



# I-29 Exit 77 (41<sup>st</sup> St.) Interchange Modification Justification Report

Project PL 0100(84) , PCN 05MH

Project IM 0293(106)77P, PCN 03RA

*Sioux Falls, SD*

*October 19, 2017*



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Sioux Falls, South Dakota  
October 19, 2017

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## Abbreviations

<b>AASHTO</b>	American Association of State Highway Transportation Officials
<b>CATEX</b>	Categorical Exclusion
<b>CMF</b>	Crash Modification Factor
<b>CRM</b>	Critical Rate Method
<b>FHWA</b>	Federal Highway Administration
<b>HCS</b>	Highway Capacity Software
<b>HOT</b>	High Occupancy Transit
<b>HOV</b>	High Occupancy Vehicle
<b>HSM</b>	Highway Safety Manual
<b>IMJR</b>	Interchange Modification Justification Report
<b>LOS</b>	Level of Service
<b>MRM</b>	Mileage Reference Marker
<b>MPO</b>	Metropolitan Planning Organization
<b>MSA</b>	Metropolitan Statistical Area
<b>SDDOT</b>	South Dakota Department of Transportation
<b>STIP</b>	Statewide Transportation Improvement Program
<b>TAZ</b>	Traffic Analysis Zone
<b>TIP</b>	Transportation Improvement Program

## EXECUTIVE SUMMARY

This Interchange Modification Justification Report (IMJR) report provides technical analysis related to proposed changes to the existing 41<sup>st</sup> Street interchange (Exit 77) on Interstate 29 in Sioux Falls, SD.

The proposed action is a reconfiguration of the existing 41<sup>st</sup> Street interchange on Interstate 29 in Sioux Falls, SD. The action is proposed to bring the existing interchange up to current design standards and provide appropriate operational capacity for future traffic demand. No adverse impacts to the Interstate highway system are forecast due to the proposed change.

The Federal policy considerations and requirements have been addressed in the Recommendations section of this report and summary responses to the eight requirements are provided below.

The proposed change is a reconfiguration of an existing interchange and improvements to the existing crossroad facility. The changes will correct current interchange and crossroad design deficiencies including short access spacing to an adjacent intersection, low peak hour ramp terminal level of service, and low peak hour crossroad level of service. The proposed change does not result in any new access points on the Interstate Highway System.

The concept alternatives involve changes to the geometric design of an existing interchange and changes to the crossroad arterial street to satisfy current design standards and meet the transportation needs in the study area. Mass transit reaches a limited market in South Dakota and HOV facilities are currently not in use because they have not been shown to be economically feasible. Neither mass transit nor HOV facilities will correct design deficiencies or provide sufficient relief to future travel demand within the study planning horizon.

The operational and safety analysis contained in this study shows that the proposed build alternatives are not expected to adversely affect the safety or efficiency of the Interstate system. The build alternatives are also expected to improve access management on the crossroad in the vicinity of the interchange.

The conceptual signing plan for the diverging diamond interchange alternative is shown in **Appendix 11**.

The proposed access is a reconfiguration of an existing interchange with full access to an arterial city street and includes all movements. The conceptual drawings have been prepared using current standards and further design using current standards is anticipated and will receive additional reviews throughout the next steps of the design.

The proposal is the result of land use and transportation plans prepared within the MPO process, including the Sioux Falls MPO Long Range Transportation Plan. The 2017-2020 STIP includes this Project in the Developmental STIP portion in the 2021-2023 funding and construction years.

Analysis techniques included evaluation of operational capacity using Highway Capacity Manual 2010 techniques via HCS 2010. Highway Safety Manual techniques were used to the extent possible in this report. Other techniques and reference materials are detailed in a Methods and Assumptions document prepared for this study and signed by City of Sioux Falls, South Dakota Department of Transportation, and Federal Highway Administration participants in July, 2014 and modified as necessary throughout the study. The Methods and Assumptions document is included in the **Appendix 2**.

# 1. INTRODUCTION

## 1.1 Background

SDDOT, the City of Sioux Falls, the Sioux Falls Metropolitan Planning Organization, and the Federal Highway Administration have conducted a study to evaluate the design, operations, policy and funding implications of modifying the 41<sup>st</sup> Street interchange (Exit 77) on I-29 in Sioux Falls, SD. The existing interchange serves an urban arterial corridor that has carried the largest traffic volumes in the state of South Dakota, including a significant amount of commuting traffic. This Interchange Modification Justification Report is being prepared in conjunction with applicable environmental reviews and analyses, and will provide traffic analysis for the selection of a preferred alternative.

## 1.2 Purpose

The *2010 Decennial Interstate Corridor Study* identified the I-29 Exit 77 interchange as a top priority project needing near-term improvement. The study cited safety concerns, geometric deficiencies at the interchange, and low peak hour level of service and recommended a DDI interchange as the most feasible interchange improvement alternative.

The *I-29 Exit 77 (41<sup>st</sup> Street) Crossroad Corridor Study (2012)* analyzed the interchange area and the crossroad arterial street in more detail and recommended a package of arterial street improvements and conversion of the interchange to a DDI configuration. The study again cited safety concerns, geometric deficiencies and level of service in determining the need for interchange improvements.

This study continues the previous planning work and provides the necessary analysis for consideration by SDDOT and FHWA.

## 1.3 Project Location

The subject interchange is at mileage reference marker 77 on Interstate 29, in southwest Sioux Falls, SD. This location is within the Sioux Falls MPO and also within the developed Sioux Falls urban area. The adjacent interchanges on I-29 are 26<sup>th</sup> Street (Exit 78) and the I-229 system interchange (Exit 75). Interchange spacing is approximately .85 miles to 26<sup>th</sup> Street from the subject interchange and about 1.78 miles to Interstate 229.

There are several local roadways in the vicinity of the interchange. The crossroad, 41<sup>st</sup> Street, is a five-lane urban street west of the interchange and a seven-lane urban street east of the interchange. 41<sup>st</sup> Street is intersected by Marion Road approximately ½ mile west of I-29. Two collector roadways, Valley View Drive/Holbrook Avenue and Terry Avenue intersect 41<sup>st</sup> Street approximately 1 mile and ¼ mile west of I-29, respectively. Madelyn Lane/Gateway Boulevard and Meadow Avenue are the closest intersecting local streets west of I-29 at 800' and 400', respectively from the I-29 southbound ramp terminal. The nearest intersection on 41<sup>st</sup> Street east of I-29 is Carolyn Avenue, approximately 230' east of the I-29 northbound ramp terminal. Empire Place, Shirley Avenue and Louise Avenue intersect 41<sup>st</sup> Street approximately 0.18 mile, 0.29, and 0.46 miles east of I-29, respectively. All these intersecting streets are controlled by traffic signals except the 41<sup>st</sup>/Carolyn intersection, which is controlled by a stop sign on the

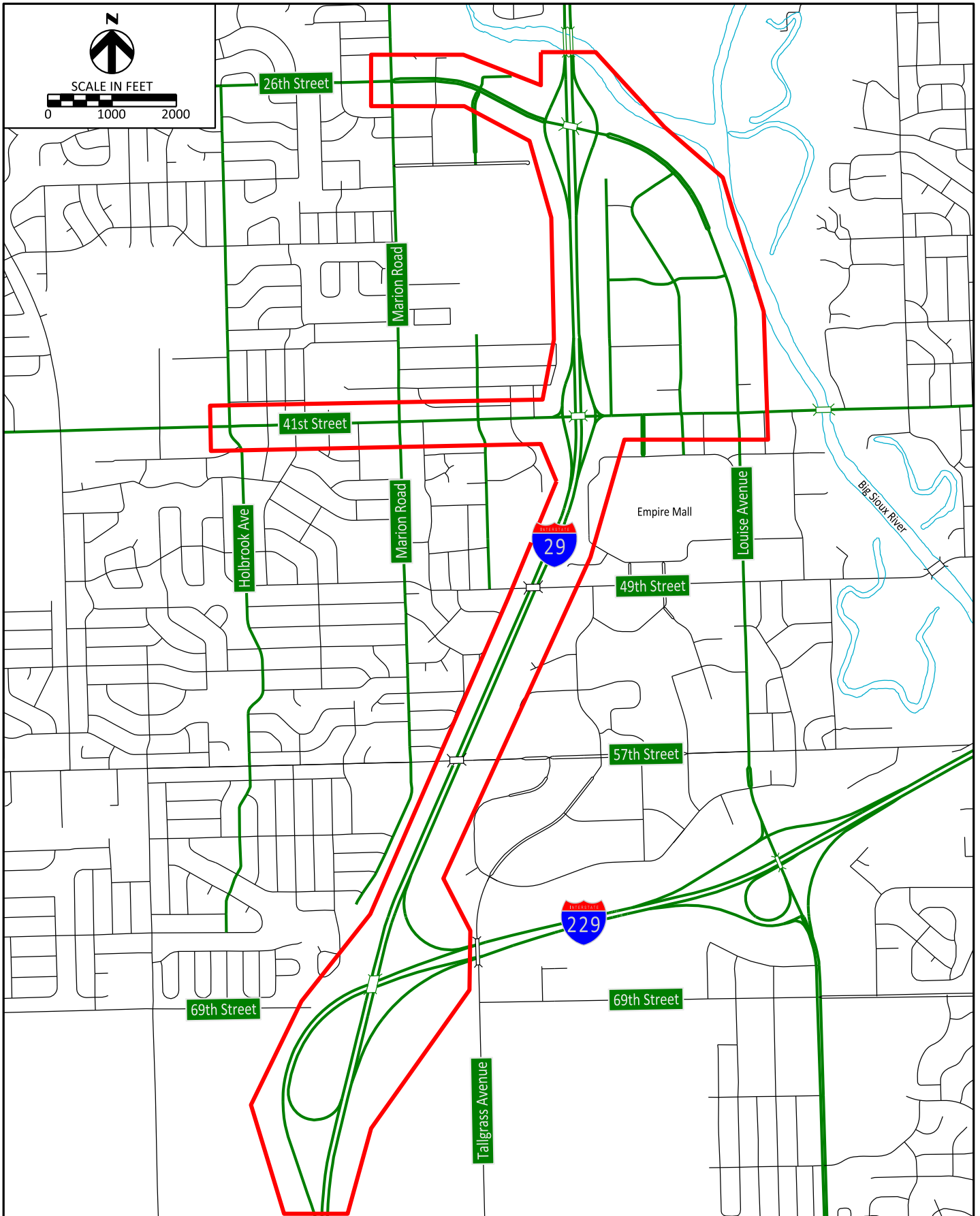
Carolyn Avenue approach. Improvements within the study area, including projects undertaken by the City of Sioux Falls, are planned to provide additional capacity along 41<sup>st</sup> Street. A solution to congestion issues in the interchange area, however, may require modification of the interchange itself.

Other local streets intersect I-29 at the adjacent 26<sup>th</sup> Street interchange or lie within the street network in the vicinity of the subject interchange. The study area, therefore, has been defined as Interstate 29, from MRM 75 to MRM 79, including Exits 75, 77, and 78, 41<sup>st</sup> Street from Valley View Road/Holbrook Avenue to just west of Louise Avenue, and portions of 26<sup>th</sup> that are part of the local street network served by the subject interchange and the adjoining interchanges. The study area is shown in **Figure 1**.

#### 1.4 Logical Termini

- West limits – Marion Road was determined to be the westerly logical termini for the interchange study. This is mainly due to the need to widen 41<sup>st</sup> Street to 3 through lanes in each direction from I-29 to Marion Road to accommodate future traffic volumes. Widening of the Marion Road/41<sup>st</sup> Street intersection is necessary to add turn lanes for adequate intersection capacity.
- East limits – The City intends to expand the Shirley Avenue/41<sup>st</sup> Street intersection and realign the extension of Shirley Avenue south of 41<sup>st</sup> Street. This will become the main entrance and exit to the Empire Mall from 41<sup>st</sup> Street. The relocation of Sioux Falls Ford dealership along the south side of 41<sup>st</sup> Street west of Shirley Avenue allows for widening of 41<sup>st</sup> Street and adding raised medians and a right turn lane. Property is not feasibly available east of Shirley Avenue for expansion of 41<sup>st</sup> Street. Therefore, Shirley Avenue is a reasonable east logical terminus for this project.
- 41<sup>st</sup> Street/Louise Avenue intersection – Although existing and future LOS at this intersection is below acceptable criteria for peak traffic periods, existing developments adjacent to the intersection limit the feasible opportunities for improvement of the intersection. Therefore, this intersection is not within in the logical termini for the I-29 Exit 77 (41<sup>st</sup> Street) interchange study. Traffic impacts at the 41<sup>st</sup> Street/Louise Avenue intersection resulting from capacity improvements at the I-29 Exit 77 (41<sup>st</sup> Street) interchange and along 41<sup>st</sup> Street have been closely evaluated in the traffic assessment. Potential improvement options for the 41<sup>st</sup> Street/Louise Avenue intersection are included in a separate, subsequent Louise Avenue corridor project between 34<sup>th</sup> Street and 49<sup>th</sup> Street.
- Marion Road limits – Marion Road has been upgraded to 2 through lanes in each direction from 39<sup>th</sup> Street to the north. Therefore, the north logical terminus for Marion Road begins at 39<sup>th</sup> Street. Widening of Marion Road extends through the 41<sup>st</sup> Street intersection so that 2 through lanes and dual left turn lanes are provided for needed capacity. The south logical terminus for Marion Road is the distance needed to transition to the existing 3 lane section. Allowance is made for the potential future expansion of Marion Road to a 5 lane section south of 41<sup>st</sup> Street.

For further background on the logical termini for the project, see the Purpose and Need Memo included in Appendix 1.



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 Date: 6/30/16  
 Chkd By: J.Unruh  
 Date: 6/30/16  
 Revision:



**Study Area**

I-29 Exit 77 (41st Street) Interchange Modification Study  
 Sioux Falls, SD

Figure

**1**



## 2. METHODOLOGY

Preparation of this report included the following work tasks:

- Data gathering
- Review previous Interstate studies and coordinate with preparation of the environmental studies, including feasible alternatives and the recommended alternative.
- Determine existing and future operational characteristics of Interstate and local street facilities.
- Prepare a deliverable report.

Traffic forecasts were prepared using output from the regional travel demand model maintained by the City of Sioux Falls and the Sioux Falls MPO. Traffic operations were analyzed using the Highway Capacity Manual techniques using HCS 2010 software modules and Highway Safety Manual techniques.

This IMJR document is organized in accordance with section 2.5.2 of FHWA's *Interstate System Access Information Guide*, August 2010.

Additional details on methodology can be found in the Methods and Assumptions agreement prepared for this project and included in the **Appendix 2**.

## **3. EXISTING CONDITIONS**

### **3.1 Demographics**

The Sioux Falls metropolitan area enjoys a robust economy and sustained population growth. During the period 1980 – 2000 the population grew at a steady rate of between 2% and 3% per year. Even in the face of the recent recession, the population continued to grow at an annual rate of 1%-2% per year and the 2010 Census shows the city with a population of 153,888, while the Metropolitan Statistical Area (MSA) had a population of 228,261 and the market area had a population of 1,043,450. (Market area is a term used in economics and human geography describing the area surrounding a central place, from which people are attracted to use the place's goods or services.)

Generally, employment for the Sioux Falls area has grown at approximately the same rate as the population and unemployment is currently near 2% in Sioux Falls, compared with a statewide rate of 2.7%, regional rate of 3.0%, and a national unemployment rate of 5.0%.

### **3.2 Existing Land Use**

The study area is comprised mainly of commercial uses ranging from big-box retail to light industrial with a smaller presence of single family and multifamily residential uses. The study area Traffic Analysis Zones (TAZ's) currently reflect the existing population and employment inputs. The future-year TAZ's show gradual infill of uses similar to those currently existing in the study area.

The future land use plan for Sioux Falls shows continued development of the existing land uses for this portion of the urban area.

### **3.3 Existing Roadway Network**

As previously identified, the existing major roadways within the study area include:

- Interstate 29 – expanded to three lanes in each direction during this study, with auxiliary lanes between interchanges north of 41<sup>st</sup> Street
- 41<sup>st</sup> Street – 5-lane urban arterial roadway west of I-29 that transitions to a 7-lane urban roadway east of I-29
- 26<sup>th</sup> Street – 4-lane divided urban arterial roadway
- Marion Road – 5-lane urban arterial roadway north of 41<sup>st</sup> Street and 3-lane urban arterial south of 41<sup>st</sup> Street
- Louise Avenue – 5-lane urban arterial roadway
- Valley View Drive/Holbrook Avenue – 2-lane urban collector roadway
- Terry Avenue – 2-lane urban collector roadway
- Lorraine Drive – 4-lane divided urban collector roadway
- Carolyn Avenue – 2-lane urban local roadway
- West Empire Place – 4-lane divided private roadway
- Shirley Avenue – 3-lane urban collector roadway
- 34<sup>th</sup> Street – 2-lane urban collector roadway
- 38<sup>th</sup> Street – 2-lane urban local roadway

### **3.4 Alternative Travel Modes**

Travel within the study area is primarily by automobile. Pedestrian activity is relatively high along the 41<sup>st</sup> Street corridor with City counts showing a peak range of 55 to 128 pedestrians per day at various locations for the years from 2003 to 2010. Pedestrian counts were also taken in March 2016 in conjunction with the traffic counts. Due to the time of year, the number of pedestrians was not as high as the previous peak levels from the City's 2003 to 2010 data. However, there were still a significant number of pedestrians along the corridor. One reason for the relatively high pedestrian use within the corridor is that the area west of I-29 contains multiple disadvantaged, handicapped, and assisted living facilities which generate pedestrians going to the Empire Mall and other commercial areas. The regional recreational trail system runs along the Skunk Creek/Big Sioux River channel on the north and east boundaries of the study area. The area is currently served by municipal transit routes 10 and 11, operating on portions of 41<sup>st</sup> Street, Marion Road, Shirley Avenue, and Louise Avenue. Buses operate on 30 minute headways during peak demand.

### **3.5 Interchanges**

Interchanges within the study area include:

- I-29/I-229 (Exit 75) – this system interchange is currently a trumpet configuration.
- I-29/41<sup>st</sup> Street (Exit 77) – the subject interchange is a diamond configuration. Both ramp termini are controlled by traffic signals.
- I-29/26<sup>th</sup> Street (Exit 78) – this service interchange is currently a diamond configuration with both ramp termini controlled by traffic signals.

Aerial photos of the existing interchanges have been included in the **Appendix 12**.

### **3.6 Existing Data**

New peak hour weekday and Saturday turning movement counts were gathered from March 9 to 13, 2016 for study area analysis intersections. Additional arterial roadway study data were available from the participating agencies, including traffic counts, crash data, and raw travel demand model output. The available data was supplemented with Interstate system counts, vehicle classifications, and traffic observations. The data is recent and of high quality.

### **3.7 Operational Performance**

Operation performance of highways is evaluated in terms of the quality of service, which describes how well a transportation facility operates from the traveler's perspective. Quality of service is usually measured with "Level of Service", a letter grade similar to those used in school. Level of service A refers to uncongested traffic conditions, with levels of service B through E describing increasingly more congested conditions and level of service F describing the highest congestion or saturation. Level of service is determined in different ways for different roadway facilities, with Interstate highway facilities evaluated in terms of vehicle density, urban intersections evaluated in terms of vehicle delay, and other facilities evaluated using other measures of roadway dynamics. All quality of service is determined using techniques developed for the Highway Capacity Manual (HCM), published by the Transportation Research Board.

The existing study area roadways were evaluated using the HCM methodologies for Interstate highways and urban streets. SDDOT has established a minimum level of service standard of “C” for interstate facilities, including ramp terminal intersections. The City of Sioux Falls has established a minimum level of service standard of “D” for arterial signalized intersections. Interstate 29 operates at acceptable levels of service under existing conditions. The arterial street system, however, experiences peak hour congestion at the following locations:

- 26<sup>th</sup> Street/Marion Rd. (AM peak)
- 26<sup>th</sup> Street/I-29 SB (Saturday peak)
- 26<sup>th</sup> Street/I-29 NB (AM peak)
- 41<sup>st</sup> Street/Louise Ave. (AM, PM, and Saturday peaks)

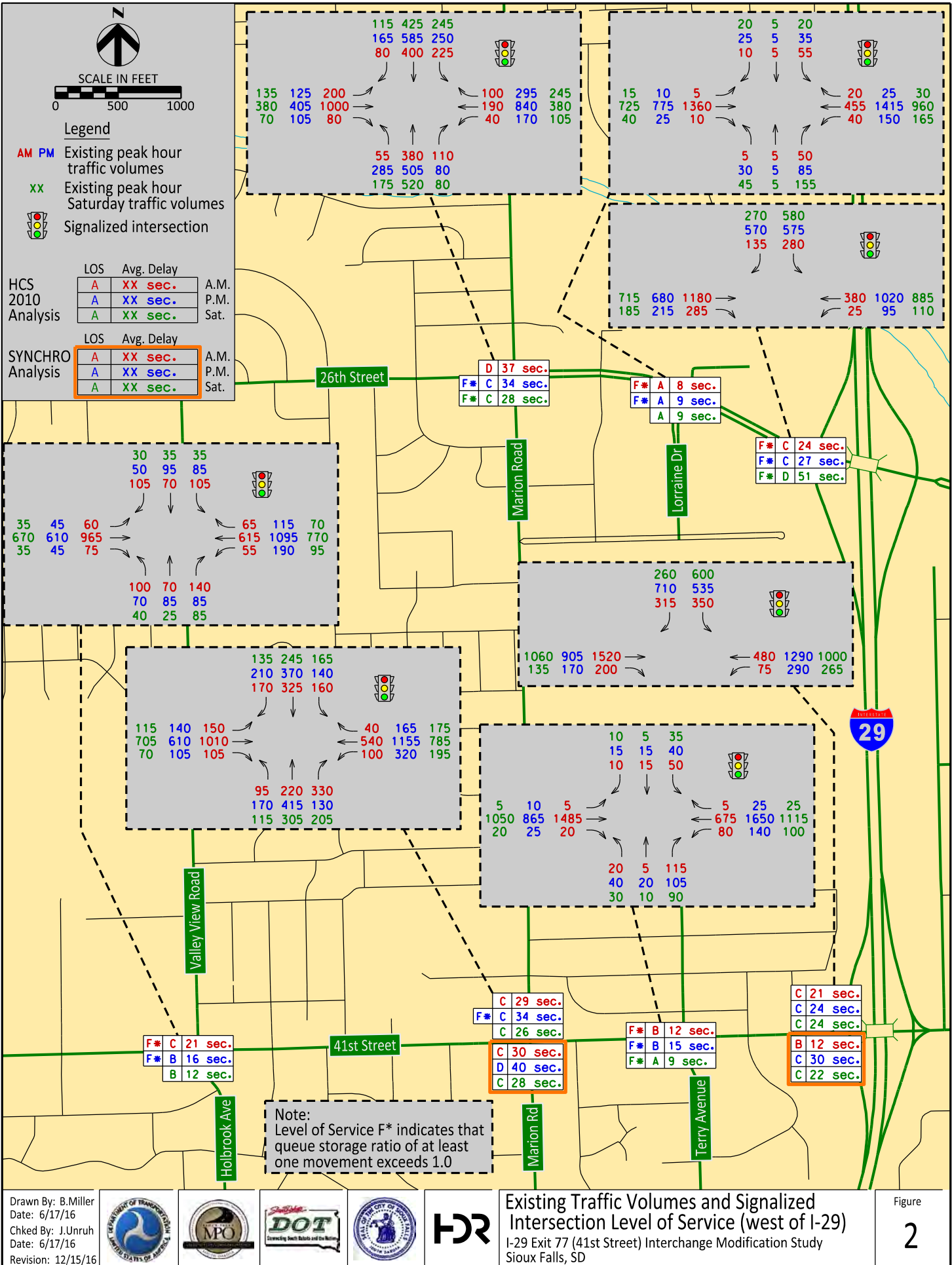
Certain movements experienced low levels of service or queues that exceeded the length of the available storage during particular peak hours. The eastbound left turn at 41<sup>st</sup> Street/I-29 NB is an example of this characteristic, with the left turn queue extending through the 41<sup>st</sup> Street/I-29 SB intersection during the AM peak.

Multimodal level of service varies widely throughout the 26<sup>th</sup> Street and 41<sup>st</sup> Street corridors. The lowest levels of service are related to locations with the absence of specific facilities for pedestrians and bicyclists in these corridors.

There are several stop-controlled intersections in the study area that are anticipated to play a role in future improvement alternatives. Those intersections are listed below along with peak hour stopped-approach level of service information:

- 38<sup>th</sup> Street/Carolyn Avenue: currently an uncontrolled intersection – no level of service analysis available.
- 38<sup>th</sup> Street/Shirley Avenue: AM-B, PM-D, SAT-D
- 41<sup>st</sup> Street/Carolyn Avenue: AM-C, PM-F, SAT-F

Daily traffic volumes in the study area are shown in **Figures 2 and 3**. Peak hour traffic volumes and levels of service are summarized in **Figures 2 through 5**. Supporting analysis printouts are provided in the **Appendix 3**.

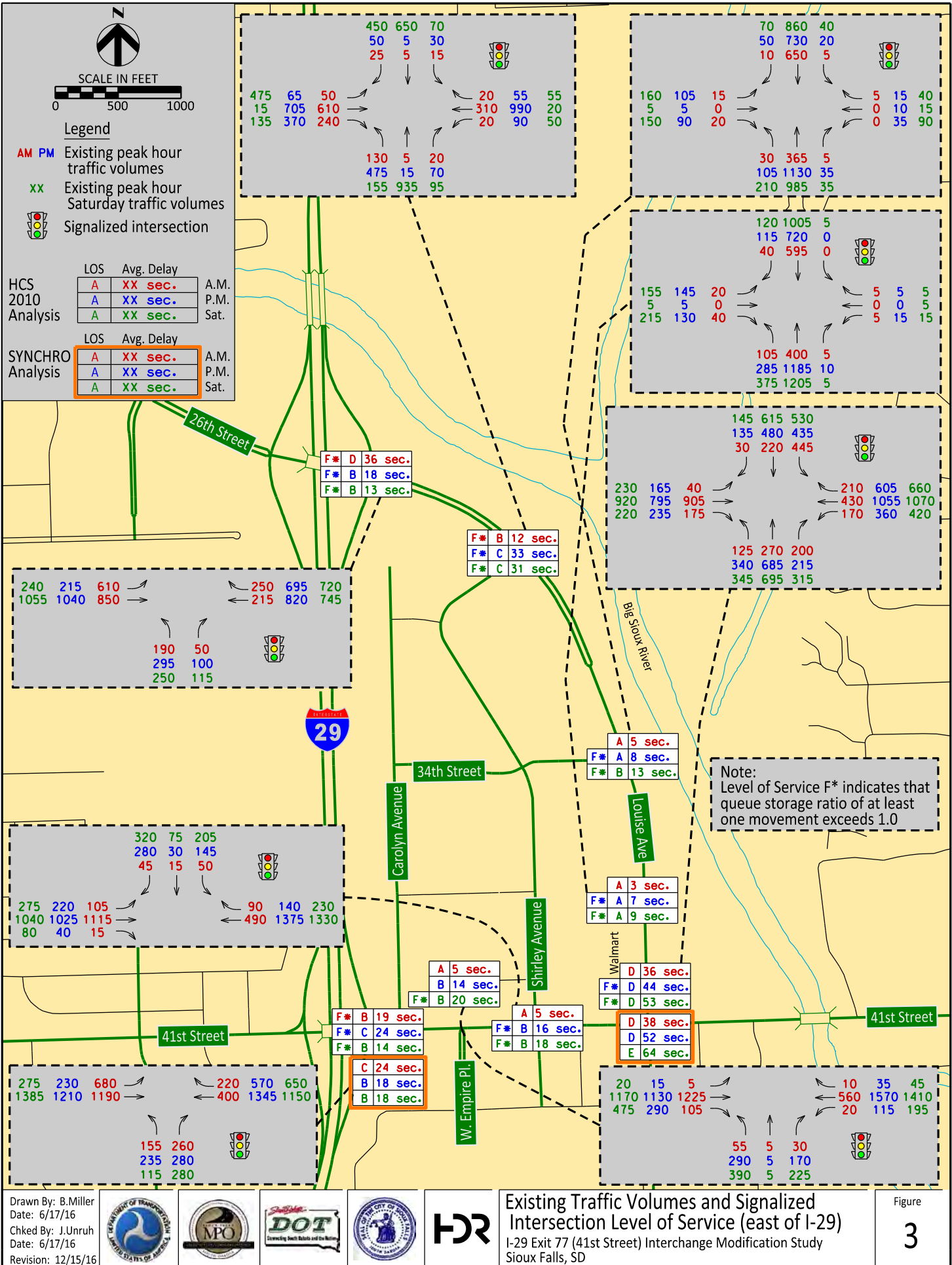


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**Existing Traffic Volumes and Signalized Intersection Level of Service (west of I-29)**  
 I-29 Exit 77 (41st Street) Interchange Modification Study  
 Sioux Falls, SD

Figure  
**2**



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 Date: 6/17/16  
 Revision: 12/15/16



**Existing Traffic Volumes and Signalized Intersection Level of Service (east of I-29)**  
 I-29 Exit 77 (41st Street) Interchange Modification Study  
 Sioux Falls, SD

Figure  
**3**



SCALE IN FEET  
0 500 1000

	AM	PM	Sat.	
	EB C	C B	C B	Auto Level of Service
	WB B	B B	B B	
	EB C	C C	C C	Pedestrian Level of Service
	WB C	C C	C C	
	EB C	C C	C C	Bicycle Level of Service
	WB C	C C	C C	
	EB A	A A	A A	Transit Level of Service
	WB A	A A	A A	

EB = Eastbound WB = Westbound Sat. = Saturday

	AM	PM	Sat.	
	EB F	D F	C D	
	WB D	D D	D D	
	EB D	D D	D D	
	WB C	D D	D D	
	EB D	D C	C C	
	WB C	C C	C C	
	EB C	A A	A A	
	WB A	B B	B B	

	AM	PM	Sat.	
	EB B	E C	C C	
	WB D	C C	C C	
	EB D	D C	D C	
	WB C	C C	C C	
	EB D	D D	D D	
	WB C	C D	D D	
	EB A	B A	A A	
	WB A	A A	A A	

	AM	PM	Sat.	
	EB C	D D	D D	
	WB C	C C	B B	
	EB C	C C	C C	
	WB D	D D	D D	
	EB D	C C	C C	
	WB C	C D	D D	
	EB A	A A	A A	
	WB A	A A	A A	

	AM	PM	Sat.	
	EB E	F E	E E	
	WB F	E E	E E	
	EB D	D D	D D	
	WB D	D D	D D	
	EB D	C D	D D	
	WB C	D D	D D	
	EB B	B B	B B	
	WB B	B B	B B	

	AM	PM	Sat.	
	EB C	C B	B C	
	WB C	E C	C C	
	EB D	D D	D D	
	WB D	D D	D D	
	EB D	D D	D D	
	WB D	D D	D D	
	EB A	A A	A A	
	WB A	B B	A A	

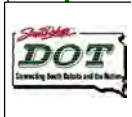
	AM	PM	Sat.	
	EB C	C C	C C	
	WB C	E E	E E	
	EB D	C C	D C	
	WB C	D D	D D	
	EB D	D D	D D	
	WB C	D D	D D	
	EB A	A A	A A	
	WB A	B B	A A	

