I-29 Exit 77 (41st 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

Prepared for:

South Dakota Department of Transportation
Office of Project Development
700 East Broadway Avenue
Pierre, South Dakota 57501-2586
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## Abbreviations

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

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

The proposed action is a reconfiguration of the existing 41st 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 41st 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 (41st 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 26th Street (Exit 78) and the I-229 system interchange (Exit 75). Interchange spacing is approximately .85 miles to 26th 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, 41st Street, is a five-lane urban street west of the interchange and a seven-lane urban street east of the interchange. 41st 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 41st 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 41st 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 41st 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 41st/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 41st 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 26th 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, 41st Street from Valley View Road/Holbrook Avenue to just west of Louise Avenue, and portions of 26th 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 41st Street to 3 through lanes in each direction from I-29 to Marion Road to accommodate future traffic volumes. Widening of the Marion Road/41st Street intersection is necessary to add turn lanes for adequate intersection capacity.

- East limits – The City intends to expand the Shirley Avenue/41st Street intersection and realign the extension of Shirley Avenue south of 41st Street. This will become the main entrance and exit to the Empire Mall from 41st Street. The relocation of Sioux Falls Ford dealership along the south side of 41st Street west of Shirley Avenue allows for widening of 41st Street and adding raised medians and a right turn lane. Property is not feasibly available east of Shirley Avenue for expansion of 41st Street. Therefore, Shirley Avenue is a reasonable east logical terminus for this project.

- 41st 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 the logical termini for the I-29 Exit 77 (41st Street) interchange study. Traffic impacts at the 41st Street/Louise Avenue intersection resulting from capacity improvements at the I-29 Exit 77 (41st Street) interchange and along 41st Street have been closely evaluated in the traffic assessment. Potential improvement options for the 41st Street/Louise Avenue intersection are included in a separate, subsequent Louise Avenue corridor project between 34th Street and 49th Street.

- Marion Road limits – Marion Road has been upgraded to 2 through lanes in each direction from 39th Street to the north. Therefore, the north logical terminus for Marion Road begins at 39th Street. Widening of Marion Road extends through the 41st 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 41st Street.

For further background on the logical termini for the project, see the Purpose and Need Memo included in Appendix 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 41st Street
- 41st Street – 5-lane urban arterial roadway west of I-29 that transitions to a 7-lane urban roadway east of I-29
- 26th Street – 4-lane divided urban arterial roadway
- Marion Road – 5-lane urban arterial roadway north of 41st Street and 3-lane urban arterial south of 41st 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
- 34th Street – 2-lane urban collector roadway
- 38th 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 41st 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 41st 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-29/41st Street (Exit 77) – the subject interchange is a diamond configuration. Both ramp termini are controlled by traffic signals.
- I-29/26th 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:

- 26th Street/Marion Rd. (AM peak)
- 26th Street/I-29 SB (Saturday peak)
- 26th Street/I-29 NB (AM peak)
- 41st 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 41st Street/I-29 NB is an example of this characteristic, with the left turn queue extending through the 41st Street/I-29 SB intersection during the AM peak.

Multimodal level of service varies widely throughout the 26th Street and 41st 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:

- 38th Street/Carolyn Avenue: currently an uncontrolled intersection – no level of service analysis available.
- 38th Street/Shirley Avenue: AM-B, PM-D, SAT-D
- 41st 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.
Existing Traffic Volumes and Signalized Intersection Level of Service (west of I-29)

Figure 2

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

Legend
AM PM  Existing peak hour traffic volumes
XX  Existing peak hour Saturday traffic volumes
Signalized intersection

HCS 2010 Analysis

SYNCHRO Analysis

LOS  Avg. Delay
A XX sec.  A.M. P.M.
B XX sec.  A.M. P.M.

Note: Level of Service F* indicates that queue storage ratio of at least one movement exceeds 1.0
Figure 4

1st Street

Carolyne Avenue

Shirley Avenue

34th Street

26th Street

41st Street

Intersection Level of Service (east of I-29)

Existing Traffic Volumes and Signalized

HCS 2010 Analysis

LOS Avg. Delay

A XX sec. A.M.

A XX sec. P.M.

A XX sec. Sat.

SYNCHRO Analysis

LOS Avg. Delay

A XX sec. A.M.

A XX sec. P.M.

A XX sec. Sat.

