I-90 EXIT 46 IMJR

South Dakota Department of Transportation Interchange Modification Justification Report (IMJR) for the Interstate 90 Exit 46 (Elk Creek Road) Interchange

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LIST OF ACRONYMS

AAWDT	Average Annual Weekday Traffic
ADT	Average Daily Traffic
EA	I-90 Exit 40 to 51 Environmental Assessment
FHWA	Federal Highway Administration
MUTCD	Manual on Uniform Traffic Control Devices (FHWA, 2009 Edition)
HCM	Highway Capacity Manual
HCS	Highway Capacity Software
HOV	High Occupancy Vehicle
I-90	Interstate 90
IMJR	Interstate Modification Justification Report
LOS	Level of Service
NCHRP	National Cooperative Highway Research Program
PDO	Property Damage Only
RCAMPO	Rapid City Area Metropolitan Planning Organization
RCP&E	Rapid City, Pierre and Eastern Railroad
SDDOT	South Dakota Department of Transportation
STIP	Statewide Transportation Improvement Program
TAZ	Transportation Analysis Zone
TRB	Transportation Research Board
WIM	Weigh In Motion

EXECUTIVE SUMMARY

The South Dakota Department of Transportation (SDDOT) has initiated an assessment of the existing interchange on Interstate 90 (I-90) at Exit 46 (Elk Creek Road) near Piedmont, 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's (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.

FHWA REQUIREMENTS

The FHWA has requirements that need to be addressed when evaluating changes to access points on interstate facilities (Federal Register, Volume 74, Number 165, August 27, 2009). The requirements are part of a policy that was put in place to maintain high levels of safety and mobility on the Interstate System. The policy consists of eight requirements that new access locations should meet. As this modification request is to maintain the existing Exit 46 interchange's diamond interchange configuration, the following is the summarized response to each requirement. The full response to each requirement can be found in Chapter 9: Recommendations.

1. **The need being addressed by the request cannot be adequately satisfied by existing interchanges to the Interstate, and/or local roads and streets in the corridor can neither provide the desired access, nor can they be reasonably improved (such as access control along surface streets, improving traffic control, modifying ramp terminals and intersections, adding turn bays or lengthening storage) to satisfactorily accommodate the design year traffic demands (23 CFR 625.2(a)).**

   This modification request is to reconfigure an existing interchange. No additional access to the Interstate System is being requested. The reconfiguration of the existing interchange will have a negligible effect on the Interstate's traffic operations when compared with the existing interchange's configuration.

2. **The need being addressed by the request cannot be adequately satisfied by reasonable transportation system management (such as ramp metering, mass transit, and HOV facilities), geometric design, and alternative improvements to the Interstate without the proposed change(s) in access (23CFR 625.2(a)).**

   This modification request is to reconfigure the geometrics of an existing interchange. No additional access to the Interstate System is being requested.

   The *Interstate 90 Black Hawk – Sturgis Corridor Preservation Study* initially developed three build alternatives, which were narrowed down to two feasible alternatives for the corridor's EA. The two alternatives evaluated in the EA were a single point and a diamond interchange. The EA noted that both alternatives would require the realignment of Elk Creek Road to the east to provide a greater separation distance between the east interchange ramps and the interstate service road intersection. Realigned Elk Creek Road would be grade-separated over both the railroad tracks and I-90.

The single point interchange alternative would have relocated the Exit 46 interchange to the east and constructed a single point interchange. The single point interchange was ruled out for three reasons. It was not considered practical at Exit 46, and it would have required installation of a traffic signal, which is not warranted with the diamond interchange configuration. It also would have cost more to construct because of the need for a larger bridge, traffic signal and more retaining walls.

The relocated diamond interchange was selected as the preferred option in the EA primarily because of cost as well as the reconstructed interchange being able to eliminate the sharp skew angle, provide better spacing between the ramp terminal and service road intersections, and greatly improve sight distance on the bridge. The EA's preferred option also includes the realignment of Elk Creek Road in order to improve spacing between the ramp terminal, service road intersections and provide for a grade-separated crossing of the railroad. The increase in distance between the ramp terminal intersections and Sturgis Road would improve the operation of the crossroad intersections, including the ramp terminal intersections by providing additional queue space for left turn and width for auxiliary lanes to be added, as warranted. The grade separation of the railroad is another benefit that would improve traffic operations and safety in the vicinity of the Exit 46 interchange.

There are no areas within the State of South Dakota that will consistently experience congestion levels extreme enough for TSM measures such as ramp metering or HOV facilities to be economically feasible in the foreseeable future.

3. **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, ramp intersections with crossroad) or on the local street network based on both the current and the planned future traffic projections. The analysis shall, particularly in urbanized areas, include at least the first adjacent existing or proposed interchange on either side of the proposed change in access (23 CFR 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, shall 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 must 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 must 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)).

   The operational analyses contained in this study indicate that mainline I-90 and ramp junction, and ramp terminal intersections are projected to operate within operational goals for both the Build and No Build scenarios through the planning horizon year of 2045.

An analysis of crash records for the most recent available five-year period (2010-2014) has been provided in the "Existing Safety Conditions" section. The safety analysis indicates that there are no discernable or correctable crash patterns within the influence area of the Exit 46 interchange. The relocated diamond interchange and reconstructed bridge would improve spacing between the ramp terminal and service road intersections, improve vertical sight distance and provide for a grade-separate crossing of the railroad. The bridge is planned to provide enough width to accommodate turn lanes at the ramp terminal intersections and a shared-use path, all of which should improve traffic operations and pedestrian/bicycle connectivity in the vicinity of Exit 46.

4. **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 for managed lanes (e.g., transit, HOVs, HOT 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)).**

   The access improvement will maintain a connection to a public road (Elk Creek Road) and will replace the current full access interchange with a reconfigured full access interchange. The reconfigured interchange will continue to provide for all traffic movements. The improvement will meet or exceed current standards for Federal-aid projects on the Interstate system.

5. **The proposal considers and is consistent with local and regional land use and transportation plans. Prior to receiving final approval, all requests for new or revised access must be included in an adopted Metropolitan Transportation Plan, in the adopted Statewide or Metropolitan Transportation Improvement Program (STIP or TIP), and the Congestion Management Process within transportation management areas, as appropriate, and as specified in 23 CFR part 450, and the transportation conformity requirements of 40 CFR parts 51 and 93.**

   The proposed interchange improvement is consistent with local land use plans and the *RCAMPO RapidTrip 2040 Long Range Transportation Plan* and *Meade Moving Forward 2040 Transportation Plan*.

6. **In corridors where the potential exists for future multiple interchange additions, a comprehensive corridor or network study must accompany all requests for new or revised access with recommendations that address all of the proposed and desired access changes within the context of a longer-range system or network plan (23 U.S.C. 109(d), 23 CFR 625.2(a), 655.603(d), and 771.111).**

   Previous studies conducted in the past 15 years, including the *South Dakota Department of Transportation Decennial Interstate Corridor Study* completed in February 2001; the *Interstate 90 Black Hawk – Sturgis Corridor Preservation Study* completed in December 2004; and the *2010 South Dakota Department of Transportation Decennial Interstate Corridor Study* completed in November 2010 indicated no need for any future interchange additions along the segments of I-90 between Exit 46 and the adjacent exits.

7. **When a new or revised access point is due to a new, expanded, or substantial change in current or planned future development or land use, requests must demonstrate appropriate coordination has occurred between the development and any proposed transportation system improvements (23 CFR 625.2(a) and 655.603(d)). The request must describe the commitments agreed upon to assure adequate collection and dispersion of the traffic resulting from the development with the adjoining local street network and Interstate access point (23 CFR 625.2(a) and 655.603(d)).**

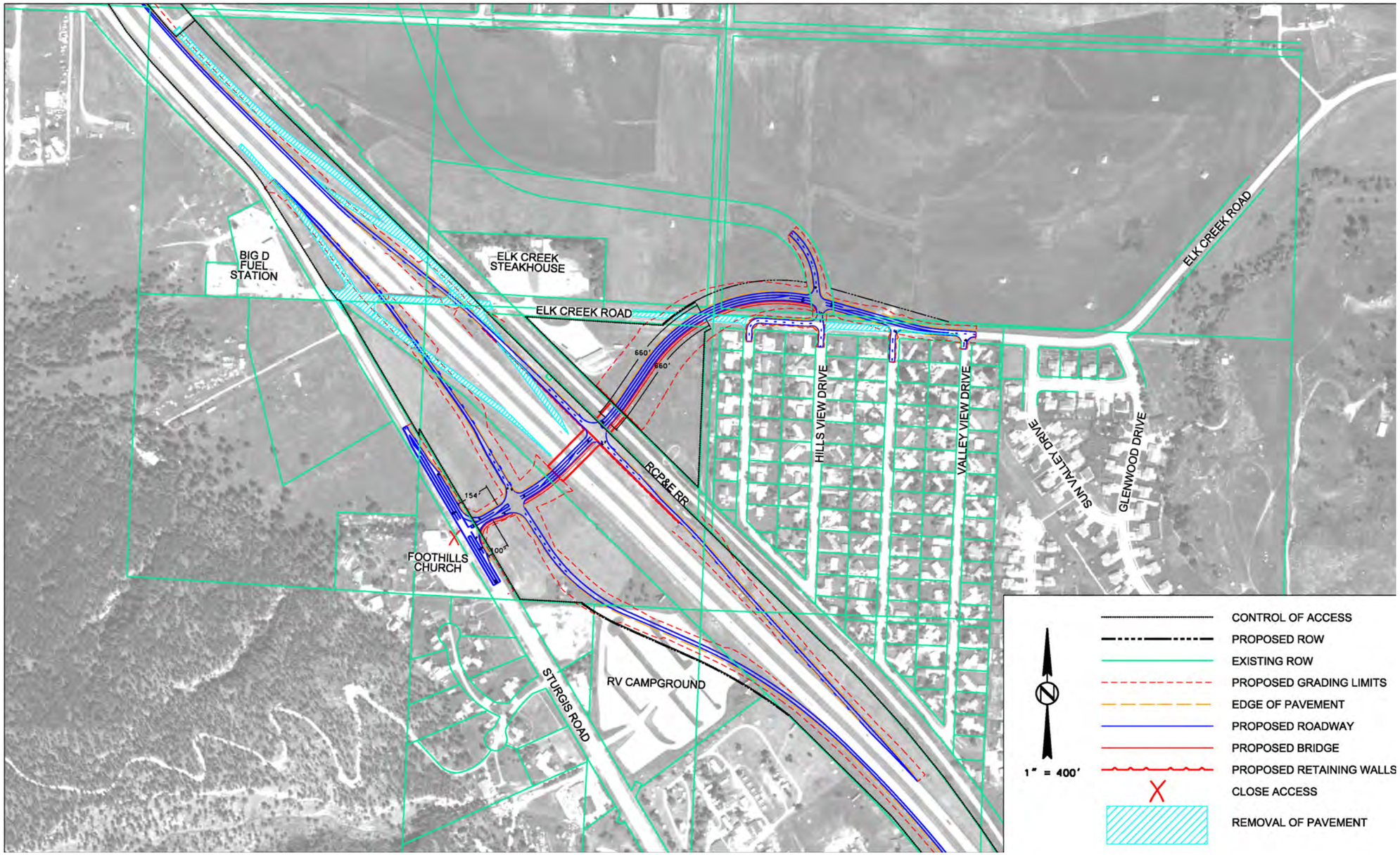
   The proposed interchange modification is the result of *the Interstate 90 Black Hawk – Sturgis Corridor Preservation Study* and the corresponding *I-90 Environmental Assessment (Exit 40 to Exit 51)*. The study was jointly coordinated by SDDOT, Meade County, and FHWA staff.

   The reconfiguration of the interchange is being proposed to accommodate future traffic growth relative to the anticipated future population growth of the entire Northern Black Hills. After analysis of several alternatives for the corridor, the *Interstate 90 Black Hawk – Sturgis Corridor Preservation Study* recommended the relocation of several service roads, the redesign of several interchanges, and the reconstruction and widening of the I-90 mainline in some areas between Black Hawk and Sturgis when traffic and conditions warrant. Unfortunately, both terrain restraints of the Northern Black Hills and the location of nearby federal lands create a geographic bottleneck that limits the amount of parallel corridors to operationally support I-90 that can be feasibly constructed.

8. **The proposal can be expected to be included as an alternative in the required environmental evaluation, review and processing. The proposal should include supporting information and current status of the environmental processing (23 CFR 771.111).**

   The proposed revised access is identified in the *RCAMPO RapidTrip 2040 Long Range Transportation Plan* and planned to be included in the 2017-2020 STIP as a result of the corridor's Environmental Assessment that was completed in September 2008 and reevaluated in September 2014. A Categorical Exclusion document will be developed upon completion of the IMJR, using the EA information as a reference. A preliminary concept of the Preferred Alternative is illustrated on **Figure ES-1**.

Figure ES-1. Exit 46 Proposed Action



1.0 INTRODUCTION

The South Dakota Department of Transportation (SDDOT) has been making progress implementing the recommendations from the *Interstate 90 (I-90) Black Hawk - Sturgis Corridor Preservation Study*. As part of that progression, the SDDOT has reached the milestone to conduct a more detailed study of the Exit 46 interchange's traffic operations and affects upon the Interstate System, and request permission from the Federal Highway Administration (FHWA) to make modifications to the Elk Creek Road interchange. This Interstate Modification Justification Report (IMJR) is prepared on behalf of the SDDOT for submittal to the FHWA.

1.1 Background

Table 1 provides an overview of the planning history of the Exit 46 interchange modification project.

Table 1. Exit 46 Planning Background

Year	Document/ Procedural Step	Exit 46 Findings
2000	*Decennial Interstate Corridor Study*	Identified concern of close service road spacing, recommended project to realign service roads. Identified similar concerns at nearby interchanges along the I-90 corridor.
2004	*I-90 Black Hawk to Sturgis Corridor Preservation Study*	Study was done to preserve transportation improvement opportunities amidst growth pressures along I-90 between Black Hawk and Sturgis. Addressed potential for widening of I-90 to six lanes and evaluated Exit 46 interchange alternatives.
2008	*Environmental Assessment, I-90 Exit 40 to Exit 51*	Selected Preferred Alternative of Realigned Exit 46 Diamond Interchange and refined design to reflect updated information. Included environmental resource evaluation for Exit 46 modification in addition to several other corridor projects.
2010	*Decennial Interstate Corridor Study*	Reaffirmed Exit 46 concerns of close service road spacing and substandard interchange design.
2013	*Piedmont Valley Shared-Use Path Study and Recommendations*	Identified path along Elk Creek Road and crossing of I-90 at Exit 46 as high priorities.
2014	*Statewide Planning Process*	SDDOT included Exit 46 reconstruction in the Developmental Program of its statewide planning process and completed an EA reevaluation.
2016	*IMJR*	Will provide documentation of preferred alternative needed for Federal approval of Exit 46 project.

As shown, the SDDOT's 2000 *Decennial Interstate Corridor Study* identified concerns with the existing Exit 46 configuration and determined that the I-90 corridor between Black Hawk and Sturgis would be one of the top segments of South Dakota's Interstate System to target for improvement. The SDDOT responded by completing the *Interstate 90 Black Hawk - Sturgis Corridor Preservation Study* in 2004, which determined that relocating the I-90 Exit 46 (Elk Creek Road) interchange would be the best alternative to prepare I-90 for future expansion. In 2008, an Environmental Assessment (EA) of Exit 40 to Exit 51 confirmed the need to relocate the Exit 46 interchange in preparation for potential future mainline I-90 expansion and determined a diamond configuration to be the preferred alternative for that relocated interchange. These findings have been confirmed by subsequently completed plans.

1.2 Purpose

The purpose of the Exit 46 interchange modification is to address deficiencies inherent in the current interchange condition and preserve future mainline I-90 expansion opportunities.

1.3 Project Location

Exit 46 is an existing interchange connection between I-90 and Elk Creek Road in the vicinity of the Cities of Piedmont and Summerset, South Dakota. The interchange is located approximately 46 miles to the east of the Wyoming state line and 11 miles to the west of the I-90/I-190 System Interchange. The interchange is located within the Rapid City Area Metropolitan Planning Organization (RCAMPO) boundary. **Figure 1** depicts the location of Exit 46.

The current configuration of Exit 46 is a skewed diamond interchange as shown on **Figure 2**. The proposed interchange modification would realign Elk Creek Road to create a perpendicular crossing of the Rapid City, Pierre and Eastern (RCP&E) Railroad and mainline I-90 to the south of the existing bridge. I-90 would continue to connect to Elk Creek road via a diamond interchange configuration. The modified interchange would create additional distance along Elk Creek Road between the interchange ramp termini and adjacent surface street intersections. The result would improve safety and efficiency of the interchange and surrounding intersections.

Figure 1. Study Area and Vicinity Map

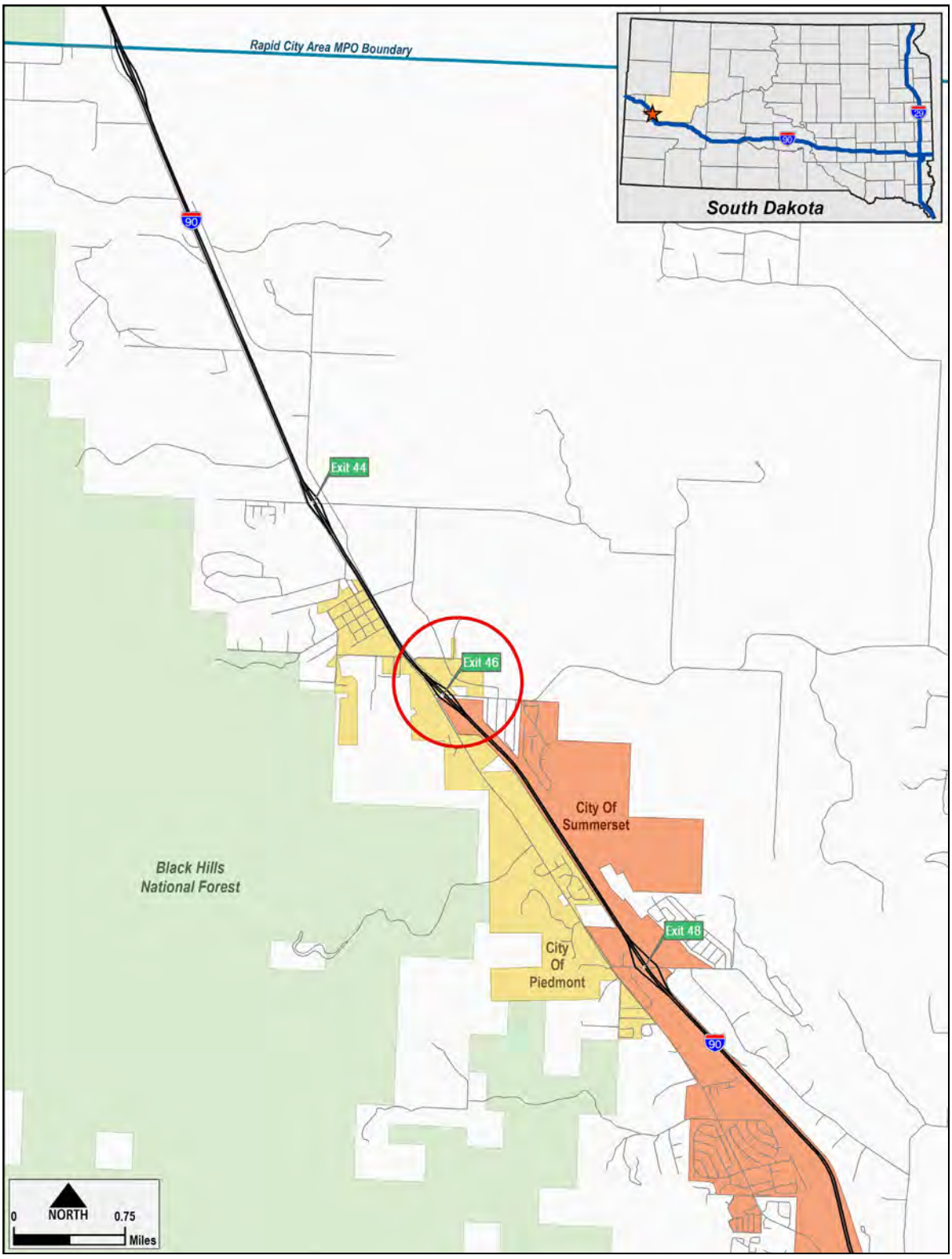


Figure 2. Current Exit 46 Configuration

2.0 METHODOLOGY

This 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 modification that:

- Does not provide full access to roads.
- 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.

2.1 Methods and Assumptions

This IMJR was developed through the following steps, which are detailed in a Methods and Assumptions Document and Amendment can be found in **Appendix A**:

1. Establishing an appropriate study area: The study area is documented in **Figure 1**. Study corridors include:
    - Elk Creek Road from the intersection with Sturgis Road to the intersection with Glenwood Drive, approximately 0.70 mile;
    - Deer View Road from Sturgis Road to Spring Valley Road, approximately 0.75 mile;
    - Stage Stop Road from Sturgis Road to La Rue Road, approximately 0.80 mile;
    - Mainline I-90 from west of I-90 Exit 44 to east of I-90 Exit 48, approximately 4½ miles;
    - The ramps for the I-90 Exit 46 (Elk Creek Road) interchange;
    - The ramps for the I-90 Exit 44 (Bethlehem Road) interchange; and
    - The ramps for the I-90 Exit 48 (Stage Stop Road) interchange.
2. Completing data collection. Conducting peak hour turning movement counts and daily traffic counts at the study area intersections and select roadway and interstate segments. Reviewing previous studies and available existing and future land use information for the study area.
3. Addressing the FHWA requirements for interstate access modifications. This step includes completion of the necessary analyses and evaluations that document the benefits and impacts of the access modification as it relates to the FHWA requirements. These analyses include:
    - Preparing horizon year traffic forecasts. Average weekday daily and peak hour traffic forecasts for both the anticipated year of project completion (2021) and the planning horizon year (2045) were prepared for the study area interstate

segments, interchanges, interstate ramp terminal intersections and adjacent arterial street intersections based on the Year 2040 RCAMPO regional travel demand model.

- Analyzing current and future traffic operations along study area roadway links. The traffic analyses were completed using the procedures and methodologies documented in the *Highway Capacity Manual* (HCM), *2010* (Transportation Research Board [TRB], 2010) in accordance with the approved Methods and Assumptions document. In addressing the FHWA requirements, this report includes documentation of predicted traffic operations with and without the interchange modification. Traffic operations analyses were completed using Highway Capacity Software (HCS™) 2010 software. However, bicycle and pedestrian level of service (LOS) evaluations for segments of facilities, in particular along Elk Creek Road, used methodologies from TRB's National Cooperative Highway Research Program (NCHRP) Report 616: Multimodal Level of Service Analysis for Urban Streets.
- Reviewing the reported crash history data for the most recently available five-year period (2010-2014) to identify crash concentrations and trends at the current Exit 46 interchange, mainline I-90 through the interchange and adjacent intersections along Elk Creek Road.
- Evaluating the potential future lane geometry and traffic control needed for the interchange modification. This includes an evaluation of auxiliary lanes, traffic signal warrants and all-way stop control.

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

3.0 EXISTING CONDITIONS

3.1 Demographics

A radius of approximately 1 mile from Exit 46 encompasses portions of the Cities of Summerset, Piedmont and unincorporated Meade County. The interchange is located within the boundary of the RCAMPO.

Because the interchange is located within the RCAMPO, population and employment information and forecasts for the area surrounding Exit 46 are included in the Year 2040 Regional Travel Demand Model. The model, updated in 2015, includes Year 2013 base information and Year 2040 forecasts. The model compiles information for individual Transportation Analysis Zones (TAZ's) surrounding the interchange, depicted on **Figure 3**.

Figure 3. Transportation Analysis Zones

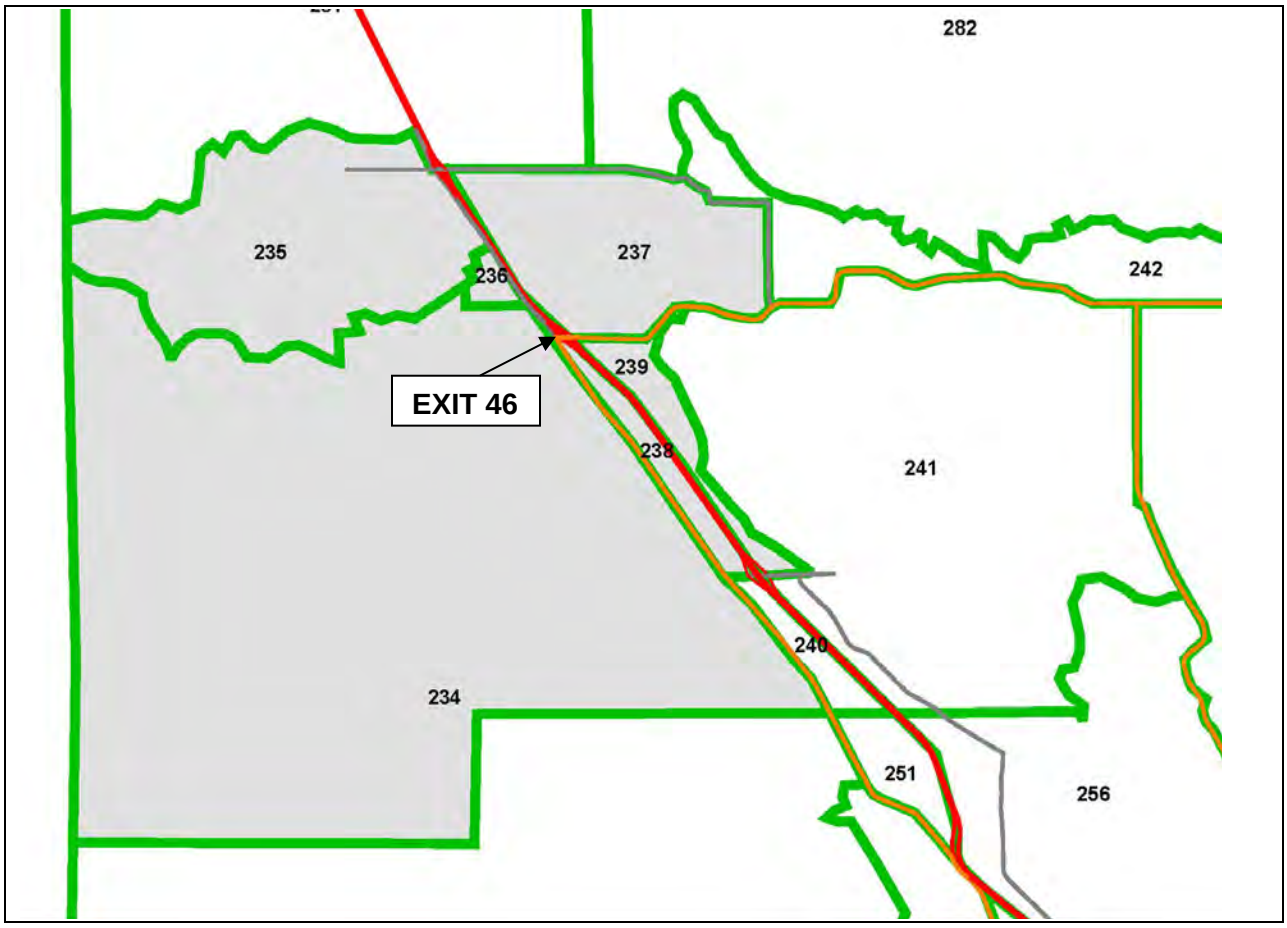


Table 2 provides base year information for the TAZ's surrounding Exit 46. As shown, the travel demand model contains a base year assumption of nearly 1,000 households and more than 600 employees in the shaded area on **Figure 3**.

Table 2. Base Year (2013) Model Demographics by TAZ

TAZ	Households	Employees
234	203	85
235	321	210
236	62	84
237	52	41
238	135	190
239	174	18
TOTAL	947	628

3.2 Existing Land Use

The Exit 46 interchange is surrounded by a mix of uses. The City of Summerset jurisdiction immediately to the south of the interchange includes land designated as single-family residential and general commercial. Land uses within the City of Piedmont (to the north and west of the interchange) include commercial retail, church, and residential. Meade County designations include residential and agricultural uses.

3.3 Existing Roadway Network

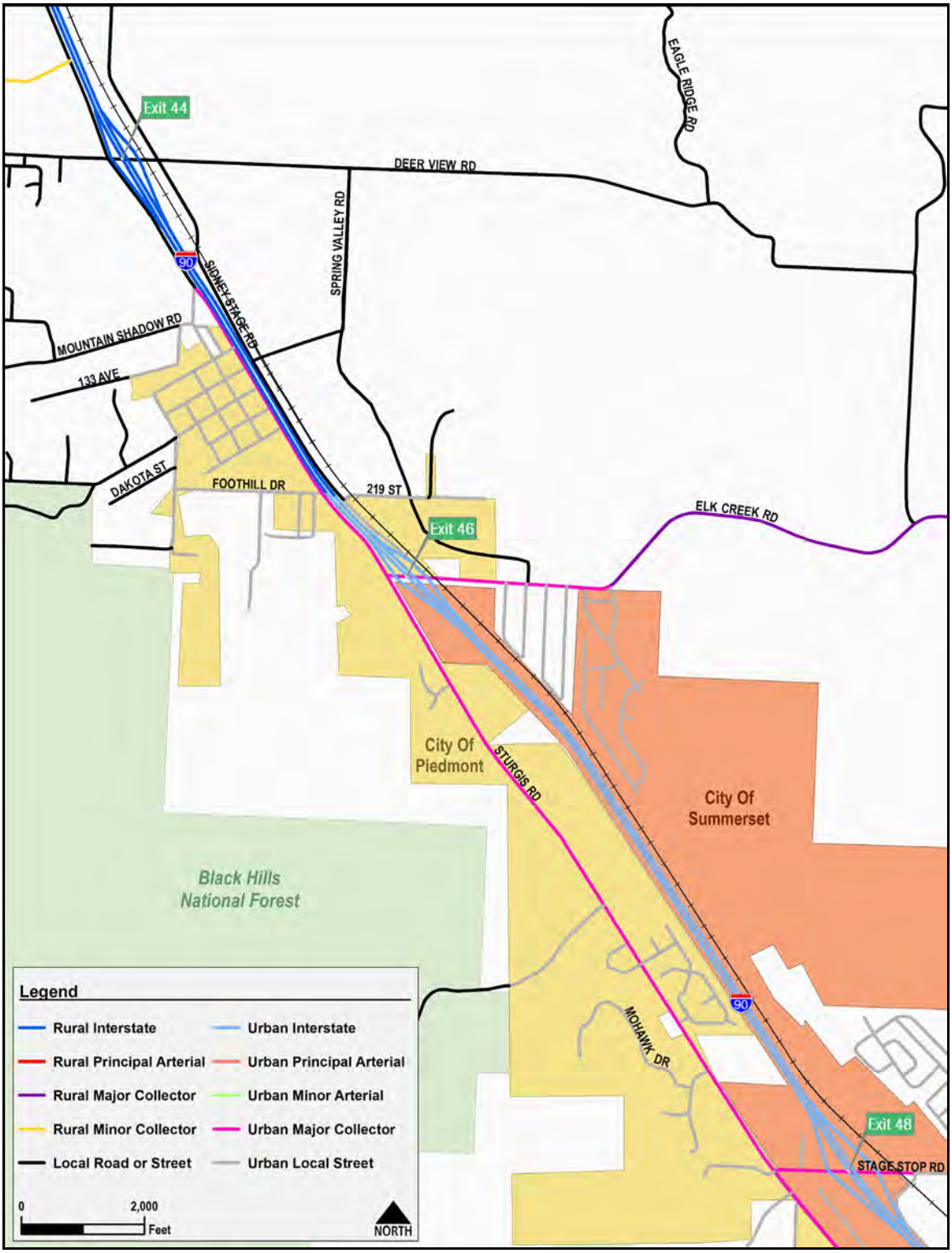
The following roadways comprise the primary roadway network surrounding Exit 46. **Figure 4** depicts the roadways and the federal functional classification.

Interstate 90: I-90 is an interstate freeway extending across state lines. It is oriented on a north-south alignment through the study area, although it is designated as an east-west interstate. Mainline I-90 provides two travel lanes in each direction through the study area.

Sturgis Road: Sturgis Road is a major collector that parallels I-90 on its west side and provides access and circulation for development in addition to serving some regional travel. South of the interchange it is three lanes wide, narrowing to two lanes north of the interchange.

Elk Creek Road: Elk Creek Road (Meade County Road 4) is the cross road for Exit 46. It serves as a major collector and extends 18 miles to the east from Sturgis Road across a significant portion of Meade County, 8 miles as a paved surface. Elk Creek Road provides two travel lanes.

Figure 4. Roadway Network



3.4 Alternative Travel Modes

Alternative (non-single occupant vehicle) travel modes that currently utilize the Exit 46 area are described as follows:

Bus Transit

Prairie Hills Transit provides weekday bus service by request between various communities along the I-90 corridor and Rapid City, including the cities of Piedmont and Summerset. Riders must contact Prairie Hills to schedule trips. Inter-state transit is provided daily along I-90 by Jefferson Bus Lines between Rapid City and Billings, Montana. No stops are provided in the vicinity of Exit 46.

Airports

There are several airports in the area, the closest of which is the Sturgis Municipal Airport, located approximately 22 miles' drive to the north from the interchange. The Sturgis Municipal Airport provides General Aviation services. The nearest commercial airport is the Rapid City Regional Airport, located approximately 26 miles' drive to the south from Exit 46.

Railroad

The RCP&E Railroad is a Class II freight railroad affiliated with the Genesee & Wyoming, Inc. rail company. The RCP&E rail line parallels I-90 on its east side through the interchange area, and crosses Elk Creek Road at grade to the east of the Exit 46 interchange.

Bicycle/Pedestrian

Exit 46 crosses I-90 at a desired location for pedestrian and bicycle travel, connecting residential neighborhoods to the east of I-90 with residential, commercial and institutional uses to the west of I-90. Though strategically located, the existing interchange configuration and surrounding infrastructure are not pedestrian and bicycle friendly. The current Elk Creek Road bridge over I-90 is restricted from pedestrian usage due to narrow width and vertical curvature, and the at-grade railroad crossing inhibits non-motorized travel.

3.5 Interchanges

I-90 Exit 46: Elk Creek Road

The existing interchange at I-90 and Elk Creek Road (Exit 46) is a skewed diamond configuration, with a spacing of approximately 525 feet between the interchange ramp intersections along Elk Creek Road. Both ramp terminal intersections are currently controlled with STOP signs on the ramps. All ramps were originally designed and striped as single lane ramps. Elk Creek Road has a two-lane cross-section. The existing bridge over mainline I-90 does not provide pedestrian or bicycle facilities, and in fact, the use of these alternate modes is currently prohibited across the bridge. There is an at-grade crossing of the RCP&E Railroad that is located approximately 115 feet to the east of the east (westbound I-90) ramp terminal intersection. The Elk Creek Road / Sturgis Road intersection lies within 100 feet of the west ramp terminal intersection. The westbound I-90 on-ramp and east service road (Sidney Stage Road) currently intersect. The existing Exit 46 interchange configuration is shown on the aerial photo in **Figure 5**.

Figure 5. Existing Configuration – I-90 Exit 46

I-90 Exit 44: Bethlehem Road

The adjacent interchange to the northwest of the I-90 Exit 46 interchange is the Exit 44 interchange. The existing interchange of I-90 and Deerview Road (218th Street) is a skewed diamond configuration, with a spacing of approximately 450 feet between the interchange ramp intersections along Deerview Road. Both ramp terminal intersections are currently controlled with STOP signs on the ramps. All ramps were originally designed and striped as single lane ramps. Deerview Road has a two-lane cross-section. There is an at-grade crossing of the RCP&E Railroad that is located approximately 110 feet to the east of the east (westbound I-90) ramp terminal intersection. The existing Exit 44 interchange configuration is shown on the aerial photo in **Figure 6**.

Figure 6. Existing Configuration – I-90 Exit 44

Exit 44 is planned to be reconstructed in the year 2017. The planned configuration is shown on **Figure 7**.

Figure 7. Planned Configuration – I-90 Exit 44

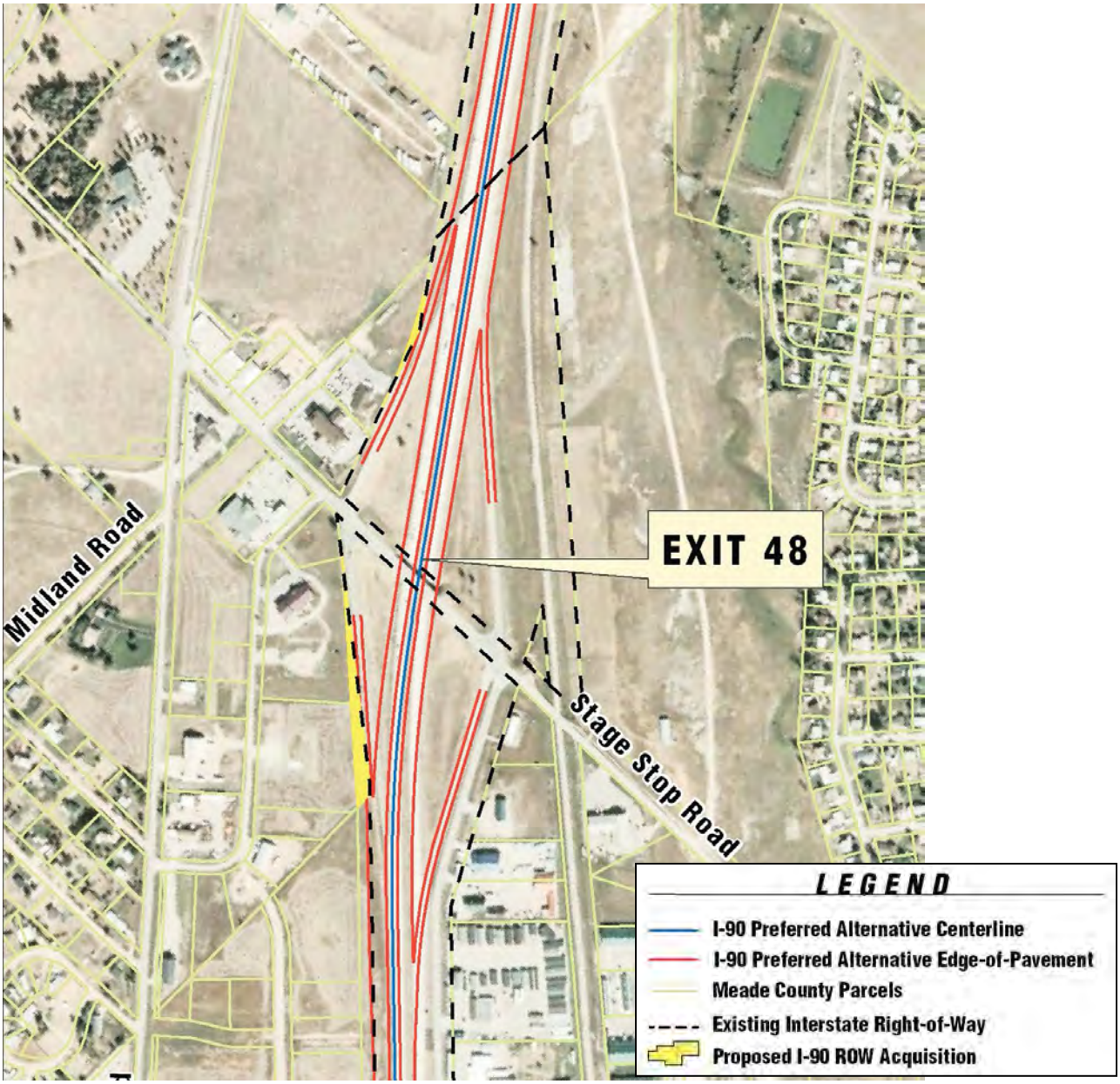
I-90 Exit 48: Stage Stop Road

The adjacent interchange to the southeast of the I-90 Exit 46 interchange is the Exit 48 interchange. The interchange is a skewed diamond configuration, with a spacing of approximately 800 feet between the interchange ramp intersections along Stage Stop Road. Both ramp terminal intersections are currently controlled with STOP signs on the ramps. Exclusive left turn lanes are provided on Stage Stop Road at the interchange ramp intersections. Stage Stop Road has a five-lane cross-section between the interchange and Sturgis Road and a two-lane cross-section to the east of the interchange. There is an at-grade crossing of the RCP&E Railroad that is located approximately 350 feet to the east of the east (westbound I-90) ramp terminal intersection. The existing Exit 48 interchange configuration is shown on the aerial photo in **Figure 8**.

Figure 8. Existing Configuration – I-90 Exit 48

Exit 48 is planned to be reconstructed in the 2021-2030 timeframe. The line diagram of the proposed interchange configuration from the *I-90 Environmental Assessment (Exit 40 to Exit 51)* is shown on **Figure 9**.

Figure 9. Planned Configuration – I-90 Exit 48



3.6 Existing Data

Traffic Volumes

Traffic volume information was provided by SDDOT staff and additional data were gathered by subconsultant resources. The portion of the data provided by the SDDOT included daily traffic volumes summarized by hour along mainline I-90 and historic data from the ATR along I-90 at the Tilford WIM location. The ATR information was used to develop seasonal factors used to adjust counted traffic levels to a representative time of the year designated in collaboration with the Study Advisory Team.

Subconsultant staff conducted intersection turning movement counts and 15-minute interval vehicle classification counts along mainline I-90 and Sturgis Road. Peak hour intersection turning movements were recorded on Tuesday, November 3, 2015 at the 15 arterial street intersections within the study area listed in **Table 3**. The traffic counts were collected in 15-minute intervals between the hours of 6:30 to 8:30 AM and 4:00 to 6:00 PM. All turning movement counts were field collected using video cameras, with counts conducted after compiling video footage. Traffic counts are provided in **Appendix B**.

Table 3. Peak Hour Intersection Turning Movement Count Locations

Ref #	Street #1	Street #2
1.	Chimney Canyon	Sturgis Rd
2.	Deerview Road	EB Ramps
3.	Deerview Road	WB Ramps
4.	Deerview Road	Sidney Stage Rd
5.	Deerview Road	Spring Valley Road
6.	Elk Creek Road	Sturgis Road
7.	Elk Creek Road	EB Ramps
8.	Elk Creek Road	WB Ramps
9.	Exit 46 WB On Ramp	Sidney Stage Road
10.	Elk Creek Road	Future Spring Valley Road / Hills View Drive (East)
11.	Elk Creek Road	Glenwood Drive
12.	Stage Stop Road	Sturgis Road
13.	Stage Stop Road	EB Ramps
14.	Stage Stop Road	WB Ramps
15.	Stage Stop Road	LaRue Road

Daily vehicle classification counts were conducted on Tuesday, November 3, 2015 along Sturgis Road to the north and to the south of Elk Creek Road and along mainline I-90 to the east of the Exit 46 interchange.

The peak hour traffic data were adjusted to represent a September 2015 weekday using seasonal adjustment factors obtained from the Tilford Weigh-In-Motion ATR #901 along mainline I-90 near Tilford to the west of the study area. Daily traffic volumes were adjusted to represent an average annual weekday using data from the Tilford Weigh-In-Motion ATR #901.

Traffic Crash Data

The SDDOT provided GIS information for all of the crashes reported in the study area during the 5-year time period between 2010 and 2014. The information included location and severity along with basic information about type and contributing factors. Individual crash reports were provided for Elk Creek Road through the interchange area to allow the project team to review safety conditions in greater detail.

Regional Travel Demand Model

The RCAMPO recently updated their travel demand model to the Year 2040, and model information was available for use in developing traffic forecasts.

3.7 Operational Performance

Traffic operations were evaluated for the study area interstate segments, interchanges, interstate ramp terminal intersections and adjacent arterial street intersections according to techniques documented in the *HCM 2010*. LOS is a qualitative measure of traffic operational conditions based on roadway capacity and vehicle delay. Levels of service are described by a letter designation ranging from LOS A to LOS F, with LOS A representing the best possible conditions and LOS F representing congested conditions. For unsignalized intersections, motor vehicle LOS is determined for movements that must yield to other vehicles, typically each minor-street movement (or shared movement) and for major-street left turns using criteria from Exhibit 19-1 in *HCM 2010*, as presented in **Table 4**. The critical movement/approach delay is reported for each intersection that was analyzed in this study.

Table 4. STOP-Controlled Intersection Level of Service Criteria

Control Delay (sec/veh)	LOS by Volume-to-Capacity Ratio	
	v/c ≤ 1.0	v/c > 1.0
0-10	A	F
>10-15	B	F
>15-25	C	F
>25-35	D	F
>35-50	E	F
>50	F	F

Note: The LOS criteria apply to each lane on a given approach and to each approach on the minor street. LOS is not calculated for major-street approaches or for the intersection as a whole.
Source: *HCM 2010* Exhibit 19-1

The LOS criteria for basic freeway segments and merge/diverge analyses is based on density, measured in passenger cars per mile per lane (pc/mi/ln), as presented in **Table 5**.

Table 5. Basic Freeway Segments & Merge/Diverge Level of Service Criteria

Level of Service	Freeway Segments Density (pc/mi/ln)	Ramp Junctions Density (pc/mi/ln)
A	≤11	≤10
B	>11-18	>10-20
C	>18-26	>20-28
D	>26-35	>28-35
E	>35-45	>35
F	Demand exceeds capacity >45	Demand exceeds capacity
Source: *HCM 2010* Exhibit 11-5 and Exhibit 13-2		

HCS™ 2010 software was used to develop the LOS calculations based on *HCM 2010* methodology, as contained in the following chapters of *HCM 2010*:

- Chapter 11 – Basic Freeway Segments
- Chapter 13 – Freeway Merge and Diverge Segments
- Chapter 19 – Two-Way STOP-Controlled Intersections

In general, the primary mobility goal for the study is LOS D or better for overall signalized intersection operations and for individual movements at unsignalized intersections; however, it is understood that there might be some instances where minor street level of service is LOS E or LOS F, in which case the volume-to-capacity ratio and 95th percentile queue lengths will also be considered. LOS C or better is the goal for mainline interstate, merge/diverge segments ramp terminal intersections. The distances between interchanges within the study area is far enough such that weaving segments do not exist.

The vehicle classification counts conducted along Sturgis Road indicate a truck percentage of 14 percent, and the vehicle classification counts conducted along mainline I-90 indicate a truck percentage of 12 percent. These truck percentages were used in the analyses. Other parameters, such as peak hour factor (PHF), used in the analyses were determined in accordance with the approved Methods and Assumptions Document.

The existing AM and PM peak hour intersection turning movements at the study area intersections are shown on **Figure 10**.

Figure 10. Existing Intersection Traffic Volumes

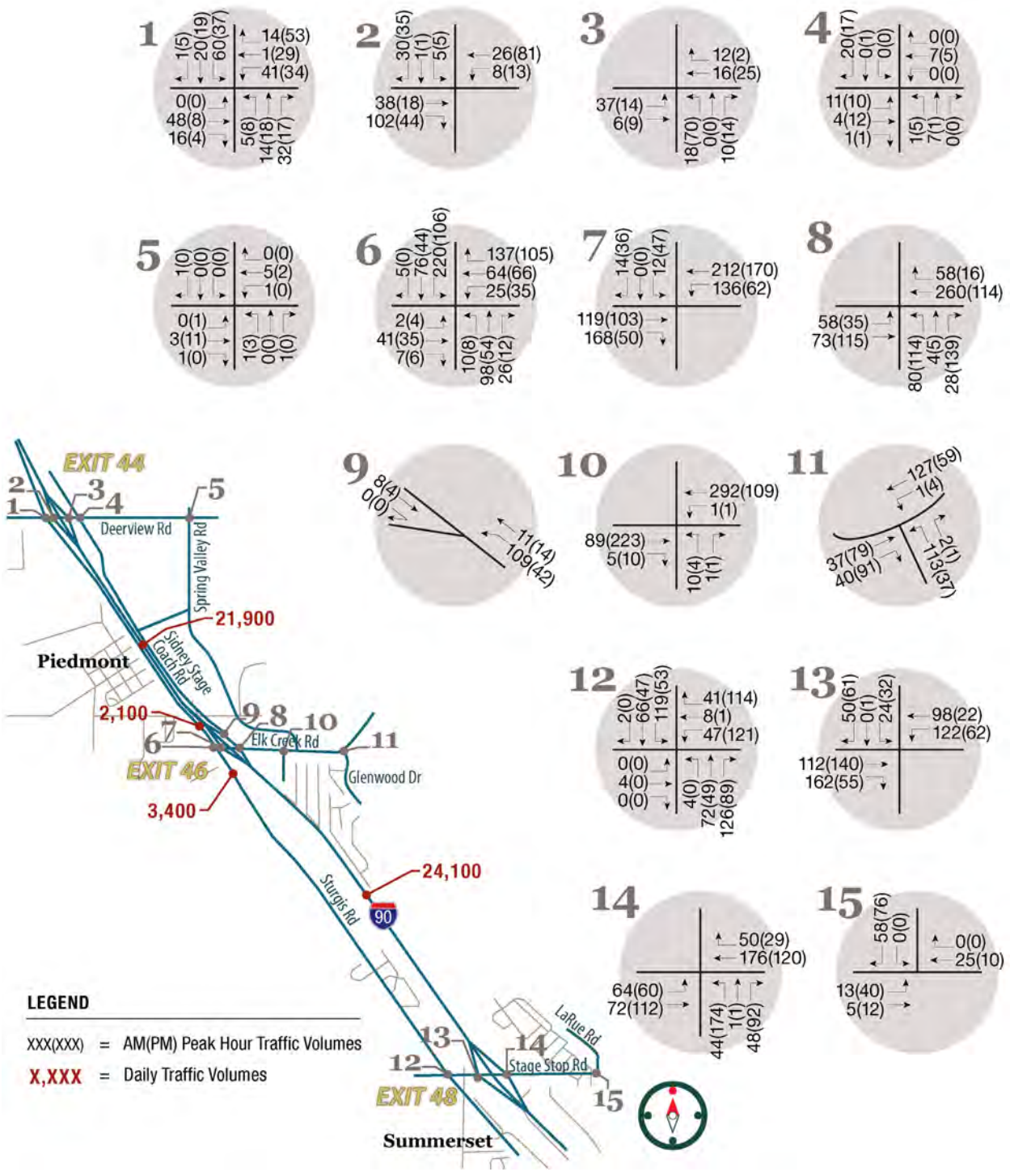


Figure 11 depicts the existing lane geometry and peak hour intersection LOS. **Table 6** summarizes the results of the existing intersection LOS analyses.

Table 6. Existing Peak Hour Intersection Levels of Service

Intersection		Level of Service Critical Approach/Movement	
		AM Peak Hour	PM Peak Hour
1	Chimney Canyon Rd / Sturgis Rd	B (SB)	B (SB)
2	Deerview Rd / EB Ramps	A (SB)	A (SB)
3	Deerview Rd / WB Ramps	A (NB)	A (NB)
4	Deerview Rd / Sidney Stage Rd	A (NB)	A (NB)
5	Deerview Rd / Spring Valley Rd	A (NB)	A (NB)
6	Elk Creek Rd / Sturgis Rd	E (WB)	B (WB)
7	Elk Creek Rd / EB Ramps	B (SB)	A (SB)
8	Elk Creek Rd / WB Ramps	B (NB)	A (NB)
9	Sidney Stage Rd / WB On Ramp	B (SB)	A (SB)
10	Elk Creek Rd / Hills View Dr	B (NB)	B (NB)
11	Elk Creek Rd / Glenwood Dr	B (NB)	B (NB)
12	Stage Stop Rd / Sturgis Rd	C (WB TH/LT)	B (WB TH/LT)
13	Stage Stop Rd / EB Ramps	A (WB LT)	A (SB)
14	Stage Stop Rd / WB Ramps	A (NB)	B (NB)
15	Stage Stop Rd / LaRue Rd	A (SB)	A (SB)

Notes: NB = northbound; EB = eastbound; SB = southbound; WB = westbound; TH = through; LT = left turn

As shown, critical movements through the study intersections currently operate at LOS C or better during the AM and PM peak hours, with the exception of the westbound approach at the Elk Creek Road/Sturgis Road intersection during AM peak hour, which operates at LOS E.

Figure 11. Existing Intersection Lane Geometry and Levels of Service

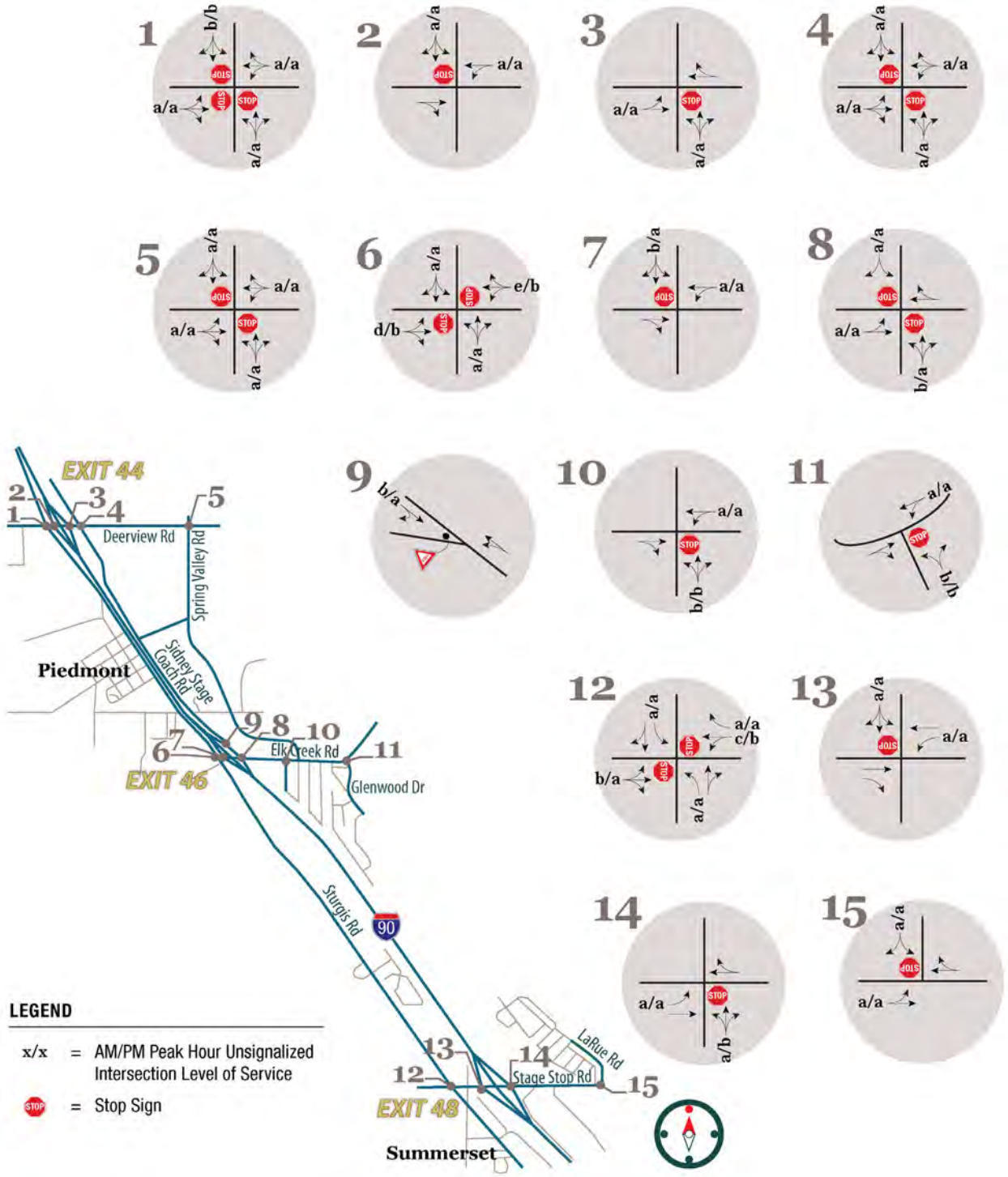


Figure 12 depicts the existing I-90 average weekday daily, eastbound and westbound peak hour mainline I-90 and ramp merge/diverge traffic volumes. **Figure 12** also shows the results of the basic freeway segments and merge/diverge LOS analyses for existing conditions. **Table 7** summarizes the results of the basic freeway segments analyses. Basic freeway segments along mainline I-90 currently operate at LOS A during the AM and PM peak hours.

Table 7. Existing Mainline I-90 Levels of Service

Interstate Direction/Segment	AM Peak Hour LOS	PM Peak Hour LOS
EB I-90 west of Exit 44	A	A
WB I-90 west of Exit 44	A	A
EB I-90 west of Exit 46	A	A
WB I-90 west of Exit 46	A	A
EB I-90 east of Exit 46	A	A
WB I-90 east of Exit 46	A	A
EB I-90 east of Exit 48	A	A
WB I-90 east of Exit 48	A	A

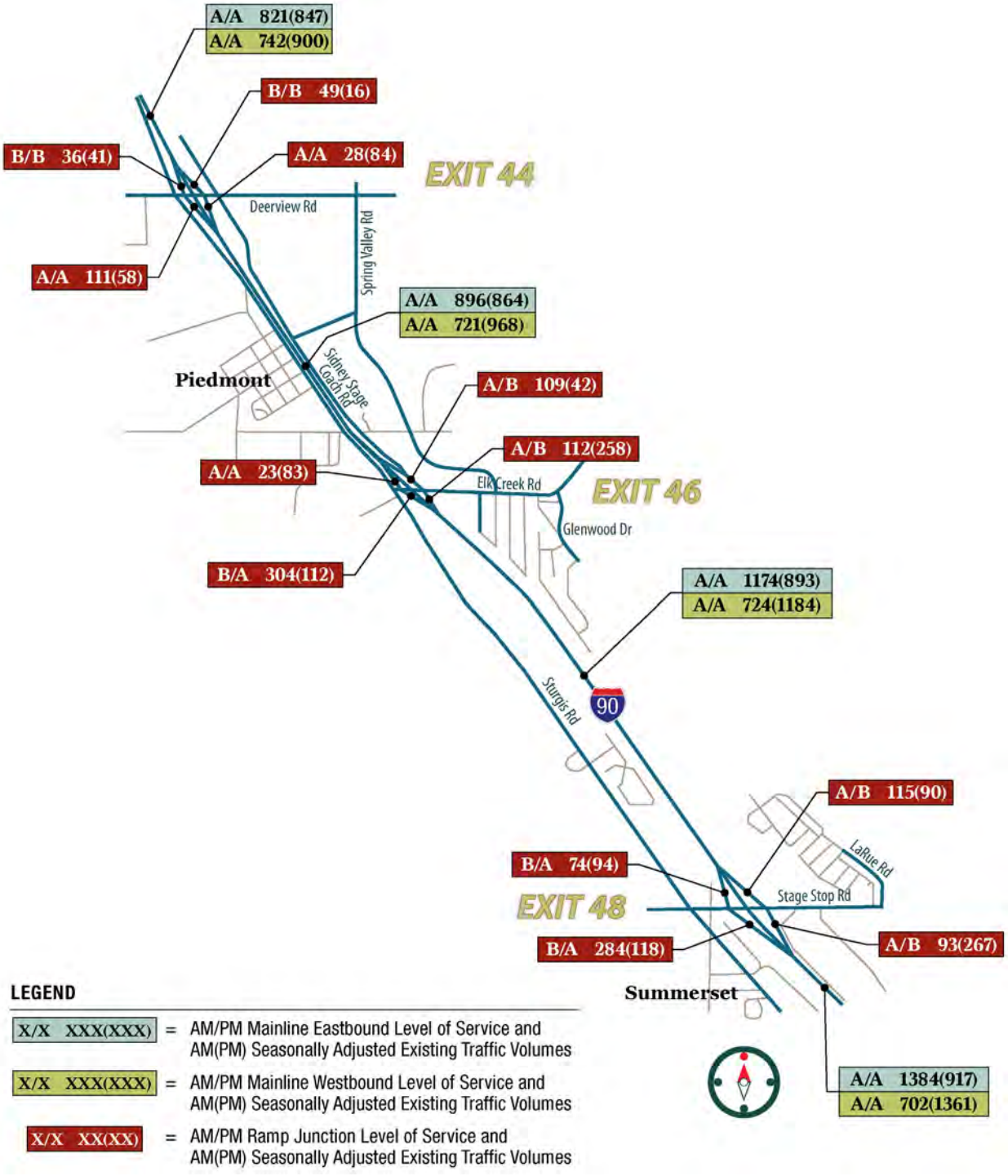
Ramp junctions within the study area currently operate at LOS B or better during the AM and PM peak hours, as depicted on **Figure 12** and summarized in **Table 8**.

Table 8. Existing Ramp Junction Levels of Service

Interchange	Ramp	Movement	AM Peak LOS	PM Peak LOS
Exit 44	I-90 EB Off-Ramp	Diverge	B	B
	I-90 WB Off-Ramp	Diverge	A	A
	I-90 EB On-Ramp	Merge	A	A
	I-90 WB On-Ramp	Merge	B	B
Exit 46	I-90 EB Off-Ramp	Diverge	A	A
	I-90 WB Off-Ramp	Diverge	A	B
	I-90 EB On-Ramp	Merge	B	A
	I-90 WB On-Ramp	Merge	A	B
Exit 48	I-90 EB Off-Ramp	Diverge	B	A
	I-90 WB Off-Ramp	Diverge	A	B
	I-90 EB On-Ramp	Merge	B	A
	I-90 WB On-Ramp	Merge	A	B

Existing conditions LOS worksheets are included in **Appendix C**.

Figure 12. Existing I-90 Traffic Volumes and Levels of Service



Bicycle and Pedestrian Facilities

To facilitate a quantitative comparison of existing conditions and build-out conditions, the NCHRP Report 616 methodology was used to analyze bicycle and pedestrian LOS. The LOS analysis described in this report does not focus on delay and capacity of the pedestrian and bicyclist facilities, but rather the quality of the experience for a user of the facilities. This approach was selected because of the relatively low traffic volume nature of this interchange. The analysis methodology considers facility width, hourly and daily traffic volumes, travel speeds, and other quantitative measures of the facility's components. The result of the analysis is a LOS rating with "A" representing the best possible conditions and "F" representing a poor experience for the end user, similar to the LOS described in previous sections.

There is some demand for non-motorized travel across I-90 in the vicinity of Exit 46, given the presence of residential neighborhoods on both sides of I-90 and amenities such as schools and retail located to the west of I-90. However, the existing Exit 46 interchange and the Elk Creek Road corridor on either side of the interchange currently has no designated pedestrian or bicycle facilities. The Elk Creek Road bridge over I-90 is narrow and without sidewalks or paths, and no sidewalks exist along Elk Creek Road. Reflecting this deficient condition, existing conditions LOS analyses reveal an average LOS C for pedestrians and LOS D for bicyclists.

3.8 Existing Safety Conditions

Crash data for the most recent five-year period (2010-2014) was analyzed. Within the Exit 46 influence area (including Elk Creek Road through the interchange, mainline I-90, and interchange ramps), a total of 56 crashes were reported over this five-year period. General crash trends are summarized as follows:

- There were no fatalities, 11 injury crashes, and 45 property damage only (PDO) crashes.
- Thirty-seven of the crashes involved one motor vehicle and 19 of the crashes involved two motor vehicles.
- Nine crashes occurred during icy, snowy, or wet roadway conditions.
- There were 17 fixed object related crashes, 14 wild/domestic animal related crashes, 11 angle crashes, four overturning crashes, three rear end crashes, one side swipe same direction crash, and one head on crash. Of the fixed object related crashes, nine were guardrail crashes, two were light/luminaire supports, and the remaining six crashes were other roadside objects.

The crashes reported within the Exit 46 influence area between the years 2010-2014 are depicted on **Figure 13**.

No correctable patterns of crashes were detected within the Exit 46 influence area; however, a higher percentage of crashes were concentrated around the Elk Creek Road / Sturgis Road intersection. This intersection accounted for 14 of the 56 total crashes reported (25 percent). No specific patterns were identified at this intersection, but several contributing factors exist along Elk Creek Road. These contributing factors include closely spaced intersections, skewed intersection approaches, poor vertical sight distance over the Exit 46 bridge, and poor turning radii for large vehicles. A diagram of collisions in this area is provided on **Figure 13**.