	AM	PM	Sat.	
	EB C	D D	D D	
	WB C	C C	B B	
	EB D	D D	D D	
	WB D	D D	D D	
	EB D	D D	D D	
	WB D	D D	D D	
	EB A	A A	A A	
	WB A	A A	A A	

	AM	PM	Sat.	
	EB C	C D	D D	
	WB E	E E	D D	
	EB D	D D	D D	
	WB C	D D	D D	
	EB D	D D	D D	
	WB C	D D	D D	
	EB A	A A	A A	
	WB B	B B	A A	

	AM	PM	Sat.	
	EB F	F F	F F	
	WB C	D D	D D	
	EB D	D D	D D	
	WB C	D D	D D	
	EB D	D D	D D	
	WB D	D D	D D	
	EB A	A A	A A	
	WB A	B B	A A	

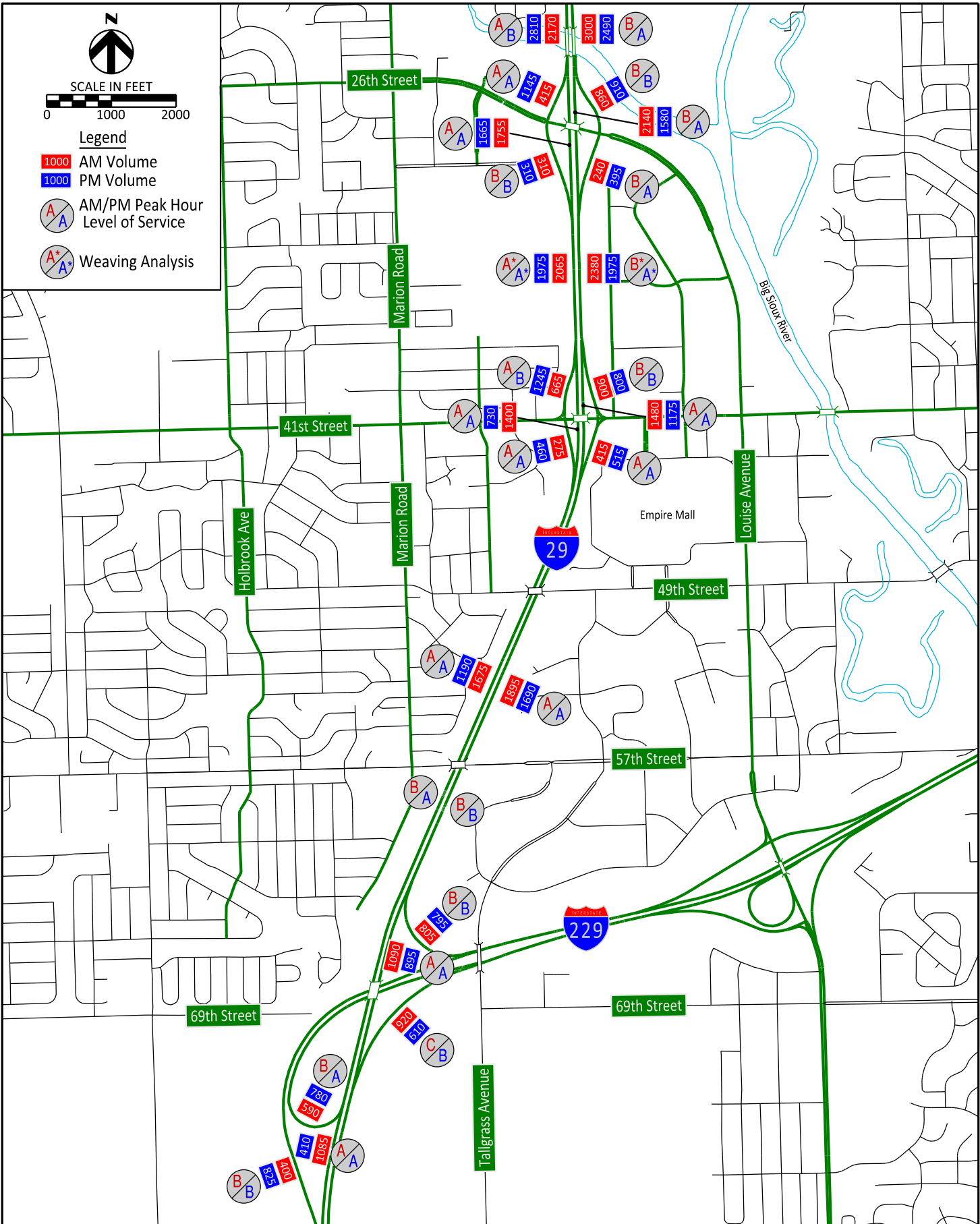
Drawn By: B. Miller  
Date: 6/17/16  
Chkd By: J. Unruh  
Date: 6/17/16  
Revision:



Existing Multimodal Peak Hour Level of Service  
I-29 Exit 77 (41st Street) Interchange Modification Study  
Sioux Falls, SD

Figure  
4





Drawn By: B. Miller  
 Date: 6/17/16  
 Chkd By: J. Unruh  
 Date: 6/17/16  
 Revision:



**Existing Peak Hour Balanced Traffic Volumes and I-29 Level of Service**  
 I-29 Exit 77 (41st Street) Interchange Modification Study  
 Sioux Falls, SD

Figure  
**5**



### 3.8 Existing Safety Conditions

An analysis of existing safety conditions was conducted, based on crash records provided by SDDOT. The analysis was conducted using the Critical Rate Method, as described in the Highway Safety Manual (HSM), published by the American Association of State Highway and Transportation Officials (AASHTO).

#### Highway Safety Manual definition:

- *Critical Rate Method (CRM) – a method in which the observed crash rate at each site is compared to a calculated critical crash rate that is unique to each site.*

Crash data for the years 2010 through 2015 were provided by SDDOT and reviewed to identify any existing crash concentrations/crash trends and develop potential crash mitigation measures. Analyses were conducted for the following roadway facilities:

- Arterial street intersections
- Arterial street segments
- Interstate mainline segments
- Interstate ramp segments

Critical crash rates were calculated for each segment or intersection and used to identify portions of the study area that displayed crash rates higher than the critical rate. Each of the above-critical locations is discussed in subsequent sections of this memorandum.

#### Segment and Intersection Crash Rates:

The study area was divided into segments representing:

- Arterial street intersections (Figures 6, 7, Table 1)
- Arterial street segments (Figures 8, 9, Table 2)
- Interstate mainline segments (Figure 10, Table 3)
- Interstate ramp segments (Figure 11, Table 4)

Mainline and ramp sections were each analyzed separately to allow calculation of representative crash rates and critical rates for each type of Interstate feature. Rate calculations included other Interstate highway sections in the Sioux Falls urban area, resulting in more robust statistical representation of crash rates.

The arterial street intersections named in the M&A document were grouped for calculation of crash rates and critical rates.

Details of the crash records for each segment and intersection are contained in the **Appendix 4**.

### Segment and Intersection Critical Crash Rates:

Critical crash rates were calculated based on the statistical populations in each spreadsheet, using the methods shown in the Highway Safety Manual (American Association of State Highway and Transportation Officials (AASHTO), 2010). Those segments and intersections that lay outside the critical rates are shown in red coloration in the last column of each spreadsheet. All the segments and intersections that lay within the critical rate are shown in green.

### Crash Trends:

Review of the crash summaries for each Interstate and arterial street section revealed a few crash trends:

- Slightly elevated incidence of single vehicle crashes on the Interstate during inclement weather.
- Rear-end crashes at arterial intersections with the highest levels of congestion.
- Angle crashes at driveways in the arterial street segments near 41<sup>st</sup> Street/Louise Ave.
- Rear-end crashes on 41<sup>st</sup> Street in the arterial street segments bounding the Interstate 29 interchange.

### Potential Mitigation Measures:

The general crash trends identified above suggest several potential strategies for reducing crash rates within the study area:

- Consider ITS-related means of communicating slippery roadway conditions to drivers and continue aggressive winter maintenance.
- Addition of high-friction surface courses on bridges, curves and weaving areas may help reduce crashes that occur during inclement weather. A section of high-friction surfacing has been installed on I-229 and may provide useful guidance about employing this technique for safety enhancement.
- Additional access management measures on 41<sup>st</sup> Street and Louise Avenue, particularly near the 41<sup>st</sup>/Louise intersection.
- Reconfiguration of the 41<sup>st</sup> Street interchange on I-29 to reduce 41<sup>st</sup> Street queues and enhance 41<sup>st</sup> Street traffic flow.

Each of the arterial intersections and Interstate segments that were identified as having crash rates outside of the critical rates are discussed in the following points.

### Arterial Intersections:

- 41<sup>st</sup> Street/Marion Road – 53% of the crashes at this intersection involved rear-end incidents, while 37% involved angle incidents. Peak hour queues and congestion may be leading to increased crash rates.
- 41<sup>st</sup> Street/I-29 SB – 78% of the crashes at this intersection involved rear-end incidents, while 17% involved angle incidents. Peak hour queues and congestion may be leading to increased crash rates.

- 41<sup>st</sup> Street/I-29 NB – 53% of the crashes at this intersection involved rear-end incidents, while 40% involved angle incidents. Peak hour queues and congestion may be leading to increased crash rates.
- 41<sup>st</sup> Street/Shirley Avenue – 63% of the crashes at this intersection involved angle incidents, while 31% involved rear-end incidents. The intersection configuration and offset of Shirley Avenue may be leading to increased crash rates. Peak hour queues and congestion may also play a role in crash incidence.
- 41<sup>st</sup> Street/Louise Avenue – 54% of the crashes at this intersection involved rear-end incidents, while 37% involved angle incidents. Peak hour queues and congestion may be leading to increased crash rates.

#### Arterial Street Segments:

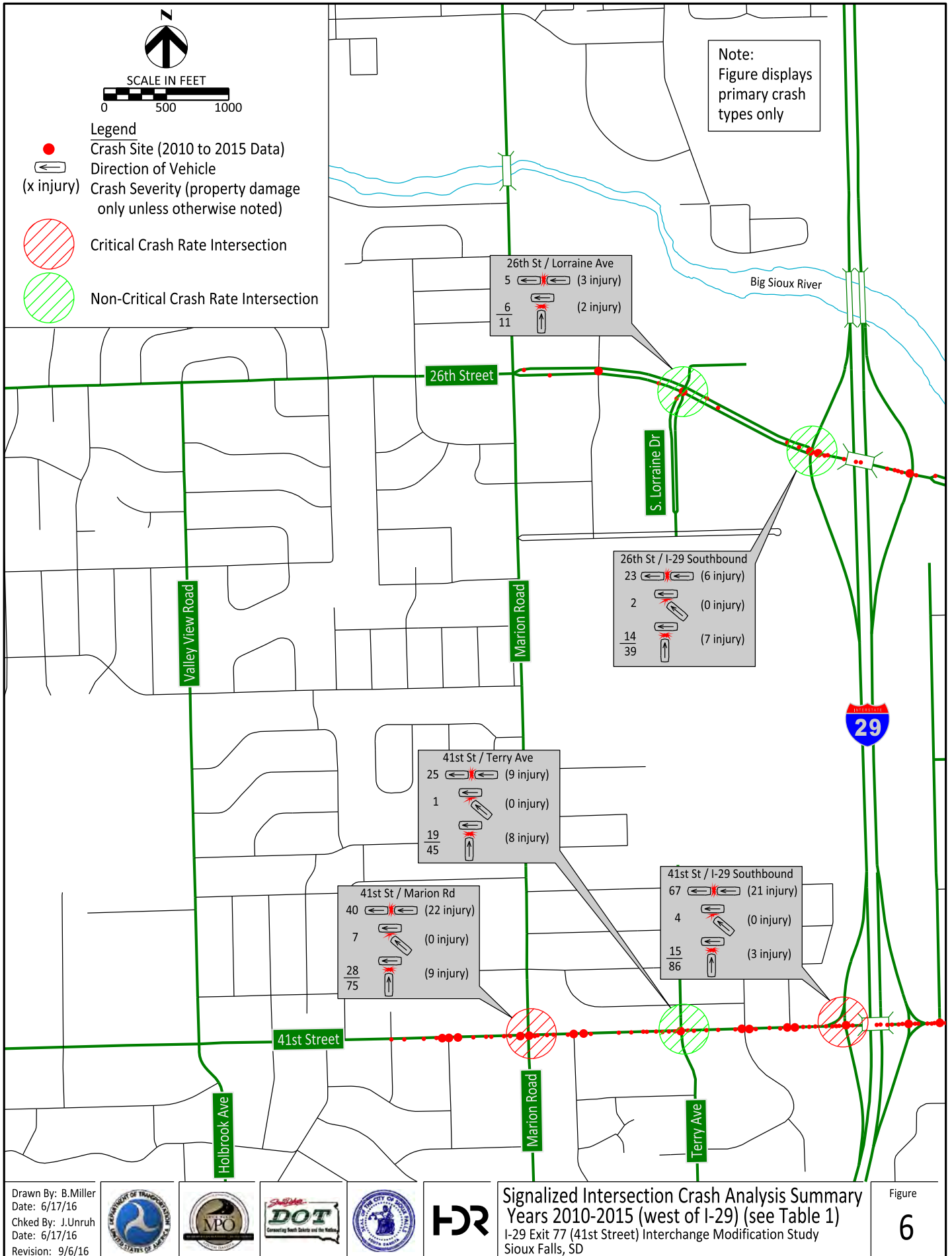
- Louise Avenue – Wal-Mart driveway to 41<sup>st</sup> Street – angle crashes at driveways appear to be leading to higher-than-normal crash rates. Queues from the adjacent intersections frequently back up into this segment making driveway maneuvers difficult.
- 41<sup>st</sup> Street – Terry Avenue to I-29 SB – peak hour queues from the I-29 interchange result in a high rate of rear-end crashes.
- 41<sup>st</sup> Street – I-29 NB to West Empire Place – peak hour queues from the I-29 interchange result in a high rate of rear-end crashes.
- 41<sup>st</sup> Street – Shirley Avenue to Louise Avenue – angle crashes at driveways and rear-end crashes appear to be leading to higher-than-normal crash rates. Queues from the adjacent intersections frequently back up into this segment making driveway maneuvers difficult and creating unexpected encounters with the back of the queue.

#### Interstate Segments:

- I-29 NB, 41<sup>st</sup> Street to 26<sup>th</sup> Street – single vehicle crashes with fixed objects appear to be leading to an elevated crash rate in this segment.
- I-29 NB, 26<sup>th</sup> Street off ramp to 26<sup>th</sup> Street on ramp – single vehicle crashes with fixed objects during slippery roadway conditions represent the predominant crash type.

#### Interstate Ramps:

No critical Interstate ramp segments were identified.

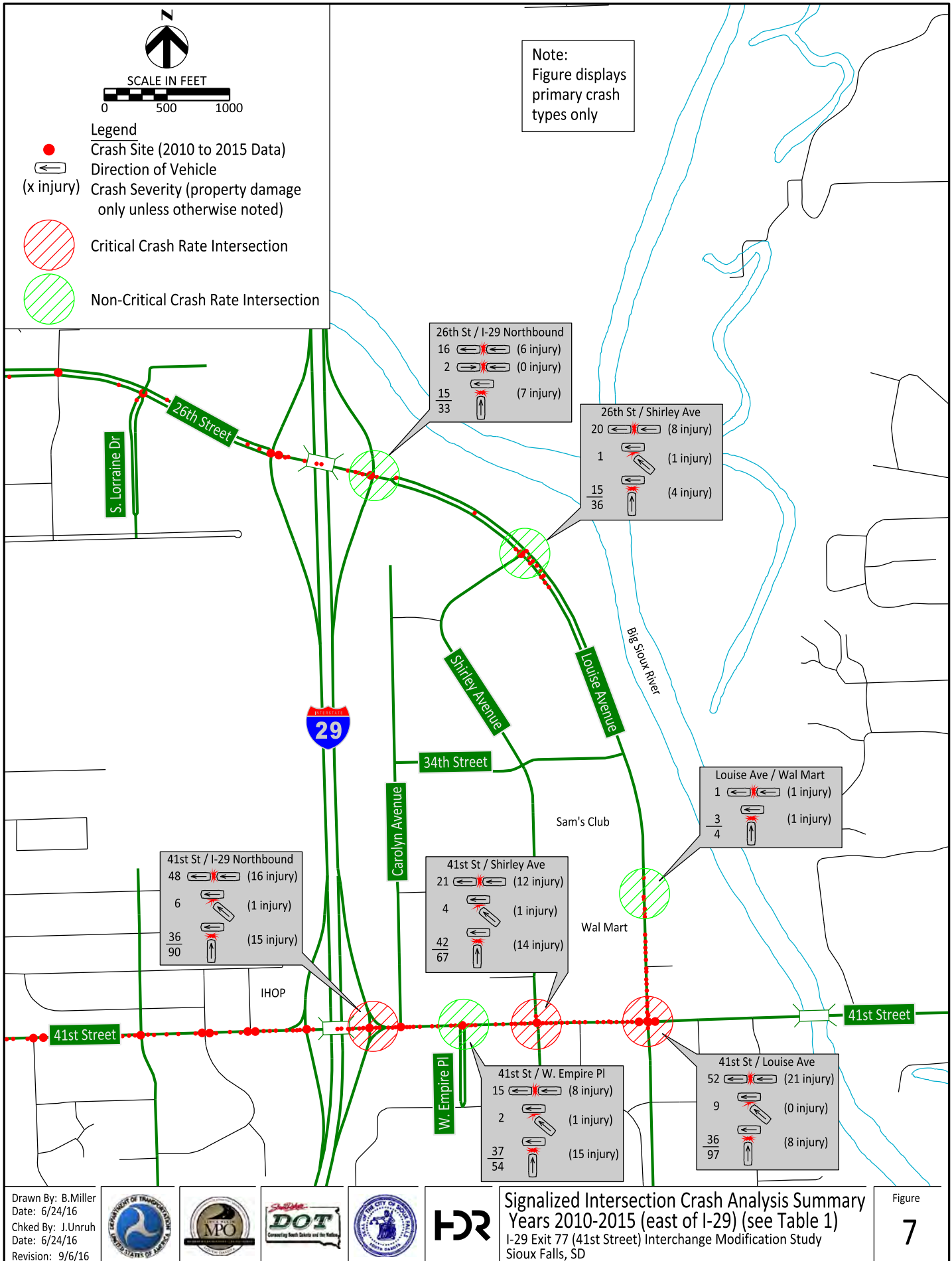


Drawn By: B. Miller  
 Date: 6/17/16  
 Chkd By: J. Unruh  
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**Signalized Intersection Crash Analysis Summary**  
 Years 2010-2015 (west of I-29) (see Table 1)  
 I-29 Exit 77 (41st Street) Interchange Modification Study  
 Sioux Falls, SD

Figure  
**6**



Drawn By: B. Miller  
Date: 6/24/16  
Chkd By: J. Unruh  
Date: 6/24/16  
Revision: 9/6/16



**Signalized Intersection Crash Analysis Summary**  
Years 2010-2015 (east of I-29) (see Table 1)  
I-29 Exit 77 (41st Street) Interchange Modification Study  
Sioux Falls, SD

Figure  
**7**

**TABLE 1 - SIGNALIZED INTERSECTION CRASH RATES (2010-2015)**

I-29/41ST ST. IMJR

INTERSECTION	NUMBER CRASHES	DAILY VOLUME	MEV <sup>1</sup>	CRASH RATE	TEV*R <sup>2</sup>	CRITICAL RATE	DIFFERENCE
2: 26TH/LORRAINE	12	24400	44.53	0.27	6575.34	0.93	-0.66
3: 26TH/I-29 SB	42	27500	50.19	0.84	23013.70	0.92	-0.08
4: 26TH/I-29 NB	33	31200	56.94	0.58	18082.19	0.91	-0.33
5: 26TH/SHIRLEY	36	30500	55.66	0.65	19726.03	0.91	-0.26
9: LOUISE/WAL-MART	4	31100	56.76	0.07	2191.78	0.91	-0.84
11: 41ST/MARION	77	40500	73.91	1.04	42191.78	0.88	<b>0.16</b>
12: 41ST/TERRY	45	32300	58.95	0.76	24657.53	0.90	-0.14
13: 41ST/I-29 SB	91	38400	70.08	1.30	49863.01	0.89	<b>0.41</b>
14: 41ST/I-29 NB	95	37500	68.44	1.39	52054.79	0.89	<b>0.50</b>
16: 41ST/W. EMPIRE	56	38300	69.90	0.80	30684.93	0.89	-0.09
17: 41ST/SHIRLEY	67	36100	65.88	1.02	36712.33	0.89	<b>0.12</b>
18: 41ST/LOUISE	101	61700	112.60	0.90	55342.47	0.85	<b>0.05</b>
COLUMN TOTAL		1676220			1196027.40		
WEIGHTED AVERAGE RATE				0.71			

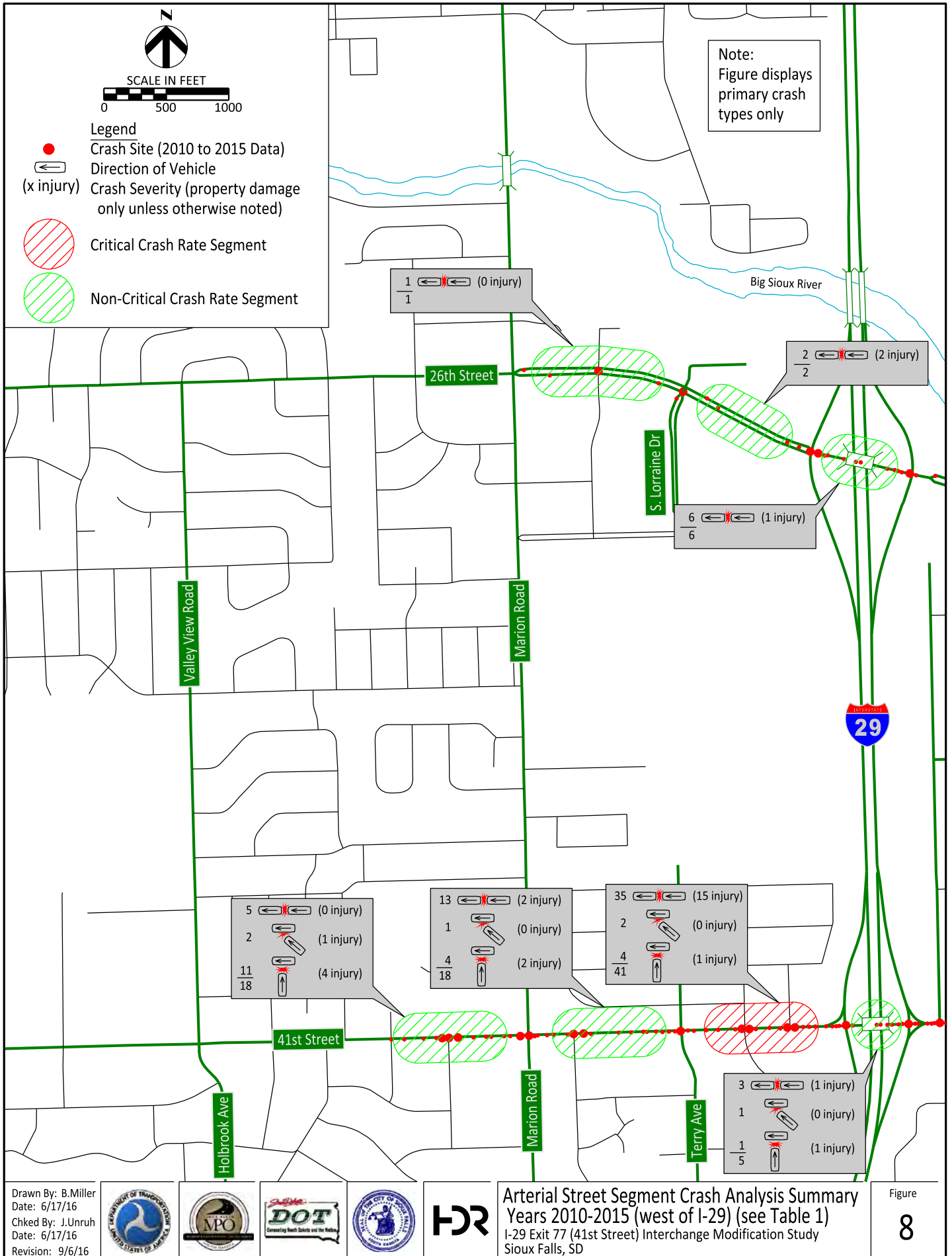
<sup>1</sup>MEV = MILLION ENTERING VEHICLES

<sup>2</sup>TEV\*R = TOTAL ENTERING VEHICLES TIMES CRASH RATE

SOURCE: HIGHWAY SAFETY MANUAL, FIRST EDITION, 2010, AASHTO

NOTE: CRITICAL RATE STATISTICS ARE BASED ON A LARGE SAMPLE OF SIGNALIZED ARTERIAL INTERSECTIONS IN SIOUX FALLS

NOTE: THE RED AND GREEN HIGHLIGHTS PROVIDE A QUICK VISUAL INDICATION OF WHICH INTERSECTIONS HAVE A CRASH RATE OUTSIDE OF THE STATISTICAL CRITICAL RATE. THE RED INTERSECTIONS ARE CONSIDERED OUTSIDE THE CRITICAL IMPROVEMENTS), WHILE THE GREEN SEGMENTS ARE INSIDE THE CRITICAL RATE. THIS CRASH ANALYSIS IS BEING PERFORMED AS PART OF THE IMJR PROCESS, A PLANNING PROCESS FOR FUTURE POTENTIAL INTERCHANGE PROJECTS. THE HIGHWAY SAFETY MANUAL (HSM) IS BEING USED AS A REFERENCE FOR PROPER PLANNING OF THE ROADWAY FEATURES THAT MAY BE ASSOCIATED WITH POTENTIAL INTERCHANGE IMPROVEMENTS. PROVIDING A COMPLETE EXPLANATION OF THE CRITICAL RATE METHOD WOULD REQUIRE RESTATEMENT OF A LARGE PORTION OF THE

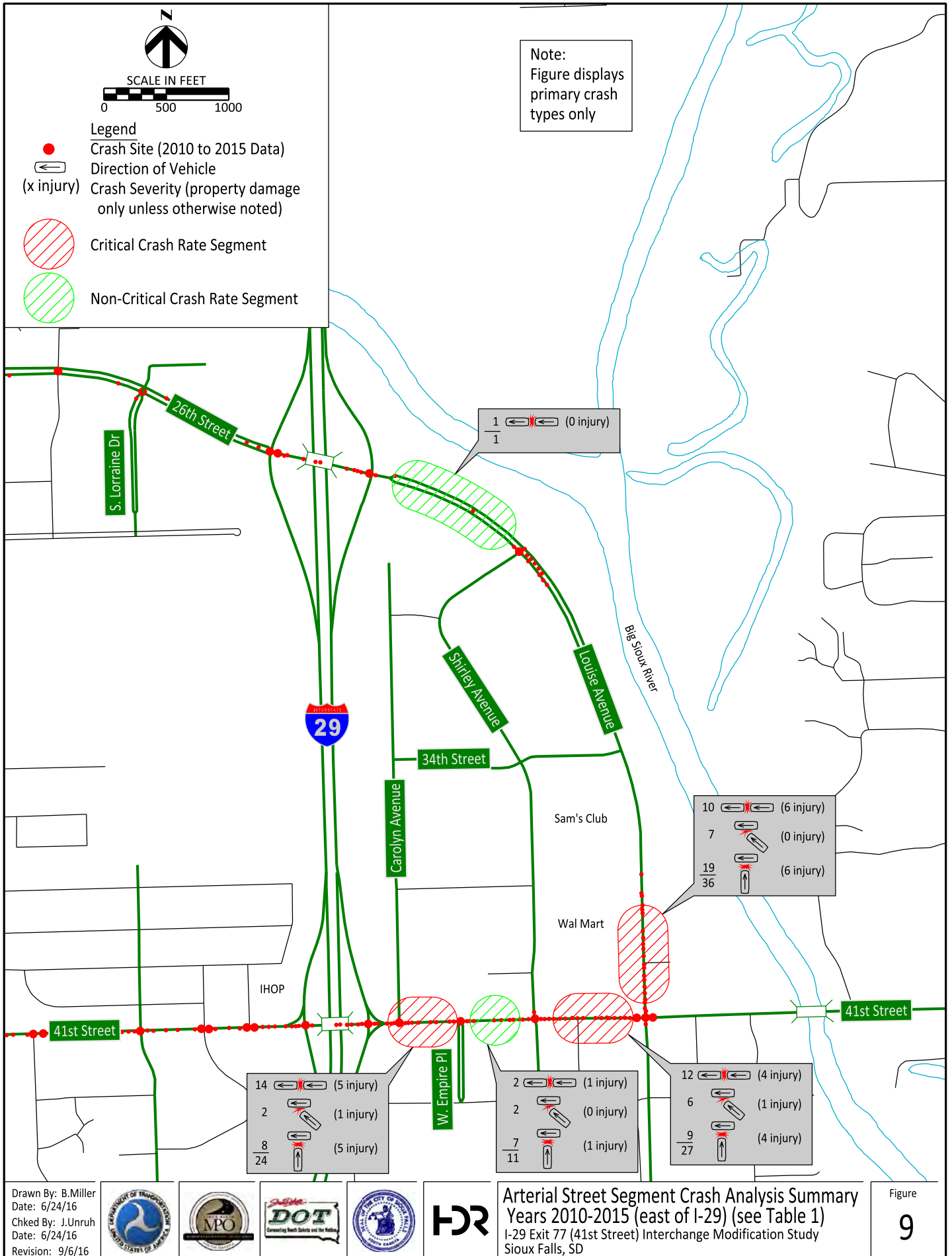


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Date: 6/17/16  
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Date: 6/17/16  
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Arterial Street Segment Crash Analysis Summary  
Years 2010-2015 (west of I-29) (see Table 1)  
I-29 Exit 77 (41st Street) Interchange Modification Study  
Sioux Falls, SD

Figure  
8



Drawn By: B. Miller  
Date: 6/24/16  
Chkd By: J. Unruh  
Date: 6/24/16  
Revision: 9/6/16



Arterial Street Segment Crash Analysis Summary  
Years 2010-2015 (east of I-29) (see Table 1)  
I-29 Exit 77 (41st Street) Interchange Modification Study  
Sioux Falls, SD