Legend

Signalized intersection

Existing peak hour traffic volumes

Existing peak hour Saturday traffic volumes

Note: Level of Service F* indicates that one movement exceeds 1.0 queue storage ratio of at least Level of Service F*.
Figure 4
Existing Multimodal Peak Hour Level of Service
I-29 Exit 77 (41st Street) Interchange Modification Study
Sioux Falls, SD

SCALE IN FEET

EB = Eastbound  WB = Westbound  Sat. = Saturday

 existing Multimodal Peak Hour Level of Service

Auto Level of Service
Pedestrian Level of Service
Bicycle Level of Service
Transit Level of Service

EB = Eastbound  WB = Westbound  Sat. = Saturday
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 41st Street/Louise Ave.
- Rear-end crashes on 41st 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 41st Street and Louise Avenue, particularly near the 41st/Louise intersection.
- Reconfiguration of the 41st Street interchange on I-29 to reduce 41st Street queues and enhance 41st 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:

- 41st 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.
- 41st 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.
• 41st 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.
• 41st 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.
• 41st 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 41st 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.
• 41st Street – Terry Avenue to I-29 SB – peak hour queues from the I-29 interchange result in a high rate of rear-end crashes.
• 41st 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.
• 41st 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, 41st Street to 26th Street – single vehicle crashes with fixed objects appear to be leading to an elevated crash rate in this segment.
• I-29 NB, 26th Street off ramp to 26th 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.
TABLE 1 - SIGNALIZED INTERSECTION CRASH RATES (2010-2015)
I-29/41ST ST. IMJR

<table>
<thead>
<tr>
<th>INTERSECTION</th>
<th>NUMBER CRASHES</th>
<th>DAILY VOLUME</th>
<th>MEV¹</th>
<th>CRASH RATE</th>
<th>TEV*R²</th>
<th>CRITICAL RATE</th>
<th>DIFFERENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2: 26TH/LORRAINE</td>
<td>12</td>
<td>24400</td>
<td>44.53</td>
<td>0.27</td>
<td>6575.34</td>
<td>0.93</td>
<td>-0.66</td>
</tr>
<tr>
<td>3: 26TH/I-29 SB</td>
<td>42</td>
<td>27500</td>
<td>50.19</td>
<td>0.84</td>
<td>23013.70</td>
<td>0.92</td>
<td>-0.08</td>
</tr>
<tr>
<td>4: 26TH/I-29 NB</td>
<td>33</td>
<td>31200</td>
<td>56.94</td>
<td>0.58</td>
<td>18082.19</td>
<td>0.91</td>
<td>-0.33</td>
</tr>
<tr>
<td>5: 26TH/SHIRLEY</td>
<td>36</td>
<td>30500</td>
<td>55.66</td>
<td>0.65</td>
<td>19726.03</td>
<td>0.91</td>
<td>-0.26</td>
</tr>
<tr>
<td>9: LOUISE/WAL-MART</td>
<td>4</td>
<td>31100</td>
<td>56.76</td>
<td>0.07</td>
<td>2191.78</td>
<td>0.91</td>
<td>-0.84</td>
</tr>
<tr>
<td>11: 41ST/MARION</td>
<td>77</td>
<td>40500</td>
<td>73.91</td>
<td>1.04</td>
<td>42191.78</td>
<td>0.88</td>
<td>0.16</td>
</tr>
<tr>
<td>12: 41ST/TERRY</td>
<td>45</td>
<td>32300</td>
<td>58.95</td>
<td>0.76</td>
<td>24657.53</td>
<td>0.90</td>
<td>-0.14</td>
</tr>
<tr>
<td>13: 41ST/I-29 SB</td>
<td>91</td>
<td>38400</td>
<td>70.08</td>
<td>1.30</td>
<td>49863.01</td>
<td>0.89</td>
<td>0.41</td>
</tr>
<tr>
<td>14: 41ST/I-29 NB</td>
<td>95</td>
<td>37500</td>
<td>68.44</td>
<td>1.39</td>
<td>52054.79</td>
<td>0.89</td>
<td>0.50</td>
</tr>
<tr>
<td>16: 41ST/W. EMPIRE</td>
<td>56</td>
<td>38300</td>
<td>69.90</td>
<td>0.80</td>
<td>30684.93</td>
<td>0.89</td>
<td>-0.09</td>
</tr>
<tr>
<td>17: 41ST/SHIRLEY</td>
<td>67</td>
<td>36100</td>
<td>65.88</td>
<td>1.02</td>
<td>36712.33</td>
<td>0.89</td>
<td>0.12</td>
</tr>
<tr>
<td>18: 41ST/LOUISE</td>
<td>101</td>
<td>61700</td>
<td>112.60</td>
<td>0.90</td>
<td>55342.47</td>
<td>0.85</td>
<td>0.05</td>
</tr>
</tbody>
</table>

