level	Number Rail Highway Crossings	Average Shoulder Width (ft)	Average Lane Width (ft)
12	4D	37+62.000	38+95.544	133.54	0.0253	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	1	0	0	0	0	0	false	false	0.0	10.00	Non-Traversable Median	14.00	Intermediate /High	0	2.00	12.00
13	4D	38+95.544	39+10.280	14.74	0.0028	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	0	0	false	false	0.0	10.00	Non-Traversable Median	26.00	Intermediate /High	0	2.00	12.00
14	4D	39+10.280	43+95.544	485.26	0.0919	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	0	0	false	false	0.0	10.00	Non-Traversable Median	26.00	Intermediate /High	0	2.00	12.00
15	4D	43+95.544	46+45.544	250.00	0.0474	2024: 23,775; 2025: 24,129; 2026: 24,482; 2027: 24,835; 2028: 25,189; 2029: 25,542; 2030: 25,896; 2031: 26,249; 2032: 26,603; 2033: 26,956; 2034: 27,310; 2035: 27,663; 2036: 28,016; 2037: 28,370; 2038: 28,723; 2039: 29,077; 2040: 29,430; 2041: 29,784; 2042: 30,137; 2043: 30,490; 2044: 30,844; 2045: 31,197; 2046: 31,551; 2047: 31,904; 2048: 32,258; 2049: 32,611; 2050: 32,965	0	0	0	0	0	0	0	false	false	0.0	10.00	Non-Traversable Median	26.00	Intermediate /High	0	2.00	12.00
16	4D	46+45.544	48+21.477	175.93	0.0333	2024: 23,775; 2025: 24,129; 2026: 24,482; 2027: 24,835; 2028: 25,189; 2029: 25,542; 2030: 25,896; 2031: 26,249; 2032: 26,603; 2033: 26,956; 2034: 27,310; 2035: 27,663; 2036: 28,016; 2037: 28,370; 2038: 28,723; 2039: 29,077; 2040: 29,430; 2041: 29,784; 2042: 30,137; 2043: 30,490; 2044: 30,844; 2045: 31,197; 2046: 31,551; 2047: 31,904; 2048: 32,258; 2049: 32,611; 2050: 32,965	0	0	0	0	0	0	0	false	false	0.0	10.00	Non-Traversable Median	14.00	Intermediate /High	0	2.00	12.00
17	4D	48+21.477	48+68.645	47.17	0.0089	2024: 23,775; 2025: 24,129; 2026: 24,482; 2027: 24,835; 2028: 25,189; 2029: 25,542; 2030: 25,896; 2031: 26,249; 2032: 26,603; 2033: 26,956; 2034: 27,310; 2035: 27,663; 2036: 28,016; 2037: 28,370; 2038: 28,723; 2039: 29,077; 2040: 29,430; 2041: 29,784; 2042: 30,137; 2043: 30,490; 2044: 30,844; 2045: 31,197; 2046: 31,551; 2047: 31,904; 2048: 32,258; 2049: 32,611; 2050: 32,965	0	0	0	0	0	0	0	false	false	0.0	10.00	Non-Traversable Median	14.00	Intermediate /High	0	2.00	12.00
18	4D	48+68.645	50+12.172	143.53	0.0272	2024: 23,775; 2025: 24,129; 2026: 24,482; 2027: 24,835; 2028: 25,189; 2029: 25,542; 2030: 25,896; 2031: 26,249; 2032: 26,603; 2033: 26,956; 2034: 27,310; 2035: 27,663; 2036: 28,016; 2037: 28,370; 2038: 28,723; 2039: 29,077; 2040: 29,430; 2041: 29,784; 2042: 30,137; 2043: 30,490; 2044: 30,844; 2045: 31,197; 2046: 31,551; 2047: 31,904; 2048: 32,258; 2049: 32,611; 2050: 32,965	0	0	1	0	0	0	0	false	false	0.0	10.00	Non-Traversable Median	38.00	Intermediate /High	0	2.00	12.00
19	4D	50+12.172	51+69.000	156.83	0.0297	2024: 23,775; 2025: 24,129; 2026: 24,482; 2027: 24,835; 2028: 25,189; 2029: 25,542; 2030: 25,896; 2031: 26,249; 2032: 26,603; 2033: 26,956; 2034: 27,310; 2035: 27,663; 2036: 28,016; 2037: 28,370; 2038: 28,723; 2039: 29,077; 2040: 29,430; 2041: 29,784; 2042: 30,137; 2043: 30,490; 2044: 30,844; 2045: 31,197; 2046: 31,551; 2047: 31,904; 2048: 32,258; 2049: 32,611; 2050: 32,965	0	0	1	0	0	0	0	false	false	0.0	10.00	Non-Traversable Median	25.00	Intermediate /High	0	2.00	12.00
20	4D	51+69.000	52+69.000	100.00	0.0189	2024-2050: 19,800	0	0	0	0	0	0	0	false	false	0.0	12.00	Traversable Median	6.00	Intermediate /High	0	2.00	12.00
21	5T	52+69.000	61+68.645	899.64	0.1704	2024-2050: 19,800	0	0	2	0	1	0	0	false	false	0.0	0.00	None	0.00	Intermediate /High	0	2.00	12.00
22	5T	61+68.645	67+46.101	577.46	0.1094	2024: 21,150; 2025: 21,375; 2026: 21,600; 2027: 21,825; 2028: 22,050; 2029: 22,275; 2030: 22,500; 2031: 22,725; 2032: 22,950; 2033: 23,175; 2034: 23,400; 2035: 23,625; 2036: 23,850; 2037: 24,075; 2038: 24,300; 2039: 24,525; 2040: 24,750; 2041: 24,975; 2042: 25,200; 2043: 25,425; 2044: 25,650; 2045: 25,875; 2046: 26,100; 2047: 26,325; 2048: 26,550; 2049: 26,775; 2050: 27,000	0	0	0	0	1	0	0	false	false	0.0	0.00	None	0.00	Intermediate /High	0	2.00	12.00
23	4U	67+46.101	69+21.101	175.00	0.0331	2024: 21,150; 2025: 21,375; 2026: 21,600; 2027: 21,825; 2028: 22,050; 2029: 22,275; 2030: 22,500; 2031: 22,725; 2032: 22,950; 2033: 23,175; 2034: 23,400; 2035: 23,625; 2036: 23,850; 2037: 24,075; 2038: 24,300; 2039: 24,525; 2040: 24,750; 2041: 24,975; 2042: 25,200; 2043: 25,425; 2044: 25,650; 2045: 25,875; 2046: 26,100; 2047: 26,325; 2048: 26,550; 2049: 26,775; 2050: 27,000	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate /High	0	2.00	12.00
24	4U	69+21.101	70+36.101	115.00	0.0218	2024: 14,406; 2025: 14,490; 2026: 14,575; 2027: 14,659; 2028: 14,743; 2029: 14,828; 2030: 14,912; 2031: 14,996; 2032: 15,081; 2033: 15,165; 2034: 15,250; 2035: 15,334; 2036: 15,418; 2037: 15,503; 2038: 15,587; 2039: 15,671; 2040: 15,756; 2041: 15,840; 2042: 15,925; 2043: 16,009; 2044: 16,093; 2045: 16,178; 2046: 16,262; 2047: 16,346; 2048: 16,431; 2049: 16,515; 2050: 16,600	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate /High	0	2.00	12.00

Seg. No.	Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT	Number Major Commercial Driveways	Number Minor Commercial Driveways	Number Major Industial/Institutional	Number Minor Industial/Institutional	Number Major Residential Driveways	Number Minor Residential Driveways	Number Other Driveways	Lighting	Automated Speed Enforcement	Density (fixed objects/mi)	Median Width (ft)	Type	Effective Median Width (ft)	Speed Level	Number Rail Highway Crossings	Average Shoulder Width (ft)	Average Lane Width (ft)
25	4U	70+36.101	74+43.703	407.60	0.0772	2024: 14,406; 2025: 14,490; 2026: 14,575; 2027: 14,659; 2028: 14,743; 2029: 14,828; 2030: 14,912; 2031: 14,996; 2032: 15,081; 2033: 15,165; 2034: 15,250; 2035: 15,334; 2036: 15,418; 2037: 15,503; 2038: 15,587; 2039: 15,671; 2040: 15,756; 2041: 15,840; 2042: 15,925; 2043: 16,009; 2044: 16,093; 2045: 16,178; 2046: 16,262; 2047: 16,346; 2048: 16,431; 2049: 16,515; 2050: 16,600	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00

Table 2. Evaluation Intersection (Section 1)

Inter. No.	Title	Location (Sta. ft)	Major AADT	Minor AADT	Legs	Traffic Control	Intersection Type	Approaches w/Left Turn Lanes	Approaches w/Right Turn Lanes	Approaches w/o Right Turn on Red	Pedestrian Volume (crossings/day)	Lighted at Night	Red Light Camera	School Nearby	Number of Bus Stops	Number of Alcohol Sales Establishments	Max Lanes Crossed	Replaced with Roundabout
1	Alt 6 - Park Access Intersection	36+51.824	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	2024: 360; 2025: 365; 2026: 370; 2027: 375; 2028: 380; 2029: 385; 2030: 390; 2031: 395; 2032: 400; 2033: 405; 2034: 410; 2035: 415; 2036: 420; 2037: 425; 2038: 430; 2039: 435; 2040: 440; 2041: 445; 2042: 450; 2043: 455; 2044: 460; 2045: 465; 2046: 470; 2047: 475; 2048: 480; 2049: 485; 2050: 490	3	Stop-Controlled	Three-Legged w/STOP control	0	0			true	false	false				false
2	Alt 6 - 41st St Intersection	51+68.664 5	2024: 23,775; 2025: 24,129; 2026: 24,482; 2027: 24,835; 2028: 25,189; 2029: 25,542; 2030: 25,896; 2031: 26,249; 2032: 26,603; 2033: 26,956; 2034: 27,310; 2035: 27,663; 2036: 28,016; 2037: 28,370; 2038: 28,723; 2039: 29,077; 2040: 29,430; 2041: 29,784; 2042: 30,137; 2043: 30,490; 2044: 30,844; 2045: 31,197; 2046: 31,551; 2047: 31,904; 2048: 32,258; 2049: 32,611; 2050: 32,965	2024: 6,935; 2025: 7,006; 2026: 7,077; 2027: 7,148; 2028: 7,219; 2029: 7,290; 2030: 7,361; 2031: 7,432; 2032: 7,503; 2033: 7,574; 2034: 7,645; 2035: 7,715; 2036: 7,786; 2037: 7,857; 2038: 7,928; 2039: 7,999; 2040: 8,070; 2041: 8,141; 2042: 8,212; 2043: 8,283; 2044: 8,354; 2045: 8,425; 2046: 8,496; 2047: 8,567; 2048: 8,638; 2049: 8,709; 2050: 8,780	3	Signalized	Three-Legged Signalized	2	2	0	15	true	false	true	0	0	6	false
3	Alt 6 - 49th St Intersection	15+85.495	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	2024: 8,734; 2025: 8,848; 2026: 8,962; 2027: 9,076; 2028: 9,190; 2029: 9,304; 2030: 9,418; 2031: 9,532; 2032: 9,646; 2033: 9,760; 2034: 9,875; 2035: 9,989; 2036: 10,103; 2037: 10,217; 2038: 10,331; 2039: 10,445; 2040: 10,559; 2041: 10,673; 2042: 10,787; 2043: 10,901; 2044: 11,015; 2045: 11,129; 2046: 11,243; 2047: 11,357; 2048: 11,471; 2049: 11,585; 2050: 11,700	3	Signalized	Three-Legged Signalized	2	0	0	15	true	false	false	0	0	5	false
4	Alt 6 - SPUI Ramp Intersection	43+95.544	2024: 23,775; 2025: 24,129; 2026: 24,482; 2027: 24,835; 2028: 25,189; 2029: 25,542; 2030: 25,896; 2031: 26,249; 2032: 26,603; 2033: 26,956; 2034: 27,310; 2035: 27,663; 2036: 28,016; 2037: 28,370; 2038: 28,723; 2039: 29,077; 2040: 29,430; 2041: 29,784; 2042: 30,137; 2043: 30,490; 2044: 30,844; 2045: 31,197; 2046: 31,551; 2047: 31,904; 2048: 32,258; 2049: 32,611; 2050: 32,965	2024: 13,589; 2025: 13,736; 2026: 13,883; 2027: 14,029; 2028: 14,176; 2029: 14,323; 2030: 14,470; 2031: 14,616; 2032: 14,763; 2033: 14,910; 2034: 15,057; 2035: 15,203; 2036: 15,350; 2037: 15,497; 2038: 15,644; 2039: 15,790; 2040: 15,937; 2041: 16,084; 2042: 16,231; 2043: 16,377; 2044: 16,524; 2045: 16,671; 2046: 16,818; 2047: 16,964; 2048: 17,111; 2049: 17,258; 2050: 17,405	4	Signalized	Four-Legged Signalized	4	4	2	20	true	false	false	0	0	6	false
5	Alt 6 - 38th St/HS Access	55+97.795	2024-2050: 19,800	2024: 2,014; 2025: 2,048; 2026: 2,082; 2027: 2,116; 2028: 2,150; 2029: 2,184; 2030: 2,218; 2031: 2,252; 2032: 2,286; 2033: 2,320; 2034: 2,355; 2035: 2,389; 2036: 2,423; 2037: 2,457; 2038: 2,491; 2039: 2,525; 2040: 2,559; 2041: 2,593; 2042: 2,627; 2043: 2,661; 2044: 2,695; 2045: 2,729; 2046: 2,763; 2047: 2,797; 2048: 2,831; 2049: 2,865; 2050: 2,900	4	Stop-Controlled	Four-Legged w/STOP control	0	0			true	false	true				false
6	Alt 6 - 33rd St Intersection	69+21.101	2024: 21,150; 2025: 21,375; 2026: 21,600; 2027: 21,825; 2028: 22,050; 2029: 22,275; 2030: 22,500; 2031: 22,725; 2032: 22,950; 2033: 23,175; 2034: 23,400; 2035: 23,625; 2036: 23,850; 2037: 24,075; 2038: 24,300; 2039: 24,525; 2040: 24,750; 2041: 24,975; 2042: 25,200; 2043: 25,425; 2044: 25,650; 2045: 25,875; 2046: 26,100; 2047: 26,325; 2048: 26,550; 2049: 26,775; 2050: 27,000	2024: 5,465; 2025: 5,507; 2026: 5,550; 2027: 5,592; 2028: 5,635; 2029: 5,677; 2030: 5,720; 2031: 5,762; 2032: 5,805; 2033: 5,847; 2034: 5,890; 2035: 5,932; 2036: 5,975; 2037: 6,017; 2038: 6,060; 2039: 6,102; 2040: 6,145; 2041: 6,187; 2042: 6,230; 2043: 6,272; 2044: 6,315; 2045: 6,357; 2046: 6,400; 2047: 6,442; 2048: 6,485; 2049: 6,527; 2050: 6,570	4	Signalized	Four-Legged Signalized	4	0	0	20	true	false	false	0	0	5	false

Table 3. Predicted Highway Crash Rates and Frequencies Summary (Section 1)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Evaluated Length (mi)	**1.2204**
Average Future Road AADT (vpd)	**24,515**
Predicted Crashes	
Total Crashes	**838.69**
Fatal and Injury Crashes	**278.93**
Property-Damage-Only Crashes	**559.76**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**33**
Percent Property-Damage-Only Crashes (%)	**67**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**25.4528**
FI Crash Rate (crashes/mi/yr)	**8.4650**
PDO Crash Rate (crashes/mi/yr)	**16.9877**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**294.84**
Travel Crash Rate (crashes/million veh-mi)	**2.85**
Travel FI Crash Rate (crashes/million veh-mi)	**0.95**
Travel PDO Crash Rate (crashes/million veh-mi)	**1.90**

Table 4. Predicted Crash Frequencies and Rates by Highway Segment/Intersection (Section 1)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)	Predicted Intersection Travel Crash Rate (crashes/million veh)
1	10+00.000	13+34.041	0.0633	6.147	0.2277	0.0633	0.1644	3.5989	0.53	
2	13+34.041	15+86.000	0.0477	4.637	0.1717	0.0477	0.1240	3.5989	0.53	
Alt 6 - 49th St Intersection	15+85.495			110.346	4.0869	1.3240	2.7629			0.39
3	15+86.000	18+42.805	0.0486	11.590	0.4292	0.1245	0.3047	8.8254	0.86	
4	18+42.805	21+08.879	0.0504	12.008	0.4447	0.1290	0.3157	8.8254	0.86	
5	21+08.879	22+86.000	0.0335	7.993	0.2961	0.0859	0.2102	8.8254	0.86	
6	22+86.000	24+96.922	0.0399	13.265	0.4913	0.1394	0.3519	12.2983	1.20	
7	24+96.922	26+94.712	0.0375	17.524	0.6490	0.1860	0.4630	17.3258	1.69	
8	26+94.712	28+98.954	0.0387	12.845	0.4757	0.1349	0.3408	12.2983	1.20	
9	28+98.954	34+34.660	0.1015	26.232	0.9715	0.2864	0.6852	9.5757	0.93	
10	34+34.660	34+59.660	0.0047	1.128	0.0418	0.0121	0.0297	8.8254	0.86	
11	34+59.660	37+62.000	0.0573	22.112	0.8189	0.2335	0.5855	14.3019	1.39	
Alt 6 - Park Access Intersection	36+51.824			45.001	1.6667	0.7260	0.9407			0.16
12	37+62.000	38+95.544	0.0253	4.608	0.1707	0.0480	0.1227	6.7480	0.66	
13	38+95.544	39+10.280	0.0028	0.441	0.0163	0.0045	0.0118	5.8547	0.57	
14	39+10.280	43+95.544	0.0919	14.528	0.5381	0.1497	0.3884	5.8547	0.57	
Alt 6 - SPUI Ramp Intersection	43+95.544			101.062	3.7430	1.2981	2.4449			0.25
15	43+95.544	46+45.544	0.0473	7.564	0.2801	0.0779	0.2022	5.9168	0.57	
16	46+45.544	48+21.477	0.0333	5.323	0.1972	0.0548	0.1423	5.9168	0.57	
17	48+21.477	48+68.645	0.0089	1.427	0.0529	0.0147	0.0382	5.9168	0.57	
18	48+68.645	50+12.172	0.0272	6.358	0.2355	0.0672	0.1683	8.6624	0.84	
19	50+12.172	51+69.000	0.0297	6.760	0.2504	0.0713	0.1790	8.4295	0.81	
Alt 6 - 41st St Intersection	51+68.645			95.561	3.5393	1.1712	2.3681			0.35
20	51+69.000	52+69.000	0.0189	1.967	0.0729	0.0203	0.0526	3.8474	0.53	
21	52+69.000	61+68.645	0.1704	56.460	2.0911	0.6059	1.4852	12.2727	1.70	
Alt 6 - 38th St/HS Access	55+97.795			90.327	3.3454	1.3762	1.9692			0.42
22	61+68.645	67+46.101	0.1094	35.031	1.2974	0.3717	0.9257	11.8632	1.35	

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)	Predicted Intersection Travel Crash Rate (crashes/million veh)
23	67+46.101	69+21.101	0.0331	6.501	0.2408	0.0708	0.1700	7.2643	0.83	
Alt 6 - 33rd St Intersection	69+21.101			102.674	3.8028	1.3081	2.4946			0.41
24	69+21.101	70+36.101	0.0218	2.480	0.0918	0.0280	0.0638	4.2166	0.74	
25	70+36.101	74+43.703	0.0772	8.789	0.3255	0.0993	0.2262	4.2166	0.74	
All Segments			1.2204	293.717	10.8784	3.1269	7.7514	8.9138	1.00	
All Intersections				544.972	20.1841	7.2038	12.9804			0.32
Total			1.2204	838.688	31.0625	10.3307	20.7318	25.4528		

Table 5. Predicted Crash Frequencies and Rates by Horizontal Design Element (Section 1)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Simple Curve 1	10+00.000	13+34.041	0.0633	6.147	0.2277	0.0633	0.1644	3.5989	0.53
Tangent	13+34.041	18+42.805	0.0964	16.226	0.6010	0.1723	0.4287	6.2370	0.69
Simple Curve 2	18+42.805	21+08.879	0.0504	12.008	0.4447	0.1290	0.3157	8.8254	0.86
Tangent	21+08.879	24+96.922	0.0735	21.258	0.7873	0.2253	0.5621	10.7131	1.04
Simple Curve 3	24+96.922	26+94.712	0.0375	17.524	0.6490	0.1860	0.4630	17.3258	1.69
Tangent	26+94.712	34+34.660	0.1401	39.076	1.4473	0.4213	1.0259	10.3272	1.01
Simple Curve 4	34+34.660	39+10.280	0.0901	28.289	1.0477	0.2981	0.7496	11.6314	1.13
Tangent	39+10.280	48+21.477	0.1726	27.415	1.0154	0.2824	0.7330	5.8837	0.57
Simple Curve 5	48+21.477	50+12.172	0.0361	7.785	0.2883	0.0819	0.2064	7.9833	0.77
Tangent	50+12.172	74+43.703	0.4605	117.987	4.3699	1.2674	3.1025	9.4891	1.24

