South Dakota

I-229 EXIT 6

10TH STREET

INTERCHANGE MODIFICATION JUSTIFICATION REPORT

Interchange Modification Justification Report for Interstate-229 Exit 6 (10th Street) Interchange

Sioux Falls, South Dakota

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Executive Summary

The South Dakota Department of Transportation (SDDOT) initiated a study of the I-229 & 10th Street (Exit 6) Single-Point Urban Interchange (SPUI) in order to develop and evaluate potential improvements within the study area. As part of the study, this Interchange Modification Justification Report (IMJR) was developed to provide a technical evaluation of the operational feasibility of the proposed improvements in fulfillment of the Federal Highway Administration (FHWA) Policy on Access to the Interstate System. The proposed access change would extend the existing interchange ramps and provide additional turn lanes at the ramp terminal intersection. The access change request is being made to improve the storage of the interchange ramps to meet the forecasted demand.

Existing condition operational analysis showed that I-229 mainline traffic operations exhibited Level of Service (LOS) C or better during the AM and PM peak hours. Under the existing conditions, 8 of the 11 intersections in the study area showed failing traffic operations in at least one of the peak periods; these conditions are due to volume to capacity ratio (V/C) issues, queue storage issues, or delay issues. The I-229 & 10th Street intersection currently operates under failing conditions with significant delays in the PM peak hour.

The operational analysis of the 2050 No-Build condition revealed capacity constraints leading to poor operating LOS throughout mainline I-229. Out of the 18 total mainline segments, 15 were shown to operate at a LOS D or worse during either the AM or PM peak hour. Under the 2050 No-Build condition, 10 intersections demonstrated inadequate traffic operations in at least one of the peak periods with high delays, inadequate queue storage, or capacity constraints. The I-229 & 10th Street intersection operated at a LOS F and LOS E during the AM and PM peak hours, respectively with V/C issues. At Cleveland Avenue & 10th Street, the intersection experienced high delays, Queue Storage Ratio (QSR) and V/C issues with extensive vehicle queuing on every approach.

The selected Build Alternatives were brought forward from the previous Major Investment Study (MIS) and analyzed to determine which alternatives to be fully considered. A screening of the alternatives was conducted based on technical analysis and input from the Study Advisory Team (SAT) that made the recommendation to advance the SPUI concept design and eliminate the DDI concept.

Additional alternative screenings were undertaken to determine the optimal SPUI concept design and E 10th Street corridor cross section necessary to provide the LOS standards required at the study interchange. A decision was made by the SAT to eliminate the required LOS standard at the interchange and instead use the 95th percentile queue length on the interchange ramps to determine the success of the alternative. This set the goal of providing queue storage for the northbound/southbound I-229 exit ramps and no longer required providing a minimum intersection delay. With this new criteria, the SPUI alternative was reevaluated and the interstate exit ramps were designed to accommodate the queues.

The operational analysis of the 2050 Build condition demonstrated the improved operations realized from widening mainline I-229. Out of the 18 total segments, 5 were determined to operate at LOS D during either the AM or PM peak hour. However, 4 of those segments were geometrically unchanged from the No-Build condition and represented operations consistent with

the previous No-Build analysis. Under the 2050 Build condition, the 95th percentile queue lengths at the I-229 & E 10th Street interchange were examined for both northbound and southbound exit ramps and it was determined that sufficient storage exists to contain the expected vehicle queues which was an improvement over the No-Build condition. However, there were 9 intersections that demonstrated inadequate traffic operations in at least one of the peak periods with high delays, inadequate queue storage, or capacity constraints. The I-229 & 10th Street intersection operated at a LOS C and LOS D during the AM and PM peak hours, respectively with V/C and QSR issues. At Cleveland Avenue, the intersection experienced high delays, V/C and QSR issues with extensive vehicle queueing on every approach.

The operational analysis of the 2027 Build condition determined that all of the mainline segments operated at a LOS C or better during the AM and PM peak hours. Under the 2027 Build condition, the 95th percentile queue lengths at the I-229 & E 10th Street interchange were examined for both northbound and southbound exit ramps and it was determined that sufficient storage exists to contain the expected vehicle queues. There were 5 intersections that demonstrated inadequate traffic operations in at least one of the peak periods with high delays, inadequate queue storage, or capacity constraints. The I-229 & 10th Street intersection operated at a LOS C during the AM and PM peak hours, with V/C and QSR issues. At Cleveland Avenue, the intersection experienced high delays, V/C and QSR issues with extensive vehicle queueing on every approach.

The Build Alternative for both the I-229 mainline and the E 10th Street corridor can be expected to provide a safety benefit when compared to the No-Build Alternative. A predictive safety analysis of alternatives was conducted using FHWA's Interactive Highway Safety Design Model (IHSDM) which concluded that the widening of the I-229 roadway and increased curve radius provided a reduction in predicted crashes of 113 crashes (21% decrease), compared to the No-Build condition, and the 10th Street arterial corridor provided a reduction in predicted crashes of 43 crashes (4% decrease), compared to the No-Build condition.

The FHWA Policy requirements have been addressed through reviews and evaluations completed in this IMJR. The Policy requirements and responses are provided in the Conclusions and Recommendations chapter of this IMJR. A summary of the FHWA Policy responses is provided below:

- FHWA Policy (2017) Requirement 1 response: The traffic operational analyses conducted for the recommended Build Alternative concluded that the proposed change in access would not have an adverse impact to operations of the Interstate System. The improvements associated with the recommended Build Alternative are expected to provide ramp storage for the expected design year 2050 weekday peak period 95th percentile queues without negatively impacting the Interstate System. Additionally, the crash prediction analysis concluded that the recommended Build Alternative is expected to yield a lower number of crashes for all crash severity than the No-Build condition. The criteria for the FHWA Policy Requirement 1 have been addressed through these operational and safety analyses.
- FHWA Policy (2017) Requirement 2 response: The proposed access action involves improvement of an existing full-movement interchange. The improved interchange will continue to serve all movements. All roadways that are part of the proposed

reconfiguration are public roadways. The proposed geometric design of the interchange conforms to all relevant SDDOT and AASHTO design standards and policies. The criteria for the FHWA Policy Requirement 2 have been addressed through the review of access and design standards.

Based on the evaluations documented in this IMJR, it can be concluded that the modification to realign and extend the ramp lanes of the existing SPUI interchange on Interstate-229 & E 10th Street in Sioux Falls, South Dakota, as illustrated in this report will not have a detrimental impact to the Interstate System and can be recommended.

1. Introduction

This Interchange Modification Justification Report (IMJR) provides documentation of the proposed interchange improvements of the I-229 & 10th Street (Exit 6) Interchange in Sioux Falls, South Dakota. This document was developed on behalf of the SDDOT, for submittal to FHWA as a request to modify Interstate access at the I-229 Exit 6 Interchange in fulfillment of the FHWA's policy concerning access to the Interstate Highway System.

1.1. Background

The I-229 MIS, completed in 2017, was a master planning effort for a variety of corridor and interchange improvements that documented the intended direction for improvements over the next 20 years. As advised in the I-229 MIS, roadway capacity improvements were recommended for the I-229 & 10th Street interchange and adjacent 10th Street & Cleveland Avenue intersection as both were projected to be at capacity by year 2035. It was also recommended to widen I-229 mainline to include three continuous travel lanes in each direction between Exit 5 to Exit 6 and improve the existing horizontal curves to facilitate safe and efficient traffic operations.

The SDDOT in conjunction with the City of Sioux Falls, Minnehaha County, the Sioux Falls Metropolitan Planning Organization (SFMPO), and the FHWA had concluded that this study was necessary to determine the proper interchange configuration that will be needed to handle current and future traffic levels.

1.2. Purpose

The purpose for this project is to examine needed transportation improvements to address existing and future travel demand on the I-229 corridor and at the I-229 & 10th Street (Exit 6) Interchange. The proposed improvements would reconstruct this interchange to fulfill current design standards, improve safety, and increase the efficiency of the transportation system along the I-229 corridor.

1.3. Project Location

The I-229 & 10th Street Interchange is located within the City of Sioux Falls in Minnehaha County, South Dakota. The interchange is located at mileage marker 6, approximately six miles east/northeast of the I-29 & I-229 systems interchange and approximately four miles south of the I-229 & I-90 systems interchange.

Within the IMJR study area, the area of influence includes freeway mainline, ramps, ramp terminal intersections and crossroad intersections within the following boundaries:

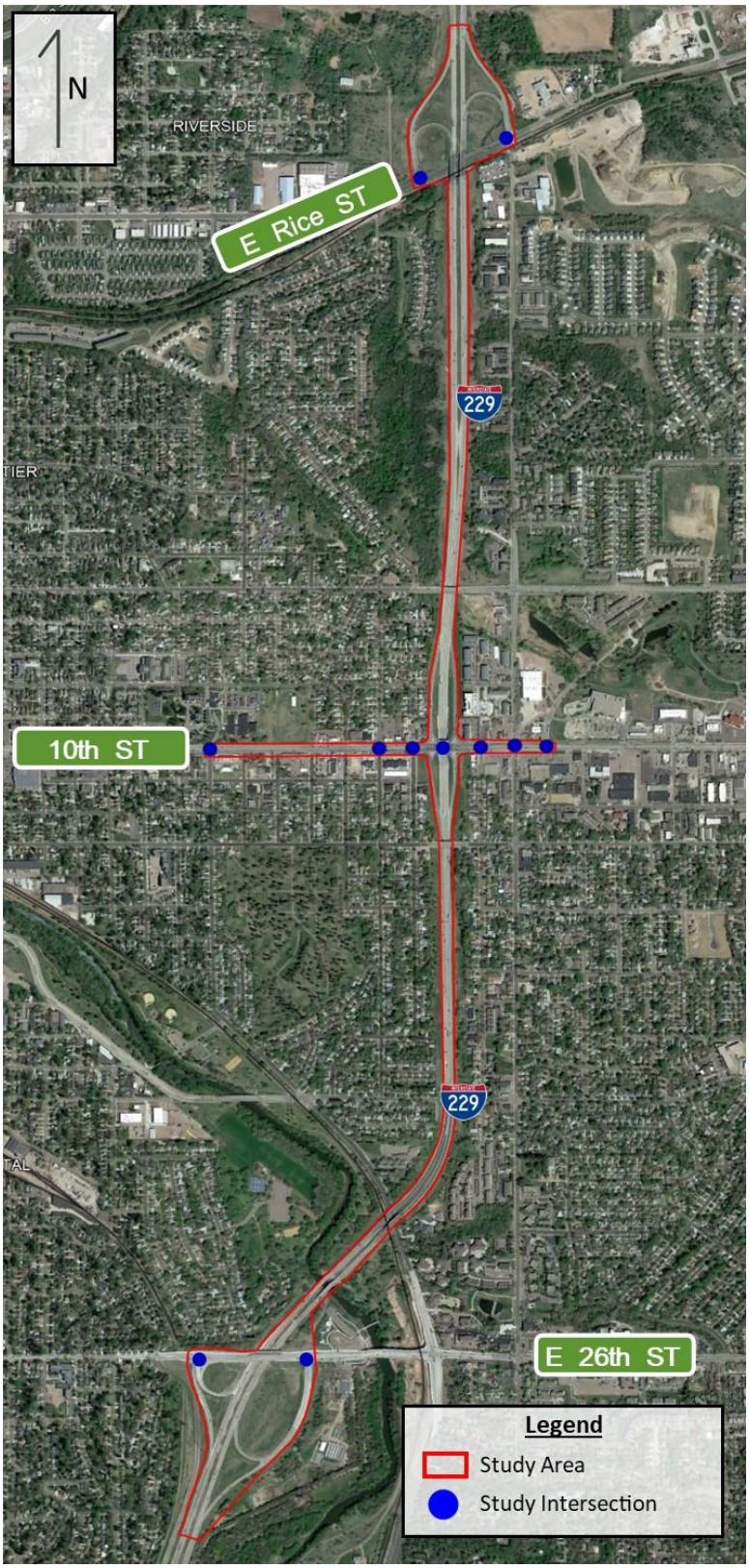
- West Limits: 10th Street & Jessica Avenue
- East Limits: 10th Street & Hy-Vee Access
- North Limits: I-229 & Exit 7 (Rice Street)
- South Limits: I-229 & Exit 5 (26th Street)

Intersections within the study area include:

- Rice Street & SB I-229 (Exit 7)
- Rice Street & NB I-229 (Exit 7)
- 10th Street & Jessica Avenue
- 10th Street & Lowell Avenue
- 10th Street & Conklin Avenue
- 10th Street & NB/SB I-229 (Exit 6)
- 10th Street & Blaine Avenue
- 10th Street & Cleveland Avenue
- 10th Street & Hy-Vee Access
- 26th Street & SB I-229 (Exit 5)
- 26th Street & NB I-229 (Exit 5)

The existing I-229 & 10th Street Interchange is a SPUI type interchange configuration. The location of the study area is shown in **Figure 1**.

Figure 1: IMJR Project Location



2. Methodology

The methodologies used to evaluate traffic operations and safety in support of the interchange access request are detailed as follows.

The area of influence identified for analysis included the freeway mainline, ramps, ramp terminal intersections and crossroad intersections within the boundaries shown in **Figure 1**. The area of influence includes the nearest adjacent interchanges to the north (Exit 7) and to the south (Exit 5) as well as the local roadway intersections along 10th Street, as listed in the previous section.

The following analysis years/scenarios were evaluated for traffic operational analysis:

- Existing (base) year 2021
- Design year 2050 No-Build
- Design year 2050 Build
- Opening year 2027 Build

Operational analysis was completed for the AM and PM peak hour periods of each scenario.

Operational analysis of locations within the area of influence was completed using Highway Capacity Software (HCS) Version 7 for the scenarios/periods outlined above. HCS 7 is a computerized analytical tool that replicates the operational analysis procedures of the Highway Capacity Manual (HCM), 6th edition. Detailed reports for each traffic operations analysis scenario can be found in the Appendix.

2.1. Traffic Forecasting

Existing traffic data was provided from participating agencies including the SDDOT and the City of Sioux Falls. Peak hour volumes and heavy vehicle percentages were extracted from the traffic data to develop a balanced Existing Conditions traffic data set of AM and PM peak hour traffic volumes.

Traffic forecasts for design year 2050 conditions and opening year 2027 conditions were prepared using existing traffic data and future forecasts. Forecasts were based on the SFMPO Travel Demand Model (TDM) and utilized existing turning pattern and vehicle classification data, as appropriate.

Traffic forecasts for the 2050 design year utilized existing peak hour traffic data along with projected future year and base year ADT volumes. Growth factors developed from the TDM data were applied to the existing traffic volume data to develop the 2050 design year peak hour traffic movement volumes. This output was compared against K factors developed for the AM and PM period at each location to verify the accuracy of growth and adjustments were made where necessary. The peak hour volumes between intersections were then smoothed and balanced to within five vehicles. The peak hour volumes between interchange ramps were smoothed and balanced to remove any vehicle flow variability. The resulting output was the 2050 design year's peak hour turning volumes for the No-Build condition. The estimated ADT volumes for the 2050 design year were used in the development of the morning (AM) and afternoon (PM) peak hour volumes. The peak hour volumes were later used for the traffic analysis to assess the level of operations for freeway sections and intersections within the study corridor.

Traffic forecasts for the 2027 opening year were developed by calculating the straight-line growth between the existing year ADT volumes and the estimated 2050 ADT volumes and interpolating. The 2027 opening year daily traffic forecast was developed and carried forward to approximate the peak hour volumes. The estimated 2027 opening year morning (AM) and afternoon (PM) peak hour volumes were later used for the traffic analysis to assess the level of operations for freeway sections and intersections within the study corridor.

Traffic forecasts are provided in tables and figures later in this IMJR in conjunction with traffic operational analyses. Detailed traffic forecast methodologies are provided in the project Traffic Forecast document located in the Appendix.

2.2. Operational Analysis Methodologies

2.2.1. Software Input Assumptions and Methodology

Data, forecasts, and conceptual layouts were used for inputs of geometry, traffic control, traffic volumes, and travel speeds. Detailed assumptions on software input assumptions and methodologies are provided in the project Methods and Assumptions (M&A) document located in the Appendix.