COLUMNS TOTAL 1676220 1196027.40
WEIGHTED AVERAGE RATE 0.71

¹MEV = MILLION ENTERING VEHICLES
²TEV*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
### TABLE 2 - ARTERIAL SEGMENT CRASH RATES (2010-2015)

**I-29/41ST ST. IMJR**

<table>
<thead>
<tr>
<th>SEGMENT</th>
<th>NUMBER CRASHES</th>
<th>SEGMENT LENGTH</th>
<th>DAILY VOLUME</th>
<th>MVMT(^1)</th>
<th>CRASH RATE</th>
<th>TEV*R(^2)</th>
<th>CRITICAL RATE</th>
<th>DIFFERENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: 26TH ST., MARION TO LORRAINE</td>
<td>2</td>
<td>0.104</td>
<td>22,000</td>
<td>4.18</td>
<td>0.48</td>
<td>10537.41</td>
<td>4.72</td>
<td>-4.24</td>
</tr>
<tr>
<td>2: 26TH ST., LORRAINE TO I-29 SB</td>
<td>4</td>
<td>0.160</td>
<td>24,200</td>
<td>7.07</td>
<td>0.57</td>
<td>13698.63</td>
<td>4.34</td>
<td>-3.77</td>
</tr>
<tr>
<td>3: 26TH ST., I-29 SB TO I-29 NB</td>
<td>6</td>
<td>0.095</td>
<td>23,300</td>
<td>4.04</td>
<td>1.49</td>
<td>34607.07</td>
<td>4.75</td>
<td>-3.26</td>
</tr>
<tr>
<td>4: 26TH ST., I-29 NB TO SHIRLEY</td>
<td>2</td>
<td>0.206</td>
<td>24,100</td>
<td>9.06</td>
<td>0.22</td>
<td>5319.86</td>
<td>4.19</td>
<td>-3.97</td>
</tr>
<tr>
<td>5: LOUISE AVE., WAL-MART TO 41ST</td>
<td>37</td>
<td>0.113</td>
<td>26,700</td>
<td>5.51</td>
<td>6.72</td>
<td>179415.69</td>
<td>4.50</td>
<td>2.22</td>
</tr>
<tr>
<td>6: 41ST ST., VALLEY VIEW TO MARION</td>
<td>21</td>
<td>0.222</td>
<td>20,900</td>
<td>8.47</td>
<td>2.48</td>
<td>51832.65</td>
<td>4.23</td>
<td>-1.75</td>
</tr>
<tr>
<td>7: 41ST ST., MARION TO TERRY</td>
<td>18</td>
<td>0.175</td>
<td>26,500</td>
<td>8.46</td>
<td>2.13</td>
<td>56360.08</td>
<td>4.23</td>
<td>-2.10</td>
</tr>
<tr>
<td>8: 41ST ST., TERRY TO I-29 SB</td>
<td>43</td>
<td>0.182</td>
<td>30,300</td>
<td>10.06</td>
<td>4.27</td>
<td>129459.58</td>
<td>4.14</td>
<td>0.13</td>
</tr>
<tr>
<td>9: 41ST ST., TERRY TO I-29 NB</td>
<td>7</td>
<td>0.053</td>
<td>26,900</td>
<td>2.60</td>
<td>2.69</td>
<td>72370.12</td>
<td>5.17</td>
<td>-2.48</td>
</tr>
<tr>
<td>10: 41ST ST., I-29 SB TO I-29 NB</td>
<td>26</td>
<td>0.081</td>
<td>26,800</td>
<td>3.96</td>
<td>6.56</td>
<td>175883.65</td>
<td>4.76</td>
<td>1.80</td>
</tr>
<tr>
<td>11: 41ST ST., W. EMPIRE TO SHIRLEY</td>
<td>12</td>
<td>0.058</td>
<td>30,400</td>
<td>3.22</td>
<td>3.73</td>
<td>113367.97</td>
<td>4.95</td>
<td>-1.22</td>
</tr>
<tr>
<td>12: 41ST ST., SHIRLEY TO LOUISE</td>
<td>29</td>
<td>0.111</td>
<td>29,300</td>
<td>5.94</td>
<td>4.89</td>
<td>143156.86</td>
<td>4.45</td>
<td>0.43</td>
</tr>
</tbody>
</table>