Table 6. Predicted Crash Frequencies by Year (Section 1)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2024	26.19	8.77	33.486	17.42	66.514
2025	26.56	8.89	33.469	17.67	66.531
2026	26.92	9.01	33.452	17.92	66.548
2027	27.29	9.12	33.435	18.16	66.565
2028	27.66	9.24	33.418	18.41	66.582
2029	28.03	9.36	33.401	18.67	66.599
2030	28.40	9.48	33.384	18.92	66.616
2031	28.77	9.60	33.367	19.17	66.633
2032	29.14	9.72	33.350	19.42	66.650
2033	29.52	9.84	33.334	19.68	66.666
2034	29.89	9.96	33.317	19.93	66.683
2035	30.27	10.08	33.301	20.19	66.699
2036	30.65	10.20	33.284	20.45	66.716
2037	31.03	10.32	33.268	20.70	66.732
2038	31.41	10.44	33.251	20.96	66.749
2039	31.79	10.56	33.235	21.22	66.765
2040	32.17	10.69	33.219	21.48	66.781
2041	32.55	10.81	33.203	21.75	66.797
2042	32.94	10.93	33.187	22.01	66.813
2043	33.33	11.05	33.171	22.27	66.829
2044	33.71	11.18	33.155	22.54	66.845
2045	34.10	11.30	33.139	22.80	66.861
2046	34.49	11.43	33.123	23.07	66.876
2047	34.88	11.55	33.108	23.33	66.892
2048	35.27	11.67	33.092	23.60	66.908
2049	35.67	11.80	33.077	23.87	66.923
2050	36.06	11.92	33.062	24.14	66.938
Total	838.69	278.93	33.258	559.76	66.742
Average	31.06	10.33	33.258	20.73	66.742

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 7. Predicted Five Lane or Fewer Crash Type Distribution (Section 1)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.09	0.0	1.29	0.2	1.38	0.2
Highway Segment	Collision with Bicycle	2.27	0.3	0.00	0.0	2.27	0.3
Highway Segment	Collision with Fixed Object	4.49	0.5	26.40	3.1	30.89	3.7
Highway Segment	Collision with Other Object	0.12	0.0	1.45	0.2	1.57	0.2
Highway Segment	Other Single-vehicle Collision	4.71	0.6	4.36	0.5	9.07	1.1
Highway Segment	Collision with Pedestrian	5.29	0.6	0.00	0.0	5.29	0.6
Highway Segment	Total Single Vehicle Crashes	16.96	2.0	33.50	4.0	50.46	6.0
Highway Segment	Angle Collision	5.15	0.6	11.19	1.3	16.34	1.9
Highway Segment	Driveway-related Collision	9.72	1.2	25.62	3.1	35.35	4.2
Highway Segment	Head-on Collision	2.22	0.3	0.70	0.1	2.92	0.3
Highway Segment	Other Multi-vehicle Collision	2.11	0.3	7.97	0.9	10.08	1.2
Highway Segment	Rear-end Collision	42.56	5.1	91.81	10.9	134.38	16.0
Highway Segment	Sideswipe, Opposite Direction Collision	1.73	0.2	2.04	0.2	3.77	0.5
Highway Segment	Sideswipe, Same Direction Collision	3.97	0.5	36.45	4.3	40.42	4.8
Highway Segment	Total Multiple Vehicle Crashes	67.47	8.0	175.79	21.0	243.26	29.0
Highway Segment	Total Highway Segment Crashes	84.43	10.1	209.29	25.0	293.72	35.0
Intersection	Collision with Animal	0.01	0.0	0.23	0.0	0.24	0.0
Intersection	Collision with Bicycle	7.49	0.9	0.00	0.0	7.49	0.9
Intersection	Collision with Fixed Object	6.89	0.8	22.01	2.6	28.90	3.4
Intersection	Non-Collision	1.71	0.2	0.75	0.1	2.46	0.3
Intersection	Collision with Other Object	0.84	0.1	1.81	0.2	2.65	0.3
Intersection	Other Single-vehicle Collision	0.44	0.1	0.45	0.1	0.89	0.1
Intersection	Collision with Parked Vehicle	0.01	0.0	0.03	0.0	0.04	0.0
Intersection	Collision with Pedestrian	4.36	0.5	0.00	0.0	4.36	0.5
Intersection	Total Intersection Single Vehicle Crashes	21.76	2.6	25.27	3.0	47.03	5.6
Intersection	Angle Collision	58.72	7.0	78.92	9.4	137.63	16.4
Intersection	Head-on Collision	7.48	0.9	8.30	1.0	15.78	1.9
Intersection	Other Multi-vehicle Collision	9.95	1.2	67.78	8.1	77.73	9.3
Intersection	Rear-end Collision	79.75	9.5	159.04	19.0	238.79	28.5
Intersection	Sideswipe	16.85	2.0	11.16	1.3	28.02	3.3
Intersection	Total Intersection Multiple Vehicle Crashes	172.75	20.6	325.20	38.8	497.94	59.4
Intersection	Total Intersection Crashes	194.50	23.2	350.47	41.8	544.97	65.0
	Total Crashes	278.93	33.3	559.76	66.7	838.69	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

IHSDM Results
(2024 to 2050)

Cliff Avenue (Exit 4)

Alternative 7 Conditions

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

May 3, 2019

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Table of Contents

List of Tables

List of Figures

Report Overview

Report Generated: May 3, 2019 10:38 AM
Report Template: System: Single Page [System] (mlcpm3, Apr 10, 2019 1:31 PM)

Evaluation Date: Fri May 03 10:37:56 CDT 2019
IHSDM Version: v14.1.0 (Mar 12, 2019)
Crash Prediction Module: v9.1.0 (Mar 12, 2019)

User Name: jdanibas
Organization Name:
Phone:
E-Mail:

Project Title: I-229 Exit 4 (Cliff Ave) - Alternative 7
Project Comment: Created Tue Apr 16 14:58:43 CDT 2019
Project Unit System: U.S. Customary

Highway Title: I-229
Highway Comment: Created Tue Apr 16 14:59:05 CDT 2019
Highway Version: 1

Evaluation Title: Evaluation 1
Evaluation Comment: Created Fri May 03 10:37:47 CDT 2019

Minimum Location: 10+00.000
Maximum Location: 92+57.134
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2024
Last Year of Analysis: 2050
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Section Types

Section 1 Evaluation

Section: Section 1
Evaluation Start Location: 10+00.000
Evaluation End Location: 92+57.134
Functional Class: Freeway
Type of Alignment: Divided, Multilane
Model Category: Freeway Segment
Calibration Factor: FI_EN=1.0; FI_EX=1.0; FI_MV=1.0; FI_SV=1.0; PDO_EN=1.0; PDO_EX=1.0; PDO_MV=1.0; PDO_SV=1.0;

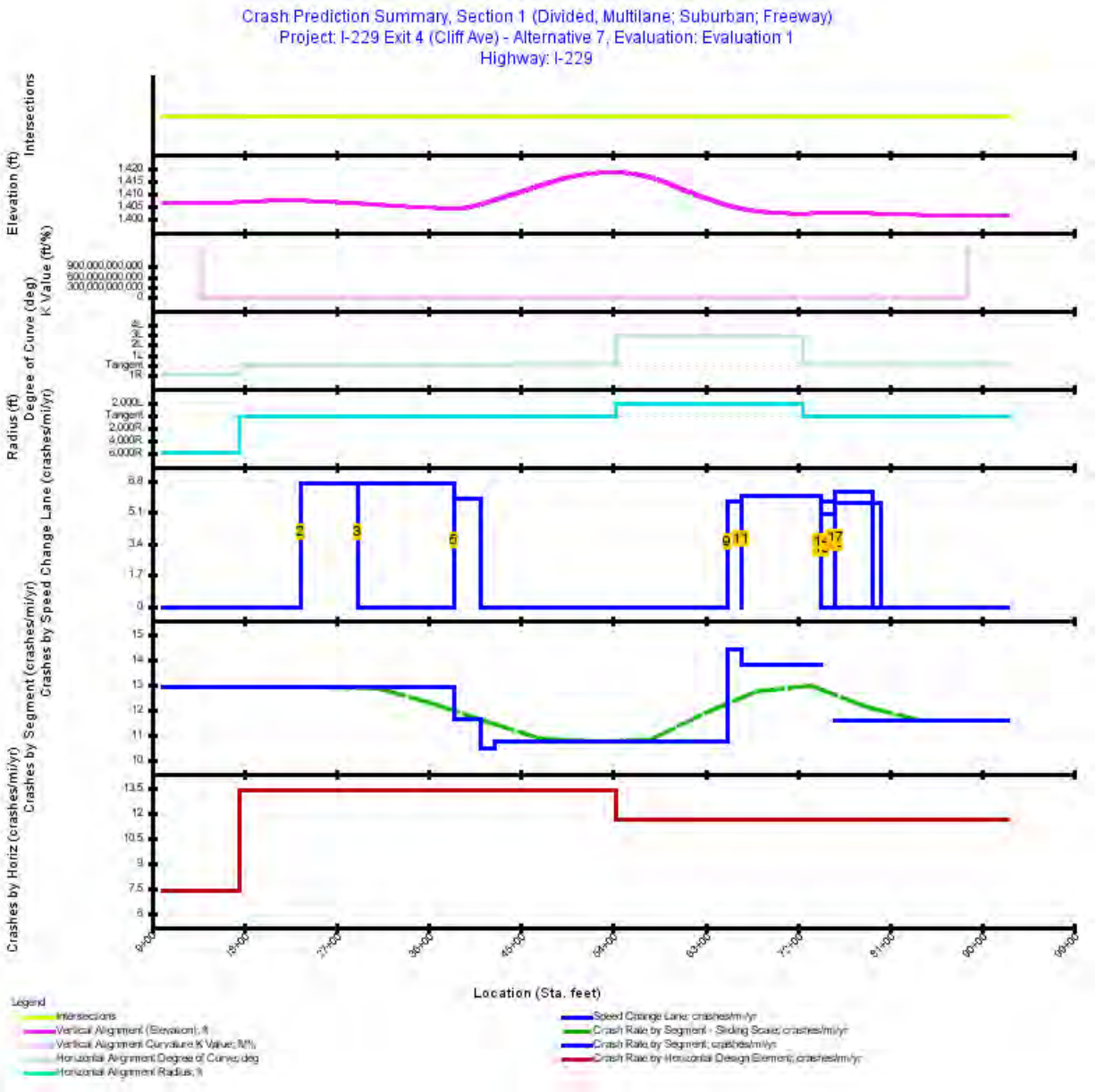

Figure 1. Crash Prediction Summary (Section 1)

Table 1. Evaluation Freeway - Homogeneous Segments (Section 1)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT	Median Width (ft)	Type	Effective Median Width (ft)
1	6F	Urban	10+00.000	38+44.179	2,844.18	0.5387	2024: 62,235; 2025: 62,933; 2026: 63,632; 2027: 64,331; 2028: 65,030; 2029: 65,729; 2030: 66,428; 2031: 67,126; 2032: 67,825; 2033: 68,524; 2034: 69,223; 2035: 69,922; 2036: 70,621; 2037: 71,320; 2038: 72,018; 2039: 72,717; 2040: 73,416; 2041: 74,115; 2042: 74,814; 2043: 75,513; 2044: 76,211; 2045: 76,910; 2046: 77,609; 2047: 78,308; 2048: 79,007; 2049: 79,706; 2050: 80,405	44.00	Non-Traversable Median	64.00
4	5F	Urban	38+44.179	41+02.826	258.65	0.0490	2024: 55,424; 2025: 56,036; 2026: 56,648; 2027: 57,260; 2028: 57,872; 2029: 58,484; 2030: 59,096; 2031: 59,708; 2032: 60,320; 2033: 60,932; 2034: 61,544; 2035: 62,155; 2036: 62,767; 2037: 63,379; 2038: 63,991; 2039: 64,603; 2040: 65,215; 2041: 65,827; 2042: 66,439; 2043: 67,051; 2044: 67,663; 2045: 68,275; 2046: 68,887; 2047: 69,499; 2048: 70,111; 2049: 70,723; 2050: 71,335	44.00	Non-Traversable Median	64.00
6	5F	Urban	41+02.826	42+36.423	133.60	0.0253	2024: 55,424; 2025: 56,036; 2026: 56,648; 2027: 57,260; 2028: 57,872; 2029: 58,484; 2030: 59,096; 2031: 59,708; 2032: 60,320; 2033: 60,932; 2034: 61,544; 2035: 62,155; 2036: 62,767; 2037: 63,379; 2038: 63,991; 2039: 64,603; 2040: 65,215; 2041: 65,827; 2042: 66,439; 2043: 67,051; 2044: 67,663; 2045: 68,275; 2046: 68,887; 2047: 69,499; 2048: 70,111; 2049: 70,723; 2050: 71,335	44.00	Non-Traversable Median	64.00
7	5F	Urban	42+36.423	65+13.782	2,277.36	0.4313	2024: 48,645; 2025: 49,197; 2026: 49,749; 2027: 50,301; 2028: 50,853; 2029: 51,406; 2030: 51,958; 2031: 52,510; 2032: 53,062; 2033: 53,614; 2034: 54,166; 2035: 54,718; 2036: 55,270; 2037: 55,822; 2038: 56,374; 2039: 56,926; 2040: 57,479; 2041: 58,031; 2042: 58,583; 2043: 59,135; 2044: 59,687; 2045: 60,239; 2046: 60,791; 2047: 61,343; 2048: 61,895; 2049: 62,447; 2050: 63,000	44.00	Non-Traversable Median	64.00
8	6F	Urban	65+13.782	66+47.379	133.60	0.0253	2024: 48,645; 2025: 49,197; 2026: 49,749; 2027: 50,301; 2028: 50,853; 2029: 51,406; 2030: 51,958; 2031: 52,510; 2032: 53,062; 2033: 53,614; 2034: 54,166; 2035: 54,718; 2036: 55,270; 2037: 55,822; 2038: 56,374; 2039: 56,926; 2040: 57,479; 2041: 58,031; 2042: 58,583; 2043: 59,135; 2044: 59,687; 2045: 60,239; 2046: 60,791; 2047: 61,343; 2048: 61,895; 2049: 62,447; 2050: 63,000	44.00	Non-Traversable Median	64.00
10	6F	Urban	66+47.379	74+33.116	785.74	0.1488	2024: 52,736; 2025: 53,325; 2026: 53,914; 2027: 54,503; 2028: 55,092; 2029: 55,681; 2030: 56,270; 2031: 56,859; 2032: 57,448; 2033: 58,037; 2034: 58,626; 2035: 59,215; 2036: 59,804; 2037: 60,393; 2038: 60,982; 2039: 61,571; 2040: 62,160; 2041: 62,749; 2042: 63,338; 2043: 63,927; 2044: 64,516; 2045: 65,105; 2046: 65,694; 2047: 66,283; 2048: 66,872; 2049: 67,461; 2050: 68,050	44.00	Non-Traversable Median	64.00
12	6F	Urban	74+33.116	75+66.713	133.60	0.0253	2024: 52,736; 2025: 53,325; 2026: 53,914; 2027: 54,503; 2028: 55,092; 2029: 55,681; 2030: 56,270; 2031: 56,859; 2032: 57,448; 2033: 58,037; 2034: 58,626; 2035: 59,215; 2036: 59,804; 2037: 60,393; 2038: 60,982; 2039: 61,571; 2040: 62,160; 2041: 62,749; 2042: 63,338; 2043: 63,927; 2044: 64,516; 2045: 65,105; 2046: 65,694; 2047: 66,283; 2048: 66,872; 2049: 67,461; 2050: 68,050	44.00	Non-Traversable Median	64.00
15	6F	Urban	75+66.713	92+57.134	1,690.42	0.3202	2024: 57,184; 2025: 57,902; 2026: 58,621; 2027: 59,340; 2028: 60,058; 2029: 60,777; 2030: 61,496; 2031: 62,214; 2032: 62,933; 2033: 63,652; 2034: 64,371; 2035: 65,089; 2036: 65,808; 2037: 66,527; 2038: 67,245; 2039: 67,964; 2040: 68,683; 2041: 69,401; 2042: 70,120; 2043: 70,839; 2044: 71,557; 2045: 72,276; 2046: 72,995; 2047: 73,713; 2048: 74,432; 2049: 75,151; 2050: 75,870	44.00	Non-Traversable Median	64.00

Table 2. Evaluation Freeway - Speed Change Lanes (Speed Change)

Seg. No.	Type	Ramp Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT	Median Width (ft)	Type	Effective Median Width (ft)
2	6SC	Exit	23+44.179	38+44.179	1,500.00	0.2841	2024: 62,235; 2025: 62,933; 2026: 63,632; 2027: 64,331; 2028: 65,030; 2029: 65,729; 2030: 66,428; 2031: 67,126; 2032: 67,825; 2033: 68,524; 2034: 69,223; 2035: 69,922; 2036: 70,621; 2037: 71,320; 2038: 72,018; 2039: 72,717; 2040: 73,416; 2041: 74,115; 2042: 74,814; 2043: 75,513; 2044: 76,211; 2045: 76,910; 2046: 77,609; 2047: 78,308; 2048: 79,007; 2049: 79,706; 2050: 80,405	44.00	Non-Traversable Median	64.00
3	6SC	Entrance	29+02.826	38+44.179	941.35	0.1783	2024: 62,235; 2025: 62,933; 2026: 63,632; 2027: 64,331; 2028: 65,030; 2029: 65,729; 2030: 66,428; 2031: 67,126; 2032: 67,825; 2033: 68,524; 2034: 69,223; 2035: 69,922; 2036: 70,621; 2037: 71,320; 2038: 72,018; 2039: 72,717; 2040: 73,416; 2041: 74,115; 2042: 74,814; 2043: 75,513; 2044: 76,211; 2045: 76,910; 2046: 77,609; 2047: 78,308; 2048: 79,007; 2049: 79,706; 2050: 80,405	44.00	Non-Traversable Median	64.00
5	5SC	Entrance	38+44.179	41+02.826	258.65	0.0490	2024: 55,424; 2025: 56,036; 2026: 56,648; 2027: 57,260; 2028: 57,872; 2029: 58,484; 2030: 59,096; 2031: 59,708; 2032: 60,320; 2033: 60,932; 2034: 61,544; 2035: 62,155; 2036: 62,767; 2037: 63,379; 2038: 63,991; 2039: 64,603; 2040: 65,215; 2041: 65,827; 2042: 66,439; 2043: 67,051; 2044: 67,663; 2045: 68,275; 2046: 68,887; 2047: 69,499; 2048: 70,111; 2049: 70,723; 2050: 71,335	44.00	Non-Traversable Median	64.00
9	6SC	Entrance	65+13.782	66+47.379	133.60	0.0253	2024: 48,645; 2025: 49,197; 2026: 49,749; 2027: 50,301; 2028: 50,853; 2029: 51,406; 2030: 51,958; 2031: 52,510; 2032: 53,062; 2033: 53,614; 2034: 54,166; 2035: 54,718; 2036: 55,270; 2037: 55,822; 2038: 56,374; 2039: 56,926; 2040: 57,479; 2041: 58,031; 2042: 58,583; 2043: 59,135; 2044: 59,687; 2045: 60,239; 2046: 60,791; 2047: 61,343; 2048: 61,895; 2049: 62,447; 2050: 63,000	44.00	Non-Traversable Median	64.00
11	6SC	Entrance	66+47.379	74+33.116	785.74	0.1488	2024: 52,736; 2025: 53,325; 2026: 53,914; 2027: 54,503; 2028: 55,092; 2029: 55,681; 2030: 56,270; 2031: 56,859; 2032: 57,448; 2033: 58,037; 2034: 58,626; 2035: 59,215; 2036: 59,804; 2037: 60,393; 2038: 60,982; 2039: 61,571; 2040: 62,160; 2041: 62,749; 2042: 63,338; 2043: 63,927; 2044: 64,516; 2045: 65,105; 2046: 65,694; 2047: 66,283; 2048: 66,872; 2049: 67,461; 2050: 68,050	44.00	Non-Traversable Median	64.00
13	6SC	Entrance	74+33.116	75+66.713	133.60	0.0253	2024: 52,736; 2025: 53,325; 2026: 53,914; 2027: 54,503; 2028: 55,092; 2029: 55,681; 2030: 56,270; 2031: 56,859; 2032: 57,448; 2033: 58,037; 2034: 58,626; 2035: 59,215; 2036: 59,804; 2037: 60,393; 2038: 60,982; 2039: 61,571; 2040: 62,160; 2041: 62,749; 2042: 63,338; 2043: 63,927; 2044: 64,516; 2045: 65,105; 2046: 65,694; 2047: 66,283; 2048: 66,872; 2049: 67,461; 2050: 68,050	44.00	Non-Traversable Median	64.00
14	6SC	Exit	74+33.116	75+66.713	133.60	0.0253	2024: 52,736; 2025: 53,325; 2026: 53,914; 2027: 54,503; 2028: 55,092; 2029: 55,681; 2030: 56,270; 2031: 56,859; 2032: 57,448; 2033: 58,037; 2034: 58,626; 2035: 59,215; 2036: 59,804; 2037: 60,393; 2038: 60,982; 2039: 61,571; 2040: 62,160; 2041: 62,749; 2042: 63,338; 2043: 63,927; 2044: 64,516; 2045: 65,105; 2046: 65,694; 2047: 66,283; 2048: 66,872; 2049: 67,461; 2050: 68,050	44.00	Non-Traversable Median	64.00
16	6SC	Entrance	75+66.713	80+13.782	447.07	0.0847	2024: 57,184; 2025: 57,902; 2026: 58,621; 2027: 59,340; 2028: 60,058; 2029: 60,777; 2030: 61,496; 2031: 62,214; 2032: 62,933; 2033: 63,652; 2034: 64,371; 2035: 65,089; 2036: 65,808; 2037: 66,527; 2038: 67,245; 2039: 67,964; 2040: 68,683; 2041: 69,401; 2042: 70,120; 2043: 70,839; 2044: 71,557; 2045: 72,276; 2046: 72,995; 2047: 73,713; 2048: 74,432; 2049: 75,151; 2050: 75,870	44.00	Non-Traversable Median	64.00
17	6SC	Exit	75+66.713	79+33.116	366.40	0.0694	2024: 57,184; 2025: 57,902; 2026: 58,621; 2027: 59,340; 2028: 60,058; 2029: 60,777; 2030: 61,496; 2031: 62,214; 2032: 62,933; 2033: 63,652; 2034: 64,371; 2035: 65,089; 2036: 65,808; 2037: 66,527; 2038: 67,245; 2039: 67,964; 2040: 68,683; 2041: 69,401; 2042: 70,120; 2043: 70,839; 2044: 71,557; 2045: 72,276; 2046: 72,995; 2047: 73,713; 2048: 74,432; 2049: 75,151; 2050: 75,870	44.00	Non-Traversable Median	64.00

Table 3. Predicted Freeway Crash Rates and Frequencies Summary (Section 1)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Effective Length (mi)	**1.1188**
Average Future Road AADT (vpd)	**63,048**
Predicted Crashes	
Total Crashes	**355.91**
Fatal and Injury Crashes	**130.32**
Property-Damage-Only Crashes	**225.59**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**37**
Percent Property-Damage-Only Crashes (%)	**63**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**11.7824**
FI Crash Rate (crashes/mi/yr)	**4.3141**
PDO Crash Rate (crashes/mi/yr)	**7.4683**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**695.14**
Travel Crash Rate (crashes/million veh-mi)	**0.51**
Travel FI Crash Rate (crashes/million veh-mi)	**0.19**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.33**

Note: *Effective Length* is the *segment length* minus the length of the *speed change lanes* if present.

