I-229 EXIT 3 (MINNESOTA AVENUE) CROSSROAD CORRIDOR STUDY

I-229 MAJOR INVESTMENT CORRIDOR STUDY
PROJECT PL 0100(87) 3616 P, PCN 044K

Sioux Falls, South Dakota
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EXECUTIVE SUMMARY

The Interstate 229 (I-229) Corridor through the City of Sioux Falls is a critical traffic corridor that provides access to the expanding east side and allows direct access to downtown. The I-229 Major Investment Study (MIS) allows the City of Sioux Falls, the Sioux Falls Metropolitan Planning Organization (MPO), the South Dakota Department of Transportation (SDOT), adjacent landowners, and area users to help determine the vision of the corridor. The I-229 Exit 3 (Minnesota Avenue) Crossroad Corridor Study is a subset of the I-229 MIS.

This study assesses existing and future conditions at the I-229 interchange at Exit 3 (Minnesota Avenue) and along Minnesota Avenue from 41st Street to 57th Street. The purpose of this study is to address the traffic operations and safety concerns for this corridor, which is a primary commuter route between downtown and southern Sioux Falls. The I-229 Exit 3 interchange already experiences congested conditions and is expected to continue to degrade through year 2035.

Preliminary concepts were developed for both the I-229 Exit 3 interchange and Minnesota Avenue corridor to address the existing and year 2035 transportation deficiencies. These 13 interchange concepts and four corridor concepts were screened to identify which concepts were to be carried forward for further development and evaluation. The remaining interchange and corridor concepts were combined to form six Build alternative scenarios and were further refined.

Each Build alternative scenario was analyzed using established evaluation criteria. Through the analysis, it is recommended that the following I-229 Exit 3 (Minnesota Avenue) Build alternative scenarios advance to be considered in future studies:

- ***Minn-2C.*** 5/4-Lane Divided Corridor with NE Quadrant Loop and NE Ramp aligned with 49th Street
- ***Minn-2D.*** 6/4- Lane Divided Corridor with NE Quadrant Loop and NE Ramp aligned with 49th Street
- ***Minn-9D.*** 6/4-Lane Divided Corridor with SPUI and NE Ramp aligned with 49th Street

The project's Study Advisory Team (SAT) consisted of representatives from the Federal Highway Administration (FHWA), SDDOT, Sioux Falls MPO, City of Sioux Falls, HDR, and HR Green. The public was involved throughout the study through public open houses, landowner meetings, and a project website. Public comments, submitted via discussion with the study team, study comment form, or electronically, were used in the development and refinement of the preliminary concepts and Build alternative scenarios.

CHAPTER 1 - INTRODUCTION

Section 1.1 - Introduction

The Interstate 229 (I-229) Corridor through the City of Sioux Falls carries commuters and tourism traffic, provides access to the expanding east side of this thriving community, and allows direct access to downtown. The I-229 Major Investment Study (MIS) allows the City of Sioux Falls, the Sioux Falls Metropolitan Planning Organization (MPO), the South Dakota Department of Transportation (SDDOT), adjacent landowners, and area users to help determine the vision of the corridor. The I-229 Exit 3 (Minnesota Avenue) Corridor Study is a sub-study of the I-229 MIS.

An MIS provides a focused evaluation of transportation needs and issues within a corridor or sub-region. An MIS is designed to provide decision makers with information on the options available to address transportation challenges before making investment decisions. An MIS can lead to the identification and decision of design concepts and investment scope.

The I-229 MIS fulfills the following objectives:

1. Complete a traffic level of service (LOS) analysis for both existing and future (2035) No-Build conditions on the I-229 mainline, select interchanges and crossroads.
2. Complete a safety analysis of I-229 mainline, interchanges and crossroads.
3. Identify locations on I-229 not in compliance with current design standards under both the current and forecasted future traffic conditions.
4. Determine the effects of incidents on traffic operations within the I-229 corridor's area of influence.
5. Develop a long-range plan consisting of feasible solutions to address the portions of the Interstate System that fail to meet current design standards, traffic level of service (LOS) expectations, and/or have identifiable safety concerns under both the current and forecasted future traffic conditions.
6. Create final products for use by the SDDOT, the City of Sioux Falls and the MPO, which will guide the Department in the implementation of recommended improvements that will maximize the efficiency of the system.

The I-229 MIS has been separated into six individual sub-studies, which include:

- *I-229 Corridor Study*
- *I-229 Exit 3 (Minnesota Avenue) Crossroad Corridor Study*
- *I-229 Exit 4 (Cliff Avenue) Crossroad Corridor Study*
- *I-229 Exit 6 (10th Street) Crossroad Corridor Study*
- *I-229 Exit 7 (Rice Street) Crossroad Corridor Study*
- *I-229 Exit 9 (Benson Road) Crossroad Corridor Study*

A map illustrating the study areas for each of the sub-studies is shown in ***FIGURE 1***.