Figure 13. 2010-2014 Crash History

3.9 Existing Environmental Constraints

An Environmental Assessment (EA) was conducted in 2008 for the entire I-90 corridor from MRM 40 to MRM 51, following from the *I-90 Black Hawk – Sturgis Corridor Preservation Study*. The EA evaluated environmental impacts associated with the Preferred Alternative for the study corridor, which included Exit 46. Some environmental resources were noted in the Exit 46 area, including right-of-way and hazardous materials. The EA concluded in 2008 with a Finding of No Significant Impact (FONSI) associated with the Preferred Alternative.

4.0 NEED

4.1 Geometric

The following substandard conditions would persist when analyzed in light of the current *South Dakota Department of Transportation Road Design Manual*:

1. No provision for turn lanes along Elk Creek Road, which would be needed based on minimum traffic volume thresholds listed in the standards
2. Substandard sag k-values relating to headlight sight distance on Ramps C (I-90 EB Off-Ramp) and D (I-90 WB On-Ramp
3. Though extended in recent years, the taper rates for the ramps to I-90 remain just below the 50:1 standard at 39:1 for the WB on ramp and 43:1 for the EB on ramp.
4. Substandard control of access spacing between the ramp terminal intersections and adjacent intersections (approximately 50 feet to Sturgis Road on the west and 125 feet to the nearest access to the east) and at-grade railroad crossing (approximately 45 feet east of ramp terminal). Standards specify a desired spacing of 660 feet, with a minimum of 100 feet.
5. Substandard intersection: connection of the Sidney Stage Road with the I-90 westbound on ramp
6. The clear zone for recovery along ramps less than 30 feet
7. The inslopes for the on ramps being 3:1 (6:1 standard)
8. The minimum right shoulder width measured at 2-4 feet along ramps (8 feet standard)
9. The minimum horizontal curve radius along ramps, measured at 310 feet (838 feet standard)

These substandard geometric conditions contribute to the prohibition of pedestrians crossing the bridge, as shown in the photo on the right, taken from the west side of the interchange looking across the bridge. The photo also illustrates the substandard control of access spacing between the ramp terminals and adjacent intersection.

In addition, the skew of the interchange creates conflicts between vehicles on the bridge and semi-tractor trailer turning movements at the ramp terminal/service road intersections, as depicted in the photo on the left (photo credit: A. Olson, September 2015).

4.2 Pavement

The need to replace or rehabilitate the pavement is often the driving force behind the timing of the majority of construction projects on the state highway system. The pavement of the existing I-90 mainline through Exit 46 is Hot Mix Asphalt on Portland Cement Concrete, last improved in the Year 2012. Pavement conditions along I-90 are currently acceptable, with improvements beyond the developmental program, but anticipated for the Year 2026 or 2027. No pavement information was available for Elk Creek Road.

4.3 Safety

The Exit 46 interchange ranked 53rd of 62 interchanges evaluated in Phase 1 of the *2000 Interstate Corridor Study* and 39th of 126 interchanges in the *2010 Interstate Corridor Study*. Neither study noted Exit 46 as a high crash location. A review of reported crashes between the Year 2010 and Year 2014 revealed no significant recurring crash patterns. Multiple safety concerns associated with the interchange were noted in meetings with members of the public and project stakeholders, including the observation that large semi tractor-trailers regularly experience difficulty making the tight turns inherent in the interchange configuration and occasionally strike guardrail or get stuck.

4.4 Structural

Constructed in 1957, the Elk Creek Road bridge over mainline I-90 at the current interchange is in structurally sufficient condition, but is functionally obsolete. The bridge is functionally obsolete because of its narrow width, insufficient span to accommodate future mainline I-90 widening, and sharp vertical curvature causing a posted regulatory speed limit of 15 mph, well below the posted speed limit along Elk Creek Road away from the interchange.

4.5 Traffic

The updated future traffic forecasts and operational analyses completed for the IMJR indicate that, in general, the Exit 46 interchange and study area intersections, are projected to operate acceptably through the year 2045, with the exception of a few critical movements/intersection approaches.

The analyses indicate that the No Build and Build scenarios are anticipated to operate comparably; however, the Build scenario provides the ability to evaluate the need for auxiliary

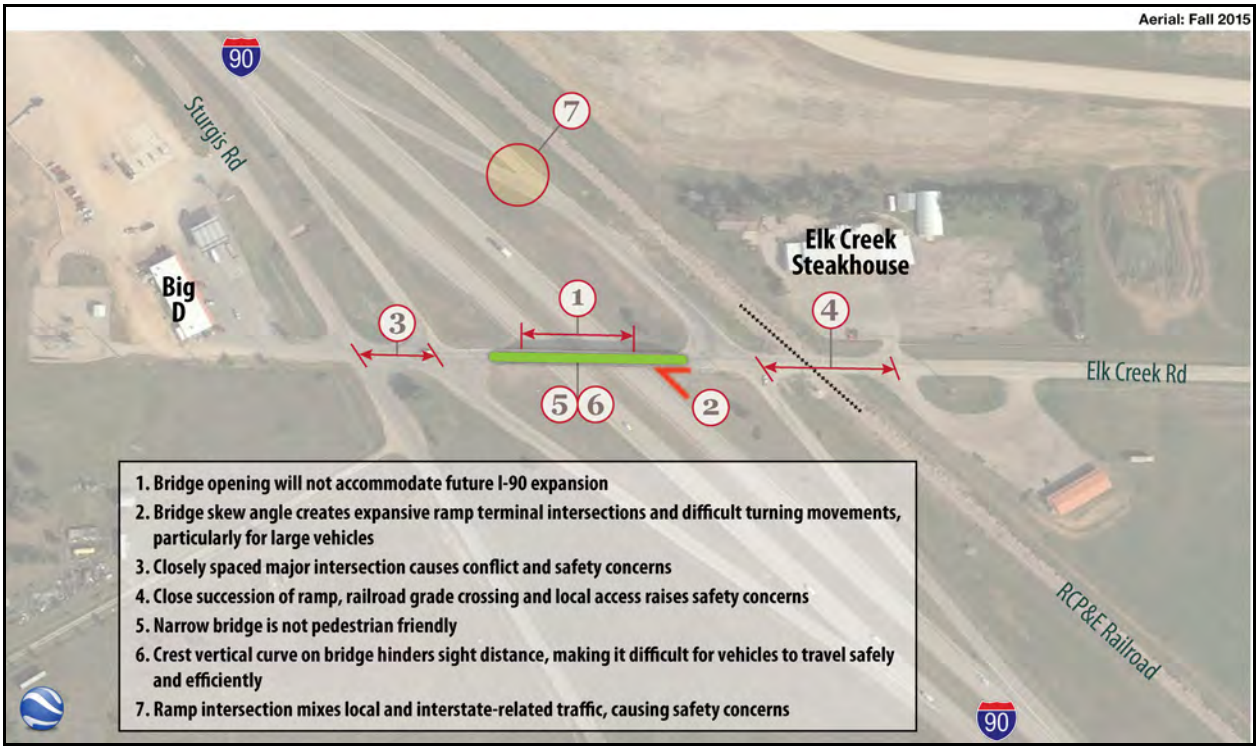
lanes at intersections and add them, as necessary. There are currently no intersection turn lanes at the Exit 46 interchange ramp terminal intersections or along Elk Creek Road, though future traffic volumes would warrant installation of turn lanes based on SDDOT *Road Design Manual* criteria.

Previous traffic analysis of the interchange resulted in similar findings, described as follows:

- The *Interstate 90 Black Hawk – Sturgis Corridor Preservation Study* concluded that traffic operations are not currently an issue at the Exit 46 interchange. When the existing (No Build) configuration was evaluated for the year 2025, the interchange ramp terminal intersections with the crossroad indicated an anticipated deterioration to a LOS C during the average AM and PM peak hours. The Study also indicated that mainline capacity may require an expansion of mainline from 2 through lanes to 3 through lanes in each direction sometime beyond the planning horizon. This potential future expansion of mainline I-90 capacity could not be accommodated with the current Exit 46 bridge.
- *South Dakota Department of Transportation Decennial Interstate Corridor Study* completed in February 2001 evaluated projected year 2010 and 2020 traffic conditions at the Exit 46 interchange and concluded that all ramp merge/diverge movements and ramp terminal intersections are projected to operate at LOS B or better through the year 2020.

Figure 14 provides an overview of the deficiencies associated with Exit 46, all of which contribute to the need for an interchange modification.

Figure 14. Exit 46 Deficiencies



5.0 ALTERNATIVES

Alternatives for the Exit 46 interchange were initially developed and evaluated as part of the *Interstate 90 Black Hawk – Sturgis Corridor Preservation Study*. The study developed three configuration options for the interchange area. A brief description of the No Build and three build alternatives follows:

5.1 No Build Alternative

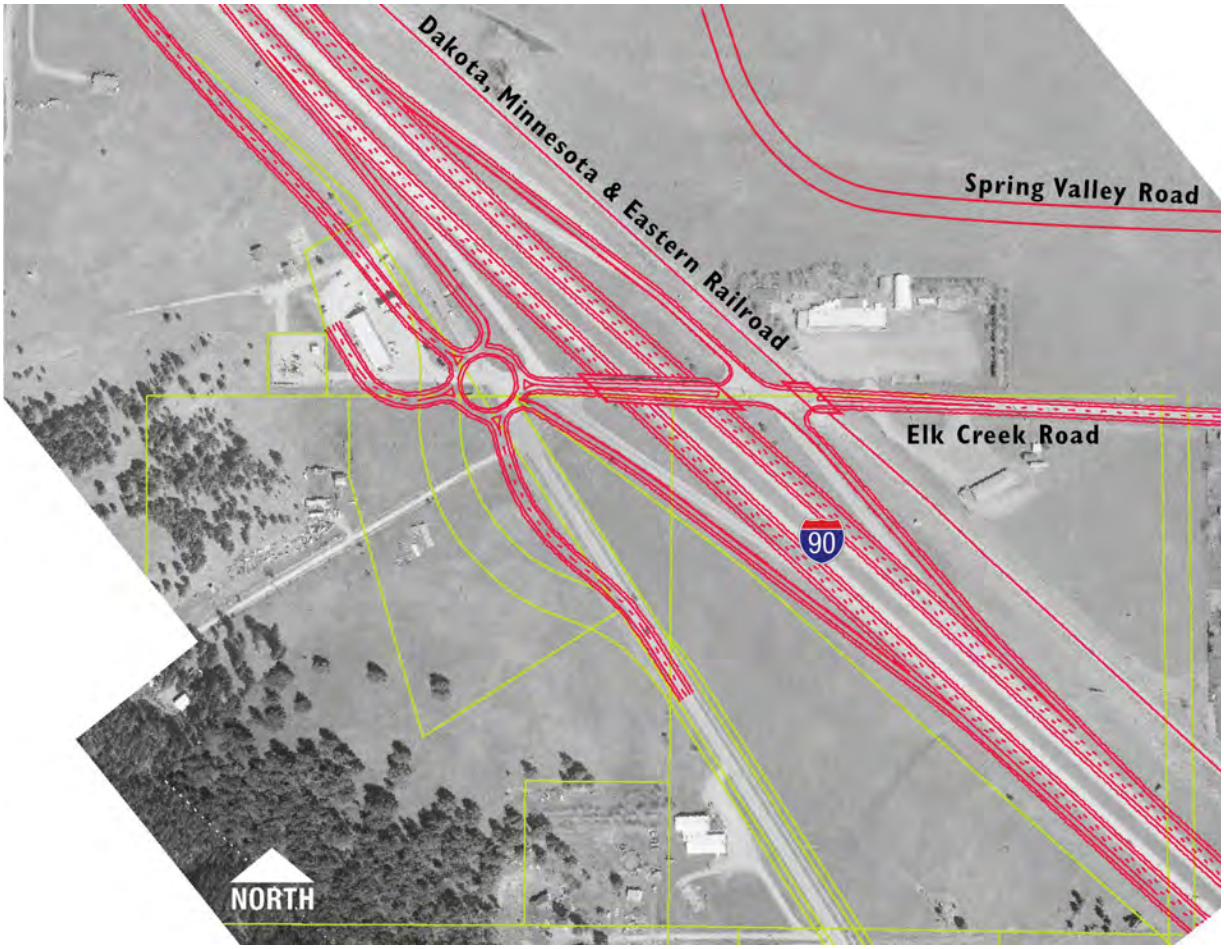
The No Build Alternative would maintain the Exit 46 interchange in its current configuration. The ramp terminals at the existing diamond interchange at Exit 46 (Elk Creek Road) are extremely close to the interstate service road, and in fact, the service road on the east side (Sidney Stage Road) currently intersects with the westbound I-90 on ramp. A project that realigned the east service road (Spring Valley Road) to the east to align opposite Hills View Drive has been completed, and the east service road intersection with the westbound I-90 on ramp is planned to be removed in the future as a separate standalone project, likely prior to the Year 2020.

5.2 Interchange Build Alternatives

The interchange build alternatives are depicted on **Figures 15-17**, as conceptualized in the *I-90 Black Hawk to Sturgis Corridor Preservation Study*.

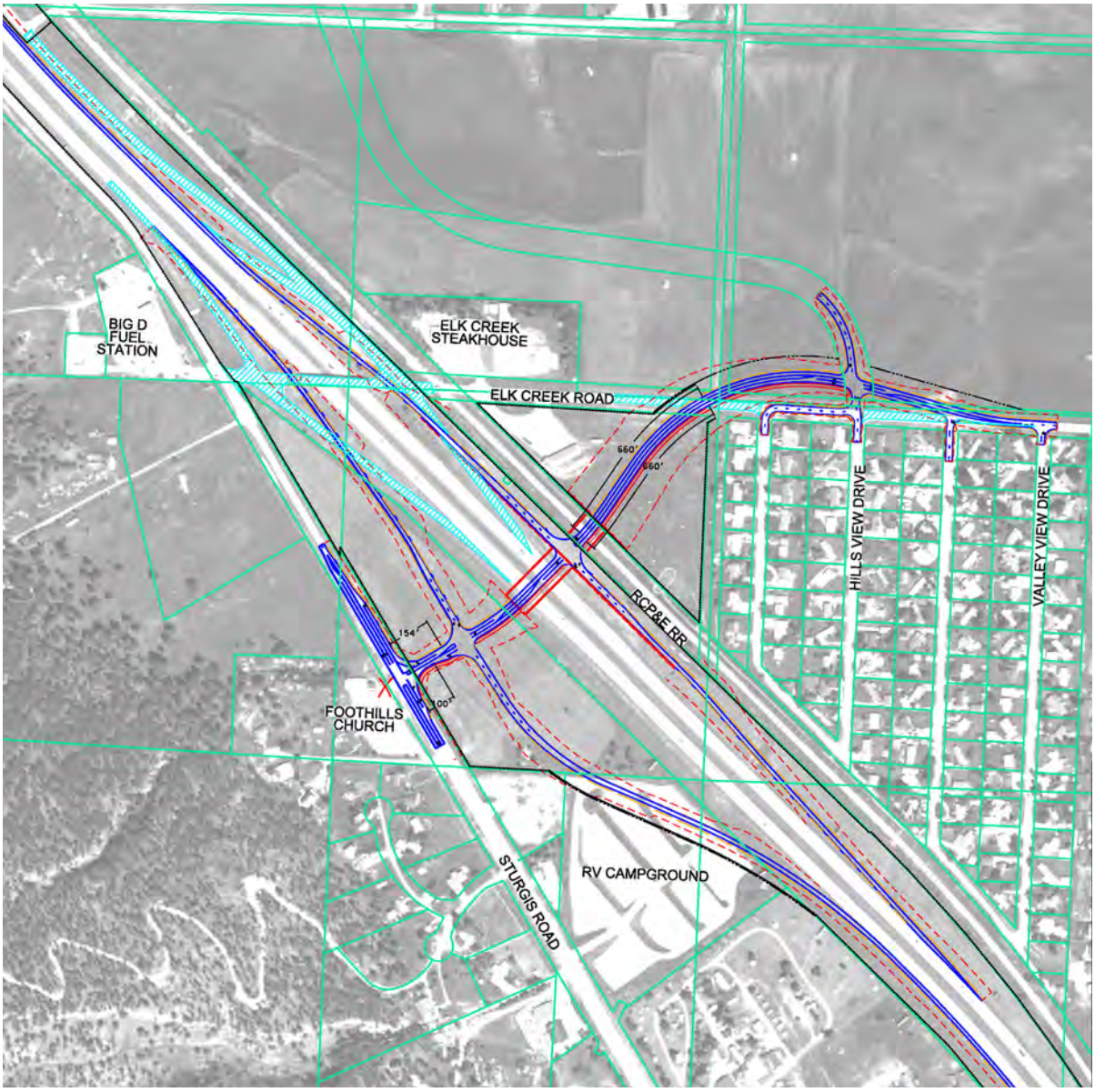
Shown on **Figure 15**, Alternative 1 would keep the existing diamond interchange configuration in its current location but realign the interstate service roads to provide increased intersection spacing. A new bridge over I-90 would be constructed with a flatter crest vertical curve to improve vertical sight distance crossing over I-90. A grade-separated railroad crossing would also be incorporated into the design with a second structure provided over the railroad. The eastbound and westbound on and off ramps would also be rebuilt to provide increased length. Alternative 1 also reserves the option to construct a six-legged, single-lane roundabout intersection that would tie together the intersections of Elk Creek Road and Sturgis Road with the eastbound ramp terminal and access to the Big D.

Figure 15. Alternative 1: Diamond Interchange with Realigned Service Roads



Shown on **Figure 16**, Alternative 2 was identified in the EA as the preferred alternative. Alternative 2 would relocate the Exit 46 interchange approximately ¼ mile to the southeast, where Sturgis Road lies farther away from mainline I-90, and reconfigure the diamond interchange to cross over I-90 at a nearly perpendicular angle, significantly reducing the skew angle at the ramp terminal intersections. A new bridge over I-90 would be constructed with a flatter crest vertical curve to improve vertical sight distance crossing over I-90, and a shared-use path could be added on the new bridge to provide a pedestrian/bicycle facility across I-90. A grade-separated railroad crossing would be incorporated into the design with a second bridge provided over the railroad. The north access to the Foothills Community Baptist Church would be closed upon implementation of Alternative 2.

Figure 16. Alternative 2: Relocated Diamond with Realigned North Service Road



As the design of Alternative 2 progressed through development of the EA, the proposed realignment of Elk Creek Road became more pronounced to the north to allow for additional distance to accumulate height to cross the railroad and I-90 and the Elk Creek Road bridge became more perpendicular to mainline I-90. The design is further depicted on **Figures 29** and **30** in this IMJR.

Shown on **Figure 17**, Alternative 3 would relocate the Exit 46 interchange approximately ¼ mile to the southeast and construct a single point urban interchange (SPUI) interchange that would cross mainline I-90 at a nearly perpendicular angle. With a SPUI, the four exit and entrance ramps converge to one intersection on the cross street, typically controlled with a traffic signal. A new bridge over I-90 would be constructed with a flatter crest vertical curve to improve vertical sight distance crossing over I-90, and a shared-use path could be added on the new bridge to provide a pedestrian/bicycle facility across I-90. A grade-separated railroad crossing would be incorporated into the design with a second bridge provided over the railroad.

Figure 17. Alternative 3: Single Point Interchange with North Service Road Connection

5.3 Transportation System Management Alternative

There are no areas within the State of South Dakota that will consistently experience congestion levels extreme enough for Transportation System Management (TSM) measures such as ramp metering or high occupancy vehicle (HOV) facilities to be economically feasible in the foreseeable future.

6.0 FUTURE YEAR TRAFFIC

6.1 Travel Demand Forecasting

The IMJR Methods and Assumptions Document describes the growth projection methodology used in the study. As outlined therein, information from the RCAMPO Year 2040 travel demand model was used to develop traffic volume forecasts for both the anticipated year of project completion (2021) and the planning horizon year (2045) along the study corridor.

To enhance the accuracy of the forecasts, and as requested by FHWA staff, the forecasting process also incorporated a comparison of base year traffic volumes in the model with comparable current traffic counts. Differences between the model information and actual counts may be utilized to adjust future year forecasts to address any systemic errors in the travel demand model.

Existing year daily count data were recorded for one location on mainline I-90 in November 2015. The mainline I-90 count data required a conversion from Average Daily Traffic (ADT) to Average Annual Weekday Traffic (AAWDT) because the model information reflects an average weekday condition. This adjustment was made using information from the Tilford Weigh-In-Motion ATR #901, which continuously records traffic volumes along mainline I-90 to the west of the study area. A comparison of the base year model estimated volume compared to the recorded count is shown in **Table 9**. There is good correlation between the counts and model.

Table 9. Traffic Count Comparison

Road Location		2015 Count AAWDT	2013 Model	2040 Model	Adjusted 2040 Forecast
Mainline I-90	Exit 46 to Exit 48	21,800	23,533	35,459	35,121

Because modeled I-90 traffic volumes and counted traffic demonstrated good consistency, future year travel demand forecasts were developed using straight line growth rates calculated directly from the model. Traffic volumes were assumed to grow on a straight line basis between the model years of 2013 and 2040. Year 2021 forecasts were developed by interpolating growth along a straight line between the travel demand model base year of 2013 and 2040. Year 2045 forecasts were developed by extending the growth rates from the travel demand model an additional five years beyond the year 2040 along a straight line.

Determined by the study area for this IMJR, growth rates were developed for mainline I-90 and each interchange area.

To begin, a growth rate was developed for locations within the study area by comparing the year 2013 and year 2040 travel demand models. Where growth rates determined from the model for interchange ramps were lower than the intersecting cross-street growth rates, the rate for the interchange ramps was matched to the intersecting cross-street. The minimum rate of growth throughout the study area was set to 1.50 percent per year, which is consistent with the mainline I-90 growth rate. The growth rates and growth factors developed for each road segment are shown in **Table 10**.

Table 10. Study Area Growth Rates & Growth Factors

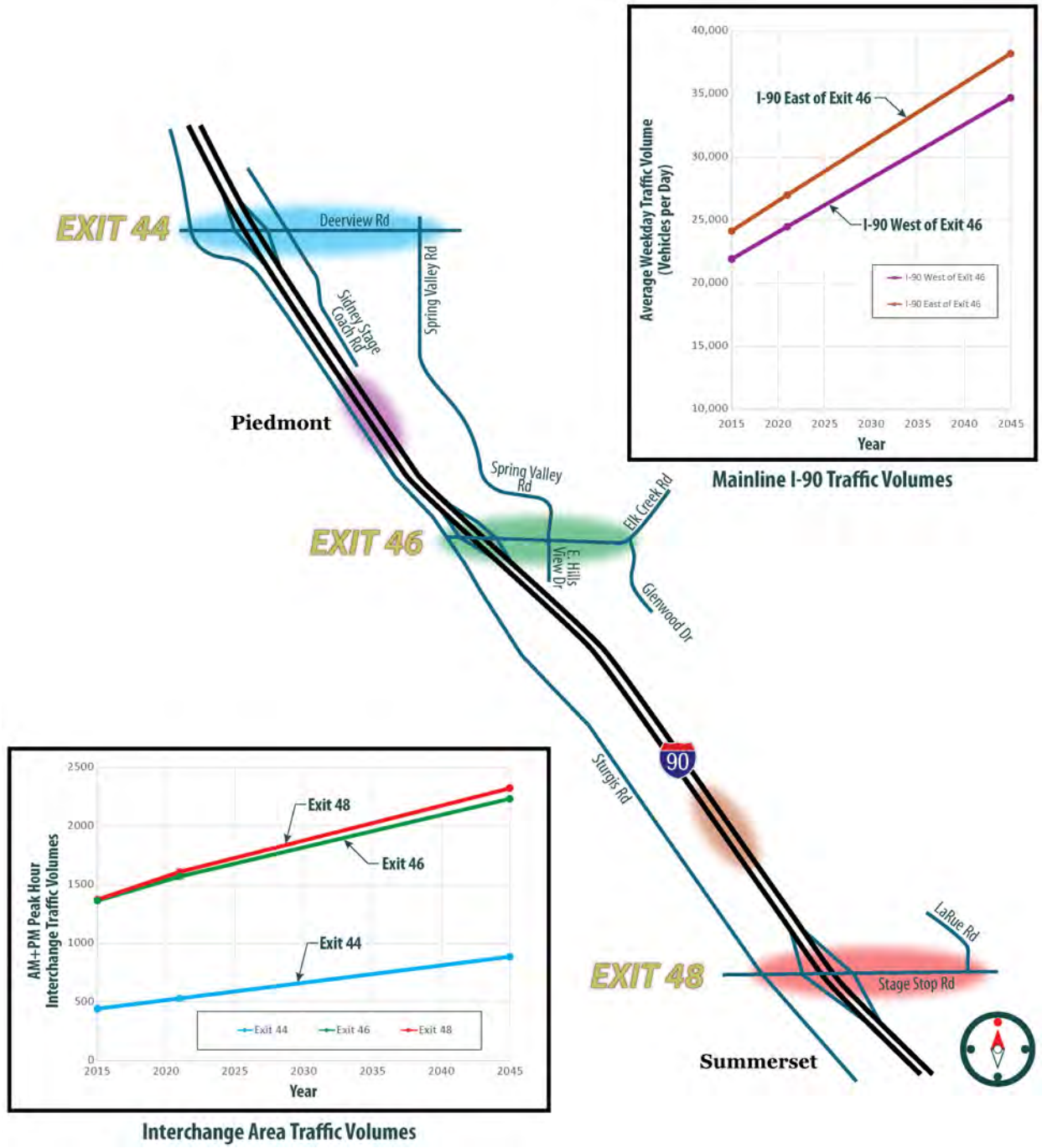
Road Location	Growth Rate	2021 Growth Factor	2045 Growth Factor
Mainline I-90	1.52%	1.12	1.58
Exit 44 / Deerview Rd	2.48%	1.19	1.97
Sturgis Rd n/o Deerview Rd & n/o Elk Creek Rd	1.50%	1.11	1.53
Exit 46 / Elk Creek Rd	1.63%	1.12	1.58
Exit 48 / Stage Stop Rd	1.77%	1.13	1.64
Sturgis Rd	1.57%	1.11	1.56

The respective growth factors for the years 2021 and 2045 were applied to the existing intersection turning movements. Turning movements between intersections along the respective study corridors were balanced, as appropriate.

Figure 18 illustrates the future growth forecasts for mainline I-90 and the Exit 44, Exit 46 and Exit 48 interchanges.

Future traffic volume forecasts were developed for both the No Build and Build scenarios. The differences for projected traffic volumes between the No Build and Build scenarios are limited to the Exit 46 interchange and Elk Creek Road corridor. For this reason, the Build scenario analyses focus on these areas and assumes that the traffic volumes along the Exit 44, Exit 48, Deerview Road, Sturgis Road and Stage Stop Road corridors will remain the same regardless of whether Exit 46 is modified.

Figure 18. Future Growth Forecasts



6.2 Traffic Conditions

Year 2021 No Build Alternative

The projected year 2021 AM and PM peak hour intersection turning movements corresponding to the No Build alternative are shown on **Figure 19**.

Figure 20 depicts the year 2021 peak hour intersection LOS for the No Build alternative. **Table 11** summarizes the results of the intersection LOS analyses.

Table 11. Year 2021 No Build Peak Hour Intersection Levels of Service

Intersection		Level of Service Critical Approach/Movement	
		AM Peak Hour	PM Peak Hour
1	Chimney Canyon Rd / Sturgis Rd	B (SB)	B (SB)
2	Deerview Rd / EB Ramps	A (SB)	A (SB)
3	Deerview Rd / WB Ramps	A (NB)	A (NB)
4	Deerview Rd / Sidney Stage Rd	A (NB)	A (NB)
5	Deerview Rd / Spring Valley Rd	A (NB/SB)	A (NB/SB)
6	Elk Creek Rd / Sturgis Rd	D (WB)	B (WB)
7	Elk Creek Rd / EB Ramps	B (SB)	A (SB)
8	Elk Creek Rd / WB Ramps	B (NB)	B (NB)
9	Sidney Stage Rd / WB On Ramp	A (NB)	A (NB)
10	Elk Creek Rd / Hills View Dr	B (NB)	B (NB)
11	Elk Creek Rd / Glenwood Dr	B (NB)	B (NB)
12	Stage Stop Rd / Sturgis Rd	C (WB TH/LT)	B (WB TH/LT)
13	Stage Stop Rd / EB Ramps	A (WB LT)	A (SB)
14	Stage Stop Rd / WB Ramps	A (NB)	B (NB)
15	Stage Stop Rd / LaRue Rd	A (SB)	A (SB)

Notes: NB = northbound; EB = eastbound; SB = southbound; WB = westbound; TH = through; LT = left turn

Based on the Year 2021 No Build scenario, movements through the study intersections are projected to operate at LOS C or better during the AM and PM peak hours, with the exception of the westbound approach at the Elk Creek Road/Sturgis Road intersection during AM peak hour, which is projected to operate at LOS D. This slight improvement compared to existing conditions is attributable to a higher peak hour factor being applied in accordance with the Methods and Assumptions Document. This was done because vehicle arrivals tend to become more evenly distributed throughout the peak hour as traffic volumes increase.

Figure 19. Year 2021 No Build Intersection Traffic Volumes

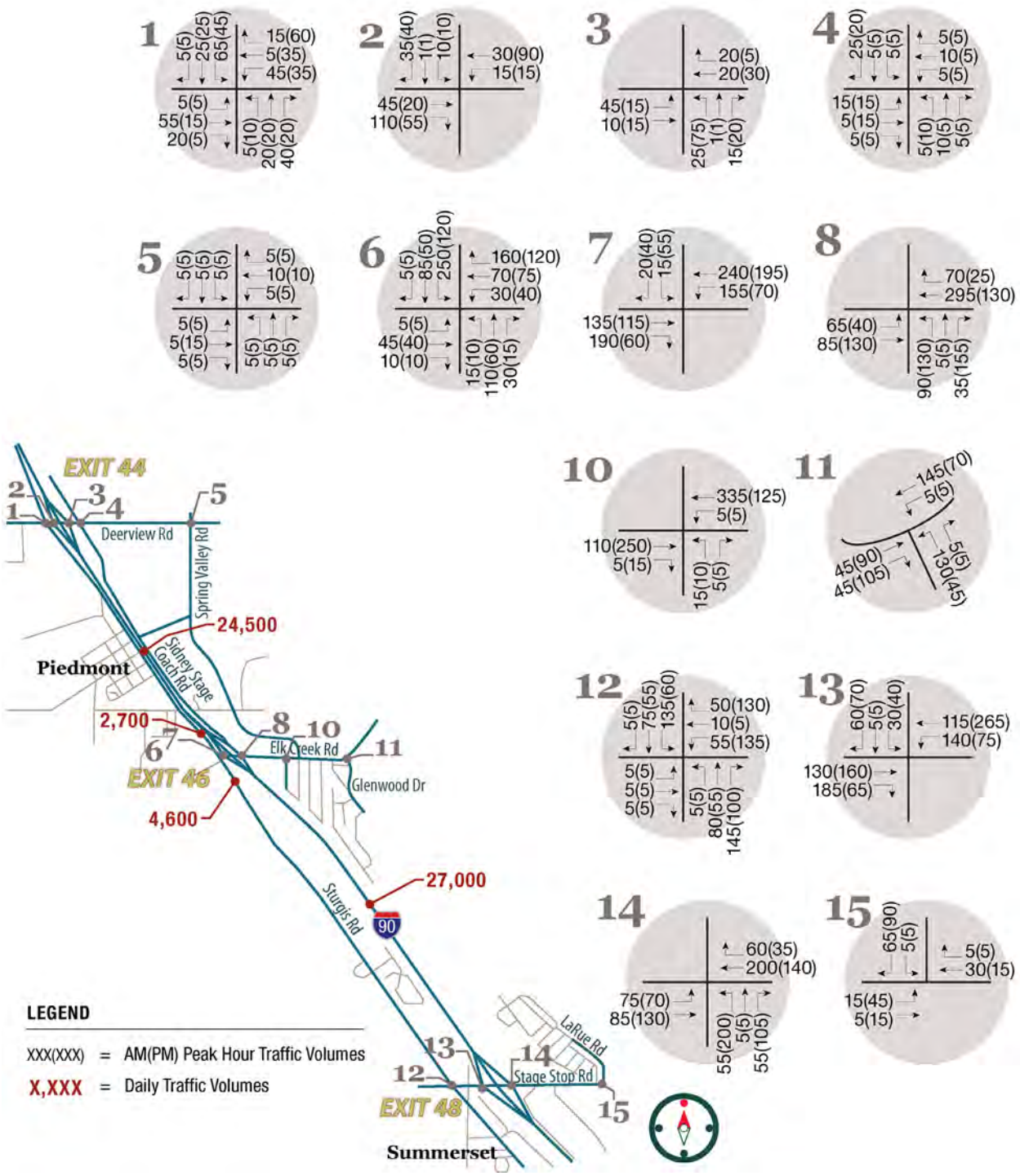
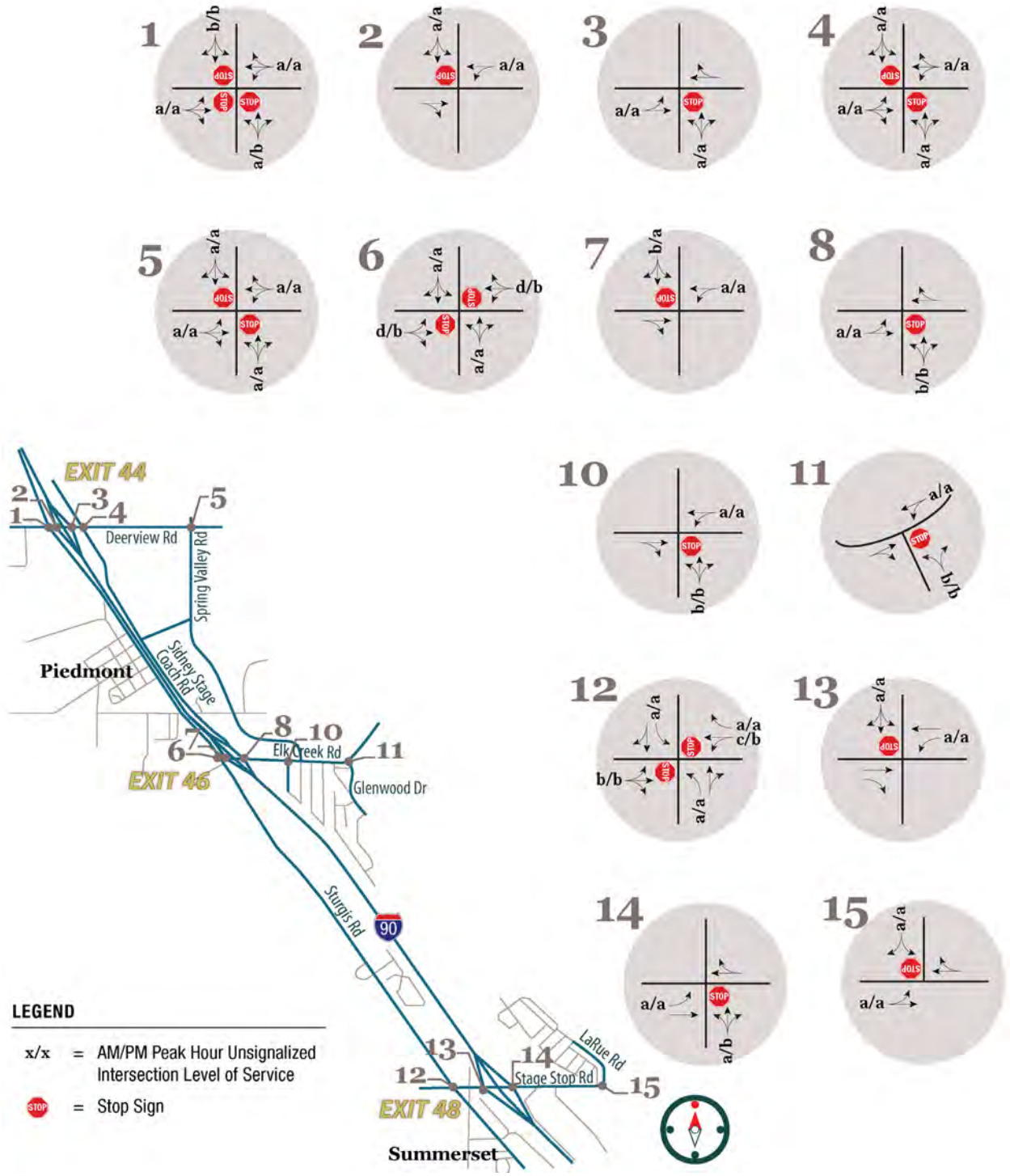


Figure 20. Year 2021 No Build Intersection Lane Geometry and Level of Service



Basic freeway segments along mainline I-90 are projected to operate at LOS B or better during the AM and PM peak hours based on the Year 2021 No Build analyses. **Figure 21** depicts the projected year 2021 I-90 average weekday daily, eastbound and westbound mainline and ramp merge/diverge traffic volumes for the No Build Alternative. **Figure 21** also shows the results of the basic freeway segments and merge/diverge LOS analyses for the Year 2021 No Build alternative. **Table 12** summarizes the results of the basic freeway segments analyses.

Table 12. Year 2021 No Build Mainline I-90 Levels of Service

Interstate Direction/Segment	AM Peak Hour LOS	PM Peak Hour LOS
EB I-90 west of Exit 44	A	A
WB I-90 west of Exit 44	A	A
EB I-90 west of Exit 46	A	A
WB I-90 west of Exit 46	A	A
EB I-90 east of Exit 46	A	A
WB I-90 east of Exit 46	A	A
EB I-90 east of Exit 48	B	A
WB I-90 east of Exit 48	A	B

Compared to existing conditions, the eastbound and westbound directions of mainline I-90 to the east of Exit 48 are projected to degrade from LOS A to LOS B during the AM and PM peak hours, respectively, based on the Year 2021 No Build scenario.

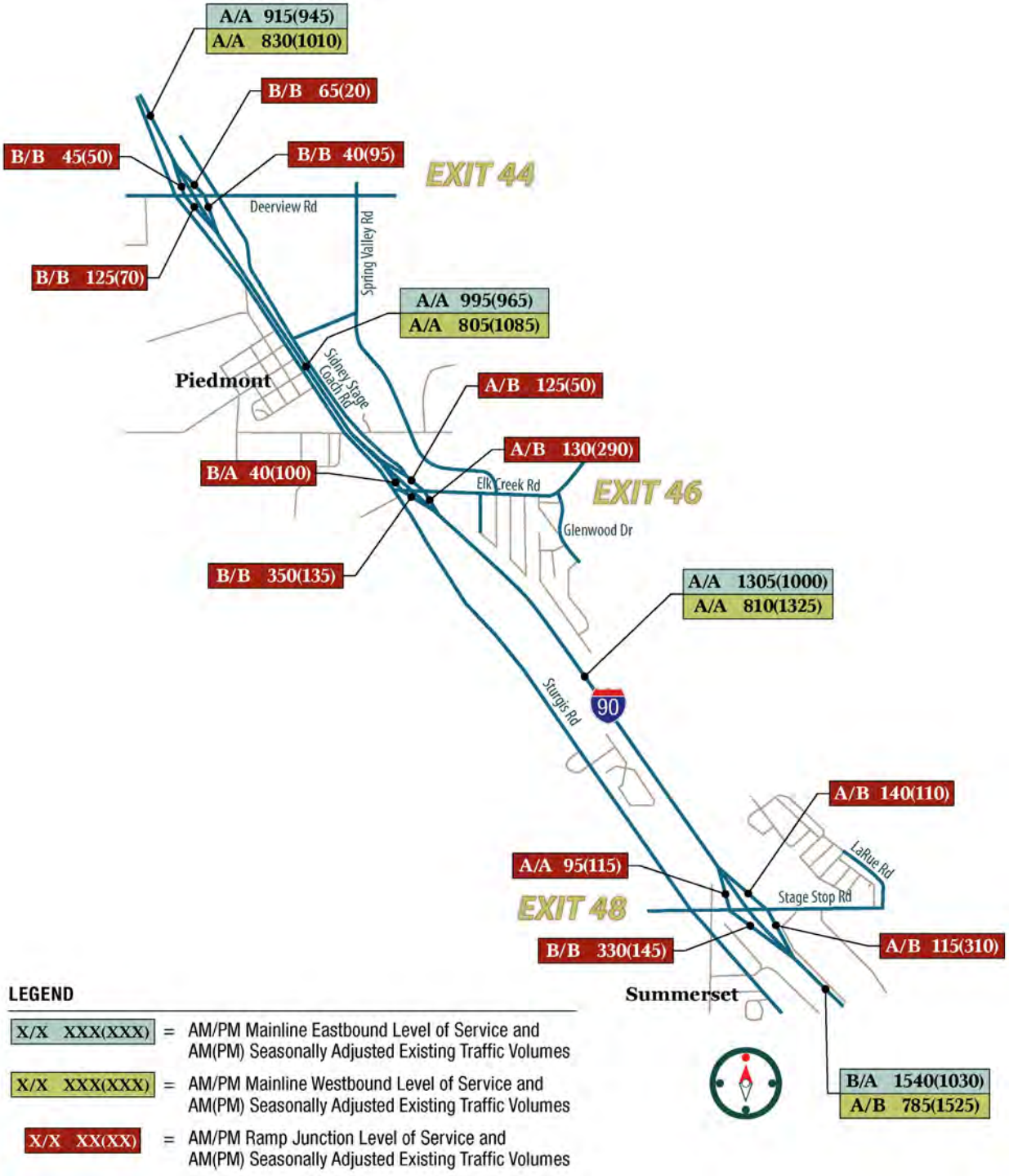
Ramp junctions within the study area are projected to operate at LOS B or better during the AM and PM peak hours based on the Year 2021 No Build scenario, as depicted on **Figure 21** and summarized in **Table 13**.

Table 13. Year 2021 No Build Ramp Junction Levels of Service

Interchange	Ramp	Movement	AM Peak LOS	PM Peak LOS
Exit 44	I-90 EB Off-Ramp	Diverge	B	B
	I-90 WB Off-Ramp	Diverge	B	B
	I-90 EB On-Ramp	Merge	B	B
	I-90 WB On-Ramp	Merge	B	B
Exit 46	I-90 EB Off-Ramp	Diverge	B	A
	I-90 WB Off-Ramp	Diverge	A	B
	I-90 EB On-Ramp	Merge	B	B
	I-90 WB On-Ramp	Merge	A	B
Exit 48	I-90 EB Off-Ramp	Diverge	A	A
	I-90 WB Off-Ramp	Diverge	A	B
	I-90 EB On-Ramp	Merge	B	B
	I-90 WB On-Ramp	Merge	A	B

Compared to existing conditions, a number of ramp junction movements are projected to degrade from LOS A to LOS B based on the Year 2021 No Build scenario.

Figure 21. Year 2021 No Build I-90 Traffic Volumes and Level of Service



Year 2045 No Build Alternative

The projected year 2045 AM and PM peak hour intersection turning movements corresponding to the Year 2045 No Build Alternative are shown on **Figure 22**.

The year 2045 No Build peak hour intersection LOS is depicted on **Figure 23** and summarized in **Table 14**.

Table 14. Year 2045 No Build Peak Hour Intersection Levels of Service

Intersection		Level of Service Critical Approach/Movement	
		AM Peak Hour	PM Peak Hour
1	Chimney Canyon Rd / Sturgis Rd	C (SB)	B (SB)
2	Deerview Rd / EB Ramps	A (SB)	A (SB)
3	Deerview Rd / WB Ramps	A (NB)	A (NB)
4	Deerview Rd / Sidney Stage Rd	A (NB)	A (NB)
5	Deerview Rd / Spring Valley Rd	A (NB/SB)	A (NB/SB)
6	Elk Creek Rd / Sturgis Rd	F (WB) v/c ratio = 1.40 95% queue = 21.3 veh	C (WB)
7	Elk Creek Rd / EB Ramps	C (SB)	B (SB)
8	Elk Creek Rd / WB Ramps	D (NB)	C (NB)
9	Sidney Stage Rd / WB On Ramp	A (NB)	A (NB)
10	Elk Creek Rd / Hills View Dr	B (NB)	B (NB)
11	Elk Creek Rd / Glenwood Dr	B (NB)	B (NB)
12	Stage Stop Rd / Sturgis Rd	D (WB TH/LT)	C (WB TH/LT)
13	Stage Stop Rd / EB Ramps	A (SB)	B (SB)
14	Stage Stop Rd / WB Ramps	B (NB)	E (NB) v/c ratio = 0.86 95% queue = 9.3 veh
15	Stage Stop Rd / LaRue Rd	A (SB)	A (SB)

Notes: NB = northbound; EB = eastbound; SB = southbound; WB = westbound;
TH = through; LT = left turn

Based on the Year 2045 No Build scenario, movements through the study intersections are projected to operate at LOS C or better during the AM and PM peak hours, with the exception of the movements or approaches at the four intersections detailed below:

- At the Elk Creek Road/Sturgis Road intersection, the westbound approach is projected to operate at LOS F during the AM peak hour and LOS D during the PM peak hour.
- At the Elk Creek Road/EB Ramps intersection, the northbound (eastbound exiting I-90) approach is projected to operate at LOS D during the AM peak hour.
- At the Stage Stop Road/Sturgis Road intersection, the westbound shared through/left turn movement is projected to operate at LOS D during the AM peak hour.
- At the Stage Stop Road/EB Ramps intersection, the northbound (eastbound exiting I-90) approach is projected to operate at LOS E during the PM peak hour.

Figure 22. Year 2045 No Build Intersection Traffic Volumes

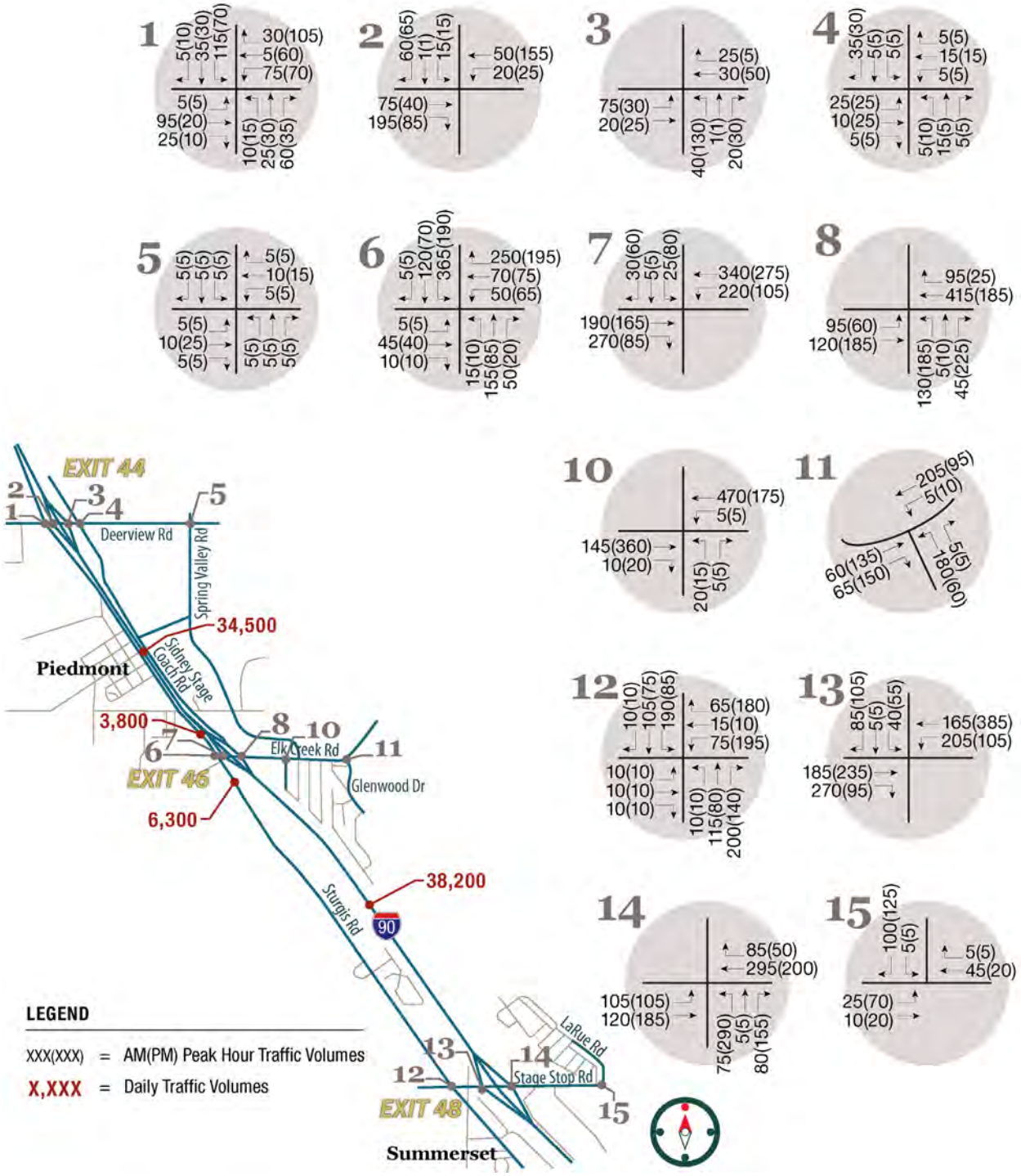


Figure 23. Year 2045 No Build Intersection Lane Geometry and Level of Service

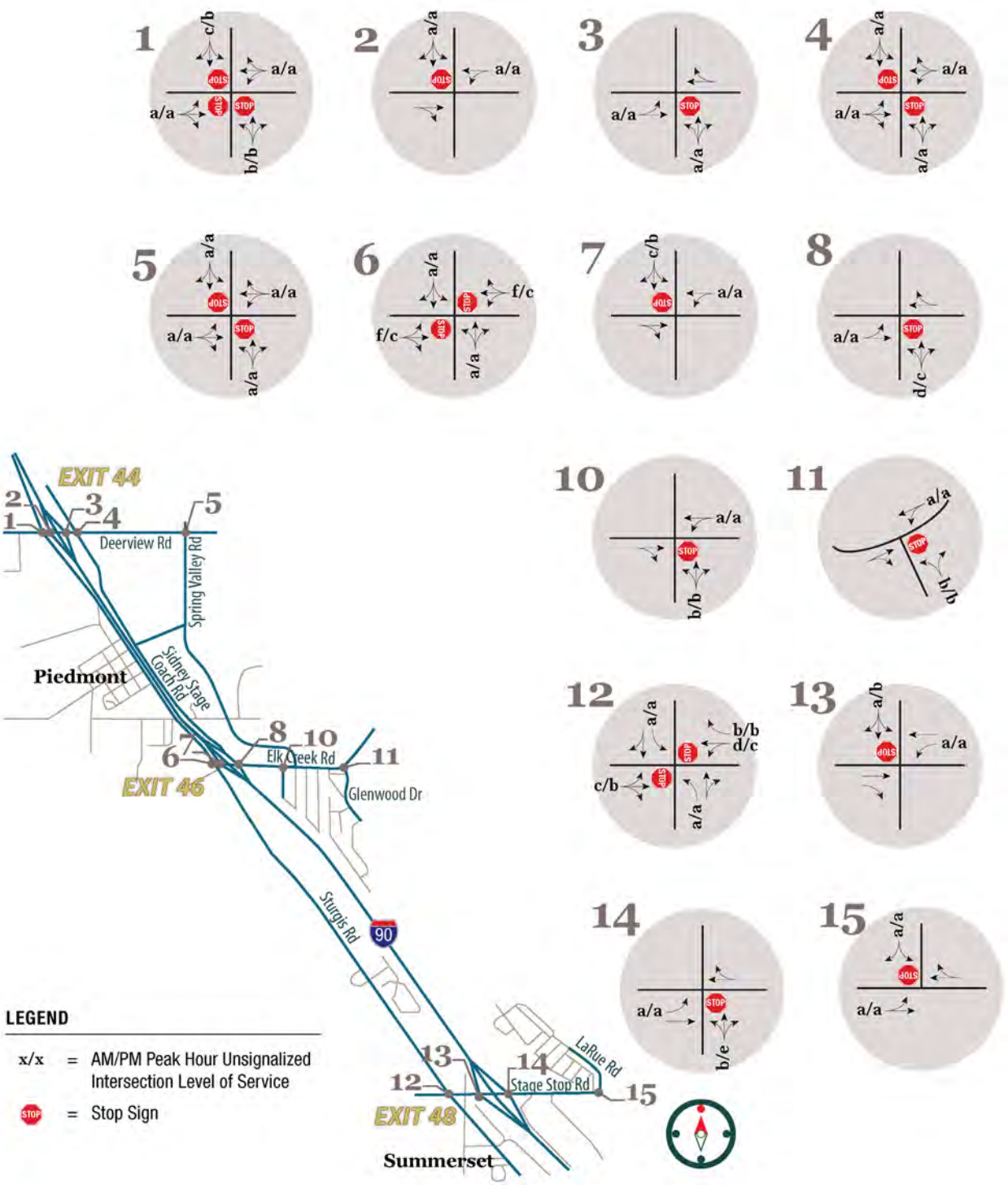


Figure 24 depicts the projected year 2045 I-90 average weekday daily, eastbound and westbound mainline and ramp merge/diverge peak hour traffic volumes for the No Build Alternative. **Figure 24** also shows the results of the basic freeway segments and merge/diverge LOS analyses for the Year 2045 No Build scenario. **Table 15** summarizes the results of the basic freeway segments analyses. The Year 2045 No Build analyses assumed that mainline I-90 would remain a four-lane interstate.

Table 15. Year 2045 No Build Mainline I-90 Levels of Service

Interstate Direction/Segment	AM Peak Hour LOS	PM Peak Hour LOS
EB I-90 west of Exit 44	A	A
WB I-90 west of Exit 44	A	A
EB I-90 west of Exit 46	A	A
WB I-90 west of Exit 46	A	B
EB I-90 east of Exit 46	B	A
WB I-90 east of Exit 46	A	B
EB I-90 east of Exit 48	B	B
WB I-90 east of Exit 48	A	B

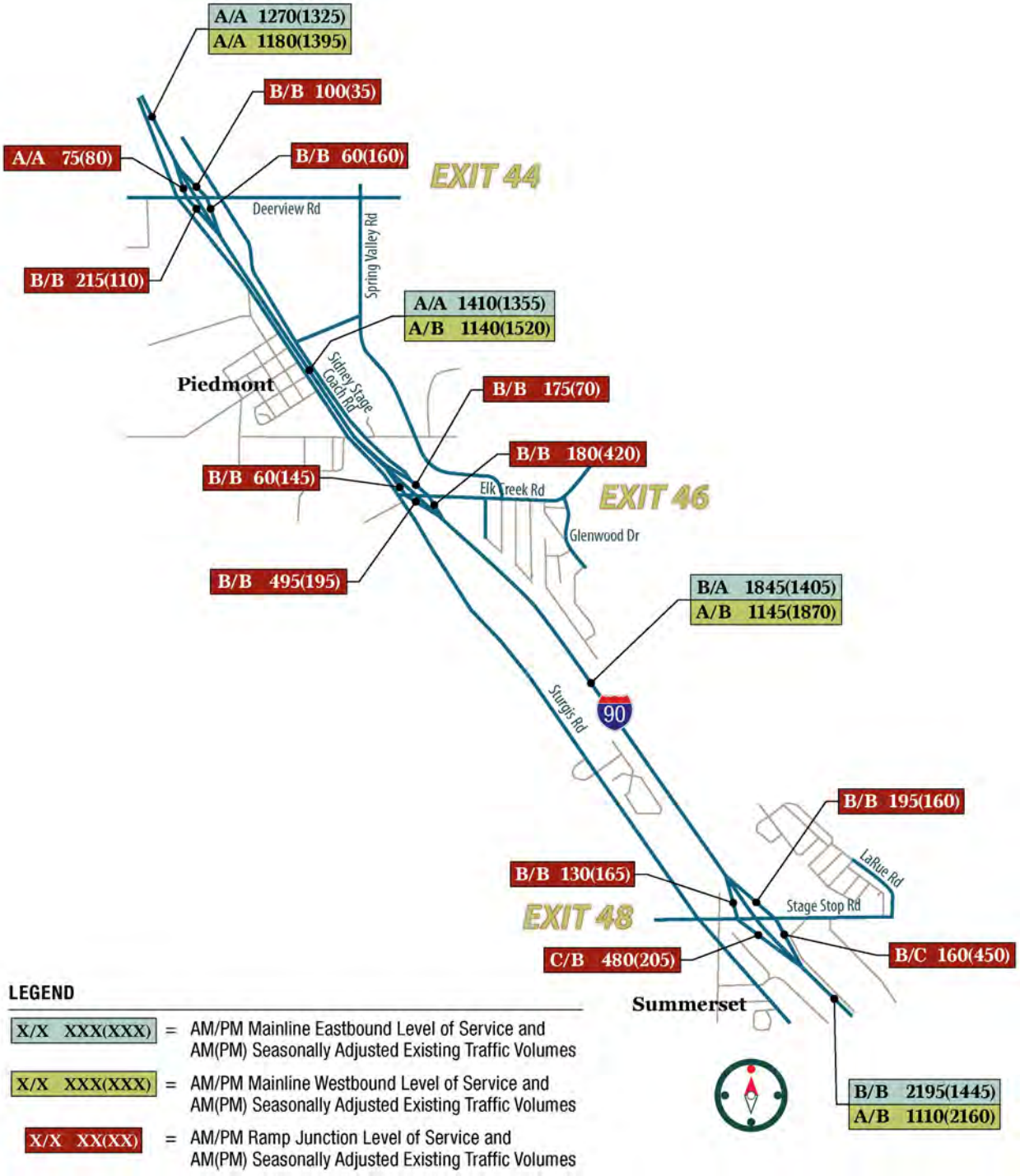
Basic freeway segments along mainline I-90 are projected to operate at LOS B or better during the AM and PM peak hours based on the 2045 No Build scenario. I-90 remains at acceptable operational levels by the Year 2045 with two travel lanes in each direction.

Ramp junctions that were analyzed within the study area are projected to operate at LOS C or better during the AM and PM peak hours based on the 2045 No Build scenario, as depicted on **Figure 24** and summarized in **Table 16**.

Table 16. Year 2045 No Build Ramp Junction Levels of Service

Interchange	Ramp	Movement	AM Peak LOS	PM Peak LOS
Exit 44	I-90 EB Off-Ramp	Diverge	A	A
	I-90 WB Off-Ramp	Diverge	B	B
	I-90 EB On-Ramp	Merge	B	B
	I-90 WB On-Ramp	Merge	B	B
Exit 46	I-90 EB Off-Ramp	Diverge	B	B
	I-90 WB Off-Ramp	Diverge	B	B
	I-90 EB On-Ramp	Merge	B	B
	I-90 WB On-Ramp	Merge	B	B
Exit 48	I-90 EB Off-Ramp	Diverge	B	B
	I-90 WB Off-Ramp	Diverge	B	C
	I-90 EB On-Ramp	Merge	C	B
	I-90 WB On-Ramp	Merge	B	B

Figure 24. Year 2045 No Build I-90 Traffic Volumes and Level of Service



For the year 2045 No Build Alternative, a number of ramp junction movements are projected to operate at LOS C, particularly at Exit 48. At Exit 46, the EB On-Ramp merge movement is projected to operate at LOS C during the AM peak hour, and the WB Off-Ramp diverge movement is projected to operate at LOS C during the PM peak hour, reflecting a pattern of heavier vehicle travel oriented to/from the east (toward Rapid City) during these peak periods.

Future No Build LOS worksheets are provided in **Appendix D**.

Alternative 1: Diamond Interchange with Realigned Service Roads

Although Alternative 1 would replace the existing bridge and address sight distance and k-value deficiencies, keeping the bridge in the same location would not correct the skew angle at the ramp terminal intersections, nor would it improve spacing between the west ramp terminal intersection and Sturgis Road. Alternative 1 would have major impacts to Big D if the six-legged single-lane roundabout were to be constructed. Alternative 1 was demonstrated to operate satisfactorily in the *I-90 Black Hawk to Sturgis Corridor Preservation Study* analyses of future conditions; however, it is eliminated because it does not fully address all of the deficiencies noted at the Exit 46 interchange.

Alternative 2: Relocated Diamond with Realigned North Service Road

Alternative 2 represents the Preferred Alternative carried forward from the Environmental Assessment for further analyses. Because of its selection as the Preferred Alternative, Alternative 2 is analyzed in detail in the IMJR, while Alternatives 1 and 3 are described as analyzed in the *I-90 Black Hawk to Sturgis Corridor Preservation Study.* The analyses of Alternative 2 focus solely on the Exit 46 interchange and Elk Creek Road corridor. It is assumed that the traffic volumes along the Exit 44, Exit 48, Deerview Road, Sturgis Road and Stage Stop Road corridors will remain the same regardless of whether Exit 46 is modified.

Figure 25 depicts the projected Year 2021 peak hour intersection turning movements at Exit 46 and along Elk Creek Road, the mainline I-90 average weekday daily and peak hour directional segment and ramp junction traffic volumes and the results of the LOS analyses corresponding to the Year 2021 Build scenario.

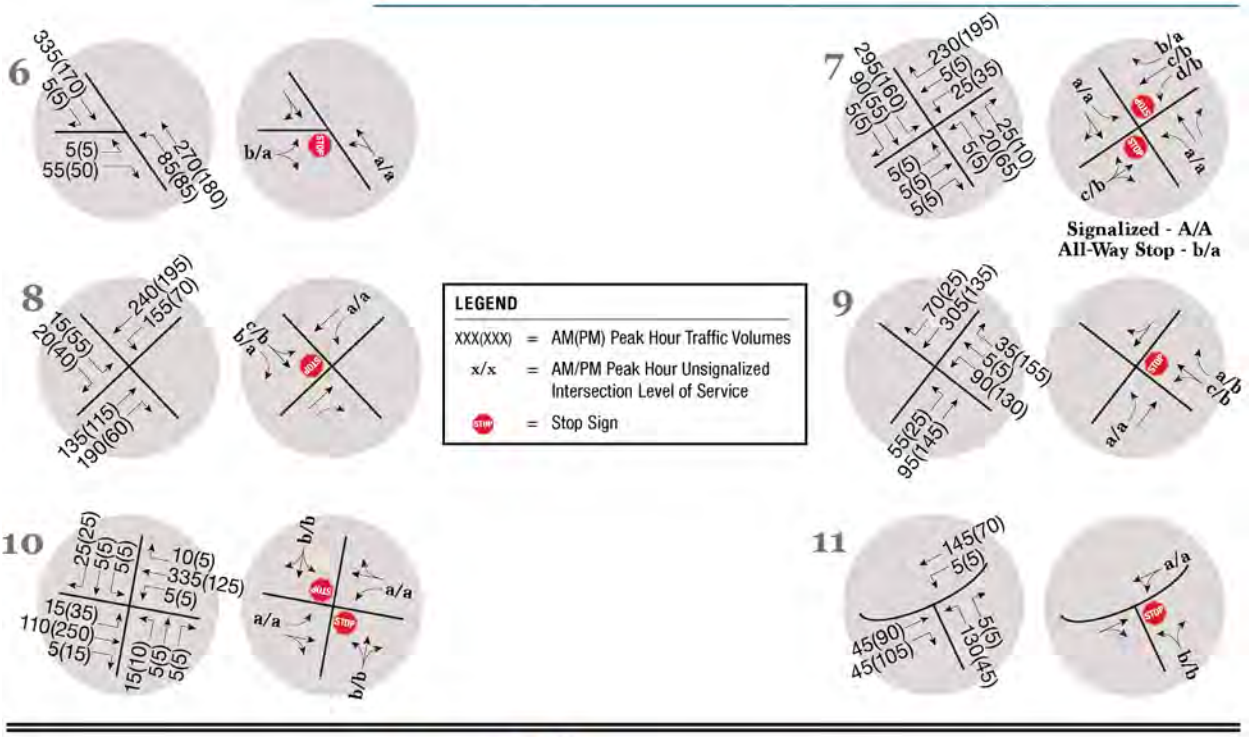
Figure 25 and **Table 17** summarize the results of the Year 2021 Build peak hour intersection LOS analyses.