Table 4. Predicted Freeway Speed Change Lane Crash Rates and Frequencies Summary (Speed Change)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Evaluated Length (mi)	**0.8902**
Average Future Road AADT (vpd)	**33,582**
Predicted Crashes	
Total Crashes	**151.22**
Fatal and Injury Crashes	**45.83**
Property-Damage-Only Crashes	**105.39**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**30**
Percent Property-Damage-Only Crashes (%)	**70**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**6.2920**
FI Crash Rate (crashes/mi/yr)	**1.9069**
PDO Crash Rate (crashes/mi/yr)	**4.3851**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**294.60**
Travel Crash Rate (crashes/million veh-mi)	**0.51**
Travel FI Crash Rate (crashes/million veh-mi)	**0.16**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.36**

Note: *Total Travel and Crash Rates/Million Vehicle Miles* for *Speed Change Lanes* reflect AADTs that are **half of the Freeway Segment AADTs** based on the assumption of 50/50 directional distribution.

Table 5. Predicted Crash Frequencies and Rates by Freeway Segment/Intersection (Section 1)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Effective Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	10+00.000	38+44.179	0.3075	107.292	3.9738	1.4252	2.5485	12.9236	0.50
4	38+44.179	41+02.826	0.0245	7.701	0.2852	0.1051	0.1801	11.6448	0.50
6	41+02.826	42+36.423	0.0253	7.172	0.2656	0.0981	0.1675	10.4975	0.45
7	42+36.423	65+13.782	0.4313	125.205	4.6372	1.7554	2.8818	10.7513	0.53
8	65+13.782	66+47.379	0.0127	4.915	0.1820	0.0665	0.1155	14.3890	0.71
10	66+47.379	74+33.116	0.0744	27.739	1.0274	0.3715	0.6559	13.8076	0.63
12	74+33.116	75+66.713	0.0000	0.000	0.0000	0.0000	0.0000		
15	75+66.713	92+57.134	0.2431	75.887	2.8106	1.0046	1.8060	11.5606	0.48
Total			1.1188	355.911	13.1819	4.8266	8.3553	11.7824	0.51

Note: *Effective Length* is the *segment length* minus the length of the *speed change lanes* if present.

Table 6. Predicted Crash Frequencies and Rates by Freeway Speed Change Lane (Speed Change)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
2	23+44.179	38+44.179	0.2841	51.455	1.9057	0.5391	1.3667	6.7082	0.52
3	29+02.826	38+44.179	0.1783	32.290	1.1959	0.4015	0.7944	6.7079	0.52
5	38+44.179	41+02.826	0.0490	7.699	0.2852	0.0961	0.1891	5.8212	0.50
9	65+13.782	66+47.379	0.0253	3.918	0.1451	0.0416	0.1035	5.7354	0.56
11	66+47.379	74+33.116	0.1488	24.113	0.8931	0.2602	0.6329	6.0013	0.54
13	74+33.116	75+66.713	0.0253	3.414	0.1264	0.0395	0.0870	4.9975	0.45
14	74+33.116	75+66.713	0.0253	3.876	0.1435	0.0429	0.1006	5.6731	0.52
16	75+66.713	80+13.782	0.0847	12.835	0.4754	0.1481	0.3273	5.6145	0.46
17	75+66.713	79+33.116	0.0694	11.622	0.4304	0.1284	0.3020	6.2027	0.51
Total			0.8902	151.222	5.6008	1.6974	3.9034	6.2920	0.51

Note: *Travel Crash Rates/Million Vehicle Miles* for *Speed Change Lanes* reflect AADTs that are **half of the Freeway Segment**

AADTs based on the assumption of 50/50 directional distribution.

Table 7. Predicted Crash Frequencies and Rates by Horizontal Design Element (Section 1)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Simple Curve 1	10+00.000	17+54.376	0.1429	28.457	1.0540	0.3780	0.6760	7.3770	0.50
Tangent	17+54.376	54+26.711	0.6955	250.591	9.2811	3.2045	6.0766	13.3442	0.88
Simple Curve 2	54+26.711	72+50.687	0.3454	108.412	4.0153	1.4312	2.5841	11.6233	0.80
Tangent	72+50.687	92+57.134	0.3800	119.673	4.4323	1.5102	2.9221	11.6638	

Table 8. Predicted Crash Frequencies by Year (Section 1)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2024	16.03	5.59	34.870	10.44	65.130
2025	16.26	5.67	34.852	10.60	65.148
2026	16.50	5.75	34.833	10.75	65.167
2027	16.73	5.83	34.814	10.91	65.186
2028	16.97	5.90	34.796	11.06	65.204
2029	17.20	5.98	34.777	11.22	65.223
2030	17.45	6.06	34.758	11.38	65.242
2031	17.69	6.14	34.739	11.54	65.261
2032	17.93	6.22	34.720	11.71	65.280
2033	18.18	6.31	34.701	11.87	65.299
2034	18.42	6.39	34.681	12.03	65.319
2035	18.67	6.47	34.662	12.20	65.338
2036	18.83	6.47	34.393	12.35	65.607
2037	19.06	6.55	34.337	12.52	65.663
2038	19.30	6.62	34.281	12.69	65.719
2039	19.54	6.69	34.225	12.85	65.775
2040	19.78	6.76	34.170	13.02	65.830
2041	20.02	6.83	34.115	13.19	65.885
2042	20.26	6.90	34.061	13.36	65.939
2043	20.50	6.97	34.007	13.53	65.993
2044	20.75	7.04	33.954	13.70	66.046
2045	20.99	7.12	33.901	13.87	66.099
2046	21.23	7.19	33.848	14.05	66.152
2047	21.48	7.26	33.796	14.22	66.204
2048	21.73	7.33	33.744	14.39	66.256
2049	21.97	7.40	33.693	14.57	66.308
2050	22.22	7.48	33.641	14.75	66.359
Total	515.69	176.92	34.308	338.77	65.692
Average	19.10	6.55	34.308	12.55	65.692

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 9. Predicted Crash Severity by Freeway Segment (Section 1)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.7231	1.8679	11.8948	23.9956	68.8101
4	0.0497	0.1262	0.8468	1.8155	4.8626
6	0.0464	0.1178	0.7902	1.6941	4.5231
7	0.8924	2.3061	14.6641	29.5332	77.8094
8	0.0400	0.1042	0.6268	1.0254	3.1186
10	0.2162	0.5581	3.4460	5.8109	17.7080
12					0.0000
15	0.5222	1.3121	8.8284	16.4627	48.7618
Total					225.5936

Table 10. Predicted Crash Severity by Speed Change Lane (Speed Change)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
2	0.2547	0.6474	4.3425	9.3101	36.9004
3	0.1897	0.4822	3.2345	6.9345	21.4491
5	0.0454	0.1153	0.7738	1.6589	5.1059
9	0.0251	0.0652	0.3924	0.6418	2.7937
11	0.1514	0.3909	2.4133	4.0696	17.0878
13	0.0205	0.0516	0.3471	0.6472	2.3477
14	0.0223	0.0561	0.3771	0.7033	2.7169
16	0.0770	0.1934	1.3012	2.4265	8.8375
17	0.0668	0.1677	1.1287	2.1046	8.1539
Total	0.8529	2.1697	14.3105	28.4964	105.3929

Table 11. Predicted Freeway Crash Type Distribution (Section 1)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.27	0.1	2.38	0.7	2.65	0.7
Highway Segment	Collision with Fixed Object	48.40	13.3	77.47	21.3	125.88	34.6
Highway Segment	Collision with Other Object	3.42	0.9	15.04	4.1	18.46	5.1
Highway Segment	Other Single-vehicle Collision	13.95	3.8	11.58	3.2	25.52	7.0
Highway Segment	Collision with Parked Vehicle	1.01	0.3	1.73	0.5	2.74	0.8
Highway Segment	Total Single Vehicle Crashes	67.04	18.4	108.20	29.8	175.24	48.2
Highway Segment	Right-Angle Collision	1.97	0.5	2.24	0.6	4.22	1.2
Highway Segment	Head-on Collision	0.51	0.1	0.25	0.1	0.76	0.2
Highway Segment	Other Multi-vehicle Collision	1.97	0.5	2.99	0.8	4.96	1.4
Highway Segment	Rear-end Collision	47.75	13.1	85.98	23.7	133.73	36.8
Highway Segment	Sideswipe, Same Direction Collision	11.46	3.2	33.15	9.1	44.60	12.3
Highway Segment	Total Multiple Vehicle Crashes	63.66	17.5	124.61	34.3	188.27	51.8
Highway Segment	Total Highway Segment Crashes	130.71	36.0	232.81	64.0	363.51	100.0
	Total Crashes	130.71	36.0	232.81	64.0	363.51	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 12. Predicted Exit Speed Change Lane Crash Type Distribution (Speed Change)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.00	0.0	0.33	0.5	0.33	0.5
Highway Segment	Collision with Fixed Object	3.76	5.6	9.89	14.8	13.65	20.4
Highway Segment	Collision with Other Object	0.31	0.5	1.43	2.1	1.74	2.6
Highway Segment	Other Single-vehicle Collision	0.94	1.4	1.10	1.6	2.04	3.0
Highway Segment	Collision with Parked Vehicle	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Total Single Vehicle Crashes	5.01	7.5	12.76	19.1	17.76	26.5
Highway Segment	Right-Angle Collision	0.21	0.3	0.57	0.9	0.78	1.2
Highway Segment	Head-on Collision	0.10	0.1	0.10	0.1	0.19	0.3
Highway Segment	Other Multi-vehicle Collision	0.31	0.5	0.76	1.1	1.07	1.6
Highway Segment	Rear-end Collision	10.53	15.7	26.99	40.3	37.52	56.0
Highway Segment	Sideswipe, Same Direction Collision	3.03	4.5	6.59	9.8	9.62	14.4
Highway Segment	Total Multiple Vehicle Crashes	14.18	21.2	35.02	52.3	49.19	73.5
Highway Segment	Total Highway Segment Crashes	19.18	28.6	47.77	71.4	66.95	100.0
	Total Crashes	19.18	28.6	47.77	71.4	66.95	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 13. Predicted Entrance Speed Change Lane Crash Type Distribution (Speed Change)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.00	0.0	0.12	0.1	0.12	0.1
Highway Segment	Collision with Fixed Object	5.24	6.2	7.51	8.8	12.75	15.0
Highway Segment	Collision with Other Object	0.51	0.6	2.10	2.5	2.61	3.1
Highway Segment	Other Single-vehicle Collision	1.81	2.1	0.93	1.1	2.74	3.2
Highway Segment	Collision with Parked Vehicle	0.11	0.1	0.17	0.2	0.28	0.3
Highway Segment	Total Single Vehicle Crashes	7.68	9.0	10.82	12.7	18.50	21.7
Highway Segment	Right-Angle Collision	0.51	0.6	0.93	1.1	1.45	1.7
Highway Segment	Head-on Collision	0.11	0.1	0.06	0.1	0.17	0.2
Highway Segment	Other Multi-vehicle Collision	0.46	0.5	0.87	1.0	1.33	1.6
Highway Segment	Rear-end Collision	14.68	17.2	30.84	36.2	45.52	53.4
Highway Segment	Sideswipe, Same Direction Collision	3.60	4.2	14.66	17.2	18.26	21.4
Highway Segment	Total Multiple Vehicle Crashes	19.36	22.7	47.37	55.6	66.72	78.3
Highway Segment	Total Highway Segment Crashes	27.03	31.7	58.19	68.3	85.23	100.0
	Total Crashes	27.03	31.7	58.19	68.3	85.23	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 14. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
38+44.179	41+02.826	for segment #4 (38+44.179 to 41+02.826), Freeway Segment of type Five-lane Freeway is using unbalanced lane processing with types Four-lane Freeway and Six-lane Freeway
41+02.826	42+36.423	for segment #6 (41+02.826 to 42+36.423), Freeway Segment of type Five-lane Freeway is using unbalanced lane processing with types Four-lane Freeway and Six-lane Freeway
42+36.423	65+13.782	for segment #7 (42+36.423 to 65+13.782), Freeway Segment of type Five-lane Freeway is using unbalanced lane processing with types Four-lane Freeway and Six-lane Freeway
38+44.179	41+02.826	for segment #5 (38+44.179 to 41+02.826), Speed Change Segment of type Five-lane Freeway Speed Change is using unbalanced lane processing with types Four-lane Freeway Speed Change and Six-lane Freeway Speed Change

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

April 29, 2019

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Table of Contents

List of Tables

List of Figures

Report Overview

Report Generated: Apr 29, 2019 3:30 PM
Report Template: System: Single Page [System] (mlcpm3, Apr 10, 2019 1:31 PM)

Evaluation Date: Mon Apr 29 15:30:44 CDT 2019
IHSDM Version: v14.1.0 (Mar 12, 2019)
Crash Prediction Module: v9.1.0 (Mar 12, 2019)

User Name: jdanibas
Organization Name:
Phone:
E-Mail:

Project Title: I-229 Exit 4 (Cliff Ave) - Alternative 7
Project Comment: Created Tue Apr 16 14:58:43 CDT 2019
Project Unit System: U.S. Customary

Highway Title: Alt 7 - NB Entrance LT Ramp
Highway Comment: Created Mon Apr 29 13:14:14 CDT 2019
Highway Version: 1

Evaluation Title: Evaluation 1
Evaluation Comment: Created Mon Apr 29 15:30:35 CDT 2019

Minimum Location: 0.000
Maximum Location: 14+11.601
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2024
Last Year of Analysis: 2050
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Section Types

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 14+11.601
Functional Class: Freeway C-D Road & System Ramp
Type of Alignment: One Direction
Model Category: C-D Road & System Ramp
Calibration Factor: CD_MV_FI=1.0; CD_MV_PDO=1.0; CD_SV_FI=1.0; CD_SV_PDO=1.0;

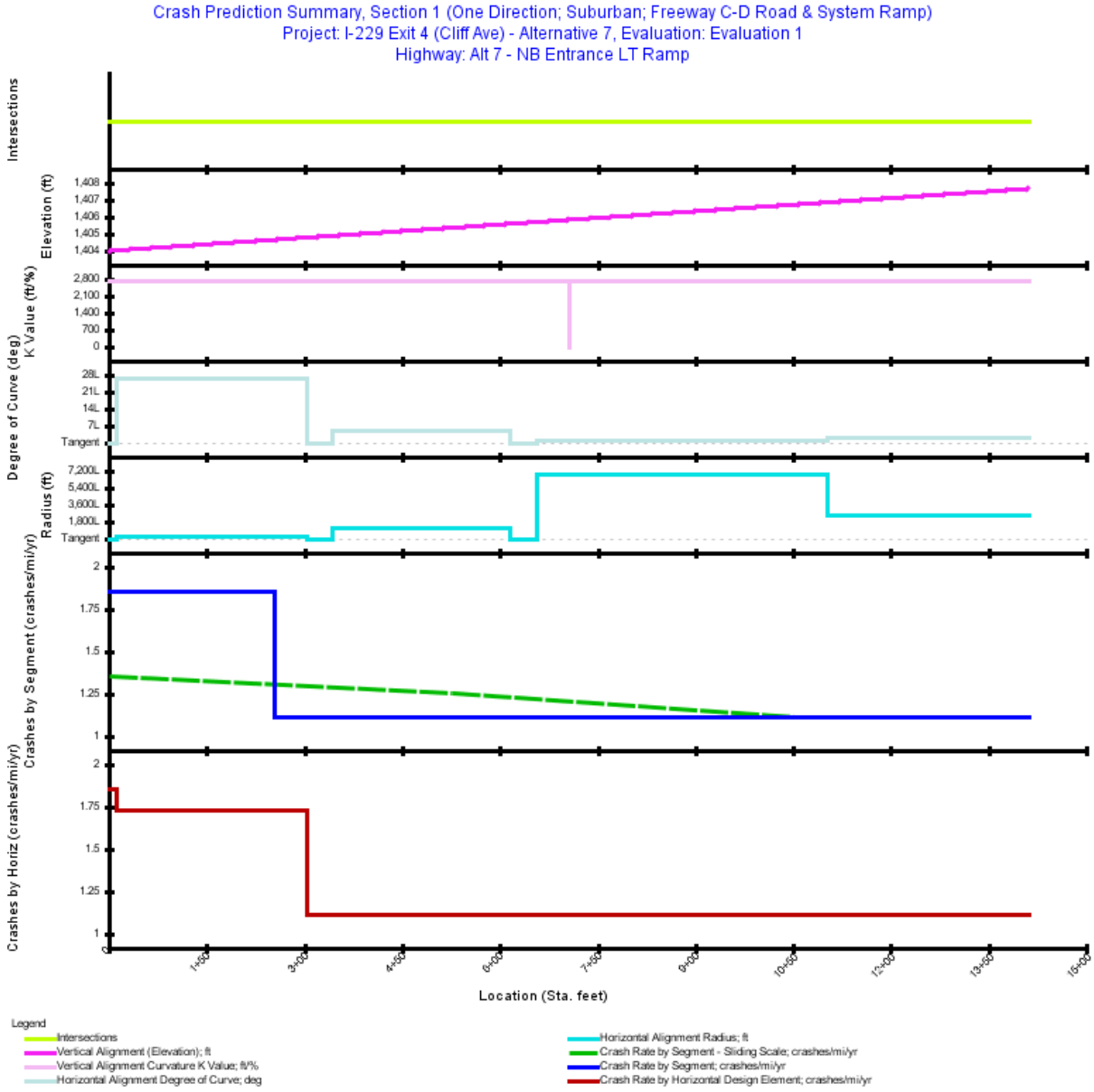

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT
1	1CD	Urban	0.000	2+53.807	253.81	0.0481	2024: 1,115; 2025: 1,125; 2026: 1,135; 2027: 1,145; 2028: 1,155; 2029: 1,165; 2030: 1,175; 2031: 1,185; 2032: 1,195; 2033: 1,205; 2034: 1,215; 2035: 1,225; 2036: 1,235; 2037: 1,245; 2038: 1,255; 2039: 1,265; 2040: 1,275; 2041: 1,285; 2042: 1,295; 2043: 1,305; 2044: 1,315; 2045: 1,325; 2046: 1,335; 2047: 1,345; 2048: 1,355; 2049: 1,365; 2050: 1,375
2	1CD	Urban	2+53.807	14+11.601	1,157.79	0.2193	2024: 4,091; 2025: 4,128; 2026: 4,165; 2027: 4,201; 2028: 4,238; 2029: 4,275; 2030: 4,312; 2031: 4,349; 2032: 4,386; 2033: 4,423; 2034: 4,460; 2035: 4,496; 2036: 4,533; 2037: 4,570; 2038: 4,607; 2039: 4,644; 2040: 4,681; 2041: 4,718; 2042: 4,755; 2043: 4,791; 2044: 4,828; 2045: 4,865; 2046: 4,902; 2047: 4,939; 2048: 4,976; 2049: 5,013; 2050: 5,050

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Evaluated Length (mi)	**0.2673**
Average Future Road AADT (vpd)	**3,972**
Predicted Crashes	
Total Crashes	**8.99**
Fatal and Injury Crashes	**4.18**
Property-Damage-Only Crashes	**4.81**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**46**
Percent Property-Damage-Only Crashes (%)	**54**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**1.2458**
FI Crash Rate (crashes/mi/yr)	**0.5793**
PDO Crash Rate (crashes/mi/yr)	**0.6666**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**10.47**
Travel Crash Rate (crashes/million veh-mi)	**0.86**
Travel FI Crash Rate (crashes/million veh-mi)	**0.40**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.46**

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	2+53.807	0.0481	2.408	0.0892	0.0424	0.0467	1.8553	4.08
2	2+53.807	14+11.601	0.2193	6.585	0.2439	0.1124	0.1315	1.1122	0.67
Total			0.2673	8.993	0.3331	0.1549	0.1782	1.2458	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	0.000	12.525	0.0024	0.119	0.0044	0.0021	0.0023	1.8553	4.08
Simple Curve 1	12.525	3+03.643	0.0551	2.573	0.0953	0.0452	0.0501	1.7281	3.50
Tangent	3+03.643	3+43.938	0.0076	0.229	0.0085	0.0039	0.0046	1.1122	0.67
Simple Curve 2	3+43.938	6+16.421	0.0516	1.550	0.0574	0.0265	0.0309	1.1122	0.67
Tangent	6+16.421	6+55.894	0.0075	0.225	0.0083	0.0038	0.0045	1.1122	0.67
Simple Curve 3	6+55.894	11+02.705	0.0846	2.541	0.0941	0.0434	0.0507	1.1122	0.67
Simple Curve 4	11+02.705	14+11.601	0.0585	1.757	0.0651	0.0300	0.0351	1.1122	0.67