Figure  
9



**TABLE 2 - ARTERIAL SEGMENT CRASH RATES (2010-2015)**

I-29/41ST ST. IMJR

SEGMENT	NUMBER CRASHES	SEGMENT LENGTH	DAILY VOLUME	MVMT <sup>1</sup>	CRASH RATE	TEV*R <sup>2</sup>	CRITICAL RATE	DIFFERENCE
1: 26TH ST., MARION TO LORRAINE	2	0.104	22,000	4.18	0.48	10537.41	4.72	-4.24
2: 26TH ST., LORRAINE TO I-29 SB	4	0.160	24,200	7.07	0.57	13698.63	4.34	-3.77
3: 26TH ST., I-29 SB TO I-29 NB	6	0.095	23,300	4.04	1.49	34607.07	4.75	-3.26
4: 26TH ST., I-29 NB TO SHIRLEY	2	0.206	24,100	9.06	0.22	5319.86	4.19	-3.97
6: LOUISE AVE., WAL-MART TO 41ST	37	0.113	26,700	5.51	6.72	179415.69	4.50	<b>2.22</b>
7: 41ST ST., VALLEY VIEW TO MARION	21	0.222	20,900	8.47	2.48	51832.65	4.23	-1.75
8: 41ST ST., MARION TO TERRY	18	0.175	26,500	8.46	2.13	56360.08	4.23	-2.10
9: 41ST ST., TERRY TO I-29 SB	43	0.182	30,300	10.06	4.27	129459.58	4.14	<b>0.13</b>
10: 41ST ST., I-29 SB TO I-29 NB	7	0.053	26,900	2.60	2.69	72370.12	5.17	-2.48
11: 41ST ST., I-29 NB TO W. EMPIRE	26	0.081	26,800	3.96	6.56	175883.65	4.76	<b>1.80</b>
12: 41ST ST., W. EMPIRE TO SHIRLEY	12	0.058	30,400	3.22	3.73	113367.97	4.95	-1.22
13: 41ST ST., SHIRLEY TO LOUISE	29	0.111	29,300	5.94	4.89	143156.86	4.45	<b>0.43</b>
COLUMN TOTALS			311400			986009.56		
WEIGHTED AVERAGE RATE					3.17			

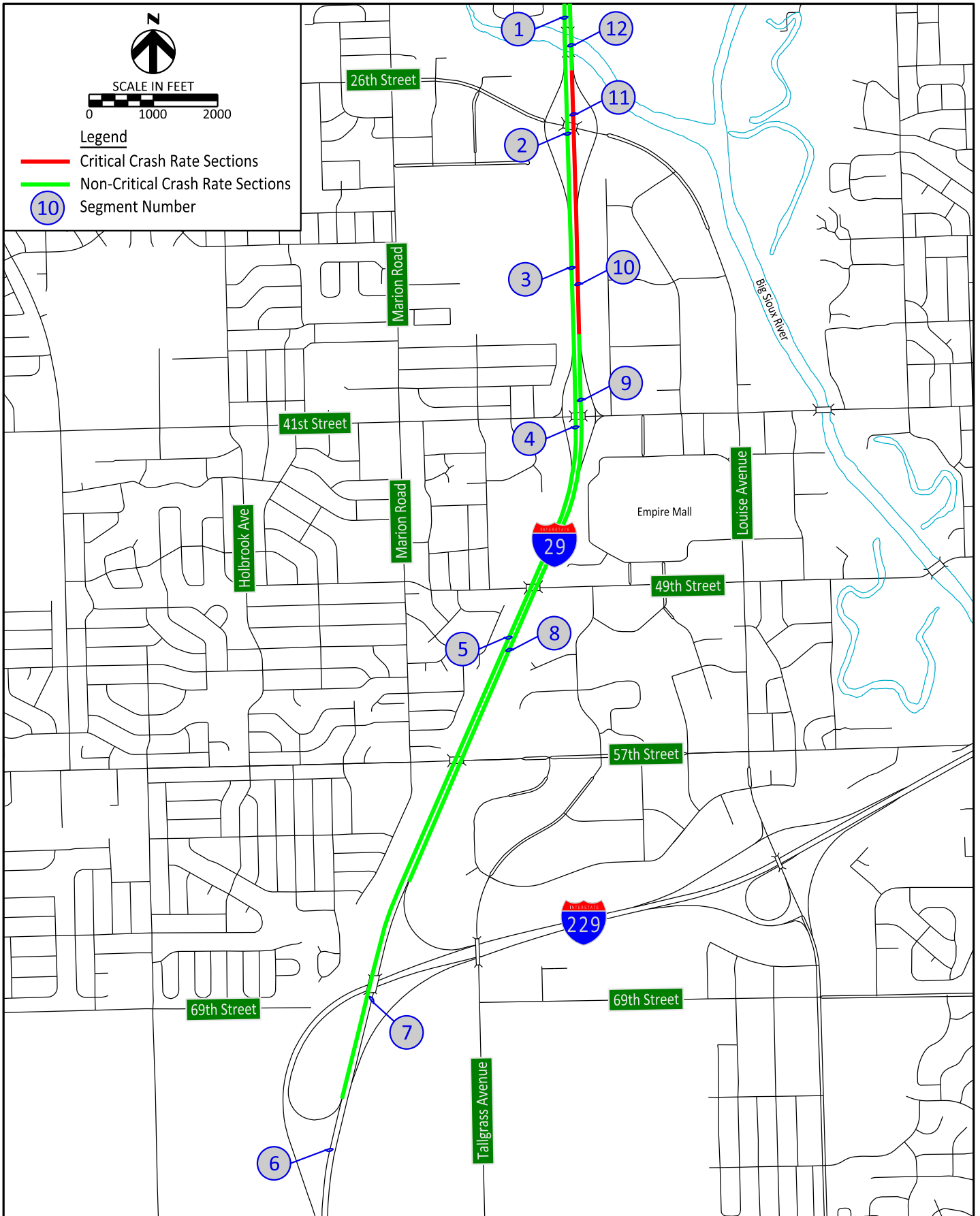
<sup>1</sup>MVMT=MILLION VEHICLE MILES TRAVELED

<sup>2</sup>TEV\*R = TOTAL ENTERING VEHICLES PER DAY, TIMES OBSERVED CRASH RATE

SOURCE: HIGHWAY SAFETY MANUAL, FIRST EDITION, 2010, AASHTO

NOTE: CRITICAL RATE STATISTICS ARE BASED ON A LARGE SAMPLE OF ARTERIAL SEGMENTS IN SIOUX FALLS

NOTE: THE RED AND GREEN HIGHLIGHTS PROVIDE A QUICK VISUAL INDICATION OF WHICH SEGMENTS HAVE A CRASH RATE OUTSIDE OF THE STATISTICAL POSSIBLY REQUIRING ATTENTION AND SAFETY IMPROVEMENTS) WHILE THE GREEN SEGMENTS ARE INSIDE THE CRITICAL RATE. THE CRASH ANALYSIS IS BEING PERFORMED AS PART OF THE IMJR PROCESS, A PLANNING PROCESS FOR FUTURE POTENTIAL INTERCHANGE PROJECTS. THE HIGHWAY SAFETY MANUAL IS BEING USED AS A REFERENCE FOR PROPER PLANNING OF THE ROADWAY FEATURES THAT MAY BE ASSOCIATED WITH POTENTIAL INTERCHANGE IMPROVEMENTS. PROVIDING A COMPLETE EXPLANATION OF THE CRITICAL RATE METHOD WOULD REQUIRE RESTATEMENT OF LARGE PORTIONS OF THE HIGHWAY SAFETY MANUAL IN THIS DOCUMENT. INSTEAD, THE HSM IS INCLUDED BY REFERENCE.



Drawn By: B. Miller  
 Date: 7/5/16  
 Chkd By: J. Unruh  
 Date: 7/5/16  
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**Interstate Segments for Crash Analysis**  
 (see Table 3)  
 I-29 Exit 77 (41st Street) Interchange Modification Study  
 Sioux Falls, SD

Figure  
**10**

**TABLE 3 - INTERSTATE SEGMENT CRASH RATES (2010-2015)**

I-29/41ST ST. IMJR

TRAVEL DIRECTION	SEGMENT	NUMBER CRASHES	SEGMENT LENGTH	DAILY VOLUME	MVMT <sup>1</sup>	CRASH RATE	TEV*R <sup>2</sup>	CRITICAL RATE	DIFFERENCE
SB	1: I-29, 12TH ST TO 26TH ST	22	0.589	31200	33.54	0.66	20466.54	1.23	-0.58
SB	2: I-29, 26TH ST TO 26TH ST	15	0.462	18500	15.60	0.96	17790.43	1.38	-0.42
SB	3: I-29, 26TH ST TO 41ST ST	15	0.330	21900	13.19	1.14	24906.60	1.42	-0.28
SB	4: I-29, 41ST ST TO 41ST ST	6	0.481	8100	7.11	0.84	6835.08	1.61	-0.77
SB	5: I-29, 41ST ST TO I-229	49	1.910	21200	73.90	0.66	14057.23	1.13	-0.47
SB	6: I-29, I-229 TO I-229	8	0.472	12500	10.77	0.74	9287.21	1.47	-0.73
NB	7: I-29, I-229 TO I-229	19	0.638	12400	14.44	1.32	16318.12	1.40	-0.08
NB	8: I-29, I-229 TO 41ST	23	1.270	21200	49.14	0.47	9923.42	1.18	-0.71
NB	9: I-29, 41ST TO 41ST	5	0.521	13100	12.46	0.40	5258.59	1.43	-1.03
NB	10: I-29, 41ST TO 26TH	20	0.248	21900	9.91	2.02	44189.13	1.50	0.52
NB	11: I-29, 26TH TO 26TH	25	0.440	17600	14.13	1.77	31133.25	1.40	0.37
NB	12: I-29, 26TH TO 12TH	17	0.669	27700	33.82	0.50	13923.87	1.23	-0.73
COLUMN TOTALS				227300			214089.46		
WEIGHTED AVERAGE RATE						0.94			

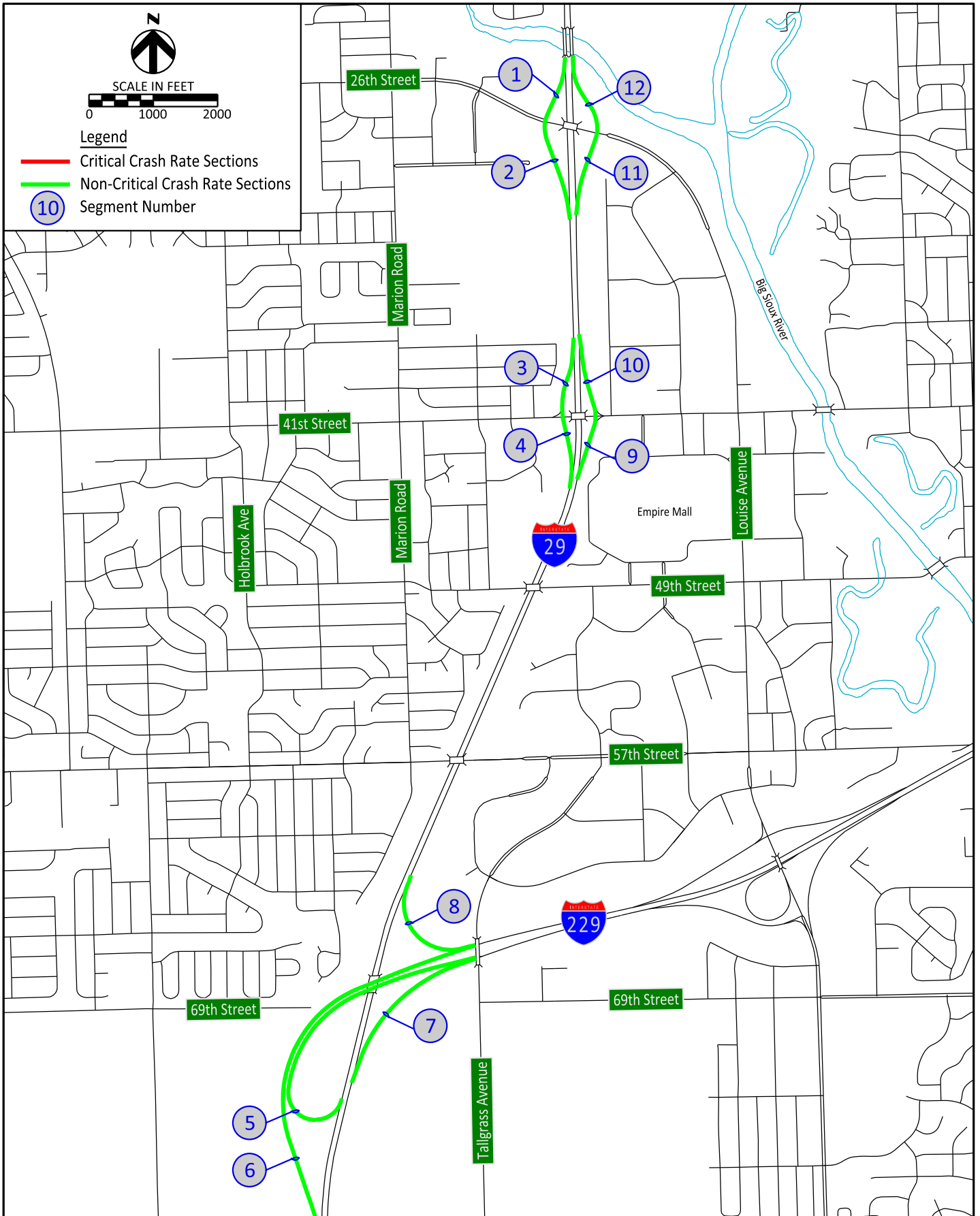
<sup>1</sup>MVMT=MILLION VEHICLE MILES TRAVELED

<sup>2</sup>TEV\*R = TOTAL ENTERING VEHICLES PER DAY, TIMES OBSERVED CRASH RATE

SOURCE: HIGHWAY SAFETY MANUAL, FIRST EDITION, 2010, AASHTO

NOTE: CRITICAL RATE STATISTICS ARE BASED ON A LARGE SAMPLE OF INTERSTATE SEGMENTS IN SIOUX FALLS

NOTE: THE RED AND GREEN HIGHLIGHTS PROVIDE A QUICK VISUAL INDICATION OF WHICH SEGMENTS HAVE A CRASH RATE OUTSIDE OF THE STATISTICAL POSSIBLY REQUIRING ATTENTION AND SAFETY IMPROVEMENTS) WHILE THE GREEN SEGMENTS ARE INSIDE THE CRITICAL RATE. THE CRASH ANALYSIS IS BEING PERFORMED AS PART OF THE IMJR PROCESS, A PLANNING PROCESS FOR FUTURE POTENTIAL INTERCHANGE PROJECTS. THE HIGHWAY SAFETY MANUAL IS BEING USED AS A REFERENCE FOR PROPER PLANNING OF THE ROADWAY FEATURES THAT MAY BE ASSOCIATED WITH POTENTIAL INTERCHANGE IMPROVEMENTS. PROVIDING A COMPLETE EXPLANATION OF THE CRITICAL RATE METHOD WOULD REQUIRE RESTATEMENT OF LARGE PORTIONS OF THE HIGHWAY SAFETY MANUAL IN THIS DOCUMENT. INSTEAD, THE HSM IS INCLUDED BY REFERENCE.



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 Chkd By: J. Unruh  
 Date: 7/5/16  
 Revision:



**Interstate Ramps for Crash Analysis**  
 (see Table 4)  
 I-29 Exit 77 (41st Street) Interchange Modification Study  
 Sioux Falls, SD

Figure  
**11**

**TABLE 4 - INTERSTATE RAMP CRASH RATES (2010-2015)**

I-29/41ST ST. IMJR

TRAVEL DIRECTION	SEGMENT	NUMBER CRASHES	SEGMENT LENGTH	DAILY VOLUME	MVMT <sup>1</sup>	CRASH RATE	TEV*R <sup>2</sup>	CRITICAL RATE	DIFFERENCE
SB	1 - 26TH STREET OFF RAMP	5	0.188	12700	4.36	1.15	11067.72	3.13	-1.99
SB	2 - 26TH STREET ON RAMP	1	0.265	3400	1.64	0.61	5590.71	4.01	-3.40
SB	3 - 41ST STREET OFF RAMP	7	0.27	13800	6.80	1.03	13405.62	2.87	-1.84
SB	4 - 41ST STREET ON RAMP	2	0.186	5100	1.73	1.16	4414.55	3.95	-2.79
SB	5 - I-229 OFF RAMP	12	0.979	8700	15.54	0.77	11269.45	2.54	-1.76
SB	6 - I-229 ON RAMP	19	1.26	9200	21.16	0.90	10243.67	2.44	-1.55
NB	7 - I-229 OFF RAMP	4	0.554	6800	6.88	0.58	11687.74	2.87	-2.29
NB	8 - I-229 ON RAMP	5	0.376	8800	6.04	0.83	10627.87	2.94	-2.11
NB	9 - 41ST STREET OFF RAMP	2	0.185	5700	1.92	1.04	5484.72	3.83	-2.79
NB	10 - 41ST STREET ON RAMP	3	0.339	8900	5.51	0.54	16335.08	2.99	-2.44
NB	11 - 26TH STREET OFF RAMP	1	0.209	4400	1.68	0.60	7384.39	3.98	-3.39
NB	12 - 26TH STREET ON RAMP	2	0.265	10100	4.88	0.41	24667.29	3.06	-2.65
COLUMN TOTAL				195590			376535.73		
WEIGHTED AVERAGE RATE						1.93			

<sup>1</sup>MVMT = MILLION VEHICLE MILES TRAVELED

<sup>2</sup>TEV\*R = TOTAL ENTERING VEHICLES TIMES CRASH RATE

SOURCE: HIGHWAY SAFETY MANUAL, FIRST EDITION, 2010, AASHTO

NOTE: CRITICAL RATE STATISTICS ARE BASED ON A LARGE SAMPLE OF INTERSTATE RAMPS IN SIOUX FALLS

NOTE: THE RED AND GREEN HIGHLIGHTS PROVIDE A QUICK VISUAL INDICATION OF WHICH SEGMENTS HAVE A CRASH RATE OUTSIDE OF THE STATISTICAL CRITICAL RATE. THE RED SEGMENTS ARE CONSIDERED OUTSIDE THE CRITICAL RATE (HAVING A CRASH RATE OUTSIDE THE NORMAL RANGE AND POSSIBLY REQUIRING ATTENTION AND SAFETY IMPROVEMENTS) WHILE THE GREEN SEGMENTS ARE INSIDE THE CRITICAL RATE. THE CRASH ANALYSIS IS BEING PERFORMED AS PART OF THE IMJR PROCESS, A PLANNING PROCESS FOR FUTURE POTENTIAL INTERCHANGE PROJECTS. THE HIGHWAY SAFETY MANUAL IS BEING USED AS A REFERENCE FOR PROPER PLANNING OF THE ROADWAY FEATURES THAT MAY BE ASSOCIATED WITH POTENTIAL INTERCHANGE IMPROVEMENTS. PROVIDING A COMPLETE EXPLANATION OF THE CRITICAL RATE METHOD WOULD REQUIRE RESTATEMENT OF LARGE PORTIONS OF THE HIGHWAY SAFETY MANUAL IN THIS DOCUMENT. INSTEAD, THE HSM IS INCLUDED BY REFERENCE.

### **3.9 Existing Environmental Constraints**

The environmental studies and analyses completed during this Interchange Modification Justification Report preparation were used to refine, screen and eliminate alternatives based, in part, on environmental impacts identified.

## 4. PROJECT NEED

The environmental evaluation process has formulated a purpose and need statement for this project, included in **Appendix 1**. Previous studies, including the 2010 Decennial Interstate Corridor Study and the I-29 Exit 77 (41<sup>st</sup> Street) Crossroad Corridor Study, have identified the need to improve the Exit 77 interchange to address safety concerns, correct geometric deficiencies, and improve low peak hour levels of service.

## 5. ALTERNATIVES

Previous studies have identified improvements on the 41<sup>st</sup> Street crossroad to provide adequate roadway capacity and improve safety. The following improvement concepts were developed to address the interchange area needs:

- No-Build Concept Option
- Local Improvements Only (previously identified improvements on the 41<sup>st</sup> Street crossroad, no change to interchange configuration)
- Single point interchange (includes previously identified crossroad improvements)
- Diverging diamond interchange (DDI) (includes previously identified crossroad improvements)

The Single-Point and Diverging Diamond interchange concepts are shown in the following pages. The Concept Options were evaluated in a Technical Memorandum. The memo, including the concept options, is included in **Appendix 8**.





See 41st Street alternatives from Marion Road to I-29

Carolyn Avenue access alternatives provided in separate memo

See 41st Street alternatives from I-29 to east of Shirley Avenue

IMPACT SUMMARY  
Wetlands: 0.39 acres

Drawn By: B. Miller  
Date: 8/30/2016  
Chkd By: J. Unruh  
Date: 8/30/2016  
Revision: 2/1/2017



Single Point Interchange Alternative

41st Street Corridor Environmental Assessment

Figure

I-1

Sioux Falls, SD





Drawn By: B.Miller  
Date: 8/30/2016  
Chkd By: J.Unruh  
Date: 8/30/2016  
Revision: 8/21/2017



Diverging Diamond Interchange Alternative

41st Street Corridor Environmental Assessment

Sioux Falls, SD

Figure  
I-2

## 6. FUTURE YEAR TRAFFIC

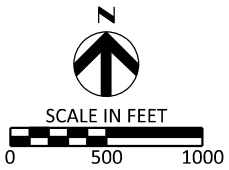
Traffic forecasts for the study area were prepared using the regional travel demand model maintained by the City of Sioux Falls and the Sioux Falls MPO. The model horizon year is 2045 and is based on local land use plans. Forecasts for the proposed 2023 construction completion year were also produced. Future year traffic demand reflects planned improvements. Peak hour traffic volumes and levels of service for the four scenarios are shown in **Figures 12 through 43**. Level of service output sheets from HCS 2010 are included in the **Appendix 5**.

The 2023 operational analysis revealed the following findings:

- Many intersections experienced peak hour conditions where the queue storage ratio of at least one movement exceeds 1.0 – defined as level of service F\*
- The 41<sup>st</sup> St./Marion Rd. intersection experiences level of service E during the PM peak hour under no-build conditions.
- The 41<sup>st</sup> St./I-29 NB ramp terminal experiences level of service F during the AM peak hour under the local improvements only alternative.
- Both interchange alternatives provide good level of service at AM, PM and Saturday peak hours.
- All Interstate mainline sections, weaving sections and ramps operate at level of service C or better.

The 2045 operational analysis revealed the following findings:

- Many intersections experienced peak hour conditions where the queue storage ratio of at least one movement exceeds 1.0 – defined as level of service F\*
- The 41<sup>st</sup> St./Marion Rd. intersection experiences level of service F during the AM and PM peak hours under no-build conditions.
- The 41<sup>st</sup> St./Terry Ave. intersection experiences level of service E during the PM peak hour under no-build conditions.
- The 41<sup>st</sup> St./I-29 NB ramp terminal experiences level of service E during the PM peak hour under no-build conditions and level of service F during the PM peak hour with the local improvements only alternative.
- Both interchange alternatives provide good level of service at AM, PM and Saturday peak hours.
- All Interstate mainline sections, weaving sections and ramps operate at level of service C or better.



**Legend**  
 Intersections with Predicted Peak Hour Congestion (defined as worse than LOS C for signalized arterial street/interstate ramp terminals and worse than LOS D for City arterial street signalized intersections)

Condition	Period	LOS/Delay (sec)
2045 No-build	AM Peak	D/53
2045 41st improvements with existing interchange		
2045 41st improvements with SPUI		
2045 41st improvements with DDI		

Condition	Period	LOS/Delay (sec)
2023 No-build	Sat Peak	E/58
2023 41st improvements with existing interchange	Sat Peak	E/67
2023 41st improvements with SPUI	Sat Peak	E/67
2023 41st improvements with DDI	Sat Peak	E/66
2045 No-build	PM Peak Sat Peak	E/63 E/66
2045 41st improvements with existing interchange	PM Peak Sat Peak	E/59 E/73
2045 41st improvements with SPUI	PM Peak Sat Peak	E/63 E/74
2045 41st improvements with DDI	PM Peak Sat Peak	E/60 E/73

Condition	Period	LOS/Delay (sec)
2023 No-build	PM Peak	E/68
2045 No-build	AM Peak	F/87
	PM Peak	F/115

2045 Interim Improvements with		
Existing Interchange	AM Peak	E/60
	PM Peak	F/97
Diverging Diamond Interchange	AM Peak	E/59
	PM Peak	F/105
Single Point Interchange	AM Peak	E/58
	PM Peak	E/67

Condition	Period	LOS/Delay (sec)
2045 No-build	PM Peak	E/59

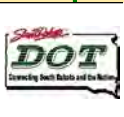
Condition	Period	LOS/Delay (sec)
2045 No-build	PM Peak	* F/85
2045 41st improvements with existing interchange	PM Peak	* F/87

Condition	Period	LOS/Delay (sec)
2045 No-build	PM Peak	E/76 * E/71
2045 41st improvements with existing interchange	PM Peak	D/51 * E/76

\* SYNCHRO analysis result

\* SYNCHRO analysis result

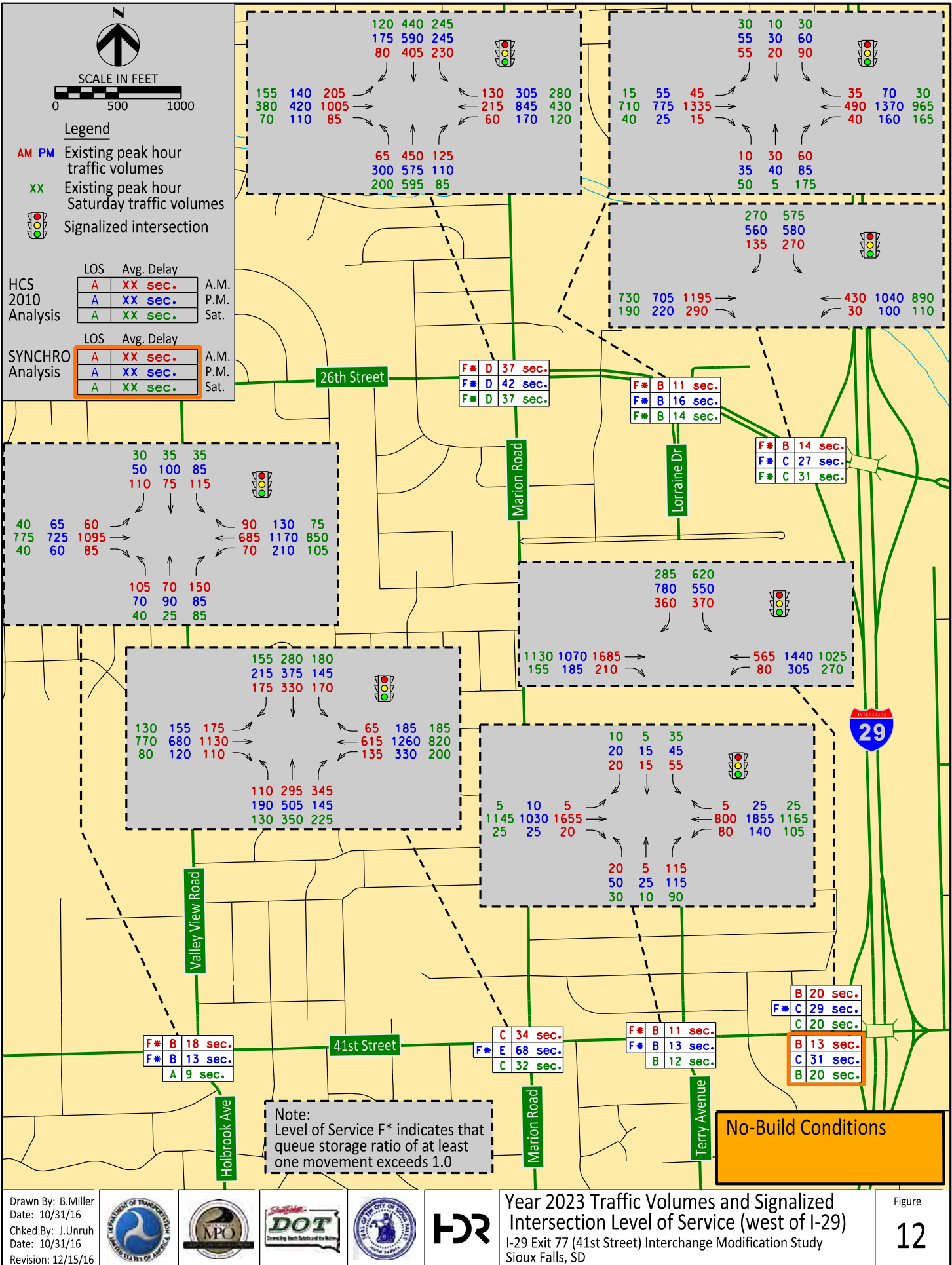
Drawn By: B.Miller  
 Date: 1/3/17  
 Chkd By: J.Unruh  
 Date: 1/3/17  
 Revision: 2/7/17



**Summary of Signalized Intersections with Predicted Peak Hour Low LOS (Yrs 2023 & 2045)**  
 I-29 Exit 77 (41st Street) Interchange Modification Study  
 Sioux Falls, SD

Figure  
**12a**



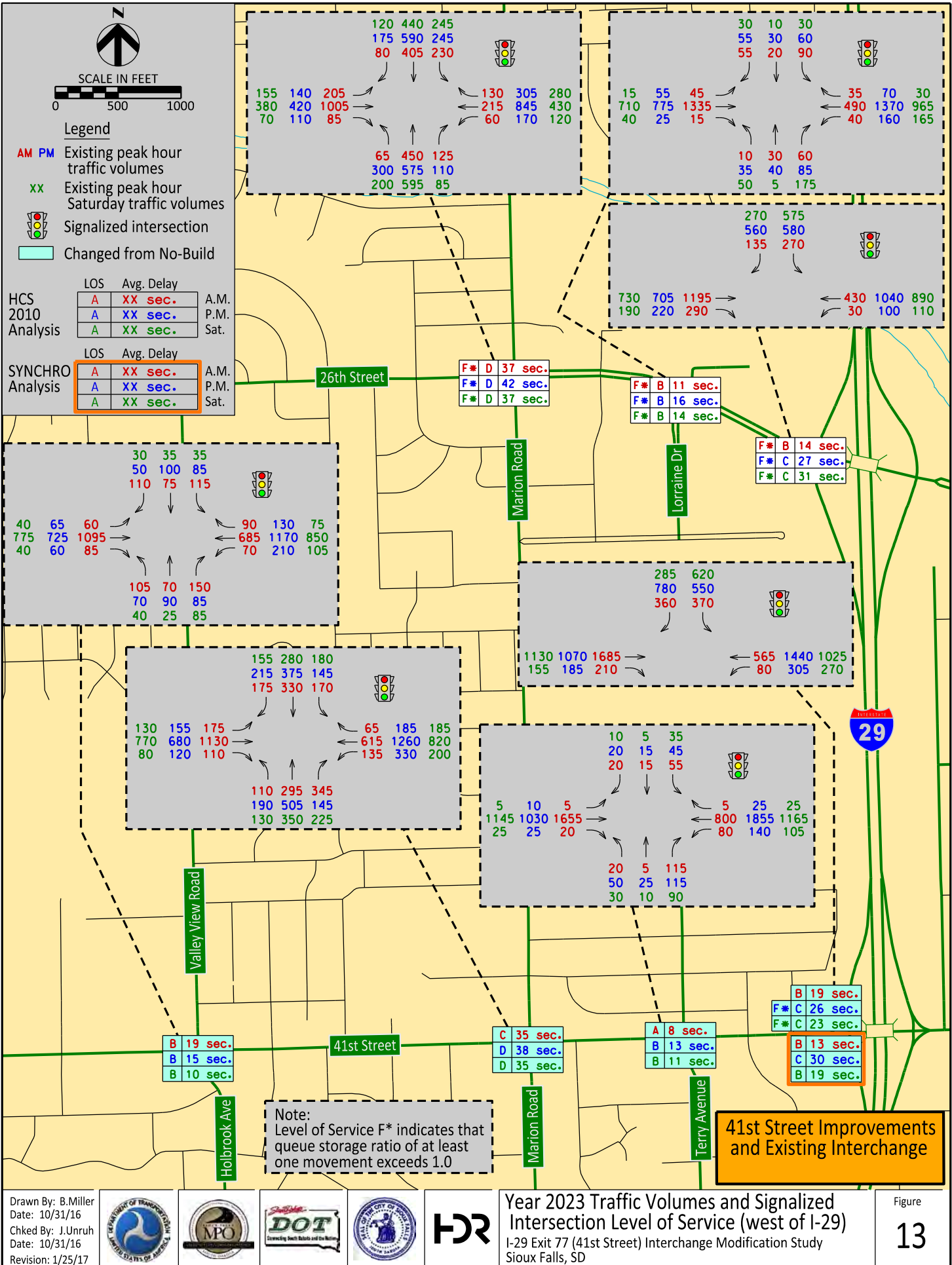


Drawn By: B.Miller  
 Date: 10/31/16  
 Chkd By: J.Unruh  
 Date: 10/31/16  
 Revision: 12/15/16