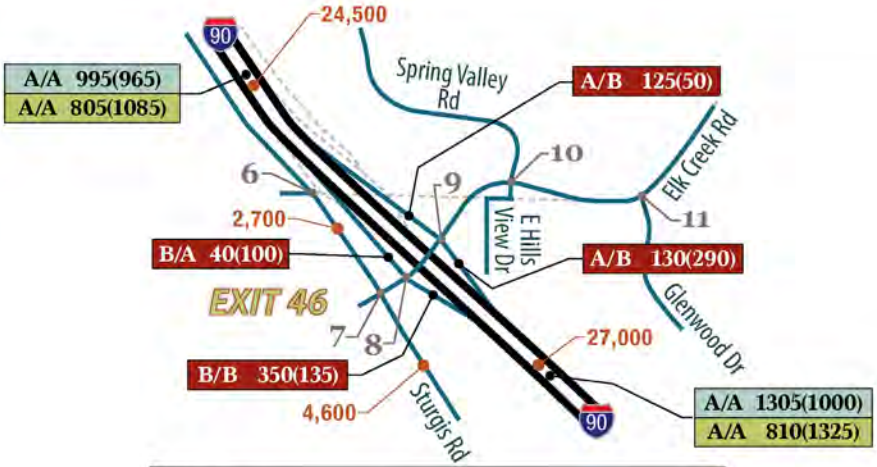
Table 17. Year 2021 Alternative 2 Peak Hour Intersection Levels of Service

Intersection		Level of Service Critical Approach/Movement	
		AM Peak Hour	PM Peak Hour
6	Elk Creek Rd / Big D Access	B (EB)	A (EB)
7	Elk Creek Rd / Sturgis Road	D (WB LT)	B (WB LT)
8	Elk Creek Rd / EB Ramps	C (SB LT/TH)	B (SB LT/TH)
9	Elk Creek Rd/ WB Ramps	C (NB LT/TH)	B (NB LT/TH)
10	Elk Creek Rd / Spring Valley Road	B (NB)	B (NB)
11	Elk Creek Rd / Glenwood Dr	B (NB)	B (NB)

Notes: NB = northbound; EB = eastbound; SB = southbound; WB = westbound; TH = through; LT = left turn

Figure 25. Year 2021 Alternative 2 Traffic Volumes and Level of Service





Based on the Year 2021 Build scenario, the Exit 46 interchange ramp terminal intersections and the study intersections along the Elk Creek Road corridor are projected to operate at LOS C or better during the AM and PM peak hours, with the exception of the westbound left turn movement at the Elk Creek Road/Sturgis Road intersection during AM peak hour, which is projected to operate at LOS D.

Since the intersection delay for the left turn movement exceeded the LOS threshold, a signal warrant analysis was completed to evaluate how close the projected peak hour intersection volumes are to satisfying signalization warrants. Based on the data available for this study, only Warrant 3, Peak Hour could be evaluated. For the Year 2021, the Elk Creek Road/Sturgis Road intersection volumes were less than 10 percent of the Warrant 3 criteria. Additionally, as a result of feedback from stakeholder meetings, an all-way STOP was evaluated at the Elk Creek Road/Sturgis Road intersection. Both a signal and all-way STOP were analyzed for illustrative purposes, and the results of each are displayed on **Figure 25**.

Basic freeway segments along mainline I-90 are projected to operate at LOS A during the AM and PM peak hours based on the 2021 Build scenario, as depicted on **Figure 25** and summarized in **Table 18**. Based on the analyses completed for the Year 2021 Build scenario, mainline I-90 is expected to operate comparably to the Year 2021 No Build scenario.

Table 18. Year 2021 Alternative 2 Mainline I-90 Levels of Service

Interstate Direction/Segment	AM Peak Hour LOS	PM Peak Hour LOS
EB I-90 west of Exit 46	A	A
WB I-90 west of Exit 46	A	A
EB I-90 east of Exit 46	A	A
WB I-90 east of Exit 46	A	A

Ramp junction LOS for the Year 2021 Build scenario is depicted on **Figure 25** and summarized in **Table 19**.

Table 19. Year 2021 Alternative 2 Ramp Junction Levels of Service

Interchange	Ramp	Movement	AM Peak LOS	PM Peak LOS
Exit 46	I-90 EB Off-Ramp	Diverge	B	A
	I-90 WB Off-Ramp	Diverge	A	B
	I-90 EB On-Ramp	Merge	B	B
	I-90 WB On-Ramp	Merge	A	B

Ramp junctions at Exit 46 are anticipated to operate comparably to the Year 2021 No Build scenario based on the analyses completed for the Year 2021 Build scenario. The reconfigured Exit 46 ramps are anticipated to be longer than the existing ramps and provide additional acceleration/deceleration length; however, this additional length does not cause merge/diverge operations at the ramp junctions to change on the LOS scale.

Year 2045 Alternative 2 Build Scenario

Figure 26 depicts the projected year 2045 peak hour intersection turning movements at Exit 46 and along Elk Creek Road, the mainline I-90 average weekday daily and peak hour directional segment and ramp junction traffic volumes and the results of the LOS analyses corresponding to the Year 2045 Build scenario.

Figure 26 and **Table 20** summarize the results of the Year 2045 Build peak hour intersection LOS analyses.

Table 20. Year 2045 Alternative 2 Peak Hour Intersection Levels of Service

Intersection		Level of Service Critical Approach/Movement	
		AM Peak Hour	PM Peak Hour
6	Elk Creek Rd / Big D Access	B (EB)	B (EB)
7	Elk Creek Rd / Sturgis Road	F (WB LT) v/c ratio = 0.49 95% queue = 2.2 veh	C (WB LT)
8	Elk Creek Rd / EB Ramps	D (SB LT/TH)	C (SB LT/TH)
9	Elk Creek Rd/ WB Ramps	D (NB LT/TH)	C (NB LT/TH)
10	Elk Creek Rd / Spring Valley Road	C (NB)	B (NB)
11	Elk Creek Rd / Glenwood Dr	B (NB)	B (NB)

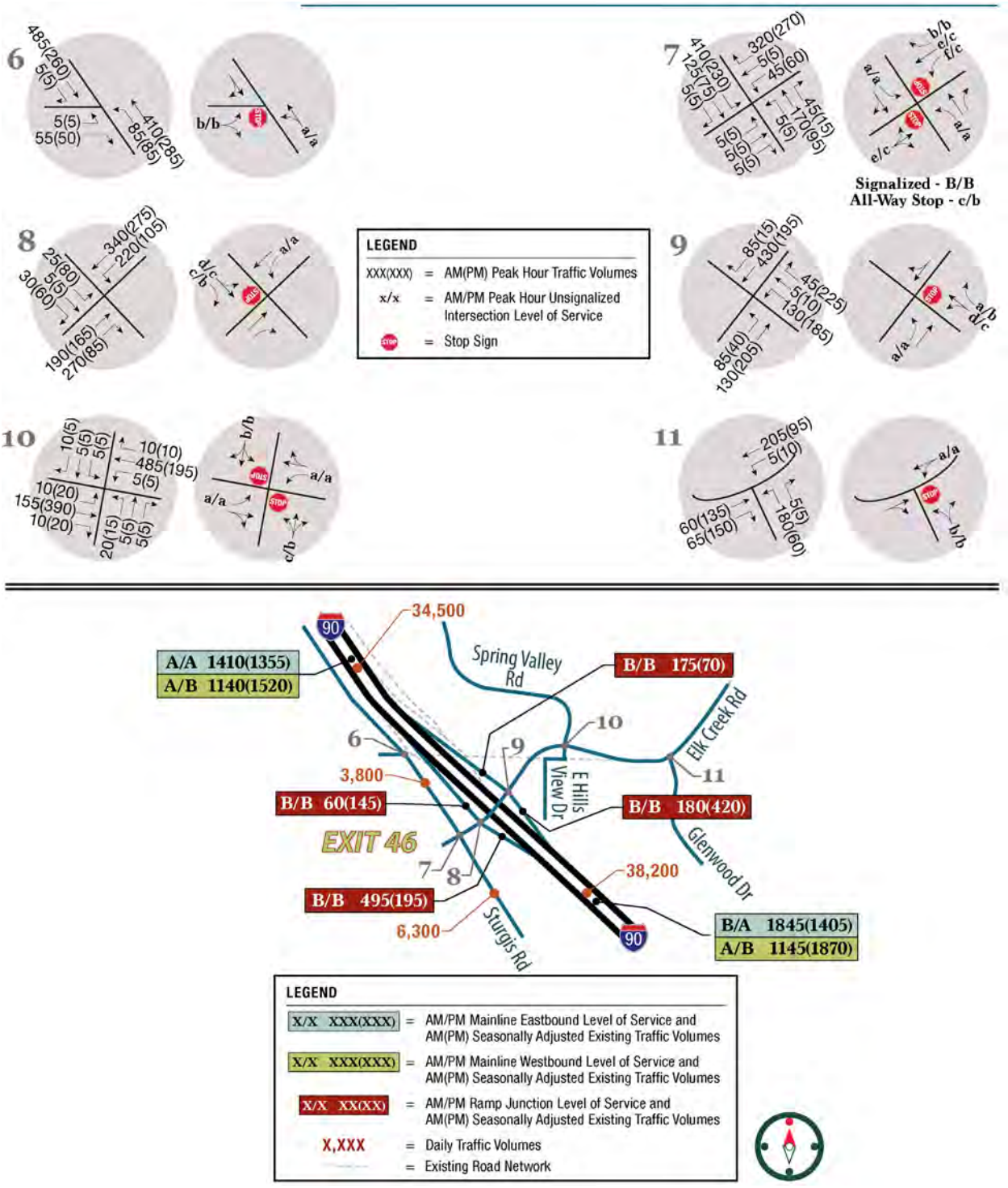
Notes: NB = northbound; EB = eastbound; SB = southbound; WB = westbound; TH = through; LT = left turn

Based on the Year 2045 Build scenario, movements through the Exit 46 interchange ramp terminal intersections and the study intersections along the Elk Creek Road corridor are projected to operate at LOS C or better during the AM and PM peak hours, with the exception of the westbound left turn movement at the Elk Creek Road/Sturgis Road intersection during AM peak hour, which is projected to operate at LOS F. For Alternative 2, the westbound approach geometry is anticipated to consist of exclusive left, through and right turn lanes. These additional approach lanes assist the v/c ratio and 95th percentile queue lengths reported on the westbound approach.

Since the reported intersection delay exceeded the LOS threshold at the Elk Creek Road/Sturgis Road and Elk Creek Road/I-90 ramp terminal intersections, a preliminary signal warrant analysis was completed to evaluate how close the projected intersection volumes are to satisfying signalization warrants. Based on the data available for this study, only Warrant 3, Peak Hour, could be evaluated as a preliminary check on the need for signalization (Warrant 3 is only applicable to conditions with extreme peaks in traffic and is not ultimately applicable to the Exit 46 area). For the Year 2045, the peak hour intersection volumes at all three intersections were less than 25 percent of the Warrant 3 criteria. Thus, it is not anticipated that any traffic signals will be warranted by the year 2045. The decision to install a future traffic signal would need to be based on a more thorough assessment of all nine *MUTCD* traffic signal warrants completed based on actual count data.

All-way STOP sign control was also evaluated at the Elk Creek Road/Sturgis Road intersection for the 2045 Build scenario. Though the overall LOS was found to be acceptable, individual movement LOS and delay would cause queueing concerns at the interchange.

Figure 26. Year 2045 Alternative 2 Traffic Volumes and Level of Service



Basic freeway segments along mainline I-90 are projected to operate at LOS B or better during the AM and PM peak hours based on the Year 2045 analyses, as depicted on **Figure 26** and summarized in **Table 21**. For the Year 2045 Alternative 2 scenario, mainline I-90 is expected to operate comparably to the Year 2045 No Build scenario.

Table 21. Year 2045 Alternative 2 Mainline I-90 Levels of Service

Interstate Direction/Segment	AM Peak Hour LOS	PM Peak Hour LOS
EB I-90 west of Exit 46	A	A
WB I-90 west of Exit 46	A	B
EB I-90 east of Exit 46	B	A
WB I-90 east of Exit 46	A	B

Ramp junction LOS for the Year 2045 Alternative 2 scenario is depicted on **Figure 26** and summarized in **Table 22**.

Table 22. Year 2045 Alternative 2 Ramp Junction Levels of Service

Interchange	Ramp	Movement	AM Peak LOS	PM Peak LOS
Exit 46	I-90 EB Off-Ramp	Diverge	B	B
	I-90 WB Off-Ramp	Diverge	B	B
	I-90 EB On-Ramp	Merge	B	B
	I-90 WB On-Ramp	Merge	B	B

For the Year 2045 Alternative 2 scenario, the ramp junctions at Exit 46 are anticipated to operate comparably to the Year 2045 No Build scenario. The reconfigured Exit 46 ramps are anticipated to be longer than the existing ramps and provide additional acceleration/deceleration length; however, this additional length does not cause ramp junction merge/diverge LOS to change. Future Build condition LOS worksheets are provided in **Appendix E**.

Alternative 3: Single Point Interchange with North Service Road Connection

The SPUI proposed in Alternative 3 would control movements at the ramp terminal intersection with a traffic signal, shown to operate acceptably in the *I-90 Black Hawk to Sturgis Corridor Preservation Study*. The relocated interchange would eliminate the existing bridge skew; however, the design of the SPUI would require a larger bridge and would likely require more retaining walls than a diamond configuration due to the proximity of the ramps and I-90. The SPUI was eliminated from consideration because it is more practical in an urban environment that necessitates a smaller interchange footprint and signalization to control traffic movements.

Bicycle and Pedestrian Analysis

With Alternative 2 and the other build alternatives, a 10-foot wide, barrier-separated shared-use path would be constructed along the south side of Elk Creek Road. This path would provide a route for cyclists and pedestrians to travel on from Sturgis Road to Sun Valley Drive along Elk Creek Road. For the build alternatives, improvements can be seen for both users with an average LOS of B for pedestrians and cyclists. This is an improvement when compared to existing conditions analysis, which indicated LOS C for pedestrians and LOS D for cyclists. Provision would also be made with each alternative for the future addition of a sidewalk along the north side of Elk Creek Road through the interchange area.

7.0 ALTERNATIVES ANALYSIS

The three build alternatives were examined to understand their relative performance and facilitate selection of a Preferred Alternative. This evaluation borrows and builds upon alternative analyses included in the 2000 and 2010 Interstate Corridor Studies, *I-90 Black Hawk to Sturgis Corridor Preservation Study*, and the *I-90 Exit 40 to 51 Environmental Assessment*.

7.1 Conformance with Transportation Plans

Each of the interchange alternatives conform with current local and state transportation plans. The proposed revised access is identified in the RCAMPO *RapidTRIP 2040 Long Range Transportation Plan* .

The existing Exit 46 interchange was first identified as having geometric needs in the 2000 Statewide Interstate Corridor Study. An interchange improvement has been in the statewide transportation planning process since 2014, and is currently listed in the developmental program for the Statewide Transportation Improvement Program (STIP). Reconstruction of the interchange is currently identified for implementation between the Years of 2021 and 2025.

7.2 Compliance with Policies and Engineering Standards

The No Build Alternative will not address the known geometric needs of the existing interchange. The following substandard conditions would persist when analyzed in light of the current *South Dakota Department of Transportation Road Design Manual*:

1. No provision for turn lanes along Elk Creek Road, which would be needed based on minimum traffic volume thresholds listed in the standards
2. Substandard sag k-values relating to headlight sight distance on Ramps C (I-90 EB Off-Ramp) and D (I-90 WB On-Ramp
3. Though extended in recent years, the taper rates for the ramps to I-90 remain just below the 50:1 standard at 39:1 for the WB on ramp and 43:1 for the EB on ramp.
4. Substandard control of access spacing between the ramp terminal intersections and adjacent intersections (approximately 50 feet to Sturgis Road on the west and 125 feet to the nearest access to the east) and at-grade railroad crossing (approximately 45 feet east of ramp terminal). Standards specify a desired spacing of 660 feet, with a minimum of 100 feet.
5. Substandard intersection: connection of the Sidney Stage Road with the I-90 westbound on ramp
6. The clear zone for recovery along ramps less than 30 feet
7. The inslopes for the on ramps being 3:1 (6:1 standard)
8. The minimum right shoulder width measured at 2-4 feet along ramps (8 feet standard)
9. The minimum horizontal curve radius along ramps, measured at 310 feet (838 feet standard)

The build alternatives would correct all geometric deficiencies except for #4, which none of the alternatives would completely correct. Alternative 1 would address intersection spacing west of the interchange by consolidating movements at a roundabout intersection-while the at-grade railroad crossing and access intersection remain east of the interchange. Alternatives 2 and 3

would address spacing concerns west of the interchange by improving existing spacing to Sturgis Road to over 100 feet (meeting minimum spacing requirements but short of desired 660-foot spacing).

7.3 Environmental Impacts

The *I-90 Exit 40 to 51 Environmental Assessment* was completed and approved in 2008, clearing the Preferred Alternative with no significant impact. The approved EA may be found at: http://www.sddot.com/business/environmental/assessments/Default.aspx. A Categorical Exclusion document is being created to address issues specific to the Exit 46 interchange.

7.4 Safety

After review of the existing crash data summarized in Section 3.8, a large percentage of crashes (25 percent) occur near Elk Creek Road and its intersection with Sturgis Road. Specific correctable crash patterns were not identified, but several contributing factors have been identified along this stretch of roadway. The factors include closely spaced intersections, skewed intersection approaches, poor vertical sight distance over the Exit 46 bridge, and poor turning radii for large vehicles. These contributing factors are removed through the construction of Alternative 2 and will likely result in an overall reduction in crashes along the Elk Creek Road corridor.

7.5 Operational Performance

The No Build Alternative was shown to provide acceptable peak hour traffic operations for all mainline, ramp merge/diverge sections at Exit 46 through the Year 2045. Surface street intersection movements would also operate acceptably, with the exception of movements noted in section 6.2 at the EB ramps intersection with Elk Creek Road and the Elk Creek Road/Sturgis Road intersection.

All of the build alternatives would provide operational conditions equal to or better than the No Build Alternative, based both on traffic analyses included in the *I-90 Black Hawk to Sturgis Corridor Preservation Study* and updated analyses of Alternative 2 in this IMJR. The current Alterntative 2 concept has been designed to incorporate additional exclusive turn lanes as warranted by SDDOT standards, and these turn lanes would provide operational benefits over the No Action condition, which provides no intersection turn lanes at Exit 46.

7.6 Evaluation Matrix

Table 23. Alternative Evaluation Matrix

	No Build	Alternative 1	Alternative 2	Alternative 3
Ramp Terminal LOS	Acceptable	Acceptable	Acceptable	Acceptable, but signalization not warranted initially, making single point intersection not feasible
I-90 LOS	Acceptable	Acceptable	Acceptable	Acceptable
Bicycle/Pedestrian Performance	No sidewalks/ paths and narrow bridge, at-grade RR Crossing	Shared-use path and potential future sidewalk provided, roundabout would be difficult to navigate	Shared-use path and potential future sidewalk provided, diamond interchange navigable	Shared-use path and potential future sidewalk provided, single point interchange can be difficult to navigate
Meets all SDDOT Geometric Design Criteria	No	Yes	Yes	Yes
Meets SDDOT Access Criteria	No	No	Yes, meets minimum acceptable	Yes, meets minimum acceptable
Ramp Terminal to Nearest Access Distance	30’	45’	100’	100’
Right-of-Way Impacts	None	Realignment of Sturgis Road would affect property	Property along new Elk Creek Road alignment owned by SDDOT	Property along new Elk Creek Road alignment owned by SDDOT
Environmental Impacts	None	Minimal	Minimal	Minimal
Utility Impacts	None	Minimal	Some	Some
Constructability	NA	Would require more bridge closure time to construct	More efficient construction as new bridge relocated from current	More efficient construction as new bridge relocated from current

7.7 Coordination

The SDDOT has a long history of public involvement in the development of transportation plans and projects. Public and stakeholder meetings were held as part of this project on Wednesday, January 20, 2016. The public meeting was attended by a total of 66 people, including members of the SAT and consultant team. The public meeting sought feedback as to the whether the proposed shared-use path should be located on the north or south side of the new Exit 46 bridge. The feedback received favors the south side as the location for the shared-use path. Other public comments were generally positive and indicate people are looking forward to the project being completed.

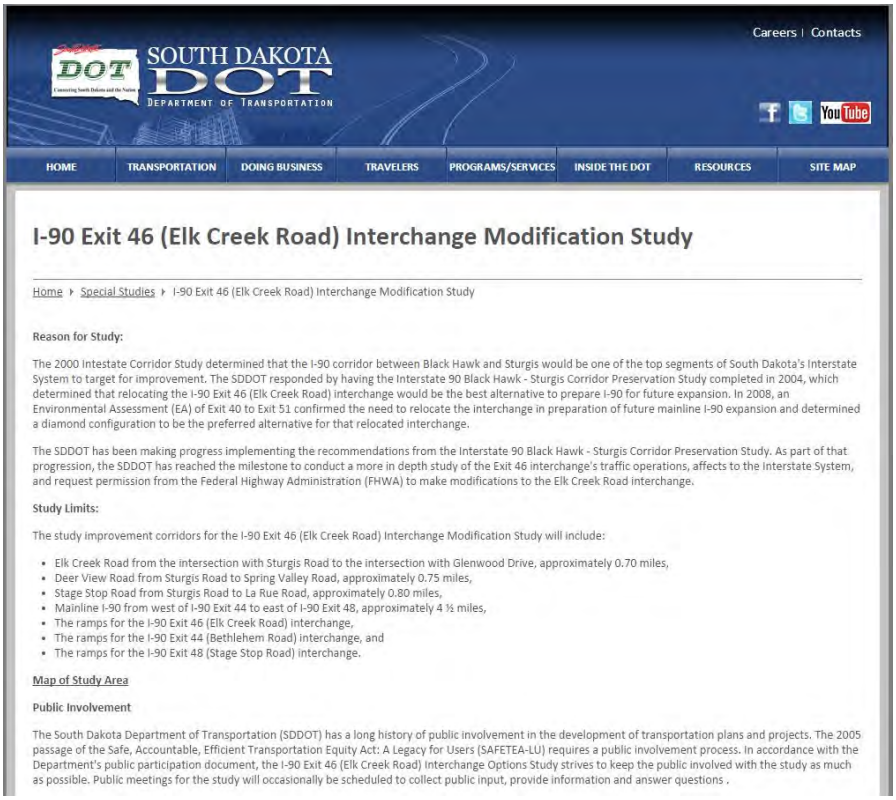
The project team also met with stakeholders who own property adjacent to the Exit 46 interchange and representatives of the Cities of Summerset and Piedmont. Feedback from the stakeholders was received to understand their transportation interests and how the proposed modifications to the Exit 46 interchange could affect them.

As part of the project, a website has been established that provides an overview of the reason for the study, a description of the study limits, and links previous studies and materials presented and disseminated at the public meeting. The website can be accessed at the following address:

http://www.sddot.com/transportation/highways/planning/specialstudies/I90Exit46/

A screenshot of the website's contents is shown on **Figure 27**.

Figure 27. I-90 Exit 46 IMJR Website



8.0 FUNDING PLAN

The *South Dakota Department of Transportation Decennial Interstate Corridor Study*, *Phase One Report* completed in August 2010 prepared a probable construction cost estimate of approximately $8.7 million (year 2010 dollars) for a relocated diamond interchange at Exit 46.

In the year 2014, the SDDOT included Exit 46 reconstruction in the Developmental Program of its statewide planning process. The planned project for replacing the existing Exit 46 interchange is currently estimated to cost $8.774 million (in 2015 dollars). The SDDOT is currently anticipating funding the project with the combination of funding sources shown in **Table 24**.

Table 24. Anticipated Funding Allocation Breakdown

Project Number	State Funding Category	Federal Funding Category	Federal Funds	State Funds	Total Funds
IM 0901(187)46 PCN 034J	Interstate	National Highway Performance Program	$7.982 Million	$0.792 Million	$8.774 Million
Total			$7.982 Million	$0.792 Million	$8.774 Million

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

As the project is anticipated to be let to contract in Federal fiscal year 2020, the inflated estimated cost for the overall project is $9.686 million.

9.0 RECOMMENDATIONS

This modification request is to reconfigure the existing Exit 46 interchange, but maintain the diamond configuration, as shown in **Figure 16** in Chapter 5.

This recommendation addresses the eight policy requirements for new or revised access points to the existing Interstate system published in the Federal Register Volume 74 Number 165; August 27, 2009.

1. **The need being addressed by the request cannot be adequately satisfied by existing interchanges to the Interstate, and/or local roads and streets in the corridor can neither provide the desired access, nor can they be reasonably improved (such as access control along surface streets, improving traffic control, modifying ramp terminals and intersections, adding turn bays or lengthening storage) to satisfactorily accommodate the design year traffic demands (23 CFR 625.2(a)).**

   This modification request is to reconfigure an existing interchange. No additional access to the Interstate System is being requested. The reconfiguration of the existing interchange will have a negligible effect on the Interstate's traffic operations when compared with the existing interchange's configuration.

   Previous studies and a desktop review of current aerial photography have revealed the following geometric deficiencies associated with the current Exit 46:

   1. No provision for turn lanes along Elk Creek Road, which would be needed based on minimum traffic volume thresholds listed in the standards
   2. Substandard sag k-values relating to headlight sight distance on Ramps C (I-90 EB Off-Ramp) and D (I-90 WB On-Ramp
   3. Though extended in recent years, the taper rates for the ramps to I-90 remain just below the 50:1 standard at 39:1 for the WB on ramp and 43:1 for the EB on ramp.
   4. Substandard control of access spacing between the ramp terminal intersections and adjacent intersections (approximately 50 feet to Sturgis Road on the west and 125 feet to the nearest access to the east) and at-grade railroad crossing (approximately 45 feet east of ramp terminal). Standards specify a desired spacing of 660 feet, with a minimum of 100 feet.
   5. Substandard intersection: connection of the Sidney Stage Road with the I-90 westbound on ramp
   6. The clear zone for recovery along ramps less than 30 feet
   7. The inslopes for the on ramps being 3:1 (6:1 standard)
   8. The minimum right shoulder width measured at 2-4 feet along ramps (8 feet standard)
   9. The minimum horizontal curve radius along ramps, measured at 310 feet (838 feet standard)

Proposed Bicycle and Pedestrian Accommodations

The Elk Creek Road bridge over I-90 at Exit 46 was constructed in 1957. is functionally obsolete and does not provide for future widening of mainline I-90 to six lanes, nor does it provide for pedestrian or bicycle facilities.

The proposed modification request includes a 10-foot wide shared-use path along the south side of Elk Creek Road extending between Hillsview Drive and Sturgis Road. To accommodate potential future needs, provision is made in the interchange design concept for the future addition of a 5-foot sidewalk along the north side of Elk Creek Road on either side of the bridge, and the bridge could be modified to carry this sidewalk over I-90.

2. The need being addressed by the request cannot be adequately satisfied by reasonable transportation system management (such as ramp metering, mass transit, and HOV facilities), geometric design, and alternative improvements to the Interstate without the proposed change(s) in access (23CFR 625.2(a)).

This modification request is to reconfigure the geometrics of an existing interchange. No additional access to the Interstate System is being requested.

The *Interstate 90 Black Hawk – Sturgis Corridor Preservation Study* initially developed three build alternatives, which were narrowed down to two feasible alternatives for the corridor's EA. The two alternatives evaluated in the EA were a single point and a diamond interchange. The EA noted that both alternatives would require the realignment of Elk Creek Road to the south to provide a greater separation distance between the east interchange ramps and the interstate service road intersection. Realigned Elk Creek Road would be grade-separated over both the railroad tracks and I-90.

The single point interchange alternative would have relocated the Exit 46 interchange to the east and constructed a single point interchange. The single point interchange was ruled out because it was not considered practical at Exit 46 and would have required installation of a traffic signal and would have cost more to construct because it would require a larger bridge, a traffic signal and more retaining walls.

The relocated diamond interchange was selected as the preferred option in the EA primarily because of cost as well as the reconstructed interchange being able to eliminate the sharp skew angle, provide better spacing between the ramp terminal and service road intersections, and greatly improve sight distance on the bridge. The EA's preferred option also includes the realignment of Elk Creek Road in order to improve spacing between the ramp terminal and service road intersections and provide for a grade-separated crossing of the railroad. The increase in distance between the ramp terminal intersections and Sturgis Road would improve the operation of the crossroad intersections, including the ramp terminal intersections by providing additional queue space for left turn and width for auxiliary lanes to be added, as warranted. The grade separation of the railroad is another benefit that would improve traffic operations and safety in the vicinity of the Exit 46 interchange.

There are no areas within the State of South Dakota that will consistently experience congestion levels extreme enough to make ramp metering or HOV facilities economically feasible in the foreseeable future.

3. 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, ramp intersections with crossroad) or on the local street network based on both the current and the planned future traffic projections. The analysis shall, particularly in urbanized areas, include at least the first adjacent existing or proposed interchange on either side of the proposed change in access (23 CFR 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, shall 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 must 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 must 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)).

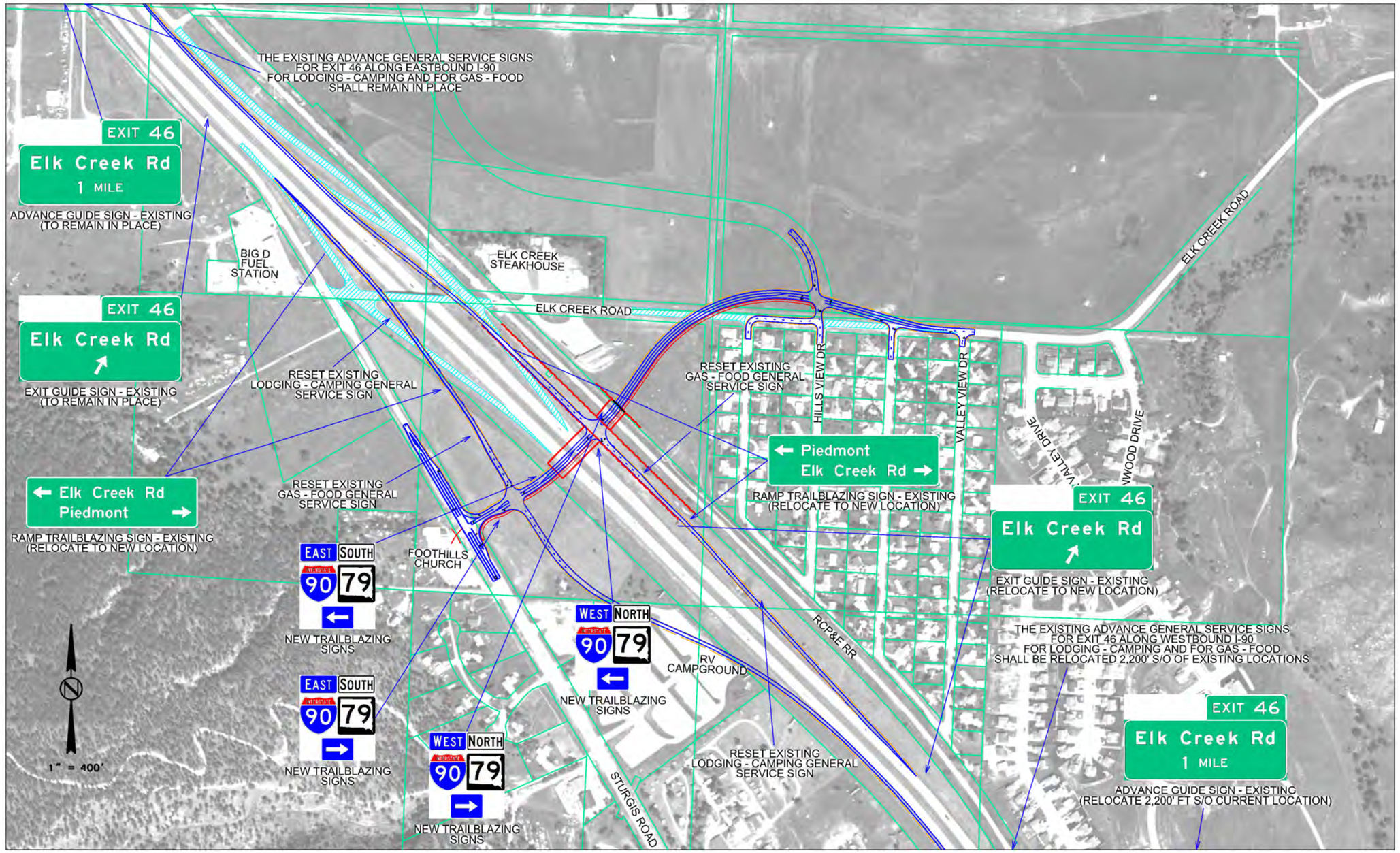
The operational analyses contained in this study indicate that mainline I-90 and ramp junction, and ramp terminal intersections are projected to operate within operational goals for both the Build and No Build scenarios through the planning horizon year of 2045.

An analysis of crash records for the most recent available five-year period (2010-2014) has been provided in the “Existing Safety Conditions” section. The safety analysis indicates that there are no discernable or correctable crash patterns within the influence area of the Exit 46 interchange. The relocated diamond interchange and reconstructed bridge would improve spacing between the ramp terminal and service road intersections, improve vertical sight distance and provide for a grade-separate crossing of the railroad. The bridge is planned to provide enough width to accommodate turn lanes at the ramp terminal intersections and a shared-use path, all of which should improve traffic operations and pedestrian/bicycle connectivity in the vicinity of Exit 46.

One of the key factors that can affect the operations of an interchange is the permanent signing associated with the interchange. As the proposal is for replacement of an existing interchange, minimal change in permanent signing is anticipated from the permanent signing that is currently in place, although some signs may need to be relocated based on the final location of the proposed future reconfigured Exit 46 interchange. A preliminary Exit 46 signing concept, showing the signs approximately one mile away on both sides of the Exit 46 interchange, is depicted on **Figure 28**.

The preliminary signing concept shows that the interstate guide signs associated with the relocated Exit 46 interchange design can be feasibly placed to provide adequate spacing between signs and accurate motorist guidance while not interfering with signing for adjacent interchanges.

Figure 28. Preliminary Conceptual Signing Plan



4. **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 for managed lanes (e.g., transit, HOVs, HOT 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)).**

   The access improvement will maintain a connection to a public road (Elk Creek Road) and will replace the current full access interchange with a reconfigured full access interchange. The reconfigured interchange will continue to provide for all traffic movements. The improvement will meet or exceed current standards for Federal-aid projects on the Interstate system.

5. **The proposal considers and is consistent with local and regional land use and transportation plans. Prior to receiving final approval, all requests for new or revised access must be included in an adopted Metropolitan Transportation Plan, in the adopted Statewide or Metropolitan Transportation Improvement Program (STIP or TIP), and the Congestion Management Process within transportation management areas, as appropriate, and as specified in 23 CFR part 450, and the transportation conformity requirements of 40 CFR parts 51 and 93.**

   The proposed interchange improvement is consistent with local land use plans and the *RCAMPO RapidTrip 2040 Long Range Transportation Plan* and *Meade Moving Forward 2040 Transportation Plan*.

6. **In corridors where the potential exists for future multiple interchange additions, a comprehensive corridor or network study must accompany all requests for new or revised access with recommendations that address all of the proposed and desired access changes within the context of a longer-range system or network plan (23 U.S.C. 109(d), 23 CFR 625.2(a), 655.603(d), and 771.111).**

   Previous studies conducted in the past 15 years, including the *South Dakota Department of Transportation Decennial Interstate Corridor Study* completed in February 2001; the *Interstate 90 Black Hawk – Sturgis Corridor Preservation Study* completed in December 2004; and the *2010 South Dakota Department of Transportation Decennial Interstate Corridor Study* completed in November 2010 indicated no need for any future interchange additions along the segments of I-90 between Exit 46 and the adjacent exits.

7. **When a new or revised access point is due to a new, expanded, or substantial change in current or planned future development or land use, requests must demonstrate appropriate coordination has occurred between the development and any proposed transportation system improvements (23 CFR 625.2(a) and 655.603(d)). The request must describe the commitments agreed upon to assure adequate collection and dispersion of the traffic resulting from the development with the adjoining local street network and Interstate access point (23 CFR 625.2(a) and 655.603(d)).**

   The proposed interchange modification is the result of *the Interstate 90 Black Hawk – Sturgis Corridor Preservation Study* and the corresponding *I-90 Environmental Assessment (Exit 40 to Exit 51)*. The study was jointly coordinated by SDDOT, Meade County, and FHWA staff. The reconfiguration of the interchange is being proposed to accommodate future traffic growth relative to the anticipated future population growth of the entire Northern Black Hills. After analysis of several alternatives for the corridor, the

Interstate 90 Black Hawk – Sturgis Corridor Preservation Study recommended the relocation of several service roads, the redesign of several interchanges, and the reconstruction and widening of the I-90 mainline in some areas between Black Hawk and Sturgis when traffic and conditions warrant. Unfortunately, both terrain restraints of the Northern Black Hills and the location of nearby federal lands create a geographic bottleneck that limits the amount of parallel corridors to operationally support I-90 that can be feasibly constructed.

8. **The proposal can be expected to be included as an alternative in the required environmental evaluation, review and processing. The proposal should include supporting information and current status of the environmental processing (23 CFR 771.111).**

   The proposed revised access is planned to be included in the 2017-2020 STIP and is the result of the corridor's Environmental Assessment completed in September 2008. A Categorical Exclusion document will be developed upon completion of the IMJR, using the EA information as a reference. A preliminary concept of the Preferred Alternative is illustrated on **Figure 29**.

   The SDDOT *Road Design Manual* provides criteria that are used to identify when left turn and right turn lanes are appropriate along major streets at intersections based on traffic levels. This criterion is described in Chapter 15, under the Turn Lane Warrants section of the Manual. The proposed modified interchange was evaluated in light of the Manual's guidance and, in combination with engineering judgement, turn lanes were identified for several intersections and movements. The resulting recommended turn lanes are shown on **Figure 29**.

Figure 29. Exit 46 Proposed Action

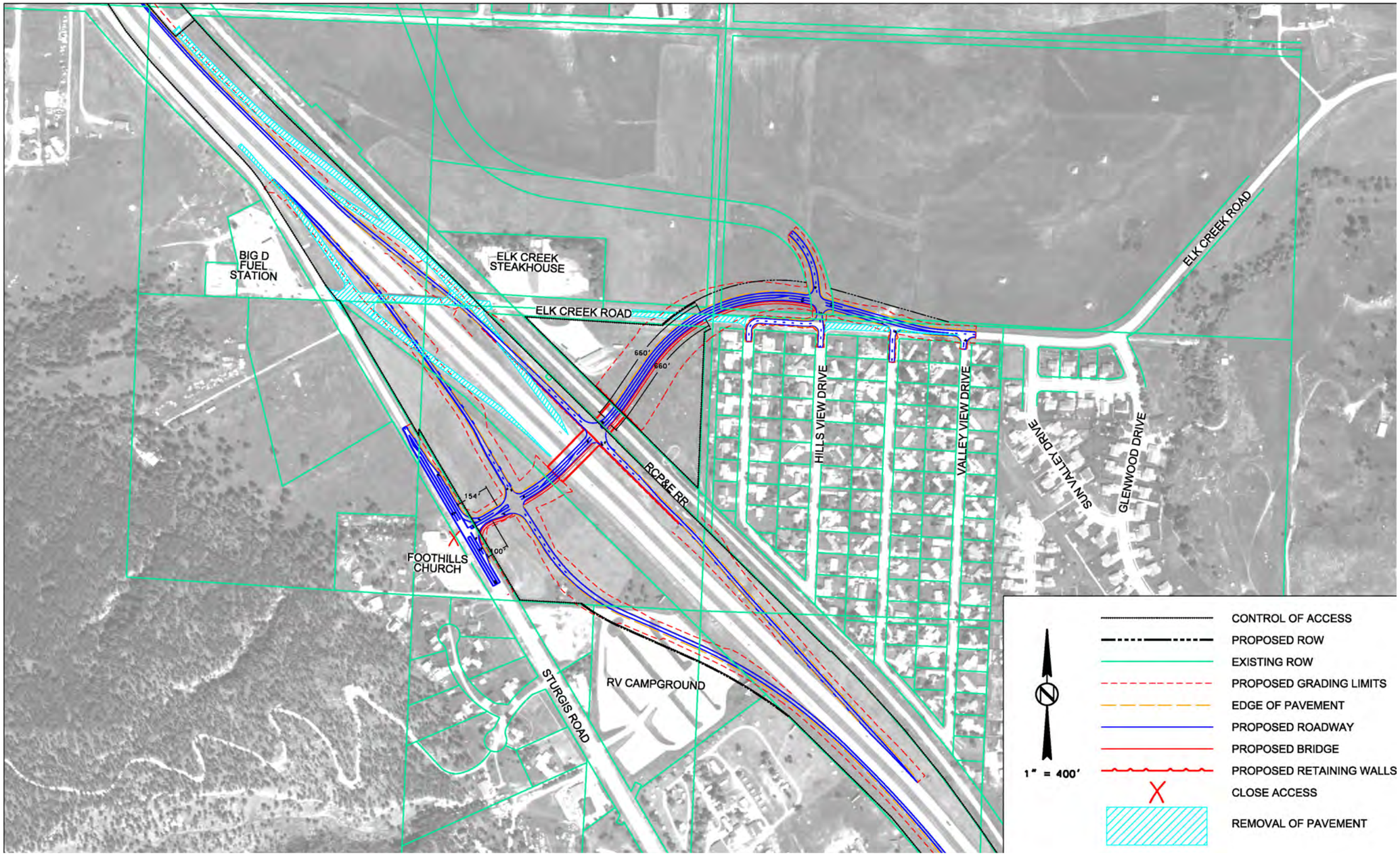
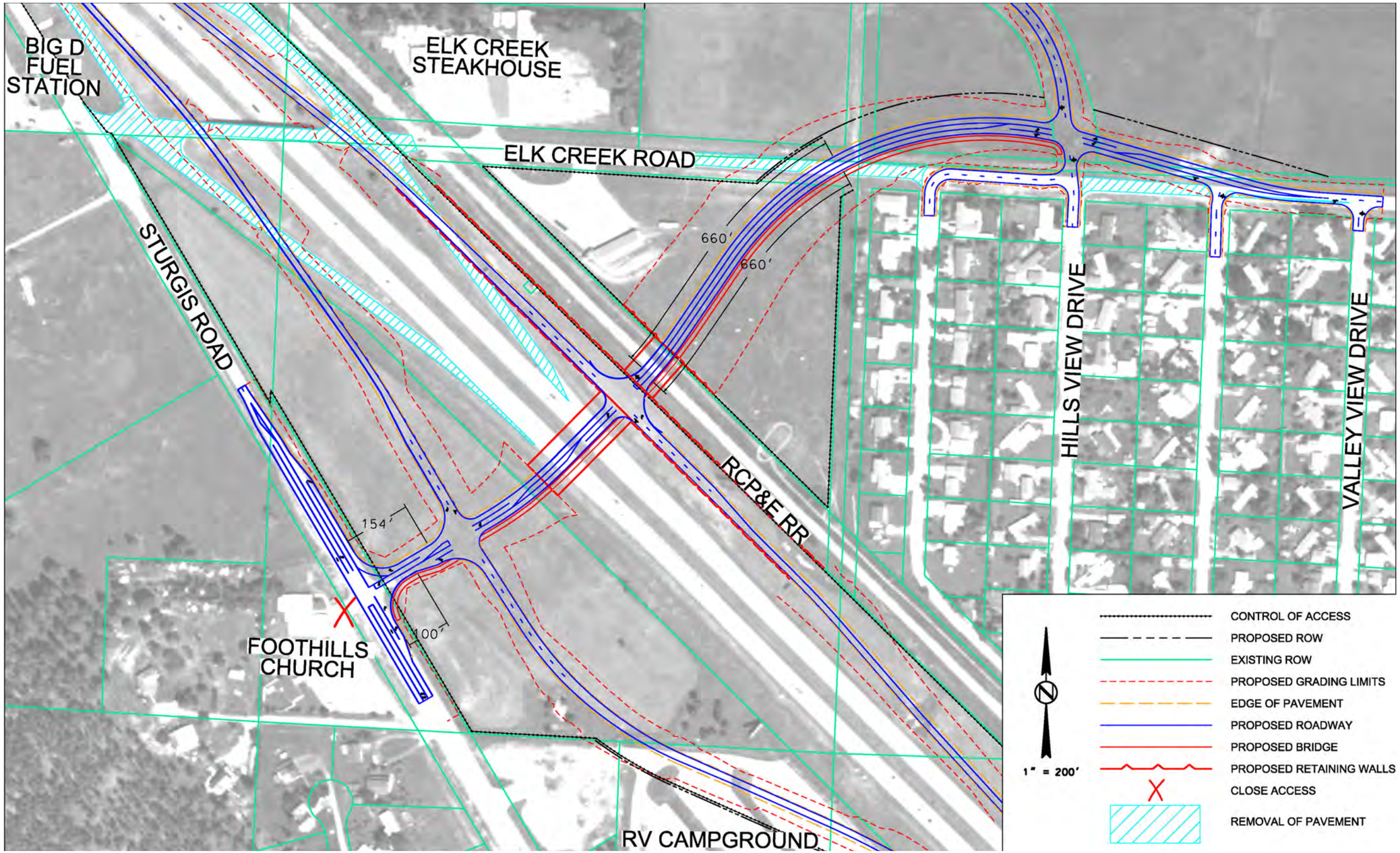


Figure 30. Exit 46 Proposed Action (Zoomed view)



APPENDIX A METHODS AND ASSUMPTIONS DOCUMENT AND AMENDMENT

1. COVER PAGE

INTERSTATE 90 EXIT 46

INTERCHANGE MODIFICATION JUSTIFICATION REPORT (IMJR)

METHODS AND ASSUMPTIONS DOCUMENT

Prepared for:

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and

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Deputy Project Manager: Devin Joslin, PE, PTOE

FHU Reference No. 115324-01
December 2015
(Methods and Assumptions Meeting held October 1, 2015)

TABLE OF CONTENTS

2. STAKEHOLDER ACCEPTANCE

The undersigned parties concur with the Methods and Assumptions for the Exit 46 Interchange Modification Justification Report (IMJR) as presented in this document.

SDDOT	FHWA
Signature	Signature
Planning Engineer	Planning/Civil Rights Specialist
Title	Title
12-15-2015	12/11/15
Date	Date

Participation of the Study Advisory Team and/or signing of this document do not constitute approval of the Exit 46 IMJR Final Report or conclusions.

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.

3. INTRODUCTION AND PROJECT DESCRIPTION

A. *Background Information*

As part of the *Interstate 90 Black Hawk – Sturgis Corridor Preservation Study* completed in 2004, it was determined that relocating the I-90 Exit 46 (Elk Creek Road) interchange would be the best alternative to prepare I-90 for future expansion. The 2008 *Environmental Assessment (EA) of Exit 40 to Exit 51* confirmed the need to relocate the interchange in preparation of future mainline I-90 expansion and determined a diamond configuration to be the preferred alternative for that relocated interchange.

The SDDOT has been making progress implementing the recommendations from the *Interstate 90 Black Hawk – Sturgis Corridor Preservation Study*. As such, the SDDOT intends to let for construction the project to relocate the Exit 46 interchange in Federal fiscal year 2020 for which this interchange study will help bring to fruition.

The Exit 46 Interchange Modification Justification Report (IMJR) must be completed to address Federal Highway Administration (FHWA) requirements prior to implementation. This document provides the Methods and Assumptions by which the IMJR will be conducted.

B. *Location and Affected Facilities*

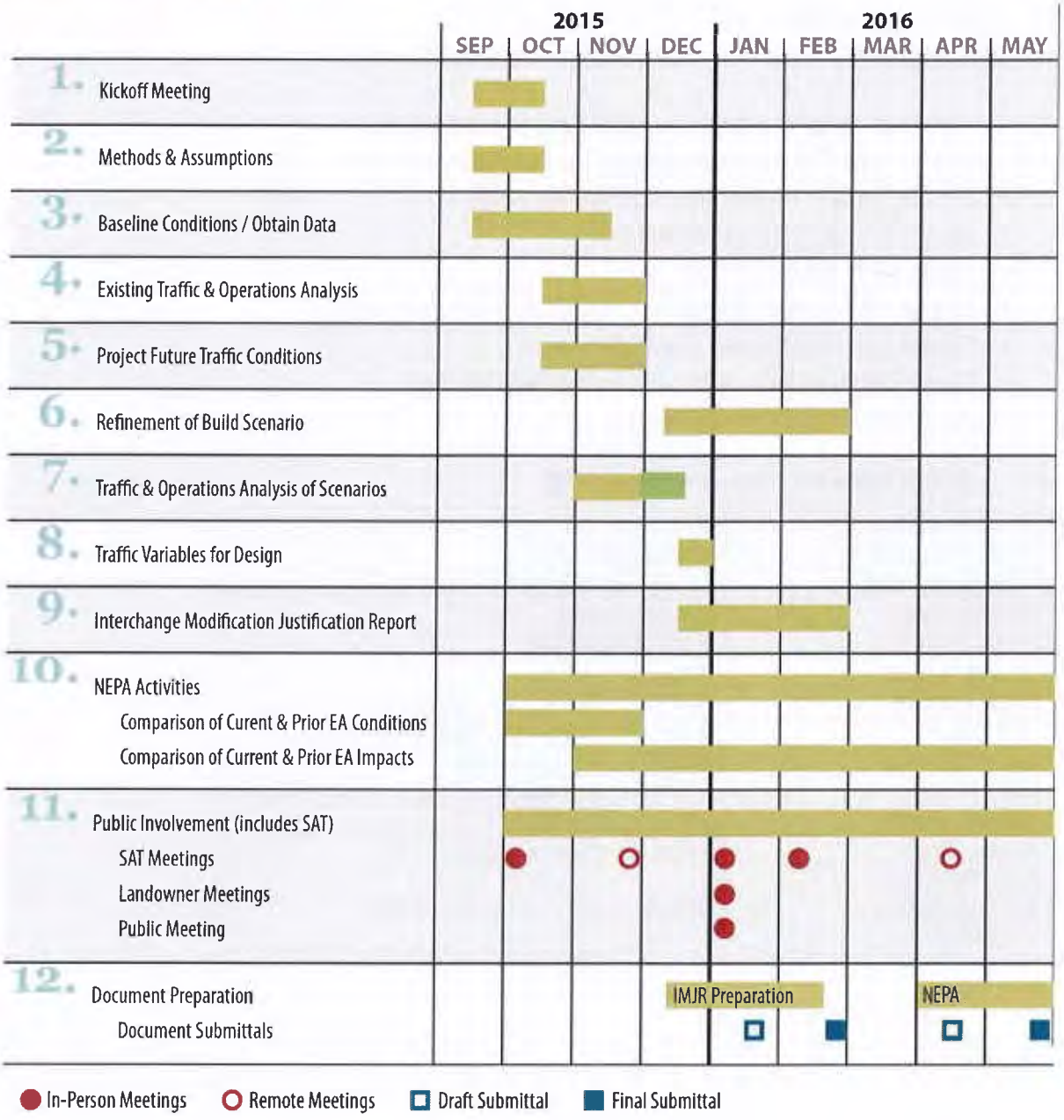
Interstate 90 (I-90) Exit 46 is configured as a diamond interchange in Meade County serving Elk Creek Road, which lies adjacent to the cities of Piedmont and Summerset. In addition to Elk Creek Road and I-90, affected facilities include Sturgis Road, Spring Valley Road, Deerview Road (Exit 44), and Stage Stop Road (Exit 48).

C. *Need for Study*

The IMJR is needed to evaluate whether Exit 46 can be relocated in a fashion that provides acceptable traffic operations and safety upon opening day and into the long term future. The IMJR will address each of FHWA's eight policy points and will be formatted according to the FHWA Interstate Access Guide, Section 3.5.3. A new environmental document will be developed alongside the IMJR to ensure that NEPA requirements are satisfied.

D. *Study Schedule*

The project officially began with a kickoff meeting with the Study Advisory Team on October 1, 2015. The anticipated project schedule, provided below, assumes this initiation date and details key activities and events needed to complete the IMJR.



Key events called out include:

- Public meeting and landowner meetings conducted in early/mid January of 2015.
- Study Advisory Team meetings held in October and December of 2015 and January, February and April of 2016.

It is anticipated that that a draft IMJR will be completed by January 2016 with the final report by late February 2016. Efforts will be made to accelerate the schedule.

E. Previous Studies

The following are the known previous studies relevant to this study.

- I-90 Black Hawk to Sturgis Corridor Preservation Study
- 2010 SDDOT Decennial Interstate Corridor Study (Phases 1-3)
- I-90 Exit 40 to 51 Environmental Assessment
- Meade County Transportation Plan
- Rapid TRIP 2040
- Exit 44 Interchange Modification Justification Report (IMJR)
- Piedmont Valley Shared Use Path Plan
- Rapid City Area Bicycle and Pedestrian Master Plan
- Elk Creek Road Corridor Plan

F. Study Advisory Team Members

Representative	Organization
Philip Anderson	City of Piedmont
George Mandas	City of Summerset
Kirk Chaffee	Meade County
Patsy Horton	Rapid City MPO
Kip Harrington	Rapid City MPO
Stacy Bartlett	SDDOT – Rapid City Region
Jeff Brosz	SDDOT – Trans. Inv. Management
Steve Johnson	SDDOT – Bridge Design
Mark Hoines	FHWA - Planning
Marc Hoelscher	FHWA - Operations
Karen Olson	SDDOT – Road Design
Brad Remmich	SDDOT – Project Development
Alice Whitebird	
Steve Gramm	

4. STUDY AREA

The study area encompasses the roadway corridors indicated on the following graphic:

Figure 1. Study Area

Study corridors include:

- Elk Creek Road from the intersection with Sturgis Road to the intersection with Glenwood Drive, approximately 0.70 miles,
- Deer View Road from Sturgis Road to Spring Valley Road, approximately 0.75 miles,
- Stage Stop Road from Sturgis Road to La Rue Road, approximately 0.80 miles,
- Mainline I-90 from west of I-90 Exit 44 to east of I-90 Exit 48, approximately 4 ½ miles,
- The ramps for the I-90 Exit 46 (Elk Creek Road) interchange,
- The ramps for the I-90 Exit 44 (Bethlehem Road) interchange, and
- The ramps for the I-90 Exit 48 (Stage Stop Road) interchange.

5. ANALYSIS YEARS/PERIODS

It is anticipated that operational analyses will be conducted for existing conditions and for years 2021 and 2045. Existing conditions analysis will be on existing traffic data. Existing traffic counts will be collected for weekday AM and PM peak period conditions. The AM peak period is assumed to extend from 6:30 AM to 8:30 AM, and the PM peak period from 4:00 PM to 6:00 PM. The peak one hour from these time frames will be selected for peak hour operational analyses.

6. DATA COLLECTION

Many sources of data will be used to establish the current baseline conditions assessment and identify existing issues affecting the transportation system. The data collection effort includes:

- Obtain and review current ordinances and guidelines
- Gather base mapping data from agencies
- Obtain existing traffic volume and turning movement data
- Gather other relevant data (e.g. land use, design plans, photography, utilities, existing development plans)
- Obtain and inventory existing crash history data
- Identify existing bicycle and pedestrian facilities
- Obtain available information regarding future development in the study area

The effort to provide traffic volume data for the project will be conducted using the following two methods:

1. Compile data from available historical and recent data with the study area from studies in the area and the SDDOT sources.

2. Collect weekday peak hour turning movement data at the study intersections. It is anticipated that turning movement data will be collected from 6:30 to 8:30 AM and from 4:00 to 6:00 PM. However, this will be confirmed and adjusted if necessary based information from method #1.

Turning movement counts will be compiled at the following intersections:

Ref #	Street #1	Street #2
1.	Chimney Canyon	Sturgis Rd
2.	Deerview Road	WB Ramps
3.	Deerview Road	EB Ramps
4.	Deerview Road	Sidney Stage Rd
5.	Deerview Road	Spring Valley Road
6.	Elk Creek Road	Sturgis Road

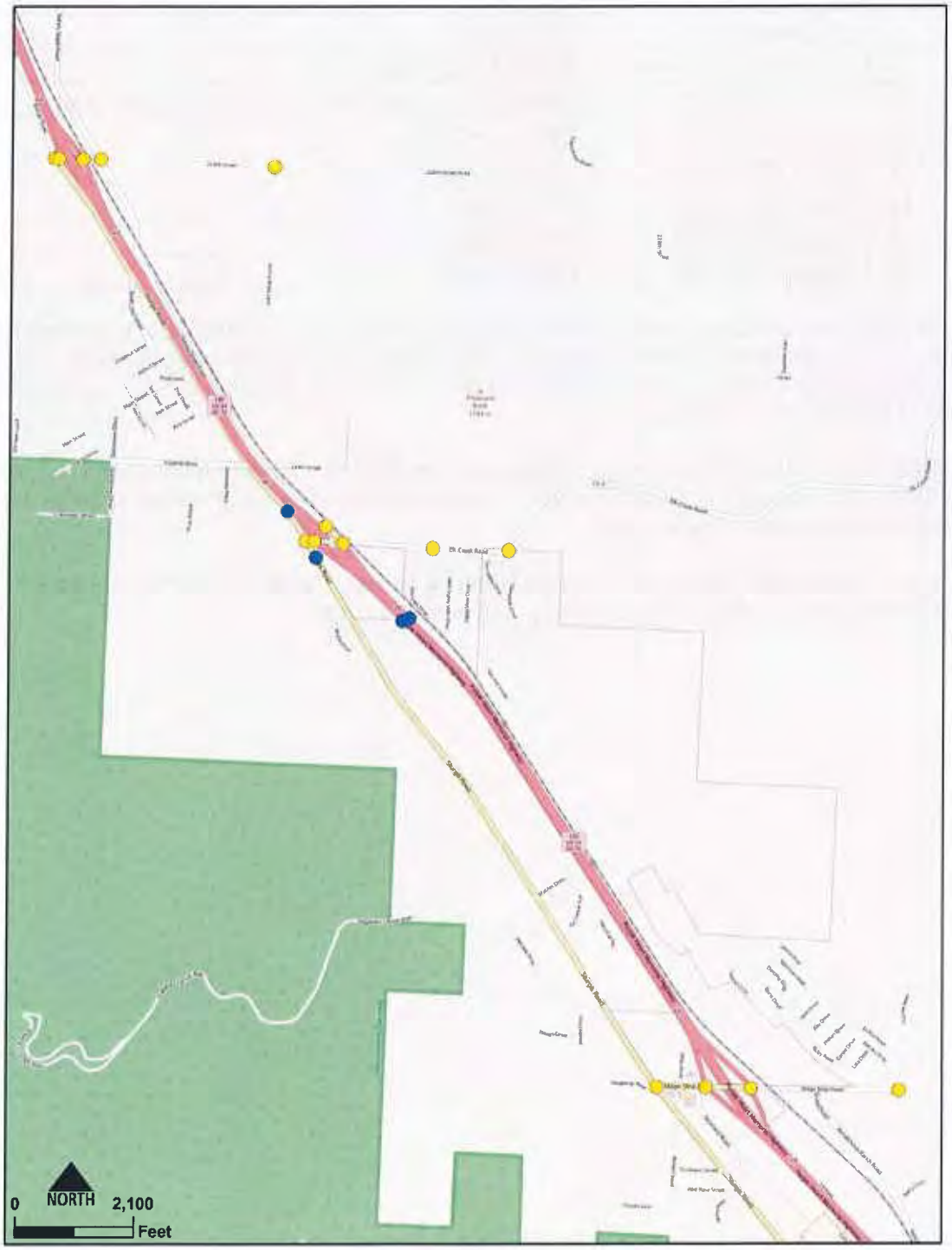
Ref #	Street #1	Street #2
7.	Elk Creek Road	WB Ramps
8.	Elk Creek Road	EB Ramps
9.	Exit 46 WB On Ramp	Sidney Stage Road
10.	Elk Creek Road	Future Spring Valley Road / Hills View Drive (East)
11.	Elk Creek Road	Glenwood Drive
12.	Stage Stop Road	Sturgis Road
13.	Stage Stop Road	EB Ramps
14.	Stage Stop Road	WB Ramps
15.	Stage Stop Road	LaRue Road

Traffic counts will be collected by All Traffic Data, Inc. All turning movement counts will be field collected using video cameras, with counts conducted after compiling the video footage. Daily vehicle classification counts will be conducted at two locations along Sturgis Road and along I-90 east of the Exit 46 interchange.

Since traffic data will be obtained from multiple sources and from different months and years. All traffic data will be factored to September 2015 using seasonal adjustment factors obtained from the weigh-in-motion station near Tilford.

The map on the following page depicts traffic count locations. Intersection turning movement counts are depicted as yellow dots and daily counts as blue dots.

Figure 2. Traffic Count Locations



7. TRAFFIC OPERATIONS ANALYSIS

Operational analysis will be based on procedures documented in the *Highway Capacity Manual 2010* (Transportation Research Board, 2010). More specifically, the following chapters of the HCM could be used to analyze specific operational conditions:

Operational Analysis

- Chapter 10 – Freeway Facilities
- Chapter 11 – Basic Freeway Segments
- Chapter 12 – Freeway Weaving Segments
- Chapter 13 – Freeway Merge and Diverge Segments
- Chapter 16 – Urban Street Facilities (Multimodal Analysis)
- Chapter 18 – Signalized Intersections
- Chapter 19 – Two-Way Stop Controlled Intersections
- Chapter 20 – All-Way Stop Controlled Intersections

Highway Capacity Software will be used to conduct operational analyses. No other traffic analysis software will be used and no micro simulations of traffic will be conducted or provided.

HCM 2010 analysis procedures require the use of certain parameters, summarized in the following table:

Traffic Parameter		I-90	Surface Streets
% heavy vehicles	Trucks and buses	Determined from recorded vehicle class on I-90	Determined from vehicle class on Sturgis Road
	RV's	0%	0%
Existing Conditions Peak Hour Factor		Determined from existing intersection counts – calculated as the PHF for the overall intersection	
Future Conditions Peak Hour Factor		0.92*	
Free-flow Speed (mph)		75	n/a
Terrain/Area Type		Level	Level
Saturation Flow Rate (vehicles per hour per lane) for two-way stop- controlled and signalized intersections		n/a	1800
Queue Length Percentile		n/a	95%ile
*A lower value may be used for the Peak Hour Factor at an intersection if the existing value is below 0.92 and future traffic forecasts indicate that the traffic stream will continue to demonstrate similar peaking characteristics. The PHF for future analysis scenarios will not be lowered below 0.88, the rural default value.			

The following table identifies urban street facilities and intersections for HCM analyses.

Urban Street Facility	Intersections		
	#	Street #1	Street #2
Exit 44: Deer View Road from Sturgis Road to Spring Valley Road	1	Chimney Canyon	Sturgis Rd
	2	Deerview Road	WB Ramps
	3	Deerview Road	EB Ramps
	4	Deerview Road	Sidney Stage Rd
	5	Deerview Road	Spring Valley Road
Exit 46: Elk Creek Road from Sturgis Road to Deerview Road	6	Elk Creek Road	Sturgis Road
	7	Elk Creek Road	WB Ramps
	8	Elk Creek Road	EB Ramps
	9	Exit 46 WB On Ramp	Sidney Stage Road
	10	Elk Creek Road	Future Spring Vly Rd / Hills View Dr E
	11	Elk Creek Road	Glenwood Drive
Exit 48: Stage Stop Road from Sturgis Road to La Rue Road	12	Stage Stop Road	Sturgis Road
	13	Stage Stop Road	EB Ramps
	14	Stage Stop Road	WB Ramps
	15	Stage Stop Road	LaRue Road

8. TRAVEL FORECAST

Exit 46 falls within the Rapid City Area MPO boundary. Therefore, the RCMPO regional travel demand model will be the basis for long range transportation projections. FHU possesses the 2040 version of the MPO travel demand model and will utilize the model to develop traffic forecasts for both the year of project completion (2021) and planning horizon year (2045) along the study corridor. Year 2021 forecasts will be developed by interpolating growth between the travel demand model base year of 2013 and 2040.

Year 2045 traffic forecasts will be developed by extending the growth rate(s) from the travel demand model an additional five years beyond 2040.

Future intersection turning movement forecasts will be developed by applying growth rates derived from the travel demand model to existing counts.

9. SAFETY ISSUES

Crash history data for the most recently available five (5) complete years will be analyzed (2010-2014) to identify crash concentrations and trends at the current Exit 46 interchange, mainline I-90 through the interchange, and adjacent intersections along Elk Creek Road. Locations showing elevated crash experience will be noted and reviewed to identify particular crash type and severity patterns.

10. SELECTION OF MEASURES OF EFFECTIVENESS (MOE)

The primary measures of effectiveness for this effort will include the following:

- Intersection and facility operations will use average delay per vehicle, density and speed as calculated by the Highway Capacity Software (HCS) to determine Level of Service (LOS).
- Bicycle and pedestrian LOS evaluations for Urban Street Analysis will rely upon scores calculated using the HCM methodology. For this analysis, no transit results will be calculated as it is assumed that no fixed route transit service will be provided.

In general, the primary mobility goal for the study will be Level of Service (LOS) D or better for overall signalized intersection operations and for individual movements at unsignalized intersections; however, it is understood that there might be some instances where minor street level of service is LOS E or LOS F, in which case the volume-to-capacity ratio and 95th percentile queue lengths will also be considered. LOS C or better will be the goal for mainline freeway, ramp terminal intersections, merge/diverge and weaving segments.