2.2.2. Performance Measures

To satisfy the study objectives, the following measures of effectiveness will be reported:

- Signalized Intersections: Level-of-Service (LOS) and Individual Movement Delay, Volume to Capacity ratio, and Queue Storage Ratio
- Freeway Segments, Ramp Junctions, and Weave Areas: LOS and Density
- Arterial Corridor Segments: LOS, and Delay
- Ramp Terminal Intersections: LOS and Individual Movement Delay, Volume to Capacity ratio, Queue Storage Ratio, and 95th Percentile Delay

The Highway Capacity Manual (HCM) defines freeway LOS in terms of passenger vehicle density per mile per lane and intersection LOS in terms of the average control delay at the intersection in seconds per vehicle. For signalized intersection the overall intersection delay is reported and for unsignalized intersections, the worst-case lane movement LOS is reported.

Table 1 and **Table 2** present the LOS thresholds used to evaluate operations along freeway elements and at intersections within the study area.

Table 1: Freeway Level of Service Thresholds

Level of Service (LOS)	Segment Density (pc/mi/ln)		
	Merge and Diverge Segment	Freeway Weaving Segment	Basic Freeway Segment
A	0 – 10	0 – 10	0 – 11
B	> 10 – 20	> 10 – 20	> 11 – 18
C	> 20 – 28	> 20 – 28	> 18 – 26
D	> 28 – 35	> 28 – 35	> 26 – 35
E	> 35	> 35	> 35 – 45
F	Demand exceeds capacity	Demand exceeds capacity	Demand exceeds capacity; > 45

Source: Highway Capacity Manual, version 6.

Table 2: Intersection Level of Service Thresholds

Level of Service (LOS)	Intersection Delay (sec/veh)	
	Signalized Intersections	Unsignalized Intersections
A	0 – 10	0 – 10
B	> 10 – 20	> 10 – 15
C	> 20 – 35	> 15 – 25
D	> 35 – 55	> 25 – 35
E	> 55 – 80	> 35 – 50
F	Demand exceeds capacity; > 80	Demand exceeds capacity; > 50

Source: Highway Capacity Manual, version 6.

The following LOS thresholds represent the minimum allowable LOS measures for future-year Build concepts to be carried forward and considered for a recommended Build Alternative. For the analysis contained within this memorandum, these LOS thresholds will also be applied to identify areas with current and future-year concerns in the No-Build Conditions.

- Freeway Segments:
  - Urban area minimum allowable LOS C; LOS B desirable
- Ramp Terminal Intersections:
  - Urban area minimum allowable LOS C.
  - Individual Movements: LOS D with overall intersection at LOS C or better.
- Signalized Non-Ramp Terminal Intersections (modified by project):
  - Urban area minimum allowable LOS D.
  - Individual Movements: LOS E with overall intersection at LOS D or better.
  - Individual Movements: Cannot operate with a v/c ratio greater than 1.0.
- Other Non-Ramp Terminal Intersections (modified by project):
  - Urban area minimum allowable LOS D.

  - Individual Movements: LOS E or F with overall intersection at LOS D or better.
- Intersections Not Modified by Project:
  - Urban area minimum allowable LOS D.

2.3. Safety Analysis Methodologies

Crash data was reviewed for the study area based on South Dakota Department of Public Safety (SDDPS) crash records for the most recent five years of available data. The following information is provided from the crash analysis:

- Segment and Intersection Crash Rates
- Segment and Intersection Critical Crash Rates (per Highway Safety Manual)
- Crash Trends
- Potential Mitigation Measures to Improve Locations Above Critical Crash Rates

A predictive safety analysis of Build Options for 2027 Year of Project Completion and 2050 Planning Horizon Year time periods was completed utilizing FHWA's Interactive Highway Safety Design Model's (IHSDM) Crash Prediction Module in accordance with the Highway Safety Manual.

3. Existing Conditions

3.1. Demographics

The Sioux Falls Metropolitan Statistical Area has seen quick, yet steady growth over the last several decades illustrated in **Table 3**. The City of Sioux Falls has seen growth at an even faster rate and if recent growth trends continue the population can be expected to increase to approximately 365,000 people by the 2050 planning year. Population growth in both the Sioux Falls Metropolitan Statistical Area (48 percent) and the City of Sioux Falls (53 percent) has outpaced the statewide growth rate (17.5 percent) between 2000 and 2020.

Table 3: Population History

	2000	2010	2020	2000-2020 Percent Increase
City of Sioux Falls	125,598	153,888	192,517	53.3%
Sioux Falls Metropolitan Area	187,093	228,261	276,730	47.9%
South Dakota	754,844	814,180	886,667	17.5%

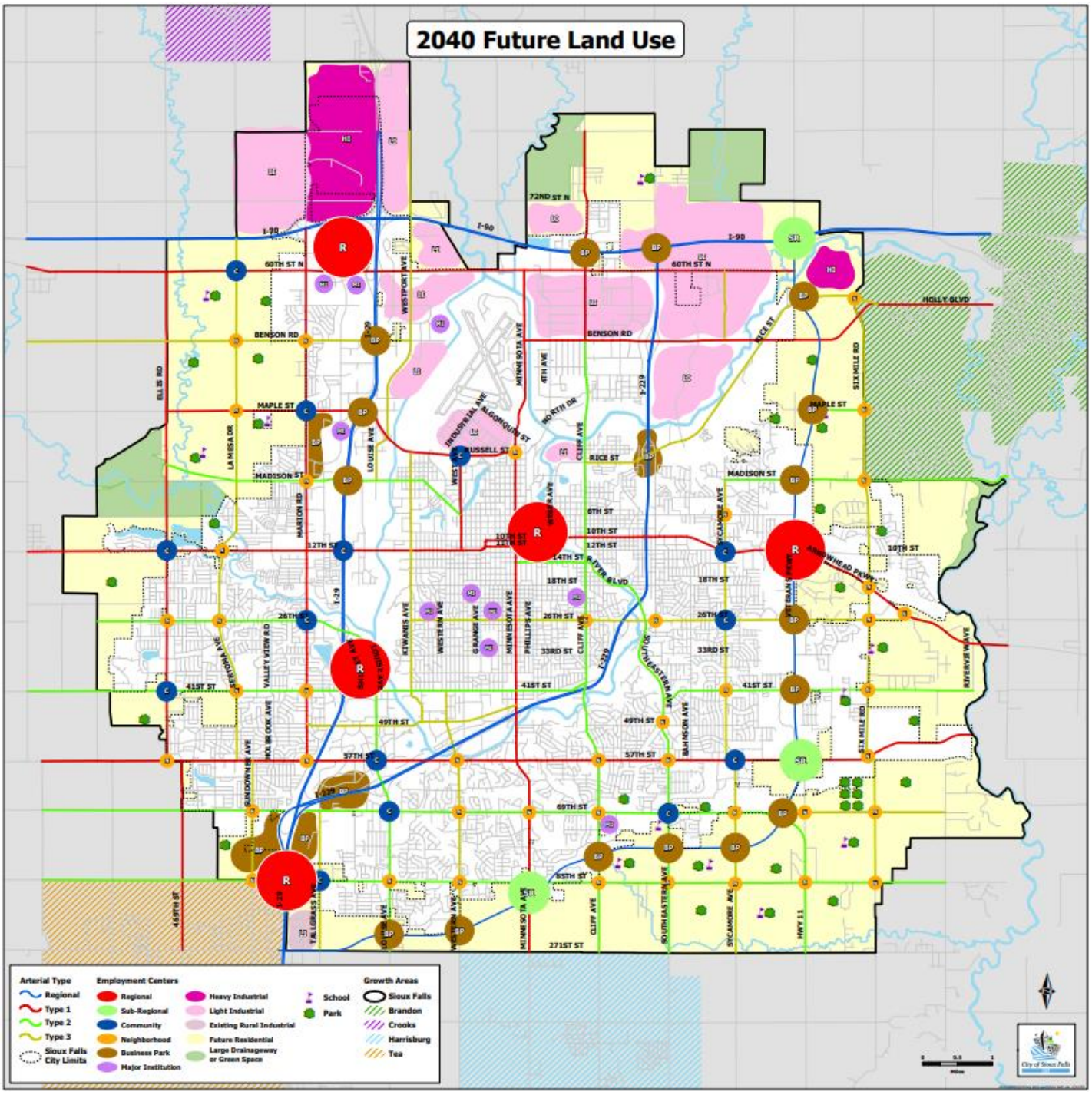
Source: United States Census Bureau (https://www.census.gov/).

Employment within the statistical area has grown along with the population. Unemployment rates within the City of Sioux Falls and the State of South Dakota were 1.5 percent and 2.4 percent, respectively, in October 2022[1].

The future land use plan for the City of Sioux Falls, as presented in the Shape Sioux Falls 2040 Comprehensive Plan, does not include any planned development at the I-229 & 10th Street interchange. It does include anticipated business park development of the area adjacent to the I-229 & Rice Street interchange, seen in **Figure 2**.

[1] Bureau of Labor Statistics, United States Department of Labor. https://www.bls.gov/eag/eag.sd.htm (retrieved November 2022).

Figure 2: City of Sioux Falls Future Land Use

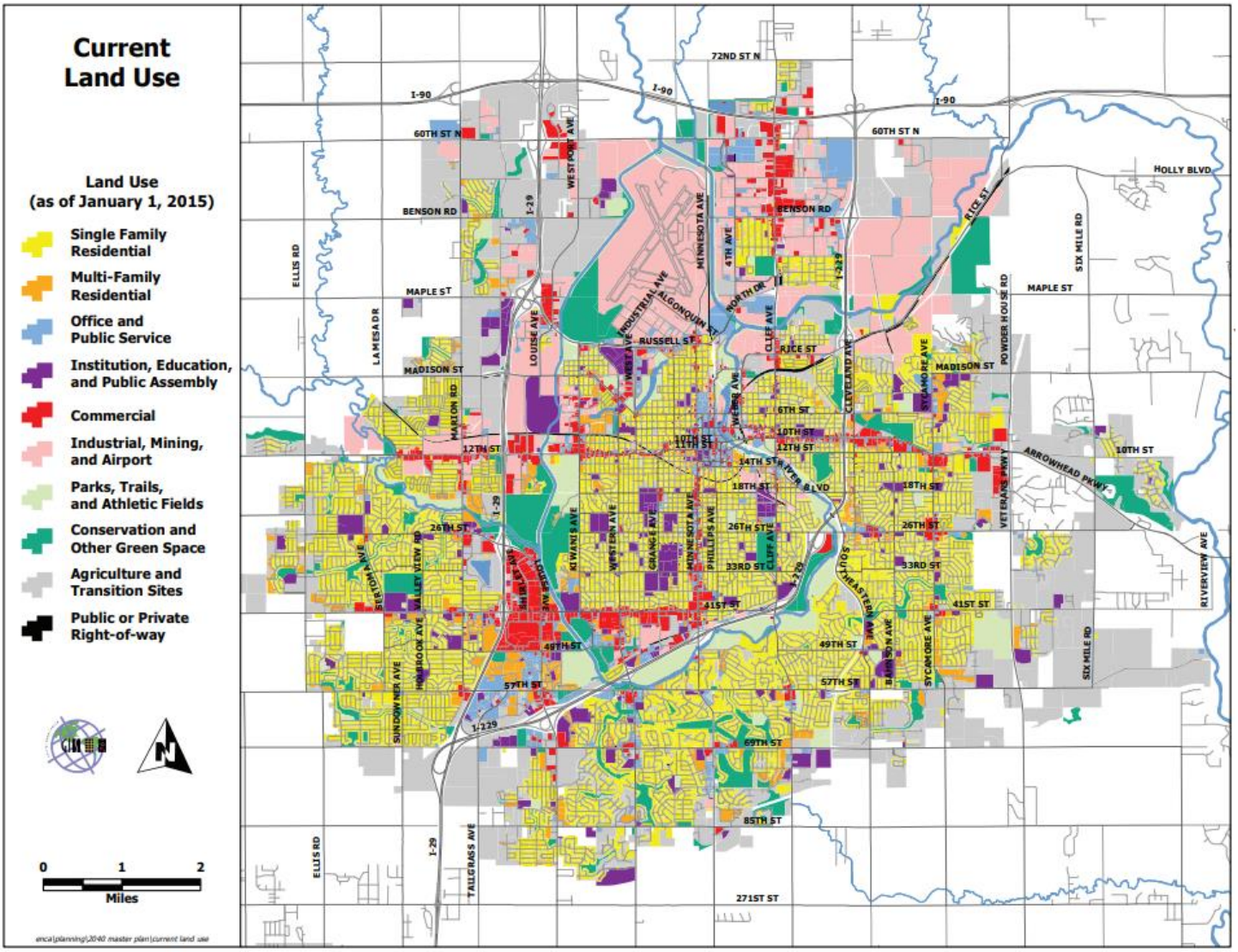


3.2. Existing Land Use

The study area comprises a mix of single family residential, multi-family residential, commercial, and office land uses. **Figure 3** illustrates current City of Sioux Falls zoning within the study area.

Commercial businesses are the most frequent land use along 10th Street and occupy all quadrants of the Exit 6 interchange. The I-229 corridor between Rice Street (Exit 7) and 26th Street (Exit 5) is predominantly bordered by residential land uses.

Figure 3: City of Sioux Falls Current Land Use



(Reproduced from Shape Sioux Falls 2040 Comprehensive Plan Zoning Map)

3.3. Existing Roadway Network

The major streets within the study area, as illustrated in **Figure 4**, are as follows:

Interstate 229

- Urban interstate facility, currently two continuous lanes in each direction with auxiliary lanes provided between the Exit 6 and Exit 7 interchanges.
    - 2018 Average Annual Daily Traffic (AADT) ranges between 29,800 to 37,700 vehicles in the project area.

Rice Street

- Urban minor arterial transitioning between a 3-lane and 4-lane roadway; west of the interstate the roadway is a 4-lane undivided facility and east of the interstate the roadway is a 3-lane facility.
    - 2018 AADT ranges between 12,500 and 13,700 vehicles in the project area.

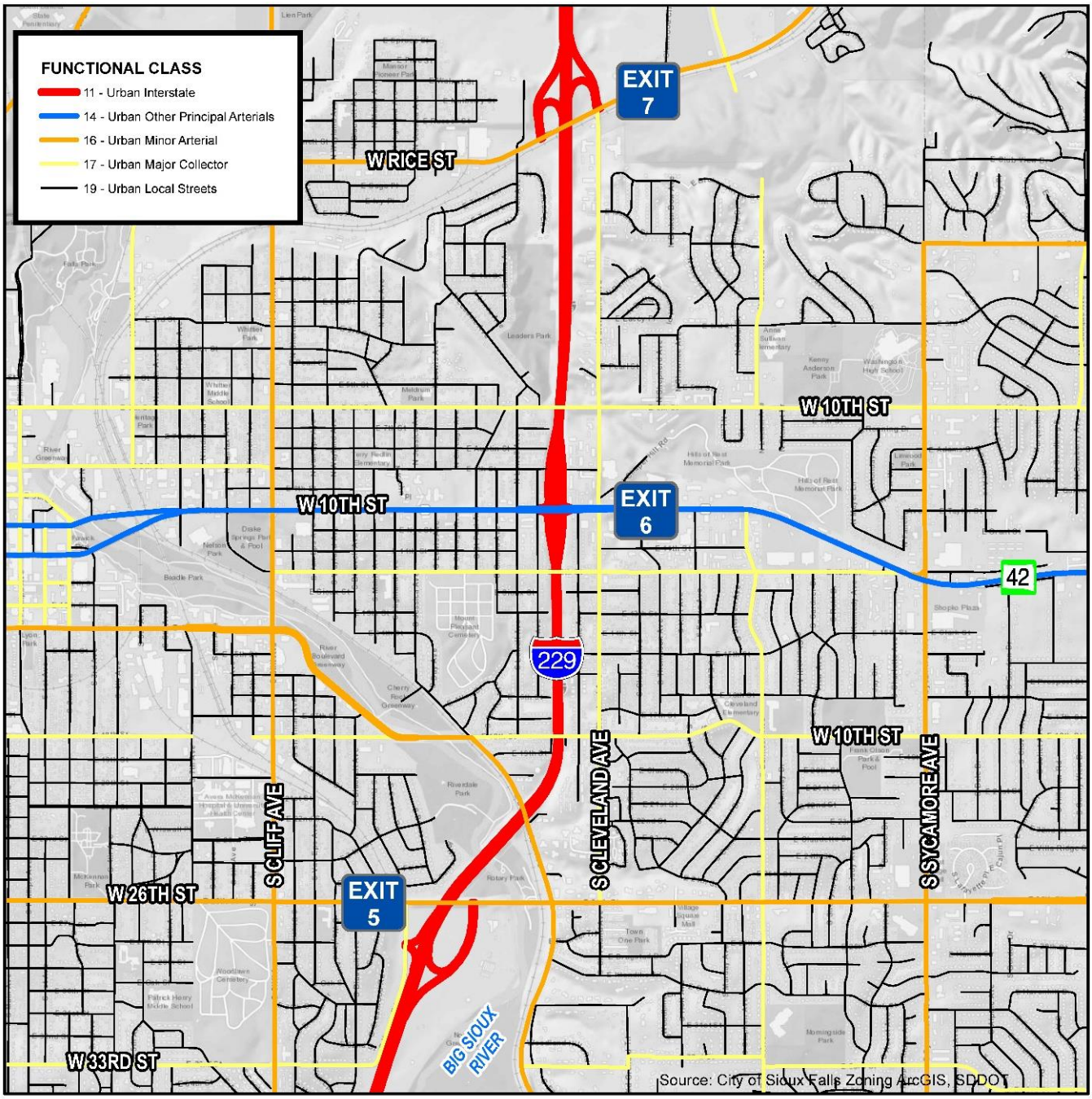
E 10th Street

- Urban principal arterial with a 4-lane divided roadway within the interchange area; east and west of the interchange area the roadway is a 4-lane undivided with a two-way left turn lane (TWLTL, 5-lane).
    - 2018 AADT ranges between 21,200 and 31,400 vehicles in the project area.