**COLUMN TOTALS**  
311400  
WEIGHTED AVERAGE RATE  
3.17

\(^1\)MVMT=MILLION VEHICLE MILES TRAVELED  
\(^2\)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

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

**I-29/41ST ST. IMJR**

<table>
<thead>
<tr>
<th>TRAVEL DIRECTION</th>
<th>SEGMENT</th>
<th>NUMBER CRASHES</th>
<th>SEGMENT LENGTH</th>
<th>DAILY VOLUME</th>
<th>MVMT1</th>
<th>CRASH RATE</th>
<th>TEV*R 2</th>
<th>CRITICAL RATE</th>
<th>DIFFERENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SB</td>
<td>1: I-29, 12TH ST TO 26TH ST</td>
<td>22</td>
<td>0.589</td>
<td>31200</td>
<td>33.54</td>
<td>0.66</td>
<td>20466.54</td>
<td>1.23</td>
<td>-0.58</td>
</tr>
<tr>
<td>SB</td>
<td>2: I-29, 26TH ST TO 26TH ST</td>
<td>15</td>
<td>0.462</td>
<td>18500</td>
<td>15.60</td>
<td>0.96</td>
<td>17790.43</td>
<td>1.38</td>
<td>-0.42</td>
</tr>
<tr>
<td>SB</td>
<td>3: I-29, 26TH ST TO 41ST ST</td>
<td>15</td>
<td>0.330</td>
<td>21900</td>
<td>13.19</td>
<td>1.14</td>
<td>24906.60</td>
<td>1.42</td>
<td>-0.28</td>
</tr>
<tr>
<td>SB</td>
<td>4: I-29, 41ST ST TO 41ST ST</td>
<td>6</td>
<td>0.481</td>
<td>8100</td>
<td>7.11</td>
<td>0.84</td>
<td>6835.08</td>
<td>1.61</td>
<td>-0.77</td>
</tr>
<tr>
<td>SB</td>
<td>5: I-29, 41ST ST TO I-229</td>
<td>49</td>
<td>1.910</td>
<td>21200</td>
<td>73.90</td>
<td>0.66</td>
<td>14057.23</td>
<td>1.13</td>
<td>-0.47</td>
</tr>
<tr>
<td>SB</td>
<td>6: I-29, I-229 TO I-229</td>
<td>8</td>
<td>0.472</td>
<td>12500</td>
<td>10.77</td>
<td>0.74</td>
<td>9287.21</td>
<td>1.47</td>
<td>-0.73</td>
</tr>
<tr>
<td>NB</td>
<td>7: I-29, I-229 TO I-229</td>
<td>19</td>
<td>0.638</td>
<td>12400</td>
<td>14.44</td>
<td>1.32</td>
<td>16318.12</td>
<td>1.40</td>
<td>-0.08</td>
</tr>
<tr>
<td>NB</td>
<td>8: I-29, I-229 TO 41ST</td>
<td>23</td>
<td>1.270</td>
<td>21200</td>
<td>49.14</td>
<td>0.47</td>
<td>9923.42</td>
<td>1.18</td>
<td>-0.71</td>
</tr>
<tr>
<td>NB</td>
<td>9: I-29, 41ST TO 41ST</td>
<td>5</td>
<td>0.521</td>
<td>13100</td>
<td>12.46</td>
<td>0.40</td>
<td>5258.59</td>
<td>1.43</td>
<td>-1.03</td>
</tr>
<tr>
<td>NB</td>
<td>10: I-29, 41ST TO 26TH</td>
<td>20</td>
<td>0.248</td>
<td>21900</td>
<td>9.91</td>
<td>2.02</td>
<td>44189.13</td>
<td>1.50</td>
<td>0.52</td>
</tr>
<tr>
<td>NB</td>
<td>11: I-29, 26TH TO 26TH</td>
<td>25</td>
<td>0.440</td>
<td>17600</td>
<td>14.13</td>
<td>1.77</td>
<td>31133.25</td>
<td>1.40</td>
<td>0.37</td>
</tr>
<tr>
<td>NB</td>
<td>12: I-29, 26TH TO 12TH</td>
<td>17</td>
<td>0.669</td>
<td>27700</td>
<td>33.82</td>
<td>0.50</td>
<td>13923.87</td>
<td>1.23</td>
<td>-0.73</td>
</tr>
</tbody>
</table>