11. FHWA INTERSTATE ACCESS MODIFICATION POLICY POINTS

The eight FHWA policy points are listed as follows, with a brief description of the level of detail anticipated to be provided for each:

1. *The need being addressed by the request cannot be adequately satisfied by existing interchanges to the Interstate, and/or local roads and streets in the corridor can neither provide the desired access, nor can they be reasonably improved (such as access control along surface streets, improving traffic control, modifying ramp terminals and intersections, adding turn bays or lengthening storage) to satisfactorily accommodate the design-year traffic demands (23 CFR 625.2(a)).*

The existing Exit 46 interchange will be reviewed to identify potential minor improvements that would accommodate future widening of I-90 while also serving interchange traffic volumes. The analysis will be described in the text of the IMJR to address this policy point.

2. *The need being addressed by the request cannot be adequately satisfied by reasonable transportation system management (such as ramp metering, mass transit, and HOV facilities), geometric design, and alternative improvements to the Interstate without the proposed change(s) in access (23 CFR 625.2(a)).*

A review of TSM strategies and tools will be conducted to determine whether any are applicable to or feasible for Exit 46. If any are found, their effect will be evaluated to determine whether they reduce peak traffic demand enough to eliminate the need for interchange relocation. SDDOT has indicated that ramp metering and HOV facilities are not used in South Dakota at this time.

3. *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, ramp intersections with crossroad) or on the local street network based on both the current and the planned future traffic projections. The analysis shall, particularly in urbanized areas, include at least the first adjacent existing or proposed interchange on either side of the proposed change in access (23 CFR 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, shall 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 must 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 must 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)).

The IMJR will include a full analysis of existing, future opening day (2021) and Year 2045 traffic operations at Exit 46, including its ramp connections to I-90 and Elk Creek Road on both sides of the interchange. Exits 44 and 48 will be analyzed similarly for current and future scenarios. The analyses are expected to yield information regarding the potential for adverse operational effects. Crash history will be reviewed to identify existing crash patterns and the influence of a relocated Exit 46 on safety will be assessed using available crash prediction methods. A preliminary Exit 46 signing concept, showing the signs one mile away on both sides of the Exit 46 interchange, will be included in the IMJR. This will be reviewed by the Region Traffic Engineer.

4. *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 for managed lanes (e.g., transit, HOVs, HOT 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)).*

The preferred alternative will be reviewed to ensure all movements are provided.

5. *The proposal considers and is consistent with local and regional land use and transportation plans. Prior to receiving final approval, all requests for new or revised access must be included in an adopted Metropolitan Transportation Plan, in the adopted Statewide or Metropolitan Transportation Improvement Program (STIP or TIP), and the Congestion Management Process within transportation management areas, as appropriate, and as specified in 23 CFR part 450, and the transportation conformity requirements of 40 CFR parts 51 and 93.*

Relevant plans will be reviewed for inclusion of the Exit 46 project.

6. *In corridors where the potential exists for future multiple interchange additions, a comprehensive corridor or network study must accompany all requests for new or revised access with recommendations that address all of the proposed and desired access changes within the context of a longer-range system or network plan (23 U.S.C. 109(d), 23 CFR 625.2(a), 655.603(d), and 771.111).*

Based on a review of previous studies, no new interchanges are anticipated in the Exit 46 vicinity. This statement will be included in the IMJR.

7. *When a new or revised access point is due to a new, expanded, or substantial change in current or planned future development or land use, requests must demonstrate appropriate coordination has occurred between the development and any proposed transportation system improvements (23 CFR 625.2(a) and 655.603(d)). The request must describe the*

commitments agreed upon to assure adequate collection and dispersion of the traffic resulting from the development with the adjoining local street network and Interstate access point (23 CFR 625.2(a) and 655.603(d)).

The IMJR effort includes outreach to local communities and landowners to understand development plans. The text will provide a qualitative description of the relationship of Exit 46 to surrounding land use and development plans. A public meeting and meetings with affected landowners are planned to be held.

8. *The proposal can be expected to be included as an alternative in the required environmental evaluation, review and processing. The proposal should include supporting information and current status of the environmental processing (23 CFR 771.111).*

The I-90 Exit 40 to 51 Environmental Assessment included Exit 46 relocation, and environmental documentation will be developed for current conditions. The IMJR will document the status of these efforts.

12. DEVIATIONS / JUSTIFICATIONS

We do not anticipate any deviations from stated standards.

13. CONCLUSION

The study will include performing a HCM2010 based traffic analysis comparison of the relocated interchange option of the I-90 Exit 46 interchange (As shown in Figure 2) brought forth by the *Environmental Assessment (EA) of Exit 40 to Exit 51* versus the existing configuration.

In addition to the interchange specific objective listed above, the study is expected to fulfill the following additional objectives:

1. Create an Interchange Modification Justification Report (IMJR) for the SDDOT to submit to FHWA.

2. Develop new environmental document specific to the I-90 Exit 46 interchange.

3. Create final products for use by the City of Piedmont, the City of Summerset, Meade County, the Rapid City Area MPO and the SDDOT which will provide guidance to implement recommended improvements and react to future development plans within the area.

14. APPENDICES

Appendix A Methods & Assumptions Meeting Notes

Appendix A Methods & Assumptions Meeting Notes

I-90 Exit 46 IMJR Meeting Minutes

Methods and Assumptions Meeting

Thursday, October 1, 2015 at 1:30 PM MST
SDDOT Rapid City Region – Large Meeting Room

ATTENDEES

Name	*Agency*
Steve Gramm	SDDOT
Brad Remmich	SDDOT
Marc Hoelscher	FHWA
Kip Harrington	Rapid City MPO
Lyle DeVries	FHU
Devin Joslin	FHU

METHODS AND ASSUMPTIONS DOCUMENT DISCUSSION

The DRAFT Methods and Assumptions Document prepared by FHU was reviewed section by section, with discussion points summarized as follows:

- **Section 1. Cover Page**
  - The attendees agreed with the contents of this section as written.
- **Section 2. Stakeholder Acceptance Page**
  - SDDOT and FHWA gave concurrence with format of stakeholder acceptance page.
- **Section 3. Introduction and Project Description**
  - The following edits were suggested:
    - Consider revising the description of the location of the interchange to more accurately describe its proximity to the boundaries of the cities of Piedmont and Summerset.
    - It was noted that a new environmental document will be produced in conjunction with the IMJR report to ensure NEPA requirements are satisfied. References to an environmental "update" within the document are to be removed.
    - A typo in the project schedule under item 9 is to be fixed regarding the spelling of "Justification."
    - January 1, 2015 was noted as the absolute latest date acceptable for a DRAFT IMJR Report.
    - The Elk Creek Road Corridor Plan is to be added to the list of Previous Studies.
    - The specific name of the Meade County Transportation Plan (Meade Moving Forward) will be added.
    - Marion Barber is to be removed from the Study Advisory Team. She would have been involved had an EA evaluating Elk Creek Road been required.

- **Section 4. Study Area**
  - The attendees agreed with the contents of this section as written.
- **Section 5. Analysis Years/Periods**
  - The attendees agreed with the contents of this section as written.
- **Section 6. Data Collection**
  - It was suggested the following items be removed from the bulleted list on page 6 describing the data collection effort:
    - Identify freight capabilities;
    - Determine functional class of the existing roadway network; and
    - Identify existing transit systems.
  - The times of the peak hours based on the count data SDDOT had provided were discussed. It appears that the AM peak hour occurs between 7:00-8:00 AM and the PM peak hour occurs between 4:45-5:45 PM, based on counts conducted at the Exit 46 ramps conducted in 2013.
    - It was agreed the peak hour intersection turning movement counts would be conducted between 6:30 AM-8:30 AM and 4:00-6:00 PM.
  - A map showing the locations where traffic count data was collected will be added to the IMJR report.
  - Seasonal factors were discussed and it was determined that data from the I-90 Tilford Weigh-In-Motion station should be used to factor counts to September 2015.
  - It was requested that SDDOT set tubes on Interstate 90 to the north of Exit 46.
- **Section 7. Traffic Operations Analysis**
  - It was requested that the values planned to be used for analysis variables, such as PHF, truck percentage, saturation flow rate, etc. be listed or methodology planned to be used to calculate them be defined.
  - Limitations to the methodology contained in Chapter 16 of the *Highway Capacity Manual, 2010* related to analysis of Urban Street Facilities (Multimodal Analysis) were briefly discussed.
    - It was noted that no signalized intersections currently exist within the study area and that certain intersections within the study area will need to be assumed to be signalized in order to conduct the multimodal analysis.
  - It was reiterated that analyses will be conducted using HCS™ 2010 software; no microsimulation will be conducted and no other traffic analysis software program is to be used.
- **Section 8. Travel Forecast**
  - It was noted that it would be difficult for the Rapid City MPO to provide year 2045 land use forecasts, given the relatively short timeframe within the traffic volume forecasts are to be completed.
  - It was agreed that the method to be used to forecast year 2045 traffic volumes was to extend the growth rate(s) from the travel demand model an additional five years beyond 2040.

- **Section 9. Safety Issues**
  - The attendees agreed with the contents of this section as written.
- **Section 10. Selection of Measures of Effectiveness (MOE)**
  - The LOS D or better requirement for individual movements at unsignalized intersections was to be evaluated on a case-by-case basis. It was noted that there may be instances where the side-street LOS is E or F, but with acceptable v/c ratios and manageable 95th percentile queue lengths.
  - Analysis of the ramp terminal intersections is also planned to be included.
- **Section 11. FHWA Interstate Access Modification Policy Points**
  - Under Policy Point #2, it was deemed that ramp metering and HOV facilities are unnecessary, as they are not used in the State of South Dakota.
  - Under Policy Point #3, the requirements for the preliminary signing concept were discussed in more detail.
    - It was noted that the plan should include signs within one mile in either direction of Exit 46.
    - Some examples of previous signing plans were shown and a preference for the plan being shown on top of an aerial background was noted.
    - The signing plan will be reviewed by the Region Traffic Engineer.
  - Under Policy Point #7, the public meeting is to be mentioned.
  - Under Policy Point #8, the word "refresh" is to be changed to study to note that a new environmental document is planned to be prepared, as opposed to an update to the EA.
- **Section 12. Deviations/Justifications**
  - The attendees agreed with the contents of this section as written.
- **Section 13. Conclusion**
  - Objective #2 noted will be revised to state that a new environmental document will be prepared.
- **Section 14. Appendices**
  - Meeting Minutes from the Methods and Assumptions meeting are to be included as an Appendix to the Methods and Assumptions document.

ACTION ITEMS

- SDDOT and FHWA gave verbal approval for traffic data collection to occur prior to formal acceptance of the Methods and Assumptions document.
- SDDOT to conduct daily counts on I-90 to the north of Exit 46.
- FHU to revise Methods and Assumptions document to reflect edits and changes noted in these meeting minutes.
- FHU to coordinate traffic data collection; traffic data collection was delayed until the week of November 2 due to a construction project at Exit 44 within the study area.

1. COVER PAGE

INTERSTATE 90 EXIT 46

INTERCHANGE MODIFICATION JUSTIFICATION REPORT (IMJR)

METHODS AND ASSUMPTIONS AMENDMENT DOCUMENT

Prepared for:

South Dakota Department of Transportation
700 East Broadway Avenue
Pierre, South Dakota 57501-2586
(605) 773-3093

and

Federal Highway Administration
116 East Dakota Avenue, Suite A
Pierre, South Dakota 57501
(605) 224-8033

Prepared by:

Felsburg Holt & Ullevig
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(303) 721-1440

Principal-In-Charge/Project Manager: Lyle DeVries, PE, PTOE
Deputy Project Manager: Devin Joslin, PE, PTOE

FHU Reference No. 115324-01
January 2016
(Methods and Assumptions Meeting held October 1, 2015)

2. STAKEHOLDER ACCEPTANCE

The undersigned parties concur with the Methods and Assumptions for the Exit 46 Interchange Modification Justification Report (IMJR) as presented in this document.

SDDOT

Signature

Planning Engineer
Title

12-15-2015
Date

FHWA

Signature

Planning/Civil Rights Specialist
Title

12/11/15
Date

AMENDMENT

SDDOT

Signature

Planning Engineer
Title

1-19-2016
Date

FHWA

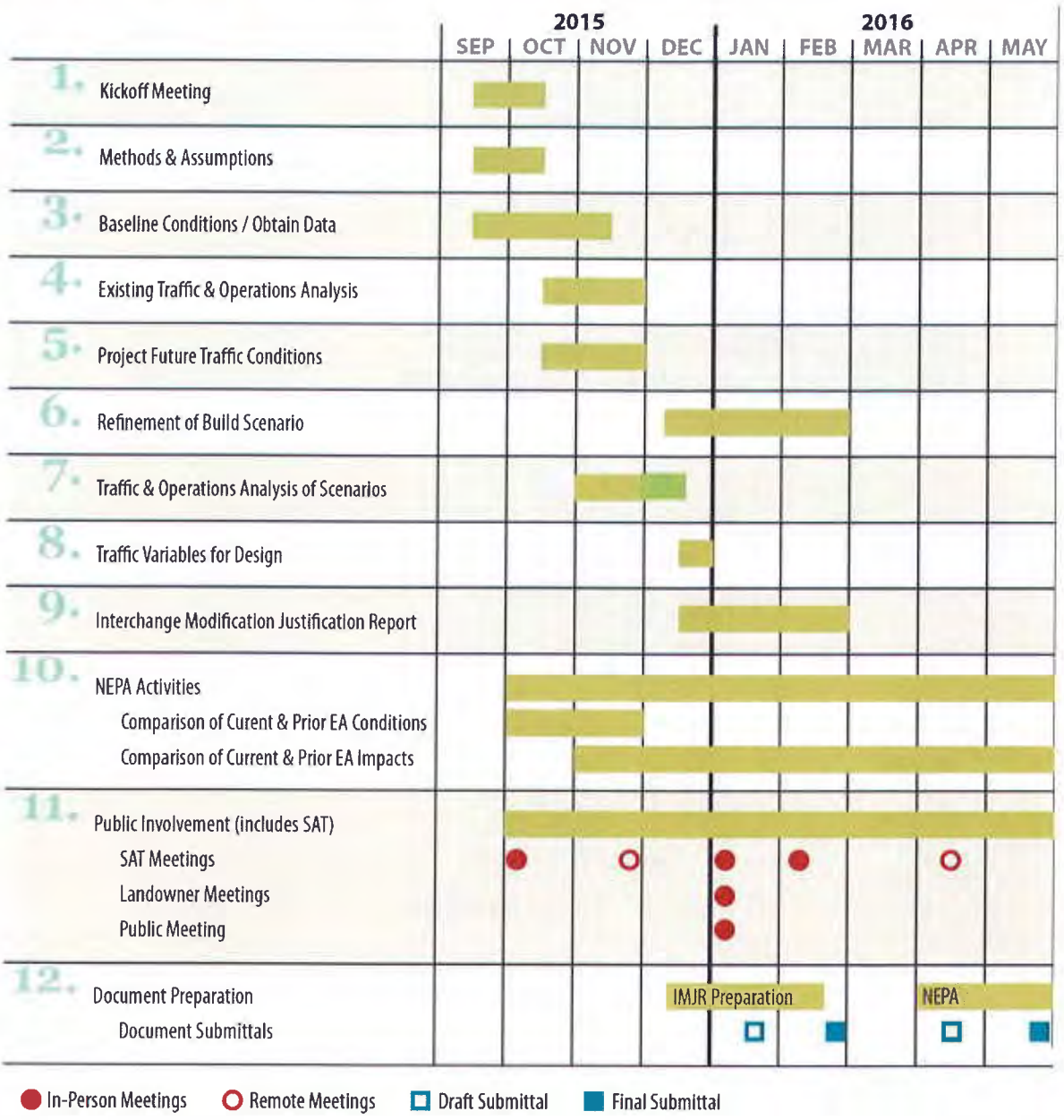
Signature

Planning/Civil Rights specialist
Title

1/21/16
Date

Participation of the Study Advisory Team and/or signing of this document do not constitute approval of the Exit 46 IMJR Final Report or conclusions.

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.



Key events called out include:

- Public meeting and landowner meetings conducted in early/mid-January of 201.
- Study Advisory Team meetings held in October and Decem ber of 2015 and January, February and April of 2016.

It is anticipated that that a draft IMJR will be completed by January 2016 with the final report by late February 2016. Efforts will be made to accelerate the schedule.

4. STUDY AREA

The study area encompasses the roadway corridors indicated on the following graphic:

Figure 1. Study Area

Study corridors include:

- Elk Creek Road from the intersection with Sturgis Road to the intersection with Glenwood Drive, approximately 0.70 miles,
- Deer View Road from Sturgis Road to Spring Valley Road, approximately 0.75 miles,
- Stage Stop Road from Sturgis Road to La Rue Road, approximately 0.80 miles,
- Mainline I-90 from west of I-90 Exit 44 to east of I-90 Exit 48, approximately 4 ½ miles,
- The ramps for the I-90 Exit 46 (Elk Creek Road) interchange,
- The ramps for the I-90 Exit 44 (Bethlehem Road) interchange, and
- The ramps for the I-90 Exit 48 (Stage Stop Road) interchange.

Ref #	Street #1	Street #2
9.	Exit 46 WB On Ramp	Sidney Stage Road
10.	Elk Creek Road	Future Spring Valley Road / Hills View Drive (East)
11.	Elk Creek Road	Glenwood Drive
12.	Stage Stop Road	Sturgis Road
13.	Stage Stop Road	EB Ramps
14.	Stage Stop Road	WB Ramps
15.	Stage Stop Road	LaRue Road

Traffic counts will be collected by All Traffic Data, Inc. All turning movement counts will be field collected using video cameras, with counts conducted after compiling the video footage. Daily vehicle classification counts will be conducted at two locations along Sturgis Road and along I-90 east of the Exit 46 interchange.

Since traffic data will be obtained from multiple sources and from different months and years. All traffic data will be factored to September 2015 using seasonal adjustment factors obtained from the weigh-in-motion station near Tilford.

The map on the following page depicts traffic count locations. Intersection turning movement counts are depicted as yellow dots and daily counts as blue dots.

7. TRAFFIC OPERATIONS ANALYSIS

Operational analysis will be based on procedures documented in the *Highway Capacity Manual 2010* (Transportation Research Board, 2010). More specifically, the following chapters of the HCM could be used to analyze specific operational conditions:

Operational Analysis

- Chapter 10 – Freeway Facilities
- Chapter 11 – Basic Freeway Segments
- Chapter 12 – Freeway Weaving Segments
- Chapter 13 – Freeway Merge and Diverge Segments
- ~~Chapter 16 – Urban Street Facilities (Multimodal Analysis)~~
- Chapter 18 – Signalized Intersections
- Chapter 19 – Two-Way Stop Controlled Intersections
- Chapter 20 – All-Way Stop Controlled Intersections

Highway Capacity Software will be used to conduct operational analyses. No other traffic analysis software will be used and no micro simulations of traffic will be conducted or provided.

HCM 2010 analysis procedures require the use of certain parameters, summarized in the following table:

Traffic Parameter		**I-90**	**Surface Streets**
% heavy vehicles	Trucks and buses	Determined from recorded vehicle class on I-90	Determined from vehicle class on Sturgis Road
	RV's	0%	0%
Existing Conditions Peak Hour Factor		Determined from existing intersection counts – calculated as the PHF for the overall intersection	
Future Conditions Peak Hour Factor		0.92*	
Free-flow Speed (mph)		75	n/a
Terrain/Area Type		Level	Level
Saturation Flow Rate (vehicles per hour per lane) for two-way stop- controlled and signalized intersections		n/a	1800
Queue Length Percentile		n/a	95%ile
*A lower value may be used for the Peak Hour Factor at an intersection if the existing value is below 0.92 and future traffic forecasts indicate that the traffic stream will continue to demonstrate similar peaking characteristics. The PHF for future analysis scenarios will not be lowered below 0.88, the rural default value.			

- Intersection and facility operations will use average delay per vehicle, density and speed as calculated by the Highway Capacity Software (HCS) to determine Level of Service (LOS).
- Bicycle and pedestrian LOS evaluations for segments of facilities will rely upon the methodologies from the NCHRP Report 616. Transit results will not be calculated as it is assumed that no fixed route transit service will be provided.

In general, the primary mobility goal for the study will be Level of Service (LOS) D or better for overall signalized intersection operations and for individual movements at unsignalized intersections; however, it is understood that there might be some instances where minor street level of service is LOS E or LOS F, in which case the volume-to-capacity ratio and 95th percentile queue lengths will also be considered. LOS C or better will be the goal for mainline freeway, ramp terminal intersections, merge/diverge and weaving segments.

11. FHWA INTERSTATE ACCESS MODIFICATION POLICY POINTS

The eight FHWA policy points are listed as follows, with a brief description of the level of detail anticipated to be provided for each:

1. *The need being addressed by the request cannot be adequately satisfied by existing interchanges to the Interstate, and/or local roads and streets in the corridor can neither provide the desired access, nor can they be reasonably improved (such as access control along surface streets, improving traffic control, modifying ramp terminals and intersections, adding turn bays or lengthening storage) to satisfactorily accommodate the design-year traffic demands (23 CFR 625.2(a)).*

The existing Exit 46 interchange will be reviewed to identify potential minor improvements that would accommodate future widening of I-90 while also serving interchange traffic volumes. The analysis will be described in the text of the IMJR to address this policy point.

2. *The need being addressed by the request cannot be adequately satisfied by reasonable transportation system management (such as ramp metering, mass transit, and HOV facilities), geometric design, and alternative improvements to the Interstate without the proposed change(s) in access (23 CFR 625.2(a)).*

A review of TSM strategies and tools will be conducted to determine whether any are applicable to or feasible for Exit 46. If any are found, their effect will be evaluated to determine whether they reduce peak traffic demand enough to eliminate the need for interchange relocation. SDDOT has indicated that ramp metering and HOV facilities are not used in South Dakota at this time.

3. *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, ramp intersections with crossroad) or on the local street network based on both the current and the planned future traffic projections. The analysis shall, particularly in urbanized areas, include at least the first adjacent existing or proposed interchange on either side of the proposed change in access (23 CFR 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, shall be*

commitments agreed upon to assure adequate collection and dispersion of the traffic resulting from the development with the adjoining local street network and Interstate access point (23 CFR 625.2(a) and 655.603(d)).

The IMJR effort includes outreach to local communities and landowners to understand development plans. The text will provide a qualitative description of the relationship of Exit 46 to surrounding land use and development plans. A public meeting and meetings with affected landowners are planned to be held.

8. *The proposal can be expected to be included as an alternative in the required environmental evaluation, review and processing. The proposal should include supporting information and current status of the environmental processing (23 CFR 771.111).*

The I-90 Exit 40 to 51 Environmental Assessment included Exit 46 relocation, and environmental documentation will be developed for current conditions. The IMJR will document the status of these efforts.

12. DEVIATIONS / JUSTIFICATIONS

We do not anticipate any deviations from stated standards.

13. CONCLUSION

The study will include performing a HCM2010 based traffic analysis comparison of the relocated interchange option of the I-90 Exit 46 interchange (As shown in Figure 2) brought forth by the *Environmental Assessment (EA) of Exit 40 to Exit 51* versus the existing configuration.

In addition to the interchange specific objective listed above, the study is expected to fulfill the following additional objectives:

1. Create an Interchange Modification Justification Report (IMJR) for the SDDOT to submit to FHWA.

2. Develop new environmental document specific to the I-90 Exit 46 interchange.

3. Create final products for use by the City of Piedmont, the City of Summerset, Meade County, the Rapid City Area MPO and the SDDOT which will provide guidance to implement recommended improvements and react to future development plans within the area.

14. APPENDICES

Appendix A Methods & Assumptions Meeting Notes

APPENDIX B TRAFFIC COUNTS

Study Name 15350 - SD 1 I-90 E-O EXIT 46
Start Date 11/03/2015
Start Time 12:00 AM
Site Code 1

Channel Direction	Direction Westbound	Direction Eastbound			cumulative		1.2	
			WB	EB	WB	EB	WB	EB
12:00 AM	3	12	8	15	8	15	10	18
12:15 AM	2	4	3	4	11	19	13	23
12:30 AM	11	6	15	7	26	26	31	31
12:45 AM	5	7	7	9	33	35	40	42
1:00 AM	6	3	7	4	32	24	38	29
1:15 AM	10	3	12	8	41	28	49	34
1:30 AM	4	8	6	10	32	31	38	37
1:45 AM	5	2	8	5	33	27	40	32
2:00 AM	2	5	6	5	32	28	38	34
2:15 AM	6	9	10	11	30	31	36	37
2:30 AM	2	9	6	11	30	32	36	38
2:45 AM	2	3	3	6	25	33	30	40
3:00 AM	1	7	7	8	26	36	31	43
3:15 AM	3	6	7	11	23	36	28	43
3:30 AM	3	3	9	8	26	33	31	40
3:45 AM	9	5	12	5	35	32	42	38
4:00 AM	8	12	11	18	39	42	47	50
4:15 AM	7	5	18	8	50	39	60	47
4:30 AM	6	14	13	19	54	50	65	60
4:45 AM	17	19	24	23	66	68	79	82
5:00 AM	18	34	27	37	82	87	98	104
5:15 AM	24	54	34	60	98	139	118	167
5:30 AM	24	78	33	81	118	201	142	241
5:45 AM	30	75	45	79	139	257	167	308
6:00 AM	56	104	71	109	183	329	220	395
6:15 AM	71	126	83	138	232	407	278	488
6:30 AM	83	170	101	183	300	509	360	611
6:45 AM	107	141	127	148	382	578	458	694
7:00 AM	170	203	190	209	501	678	601	814
7:15 AM	133	264	150	272	568	812	682	974
7:30 AM	125	277	142	285	609	914	731	1097

7:45 AM	101	197	121	212	603	978	724	1174		
8:00 AM	114	152	136	156	549	925	659	1110		
8:15 AM	136	131	157	141	556	794	667	953		
8:30 AM	109	129	134	137	548	646	658	775		
8:45 AM	112	123	135	141	562	575	674	690		
9:00 AM	114	123	145	134	571	553	685	664		
9:15 AM	97	138	125	147	539	559	647	671		
9:30 AM	93	130	116	137	521	559	625	671		
9:45 AM	101	132	118	146	504	564	605	677		
10:00 AM	107	119	119	135	478	565	574	678		
10:15 AM	120	130	138	144	491	562	589	674		
10:30 AM	107	132	132	151	507	576	608	691		
10:45 AM	109	97	123	115	512	545	614	654		
11:00 AM	103	113	122	129	515	539	618	647		
11:15 AM	112	125	134	139	511	534	613	641		
11:30 AM	98	120	111	143	490	526	588	631		
11:45 AM	104	137	122	154	489	565	587	678		
12:00 PM	109	112	126	130	493	566	592	679		
12:15 PM	124	122	136	138	495	565	594	678		
12:30 PM	122	114	139	132	523	554	628	665		
12:45 PM	107	116	122	132	523	532	628	638		
1:00 PM	128	109	142	121	539	523	647	628		
1:15 PM	126	144	147	171	550	556	660	667		
1:30 PM	162	115	179	127	590	551	708	661		
1:45 PM	128	121	147	142	615	561	738	673		
2:00 PM	124	128	139	146	612	586	734	703		
2:15 PM	164	113	174	136	639	551	767	661		
2:30 PM	126	127	137	140	597	564	716	677		
2:45 PM	155	112	169	138	619	560	743	672		
3:00 PM	138	124	163	144	643	558	772	670		
3:15 PM	146	143	164	174	633	596	760	715		
3:30 PM	189	157	196	181	692	637	830	764		
3:45 PM	185	147	195	182	718	681	862	817		
4:00 PM	205	172	221	185	776	722	931	866		
4:15 PM	205	184	219	209	831	757	997	908		
4:30 PM	194	184	210	202	845	778	1014	934		
4:45 PM	238	179	251	194	901	790	1081	948		
5:00 PM	224	177	234	202	914	807	1097	968		
5:15 PM	254	155	259	174	954	772	1145	926		
5:30 PM	238	160	243	174	987	744	1184	893	2077	
5:45 PM	184	139	191	150	927	700	1112	840	9.4%	
6:00 PM	150	97	161	124	854	622	1025	746		
6:15 PM	124	96	134	119	729	567	875	680		
6:30 PM	111	86	117	105	603	498	724	598		

6:45 PM	104	65	114	86	526	434	631	521
7:00 PM	104	50	111	58	476	368	571	442
7:15 PM	74	56	86	70	428	319	514	383
7:30 PM	81	61	90	74	401	288	481	346
7:45 PM	67	65	74	69	361	271	433	325
8:00 PM	62	49	71	57	321	270	385	324
8:15 PM	79	39	85	44	320	244	384	293
8:30 PM	71	39	80	49	310	219	372	263
8:45 PM	64	44	72	60	308	210	370	252
9:00 PM	55	29	61	34	298	187	358	224
9:15 PM	47	38	54	48	267	191	320	229
9:30 PM	39	24	42	29	229	171	275	205
9:45 PM	25	21	34	27	191	138	229	166
10:00 PM	14	14	19	23	149	127	179	152
10:15 PM	20	23	25	30	120	109	144	131
10:30 PM	18	17	23	25	101	105	121	126
10:45 PM	20	8	22	13	89	91	107	109
11:00 PM	12	9	16	12	86	80	103	96
11:15 PM	12	12	17	18	78	68	94	82
11:30 PM	6	7	13	10	68	53	82	64
11:45 PM	7	7	8	9	54	49	65	59
			9215	9274				
				18489				
			1.2	22186.8	9.4%			
			1.18	21817.02				

Study Name 15350 - SD 1
Start Date 11/03/2015
Start Time 12:00 AM
Site Code 1

Channel Direction	Direction Westbound	Direction Eastbound
12:00 AM	0	0
12:15 AM	1	0
12:30 AM	2	0
12:45 AM	0	0
1:00 AM	0	1
1:15 AM	0	0
1:30 AM	0	0
1:45 AM	0	0
2:00 AM	1	0
2:15 AM	0	0
2:30 AM	0	0
2:45 AM	0	0
3:00 AM	0	0
3:15 AM	0	0
3:30 AM	3	1
3:45 AM	1	0
4:00 AM	1	1
4:15 AM	9	0
4:30 AM	6	1
4:45 AM	7	2
5:00 AM	4	1
5:15 AM	3	3
5:30 AM	2	0
5:45 AM	4	3
6:00 AM	4	2
6:15 AM	4	2
6:30 AM	7	6
6:45 AM	8	2
7:00 AM	4	1
7:15 AM	8	4
7:30 AM	4	3
7:45 AM	8	4
8:00 AM	11	3
8:15 AM	10	4
8:30 AM	14	6
8:45 AM	9	7
9:00 AM	14	4
9:15 AM	8	5
9:30 AM	9	2
9:45 AM	7	6

10:00 AM	4	5
10:15 AM	6	4
10:30 AM	8	11
10:45 AM	6	11
11:00 AM	7	5
11:15 AM	8	2
11:30 AM	5	4
11:45 AM	9	4
12:00 PM	7	4
12:15 PM	6	5
12:30 PM	6	9
12:45 PM	7	4
1:00 PM	6	6
1:15 PM	7	7
1:30 PM	9	2
1:45 PM	6	6
2:00 PM	5	7
2:15 PM	4	11
2:30 PM	3	2
2:45 PM	4	12
3:00 PM	6	4
3:15 PM	5	6
3:30 PM	1	8
3:45 PM	3	11
4:00 PM	4	7
4:15 PM	3	6
4:30 PM	6	7
4:45 PM	4	5
5:00 PM	1	4
5:15 PM	1	4
5:30 PM	0	2
5:45 PM	1	4
6:00 PM	1	18
6:15 PM	1	6
6:30 PM	1	9
6:45 PM	1	5
7:00 PM	2	1
7:15 PM	1	3
7:30 PM	4	2
7:45 PM	1	0
8:00 PM	1	2
8:15 PM	2	4
8:30 PM	1	1
8:45 PM	1	4
9:00 PM	0	2
9:15 PM	0	1
9:30 PM	0	1
9:45 PM	0	2
10:00 PM	0	1
10:15 PM	0	0
10:30 PM	0	0
10:45 PM	0	0
11:00 PM	1	0
11:15 PM	1	1
11:30 PM	1	0
11:45 PM	0	0

Study Name 15350 - SD 1
Start Date 11/03/2015
Start Time 12:00 AM
Site Code 1

Channel Direction	Direction Westbound	Direction Eastbound
12:00 AM	5	3
12:15 AM	0	0
12:30 AM	2	1
12:45 AM	2	2
1:00 AM	1	0
1:15 AM	2	5
1:30 AM	2	2
1:45 AM	3	3
2:00 AM	3	0
2:15 AM	4	2
2:30 AM	4	2
2:45 AM	1	3
3:00 AM	6	1
3:15 AM	4	5
3:30 AM	3	4
3:45 AM	2	0
4:00 AM	2	5
4:15 AM	2	3
4:30 AM	1	4
4:45 AM	0	2
5:00 AM	5	2
5:15 AM	7	3
5:30 AM	7	3
5:45 AM	11	1
6:00 AM	11	3
6:15 AM	8	10
6:30 AM	11	7
6:45 AM	12	5
7:00 AM	16	5
7:15 AM	9	4
7:30 AM	13	5
7:45 AM	12	11
8:00 AM	11	1
8:15 AM	11	6
8:30 AM	11	2
8:45 AM	14	11
9:00 AM	17	7
9:15 AM	20	4
9:30 AM	14	5
9:45 AM	10	8

10:00 AM	8	11
10:15 AM	12	10
10:30 AM	17	8
10:45 AM	8	7
11:00 AM	12	11
11:15 AM	14	12
11:30 AM	8	19
11:45 AM	9	13
12:00 PM	10	14
12:15 PM	6	11
12:30 PM	11	9
12:45 PM	8	12
1:00 PM	8	6
1:15 PM	14	20
1:30 PM	8	10
1:45 PM	13	15
2:00 PM	10	11
2:15 PM	6	12
2:30 PM	8	11
2:45 PM	10	14
3:00 PM	19	16
3:15 PM	13	25
3:30 PM	6	16
3:45 PM	7	24
4:00 PM	12	6
4:15 PM	11	19
4:30 PM	10	11
4:45 PM	9	10
5:00 PM	9	21
5:15 PM	4	15
5:30 PM	5	12
5:45 PM	6	7
6:00 PM	10	9
6:15 PM	9	17
6:30 PM	5	10
6:45 PM	9	16
7:00 PM	5	7
7:15 PM	11	11
7:30 PM	5	11
7:45 PM	6	4
8:00 PM	8	6
8:15 PM	4	1
8:30 PM	8	9
8:45 PM	7	12
9:00 PM	6	3
9:15 PM	7	9
9:30 PM	3	4
9:45 PM	9	4
10:00 PM	5	8
10:15 PM	5	7
10:30 PM	5	8
10:45 PM	2	5
11:00 PM	3	3
11:15 PM	4	5
11:30 PM	6	3
11:45 PM	1	2

All Traffic Data Services, Inc
9660 W 44th Ave
Wheat Ridge,CO 80033
www.alltrafficdata.net

Site Code: 3
Station ID: 3
STURGIS RD N/O BIG D FUEL ACCESSES
STURGIS RD N/O BIG D FUEL ACCESSES

NB

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Total
11/03/15	0	0	0	0	1	0	0	0	0	0	0	0	0	1
01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:00	0	0	1	0	0	0	0	0	0	0	0	0	0	1
03:00	0	0	1	0	0	0	0	0	0	0	0	0	0	1
04:00	0	4	0	0	0	0	0	0	0	0	0	0	0	4
05:00	0	6	5	0	1	0	0	0	0	0	0	0	0	12
06:00	0	20	17	2	4	0	0	0	0	0	0	0	0	43
07:00	0	55	33	3	16	1	1	1	0	0	0	0	0	110
08:00	1	22	17	2	11	0	0	1	1	0	0	0	0	55
09:00	2	32	16	0	9	0	0	2	1	0	0	0	0	62
10:00	1	20	13	0	11	2	0	3	1	0	0	0	0	51
11:00	0	28	14	3	11	0	0	0	0	0	0	0	0	56
12 PM	0	26	16	0	12	1	0	2	0	0	0	0	0	57
13:00	0	18	14	0	11	1	1	1	0	0	0	0	0	46
14:00	0	33	18	1	16	2	0	0	0	0	0	0	0	70
15:00	0	26	14	1	12	0	0	1	0	0	0	0	0	54
16:00	2	44	22	0	10	0	1	1	1	0	0	0	0	81
17:00	1	51	20	0	9	1	0	1	0	0	0	0	0	83
18:00	0	28	17	0	7	0	0	0	0	0	0	0	0	52
19:00	0	9	4	0	5	0	0	0	0	0	0	0	0	18
20:00	0	7	7	0	3	0	0	0	0	0	0	0	0	17
21:00	0	4	4	0	1	0	0	0	0	0	0	0	0	9
22:00	0	1	1	0	2	0	0	0	0	0	0	0	0	4
23:00	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Total	7	435	254	12	152	8	3	13	4	0	0	0	0	888
Percent	0.8%	49.0%	28.6%	1.4%	17.1%	0.9%	0.3%	1.5%	0.5%	0.0%	0.0%	0.0%	0.0%	
AM Peak	09:00	07:00	07:00	07:00	07:00	10:00	07:00	10:00	08:00					07:00
Vol.	2	55	33	3	16	2	1	3	1					110
PM Peak	16:00	17:00	16:00	14:00	14:00	14:00	13:00	12:00	16:00					17:00
Vol.	2	51	22	1	16	2	1	2	1					83
Grand Total	7	435	254	12	152	8	3	13	4	0	0	0	0	888
Percent	0.8%	49.0%	28.6%	1.4%	17.1%	0.9%	0.3%	1.5%	0.5%	0.0%	0.0%	0.0%	0.0%	

All Traffic Data Services, Inc
9660 W 44th Ave
Wheat Ridge,CO 80033
www.alltrafficdata.net

Site Code: 3
Station ID: 3
STURGIS RD N/O BIG D FUEL ACCESSES
STURGIS RD N/O BIG D FUEL ACCESSES

SB

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Total
11/03/15	0	1	3	0	0	0	0	0	0	0	0	0	0	4
01:00	0	0	1	0	0	0	0	0	0	0	0	0	0	1
02:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:00	0	0	1	0	0	0	0	0	0	0	0	0	0	1
05:00	1	4	1	0	0	0	0	0	0	0	0	0	0	6
06:00	0	10	8	1	1	0	0	0	0	0	0	0	0	20
07:00	1	54	26	0	7	0	0	0	0	0	0	0	0	88
08:00	0	22	9	1	9	0	0	1	0	0	0	0	0	42
09:00	2	29	14	0	10	0	0	1	0	0	0	0	0	56
10:00	0	19	15	0	8	2	0	0	0	0	0	0	0	44
11:00	1	30	17	1	8	0	0	0	0	0	0	0	0	57
12 PM	1	34	14	0	6	1	0	3	0	0	0	0	0	59
13:00	0	23	13	0	5	1	0	1	0	0	0	0	0	43
14:00	1	40	22	2	3	0	0	1	0	1	0	0	0	70
15:00	0	34	21	1	11	0	0	1	0	0	0	0	0	68
16:00	0	36	18	0	6	2	0	2	0	0	0	0	0	64
17:00	1	35	25	0	6	0	0	0	0	0	0	0	0	67
18:00	0	29	14	0	4	0	0	1	0	0	0	0	0	48
19:00	0	17	8	0	1	0	0	0	0	0	0	0	0	26
20:00	0	10	6	0	1	0	0	0	0	0	0	0	0	17
21:00	0	4	5	0	1	0	0	0	0	0	0	0	0	10
22:00	0	3	2	0	1	0	0	0	0	0	0	0	0	6
23:00	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Total	8	434	244	6	88	6	0	11	0	1	0	0	0	798
Percent	1.0%	54.4%	30.6%	0.8%	11.0%	0.8%	0.0%	1.4%	0.0%	0.1%	0.0%	0.0%	0.0%	
AM Peak	09:00	07:00	07:00	06:00	09:00	10:00		08:00						07:00
Vol.	2	54	26	1	10	2		1						88
PM Peak	12:00	14:00	17:00	14:00	15:00	16:00		12:00		14:00				14:00
Vol.	1	40	25	2	11	2		3		1				70
Grand Total	8	434	244	6	88	6	0	11	0	1	0	0	0	798
Percent	1.0%	54.4%	30.6%	0.8%	11.0%	0.8%	0.0%	1.4%	0.0%	0.1%	0.0%	0.0%	0.0%	

All Traffic Data Services, Inc
9660 W 44th Ave
Wheat Ridge,CO 80033
www.alltrafficdata.net

Site Code: 4
Station ID: 4
STURGIS RD N/O BAPTIST CHURCH ACCESS
STURGIS RD N/O BAPTIST CHURCH ACCESS

NB

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Total
11/03/15	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:00	0	2	0	0	0	0	0	0	0	0	0	0	0	2
02:00	0	1	1	0	0	0	0	0	0	0	0	0	0	2
03:00	0	3	0	0	0	0	0	0	0	0	0	0	0	3
04:00	0	2	0	0	0	0	0	0	0	0	0	0	0	2
05:00	0	6	2	0	0	0	0	0	0	0	0	0	0	8
06:00	1	26	9	1	6	0	0	0	0	0	0	0	0	43
07:00	3	130	40	7	18	2	0	1	0	0	0	0	0	201
08:00	0	32	16	0	7	0	0	0	0	0	0	0	0	55
09:00	1	38	14	0	8	0	0	1	0	0	0	0	0	62
10:00	2	39	14	0	8	1	0	3	0	0	0	0	1	68
11:00	1	45	19	0	9	1	0	0	1	0	0	0	0	76
12 PM	0	42	16	0	5	0	0	1	0	0	0	0	0	64
13:00	3	51	23	0	13	1	0	2	0	0	0	0	0	93
14:00	0	82	34	1	19	2	0	2	0	0	0	0	0	140
15:00	1	62	26	2	12	0	0	3	0	0	0	0	0	106
16:00	1	98	20	1	12	1	0	3	0	0	0	0	0	136
17:00	3	107	34	0	8	0	0	0	0	0	0	0	0	152
18:00	0	56	28	0	13	1	0	1	0	0	0	0	0	99
19:00	1	38	9	0	5	0	0	0	0	0	0	0	0	53
20:00	1	20	9	1	3	0	0	0	0	0	0	0	0	34
21:00	1	13	5	0	2	0	0	0	0	0	0	0	0	21
22:00	0	2	1	0	0	0	0	0	0	0	0	0	0	3
23:00	0	4	1	0	0	0	0	0	0	0	0	0	0	5
Total	19	899	321	13	148	9	0	17	1	0	0	0	1	1428
Percent	1.3%	63.0%	22.5%	0.9%	10.4%	0.6%	0.0%	1.2%	0.1%	0.0%	0.0%	0.0%	0.1%	
AM Peak	07:00	07:00	07:00	07:00	07:00	07:00		10:00	11:00				10:00	07:00
Vol.	3	130	40	7	18	2		3	1				1	201
PM Peak	13:00	17:00	14:00	15:00	14:00	14:00		15:00						17:00
Vol.	3	107	34	2	19	2		3						152
Grand Total	19	899	321	13	148	9	0	17	1	0	0	0	1	1428
Percent	1.3%	63.0%	22.5%	0.9%	10.4%	0.6%	0.0%	1.2%	0.1%	0.0%	0.0%	0.0%	0.1%	

All Traffic Data Services, Inc
9660 W 44th Ave
Wheat Ridge,CO 80033
www.alltrafficdata.net

Site Code: 4
Station ID: 4
STURGIS RD N/O BAPTIST CHURCH ACCESS
STURGIS RD N/O BAPTIST CHURCH ACCESS

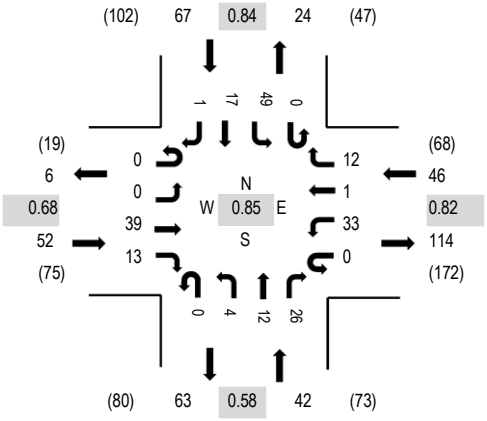
SB

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Total
11/03/15	0	4	0	0	0	0	0	0	0	0	0	0	0	4
01:00	0	3	0	0	0	0	0	0	0	0	0	0	0	3
02:00	0	2	0	0	1	0	0	0	0	0	0	0	0	3
03:00	0	0	0	0	0	0	0	1	0	0	0	0	0	1
04:00	0	6	3	0	0	0	0	1	0	0	0	0	0	10
05:00	1	22	7	0	2	0	0	0	0	0	0	0	0	32
06:00	1	47	18	2	4	0	0	0	0	0	0	0	0	72
07:00	4	177	47	6	3	2	0	2	0	0	0	0	0	241
08:00	0	52	14	0	4	0	0	0	0	0	0	0	0	70
09:00	0	44	20	0	4	1	0	0	0	0	0	0	0	69
10:00	3	48	12	0	3	2	0	1	0	0	0	0	0	69
11:00	1	52	18	0	3	1	0	0	0	0	0	0	0	75
12 PM	0	65	15	0	2	1	0	0	0	0	0	0	0	83
13:00	4	51	16	0	2	0	0	0	0	0	0	0	0	73
14:00	1	94	29	6	0	0	0	0	0	0	0	0	0	130
15:00	1	76	19	1	4	3	0	0	0	0	0	0	0	104
16:00	4	103	27	0	6	2	2	0	0	0	0	0	0	144
17:00	2	71	20	1	4	1	0	0	0	1	0	0	0	100
18:00	1	18	9	0	2	0	0	0	0	0	0	0	0	30
19:00	0	44	2	0	1	0	0	0	0	0	0	0	0	47
20:00	0	20	2	0	1	0	0	0	0	0	0	0	0	23
21:00	0	9	4	0	0	0	0	0	0	0	0	0	0	13
22:00	0	7	0	0	0	0	0	0	0	0	0	0	0	7
23:00	0	1	1	0	0	0	0	0	0	0	0	0	0	2
Total	23	1016	283	16	46	13	2	5	0	1	0	0	0	1405
Percent	1.6%	72.3%	20.1%	1.1%	3.3%	0.9%	0.1%	0.4%	0.0%	0.1%	0.0%	0.0%	0.0%	
AM Peak	07:00	07:00	07:00	07:00	06:00	07:00		07:00						07:00
Vol.	4	177	47	6	4	2		2						241
PM Peak	13:00	16:00	14:00	14:00	16:00	15:00	16:00			17:00				16:00
Vol.	4	103	29	6	6	3	2			1				144
Grand Total	23	1016	283	16	46	13	2	5	0	1	0	0	0	1405
Percent	1.6%	72.3%	20.1%	1.1%	3.3%	0.9%	0.1%	0.4%	0.0%	0.1%	0.0%	0.0%	0.0%	

All Traffic Data Services Inc.
(303) 216-2439
www.alltrafficdata.net

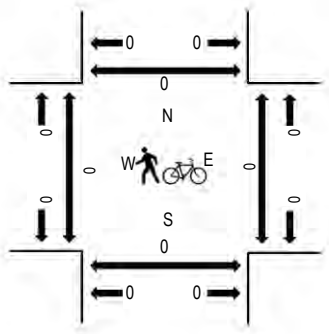
Location: 1 STURGIS RD & DEERVIEW ROAD AM
Date and Start Time: Tuesday, November 3, 2015
Peak Hour: 06:45 AM - 07:45 AM
Peak 15-Minutes: 07:00 AM - 07:15 AM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles in Crosswalk



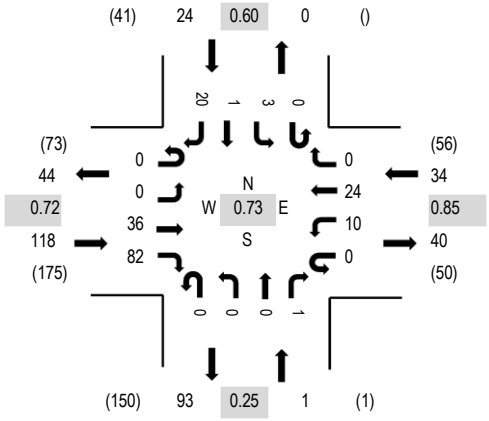
Traffic Counts

Interval Start Time	DEERVIEW ROAD Eastbound				DEERVIEW ROAD Westbound				STURGIS RD Northbound				STURGIS RD Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
6:30:00 AM	0	0	10	0	0	2	1	2	0	0	4	5	0	13	3	0	40	192	0	0	0	0
6:45:00 AM	0	0	5	1	0	8	1	1	0	1	2	1	0	10	5	1	36	207	0	0	0	0
7:00:00 AM	0	0	16	3	0	11	0	3	0	0	3	7	0	14	4	0	61	203	0	0	0	0
7:15:00 AM	0	0	6	6	0	9	0	3	0	3	5	10	0	9	4	0	55	164	0	0	0	0
7:30:00 AM	0	0	12	3	0	5	0	5	0	0	2	8	0	16	4	0	55	126	0	0	0	0
7:45:00 AM	0	0	4	1	0	2	4	3	0	1	4	3	0	6	3	1	32		0	0	0	0
8:00:00 AM	0	0	6	1	0	2	2	0	0	2	3	2	0	3	1	0	22		0	0	0	0
8:15:00 AM	0	0	1	0	0	1	0	3	0	2	4	1	0	4	1	0	17		0	0	0	0
Count Total	0	0	60	15	0	40	8	20	0	9	27	37	0	75	25	2	318		0	0	0	0
Peak Hour	0	0	39	13	0	33	1	12	0	4	12	26	0	49	17	1	207		0	0	0	0

All Traffic Data Services Inc.
(303) 216-2439
www.alltrafficdata.net

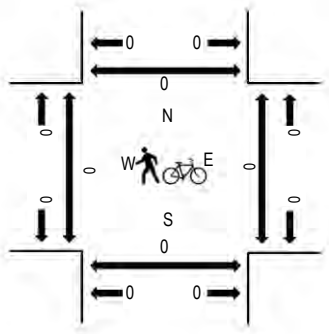
Location: 2 I-90 EB RAMPS & DEERVIEW ROAD AM
Date and Start Time: Tuesday, November 3, 2015
Peak Hour: 07:00 AM - 08:00 AM
Peak 15-Minutes: 07:00 AM - 07:15 AM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles in Crosswalk



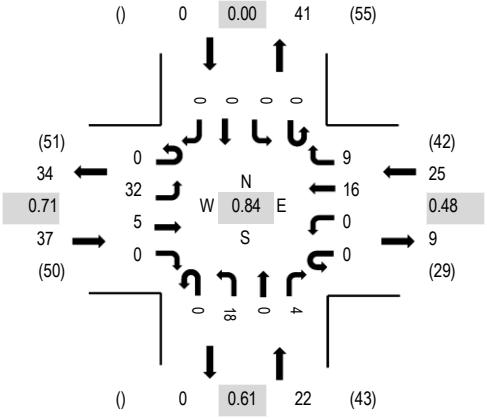
Traffic Counts

Interval Start Time	DEERVIEW ROAD Eastbound				DEERVIEW ROAD Westbound				I-90 EB RAMPS Northbound				I-90 EB RAMPS Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
6:30:00 AM	0	0	2	24	0	3	5	0	0	0	0	0	0	1	0	4	39	162	0	0	0	0
6:45:00 AM	0	0	2	9	0	1	2	0	0	0	0	0	0	0	0	8	22	174	0	0	0	0
7:00:00 AM	0	0	10	31	0	3	7	0	0	0	0	0	0	3	0	7	61	177	0	0	0	0
7:15:00 AM	0	0	8	16	0	2	6	0	0	0	0	1	0	0	0	7	40	138	0	0	0	0
7:30:00 AM	0	0	12	29	0	1	5	0	0	0	0	0	0	0	1	3	51	111	0	0	0	0
7:45:00 AM	0	0	6	6	0	4	6	0	0	0	0	0	0	0	0	3	25		0	0	0	0
8:00:00 AM	0	0	3	10	0	3	3	0	0	0	0	0	0	1	0	2	22		0	0	0	0
8:15:00 AM	0	0	1	6	0	1	4	0	0	0	0	0	0	0	0	1	13		0	0	0	0
Count Total	0	0	44	131	0	18	38	0	0	0	0	1	0	5	1	35	273		0	0	0	0
Peak Hour	0	0	36	82	0	10	24	0	0	0	0	1	0	3	1	20	177		0	0	0	0

All Traffic Data Services Inc.
(303) 216-2439
www.alltrafficdata.net

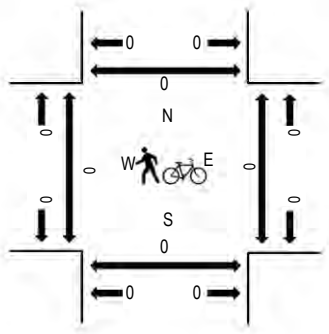
Location: 3 I-90 WB RAMPS & DEERVIEW ROAD AM
Date and Start Time: Tuesday, November 3, 2015
Peak Hour: 07:00 AM - 08:00 AM
Peak 15-Minutes: 07:15 AM - 07:30 AM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles in Crosswalk



Traffic Counts

Interval Start Time	DEERVIEW ROAD Eastbound				DEERVIEW ROAD Westbound				I-90 WB RAMPS Northbound				I-90 WB RAMPS Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
6:30:00 AM	0	3	1	0	0	0	4	2	0	1	0	4	0	0	0	0	15	76	0	0	0	0
6:45:00 AM	0	3	1	0	0	0	1	2	0	2	0	7	0	0	0	0	16	81	0	0	0	0
7:00:00 AM	0	9	2	0	0	0	4	0	0	5	0	0	0	0	0	0	20	84	0	0	0	0
7:15:00 AM	0	7	1	0	0	0	5	8	0	4	0	0	0	0	0	0	25	76	0	0	0	0
7:30:00 AM	0	12	1	0	0	0	3	0	0	4	0	0	0	0	0	0	20	59	0	0	0	0
7:45:00 AM	0	4	1	0	0	0	4	1	0	5	0	4	0	0	0	0	19		0	0	0	0
8:00:00 AM	0	2	2	0	0	0	5	0	0	0	0	3	0	0	0	0	12		0	0	0	0
8:15:00 AM	0	0	1	0	0	0	1	2	0	3	0	1	0	0	0	0	8		0	0	0	0
Count Total	0	40	10	0	0	0	27	15	0	24	0	19	0	0	0	0	135		0	0	0	0
Peak Hour	0	32	5	0	0	0	16	9	0	18	0	4	0	0	0	0	84		0	0	0	0

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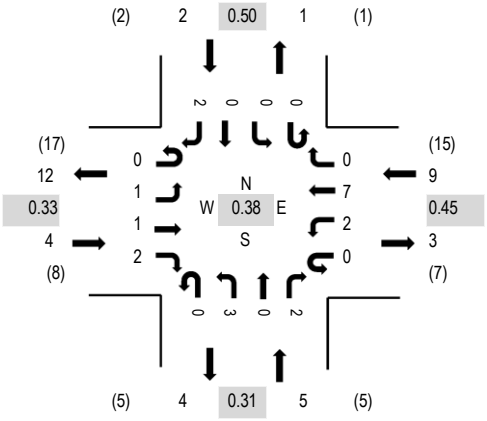
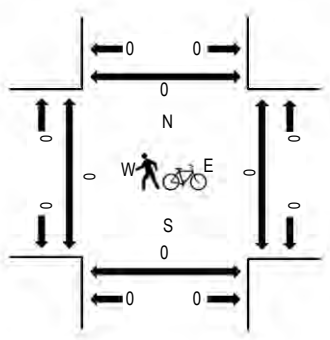
Location: 4 SPRING VALLEY RD & DEERVIEW ROAD AM
Date and Start Time: Tuesday, November 3, 2015
Peak Hour: 06:30 AM - 07:30 AM
Peak 15-Minutes: 06:30 AM - 06:45 AM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles in Crosswalk



Traffic Counts

Interval Start Time	DEERVIEW ROAD Eastbound				DEERVIEW ROAD Westbound				SPRING VALLEY RD Northbound				SPRING VALLEY RD Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
6:30:00 AM	0	1	1	1	0	1	4	0	0	3	0	1	0	0	0	1	13	20	0	0	0	0
6:45:00 AM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	9	0	0	0	0
7:00:00 AM	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	2	11	0	0	0	0
7:15:00 AM	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	1	4	13	0	0	0	0
7:30:00 AM	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	10	0	0	0	0
7:45:00 AM	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	3		0	0	0	0
8:00:00 AM	0	0	1	0	0	0	3	0	0	0	0	0	0	0	0	0	4		0	0	0	0
8:15:00 AM	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1		0	0	0	0
Count Total	0	1	5	2	0	3	12	0	0	3	0	2	0	0	0	2	30		0	0	0	0
Peak Hour	0	1	1	2	0	2	7	0	0	3	0	2	0	0	0	2	20		0	0	0	0

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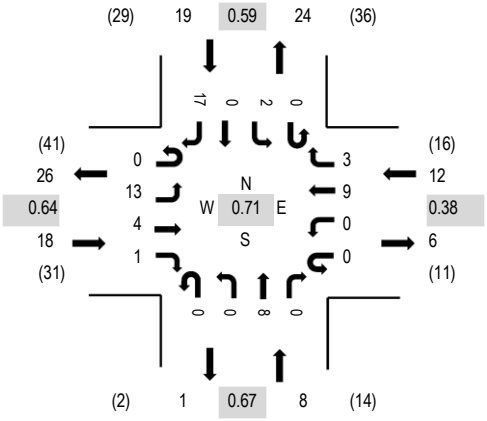
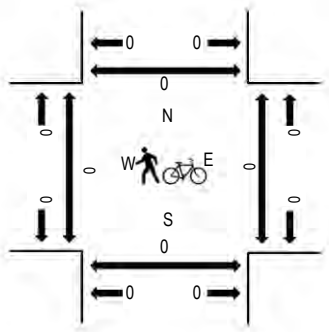
Location: 5 SIDNEY STAGE RD & DEERVIEW ROAD AM
Date and Start Time: Tuesday, November 3, 2015
Peak Hour: 06:30 AM - 07:30 AM
Peak 15-Minutes: 06:30 AM - 06:45 AM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles in Crosswalk



Traffic Counts

Interval Start Time	DEERVIEW ROAD Eastbound				DEERVIEW ROAD Westbound				SIDNEY STAGE RD Northbound				SIDNEY STAGE RD Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
6:30:00 AM	0	4	2	0	0	0	5	3	0	0	2	0	0	2	0	2	20	57	0	0	0	0
6:45:00 AM	0	6	0	1	0	0	0	0	0	0	3	0	0	0	0	2	12	40	0	0	0	0
7:00:00 AM	0	3	1	0	0	0	0	0	0	0	1	0	0	0	0	5	10	35	0	0	0	0
7:15:00 AM	0	0	1	0	0	0	4	0	0	0	2	0	0	0	0	8	15	39	0	0	0	0
7:30:00 AM	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	3	33	0	0	0	0
7:45:00 AM	0	0	2	0	0	0	0	0	0	1	1	0	0	0	0	3	7		0	0	0	0
8:00:00 AM	0	5	2	0	0	0	2	0	0	0	2	0	0	0	1	2	14		0	0	0	0
8:15:00 AM	0	3	0	0	0	0	2	0	0	0	1	0	0	0	0	3	9		0	0	0	0
Count Total	0	21	9	1	0	0	13	3	0	2	12	0	0	2	1	26	90		0	0	0	0
Peak Hour	0	13	4	1	0	0	9	3	0	0	8	0	0	2	0	17	57		0	0	0	0

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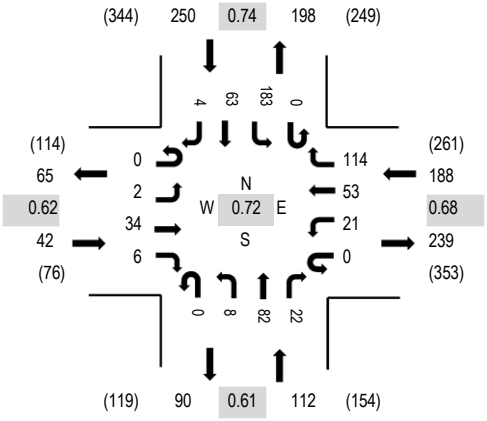
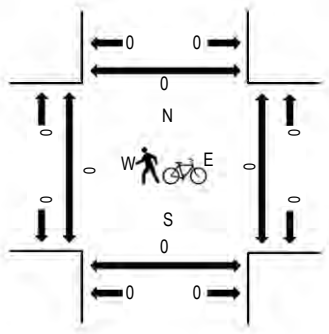
Location: 6 STURGIS RD & ELK CREEK ROAD AM
Date and Start Time: Tuesday, November 3, 2015
Peak Hour: 07:00 AM - 08:00 AM
Peak 15-Minutes: 07:15 AM - 07:30 AM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles in Crosswalk



Traffic Counts

Interval Start Time	ELK CREEK ROAD Eastbound				ELK CREEK ROAD Westbound				STURGIS RD Northbound				STURGIS RD Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
6:30:00 AM	0	0	10	0	0	0	9	6	0	3	4	1	0	16	5	0	54	460	0	0	1	0
6:45:00 AM	0	0	8	2	0	1	12	11	0	2	5	3	0	17	4	0	65	574	0	0	0	0
7:00:00 AM	0	1	14	2	0	7	9	33	0	2	20	5	0	36	7	0	136	592	0	0	0	0
7:15:00 AM	0	0	9	1	0	9	19	41	0	1	36	9	0	63	15	2	205	515	0	0	0	0
7:30:00 AM	0	0	4	1	0	4	13	34	0	3	21	3	0	54	30	1	168	375	0	0	0	0
7:45:00 AM	0	1	7	2	0	1	12	6	0	2	5	5	0	30	11	1	83		0	0	0	0
8:00:00 AM	0	0	8	0	0	5	6	9	0	5	8	0	0	13	4	1	59		0	0	0	0
8:15:00 AM	0	0	6	0	0	2	10	2	0	0	6	5	0	27	6	1	65		0	0	0	0
Count Total	0	2	66	8	0	29	90	142	0	18	105	31	0	256	82	6	835		0	0	1	0
Peak Hour	0	2	34	6	0	21	53	114	0	8	82	22	0	183	63	4	592		0	0	0	0

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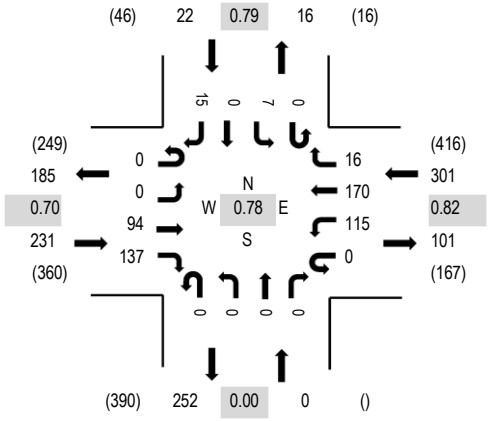
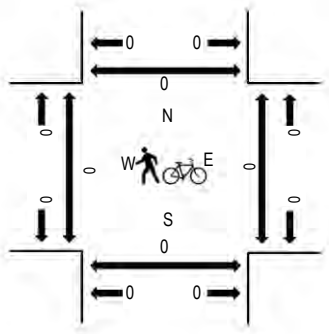
Location: 7 I-90 EB RAMPS & ELK CREEK ROAD AM
Date and Start Time: Tuesday, November 3, 2015
Peak Hour: 06:45 AM - 07:45 AM
Peak 15-Minutes: 07:15 AM - 07:30 AM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles in Crosswalk