The remainder of this document focuses on the I-229 Exit 3 (Minnesota Avenue) Crossroad Corridor Study.

Section 1.2 - Project Description / Study Area

The I-229 Exit 3 (Minnesota Avenue) Crossroad Corridor Study focuses on the assessment of existing and future conditions at the I-229 Exit 3 interchange and Minnesota Avenue corridor between and including 41st Street and 57th Street. The study area is located in south-central Sioux Falls, approximately 2 miles south of downtown Sioux Falls and 3 miles east/northeast of the I-29/I-229 system interchange. The Minnesota Avenue corridor is a primary commuter route between downtown and the urban/suburban residential areas throughout the southern Sioux Falls metropolitan area.

An illustration of the study area is shown in ***FIGURE 2***. There are nine study area intersections located on Minnesota Avenue, including:

- 41st Street
- 43rd Street
- 49th Street
- I-229 Southbound Ramp Terminal
- I-229 Northbound Ramp Terminal
- Yankton Trail Park Entrance
- Lotta Street
- Batcheller Lane
- 57th Street

Figure 1. I-229 MIS Study Area Map

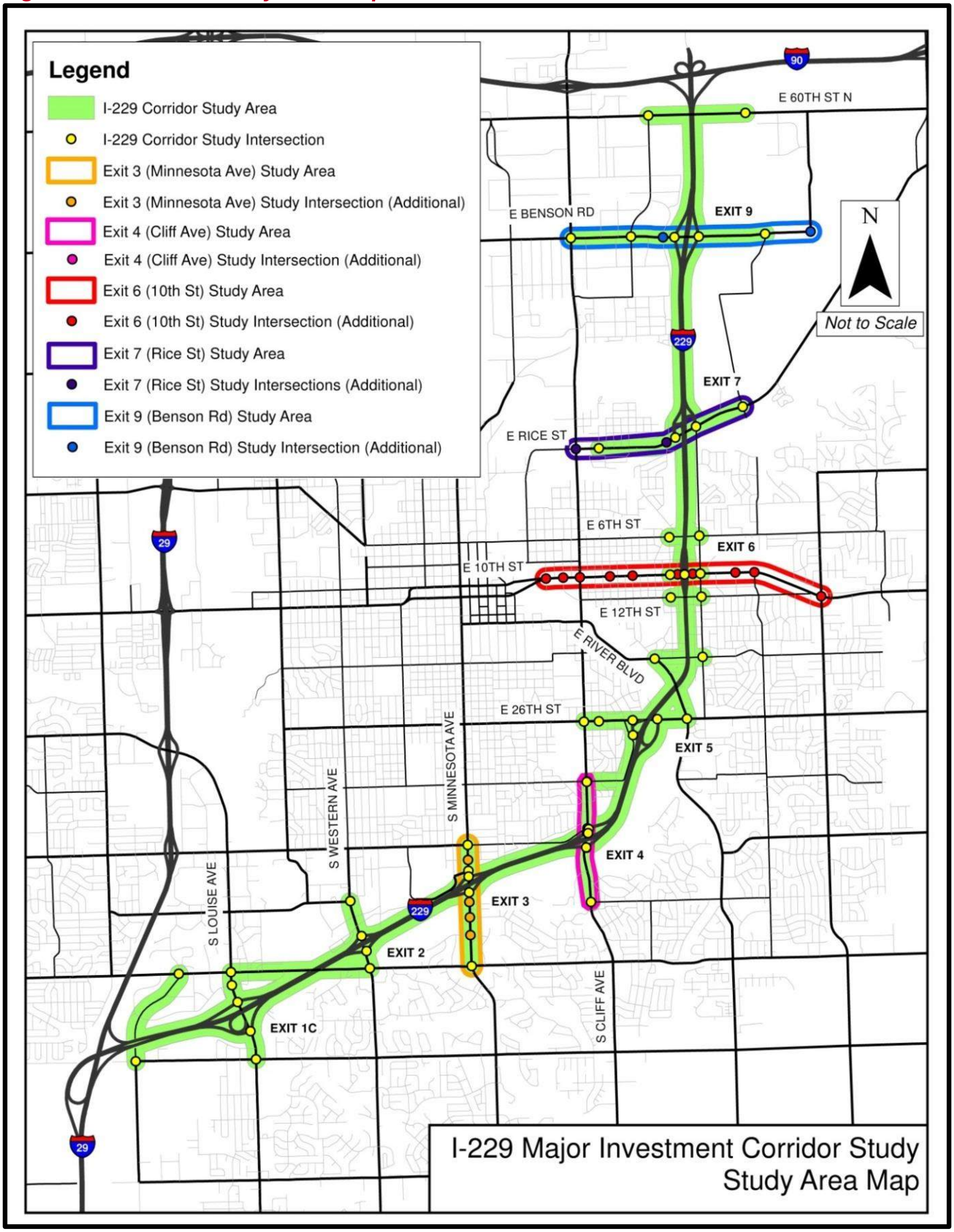


Figure 2. I-229 Exit 3 (Minnesota Avenue) Corridor Study Area

Section 1.3 - Purpose

The purpose of this study is to address the traffic operations and safety concerns at the I-229 Exit 3 (Minnesota Avenue) interchange and along the Minnesota Avenue corridor. The following specific issues/needs were identified for this study:

- Congestion at the I-229 Exit 3 (Minnesota Avenue) interchange
- Congestion throughout the Minnesota Avenue corridor, between and including the 41st Street and 57th Street intersections
- Closely-spaced interchanges throughout the I-229 corridor
- Additional traffic operational impacts to the I-229 Exit 3 interchange and Minnesota Avenue due to the extension of 49th Street to the west of Minnesota Avenue
- Future traffic growth within the study area and the impact to interchange operations
- Conclusions and recommendations from the 41st Street Corridor Study
- Improved pedestrian and bicycle access and crossings

The primary goal of this study is to develop feasible solutions to address the identified issues and needs. The solutions will follow current design standards and provide acceptable traffic LOS and operations under both current and future traffic conditions.