26th Street

- Urban minor arterial varying between 3-lane and 5-lane sections. 26th Street is being reconstructed to a 4-lane divided roadway through the I-229 interchange as part of an on-going interchange project (complete in 2020).
    - 2018 AADT ranges between 12,400 and 28,500 vehicles in the project area.

Figure 4: Existing Roadway Network



3.4. Interchanges

Three interchanges are located within the study area, Exits 5, 6, and 7, and are further described in the following subsections.

3.4.1. I-229 & 26th Street (Exit 5)

The interchange completed a major reconstruction project in 2020 and was reconstructed to a standard folded diamond configuration. The northbound I-229 ramp connections were widened near the ramp terminal intersection but are unchanged near the ramp gores. The southbound ramp configuration was entirely reconfigured.

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

26th Street was widened, and additional turn lanes were provided at the ramp terminal intersections; both are controlled by traffic signals.

The 26th Street at Yeager Road intersection will be under minor street stop control. The expansion of 26th Street will extend to the east and include significant reconfiguration of the intersection with Southeastern Avenue. The first access to the east will be approximately 300 feet away at a business driveway, with the first major intersection approximately 1,250 feet away at Southeastern Avenue.

3.4.2. I-229 & 10th Street (Exit 6)

This service interchange along I-229 is a Single Point Urban Interchange (SPUI). All ramp connections are currently single lane ramps at the merge and diverge locations with I-229, with full auxiliary lanes provided between the adjacent interchange to the north. At this interchange, 10th Street travels over I-229 on a single bridge structure.

The ramp connections are a SPUI design that is currently controlled by a single traffic signal. The nearest intersection west of the interchange is approximately 275 feet at Conklin Avenue which is a Right-In/Right Out (RI/RO) access, the nearest full access intersection is approximately 600 feet away at Lowell Avenue (traffic signal control). The nearest intersection east of the interchange is approximately 375 feet at Blaine Avenue which is a Right-In/Right Out (RI/RO) access, the nearest full access intersection is approximately 700 feet away at Cleveland Avenue (traffic signal control).

3.4.3. I-229 & Rice Street (Exit 7)

This service interchange along I-229 is a folded diamond configuration to the north. All ramp connections are currently single lane ramps at the merge and diverge locations with I-229, with full auxiliary lanes provided between the adjacent interchange to the south and north. At this interchange, I-229 travels over Rice Street on two separate bridge structures.

Both ramp terminal intersections are currently controlled by traffic signals with approximately 1,000 feet between the intersections. The south leg of the eastern ramp terminal (northbound I-229) is Cleveland Avenue. The nearest intersection west of the interchange is approximately 450 feet away at Lowell Avenue (minor street stop control), the nearest intersection to the east is approximately 2,250 feet away at Bahnson Avenue (minor stop control).

3.5. Alternative Travel Modes

Travel along the existing transportation network within and around the study area is primarily by automobile. However, other forms are present:

3.5.1. Bicycle and Pedestrian Facilities

Sidewalks are provided on both sides of the 10th Street corridor.

3.5.2. Transit

Fixed-route transit within the Sioux Falls metropolitan area is served by the Sioux Area Metro.

3.5.3. Airports

The nearest commercial airport is the Sioux Falls Regional Airport located approximately three miles north and two miles west of the I-229 Exit 6 Interchange. The airport may be accessed via I-229 Exit 8 (Benson Road).

3.5.4. Railroad

No passenger or freight rail lines run through the study area.

3.6. Existing Data

Existing data was collected at the onset of the study and updated as needed to fulfill the study objectives. The source of data was identified in the project Methods and Assumptions document, which was agreed upon through the signing of that document by FHWA and SDDOT.

3.6.1. Existing Traffic Volumes

Existing traffic data was provided from participating agencies including the SDDOT and the City of Sioux Falls. Peak hour volumes and heavy vehicle percentages were extracted from the data to develop a balanced Existing Conditions traffic data set of AM and PM peak hour traffic volumes.

Due to construction activity within the study area and the recent health pandemic, traffic volumes and turning movement volumes were not able to be collected as part of this study. However, traffic data from several recent studies was provided and utilized for this project. **Table 4** lists the study intersections and the most recent count year provided; the SDDOT provided 2018 data for I-229 mainline and ramp locations within the project area.

Table 4: Intersection Count Information

Main Street	Cross Street	Count Year(s)
10th Street	Jessica Avenue	2017
10th Street	Lowell Avenue	2017/2015
10th Street	Conklin Avenue	2013
10th Street	I-229 SPUI	2019/2016
10th Street	Blaine Avenue	2013
10th Street	Cleveland Avenue	2019/2018
10th Street	Hy-Vee Entrance	2019
26th Street	I-229 SB Ramp Terminal	2016
26th Street	I-229 NB Ramp Terminal	2018
Rice Street	I-229 SB Ramp Terminal	2018
Rice Street	I-229 NB Ramp Terminal	2018

All historical traffic count data was factored up to an existing 2021 estimate based on the existing count year, historical average annual daily traffic (AADT), and balancing between study intersections.

3.7. Operational Performance

3.7.1. Existing Traffic Operations

Traffic operation analysis was performed for existing (year 2021) conditions for the AM and PM peak hours to determine the current operations within the area of influence. The HCM methodologies and HCS 7 was used to obtain the average delay and corresponding Level of Service for each interstate mainline segment, including basic freeway segments, merge and diverge segments, two-way stop-controlled intersections (minor crossroad and ramp-terminal intersection), and signalized intersections. The LOS results are shown in **Table 5** and **Table 6.** HCS reports are provided in the Appendix.

Table 5: Existing (2021) Freeway Operations Summary

Road	Description	Analysis Type	AM Peak LOS	PM Peak LOS
NB I-229	NB I-229: southwest of Exit 5	Basic	B	B
	NB I-229: between Exit 5 Exit and Entrance Ramps	Basic	B	B
	NB I-229: Exit 5 Entrance Ramp	Merge	C	B
	NB I-229: between Exit 5 and Exit 6	Basic	C	B
	NB I-229: Exit 6 Exit Ramp	Diverge	B	A
	NB I-229: between Exit 6 Exit and Entrance Ramps	Basic	B	A
	NB I-229: between Exit 6 and Exit 7	Basic	B	A
		Weave	B	A
	NB I-229: between Exit 7 Exit and Entrance Ramps	Basic	B	A
	NB I-229: north of Exit 7	Basic	B	A
SB I-229	SB I-229: north of Exit 7	Basic	A	B
	SB I-229: between Exit 7 Exit and Entrance Ramps	Basic	A	C
	SB I-229: between Exit 7 and Exit 6	Basic	A	B
		Weave	B	B
	SB I-229: between Exit 6 Exit and Entrance Ramps	Basic	A	B
	SB I-229: Exit 6 Entrance Ramp	Merge	B	B
	SB I-229: between Exit 6 and Exit 5	Basic	B	C
	SB I-229: Exit 5 Exit Ramp	Diverge	B	C
	SB I-229: between Exit 5 Exit and Entrance Ramps	Basic	B	B
	SB I-229: southwest of Exit 5	Basic	B	B

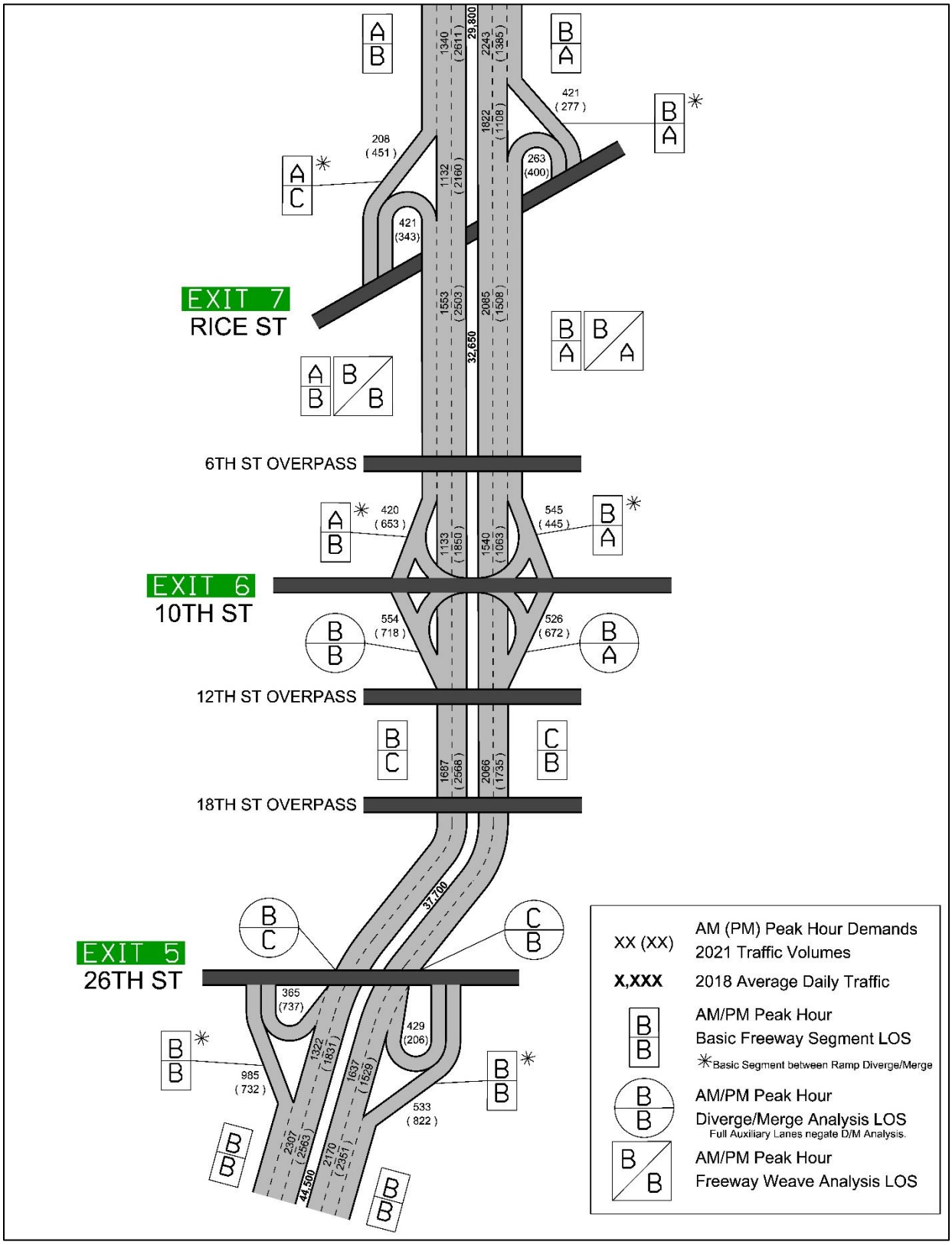
Notes:
- Bold/Highlighted indicates a poor LOS

Of the five total LOS C segments or junctions, the 4-lane section of I-229 between Exit 5 and Exit 6 includes four of the LOS C results. Currently the basic lanes have LOS C directionally with northbound in the AM peak hour and southbound in the PM peak hour. With the basic lane approaching capacity, the northbound merge from Exit 5 and the southbound diverge to Exit 5 both currently operate at a LOS C. The ramps merge and diverge from Exit 6 are not an issue on this segment as they both have long acceleration and deceleration lanes provided.

The southbound direction between Exit 6 and Exit 5 in the PM peak hour is currently approaching the LOS C/D threshold; it is within approximately 300 vehicles or approximately 10% of the volume threshold to be LOS D.

The final LOS C is located along southbound I-229 between the Exit 7 ramps, this location is just over the density criteria for LOS B/C and should continue to operate well in the short term.

Figure 5: Existing (2021) Freeway Summary



For the arterial intersection analysis, a total of 11 study intersections were included in the analysis, this includes 9 traffic signals, and 2 right-in/right-out (RI/RO) intersections. Results for the intersection analysis in the project area are shown in **Table 6**.

Table 6: Existing (2021) Arterial Intersection Operations Summary

Major Roadway	Intersecting Roadway	Control Type	AM Peak Hour					PM Peak Hour				
			Approach				INT.	Approach				INT.
			EB	WB	NB	SB		EB	WB	NB	SB	
Rice Street	I-229 SB Ramp Terminal	Signal	A	A	NA	**D -**	**B -**	B	B	NA	**D -**	**C -**
Rice Street	I-229 NB Ramp Terminal	Signal	B	B	D	C	C	B	B	C	**E -***	**C -***
10th Street	Jessica Avenue	Signal	A	A	**E***	NA	**A***	A	A	**E-**	NA	**A-**
10th Street	Lowell Avenue	Signal	A	A	D	D	A	B	**A***	D	D	**B***
10th Street	Conklin Avenue	RI/RO	--	--	C	C	C	--	--	C	B	C
10th Street	I-229 SPUI	Signal	**D -**	C	D	D	**D -**	**F**	**F**	C	D	**F**
10th Street	Blaine Avenue	RI/RO	--	--	B	NA	B	--	--	C	NA	C
10th Street	Cleveland Avenue	Signal	B	C	**D***	**E**	**C***	B	C	**D***	**E***	**C***
10th Street	Hy-Vee Entrance	Signal	A	A	D	D	A	A	A	D	**D***	**B***
26th Street	I-229 SB Ramp Terminal	Signal	C	**A***	C	NA	**A***	**D***	A	B	NA	**C***
26th Street	I-229 NB Ramp Terminal	Signal	A	C	C	NA	C	C	A	C	NA	C

Notes:
- ”n/a” denotes an approach that does not exist at the intersection. “—” denotes an approach with no delay due to control type.
- Bold/Highlighted indicates a poor LOS due to LOS E/F, volume to capacity (V/C) ratio > 1.0, or queue storage issue.
- “ * ” Queue storage ratio (QSR) greater than 1.0 for at least one movement resulting in entire intersection considered failing.
- “ – “ At least one movement is deemed failing resulting in entire intersection considered failing (not noted if intersection is LOS F).

Under the existing conditions, there are eight intersections that currently have failing traffic operations in at least one of the peak periods; these conditions are due to volume to capacity issues, queue storage issues, or delay issues. Therefore, three intersections currently have acceptable operations in both peak periods.

Along Rice Street, both ramp terminal intersections operate at a LOS C or better; however, both intersections have at least one movement that fails. The southbound left turns at the southbound ramp operates at a LOS E, the southbound left at the northbound ramp operates at a LOS F with both Queue Storage Ratio (QSR) QSR and Volume to Capacity Ratio (V/C) issues.

Along 10th Street, only the I-229 SPUI intersection operates under failing conditions. At Cleveland Avenue, the southbound approach is at a LOS E in both peak hours with QSR issues, this is created by capacity issues on this approach leg. At Jessica Avenue, the northbound approach is at a LOS E in both peak hours with the overall intersection at a LOS A, this minor approach delay is created by the signal timing which provides more time for 10th Street.