**COLUMN TOTALS**

<table>
<thead>
<tr>
<th>NUMBER CRASHES</th>
<th>SEGMENT LENGTH</th>
<th>DAILY VOLUME</th>
<th>MVMT1</th>
<th>CRASH RATE</th>
<th>TEV*R 2</th>
<th>CRITICAL RATE</th>
<th>DIFFERENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>227300</td>
<td>214089.46</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**WEIGHTED AVERAGE RATE**

| 0.94 |

---

1 **MVMT=MILLION VEHICLE MILES TRAVELED**

2 **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

# Table 4 - Interstate Ramp Crash Rates (2010-2015)

## I-29/41st St. IMJR

<table>
<thead>
<tr>
<th>Travel Direction</th>
<th>Segment Description</th>
<th>Number of Crashes</th>
<th>Segment Length</th>
<th>Daily Volume</th>
<th>MVMT&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Crash Rate</th>
<th>TEV*R&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Critical Rate</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>SB</td>
<td>1 - 26th Street Off Ramp</td>
<td>5</td>
<td>0.188</td>
<td>12700</td>
<td>4.36</td>
<td>1.15</td>
<td>11067.72</td>
<td>3.13</td>
<td>-1.99</td>
</tr>
<tr>
<td>SB</td>
<td>2 - 26th Street On Ramp</td>
<td>1</td>
<td>0.265</td>
<td>3400</td>
<td>1.64</td>
<td>0.61</td>
<td>5590.71</td>
<td>4.01</td>
<td>-3.40</td>
</tr>
<tr>
<td>SB</td>
<td>3 - 41st Street Off Ramp</td>
<td>7</td>
<td>0.27</td>
<td>13800</td>
<td>6.80</td>
<td>1.03</td>
<td>13405.62</td>
<td>2.87</td>
<td>-1.84</td>
</tr>
<tr>
<td>SB</td>
<td>4 - 41st Street On Ramp</td>
<td>2</td>
<td>0.186</td>
<td>5100</td>
<td>1.73</td>
<td>1.16</td>
<td>4414.55</td>
<td>3.95</td>
<td>-2.79</td>
</tr>
<tr>
<td>SB</td>
<td>5 - I-229 Off Ramp</td>
<td>12</td>
<td>0.979</td>
<td>8700</td>
<td>15.54</td>
<td>0.77</td>
<td>11269.45</td>
<td>2.54</td>
<td>-1.76</td>
</tr>
<tr>
<td>SB</td>
<td>6 - I-229 On Ramp</td>
<td>19</td>
<td>1.26</td>
<td>9200</td>
<td>21.16</td>
<td>0.90</td>
<td>10243.67</td>
<td>2.44</td>
<td>-1.55</td>
</tr>
<tr>
<td>NB</td>
<td>7 - I-229 Off Ramp</td>
<td>4</td>
<td>0.554</td>
<td>6800</td>
<td>6.88</td>
<td>0.58</td>
<td>11687.74</td>
<td>2.87</td>
<td>-2.29</td>
</tr>
<tr>
<td>NB</td>
<td>8 - I-229 On Ramp</td>
<td>5</td>
<td>0.376</td>
<td>8800</td>
<td>6.04</td>
<td>0.83</td>
<td>10627.87</td>
<td>2.94</td>
<td>-2.11</td>
</tr>
<tr>
<td>NB</td>
<td>9 - 41st Street Off Ramp</td>
<td>2</td>
<td>0.185</td>
<td>5700</td>
<td>1.92</td>
<td>1.04</td>
<td>5484.72</td>
<td>3.83</td>
<td>-2.79</td>
</tr>
<tr>
<td>NB</td>
<td>10 - 41st Street On Ramp</td>
<td>3</td>
<td>0.339</td>
<td>8900</td>
<td>5.51</td>
<td>0.54</td>
<td>16335.08</td>
<td>2.99</td>
<td>-2.44</td>
</tr>
<tr>
<td>NB</td>
<td>11 - 26th Street Off Ramp</td>
<td>1</td>
<td>0.209</td>
<td>4400</td>
<td>1.68</td>
<td>0.60</td>
<td>7384.39</td>
<td>3.98</td>
<td>-3.39</td>
</tr>
<tr>
<td>NB</td>
<td>12 - 26th Street On Ramp</td>
<td>2</td>
<td>0.265</td>
<td>10100</td>
<td>4.88</td>
<td>0.41</td>
<td>24667.29</td>
<td>3.06</td>
<td>-2.65</td>
</tr>
</tbody>
</table>

| Column Total     | 195590                            | 376535.73         |                |              | 1.93         |             |               |