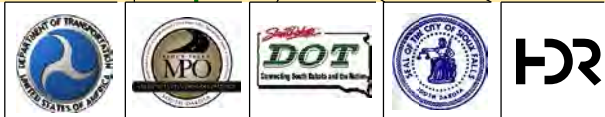


Year 2023 Traffic Volumes and Signalized Intersection Level of Service (west of I-29)  
 I-29 Exit 77 (41st Street) Interchange Modification Study  
 Sioux Falls, SD

Figure  
 12

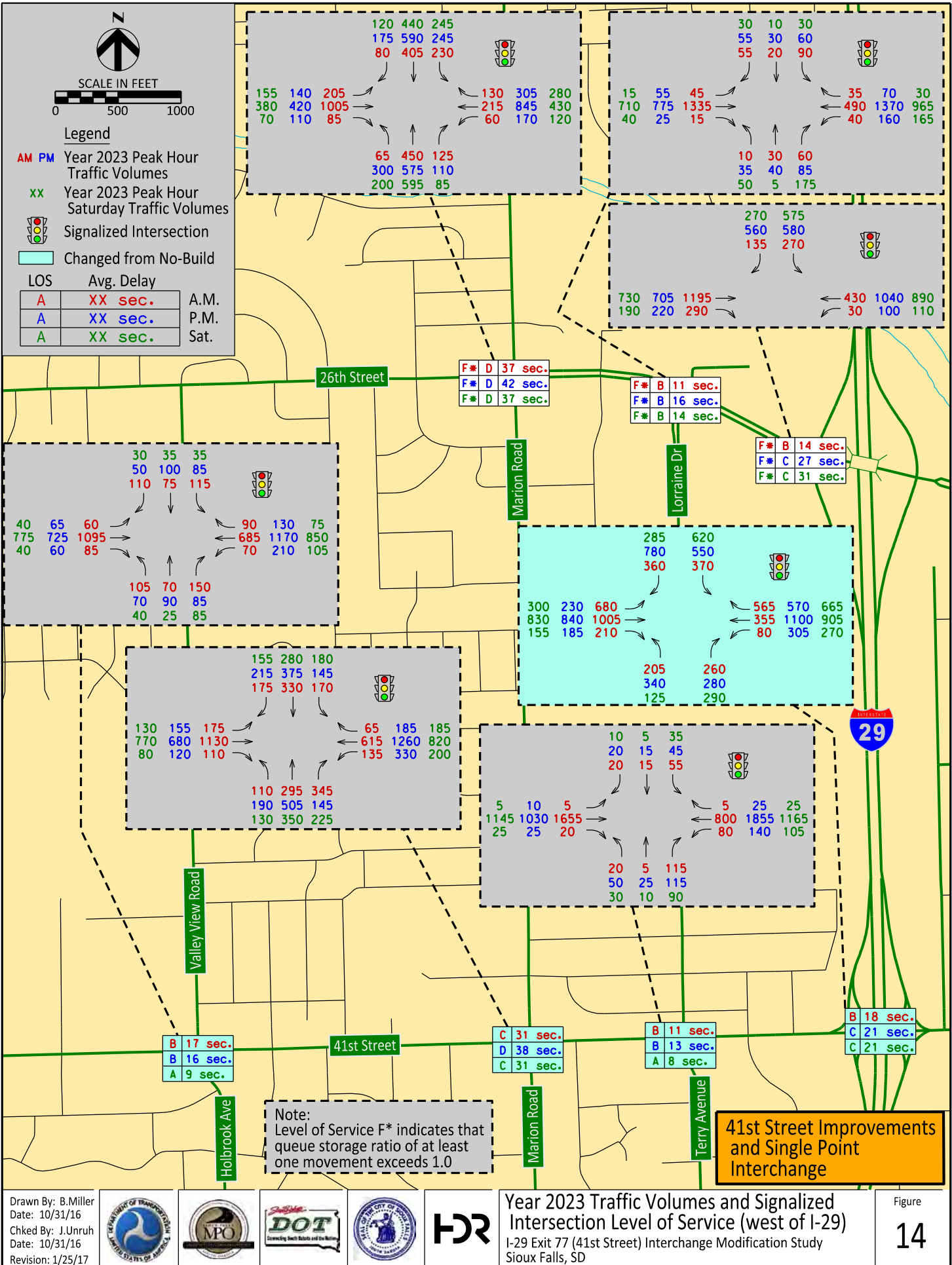


Drawn By: B.Miller  
 Date: 10/31/16  
 Chkd By: J.Unruh  
 Date: 10/31/16  
 Revision: 1/25/17



Year 2023 Traffic Volumes and Signalized Intersection Level of Service (west of I-29) I-29 Exit 77 (41st Street) Interchange Modification Study Sioux Falls, SD

Figure 13

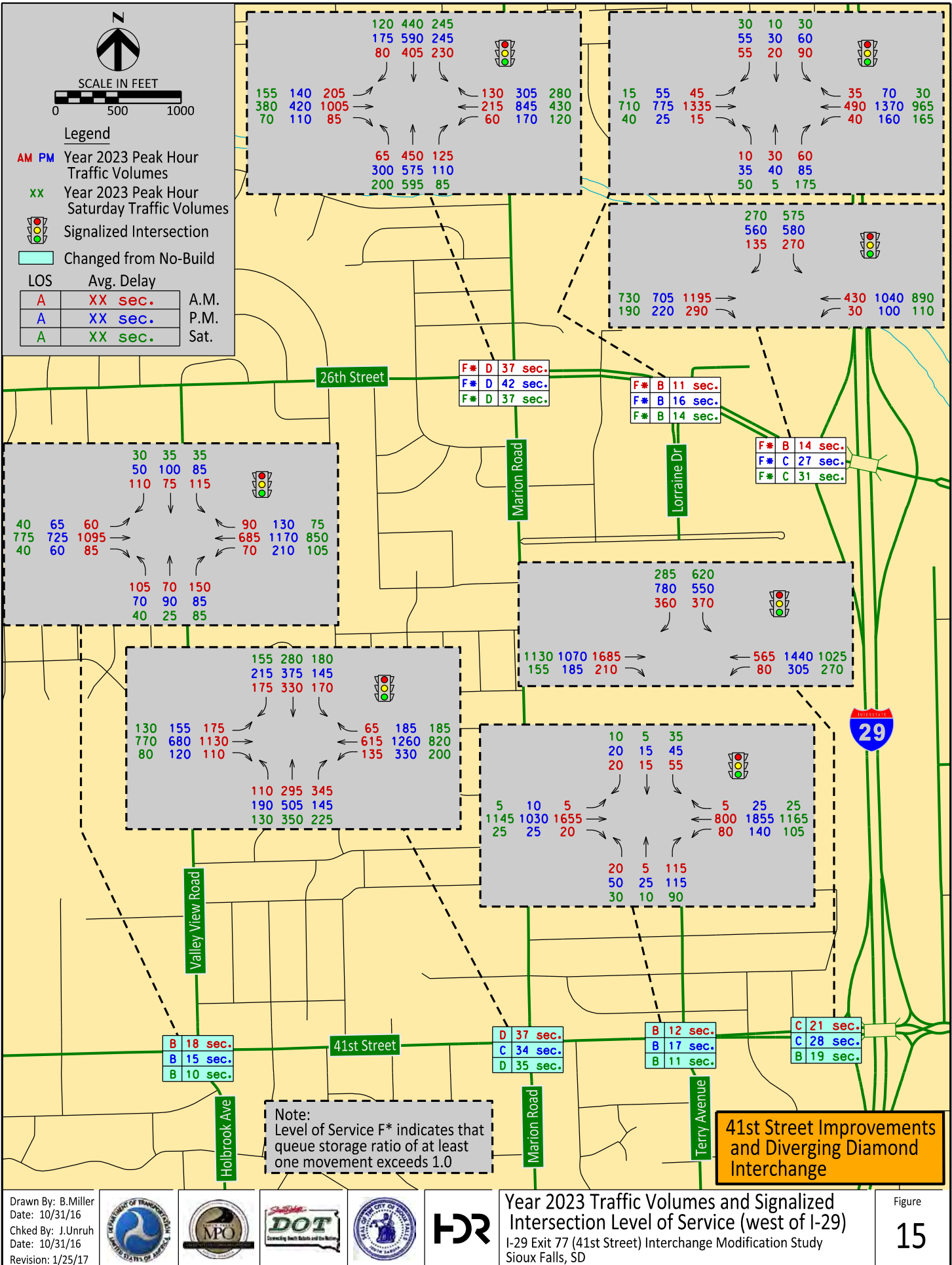


Drawn By: B.Miller  
 Date: 10/31/16  
 Chkd By: J.Unruh  
 Date: 10/31/16  
 Revision: 1/25/17



Year 2023 Traffic Volumes and Signalized Intersection Level of Service (west of I-29)  
 I-29 Exit 77 (41st Street) Interchange Modification Study  
 Sioux Falls, SD

Figure 14



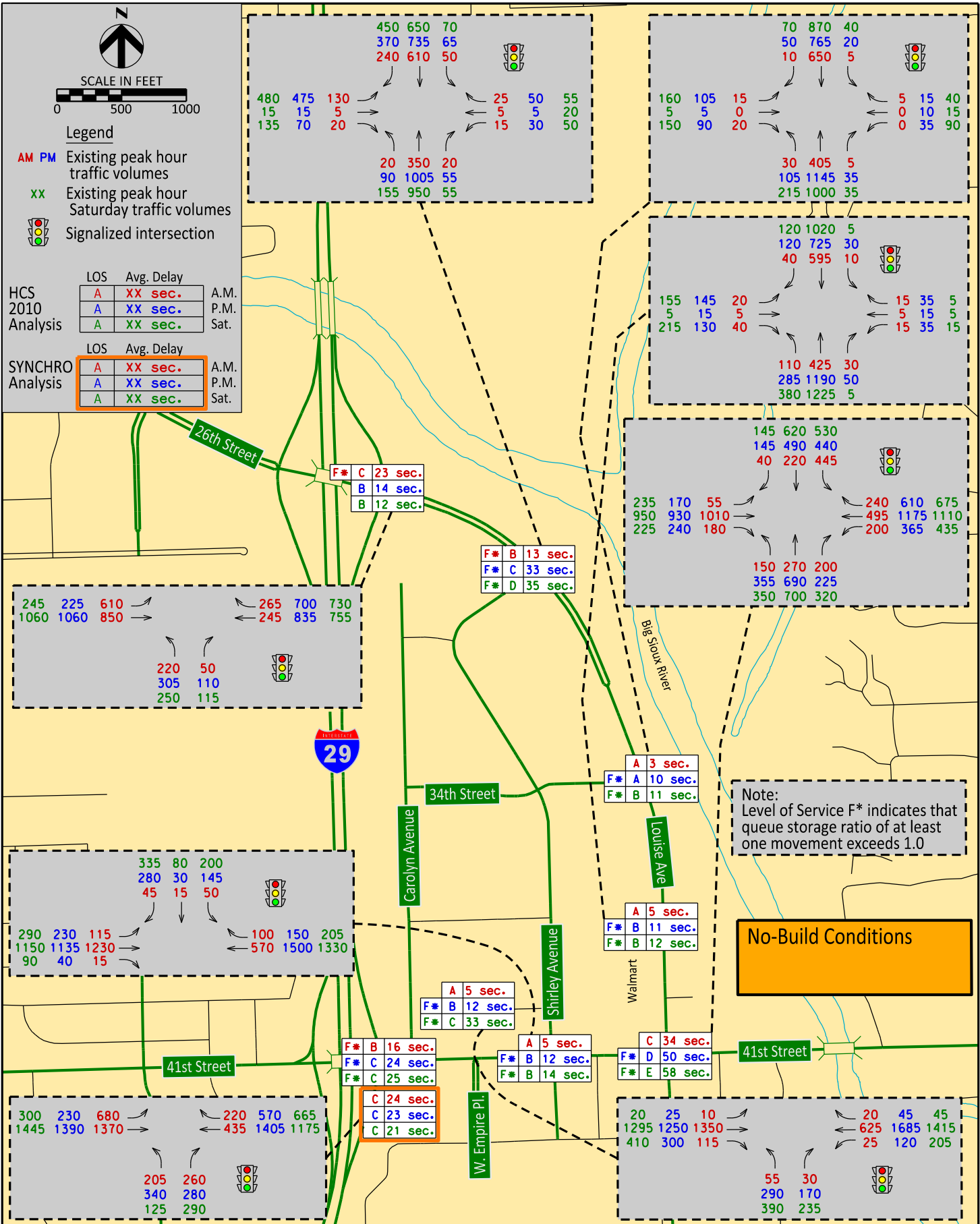
Drawn By: B.Miller  
 Date: 10/31/16  
 Chkd By: J.Unruh  
 Date: 10/31/16  
 Revision: 1/25/17



Year 2023 Traffic Volumes and Signalized Intersection Level of Service (west of I-29)  
 I-29 Exit 77 (41st Street) Interchange Modification Study  
 Sioux Falls, SD

Figure  
 15



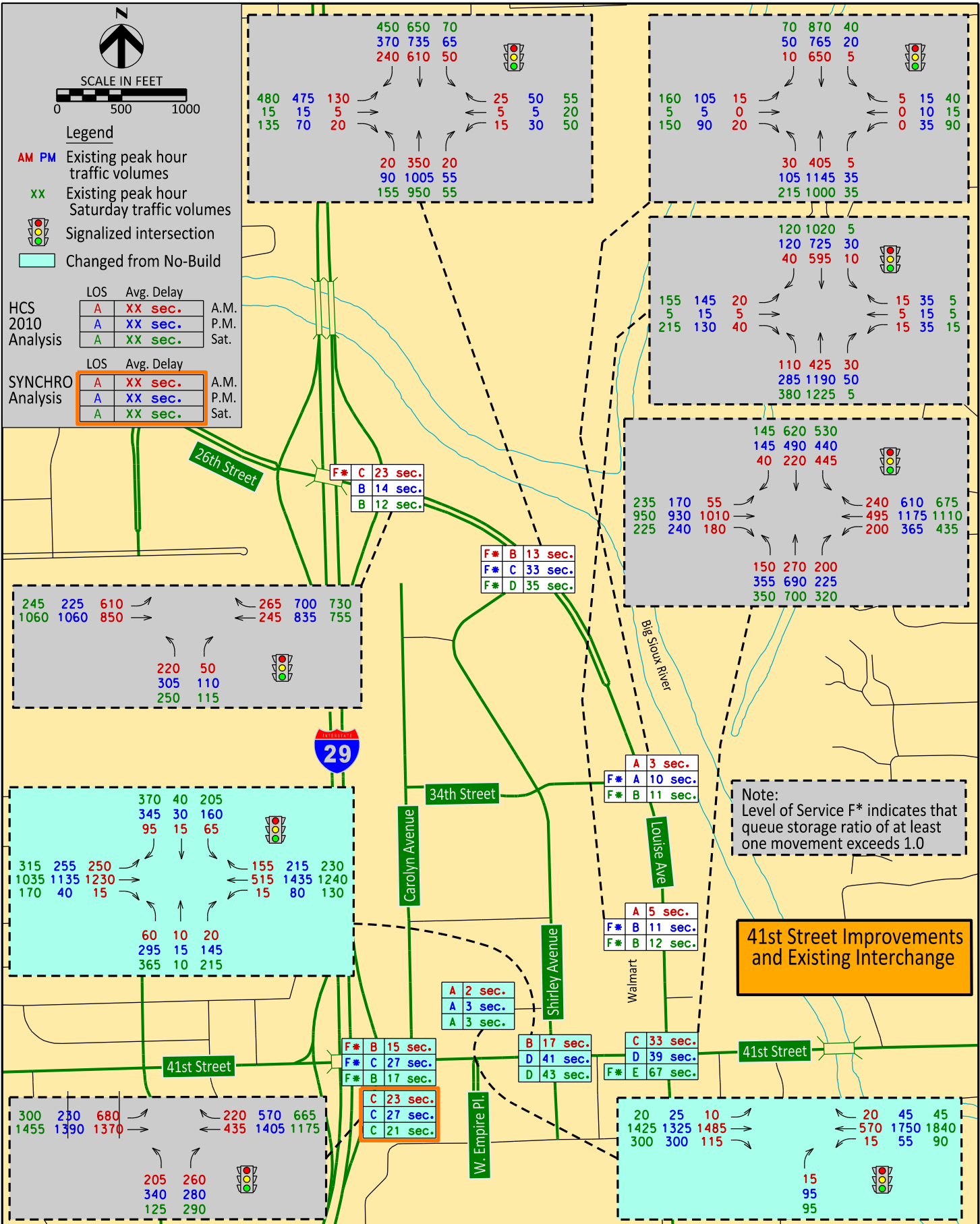


Drawn By: B.Miller  
 Date: 10/31/16  
 Chkd By: J.Unruh  
 Date: 10/31/16  
 Revision: 12/15/16



**Year 2023 Traffic Volumes and Signalized Intersection Level of Service (east of I-29)**  
 I-29 Exit 77 (41st Street) Interchange Modification Study  
 Sioux Falls, SD

Figure **16**

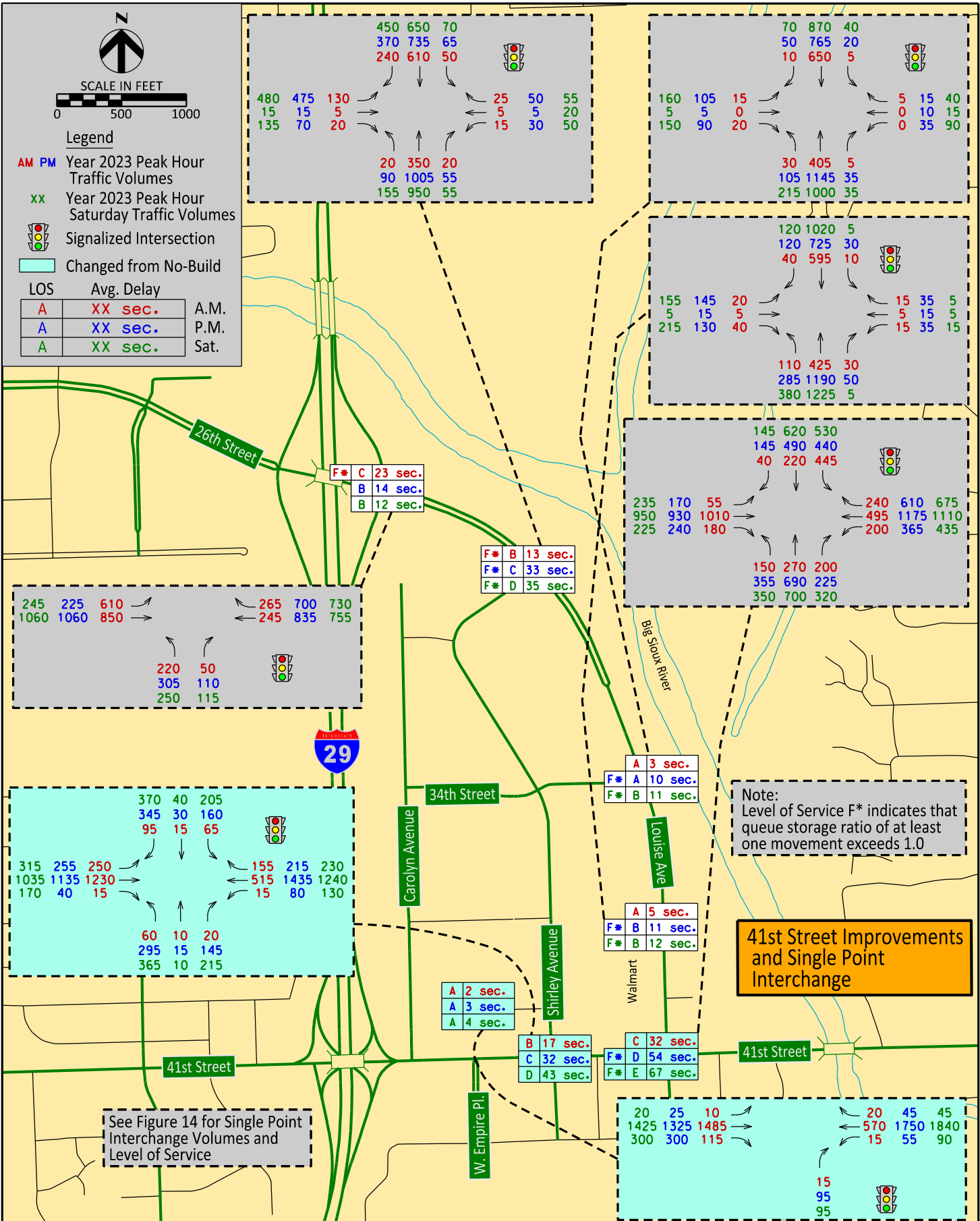


Drawn By: B.Miller  
 Date: 10/31/16  
 Chkd By: J.Unruh  
 Date: 10/31/16  
 Revision: 2/7/17



**Year 2023 Traffic Volumes and Signalized Intersection Level of Service (east of I-29)**  
 I-29 Exit 77 (41st Street) Interchange Modification Study  
 Sioux Falls, SD

Figure 17

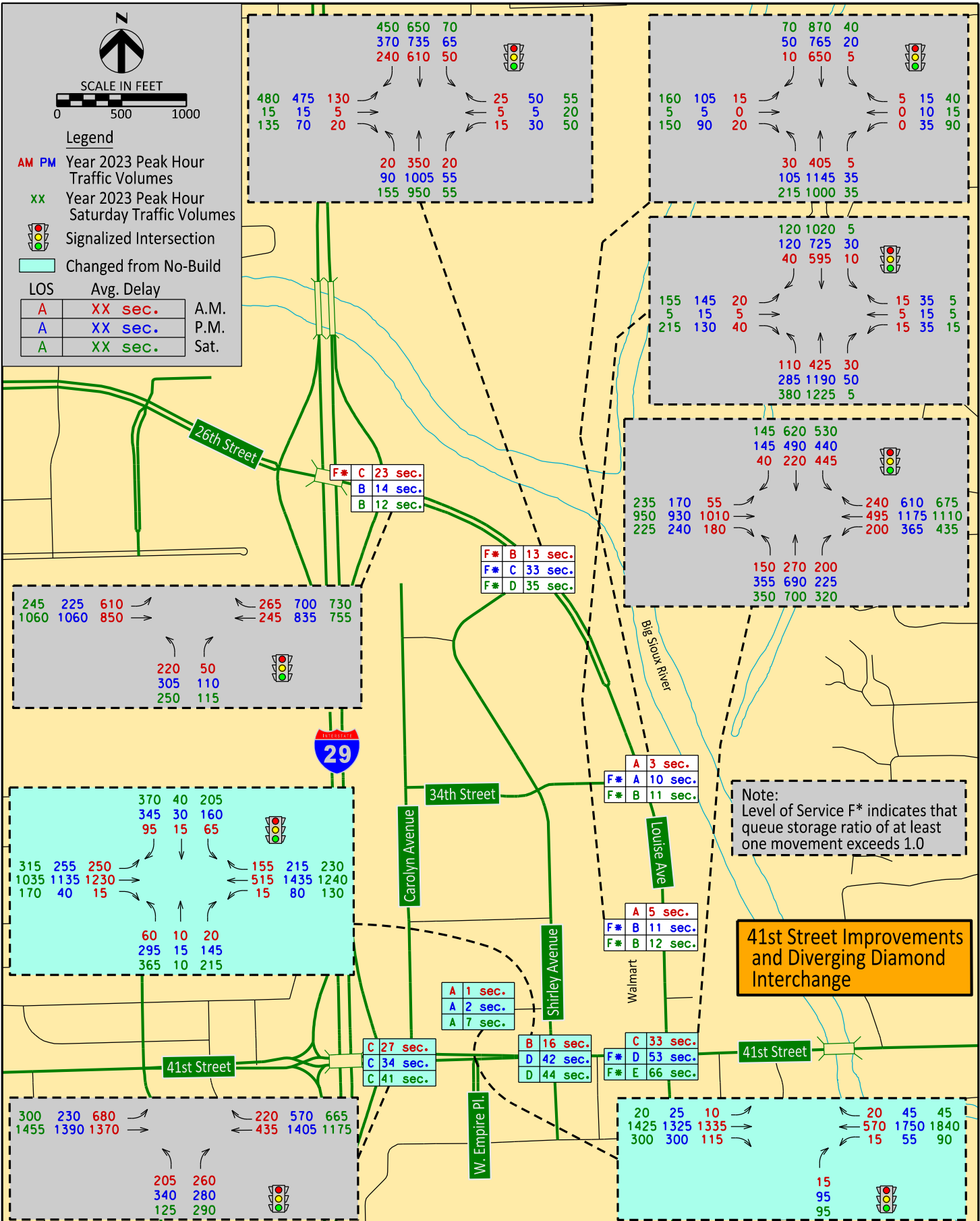


Drawn By: B. Miller  
 Date: 10/31/16  
 Chkd By: J. Unruh  
 Date: 10/31/16  
 Revision: 2/7/17



**HR** Year 2023 Traffic Volumes and Signalized Intersection Level of Service (east of I-29)  
 I-29 Exit 77 (41st Street) Interchange Modification Study  
 Sioux Falls, SD

Figure 18

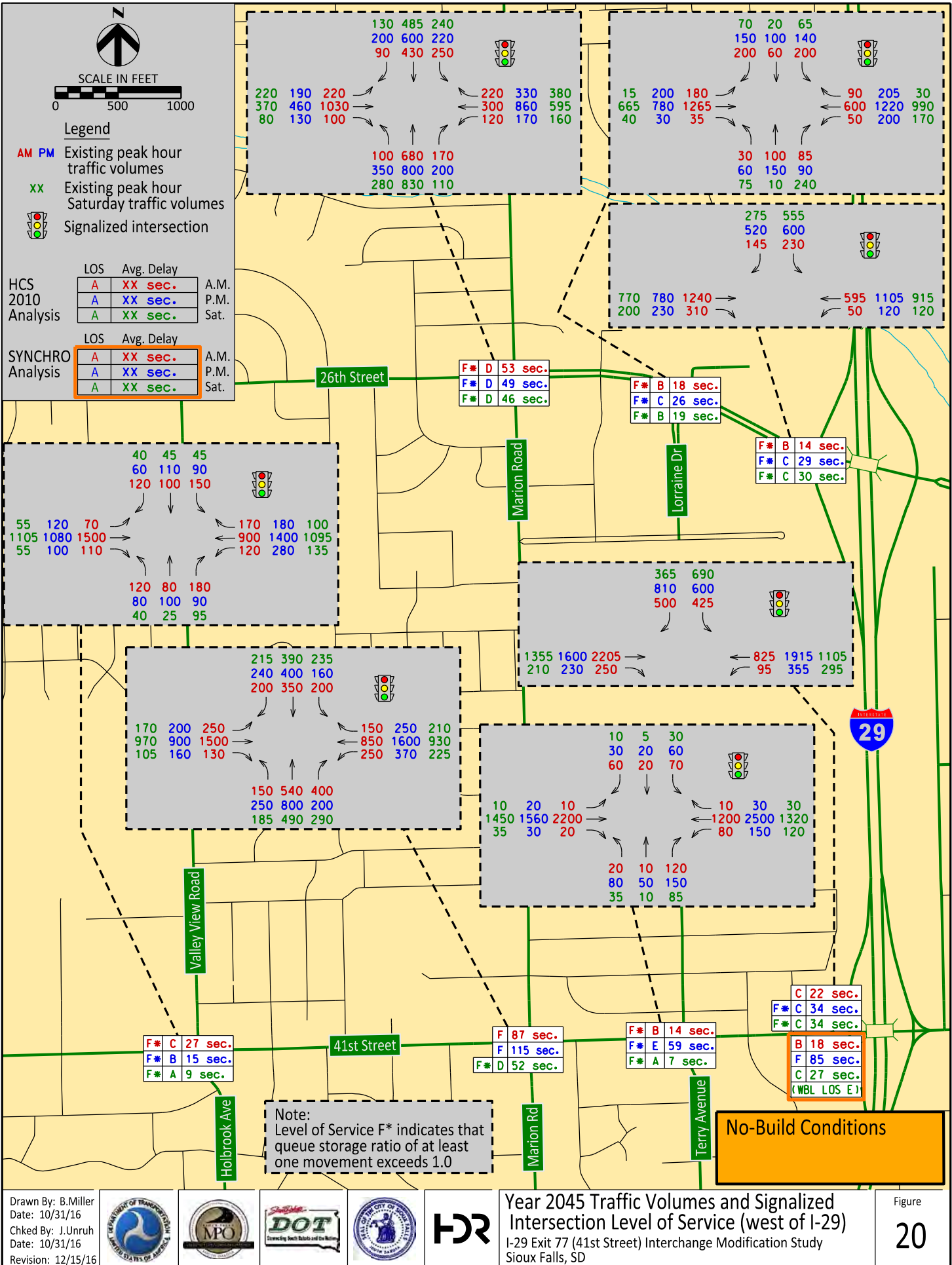


Drawn By: B.Miller  
 Date: 10/31/16  
 Chkd By: J.Unruh  
 Date: 10/31/16  
 Revision: 2/7/17



**Year 2023 Traffic Volumes and Signalized Intersection Level of Service (east of I-29)**  
 I-29 Exit 77 (41st Street) Interchange Modification Study  
 Sioux Falls, SD