The 10th Street at I-229 SPUI intersection currently operates under significant delays in the PM peak hour; however, the AM peak is operating at a LOS D with a movement at LOS E. The single

left turn lane on all four approaches of the SPUI create significant delays and vehicles are not served within a cycle length at the intersection.

Although the 26th Street interchange had recently completed construction, the resulting design was shown to incur operational issues during both peak periods. The southbound I-229 ramp terminal intersection demonstrated queue storage issues on 26th Street for the westbound left turn lanes and eastbound right turn lane during the AM and PM peak hours, respectively.

The Streets module within HCS analysis was used to analyze pedestrian and bicycle facilities using the HCM multi-modal methodology and is summarized in the following table for intersections. Multi-modal methodology limitations only allow for the analysis of signalized intersections. Most of the intersections have a LOS C or better for both the pedestrian and bicycle LOS. There are 3 locations that have a poor LOS, all of which are at intersections that will not be impacted by changes to the Exit 6 interchange.

Table 7: Existing (2021) Multimodal Operations Summary

Major Roadway	Intersecting Roadway	Metric	AM Peak Hour					PM Peak Hour				
			Approach				INT.	Approach				INT.
			EB	WB	NB	SB		EB	WB	NB	SB	
Rice Street	I-229 SB Ramp Terminal	Ped LOS	A	B	B	B	NA	A	B	B	B	NA
		Bicycle LOS	A	A	-	F	NA	A	A	-	F	NA
Rice Street	I-229 NB Ramp Terminal	Ped LOS	B	B	B	B	NA	B	B	B	B	NA
		Bicycle LOS	A	A	A	A	NA	B	A	A	A	NA
10th Street	Jessica Avenue	Ped LOS	B	A	B	B	NA	B	A	B	B	NA
		Bicycle LOS	A	B	F	-	NA	B	A	F	-	NA
10th Street	Lowell Avenue	Ped LOS	B	B	B	B	NA	B	B	B	B	NA
		Bicycle LOS	A	B	A	A	NA	B	A	A	A	NA
10th Street	I-229 SPUI	Ped LOS	B	B	B	B	NA	B	B	B	B	NA
		Bicycle LOS	A	A	A	A	NA	A	A	A	A	NA
10th Street	Cleveland Avenue	Ped LOS	B	B	B	B	NA	B	B	B	B	NA
		Bicycle LOS	A	B	A	A	NA	B	A	A	A	NA
10th Street	Hy-Vee Entrance	Ped LOS	B	B	B	B	NA	B	B	B	B	NA
		Bicycle LOS	A	B	A	A	NA	B	A	A	A	NA
26th Street	I-229 SB Ramp Terminal	Ped LOS	B	A	B	B	NA	B	A	B	B	NA
		Bicycle LOS	A	B	F	-	NA	A	B	F	-	NA
26th Street	I-229 NB Ramp Terminal	Ped LOS	B	A	C	B	NA	B	A	C	B	NA
		Bicycle LOS	A	B	A	-	NA	A	B	B	-	NA

Notes:
- ”n/a” denotes an approach that does not exist at the intersection. “—” denotes an approach with no delay due to control type.
- Bold/Highlighted indicates a poor LOS

3.8. Existing Safety Conditions

A review of crash data was completed for the I-229 Exit 6 study area to identify potential trends or safety concerns within the study area. Crash data from January 1, 2015 through December 31, 2019 was provided by the South Dakota Department of Transportation (SDDOT). The type and severity of crashes were reviewed, and crash rates were calculated for each study intersection.

The crash rate at each intersection or segment is expressed as a number of crashes per million entering vehicles (MEV). A critical crash rate is a statistical rate that is unique to each intersection or segment and is based on vehicular exposure and the average crash rate for similar facility; the critical crash rate provides a statistical threshold for screening intersections and segment safety concerns.

The critical index is the crash rate divided by the critical crash rate, a ratio of the observed crash rate to the critical crash rate. An intersection or segment with a crash rate higher than the critical rate (critical index > 1.0) can indicate a safety concern and the site should be further reviewed; a site with a critical index below 1.0 implies that the site does not deviate significantly from the statewide trends.

The following sections provide a summary of the mainline I-229 crashes, I-229 ramp crashes, intersection crashes, and arterial segment crashes.

3.8.1. Existing Crash History

Crash history was evaluated for the approximately 3 mile I-229 segment between Exit 5 and Exit 7. The crash analyses looked at mainline segments, ramps, and intersections.

There were a total of 353 crashes along mainline I-229 from south of Exit 5 to north of Exit 7 in the 5-year period. There were 42 crashes resulting in injuries or possible injuries (4 incapacitating injuries). There were 2 fatalities reported in the study period. **Table 8** summarizes the crashes by severity for each I-229 segment. Any mainline I-229 segments with a crash rate that exceeds the calculated critical rate can be seen highlighted in red.

Table 8: Mainline I-229 Crashes

	Description	Crash Severity							Crash Rate Information		
	Segment	Fatal	A	B	C	PD	Wild Animal	Total	Crash Rate	Critical Rate	Critical Index
Northbound I-229	Between Exits 4 & 5*	0	0	1	0	3	0	4	0.42	1.93	0.22
	Exit 5 Diverge	0	0	0	1	9	1	11	1.91	2.21	0.87
	Exit 5 between Ramps	0	0	0	0	5	3	8	0.90	1.97	0.46
	Exit 5 Merge	0	0	0	0	5	2	7	1.17	2.18	0.54
	Between Exits 5 & 6	1	2	3	2	33	4	45	**1.58**	**1.54**	**1.03**
	Exit 6 Diverge	0	1	1	3	18	1	24	**2.63**	**1.95**	**1.35**
	Exit 6 between Ramps	0	0	0	0	8	0	8	0.83	1.92	0.43
	Exit 6 Merge	0	0	1	1	4	0	6	1.42	2.42	0.59
	Between Exits 6 & 7	0	0	1	3	9	9	22	1.08	1.63	0.66
	Exit 7 Diverge	0	1	0	0	3	6	10	2.36	2.42	0.98
	Exit 7 between Ramps	0	0	0	0	3	4	7	1.10	2.15	0.51
	Exit 7 Merge	0	0	1	0	19	6	26	**6.73**	**2.49**	**2.70**
Southbound I-229	Exit 7 Diverge	0	0	0	1	5	2	8	2.07	2.49	0.83
	Exit 7 between Ramps	0	0	0	0	4	3	7	1.22	2.21	0.55
	Exit 7 Merge	0	0	2	1	18	1	22	**5.19**	**2.42**	**2.15**
	Between Exits 7 & 6	0	0	1	2	9	13	25	1.33	1.66	0.80
	Exit 6 Diverge	0	0	1	1	12	1	15	**3.54**	**2.42**	**1.46**
	Exit 6 between Ramps	0	0	2	2	10	1	15	1.77	1.99	0.89
	Exit 6 Merge	0	0	0	0	18	0	18	1.53	1.84	0.83
	Between Exits 6 & 5	1	0	2	4	30	0	37	1.36	1.55	0.88
	Exit 5 Diverge	0	0	0	0	3	1	4	1.48	2.80	0.53
	Exit 5 between Ramps	0	0	0	0	2	1	3	0.51	2.20	0.23
	Exit 5 Merge	0	0	0	0	7	3	10	1.73	2.21	0.78
	Between Exits 5 & 4*	0	0	1	0	6	4	11	1.21	1.95	0.62
	TOTAL	**2**	**4**	**17**	**21**	**243**	**66**	**353**	n/a	n/a	n/a

- All mainline segments are Urban Interstate with a Statewide Average Crash Rate of 1.03.
- **Bold/Shaded** indicates a calculated crash rate that is at or exceeding the critical rate.
- * Does not include northbound Merge or southbound Diverge crashes at Exit 4.

In the past five years, there were five main line segments that have been determined to be above the critical crash rates. In the northbound direction there were critical crash indices above 1.0 at segments between Exit 5 and 6, at the Exit 6 offramp, and at the Exit 7 onramp. In the southbound direction there were crash indices above 1.0 at the Exit 7 onramp, and at the Exit 6 offramp.

The crash history for the mainline ramps at I-229 Exit 5, 6, and 7 interchanges was evaluated. There were a total of 47 crashes on the I-229 Exit 5, Exit 6, and Exit 7 ramp connections during the 5-year period. **Table 9** summarizes the crashes by severity for each ramp along I-229. Any I-229 ramps with a crash rate that exceeds calculated critical rate or had a severe crash during the 5-year analysis period can be seen highlighted in red.

Table 9: I-229 Ramp Crashes

	Description	Crash Severity							Rate Information		
	Segment	Fatal	A	B	C	PD	Wild Animal	Total	Crash Rate	Critical Rate	Critical Index
NB I-229 Ramps	Exit 5 Off Ramp	0	0	0	0	4	0	4	0.83	2.33	0.36
	Exit 5 On Ramp	0	0	1	1	11	0	13	**7.67**	**3.33**	**2.30**
	Exit 6 Off Ramp	0	0	0	0	2	0	2	0.57	2.57	0.22
	Exit 6 On Ramp	0	0	0	1	2	0	3	1.15	2.84	0.40
	Exit 7 Off Ramp	0	0	0	1	7	0	8	**8.09**	**4.17**	**1.94**
	Exit 7 On Ramp	0	1	0	0	1	0	2	1.51	3.68	0.41
SB I-229 Ramps	Exit 7 Off Ramp	0	0	0	0	0	0	0	0.00	3.54	0.00
	Exit 7 On Ramp	0	0	1	0	2	0	3	3.08	4.20	0.73
	Exit 6 Off Ramp	0	0	0	0	0	0	0	0.00	2.80	0.00
	Exit 6 On Ramp	0	0	0	1	8	0	9	**4.92**	**3.24**	**1.52**
	Exit 5 Off Ramp	0	0	0	0	1	0	1	1.63	5.19	0.31
	Exit 5 On Ramp	0	0	0	1	1	0	2	2.10	4.23	0.50
	TOTAL	**0**	**1**	**2**	**5**	**39**	**0**	**47**			

- All mainline segments are Urban Interstate with a Statewide Average Crash Rate of 1.03.
- **Bold/Shaded** indicates a calculated crash rate that is at or exceeding the critical rate.

In the past five years, there were three I-229 ramps that have been determined to be above the critical crash rates. In the northbound direction there were critical crash indices above 1.0 on the Exit 5 onramp, and on the Exit 7 offramp. In the southbound direction there were crash indices above 1.0 on the Exit 6 onramp.

The crash history was evaluated on the three quarter-mile long segment of E 10th Street between Jessica Avenue and the Hy-Vee Access and at the ramp terminal intersection at each of the I-229 and Exit 5, 6, and 7 study interchanges. There was a total of 643 crashes at the 12 intersections (6 ramp terminal interchange intersections, 6 other intersections) analyzed as part of this project between 2015 and 2019. There were 7 incapacitating injury, 40 evident injury, 116 possible injury, and 480 property damage only crash incidents.

Table 10 summarizes the crashes by severity for each study intersection. Any intersections with a crash rate that exceeds calculated critical rate or had a severe crash during the 5-year analysis period can be seen highlighted in red.

Table 10: Intersection Crashes

Intersection		Crash Severity							Rate Information		
		Fatal	A	B	C	PD	Wild Animal	Total	Crash Rate	Critical Rate	Critical Index
Rice St	Rice St at I-229 SB Ramp Terminal**	0	1	1	3	9	0	14	0.51	0.99	0.52
	Rice St at I-229 NB Ramp Terminal**	0	0	2	10	39	0	51	**1.53**	**0.95**	**1.61**
10th St	10th St at Jessica Ave**	0	0	0	3	9	0	12	0.28	0.90	0.31
	10th St at Lowell Ave**	0	1	5	12	34	0	52	**1.11**	**0.89**	**1.25**
	10th St at Conklin Ave	0	0	1	1	4	0	6	0.14	1.41	0.10
	10th St at I-229 SPUI**	0	3	3	24	120	0	150	**2.47**	**0.85**	**2.90**
	10th St at Blaine Ave	0	0	0	0	5	0	5	0.09	1.35	0.07
	10th St at Cleveland Ave**	0	1	14	25	124	0	164	**2.56**	**1.26**	**2.03**
	10th St at Hy-Vee Access**	0	0	0	6	19	0	25	0.61	0.91	0.67
26th St	26th St at Yeager Rd**	0	0	4	12	33	0	49	**1.16**	**0.91**	**1.28**
	Yeager Rd at SB Ramp Terminal	0	1	0	3	12	0	16	**1.01**	**0.65**	**1.54**
	26th St at NB Ramp Terminal**	0	0	10	17	72	0	99	**1.93**	**0.88**	**2.20**
	TOTAL	**0**	**7**	**40**	**116**	**480**	**0**	**643**	n/a	n/a	n/a

- **Signalized Intersection
- **Bold/Red Shaded** indicates a calculated crash rate that is at or exceeding the critical rate.
- (2) Notes non-study intersections included.

In the past five years, there were seven intersections that have been determined to be above the critical crash rates. Below is a brief summary of the trends seen in these crashes as well as a summary of locations where the crash rate exceeds the calculated critical rate.

At the Exit 7 (Rice St) interchange, the northbound ramp terminal intersection had a critical crash index above 1.0. The northbound ramp terminal intersection also includes Cleveland Avenue on the south leg of this intersection.

At the Exit 6 (10th St) interchange, the SPUI ramp terminal intersection had a critical crash index above 1.0. The intersection of 10th Street & Lowell Avenue, and 10th Street & Cleveland Avenue also had critical crash indices above 1.0. The intersections with I-229 and Cleveland Avenue represent the majority of crash incidents and contain many incidents of higher severity level.

At the Exit 5 (26th St) interchange, the northbound and southbound ramp terminal intersections had a critical crash index above 1.0. The Yeager Road intersection with 26th Street also had a crash index above 1.0. However, the 26th Street interchange has been recently reconstructed and safety concerns or crash trends evident here may change significantly with the new interchange and roadway design.

3.9. Existing Environmental Conditions

The environmental conditions and potential impacts to the natural environment based on the recommended alternatives will be identified in the Environmental Screening Report.

4. Design Year 2050 No-Build Conditions

A summary of future year No-Build conditions are provided in the following sections. The future year No-Build conditions consist of future year traffic volumes on existing geometry plus adjacent planned roadway improvements. The future year No-Build conditions summaries are provided through documentation of adjacent planned roadway improvements, and design year No-Build traffic forecasts and operations

The future-year traffic volumes were developed using the Existing Conditions peak hour traffic volumes and the SFMPO travel demand model. Future year 2027 represents the Year of Project Completion and 2050 represents the Planning Year horizon for the interchange and corridor improvements.

4.1. Adjacent Planned Roadway Improvements

The City of Sioux Falls has planned roadway improvements in the Capital Improvement Plan under the asphalt rehabilitation program which include plans to add a third travel lane in the eastbound direction of the E 10th Street corridor beginning at the interchange with I-229 and ending at the Thompson Avenue intersection. This planned improvement was included in the future year analyses.

4.2. Design Year 2050 No-Build Traffic Operations

Traffic operation analysis was performed for design year 2050 No-Build conditions for the AM and PM peak hours to determine the expected operations within the area of influence. The HCM methodologies and HCS 7 was used to obtain the average delay and corresponding Level of Service for each interstate mainline segment, including basic freeway segments, merge and diverge segments, two-way stop-controlled intersections (minor crossroad and ramp-terminal intersection), and signalized intersections. The LOS results are shown in **Table 11** and **Table 12.** HCS reports are provided in the Appendix.