<sup>1</sup> MVMT = Million Vehicle Miles Traveled

<sup>2</sup> TEV*R = Total Entering Vehicles Times Crash Rate


Note: Critical rate statistics are based on a large sample of interstate ramps in Sioux Falls.

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 (41st 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 41st 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 41st 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

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

Carolyn Avenue access alternatives provided in separate memo

41st Street Corridor Environmental Assessment

Single Point Interchange Alternative

Sioux Falls, SD
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

Diverging Diamond Interchange Alternative

41st Street Corridor Environmental Assessment

Sioux Falls, SD
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 41st St./Marion Rd. intersection experiences level of service E during the PM peak hour under no-build conditions.
- The 41st 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 41st St./Marion Rd. intersection experiences level of service F during the AM and PM peak hours under no-build conditions.
- The 41st St./Terry Ave. intersection experiences level of service E during the PM peak hour under no-build conditions.
- The 41st St./I-29 NB ramp terminal experiences level of service E 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)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Period</th>
<th>LOS/Delay (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2023 No-build</td>
<td>PM Peak</td>
<td>E/68</td>
</tr>
<tr>
<td>2045 No-build</td>
<td>AM Peak</td>
<td>F/85</td>
</tr>
<tr>
<td>2045 No-build</td>
<td>PM Peak</td>
<td>F/115</td>
</tr>
<tr>
<td>2045 Interim Improvements with Existing Interchange</td>
<td>AM Peak</td>
<td>E/60</td>
</tr>
<tr>
<td>2045 Interim Improvements with Existing Interchange</td>
<td>PM Peak</td>
<td>F/97</td>
</tr>
<tr>
<td>2045 Interim Improvements with Diverging Diamond Interchange</td>
<td>AM Peak</td>
<td>E/59</td>
</tr>
<tr>
<td>2045 Interim Improvements with Diverging Diamond Interchange</td>
<td>PM Peak</td>
<td>F/105</td>
</tr>
<tr>
<td>2045 Interim Improvements with Single Point Interchange</td>
<td>AM Peak</td>
<td>E/58</td>
</tr>
<tr>
<td>2045 Interim Improvements with Single Point Interchange</td>
<td>PM Peak</td>
<td>E/67</td>
</tr>
</tbody>
</table>

* SYNCHRO analysis result

Condition | Period | LOS/Delay (sec)
-----------|--------|-----------------|
2045 No-build | PM Peak | E/59 |
2045 41st improvements with existing interchange | PM Peak | * F/85 |

* SYNCHRO analysis result
Figure M

Valley View

Terry Avenue

41st Street

Holbrook Ave

41st Street Improvements and Existing Interchange

Note: Level of Service F* indicates that queue storage ratio of at least one movement exceeds 1.0

Legend

AM PM Existing peak hour traffic volumes
XX Existing peak hour Saturday traffic volumes
Signalized intersection
Changed from No-Build

LOS Avg. Delay
HCS 2010 Analysis A XX sec. A.M.
A XX sec. P.M.
A XX sec. Sat.
SYNCHRO Analysis A XX sec. A.M.
A XX sec. P.M.
A XX sec. Sat.

Drawn By: B.Miller
Date: 10/31/16
Checked 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

13

35
Intersection Level of Service (east of I-29)

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
See Figure 14 for Single Point Interchange Volumes and Level of Service
No-Build Conditions

Level of Service F* indicates that queue storage ratio of at least 1.0 exceeds one movement.

Note:

Figure 20

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
**Legend**

- AM PM: Existing peak hour traffic volumes
- XX: Existing peak hour Saturday traffic volumes
- Signalized intersection
- Changed from No-Build

**HCS 2010 Analysis**

- LOS: A.M., P.M., Sat.