Figure **19**



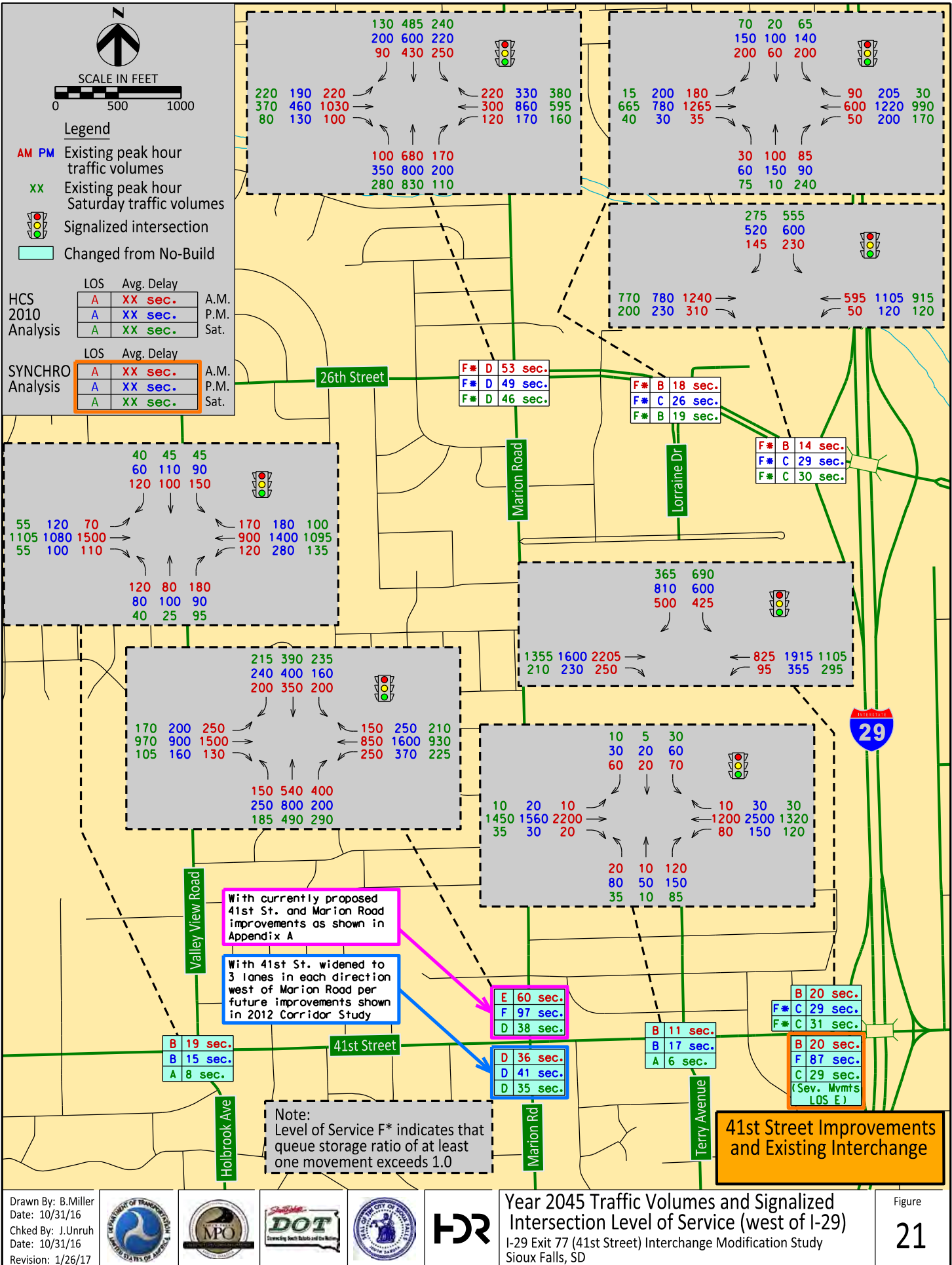
Drawn By: B.Miller  
 Date: 10/31/16  
 Chkd By: J.Unruh  
 Date: 10/31/16  
 Revision: 12/15/16



Year 2045 Traffic Volumes and Signalized Intersection Level of Service (west of I-29)  
 I-29 Exit 77 (41st Street) Interchange Modification Study  
 Sioux Falls, SD

Figure  
 20



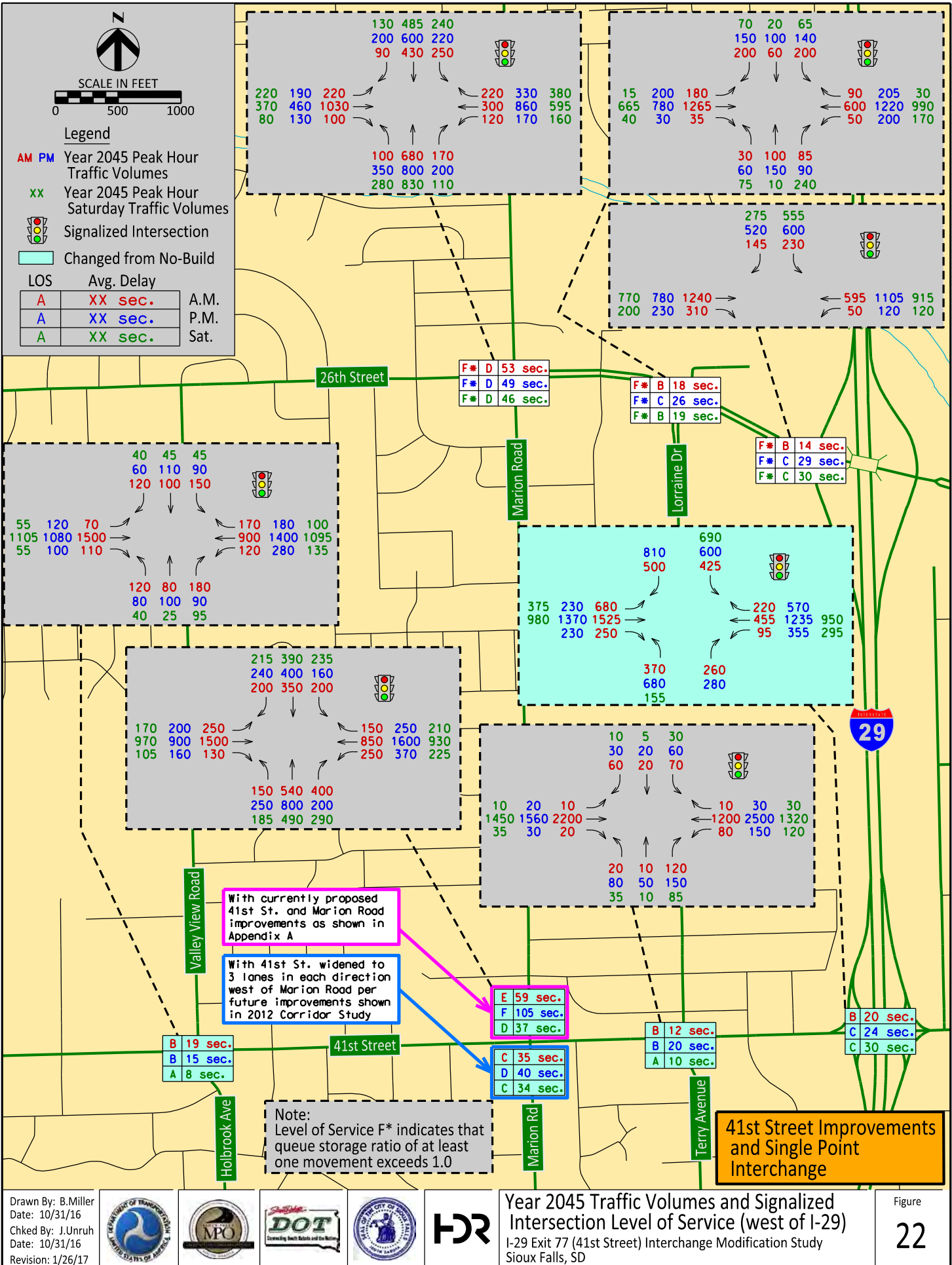


Drawn By: B.Miller  
 Date: 10/31/16  
 Chkd By: J.Unruh  
 Date: 10/31/16  
 Revision: 1/26/17



Year 2045 Traffic Volumes and Signalized Intersection Level of Service (west of I-29)  
 I-29 Exit 77 (41st Street) Interchange Modification Study  
 Sioux Falls, SD

Figure  
**21**

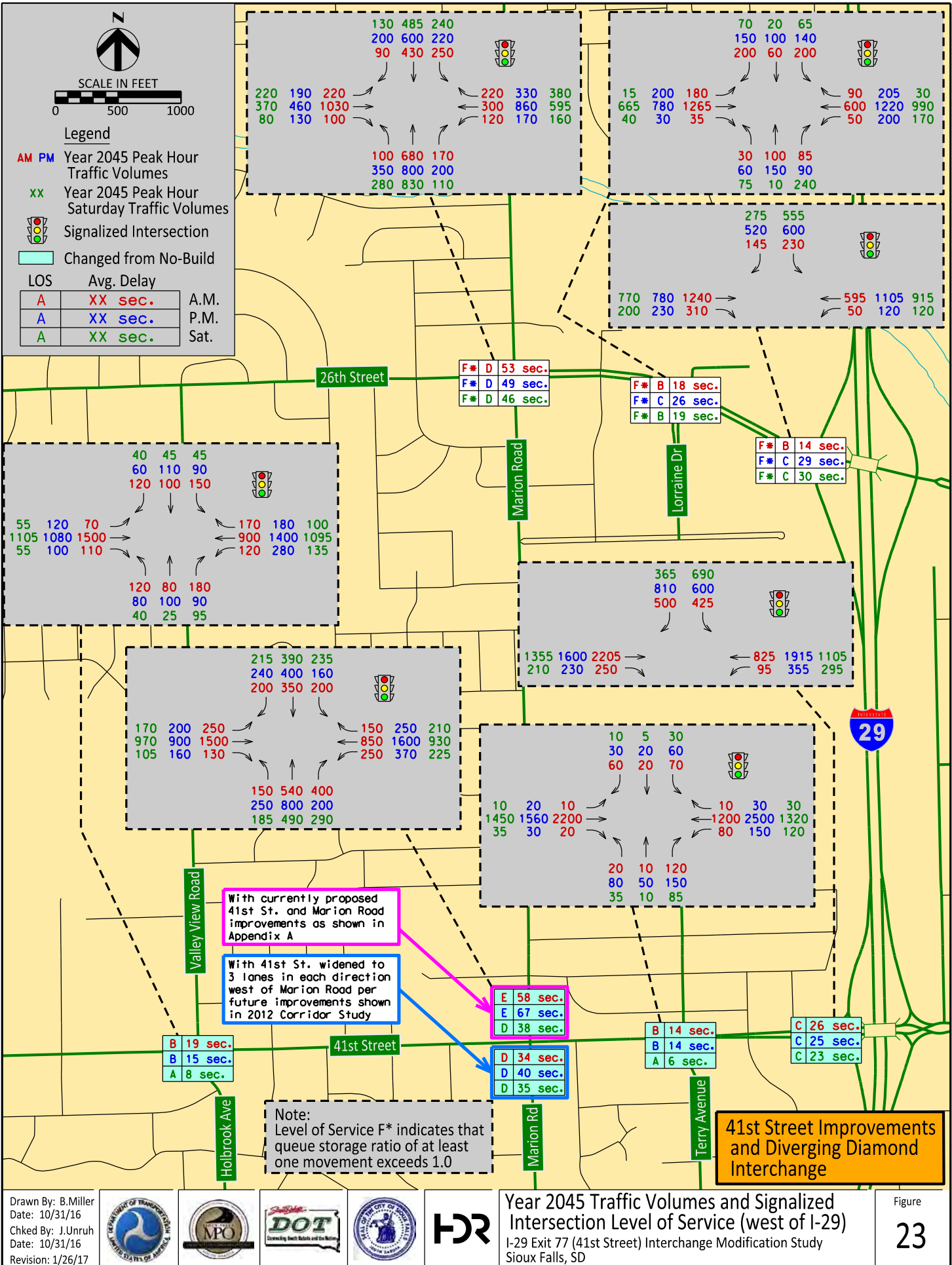


Drawn By: B.Miller  
 Date: 10/31/16  
 Chkd By: J.Unruh  
 Date: 10/31/16  
 Revision: 1/26/17

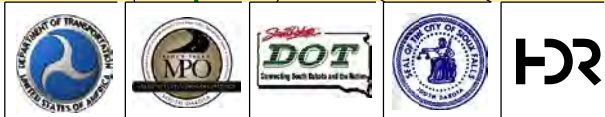


Year 2045 Traffic Volumes and Signalized Intersection Level of Service (west of I-29)  
 I-29 Exit 77 (41st Street) Interchange Modification Study  
 Sioux Falls, SD

Figure  
 22



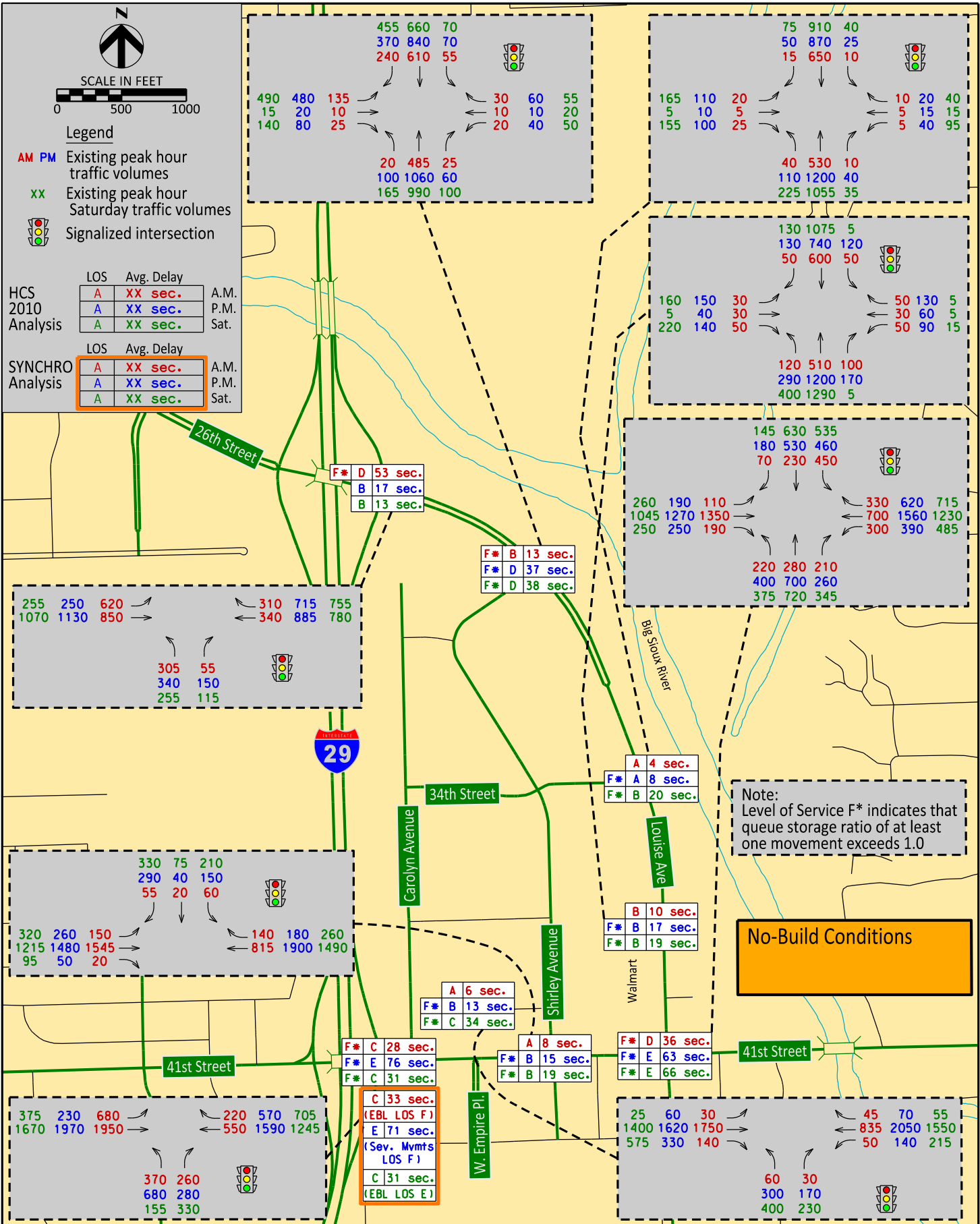
Drawn By: B.Miller  
 Date: 10/31/16  
 Chkd By: J.Unruh  
 Date: 10/31/16  
 Revision: 1/26/17



Year 2045 Traffic Volumes and Signalized Intersection Level of Service (west of I-29)  
 I-29 Exit 77 (41st Street) Interchange Modification Study  
 Sioux Falls, SD

Figure  
**23**



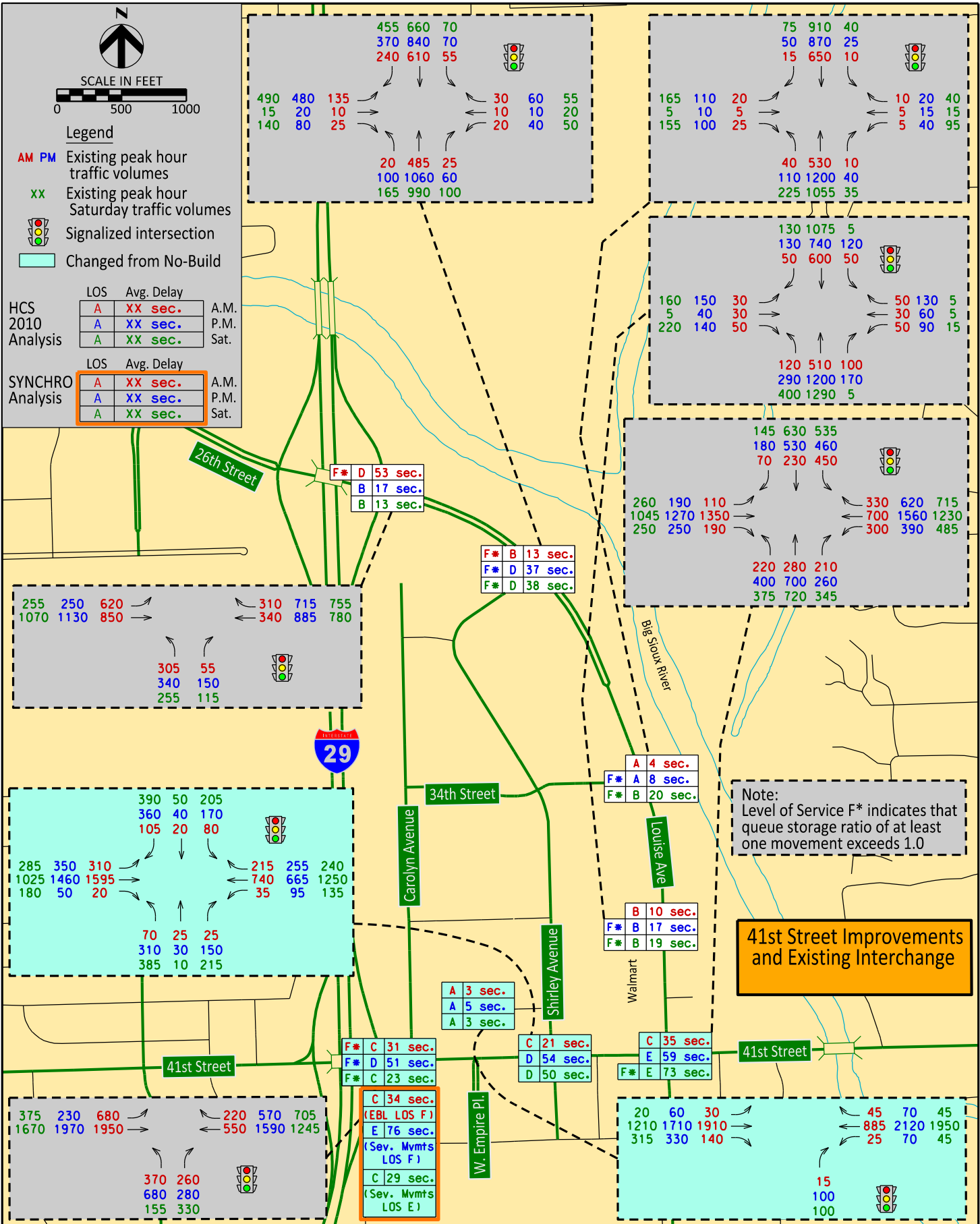


Drawn By: B. Miller  
 Date: 10/31/16  
 Chkd By: J. Unruh  
 Date: 10/31/16  
 Revision: 12/15/16



Year 2045 Traffic Volumes and Signalized Intersection Level of Service (east of I-29)  
 I-29 Exit 77 (41st Street) Interchange Modification Study  
 Sioux Falls, SD

Figure  
 24

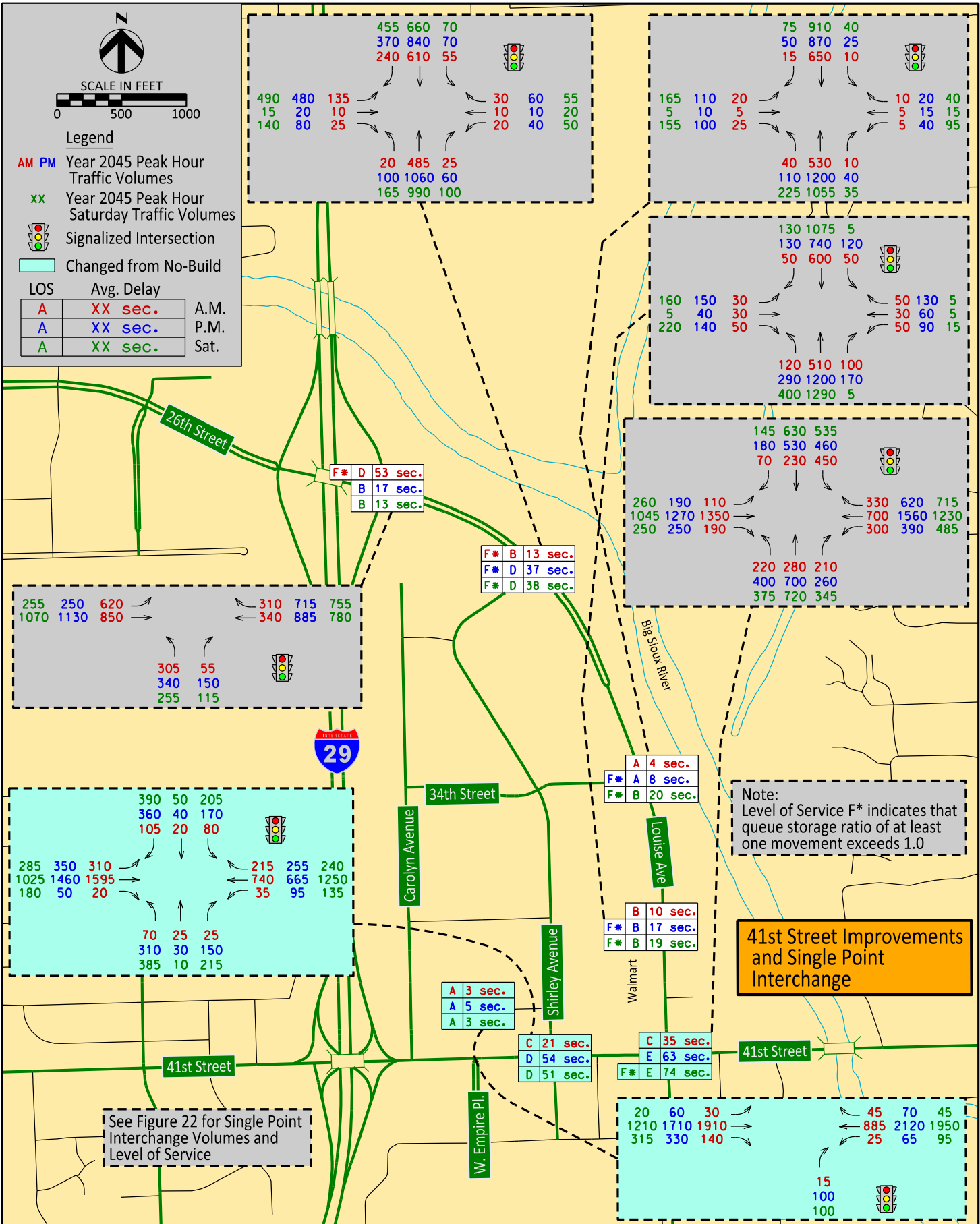


Drawn By: B.Miller  
 Date: 10/31/16  
 Chkd By: J.Unruh  
 Date: 10/31/16  
 Revision: 2/7/17



**Year 2045 Traffic Volumes and Signalized Intersection Level of Service (east of I-29)**  
 I-29 Exit 77 (41st Street) Interchange Modification Study  
 Sioux Falls, SD

Figure **25**

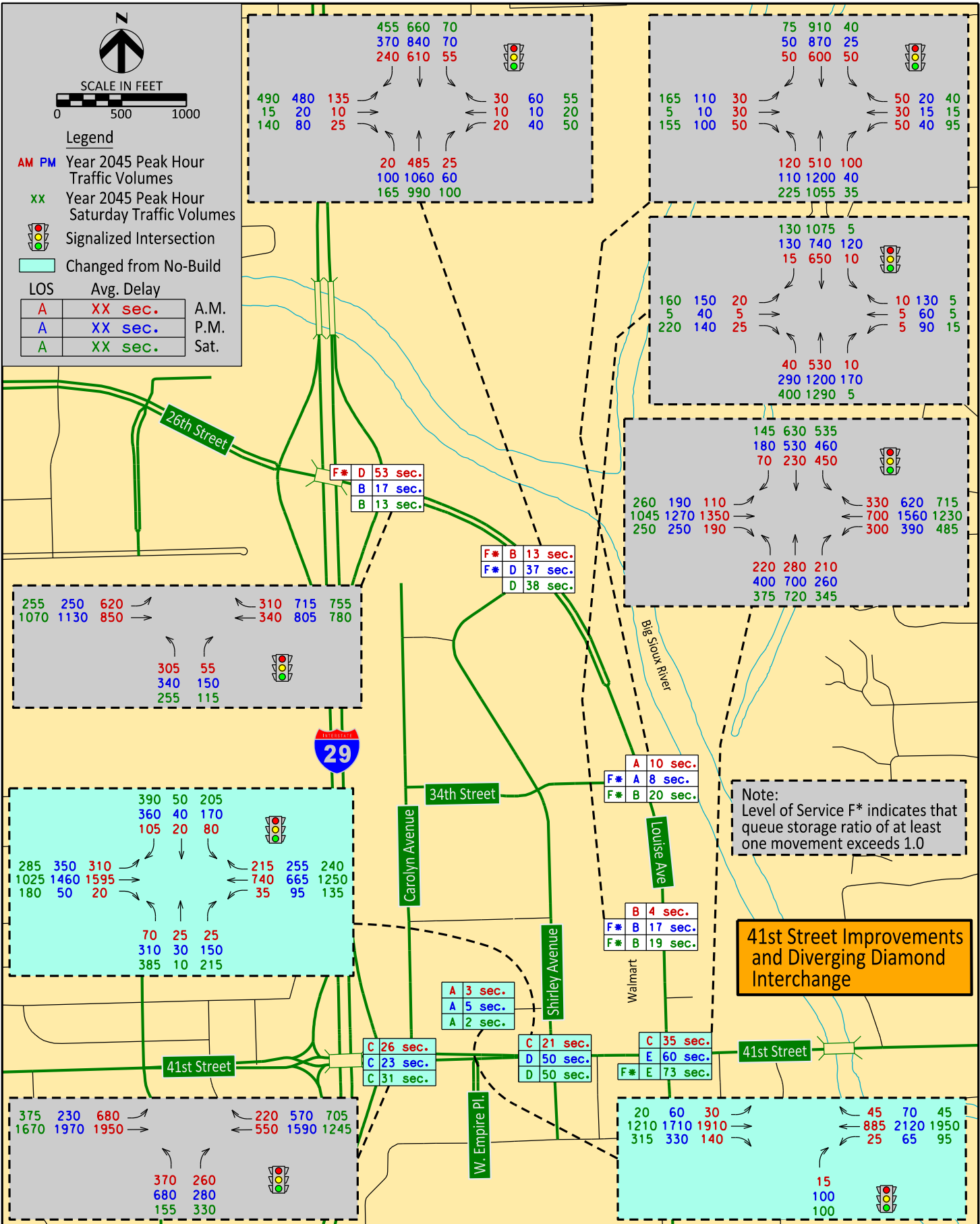


Drawn By: B. Miller  
 Date: 10/31/16  
 Chkd By: J. Unruh  
 Date: 10/31/16  
 Revision: 2/7/17



**Year 2045 Traffic Volumes and Signalized Intersection Level of Service (east of I-29)**  
 I-29 Exit 77 (41st Street) Interchange Modification Study  
 Sioux Falls, SD

Figure **26**



Drawn By: B.Miller  
 Date: 10/31/16  
 Chkd By: J.Unruh  
 Date: 10/31/16  
 Revision: 2/7/17



**Year 2045 Traffic Volumes and Signalized Intersection Level of Service (east of I-29)**  
 I-29 Exit 77 (41st Street) Interchange Modification Study  
 Sioux Falls, SD

Figure **27**



SCALE IN FEET  
0 500 1000

	AM	PM	Sat.	
	EB C	PM C	Sat. C	Auto Level of Service
	EB B	PM B	Sat. B	Pedestrian Level of Service
	EB C	PM C	Sat. C	Bicycle Level of Service
	EB A	PM A	Sat. A	Transit Level of Service

EB = Eastbound WB = Westbound Sat. = Saturday

	AM	PM	Sat.
	EB E	PM C	Sat. D
	EB C	PM D	Sat. D
	EB D	PM D	Sat. D
	EB B	PM A	Sat. A

	AM	PM	Sat.
	EB C	PM E	Sat. E
	EB D	PM D	Sat. D
	EB C	PM D	Sat. D
	EB A	PM B	Sat. A

	AM	PM	Sat.
	NB B	PM B	Sat. C
	NB E	PM F	Sat. F
	NB C	PM D	Sat. D
	NB D	PM D	Sat. D

	AM	PM	Sat.
	NB B	PM B	Sat. C
	NB C	PM D	Sat. D
	NB C	PM D	Sat. D
	NB A	PM A	Sat. A

	AM	PM	Sat.
	NB B	PM D	Sat. E
	NB A	PM B	Sat. B
	NB C	PM D	Sat. D
	NB D	PM D	Sat. D

	AM	PM	Sat.
	EB C	PM C	Sat. C
	EB C	PM D	Sat. E
	EB D	PM D	Sat. D
	EB A	PM A	Sat. A

	AM	PM	Sat.
	EB E	PM F	Sat. F
	EB C	PM C	Sat. C
	EB D	PM D	Sat. D
	EB A	PM A	Sat. A

	AM	PM	Sat.
	EB C	PM C	Sat. F
	EB E	PM E	Sat. F
	EB D	PM D	Sat. D
	EB A	PM A	Sat. C

No-Build Conditions

Drawn By: B.Miller  
Date: 10/31/16  
Chkd By: J.Unruh  
Date: 10/31/16  
Revision:



Year 2023 Multimodal Peak Hour  
Level of Service  
I-29 Exit 77 (41st Street) Interchange Modification Study  
Sioux Falls, SD