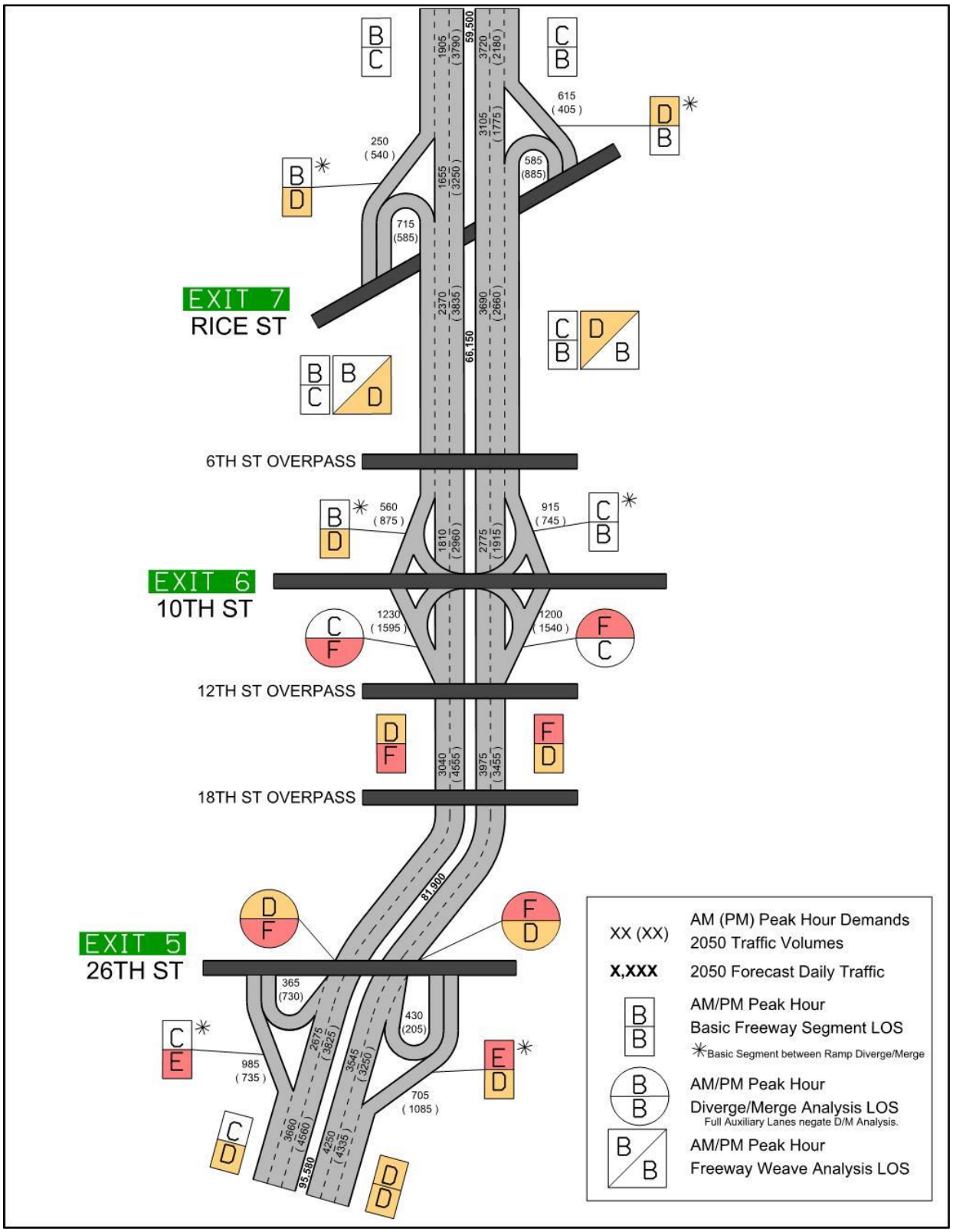
Table 11: No-Build (2050) Freeway Operations Summary

Road	Description	Analysis Type	AM Peak LOS	PM Peak LOS
NB I-229	NB I-229: southwest of Exit 5	Basic	**D**	**D**
	NB I-229: between Exit 5 Exit and Entrance Ramps	Basic	**E**	**D**
	NB I-229: Exit 5 Entrance Ramp	Merge	**F**	**D**
	NB I-229: between Exit 5 and Exit 6	Basic	**F**	**D**
	NB I-229: Exit 6 Exit Ramp	Diverge	**F**	C
	NB I-229: between Exit 6 Exit and Entrance Ramps	Basic	C	B
	NB I-229: between Exit 6 and Exit 7	Basic	C	B
		Weave	**D**	B
	NB I-229: between Exit 7 Exit and Entrance Ramps	Basic	**D**	B
	NB I-229: north of Exit 7	Basic	C	B
SB I-229	SB I-229: north of Exit 7	Basic	B	C
	SB I-229: between Exit 7 Exit and Entrance Ramps	Basic	B	**D**
	SB I-229: between Exit 7 and Exit 6	Basic	B	C
		Weave	B	**D**
	SB I-229: between Exit 6 Exit and Entrance Ramps	Basic	B	**D**
	SB I-229: Exit 6 Entrance Ramp	Merge	C	**F**
	SB I-229: between Exit 6 and Exit 5	Basic	**D**	**F**
	SB I-229: Exit 5 Exit Ramp	Diverge	**D**	**F**
	SB I-229: between Exit 5 Exit and Entrance Ramps	Basic	C	**E**
	SB I-229: southwest of Exit 5	Basic	C	**D**

Notes:
- Bold/Highlighted indicates a poor LOS

The analysis of the 2050 No-Build condition revealed capacity constraints leading to poor operating LOS throughout mainline I-229. Out of the 18 total mainline segments, 15 were shown to operate at a LOS D or worse during either the AM or PM peak hour. There were three mainline segments that operated at a LOS C or better during the AM and PM peak hours.

Figure 6: No-Build (2050) Freeway Summary



For the arterial intersection analysis, a total of 11 study intersections were included in the analysis, this includes 9 traffic signals, and 2 right-in/right-out (RI/RO) intersections. Results for the intersection analysis in the project area are shown in **Table 12**.

Table 12: No-Build (2050) Arterial Intersection Operations Summary

Major Roadway	Intersecting Roadway	Control Type	AM Peak Hour					PM Peak Hour				
			Approach				INT.	Approach				INT.
			EB	WB	NB	SB		EB	WB	NB	SB	
Rice Street	I-229 SB Ramp Terminal	Signal	**B***	B	NA	**E**	**C-***	**C***	C	NA	**D***	**C***
Rice Street	I-229 NB Ramp Terminal	Signal	**F**	**F**	**F***	**E***	**F**	**F**	D	**F***	**F***	**F**
10th Street	Jessica Avenue	Signal	A	A	**C**	NA	**A**	B	A	**D**	NA	**B**
10th Street	Lowell Avenue	Signal	A	B	E	E	B	D	**C***	D	**F**	**D-***
10th Street	Conklin Avenue	RI/RO			D	D	D			F	C	**F**
10th Street	I-229 SPUI	Signal	**F**	D	**F**	D	**F**	**E**	**D**	**D**	**F**	**E-**
10th Street	Blaine Avenue	RI/RO			C	NA	C			E	NA	**E**
10th Street	Cleveland Avenue	Signal	**D***	**F**	**F***	**F**	**F**	**B***	**F**	**F***	**F***	**F**
10th Street	Hy-Vee Entrance	Signal	**A***	B	E	**F**	**B-***	**A***	B	**E***	**E***	**B***
26th Street	I-229 SB Ramp Terminal	Signal	B	A	B	NA	B	C	A	B	NA	B
26th Street	I-229 NB Ramp Terminal	Signal	C	B	B	NA	B	B	A	**F**	NA	**E-**

Notes:
- "n/a" denotes an approach that does not exist at the intersection. "—" denotes an approach with no delay due to control type.
- Bold/Highlighted indicates a poor LOS due to LOS E/F, volume to capacity (V/C) ratio > 1.0, or queue storage issue.
- " * " Queue storage ratio (QSR) greater than 1.0 for at least one movement resulting in entire intersection considered failing.
- " – " At least one movement is deemed failing resulting in entire intersection considered failing (not noted if intersection is LOS F).

The 95th percentile queue lengths at the I-229 & E 10th Street interchange were examined for both northbound and southbound exit ramps to determine whether sufficient storage exists to contain the expected vehicle queues. The northbound exit ramp provides approximately 825 feet of storage and 2050 No-Build analysis produced vehicle queues that would likely extend 1,325' and 1,085' during the AM and PM peak hour, respectively. The southbound exit ramp provides approximately 1,200 feet of storage and 2050 No-Build analysis produced vehicle queues that would likely extend 495' and 1,430' during the AM and PM peak hour, respectively. The HCS queue lengths would not be contained within the ramp storage area and would likely impact the mainline traffic flow.

The analysis of the 2050 No-Build condition determined that there were ten intersections that demonstrated inadequate traffic operations in at least one of the peak periods. The intersections exhibited issues with high delays, inadequate queue storage, or capacity constraints.

Along Rice Street, all intersections operated with LOS F or QSR and V/C issues that designate them failing. The southbound ramp terminal intersection operated at a LOS C with a QSR greater than 1, the northbound ramp terminal intersection operated at a LOS F with a QSR greater than 1 and V/C issues.

Along 10th Street, the ramp terminal intersection operated at a LOS F and LOS E during the AM and PM peak hours, respectively with V/C issues. The other arterial intersections along 10th Street all demonstrated poor operations with the exception of Jessica Avenue. At Lowell Avenue, the westbound approach demonstrated QSR issues. The right-in, right-out intersections with Conklin Avenue and Blaine Avenue, were shown to operate at LOS F and LOS E, respectively. At Cleveland Avenue, the intersection experienced high delays, QSR and V/C issues with extensive vehicle queuing on every approach. At the Hy-Vee access, the northbound and southbound approaches demonstrated QSR issues.

Along 26th Street, the southbound ramp terminal intersection operated at LOS B or better, but the northbound ramp terminal intersection was shown to operate at LOS E with the heavy northbound right turn volume contributing to high delays and V/C issues.

The Streets module within HCS analysis was used to analyze pedestrian and bicycle facilities using the HCM multi-modal methodology and is summarized in the following table for intersections. Multi-modal methodology limitations only allow for the analysis of signalized intersections. Most of the intersections have a LOS C or better for both the pedestrian and bicycle LOS. There are 3 locations that have a poor LOS, all of which are at intersections that will not be impacted by changes to the Exit 6 interchange.

Table 13: No-Build (2050) Multimodal Operations Summary

Major Roadway	Intersecting Roadway	Metric	AM Peak Hour					PM Peak Hour				
			Approach				INT.	Approach				INT.
			EB	WB	NB	SB		EB	WB	NB	SB	
Rice Street	I-229 SB Ramp Terminal	Ped LOS	A	B	B	B	NA	A	B	B	B	NA
		Bicycle LOS	A	B	-	F	NA	B	B	-	F	NA
Rice Street	I-229 NB Ramp Terminal	Ped LOS	B	B	B	B	NA	B	B	B	B	NA
		Bicycle LOS	A	B	B	B	NA	C	A	A	B	NA
10th Street	Jessica Avenue	Ped LOS	B	A	B	B	NA	B	A	B	B	NA
		Bicycle LOS	A	B	F	-	NA	B	B	F	-	NA
10th Street	Lowell Avenue	Ped LOS	B	B	B	B	NA	B	B	B	B	NA
		Bicycle LOS	A	B	A	A	NA	B	B	A	A	NA
10th Street	I-229 SPUI	Ped LOS	B	B	B	B	NA	B	B	B	B	NA
		Bicycle LOS	A	B	B	A	NA	B	B	A	B	NA
10th Street	Cleveland Avenue	Ped LOS	B	B	B	B	NA	B	B	B	B	NA
		Bicycle LOS	B	B	B	B	NA	C	B	B	B	NA
10th Street	Hy-Vee Entrance	Ped LOS	B	B	B	B	NA	B	B	B	B	NA
		Bicycle LOS	B	B	A	A	NA	C	B	A	A	NA
26th Street	I-229 SB Ramp Terminal	Ped LOS	B	A	B	B	NA	B	A	B	B	NA
		Bicycle LOS	A	B	F	-	NA	A	B	F	-	NA
26th Street	I-229 NB Ramp Terminal	Ped LOS	B	A	C	B	NA	B	A	C	B	NA
		Bicycle LOS	A	B	B	-	NA	A	B	B	-	NA

Notes:
- "n/a" denotes an approach that does not exist at the intersection. "—" denotes an approach with no delay due to control type.
- Bold/Highlighted indicates a poor LOS

5. Need

Analysis was conducted of the Interstate-229 mainline and E 10th Street crossroad operations under 2021 conditions. That analysis indicated that all Interstate facilities operated at LOS C or better during the AM and PM peak periods. However, many of the intersections on the E 10th Street crossroad corridor, operate under failing conditions.

Planned growth within the SFMPO area indicate that travel demand will increase in the future and put increased pressure on transportation facilities within the study area.

The design year 2050 No-Build analysis indicated that many of the mainline I-229 segments can be expected to operate at a LOS D or worse during either the AM or PM peak hour. The analysis determined that the crossroad intersections also exhibited issues with high delays, inadequate queue storage, or capacity constraints.

The purpose and project need of the proposed access change is to provide adequate near and long-term Interstate operations and to provide safe access to and from the Interstate System.

6. Alternatives

This chapter presents the concepts developed for the I-229 Exit 6 (10th Street) Interchange. The selected Build Alternatives, brought forward from the previous MIS, were analyzed to determine the recommended alternative that will be fully considered later in the IMJR and the Environmental Document.

6.1. Build Alternatives

The alternative options carried forward from the MIS study are as follows:

1. **Single Point Urban Interchange (SPUI)**
    a. Widen the existing SPUI
    b. 4-lane divided corridor

2. **Single Point Urban Interchange (SPUI)**
    a. Widen the existing SPUI
    b. 5-lane undivided corridor

3. **Diverging Diamond Interchange (DDI)**
    a. Reconstructs the existing interchange to a DDI
    b. 4-lane divided corridor

4. **Diverging Diamond Interchange (DDI)**
    a. Reconstructs the existing interchange to a DDI
    b. 5-lane divided corridor

6.2. Alternatives Carried Forward in IMJR

A screening of the alternatives was conducted based on technical analysis and input from the Study Advisory Team. That screening, documented in the April 9, 2021, Build Concept Evaluation memo (Appendix), made the recommendation to advance the SPUI concept design and eliminate the DDI concept. The SPUI concept was able to provide lower delays compared to the DDI concept and required a smaller geometric footprint and reduced property acquisitions.

Additional alternative screenings were undertaken to determine the optimal SPUI concept design and E 10th Street corridor cross section necessary to provide the LOS standards required at the study interchange. A decision was made, by the SAT, to prolong the service life of the existing 10th Street bridge structure to correspond to a future bridge replacement required to meet the evolving capacity needs of the I-229 mainline. As part of this decision, the required LOS standard at the interchange was eliminated and instead the 95th percentile queue length on the interchange ramps was used to determine the success of the alternative. This set the goal of providing queue storage for the northbound/southbound I-229 exit ramps and no longer required providing a minimum intersection delay. With this new criteria, the SPUI alternative was reevaluated and the interstate exit ramps were designed to accommodate the queues. The SPUI alternative can be seen in **Figure 7**.

All alternative analyses include Interstate-229 mainline widening between Exit 5 ramps and Exit 6 ramps. The mainline widening provides 3 continuous travel lanes between the northbound Exit 5 off ramp and the Exit 6 onramps and 3 continuous travel lanes between the southbound Exit 6 offramp to the Exit 5 onramp. The mainline widening was limited to the segments between Exit 5 and Exit 6 and segments outside of this area remained unchanged.

7. Alternative Analysis

Design year No-Build and Build condition traffic forecasts are the same for the mainline Interstate-229 system and crossroad corridors.

7.1. Design Year 2050 Build Condition Analysis

Traffic operation analysis was performed for design year 2050 Build conditions for the AM and PM peak hours to determine the expected operations within the area of influence. The HCM methodologies and HCS 7 was used to obtain the average delay and corresponding Level of Service for each interstate mainline segment, including basic freeway segments, merge and diverge segments, two-way stop-controlled intersections (minor crossroad and ramp-terminal intersection), and signalized intersections. The LOS results are shown in **Table 14** and **Table 15.** HCS reports are provided in the Appendix.