Traffic Counts

Interval Start Time	ELK CREEK ROAD Eastbound				ELK CREEK ROAD Westbound				I-90 EB RAMPS Northbound				I-90 EB RAMPS Southbound				Total	Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right			West	East	South	North
6:30:00 AM	0	0	14	20	0	25	9	0	0	0	0	0	0	3	0	6	77	470	0	1	0	0
6:45:00 AM	0	0	10	21	0	23	17	0	0	0	0	0	0	1	0	6	78	554	0	0	0	0
7:00:00 AM	0	0	22	31	0	33	44	0	0	0	0	0	0	4	0	3	137	552	0	0	0	0
7:15:00 AM	0	0	39	43	0	23	69	0	0	0	0	0	0	1	0	3	178	463	0	0	0	0
7:30:00 AM	0	0	23	42	0	36	40	16	0	0	0	0	0	1	0	3	161	352	0	0	0	0
7:45:00 AM	0	0	15	22	0	17	15	0	0	0	0	0	0	4	0	3	76		0	0	0	0
8:00:00 AM	0	0	8	10	0	10	16	0	0	0	0	0	0	2	0	2	48		0	0	0	0
8:15:00 AM	0	0	18	22	0	12	11	0	0	0	0	0	0	2	0	2	67		0	0	0	0
Count Total	0	0	149	211	0	179	221	16	0	0	0	0	0	18	0	28	822		0	1	0	0
Peak Hour	0	0	94	137	0	115	170	16	0	0	0	0	0	7	0	15	554		0	0	0	0

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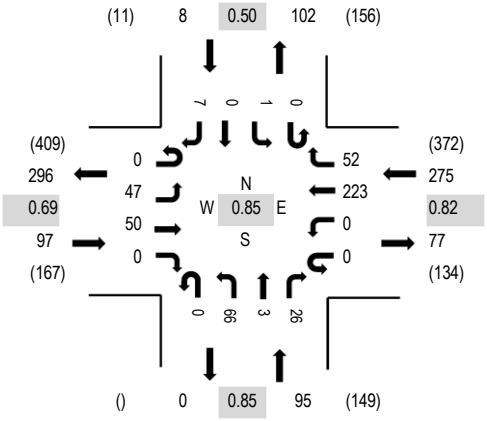
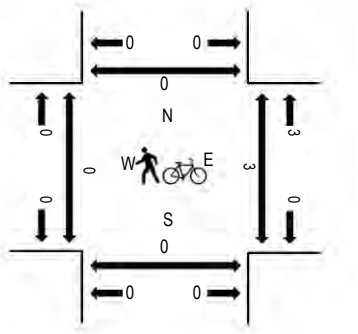
Location: 8 I-90 WB RAMPS & ELK CREEK ROAD AM
Date and Start Time: Tuesday, November 3, 2015
Peak Hour: 06:45 AM - 07:45 AM
Peak 15-Minutes: 07:15 AM - 07:30 AM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles in Crosswalk



Traffic Counts

Interval Start Time	ELK CREEK ROAD Eastbound				ELK CREEK ROAD Westbound				I-90 WB RAMPS Northbound				I-90 WB RAMPS Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
6:30:00 AM	0	8	9	0	0	0	23	9	0	5	1	4	0	0	0	1	60	396	0	0	0	0
6:45:00 AM	0	6	6	0	0	0	30	7	0	9	1	8	0	0	0	1	68	475	0	0	0	0
7:00:00 AM	0	8	17	0	0	0	58	18	0	21	1	5	0	0	0	1	129	468	0	2	0	0
7:15:00 AM	0	20	15	0	0	0	65	13	0	18	0	4	0	1	0	3	139	396	0	1	0	0
7:30:00 AM	0	13	12	0	0	0	70	14	0	18	1	9	0	0	0	2	139	303	0	0	0	0
7:45:00 AM	0	5	14	0	0	0	22	3	0	10	1	5	0	0	0	1	61		0	0	0	0
8:00:00 AM	0	10	5	0	0	0	18	3	0	10	0	10	0	1	0	0	57		0	0	0	0
8:15:00 AM	0	12	7	0	0	0	17	2	0	6	0	2	0	0	0	0	46		0	0	0	0
Count Total	0	82	85	0	0	0	303	69	0	97	5	47	0	2	0	9	699		0	3	0	0
Peak Hour	0	47	50	0	0	0	223	52	0	66	3	26	0	1	0	7	475		0	3	0	0

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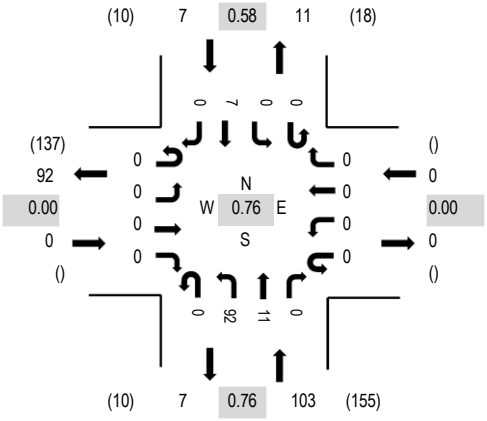
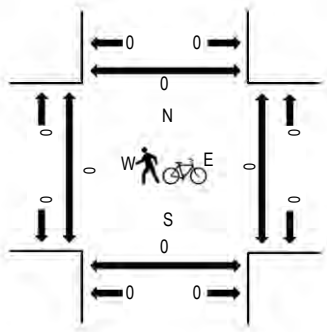
Location: 9 SIDNEY STAGE ROAD SPLIT & I-90 WB RAMP AM
Date and Start Time: Tuesday, November 3, 2015
Peak Hour: 06:45 AM - 07:45 AM
Peak 15-Minutes: 07:30 AM - 07:45 AM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles in Crosswalk



Traffic Counts

Interval Start Time	I-90 WB ON RAMP Eastbound				I-90 WB RAMP Westbound				SIDNEY STAGE ROAD SPLIT Northbound				SIDNEY STAGE ROAD SPLIT Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
6:30:00 AM	0	0	0	0	0	0	0	0	0	16	1	0	0	0	1	0	18	92	0	0	0	0
6:45:00 AM	0	0	0	0	0	0	0	0	0	11	4	0	0	0	1	0	16	110	0	0	0	0
7:00:00 AM	0	0	0	0	0	0	0	0	0	21	2	0	0	0	1	0	24	106	0	0	0	0
7:15:00 AM	0	0	0	0	0	0	0	0	0	28	3	0	0	0	3	0	34	92	0	0	0	0
7:30:00 AM	0	0	0	0	0	0	0	0	0	32	2	0	0	0	2	0	36	73	0	0	0	0
7:45:00 AM	0	0	0	0	0	0	0	0	0	9	2	0	0	0	1	0	12		0	0	0	0
8:00:00 AM	0	0	0	0	0	0	0	0	0	9	1	0	0	0	0	0	10		0	0	0	0
8:15:00 AM	0	0	0	0	0	0	0	0	0	11	3	0	0	0	1	0	15		0	0	0	0
Count Total	0	0	0	0	0	0	0	0	0	137	18	0	0	0	10	0	165		0	0	0	0
Peak Hour	0	0	0	0	0	0	0	0	0	92	11	0	0	0	7	0	110		0	0	0	0

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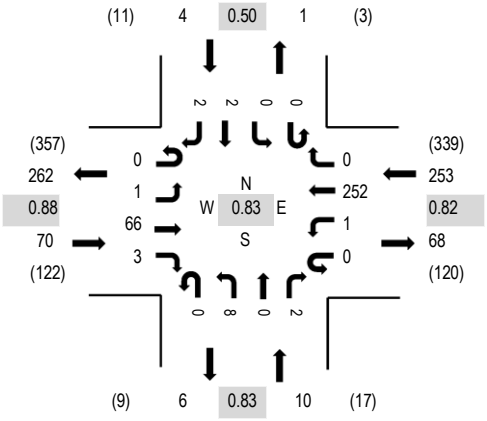
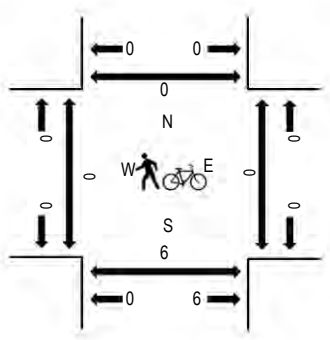
Location: 10 HILLS VIEW DR EAST & ELK CREEK ROAD AM
Date and Start Time: Tuesday, November 3, 2015
Peak Hour: 06:45 AM - 07:45 AM
Peak 15-Minutes: 07:30 AM - 07:45 AM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles in Crosswalk



Traffic Counts

Interval Start Time	ELK CREEK ROAD Eastbound				ELK CREEK ROAD Westbound				HILLS VIEW DR EAST Northbound				HILLS VIEW DR EAST Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
6:30:00 AM	0	0	11	0	0	0	29	0	0	2	1	0	0	1	2	1	47	283	0	0	0	0
6:45:00 AM	0	1	11	0	0	0	30	0	0	1	0	1	0	0	0	0	44	337	0	0	0	0
7:00:00 AM	0	0	20	0	0	0	70	0	0	3	0	0	0	0	0	1	94	337	0	0	6	0
7:15:00 AM	0	0	17	2	0	1	75	0	0	1	0	1	0	0	0	1	98	282	0	0	0	0
7:30:00 AM	0	0	18	1	0	0	77	0	0	3	0	0	0	0	2	0	101	206	0	0	0	0
7:45:00 AM	0	0	19	1	0	0	21	1	0	1	0	0	0	0	0	1	44		0	0	0	0
8:00:00 AM	0	0	16	0	0	0	21	0	0	0	0	0	0	0	0	2	39		0	0	0	0
8:15:00 AM	0	0	5	0	0	0	14	0	0	3	0	0	0	0	0	0	22		0	0	0	0
Count Total	0	1	117	4	0	1	337	1	0	14	1	2	0	1	4	6	489		0	0	6	0
Peak Hour	0	1	66	3	0	1	252	0	0	8	0	2	0	0	2	2	337		0	0	6	0

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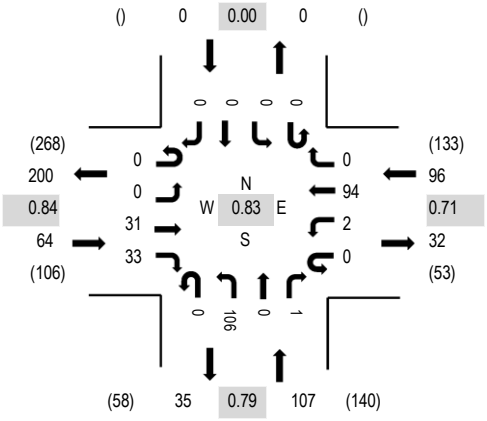
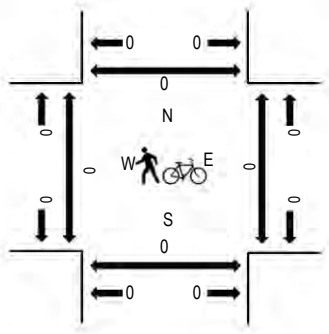
Location: 11 GLENWOOD DR & ELK CREEK ROAD AM
Date and Start Time: Tuesday, November 3, 2015
Peak Hour: 07:00 AM - 08:00 AM
Peak 15-Minutes: 07:15 AM - 07:30 AM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles in Crosswalk



Traffic Counts

Interval Start Time	ELK CREEK ROAD Eastbound				ELK CREEK ROAD Westbound				GLENWOOD DR Northbound				GLENWOOD DR Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
6:30:00 AM	0	0	5	5	0	1	12	0	0	9	0	0	0	0	0	0	32	223	0	0	0	0
6:45:00 AM	0	0	7	4	0	0	11	0	0	12	0	0	0	0	0	0	34	265	0	0	0	0
7:00:00 AM	0	0	9	10	0	1	25	0	0	31	0	1	0	0	0	0	77	267	0	0	0	0
7:15:00 AM	0	0	6	7	0	1	33	0	0	33	0	0	0	0	0	0	80	218	0	0	0	0
7:30:00 AM	0	0	8	9	0	0	23	0	0	34	0	0	0	0	0	0	74	156	0	0	0	0
7:45:00 AM	0	0	8	7	0	0	13	0	0	8	0	0	0	0	0	0	36		0	0	0	0
8:00:00 AM	0	0	6	8	0	0	7	0	0	7	0	0	0	0	0	0	28		0	0	0	0
8:15:00 AM	0	0	2	5	0	0	6	0	0	4	0	1	0	0	0	0	18		0	0	0	0
Count Total	0	0	51	55	0	3	130	0	0	138	0	2	0	0	0	0	379		0	0	0	0
Peak Hour	0	0	31	33	0	2	94	0	0	106	0	1	0	0	0	0	267		0	0	0	0

All Traffic Data Services Inc.

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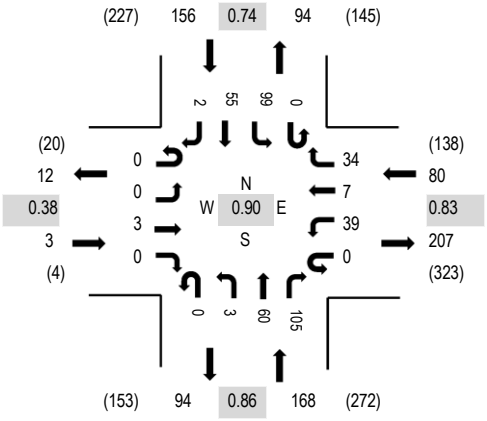
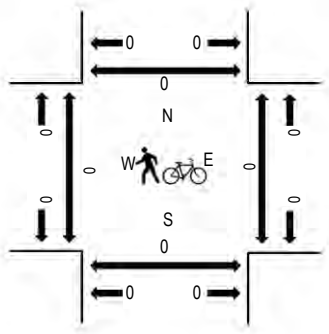
Location: 12 STURGIS RD & STAGESTOP ROAD AM
Date and Start Time: Tuesday, November 3, 2015
Peak Hour: 07:00 AM - 08:00 AM
Peak 15-Minutes: 07:00 AM - 07:15 AM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles in Crosswalk



Traffic Counts

Interval Start Time	STAGESTOP ROAD Eastbound				STAGESTOP ROAD Westbound				STURGIS RD Northbound				STURGIS RD Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
6:30:00 AM	0	0	0	0	0	8	0	5	0	0	3	15	0	12	8	0	51	342	0	0	0	0
6:45:00 AM	0	0	0	0	0	10	0	2	0	0	10	26	0	21	10	0	79	402	0	0	0	0
7:00:00 AM	0	0	2	0	0	9	2	11	0	0	17	32	0	30	10	0	113	407	0	0	0	0
7:15:00 AM	0	0	1	0	0	9	0	8	0	0	17	28	0	18	18	0	99	345	0	0	0	0
7:30:00 AM	0	0	0	0	0	9	2	6	0	0	16	25	0	38	14	1	111	299	0	0	0	0
7:45:00 AM	0	0	0	0	0	12	3	9	0	3	10	20	0	13	13	1	84		0	0	0	0
8:00:00 AM	0	0	0	0	0	6	2	10	0	1	6	15	0	6	5	0	51		0	0	0	0
8:15:00 AM	0	0	0	1	0	7	3	5	0	2	10	16	0	5	4	0	53		0	0	0	0
Count Total	0	0	3	1	0	70	12	56	0	6	89	177	0	143	82	2	641		0	0	0	0
Peak Hour	0	0	3	0	0	39	7	34	0	3	60	105	0	99	55	2	407		0	0	0	0

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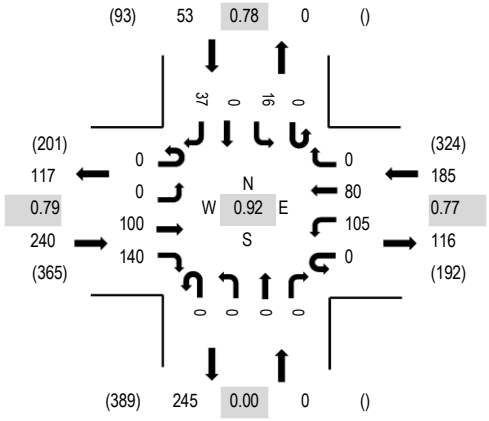
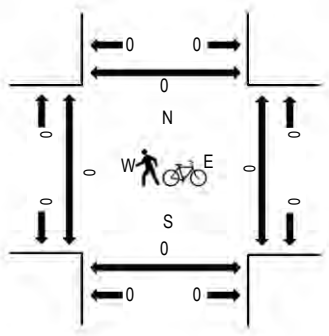
Location: 13 I-90 EB RAMPS & STAGESTOP ROAD AM
Date and Start Time: Tuesday, November 3, 2015
Peak Hour: 06:45 AM - 07:45 AM
Peak 15-Minutes: 07:00 AM - 07:15 AM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles in Crosswalk



Traffic Counts

Interval Start Time	STAGESTOP ROAD Eastbound				STAGESTOP ROAD Westbound				I-90 EB RAMPS Northbound				I-90 EB RAMPS Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
6:30:00 AM	0	0	14	22	0	29	13	0	0	0	0	0	0	4	0	6	88	446	0	0	0	0
6:45:00 AM	0	0	22	28	0	18	22	0	0	0	0	0	0	4	0	6	100	478	0	0	0	0
7:00:00 AM	0	0	37	39	0	20	19	0	0	0	0	0	0	2	0	13	130	474	0	0	0	0
7:15:00 AM	0	0	21	36	0	33	27	0	0	0	0	0	0	3	0	8	128	400	0	0	0	0
7:30:00 AM	0	0	20	37	0	34	12	0	0	0	0	0	0	7	0	10	120	336	0	0	0	0
7:45:00 AM	0	0	15	23	0	15	24	0	0	0	0	0	0	8	0	11	96		0	0	0	1
8:00:00 AM	0	0	15	9	0	16	9	0	0	0	0	0	0	3	0	4	56		0	0	0	2
8:15:00 AM	0	0	13	14	0	16	17	0	0	0	0	0	0	4	0	0	64		0	0	0	0
Count Total	0	0	157	208	0	181	143	0	0	0	0	0	0	35	0	58	782		0	0	0	3
Peak Hour	0	0	100	140	0	105	80	0	0	0	0	0	0	16	0	37	478		0	0	0	1

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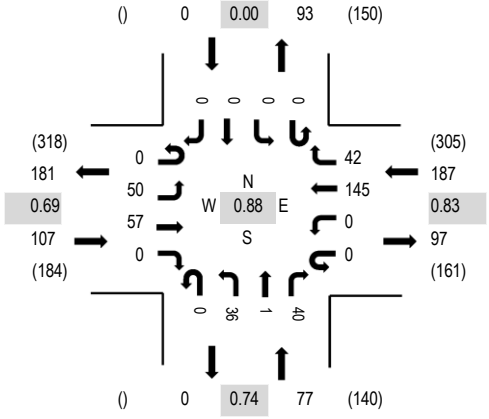
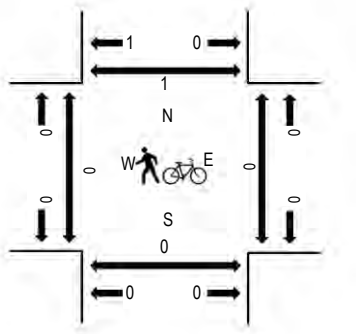
Location: 14 I-90 WB RAMPS & STAGESTOP ROAD AM
Date and Start Time: Tuesday, November 3, 2015
Peak Hour: 07:00 AM - 08:00 AM
Peak 15-Minutes: 07:30 AM - 07:45 AM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles in Crosswalk



Traffic Counts

Interval Start Time	STAGESTOP ROAD Eastbound				STAGESTOP ROAD Westbound				I-90 WB RAMPS Northbound				I-90 WB RAMPS Southbound				Total	Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right			West	East	South	North
6:30:00 AM	0	12	4	0	0	0	37	2	0	6	0	8	0	0	0	0	69	333	0	0	0	0
6:45:00 AM	0	13	11	0	0	0	27	5	0	9	1	8	0	0	0	0	74	369	0	0	0	0
7:00:00 AM	0	21	18	0	0	0	35	15	0	9	0	6	0	0	0	0	104	371	0	0	0	0
7:15:00 AM	0	13	4	0	0	0	44	12	0	9	0	4	0	0	0	0	86	325	0	0	0	0
7:30:00 AM	0	12	16	0	0	0	40	14	0	7	0	16	0	0	0	0	105	296	0	0	0	0
7:45:00 AM	0	4	19	0	0	0	26	1	0	11	1	14	0	0	0	0	76		0	0	0	1
8:00:00 AM	0	8	13	0	0	0	17	4	0	9	1	6	0	0	0	0	58		0	0	0	2
8:15:00 AM	0	9	7	0	0	0	24	2	0	8	0	7	0	0	0	0	57		0	0	0	0
Count Total	0	92	92	0	0	0	250	55	0	68	3	69	0	0	0	0	629		0	0	0	3
Peak Hour	0	50	57	0	0	0	145	42	0	36	1	40	0	0	0	0	371		0	0	0	1

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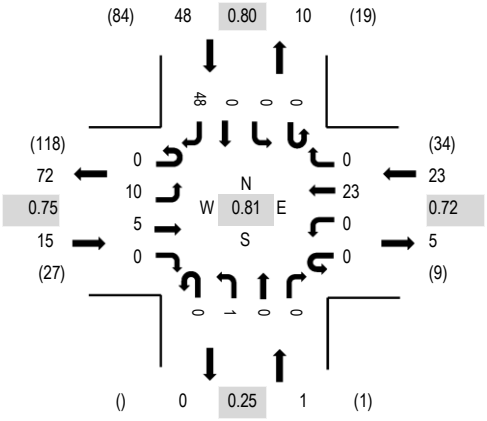
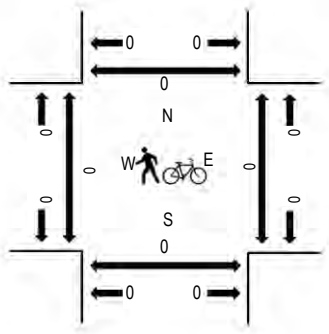
Location: 15 LARUE RD & STAGESTOP ROAD AM
Date and Start Time: Tuesday, November 3, 2015
Peak Hour: 06:45 AM - 07:45 AM
Peak 15-Minutes: 07:30 AM - 07:45 AM

Peak Hour - All Vehicles



Peak Hour - Pedestrians/Bicycles in Crosswalk



Note: Total study counts contained in parentheses.

Traffic Counts

Interval Start Time	STAGESTOP ROAD Eastbound				STAGESTOP ROAD Westbound				LARUE RD Northbound				LARUE RD Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
6:30:00 AM	0	1	1	0	0	0	5	0	0	0	0	0	0	0	0	13	20	80	0	0	0	0
6:45:00 AM	0	4	1	0	0	0	5	0	0	0	0	0	0	0	0	11	21	87	0	0	0	0
7:00:00 AM	0	2	3	0	0	0	6	0	0	0	0	0	0	0	0	14	25	85	0	0	0	0
7:15:00 AM	0	1	0	0	0	0	4	0	0	1	0	0	0	0	0	8	14	71	0	0	0	0
7:30:00 AM	0	3	1	0	0	0	8	0	0	0	0	0	0	0	0	15	27	66	0	0	0	0
7:45:00 AM	0	5	0	0	0	0	3	0	0	0	0	0	0	0	0	11	19		0	0	0	0
8:00:00 AM	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	7	11		0	0	0	0
8:15:00 AM	0	1	0	0	0	0	3	0	0	0	0	0	0	1	0	4	9		0	0	0	0
Count Total	0	19	8	0	0	0	34	0	0	1	0	0	0	1	0	83	146		0	0	0	0
Peak Hour	0	10	5	0	0	0	23	0	0	1	0	0	0	0	0	48	87		0	0	0	0

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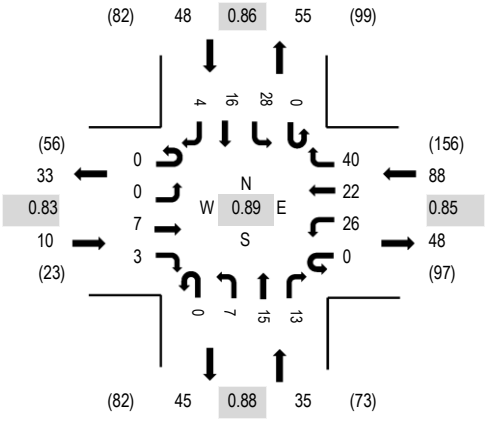
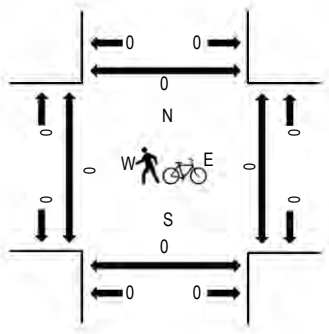
Location: 1 STURGIS RD & DEERVIEW ROAD PM
Date and Start Time: Tuesday, November 3, 2015
Peak Hour: 05:00 PM - 06:00 PM
Peak 15-Minutes: 05:15 PM - 05:30 PM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles in Crosswalk



Traffic Counts

Interval Start Time	DEERVIEW ROAD Eastbound				DEERVIEW ROAD Westbound				STURGIS RD Northbound				STURGIS RD Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
4:00:00 PM	0	0	3	0	0	3	4	8	0	0	5	6	0	2	6	0	37	153	1	0	0	0
4:15:00 PM	0	0	0	0	0	5	4	4	0	0	5	6	0	2	3	0	29	156	0	0	0	0
4:30:00 PM	0	0	4	1	0	7	7	7	0	0	2	6	0	5	4	0	43	178	0	0	0	0
4:45:00 PM	0	0	4	1	0	4	6	9	0	2	4	2	0	9	3	0	44	178	0	0	0	0
5:00:00 PM	0	0	2	1	0	6	5	10	0	3	1	2	0	6	3	1	40	181	0	0	0	0
5:15:00 PM	0	0	1	0	0	10	8	8	0	1	6	3	0	10	4	0	51		0	0	0	0
5:30:00 PM	0	0	2	1	0	5	5	8	0	3	5	2	0	7	5	0	43		0	0	0	0
5:45:00 PM	0	0	2	1	0	5	4	14	0	0	3	6	0	5	4	3	47		0	0	0	0
Count Total	0	0	18	5	0	45	43	68	0	9	31	33	0	46	32	4	334		1	0	0	0
Peak Hour	0	0	7	3	0	26	22	40	0	7	15	13	0	28	16	4	181		0	0	0	0

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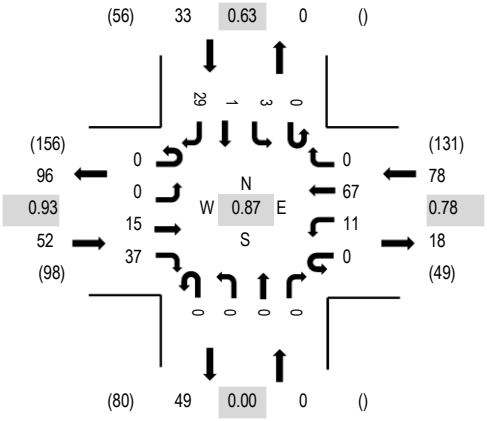
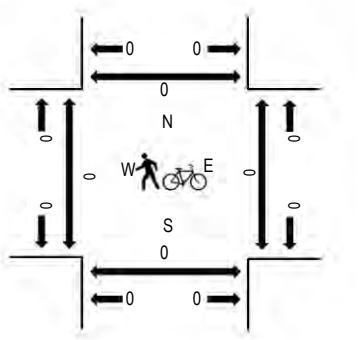
Location: 2 I-90 EB RAMPS & DEERVIEW ROAD PM
Date and Start Time: Tuesday, November 3, 2015
Peak Hour: 05:00 PM - 06:00 PM
Peak 15-Minutes: 05:45 PM - 06:00 PM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles in Crosswalk



Traffic Counts

Interval Start Time	DEERVIEW ROAD Eastbound				DEERVIEW ROAD Westbound				I-90 EB RAMPS Northbound				I-90 EB RAMPS Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
4:00:00 PM	0	0	8	6	0	2	12	0	0	0	0	0	0	3	0	2	33	122	1	0	0	0
4:15:00 PM	0	0	3	2	0	2	9	0	0	0	0	0	0	0	0	5	21	131	0	0	0	0
4:30:00 PM	0	0	10	8	0	3	16	0	0	0	0	0	0	2	0	4	43	155	0	0	0	0
4:45:00 PM	0	0	4	5	0	3	6	0	0	0	0	0	0	1	0	6	25	141	0	0	0	0
5:00:00 PM	0	0	3	10	0	3	20	0	0	0	0	0	0	2	0	4	42	163	0	0	0	0
5:15:00 PM	0	0	3	11	0	3	15	0	0	0	0	0	0	0	0	13	45		0	0	0	0
5:30:00 PM	0	0	4	8	0	2	10	0	0	0	0	0	0	1	1	3	29		0	0	0	0
5:45:00 PM	0	0	5	8	0	3	22	0	0	0	0	0	0	0	0	9	47		0	0	0	0
Count Total	0	0	40	58	0	21	110	0	0	0	0	0	0	9	1	46	285		1	0	0	0
Peak Hour	0	0	15	37	0	11	67	0	0	0	0	0	0	3	1	29	163		0	0	0	0

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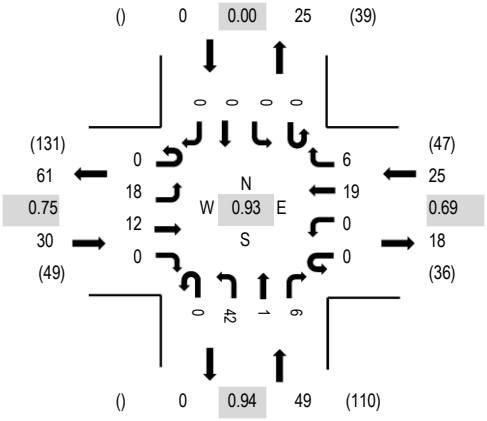
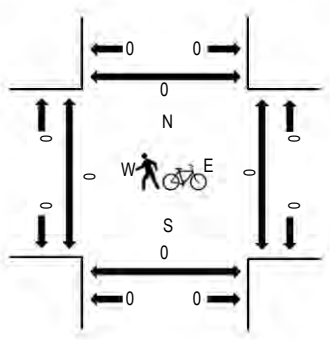
Location: 3 I-90 WB RAMPS & DEERVIEW ROAD PM
Date and Start Time: Tuesday, November 3, 2015
Peak Hour: 04:00 PM - 05:00 PM
Peak 15-Minutes: 04:30 PM - 04:45 PM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles in Crosswalk



Traffic Counts

Interval Start Time	DEERVIEW ROAD Eastbound				DEERVIEW ROAD Westbound				I-90 WB RAMPS Northbound				I-90 WB RAMPS Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
4:00:00 PM	0	5	5	0	0	0	3	1	0	12	0	1	0	0	0	0	27	104	0	0	0	0
4:15:00 PM	0	4	2	0	0	0	4	1	0	9	1	3	0	0	0	0	24	103	0	0	0	0
4:30:00 PM	0	5	3	0	0	0	4	3	0	12	0	1	0	0	0	0	28	104	0	0	0	0
4:45:00 PM	0	4	2	0	0	0	8	1	0	9	0	1	0	0	0	0	25	96	0	0	0	0
5:00:00 PM	0	1	4	0	0	0	5	0	0	13	0	3	0	0	0	0	26	102	0	0	0	0
5:15:00 PM	0	4	0	0	0	0	5	2	0	12	0	2	0	0	0	0	25		0	0	0	0
5:30:00 PM	0	2	2	0	0	0	2	0	0	12	0	2	0	0	0	0	20		0	0	0	0
5:45:00 PM	0	5	1	0	0	0	8	0	0	13	0	4	0	0	0	0	31		0	0	0	0
Count Total	0	30	19	0	0	0	39	8	0	92	1	17	0	0	0	0	206		0	0	0	0
Peak Hour	0	18	12	0	0	0	19	6	0	42	1	6	0	0	0	0	104		0	0	0	0

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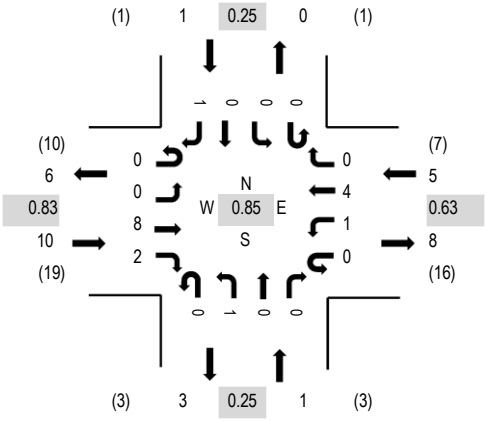
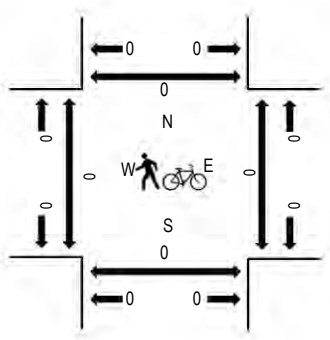
Location: 4 SPRING VALLEY RD & DEERVIEW ROAD PM
Date and Start Time: Tuesday, November 3, 2015
Peak Hour: 04:00 PM - 05:00 PM
Peak 15-Minutes: 04:00 PM - 04:15 PM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles in Crosswalk



Traffic Counts

Interval Start Time	DEERVIEW ROAD Eastbound				DEERVIEW ROAD Westbound				SPRING VALLEY RD Northbound				SPRING VALLEY RD Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
4:00:00 PM	0	0	2	1	0	0	1	0	0	1	0	0	0	0	0	0	5	17	0	0	0	0
4:15:00 PM	0	0	2	1	0	0	2	0	0	0	0	0	0	0	0	0	5	15	0	0	0	0
4:30:00 PM	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	1	4	13	0	0	0	0
4:45:00 PM	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	3	9	0	0	0	0
5:00:00 PM	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	3	13	0	0	0	0
5:15:00 PM	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	3		0	0	0	0
5:30:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0
5:45:00 PM	0	1	4	0	0	0	1	0	0	1	0	0	0	0	0	0	7		0	0	0	0
Count Total	0	1	16	2	0	1	6	0	0	3	0	0	0	0	0	1	30		0	0	0	0
Peak Hour	0	0	8	2	0	1	4	0	0	1	0	0	0	0	0	1	17		0	0	0	0

All Traffic Data Services Inc.

(303) 216-2439
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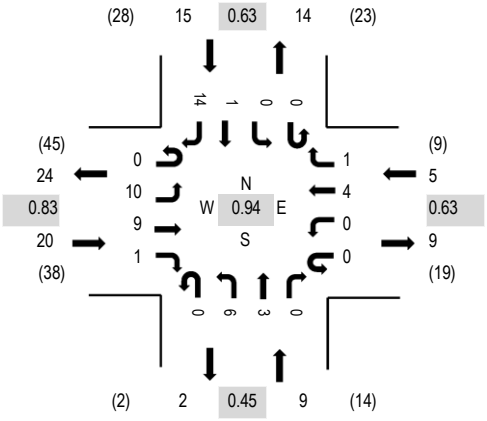
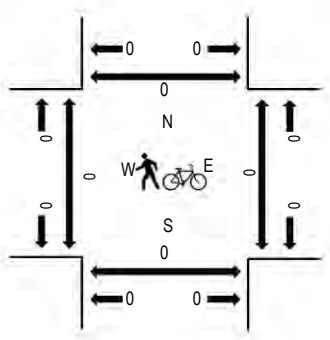
Location: 5 SIDNEY STAGE RD & DEERVIEW ROAD PM
Date and Start Time: Tuesday, November 3, 2015
Peak Hour: 04:00 PM - 05:00 PM
Peak 15-Minutes: 04:00 PM - 04:15 PM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles in Crosswalk



Traffic Counts

Interval Start Time	DEERVIEW ROAD Eastbound				DEERVIEW ROAD Westbound				SIDNEY STAGE RD Northbound				SIDNEY STAGE RD Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
4:00:00 PM	0	3	2	1	0	0	0	1	0	2	2	0	0	0	1	1	13	49	0	0	0	0
4:15:00 PM	0	2	3	0	0	0	2	0	0	0	0	0	0	0	0	3	10	46	0	0	0	0
4:30:00 PM	0	3	3	0	0	0	1	0	0	0	0	0	0	0	0	6	13	48	0	0	0	0
4:45:00 PM	0	2	1	0	0	0	1	0	0	4	1	0	0	0	0	4	13	41	0	0	0	0
5:00:00 PM	0	2	4	0	0	0	0	0	0	1	0	0	0	0	0	3	10	40	0	0	0	0
5:15:00 PM	0	3	1	0	0	0	2	0	0	0	1	0	0	0	0	5	12		0	0	0	0
5:30:00 PM	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	2	6		0	0	0	0
5:45:00 PM	0	0	4	0	0	0	2	0	0	3	0	0	0	0	0	3	12		0	0	0	0
Count Total	0	18	19	1	0	0	8	1	0	10	4	0	0	0	1	27	89		0	0	0	0
Peak Hour	0	10	9	1	0	0	4	1	0	6	3	0	0	0	1	14	49		0	0	0	0

All Traffic Data Services Inc.
(303) 216-2439
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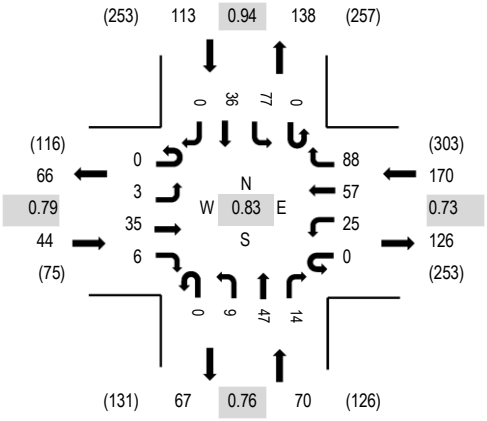
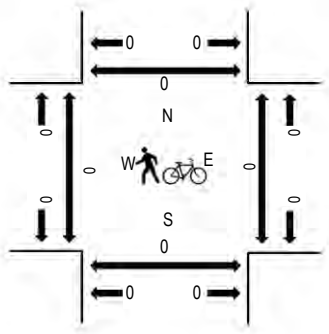
Location: 6 STURGIS RD & ELK CREEK ROAD PM
Date and Start Time: Tuesday, November 3, 2015
Peak Hour: 05:00 PM - 06:00 PM
Peak 15-Minutes: 05:30 PM - 05:45 PM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles in Crosswalk



Traffic Counts

Interval Start Time	ELK CREEK ROAD Eastbound				ELK CREEK ROAD Westbound				STURGIS RD Northbound				STURGIS RD Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
4:00:00 PM	0	2	4	2	0	6	10	17	0	3	15	0	0	24	8	2	93	360	1	0	0	1
4:15:00 PM	0	0	6	1	0	4	10	13	0	3	15	0	0	33	9	0	94	347	0	0	0	0
4:30:00 PM	0	2	9	1	0	10	9	16	0	2	9	0	0	22	5	0	85	358	0	0	0	0
4:45:00 PM	0	0	4	0	0	7	9	22	0	1	8	0	0	25	11	1	88	393	0	0	0	0
5:00:00 PM	0	0	5	2	0	6	10	18	0	1	7	1	0	28	2	0	80	397	0	0	0	0
5:15:00 PM	0	2	10	2	0	9	15	14	0	4	13	6	0	15	15	0	105		0	0	0	0
5:30:00 PM	0	1	10	1	0	5	22	31	0	1	17	3	0	20	9	0	120		0	0	0	0
5:45:00 PM	0	0	10	1	0	5	10	25	0	3	10	4	0	14	10	0	92		0	0	0	0
Count Total	0	7	58	10	0	52	95	156	0	18	94	14	0	181	69	3	757		1	0	0	1
Peak Hour	0	3	35	6	0	25	57	88	0	9	47	14	0	77	36	0	397		0	0	0	0

All Traffic Data Services Inc.

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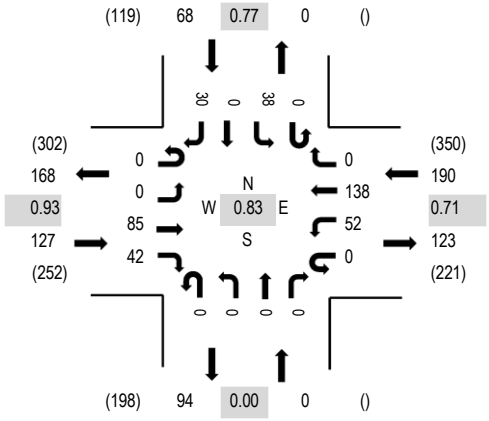
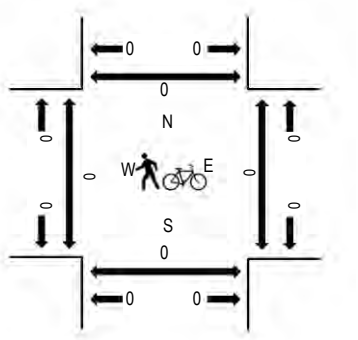
Location: 7 I-90 EB RAMPS & ELK CREEK ROAD PM
Date and Start Time: Tuesday, November 3, 2015
Peak Hour: 04:45 PM - 05:45 PM
Peak 15-Minutes: 05:30 PM - 05:45 PM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles in Crosswalk



Traffic Counts

Interval Start Time	ELK CREEK ROAD Eastbound				ELK CREEK ROAD Westbound				I-90 EB RAMPS Northbound				I-90 EB RAMPS Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
4:00:00 PM	0	0	14	14	0	11	29	0	0	0	0	0	0	10	0	4	82	337	0	0	0	0
4:15:00 PM	0	0	21	18	0	9	22	0	0	0	0	0	0	5	0	5	80	348	0	0	0	0
4:30:00 PM	0	0	17	13	0	17	29	0	0	0	0	0	0	6	0	6	88	357	0	0	0	0
4:45:00 PM	0	0	16	13	0	12	29	0	0	0	0	0	0	8	0	9	87	385	0	0	0	0
5:00:00 PM	0	0	20	14	0	15	31	0	0	0	0	0	0	9	0	4	93	384	0	0	0	0
5:15:00 PM	0	0	25	6	0	9	27	0	0	0	0	0	0	12	0	10	89		0	0	0	0
5:30:00 PM	0	0	24	9	0	16	51	0	0	0	0	0	0	9	0	7	116		0	0	0	0
5:45:00 PM	0	0	15	13	0	9	34	0	0	0	0	0	0	10	0	5	86		0	0	0	0
Count Total	0	0	152	100	0	98	252	0	0	0	0	0	0	69	0	50	721		0	0	0	0
Peak Hour	0	0	85	42	0	52	138	0	0	0	0	0	0	38	0	30	385		0	0	0	0

All Traffic Data Services Inc.

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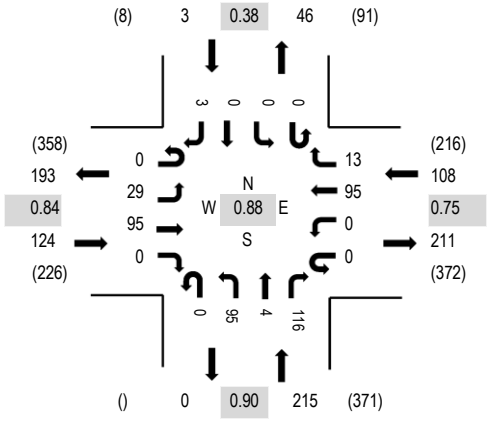
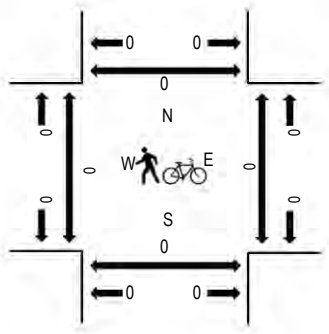
Location: 8 I-90 WB RAMPS & ELK CREEK ROAD PM
Date and Start Time: Tuesday, November 3, 2015
Peak Hour: 04:45 PM - 05:45 PM
Peak 15-Minutes: 05:30 PM - 05:45 PM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles in Crosswalk



Traffic Counts

Interval Start Time	ELK CREEK ROAD Eastbound				ELK CREEK ROAD Westbound				I-90 WB RAMPS Northbound				I-90 WB RAMPS Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
4:00:00 PM	0	8	19	0	0	0	25	6	0	19	4	18	0	0	0	1	100	391	0	0	0	0
4:15:00 PM	0	6	20	0	0	0	14	5	0	15	0	24	0	0	0	1	85	393	0	0	0	0
4:30:00 PM	0	4	20	0	0	0	30	2	0	18	0	19	0	1	0	0	94	416	0	0	0	0
4:45:00 PM	0	5	19	0	0	0	21	7	0	23	1	36	0	0	0	0	112	450	0	0	0	0
5:00:00 PM	0	8	20	0	0	0	21	3	0	21	1	27	0	0	0	1	102	430	0	0	0	0
5:15:00 PM	0	7	30	0	0	0	18	2	0	21	2	26	0	0	0	2	108		0	0	0	0
5:30:00 PM	0	9	26	0	0	0	35	1	0	30	0	27	0	0	0	0	128		0	0	0	0
5:45:00 PM	0	4	21	0	0	0	20	6	0	20	0	19	0	0	0	2	92		0	0	0	0
Count Total	0	51	175	0	0	0	184	32	0	167	8	196	0	1	0	7	821		0	0	0	0
Peak Hour	0	29	95	0	0	0	95	13	0	95	4	116	0	0	0	3	450		0	3	0	0

All Traffic Data Services Inc.
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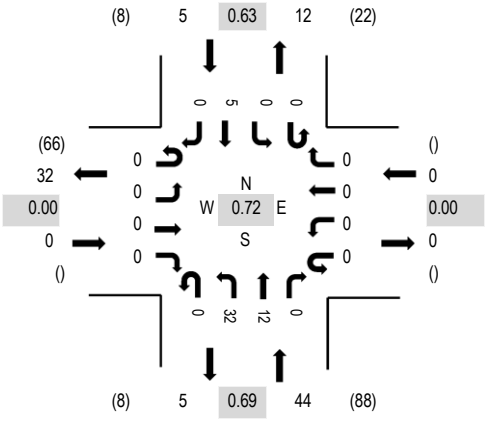
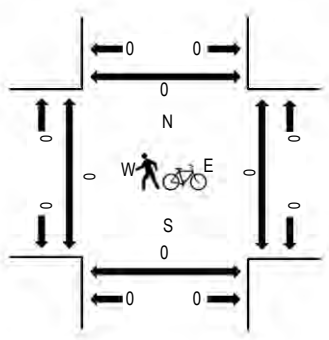
Location: 9 SIDNEY STAGE ROAD SPLIT & I-90 WB RAMP PM
Date and Start Time: Tuesday, November 3, 2015
Peak Hour: 05:00 PM - 06:00 PM
Peak 15-Minutes: 05:15 PM - 05:30 PM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles in Crosswalk



Traffic Counts

Interval Start Time	I-90 WB ON RAMP Eastbound				I-90 WB RAMP Westbound				SIDNEY STAGE ROAD SPLIT Northbound				SIDNEY STAGE ROAD SPLIT Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
4:00:00 PM	0	0	0	0	0	0	0	0	0	11	2	0	0	0	1	0	14	47	0	0	0	0
4:15:00 PM	0	0	0	0	0	0	0	0	0	10	5	0	0	0	1	0	16	43	0	0	0	0
4:30:00 PM	0	0	0	0	0	0	0	0	0	7	0	0	0	0	1	0	8	44	0	0	0	0
4:45:00 PM	0	0	0	0	0	0	0	0	0	6	3	0	0	0	0	0	9	45	0	0	0	0
5:00:00 PM	0	0	0	0	0	0	0	0	0	6	3	0	0	0	1	0	10	49	0	0	0	0
5:15:00 PM	0	0	0	0	0	0	0	0	0	11	5	0	0	0	1	0	17		0	0	0	0
5:30:00 PM	0	0	0	0	0	0	0	0	0	8	0	0	0	0	1	0	9		0	0	0	0
5:45:00 PM	0	0	0	0	0	0	0	0	0	7	4	0	0	0	2	0	13		0	0	0	0
Count Total	0	0	0	0	0	0	0	0	0	66	22	0	0	0	8	0	96		0	0	0	0
Peak Hour	0	0	0	0	0	0	0	0	0	32	12	0	0	0	5	0	49		0	0	0	0

All Traffic Data Services Inc.
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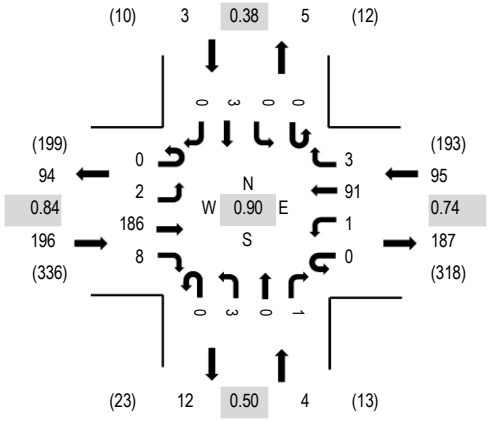
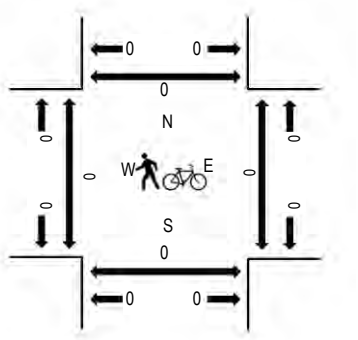
Location: 10 HILLS VIEW DR EAST & ELK CREEK ROAD PM
Date and Start Time: Tuesday, November 3, 2015
Peak Hour: 04:45 PM - 05:45 PM
Peak 15-Minutes: 04:45 PM - 05:00 PM

Peak Hour - All Vehicles



Peak Hour - Pedestrians/Bicycles in Crosswalk



Note: Total study counts contained in parentheses.

Traffic Counts

Interval Start Time	ELK CREEK ROAD Eastbound				ELK CREEK ROAD Westbound				HILLS VIEW DR EAST Northbound				HILLS VIEW DR EAST Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
4:00:00 PM	0	1	29	3	0	1	25	0	0	2	0	0	0	0	1	1	63	273	0	0	3	0
4:15:00 PM	0	3	37	0	0	0	15	0	0	1	0	1	0	0	0	3	60	271	0	0	0	0
4:30:00 PM	0	0	30	2	0	0	29	1	0	1	1	1	0	0	1	1	67	286	0	0	0	0
4:45:00 PM	0	0	55	3	0	1	21	0	0	0	0	1	0	0	2	0	83	298	0	0	0	0
5:00:00 PM	0	0	38	1	0	0	19	1	0	1	0	0	0	0	1	0	61	279	0	0	0	0
5:15:00 PM	0	1	51	2	0	0	21	0	0	0	0	0	0	0	0	0	75		0	0	0	0
5:30:00 PM	0	1	42	2	0	0	30	2	0	2	0	0	0	0	0	0	79		0	0	0	0
5:45:00 PM	0	0	32	3	0	0	26	1	0	1	0	1	0	0	0	0	64		0	0	0	0
Count Total	0	6	314	16	0	2	186	5	0	8	1	4	0	0	5	5	552		0	0	3	0
Peak Hour	0	2	186	8	0	1	91	3	0	3	0	1	0	0	3	0	298		0	0	6	0

All Traffic Data Services Inc.

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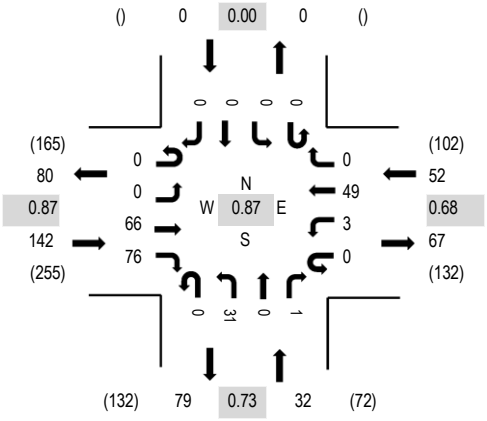
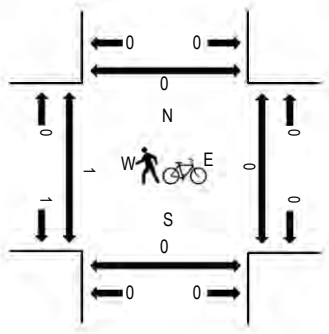
Location: 11 GLENWOOD DR & ELK CREEK ROAD PM
Date and Start Time: Tuesday, November 3, 2015
Peak Hour: 04:45 PM - 05:45 PM
Peak 15-Minutes: 05:30 PM - 05:45 PM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles in Crosswalk



Traffic Counts

Interval Start Time	ELK CREEK ROAD Eastbound				ELK CREEK ROAD Westbound				GLENWOOD DR Northbound				GLENWOOD DR Southbound				Total	Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right			West	East	South	North
4:00:00 PM	0	0	13	16	0	0	14	0	0	10	0	0	0	0	0	0	53	215	0	0	0	0
4:15:00 PM	0	0	16	18	0	0	5	0	0	9	0	2	0	0	0	0	50	210	0	0	0	0
4:30:00 PM	0	0	15	9	0	0	13	0	0	13	0	2	0	0	0	0	52	213	0	0	0	0
4:45:00 PM	0	0	15	26	0	0	12	0	0	6	0	1	0	0	0	0	60	226	1	0	0	0
5:00:00 PM	0	0	15	14	0	0	12	0	0	7	0	0	0	0	0	0	48	214	0	0	0	0
5:15:00 PM	0	0	19	18	0	1	8	0	0	7	0	0	0	0	0	0	53		0	0	0	0
5:30:00 PM	0	0	17	18	0	2	17	0	0	11	0	0	0	0	0	0	65		0	0	0	0
5:45:00 PM	0	0	16	10	0	0	18	0	0	3	0	1	0	0	0	0	48		0	0	0	0
Count Total	0	0	126	129	0	3	99	0	0	66	0	6	0	0	0	0	429		1	0	0	0
Peak Hour	0	0	66	76	0	3	49	0	0	31	0	1	0	0	0	0	226		0	0	0	0

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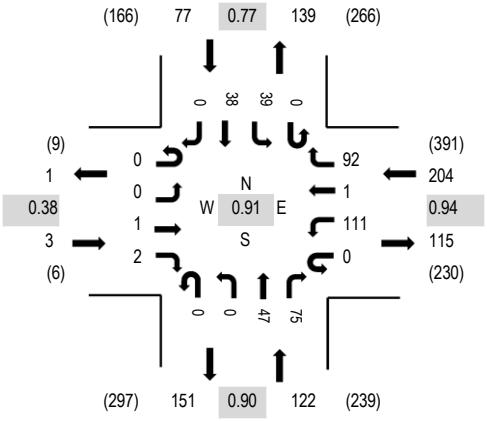
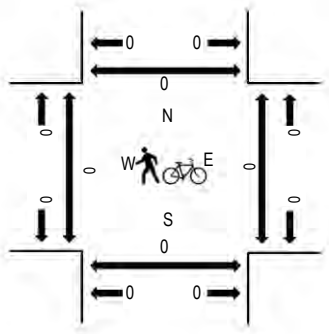
Location: 12 STURGIS RD & STAGESTOP ROAD PM
Date and Start Time: Tuesday, November 3, 2015
Peak Hour: 05:00 PM - 06:00 PM
Peak 15-Minutes: 05:15 PM - 05:30 PM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles in Crosswalk



Traffic Counts

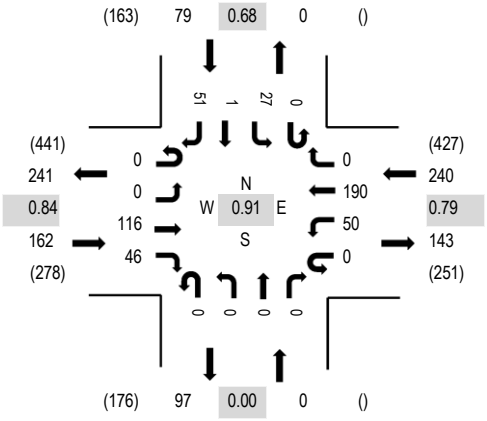
Interval Start Time	STAGESTOP ROAD Eastbound				STAGESTOP ROAD Westbound				STURGIS RD Northbound				STURGIS RD Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
4:00:00 PM	0	0	2	0	0	24	3	16	0	1	16	19	0	12	8	0	101	396	0	0	0	0
4:15:00 PM	0	0	0	0	0	26	1	20	0	0	17	12	0	12	11	0	99	385	0	0	0	0
4:30:00 PM	0	0	0	1	0	28	1	20	0	0	9	18	0	11	14	1	103	397	0	0	0	0
4:45:00 PM	0	0	0	0	0	22	1	25	0	0	4	21	0	8	12	0	93	397	0	0	0	0
5:00:00 PM	0	0	0	0	0	25	0	23	0	0	10	17	0	8	7	0	90	406	0	0	0	0
5:15:00 PM	0	0	0	0	0	30	0	24	0	0	17	17	0	14	9	0	111		0	0	0	0
5:30:00 PM	0	0	0	1	0	24	1	23	0	0	10	19	0	14	11	0	103		0	0	0	0
5:45:00 PM	0	0	1	1	0	32	0	22	0	0	10	22	0	3	11	0	102		0	0	0	0
Count Total	0	0	3	3	0	211	7	173	0	1	93	145	0	82	83	1	802		0	0	0	0
Peak Hour	0	0	1	2	0	111	1	92	0	0	47	75	0	39	38	0	406		0	0	0	0

All Traffic Data Services Inc.

(303) 216-2439
www.alltrafficdata.net

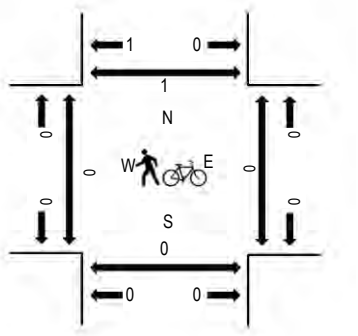
Location: 13 I-90 EB RAMPS & STAGESTOP ROAD PM
Date and Start Time: Tuesday, November 3, 2015
Peak Hour: 04:45 PM - 05:45 PM
Peak 15-Minutes: 05:00 PM - 05:15 PM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles in Crosswalk



Traffic Counts

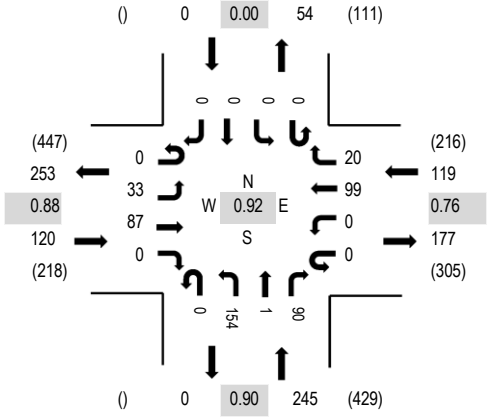
Interval Start Time	STAGESTOP ROAD Eastbound				STAGESTOP ROAD Westbound				I-90 EB RAMPS Northbound				I-90 EB RAMPS Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
4:00:00 PM	0	0	22	6	0	10	46	0	0	0	0	0	0	5	0	15	104	413	0	0	0	1
4:15:00 PM	0	0	26	7	0	14	32	0	0	0	0	0	0	8	0	17	104	441	0	0	0	0
4:30:00 PM	0	0	17	15	0	9	32	0	0	0	0	0	0	5	0	13	91	461	0	0	0	0
4:45:00 PM	0	0	25	7	0	19	43	0	0	0	0	0	0	6	0	14	114	481	0	0	0	0
5:00:00 PM	0	0	27	15	0	11	65	0	0	0	0	0	0	6	0	8	132	455	0	0	0	1
5:15:00 PM	0	0	30	10	0	11	44	0	0	0	0	0	0	11	0	18	124		0	0	0	0
5:30:00 PM	0	0	34	14	0	9	38	0	0	0	0	0	0	4	1	11	111		0	0	0	0
5:45:00 PM	0	0	15	8	0	10	34	0	0	0	0	0	0	10	0	11	88		0	0	0	0
Count Total	0	0	196	82	0	93	334	0	0	0	0	0	0	55	1	107	868		0	0	0	2
Peak Hour	0	0	116	46	0	50	190	0	0	0	0	0	0	27	1	51	481		0	0	0	1

All Traffic Data Services Inc.

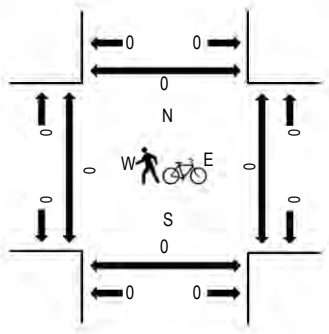
(303) 216-2439
www.alltrafficdata.net

Location: 14 I-90 WB RAMPS & STAGESTOP ROAD PM
Date and Start Time: Tuesday, November 3, 2015
Peak Hour: 04:30 PM - 05:30 PM
Peak 15-Minutes: 05:15 PM - 05:30 PM

Peak Hour - All Vehicles



Peak Hour - Pedestrians/Bicycles in Crosswalk



Note: Total study counts contained in parentheses.