**SYNCHRO Analysis**

- A.M., P.M., Sat.
- XX sec.

**Note:**
- Level of Service F* indicates that queue storage ratio of at least one movement exceeds 1.0
- With currently proposed 41st St. and Marion Road improvements as shown in Appendix A
- With 41st St. widened to 3 lanes in each direction west of Marion Road per future improvements shown in 2012 Corridor Study

**With Existing Interchange**

**Existing Interchange Level of Service (west of I-29)**

**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
**Checked By:** J. Linnah
**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
**Legend**

- AM PM: Existing peak hour traffic volumes
- XX: Existing peak hour Saturday traffic volumes
- Signalized intersection

**HCS 2010 Analysis**

- LOS: Avg. Delay
  - A: XX sec.
  - B: XX sec.
  - C: XX sec.

**SYNCHRO Analysis**

- A: XX sec.
  - A.M.
  - P.M.

**Note:** Level of Service F* indicates that one movement exceeds 1.0 queue storage ratio of at least Level of Service F. Existing peak hour traffic volumes.

**Year 2045 Traffic Volumes and Signalized Intersection Level of Service (east of I-29)**

- 29th Street
- 34th Street
- Carolina Avenue
- Louise Avenue
- 41st Street
- W. Empire Pl.

**No-Build Conditions**

- Big Sioux West

**Drawn By:** B. Miller
**Date:** 10/31/16
**Checked By:** J. Linnah
**Date:** 12/15/16

**Revision:** 12/15/16

**Figure 24**

**I-29 Exit 77 (41st Street) Interchange Modification Study**

**Sioux Falls, SD**
Figure 41st Street Improvements and Single Point Interchange

Note: Level of Service F* indicates that queue storage ratio of at least one movement exceeds 1.0

See Figure 22 for Single Point Interchange Volumes and Level of Service

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

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

Note:
Level of Service F* indicates that queue storage ratio of at least 1.0

41st Street Improvements and Diverging Diamond Interchange

Legend
- AM PM
- Year 2045 Peak Hour Traffic Volumes
- XX Year 2045 Peak Hour Saturday Traffic Volumes
- Signalized Intersection
- Changed from No-Build

LOS | Avg. Delay
---|---
A  | XX sec.
A  | XX sec.
A  | XX sec.

<table>
<thead>
<tr>
<th>AM</th>
<th>A.M.</th>
<th>P.M.</th>
<th>Sat.</th>
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<tbody>
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<td>XX</td>
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</tr>
</tbody>
</table>

Drawn By: B Miller
Date: 10/31/16
Checked By: J Unruh
Date: 10/31/16
Revision: 2/7/17
Figure 28

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

No-Build Conditions
Figure 29

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

Level of Service
- Auto
- Pedestrian
- Bicycle
- Transit

EB = Eastbound  WB = Westbound  Sat. = Saturday

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

Better than No-Build  Worse than No-Build

41st Street Improvements and Existing Interchange

1/20/17

Drawn By: B. Miller
Date: 10/31/16

Checked By: J. Jirouch
Date: 10/31/16

Revision: 1/20/17

Scale in Feet
0 500 1000
Figure 31: Year 2023 Multimodal Peak Hour Level of Service I-29 Exit 77 (41st Street) Interchange Modification Study Sioux Falls, SD

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

Level of Service

Auto
Pedestrian
Bicycle
Transit

EB = Eastbound
WB = Westbound
Sat. = Saturday

E Better than No-Build
E Worse than No-Build

1/20/17

41st Street Improvements and Diverging Diamond Interchange
Figure 33

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

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

Level of Service
- Auto
- Pedestrian
- Bicycle
- Transit
- Level of Service

Better than No-Build
Worse than No-Build

EB = Eastbound
WB = Westbound
Sat. = Saturday

SCALE IN FEET
0 500 1000
Figure 39

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

Legend

- AM Volume
- PM Volume
- AM/PM Peak Hour Level of Service
- Weaving Analysis
  - Better than No-Build
  - Worse than No-Build

SCALE IN FEET

Legend

- AM Volume
- PM Volume
- AM/PM Peak Hour Level of Service
- Weaving Analysis
  - Better than No-Build
  - Worse than No-Build

Interchange and Diverging Diamond
41st Street Improvements

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

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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

No-Build Conditions
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-29/41st 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 (41st 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 41st 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 41st Street as part of the I-29 Exit 77 (41st St.) Crossroad Corridor Study. Those alternatives each addressed retrofitting the accesses along 41st Street to improve access management. That study recommended alternatives that include a center median on 41st Street and the closure of the 41st Street/Carolyn Avenue intersection.