Figure 7: Alternative Concept

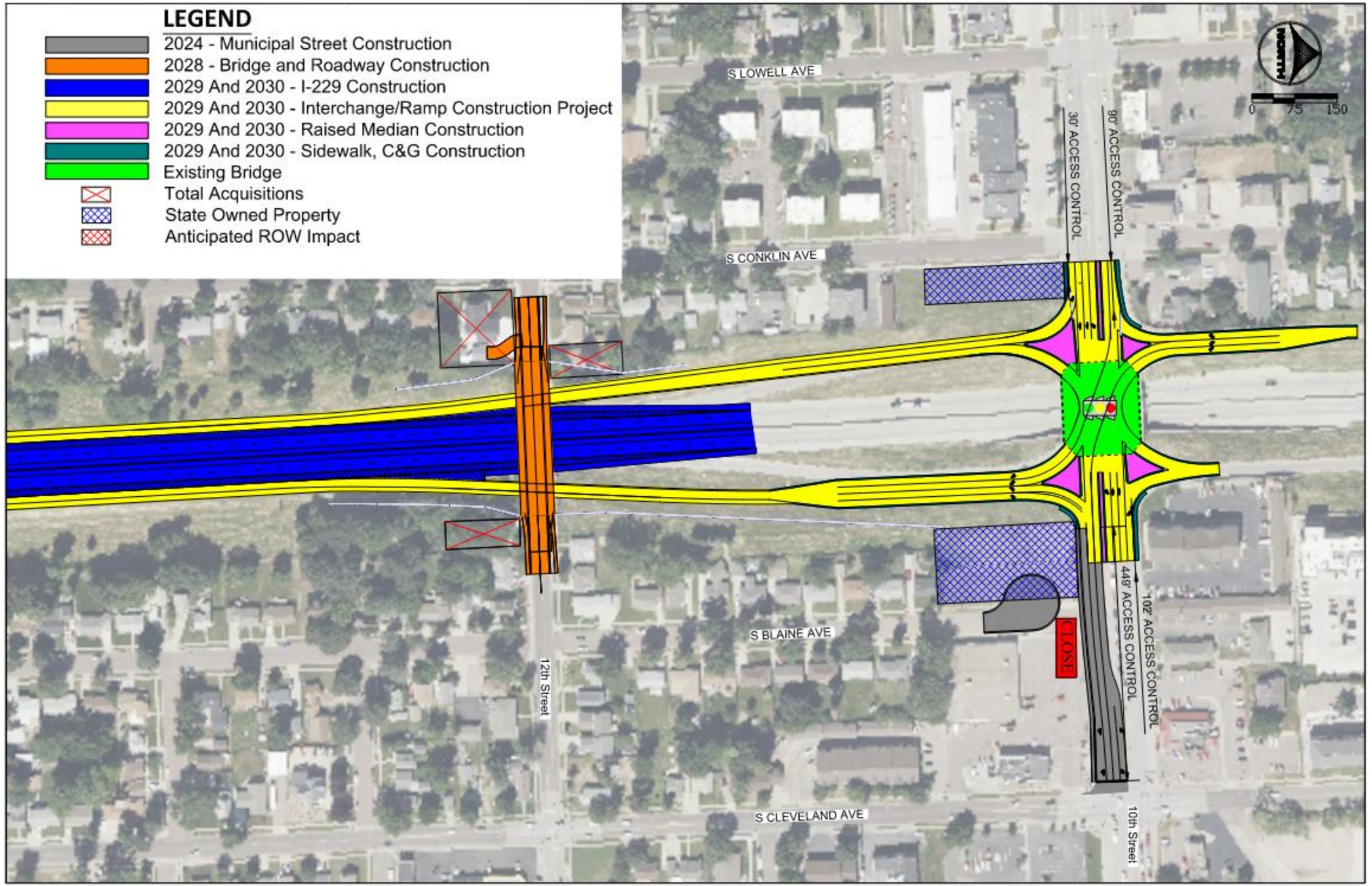


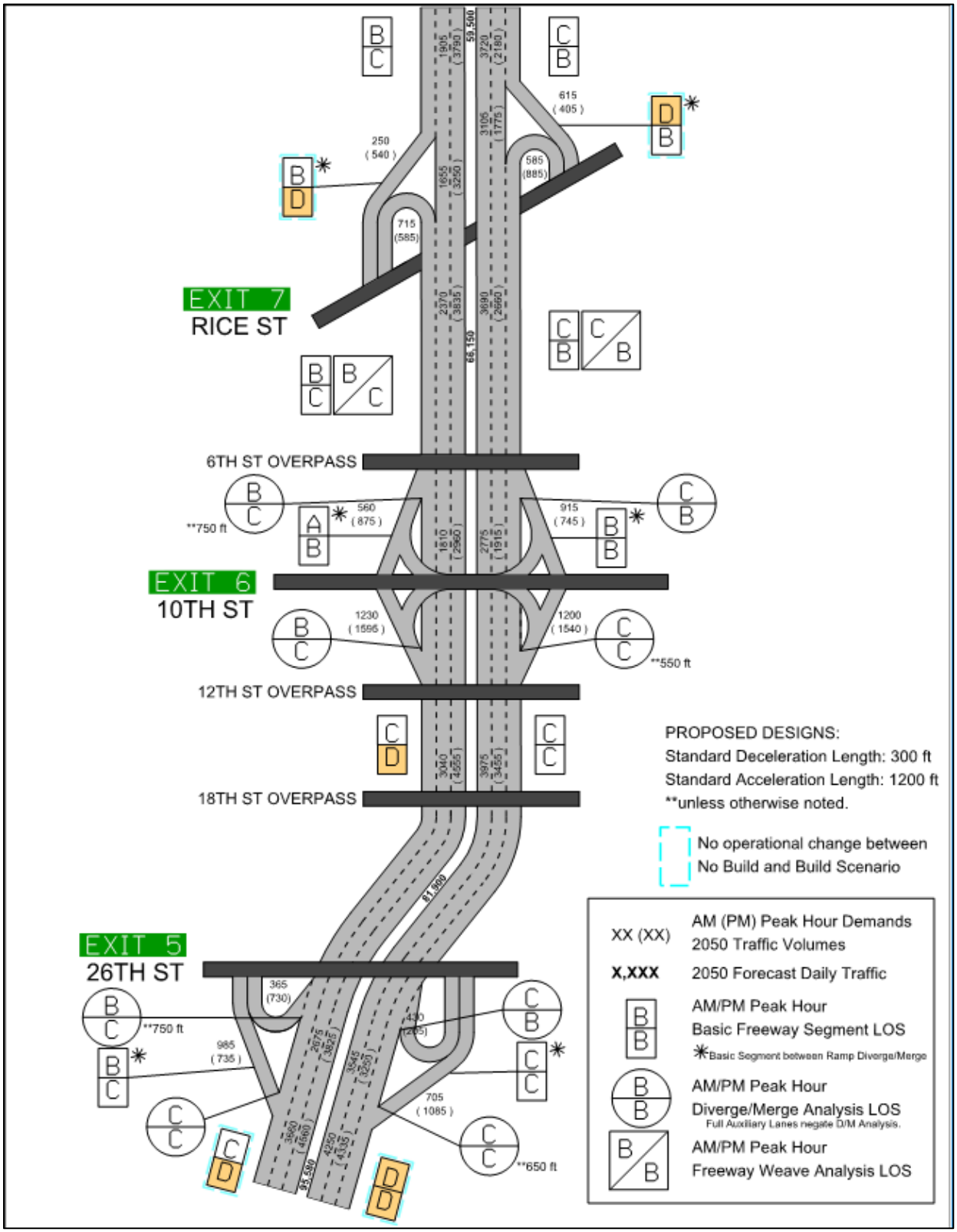
Table 14: Build (2050) Freeway Operations Summary

Road	Description	Analysis Type	AM Peak LOS	PM Peak LOS
NB I-229	NB I-229: southwest of Exit 5	Basic	**D**	**D**
	NB I-229: between Exit 5 Exit and Entrance Ramps	Basic	C	C
	NB I-229: Exit 5 Entrance Ramp	Merge	C	B
	NB I-229: between Exit 5 and Exit 6	Basic	C	C
	NB I-229: Exit 6 Exit Ramp	Diverge	C	C
	NB I-229: between Exit 6 Exit and Entrance Ramps	Basic	B	B
	NB I-229: between Exit 6 and Exit 7	Basic	C	B
		Weave	C	B
	NB I-229: between Exit 7 Exit and Entrance Ramps	Basic	**D**	B
	NB I-229: north of Exit 7	Basic	C	B
SB I-229	SB I-229: north of Exit 7	Basic	B	C
	SB I-229: between Exit 7 Exit and Entrance Ramps	Basic	B	**D**
	SB I-229: between Exit 7 and Exit 6	Basic	B	C
		Weave	B	C
	SB I-229: between Exit 6 Exit and Entrance Ramps	Basic	A	B
	SB I-229: Exit 6 Entrance Ramp	Merge	B	C
	SB I-229: between Exit 6 and Exit 5	Basic	C	**D**
	SB I-229: Exit 5 Exit Ramp	Diverge	B	C
	SB I-229: between Exit 5 Exit and Entrance Ramps	Basic	B	C
	SB I-229: southwest of Exit 5	Basic	C	**D**

Notes:
- Bold/Highlighted indicates a poor LOS

The analysis of the 2050 Build condition demonstrated the improved operations that were realized from widening mainline I-229. Compared to the previous No-Build analysis, there were operational improvements at many of the mainline segments. Out of the 18 total segments, 5 were determined to operate at LOS D during either the AM or PM peak hour. However, 4 of those segments were geometrically unchanged from the No-Build condition and represented operations consistent with the previous No-Build analysis. The SB I-229 basic segment between Exit 6 to Exit 5 operated at LOS D during the PM peak hour which was improved from LOS F in the No-Build condition.

Figure 8: Build (2050) Freeway Summary



For the arterial intersection analysis, a total of 10 study intersections were included in the analysis, which were all controlled by traffic signals. The right-in/right-out (RI/RO) Blaine Avenue intersection was removed from analysis as they will no longer access 10th Street. Results for the intersection analysis in the project area are shown in **Table 15**.

Table 15: Build (2050) Arterial Intersection Operations Summary

Major Roadway	Intersecting Roadway	Control Type	AM Peak Hour					PM Peak Hour				
			Approach				INT.	Approach				INT.
			EB	WB	NB	SB		EB	WB	NB	SB	
Rice Street	I-229 SB Ramp Terminal	Signal	**B***	B	NA	**E**	**C-***	**C***	C	NA	**D***	**C***
Rice Street	I-229 NB Ramp Terminal	Signal	**F**	**F**	**F***	**E***	**F**	**F**	D	**F***	**F***	**F**
10th Street	Jessica Avenue	Signal	A	A	**E***	NA	**A***	A	A	**F***	NA	**A***
10th Street	Lowell Avenue	Signal	A	A	D	E	B	E	**D**	D	F	**E**
10th Street	Conklin Avenue	RI/RO			D	D	D			F	C	**F**
10th Street	I-229 SPUI	Signal	C	B	**D***	**E**	**C**	**C**	**B***	**D-***	**F***	**D-***
10th Street	Blaine Avenue	-										
10th Street	Cleveland Avenue	Signal	**D-***	**F**	**F***	**F**	**F***	**D-***	**F**	**F***	**F***	**F***
10th Street	Hy-Vee Entrance	Signal	**A***	B	E	E	**B-***	**A***	B	**E***	**E***	**B***
26th Street	I-229 SB Ramp Terminal	Signal	B	A	B	NA	B	C	A	B	NA	B
26th Street	I-229 NB Ramp Terminal	Signal	C	B	B	NA	B	B	A	**F**	NA	**E-**

Notes:
- ”n/a” denotes an approach that does not exist at the intersection. “—” denotes an approach with no delay due to control type.
- Bold/Highlighted indicates a poor LOS due to LOS E/F, volume to capacity (V/C) ratio > 1.0, or queue storage issue.
- “ * ” Queue storage ratio (QSR) greater than 1.0 for at least one movement resulting in entire intersection considered failing.
- “ – “ At least one movement is deemed failing resulting in entire intersection considered failing (not noted if intersection is LOS F).

The 95th percentile queue lengths at the I-229 & E 10th Street interchange were examined for both northbound and southbound exit ramps to determine whether sufficient storage exists to contain the expected vehicle queues. The northbound exit ramp produced vehicle queues that would likely extend 440’ and 625’ during the AM and PM peak hour, respectively. The southbound exit ramp produced vehicle queues that would likely extend 505’ and 570’ during the AM and PM peak hour, respectively. The HCS queue lengths would be contained within the ramp storage area and not impact the mainline traffic flow. It should be noted that limitations to the HCM methodology does not account for queue spillback from adjacent intersections and residual queues from the adjacent Cleveland Avenue intersection would likely impact the performance of the I-229 Exit 6 interchange.

The analysis of the 2050 Build condition determined that there were nine intersections that demonstrated inadequate traffic operations in at least one of the peak periods. The intersections exhibited issues with high delays, inadequate queue storage, or capacity constraints.

Along Rice Street, all intersections operated with QSR and V/C issues that designate them failing. The southbound ramp terminal intersection operated at a LOS C with a QSR greater than 1, the

northbound ramp terminal intersection operated at a LOS C with a QSR greater than 1 and V/C issues.

Along 10th Street, the ramp terminal intersection operated at a LOS C and LOS D during the AM and PM peak hours, respectively with V/C and QSR issues. The other arterial intersections along 10th Street all demonstrated poor operations. At Jessica Avenue and Lowell Avenue, there were demonstrated QSR issues. At Cleveland Avenue, the intersection experienced high delays, V/C and QSR issues with extensive vehicle queueing on every approach. At the Hy-Vee access, the southbound approach demonstrated QSR issues.

Along 26th Street, the southbound ramp terminal intersection operated at LOS B or better, but the northbound ramp terminal intersection was shown to operate at LOS E with the heavy northbound right turn volume contributing to high delays and V/C issues.

The Streets module within HCS analysis was used to analyze pedestrian and bicycle facilities using the HCM multi-modal methodology and is summarized in the following table for intersections. Multi-modal methodology limitations only allow for the analysis of signalized intersections. Most of the intersections have a LOS C or better for both the pedestrian and bicycle LOS. There are 3 locations that have a poor LOS, all of which are at intersections that will not be impacted by changes to the Exit 6 interchange.

Table 16: Build (2050) Multimodal Operations Summary

Major Roadway	Intersecting Roadway	Metric	AM Peak Hour					PM Peak Hour				
			Approach				INT.	Approach				INT.
			EB	WB	NB	SB		EB	WB	NB	SB	
Rice Street	I-229 SB Ramp Terminal	Ped LOS	A	B	B	B	NA	A	B	B	B	NA
		Bicycle LOS	A	B	-	F	NA	B	B	-	F	NA
Rice Street	I-229 NB Ramp Terminal	Ped LOS	B	B	B	B	NA	B	B	B	B	NA
		Bicycle LOS	A	B	B	B	NA	C	A	A	B	NA
10th Street	Jessica Avenue	Ped LOS	B	A	B	B	NA	B	A	B	B	NA
		Bicycle LOS	A	B	F	-	NA	B	B	F	-	NA
10th Street	Lowell Avenue	Ped LOS	B	B	B	B	NA	B	B	B	B	NA
		Bicycle LOS	A	B	A	A	NA	B	B	A	A	NA
10th Street	I-229 SPUI	Ped LOS	B	B	B	B	NA	B	B	B	B	NA
		Bicycle LOS	B	C	C	A	NA	C	B	C	B	NA
10th Street	Cleveland Avenue	Ped LOS	B	B	B	B	NA	B	B	B	B	NA
		Bicycle LOS	A	B	B	B	NA	B	B	B	B	NA
10th Street	Hy-Vee Entrance	Ped LOS	B	B	B	B	NA	B	B	C	B	NA
		Bicycle LOS	B	B	A	A	NA	B	B	A	A	NA
26th Street	I-229 SB Ramp Terminal	Ped LOS	B	A	B	B	NA	B	A	B	B	NA
		Bicycle LOS	A	B	F	-	NA	A	B	F	-	NA
26th Street	I-229 NB Ramp Terminal	Ped LOS	B	A	C	B	NA	B	A	C	B	NA
		Bicycle LOS	A	B	B	-	NA	A	B	B	-	NA

Notes:
- ”n/a” denotes an approach that does not exist at the intersection. “—” denotes an approach with no delay due to control type.
- Bold/Highlighted indicates a poor LOS

7.2. Opening Year 2027 Build Condition Analysis

Traffic operation analysis was performed for design year 2027 Build conditions for the AM and PM peak hours to determine the expected operations within the area of influence. The HCM methodologies and HCS 7 was used to obtain the average delay and corresponding Level of Service for each interstate mainline segment, including basic freeway segments, merge and diverge segments, two-way stop-controlled intersections (minor crossroad and ramp-terminal intersection), and signalized intersections. The LOS results are shown in **Table 17** and **Table 18.** HCS reports are provided in the Appendix.