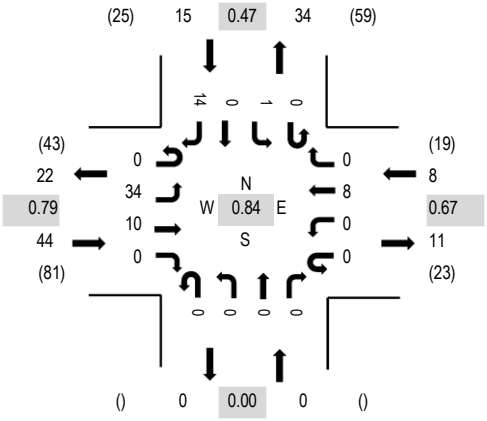
Traffic Counts

Interval Start Time	STAGESTOP ROAD Eastbound				STAGESTOP ROAD Westbound				I-90 WB RAMPS Northbound				I-90 WB RAMPS Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
4:00:00 PM	0	8	13	0	0	0	22	2	0	28	0	10	0	0	0	0	83	400	0	0	0	0
4:15:00 PM	0	9	15	0	0	0	18	5	0	25	0	24	0	0	0	0	96	448	0	0	0	2
4:30:00 PM	0	8	22	0	0	0	13	3	0	41	0	27	0	0	0	0	114	484	0	0	0	0
4:45:00 PM	0	9	18	0	0	0	19	7	0	36	0	18	0	0	0	0	107	471	0	0	0	0
5:00:00 PM	0	7	22	0	0	0	33	5	0	40	0	24	0	0	0	0	131	463	0	0	0	0
5:15:00 PM	0	9	25	0	0	0	34	5	0	37	1	21	0	0	0	0	132		0	0	0	0
5:30:00 PM	0	12	22	0	0	0	14	7	0	32	0	14	0	0	0	0	101		0	0	0	0
5:45:00 PM	0	10	9	0	0	0	25	4	0	30	0	21	0	0	0	0	99		0	0	0	0
Count Total	0	72	146	0	0	0	178	38	0	269	1	159	0	0	0	0	863		0	0	0	2
Peak Hour	0	33	87	0	0	0	99	20	0	154	1	90	0	0	0	0	484		0	0	0	1

All Traffic Data Services Inc.
(303) 216-2439
www.alltrafficdata.net

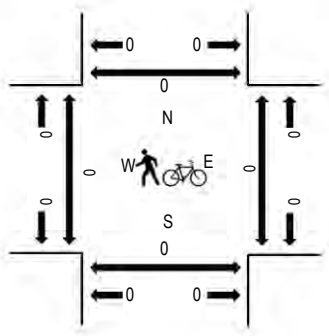
Location: 15 LARUE RD & STAGESTOP ROAD PM
Date and Start Time: Tuesday, November 3, 2015
Peak Hour: 05:00 PM - 06:00 PM
Peak 15-Minutes: 05:45 PM - 06:00 PM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles in Crosswalk



Traffic Counts

Interval Start Time	STAGESTOP ROAD Eastbound				STAGESTOP ROAD Westbound				LARUE RD Northbound				LARUE RD Southbound					Rolling Hour	Pedestrain Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
4:00:00 PM	0	1	4	0	0	0	5	0	0	0	0	0	0	0	0	2	12	58	0	0	0	0
4:15:00 PM	0	7	1	0	0	0	1	0	0	0	0	0	0	0	0	2	11	58	0	0	0	0
4:30:00 PM	0	11	5	0	0	0	2	0	0	0	0	0	0	0	0	1	19	63	0	0	0	0
4:45:00 PM	0	6	2	0	0	0	3	0	0	0	0	0	0	0	0	5	16	63	0	0	0	0
5:00:00 PM	0	7	1	0	0	0	1	0	0	0	0	0	0	0	0	3	12	67	0	0	0	0
5:15:00 PM	0	8	5	0	0	0	2	0	0	0	0	0	0	0	0	1	16		0	0	0	0
5:30:00 PM	0	12	2	0	0	0	2	0	0	0	0	0	0	0	0	3	19		0	0	0	0
5:45:00 PM	0	7	2	0	0	0	3	0	0	0	0	0	0	1	0	7	20		0	0	0	0
Count Total	0	59	22	0	0	0	19	0	0	0	0	0	0	1	0	24	125		0	0	0	0
Peak Hour	0	34	10	0	0	0	8	0	0	0	0	0	0	1	0	14	67		0	0	0	0

APPENDIX C EXISTING CONDITIONS LOS WORKSHEETS

FREEWAY LOS

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	TS
Agency or Company:	FHU
Date Performed:	12/2/2015
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	EB
From/To:	E/O Exit 48
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	1384	veh/h
Peak-hour factor, PHF	0.86	
Peak 15-min volume, v15	402	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	853	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	853	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	11.4	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	TS
Agency or Company:	FHU
Date Performed:	12/2/2015
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	WB
From/To:	E/O Exit 48
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	702	veh/h
Peak-hour factor, PHF	0.79	
Peak 15-min volume, v15	222	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	471	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	471	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	6.3	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	TS
Agency or Company:	FHU
Date Performed:	12/2/2015
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	EB
From/To:	Exit 48 - Exit 46
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	1174	veh/h
Peak-hour factor, PHF	0.86	
Peak 15-min volume, v15	341	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	724	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	724	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	9.7	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	TS
Agency or Company:	FHU
Date Performed:	12/2/2015
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	WB
From/To:	Exit 48 - Exit 46
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	724	veh/h
Peak-hour factor, PHF	0.79	
Peak 15-min volume, v15	229	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	486	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	486	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	6.5	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	TS
Agency or Company:	FHU
Date Performed:	12/2/2015
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	EB
From/To:	Exit 46 - Exit 44
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	896	veh/h
Peak-hour factor, PHF	0.86	
Peak 15-min volume, v15	260	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	552	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	552	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	7.4	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	TS
Agency or Company:	FHU
Date Performed:	12/2/2015
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	WB
From/To:	Exit 46 - Exit 44
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	721	veh/h
Peak-hour factor, PHF	0.79	
Peak 15-min volume, v15	228	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	484	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	484	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	6.5	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	TS
Agency or Company:	FHU
Date Performed:	12/2/2015
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	EB
From/To:	NO Exit 44
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	821	veh/h
Peak-hour factor, PHF	0.86	
Peak 15-min volume, v15	239	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	506	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	506	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	6.7	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	TS
Agency or Company:	FHU
Date Performed:	12/2/2015
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	WB
From/To:	NO Exit 44
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	742	veh/h
Peak-hour factor, PHF	0.79	
Peak 15-min volume, v15	235	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	498	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	498	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	6.6	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	TS
Agency or Company:	FHU
Date Performed:	12/2/2015
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	EB
From/To:	E/O Exit 48
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	917	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	249	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	528	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	528	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	7.0	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	TS
Agency or Company:	FHU
Date Performed:	12/2/2015
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	WB
From/To:	E/O Exit 48
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	1361	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	358	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	759	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	759	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	10.1	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	TS
Agency or Company:	FHU
Date Performed:	12/2/2015
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	EB
From/To:	Exit 48 - Exit 46
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	893	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	243	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	514	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	514	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	6.9	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	TS
Agency or Company:	FHU
Date Performed:	12/2/2015
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	WB
From/To:	Exit 48 - Exit 46
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	1184	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	312	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	661	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	661	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	8.8	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	TS
Agency or Company:	FHU
Date Performed:	12/2/2015
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	EB
From/To:	Exit 46 - Exit 44
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	864	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	235	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	498	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	498	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	6.6	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	TS
Agency or Company:	FHU
Date Performed:	12/2/2015
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	WB
From/To:	Exit 46 - Exit 44
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	968	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	255	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	540	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	540	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	7.2	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	TS
Agency or Company:	FHU
Date Performed:	12/2/2015
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	EB
From/To:	NO Exit 44
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	847	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	230	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	488	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	488	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	6.5	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	TS
Agency or Company:	FHU
Date Performed:	12/2/2015
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	WB
From/To:	NO Exit 44
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	900	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	237	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	502	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	502	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	6.7	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 44
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	785	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	111	vph
Length of first accel/decel lane	700	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	785	111		vph
Peak-hour factor, PHF	0.86	0.73		
Peak 15-min volume, v15	228	38		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	968	161	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 968 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1129	4800	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 968 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1129	4600	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 9.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable,	M_S = 0.284	
Space mean speed in ramp influence area,	S_R = 65.6	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 65.6	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 44
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	693	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	49	vph
Length of first accel/decel lane	375	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	693	49		vph
Peak-hour factor, PHF	0.79	0.84		
Peak 15-min volume, v15	219	15		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	930	62	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 930 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	992	4800	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 930 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	992	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 10.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.305	
Space mean speed in ramp influence area,	S_R = 64.9	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 64.9	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 44
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	721	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	28	vph
Length of first accel/decel lane	375	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	721	28		vph
Peak-hour factor, PHF	0.79	0.84		
Peak 15-min volume, v15	228	8		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	967	35	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 967 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	967	4800	No
$v_{FO} = v_F - v_R$	932	4800	No
v_R	35	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 967 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	967	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_R - 0.009 L_{12}$ = 9.2 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable, D_S = 0.431

Space mean speed in ramp influence area, S_R = 60.8 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 60.8 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 44
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	821	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	36	vph
Length of first accel/decel lane	225	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	821	36		vph
Peak-hour factor, PHF	0.86	0.73		
Peak 15-min volume, v15	239	12		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1012	52	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1012 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1012	4800	No
$v_{FO} = v_F - v_R$	960	4800	No
v_R	52	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 1012 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1012	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_{12}$ = 10.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.433

Space mean speed in ramp influence area, S_R = 60.7 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 60.7 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.70

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 44
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	806	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	58	vph
Length of first accel/decel lane	700	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	806	58		vph
Peak-hour factor, PHF	0.92	0.87		
Peak 15-min volume, v15	219	17		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	929	71	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 929 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1000	4800	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 929 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1000	4600	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 8.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable,	M_S = 0.283	
Space mean speed in ramp influence area,	S_R = 65.7	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 65.7	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 44
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	884	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	16	vph
Length of first accel/decel lane	375	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	884	16		vph
Peak-hour factor, PHF	0.95	0.93		
Peak 15-min volume, v15	233	4		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	986	18	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 986 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1004	4800	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 986 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1004	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 10.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.305	
Space mean speed in ramp influence area,	S_R = 64.9	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 64.9	mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.70

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 44
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	884	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	84	vph
Length of first accel/decel lane	375	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	884	84		vph
Peak-hour factor, PHF	0.95	0.93		
Peak 15-min volume, v15	233	23		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	986	96	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 986 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	986	4800	No
$v_{FO} = v_F - v_R$	890	4800	No
v_R	96	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 986 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	986	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 9.4 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable,	D_S = 0.437	
Space mean speed in ramp influence area,	S_R = 60.6	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 60.6	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 44
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	847	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	41	vph
Length of first accel/decel lane	225	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	847	41		vph
Peak-hour factor, PHF	0.92	0.87		
Peak 15-min volume, v15	230	12		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	976	50	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 976 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	976	4800	No
$v_{FO} = v_F - v_R$	926	4800	No
v_R	50	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 976 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	976	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 10.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.433

Space mean speed in ramp influence area, S_R = 60.7 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 60.7 mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 46
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	870	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	304	vph
Length of first accel/decel lane	645	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	870	304		vph
Peak-hour factor, PHF	0.86	0.78		
Peak 15-min volume, v15	253	97		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1072	413	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1072 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1485	4800	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1072 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1485	4600	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 12.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.293	
Space mean speed in ramp influence area,	S_R = 65.3	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 65.3	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 46
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	612	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	109	vph
Length of first accel/decel lane	615	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	612	109		vph
Peak-hour factor, PHF	0.79	0.76		
Peak 15-min volume, v15	194	36		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	821	152	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 821 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	973	4800	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12} /2		No	

If yes, v_{12A} = 821 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	973	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 9.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable,	M_S = 0.288	
Space mean speed in ramp influence area,	S_R = 65.5	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 65.5	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 46
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	724	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	112	vph
Length of first accel/decel lane	515	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	724	112		vph
Peak-hour factor, PHF	0.79	0.85		
Peak 15-min volume, v15	229	33		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	971	140	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 971 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	971	4800	No
$v_{FO} = v_F - v_R$	831	4800	No
v_R	140	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 971 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	971	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_D$ = 8.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable, D_S = 0.441

Space mean speed in ramp influence area, S_R = 60.5 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 60.5 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 46
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	896	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	23	vph
Length of first accel/decel lane	450	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	896	23		vph
Peak-hour factor, PHF	0.86	0.78		
Peak 15-min volume, v15	260	7		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %		%
Length	0.00 mi	0.00 mi		mi
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1104	31	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1104 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1104	4800	No
$v_{FO} = v_F - v_R$	1073	4800	No
v_R	31	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1104 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1104	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 9.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable,	D_S = 0.431	
Space mean speed in ramp influence area,	S_R = 60.8	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 60.8	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 46
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	781	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	112	vph
Length of first accel/decel lane	645	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	781	112		vph
Peak-hour factor, PHF	0.92	0.83		
Peak 15-min volume, v15	212	34		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	900	143	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 900 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1043	4800	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 900 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1043	4600	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 9.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable,	M_S = 0.287	
Space mean speed in ramp influence area,	S_R = 65.5	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 65.5	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 46
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	926	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	42	vph
Length of first accel/decel lane	615	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	926	42		vph
Peak-hour factor, PHF	0.95	0.72		
Peak 15-min volume, v15	244	15		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1033	62	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1033 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1095	4800	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1033 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1095	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 10.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.290	
Space mean speed in ramp influence area,	S_R = 65.4	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 65.4	mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.70

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 46
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	1184	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	258	vph
Length of first accel/decel lane	515	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1184	258		vph
Peak-hour factor, PHF	0.95	0.88		
Peak 15-min volume, v15	312	73		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %		%
Length	0.00 mi	0.00 mi		mi
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1321	311	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1321 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1321	4800	No
$v_{FO} = v_F - v_R$	1010	4800	No
v_R	311	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 1321 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1321	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_{12}$ = 11.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.456

Space mean speed in ramp influence area, S_R = 60.0 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 60.0 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.70

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 46
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	864	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	83	vph
Length of first accel/decel lane	450	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	864	83		vph
Peak-hour factor, PHF	0.92	0.83		
Peak 15-min volume, v15	235	25		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	995	106	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 995 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	995	4800	No
$v_{FO} = v_F - v_R$	889	4800	No
v_R	106	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 995 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	995	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 8.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable,	D_S = 0.438	
Space mean speed in ramp influence area,	S_R = 60.6	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 60.6	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 48
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	1100	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	284	vph
Length of first accel/decel lane	640	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1100	284		vph
Peak-hour factor, PHF	0.86	0.92		
Peak 15-min volume, v15	320	77		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1356	327	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1356 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1683	4800	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1356 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1683	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 14.4 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.297	
Space mean speed in ramp influence area,	S_R = 65.2	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 65.2	mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.70

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 48
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	609	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	115	vph
Length of first accel/decel lane	620	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	609	115		vph
Peak-hour factor, PHF	0.79	0.88		
Peak 15-min volume, v15	193	33		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	817	139	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 817 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	956	4800	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 817 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	956	4600	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 9.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable,	M_S = 0.288	
Space mean speed in ramp influence area,	S_R = 65.5	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 65.5	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 48
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	702	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	93	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	702	93		vph
Peak-hour factor, PHF	0.79	0.88		
Peak 15-min volume, v15	222	26		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	942	112	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 942 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	942	4800	No
$v_{FO} = v_F - v_R$	830	4800	No
v_R	112	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 942 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	942	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_{12}$ = 7.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable,	D_S = 0.438	
Space mean speed in ramp influence area,	S_R = 60.5	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 60.5	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 48
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	1174	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	74	vph
Length of first accel/decel lane	350	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1174	74		vph
Peak-hour factor, PHF	0.86	0.92		
Peak 15-min volume, v15	341	20		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1447	85	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1447 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1447	4800	No
$v_{FO} = v_F - v_R$	1362	4800	No
v_R	85	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1447 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1447	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 13.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.436

Space mean speed in ramp influence area, S_R = 60.6 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 60.6 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.70

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 48
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	799	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	118	vph
Length of first accel/decel lane	640	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	799	118		vph
Peak-hour factor, PHF	0.91	0.92		
Peak 15-min volume, v15	220	32		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	931	136	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 931 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1067	4800	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 931 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1067	4600	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 9.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable,	M_S = 0.288	
Space mean speed in ramp influence area,	S_R = 65.5	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 65.5	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 48
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	1094	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	90	vph
Length of first accel/decel lane	620	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1094	90		vph
Peak-hour factor, PHF	0.95	0.92		
Peak 15-min volume, v15	288	24		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1221	104	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1221 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1325	4800	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1221 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1325	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 11.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.292	
Space mean speed in ramp influence area,	S_R = 65.4	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 65.4	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 48
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	1361	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	267	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1361	267		vph
Peak-hour factor, PHF	0.95	0.92		
Peak 15-min volume, v15	358	73		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1519	308	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1519 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1519	4800	No
$v_{FO} = v_F - v_R$	1211	4800	No
v_R	308	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 1519 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1519	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_{12}$ = 12.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.456

Space mean speed in ramp influence area, S_R = 60.0 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 60.0 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 48
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	893	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	94	vph
Length of first accel/decel lane	350	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	893	94		vph
Peak-hour factor, PHF	0.92	0.91		
Peak 15-min volume, v15	243	26		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1029	109	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1029 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1029	4800	No
$v_{FO} = v_F - v_R$	920	4800	No
v_R	109	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 No

If yes, v_{12A} = 1029 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1029	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_D$ = 10.0- pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable, D_S = 0.438

Space mean speed in ramp influence area, S_R = 60.6 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 60.6 mph

SURFACE STREET LOS

HCS 2010 Two-Way Stop Control Summary Report

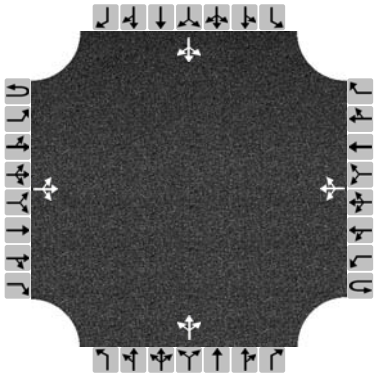
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	11/20/2015
Analysis Year	2015
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	1-Chimney Canyon/Sturgis
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Chimney Canyon
North/South Street	Sturgis Road
Peak Hour Factor	0.85
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	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		0	48	16		41	1	14		5	14	32		60	20	1
Percent Heavy Vehicles		14				14				14	14	14		14	14	14
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						48					60				96	
Capacity		1523				1449					837				676	
v/c Ratio						0.03					0.07				0.14	
95% Queue Length						0.1					0.2				0.5	
Control Delay (s/veh)		7.4				7.6					9.6				11.2	
Level of Service (LOS)		A				A					A				B	
Approach Delay (s/veh)					5.7				9.6				11.2			
Approach LOS					A				A				B			

HCS 2010 Two-Way Stop Control Summary Report

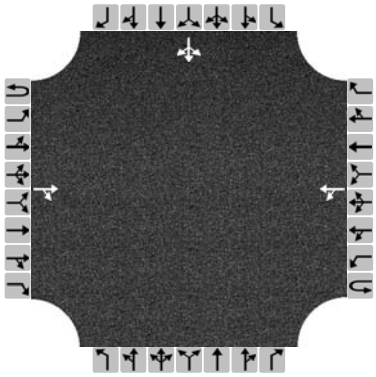
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	11/20/2015
Analysis Year	2015
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	2-Deerview Road/WB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Deerview Road
North/South Street	EB Ramps
Peak Hour Factor	0.73
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	0	1	0		0	0	0		0	1	0
Configuration				TR		LT									LTR	
Volume (veh/h)			38	102		8	26							5	1	30
Percent Heavy Vehicles						12								12	12	12
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						47									49	
Capacity						1374									1234	
v/c Ratio						0.03									0.04	
95% Queue Length						0.0									0.1	
Control Delay (s/veh)						7.6									8.0	
Level of Service (LOS)						A									A	
Approach Delay (s/veh)					1.8								8.0			
Approach LOS					A								A			

HCS 2010 Two-Way Stop Control Summary Report

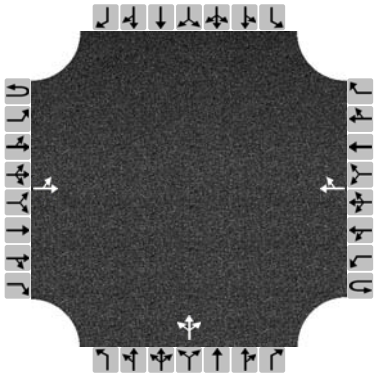
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	11/20/2015
Analysis Year	2015
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	3-Deerview Road/WB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Deerview Road
North/South Street	WB Ramps
Peak Hour Factor	0.84
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	0	1	0		0	1	0		0	0	0
Configuration		LT						TR			LTR					
Volume (veh/h)		37	6				16	12		18	0	10				
Percent Heavy Vehicles		12								12	12	12				
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		51									33					
Capacity		1570									1369					
v/c Ratio		0.03									0.02					
95% Queue Length		0.1									0.1					
Control Delay (s/veh)		7.4									7.7					
Level of Service (LOS)		A									A					
Approach Delay (s/veh)	6.4								7.7							
Approach LOS	A								A							

HCS 2010 Two-Way Stop Control Summary Report

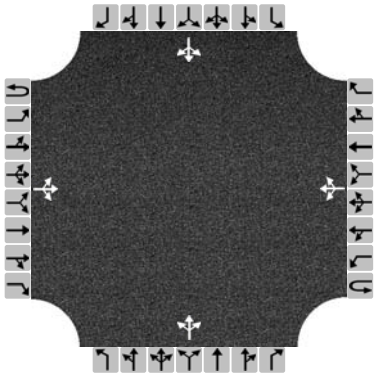
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	11/20/2015
Analysis Year	2015
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	4-Deerview Road/Sidney
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Deerview Road
North/South Street	Sidney Stage Road
Peak Hour Factor	0.71
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	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		11	4	1		0	7	0		1	7	0		0	0	20
Percent Heavy Vehicles		14				14				14	14	14		14	14	14
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		15									11				28	
Capacity		1601				1605					842				1068	
v/c Ratio		0.01									0.01				0.03	
95% Queue Length		0.0									0.0				0.1	
Control Delay (s/veh)		7.3				7.2					9.3				8.5	
Level of Service (LOS)		A				A					A				A	
Approach Delay (s/veh)	5.0								9.3				8.5			
Approach LOS	A								A				A			

HCS 2010 Two-Way Stop Control Summary Report

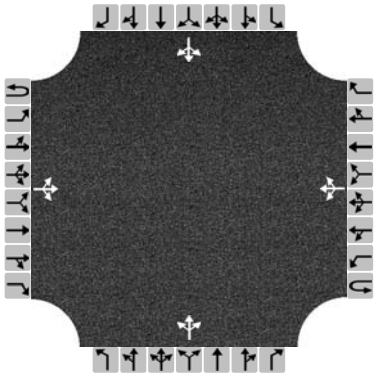
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	11/20/2015
Analysis Year	2015
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	5-Deerview Road/Spring
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Deerview Road
North/South Street	Spring Valley Road
Peak Hour Factor	0.38
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	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		0	3	1		1	5	0		1	0	1		0	0	1
Percent Heavy Vehicles		14				14				14	14	14		14	14	14
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						3					6				3	
Capacity		1597				1600					1020				1064	
v/c Ratio						0.00					0.01				0.00	
95% Queue Length						0.0					0.0				0.0	
Control Delay (s/veh)		7.3				7.3					8.5				8.4	
Level of Service (LOS)		A				A					A				A	
Approach Delay (s/veh)					1.4				8.5				8.4			
Approach LOS					A				A				A			

HCS 2010 Two-Way Stop Control Summary Report

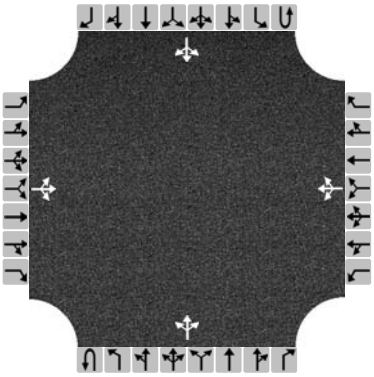
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	11/20/2015
Analysis Year	2015
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	6-Elk Creek Road/Strugis
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	Sturgis Road
Peak Hour Factor	0.72
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	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		2	41	7		25	64	137		10	98	26		220	76	5
Percent Heavy Vehicles		14	14	14		14	14	14		14				14		
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)			70				314			14				306		
Capacity			220				379			1468				1397		
v/c Ratio			0.32				0.83			0.01				0.22		
95% Queue Length			1.3				7.5			0.0				0.8		
Control Delay (s/veh)			28.7				47.0			7.5				8.3		
Level of Service (LOS)			D				E			A				A		
Approach Delay (s/veh)	28.7				47.0				0.6				6.6			
Approach LOS	D				E				A				A			

HCS 2010 Two-Way Stop Control Summary Report

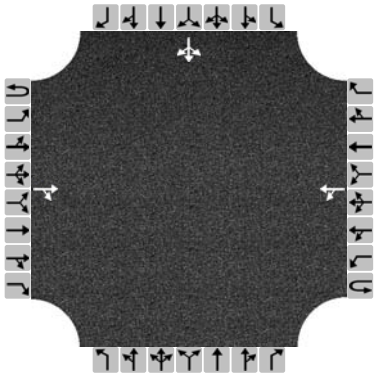
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	11/20/2015
Analysis Year	2015
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	7-Elk Creek Road/EB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	EB Ramps
Peak Hour Factor	0.78
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	0	1	0		0	0	0		0	1	0
Configuration				TR		LT									LTR	
Volume (veh/h)			119	168		136	212							12	0	14
Percent Heavy Vehicles						12								12	12	12
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						446									33	
Capacity						1184									696	
v/c Ratio						0.38									0.05	
95% Queue Length						0.5									0.1	
Control Delay (s/veh)						8.6									10.4	
Level of Service (LOS)						A									B	
Approach Delay (s/veh)					4.2								10.4			
Approach LOS					A								B			

HCS 2010 Two-Way Stop Control Summary Report

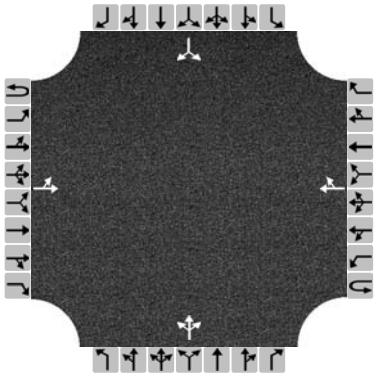
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	11/20/2015
Analysis Year	2015
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	8-Elk Creek Road/WB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	WB Ramps
Peak Hour Factor	0.85
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	0	1	0		0	1	0		0	0	0
Configuration		LT						TR			LTR				LR	
Volume (veh/h)		58	73				260	58		80	4	28		0		0
Percent Heavy Vehicles		12								12	12	12		3		3
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		154									132					
Capacity		1178									640					
v/c Ratio		0.13									0.21					
95% Queue Length		0.2									0.8					
Control Delay (s/veh)		8.2									12.1					
Level of Service (LOS)		A									B					
Approach Delay (s/veh)	3.9								12.1							
Approach LOS	A								B							

HCS 2010 Two-Way Stop Control Summary Report

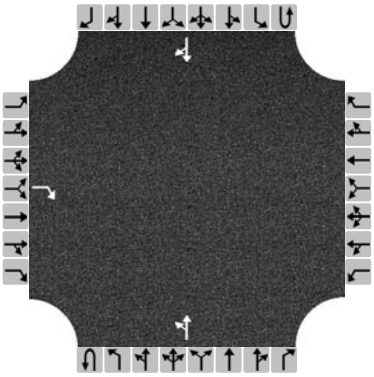
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	11/20/2015
Analysis Year	2015
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	9-Sidney Stage Rd/WB Ramp
Jurisdiction	South Dakota DOT / FHWA
East/West Street	WB Ramp
North/South Street	Sidney Stage
Peak Hour Factor	0.76
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	0	1	0	0	0	1	0
Configuration				R						LT						TR
Volume (veh/h)				0						109	11				8	0
Percent Heavy Vehicles				12						12						
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)										157						
Capacity				1066						1600						
v/c Ratio										0.10						
95% Queue Length										0.3						
Control Delay (s/veh)				8.4						7.5						
Level of Service (LOS)				A						A						
Approach Delay (s/veh)									6.9							
Approach LOS									A							

HCS 2010 Two-Way Stop Control Summary Report

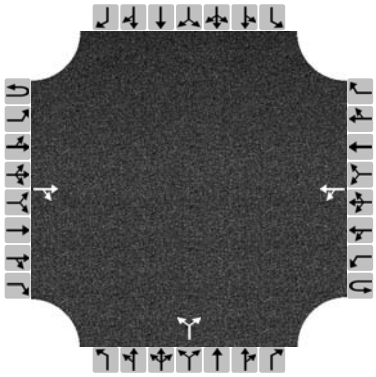
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	11/20/2015
Analysis Year	2015
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	10-Elk Creek/Hills View
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	Hills View Drive
Peak Hour Factor	0.83
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	0	1	0		0	0	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			89	5		1	292			10		1				
Percent Heavy Vehicles						14				14		14				
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						353					13					
Capacity						1468					572					
v/c Ratio						0.24					0.02					
95% Queue Length						0.0					0.1					
Control Delay (s/veh)						7.5					11.4					
Level of Service (LOS)						A					B					
Approach Delay (s/veh)					0.0				11.4							
Approach LOS					A				B							

HCS 2010 Two-Way Stop Control Summary Report

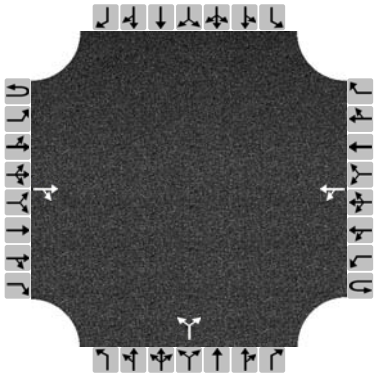
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	11/20/2015
Analysis Year	2015
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	11-Elk Creek/Glenwood
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	Glenwood Drive
Peak Hour Factor	0.83
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	0	1	0		0	0	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			37	40		1	127			113		2				
Percent Heavy Vehicles						14				14		14				
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						154					138					
Capacity						1427					740					
v/c Ratio						0.11					0.19					
95% Queue Length						0.0					0.7					
Control Delay (s/veh)						7.5					11.0					
Level of Service (LOS)						A					B					
Approach Delay (s/veh)					0.1				11.0							
Approach LOS					A				B							

HCS 2010 Two-Way Stop Control Summary Report

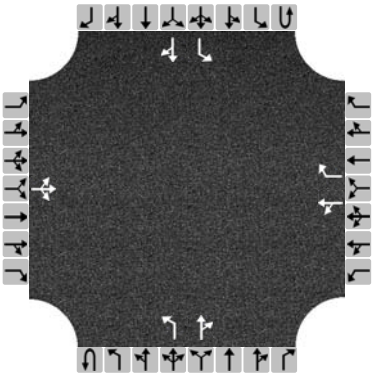
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	11/20/2015
Analysis Year	2015
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	12-Stage Stop Rd/Sturgis
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Stage Stop Road
North/South Street	Stugis Road
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	1	0	0	1	1	0
Configuration			LTR			LT		R		L		TR		L		TR
Volume (veh/h)		0	4	0		47	8	41		4	72	126		119	66	2
Percent Heavy Vehicles		14	14	14		14	14	14		14				14		
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)			4			61		46		4				132		
Capacity			373			420		865		1449				1279		
v/c Ratio			0.01			0.15		0.05		0.00				0.10		
95% Queue Length			0.0			0.5		0.2		0.0				0.3		
Control Delay (s/veh)			14.8			15.0		9.4		7.5				8.1		
Level of Service (LOS)			B			C		A		A				A		
Approach Delay (s/veh)	14.8				12.5				0.1				5.2			
Approach LOS	B				B				A				A			

HCS 2010 Two-Way Stop Control Summary Report

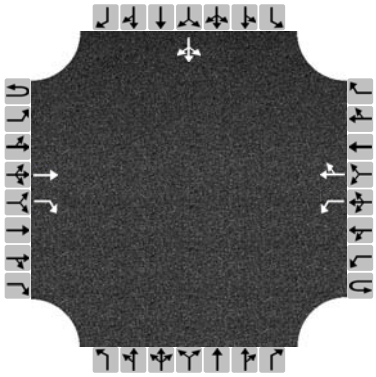
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	11/20/2015
Analysis Year	2015
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	12-Stage Stop Rd/Sturgis
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Stage Stop Road
North/South Street	EB Ramps
Peak Hour Factor	0.92
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	1	0	1	1	0		0	0	0		0	1	0
Configuration			T	R		L		TR							LTR	
Volume (veh/h)			112	162		122	98	0						24	0	50
Percent Heavy Vehicles						12								12	12	12
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						133									80	
Capacity						1256									1398	
v/c Ratio						0.11									0.06	
95% Queue Length						0.4									0.2	
Control Delay (s/veh)						8.2									7.7	
Level of Service (LOS)						A									A	
Approach Delay (s/veh)					4.5								7.7			
Approach LOS					A								A			

HCS 2010 Two-Way Stop Control Summary Report

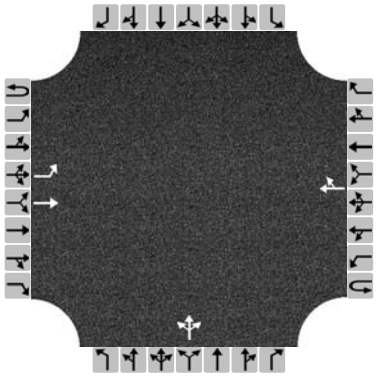
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	11/20/2015
Analysis Year	2015
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	14-Stage Stop Rd/WB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Stage Stop Road
North/South Street	WB Ramps
Peak Hour Factor	0.88
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	1	1	0	0	0	1	0		0	1	0		0	0	0
Configuration		L	T					TR			LTR					
Volume (veh/h)		64	72				176	50		44	1	48				
Percent Heavy Vehicles		12								12	12	12				
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		73									106					
Capacity		1301									1159					
v/c Ratio		0.06									0.09					
95% Queue Length		0.2									0.3					
Control Delay (s/veh)		7.9									8.4					
Level of Service (LOS)		A									A					
Approach Delay (s/veh)	3.7								8.4							
Approach LOS	A								A							

HCS 2010 Two-Way Stop Control Summary Report

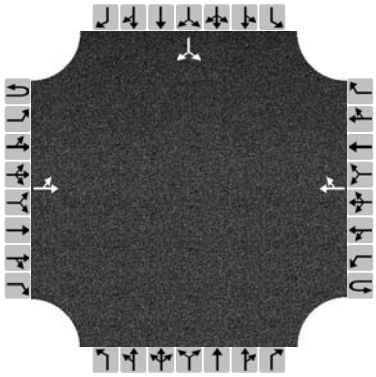
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	11/20/2015
Analysis Year	2015
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	15-Stage Stop Rd/LaRue Rd
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Stage Stop Road
North/South Street	LaRue Road
Peak Hour Factor	0.81
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	0	1	0		0	0	0		0	0	0
Configuration		LT						TR							LR	
Volume (veh/h)		13	5				25	0						0		58
Percent Heavy Vehicles		14												14		14
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		22													72	
Capacity		1573													1039	
v/c Ratio		0.01													0.07	
95% Queue Length		0.0													0.2	
Control Delay (s/veh)		7.3													8.7	
Level of Service (LOS)		A													A	
Approach Delay (s/veh)	5.3												8.7			
Approach LOS	A												A			

HCS 2010 Two-Way Stop Control Summary Report

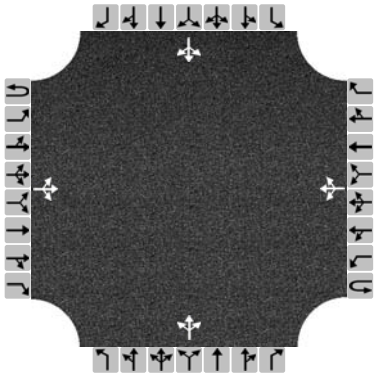
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	11/20/2015
Analysis Year	2015
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	1-Chimney Canyon/Sturgis
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Chimney Canyon
North/South Street	Sturgis Road
Peak Hour Factor	0.89
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	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		0	8	4		34	29	53		8	18	17		37	19	5
Percent Heavy Vehicles		14				14				14	14	14		14	14	14
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						38					48				69	
Capacity		1427				1528					797				730	
v/c Ratio						0.02					0.06				0.09	
95% Queue Length						0.1					0.2				0.3	
Control Delay (s/veh)		7.5				7.4					9.8				10.4	
Level of Service (LOS)		A				A					A				B	
Approach Delay (s/veh)					2.3				9.8				10.4			
Approach LOS					A				A				B			

HCS 2010 Two-Way Stop Control Summary Report

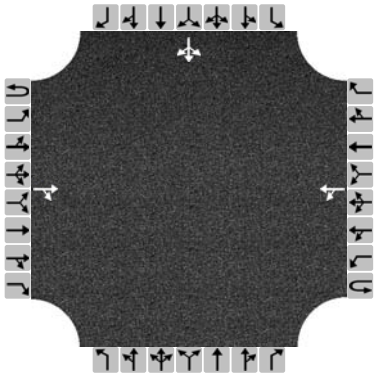
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	11/20/2015
Analysis Year	2015
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	2-Deerview Road/WB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Deerview Road
North/South Street	EB Ramps
Peak Hour Factor	0.87
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	0	1	0		0	0	0		0	1	0
Configuration				TR		LT									LTR	
Volume (veh/h)			18	44		13	81							5	1	35
Percent Heavy Vehicles						12								12	12	12
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						108									47	
Capacity						1520									1129	
v/c Ratio						0.07									0.04	
95% Queue Length						0.0									0.1	
Control Delay (s/veh)						7.4									8.3	
Level of Service (LOS)						A									A	
Approach Delay (s/veh)					1.1								8.3			
Approach LOS					A								A			

HCS 2010 Two-Way Stop Control Summary Report

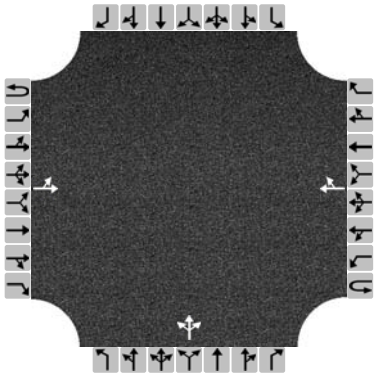
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	11/20/2015
Analysis Year	2015
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	3-Deerview Road/WB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Deerview Road
North/South Street	WB Ramps
Peak Hour Factor	0.93
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	0	1	0		0	1	0		0	0	0
Configuration		LT						TR			LTR					
Volume (veh/h)		14	9				25	2		70	0	14				
Percent Heavy Vehicles		12								12	12	12				
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		25									90					
Capacity		1576									1120					
v/c Ratio		0.02									0.08					
95% Queue Length		0.0									0.3					
Control Delay (s/veh)		7.3									8.5					
Level of Service (LOS)		A									A					
Approach Delay (s/veh)	4.4								8.5							
Approach LOS	A								A							

HCS 2010 Two-Way Stop Control Summary Report

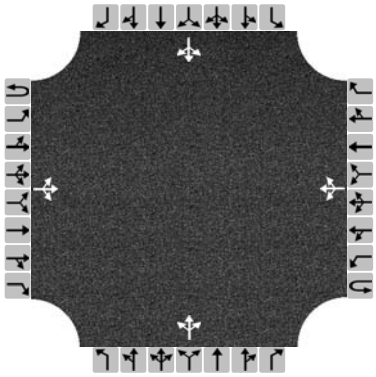
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	11/20/2015
Analysis Year	2015
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	4-Deerview Road/Sidney
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Deerview Road
North/South Street	Sidney Stage Road
Peak Hour Factor	0.94
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	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		10	12	1		0	5	0		5	1	0		0	1	17
Percent Heavy Vehicles		14				14				14	14	14		14	14	14
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

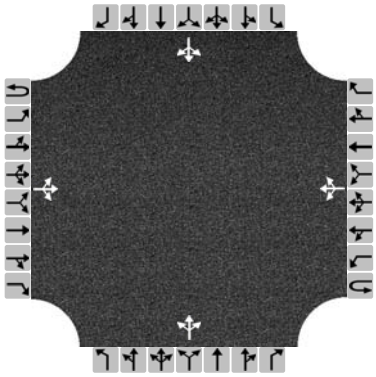
Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		11									6				19	
Capacity		1608				1596					918				1059	
v/c Ratio		0.01									0.01				0.02	
95% Queue Length		0.0									0.0				0.1	
Control Delay (s/veh)		7.3				7.3					8.9				8.5	
Level of Service (LOS)		A				A					A				A	
Approach Delay (s/veh)	3.2								8.9				8.5			
Approach LOS	A								A				A			

HCS 2010 Two-Way Stop Control Summary Report

General Information		Site Information	
Analyst	DCJ	Intersection	5-Deerview Road/Spring
Agency/Co.	Felsburg Holt & Ullevig	Jurisdiction	South Dakota DOT / FHWA
Date Performed	11/20/2015	East/West Street	Deerview Road
Analysis Year	2015	North/South Street	Spring Valley Road
Time Analyzed	PM	Peak Hour Factor	0.85
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	I-90 Exit 46 IMJR		

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	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		1	11	0		0	2	0		3	0	0		0	0	0
Percent Heavy Vehicles		14				14				14	14	14		14	14	14
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		1									4					
Capacity		1612				1597					998					
v/c Ratio		0.00									0.00					
95% Queue Length		0.0									0.0					
Control Delay (s/veh)		7.2				7.3					8.6					
Level of Service (LOS)		A				A					A					
Approach Delay (s/veh)	0.5								8.6							
Approach LOS	A								A							

HCS 2010 Two-Way Stop Control Summary Report

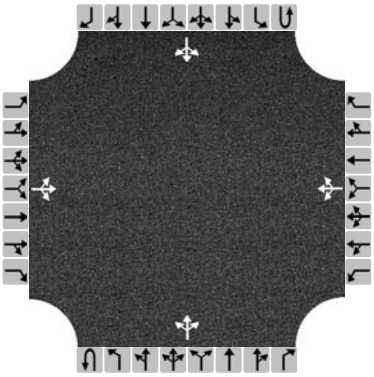
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	11/20/2015
Analysis Year	2015
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	6-Elk Creek Road/Strugis
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	Sturgis Road
Peak Hour Factor	0.83
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	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		4	35	6		35	66	105		8	54	12		106	44	0
Percent Heavy Vehicles		14	14	14		14	14	14		14				14		
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)			54				249			10				128		
Capacity			502				660			1544				1511		
v/c Ratio			0.11				0.38			0.01				0.08		
95% Queue Length			0.4				1.8			0.0				0.3		
Control Delay (s/veh)			13.0				13.7			7.3				7.6		
Level of Service (LOS)			B				B			A				A		
Approach Delay (s/veh)	13.0				13.7				0.9				5.6			
Approach LOS	B				B				A				A			

HCS 2010 Two-Way Stop Control Summary Report

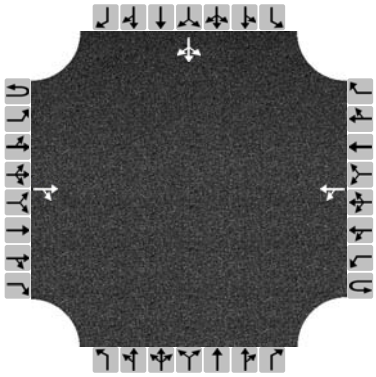
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	11/20/2015
Analysis Year	2015
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	7-Elk Creek Road/EB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	EB Ramps
Peak Hour Factor	0.83
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	0	1	0		0	0	0		0	1	0
Configuration				TR		LT									LTR	
Volume (veh/h)			103	50		62	170							47	0	36
Percent Heavy Vehicles						12								12	12	12
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						280									100	
Capacity						1383									916	
v/c Ratio						0.20									0.11	
95% Queue Length						0.2									0.4	
Control Delay (s/veh)						7.8									9.4	
Level of Service (LOS)						A									A	
Approach Delay (s/veh)					2.4								9.4			
Approach LOS					A								A			

HCS 2010 Two-Way Stop Control Summary Report

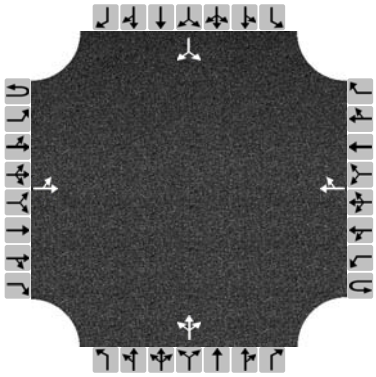
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	11/20/2015
Analysis Year	2015
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	8-Elk Creek Road/WB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	WB Ramps
Peak Hour Factor	0.88
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	0	1	0		0	1	0		0	0	0
Configuration		LT						TR			LTR				LR	
Volume (veh/h)		35	115				114	16		114	5	139		0		0
Percent Heavy Vehicles		12								12	12	12		3		3
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		171									294					
Capacity		1426									1383					
v/c Ratio		0.12									0.21					
95% Queue Length		0.1									0.8					
Control Delay (s/veh)		7.6									8.3					
Level of Service (LOS)		A									A					
Approach Delay (s/veh)	2.0								8.3							
Approach LOS	A								A							

HCS 2010 Two-Way Stop Control Summary Report

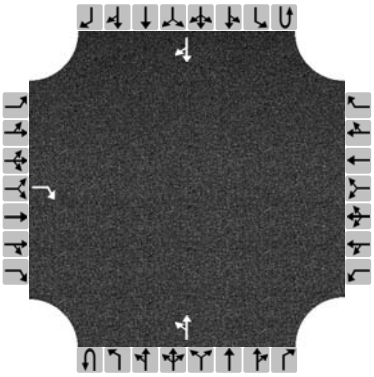
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	11/20/2015
Analysis Year	2015
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	9-Sidney Stage Rd/WB Ramp
Jurisdiction	South Dakota DOT / FHWA
East/West Street	WB Ramp
North/South Street	Sidney Stage
Peak Hour Factor	0.72
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	0	1	0	0	0	1	0
Configuration				R						LT						TR
Volume (veh/h)				0						42	14				4	0
Percent Heavy Vehicles				12						12						
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)										77						
Capacity				1073						1606						
v/c Ratio										0.05						
95% Queue Length										0.1						
Control Delay (s/veh)				8.4						7.3						
Level of Service (LOS)				A						A						
Approach Delay (s/veh)									5.6							
Approach LOS									A							

HCS 2010 Two-Way Stop Control Summary Report

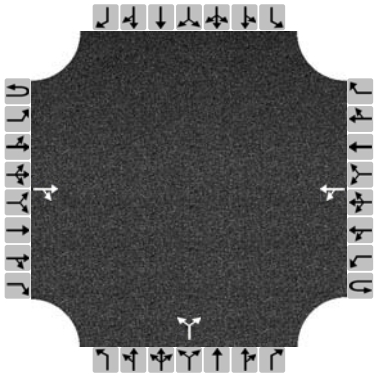
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	11/20/2015
Analysis Year	2015
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	10-Elk Creek/Hills View
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	Hills View Drive
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	0	1	0		0	0	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			223	10		1	109			4		1				
Percent Heavy Vehicles						14				14		14				
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						122					5					
Capacity						1298					649					
v/c Ratio						0.09					0.01					
95% Queue Length						0.0					0.0					
Control Delay (s/veh)						7.8					10.6					
Level of Service (LOS)						A					B					
Approach Delay (s/veh)					0.1				10.6							
Approach LOS					A				B							

HCS 2010 Two-Way Stop Control Summary Report

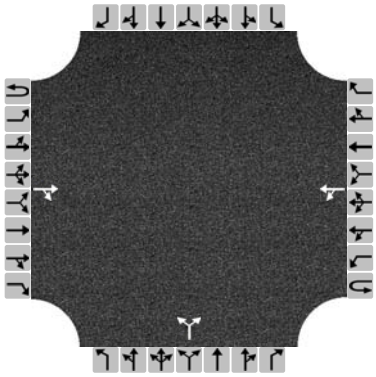
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	11/20/2015
Analysis Year	2015
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	11-Elk Creek/Glenwood
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	Glenwood Drive
Peak Hour Factor	0.87
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	0	1	0		0	0	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			79	91		4	59			37		1				
Percent Heavy Vehicles						14				14		14				
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						73					44					
Capacity						1306					739					
v/c Ratio						0.06					0.06					
95% Queue Length						0.0					0.2					
Control Delay (s/veh)						7.8					10.2					
Level of Service (LOS)						A					B					
Approach Delay (s/veh)					0.6				10.2							
Approach LOS					A				B							

HCS 2010 Two-Way Stop Control Summary Report

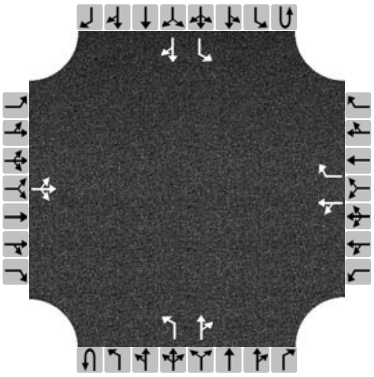
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	11/20/2015
Analysis Year	2015
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	12-Stage Stop Rd/Sturgis
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Stage Stop Road
North/South Street	Stugis 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	1	0		0	1	1	0	1	1	0	0	1	1	0
Configuration			LTR			LT		R		L		TR		L		TR
Volume (veh/h)		0	0	1		121	1	114		0	49	89		53	47	0
Percent Heavy Vehicles		14	14	14		14	14	14		14				14		
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)			1			134		125						58		
Capacity			982			634		919		1478				1357		
v/c Ratio			0.00			0.21		0.14						0.04		
95% Queue Length			0.0			0.8		0.5						0.1		
Control Delay (s/veh)			8.7			12.2		9.5		7.4				7.8		
Level of Service (LOS)			A			B		A		A				A		
Approach Delay (s/veh)	8.7				10.9								4.1			
Approach LOS	A				B								A			

HCS 2010 Two-Way Stop Control Summary Report

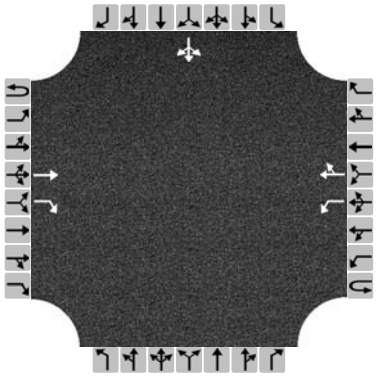
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	11/20/2015
Analysis Year	2015
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	13-Stage Stop Rd/EB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Stage Stop Road
North/South Street	EB Ramps
Peak Hour Factor	0.91
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	1	0	1	1	0		0	0	0		0	1	0
Configuration			T	R		L		TR							LTR	
Volume (veh/h)			140	55		62	232	0						32	1	61
Percent Heavy Vehicles						12								12	12	12
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						68									103	
Capacity						1349									1200	
v/c Ratio						0.05									0.09	
95% Queue Length						0.2									0.3	
Control Delay (s/veh)						7.8									8.3	
Level of Service (LOS)						A									A	
Approach Delay (s/veh)					1.6								8.3			
Approach LOS					A								A			

HCS 2010 Two-Way Stop Control Summary Report

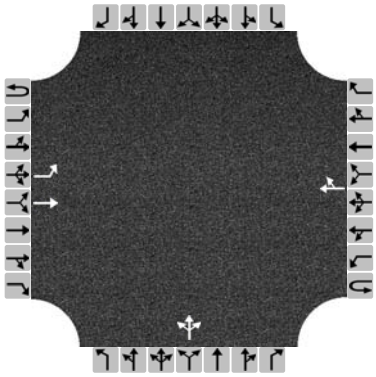
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	11/20/2015
Analysis Year	2015
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	14-Stage Stop Rd/WB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Stage Stop Road
North/South Street	WB Ramps
Peak Hour Factor	0.92
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	1	1	0	0	0	1	0		0	1	0		0	0	0
Configuration		L	T					TR			LTR					
Volume (veh/h)		60	112				120	29		174	1	92				
Percent Heavy Vehicles		12								12	12	12				
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		65									290					
Capacity		1409									923					
v/c Ratio		0.05									0.31					
95% Queue Length		0.1									1.4					
Control Delay (s/veh)		7.7									10.7					
Level of Service (LOS)		A									B					
Approach Delay (s/veh)	2.7								10.7							
Approach LOS	A								B							

HCS 2010 Two-Way Stop Control Summary Report

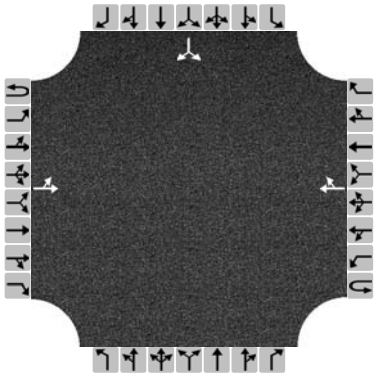
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	11/20/2015
Analysis Year	2015
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	15-Stage Stop Rd/LaRue Rd
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Stage Stop Road
North/South Street	LaRue Road
Peak Hour Factor	0.84
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	0	1	0		0	0	0		0	0	0
Configuration		LT						TR							LR	
Volume (veh/h)		40	12				10	0						0		76
Percent Heavy Vehicles		14												14		14
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		62													90	
Capacity		1598													1065	
v/c Ratio		0.04													0.08	
95% Queue Length		0.1													0.3	
Control Delay (s/veh)		7.3													8.7	
Level of Service (LOS)		A													A	
Approach Delay (s/veh)	5.7												8.7			
Approach LOS	A												A			

APPENDIX D FUTURE NO BUILD LOS WORKSHEETS

FREEWAY LOS

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	TS
Agency or Company:	FHU
Date Performed:	12/15/2015
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	EB
From/To:	S/O Exit 48
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	1540	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	418	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	887	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	887	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	11.8	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	TS
Agency or Company:	FHU
Date Performed:	12/15/2015
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	WB
From/To:	S/O Exit 48
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	785	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	213	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	452	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	452	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	6.0	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	TS
Agency or Company:	FHU
Date Performed:	12/15/2015
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	EB
From/To:	Exit 48 - Exit 46
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	1305	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	355	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	752	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	752	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	10.0	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	TS
Agency or Company:	FHU
Date Performed:	12/15/2015
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	WB
From/To:	Exit 48 - Exit 46
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	810	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	220	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	467	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	467	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	6.2	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	TS
Agency or Company:	FHU
Date Performed:	12/15/2015
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	EB
From/To:	Exit 46 - Exit 44
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	995	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	270	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	573	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	573	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	7.6	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	TS
Agency or Company:	FHU
Date Performed:	12/15/2015
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	WB
From/To:	Exit 46 - Exit 44
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	805	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	219	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	464	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	464	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	6.2	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	TS
Agency or Company:	FHU
Date Performed:	12/15/2015
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	EB
From/To:	NO Exit 44
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	915	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	249	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	527	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	527	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	7.0	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	TS
Agency or Company:	FHU
Date Performed:	12/15/2015
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	WB
From/To:	NO Exit 44
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	830	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	226	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	478	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	478	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	6.4	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	TS
Agency or Company:	FHU
Date Performed:	12/15/2015
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	EB
From/To:	S/O Exit 48
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	1030	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	280	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	593	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	593	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	7.9	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	TS
Agency or Company:	FHU
Date Performed:	12/15/2015
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	WB
From/To:	S/O Exit 48
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2015
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	1525	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	414	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	879	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	879	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	11.7	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	TS
Agency or Company:	FHU
Date Performed:	12/15/2015
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	EB
From/To:	Exit 48 - Exit 46
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	1000	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	272	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	576	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	576	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	7.7	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	TS
Agency or Company:	FHU
Date Performed:	12/15/2015
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	WB
From/To:	Exit 48 - Exit 46
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	1325	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	349	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	739	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	739	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	9.9	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	TS
Agency or Company:	FHU
Date Performed:	12/15/2015
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	EB
From/To:	Exit 46 - Exit 44
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	965	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	262	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	556	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	556	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	7.4	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	TS
Agency or Company:	FHU
Date Performed:	12/15/2015
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	WB
From/To:	Exit 46 - Exit 44
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	1085	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	295	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	625	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	625	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	8.3	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	TS
Agency or Company:	FHU
Date Performed:	12/15/2015
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	EB
From/To:	NO Exit 44
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	945	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	257	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	544	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	544	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	7.3	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	TS
Agency or Company:	FHU
Date Performed:	12/15/2015
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	WB
From/To:	NO Exit 44
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	1010	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	274	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	582	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	582	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	7.8	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	TS
Agency/Co.:	FHU
Date performed:	12/15/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 44
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	870	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	125	vph
Length of first accel/decel lane	375	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	870	125		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	236	34		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1002	144	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1002 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1146	4800	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1002 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1146	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 12.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.307	
Space mean speed in ramp influence area,	S_R = 64.9	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 64.9	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	TS
Agency/Co.:	FHU
Date performed:	12/15/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 44
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	765	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	65	vph
Length of first accel/decel lane	175	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	765	65		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	208	18		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	881	75	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 881 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	956	4800	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 881 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	956	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 11.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.319	
Space mean speed in ramp influence area,	S_R = 64.5	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 64.5	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	TS
Agency/Co.:	FHU
Date performed:	12/15/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 44
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	805	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	40	vph
Length of first accel/decel lane	125	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	805	40		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	219	11		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %		%
Length	0.00 mi	0.00 mi		mi
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	927	46	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 927 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	927	4800	No
$v_{FO} = v_F - v_R$	881	4800	No
v_R	46	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 927 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	927	4400	No

Level of Service Determination (if not F)

Density, $D_D = 4.252 + 0.0086 v_R - 0.009 L_{12}$ = 11.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	D_S = 0.432	
Space mean speed in ramp influence area,	S_R = 60.7	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 60.7	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	TS
Agency/Co.:	FHU
Date performed:	12/15/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 44
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	915	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	45	vph
Length of first accel/decel lane	100	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	915	45		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	249	12		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1054	52	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1054 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1054	4800	No
$v_{FO} = v_F - v_R$	1002	4800	No
v_R	52	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 1054 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1054	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_R - 0.009 L_{12}$ = 12.4 pc/mi/ln D

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.433

Space mean speed in ramp influence area, S_R = 60.7 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 60.7 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.70

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	TS
Agency/Co.:	FHU
Date performed:	12/15/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 44
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	895	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	70	vph
Length of first accel/decel lane	375	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	895	70		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	243	19		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1031	81	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1031 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1112	4800	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1031 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1112	4600	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 11.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.307	
Space mean speed in ramp influence area,	S_R = 64.9	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 64.9	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	TS
Agency/Co.:	FHU
Date performed:	12/15/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 44
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	990	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	20	vph
Length of first accel/decel lane	175	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	990	20		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	269	5		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1141	23	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1141 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1164	4800	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1141 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1164	4600	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 13.4 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.321	
Space mean speed in ramp influence area,	S_R = 64.4	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 64.4	mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.70

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	TS
Agency/Co.:	FHU
Date performed:	12/15/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 44
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	1085	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	95	vph
Length of first accel/decel lane	125	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1085	95		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	295	26		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1250	109	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1250 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1250	4800	No
$v_{FO} = v_F - v_R$	1141	4800	No
v_R	109	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1250 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1250	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086 v_{12} - 0.009 L_D$ = 13.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.438

Space mean speed in ramp influence area, S_R = 60.6 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 60.6 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	TS
Agency/Co.:	FHU
Date performed:	12/15/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 44
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	945	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	50	vph
Length of first accel/decel lane	100	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	945	50		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	257	14		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %		%
Length	0.00 mi	0.00 mi		mi
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1089	58	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1089 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1089	4800	No
$v_{FO} = v_F - v_R$	1031	4800	No
v_R	58	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 1089 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1089	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_R - 0.009 L_{12}$ = 12.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.433

Space mean speed in ramp influence area, S_R = 60.7 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 60.7 mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	TS
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 46
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	955	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	350	vph
Length of first accel/decel lane	645	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	955	350		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	260	95		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1100	403	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1100 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1503	4800	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1100 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1503	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 13.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.293	
Space mean speed in ramp influence area,	S_R = 65.3	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 65.3	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	TS
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 46
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	680	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	125	vph
Length of first accel/decel lane	615	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	680	125		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	185	34		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	783	144	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 783 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	927	4800	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 783 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	927	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 8.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable,	M_S = 0.288	
Space mean speed in ramp influence area,	S_R = 65.5	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 65.5	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	TS
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 46
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	810	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	130	vph
Length of first accel/decel lane	515	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	810	130		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	220	35		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	933	150	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 933 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	933	4800	No
$v_{FO} = v_F - v_R$	783	4800	No
v_R	150	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 933 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	933	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 7.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable,	D_S = 0.442	
Space mean speed in ramp influence area,	S_R = 60.4	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 60.4	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	TS
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 46
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	995	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	40	vph
Length of first accel/decel lane	450	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	995	40		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	270	11		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1146	46	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1146 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1146	4800	No
$v_{FO} = v_F - v_R$	1100	4800	No
v_R	46	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 1146 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1146	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_{12}$ = 10.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.432

Space mean speed in ramp influence area, S_R = 60.7 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 60.7 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.70

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	TS
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 46
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	865	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	135	vph
Length of first accel/decel lane	645	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	865	135		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	235	37		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	997	156	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 997 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1153	4800	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 997 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1153	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 10.4 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.288	
Space mean speed in ramp influence area,	S_R = 65.5	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 65.5	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	TS
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 46
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	1035	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	50	vph
Length of first accel/decel lane	615	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1035	50		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	281	14		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1192	58	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1192 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1250	4800	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1192 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1250	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 11.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.292	
Space mean speed in ramp influence area,	S_R = 65.4	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 65.4	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	TS
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 46
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	1325	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	290	vph
Length of first accel/decel lane	515	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1325	290		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	360	79		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1527	334	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1527 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1527	4800	No
$v_{FO} = v_F - v_R$	1193	4800	No
v_R	334	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1527 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1527	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086 v_{12} - 0.009 L_D$ = 12.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.458

Space mean speed in ramp influence area, S_R = 59.9 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 59.9 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	TS
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 46
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	965	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	100	vph
Length of first accel/decel lane	450	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	965	100		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	262	27		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1112	115	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1112 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1112	4800	No
$v_{FO} = v_F - v_R$	997	4800	No
v_R	115	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 1112 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1112	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 9.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable, D_S = 0.438

Space mean speed in ramp influence area, S_R = 60.5 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 60.5 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.70

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	TS
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 48
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	1210	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	330	vph
Length of first accel/decel lane	665	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1210	330		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	329	90		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1394	380	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1394 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1774	4800	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1394 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1774	4600	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 15.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.297	
Space mean speed in ramp influence area,	S_R = 65.2	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 65.2	mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.70

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	TS
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 48
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	670	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	140	vph
Length of first accel/decel lane	525	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	670	140		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	182	38		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	772	161	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 772 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	933	4800	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 772 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	933	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 9.4 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable,	M_S = 0.294	
Space mean speed in ramp influence area,	S_R = 65.3	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 65.3	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	TS
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 48
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	785	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	115	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	785	115		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	213	31		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	904	132	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 904 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	904	4800	No
$v_{FO} = v_F - v_R$	772	4800	No
v_R	132	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 904 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	904	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 7.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable,	D_S = 0.440	
Space mean speed in ramp influence area,	S_R = 60.5	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 60.5	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	TS
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 48
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	1305	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	95	vph
Length of first accel/decel lane	875	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1305	95		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	355	26		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1504	109	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1504 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1504	4800	No
$v_{FO} = v_F - v_R$	1395	4800	No
v_R	109	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 1504 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1504	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_{12}$ = 9.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable,	D_S = 0.438	
Space mean speed in ramp influence area,	S_R = 60.6	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 60.6	mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.70

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	TS
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 48
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	885	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	145	vph
Length of first accel/decel lane	665	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	885	145		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	240	39		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1020	167	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1020 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1187	4800	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1020 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1187	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 10.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.287	
Space mean speed in ramp influence area,	S_R = 65.5	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 65.5	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	TS
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 48
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	1215	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	110	vph
Length of first accel/decel lane	525	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1215	110		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	330	30		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1400	127	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1400 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1527	4800	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 No

If yes, v_{12A} = 1400 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1527	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 14.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.302	
Space mean speed in ramp influence area,	S_R = 65.0	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 65.0	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	TS
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 48
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	1525	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	310	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1525	310		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	414	84		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1757	357	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1757 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1757	4800	No
$v_{FO} = v_F - v_R$	1400	4800	No
v_R	357	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1757 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1757	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 14.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	D_S = 0.460	
Space mean speed in ramp influence area,	S_R = 59.8	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 59.8	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	TS
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 48
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2021
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	1000	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	115	vph
Length of first accel/decel lane	875	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1000	115		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	272	31		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1152	132	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1152 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1152	4800	No
$v_{FO} = v_F - v_R$	1020	4800	No
v_R	132	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1152 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1152	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_{12}$ = 6.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable, D_S = 0.440

Space mean speed in ramp influence area, S_R = 60.5 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 60.5 mph

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	12/15/2015
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	EB
From/To:	East of Exit 48
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	2195	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	596	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	1265	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	1265	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	74.2	mi/h
Number of lanes, N	2	
Density, D	17.0	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	12/15/2015
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	WB
From/To:	East of Exit 44
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	1110	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	302	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	639	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	639	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	8.5	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	12/15/2015
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	EB
From/To:	Exit 46 - Exit 48
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	1845	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	501	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	1063	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	1063	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	14.2	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	12/15/2015
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	WB
From/To:	Exit 46 - Exit 48
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	1145	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	311	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	660	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	660	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	8.8	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	12/15/2015
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	EB
From/To:	Exit 44 - Exit 46
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	1410	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	383	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	812	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	812	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	10.8	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	12/15/2015
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	WB
From/To:	Exit 44 - Exit 46
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	1355	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	368	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	781	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	781	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	10.4	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	12/15/2015
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	EB
From/To:	West of Exit 44
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	1270	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	345	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	732	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	732	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	9.8	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	12/15/2015
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	WB
From/To:	West of Exit 44
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	1180	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	321	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	680	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	680	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	9.1	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	12/15/2015
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	EB
From/To:	East of Exit 48
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	1445	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	393	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	832	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	832	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	11.1	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	12/15/2015
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	WB
From/To:	East of Exit 48
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	2160	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	587	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	1244	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	1244	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	74.3	mi/h
Number of lanes, N	2	
Density, D	16.7	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	12/15/2015
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	EB
From/To:	Exit 46 - Exit 48
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	1405	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	382	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	809	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	809	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	10.8	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	12/15/2015
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	WB
From/To:	Exit 46 - Exit 48
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	1870	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	508	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	1077	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	1077	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	74.9	mi/h
Number of lanes, N	2	
Density, D	14.4	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	12/15/2015
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	EB
From/To:	Exit 44 - Exit 46
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	1355	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	368	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	781	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	781	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	10.4	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	12/15/2015
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	WB
From/To:	Exit 44 - Exit 46
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	1520	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	413	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	876	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	876	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	11.7	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	12/15/2015
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	EB
From/To:	West of Exit 44
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	1325	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	360	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	763	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	763	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	10.2	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	DCJ
Agency or Company:	FHU
Date Performed:	12/15/2015
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	WB
From/To:	West of Exit 44
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Flow Inputs and Adjustments

Volume, V	1395	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	379	v
Trucks and buses	12	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.943	
Driver population factor, fp	1.00	
Flow rate, vp	804	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	75.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	75.0	mi/h

LOS and Performance Measures

Flow rate, vp	804	pc/h/ln
Free-flow speed, FFS	75.0	mi/h
Average passenger-car speed, S	75.0	mi/h
Number of lanes, N	2	
Density, D	10.7	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 44
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	1195	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	215	vph
Length of first accel/decel lane	665	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1195	215		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	325	58		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1377	248	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1377 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1625	4800	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1377 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1625	4600	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 13.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.294	
Space mean speed in ramp influence area,	S_R = 65.3	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 65.3	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 44
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	1080	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	100	vph
Length of first accel/decel lane	525	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1080	100		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	293	27		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1244	115	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1244 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1359	4800	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1244 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1359	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 12.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.299	
Space mean speed in ramp influence area,	S_R = 65.1	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 65.1	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 44
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	1140	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	60	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1140	60		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	310	16		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1313	69	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1313 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1313	4800	No
$v_{FO} = v_F - v_R$	1244	4800	No
v_R	69	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 1313 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1313	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_R - 0.009 L_{12}$ = 11.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.434