Section 1.4 - Methods and Assumptions

The SDDOT provides a ***Methods and Assumptions*** template for SDDOT planning studies. This template guided the development of a specific document for the I-229 Exit 3 (Minnesota Avenue) Crossroad Corridor Study. This Methods and Assumptions document is used to outline technical methodologies and key assumptions used in the course of the study. The document can be found in ***Appendix A. Methods and Assumptions for Sub-Study 2***.

The original Methods and Assumptions document was amended as follows:

- ***Amendment 1*** includes changes to accommodate updated schedule, Study Advisory Team (SAT) members, traffic forecasting methodology, and right-turn on red volumes, as discussed at the SAT meeting held on August 13, 2014.
- ***Amendment 2*** includes changes related to updated schedule, addition of Sub-Study 5 (Exit 7: Rice Street), year of failure analysis, and crash prediction analysis (safety) as discussed at the SAT meeting held on November 2, 2015.

CHAPTER 2 - EXISTING AND YEAR 2035 NO-BUILD CONDITIONS

Assessment of existing conditions and 2035 No-Build conditions is based on traffic data collected and developed as part of overall I-229 MIS. Traffic data applicable to Exit 3 (Minnesota Avenue) includes base mapping, existing and future-year 2035 No-Build traffic volume data, and crash data. The existing conditions analysis is representative of year 2012. Content in this chapter focuses on analysis of the I-229 Exit 3 (Minnesota Avenue) Crossroad Corridor Study area previously shown in ***FIGURE 2***.

Section 2.1 - Traffic Capacity and Analysis Methodologies

The Existing (2012) conditions and 2035 No-Build conditions AM and PM peak hour traffic operations were analyzed throughout the study area, which included the 4 signalized intersections, 5 unsignalized intersections, 2 basic freeway segments, and 4 weave segments. The study area AM and PM peak hours are representative of 7:15–8:15 AM and 4:30–5:30 PM, respectively. The operational analysis results include:

- Signalized ramp terminal intersections
- Arterial intersections
- Basic Freeway, Ramp Junctions and Weave Areas

Traffic analysis methodologies used to determine operational capacity are outlined in ***APPENDIX B1. TRAFFIC CAPACITY ANALYSIS METHODOLOGIES***. LOS is based on procedures from the ***Highway Capacity Manual*** (***HCM 2010***).