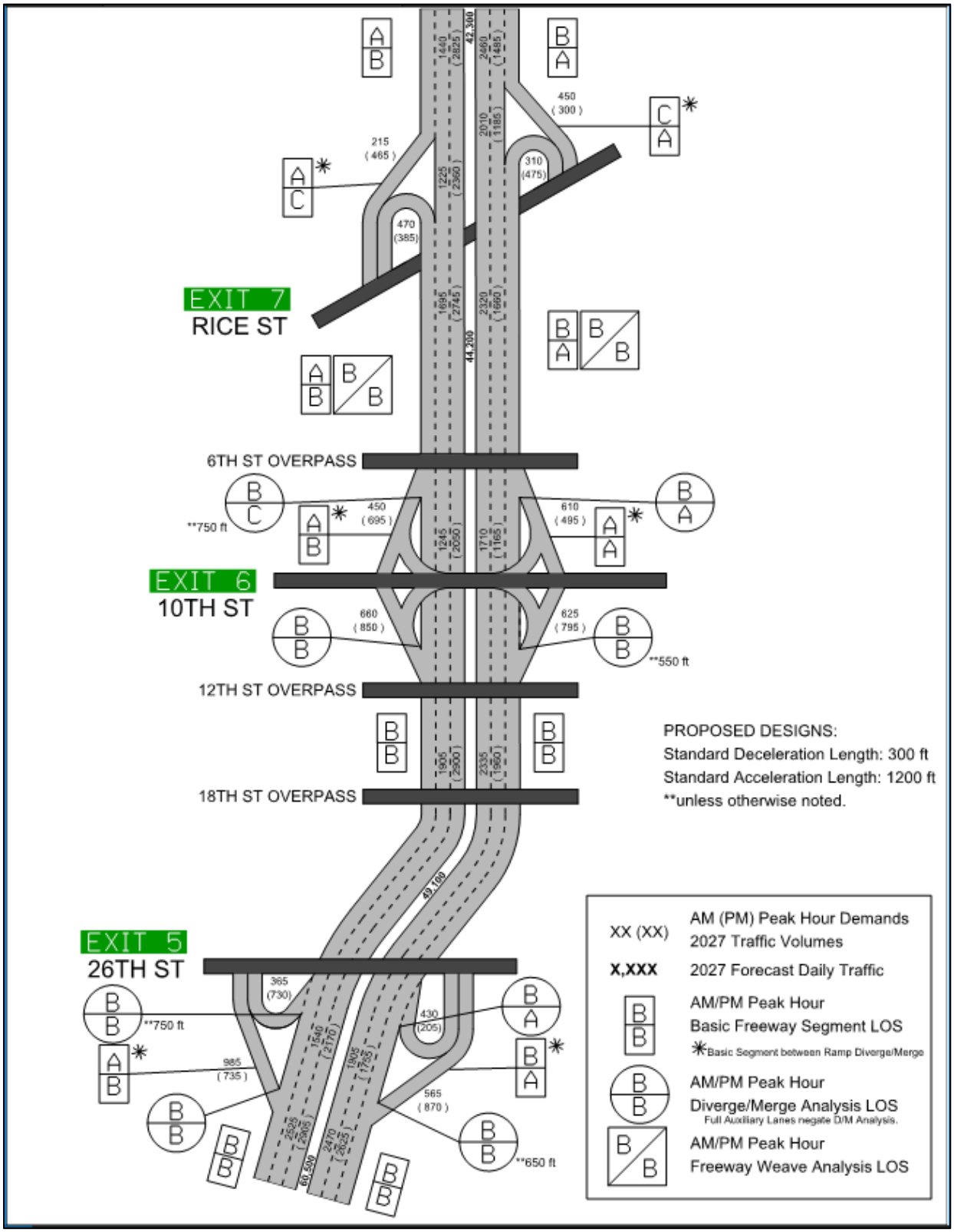
Table 17: Build (2027) Freeway Operations Summary

Road	Description	Analysis Type	AM Peak LOS	PM Peak LOS
NB I-229	NB I-229: southwest of Exit 5	Basic	B	B
	NB I-229: between Exit 5 Exit and Entrance Ramps	Basic	B	A
	NB I-229: Exit 5 Entrance Ramp	Merge	C	B
	NB I-229: between Exit 5 and Exit 6	Basic	B	B
	NB I-229: Exit 6 Exit Ramp	Diverge	B	B
	NB I-229: between Exit 6 Exit and Entrance Ramps	Basic	A	A
	NB I-229: between Exit 6 and Exit 7	Basic	B	A
		Weave	B	B
	NB I-229: between Exit 7 Exit and Entrance Ramps	Basic	C	A
	NB I-229: north of Exit 7	Basic	B	A
SB I-229	SB I-229: north of Exit 7	Basic	A	B
	SB I-229: between Exit 7 Exit and Entrance Ramps	Basic	A	C
	SB I-229: between Exit 7 and Exit 6	Basic	A	B
		Weave	B	B
	SB I-229: between Exit 6 Exit and Entrance Ramps	Basic	A	B
	SB I-229: Exit 6 Entrance Ramp	Merge	B	B
	SB I-229: between Exit 6 and Exit 5	Basic	B	B
	SB I-229: Exit 5 Exit Ramp	Diverge	B	B
	SB I-229: between Exit 5 Exit and Entrance Ramps	Basic	A	B
	SB I-229: southwest of Exit 5	Basic	B	B

Notes:
- Bold/Highlighted indicates a poor LOS

The analysis of the 2027 Build condition demonstrated the improved operations that were realized from widening mainline I-229. All of the mainline segments were shown to operate at a LOS C or better during the AM and PM peak hours. There were three mainline segments that operated at a LOS C or better during the AM and PM peak hours.

Figure 9: Build (2027) Freeway Summary



For the arterial intersection analysis, a total of 10 study intersections were included in the analysis, which were all controlled by traffic signals. The right-in/right-out (RI/RO) Blaine Avenue intersection was removed from analysis as they will no longer access 10th Street. Results for the intersection analysis in the project area are shown in **Table 18**.

Table 18: Build (2027) Arterial Intersection Operations Summary

Major Roadway	Intersecting Roadway	Control Type	AM Peak Hour					PM Peak Hour				
			Approach				INT.	Approach				INT.
			EB	WB	NB	SB		EB	WB	NB	SB	
Rice Street	I-229 SB Ramp Terminal	Signal	A	A		B	B	B	C		**D***	**C-**
Rice Street	I-229 NB Ramp Terminal	Signal	A	C	C	B	B	C	B	D	**E-***	**C-**
10th Street	Jessica Avenue	Signal	A	A	D		A	A	A	D		A
10th Street	Lowell Avenue	Signal	A	A	C	D	A	C	B	D	D	B
10th Street	Conklin Avenue	RI/RO			C	C	C			C	C	**C**
10th Street	I-229 SPUI	Signal	B	B	C	**E**	**C-**	B	B	**F-***	**D***	**C-***
10th Street	Blaine Avenue											
10th Street	Cleveland Avenue	Signal	A	C	**D***	F	**C-***	B*	C	**D***	**E**	**C-***
10th Street	Hy-Vee Entrance	Signal	A	A	C	C	A	A	A	D	D	A
26th Street	I-229 SB Ramp Terminal	Signal	B	A	A		A	C	A	A		B
26th Street	I-229 NB Ramp Terminal	Signal	B	B	B		B	B	A	**F**		D-

Notes:
- "n/a" denotes an approach that does not exist at the intersection. "—" denotes an approach with no delay due to control type.
- Bold/Highlighted indicates a poor LOS due to LOS E/F, volume to capacity (V/C) ratio > 1.0, or queue storage issue.
- " * " Queue storage ratio (QSR) greater than 1.0 for at least one movement resulting in entire intersection considered failing.
- " – " At least one movement is deemed failing resulting in entire intersection considered failing (not noted if intersection is LOS F).

The 95th percentile queue lengths at the I-229 & E 10th Street interchange were examined for both northbound and southbound exit ramps to determine whether sufficient storage exists to contain the expected vehicle queues. The northbound exit ramp produced vehicle queues that would likely extend 140' and 485' during the AM and PM peak hour, respectively. The southbound exit ramp produced vehicle queues that would likely extend 400' and 310' during the AM and PM peak hour, respectively. The provided HCS queue lengths would be contained within the ramp storage area and not impact the mainline traffic flow. It should be noted that limitations to the HCM methodology does not account for queue spillback from adjacent intersections and residual queues from the adjacent Cleveland Avenue intersection could impact the performance of the I-229 Exit 6 interchange.

The analysis of the 2027 Build condition determined that there were five intersections that demonstrated inadequate traffic operations in at least one of the peak periods. The intersections exhibited issues with high delays, inadequate queue storage, or capacity constraints.

Along Rice Street, both ramp terminal intersections operated with QSR and V/C issues that designate them failing during the PM peak hour. The southbound ramp terminal intersection

operated at a LOS C with a QSR greater than 1, the northbound ramp terminal intersection operated at a LOS C with a QSR greater than 1 and V/C issues.

Along 10th Street, the ramp terminal intersection operated at a LOS C during the AM and PM peak hours, with V/C and QSR issues. At Cleveland Avenue, the intersection experienced high delays, V/C and QSR issues with extensive vehicle queueing on every approach. The other arterial intersections along 10th Street all demonstrated acceptable operations with LOS B or greater.

Along 26th Street, the southbound ramp terminal intersection operated at LOS B or better, but the northbound ramp terminal intersection was shown to operate at LOS D with the heavy northbound right turn volume contributing to high delays and V/C issues.

The Streets module within HCS analysis was used to analyze pedestrian and bicycle facilities using the HCM multi-modal methodology and is summarized in the following table for intersections. Multi-modal methodology limitations only allow for the analysis of signalized intersections. Most of the intersections have a LOS C or better for both the pedestrian and bicycle LOS. There are 3 locations that have a poor LOS, all of which are at intersections that will not be impacted by changes to the Exit 6 interchange.

Table 19: Build (2027) Multimodal Operations Summary

Major Roadway	Intersecting Roadway	Metric	AM Peak Hour					PM Peak Hour				
			Approach				INT.	Approach				INT.
			EB	WB	NB	SB		EB	WB	NB	SB	
Rice Street	I-229 SB Ramp Terminal	Ped LOS	A	B	B	B	NA	A	B	B	B	NA
		Bicycle LOS	A	A	-	F	NA	A	A	-	F	NA
Rice Street	I-229 NB Ramp Terminal	Ped LOS	B	B	B	B	NA	B	B	B	B	NA
		Bicycle LOS	A	A	A	A	NA	C	A	A	A	NA
10th Street	Jessica Avenue	Ped LOS	B	A	B	B	NA	B	A	B	B	NA
		Bicycle LOS	A	B	F	-	NA	B	A	F	-	NA
10th Street	Lowell Avenue	Ped LOS	B	B	B	B	NA	B	B	B	B	NA
		Bicycle LOS	A	B	A	A	NA	B	B	A	A	NA
10th Street	I-229 SPUI	Ped LOS	B	B	B	B	NA	B	B	B	B	NA
		Bicycle LOS	A	B	B	A	NA	B	A	A	A	NA
10th Street	Cleveland Avenue	Ped LOS	B	B	B	B	NA	B	B	B	B	NA
		Bicycle LOS	A	B	A	A	NA	B	A	A	A	NA
10th Street	Hy-Vee Entrance	Ped LOS	B	B	B	B	NA	B	B	B	B	NA
		Bicycle LOS	A	B	A	A	NA	B	A	A	A	NA
26th Street	I-229 SB Ramp Terminal	Ped LOS	B	A	B	B	NA	B	A	B	B	NA
		Bicycle LOS	A	B	F	-	NA	A	A	F	-	NA
26th Street	I-229 NB Ramp Terminal	Ped LOS	B	A	C	B	NA	B	A	C	B	NA
		Bicycle LOS	A	B	A	-	NA	A	B	B	-	NA

Notes:
- "n/a" denotes an approach that does not exist at the intersection. "—" denotes an approach with no delay due to control type.
- Bold/Highlighted indicates a poor LOS

7.3. Conformance with Transportation Plans

The proposed interchange improvements conform to both state and local plans. As advised in the I-229 MIS, roadway capacity improvements were recommended for the I-229 & 10th Street interchange and adjacent 10th Street & Cleveland Avenue intersection as both were projected to be at capacity by year 2035. It was also recommended to widen I-229 mainline to include three continuous travel lanes in each direction between Exit 5 to Exit 6 and improve the existing horizontal curves to facilitate safe and efficient traffic operations.

Preliminary engineering tasks have been programmed for Exit 6 in the 2022 fiscal year in the current STIP, with tentative construction beginning in 2025. Local plans to widen the 10th Street corridor, east of the Exit 6 interchange, have been included in programmed projects.

7.4. Compliance with Policies and Engineering Studies

The interchange No-Build Alternative does not meet the project need of providing adequate near and long-term Interstate operations and to provide safe access to and from the Interstate System. As noted previously, the SAT decided to eliminate the minimum LOS standard at the interchange and instead use the 95th percentile queue length on the interchange ramps to determine the success of the alternative. The Build Alternative will provide adequate queue storage on the interchange ramps to prevent interference with the mainline Interstate movements. All other design and administrative aspects of the Build Alternative will comply with the latest guidance provided by AASHTO, FHWA, and the SDDOT Road Design Manual.

Control of Access (COA) along the E 10th Street corridor is an important consideration for the long-term operational and safety performance of the interchange. The following summarizes existing and proposed access locations and their relation to COA requirements for new construction. Reconstruction projects are not subject to the access management rules set here; the COA requirements are provided as comparative guidance.

The established COA requirements along the crossroad corridor upstream and downstream of an interchange are provided in the SDDOT Road Design Manual for highways on the state system. The minimum access spacing for urban developed classified roadway systems requires at least 100’ from the radius of the ramp termini to an unsignalized access and 1,320’ from the ramp termini to a traffic signal-controlled intersection.

The COA requirements for arterial roadways within the jurisdiction of the City of Sioux Falls are provided in the Engineering Design Standards for Public Improvements. The minimum spacing for full access intersection or traffic signals along arterial roadways is 1,320’ apart. The spacing between other unsignalized intersection access is varied and at the discretion of the City Engineer.

The existing COA on the west side of the interchange extends approximately 50’ to the first unsignalized intersection with Conklin Avenue and approximately 375’ to the first signalized intersection with Lowell Avenue. The existing COA on the east side of the interchange currently extends approximately 105’ with the intersection of Blaine Avenue and the Super 8 Hotel access and approximately 430’ to the first signalized intersection with Cleveland Avenue.