Space mean speed in ramp influence area, S_R = 60.7 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 60.7 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 44
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	1270	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	75	vph
Length of first accel/decel lane	875	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1270	75		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	345	20		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1463	86	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1463 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1463	4800	No
$v_{FO} = v_F - v_R$	1377	4800	No
v_R	86	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 1463 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1463	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_D$ = 9.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable,	D_S = 0.436	
Space mean speed in ramp influence area,	S_R = 60.6	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 60.6	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 44
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	1245	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	110	vph
Length of first accel/decel lane	665	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1245	110		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	338	30		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1434	127	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1434 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1561	4800	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1434 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1561	4600	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 13.4 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.293	
Space mean speed in ramp influence area,	S_R = 65.3	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 65.3	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 44
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	1360	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	35	vph
Length of first accel/decel lane	525	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1360	35		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	370	10		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1567	40	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1567 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1607	4800	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1567 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1607	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 14.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.304	
Space mean speed in ramp influence area,	S_R = 65.0	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 65.0	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 44
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	1520	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	160	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1520	160		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	413	43		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1751	184	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1751 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1751	4800	No
$v_{FO} = v_F - v_R$	1567	4800	No
v_R	184	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 1751 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1751	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 14.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.445

Space mean speed in ramp influence area, S_R = 60.3 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 60.3 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 44
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	1325	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	80	vph
Length of first accel/decel lane	875	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1325	80		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	360	22		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1527	92	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1527 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1527	4800	No
$v_{FO} = v_F - v_R$	1435	4800	No
v_R	92	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1527 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1527	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_R - 0.009 L_D$ = 9.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable, D_S = 0.436

Space mean speed in ramp influence area, S_R = 60.6 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 60.6 mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 46
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	1350	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	495	vph
Length of first accel/decel lane	645	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1350	495		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	367	135		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1555	570	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1555 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	2125	4800	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1555 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	2125	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 17.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.309	
Space mean speed in ramp influence area,	S_R = 64.8	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 64.8	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 46
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	965	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	175	vph
Length of first accel/decel lane	615	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	965	175		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	262	48		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1112	202	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1112 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1314	4800	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1112 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1314	4600	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 11.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.292	
Space mean speed in ramp influence area,	S_R = 65.3	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 65.3	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 46
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	1145	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	180	vph
Length of first accel/decel lane	515	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1145	180		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	311	49		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1319	207	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1319 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1319	4800	No
$v_{FO} = v_F - v_R$	1112	4800	No
v_R	207	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 1319 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1319	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_{12}$ = 11.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.447

Space mean speed in ramp influence area, S_R = 60.3 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 60.3 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 46
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	1410	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	60	vph
Length of first accel/decel lane	450	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1410	60		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	383	16		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %		%
Length	0.00 mi	0.00 mi		mi
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1625	69	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1625 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1625	4800	No
$v_{FO} = v_F - v_R$	1556	4800	No
v_R	69	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 1625 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1625	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_{12}$ = 14.2 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.434

Space mean speed in ramp influence area, S_R = 60.7 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 60.7 mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 46
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	1210	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	195	vph
Length of first accel/decel lane	645	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1210	195		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	329	53		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1394	225	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1394 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1619	4800	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1394 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1619	4600	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 14.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.296	
Space mean speed in ramp influence area,	S_R = 65.2	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 65.2	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 46
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	1450	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	70	vph
Length of first accel/decel lane	615	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1450	70		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	394	19		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1671	81	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1671 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1752	4800	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1671 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1752	4600	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 15.2 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.300	
Space mean speed in ramp influence area,	S_R = 65.1	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 65.1	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 46
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	1870	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	420	vph
Length of first accel/decel lane	515	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1870	420		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	508	114		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	2155	484	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2155 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	2155	4800	No
$v_{FO} = v_F - v_R$	1671	4800	No
v_R	484	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 2155 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2155	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_{12}$ = 18.2 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.472

Space mean speed in ramp influence area, S_R = 59.4 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 59.4 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 46
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	1355	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	145	vph
Length of first accel/decel lane	450	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1355	145		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	368	39		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1561	167	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1561 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1561	4800	No
$v_{FO} = v_F - v_R$	1394	4800	No
v_R	167	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 1561 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1561	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_{12}$ = 13.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.443

Space mean speed in ramp influence area, S_R = 60.4 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 60.4 mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 48
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	1715	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	480	vph
Length of first accel/decel lane	640	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1715	480		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	466	130		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1976	553	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1976 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	2529	4800	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1976 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	2529	4600	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 20.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M_S = 0.325	
Space mean speed in ramp influence area,	S_R = 64.3	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 64.3	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 48
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	950	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	195	vph
Length of first accel/decel lane	620	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	950	195		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	258	53		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1095	225	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1095 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1320	4800	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1095 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1320	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 11.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.292	
Space mean speed in ramp influence area,	S_R = 65.4	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 65.4	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 48
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	1110	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	160	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1110	160		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	302	43		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1279	184	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1279 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1279	4800	No
$v_{FO} = v_F - v_R$	1095	4800	No
v_R	184	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 1279 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1279	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_R - 0.009 L_{12}$ = 10.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.445

Space mean speed in ramp influence area, S_R = 60.3 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 60.3 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 48
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	1845	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	130	vph
Length of first accel/decel lane	350	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1845	130		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	501	35		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	2126	150	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2126 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	2126	4800	No
$v_{FO} = v_F - v_R$	1976	4800	No
v_R	150	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 2126 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2126	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_{12}$ = 19.4 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	D_S = 0.442	
Space mean speed in ramp influence area,	S_R = 60.4	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 60.4	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 48
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	1240	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	205	vph
Length of first accel/decel lane	640	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1240	205		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	337	56		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1429	236	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1429 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1665	4800	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1429 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1665	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 14.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.297	
Space mean speed in ramp influence area,	S_R = 65.2	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 65.2	mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 48
Jurisdiction:	FHWA/SSDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	1710	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	160	vph
Length of first accel/decel lane	620	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1710	160		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	465	43		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1970	184	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1970 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	2154	4800	No

v_3 or v_{av34} = 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1970 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	2154	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 18.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.311	
Space mean speed in ramp influence area,	S_R = 64.7	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 64.7	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	WB
Junction:	Exit 48
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	2160	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	450	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2160	450		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	587	122		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	2489	518	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2489 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	2489	4800	No
$v_{FO} = v_F - v_R$	1971	4800	No
v_R	518	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 2489 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2489	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_{12}$ = 21.2 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, D_S = 0.475

Space mean speed in ramp influence area, S_R = 59.3 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 59.3 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	DCJ
Agency/Co.:	FHU
Date performed:	12/31/2015
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	EB
Junction:	Exit 48
Jurisdiction:	FHWA/SDDOT
Analysis Year:	2045
Description:	Exit 46 IMJR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	75.0	mph
Volume on freeway	1405	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	165	vph
Length of first accel/decel lane	350	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1405	165		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	382	45		v
Trucks and buses	12	12		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %	%	
Length	0.00 mi	0.00 mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.943	0.943	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1619	190	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1619 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1619	4800	No
$v_{FO} = v_F - v_R$	1429	4800	No
v_R	190	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34}	> 2700 pc/h?	No	
Is v_3 or v_{av34}	> 1.5 v_{12} /2	No	

If yes, v_{12A} = 1619 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1619	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086\, v_R - 0.009\, L_{12}$ = 15.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.445

Space mean speed in ramp influence area, S_R = 60.3 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 60.3 mph

SURFACE STREET LOS

HCS 2010 Two-Way Stop Control Summary Report

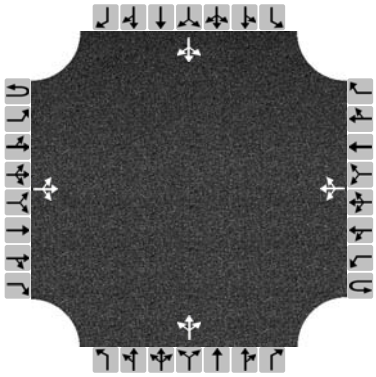
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2021
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	1-Chimney Canyon/Sturgis
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Chimney Canyon
North/South Street	Sturgis Road
Peak Hour Factor	0.92
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	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		5	55	20		45	5	15		5	20	40		65	25	5
Percent Heavy Vehicles		14				14				14	14	14		14	14	14
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		5				49					70				103	
Capacity		1518				1441					812				653	
v/c Ratio		0.00				0.03					0.09				0.16	
95% Queue Length		0.0				0.1					0.3				0.6	
Control Delay (s/veh)		7.4				7.6					9.8				11.5	
Level of Service (LOS)		A				A					A				B	
Approach Delay (s/veh)	0.4				5.4				9.8				11.5			
Approach LOS	A				A				A				B			

HCS 2010 Two-Way Stop Control Summary Report

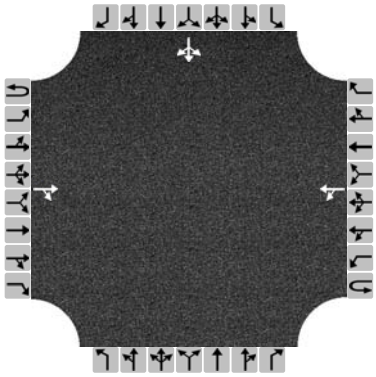
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2021
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	2-Deerview Road/EB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Deerview Road
North/South Street	EB Ramps
Peak Hour Factor	0.88
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	0	1	0		0	0	0		0	1	0
Configuration				TR		LT									LTR	
Volume (veh/h)			45	110		15	30							10	1	35
Percent Heavy Vehicles						12								12	12	12
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						51									52	
Capacity						1393									1346	
v/c Ratio						0.04									0.04	
95% Queue Length						0.0									0.1	
Control Delay (s/veh)						7.6									7.8	
Level of Service (LOS)						A									A	
Approach Delay (s/veh)					2.6								7.8			
Approach LOS					A								A			

HCS 2010 Two-Way Stop Control Summary Report

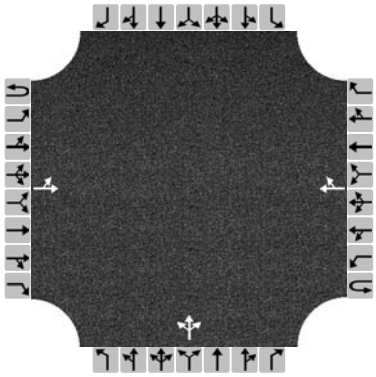
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2021
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	3-Deerview Road/WB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Deerview Road
North/South Street	WB Ramps
Peak Hour Factor	0.92
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	0	1	0		0	1	0		0	0	0
Configuration		LT						TR			LTR					
Volume (veh/h)		45	10				20	20		25	1	15				
Percent Heavy Vehicles		12								12	12	12				
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		60									44					
Capacity		1556									1323					
v/c Ratio		0.04									0.03					
95% Queue Length		0.1									0.1					
Control Delay (s/veh)		7.4									7.8					
Level of Service (LOS)		A									A					
Approach Delay (s/veh)	6.1								7.8							
Approach LOS	A								A							

HCS 2010 Two-Way Stop Control Summary Report

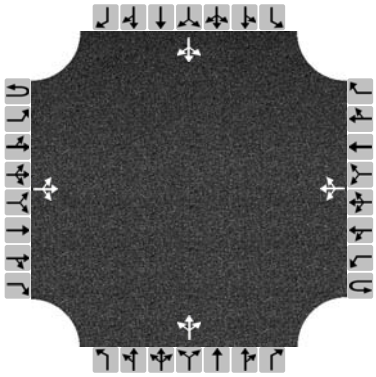
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2021
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	4-Deerview Road/Sidney
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Deerview Road
North/South Street	Sidney Stage Road
Peak Hour Factor	0.88
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	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		15	5	5		5	10	5		5	10	5		5	5	25
Percent Heavy Vehicles		14				14				14	14	14		14	14	14
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

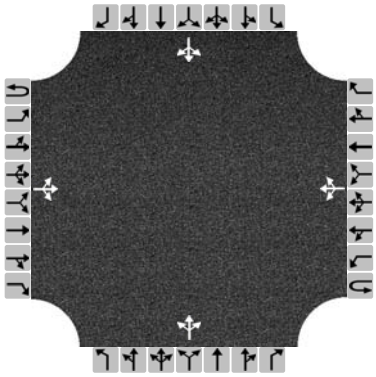
Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		17				6					23				40	
Capacity		1592				1598					879				987	
v/c Ratio		0.01				0.00					0.03				0.04	
95% Queue Length		0.0				0.0					0.1				0.1	
Control Delay (s/veh)		7.3				7.3					9.2				8.8	
Level of Service (LOS)		A				A					A				A	
Approach Delay (s/veh)	4.3				1.9				9.2				8.8			
Approach LOS	A				A				A				A			

HCS 2010 Two-Way Stop Control Summary Report

General Information		Site Information	
Analyst	TS	Intersection	5-Deerview Road/Spring
Agency/Co.	Felsburg Holt & Ullevig	Jurisdiction	South Dakota DOT / FHWA
Date Performed	12/15/2015	East/West Street	Deerview Road
Analysis Year	2021	North/South Street	Spring Valley Road
Time Analyzed	AM	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	I-90 Exit 46 IMJR		

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	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		5	5	5		5	10	5		5	5	5		5	5	5
Percent Heavy Vehicles		14				14				14	14	14		14	14	14
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		5				5					15				15	
Capacity		1593				1601					943				941	
v/c Ratio		0.00				0.00					0.02				0.02	
95% Queue Length		0.0				0.0					0.0				0.0	
Control Delay (s/veh)		7.3				7.3					8.9				8.9	
Level of Service (LOS)		A				A					A				A	
Approach Delay (s/veh)	2.4				1.7				8.9				8.9			
Approach LOS	A				A				A				A			

HCS 2010 Two-Way Stop Control Summary Report

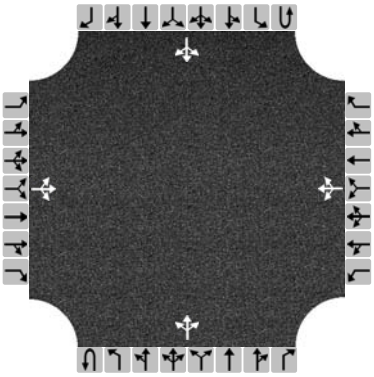
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2021
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	6-Elk Creek Road/Strugis
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	Sturgis Road
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	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		5	45	10		30	70	160		15	110	30		250	85	5
Percent Heavy Vehicles		14	14	14		14	14	14		14				14		
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)			68				296			17				284		
Capacity			242				420			1481				1413		
v/c Ratio			0.28				0.70			0.01				0.20		
95% Queue Length			1.1				5.3			0.0				0.8		
Control Delay (s/veh)			25.5				31.6			7.5				8.2		
Level of Service (LOS)			D				D			A				A		
Approach Delay (s/veh)	25.5				31.6				0.8				6.5			
Approach LOS	D				D				A				A			

HCS 2010 Two-Way Stop Control Summary Report

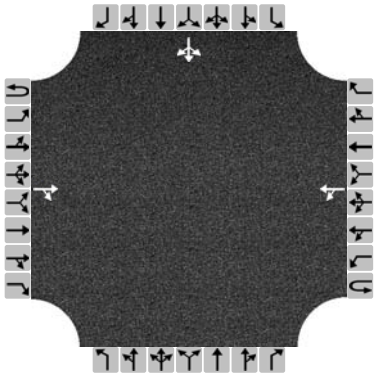
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2021
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	7-Elk Creek Road/EB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	EB Ramps
Peak Hour Factor	0.92
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	0	1	0		0	0	0		0	1	0
Configuration				TR		LT									LTR	
Volume (veh/h)			135	190		155	240							15	5	20
Percent Heavy Vehicles						12								12	12	12
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						429									43	
Capacity						1198									601	
v/c Ratio						0.36									0.07	
95% Queue Length						0.5									0.2	
Control Delay (s/veh)						8.5									11.5	
Level of Service (LOS)						A									B	
Approach Delay (s/veh)					4.2								11.5			
Approach LOS					A								B			

HCS 2010 Two-Way Stop Control Summary Report

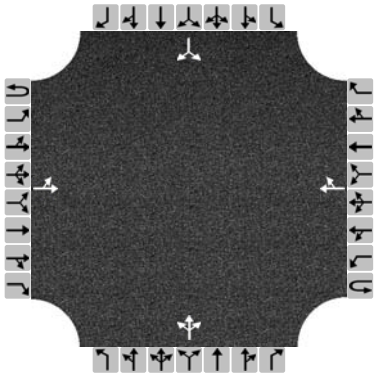
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2021
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	8-Elk Creek Road/WB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	WB Ramps
Peak Hour Factor	0.92
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	0	1	0		0	1	0		0	0	0
Configuration		LT						TR			LTR				LR	
Volume (veh/h)		65	85				295	70		90	5	35		0		0
Percent Heavy Vehicles		12								12	12	12		3		3
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		163									141					
Capacity		1155									631					
v/c Ratio		0.14									0.22					
95% Queue Length		0.2									0.9					
Control Delay (s/veh)		8.3									12.3					
Level of Service (LOS)		A									B					
Approach Delay (s/veh)	3.9								12.3							
Approach LOS	A								B							

HCS 2010 Two-Way Stop Control Summary Report

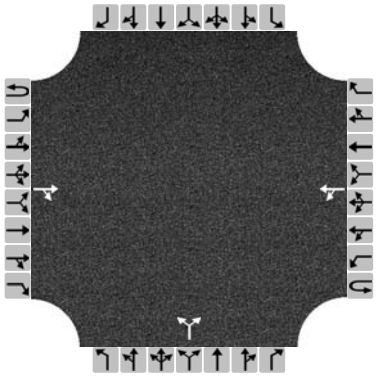
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2021
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	10-Elk Creek/Hills View
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	Hills View Drive
Peak Hour Factor	0.88
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	0	1	0		0	0	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			110	5		5	335			15		5				
Percent Heavy Vehicles						14				14		14				
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						387					23					
Capacity						1446					578					
v/c Ratio						0.27					0.04					
95% Queue Length						0.0					0.1					
Control Delay (s/veh)						7.5					11.5					
Level of Service (LOS)						A					B					
Approach Delay (s/veh)					0.2				11.5							
Approach LOS					A				B							

HCS 2010 Two-Way Stop Control Summary Report

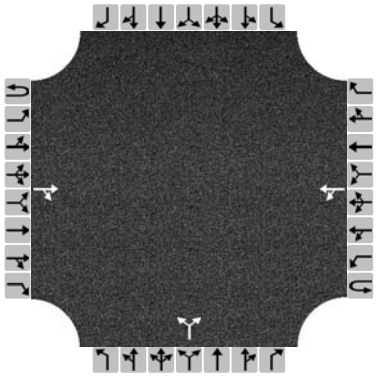
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2021
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	11-Elk Creek/Glenwood
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	Glenwood Drive
Peak Hour Factor	0.92
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	0	1	0		0	0	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			45	45		5	145			130		5				
Percent Heavy Vehicles						14				14		14				
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						163					146					
Capacity						1421					724					
v/c Ratio						0.11					0.20					
95% Queue Length						0.0					0.8					
Control Delay (s/veh)						7.5					11.2					
Level of Service (LOS)						A					B					
Approach Delay (s/veh)					0.3				11.2							
Approach LOS					A				B							

HCS 2010 Two-Way Stop Control Summary Report

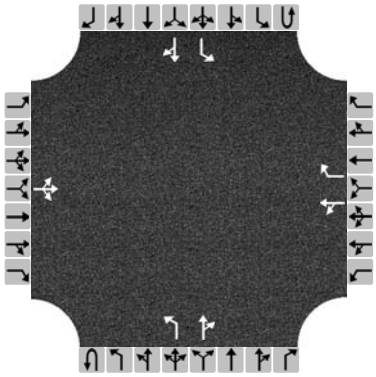
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2021
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	12-Stage Stop Rd/Sturgis
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Stage Stop Road
North/South Street	Stugis Road
Peak Hour Factor	0.92
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	1	0	0	1	1	0
Configuration			LTR			LT		R		L		TR		L		TR
Volume (veh/h)		5	5	5		55	10	50		5	80	145		135	75	5
Percent Heavy Vehicles		14	14	14		14	14	14		14				14		
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)			15			71		54		5				147		
Capacity			427			375		847		1434				1252		
v/c Ratio			0.04			0.19		0.06		0.00				0.12		
95% Queue Length			0.1			0.7		0.2		0.0				0.4		
Control Delay (s/veh)			13.7			16.8		9.5		7.5				8.3		
Level of Service (LOS)			B			C		A		A				A		
Approach Delay (s/veh)	13.7				13.5				0.2				5.2			
Approach LOS	B				B				A				A			

HCS 2010 Two-Way Stop Control Summary Report

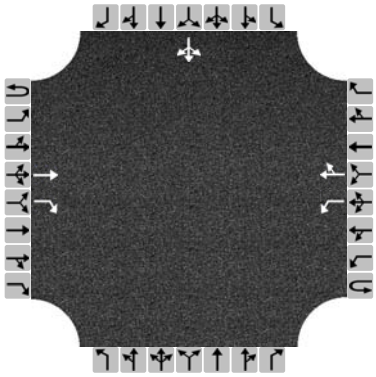
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2021
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	12-Stage Stop Rd/Sturgis
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Stage Stop Road
North/South Street	EB Ramps
Peak Hour Factor	0.92
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	1	0	1	1	0		0	0	0		0	1	0
Configuration			T	R		L		TR							LTR	
Volume (veh/h)			130	185		140	115	0						30	5	60
Percent Heavy Vehicles						12								12	12	12
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						152									103	
Capacity						1210									1258	
v/c Ratio						0.13									0.08	
95% Queue Length						0.4									0.3	
Control Delay (s/veh)						8.4									8.1	
Level of Service (LOS)						A									A	
Approach Delay (s/veh)					4.6								8.1			
Approach LOS					A								A			

HCS 2010 Two-Way Stop Control Summary Report

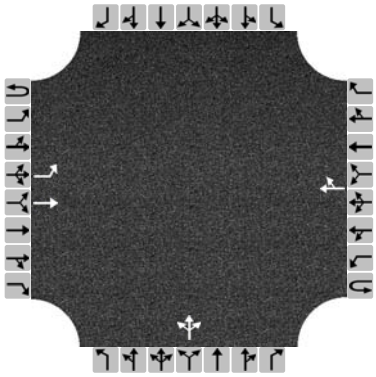
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2021
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	14-Stage Stop Rd/WB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Stage Stop Road
North/South Street	WB Ramps
Peak Hour Factor	0.92
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	1	1	0	0	0	1	0		0	1	0		0	0	0
Configuration		L	T					TR			LTR					
Volume (veh/h)		75	85				200	60		55	5	55				
Percent Heavy Vehicles		12								12	12	12				
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		82									125					
Capacity		1273									989					
v/c Ratio		0.06									0.13					
95% Queue Length		0.2									0.4					
Control Delay (s/veh)		8.0									9.2					
Level of Service (LOS)		A									A					
Approach Delay (s/veh)	3.8								9.2							
Approach LOS	A								A							

HCS 2010 Two-Way Stop Control Summary Report

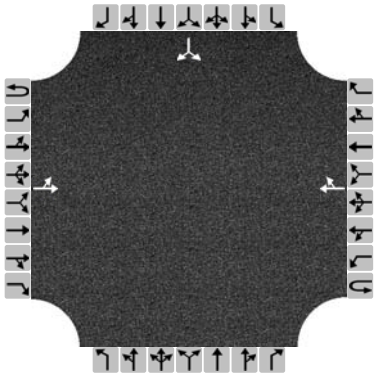
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2021
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	15-Stage Stop Rd/LaRue Rd
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Stage Stop Road
North/South Street	LaRue Road
Peak Hour Factor	0.92
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	0	1	0		0	0	0		0	0	0
Configuration		LT						TR							LR	
Volume (veh/h)		15	5				30	5						5		65
Percent Heavy Vehicles		14												14		14
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		21													76	
Capacity		1564													1025	
v/c Ratio		0.01													0.07	
95% Queue Length		0.0													0.2	
Control Delay (s/veh)		7.3													8.8	
Level of Service (LOS)		A													A	
Approach Delay (s/veh)	5.6												8.8			
Approach LOS	A												A			

HCS 2010 Two-Way Stop Control Summary Report

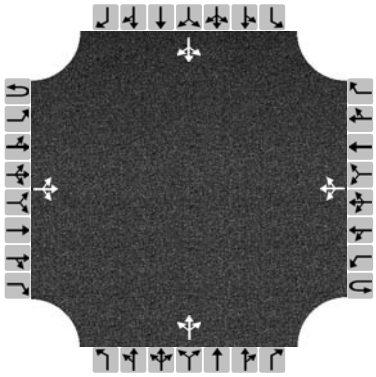
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2021
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	1-Chimney Canyon/Sturgis
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Chimney Canyon
North/South Street	Sturgis Road
Peak Hour Factor	0.92
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	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		5	15	5		35	35	60		10	20	20		45	25	5
Percent Heavy Vehicles		14				14				14	14	14		14	14	14
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		5				38					55				81	
Capacity		1415				1518					773				693	
v/c Ratio		0.00				0.03					0.07				0.12	
95% Queue Length		0.0				0.1					0.2				0.4	
Control Delay (s/veh)		7.6				7.4					10.0				10.9	
Level of Service (LOS)		A				A					B				B	
Approach Delay (s/veh)	1.5				2.1				10.0				10.9			
Approach LOS	A				A				B				B			

HCS 2010 Two-Way Stop Control Summary Report

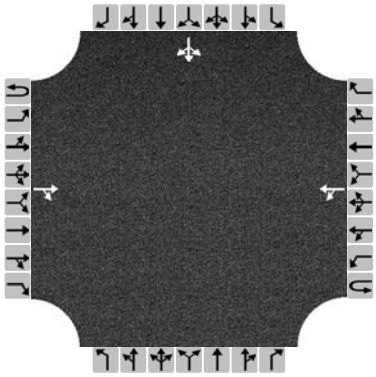
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2021
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	2-Deerview Road/WB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Deerview Road
North/South Street	EB Ramps
Peak Hour Factor	0.88
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	0	1	0		0	0	0		0	1	0
Configuration				TR		LT									LTR	
Volume (veh/h)			20	55		15	90							10	1	40
Percent Heavy Vehicles						12								12	12	12
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						119									57	
Capacity						1503									1203	
v/c Ratio						0.08									0.05	
95% Queue Length						0.0									0.1	
Control Delay (s/veh)						7.4									8.1	
Level of Service (LOS)						A									A	
Approach Delay (s/veh)					1.1								8.1			
Approach LOS					A								A			

HCS 2010 Two-Way Stop Control Summary Report

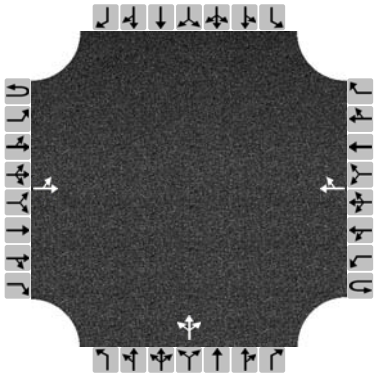
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2021
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	3-Deerview Road/WB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Deerview Road
North/South Street	WB Ramps
Peak Hour Factor	0.92
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	0	1	0		0	1	0		0	0	0
Configuration		LT						TR			LTR					
Volume (veh/h)		15	15				30	5		75	1	20				
Percent Heavy Vehicles		12								12	12	12				
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

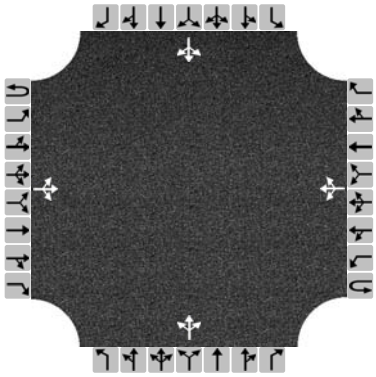
Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		32									105					
Capacity		1564									1155					
v/c Ratio		0.02									0.09					
95% Queue Length		0.0									0.3					
Control Delay (s/veh)		7.3									8.4					
Level of Service (LOS)		A									A					
Approach Delay (s/veh)	3.7								8.4							
Approach LOS	A								A							

HCS 2010 Two-Way Stop Control Summary Report

General Information		Site Information	
Analyst	TS	Intersection	4-Deerview Road/Sidney
Agency/Co.	Felsburg Holt & Ullevig	Jurisdiction	South Dakota DOT / FHWA
Date Performed	12/15/2015	East/West Street	Deerview Road
Analysis Year	2021	North/South Street	Sidney Stage Road
Time Analyzed	PM	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	I-90 Exit 46 IMJR		

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	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		15	15	5		5	5	5		10	5	5		5	5	20
Percent Heavy Vehicles		14				14				14	14	14		14	14	14
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		16				5					21				32	
Capacity		1601				1586					899				992	
v/c Ratio		0.01				0.00					0.02				0.03	
95% Queue Length		0.0				0.0					0.1				0.1	
Control Delay (s/veh)		7.3				7.3					9.1				8.7	
Level of Service (LOS)		A				A					A				A	
Approach Delay (s/veh)	3.2				2.4				9.1				8.7			
Approach LOS	A				A				A				A			

HCS 2010 Two-Way Stop Control Summary Report

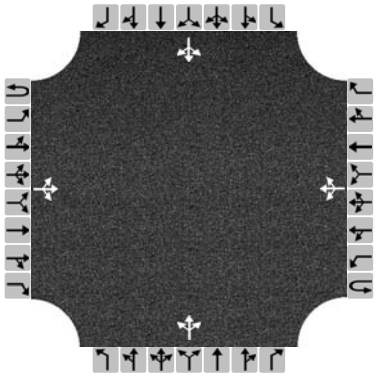
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2021
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	5-Deerview Road/Spring
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Deerview Road
North/South Street	Spring Valley Road
Peak Hour Factor	0.92
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	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		5	15	5		5	10	5		5	5	5		5	5	5
Percent Heavy Vehicles		14				14				14	14	14		14	14	14
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		5				5					15				15	
Capacity		1593				1586					931				932	
v/c Ratio		0.00				0.00					0.02				0.02	
95% Queue Length		0.0				0.0					0.0				0.0	
Control Delay (s/veh)		7.3				7.3					8.9				8.9	
Level of Service (LOS)		A				A					A				A	
Approach Delay (s/veh)	1.4				1.8				8.9				8.9			
Approach LOS	A				A				A				A			

HCS 2010 Two-Way Stop Control Summary Report

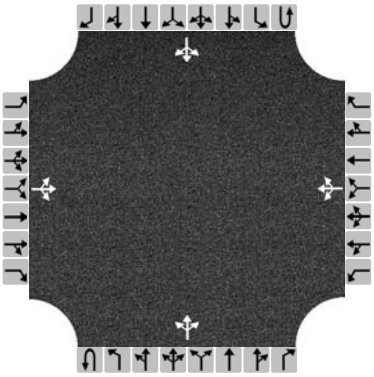
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2021
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	6-Elk Creek Road/Strugis
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	Sturgis Road
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	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		5	40	10		40	75	120		10	60	15		120	50	5
Percent Heavy Vehicles		14	14	14		14	14	14		14				14		
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)			62				266			11				136		
Capacity			490				636			1531				1503		
v/c Ratio			0.13				0.42			0.01				0.09		
95% Queue Length			0.4				2.1			0.0				0.3		
Control Delay (s/veh)			13.4				14.7			7.4				7.6		
Level of Service (LOS)			B				B			A				A		
Approach Delay (s/veh)	13.4				14.7				0.9				5.4			
Approach LOS	B				B				A				A			

HCS 2010 Two-Way Stop Control Summary Report

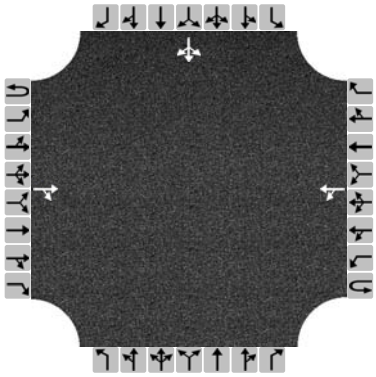
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2021
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	7-Elk Creek Road/EB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	EB Ramps
Peak Hour Factor	0.92
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	0	1	0		0	0	0		0	1	0
Configuration				TR		LT									LTR	
Volume (veh/h)			115	60		70	195							55	5	40
Percent Heavy Vehicles						12								12	12	12
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						288									108	
Capacity						1376									836	
v/c Ratio						0.21									0.13	
95% Queue Length						0.2									0.4	
Control Delay (s/veh)						7.8									9.9	
Level of Service (LOS)						A									A	
Approach Delay (s/veh)					2.4								9.9			
Approach LOS					A								A			

HCS 2010 Two-Way Stop Control Summary Report

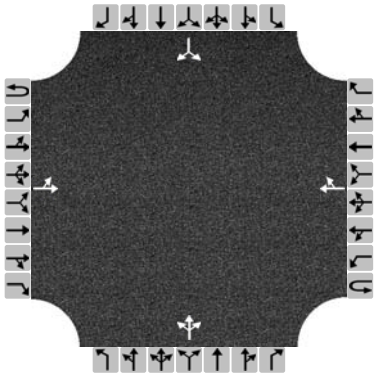
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2021
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	8-Elk Creek Road/WB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	WB Ramps
Peak Hour Factor	0.92
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	0	1	0		0	1	0		0	0	0
Configuration		LT						TR			LTR				LR	
Volume (veh/h)		40	130				130	25		130	5	155		5		5
Percent Heavy Vehicles		12								12	12	12		3		3
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		184									314				10	
Capacity		1402									1003				793	
v/c Ratio		0.13									0.31				0.01	
95% Queue Length		0.1									1.3				0.0	
Control Delay (s/veh)		7.6									10.2				9.6	
Level of Service (LOS)		A									B				A	
Approach Delay (s/veh)	2.0								10.2				9.6			
Approach LOS	A								B				A			

HCS 2010 Two-Way Stop Control Summary Report

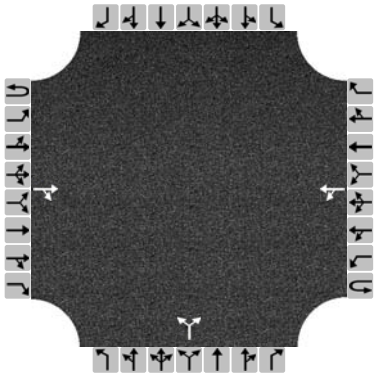
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2021
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	10-Elk Creek/Hills View
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	Hills View Drive
Peak Hour Factor	0.92
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	0	1	0		0	0	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			250	15		5	125			10		5				
Percent Heavy Vehicles						14				14		14				
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						141					16					
Capacity						1267					626					
v/c Ratio						0.11					0.03					
95% Queue Length						0.0					0.1					
Control Delay (s/veh)						7.9					10.9					
Level of Service (LOS)						A					B					
Approach Delay (s/veh)					0.3				10.9							
Approach LOS					A				B							

HCS 2010 Two-Way Stop Control Summary Report

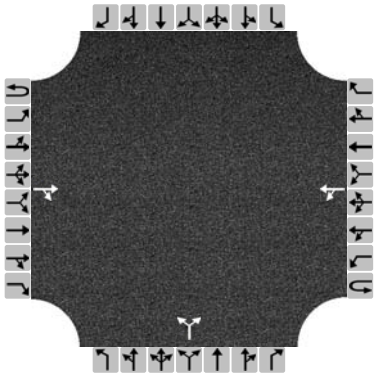
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2021
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	11-Elk Creek/Glenwood
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	Glenwood Drive
Peak Hour Factor	0.92
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	0	1	0		0	0	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			90	105		5	70			45		5				
Percent Heavy Vehicles						14				14		14				
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						81					54					
Capacity						1288					729					
v/c Ratio						0.06					0.07					
95% Queue Length						0.0					0.2					
Control Delay (s/veh)						7.8					10.3					
Level of Service (LOS)						A					B					
Approach Delay (s/veh)					0.5				10.3							
Approach LOS					A				B							

HCS 2010 Two-Way Stop Control Summary Report

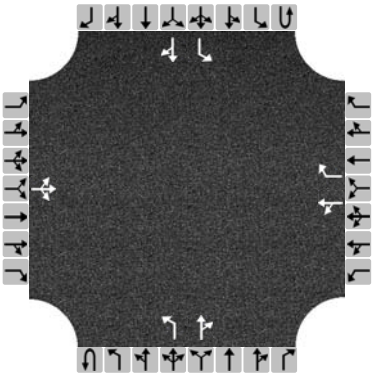
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2021
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	12-Stage Stop Rd/Sturgis
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Stage Stop Road
North/South Street	Stugis Road
Peak Hour Factor	0.92
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	1	0	0	1	1	0
Configuration			LTR			LT		R		L		TR		L		TR
Volume (veh/h)		5	5	5		135	5	130		5	55	100		60	55	5
Percent Heavy Vehicles		14	14	14		14	14	14		14				14		
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)			15			152		141		5				65		
Capacity			571			575		906		1462				1337		
v/c Ratio			0.03			0.26		0.16		0.00				0.05		
95% Queue Length			0.1			1.1		0.5		0.0				0.2		
Control Delay (s/veh)			11.5			13.5		9.7		7.5				7.8		
Level of Service (LOS)			B			B		A		A				A		
Approach Delay (s/veh)	11.5				11.6				0.2				3.9			
Approach LOS	B				B				A				A			

HCS 2010 Two-Way Stop Control Summary Report

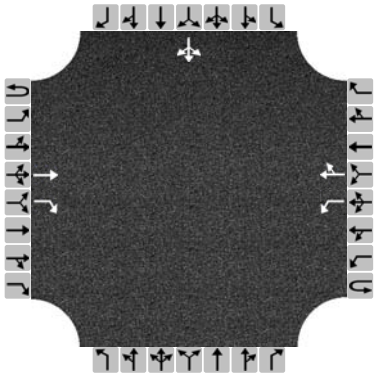
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2021
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	13-Stage Stop Rd/EB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Stage Stop Road
North/South Street	EB Ramps
Peak Hour Factor	0.92
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	1	0	1	1	0		0	0	0		0	1	0
Configuration			T	R		L		TR							LTR	
Volume (veh/h)			160	65		75	265	0						40	5	70
Percent Heavy Vehicles						12								12	12	12
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						82									124	
Capacity						1314									1130	
v/c Ratio						0.06									0.11	
95% Queue Length						0.2									0.4	
Control Delay (s/veh)						7.9									8.6	
Level of Service (LOS)						A									A	
Approach Delay (s/veh)					1.8								8.6			
Approach LOS					A								A			

HCS 2010 Two-Way Stop Control Summary Report

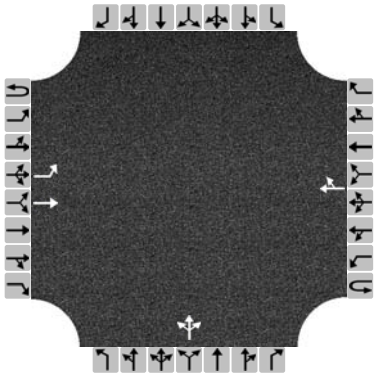
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2021
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	14-Stage Stop Rd/WB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Stage Stop Road
North/South Street	WB Ramps
Peak Hour Factor	0.92
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	1	1	0	0	0	1	0		0	1	0		0	0	0
Configuration		L	T					TR			LTR					
Volume (veh/h)		70	130				140	35		200	5	105				
Percent Heavy Vehicles		12								12	12	12				
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		76									336					
Capacity		1376									835					
v/c Ratio		0.06									0.40					
95% Queue Length		0.2									2.0					
Control Delay (s/veh)		7.8									12.2					
Level of Service (LOS)		A									B					
Approach Delay (s/veh)	2.7								12.2							
Approach LOS	A								B							

HCS 2010 Two-Way Stop Control Summary Report

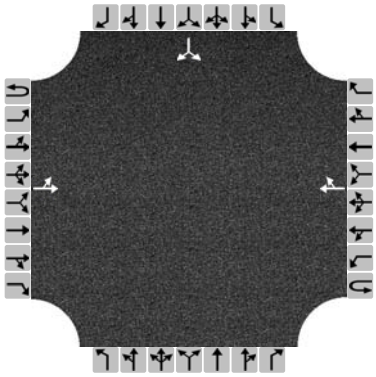
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2021
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	15-Stage Stop Rd/LaRue Rd
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Stage Stop Road
North/South Street	LaRue Road
Peak Hour Factor	0.92
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	0	1	0		0	0	0		0	0	0
Configuration		LT						TR							LR	
Volume (veh/h)		45	15				15	5						5		90
Percent Heavy Vehicles		14												14		14
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		65													103	
Capacity		1586													1043	
v/c Ratio		0.04													0.10	
95% Queue Length		0.1													0.3	
Control Delay (s/veh)		7.3													8.8	
Level of Service (LOS)		A													A	
Approach Delay (s/veh)	5.6												8.8			
Approach LOS	A												A			

HCS 2010 Two-Way Stop Control Summary Report

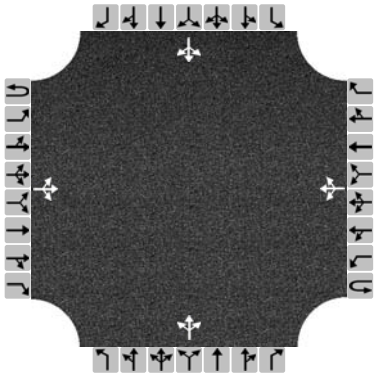
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2045
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	1-Chimney Canyon/Sturgis
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Chimney Canyon
North/South Street	Sturgis Road
Peak Hour Factor	0.92
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	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		5	95	25		75	5	30		10	25	60		115	35	5
Percent Heavy Vehicles		14				14				14	14	14		14	14	14
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		5				82					103				168	
Capacity		1496				1382					720				506	
v/c Ratio		0.00				0.06					0.14				0.33	
95% Queue Length		0.0				0.2					0.5				1.4	
Control Delay (s/veh)		7.4				7.8					10.8				15.6	
Level of Service (LOS)		A				A					B				C	
Approach Delay (s/veh)	0.3				5.5				10.8				15.6			
Approach LOS	A				A				B				C			

HCS 2010 Two-Way Stop Control Summary Report

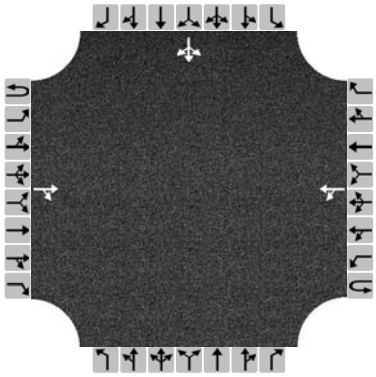
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2045
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	2-Deerview Road/EB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Deerview Road
North/South Street	EB Ramps
Peak Hour Factor	0.88
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	0	1	0		0	0	0		0	1	0
Configuration				TR		LT									LTR	
Volume (veh/h)			75	195		20	50							15	1	60
Percent Heavy Vehicles						12								12	12	12
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						80									86	
Capacity						1247									1272	
v/c Ratio						0.06									0.07	
95% Queue Length						0.1									0.2	
Control Delay (s/veh)						7.9									8.0	
Level of Service (LOS)						A									A	
Approach Delay (s/veh)					2.4								8.0			
Approach LOS					A								A			

HCS 2010 Two-Way Stop Control Summary Report

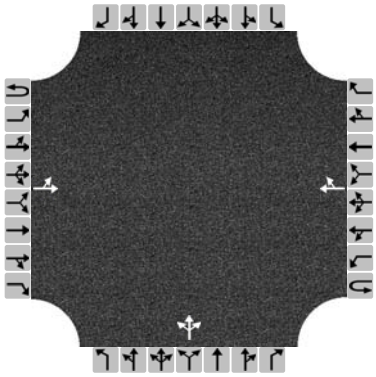
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2045
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	3-Deerview Road/WB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Deerview Road
North/South Street	WB Ramps
Peak Hour Factor	0.92
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	0	1	0		0	1	0		0	0	0
Configuration		LT						TR			LTR					
Volume (veh/h)		75	20				30	25		40	1	20				
Percent Heavy Vehicles		12								12	12	12				
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

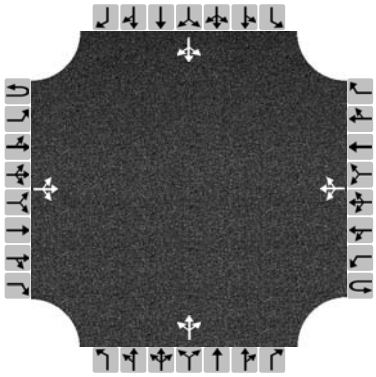
Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		104									66					
Capacity		1535									1125					
v/c Ratio		0.07									0.06					
95% Queue Length		0.2									0.2					
Control Delay (s/veh)		7.5									8.4					
Level of Service (LOS)		A									A					
Approach Delay (s/veh)	6.0								8.4							
Approach LOS	A								A							

HCS 2010 Two-Way Stop Control Summary Report

General Information		Site Information	
Analyst	DCJ	Intersection	4-Deerview Road/Sidney
Agency/Co.	Felsburg Holt & Ullevig	Jurisdiction	South Dakota DOT / FHWA
Date Performed	12/15/2015	East/West Street	Deerview Road
Analysis Year	2045	North/South Street	Sidney Stage Road
Time Analyzed	AM	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	I-90 Exit 46 IMJR		

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	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		25	10	5		5	15	5		5	15	5		5	5	35
Percent Heavy Vehicles		14				14				14	14	14		14	14	14
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		27				5					26				48	
Capacity		1586				1593					827				995	
v/c Ratio		0.02				0.00					0.03				0.05	
95% Queue Length		0.1				0.0					0.1				0.2	
Control Delay (s/veh)		7.3				7.3					9.5				8.8	
Level of Service (LOS)		A				A					A				A	
Approach Delay (s/veh)	4.6				1.4				9.5				8.8			
Approach LOS	A				A				A				A			

HCS 2010 Two-Way Stop Control Summary Report

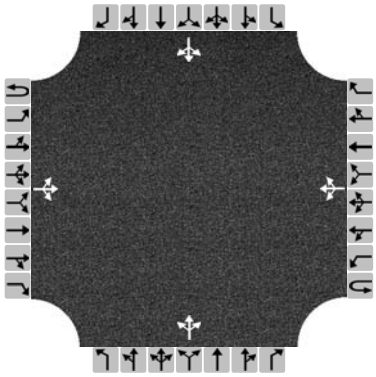
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2045
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	5-Deerview Road/Spring
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Deerview Road
North/South Street	Spring Valley Road
Peak Hour Factor	0.92
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	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		5	10	5		5	10	5		5	5	5		5	5	5
Percent Heavy Vehicles		14				14				14	14	14		14	14	14
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		5				5					15				15	
Capacity		1593				1593					936				936	
v/c Ratio		0.00				0.00					0.02				0.02	
95% Queue Length		0.0				0.0					0.0				0.0	
Control Delay (s/veh)		7.3				7.3					8.9				8.9	
Level of Service (LOS)		A				A					A				A	
Approach Delay (s/veh)	1.7				1.7				8.9				8.9			
Approach LOS	A				A				A				A			

HCS 2010 Two-Way Stop Control Summary Report

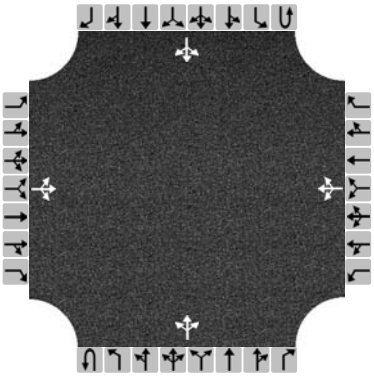
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2045
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	6-Elk Creek Road/Strugis
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	Sturgis Road
Peak Hour Factor	0.92
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	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		5	45	10		50	70	250		15	155	50		365	120	5
Percent Heavy Vehicles		14	14	14		14	14	14		14				14		
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)			65				402			16				397		
Capacity			129				288			1442				1340		
v/c Ratio			0.50				1.40			0.01				0.30		
95% Queue Length			2.3				21.3			0.0				1.3		
Control Delay (s/veh)			58.0				231.9			7.5				8.8		
Level of Service (LOS)			F				F			A				A		
Approach Delay (s/veh)	58.0				231.9				0.6				7.3			
Approach LOS	F				F				A				A			

HCS 2010 Two-Way Stop Control Summary Report

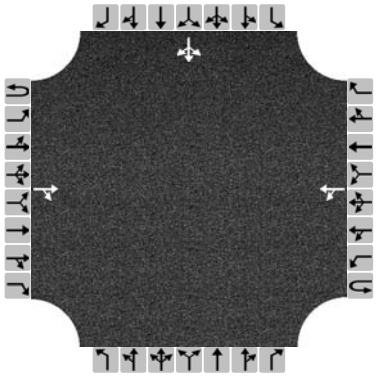
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2045
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	7-Elk Creek Road/EB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	EB Ramps
Peak Hour Factor	0.92
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	0	1	0		0	0	0		0	1	0
Configuration				TR		LT									LTR	
Volume (veh/h)			190	270		220	340							25	5	30
Percent Heavy Vehicles						12								12	12	12
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						609									65	
Capacity						1058									362	
v/c Ratio						0.58									0.18	
95% Queue Length						0.9									0.6	
Control Delay (s/veh)						9.4									17.1	
Level of Service (LOS)						A									C	
Approach Delay (s/veh)					5.3								17.1			
Approach LOS					A								C			

HCS 2010 Two-Way Stop Control Summary Report

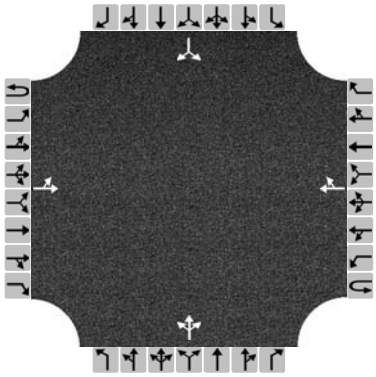
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2045
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	8-Elk Creek Road/WB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	WB Ramps
Peak Hour Factor	0.92
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	0	1	0		0	1	0		0	0	0
Configuration		LT						TR			LTR				LR	
Volume (veh/h)		95	120				415	95		130	5	45		5		15
Percent Heavy Vehicles		12								12	12	12		14		14
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		233									195				21	
Capacity		1010									313				716	
v/c Ratio		0.23									0.62				0.03	
95% Queue Length		0.3									3.9				0.1	
Control Delay (s/veh)		9.0									33.7				10.2	
Level of Service (LOS)		A									D				B	
Approach Delay (s/veh)	4.5								33.7				10.2			
Approach LOS	A								D				B			

HCS 2010 Two-Way Stop Control Summary Report

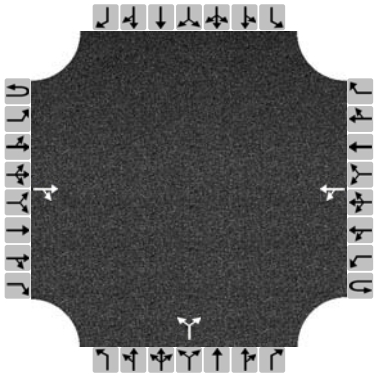
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2045
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	10-Elk Creek/Hills View
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	Hills View Drive
Peak Hour Factor	0.92
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	0	1	0		0	0	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			145	10		5	470			20		5				
Percent Heavy Vehicles						14				14		14				
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						516					27					
Capacity						1401					456					
v/c Ratio						0.37					0.06					
95% Queue Length						0.0					0.2					
Control Delay (s/veh)						7.6					13.4					
Level of Service (LOS)						A					B					
Approach Delay (s/veh)					0.1				13.4							
Approach LOS					A				B							

HCS 2010 Two-Way Stop Control Summary Report

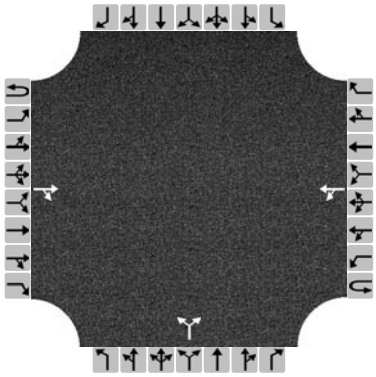
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2045
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	11-Elk Creek/Glenwood
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	Glenwood Drive
Peak Hour Factor	0.88
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	0	1	0		0	0	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			60	65		5	20			180		5				
Percent Heavy Vehicles						14				14		14				
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						29					211					
Capacity						1368					824					
v/c Ratio						0.02					0.26					
95% Queue Length						0.0					1.0					
Control Delay (s/veh)						7.6					10.9					
Level of Service (LOS)						A					B					
Approach Delay (s/veh)					1.6				10.9							
Approach LOS					A				B							

HCS 2010 Two-Way Stop Control Summary Report

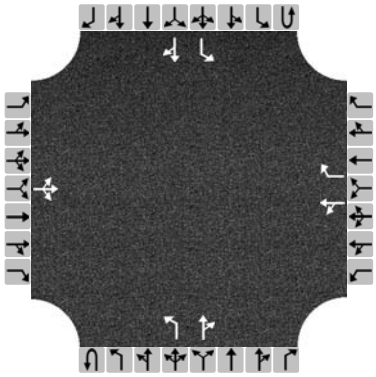
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2045
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	12-Stage Stop Rd/Sturgis
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Stage Stop Road
North/South Street	Stugis Road
Peak Hour Factor	0.92
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	1	0	0	1	1	0
Configuration			LTR			LT		R		L		TR		L		TR
Volume (veh/h)		10	10	10		75	15	65		10	115	200		190	105	10
Percent Heavy Vehicles		14	14	14		14	14	14		14				14		
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)			33			98		71		11				207		
Capacity			282			238		776		1388				1151		
v/c Ratio			0.12			0.41		0.09		0.01				0.18		
95% Queue Length			0.4			1.9		0.3		0.0				0.7		
Control Delay (s/veh)			19.4			30.4		10.1		7.6				8.8		
Level of Service (LOS)			C			D		B		A				A		
Approach Delay (s/veh)	19.4				20.8				0.2				5.5			
Approach LOS	C				C				A				A			

HCS 2010 Two-Way Stop Control Summary Report

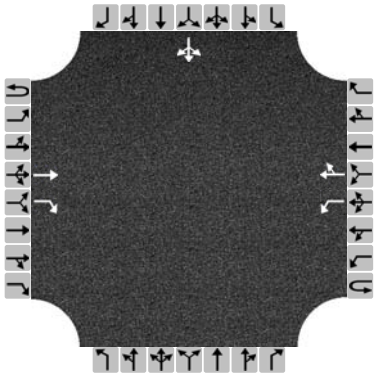
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2045
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	13-Stage Stop Rd/EB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Stage Stop Road
North/South Street	EB Ramps
Peak Hour Factor	0.92
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	1	0	1	1	0		0	0	0		0	1	0
Configuration			T	R		L		TR							LTR	
Volume (veh/h)			185	270		205	165	0						40	5	85
Percent Heavy Vehicles						12								12	12	12
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						223									140	
Capacity						1063									952	
v/c Ratio						0.21									0.15	
95% Queue Length						0.8									0.5	
Control Delay (s/veh)						9.3									9.4	
Level of Service (LOS)						A									A	
Approach Delay (s/veh)					5.1								9.4			
Approach LOS					A								A			

HCS 2010 Two-Way Stop Control Summary Report

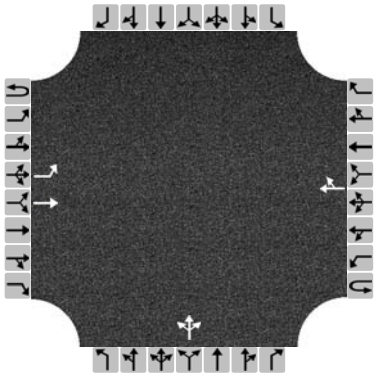
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2045
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	14-Stage Stop Rd/WB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Stage Stop Road
North/South Street	WB Ramps
Peak Hour Factor	0.92
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	1	1	0	0	0	1	0		0	1	0		0	0	0
Configuration		L	T					TR			LTR					
Volume (veh/h)		105	120				295	85		75	5	80				
Percent Heavy Vehicles		12								12	12	12				
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		114									174					
Capacity		1139									767					
v/c Ratio		0.10									0.23					
95% Queue Length		0.3									0.9					
Control Delay (s/veh)		8.5									11.1					
Level of Service (LOS)		A									B					
Approach Delay (s/veh)	4.0								11.1							
Approach LOS	A								B							

HCS 2010 Two-Way Stop Control Summary Report

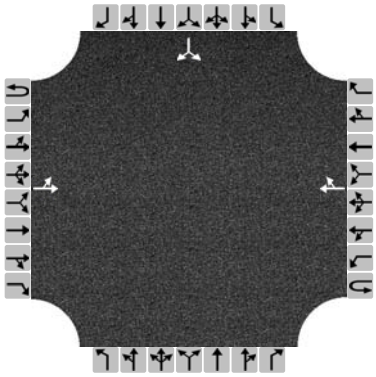
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2045
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	15-Stage Stop Rd/LaRue Rd
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Stage Stop Road
North/South Street	LaRue Road
Peak Hour Factor	0.92
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	0	1	0		0	0	0		0	0	0
Configuration		LT						TR							LR	
Volume (veh/h)		25	10				45	5						5		100
Percent Heavy Vehicles		14												14		14
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		38													114	
Capacity		1543													1004	
v/c Ratio		0.02													0.11	
95% Queue Length		0.1													0.4	
Control Delay (s/veh)		7.4													9.0	
Level of Service (LOS)		A													A	
Approach Delay (s/veh)	5.3												9.0			
Approach LOS	A												A			

HCS 2010 Two-Way Stop Control Summary Report

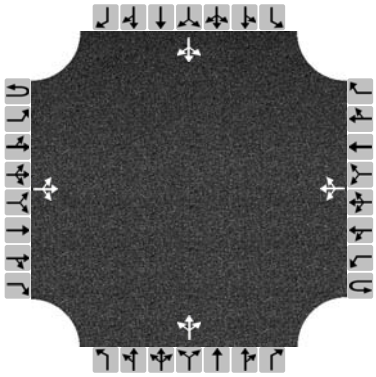
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2045
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	1-Chimney Canyon/Sturgis
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Chimney Canyon
North/South Street	Sturgis Road
Peak Hour Factor	0.92
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	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		5	20	10		70	60	105		15	30	35		70	30	10
Percent Heavy Vehicles		14				14				14	14	14		14	14	14
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		5				76					87				120	
Capacity		1325				1502					658				541	
v/c Ratio		0.00				0.05					0.13				0.22	
95% Queue Length		0.0				0.2					0.5				0.8	
Control Delay (s/veh)		7.7				7.5					11.3				13.5	
Level of Service (LOS)		A				A					B				B	
Approach Delay (s/veh)	1.0				2.5				11.3				13.5			
Approach LOS	A				A				B				B			

HCS 2010 Two-Way Stop Control Summary Report

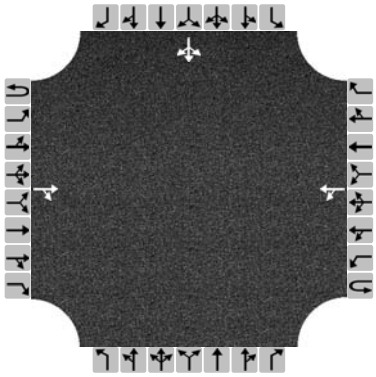
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2045
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	2-Deerview Road/EB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Deerview Road
North/South Street	EB Ramps
Peak Hour Factor	0.92
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	0	1	0		0	0	0		0	1	0
Configuration				TR		LT									LTR	
Volume (veh/h)			40	85		25	155							15	1	65
Percent Heavy Vehicles						12								12	12	12
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

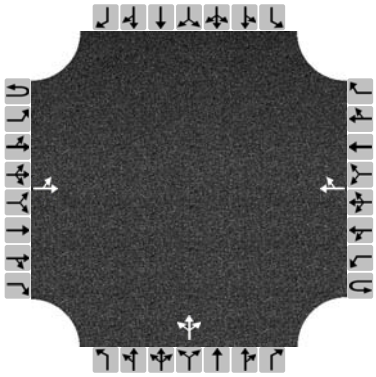
Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						195									88	
Capacity						1442									1082	
v/c Ratio						0.14									0.08	
95% Queue Length						0.1									0.3	
Control Delay (s/veh)						7.5									8.6	
Level of Service (LOS)						A									A	
Approach Delay (s/veh)					1.2								8.6			
Approach LOS					A								A			

HCS 2010 Two-Way Stop Control Summary Report

General Information		Site Information	
Analyst	DCJ	Intersection	3-Deerview Road/WB Ramps
Agency/Co.	Felsburg Holt & Ullevig	Jurisdiction	South Dakota DOT / FHWA
Date Performed	12/15/2015	East/West Street	Deerview Road
Analysis Year	2045	North/South Street	WB Ramps
Time Analyzed	PM	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	I-90 Exit 46 IMJR		

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	0	1	0		0	1	0		0	0	0
Configuration		LT						TR			LTR					
Volume (veh/h)		30	25				50	5		130	1	30				
Percent Heavy Vehicles		12								12	12	12				
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		60									175					
Capacity		1537									1033					
v/c Ratio		0.04									0.17					
95% Queue Length		0.1									0.6					
Control Delay (s/veh)		7.4									9.2					
Level of Service (LOS)		A									A					
Approach Delay (s/veh)	4.1								9.2							
Approach LOS	A								A							

HCS 2010 Two-Way Stop Control Summary Report

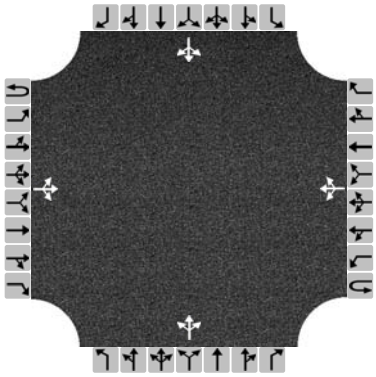
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2045
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	4-Deerview Road/Sidney
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Deerview Road
North/South Street	Sidney Stage Road
Peak Hour Factor	0.92
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	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		25	25	5		5	15	5		10	5	5		5	5	30
Percent Heavy Vehicles		14				14				14	14	14		14	14	14
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

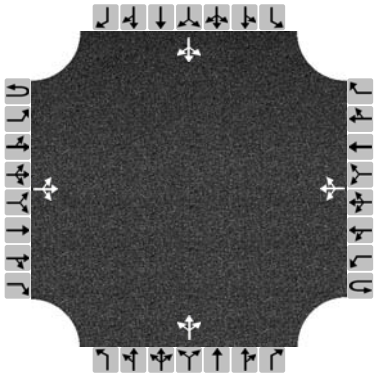
Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		27				5					21				43	
Capacity		1586				1572					844				984	
v/c Ratio		0.02				0.00					0.02				0.04	
95% Queue Length		0.1				0.0					0.1				0.1	
Control Delay (s/veh)		7.3				7.3					9.4				8.8	
Level of Service (LOS)		A				A					A				A	
Approach Delay (s/veh)	3.4				1.4				9.4				8.8			
Approach LOS	A				A				A				A			

HCS 2010 Two-Way Stop Control Summary Report

General Information		Site Information	
Analyst	DCJ	Intersection	5-Deerview Road/Spring
Agency/Co.	Felsburg Holt & Ullevig	Jurisdiction	South Dakota DOT / FHWA
Date Performed	12/15/2015	East/West Street	Deerview Road
Analysis Year	2045	North/South Street	Spring Valley Road
Time Analyzed	PM	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	I-90 Exit 46 IMJR		

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	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		5	25	5		5	15	5		5	5	5		5	5	5
Percent Heavy Vehicles		14				14				14	14	14		14	14	14
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		5				5					15				15	
Capacity		1586				1572					908				917	
v/c Ratio		0.00				0.00					0.02				0.02	
95% Queue Length		0.0				0.0					0.1				0.0	
Control Delay (s/veh)		7.3				7.3					9.0				9.0	
Level of Service (LOS)		A				A					A				A	
Approach Delay (s/veh)	1.0				1.4				9.0				9.0			
Approach LOS	A				A				A				A			