The 41st 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 41st 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 38th Street and Shirley Avenue to reach 41st Street. The analysis is summarized in Figures 44 and 45 and in the Technical Memorandum, reproduced in the Appendix 5.
Critical Non-Signalized Intersection LOS Year 2023 and 2045 Traffic Volumes and No-Build Conditions

Legend
- AM PM Peak Hour Traffic Volumes
- XX Peak Hour Saturday Traffic Volumes
- 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

Year 2023

- 90 40
- 90 0
- 140 35
- 130 35
- 100 15
- 100 60
- 50 5
- 150 40
- 100 30
- 140 10

Year 2045

- 90 15
- 90 0
- 140 35
- 130 35
- 100 15
- 100 60
- 50 5
- 150 40
- 100 30
- 140 10

Traffic Volumes
- Peak Hour
- Peak Hour Saturday
- AM
- PM

LOS
- A.M. Peak Hour
- P.M. Peak Hour
- Saturday Peak Hour

Scale in Feet

0 200 400

Menards

Shirley Avenue

Walmart

Carolyn Avenue

34th Street

38th Street

41st Street

Empire Mall

Year 2023

- 85
- 65
- 50
- 20
- 115
- 70
- 50

Year 2045

- 85
- 65
- 50
- 20
- 115
- 70
- 50

B.M. Miller
10/26/16

J. Unruh
10/26/16

1/25/17

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

Figure 44
Critical Non-Signalized Intersection LOS

Year 2023 and 2045 Traffic Volumes and

Peak Hour Traffic Volumes
Peak Hour Saturday Traffic Volumes
A.M. Peak Hour LOS
P.M. Peak Hour LOS
Saturday Peak Hour LOS

Legend

AM PM
Traffic Volumes
Peak Hour Saturday Traffic Volumes
XX
A.M. Peak Hour LOS
Build Conditions
Existing Access Easement
Roadway Construction
Raised Island / Median

Signalized Intersection
Stop Controlled Intersection

Note:
Build conditions analysis assumes no access to 41st Street at Carolyn Avenue (worst case scenario)

Empire Mall
Caroline Avenue
Shirley Avenue
38th Street
34th Street
Menards
41st Street
Walmart

Build Conditions
(Same for all improvement scenarios)

Year 2023

<table>
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<tr>
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<th>AM</th>
<th>PM</th>
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<tr>
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<td>45</td>
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Year 2045

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Year 2023

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Year 2045

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</table>

Note:
Build conditions analysis assumes no access to 41st Street at Carolyn Avenue (worst case scenario)

Empire Mall
Caroline Avenue
Shirley Avenue
38th Street
34th Street
Menards
41st Street
Walmart

Build Conditions
(Same for all improvement scenarios)
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 41st 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 41st 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-29/41st 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.

<table>
<thead>
<tr>
<th>Project Number</th>
<th>State Funding Category</th>
<th>Federal Funding Category</th>
<th>Federal Funds ($ million)</th>
<th>State Funds ($ million)</th>
<th>City Funds ($ million)</th>
<th>Total Funds ($ million)</th>
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<td>IM 0293(106)77 P PCN03RA</td>
<td>Interstate</td>
<td>National Highway Performance</td>
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<tr>
<td>Total</td>
<td></td>
<td></td>
<td>$22.8</td>
<td>$2.4</td>
<td>$13.7</td>
<td>$38.9</td>
</tr>
</tbody>
</table>

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 (41st Street) alone and/or modifications to the existing interchange configuration will not improve traffic conditions adequately to meet applicable criteria. Improvements to 41st 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.
Control of Access and Right-of-Way for Diverging Diamond Interchange
41st Street Corridor Interchange Study

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

Signalized Intersection

1,900' auxiliary lane to 26th St. off-ramp gore

Drawn By: B. Miller
Date: 7/12/2017
Checked By: J. Unruh
Date: 7/12/2017
Revision: 
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: 41st St. West of I-29 Alternatives Evaluation
10 – Technical Memo 8: 41st St. East of I-29 Alternatives Evaluation
11 – Concept Signing Plan
12 – Interchange Area Air Photos