Figure  
28



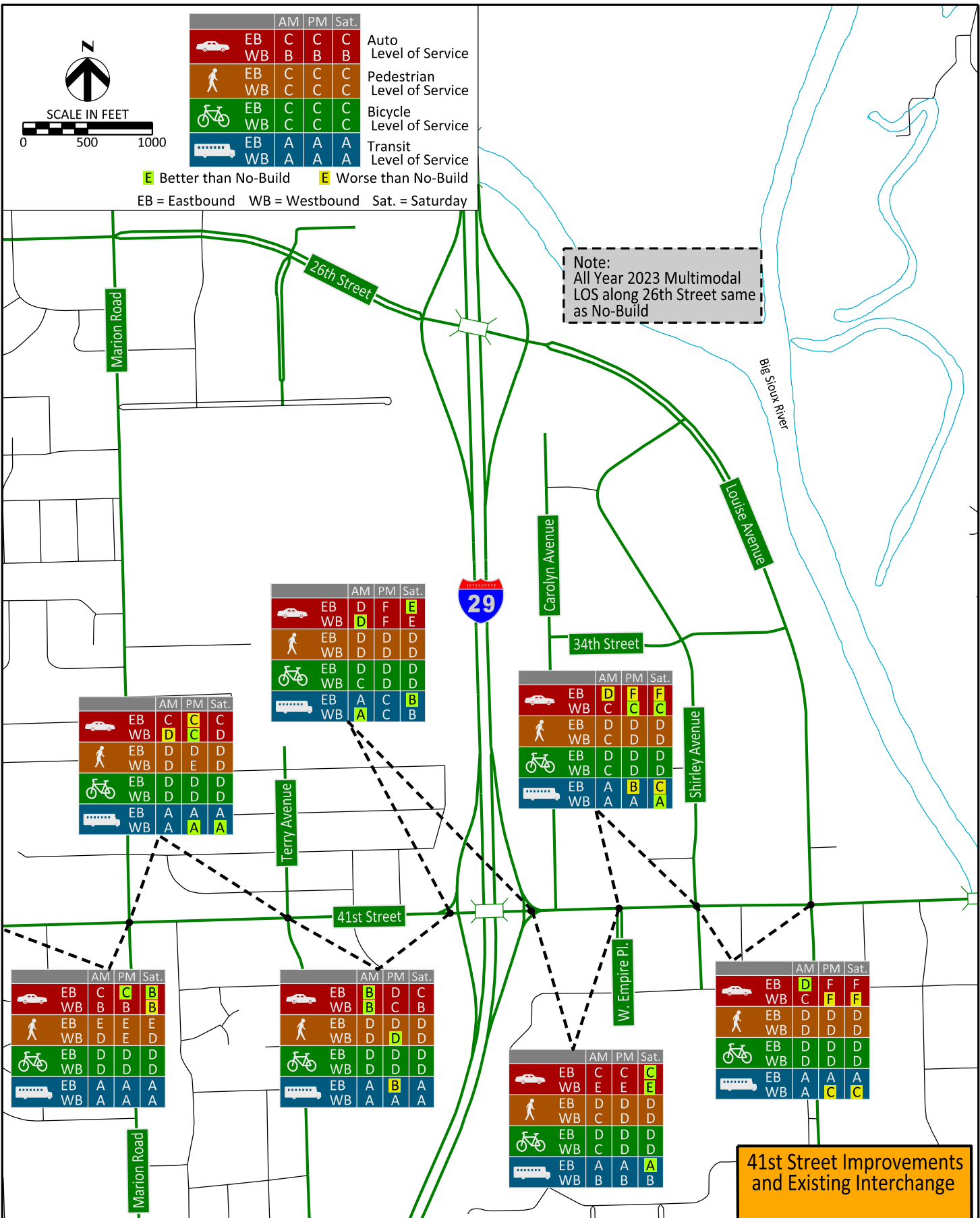


SCALE IN FEET  
0 500 1000

		AM	PM	Sat.	
	EB	C	C	C	Auto Level of Service
	WB	B	B	B	
	EB	C	C	C	Pedestrian Level of Service
	WB	C	C	C	
	EB	C	C	C	Bicycle Level of Service
	WB	C	C	C	
	EB	A	A	A	Transit Level of Service
	WB	A	A	A	

**E** Better than No-Build      **F** Worse than No-Build  
EB = Eastbound    WB = Westbound    Sat. = Saturday

Note:  
All Year 2023 Multimodal  
LOS along 26th Street same  
as No-Build



		AM	PM	Sat.
	EB	C	C	C
	WB	D	C	D
	EB	D	D	D
	WB	D	E	D
	EB	D	D	D
	WB	D	D	D
	EB	A	A	A
	WB	A	A	A

		AM	PM	Sat.
	EB	D	F	E
	WB	D	F	E
	EB	D	D	D
	WB	D	D	D
	EB	D	D	D
	WB	C	D	D
	EB	A	C	B
	WB	A	C	B

		AM	PM	Sat.
	EB	D	F	F
	WB	C	C	C
	EB	D	D	D
	WB	C	D	D
	EB	D	D	D
	WB	C	D	D
	EB	A	B	C
	WB	A	A	A

		AM	PM	Sat.
	EB	C	C	B
	WB	B	B	B
	EB	E	F	E
	WB	D	F	D
	EB	D	D	D
	WB	D	D	D
	EB	A	A	A
	WB	A	A	A

		AM	PM	Sat.
	EB	B	D	C
	WB	B	C	B
	EB	D	D	D
	WB	D	D	D
	EB	D	D	D
	WB	D	D	D
	EB	A	B	A
	WB	A	A	A

		AM	PM	Sat.
	EB	D	F	F
	WB	C	F	F
	EB	D	D	D
	WB	D	D	D
	EB	D	D	D
	WB	D	D	D
	EB	A	A	A
	WB	A	C	C

		AM	PM	Sat.
	EB	C	C	C
	WB	E	E	E
	EB	D	D	D
	WB	C	D	D
	EB	C	D	D
	WB	D	D	D
	EB	A	A	A
	WB	B	B	B

41st Street Improvements  
and Existing Interchange

Drawn By: B.Miller  
Date: 10/31/16  
Chkd By: J.Unruh  
Date: 10/31/16  
Revision: 1/20/17



Year 2023 Multimodal Peak Hour  
Level of Service  
I-29 Exit 77 (41st Street) Interchange Modification Study  
Sioux Falls, SD

Figure  
**29**

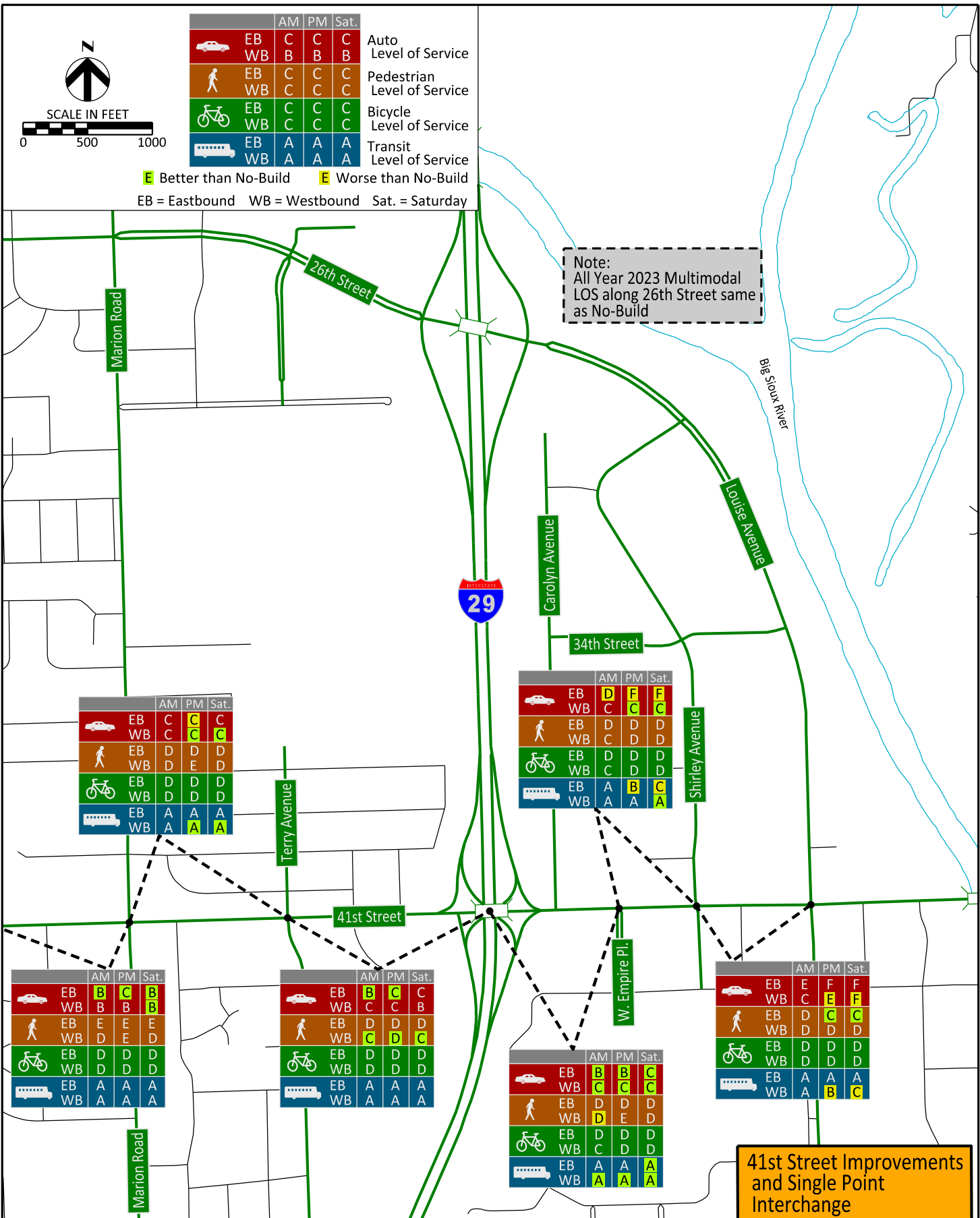


SCALE IN FEET  
0 500 1000

		AM	PM	Sat.	
	EB WB	C B	C B	C B	Auto Level of Service
	EB WB	C C	C C	C C	Pedestrian Level of Service
	EB WB	C C	C C	C C	Bicycle Level of Service
	EB WB	A A	A A	A A	Transit Level of Service

**E** Better than No-Build    **F** Worse than No-Build  
EB = Eastbound    WB = Westbound    Sat. = Saturday

Note:  
All Year 2023 Multimodal  
LOS along 26th Street same  
as No-Build



		AM	PM	Sat.
	EB WB	C C	C C	C C
	EB WB	D D	D E	D D
	EB WB	D D	D D	D D
	EB WB	A A	A A	A A

		AM	PM	Sat.
	EB WB	D C	F C	F C
	EB WB	D C	D D	D D
	EB WB	D C	D D	D D
	EB WB	A A	B A	C A

		AM	PM	Sat.
	EB WB	B B	C B	B B
	EB WB	E D	F E	E D
	EB WB	D D	D D	D D
	EB WB	A A	A A	A A

		AM	PM	Sat.
	EB WB	B C	C C	C B
	EB WB	D C	D D	D D
	EB WB	D D	D D	D D
	EB WB	A A	A A	A A

		AM	PM	Sat.
	EB WB	E C	F E	F F
	EB WB	D D	C D	C D
	EB WB	D D	D D	D D
	EB WB	A A	A B	A C

		AM	PM	Sat.
	EB WB	B C	B C	C C
	EB WB	D D	E E	D D
	EB WB	D C	D D	D D
	EB WB	A A	A A	A A

41st Street Improvements  
and Single Point  
Interchange

Drawn By: B. Miller  
Date: 10/31/16  
Chkd By: J. Unruh  
Date: 10/31/16  
Revision: 1/20/17



Year 2023 Multimodal Peak Hour  
Level of Service  
I-29 Exit 77 (41st Street) Interchange Modification Study  
Sioux Falls, SD

Figure  
**30**

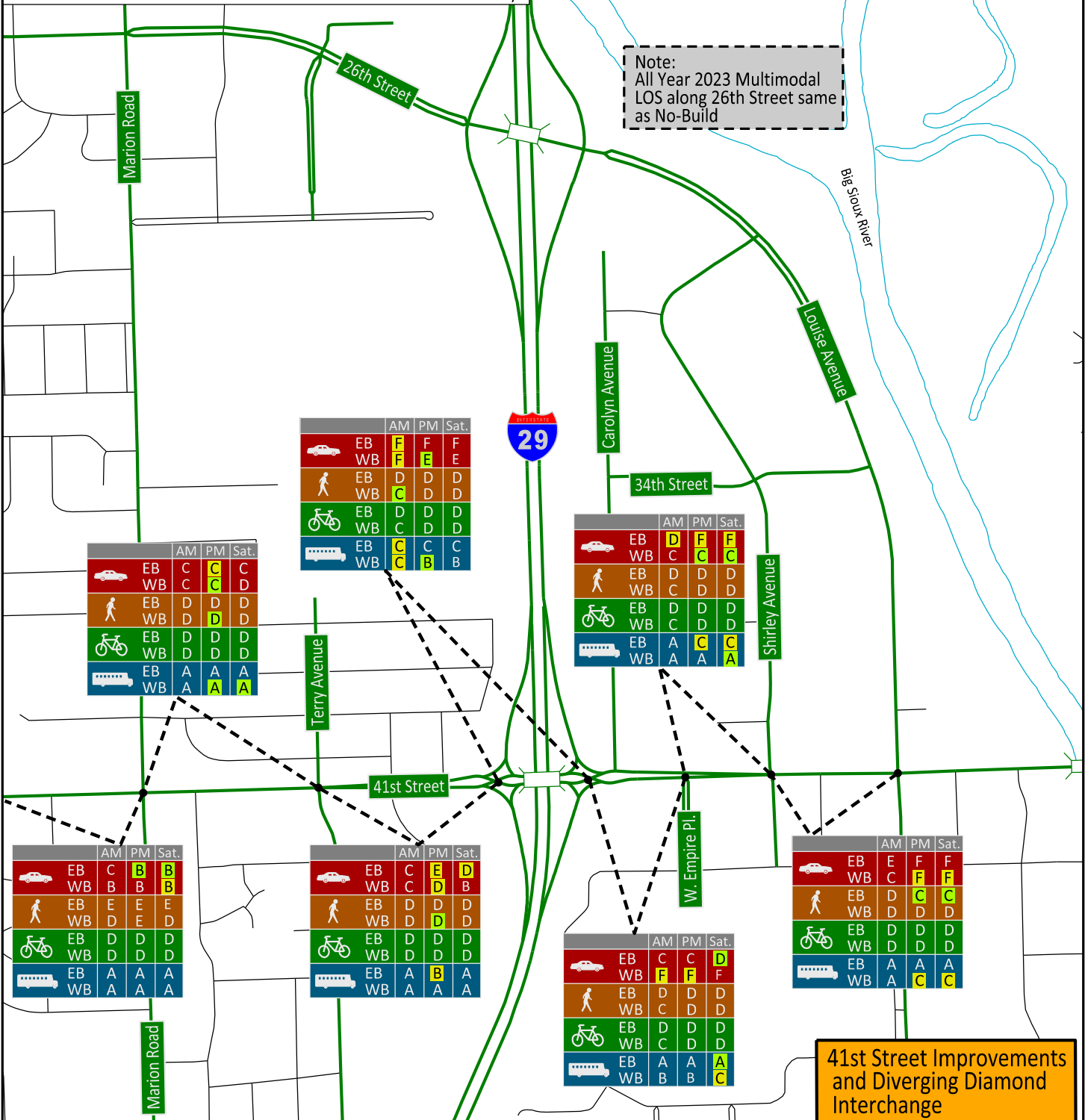


SCALE IN FEET  
0 500 1000

		AM	PM	Sat.	
	EB	C	C	C	Auto Level of Service
	WB	B	B	B	
	EB	C	C	C	Pedestrian Level of Service
	WB	C	C	C	
	EB	C	C	C	Bicycle Level of Service
	WB	C	C	C	
	EB	A	A	A	Transit Level of Service
	WB	A	A	A	

**E** Better than No-Build      **F** Worse than No-Build  
EB = Eastbound    WB = Westbound    Sat. = Saturday

Note:  
All Year 2023 Multimodal  
LOS along 26th Street same  
as No-Build



		AM	PM	Sat.
	EB	C	C	C
	WB	C	C	D
	EB	D	D	D
	WB	D	D	D
	EB	D	D	D
	WB	D	D	D
	EB	A	A	A
	WB	A	A	A

		AM	PM	Sat.
	EB	F	F	F
	WB	F	E	E
	EB	D	D	D
	WB	C	D	D
	EB	D	D	D
	WB	C	D	D
	EB	C	C	C
	WB	C	B	B

		AM	PM	Sat.
	EB	D	F	F
	WB	C	C	C
	EB	D	D	D
	WB	C	D	D
	EB	D	D	D
	WB	C	D	D
	EB	A	C	C
	WB	A	A	A

		AM	PM	Sat.
	EB	C	B	B
	WB	B	B	B
	EB	E	F	F
	WB	D	E	D
	EB	D	D	D
	WB	D	D	D
	EB	A	A	A
	WB	A	A	A

		AM	PM	Sat.
	EB	C	E	D
	WB	C	D	B
	EB	D	D	D
	WB	D	D	D
	EB	D	D	D
	WB	D	D	D
	EB	A	B	A
	WB	A	A	A

		AM	PM	Sat.
	EB	E	F	F
	WB	C	F	F
	EB	D	C	C
	WB	D	D	D
	EB	D	D	D
	WB	D	D	D
	EB	A	A	A
	WB	A	C	C

		AM	PM	Sat.
	EB	C	C	D
	WB	F	F	F
	EB	D	D	D
	WB	C	D	D
	EB	D	D	D
	WB	C	D	D
	EB	A	A	A
	WB	B	B	C

41st Street Improvements  
and Diverging Diamond  
Interchange

Drawn By: B.Miller  
Date: 10/31/16  
Chkd By: J.Unruh  
Date: 10/31/16  
Revision: 1/20/17



Year 2023 Multimodal Peak Hour  
Level of Service  
I-29 Exit 77 (41st Street) Interchange Modification Study  
Sioux Falls, SD

Figure  
**31**





SCALE IN FEET  
0 500 1000

	AM	PM	Sat.	
	EB C	C B	C B	Auto Level of Service
	EB C	C C	C C	Pedestrian Level of Service
	EB C	C C	C C	Bicycle Level of Service
	EB A	A A	A A	Transit Level of Service

EB = Eastbound WB = Westbound Sat. = Saturday

	AM	PM	Sat.
	EB F	C C	C D
	EB D	D D	D D
	EB D	D D	D C
	EB D	A B	A A

	AM	PM	Sat.
	EB C	E C	E C
	EB D	D D	D D
	EB C	D D	D D
	EB A	B A	B A

	AM	PM	Sat.
	NB B	C C	C F
	NB D	D D	D D
	NB D	D D	D D
	NB A	A C	A C

	AM	PM	Sat.
	NB B	B C	C E
	NB D	D D	D D
	NB D	D D	D D
	NB A	A A	A B

	AM	PM	Sat.
	NB B	D E	E D
	NB D	D D	D D
	NB D	D D	D D
	NB A	B A	B A

	AM	PM	Sat.
	EB C	C C	C C
	EB D	D D	D D
	EB D	D D	D D
	EB A	A B	A B

	AM	PM	Sat.
	EB C	D D	D C
	EB D	D D	D D
	EB D	C D	C D
	EB A	A B	A A

	AM	PM	Sat.
	EB E	F F	F F
	EB D	D D	D D
	EB D	D D	D D
	EB B	C C	C C

	AM	PM	Sat.
	EB C	B B	B E
	EB D	D D	D D
	EB D	D D	D D
	EB A	A A	A B

	AM	PM	Sat.
	EB D	D C	C F
	EB D	D D	D D
	EB D	D D	D D
	EB A	A A	A B

	AM	PM	Sat.
	EB F	D D	D A
	EB E	E E	E E
	EB D	D D	D D
	EB C	B B	B A

	AM	PM	Sat.
	EB C	E E	E B
	EB D	D D	D D
	EB D	D D	D D
	EB A	B B	B A

	AM	PM	Sat.
	EB E	F C	F D
	EB D	D D	D D
	EB D	D D	D D
	EB A	A A	A A

	AM	PM	Sat.
	EB C	C F	F F
	EB D	D D	D D
	EB D	D D	D D
	EB A	A C	C C

No-Build Conditions

Drawn By: B.Miller  
Date: 10/31/16  
Chkd By: J.Unruh  
Date: 10/31/16  
Revision: 12/7/16



Year 2045 Multimodal Peak Hour Level of Service  
I-29 Exit 77 (41st Street) Interchange Modification Study  
Sioux Falls, SD

Figure  
**32**

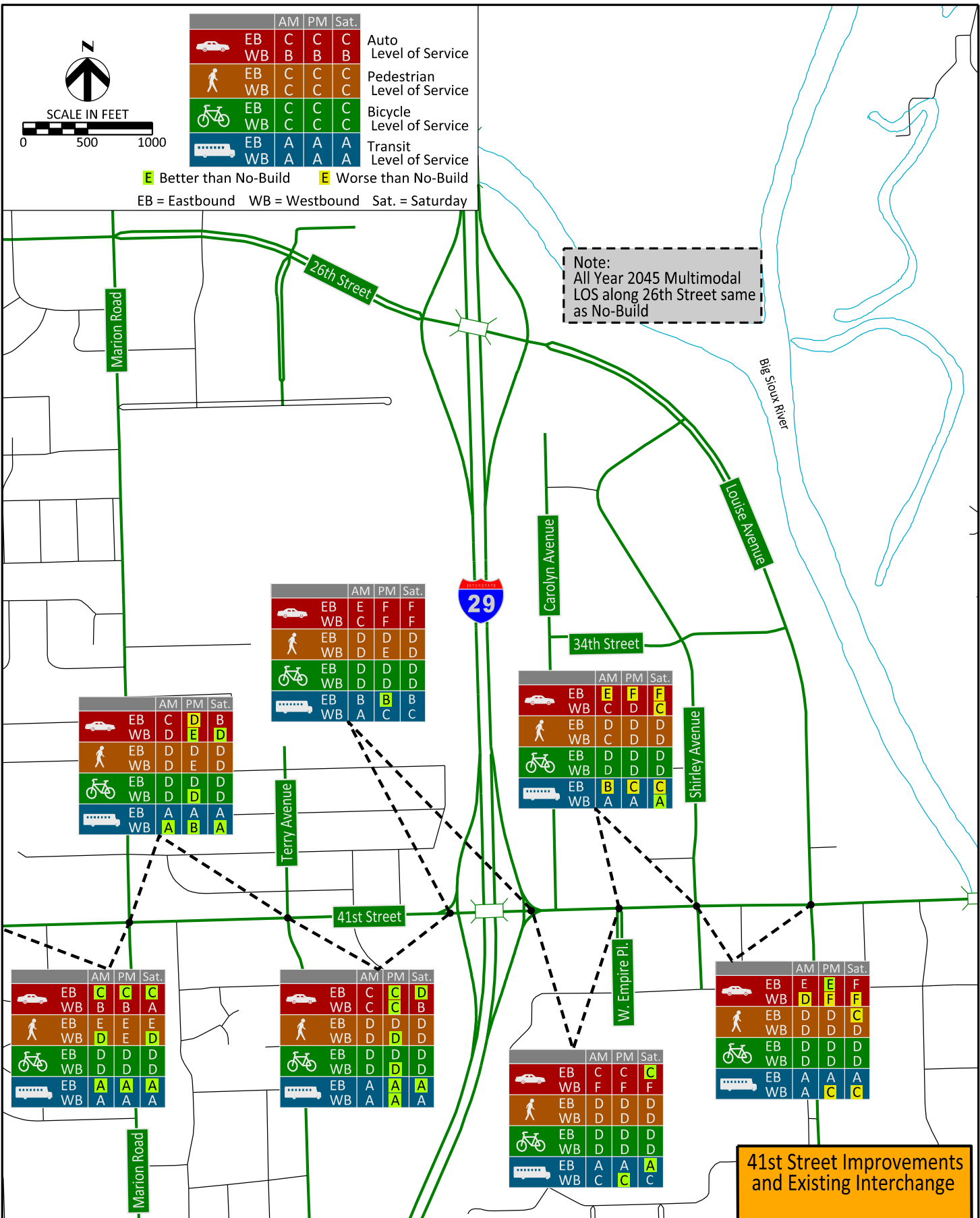


SCALE IN FEET  
0 500 1000

		AM	PM	Sat.	
	EB	C	C	C	Auto Level of Service
	WB	B	B	B	
	EB	C	C	C	Pedestrian Level of Service
	WB	C	C	C	
	EB	C	C	C	Bicycle Level of Service
	WB	C	C	C	
	EB	A	A	A	Transit Level of Service
	WB	A	A	A	

**E** Better than No-Build      **F** Worse than No-Build  
EB = Eastbound    WB = Westbound    Sat. = Saturday

Note:  
All Year 2045 Multimodal  
LOS along 26th Street same  
as No-Build



		AM	PM	Sat.
	EB	C	D	B
	WB	D	E	D
	EB	D	D	D
	WB	D	E	D
	EB	D	D	D
	WB	D	D	D
	EB	A	A	A
	WB	A	B	A

		AM	PM	Sat.
	EB	E	F	F
	WB	C	F	F
	EB	D	D	D
	WB	D	E	D
	EB	D	D	D
	WB	D	D	D
	EB	B	B	C
	WB	A	C	C

		AM	PM	Sat.
	EB	E	F	F
	WB	C	D	C
	EB	D	D	D
	WB	C	D	D
	EB	D	D	D
	WB	D	D	D
	EB	B	C	C
	WB	A	A	A

		AM	PM	Sat.
	EB	C	C	C
	WB	B	B	A
	EB	E	F	E
	WB	D	E	D
	EB	D	D	D
	WB	D	D	D
	EB	A	A	A
	WB	A	A	A

		AM	PM	Sat.
	EB	C	C	D
	WB	C	C	B
	EB	D	D	D
	WB	D	D	D
	EB	D	D	D
	WB	D	D	D
	EB	A	A	A
	WB	A	A	A

		AM	PM	Sat.
	EB	C	C	C
	WB	F	F	F
	EB	D	D	D
	WB	D	D	D
	EB	D	D	D
	WB	D	D	D
	EB	A	A	A
	WB	C	C	C

		AM	PM	Sat.
	EB	E	F	F
	WB	D	F	F
	EB	D	D	C
	WB	D	D	D
	EB	D	D	D
	WB	D	D	D
	EB	A	A	A
	WB	A	C	C

41st Street Improvements  
and Existing Interchange

Drawn By: B.Miller  
Date: 10/31/16  
Chkd By: J.Unruh  
Date: 10/31/16  
Revision: 1/20/17



Year 2045 Multimodal Peak Hour  
Level of Service  
I-29 Exit 77 (41st Street) Interchange Modification Study  
Sioux Falls, SD

Figure  
**33**

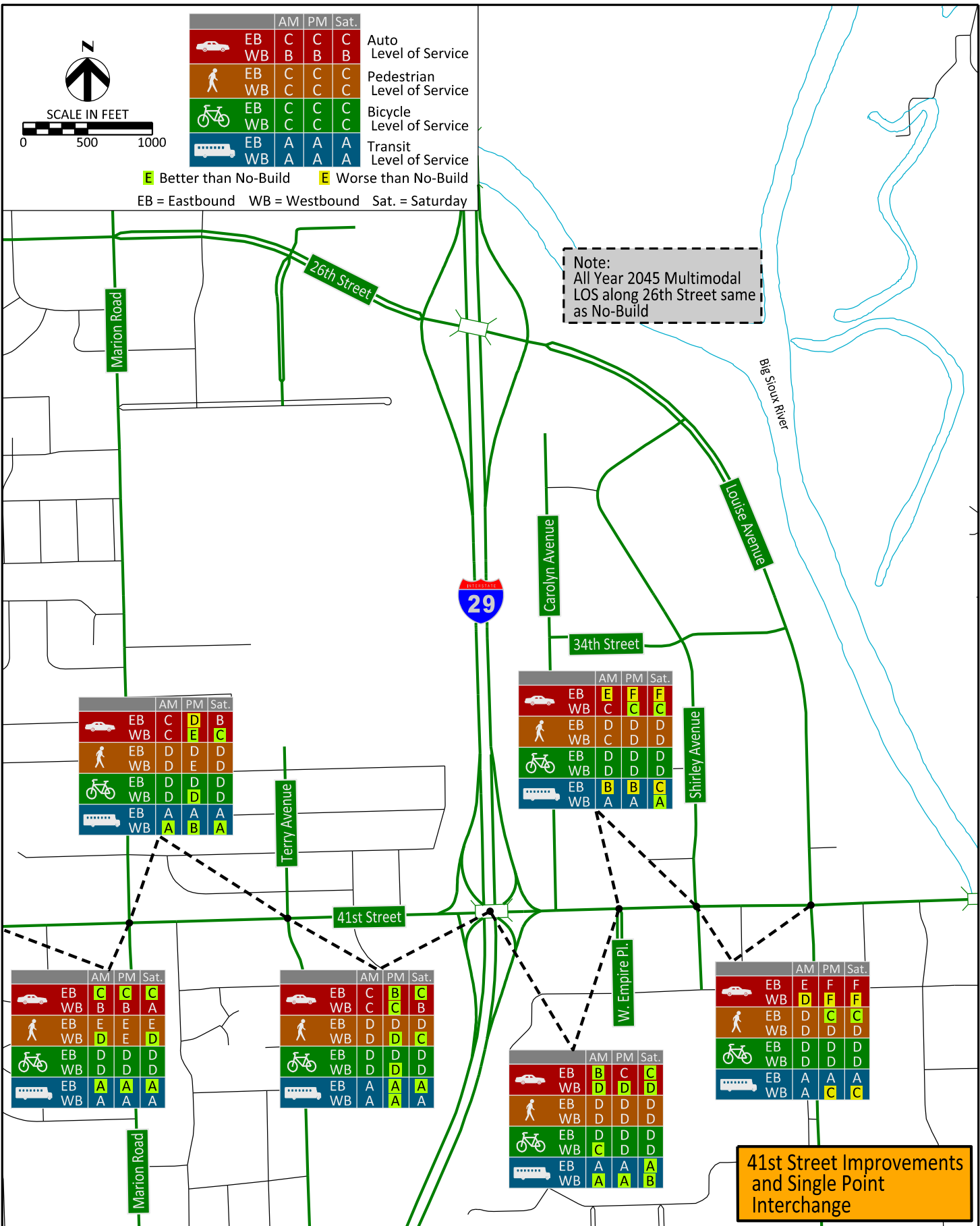


SCALE IN FEET  
0 500 1000

		AM	PM	Sat.	
	EB WB	C B	C B	C B	Auto Level of Service
	EB WB	C C	C C	C C	Pedestrian Level of Service
	EB WB	C C	C C	C C	Bicycle Level of Service
	EB WB	A A	A A	A A	Transit Level of Service

**E** Better than No-Build      **F** Worse than No-Build  
EB = Eastbound    WB = Westbound    Sat. = Saturday

Note:  
All Year 2045 Multimodal  
LOS along 26th Street same  
as No-Build



		AM	PM	Sat.
	EB WB	C C	D E	B C
	EB WB	D D	D E	D D
	EB WB	D D	D D	D D
	EB WB	A A	A B	A A

		AM	PM	Sat.
	EB WB	E C	F C	F C
	EB WB	D C	D D	D D
	EB WB	D D	D D	D D
	EB WB	B A	B A	C A

		AM	PM	Sat.
	EB WB	C B	C B	C A
	EB WB	E D	F E	E D
	EB WB	D D	D D	D D
	EB WB	A A	A A	A A

		AM	PM	Sat.
	EB WB	C C	B C	C B
	EB WB	D D	D D	D C
	EB WB	D D	D D	D D
	EB WB	A A	A A	A A

		AM	PM	Sat.
	EB WB	B D	C D	C D
	EB WB	D D	D D	D D
	EB WB	D C	D D	D D
	EB WB	A A	A A	A B

		AM	PM	Sat.
	EB WB	E D	F F	F F
	EB WB	D D	C D	C D
	EB WB	D D	D D	D D
	EB WB	A A	A C	A C

41st Street Improvements  
and Single Point  
Interchange

Drawn By: B.Miller  
Date: 10/31/16  
Chkd By: J.Unruh  
Date: 10/31/16  
Revision: 1/20/17