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2024	0.30	0.14	46.934	0.16	53.066
2025	0.31	0.14	46.898	0.16	53.102
2026	0.31	0.14	46.863	0.16	53.137
2027	0.31	0.14	46.828	0.17	53.172
2028	0.31	0.15	46.794	0.17	53.206
2029	0.32	0.15	46.760	0.17	53.240
2030	0.32	0.15	46.726	0.17	53.274
2031	0.32	0.15	46.692	0.17	53.308
2032	0.32	0.15	46.659	0.17	53.341
2033	0.32	0.15	46.626	0.17	53.374
2034	0.33	0.15	46.593	0.17	53.407
2035	0.33	0.15	46.562	0.18	53.438
2036	0.33	0.15	46.530	0.18	53.470
2037	0.33	0.15	46.498	0.18	53.502
2038	0.34	0.16	46.467	0.18	53.533
2039	0.34	0.16	46.436	0.18	53.564
2040	0.34	0.16	46.405	0.18	53.595
2041	0.34	0.16	46.375	0.18	53.625
2042	0.34	0.16	46.345	0.18	53.655
2043	0.35	0.16	46.316	0.19	53.684
2044	0.35	0.16	46.286	0.19	53.714
2045	0.35	0.16	46.257	0.19	53.743
2046	0.35	0.16	46.228	0.19	53.772
2047	0.35	0.16	46.199	0.19	53.801
2048	0.36	0.17	46.171	0.19	53.829
2049	0.36	0.17	46.143	0.19	53.857
2050	0.36	0.17	46.115	0.20	53.885
Total	8.99	4.18	46.495	4.81	53.505
Average	0.33	0.15	46.495	0.18	53.505

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0244	0.0741	0.4717	0.5756	1.2621
2	0.0647	0.1963	1.2496	1.5247	3.5497
Total	0.0892	0.2704	1.7214	2.1004	4.8117

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.01	0.1	0.07	0.7	0.08	0.8
Highway Segment	Collision with Fixed Object	1.86	20.6	2.13	23.7	3.99	44.3
Highway Segment	Collision with Other Object	0.13	1.5	0.41	4.6	0.55	6.1
Highway Segment	Other Single-vehicle Collision	0.54	5.9	0.32	3.5	0.85	9.5
Highway Segment	Collision with Parked Vehicle	0.04	0.4	0.05	0.5	0.09	1.0
Highway Segment	Total Single Vehicle Crashes	2.57	28.6	2.97	33.1	5.55	61.7
Highway Segment	Right-Angle Collision	0.05	0.6	0.03	0.4	0.08	0.9
Highway Segment	Head-on Collision	0.01	0.1	0.00	0.0	0.02	0.2
Highway Segment	Other Multi-vehicle Collision	0.05	0.6	0.04	0.5	0.09	1.0
Highway Segment	Rear-end Collision	1.21	13.4	1.27	14.1	2.48	27.5
Highway Segment	Sideswipe, Same Direction Collision	0.29	3.2	0.49	5.4	0.78	8.7
Highway Segment	Total Multiple Vehicle Crashes	1.61	17.9	1.84	20.4	3.45	38.3
Highway Segment	Total Highway Segment Crashes	4.18	46.5	4.81	53.5	8.99	100.0
	Total Crashes	4.18	46.5	4.81	53.5	8.99	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
0.000	2+53.807	for segment #1 (0.000 to 2+53.807), Left shoulder width (1.0 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.
2+53.807	14+11.601	for segment #2 (2+53.807 to 14+11.601), Left shoulder width (1.0 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

April 29, 2019

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Table of Contents

List of Tables

List of Figures

Report Overview

Report Generated: Apr 29, 2019 3:31 PM
Report Template: System: Single Page [System] (mlcpm3, Apr 10, 2019 1:31 PM)

Evaluation Date: Mon Apr 29 15:31:41 CDT 2019
IHSDM Version: v14.1.0 (Mar 12, 2019)
Crash Prediction Module: v9.1.0 (Mar 12, 2019)

User Name: jdanibas
Organization Name:
Phone:
E-Mail:

Project Title: I-229 Exit 4 (Cliff Ave) - Alternative 7
Project Comment: Created Tue Apr 16 14:58:43 CDT 2019
Project Unit System: U.S. Customary

Highway Title: Alt 7 - NB Entrance RT Ramp
Highway Comment: Created Mon Apr 29 13:20:18 CDT 2019
Highway Version: 1

Evaluation Title: Evaluation 1
Evaluation Comment: Created Mon Apr 29 15:31:34 CDT 2019

Minimum Location: 0.000
Maximum Location: 3+36.905
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2024
Last Year of Analysis: 2050
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Section Types

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 3+36.905
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp
Calibration Factor: ENT_RAMP_MV_FI=1.0; ENT_RAMP_MV_PDO=1.0; ENT_RAMP_SV_FI=1.0; ENT_RAMP_SV_PDO=1.0;

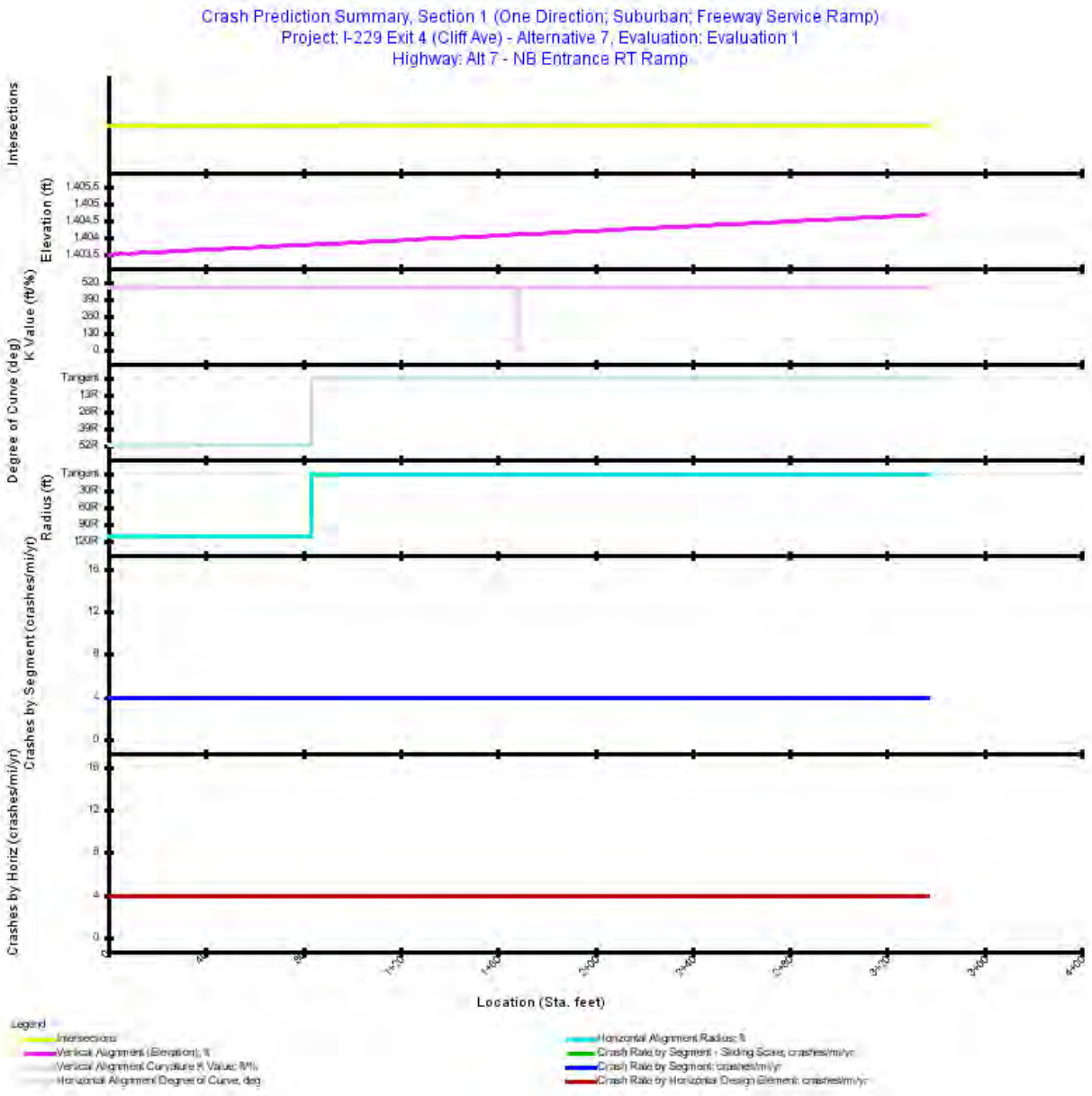

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT
1	1EN	Urban	0.000	3+36.905	336.90	0.0638	2024: 2,976; 2025: 3,003; 2026: 3,030; 2027: 3,056; 2028: 3,083; 2029: 3,110; 2030: 3,137; 2031: 3,164; 2032: 3,191; 2033: 3,218; 2034: 3,245; 2035: 3,271; 2036: 3,298; 2037: 3,325; 2038: 3,352; 2039: 3,379; 2040: 3,406; 2041: 3,433; 2042: 3,460; 2043: 3,486; 2044: 3,513; 2045: 3,540; 2046: 3,567; 2047: 3,594; 2048: 3,621; 2049: 3,648; 2050: 3,675

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Evaluated Length (mi)	**0.0638**
Average Future Road AADT (vpd)	**3,325**
Predicted Crashes	
Total Crashes	**6.78**
Fatal and Injury Crashes	**2.97**
Property-Damage-Only Crashes	**3.81**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**44**
Percent Property-Damage-Only Crashes (%)	**56**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**3.9365**
FI Crash Rate (crashes/mi/yr)	**1.7234**
PDO Crash Rate (crashes/mi/yr)	**2.2131**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**2.09**
Travel Crash Rate (crashes/million veh-mi)	**3.24**
Travel FI Crash Rate (crashes/million veh-mi)	**1.42**
Travel PDO Crash Rate (crashes/million veh-mi)	**1.82**

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	3+36.905	0.0638	6.782	0.2512	0.1100	0.1412	3.9365	3.24
Total			0.0638	6.782	0.2512	0.1100	0.1412	3.9365	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Simple Curve 1	0.000	83.155	0.0157	1.674	0.0620	0.0271	0.0349	3.9365	3.24
Tangent	83.155	3+36.905	0.0481	5.108	0.1892	0.0828	0.1064	3.9365	3.24

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2024	0.23	0.10	43.810	0.13	56.190
2025	0.23	0.10	43.807	0.13	56.193
2026	0.23	0.10	43.805	0.13	56.195
2027	0.24	0.10	43.803	0.13	56.197
2028	0.24	0.10	43.800	0.13	56.200
2029	0.24	0.10	43.798	0.14	56.202
2030	0.24	0.10	43.795	0.14	56.205
2031	0.24	0.11	43.793	0.14	56.207
2032	0.24	0.11	43.791	0.14	56.209
2033	0.24	0.11	43.788	0.14	56.212
2034	0.25	0.11	43.786	0.14	56.214
2035	0.25	0.11	43.784	0.14	56.216
2036	0.25	0.11	43.781	0.14	56.219
2037	0.25	0.11	43.779	0.14	56.221
2038	0.25	0.11	43.777	0.14	56.223
2039	0.25	0.11	43.775	0.14	56.225
2040	0.26	0.11	43.772	0.14	56.228
2041	0.26	0.11	43.770	0.14	56.230
2042	0.26	0.11	43.768	0.14	56.232
2043	0.26	0.11	43.766	0.15	56.234
2044	0.26	0.11	43.764	0.15	56.236
2045	0.26	0.12	43.762	0.15	56.238
2046	0.26	0.12	43.760	0.15	56.240
2047	0.27	0.12	43.758	0.15	56.242
2048	0.27	0.12	43.755	0.15	56.245
2049	0.27	0.12	43.753	0.15	56.247
2050	0.27	0.12	43.751	0.15	56.249
Total	6.78	2.97	43.779	3.81	56.221
Average	0.25	0.11	43.779	0.14	56.221

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0633	0.1920	1.2223	1.4914	3.8128

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.01	0.2	0.08	1.1	0.09	1.3
Highway Segment	Collision with Fixed Object	1.94	28.5	2.52	37.1	4.45	65.7
Highway Segment	Collision with Other Object	0.14	2.0	0.49	7.2	0.63	9.2
Highway Segment	Other Single-vehicle Collision	0.56	8.2	0.38	5.5	0.93	13.8
Highway Segment	Collision with Parked Vehicle	0.04	0.6	0.06	0.8	0.10	1.4
Highway Segment	Total Single Vehicle Crashes	2.68	39.5	3.52	51.9	6.20	91.4
Highway Segment	Right-Angle Collision	0.01	0.1	0.01	0.1	0.01	0.2
Highway Segment	Head-on Collision	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Other Multi-vehicle Collision	0.01	0.1	0.01	0.1	0.02	0.2
Highway Segment	Rear-end Collision	0.22	3.2	0.20	3.0	0.42	6.2
Highway Segment	Sideswipe, Same Direction Collision	0.05	0.8	0.08	1.2	0.13	1.9
Highway Segment	Total Multiple Vehicle Crashes	0.29	4.2	0.30	4.4	0.58	8.6
Highway Segment	Total Highway Segment Crashes	2.97	43.8	3.81	56.2	6.78	100.0
	Total Crashes	2.97	43.8	3.81	56.2	6.78	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
0.000	3+36.905	for segment #1 (0.000 to 3+36.905), The ramp type for Ramp Alt 7 - NB Entrance RT Ramp is set at the Ramp Connection (Entrance) and in the Ramp (Entrance). The Ramp value takes precedence.
0.000	3+36.905	for segment #1 (0.000 to 3+36.905), Left shoulder width (1.0 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

April 29, 2019

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Table of Contents

List of Tables

List of Figures

Report Overview

Report Generated: Apr 29, 2019 3:16 PM
Report Template: System: Single Page [System] (mlcpm3, Apr 10, 2019 1:31 PM)

Evaluation Date: Mon Apr 29 15:16:51 CDT 2019
IHSDM Version: v14.1.0 (Mar 12, 2019)
Crash Prediction Module: v9.1.0 (Mar 12, 2019)

User Name: jdanibas
Organization Name:
Phone:
E-Mail:

Project Title: I-229 Exit 4 (Cliff Ave) - Alternative 7
Project Comment: Created Tue Apr 16 14:58:43 CDT 2019
Project Unit System: U.S. Customary

Highway Title: Alt 7 - NB Exit LT Ramp
Highway Comment: Created Mon Apr 29 12:53:40 CDT 2019
Highway Version: 1

Evaluation Title: Evaluation 1
Evaluation Comment: Created Mon Apr 29 15:16:42 CDT 2019

Minimum Location: 0.000
Maximum Location: 13+23.882
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2024
Last Year of Analysis: 2050
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Section Types

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 13+23.882
Functional Class: Freeway C-D Road & System Ramp
Type of Alignment: One Direction
Model Category: C-D Road & System Ramp
Calibration Factor: CD_MV_FI=1.0; CD_MV_PDO=1.0; CD_SV_FI=1.0; CD_SV_PDO=1.0;

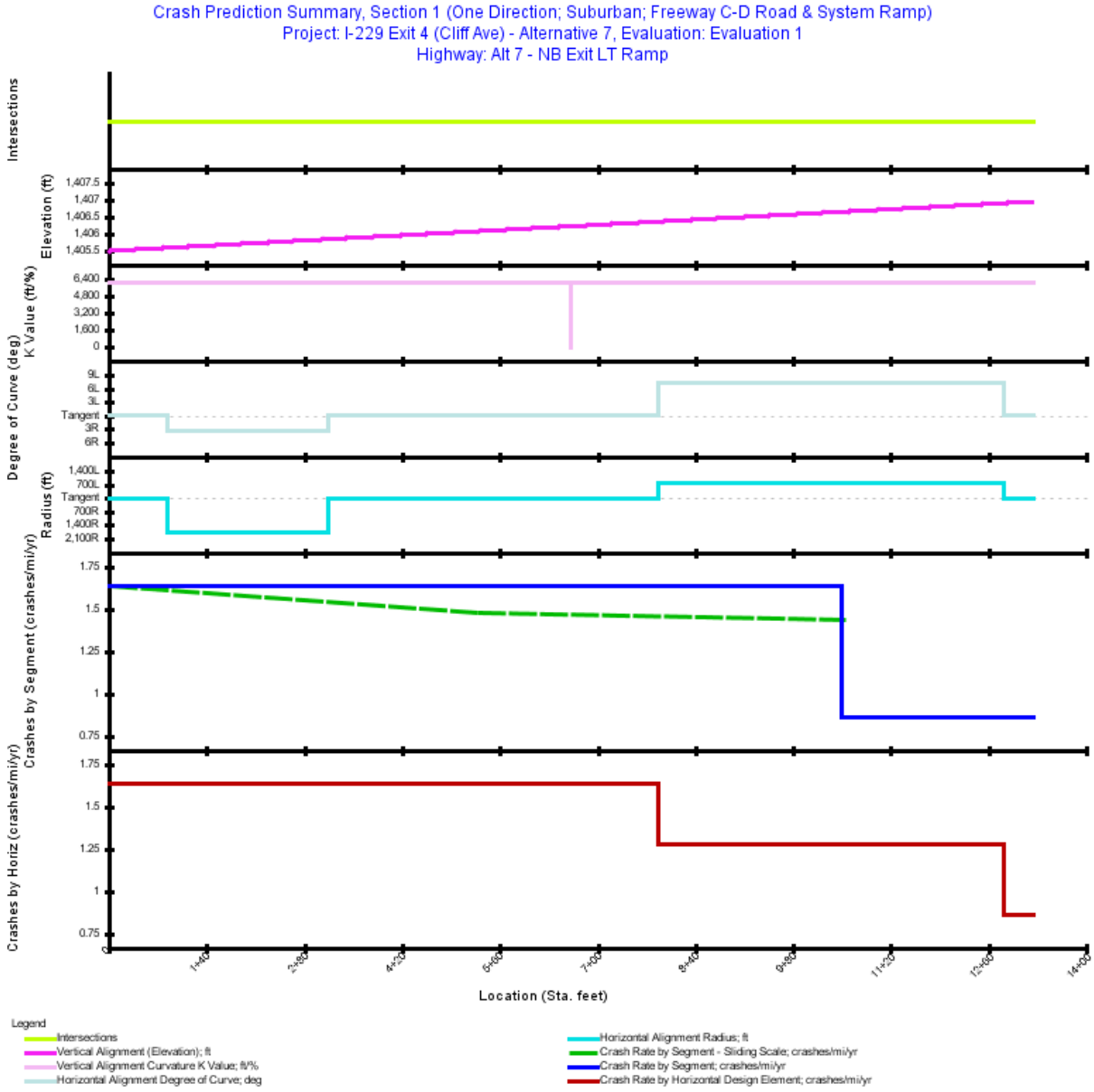

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT
1	1CD	Urban	0.000	10+49.661	1,049.66	0.1988	2024: 6,810; 2025: 6,897; 2026: 6,984; 2027: 7,071; 2028: 7,158; 2029: 7,244; 2030: 7,331; 2031: 7,418; 2032: 7,505; 2033: 7,592; 2034: 7,679; 2035: 7,766; 2036: 7,853; 2037: 7,940; 2038: 8,027; 2039: 8,114; 2040: 8,200; 2041: 8,287; 2042: 8,374; 2043: 8,461; 2044: 8,548; 2045: 8,635; 2046: 8,722; 2047: 8,809; 2048: 8,896; 2049: 8,983; 2050: 9,070
2	1CD	Urban	10+49.661	13+23.882	274.22	0.0519	2024-2050: 3,294

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Evaluated Length (mi)	**0.2507**
Average Future Road AADT (vpd)	**6,977**
Predicted Crashes	
Total Crashes	**10.01**
Fatal and Injury Crashes	**4.47**
Property-Damage-Only Crashes	**5.54**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**45**
Percent Property-Damage-Only Crashes (%)	**55**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**1.4785**
FI Crash Rate (crashes/mi/yr)	**0.6601**
PDO Crash Rate (crashes/mi/yr)	**0.8184**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**17.24**
Travel Crash Rate (crashes/million veh-mi)	**0.58**
Travel FI Crash Rate (crashes/million veh-mi)	**0.26**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.32**

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	10+49.661	0.1988	8.801	0.3260	0.1444	0.1815	1.6396	0.57
2	10+49.661	13+23.882	0.0519	1.209	0.0448	0.0211	0.0237	0.8619	0.72
Total			0.2507	10.009	0.3707	0.1655	0.2052	1.4785	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	0.000	83.041	0.0157	0.696	0.0258	0.0114	0.0144	1.6396	0.57
Simple Curve 1	83.041	3+14.449	0.0438	1.940	0.0719	0.0318	0.0400	1.6396	0.57
Tangent	3+14.449	7+87.443	0.0896	3.966	0.1469	0.0651	0.0818	1.6396	0.57
Simple Curve 2	7+87.443	12+80.974	0.0935	3.218	0.1192	0.0539	0.0653	1.2751	0.64
Tangent	12+80.974	13+23.882	0.0081	0.189	0.0070	0.0033	0.0037	0.8619	0.72

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2024	0.33	0.15	45.152	0.18	54.848
2025	0.33	0.15	45.107	0.18	54.893
2026	0.33	0.15	45.062	0.18	54.938
2027	0.34	0.15	45.019	0.18	54.981
2028	0.34	0.15	44.977	0.19	55.023
2029	0.34	0.15	44.936	0.19	55.064
2030	0.35	0.16	44.896	0.19	55.104
2031	0.35	0.16	44.856	0.19	55.144
2032	0.35	0.16	44.818	0.20	55.182
2033	0.36	0.16	44.781	0.20	55.219
2034	0.36	0.16	44.744	0.20	55.256
2035	0.36	0.16	44.709	0.20	55.291
2036	0.37	0.16	44.674	0.20	55.326
2037	0.37	0.17	44.641	0.20	55.359
2038	0.37	0.17	44.608	0.21	55.392
2039	0.38	0.17	44.576	0.21	55.424
2040	0.38	0.17	44.545	0.21	55.455
2041	0.38	0.17	44.516	0.21	55.484
2042	0.39	0.17	44.486	0.21	55.514
2043	0.39	0.17	44.458	0.22	55.542
2044	0.40	0.17	44.431	0.22	55.569
2045	0.40	0.18	44.404	0.22	55.596
2046	0.40	0.18	44.378	0.22	55.622
2047	0.41	0.18	44.353	0.23	55.647
2048	0.41	0.18	44.329	0.23	55.671
2049	0.41	0.18	44.306	0.23	55.694
2050	0.42	0.18	44.283	0.23	55.717
Total	10.01	4.47	44.650	5.54	55.350
Average	0.37	0.17	44.650	0.20	55.350