HCS 2010 Two-Way Stop Control Summary Report

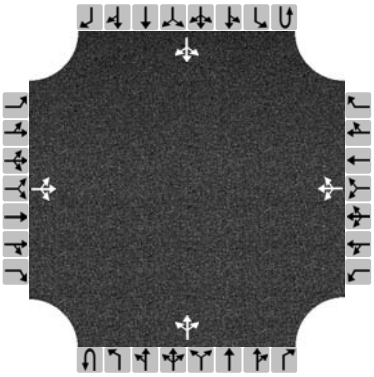
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2045
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	6-Elk Creek Road/Strugis
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	Sturgis Road
Peak Hour Factor	0.92
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	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		5	40	10		65	75	195		10	85	20		190	70	5
Percent Heavy Vehicles		14	14	14		14	14	14		14				14		
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)			59				365			11				207		
Capacity			362				544			1508				1467		
v/c Ratio			0.16				0.67			0.01				0.14		
95% Queue Length			0.6				5.0			0.0				0.5		
Control Delay (s/veh)			16.9				24.1			7.4				7.9		
Level of Service (LOS)			C				C			A				A		
Approach Delay (s/veh)	16.9				24.1				0.7				6.0			
Approach LOS	C				C				A				A			

HCS 2010 Two-Way Stop Control Summary Report

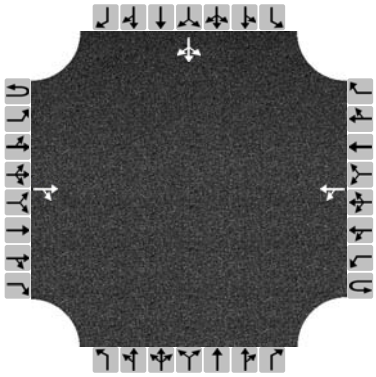
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2045
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	7-Elk Creek Road/EB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	EB Ramps
Peak Hour Factor	0.92
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	0	1	0		0	0	0		0	1	0
Configuration				TR		LT									LTR	
Volume (veh/h)			165	85		105	275							80	5	60
Percent Heavy Vehicles						12								12	12	12
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						413									157	
Capacity						1285									631	
v/c Ratio						0.32									0.25	
95% Queue Length						0.3									1.0	
Control Delay (s/veh)						8.1									12.6	
Level of Service (LOS)						A									B	
Approach Delay (s/veh)					2.9								12.6			
Approach LOS					A								B			

HCS 2010 Two-Way Stop Control Summary Report

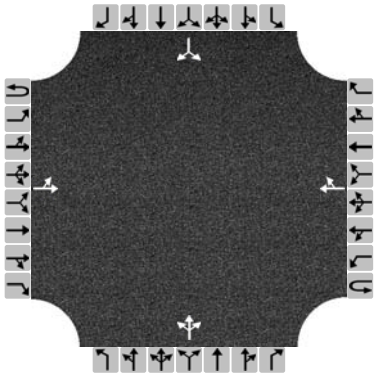
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2045
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	8-Elk Creek Road/WB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	WB Ramps
Peak Hour Factor	0.92
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	0	1	0		0	1	0		0	0	0
Configuration		LT						TR			LTR				LR	
Volume (veh/h)		60	185				185	25		185	10	225		5		10
Percent Heavy Vehicles		12								12	12	12		14		14
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		266									457				16	
Capacity		1333									729				749	
v/c Ratio		0.20									0.63				0.02	
95% Queue Length		0.2									4.5				0.1	
Control Delay (s/veh)		7.8									17.9				9.9	
Level of Service (LOS)		A									C				A	
Approach Delay (s/veh)	2.2								17.9				9.9			
Approach LOS	A								C				A			

HCS 2010 Two-Way Stop Control Summary Report

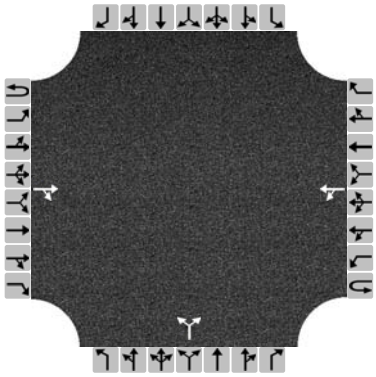
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2045
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	10-Elk Creek/Hills View
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	Hills View Drive
Peak Hour Factor	0.92
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	0	1	0		0	0	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			360	20		5	175			15		5				
Percent Heavy Vehicles						14				14		14				
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						195					21					
Capacity						1139					493					
v/c Ratio						0.17					0.04					
95% Queue Length						0.0					0.1					
Control Delay (s/veh)						8.2					12.6					
Level of Service (LOS)						A					B					
Approach Delay (s/veh)					0.2				12.6							
Approach LOS					A				B							

HCS 2010 Two-Way Stop Control Summary Report

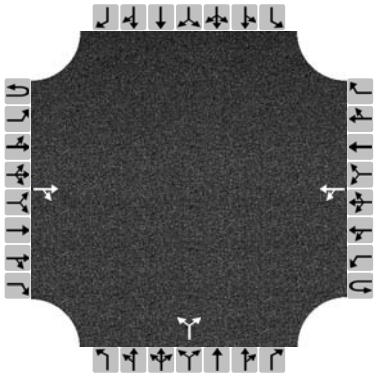
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2045
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	11-Elk Creek/Glenwood
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	Glenwood Drive
Peak Hour Factor	0.92
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	0	1	0		0	0	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			135	150		10	95			60		5				
Percent Heavy Vehicles						14				14		14				
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						114					70					
Capacity						1184					624					
v/c Ratio						0.10					0.11					
95% Queue Length						0.0					0.4					
Control Delay (s/veh)						8.1					11.5					
Level of Service (LOS)						A					B					
Approach Delay (s/veh)					0.9				11.5							
Approach LOS					A				B							

HCS 2010 Two-Way Stop Control Summary Report

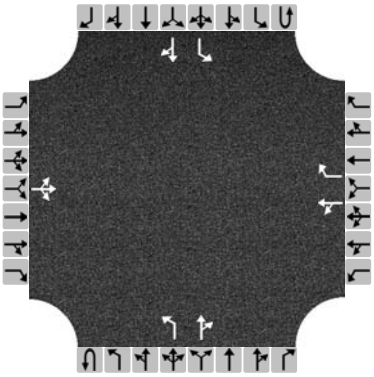
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2045
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	12-Stage Stop Rd/Sturgis
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Stage Stop Road
North/South Street	Stugis Road
Peak Hour Factor	0.92
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	1	0	0	1	1	0
Configuration			LTR			LT		R		L		TR		L		TR
Volume (veh/h)		10	10	10		195	10	180		10	80	140		85	75	10
Percent Heavy Vehicles		14	14	14		14	14	14		14				14		
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)			33			223		196		11				92		
Capacity			434			441		851		1427				1259		
v/c Ratio			0.08			0.51		0.23		0.01				0.07		
95% Queue Length			0.2			2.8		0.9		0.0				0.2		
Control Delay (s/veh)			14.0			21.2		10.5		7.5				8.1		
Level of Service (LOS)			B			C		B		A				A		
Approach Delay (s/veh)	14.0				15.8				0.3				4.0			
Approach LOS	B				C				A				A			

HCS 2010 Two-Way Stop Control Summary Report

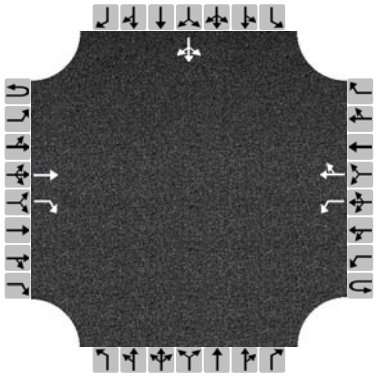
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2045
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	13-Stage Stop Rd/EB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Stage Stop Road
North/South Street	EB Ramps
Peak Hour Factor	0.92
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	1	0	1	1	0		0	0	0		0	1	0
Configuration			T	R		L		TR							LTR	
Volume (veh/h)			235	95		105	385	0						55	5	105
Percent Heavy Vehicles						12								12	12	12
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						114									179	
Capacity						1194									832	
v/c Ratio						0.10									0.22	
95% Queue Length						0.3									0.8	
Control Delay (s/veh)						8.3									10.5	
Level of Service (LOS)						A									B	
Approach Delay (s/veh)					1.8								10.5			
Approach LOS					A								B			

HCS 2010 Two-Way Stop Control Summary Report

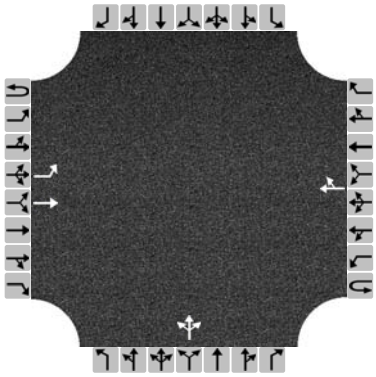
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2045
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	14-Stage Stop Rd/WB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Stage Stop Road
North/South Street	WB Ramps
Peak Hour Factor	0.92
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	1	1	0	0	0	1	0		0	1	0		0	0	0
Configuration		L	T					TR			LTR					
Volume (veh/h)		105	185				200	50		290	5	155				
Percent Heavy Vehicles		12								12	12	12				
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		114									488					
Capacity		1285									570					
v/c Ratio		0.09									0.86					
95% Queue Length		0.3									9.3					
Control Delay (s/veh)		8.1									37.9					
Level of Service (LOS)		A									E					
Approach Delay (s/veh)	2.9								37.9							
Approach LOS	A								E							

HCS 2010 Two-Way Stop Control Summary Report

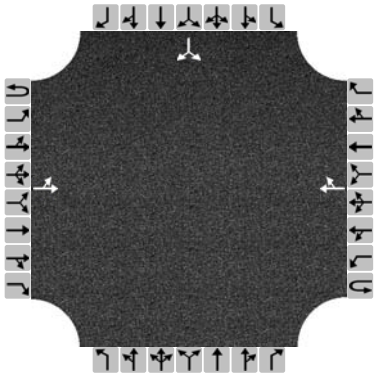
General Information

Analyst	DCJ
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2045
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	15-Stage Stop Rd/LaRue Rd
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Stage Stop Road
North/South Street	LaRue Road
Peak Hour Factor	0.92
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	0	1	0		0	0	0		0	0	0
Configuration		LT						TR							LR	
Volume (veh/h)		70	20				20	5						5		125
Percent Heavy Vehicles		14												14		14
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		98													141	
Capacity		1578													1034	
v/c Ratio		0.06													0.14	
95% Queue Length		0.2													0.5	
Control Delay (s/veh)		7.4													9.0	
Level of Service (LOS)		A													A	
Approach Delay (s/veh)	5.8												9.0			
Approach LOS	A												A			

APPENDIX E FUTURE BUILD LOS WORKSHEETS

SURFACE STREET LOS

HCS 2010 Two-Way Stop Control Summary Report

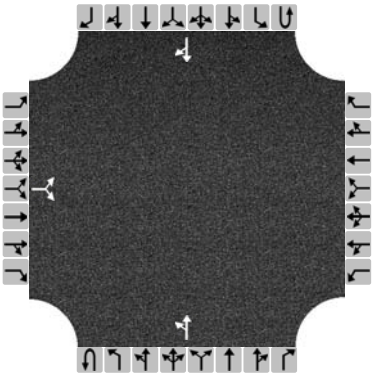
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	01/06/2015
Analysis Year	2021
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	6-Strugis/Big D Access
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Big D Truck Stop Access
North/South Street	Sturgis Road
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	0	0	0	0	1	0	0	0	1	0
Configuration			LR							LT						TR
Volume (veh/h)		5		55						85	270				335	5
Percent Heavy Vehicles		12		12						12						
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)			68							404						
Capacity			594							1165						
v/c Ratio			0.11							0.35						
95% Queue Length			0.4							0.3						
Control Delay (s/veh)			11.8							8.4						
Level of Service (LOS)			B							A						
Approach Delay (s/veh)	11.8								2.6							
Approach LOS	B								A							

HCS 2010 Two-Way Stop Control Summary Report

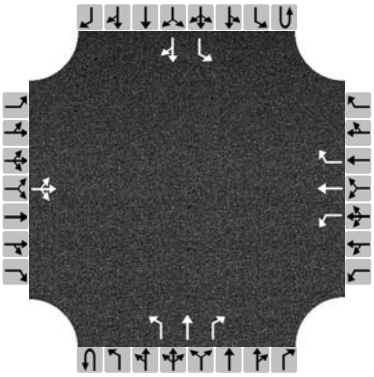
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	01/06/2016
Analysis Year	2021
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	7-Elk Creek Road/Sturgis
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	Sturgis Road
Peak Hour Factor	0.92
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		1	1	1	0	1	1	1	0	1	1	0
Configuration			LTR			L	T	R		L	T	R		L		TR
Volume (veh/h)		5	5	5		25	5	230		5	120	25		295	90	5
Percent Heavy Vehicles		12	12	12		12	12	12		12				12		
Proportion Time Blocked																
Right Turn Channelized	No				Yes				Yes				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)			15			27	5	250		5				321		
Capacity			239			205	210	893		1427				1395		
v/c Ratio			0.06			0.13	0.02	0.28		0.00				0.23		
95% Queue Length			0.2			0.4	0.1	1.1		0.0				0.9		
Control Delay (s/veh)			21.1			25.3	22.6	10.6		7.5				8.4		
Level of Service (LOS)			C			D	C	B		A				A		
Approach Delay (s/veh)	21.1				12.2				0.2				6.3			
Approach LOS	C				B				A				A			

HCS 2010 Two-Way Stop Control Summary Report

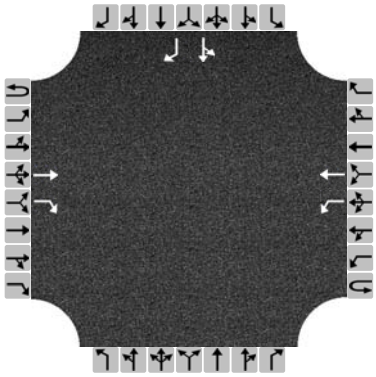
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	01/06/2016
Analysis Year	2021
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	8-Elk Creek Road/EB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	EB Ramps
Peak Hour Factor	0.92
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	1	0	1	1	0		0	0	0		0	1	1
Configuration			T	R		L	T							LT		R
Volume (veh/h)			135	190		155	240							15	0	20
Percent Heavy Vehicles						14								14	14	14
Proportion Time Blocked																
Right Turn Channelized	Yes				No				No				Yes			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						168								16		22
Capacity						1375								298		709
v/c Ratio						0.12								0.05		0.03
95% Queue Length						0.4								0.2		0.1
Control Delay (s/veh)						8.0								17.7		10.2
Level of Service (LOS)						A								C		B
Approach Delay (s/veh)					3.1								13.4			
Approach LOS					A								B			

HCS 2010 Two-Way Stop Control Summary Report

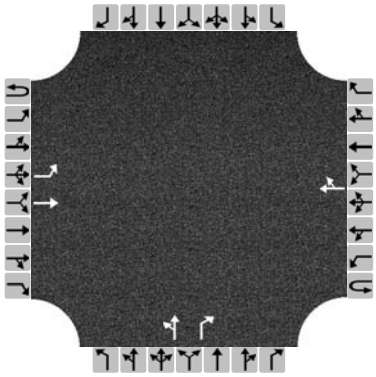
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	01/06/2016
Analysis Year	2021
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	9-Elk Creek Rd/WB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	WB Ramps
Peak Hour Factor	0.92
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	1	1	0	0	0	1	0		0	1	1		0	0	0
Configuration		L	T					TR		LT		R				
Volume (veh/h)		55	95				305	70		90	5	35				
Percent Heavy Vehicles		14								14	14	14				
Proportion Time Blocked																
Right Turn Channelized	No				No				Yes				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		60								103		38				
Capacity		1098								447		925				
v/c Ratio		0.05								0.23		0.04				
95% Queue Length		0.2								0.9		0.1				
Control Delay (s/veh)		8.5								15.5		9.1				
Level of Service (LOS)		A								C		A				
Approach Delay (s/veh)	3.1								13.5							
Approach LOS	A								B							

HCS 2010 Two-Way Stop Control Summary Report

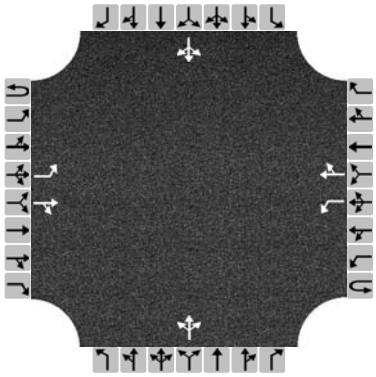
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	01/06/2016
Analysis Year	2021
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	10-Elk Creek/Sidney Stage
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	Sidney Stage Road
Peak Hour Factor	0.92
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	1	1	0	0	1	1	0		0	1	0		0	1	0
Configuration		L		TR		L		TR			LTR				LTR	
Volume (veh/h)		15	110	5		5	335	10		15	5	5		5	5	25
Percent Heavy Vehicles		12				12				12	12	12		12	12	12
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		16				5					26				37	
Capacity		1130				1454					503				572	
v/c Ratio		0.01				0.00					0.05				0.06	
95% Queue Length		0.0				0.0					0.2				0.2	
Control Delay (s/veh)		8.2				7.5					12.5				11.7	
Level of Service (LOS)		A				A					B				B	
Approach Delay (s/veh)	0.9				0.1				12.5				11.7			
Approach LOS	A				A				B				B			

HCS 2010 Two-Way Stop Control Summary Report

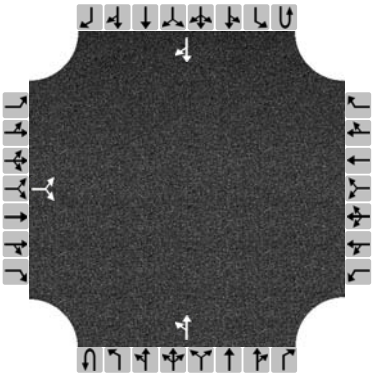
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	01/06/2015
Analysis Year	2021
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	6-Strugis/Big D Access
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Big D Truck Stop Access
North/South Street	Sturgis Road
Peak Hour Factor	0.92
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	1	0	0	0	1	0
Configuration			LR							LT						TR
Volume (veh/h)		5		50						85	180				170	5
Percent Heavy Vehicles		12		12						12						
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)			59							288						
Capacity			792							1376						
v/c Ratio			0.07							0.21						
95% Queue Length			0.2							0.2						
Control Delay (s/veh)			9.9							7.8						
Level of Service (LOS)			A							A						
Approach Delay (s/veh)	9.9								2.9							
Approach LOS	A								A							

HCS 2010 Two-Way Stop Control Summary Report

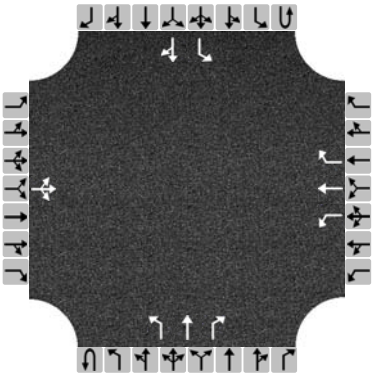
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	01/06/2016
Analysis Year	2021
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	7-Elk Creek Road/Sturgis
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	Sturgis Road
Peak Hour Factor	0.92
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		1	1	1	0	1	1	1	0	1	1	0
Configuration			LTR			L	T	R		L	T	R		L		TR
Volume (veh/h)		5	5	5		35	5	195		5	65	10		160	55	5
Percent Heavy Vehicles		12	12	12		12	12	12		12				12		
Proportion Time Blocked																
Right Turn Channelized	No				Yes				Yes				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)			15			38	5	212		5				174		
Capacity			460			420	406	964		1475				1467		
v/c Ratio			0.03			0.09	0.01	0.22		0.00				0.12		
95% Queue Length			0.1			0.3	0.0	0.8		0.0				0.4		
Control Delay (s/veh)			13.1			14.4	14.0	9.8		7.4				7.8		
Level of Service (LOS)			B			B	B	A		A				A		
Approach Delay (s/veh)	13.1				10.6				0.4				5.7			
Approach LOS	B				B				A				A			

HCS 2010 Two-Way Stop Control Summary Report

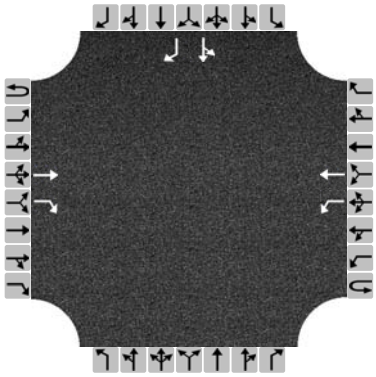
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	01/06/2016
Analysis Year	2021
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	8-Elk Creek Road/EB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	EB Ramps
Peak Hour Factor	0.92
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	1	0	1	1	0		0	0	0		0	1	1
Configuration			T	R		L	T							LT		R
Volume (veh/h)			115	60		70	195							55	0	40
Percent Heavy Vehicles						14								14	14	14
Proportion Time Blocked																
Right Turn Channelized	Yes				No				No				Yes			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						76								60		43
Capacity						1401								467		802
v/c Ratio						0.05								0.13		0.05
95% Queue Length						0.2								0.4		0.2
Control Delay (s/veh)						7.7								13.8		9.7
Level of Service (LOS)						A								B		A
Approach Delay (s/veh)					2.0								12.1			
Approach LOS					A								B			

HCS 2010 Two-Way Stop Control Summary Report

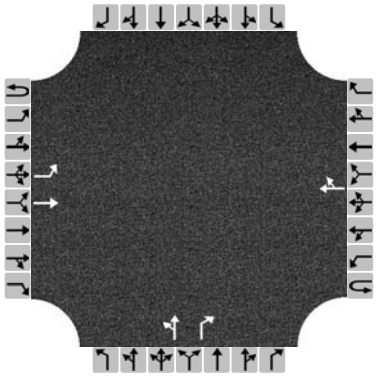
General Information

Analyst	TS
Agency/Co.	FHU
Date Performed	01/06/2016
Analysis Year	2021
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	9-Elk Creek Rd/WB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	WB Ramps
Peak Hour Factor	0.92
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	1	1	0	0	0	1	0		0	1	1		0	0	0
Configuration		L	T					TR		LT		R				
Volume (veh/h)		25	145				135	25		130	5	155				
Percent Heavy Vehicles		14								14	14	14				
Proportion Time Blocked																
Right Turn Channelized	No				No				Yes				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		27								146		168				
Capacity		1343								606		861				
v/c Ratio		0.02								0.24		0.20				
95% Queue Length		0.1								0.9		0.7				
Control Delay (s/veh)		7.7								12.8		10.2				
Level of Service (LOS)		A								B		B				
Approach Delay (s/veh)	1.1								11.3							
Approach LOS	A								B							

HCS 2010 Two-Way Stop Control Summary Report

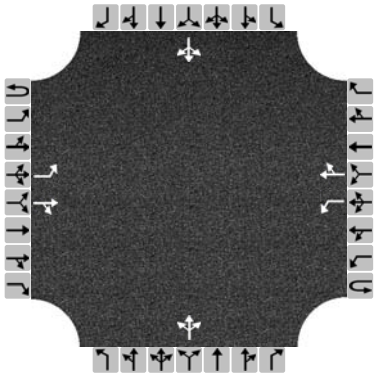
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2021
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	10-Elk Creek/Sidney Stage
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	Sidney Stage Road
Peak Hour Factor	0.92
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	1	1	0	0	1	1	0		0	1	0		0	1	0
Configuration		L		TR		L		TR			LTR				LTR	
Volume (veh/h)		35	250	15		5	125	5		10	5	5		5	5	25
Percent Heavy Vehicles		12				12				12	12	12		12	12	12
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		38				5					21				37	
Capacity		1382				1267					515				694	
v/c Ratio		0.03				0.00					0.04				0.05	
95% Queue Length		0.1				0.0					0.1				0.2	
Control Delay (s/veh)		7.7				7.9					12.3				10.5	
Level of Service (LOS)		A				A					B				B	
Approach Delay (s/veh)	0.9				0.3				12.3				10.5			
Approach LOS	A				A				B				B			

ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	*TS*
Agency/Co.	*FHU*
Date Performed	*1/27/2016*
Analysis Time Period	*AM Peak Hour*

Site Information

Intersection	*#7 Elk Creek/Sturgis Road*
Jurisdiction	*SDDOT*
Analysis Year	*2021*

Project ID *Exit 46 IMJR*

East/West Street: *Elk Creek Road* | North/South Street: *Sturgis Road*

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	*5*	*5*	*5*	*25*	*5*	*230*
%Thrus Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	*5*	*20*	*25*	*295*	*90*	*5*
%Thrus Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	*LTR*		*L*	*TR*	*L*	*TR*	*L*	*TR*
PHF	*0.92*		*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
Flow Rate (veh/h)	*15*		*27*	*254*	*5*	*48*	*320*	102
% Heavy Vehicles	*12*		*12*	*12*	*12*	*12*	*12*	*12*
No. Lanes	*1*		*2*		*2*		*2*	
Geometry Group	*4b*		*5*		*5*		*5*	
Duration, T	*0.25*							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	*0.3*		*1.0*	*0.0*	*1.0*	*0.0*	*1.0*	*0.0*
Prop. Right-Turns	*0.3*		*0.0*	*1.0*	*0.0*	*0.6*	*0.0*	*0.0*
Prop. Heavy Vehicle	*0.1*		*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
hLT-adj	*0.2*	*0.2*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*
hRT-adj	*-0.6*	*-0.6*	*-0.7*	*-0.7*	*-0.7*	*-0.7*	*-0.7*	*-0.7*
hHV-adj	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*
hadj, computed	*0.1*		*0.7*	*-0.5*	*0.7*	*-0.2*	*0.7*	*0.2*

Departure Headway and Service Time

hd, initial value (s)	*3.20*		*3.20*	*3.20*	*3.20*	*3.20*	*3.20*	*3.20*
x, initial	*0.01*		*0.02*	*0.23*	*0.00*	*0.04*	*0.28*	*0.09*
hd, final value (s)	*6.25*		*6.53*	*5.35*	*6.60*	*5.70*	*6.11*	*5.57*
x, final value	*0.026*		*0.049*	*0.377*	*0.009*	*0.076*	*0.543*	*0.158*
Move-up time, m (s)	*2.3*		*2.3*		*2.3*		*2.3*	
Service Time, t_s (s)	*4.0*		*4.2*	*3.0*	*4.3*	*3.4*	*3.8*	*3.3*

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	*500*		*540*	*668*	*500*	*600*	*593*	*638*
Delay (s/veh)	*9.1*		*9.6*	*11.2*	*9.4*	*8.9*	*15.8*	*9.3*
LOS	*A*		*A*	*B*	*A*	*A*	*C*	*A*
Approach: Delay (s/veh)	*9.1*		*11.1*		*8.9*		*14.3*	
LOS	*A*		*B*		*A*		*B*	
Intersection Delay (s/veh)	*12.6*							
Intersection LOS	*B*							

ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	*TS*
Agency/Co.	*FHU*
Date Performed	*1/27/2016*
Analysis Time Period	*PM Peak Hour*

Site Information

Intersection	*#7 Elk Creek/Sturgis Road*
Jurisdiction	*SDDOT*
Analysis Year	*2021*

Project ID *Exit 46 IMJR*

East/West Street: *Elk Creek Road* | North/South Street: *Sturgis Road*

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	*5*	*5*	*5*	*35*	*5*	*195*
%Thrus Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	*5*	*65*	*10*	*160*	*55*	*0*
%Thrus Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	*LTR*		*L*	*TR*	*L*	*TR*	*L*	*TR*
PHF	*0.92*		*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
Flow Rate (veh/h)	*15*		*38*	*216*	*5*	*80*	*173*	*59*
% Heavy Vehicles	*12*		*12*	*12*	*12*	*12*	*12*	*12*
No. Lanes	*1*		*2*		*2*		*2*	
Geometry Group	*4b*		*5*		*5*		*5*	
Duration, T	*0.25*							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	*0.3*		*1.0*	*0.0*	*1.0*	*0.0*	*1.0*	*0.0*
Prop. Right-Turns	*0.3*		*0.0*	*1.0*	*0.0*	*0.1*	*0.0*	*0.0*
Prop. Heavy Vehicle	*0.1*		*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
hLT-adj	*0.2*	*0.2*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*
hRT-adj	*-0.6*	*-0.6*	*-0.7*	*-0.7*	*-0.7*	*-0.7*	*-0.7*	*-0.7*
hHV-adj	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*
hadj, computed	*0.1*		*0.7*	*-0.5*	*0.7*	*0.1*	*0.7*	*0.2*

Departure Headway and Service Time

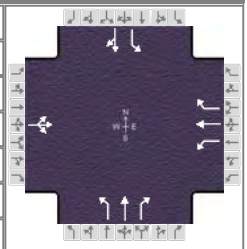
hd, initial value (s)	*3.20*		*3.20*	*3.20*	*3.20*	*3.20*	*3.20*	*3.20*
x, initial	*0.01*		*0.03*	*0.19*	*0.00*	*0.07*	*0.15*	*0.05*
hd, final value (s)	*5.77*		*6.09*	*4.91*	*6.20*	*5.61*	*6.01*	*5.51*
x, final value	*0.024*		*0.064*	*0.295*	*0.009*	*0.125*	*0.289*	*0.090*
Move-up time, m (s)	*2.3*		*2.3*		*2.3*		*2.3*	
Service Time, t_s (s)	*3.5*		*3.8*	*2.6*	*3.9*	*3.3*	*3.7*	*3.2*

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	*750*		*633*	*745*	*500*	*667*	*597*	*656*
Delay (s/veh)	*8.6*		*9.2*	*9.7*	*9.0*	*9.1*	*11.1*	*8.8*
LOS	*A*		*A*	*A*	*A*	*A*	*B*	*A*
Approach: Delay (s/veh)	*8.6*		*9.6*		*9.1*		*10.5*	
LOS	*A*		*A*		*A*		*B*	
Intersection Delay (s/veh)	*9.9*							
Intersection LOS	*A*							

HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency				Duration, h	0.25
Analyst		Analysis Date	1/27/2016	Area Type	Other
Jurisdiction		Time Period		PHF	0.92
Urban Street	Elk Creek Road	Analysis Year	2016	Analysis Period	1> 7:00
Intersection	Elk Creek Road/Sturgis…	File Name	#7 - Elk Creek-Sturgis Road AM.xus		
Project Description	Exit 46 IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	5	5	5	25	5	230	5	20	25	295	90	5

Signal Information			
Cycle, s	33.7	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4
Green	1.3	5.8	0.3	1.7	4.6	0.0	5	6	7	8
Yellow	3.0	3.0	3.0	3.0	3.0	0.0				
Red	1.0	1.0	1.0	1.0	1.0	0.0				

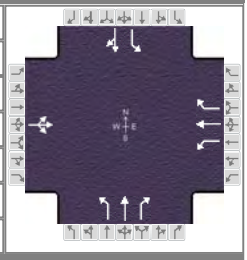
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6	3	8	7	4
Case Number		8.3	1.0	3.0	1.1	3.0	1.1	4.0
Phase Duration, s		9.8	5.3	15.1	4.3	8.6	10.0	14.3
Change Period, ($Y+R_c$), s		4.0	4.0	4.0	4.0	4.0	4.0	4.0
Max Allow Headway (*MAH*), s		3.3	3.0	3.3	3.0	3.0	3.0	3.0
Queue Clearance Time (g_s), s		2.3	2.4	7.1	2.1	2.6	7.6	3.6
Green Extension Time (g_e), s		0.0	0.0	0.0	0.0	0.0	0.0	0.1
Phase Call Probability		1.00	0.22	1.00	0.05	0.77	0.95	0.99
Max Out Probability		0.70	0.34	1.00	0.08	0.62	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		16		27	5	250	5	22	27	321	103	
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1457		1531	1607	1362	1531	1607	1362	1531	1592	
Queue Service Time (g_s), s		0.0		0.4	0.1	5.1	0.1	0.4	0.6	5.6	1.6	
Cycle Queue Clearance Time (g_c), s		0.3		0.4	0.1	5.1	0.1	0.4	0.6	5.6	1.6	
Green Ratio (*g/C*)		0.17		0.27	0.33	0.33	0.14	0.14	0.14	0.37	0.30	
Capacity (*c*), veh/h		393		482	531	450	386	218	185	642	485	
Volume-to-Capacity Ratio (*X*)		0.042		0.056	0.010	0.555	0.014	0.100	0.147	0.499	0.213	
Available Capacity (c_a), veh/h		401		693	531	450	645	286	242	642	485	
Back of Queue (*Q*), veh/ln (50 th percentile)		0.1		0.1	0.0	0.9	0.0	0.1	0.1	1.0	0.3	
Queue Storage Ratio (*RQ*) (50 th percentile)		0.00		0.03	0.00	0.26	0.00	0.00	0.02	0.13	0.00	
Uniform Delay (d_1), s/veh		11.7		9.2	7.6	9.3	12.4	12.8	12.9	8.5	8.7	
Incremental Delay (d_2), s/veh		0.0		0.0	0.0	0.9	0.0	0.1	0.1	0.2	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	
Control Delay (*d*), s/veh		11.7		9.2	7.6	10.2	12.4	12.8	13.0	8.7	8.8	
Level of Service (LOS)		B		A	A	B	B	B	B	A	A	
Approach Delay, s/veh / LOS	11.7	B		10.0	B		12.9	B		8.7	A	
Intersection Delay, s/veh / LOS	9.6						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.4	B	2.2	B	2.4	B	2.1	B
Bicycle LOS Score / LOS	0.5	A	1.0	A	0.6	A	1.2	A

HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency				Duration, h	0.25
Analyst		Analysis Date	1/27/2016	Area Type	Other
Jurisdiction		Time Period		PHF	0.92
Urban Street	Elk Creek Road	Analysis Year	2016	Analysis Period	1> 7:00
Intersection	Elk Creek Road/Sturgis…	File Name	#7 - Elk Creek-Sturgis Road PM.xus		
Project Description	Exit 46 IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	5	5	5	35	5	195	5	65	10	160	55	5

Signal Information			
Cycle, s	32.9	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4
Green	1.8	5.8	0.3	0.5	4.5	0.0	5	6	7	8
Yellow	3.0	3.0	3.0	3.0	3.0	0.0				
Red	1.0	1.0	1.0	1.0	1.0	0.0				

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6	3	8	7	4
Case Number		8.3	1.0	3.0	1.1	3.0	1.1	4.0
Phase Duration, s		9.8	5.8	15.6	4.3	8.5	8.8	13.0
Change Period, ($Y+R_c$), s		4.0	4.0	4.0	4.0	4.0	4.0	4.0
Max Allow Headway (*MAH*), s		3.3	3.0	3.3	3.0	3.0	3.0	3.0
Queue Clearance Time (g_s), s		2.3	2.6	5.9	2.1	3.3	4.8	3.0
Green Extension Time (g_e), s		0.0	0.0	0.0	0.0	0.0	0.0	0.1
Phase Call Probability		1.00	0.29	1.00	0.05	0.75	0.80	0.95
Max Out Probability		0.67	0.49	1.00	0.08	1.00	1.00	0.99

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		16		38	5	212	5	71	11	174	65	
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1457		1531	1607	1362	1531	1607	1362	1531	1583	
Queue Service Time (g_s), s		0.0		0.6	0.1	3.9	0.1	1.3	0.2	2.8	1.0	
Cycle Queue Clearance Time (g_c), s		0.3		0.6	0.1	3.9	0.1	1.3	0.2	2.8	1.0	
Green Ratio (*g/C*)		0.18		0.29	0.35	0.35	0.15	0.14	0.14	0.34	0.27	
Capacity (*c*), veh/h		405		516	567	481	398	219	186	558	432	
Volume-to-Capacity Ratio (*X*)		0.040		0.074	0.010	0.441	0.014	0.322	0.059	0.312	0.151	
Available Capacity (c_a), veh/h		412		713	567	481	664	293	249	615	432	
Back of Queue (*Q*), veh/ln (50 th percentile)		0.1		0.1	0.0	0.6	0.0	0.3	0.0	0.5	0.2	
Queue Storage Ratio (*RQ*) (50 th percentile)		0.00		0.03	0.00	0.17	0.00	0.00	0.01	0.07	0.00	
Uniform Delay (d_1), s/veh		11.2		8.5	6.9	8.1	12.0	12.8	12.4	8.2	9.1	
Incremental Delay (d_2), s/veh		0.0		0.0	0.0	0.2	0.0	0.3	0.0	0.1	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	
Control Delay (*d*), s/veh		11.2		8.5	6.9	8.4	12.1	13.1	12.4	8.3	9.1	
Level of Service (LOS)		B		A	A	A	B	B	B	A	A	
Approach Delay, s/veh / LOS	11.2	B		8.4	A		13.0	B		8.5	A	
Intersection Delay, s/veh / LOS	9.2						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.4	B	2.2	B	2.4	B	2.1	B
Bicycle LOS Score / LOS	0.5	A	0.9	A	0.6	A	0.9	A

HCS 2010 Two-Way Stop Control Summary Report

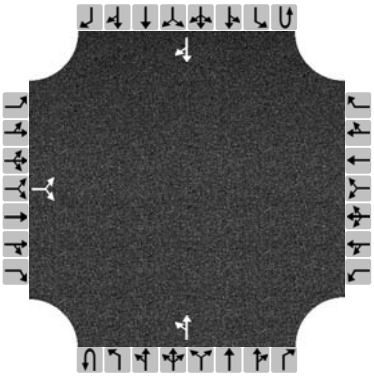
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	01/06/2015
Analysis Year	2045
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	6-Strugis/Big D Access
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Big D Truck Stop Access
North/South Street	Sturgis Road
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	0	0	0	0	1	0	0	0	1	0
Configuration			LR							LT						TR
Volume (veh/h)		5		55						85	410				485	5
Percent Heavy Vehicles		12		12						12						
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)			68							563						
Capacity			452							1008						
v/c Ratio			0.15							0.56						
95% Queue Length			0.5							0.3						
Control Delay (s/veh)			14.4							9.0						
Level of Service (LOS)			B							A						
Approach Delay (s/veh)	14.4								2.5							
Approach LOS	B								A							

HCS 2010 Two-Way Stop Control Summary Report

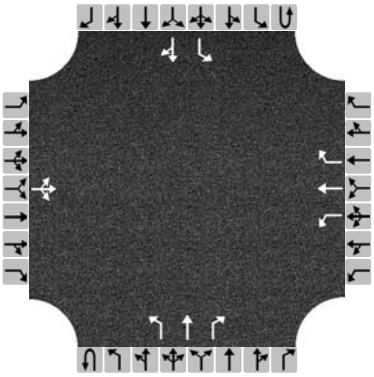
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	01/06/2016
Analysis Year	2045
Time Analyzed	AM
Intersection Orientation	North-South
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	7-Elk Creek Road/Sturgis
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	Sturgis Road
Peak Hour Factor	0.92
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		1	1	1	0	1	1	1	0	1	1	0
Configuration			LTR			L	T	R		L	T	R		L		TR
Volume (veh/h)		5	5	5		45	5	320		5	170	45		410	125	5
Percent Heavy Vehicles		12	12	12		12	12	12		12				12		
Proportion Time Blocked																
Right Turn Channelized	No				Yes				Yes				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)			15			49	5	348		5				446		
Capacity			114			105	113	832		1382				1331		
v/c Ratio			0.13			0.47	0.04	0.42		0.00				0.34		
95% Queue Length			0.4			2.0	0.1	2.1		0.0				1.5		
Control Delay (s/veh)			41.2			66.2	38.4	12.4		7.6				9.1		
Level of Service (LOS)			E			F	E	B		A				A		
Approach Delay (s/veh)	41.2				19.3				0.2				6.9			
Approach LOS	E				C				A				A			

HCS 2010 Two-Way Stop Control Summary Report

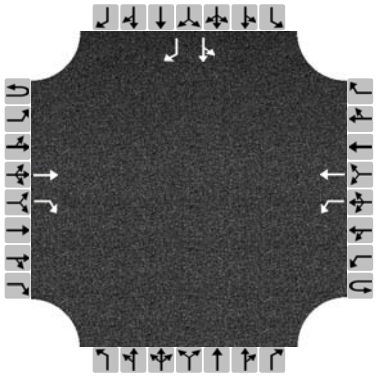
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	01/06/2016
Analysis Year	2045
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	8-Elk Creek Road/EB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	EB Ramps
Peak Hour Factor	0.92
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	1	0	1	1	0		0	0	0		0	1	1
Configuration			T	R		L	T							LT		R
Volume (veh/h)			190	270		220	340							25	5	30
Percent Heavy Vehicles						14								14	14	14
Proportion Time Blocked																
Right Turn Channelized	Yes				No				No				Yes			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						239								32		33
Capacity						1306								175		355
v/c Ratio						0.18								0.18		0.09
95% Queue Length						0.7								0.6		0.3
Control Delay (s/veh)						8.4								30.2		16.2
Level of Service (LOS)						A								D		C
Approach Delay (s/veh)					3.3								22.8			
Approach LOS					A								C			

HCS 2010 Two-Way Stop Control Summary Report

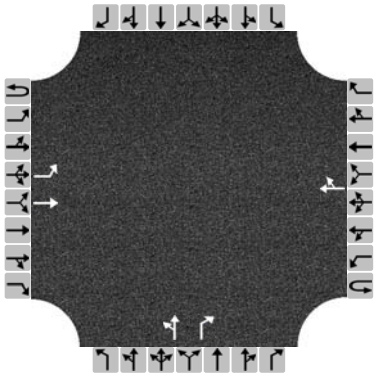
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	01/06/2016
Analysis Year	2045
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	9-Elk Creek Rd/WB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	WB Ramps
Peak Hour Factor	0.92
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	1	1	0	0	0	1	0		0	1	1		0	0	0
Configuration		L	T					TR		LT		R				
Volume (veh/h)		85	130				430	85		130	5	45				
Percent Heavy Vehicles		14								14	14	14				
Proportion Time Blocked																
Right Turn Channelized	No				No				Yes				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		92								146		49				
Capacity		963								320		881				
v/c Ratio		0.10								0.46		0.06				
95% Queue Length		0.3								2.3		0.2				
Control Delay (s/veh)		9.1								25.4		9.3				
Level of Service (LOS)		A								D		A				
Approach Delay (s/veh)	3.6								20.7							
Approach LOS	A								C							

HCS 2010 Two-Way Stop Control Summary Report

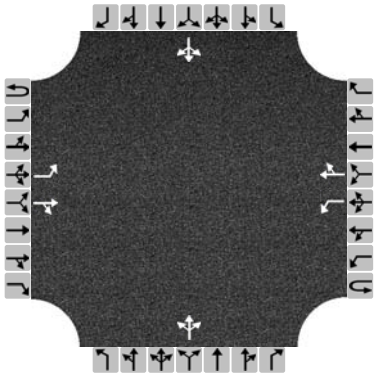
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	01/06/2016
Analysis Year	2045
Time Analyzed	AM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	10-Elk Creek/Sidney Stage
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	Sidney Stage Road
Peak Hour Factor	0.92
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	1	1	0	0	1	1	0		0	1	0		0	1	0
Configuration		L		TR		L		TR			LTR				LTR	
Volume (veh/h)		10	155	10		5	485	10		20	5	5		5	5	10
Percent Heavy Vehicles		12				12				12	12	12		12	12	12
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		11				5					32				21	
Capacity		981				1389					392				402	
v/c Ratio		0.01				0.00					0.08				0.05	
95% Queue Length		0.0				0.0					0.3				0.2	
Control Delay (s/veh)		8.7				7.6					15.0				14.5	
Level of Service (LOS)		A				A					C				B	
Approach Delay (s/veh)	0.5				0.1				15.0				14.5			
Approach LOS	A				A				C				B			

HCS 2010 Two-Way Stop Control Summary Report

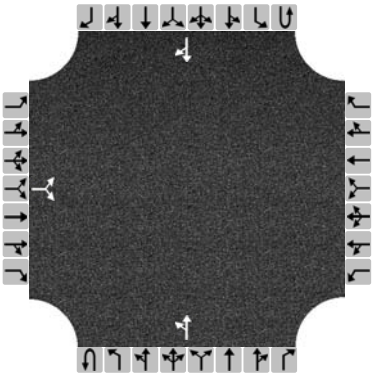
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	01/06/2015
Analysis Year	2045
Time Analyzed	PM
Intersection Orientation	North-South
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	6-Strugis/Big D Access
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Big D Truck Stop Access
North/South Street	Sturgis Road
Peak Hour Factor	0.92
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	1	0	0	0	1	0
Configuration			LR							LT						TR
Volume (veh/h)		5		50						85	285				260	5
Percent Heavy Vehicles		12		12						12						
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

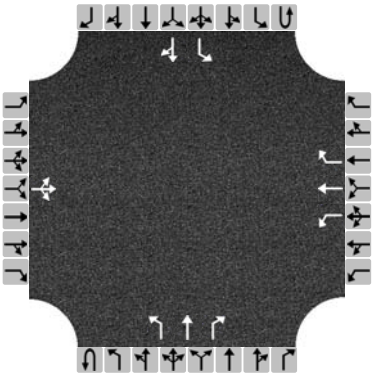
Delay, Queue Length, and Level of Service

Flow Rate (veh/h)			59							402						
Capacity			680							1267						
v/c Ratio			0.09							0.32						
95% Queue Length			0.3							0.2						
Control Delay (s/veh)			10.8							8.1						
Level of Service (LOS)			B							A						
Approach Delay (s/veh)	10.8								2.4							
Approach LOS	B								A							

HCS 2010 Two-Way Stop Control Summary Report

General Information		Site Information	
Analyst	TS	Intersection	7-Elk Creek Road/Sturgis
Agency/Co.	Felsburg Holt & Ullevig	Jurisdiction	South Dakota DOT / FHWA
Date Performed	01/06/2016	East/West Street	Elk Creek Road
Analysis Year	2045	North/South Street	Sturgis Road
Time Analyzed	PM	Peak Hour Factor	0.92
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	I-90 Exit 46 IMJR		

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		1	1	1	0	1	1	1	0	1	1	0
Configuration			LTR			L	T	R		L	T	R		L		TR
Volume (veh/h)		5	5	5		60	5	270		5	95	15		230	75	5
Percent Heavy Vehicles		12	12	12		12	12	12		12				12		
Proportion Time Blocked																
Right Turn Channelized	No				Yes				Yes				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)			15			65	5	293		5				250		
Capacity			314			289	289	925		1447				1427		
v/c Ratio			0.05			0.22	0.02	0.32		0.00				0.18		
95% Queue Length			0.1			0.8	0.1	1.4		0.0				0.6		
Control Delay (s/veh)			17.0			21.0	17.7	10.7		7.5				8.1		
Level of Service (LOS)			C			C	C	B		A				A		
Approach Delay (s/veh)	17.0				12.6				0.3				6.0			
Approach LOS	C				B				A				A			

HCS 2010 Two-Way Stop Control Summary Report

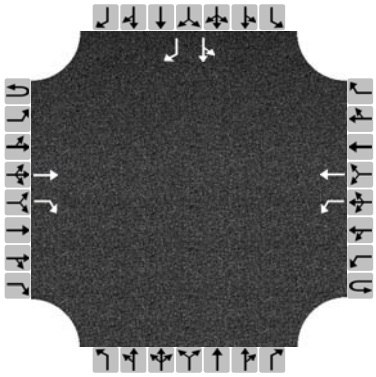
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	01/06/2016
Analysis Year	2045
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	8-Elk Creek Road/EB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	EB Ramps
Peak Hour Factor	0.92
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	1	0	1	1	0		0	0	0		0	1	1
Configuration			T	R		L	T							LT		R
Volume (veh/h)			165	85		105	275							80	5	60
Percent Heavy Vehicles						14								14	14	14
Proportion Time Blocked																
Right Turn Channelized	Yes				No				No				Yes			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)						114								92		65
Capacity						1338								326		556
v/c Ratio						0.09								0.28		0.12
95% Queue Length						0.3								1.1		0.4
Control Delay (s/veh)						7.9								20.3		12.3
Level of Service (LOS)						A								C		B
Approach Delay (s/veh)					2.2								16.8			
Approach LOS					A								C			

HCS 2010 Two-Way Stop Control Summary Report

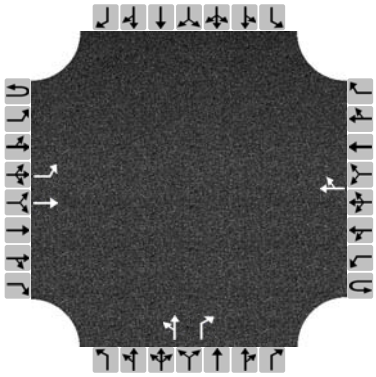
General Information

Analyst	TS
Agency/Co.	FHU
Date Performed	01/06/2016
Analysis Year	2045
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	9-Elk Creek Rd/WB Ramps
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	WB Ramps
Peak Hour Factor	0.92
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	1	1	0	0	0	1	0		0	1	1		0	0	0
Configuration		L	T					TR		LT		R				
Volume (veh/h)		40	205				195	15		185	10	225				
Percent Heavy Vehicles		14								14	14	14				
Proportion Time Blocked																
Right Turn Channelized	No				No				Yes				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		43								212		245				
Capacity		1282								489		792				
v/c Ratio		0.03								0.43		0.31				
95% Queue Length		0.1								2.2		1.3				
Control Delay (s/veh)		7.9								17.9		11.6				
Level of Service (LOS)		A								C		B				
Approach Delay (s/veh)	1.3								14.2							
Approach LOS	A								B							

HCS 2010 Two-Way Stop Control Summary Report

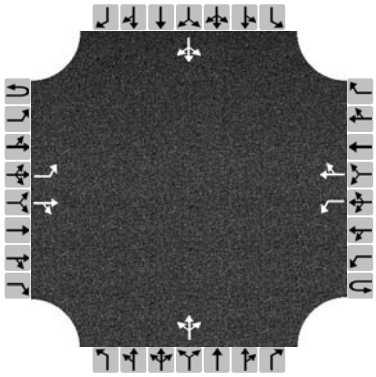
General Information

Analyst	TS
Agency/Co.	Felsburg Holt & Ullevig
Date Performed	12/15/2015
Analysis Year	2045
Time Analyzed	PM
Intersection Orientation	East-West
Project Description	I-90 Exit 46 IMJR

Site Information

Intersection	10-Elk Creek/Sidney Stage
Jurisdiction	South Dakota DOT / FHWA
East/West Street	Elk Creek Road
North/South Street	Sidney Stage Road
Peak Hour Factor	0.92
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	1	1	0	0	1	1	0		0	1	0		0	1	0
Configuration		L		TR		L		TR			LTR				LTR	
Volume (veh/h)		20	390	20		5	190	10		15	5	5		5	5	5
Percent Heavy Vehicles		12				12				12	12	12		12	12	12
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		22				5					26				15	
Capacity		1294				1108					406				413	
v/c Ratio		0.02				0.00					0.06				0.04	
95% Queue Length		0.1				0.0					0.2				0.1	
Control Delay (s/veh)		7.8				8.3					14.5				14.1	
Level of Service (LOS)		A				A					B				B	
Approach Delay (s/veh)	0.4				0.2				14.5				14.1			
Approach LOS	A				A				B				B			

ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	*TS*
Agency/Co.	*FHU*
Date Performed	*1/27/2016*
Analysis Time Period	*AM Peak Hour*

Site Information

Intersection	*#7 Elk Creek/Sturgis Road*
Jurisdiction	*SDDOT*
Analysis Year	

Project ID *Exit 46 IMJR*

East/West Street: *Elk Creek Road* | North/South Street: *Sturgis Road*

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	*5*	*5*	*5*	*45*	*5*	*320*
%Thrus Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	*5*	*170*	*45*	*410*	*125*	*5*
%Thrus Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	*LTR*		*L*	*TR*	*L*	*TR*	*L*	*TR*
PHF	*0.92*		*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
Flow Rate (veh/h)	*15*		*48*	*352*	*5*	*232*	*445*	140
% Heavy Vehicles	*12*		*12*	*12*	*12*	*12*	*12*	*12*
No. Lanes	*1*		*2*		*2*		*2*	
Geometry Group	*4b*		*5*		*5*		*5*	
Duration, T	*0.25*							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	*0.3*		*1.0*	*0.0*	*1.0*	*0.0*	*1.0*	*0.0*
Prop. Right-Turns	*0.3*		*0.0*	*1.0*	*0.0*	*0.2*	*0.0*	*0.0*
Prop. Heavy Vehicle	*0.1*		*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
hLT-adj	*0.2*	*0.2*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*
hRT-adj	*-0.6*	*-0.6*	*-0.7*	*-0.7*	*-0.7*	*-0.7*	*-0.7*	*-0.7*
hHV-adj	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*
hadj, computed	*0.1*		*0.7*	*-0.5*	*0.7*	*0.1*	*0.7*	*0.2*

Departure Headway and Service Time

hd, initial value (s)	*3.20*		*3.20*	*3.20*	*3.20*	*3.20*	*3.20*	*3.20*
x, initial	*0.01*		*0.04*	*0.31*	*0.00*	*0.21*	*0.40*	*0.12*
hd, final value (s)	*7.80*		*7.60*	*6.40*	*7.58*	*6.92*	*7.02*	*6.49*
x, final value	*0.033*		*0.101*	*0.626*	*0.011*	*0.446*	*0.867*	*0.252*
Move-up time, m (s)	*2.3*		*2.3*		*2.3*		*2.3*	
Service Time, t_s (s)	*5.5*		*5.3*	*4.1*	*5.3*	*4.6*	*4.7*	*4.2*

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	*500*		*480*	*559*	*500*	*516*	*511*	*560*
Delay (s/veh)	*10.8*		*11.2*	*19.2*	*10.4*	*15.1*	*40.1*	*11.4*
LOS	*B*		*B*	*C*	*B*	*C*	*E*	*B*
Approach: Delay (s/veh)	*10.8*		*18.3*		*15.0*		*33.2*	
LOS	*B*		*C*		*B*		*D*	
Intersection Delay (s/veh)	*24.6*							
Intersection LOS	*C*							

 HCS+™ Version 5.6 Generated: 2/4/2016 10:24 AM

ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	*TS*
Agency/Co.	*FHU*
Date Performed	*1/27/2016*
Analysis Time Period	*PM Peak Hour*

Site Information

Intersection	*#7 Elk Creek/Sturgis Road*
Jurisdiction	*SDDOT*
Analysis Year	*2045*

Project ID *Exit 46 IMJR*

East/West Street: *Elk Creek Road* | North/South Street: *Sturgis Road*

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	*5*	*5*	*5*	*60*	*5*	*270*
%Thrus Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	*5*	*95*	*15*	*230*	*75*	*5*
%Thrus Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	*LTR*		*L*	*TR*	*L*	*TR*	*L*	*TR*
PHF	*0.92*		*0.92*	*0.92*	*0.92*	*0.92*	*0.92*	*0.92*
Flow Rate (veh/h)	*15*		*65*	*298*	*5*	*119*	*249*	86
% Heavy Vehicles	*12*		*12*	*12*	*12*	*12*	*12*	*12*
No. Lanes	*1*		*2*		*2*		*2*	
Geometry Group	*4b*		*5*		*5*		*5*	
Duration, T	*0.25*							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	*0.3*		*1.0*	*0.0*	*1.0*	*0.0*	*1.0*	*0.0*
Prop. Right-Turns	*0.3*		*0.0*	*1.0*	*0.0*	*0.1*	*0.0*	*0.1*
Prop. Heavy Vehicle	*0.1*		*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
hLT-adj	*0.2*	*0.2*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*
hRT-adj	*-0.6*	*-0.6*	*-0.7*	*-0.7*	*-0.7*	*-0.7*	*-0.7*	*-0.7*
hHV-adj	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*
hadj, computed	*0.1*		*0.7*	*-0.5*	*0.7*	*0.1*	*0.7*	*0.2*

Departure Headway and Service Time

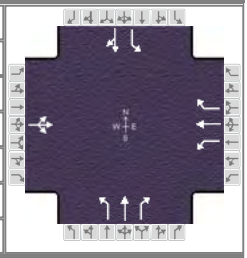
hd, initial value (s)	*3.20*		*3.20*	*3.20*	*3.20*	*3.20*	*3.20*	*3.20*
x, initial	*0.01*		*0.06*	*0.26*	*0.00*	*0.11*	*0.22*	*0.08*
hd, final value (s)	*6.41*		*6.54*	*5.36*	*6.76*	*6.16*	*6.45*	*5.90*
x, final value	*0.027*		*0.118*	*0.443*	*0.009*	*0.204*	*0.446*	*0.141*
Move-up time, m (s)	*2.3*		*2.3*		*2.3*		*2.3*	
Service Time, t_s (s)	*4.1*		*4.2*	*3.1*	*4.5*	*3.9*	*4.1*	*3.6*

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	*500*		*542*	*677*	*500*	*595*	*553*	*614*
Delay (s/veh)	*9.3*		*10.1*	*12.3*	*9.5*	*10.4*	*14.2*	*9.6*
LOS	*A*		*B*	*B*	*A*	*B*	*B*	*A*
Approach: Delay (s/veh)	*9.3*		*11.9*		*10.4*		*13.0*	
LOS	*A*		*B*		*B*		*B*	
Intersection Delay (s/veh)	*12.1*							
Intersection LOS	*B*							

HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency				Duration, h	0.25
Analyst		Analysis Date	1/27/2016	Area Type	Other
Jurisdiction		Time Period		PHF	0.92
Urban Street	Elk Creek Road	Analysis Year	2016	Analysis Period	1> 7:00
Intersection	Elk Creek Road/Sturgis…	File Name	#7 - Elk Creek-Sturgis Road AM.xus		
Project Description	Exit 46 IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	5	5	5	45	5	320	5	170	45	410	125	5

Signal Information			
Cycle, s	40.2	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4
Green	2.5	6.0	0.4	4.6	6.6	0.0	5	6	7	8
Yellow	3.0	3.0	3.0	3.0	3.0	0.0				
Red	1.0	1.0	1.0	1.0	1.0	0.0				

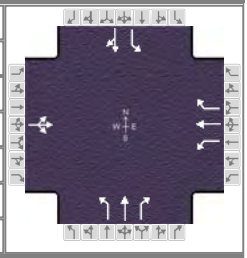
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6	3	8	7	4
Case Number		8.3	1.0	3.0	1.1	3.0	1.1	4.0
Phase Duration, s		10.0	6.5	16.5	4.4	10.6	13.0	19.3
Change Period, ($Y+R_c$), s		4.0	4.0	4.0	4.0	4.0	4.0	4.0
Max Allow Headway (*MAH*), s		3.3	3.0	3.3	3.0	3.0	3.0	3.0
Queue Clearance Time (g_s), s		2.4	3.0	11.5	2.1	6.4	11.0	4.4
Green Extension Time (g_e), s		0.3	0.0	0.6	0.0	0.4	0.0	0.1
Phase Call Probability		1.00	0.42	1.00	0.06	0.99	0.99	1.00
Max Out Probability		0.78	1.00	0.01	0.09	0.00	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		16		49	5	348	5	185	49	446	141	
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1456		1531	1607	1362	1531	1607	1362	1531	1596	
Queue Service Time (g_s), s		0.0		1.0	0.1	9.5	0.1	4.4	1.2	9.0	2.4	
Cycle Queue Clearance Time (g_c), s		0.4		1.0	0.1	9.5	0.1	4.4	1.2	9.0	2.4	
Green Ratio (*g/C*)		0.15		0.26	0.31	0.31	0.17	0.17	0.17	0.44	0.38	
Capacity (*c*), veh/h		337		454	501	425	380	266	225	585	607	
Volume-to-Capacity Ratio (*X*)		0.048		0.108	0.011	0.819	0.014	0.695	0.217	0.762	0.233	
Available Capacity (c_a), veh/h		337		587	840	712	595	1480	1254	585	607	
Back of Queue (*Q*), veh/ln (50 th percentile)		0.1		0.2	0.0	2.1	0.0	1.3	0.3	2.5	0.5	
Queue Storage Ratio (*RQ*) (50 th percentile)		0.00		0.07	0.00	0.58	0.00	0.00	0.04	0.35	0.00	
Uniform Delay (d_1), s/veh		14.7		11.4	9.5	12.8	13.7	15.8	14.5	9.8	8.5	
Incremental Delay (d_2), s/veh		0.0		0.0	0.0	1.5	0.0	1.2	0.2	5.3	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	
Control Delay (*d*), s/veh		14.7		11.4	9.5	14.3	13.8	17.0	14.7	15.1	8.5	
Level of Service (LOS)		B		B	A	B	B	B	B	B	A	
Approach Delay, s/veh / LOS	14.7	B		13.9	B		16.5	B		13.5	B	
Intersection Delay, s/veh / LOS	14.2						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.4	B	2.2	B	2.4	B	2.1	B
Bicycle LOS Score / LOS	0.5	A	1.2	A	0.9	A	1.5	A

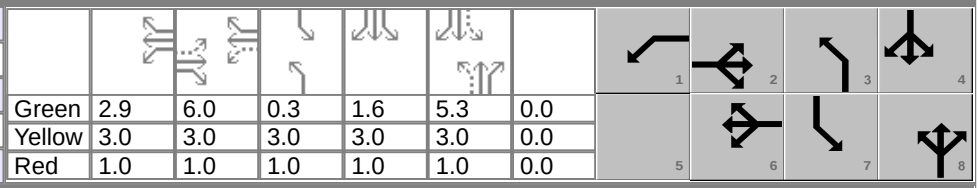
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency				Duration, h	0.25
Analyst		Analysis Date	1/27/2016	Area Type	Other
Jurisdiction		Time Period		PHF	0.92
Urban Street	Elk Creek Road	Analysis Year	2016	Analysis Period	1> 7:00
Intersection	Elk Creek Road/Sturgis…	File Name	#7 - Elk Creek-Sturgis Road PM.xus		
Project Description	Exit 46 IMJR				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	5	5	5	60	5	270	5	95	15	230	75	5

Signal Information			
Cycle, s	36.1	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	2.9	6.0	0.3	1.6	5.3	0.0
Yellow	3.0	3.0	3.0	3.0	3.0	0.0
Red	1.0	1.0	1.0	1.0	1.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6	3	8	7	4
Case Number		8.3	1.0	3.0	1.1	3.0	1.1	4.0
Phase Duration, s		10.0	6.9	16.9	4.3	9.3	9.9	14.9
Change Period, ($Y+R_c$), s		4.0	4.0	4.0	4.0	4.0	4.0	4.0
Max Allow Headway (*MAH*), s		3.3	3.0	3.3	3.0	3.0	3.0	3.0
Queue Clearance Time (g_s), s		2.3	3.1	8.4	2.1	4.1	6.5	3.5
Green Extension Time (g_e), s		0.3	0.0	0.4	0.0	0.0	0.0	0.1
Phase Call Probability		1.00	0.48	1.00	0.05	0.88	0.92	0.99
Max Out Probability		0.74	1.00	0.08	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		16		65	5	293	5	103	16	250	87	
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1456		1531	1607	1362	1531	1607	1362	1531	1589	
Queue Service Time (g_s), s		0.0		1.1	0.1	6.4	0.1	2.1	0.4	4.5	1.5	
Cycle Queue Clearance Time (g_c), s		0.3		1.1	0.1	6.4	0.1	2.1	0.4	4.5	1.5	
Green Ratio (*g/C*)		0.17		0.30	0.36	0.36	0.15	0.15	0.15	0.37	0.30	
Capacity (*c*), veh/h		375		522	574	486	386	234	198	554	479	
Volume-to-Capacity Ratio (*X*)		0.043		0.125	0.009	0.604	0.014	0.441	0.082	0.452	0.181	
Available Capacity (c_a), veh/h		375		654	668	566	627	267	227	556	479	
Back of Queue (*Q*), veh/ln (50 th percentile)		0.1		0.2	0.0	1.2	0.0	0.6	0.1	0.9	0.3	
Queue Storage Ratio (*RQ*) (50 th percentile)		0.00		0.07	0.00	0.32	0.00	0.00	0.01	0.12	0.00	
Uniform Delay (d_1), s/veh		12.7		9.3	7.5	9.5	12.9	14.1	13.3	9.0	9.3	
Incremental Delay (d_2), s/veh		0.0		0.0	0.0	0.6	0.0	0.5	0.1	0.2	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	
Control Delay (*d*), s/veh		12.7		9.3	7.5	10.1	12.9	14.6	13.4	9.2	9.4	
Level of Service (LOS)		B		A	A	B	B	B	B	A	A	
Approach Delay, s/veh / LOS	12.7	B		10.0	A		14.3	B		9.2	A	
Intersection Delay, s/veh / LOS	10.4						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.4	B	2.2	B	2.4	B	2.1	B
Bicycle LOS Score / LOS	0.5	A	1.1	A	0.7	A	1.0	A