Year 2045 Multimodal Peak Hour  
Level of Service  
I-29 Exit 77 (41st Street) Interchange Modification Study  
Sioux Falls, SD

Figure  
**34**

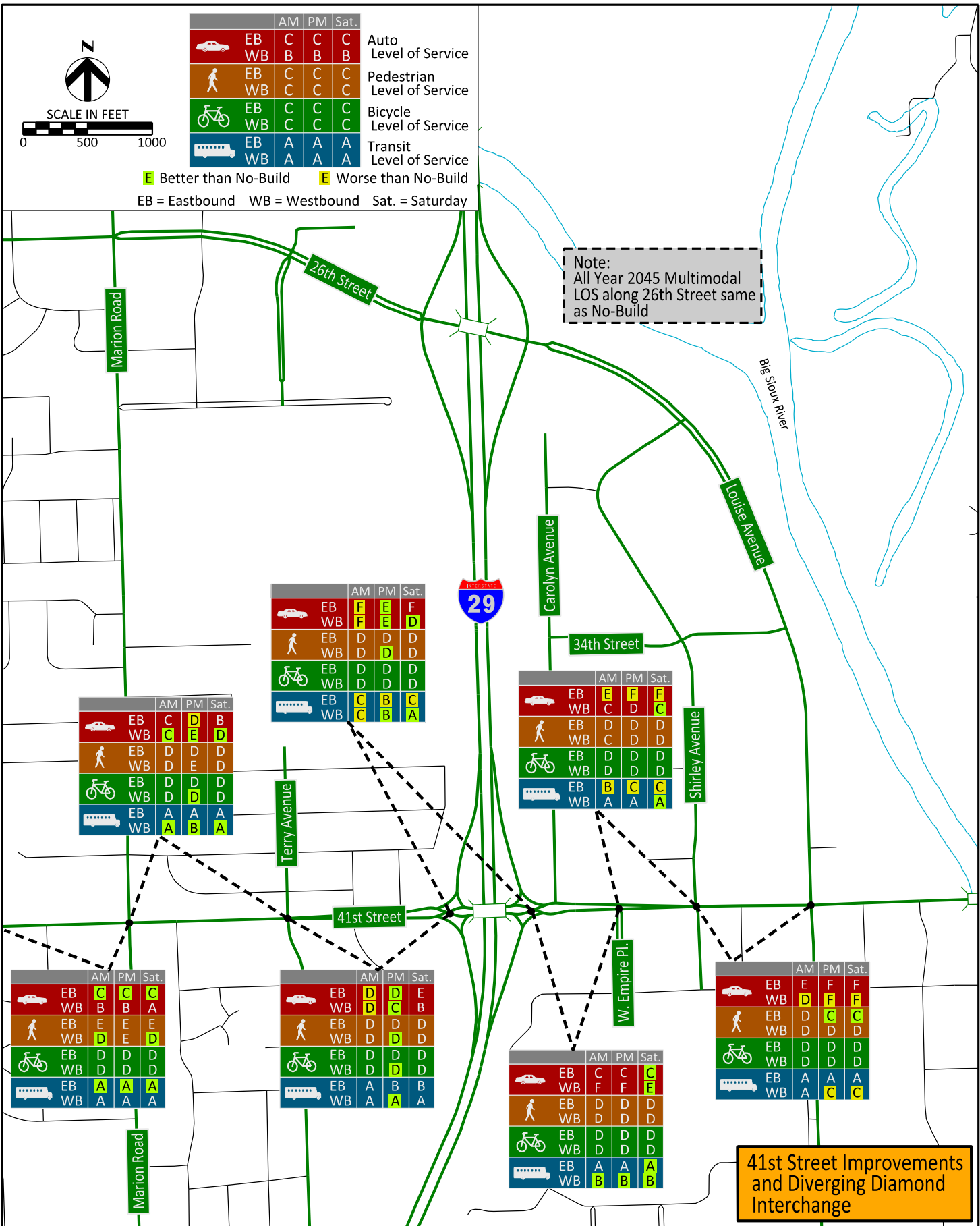


SCALE IN FEET  
0 500 1000

		AM	PM	Sat.	
	EB	C	C	C	Auto Level of Service
	WB	B	B	B	
	EB	C	C	C	Pedestrian Level of Service
	WB	C	C	C	
	EB	C	C	C	Bicycle Level of Service
	WB	C	C	C	
	EB	A	A	A	Transit Level of Service
	WB	A	A	A	

**E** Better than No-Build      **F** Worse than No-Build  
EB = Eastbound    WB = Westbound    Sat. = Saturday

Note:  
All Year 2045 Multimodal  
LOS along 26th Street same  
as No-Build



		AM	PM	Sat.
	EB	C	D	B
	WB	C	E	D
	EB	D	D	D
	WB	D	E	D
	EB	D	D	D
	WB	D	D	D
	EB	A	A	A
	WB	A	B	A

		AM	PM	Sat.
	EB	F	E	F
	WB	F	E	D
	EB	D	D	D
	WB	D	D	D
	EB	D	D	D
	WB	D	D	D
	EB	C	B	C
	WB	C	B	A

		AM	PM	Sat.
	EB	E	F	F
	WB	C	D	C
	EB	D	D	D
	WB	C	D	D
	EB	D	D	D
	WB	D	D	D
	EB	B	C	C
	WB	A	A	A

		AM	PM	Sat.
	EB	C	C	C
	WB	B	B	A
	EB	E	F	E
	WB	D	E	D
	EB	D	D	D
	WB	D	D	D
	EB	A	A	A
	WB	A	A	A

		AM	PM	Sat.
	EB	D	D	E
	WB	D	C	B
	EB	D	D	D
	WB	D	D	D
	EB	D	D	D
	WB	D	D	D
	EB	A	B	B
	WB	A	A	A

		AM	PM	Sat.
	EB	C	C	C
	WB	F	F	E
	EB	D	D	D
	WB	D	D	D
	EB	D	D	D
	WB	D	D	D
	EB	A	A	A
	WB	B	B	B

		AM	PM	Sat.
	EB	E	F	F
	WB	D	F	F
	EB	D	D	D
	WB	D	D	D
	EB	D	D	D
	WB	D	D	D
	EB	A	A	A
	WB	A	C	C

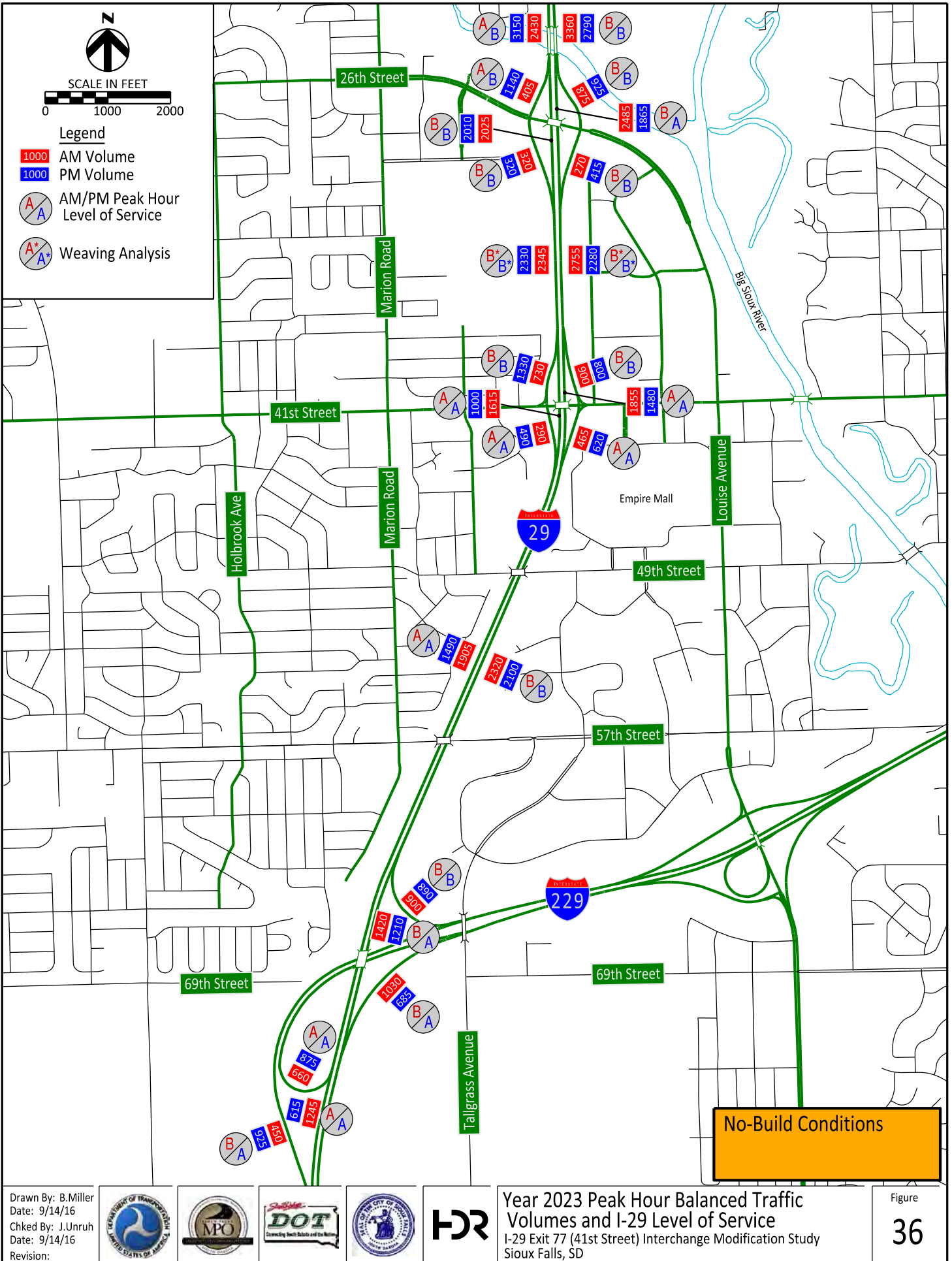
41st Street Improvements  
and Diverging Diamond  
Interchange

Drawn By: B.Miller  
Date: 10/31/16  
Chkd By: J.Unruh  
Date: 10/31/16  
Revision: 1/20/17



Year 2045 Multimodal Peak Hour  
Level of Service  
I-29 Exit 77 (41st Street) Interchange Modification Study  
Sioux Falls, SD

Figure  
**35**



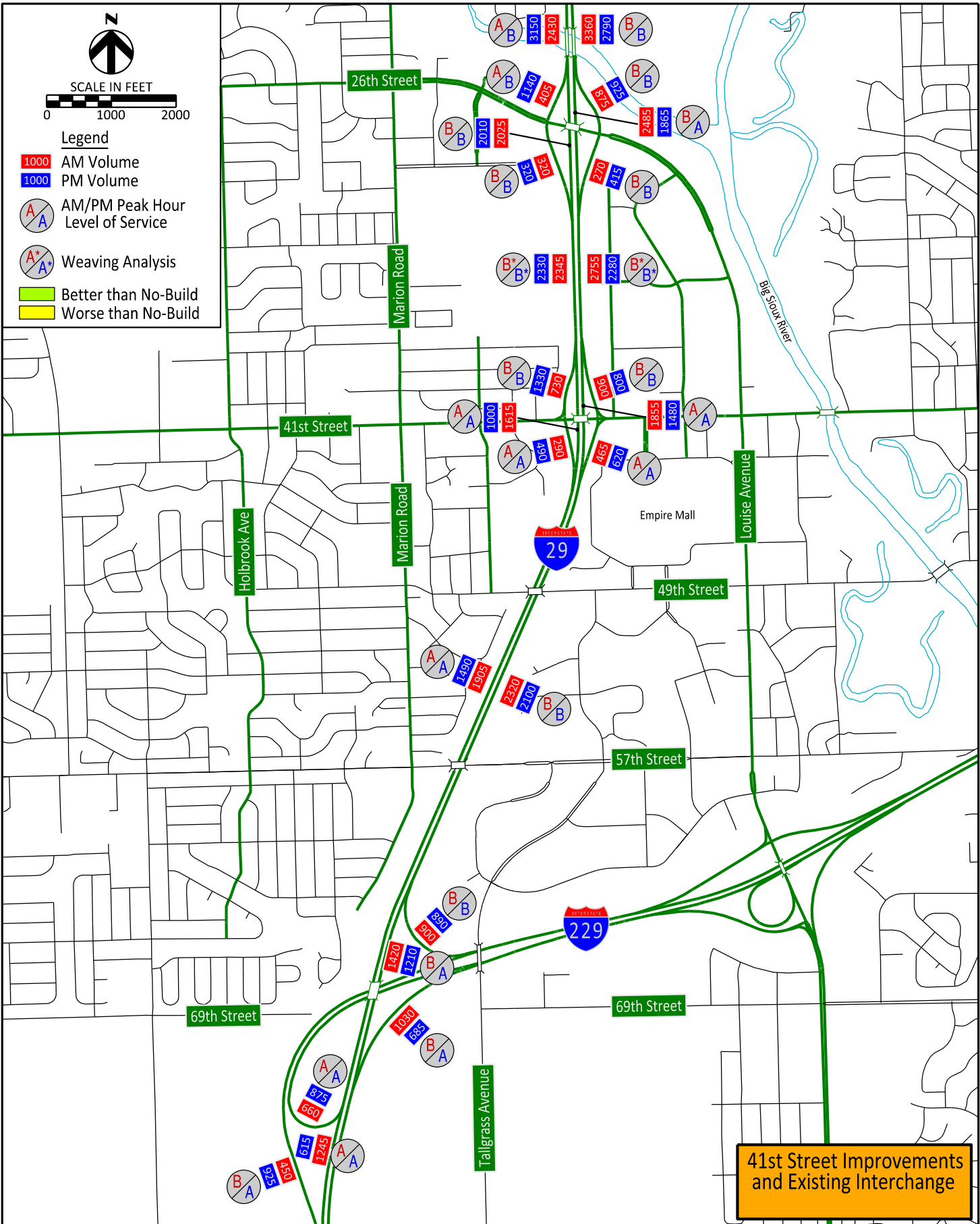
Drawn By: B. Miller  
 Date: 9/14/16  
 Chkd By: J. Unruh  
 Date: 9/14/16  
 Revision:



**Year 2023 Peak Hour Balanced Traffic Volumes and I-29 Level of Service**  
 I-29 Exit 77 (41st Street) Interchange Modification Study  
 Sioux Falls, SD

Figure  
**36**





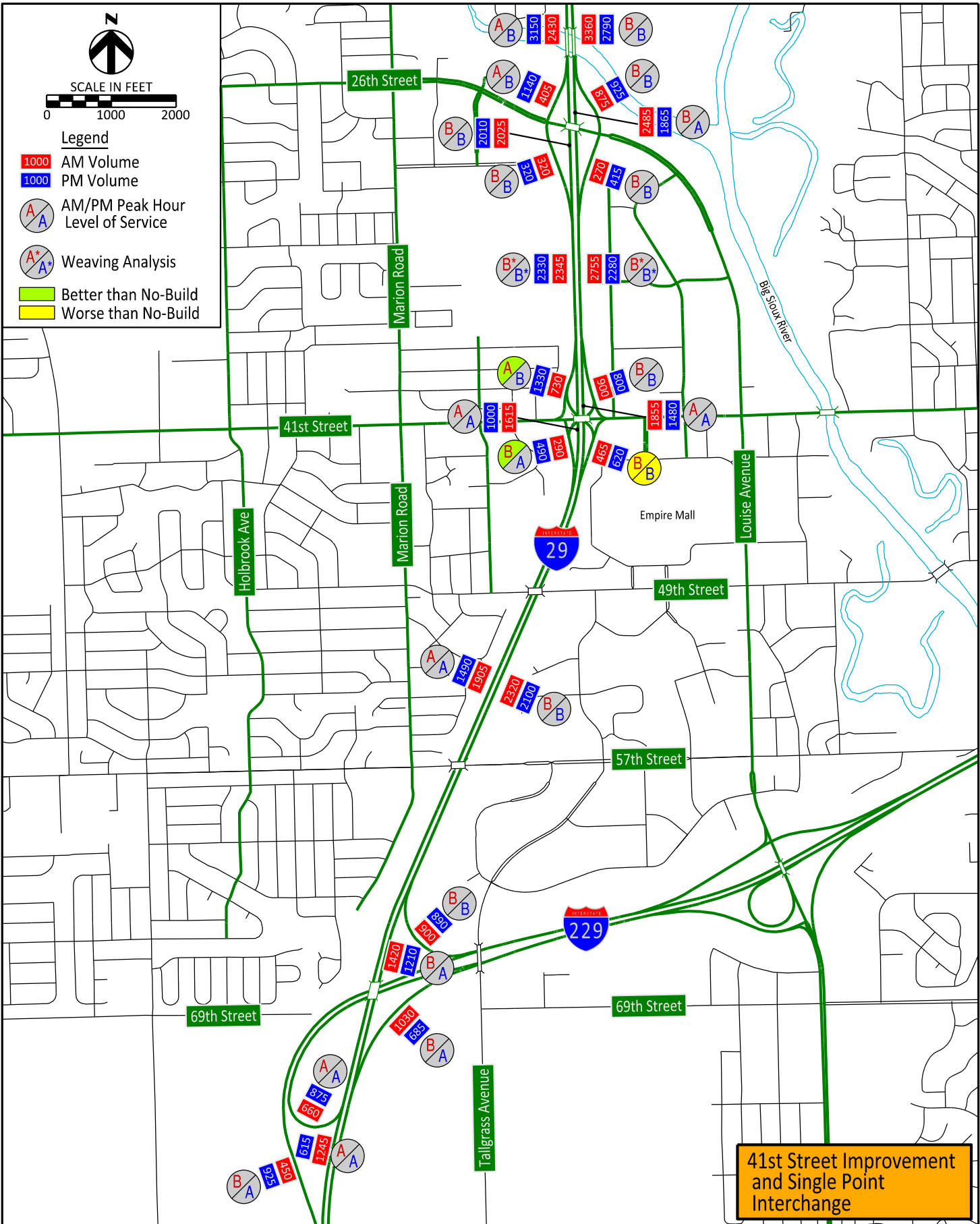
41st Street Improvements and Existing Interchange

Drawn By: B. Miller  
 Date: 9/14/16  
 Chkd By: J. Unruh  
 Date: 9/14/16  
 Revision: 1/20/17



Year 2023 Peak Hour Balanced Traffic Volumes and I-29 Level of Service  
 I-29 Exit 77 (41st Street) Interchange Modification Study  
 Sioux Falls, SD

Figure  
**37**



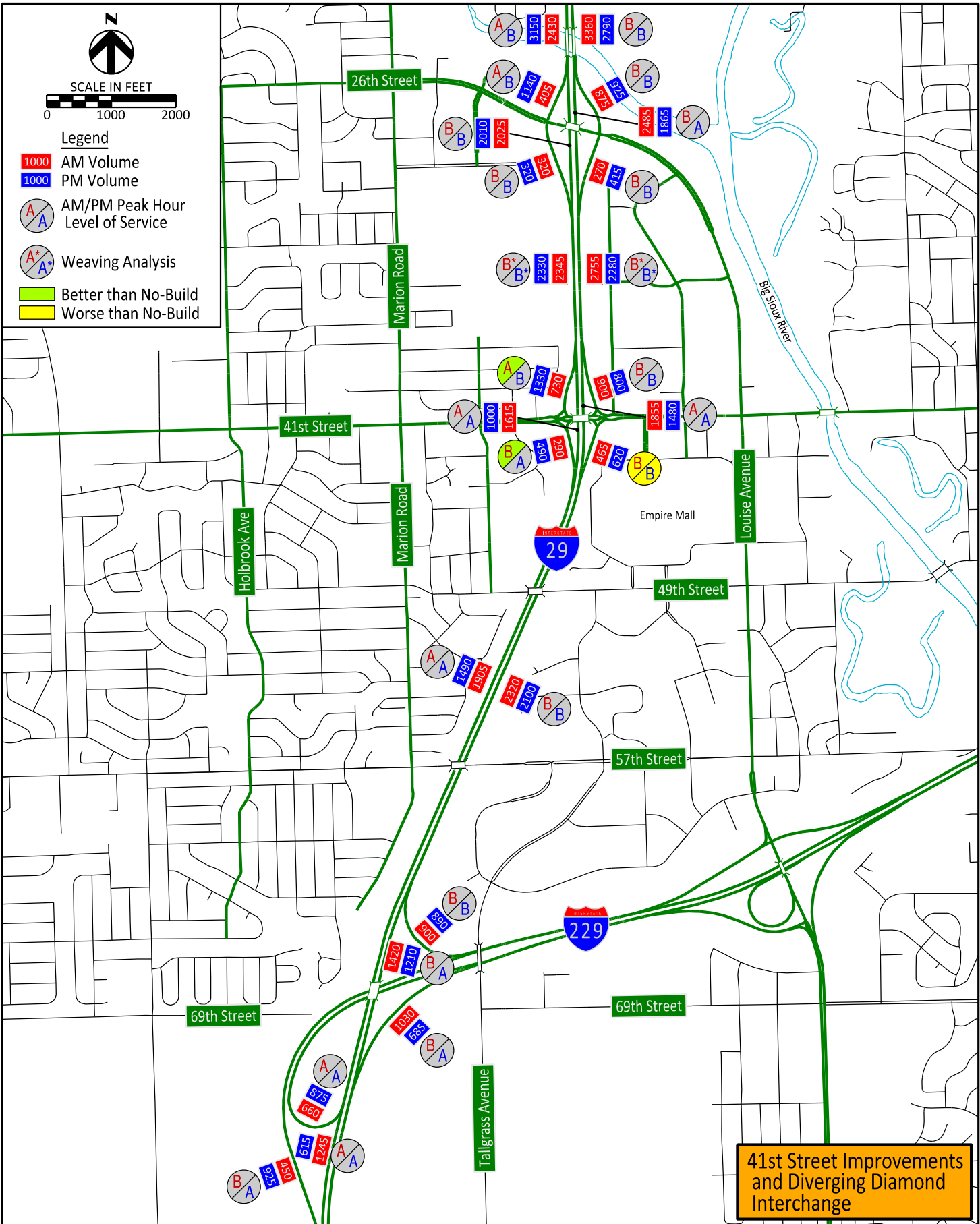
41st Street Improvement and Single Point Interchange

Drawn By: B.Miller  
 Date: 9/14/16  
 Chkd By: J.Unruh  
 Date: 9/14/16  
 Revision: 1/20/17



Year 2023 Peak Hour Balanced Traffic Volumes and I-29 Level of Service  
 I-29 Exit 77 (41st Street) Interchange Modification Study  
 Sioux Falls, SD

Figure  
 38



41st Street Improvements and Diverging Diamond Interchange

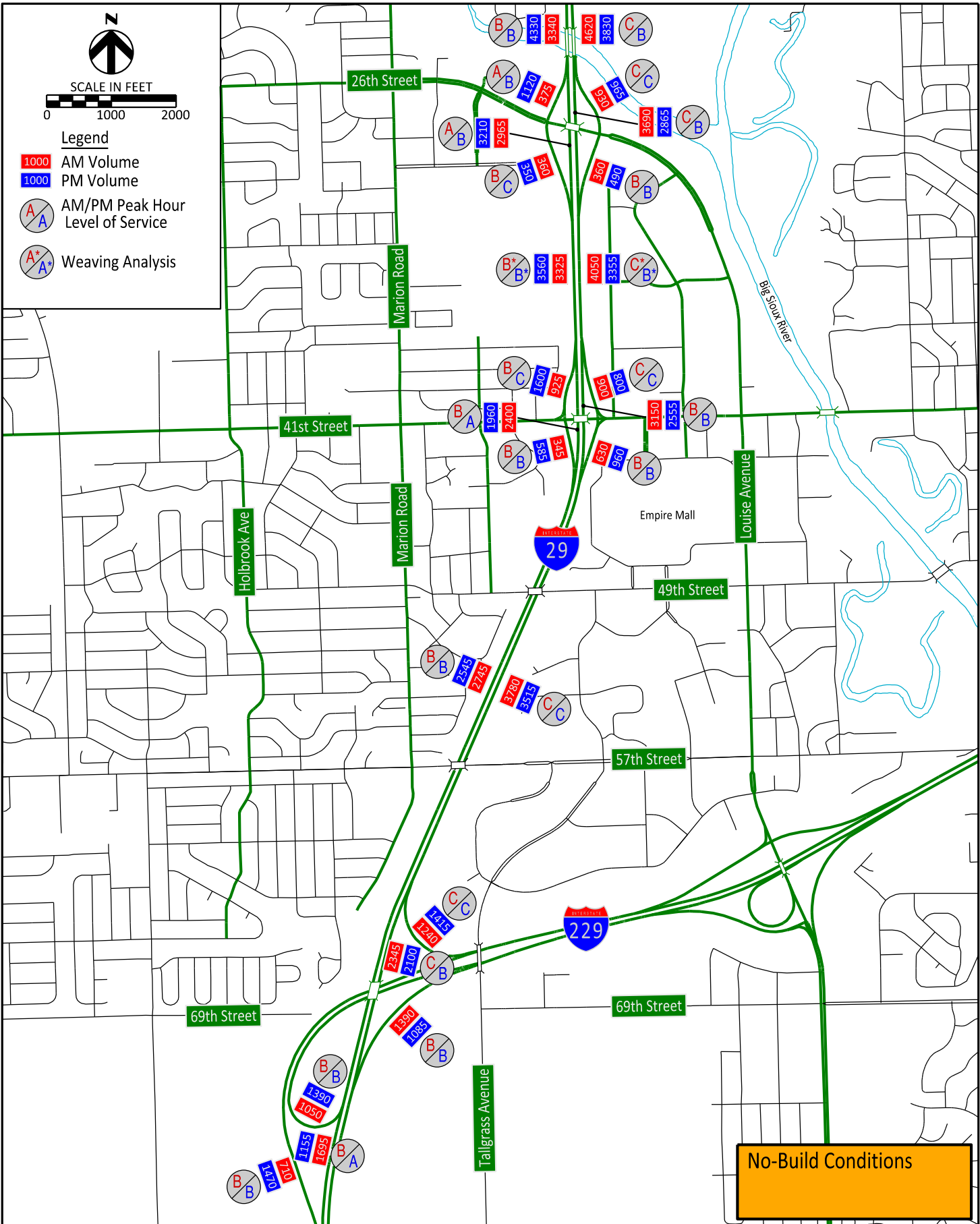
Drawn By: B.Miller  
 Date: 9/14/16  
 Chkd By: J.Unruh  
 Date: 9/14/16  
 Revision: 1/20/17



Year 2023 Peak Hour Balanced Traffic Volumes and I-29 Level of Service  
 I-29 Exit 77 (41st Street) Interchange Modification Study  
 Sioux Falls, SD

Figure  
**39**





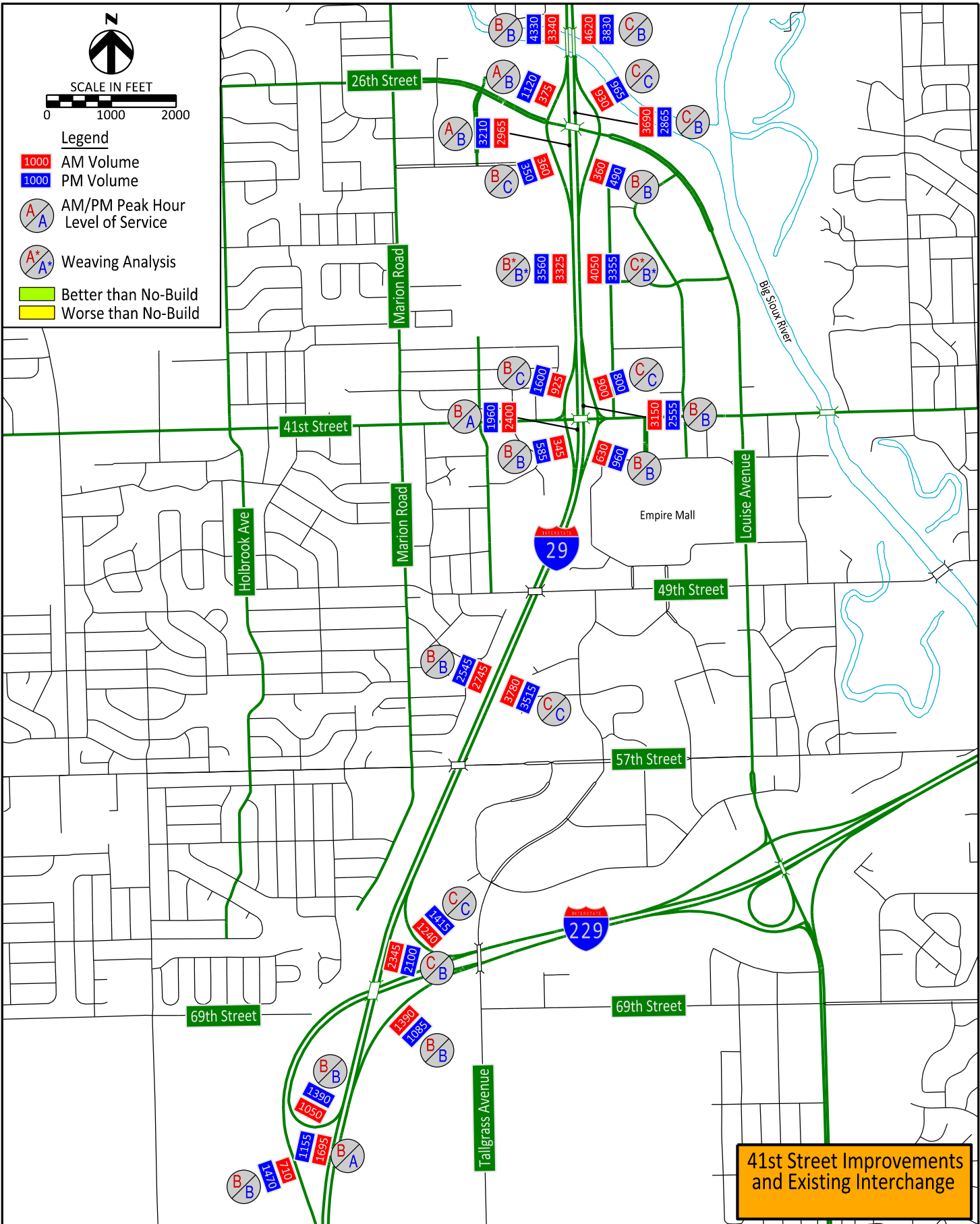
No-Build Conditions

Drawn By: B. Miller  
 Date: 9/14/16  
 Chkd By: J. Unruh  
 Date: 9/14/16  
 Revision:



Year 2045 Peak Hour Balanced Traffic Volumes and I-29 Level of Service  
 I-29 Exit 77 (41st Street) Interchange Modification Study  
 Sioux Falls, SD