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0832	0.2522	1.6054	1.9589	4.9011
2	0.0121	0.0368	0.2344	0.2861	0.6391
Total	0.0953	0.2890	1.8398	2.2449	5.5402

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.01	0.1	0.05	0.5	0.06	0.6
Highway Segment	Collision with Fixed Object	1.66	16.6	1.71	17.0	3.37	33.6
Highway Segment	Collision with Other Object	0.12	1.2	0.33	3.3	0.45	4.5
Highway Segment	Other Single-vehicle Collision	0.48	4.8	0.26	2.5	0.73	7.3
Highway Segment	Collision with Parked Vehicle	0.04	0.3	0.04	0.4	0.07	0.7
Highway Segment	Total Single Vehicle Crashes	2.30	23.0	2.38	23.8	4.68	46.8
Highway Segment	Right-Angle Collision	0.07	0.7	0.06	0.6	0.12	1.2
Highway Segment	Head-on Collision	0.02	0.2	0.01	0.1	0.02	0.2
Highway Segment	Other Multi-vehicle Collision	0.07	0.7	0.08	0.8	0.14	1.4
Highway Segment	Rear-end Collision	1.63	16.2	2.18	21.8	3.81	38.0
Highway Segment	Sideswipe, Same Direction Collision	0.39	3.9	0.84	8.4	1.23	12.3
Highway Segment	Total Multiple Vehicle Crashes	2.17	21.7	3.16	31.5	5.33	53.2
Highway Segment	Total Highway Segment Crashes	4.47	44.6	5.54	55.4	10.01	100.0
	Total Crashes	4.47	44.6	5.54	55.4	10.01	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
0.000	10+49.661	for segment #1 (0.000 to 10+49.661), Left shoulder width (1.0 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.
10+49.661	13+23.882	for segment #2 (10+49.661 to 13+23.882), Left shoulder width (1.0 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

April 29, 2019

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Table of Contents

List of Tables

List of Figures

Report Overview

Report Generated: Apr 29, 2019 3:21 PM
Report Template: System: Single Page [System] (mlcpm3, Apr 10, 2019 1:31 PM)

Evaluation Date: Mon Apr 29 15:21:16 CDT 2019
IHSDM Version: v14.1.0 (Mar 12, 2019)
Crash Prediction Module: v9.1.0 (Mar 12, 2019)

User Name: jdanibas
Organization Name:
Phone:
E-Mail:

Project Title: I-229 Exit 4 (Cliff Ave) - Alternative 7
Project Comment: Created Tue Apr 16 14:58:43 CDT 2019
Project Unit System: U.S. Customary

Highway Title: Alt 7 - NB Exit RT Ramp
Highway Comment: Created Mon Apr 29 13:09:35 CDT 2019
Highway Version: 1

Evaluation Title: Evaluation 1
Evaluation Comment: Created Mon Apr 29 15:21:05 CDT 2019

Minimum Location: 0.000
Maximum Location: 1+90.496
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2024
Last Year of Analysis: 2050
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Section Types

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 1+90.496
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp
Calibration Factor: EX_RAMP_MV_FI=1.0; EX_RAMP_MV_PDO=1.0; EX_RAMP_SV_FI=1.0; EX_RAMP_SV_PDO=1.0;

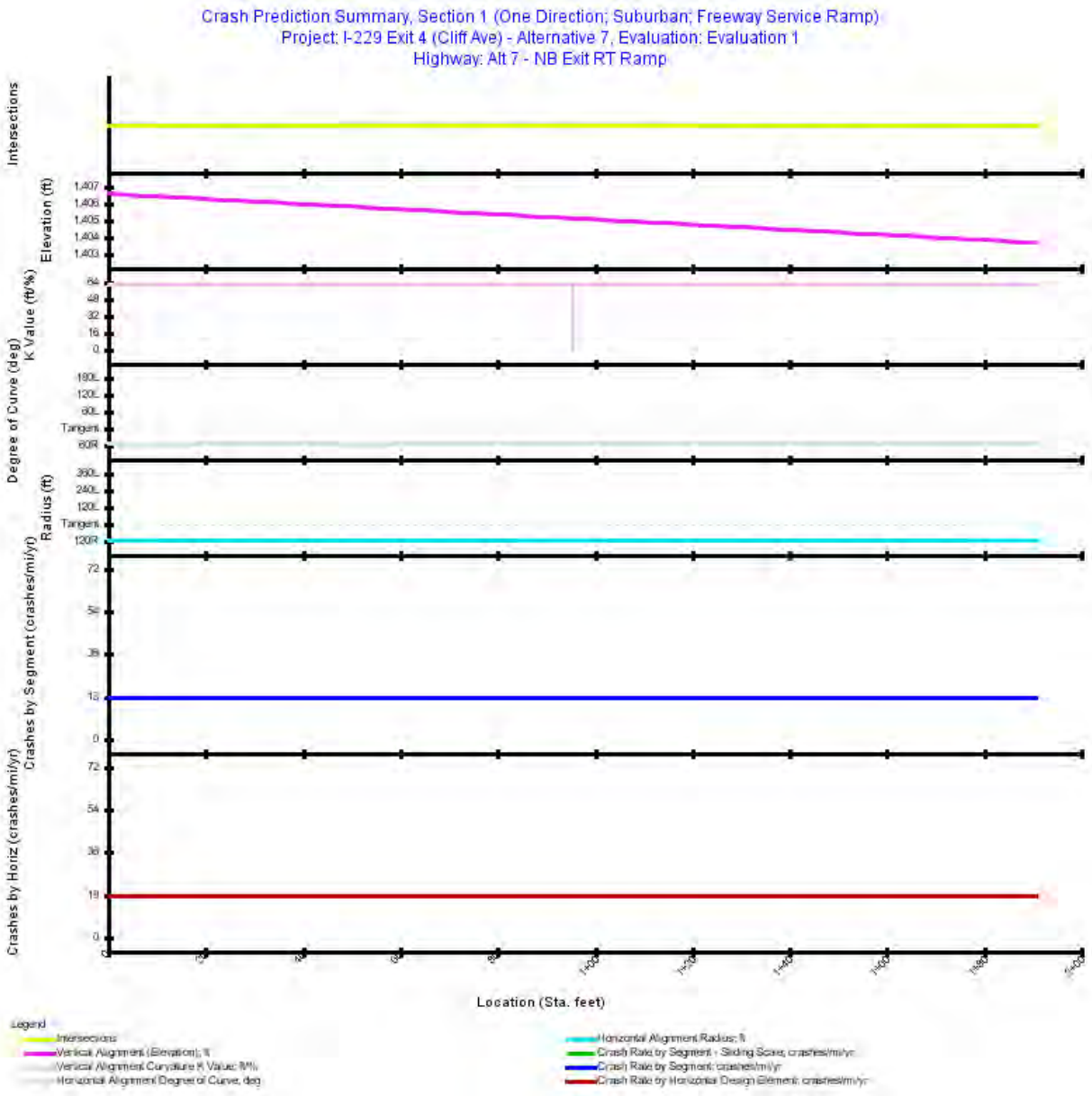

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT
1	1EX	Urban	0.000	1+90.496	190.50	0.0361	2024: 3,243; 2025: 3,284; 2026: 3,326; 2027: 3,367; 2028: 3,409; 2029: 3,450; 2030: 3,491; 2031: 3,533; 2032: 3,574; 2033: 3,616; 2034: 3,657; 2035: 3,698; 2036: 3,740; 2037: 3,781; 2038: 3,823; 2039: 3,864; 2040: 3,905; 2041: 3,947; 2042: 3,988; 2043: 4,030; 2044: 4,071; 2045: 4,112; 2046: 4,154; 2047: 4,195; 2048: 4,237; 2049: 4,278; 2050: 4,320

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Evaluated Length (mi)	**0.0361**
Average Future Road AADT (vpd)	**3,781**
Predicted Crashes	
Total Crashes	**16.88**
Fatal and Injury Crashes	**7.60**
Property-Damage-Only Crashes	**9.28**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**45**
Percent Property-Damage-Only Crashes (%)	**55**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**17.3242**
FI Crash Rate (crashes/mi/yr)	**7.7974**
PDO Crash Rate (crashes/mi/yr)	**9.5267**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**1.34**
Travel Crash Rate (crashes/million veh-mi)	**12.55**
Travel FI Crash Rate (crashes/million veh-mi)	**5.65**
Travel PDO Crash Rate (crashes/million veh-mi)	**6.90**

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	1+90.496	0.0361	16.876	0.6250	0.2813	0.3437	17.3242	12.55
Total			0.0361	16.876	0.6250	0.2813	0.3437	17.3242	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Simple Curve 1	0.000	1+90.496	0.0361	16.876	0.6250	0.2813	0.3437	17.3242	12.55

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2024	0.56	0.25	44.930	0.31	55.070
2025	0.57	0.25	44.936	0.31	55.064
2026	0.57	0.26	44.943	0.32	55.057
2027	0.58	0.26	44.949	0.32	55.051
2028	0.58	0.26	44.956	0.32	55.044
2029	0.59	0.26	44.962	0.32	55.038
2030	0.59	0.27	44.968	0.33	55.032
2031	0.60	0.27	44.974	0.33	55.026
2032	0.60	0.27	44.980	0.33	55.020
2033	0.61	0.27	44.986	0.33	55.014
2034	0.61	0.28	44.991	0.34	55.009
2035	0.62	0.28	44.997	0.34	55.003
2036	0.62	0.28	45.003	0.34	54.997
2037	0.62	0.28	45.008	0.34	54.992
2038	0.63	0.28	45.014	0.35	54.986
2039	0.64	0.29	45.019	0.35	54.981
2040	0.64	0.29	45.025	0.35	54.975
2041	0.65	0.29	45.030	0.35	54.970
2042	0.65	0.29	45.035	0.36	54.965
2043	0.65	0.29	45.041	0.36	54.959
2044	0.66	0.30	45.046	0.36	54.954
2045	0.66	0.30	45.051	0.36	54.949
2046	0.67	0.30	45.056	0.37	54.944
2047	0.67	0.30	45.061	0.37	54.939
2048	0.68	0.31	45.066	0.37	54.934
2049	0.68	0.31	45.071	0.38	54.929
2050	0.69	0.31	45.076	0.38	54.924
Total	16.88	7.60	45.009	9.28	54.991
Average	0.62	0.28	45.009	0.34	54.991

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.2372	0.7192	2.9904	3.6489	9.2802

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.03	0.2	0.20	1.2	0.23	1.4
Highway Segment	Collision with Fixed Object	5.41	32.1	6.53	38.7	11.94	70.8
Highway Segment	Collision with Other Object	0.38	2.3	1.27	7.5	1.65	9.8
Highway Segment	Other Single-vehicle Collision	1.56	9.2	0.98	5.8	2.54	15.0
Highway Segment	Collision with Parked Vehicle	0.11	0.7	0.15	0.9	0.26	1.5
Highway Segment	Total Single Vehicle Crashes	7.49	44.4	9.13	54.1	16.62	98.5
Highway Segment	Right-Angle Collision	0.00	0.0	0.00	0.0	0.01	0.0
Highway Segment	Head-on Collision	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Other Multi-vehicle Collision	0.00	0.0	0.00	0.0	0.01	0.0
Highway Segment	Rear-end Collision	0.08	0.5	0.11	0.6	0.18	1.1
Highway Segment	Sideswipe, Same Direction Collision	0.02	0.1	0.04	0.2	0.06	0.4
Highway Segment	Total Multiple Vehicle Crashes	0.10	0.6	0.15	0.9	0.26	1.5
Highway Segment	Total Highway Segment Crashes	7.60	45.0	9.28	55.0	16.88	100.0
	Total Crashes	7.60	45.0	9.28	55.0	16.88	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
0.000	1+90.496	for segment #1 (0.000 to 1+90.496), The ramp type for Ramp Alt 7 - NB Exit RT Ramp is set at the Ramp Connection (Exit) and in the Ramp (Exit). The Ramp value takes precedence.
0.000	1+90.496	for segment #1 (0.000 to 1+90.496), Left shoulder width (1.0 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

April 29, 2019

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Table of Contents

List of Tables

List of Figures

Report Overview

Report Generated: Apr 29, 2019 3:36 PM
Report Template: System: Single Page [System] (mlcpm3, Apr 10, 2019 1:31 PM)

Evaluation Date: Mon Apr 29 15:35:59 CDT 2019
IHSDM Version: v14.1.0 (Mar 12, 2019)
Crash Prediction Module: v9.1.0 (Mar 12, 2019)

User Name: jdanibas
Organization Name:
Phone:
E-Mail:

Project Title: I-229 Exit 4 (Cliff Ave) - Alternative 7
Project Comment: Created Tue Apr 16 14:58:43 CDT 2019
Project Unit System: U.S. Customary

Highway Title: Alt 7 - SB Entrance LT Ramp
Highway Comment: Created Mon Apr 29 14:02:16 CDT 2019
Highway Version: 1

Evaluation Title: Evaluation 1
Evaluation Comment: Created Mon Apr 29 15:35:49 CDT 2019

Minimum Location: 0.000
Maximum Location: 11+57.768
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2024
Last Year of Analysis: 2050
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Section Types

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 11+57.768
Functional Class: Freeway C-D Road & System Ramp
Type of Alignment: One Direction
Model Category: C-D Road & System Ramp
Calibration Factor: CD_MV_FI=1.0; CD_MV_PDO=1.0; CD_SV_FI=1.0; CD_SV_PDO=1.0;

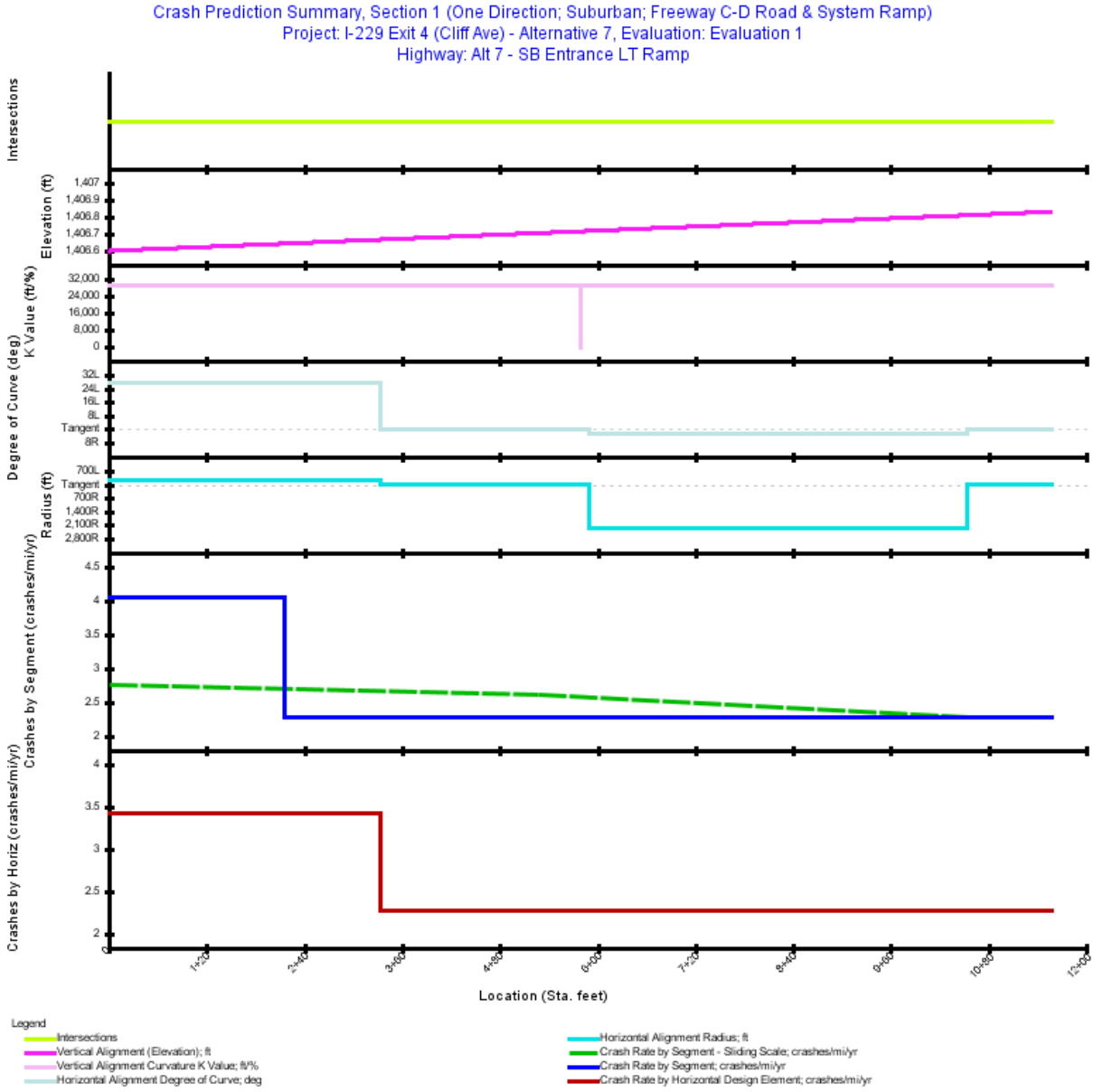

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT
1	1CD	Urban	0.000	2+15.770	215.77	0.0409	2024: 2,835; 2025: 2,861; 2026: 2,886; 2027: 2,911; 2028: 2,936; 2029: 2,961; 2030: 2,986; 2031: 3,012; 2032: 3,037; 2033: 3,062; 2034: 3,087; 2035: 3,112; 2036: 3,137; 2037: 3,162; 2038: 3,188; 2039: 3,213; 2040: 3,238; 2041: 3,263; 2042: 3,288; 2043: 3,313; 2044: 3,339; 2045: 3,364; 2046: 3,389; 2047: 3,414; 2048: 3,439; 2049: 3,464; 2050: 3,490
2	1CD	Urban	2+15.770	11+57.768	942.00	0.1784	2024: 6,779; 2025: 6,838; 2026: 6,898; 2027: 6,958; 2028: 7,018; 2029: 7,078; 2030: 7,138; 2031: 7,197; 2032: 7,257; 2033: 7,317; 2034: 7,377; 2035: 7,437; 2036: 7,497; 2037: 7,557; 2038: 7,616; 2039: 7,676; 2040: 7,736; 2041: 7,796; 2042: 7,856; 2043: 7,916; 2044: 7,975; 2045: 8,035; 2046: 8,095; 2047: 8,155; 2048: 8,215; 2049: 8,275; 2050: 8,335

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Evaluated Length (mi)	**0.2193**
Average Future Road AADT (vpd)	**6,738**
Predicted Crashes	
Total Crashes	**15.45**
Fatal and Injury Crashes	**6.89**
Property-Damage-Only Crashes	**8.55**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**45**
Percent Property-Damage-Only Crashes (%)	**55**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**2.6096**
FI Crash Rate (crashes/mi/yr)	**1.1646**
PDO Crash Rate (crashes/mi/yr)	**1.4450**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**14.56**
Travel Crash Rate (crashes/million veh-mi)	**1.06**
Travel FI Crash Rate (crashes/million veh-mi)	**0.47**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.59**

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	2+15.770	0.0409	4.470	0.1655	0.0757	0.0898	4.0510	3.51
2	2+15.770	11+57.768	0.1784	10.980	0.4067	0.1797	0.2270	2.2794	0.83
Total			0.2193	15.450	0.5722	0.2554	0.3168	2.6096	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Simple Curve 1	0.000	3+32.770	0.0630	5.834	0.2161	0.0980	0.1180	3.4282	2.57
Tangent	3+32.770	5+89.120	0.0486	2.988	0.1107	0.0489	0.0618	2.2794	0.83
Simple Curve 2	5+89.120	10+54.304	0.0881	5.422	0.2008	0.0887	0.1121	2.2794	0.83
Tangent	10+54.304	11+57.768	0.0196	1.206	0.0447	0.0197	0.0249	2.2794	0.83

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2024	0.52	0.23	44.899	0.29	55.101
2025	0.53	0.24	44.876	0.29	55.124
2026	0.53	0.24	44.853	0.29	55.147
2027	0.53	0.24	44.831	0.29	55.169
2028	0.54	0.24	44.809	0.30	55.191
2029	0.54	0.24	44.787	0.30	55.213
2030	0.55	0.24	44.766	0.30	55.234
2031	0.55	0.24	44.745	0.30	55.255
2032	0.55	0.25	44.724	0.30	55.276
2033	0.56	0.25	44.704	0.31	55.296
2034	0.56	0.25	44.684	0.31	55.316
2035	0.56	0.25	44.664	0.31	55.336
2036	0.57	0.25	44.645	0.32	55.355
2037	0.57	0.26	44.626	0.32	55.374
2038	0.58	0.26	44.608	0.32	55.392
2039	0.58	0.26	44.589	0.32	55.411
2040	0.58	0.26	44.571	0.32	55.429
2041	0.59	0.26	44.553	0.33	55.447
2042	0.59	0.26	44.536	0.33	55.464
2043	0.60	0.27	44.519	0.33	55.481
2044	0.60	0.27	44.502	0.33	55.498
2045	0.60	0.27	44.486	0.34	55.514
2046	0.61	0.27	44.470	0.34	55.530
2047	0.61	0.27	44.454	0.34	55.546
2048	0.62	0.27	44.438	0.34	55.562
2049	0.62	0.28	44.423	0.34	55.577
2050	0.62	0.28	44.408	0.35	55.592
Total	15.45	6.89	44.628	8.55	55.372
Average	0.57	0.26	44.628	0.32	55.372