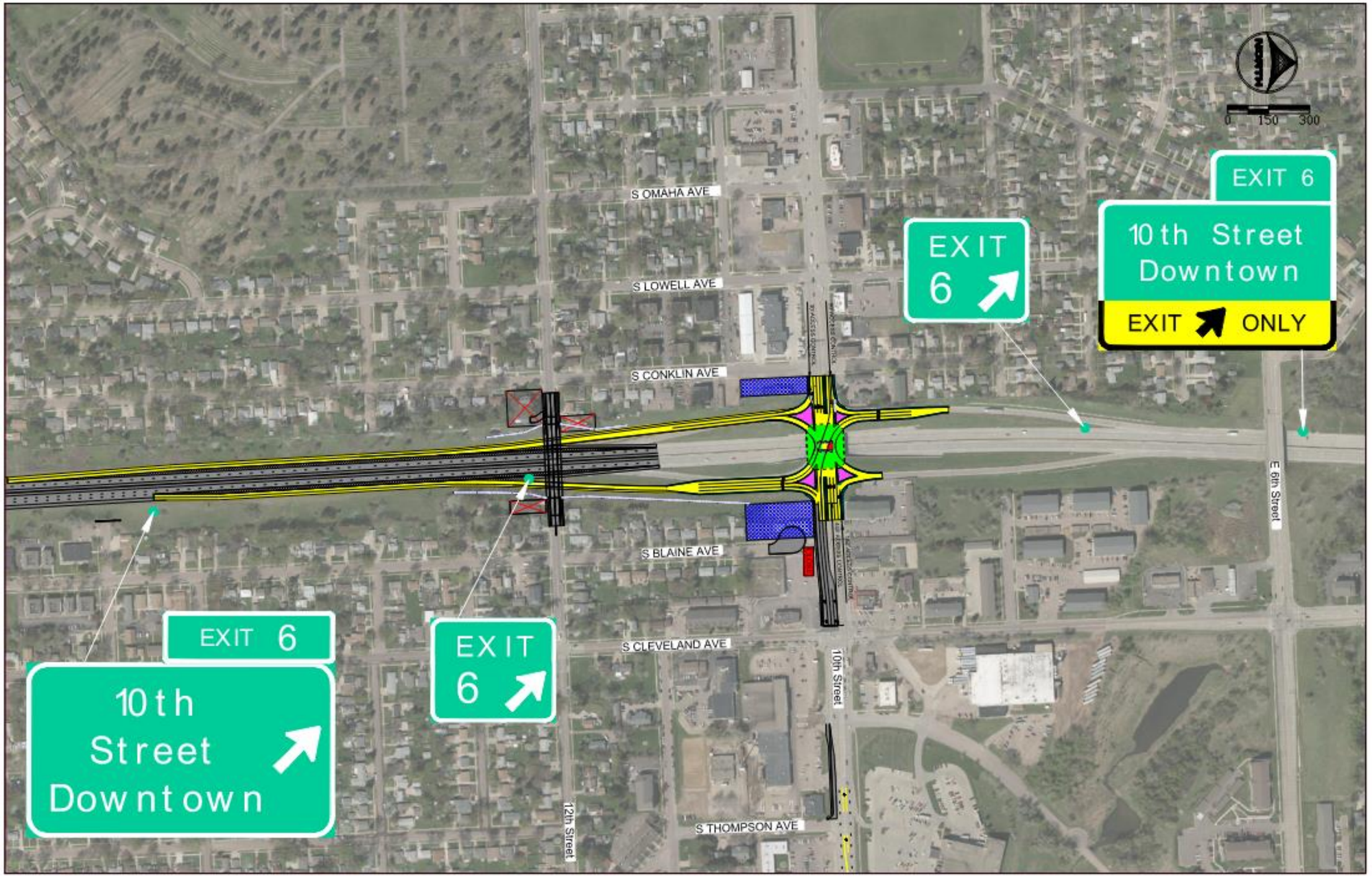
The proposed alternative would maintain the existing COA west of the interchange. To the east of the interchange, the Blaine Avenue intersection would be closed, as part of a separate City project. The Super 8 Hotel access would remain, and no changes would be made to the existing signalized intersection spacing with Cleveland Avenue.

The locations of the ramp junctions with mainline I-229 in the proposed Build Alternative interchange configuration do not change significantly compared to the existing ramp configuration. The existing guide sign layout is not expected to require any significant changes and would adequately meet the needs of the revised interchange with minor revisions to sign placement to be completed during the final design.

7.5. Alternative Guide Sign Layout

The recommended alternative guide sign layout can be seen in **Figure 10**.

Figure 10: Alternative Guide Sign Layout



7.6. Environmental Impacts

An Environmental Screening Report document is being developed in conjunction with the IMJR to understand the environmental resources located within the project corridor. The analysis of environmental impacts of the No-Build and Build Alternatives will be documented during the National Environmental Policy Act (NEPA) process. See the Environmental Screening Report document for additional information.

7.7. Safety

The Build Alternative for both the I-229 Mainline and the Exit 6 Interchange are expected to provide a safety benefit when compared to the No-Build Alternative. A predictive safety analysis of alternatives was conducted using FHWA's Interactive Highway Safety Design Model (IHSDM); this is a faithful implementation of the crash prediction methods documented in Part C of the Highway Safety Manual (HSM). IHSDM output sheets are provided in the Appendix.

7.7.1. I-229 Mainline Build Alternatives

The I-229 Mainline IHSDM model limits are from the northern gore area of Exit 5 to the crossover area approximately 3,300 feet north of 10th Street; The mainline I-229 model analyzed crashes along I-229, including all ramp connections; the I-229 ramps, 10th Street arterial, and intersections were included in a separate safety model due to limitations within the application.

The following alternatives were analyzed:

- **No-Build**
  - Existing configuration of I-229 Mainline and ramp connections
- **Build - Curve and Shoulder Improvements**
  - Increase the radius of the curve just north of the Southeastern Avenue overpass by approximately 85 feet
  - Widen inside shoulder from 8' to 10'; 10' outside shoulder
  - Additional lanes on I-229 both northbound and southbound
  - New ramp connection locations for interchange Build Alternative

Table 20 shows the I-229 mainline safety analysis results, all proposed Build Alternatives have a significant reduction in predicted crashes when compared to the No-Build condition.

Table 20: I-229 Mainline Predicted Crashes (IHSDM) Results

Facility Type	Crash Type	No-Build	Build
Freeway Segment	Fatal/Injury	168	144
	Property Only	369	280
Speed Change Areas	Fatal/Injury	42	60
	Property Only	102	136
ALTERNATIVE TOTALS	Fatal/Injury	270	204
	Property Only	411	416
	TOTAL	**681**	**620**
	% Reduction	**-**	**9.0%**

Under the Build Alternative, the widening of the I-229 roadway and increased curve radius provided a reduction in predicted crashes of 113 crashes, compared to the No-Build condition, which resulted in a reduction in predicted crashes of approximately 21%. The number of predicted crashes within speed change areas demonstrated an increase due to the expanded size of the speed change areas. The total number of predicted crashes will decrease by appropriately 61 crash incidents, which results in a total reduction in predicted crashes of 9.0%.

Based on the safety analysis, the Build Alternative will provide a safety benefit over the No-Build conditions.

7.7.1. 10th Street (Exit 6) Interchange Alternatives

The arterial corridor model limits include 10th Street from approximately 125 feet east of Jessica Avenue to just west of the signalized Hy-Vee Store access; a total length of just under ¾-mile. The analysis for the 10th Street arterial includes all side street intersections and driveways within the modeled area.

The following alternatives were analyzed:

- **No-Build**
  - Existing configuration of the Exit 6 (10th Street) Interchange
- **Build SPUI**
  - Upgrade existing SPUI ramps for queue storage and additional turn lanes at the E 10th Street exit ramps
  - Add an additional eastbound through lane to 10th Street from the SPUI to Thompson Avenue (separate City project)
  - Close the Blaine Avenue access (separate City project)

Table 21 shows the interchange safety analysis results.

Table 21: Exit 6 (10th Street) Interchange Predicted Crashes (IHSDM) Results

Facility Type	Crash Type	No-Build	Build SPUI
Arterial Corridor & Intersections	Fatal/Injury	403	385
	Property Only	692	667
Ramp Connections	Fatal/Injury	32	41
	Property Only	30	42
ALTERNATIVE TOTALS	Fatal/Injury	436	426
	Property Only	722	709
	TOTAL	1,158	1,135
	% Reduction	-	2.1%

Under the Build Alternative, the 10th Street arterial corridor provided a reduction in predicted crashes of 43 crashes, compared to the No-Build condition, which resulted in a reduction in predicted crashes of approximately 4%. The reduction in predicted crashes for the Build Alternative occurs on the 10th Street arterial corridor, primarily due to the removal of the Blaine Avenue access. The increased capacity does not seem to provide a significant safety benefit at the Cleveland Avenue intersection. The Build Alternative has similar crashes to existing SPUI as the increased capacity and increased number of lanes on the ramps seem to offset one another from a safety perspective. The number of predicted crashes within ramp connection areas demonstrated an increase due to the increased ramp length and number of lanes on each ramp. The total number of predicted crashes will decrease by appropriately 22 crash incidents, which results in a total reduction in predicted crashes of 2.1%.

It should be noted that the arterial No-Build crashes estimated by IHSDM were significantly lower than the actual crash frequencies observed along 10th Street, particularly at the I-229 interchange and Cleveland Avenue intersections. Along 10th Street, the IHSDM model estimated approximately 48 crashes per year, while the previous 5-years of historical crash data had generated 86 crashes per year, which is a 44% difference. On the I-229 freeway section, the IHSDM model estimated approximately 29 crashes per year, while the previous 5-years of historical crash data had generated 36 crashes per year in the study area, which is a 19% difference. IHSDM does include an empirical-bayes adjustment for the No-Build Alternative based on existing crash history; however, due to the significant changes in the design of the Build Alternatives, this option isn't applicable in IHSDM.

7.8. Evaluation Matrix

Table 22 provides a comparison of the No-Build and Build Alternative. Evaluation criteria were established from the project Purpose and Need and feeds into the Environmental Document screening process. Ratings for each of the criterion are based on future performance expectations or Yes/No.

The Build concept assessment showed a present value project cost of $3.7 million dollars. The traffic safety analysis showed a decrease in expected crash frequency. The traffic operations at the interchange show an expected decrease to vehicle delays at each ramp approach with decreased queue length.

Table 22: Alternative Evaluation Matrix

Evaluation Criteria	No Build	Build Alternative
		Ramp Improvements
Meets SDDOT Design Criteria		YES
Meets SDDOT Access Spacing Criteria		YES
Meets City Access Spacing Criteria		NO
Access Closures		0
Acquisitions - Residential		0
Acquisitions - Business		0
Total Acreage of ROW Required		0
Transit Mobility	Bus Route 4 (10th Street & Cleveland Ave), Bus Route 7 (6th Street, Rice Street), Bus Route 9 (18th Street)	temporary construction impacts; sidewalks generally consistent with no build
Land Use/Socioeconomics		not likely
Environmental Justice		not likely
Section 4(f)/Section 6(f)		not likely
Noise Impacts (Risk for)		YES
Floodplains		NO
Wetlands/River Impacts		NO
Safety Improvement - % Reduction in Crashes (2027 through 2050 Crashes)		4.57%
Operational Performance (AM/PM)_	**F** (100.6) / **F** (68.2)	**E** (61.8) / **F** (116.7)
Worst Ramp Terminal Performance 2050	Northbound Ramp AM **LOS F** (154.2)	Northbound Ramp PM **LOS F** (80.3)
Worst Ramp 95th Percentile Queue	Northbound Ramp 1,325'	Northbound Ramp 625'
Non-Motorized Facilities (AM/PM)	**C** (2.72) / **C** (2.67)	**C** (2.72) / **C** (3.25)
Maintenance of Traffic During Construction		YES
Allows for Phased Construction		YES
Interchange Structure Costs ($M)	-	$0.7
Entrance / Entrance Ramp Costs ($M)	-	$1.7
10th Street Roadway Costs ($M)	-	$1.0
Cleveland Avenue Costs ($M)	-	$0.0
Total Project Costs (Millions in 2021 dollars)	**-**	**$3.4**
Adjustment to 2022 dollars (10% increase)	-	**$3.7**

7.9. Coordination

Stakeholder and public involvement are centered on major milestones within the IMJR and NEPA study components:

- Stakeholder and Public Meeting #1 (occurred 2022): Gather feedback on study area issues and needs.
- Public Meeting #2 (to be facilitated early 2024): Present refined Build Alternative and potential Right of Way impacts.
- Public Meeting #3 (to be facilitated mid 2024): As part of the development of the NEPA Document, requesting public comment on the recommended alternative and environmental impacts.

Project stakeholders were invited to take part in smaller, group discussion meetings prior to each public meeting. This allowed for small-group discussions with the Study Advisory Team. Stakeholders consisted of property and business owners and managers along the E 10th Street corridor, emergency responders, government representatives, and others identified to have a strong transportation interest along the corridor.

At the initial set of public and stakeholder meetings held January 26, 2022, the study team gathered feedback from the public regarding the issues and needs they see within and around the I-229 Exit 6 Interchange and presented the proposed interchange and corridor Build Alternatives developed for the study area for comment and feedback. Many of the comments focused on the desire to maintain property access during construction and minimizing impacts to each respective property owner.

The second public meeting, to be facilitated in early 2024, will present the proposed interchange and corridor Build Alternative developed for the study area for comment and feedback.

The third public meeting, to be facilitated in mid 2024, will be held in conjunction with the publication of the NEPA Document, requesting feedback from the public on the proposed recommended alternative and the identified impacts.

Project information has been disseminated to the public through the project website at http://www.i229exit6.com. The website provides links to study materials such as concept and Build Alternative figures, evaluation summaries, and public information meeting material. The website also provides study contact information for SDDOT and consultant project managers. Viewers of the website have the opportunity to submit comments and questions directly from the website.

8. Funding Plan

The following table provides the planned project that will include the proposed improvements identified as part of this IMJR. Estimated costs are calculated at $3.7 million.

Table 23: Anticipated Funding Allocation (2022 dollars)

Project Number	Federal Funding Category	State Funding Category	Federal Funds ($ million)	State Funds ($ million)	Total Funds (S million)
IM 2292(06)5 N	National Highway Performance Program	Interstate Maintenance	$3.352 (90.97%)	$0.333 (9.03%)	$3.685
		TOTAL:	$3.352	$0.333	$3.685

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

9. Conclusions and Recommendations

Based on the evaluations and conclusions documented in this IMJR, it is recommended to modify the existing interchange on I-229 at E 10th Street in Sioux Falls, South Dakota as illustrated in this report. It is further recommended that the E 10th Street interchange be monitored for future capacity improvements to improve the forecasted 2050 traffic operations.

The technical analysis contained herein demonstrates that the two policy requirements for new or revised access points to the existing Interstate System, published in the May 22, 2017 policy guidance, have been met.

1. **An operational and safety analysis has concluded that the proposed change in access does not have a significant adverse impact on the safety and operation of the Interstate facility (which includes mainline lanes, existing, new, or modified ramps, and ramp intersections with crossroad) or on the local street network based on both the current and planned future traffic projections. The analysis should, particularly in urbanized areas, include at least the first adjacent existing or proposed interchange on either side of the proposed change in access (Title 23, Code of Federal Regulations (CFR) paragraphs 625.2(a), 655.603(d) and 771.111(f). The crossroads and the local street network, to at least the first major intersection on either side of the proposed change in access, should be included in this analysis to the extent necessary to fully evaluate the safety and operational impacts that the proposed change in access and other transportation improvements may have on the local street network (23 CFR 625.2(a) and 655.603(d)). Requests for a proposed change in access should include a description and assessment of the impacts and ability of the proposed changes to safely and efficiently collect, distribute, and accommodate traffic on the Interstate facility, ramps, intersection of ramps with crossroad, and local street network (23 CFR 625.2(a) and 655.603(d)). Each request should also include a conceptual plan of the type and location of the signs proposed to support each design alternative (23 U.S.C. 109(d) and 23 CFR 655.603(d)).**

The traffic operational analyses conducted for the recommended Build Alternative concluded that the proposed change in access would not have an adverse impact to operations of the Interstate System. The improvements associated with the recommended Build Alternative are expected to provide ramp storage for the expected design year 2050 weekday peak period 95th percentile queues without negatively impacting the Interstate System. Additionally, the crash prediction analysis concluded that the recommended Build Alternative is expected to yield a lower number of crashes for all crash severity than the No-Build condition. The criteria for the FHWA Policy Requirement 1 have been addressed through these operational and safety analyses.

2. **The proposed access connects to a public road only and will provide for all traffic movements. Less than "full interchanges" may be considered on a case-by-case basis for applications requiring special access, such as managed lanes (e.g., transit or high occupancy vehicle and high occupancy toll lanes) or park and ride lots. The proposed access will be designed to meet or exceed current standards (23 CFR 625.2(a), 625.4(a)(2), and 655.603(d)). In rare instances where all basic movements are not provided by the proposed design, the report should include a full-**

interchange option with a comparison of the operational and safety analyses to the partial-interchange option. The report should also include the mitigation proposed to compensate for the missing movements, including wayfinding signage, impacts on local intersections, mitigation of driver expectation leading to wrong-way movement on ramps, etc. The report should describe whether future provision of a full interchange is precluded by the proposed design.

The proposed access action involves improvement of an existing full-movement interchange. The improved interchange will continue to serve all movements. All roadways that are part of the proposed reconfiguration are public roadways. The proposed geometric design of the interchange conforms to all relevant SDDOT and AASHTO design standards and policies. The criteria for the FHWA Policy Requirement 2 have been addressed through the review of access and design standards.

Based on the evaluations and conclusions documented in this IMJR, it is recommended to modify the existing SPUI interchange at I-229 & 10th Street (Exit 6) to realign and extend the ramp lanes as illustrated in this report. The interchange improvements should be closely coordinated with the local agency to ensure improvements needed at adjacent intersections are constructed in coordination with the interchange improvements.

Appendices (Available Electronically)

A. Methods and Assumptions Document
B. Traffic Forecast Memo
C. Existing Condition Memo
D. Future Conditions Memo
E. Build Concept
F. HCS Analysis Reports
G. Concept Evaluation Memorandum
H. Safety Memo / IHSDM Output