Figure  
 40



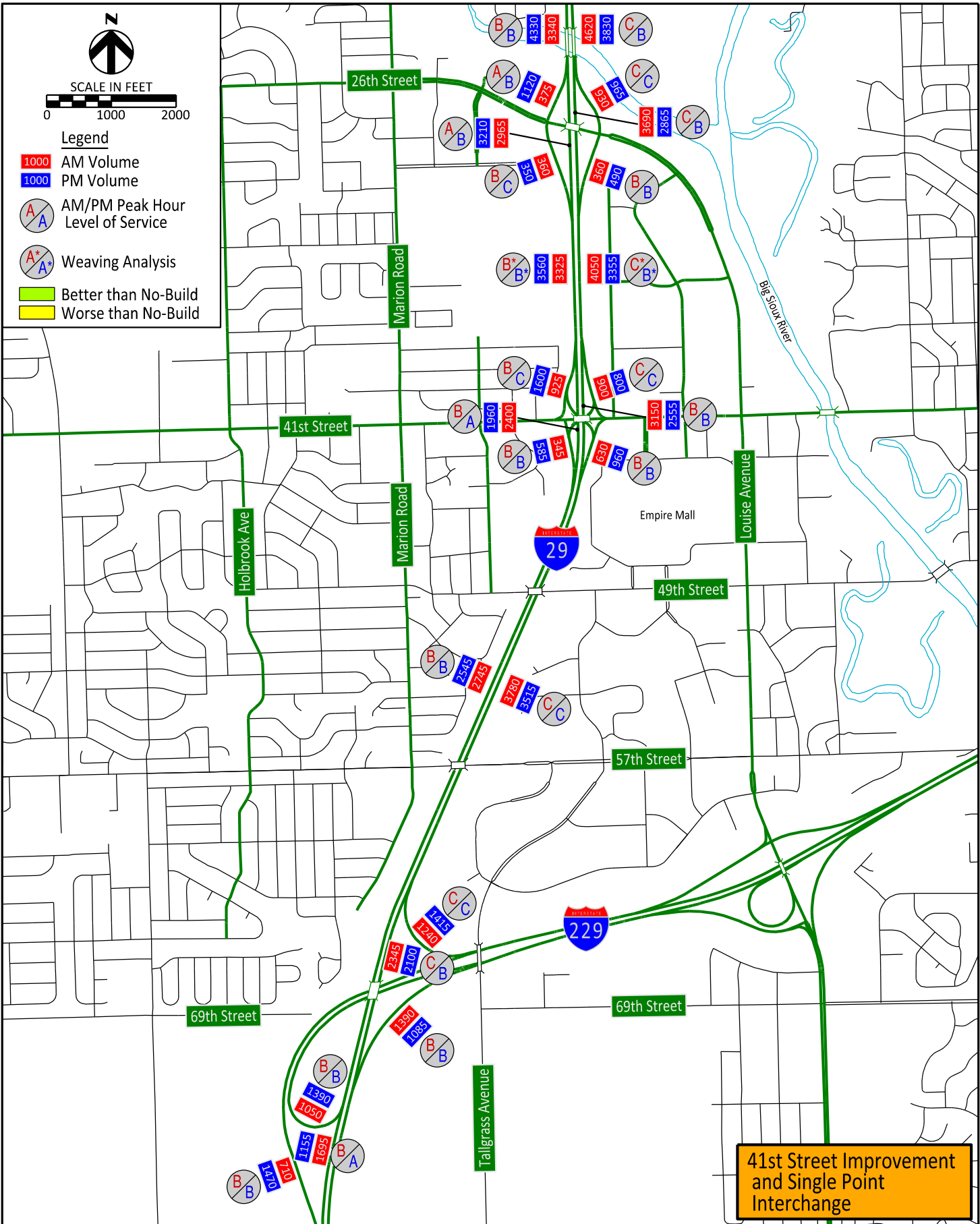
41st Street Improvements and Existing Interchange

Drawn By: B. Miller  
 Date: 9/14/16  
 Chkd By: J. Unruh  
 Date: 9/14/16  
 Revision:



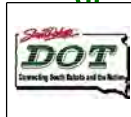
Year 2045 Peak Hour Balanced Traffic Volumes and I-29 Level of Service  
 I-29 Exit 77 (41st Street) Interchange Modification Study  
 Sioux Falls, SD

Figure  
**41**



41st Street Improvement and Single Point Interchange

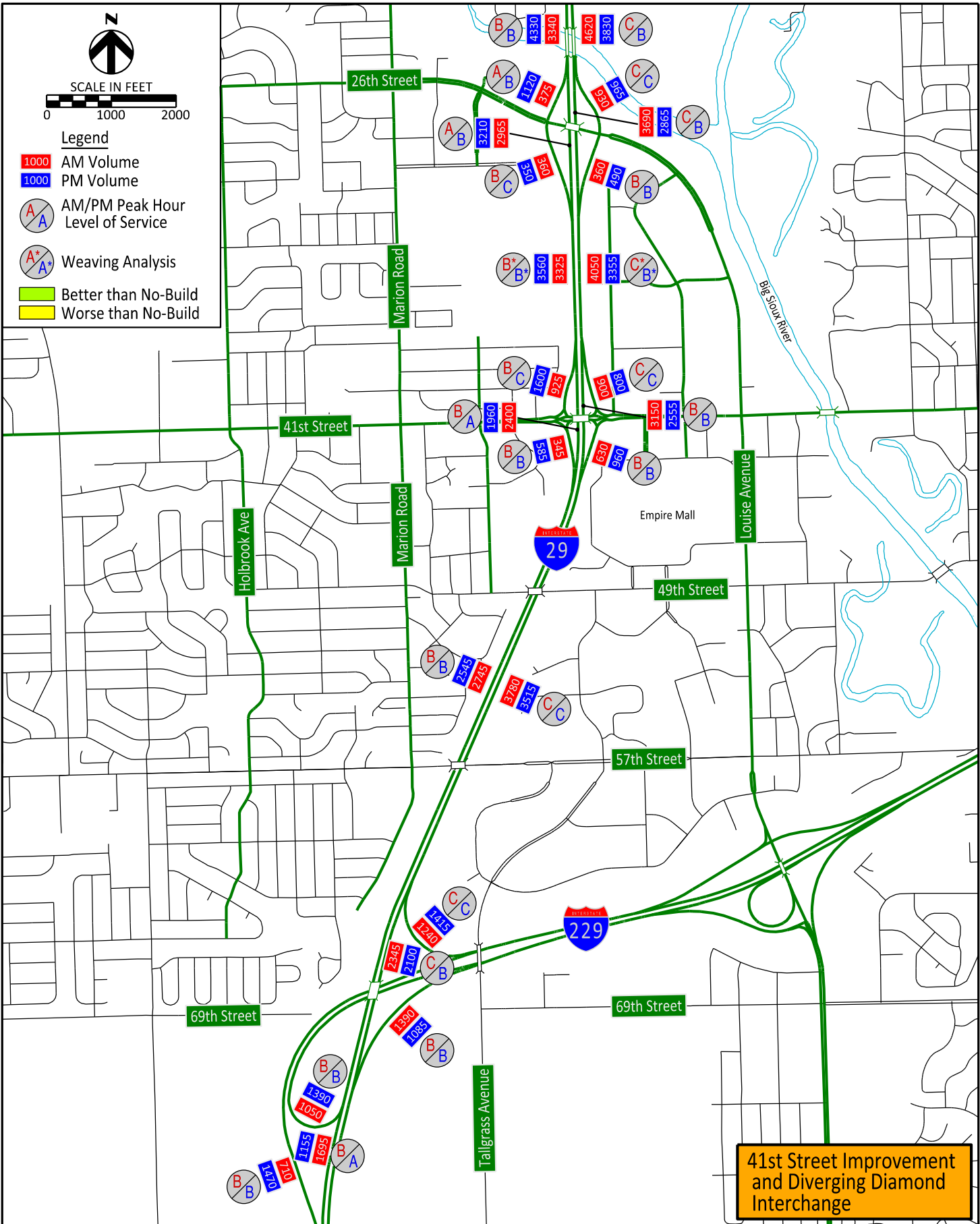
Drawn By: B.Miller  
 Date: 9/14/16  
 Chkd By: J.Unruh  
 Date: 9/14/16  
 Revision:



Year 2045 Peak Hour Balanced Traffic Volumes and I-29 Level of Service  
 I-29 Exit 77 (41st Street) Interchange Modification Study  
 Sioux Falls, SD

Figure

42



41st Street Improvement and Diverging Diamond Interchange

Drawn By: B.Miller  
 Date: 9/14/16  
 Chkd By: J.Unruh  
 Date: 9/14/16  
 Revision:



Year 2045 Peak Hour Balanced Traffic Volumes and I-29 Level of Service  
 I-29 Exit 77 (41st Street) Interchange Modification Study  
 Sioux Falls, SD

Figure  
 43

## 7. ALTERNATIVES ANALYSIS

The interchange improvement scenarios were analyzed and compared to determine which may be most suitable for meeting the project need. The areas of analysis and comparison are discussed in the following sections.

### 7.1 Conformance with Transportation Plans

Local (MPO and City) and State transportation plans, including the Sioux Falls MPO Long Range Transportation Plan have identified a need for an improved interchange at I-29/41<sup>st</sup> Street that meets design standards, improves safety, and provides adequate capacity to serve future travel demand. Both the single point and DDI alternatives satisfy the existing transportation planning considerations.

### 7.2 Compliance with Policies and Engineering Standards

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

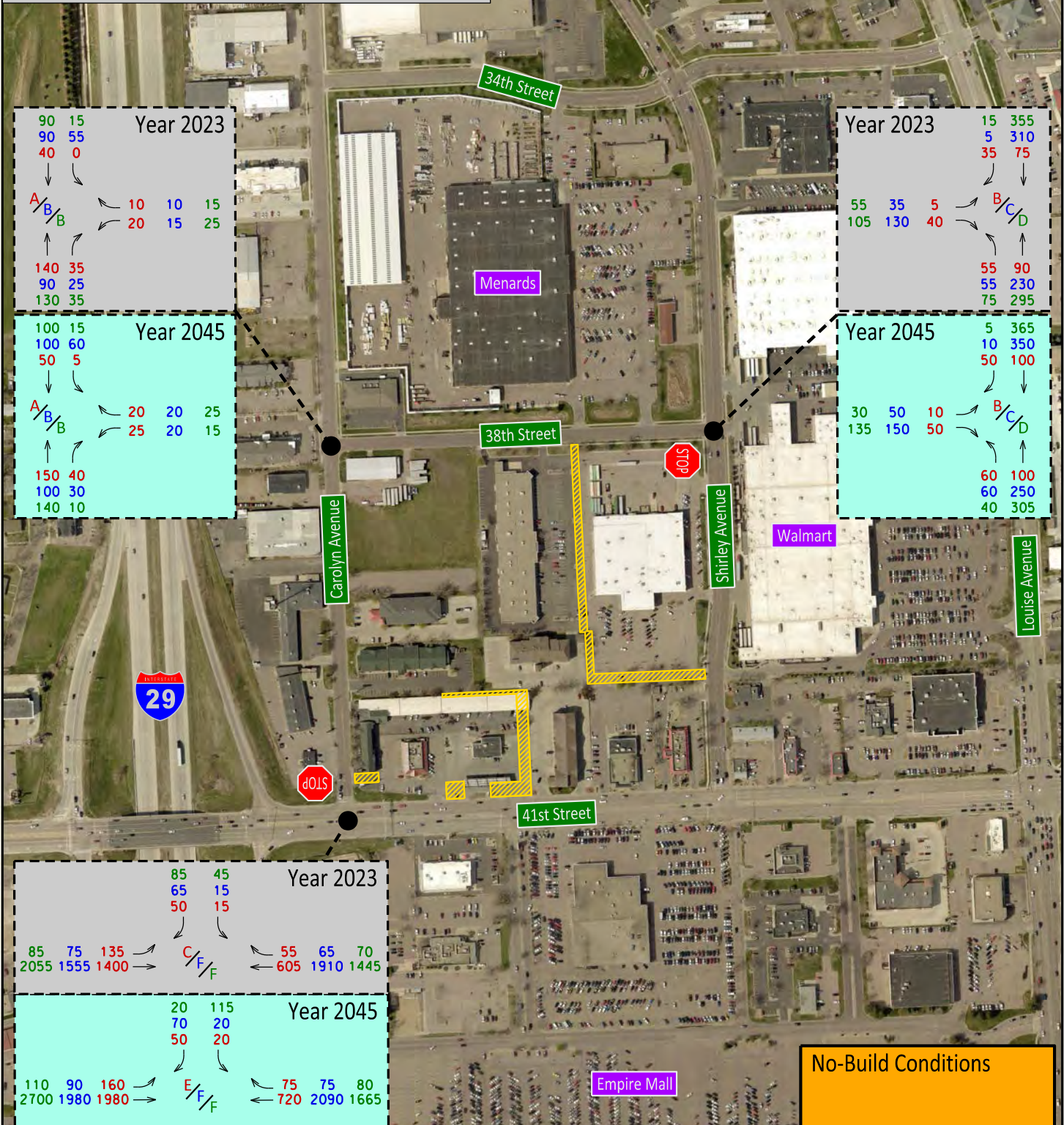
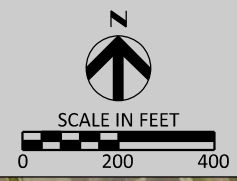
Access management was examined at adjacent local street intersections and commercial driveways. SDDOT design standards call for access spacing of at least 100' from the Interstate highway right-of-way line at ramp termini when rebuilding an existing urban interchange, but further recommend extending the control of access to meet the access spacing requirements established by South Dakota Administrative Rule 70:09. The Administrative Rules call for unsignalized access spacing of 100' to 660' and minimum signalized access spacing of 1320', depending on the classification of the arterial street (41<sup>st</sup> Street is not within SDDOT jurisdiction and is not currently classified in the State system). City of Sioux Falls design standards call for ¼ mile full access spacing on arterial roadways like 41<sup>st</sup> Street, but list spacing of unsignalized partial access as "varies". Other guidelines and research recommends signalized intersections no closer than ¼ mile from interchange ramp termini, but allow unsignalized partial access at spacing less than ¼ mile. Several alternatives were examined for improvements on 41<sup>st</sup> Street as part of the *I-29 Exit 77 (41<sup>st</sup> St.) Crossroad Corridor Study*. Those alternatives each addressed retrofitting the accesses along 41<sup>st</sup> Street to improve access management. That study recommended alternatives that include a center median on 41<sup>st</sup> Street and the closure of the 41<sup>st</sup> Street/Carolyn Avenue intersection.

The 41<sup>st</sup> Street/Carolyn Avenue intersection was further evaluated in a Technical Memorandum as part of this study. That evaluation determined that the only feasible alternative for the intersection is to close access to Carolyn Avenue at 41<sup>st</sup> Street because of its proximity to the I-29 interchange. Carolyn Avenue would be provided with a cul-de-sac for local traffic and local traffic would also be rerouted via 38<sup>th</sup> Street and Shirley Avenue to reach 41<sup>st</sup> Street. The analysis is summarized in **Figures 44** and **45** and in the Technical Memorandum, reproduced in the **Appendix 5**.



**Legend**

- AM PM Peak Hour Traffic Volumes
- XX Peak Hour Saturday Traffic Volumes
- B/C/D A.M. Peak Hour LOS  
P.M. Peak Hour LOS  
Saturday Peak Hour LOS
- Signalized Intersection
- Stop Controlled Intersection
- Existing Access Easement



No-Build Conditions

Drawn By: B.Miller  
Date: 10/26/16  
Chkd By: J.Unruh  
Date: 10/26/16  
Revision: 1/25/17



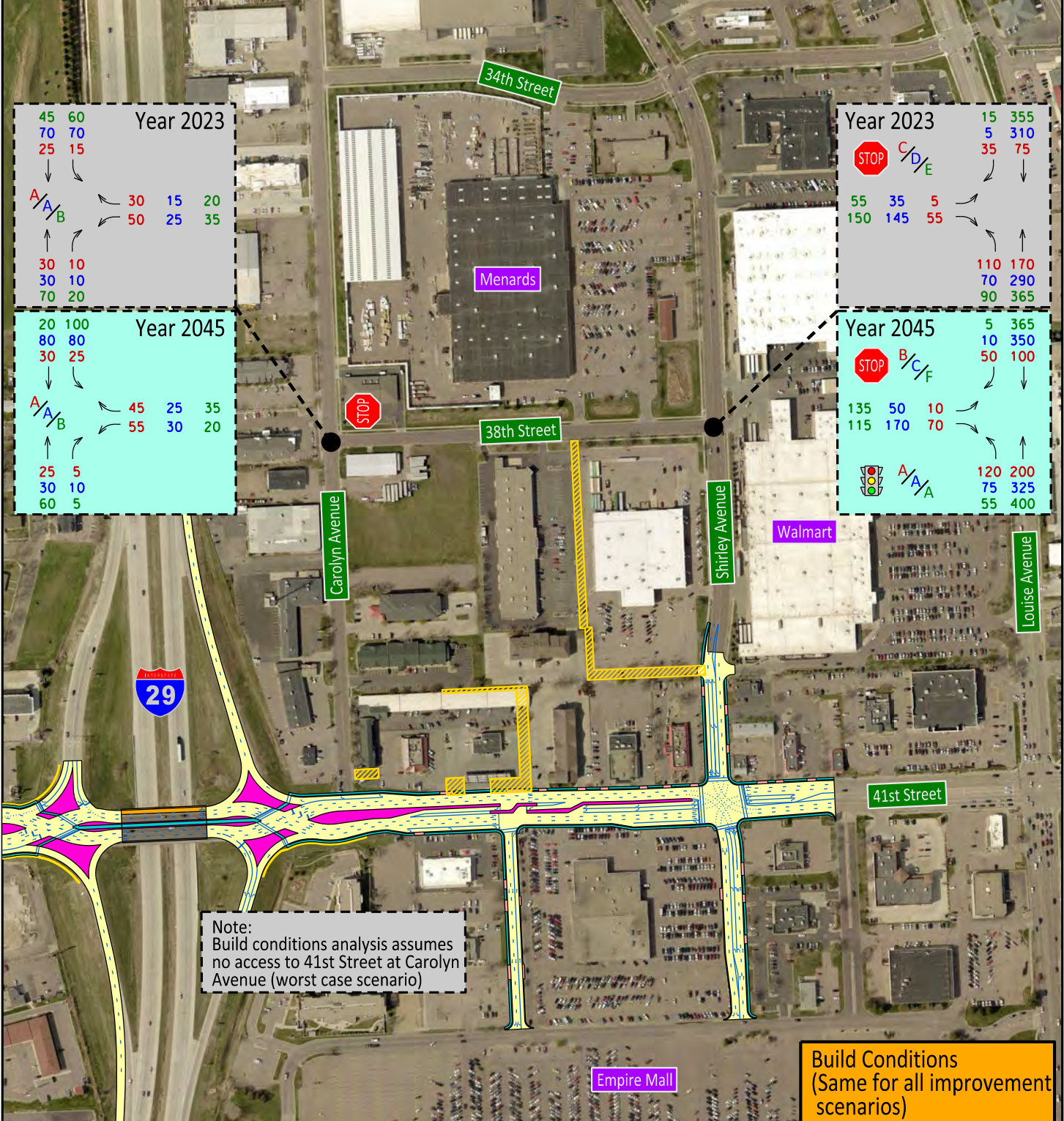
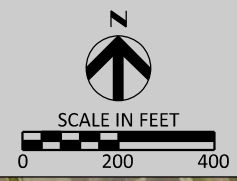
Year 2023 and 2045 Traffic Volumes and Critical Non-Signalized Intersection LOS  
I-29 Exit 77 (41st Street) Interchange Modification Study  
Sioux Falls, SD

Figure  
**44**

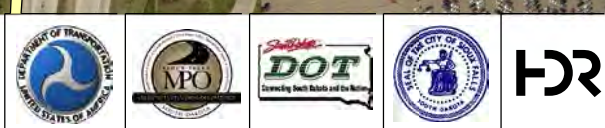


**Legend**

- AM PM Peak Hour Traffic Volumes
- XX Peak Hour Saturday Traffic Volumes
- B/C/D A.M. Peak Hour LOS
- C/D A.M. Peak Hour LOS
- D A.M. Peak Hour LOS
- Signalized Intersection
- STOP Stop Controlled Intersection
- Existing Access Easement
- Roadway Construction
- Raised Island / Median



Drawn By: B.Miller  
Date: 10/25/16  
Chkd By: J.Unruh  
Date: 10/25/16  
Revision: 2/7/17



**Year 2023 and 2045 Traffic Volumes and Critical Non-Signalized Intersection LOS**  
I-29 Exit 77 (41st Street) Interchange Modification Study  
Sioux Falls, SD

Figure  
**45**

### **7.3 Environmental Impacts**

The proposed interchange scenarios have been thoroughly considered in the environmental analysis process, and a preferred alternative will be selected based on the study findings. Reconfiguration of the Exit 77 interchange to a single-point or DDI interchange may require small additional pieces of right of way along 41<sup>st</sup> Street. Sound walls currently exist along I-29 within the study area and sound impacts of interchange reconfiguration will be studied as part of the environmental documentation.

### **7.4 Safety**

A predictive analysis of the alternatives was conducted and the technical memo documenting that analysis is included in the **Appendix 6**. The predictive analysis indicates that both the single-point and DDI interchange configurations will provide better safety than the existing diamond configuration. The DDI alternative also shows lower crash frequency when compared to the single-point alternative. Therefore, the DDI alternative is predicted to provide the best safety performance of the alternatives considered.

### **7.5 Operational Performance**

The operations of the alternative scenarios were evaluated using appropriate level of service techniques. Performance was analyzed for forecast traffic conditions with each of the alternatives. Results of the operational analyses are shown in **Figures 12 through 43**.

The analysis indicates that the single-point and DDI alternatives result in acceptable level of service on the Interstate system and the arterial street system. The no-build and local improvements only alternatives show sub-standard levels of service at the interchange ramp terminals.

### **7.6 Evaluation of Alternatives**

A Technical Memorandum was prepared which compares the Single-Point and DDI interchange alternatives. That comparison determined that the DDI alternative provides the best technical solution for the transportation needs at the I-29 exit 77 interchange. A preferred alternative will be determined through the environmental process. The Technical Memorandum is reproduced in the **Appendix 8**.

### **7.7 Coordination**

The 41<sup>st</sup> Street corridor, including its interchange at Interstate 29, has been the subject of agency coordination and public involvement as part of the corridor planning process, including public meetings. The potential corridor improvements have also been the subject of review and coordination through the regular meetings of the MPO committees.



## 8. FUNDING PLAN

The 2017-2020 Statewide Transportation Improvements Program (STIP) does not contain a project for reconstruction of the I-29/41<sup>st</sup> Street interchange. The interchange reconstruction project is in the SDDOT's developmental program between 2021 and 2024. Current SDDOT budget estimates for interchange improvements are shown below.

<b>Project Number</b>	<b>State Funding Category</b>	<b>Federal Funding Category</b>	<b>Federal Funds (\$ million)</b>	<b>State Funds (\$ million)</b>	<b>City Funds (\$ million)</b>	<b>Total Funds (\$ million)</b>
IM 0293(106)77 P PCN03RA	Interstate	National Highway Performance	\$17.6	\$2.4		\$20.0
P1400(16) P PCN 05NF	Local Urban Systems	Surface Transportation Block Grant	\$5.2		\$13.7	\$18.9
<b>Total</b>			<b>\$22.8</b>	<b>\$2.4</b>	<b>\$13.7</b>	<b>\$38.9</b>

**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 2023 or beyond, the inflated cost for the overall project is \$43.4 million.

## 9. RECOMMENDATIONS

The technical analysis contained in this Interchange Modification Justification Report has found that the diverging diamond interchange alternative provides the best technical solution for transportation needs in the study area. The single point interchange alternative also provides operations and safety improvements over the planned improvements to the local street system. The preferred option is being selected as part of the completion of the environmental review process.

The eight considerations and requirements for Interstate access are addressed below:

- 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.

*The proposed change is a reconfiguration of an existing interchange and improvements to the existing crossroad facility. The changes will correct current interchange and crossroad design deficiencies. Based on the analysis of various alternatives, improvements on the crossroad (41<sup>st</sup> Street) alone and/or modifications to the existing interchange configuration will not improve traffic conditions adequately to meet applicable criteria. Improvements to 41<sup>st</sup> Street (such as intersection improvements east of I-29 and added through lanes west of I-29) are being planned by the City of Sioux Falls. The proposed change does not result in any new access points on the Interstate Highway System.*

- 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 with the proposed change(s) in access.

*The concept alternatives involve changes to the geometric design of an existing interchange and changes to the crossroad arterial street to satisfy current design standards and meet the transportation needs in the study area. Mass transit reaches a limited market in South Dakota and HOV facilities are currently not in use because they have not been shown to be economically feasible. Neither mass transit or HOV facilities will correct design deficiencies or provide sufficient relief to future travel demand within the study planning horizon.*

- 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, 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. 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. Each request must also include a conceptual plan of the type and location of the signs proposed to support each design alternative.

*The operational and safety analysis contained in this study shows that the proposed build scenarios are not expected to adversely affect the safety or efficiency of the Interstate system. All build alternatives are also expected to improve access management on the crossroad in the vicinity of the interchange.*

*The conceptual signing plan for the DDI alternative is shown in the **Appendix 11**.*

*Figure 46 illustrates these features of the Diverging Diamond Interchange:*

- *existing and proposed control of access limits*
  - *existing and proposed right-of-way limits*
  - *distances to adjacent access points*
- 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.

*The proposed access is a reconfiguration of an existing interchange with full access to an arterial city street and includes all movements. The conceptual drawings have been prepared using current standards and further design using current standards is anticipated. Additional refinement will take place during the environmental and design phases of the project.*

- 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.

*The proposal is the result of land use and transportation plans prepared within the MPO process, including the Sioux Falls MPO Long Range Transportation Plan. The 2017-2020 STIP includes this Project in the Developmental STIP portion in the 2021-2013 funding and construction years.*

- 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.

*SDDOT has prepared a study of the Interstate Highway System in South Dakota and this IMJR to address Interstate access needs. No additional interchanges are anticipated within the study area.*

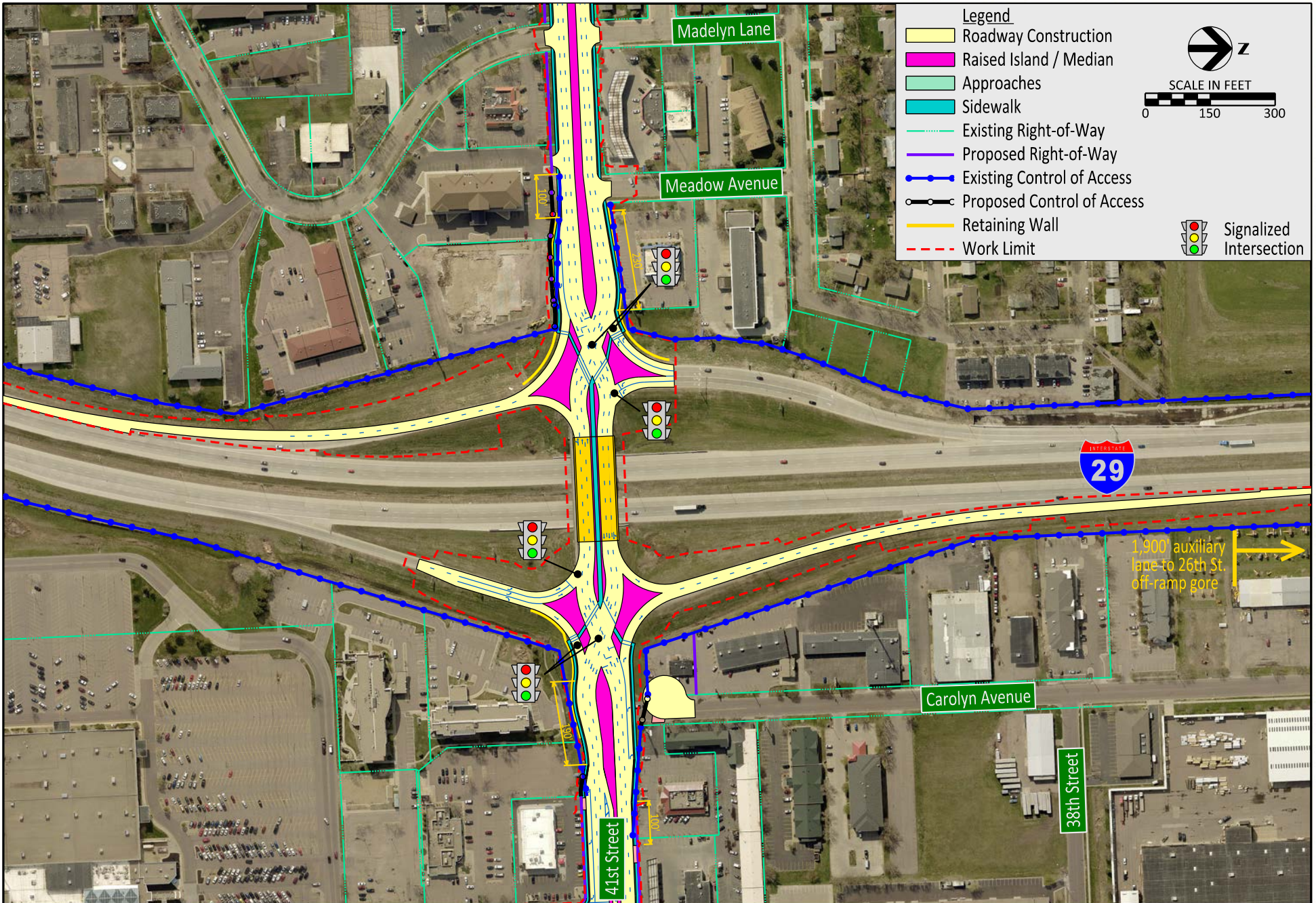
- 7) When a new or revised access point is due to a new, expanded, or substantial change in current or planned future development or land use, requests must demonstrate appropriate coordination has occurred between the development and any proposed transportation system improvements. The request must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

*The revised access point is due to geometric deficiencies in the existing interchange and general regional growth. The proposed change is not related to a particular development or land use change.*

- 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 environmental processing.

*The alternatives developed in this IMJR will serve as the technical basis for the environmental review process. The environmental studies are expected to be completed in time to allow construction in the 2021 to 2023 timeframe.*





**Legend**

- Roadway Construction
- Raised Island / Median
- Approaches
- Sidewalk
- Existing Right-of-Way
- Proposed Right-of-Way
- Existing Control of Access
- Proposed Control of Access
- Retaining Wall
- Work Limit

N  
 SCALE IN FEET

Signalized Intersection

Drawn By: B. Miller  
 Date: 7/12/2017  
 Chkd By: J. Unruh  
 Date: 7/12/2017  
 Revision:



**Control of Access and Right-of-Way for  
 Diverging Diamond Interchange**  
 41st Street Corridor Interchange Study

Figure  
**46**  
 Sioux Falls, SD

## **APPENDIX**

**1 – Purpose and Need Memo**

**2 – Methods and Assumptions Document**

**3 – Technical Memo 1: Existing Traffic Conditions**

**4 – Technical Memo 2: Existing Conditions Crash Analysis**

**5 – Technical Memo 3: Future Traffic Conditions**

**6 – Technical Memo 4: Predictive Crash Analysis**

**7 – Technical Memo 5: Carolyn Avenue Alternatives Evaluation**

**8 – Technical Memo 6: Interchange Alternatives Evaluation**

**9 – Technical Memo 7: 41<sup>st</sup> St. West of I-29 Alternatives Evaluation**

**10 – Technical Memo 8: 41<sup>st</sup> St. East of I-29 Alternatives Evaluation**

**11 – Concept Signing Plan**

**12 – Interchange Area Air Photos**