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0436	0.1322	0.8414	1.0267	2.4259
2	0.1035	0.3137	1.9971	2.4369	6.1291
Total	0.1470	0.4459	2.8386	3.4636	8.5549

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.02	0.1	0.11	0.7	0.13	0.9
Highway Segment	Collision with Fixed Object	3.18	20.6	3.72	24.1	6.90	44.7
Highway Segment	Collision with Other Object	0.22	1.5	0.72	4.7	0.95	6.1
Highway Segment	Other Single-vehicle Collision	0.92	5.9	0.56	3.6	1.47	9.5
Highway Segment	Collision with Parked Vehicle	0.07	0.4	0.08	0.5	0.15	1.0
Highway Segment	Total Single Vehicle Crashes	4.40	28.5	5.20	33.6	9.60	62.1
Highway Segment	Right-Angle Collision	0.08	0.5	0.06	0.4	0.14	0.9
Highway Segment	Head-on Collision	0.02	0.1	0.01	0.0	0.03	0.2
Highway Segment	Other Multi-vehicle Collision	0.08	0.5	0.08	0.5	0.16	1.0
Highway Segment	Rear-end Collision	1.87	12.1	2.32	15.0	4.19	27.1
Highway Segment	Sideswipe, Same Direction Collision	0.45	2.9	0.89	5.8	1.34	8.7
Highway Segment	Total Multiple Vehicle Crashes	2.50	16.1	3.36	21.7	5.85	37.9
Highway Segment	Total Highway Segment Crashes	6.89	44.6	8.55	55.4	15.45	100.0
	Total Crashes	6.89	44.6	8.55	55.4	15.45	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
0.000	2+15.770	for segment #1 (0.000 to 2+15.770), Left shoulder width (1.0 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.
2+15.770	11+57.768	for segment #2 (2+15.770 to 11+57.768), Left shoulder width (1.0 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

April 29, 2019

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Table of Contents

List of Tables

List of Figures

Report Overview

Report Generated: Apr 29, 2019 3:32 PM
Report Template: System: Single Page [System] (mlcpm3, Apr 10, 2019 1:31 PM)

Evaluation Date: Mon Apr 29 15:32:49 CDT 2019
IHSDM Version: v14.1.0 (Mar 12, 2019)
Crash Prediction Module: v9.1.0 (Mar 12, 2019)

User Name: jdanibas
Organization Name:
Phone:
E-Mail:

Project Title: I-229 Exit 4 (Cliff Ave) - Alternative 7
Project Comment: Created Tue Apr 16 14:58:43 CDT 2019
Project Unit System: U.S. Customary

Highway Title: Alt 7 - SB Exit LT Ramp
Highway Comment: Created Mon Apr 29 13:47:36 CDT 2019
Highway Version: 1

Evaluation Title: Evaluation 1
Evaluation Comment: Created Mon Apr 29 15:32:37 CDT 2019

Minimum Location: 0.000
Maximum Location: 20+88.001
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2024
Last Year of Analysis: 2050
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Section Types

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 20+88.001
Functional Class: Freeway C-D Road & System Ramp
Type of Alignment: One Direction
Model Category: C-D Road & System Ramp
Calibration Factor: CD_MV_FI=1.0; CD_MV_PDO=1.0; CD_SV_FI=1.0; CD_SV_PDO=1.0;

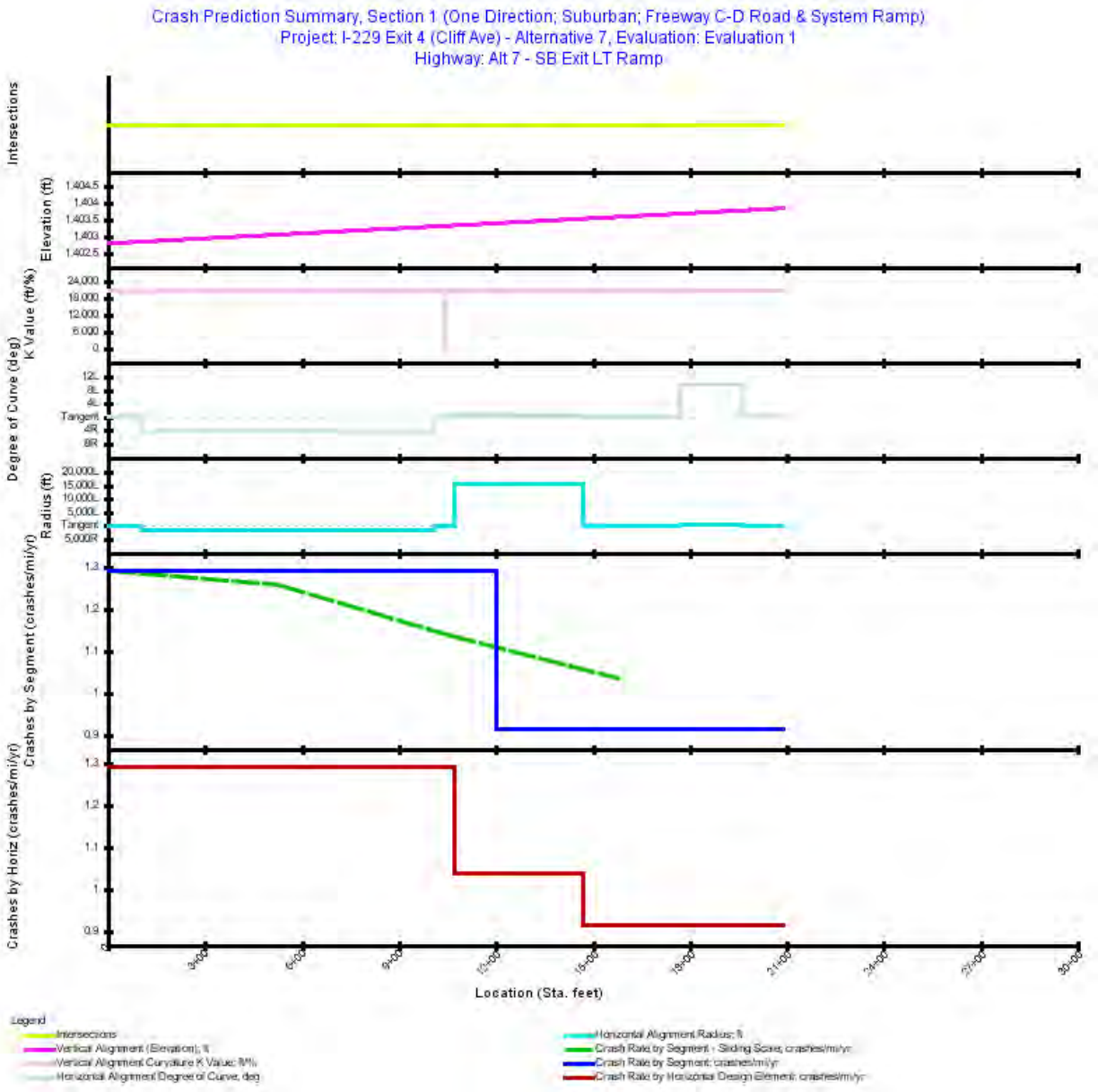

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT
1	1CD	Urban	0.000	12+02.812	1,202.81	0.2278	2024: 4,447; 2025: 4,577; 2026: 4,706; 2027: 4,836; 2028: 4,966; 2029: 5,095; 2030: 5,225; 2031: 5,355; 2032: 5,485; 2033: 5,614; 2034: 5,744; 2035: 5,874; 2036: 6,003; 2037: 6,133; 2038: 6,263; 2039: 6,393; 2040: 6,522; 2041: 6,652; 2042: 6,782; 2043: 6,911; 2044: 7,041; 2045: 7,171; 2046: 7,301; 2047: 7,430; 2048: 7,560; 2049: 7,690; 2050: 7,820
2	1CD	Urban	12+02.812	20+88.001	885.19	0.1676	2024: 3,046; 2025: 3,135; 2026: 3,224; 2027: 3,313; 2028: 3,401; 2029: 3,490; 2030: 3,579; 2031: 3,668; 2032: 3,756; 2033: 3,845; 2034: 3,934; 2035: 4,023; 2036: 4,112; 2037: 4,200; 2038: 4,289; 2039: 4,378; 2040: 4,467; 2041: 4,555; 2042: 4,644; 2043: 4,733; 2044: 4,822; 2045: 4,911; 2046: 4,999; 2047: 5,088; 2048: 5,177; 2049: 5,266; 2050: 5,355

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Evaluated Length (mi)	**0.3955**
Average Future Road AADT (vpd)	**5,314**
Predicted Crashes	
Total Crashes	**12.09**
Fatal and Injury Crashes	**5.47**
Property-Damage-Only Crashes	**6.62**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**45**
Percent Property-Damage-Only Crashes (%)	**55**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**1.1326**
FI Crash Rate (crashes/mi/yr)	**0.5123**
PDO Crash Rate (crashes/mi/yr)	**0.6203**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**20.71**
Travel Crash Rate (crashes/million veh-mi)	**0.58**
Travel FI Crash Rate (crashes/million veh-mi)	**0.26**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.32**

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	12+02.812	0.2278	7.944	0.2942	0.1318	0.1625	1.2916	0.58
2	12+02.812	20+88.001	0.1676	4.149	0.1537	0.0708	0.0828	0.9166	0.60
Total			0.3955	12.093	0.4479	0.2026	0.2453	1.1326	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Tangent	0.000	99.687	0.0189	0.658	0.0244	0.0109	0.0135	1.2916	0.58
Simple Curve 1	99.687	10+10.841	0.1726	6.018	0.2229	0.0998	0.1231	1.2916	0.58
Tangent	10+10.841	10+72.941	0.0118	0.410	0.0152	0.0068	0.0084	1.2916	0.58
Simple Curve 2	10+72.941	14+68.789	0.0750	2.104	0.0779	0.0355	0.0424	1.0396	0.59
Tangent	14+68.789	17+66.704	0.0564	1.396	0.0517	0.0238	0.0279	0.9166	0.60
Simple Curve 3	17+66.704	19+63.014	0.0372	0.920	0.0341	0.0157	0.0184	0.9166	0.60
Tangent	19+63.014	20+88.001	0.0237	0.586	0.0217	0.0100	0.0117	0.9166	0.60

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2024	0.34	0.16	46.833	0.18	53.167
2025	0.34	0.16	46.684	0.18	53.316
2026	0.35	0.17	46.541	0.19	53.459
2027	0.36	0.17	46.401	0.19	53.599
2028	0.37	0.17	46.267	0.20	53.733
2029	0.38	0.17	46.138	0.20	53.862
2030	0.39	0.18	46.013	0.21	53.987
2031	0.40	0.18	45.891	0.21	54.109
2032	0.41	0.18	45.775	0.22	54.225
2033	0.41	0.19	45.662	0.23	54.338
2034	0.42	0.19	45.552	0.23	54.448
2035	0.43	0.20	45.446	0.23	54.554
2036	0.44	0.20	45.344	0.24	54.656
2037	0.45	0.20	45.245	0.24	54.755
2038	0.46	0.21	45.150	0.25	54.850
2039	0.47	0.21	45.057	0.26	54.943
2040	0.47	0.21	44.968	0.26	55.032
2041	0.48	0.22	44.881	0.27	55.119
2042	0.49	0.22	44.798	0.27	55.202
2043	0.50	0.22	44.717	0.28	55.283
2044	0.51	0.23	44.639	0.28	55.361
2045	0.52	0.23	44.563	0.29	55.437
2046	0.53	0.23	44.490	0.29	55.510
2047	0.53	0.24	44.420	0.30	55.580
2048	0.54	0.24	44.352	0.30	55.648
2049	0.55	0.24	44.286	0.31	55.714
2050	0.56	0.25	44.222	0.31	55.778
Total	12.09	5.47	45.230	6.62	54.770
Average	0.45	0.20	45.230	0.24	54.770

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0759	0.2300	1.4645	1.7869	4.3869
2	0.0408	0.1237	0.7874	0.9607	2.2366
Total	0.1166	0.3537	2.2518	2.7477	6.6235

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.01	0.1	0.07	0.6	0.08	0.7
Highway Segment	Collision with Fixed Object	2.15	17.8	2.22	18.4	4.37	36.1
Highway Segment	Collision with Other Object	0.15	1.3	0.43	3.6	0.58	4.8
Highway Segment	Other Single-vehicle Collision	0.62	5.1	0.33	2.7	0.95	7.9
Highway Segment	Collision with Parked Vehicle	0.04	0.4	0.05	0.4	0.09	0.8
Highway Segment	Total Single Vehicle Crashes	2.98	24.6	3.10	25.6	6.08	50.2
Highway Segment	Right-Angle Collision	0.08	0.6	0.06	0.5	0.14	1.2
Highway Segment	Head-on Collision	0.02	0.2	0.01	0.1	0.03	0.2
Highway Segment	Other Multi-vehicle Collision	0.08	0.6	0.09	0.7	0.16	1.3
Highway Segment	Rear-end Collision	1.87	15.5	2.43	20.1	4.30	35.6
Highway Segment	Sideswipe, Same Direction Collision	0.45	3.7	0.94	7.8	1.39	11.5
Highway Segment	Total Multiple Vehicle Crashes	2.49	20.6	3.52	29.1	6.02	49.8
Highway Segment	Total Highway Segment Crashes	5.47	45.2	6.62	54.8	12.09	100.0
	Total Crashes	5.47	45.2	6.62	54.8	12.09	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
0.000	12+02.812	for segment #1 (0.000 to 12+02.812), Left shoulder width (1.0 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.
12+02.812	20+88.001	for segment #2 (12+02.812 to 20+88.001), Left shoulder width (1.0 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

April 29, 2019

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Table of Contents

List of Tables

List of Figures

Report Overview

Report Generated: Apr 29, 2019 3:37 PM
Report Template: System: Single Page [System] (mlcpm3, Apr 10, 2019 1:31 PM)

Evaluation Date: Mon Apr 29 15:37:06 CDT 2019
IHSDM Version: v14.1.0 (Mar 12, 2019)
Crash Prediction Module: v9.1.0 (Mar 12, 2019)

User Name: jdanibas
Organization Name:
Phone:
E-Mail:

Project Title: I-229 Exit 4 (Cliff Ave) - Alternative 7
Project Comment: Created Tue Apr 16 14:58:43 CDT 2019
Project Unit System: U.S. Customary

Highway Title: Alt 7 - SB Exit RT Ramp
Highway Comment: Created Mon Apr 29 13:55:20 CDT 2019
Highway Version: 1

Evaluation Title: Evaluation 1
Evaluation Comment: Created Mon Apr 29 15:36:58 CDT 2019

Minimum Location: 0.000
Maximum Location: 6+09.697
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2024
Last Year of Analysis: 2050
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Section Types

Freeway Ramp Evaluation

Section: Section 1
Evaluation Start Location: 0.000
Evaluation End Location: 6+09.697
Functional Class: Freeway Service Ramp
Type of Alignment: One Direction
Model Category: Freeway Service Ramp
Calibration Factor: EX_RAMP_MV_FI=1.0; EX_RAMP_MV_PDO=1.0; EX_RAMP_SV_FI=1.0; EX_RAMP_SV_PDO=1.0;

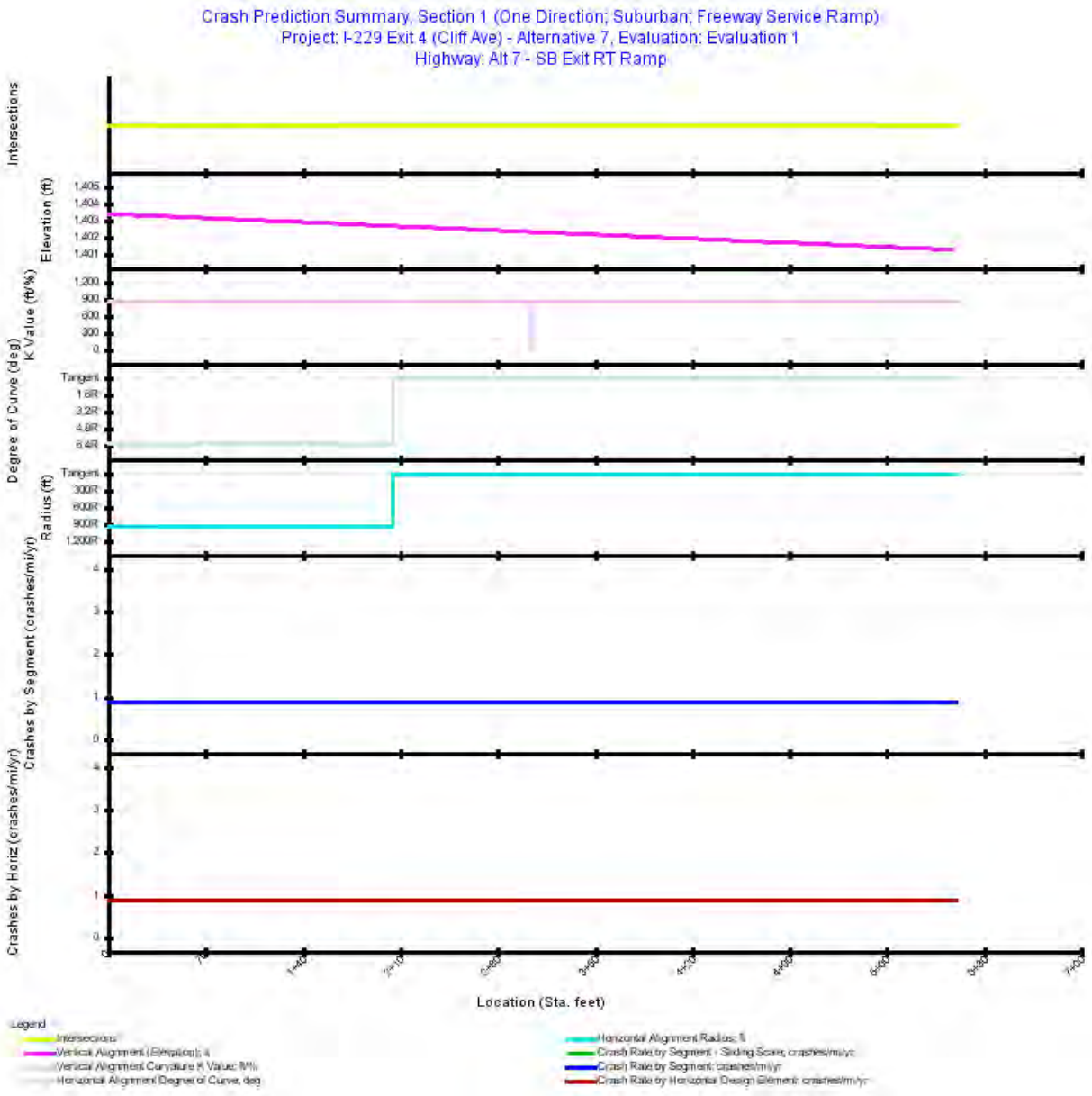

Figure 1. Crash Prediction Summary (Freeway Ramp Sections)

Table 1. Evaluation Freeway - Homogeneous Segments (Freeway Ramp Sections)

Seg. No.	Type	Area Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT
1	1EX	Urban	0.000	6+09.697	609.70	0.1155	2024: 1,400; 2025: 1,441; 2026: 1,482; 2027: 1,523; 2028: 1,564; 2029: 1,605; 2030: 1,646; 2031: 1,687; 2032: 1,728; 2033: 1,769; 2034: 1,810; 2035: 1,850; 2036: 1,891; 2037: 1,932; 2038: 1,973; 2039: 2,014; 2040: 2,055; 2041: 2,096; 2042: 2,137; 2043: 2,178; 2044: 2,219; 2045: 2,260; 2046: 2,301; 2047: 2,342; 2048: 2,383; 2049: 2,424; 2050: 2,465

Table 2. Predicted Ramp Crash Rates and Frequencies Summary (Freeway Ramp Sections)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Evaluated Length (mi)	**0.1155**
Average Future Road AADT (vpd)	**1,932**
Predicted Crashes	
Total Crashes	**2.75**
Fatal and Injury Crashes	**1.37**
Property-Damage-Only Crashes	**1.39**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**50**
Percent Property-Damage-Only Crashes (%)	**50**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**0.8834**
FI Crash Rate (crashes/mi/yr)	**0.4384**
PDO Crash Rate (crashes/mi/yr)	**0.4450**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**2.20**
Travel Crash Rate (crashes/million veh-mi)	**1.25**
Travel FI Crash Rate (crashes/million veh-mi)	**0.62**
Travel PDO Crash Rate (crashes/million veh-mi)	**0.63**

Table 3. Predicted Crash Frequencies and Rates by Ramp Segment/Intersection (Freeway Ramp Sections)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
1	0.000	6+09.697	0.1155	2.754	0.1020	0.0506	0.0514	0.8834	1.25
Total			0.1155	2.754	0.1020	0.0506	0.0514	0.8834	

Table 4. Predicted Crash Frequencies and Rates by Horizontal Design Element (Freeway Ramp Sections)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Simple Curve 1	0.000	2+04.210	0.0387	0.922	0.0342	0.0170	0.0172	0.8834	1.25
Tangent	2+04.210	6+09.697	0.0768	1.832	0.0678	0.0337	0.0342	0.8834	1.25

Table 5. Predicted Crash Frequencies by Year (Freeway Ramp Sections)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2024	0.08	0.04	49.596	0.04	50.404
2025	0.08	0.04	49.600	0.04	50.400
2026	0.09	0.04	49.603	0.04	50.397
2027	0.09	0.04	49.607	0.04	50.393
2028	0.09	0.04	49.609	0.04	50.391
2029	0.09	0.04	49.612	0.04	50.388
2030	0.09	0.04	49.615	0.05	50.385
2031	0.09	0.05	49.617	0.05	50.383
2032	0.09	0.05	49.619	0.05	50.381
2033	0.10	0.05	49.621	0.05	50.379
2034	0.10	0.05	49.623	0.05	50.377
2035	0.10	0.05	49.624	0.05	50.376
2036	0.10	0.05	49.626	0.05	50.374
2037	0.10	0.05	49.627	0.05	50.373
2038	0.10	0.05	49.629	0.05	50.371
2039	0.10	0.05	49.630	0.05	50.370
2040	0.11	0.05	49.631	0.05	50.369
2041	0.11	0.05	49.632	0.06	50.368
2042	0.11	0.06	49.633	0.06	50.367
2043	0.11	0.06	49.633	0.06	50.367
2044	0.11	0.06	49.634	0.06	50.366
2045	0.11	0.06	49.634	0.06	50.366
2046	0.12	0.06	49.635	0.06	50.365
2047	0.12	0.06	49.635	0.06	50.365
2048	0.12	0.06	49.635	0.06	50.365
2049	0.12	0.06	49.636	0.06	50.364
2050	0.12	0.06	49.636	0.06	50.364
Total	2.75	1.37	49.625	1.39	50.375
Average	0.10	0.05	49.625	0.05	50.375

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Predicted Crash Severity by Ramp Segment (Freeway Ramp Sections)

Seg. No.	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
1	0.0427	0.1294	0.5381	0.6566	1.3874

Table 7. Predicted Freeway Ramp Crash Type Distribution (Freeway Ramp Sections)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.01	0.2	0.03	1.1	0.03	1.3
Highway Segment	Collision with Fixed Object	0.95	34.7	0.95	34.5	1.91	69.2
Highway Segment	Collision with Other Object	0.07	2.4	0.18	6.7	0.25	9.1
Highway Segment	Other Single-vehicle Collision	0.28	10.0	0.14	5.2	0.42	15.1
Highway Segment	Collision with Parked Vehicle	0.02	0.7	0.02	0.8	0.04	1.5
Highway Segment	Total Single Vehicle Crashes	1.32	48.0	1.33	48.2	2.65	96.2
Highway Segment	Right-Angle Collision	0.00	0.1	0.00	0.0	0.00	0.1
Highway Segment	Head-on Collision	0.00	0.0	0.00	0.0	0.00	0.0
Highway Segment	Other Multi-vehicle Collision	0.00	0.1	0.00	0.1	0.00	0.1
Highway Segment	Rear-end Collision	0.03	1.2	0.04	1.5	0.07	2.7
Highway Segment	Sideswipe, Same Direction Collision	0.01	0.3	0.02	0.6	0.02	0.9
Highway Segment	Total Multiple Vehicle Crashes	0.04	1.6	0.06	2.2	0.10	3.8
Highway Segment	Total Highway Segment Crashes	1.37	49.6	1.39	50.4	2.75	100.0
	Total Crashes	1.37	49.6	1.39	50.4	2.75	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 8. Evaluation Message

Start Location (Sta. ft)	End Location (Sta. ft)	Message
0.000	6+09.697	for segment #1 (0.000 to 6+09.697), The ramp type for Ramp Alt 7 - SB Exit RT Ramp is set at the Ramp Connection (Exit) and in the Ramp (Exit). The Ramp value takes precedence.
0.000	6+09.697	for segment #1 (0.000 to 6+09.697), Left shoulder width (1.0 feet) is less than specified boundaries (2.0 feet); adjusted in CMF calculations.

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

May 2, 2019

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Table of Contents

List of Tables

List of Figures

Report Overview

Report Generated: May 2, 2019 4:50 PM
Report Template: System: Single Page [System] (mlcpm3, Apr 10, 2019 1:31 PM)

Evaluation Date: Thu May 02 16:50:12 CDT 2019
IHSDM Version: v14.1.0 (Mar 12, 2019)
Crash Prediction Module: v9.1.0 (Mar 12, 2019)

User Name: jdanibas
Organization Name:
Phone:
E-Mail:

Project Title: I-229 Exit 4 (Cliff Ave) - Alternative 7
Project Comment: Created Tue Apr 16 14:58:43 CDT 2019
Project Unit System: U.S. Customary

Highway Title: Cliff Ave
Highway Comment: Created Tue Apr 16 15:32:22 CDT 2019
Highway Version: 1

Evaluation Title: Evaluation 1
Evaluation Comment: Created Thu May 02 16:50:01 CDT 2019

Minimum Location: 10+00.000
Maximum Location: 74+43.703
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2024
Last Year of Analysis: 2050
Empirical-Bayes Analysis: None
First Year of Observed Crashes:
Last Year of Observed Crashes:

Section Types

Section 1 Evaluation

Section: Section 1
Evaluation Start Location: 10+00.000
Evaluation End Location: 74+43.703
Area Type: Urban
Functional Class: Arterial
Type of Alignment: Divided, Multilane
Model Category: Urban/Suburban Arterial
Calibration Factor: 3SG=1.0; 3ST=1.0; 4D=1.0; 4SG=1.0; 4ST=1.0; 4U=1.0; 5T=1.0;

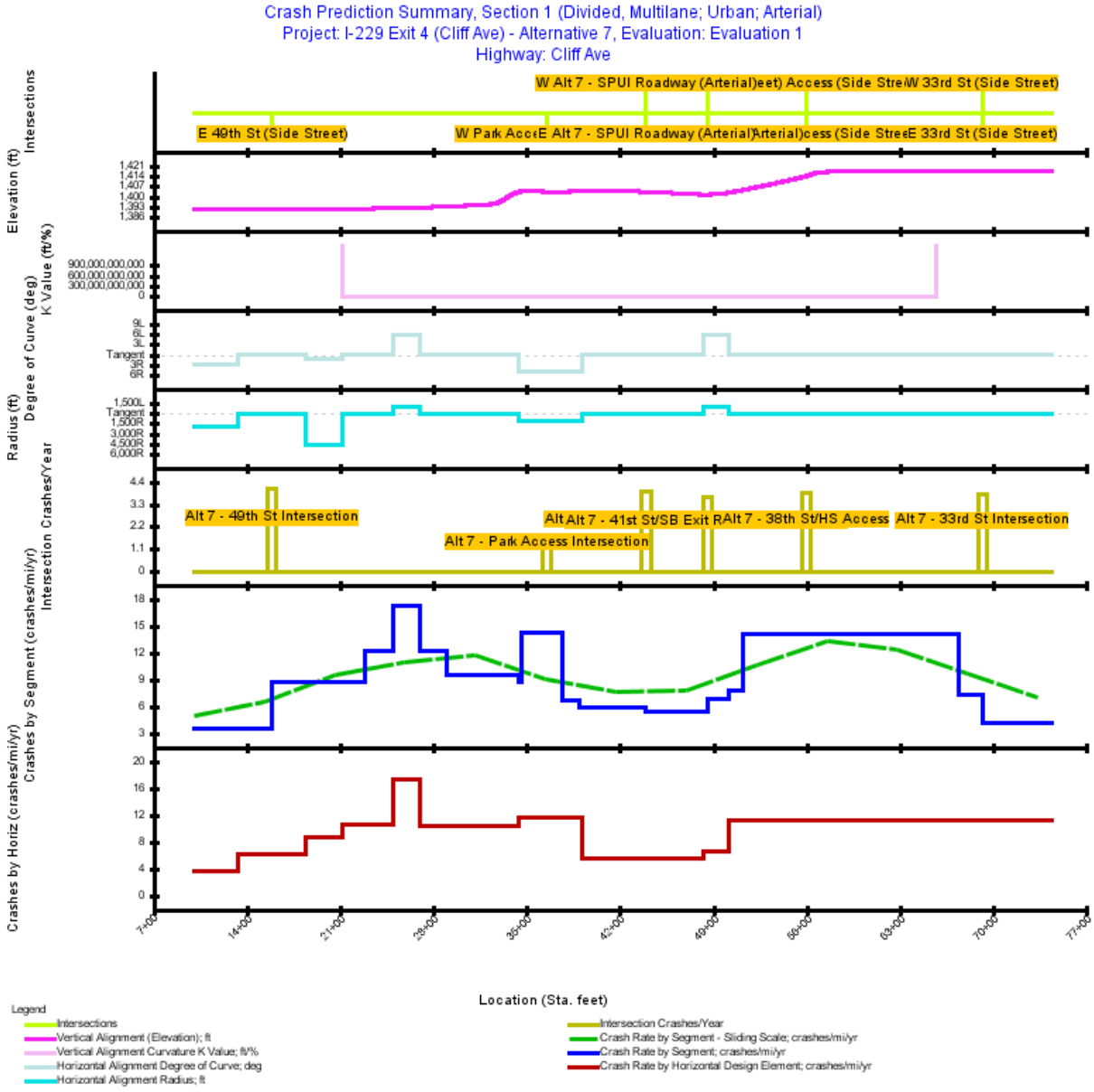


Figure 1. Crash Prediction Summary (Section 1)

Table 1. Evaluation Highway - Homogeneous Segments (Section 1)

Seg. No.	Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT	Number Major Commercial Driveways	Number Minor Commercial Driveways	Number Major Industial/Institutional	Number Minor Industial/Institutional	Number Major Residential Driveways	Number Minor Residential Driveways	Number Other Driveways	Lighting	Automated Speed Enforcement	Density (fixed objects/mi)	Median Width (ft)	Type	Effective Median Width (ft)	Speed Level	Number Rail Highway Crossings	Average Shoulder Width (ft)	Average Lane Width (ft)
1	4D	10+00.000	13+34.041	334.04	0.0633	2024: 14,262; 2025: 14,606; 2026: 14,950; 2027: 15,293; 2028: 15,637; 2029: 15,981; 2030: 16,325; 2031: 16,668; 2032: 17,012; 2033: 17,356; 2034: 17,700; 2035: 18,043; 2036: 18,387; 2037: 18,731; 2038: 19,075; 2039: 19,418; 2040: 19,762; 2041: 20,106; 2042: 20,450; 2043: 20,793; 2044: 21,137; 2045: 21,481; 2046: 21,825; 2047: 22,168; 2048: 22,512; 2049: 22,856; 2050: 23,200	0	0	0	0	0	0	0	false	false	0.0	12.00	Traversable Median	12.00	Intermediate/High	0	2.00	12.00
2	4D	13+34.041	15+86.000	251.96	0.0477	2024: 14,262; 2025: 14,606; 2026: 14,950; 2027: 15,293; 2028: 15,637; 2029: 15,981; 2030: 16,325; 2031: 16,668; 2032: 17,012; 2033: 17,356; 2034: 17,700; 2035: 18,043; 2036: 18,387; 2037: 18,731; 2038: 19,075; 2039: 19,418; 2040: 19,762; 2041: 20,106; 2042: 20,450; 2043: 20,793; 2044: 21,137; 2045: 21,481; 2046: 21,825; 2047: 22,168; 2048: 22,512; 2049: 22,856; 2050: 23,200	0	0	0	0	0	0	0	false	false	0.0	12.00	Traversable Median	12.00	Intermediate/High	0	2.00	12.00
3	4U	15+86.000	18+42.805	256.81	0.0486	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
4	4U	18+42.805	21+08.879	266.07	0.0504	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
5	4U	21+08.879	22+86.000	177.12	0.0336	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
6	5T	22+86.000	24+96.922	210.92	0.0399	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
7	5T	24+96.922	26+94.712	197.79	0.0375	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	1	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
8	5T	26+94.712	28+98.954	204.24	0.0387	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
9	4U	28+98.954	34+34.660	535.71	0.1015	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	2	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
10	4U	34+34.660	34+59.660	25.00	0.0047	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
11	5T	34+59.660	37+62.000	302.34	0.0573	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	1	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00

Seg. No.	Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT	Number Major Commercial Driveways	Number Minor Commercial Driveways	Number Major Industial/Institutional	Number Minor Industial/Institutional	Number Major Residential Driveways	Number Minor Residential Driveways	Number Other Driveways	Lighting	Automated Speed Enforcement	Density (fixed objects/mi)	Median Width (ft)	Type	Effective Median Width (ft)	Speed Level	Number Rail Highway Crossings	Average Shoulder Width (ft)	Average Lane Width (ft)
12	4D	37+62.000	38+95.544	133.54	0.0253	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	1	0	0	0	0	0	false	false	0.0	10.00	Non-Traversable Median	14.00	Intermediate/High	0	2.00	12.00
13	4D	38+95.544	39+10.280	14.74	0.0028	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	0	0	false	false	0.0	10.00	Non-Traversable Median	26.00	Intermediate/High	0	2.00	12.00
14	4D	39+10.280	43+95.544	485.26	0.0919	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	0	0	0	0	0	0	0	false	false	0.0	10.00	Non-Traversable Median	26.00	Intermediate/High	0	2.00	12.00
15	4D	43+95.544	45+53.645	158.10	0.0299	2024: 22,375; 2025: 22,687; 2026: 23,000; 2027: 23,312; 2028: 23,625; 2029: 23,937; 2030: 24,250; 2031: 24,562; 2032: 24,875; 2033: 25,187; 2034: 25,500; 2035: 25,812; 2036: 26,125; 2037: 26,437; 2038: 26,750; 2039: 27,062; 2040: 27,375; 2041: 27,687; 2042: 28,000; 2043: 28,312; 2044: 28,625; 2045: 28,937; 2046: 29,250; 2047: 29,562; 2048: 29,875; 2049: 30,187; 2050: 30,500	0	0	0	0	0	0	0	false	false	0.0	10.00	Non-Traversable Median	26.00	Intermediate/High	0	2.00	12.00
16	4D	45+53.645	46+45.544	91.90	0.0174	2024: 22,375; 2025: 22,687; 2026: 23,000; 2027: 23,312; 2028: 23,625; 2029: 23,937; 2030: 24,250; 2031: 24,562; 2032: 24,875; 2033: 25,187; 2034: 25,500; 2035: 25,812; 2036: 26,125; 2037: 26,437; 2038: 26,750; 2039: 27,062; 2040: 27,375; 2041: 27,687; 2042: 28,000; 2043: 28,312; 2044: 28,625; 2045: 28,937; 2046: 29,250; 2047: 29,562; 2048: 29,875; 2049: 30,187; 2050: 30,500	0	0	0	0	0	0	0	false	false	0.0	10.00	Non-Traversable Median	38.00	Intermediate/High	0	2.00	12.00
17	4D	46+45.544	48+21.477	175.93	0.0333	2024: 22,375; 2025: 22,687; 2026: 23,000; 2027: 23,312; 2028: 23,625; 2029: 23,937; 2030: 24,250; 2031: 24,562; 2032: 24,875; 2033: 25,187; 2034: 25,500; 2035: 25,812; 2036: 26,125; 2037: 26,437; 2038: 26,750; 2039: 27,062; 2040: 27,375; 2041: 27,687; 2042: 28,000; 2043: 28,312; 2044: 28,625; 2045: 28,937; 2046: 29,250; 2047: 29,562; 2048: 29,875; 2049: 30,187; 2050: 30,500	0	0	0	0	0	0	0	false	false	0.0	10.00	Non-Traversable Median	26.00	Intermediate/High	0	2.00	12.00
18	4D	48+21.477	48+53.645	32.17	0.0061	2024: 22,375; 2025: 22,687; 2026: 23,000; 2027: 23,312; 2028: 23,625; 2029: 23,937; 2030: 24,250; 2031: 24,562; 2032: 24,875; 2033: 25,187; 2034: 25,500; 2035: 25,812; 2036: 26,125; 2037: 26,437; 2038: 26,750; 2039: 27,062; 2040: 27,375; 2041: 27,687; 2042: 28,000; 2043: 28,312; 2044: 28,625; 2045: 28,937; 2046: 29,250; 2047: 29,562; 2048: 29,875; 2049: 30,187; 2050: 30,500	0	0	0	0	0	0	0	false	false	0.0	10.00	Non-Traversable Median	26.00	Intermediate/High	0	2.00	12.00
19	4D	48+53.645	50+12.172	158.53	0.0300	2024: 21,150; 2025: 21,375; 2026: 21,600; 2027: 21,825; 2028: 22,050; 2029: 22,275; 2030: 22,500; 2031: 22,725; 2032: 22,950; 2033: 23,175; 2034: 23,400; 2035: 23,625; 2036: 23,850; 2037: 24,075; 2038: 24,300; 2039: 24,525; 2040: 24,750; 2041: 24,975; 2042: 25,200; 2043: 25,425; 2044: 25,650; 2045: 25,875; 2046: 26,100; 2047: 26,325; 2048: 26,550; 2049: 26,775; 2050: 27,000	0	0	1	0	0	0	0	false	false	0.0	10.00	Non-Traversable Median	14.00	Intermediate/High	0	2.00	12.00
20	4D	50+12.172	51+25.172	113.00	0.0214	2024: 21,150; 2025: 21,375; 2026: 21,600; 2027: 21,825; 2028: 22,050; 2029: 22,275; 2030: 22,500; 2031: 22,725; 2032: 22,950; 2033: 23,175; 2034: 23,400; 2035: 23,625; 2036: 23,850; 2037: 24,075; 2038: 24,300; 2039: 24,525; 2040: 24,750; 2041: 24,975; 2042: 25,200; 2043: 25,425; 2044: 25,650; 2045: 25,875; 2046: 26,100; 2047: 26,325; 2048: 26,550; 2049: 26,775; 2050: 27,000	0	0	1	0	0	0	0	false	false	0.0	10.00	Non-Traversable Median	7.00	Intermediate/High	0	2.00	12.00
21	5T	51+25.172	67+46.101	1620.93	0.3070	2024: 21,150; 2025: 21,375; 2026: 21,600; 2027: 21,825; 2028: 22,050; 2029: 22,275; 2030: 22,500; 2031: 22,725; 2032: 22,950; 2033: 23,175; 2034: 23,400; 2035: 23,625; 2036: 23,850; 2037: 24,075; 2038: 24,300; 2039: 24,525; 2040: 24,750; 2041: 24,975; 2042: 25,200; 2043: 25,425; 2044: 25,650; 2045: 25,875; 2046: 26,100; 2047: 26,325; 2048: 26,550; 2049: 26,775; 2050: 27,000	0	0	2	0	3	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
22	4U	67+46.101	69+21.101	175.00	0.0331	2024: 21,150; 2025: 21,375; 2026: 21,600; 2027: 21,825; 2028: 22,050; 2029: 22,275; 2030: 22,500; 2031: 22,725; 2032: 22,950; 2033: 23,175; 2034: 23,400; 2035: 23,625; 2036: 23,850; 2037: 24,075; 2038: 24,300; 2039: 24,525; 2040: 24,750; 2041: 24,975; 2042: 25,200; 2043: 25,425; 2044: 25,650; 2045: 25,875; 2046: 26,100; 2047: 26,325; 2048: 26,550; 2049: 26,775; 2050: 27,000	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00
23	4U	69+21.101	70+36.101	115.00	0.0218	2024: 14,406; 2025: 14,490; 2026: 14,575; 2027: 14,659; 2028: 14,743; 2029: 14,828; 2030: 14,912; 2031: 14,996; 2032: 15,081; 2033: 15,165; 2034: 15,250; 2035: 15,334; 2036: 15,418; 2037: 15,503; 2038: 15,587; 2039: 15,671; 2040: 15,756; 2041: 15,840; 2042: 15,925; 2043: 16,009; 2044: 16,093; 2045: 16,178; 2046: 16,262; 2047: 16,346; 2048: 16,431; 2049: 16,515; 2050: 16,600	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00

Seg. No.	Type	Start Location (Sta. ft)	End Location (Sta. ft)	Length (ft)	Length(mi)	AADT	Number Major Commercial Driveways	Number Minor Commercial Driveways	Number Major Industial/Institutional	Number Minor Industial/Institutional	Number Major Residential Driveways	Number Minor Residential Driveways	Number Other Driveways	Lighting	Automated Speed Enforcement	Density (fixed objects/mi)	Median Width (ft)	Type	Effective Median Width (ft)	Speed Level	Number Rail Highway Crossings	Average Shoulder Width (ft)	Average Lane Width (ft)
24	4U	70+36.101	74+43.703	407.60	0.0772	2024: 14,406; 2025: 14,490; 2026: 14,575; 2027: 14,659; 2028: 14,743; 2029: 14,828; 2030: 14,912; 2031: 14,996; 2032: 15,081; 2033: 15,165; 2034: 15,250; 2035: 15,334; 2036: 15,418; 2037: 15,503; 2038: 15,587; 2039: 15,671; 2040: 15,756; 2041: 15,840; 2042: 15,925; 2043: 16,009; 2044: 16,093; 2045: 16,178; 2046: 16,262; 2047: 16,346; 2048: 16,431; 2049: 16,515; 2050: 16,600	0	0	0	0	0	0	0	false	false	0.0	0.00	None	0.00	Intermediate/High	0	2.00	12.00

Table 2. Evaluation Intersection (Section 1)

Inter. No.	Title	Location (Sta. ft)	Major AADT	Minor AADT	Legs	Traffic Control	Intersection Type	Approaches w/Left Turn Lanes	Approaches w/Right Turn Lanes	Approaches w/o Right Turn on Red	Pedestrian Volume (crossings/day)	Lighted at Night	Red Light Camera	School Nearby	Number of Bus Stops	Number of Alcohol Sales Establishments	Max Lanes Crossed	Replaced with Roundabout
1	Alt 7 - Park Access Intersection	36+51.824	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	2024: 360; 2025: 365; 2026: 370; 2027: 375; 2028: 380; 2029: 385; 2030: 390; 2031: 395; 2032: 400; 2033: 405; 2034: 410; 2035: 415; 2036: 420; 2037: 425; 2038: 430; 2039: 435; 2040: 440; 2041: 445; 2042: 450; 2043: 455; 2044: 460; 2045: 465; 2046: 470; 2047: 475; 2048: 480; 2049: 485; 2050: 490	3	Stop-Controlled	Three-Legged w/STOP control	0	0			true	false	false				false
2	Alt 7 - 49th St Intersection	15+85.495	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	2024: 8,734; 2025: 8,848; 2026: 8,962; 2027: 9,076; 2028: 9,190; 2029: 9,304; 2030: 9,418; 2031: 9,532; 2032: 9,646; 2033: 9,760; 2034: 9,875; 2035: 9,989; 2036: 10,103; 2037: 10,217; 2038: 10,331; 2039: 10,445; 2040: 10,559; 2041: 10,673; 2042: 10,787; 2043: 10,901; 2044: 11,015; 2045: 11,129; 2046: 11,243; 2047: 11,357; 2048: 11,471; 2049: 11,585; 2050: 11,700	3	Signalized	Three-Legged Signalized	2	0	0	15	true	false	false	0	0	5	false
3	Alt 7 - SPUI Ramp Intersection	43+95.544	2024: 23,662; 2025: 24,006; 2026: 24,350; 2027: 24,693; 2028: 25,037; 2029: 25,381; 2030: 25,725; 2031: 26,068; 2032: 26,412; 2033: 26,756; 2034: 27,100; 2035: 27,443; 2036: 27,787; 2037: 28,131; 2038: 28,475; 2039: 28,818; 2040: 29,162; 2041: 29,506; 2042: 29,850; 2043: 30,193; 2044: 30,537; 2045: 30,881; 2046: 31,225; 2047: 31,568; 2048: 31,912; 2049: 32,256; 2050: 32,600	2024: 13,589; 2025: 13,736; 2026: 13,883; 2027: 14,029; 2028: 14,176; 2029: 14,323; 2030: 14,470; 2031: 14,616; 2032: 14,763; 2033: 14,910; 2034: 15,057; 2035: 15,203; 2036: 15,350; 2037: 15,497; 2038: 15,644; 2039: 15,790; 2040: 15,937; 2041: 16,084; 2042: 16,231; 2043: 16,377; 2044: 16,524; 2045: 16,671; 2046: 16,818; 2047: 16,964; 2048: 17,111; 2049: 17,258; 2050: 17,405	4	Signalized	Four-Legged Signalized	4	3	1	20	true	false	false	0	0	6	false
4	Alt 7 - 41st St/SB Exit RT/Thru Intersection	48+53.645	2024: 1,400; 2025: 1,441; 2026: 1,482; 2027: 1,523; 2028: 1,564; 2029: 1,605; 2030: 1,646; 2031: 1,687; 2032: 1,728; 2033: 1,769; 2034: 1,810; 2035: 1,850; 2036: 1,891; 2037: 1,932; 2038: 1,973; 2039: 2,014; 2040: 2,055; 2041: 2,096; 2042: 2,137; 2043: 2,178; 2044: 2,219; 2045: 2,260; 2046: 2,301; 2047: 2,342; 2048: 2,383; 2049: 2,424; 2050: 2,465	2024: 22,375; 2025: 22,687; 2026: 23,000; 2027: 23,312; 2028: 23,625; 2029: 23,937; 2030: 24,250; 2031: 24,562; 2032: 24,875; 2033: 25,187; 2034: 25,500; 2035: 25,812; 2036: 26,125; 2037: 26,437; 2038: 26,750; 2039: 27,062; 2040: 27,375; 2041: 27,687; 2042: 28,000; 2043: 28,312; 2044: 28,625; 2045: 28,937; 2046: 29,250; 2047: 29,562; 2048: 29,875; 2049: 30,187; 2050: 30,500	4	Signalized	Four-Legged Signalized	1	3	0	20	true	false	true	0	0	6	false
5	Alt 7 - 38th St/HS Access	55+97.795	2024: 21,150; 2025: 21,375; 2026: 21,600; 2027: 21,825; 2028: 22,050; 2029: 22,275; 2030: 22,500; 2031: 22,725; 2032: 22,950; 2033: 23,175; 2034: 23,400; 2035: 23,625; 2036: 23,850; 2037: 24,075; 2038: 24,300; 2039: 24,525; 2040: 24,750; 2041: 24,975; 2042: 25,200; 2043: 25,425; 2044: 25,650; 2045: 25,875; 2046: 26,100; 2047: 26,325; 2048: 26,550; 2049: 26,775; 2050: 27,000	2024: 2,014; 2025: 2,048; 2026: 2,082; 2027: 2,116; 2028: 2,150; 2029: 2,184; 2030: 2,218; 2031: 2,252; 2032: 2,286; 2033: 2,320; 2034: 2,355; 2035: 2,389; 2036: 2,423; 2037: 2,457; 2038: 2,491; 2039: 2,525; 2040: 2,559; 2041: 2,593; 2042: 2,627; 2043: 2,661; 2044: 2,695; 2045: 2,729; 2046: 2,763; 2047: 2,797; 2048: 2,831; 2049: 2,865; 2050: 2,900	4	Stop-Controlled	Four-Legged w/STOP control	0	0			true	false	true				false
6	Alt 7 - 33rd St Intersection	69+21.101	2024: 21,150; 2025: 21,375; 2026: 21,600; 2027: 21,825; 2028: 22,050; 2029: 22,275; 2030: 22,500; 2031: 22,725; 2032: 22,950; 2033: 23,175; 2034: 23,400; 2035: 23,625; 2036: 23,850; 2037: 24,075; 2038: 24,300; 2039: 24,525; 2040: 24,750; 2041: 24,975; 2042: 25,200; 2043: 25,425; 2044: 25,650; 2045: 25,875; 2046: 26,100; 2047: 26,325; 2048: 26,550; 2049: 26,775; 2050: 27,000	2024: 5,465; 2025: 5,507; 2026: 5,550; 2027: 5,592; 2028: 5,635; 2029: 5,677; 2030: 5,720; 2031: 5,762; 2032: 5,805; 2033: 5,847; 2034: 5,890; 2035: 5,932; 2036: 5,975; 2037: 6,017; 2038: 6,060; 2039: 6,102; 2040: 6,145; 2041: 6,187; 2042: 6,230; 2043: 6,272; 2044: 6,315; 2045: 6,357; 2046: 6,400; 2047: 6,442; 2048: 6,485; 2049: 6,527; 2050: 6,570	4	Signalized	Four-Legged Signalized	4	0	0	20	true	false	false	0	0	5	false

Table 3. Predicted Highway Crash Rates and Frequencies Summary (Section 1)

First Year of Analysis	**2024**
Last Year of Analysis	**2050**
Evaluated Length (mi)	**1.2204**
Average Future Road AADT (vpd)	**24,830**
Predicted Crashes	
Total Crashes	**881.28**
Fatal and Injury Crashes	**289.92**
Property-Damage-Only Crashes	**591.36**
Percent of Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	**33**
Percent Property-Damage-Only Crashes (%)	**67**
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	**26.7455**
FI Crash Rate (crashes/mi/yr)	**8.7987**
PDO Crash Rate (crashes/mi/yr)	**17.9468**
Predicted Travel Crash Rate	
Total Travel (million veh-mi)	**298.63**
Travel Crash Rate (crashes/million veh-mi)	**2.95**
Travel FI Crash Rate (crashes/million veh-mi)	**0.97**
Travel PDO Crash Rate (crashes/million veh-mi)	**1.98**

Table 4. Predicted Crash Frequencies and Rates by Highway Segment/Intersection (Section 1)

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)	Predicted Intersection Travel Crash Rate (crashes/million veh)
1	10+00.000	13+34.041	0.0633	6.147	0.2277	0.0633	0.1644	3.5989	0.53	
2	13+34.041	15+86.000	0.0477	4.637	0.1717	0.0477	0.1240	3.5989	0.53	
Alt 7 - 49th St Intersection	15+85.495			110.346	4.0869	1.3240	2.7629			0.39
3	15+86.000	18+42.805	0.0486	11.590	0.4292	0.1245	0.3047	8.8254	0.86	
4	18+42.805	21+08.879	0.0504	12.008	0.4447	0.1290	0.3157	8.8254	0.86	
5	21+08.879	22+86.000	0.0335	7.993	0.2961	0.0859	0.2102	8.8254	0.86	
6	22+86.000	24+96.922	0.0399	13.265	0.4913	0.1394	0.3519	12.2983	1.20	
7	24+96.922	26+94.712	0.0375	17.524	0.6490	0.1860	0.4630	17.3258	1.69	
8	26+94.712	28+98.954	0.0387	12.845	0.4757	0.1349	0.3408	12.2983	1.20	
9	28+98.954	34+34.660	0.1015	26.232	0.9715	0.2864	0.6852	9.5757	0.93	
10	34+34.660	34+59.660	0.0047	1.128	0.0418	0.0121	0.0297	8.8254	0.86	
11	34+59.660	37+62.000	0.0573	22.112	0.8189	0.2335	0.5855	14.3019	1.39	
Alt 7 - Park Access Intersection	36+51.824			45.001	1.6667	0.7260	0.9407			0.16
12	37+62.000	38+95.544	0.0253	4.608	0.1707	0.0480	0.1227	6.7480	0.66	
13	38+95.544	39+10.280	0.0028	0.441	0.0163	0.0045	0.0118	5.8547	0.57	
14	39+10.280	43+95.544	0.0919	14.528	0.5381	0.1497	0.3884	5.8547	0.57	
Alt 7 - SPUI Ramp Intersection	43+95.544			105.789	3.9181	1.3571	2.5610			0.27
15	43+95.544	45+53.645	0.0299	4.384	0.1624	0.0452	0.1172	5.4222	0.56	
16	45+53.645	46+45.544	0.0174	2.548	0.0944	0.0263	0.0681	5.4222	0.56	
17	46+45.544	48+21.477	0.0333	4.878	0.1807	0.0503	0.1304	5.4222	0.56	
18	48+21.477	48+53.645	0.0061	0.892	0.0330	0.0092	0.0238	5.4222	0.56	
Alt 7 - 41st St/SB Exit RT/Thru Intersection	48+53.645			99.847	3.6980	1.0652	2.6329			0.34
19	48+53.645	50+12.172	0.0300	5.597	0.2073	0.0591	0.1482	6.9040	0.79	
20	50+12.172	51+25.172	0.0214	4.472	0.1656	0.0475	0.1181	7.7390	0.88	
21	51+25.172	67+46.101	0.3070	116.772	4.3249	1.2440	3.0809	14.0878	1.60	
Alt 7 - 38th St/HS Access	55+97.795			105.259	3.8985	1.6329	2.2656			0.41
22	67+46.101	69+21.101	0.0331	6.501	0.2408	0.0708	0.1700	7.2643	0.83	

Segment Number/Intersection Name/Cross Road	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)	Predicted Intersection Travel Crash Rate (crashes/million veh)
Alt 7 - 33rd St Intersection	69+21.101			102.674	3.8028	1.3081	2.4946			0.41
23	69+21.101	70+36.101	0.0218	2.480	0.0918	0.0280	0.0638	4.2166	0.74	
24	70+36.101	74+43.703	0.0772	8.789	0.3255	0.0993	0.2262	4.2166	0.74	
All Segments			1.2204	312.369	11.5692	3.3246	8.2446	9.4799	1.05	
All Intersections				568.916	21.0710	7.4133	13.6576			0.33
Total			1.2204	881.285	32.6402	10.7379	21.9023	26.7455		

Table 5. Predicted Crash Frequencies and Rates by Horizontal Design Element (Section 1)

Title	Start Location (Sta. ft)	End Location (Sta. ft)	Length (mi)	Total Predicted Crashes for Evaluation Period	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	Predicted Crash Rate (crashes/mi/yr)	Predicted Travel Crash Rate (crashes/million veh-mi)
Simple Curve 1	10+00.000	13+34.041	0.0633	6.147	0.2277	0.0633	0.1644	3.5989	0.53
Tangent	13+34.041	18+42.805	0.0964	16.226	0.6010	0.1723	0.4287	6.2370	0.69
Simple Curve 2	18+42.805	21+08.879	0.0504	12.008	0.4447	0.1290	0.3157	8.8254	0.86
Tangent	21+08.879	24+96.922	0.0735	21.258	0.7873	0.2253	0.5621	10.7131	1.04
Simple Curve 3	24+96.922	26+94.712	0.0375	17.524	0.6490	0.1860	0.4630	17.3258	1.69
Tangent	26+94.712	34+34.660	0.1401	39.076	1.4473	0.4213	1.0259	10.3272	1.01
Simple Curve 4	34+34.660	39+10.280	0.0901	28.289	1.0477	0.2981	0.7496	11.6314	1.13
Tangent	39+10.280	48+21.477	0.1726	26.338	0.9755	0.2714	0.7041	5.6526	0.57
Simple Curve 5	48+21.477	50+12.172	0.0361	6.489	0.2403	0.0683	0.1720	6.6540	0.75
Tangent	50+12.172	74+43.703	0.4605	139.013	5.1486	1.4896	3.6590	11.1801	1.33

Table 6. Predicted Crash Frequencies by Year (Section 1)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2024	27.19	8.99	33.062	18.20	66.938
2025	27.60	9.12	33.047	18.48	66.953
2026	28.02	9.25	33.032	18.76	66.968
2027	28.43	9.39	33.019	19.04	66.981
2028	28.84	9.52	33.005	19.32	66.995
2029	29.26	9.65	32.992	19.61	67.008
2030	29.68	9.79	32.979	19.89	67.021
2031	30.09	9.92	32.967	20.17	67.033
2032	30.51	10.05	32.955	20.46	67.046
2033	30.93	10.19	32.943	20.74	67.057
2034	31.35	10.32	32.931	21.03	67.069
2035	31.77	10.46	32.920	21.31	67.080
2036	32.19	10.59	32.909	21.60	67.091
2037	32.62	10.73	32.899	21.89	67.101
2038	33.04	10.87	32.888	22.17	67.112
2039	33.46	11.00	32.878	22.46	67.122
2040	33.89	11.14	32.868	22.75	67.132
2041	34.31	11.27	32.858	23.04	67.142
2042	34.74	11.41	32.849	23.33	67.151
2043	35.17	11.55	32.839	23.62	67.161
2044	35.59	11.69	32.830	23.91	67.170
2045	36.02	11.82	32.821	24.20	67.179
2046	36.45	11.96	32.812	24.49	67.188
2047	36.88	12.10	32.804	24.78	67.196
2048	37.31	12.24	32.795	25.08	67.205
2049	37.75	12.38	32.787	25.37	67.213
2050	38.18	12.52	32.779	25.67	67.221
Total	881.28	289.92	32.898	591.36	67.102
Average	32.64	10.74	32.898	21.90	67.102

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 7. Predicted Crash Severity by Urban Arterial (Section 1)

Seg. No.	Type	Fatal (K) Crashes (crashes)	Incapacitating Injury (A) Crashes (crashes)	Non-Incapacitating Injury (B) Crashes (crashes)	Possible Injury (C) Crashes (crashes)	No Injury (O) Crashes (crashes)
4	USAIntersection	0.0554	1.1491	8.6195	18.9354	71.0876

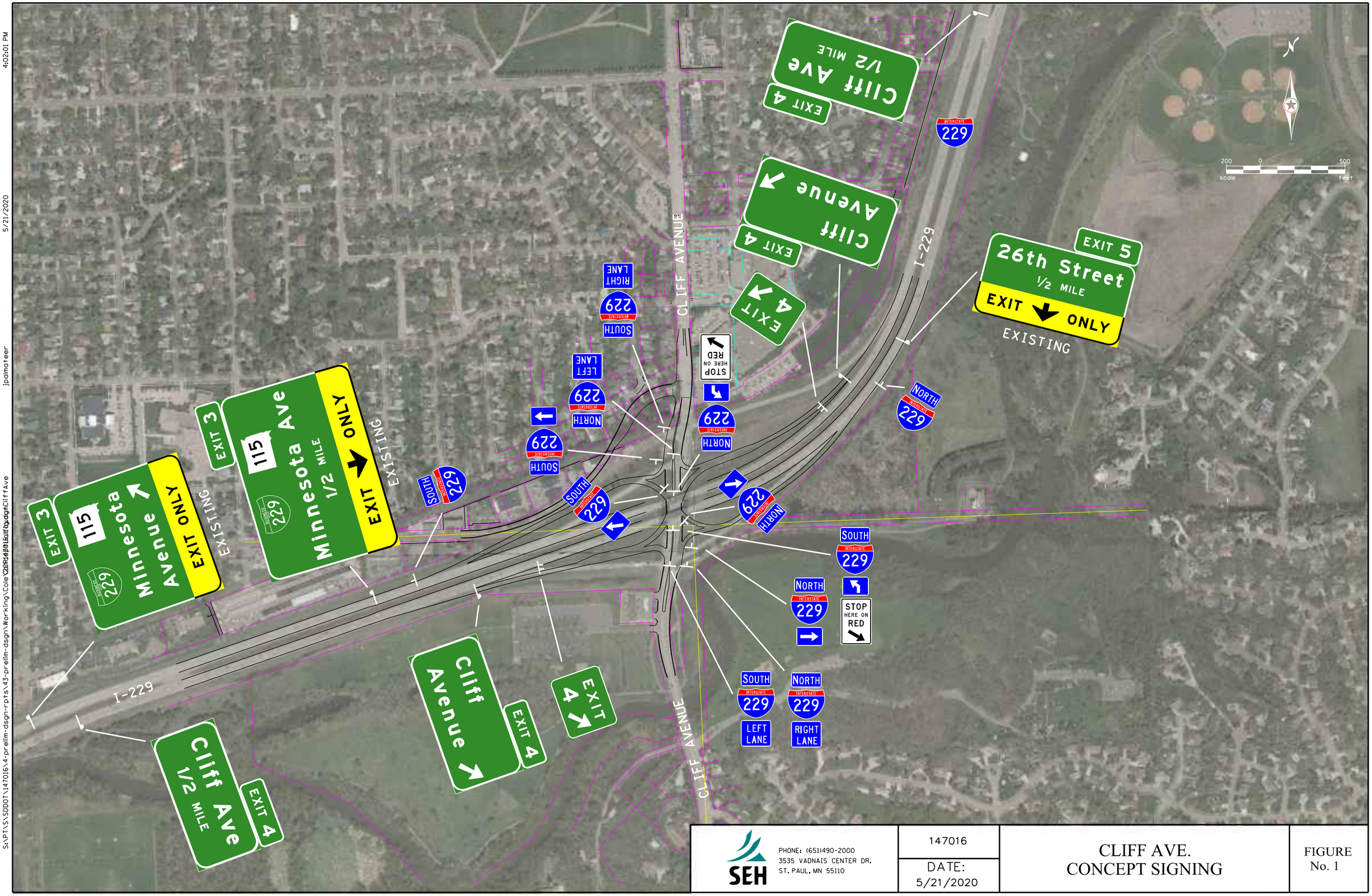
Table 8. Predicted Five Lane or Fewer Crash Type Distribution (Section 1)

Element Type	Crash Type	Fatal and Injury		Property Damage Only		Total	
		Crashes	Crashes (%)	Crashes	Crashes (%)	Crashes	Crashes (%)
Highway Segment	Collision with Animal	0.09	0.0	1.34	0.2	1.44	0.2
Highway Segment	Collision with Bicycle	2.53	0.3	0.00	0.0	2.53	0.3
Highway Segment	Collision with Fixed Object	4.60	0.6	27.34	3.5	31.94	4.1
Highway Segment	Collision with Other Object	0.12	0.0	1.55	0.2	1.67	0.2
Highway Segment	Other Single-vehicle Collision	4.91	0.6	4.52	0.6	9.42	1.2
Highway Segment	Collision with Pedestrian	5.72	0.7	0.00	0.0	5.72	0.7
Highway Segment	Total Single Vehicle Crashes	17.97	2.3	34.76	4.4	52.73	6.7
Highway Segment	Angle Collision	5.28	0.7	11.65	1.5	16.93	2.2
Highway Segment	Driveway-related Collision	11.80	1.5	31.31	4.0	43.12	5.5
Highway Segment	Head-on Collision	2.27	0.3	0.71	0.1	2.98	0.4
Highway Segment	Other Multi-vehicle Collision	2.11	0.3	8.00	1.0	10.11	1.3
Highway Segment	Rear-end Collision	44.48	5.7	95.92	12.3	140.40	18.0
Highway Segment	Sideswipe, Opposite Direction Collision	1.73	0.2	2.13	0.3	3.86	0.5
Highway Segment	Sideswipe, Same Direction Collision	4.12	0.5	38.13	4.9	42.25	5.4
Highway Segment	Total Multiple Vehicle Crashes	71.79	9.2	187.85	24.0	259.64	33.2
Highway Segment	Total Highway Segment Crashes	89.76	11.5	222.60	28.5	312.37	40.0
Intersection	Collision with Animal	0.01	0.0	0.23	0.0	0.24	0.0
Intersection	Collision with Bicycle	6.78	0.9	0.00	0.0	6.78	0.9
Intersection	Collision with Fixed Object	5.93	0.8	18.78	2.4	24.71	3.2
Intersection	Non-Collision	1.39	0.2	0.72	0.1	2.11	0.3
Intersection	Collision with Other Object	0.71	0.1	1.56	0.2	2.27	0.3
Intersection	Other Single-vehicle Collision	0.37	0.0	0.38	0.0	0.75	0.1
Intersection	Collision with Parked Vehicle	0.01	0.0	0.03	0.0	0.03	0.0
Intersection	Collision with Pedestrian	4.36	0.6	0.00	0.0	4.36	0.6
Intersection	Total Intersection Single Vehicle Crashes	19.56	2.5	21.69	2.8	41.25	5.3
Intersection	Angle Collision	53.95	6.9	69.99	9.0	123.95	15.9
Intersection	Head-on Collision	6.72	0.9	7.42	0.9	14.14	1.8
Intersection	Other Multi-vehicle Collision	8.77	1.1	58.22	7.5	66.99	8.6
Intersection	Rear-end Collision	66.81	8.6	130.67	16.7	197.49	25.3
Intersection	Sideswipe	15.58	2.0	9.68	1.2	25.26	3.2
Intersection	Total Intersection Multiple Vehicle Crashes	151.84	19.4	275.98	35.3	427.82	54.7
Intersection	Total Intersection Crashes	171.40	21.9	297.67	38.1	469.07	60.0
	Total Crashes	261.16	33.4	520.27	66.6	781.44	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Appendix M

Conceptual Signing Plan



SEH PHONE: (651)490-2000 3535 VADNAIS CENTER DR. ST. PAUL, MN 55110	147016 DATE: 5/21/2020	CLIFF AVE. CONCEPT SIGNING	FIGURE No. 1

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