Section 2.2 - Existing Conditions Operational Results

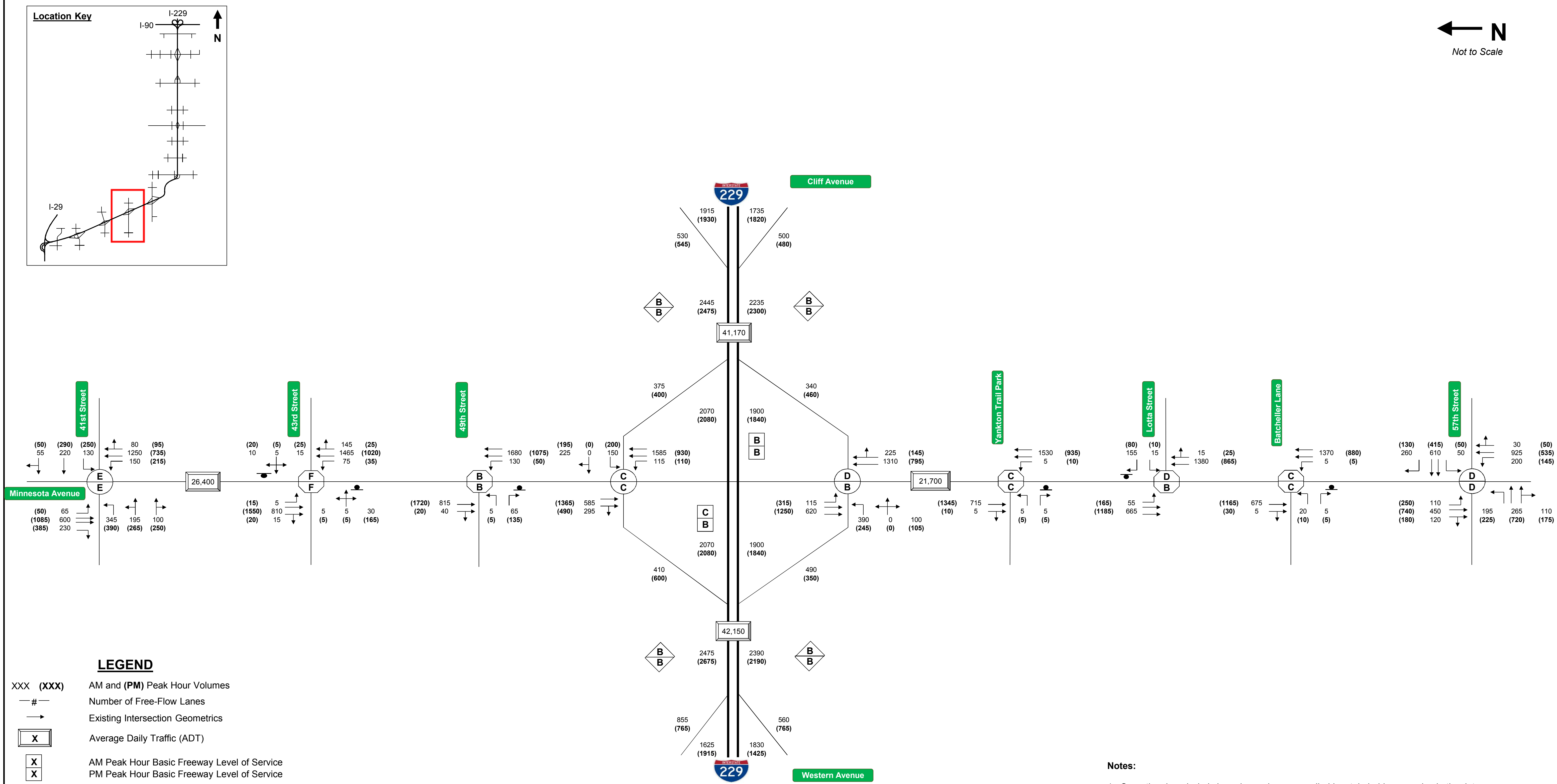
The existing conditions LOS results for all intersection and freeway locations within the I-229 Exit 3 (Minnesota Avenue) corridor study area are depicted in ***FIGURE 3***.

This existing conditions analysis found that the freeway facilities are operating at a desirable LOS C or better throughout the study area. Ramp terminals and other arterial intersections that have degraded beyond the acceptable LOS C or D threshold with regard to the goals of this study are shown in ***TABLE 1***. At the interchange, the northbound I-229 Exit 3 ramp terminal measures LOS D in the AM peak hour. The existing HCS reports are provided in ***APPENDIX B2. EXISTING HCS 2010 REPORTS***.

Table 1. Existing Conditions Deficient Locations Based on Operational Analysis

LOCATION	AM	PM
Minnesota Avenue and 41st Street	LOS E	LOS E
Minnesota Avenue and 43rd Street	LOS F	LOS F
Minnesota Avenue and NB Ramp Terminal	LOS D	-

Note: Acceptable threshold is LOS D for signalized non-ramp terminal intersections and LOS C for ramp terminal intersections and basic freeway, ramp junctions, and weave segments.



LEGEND

XXX **(XXX)** AM and **(PM)** Peak Hour Volumes
Number of Free-Flow Lanes
Existing Intersection Geometrics
Average Daily Traffic (ADT)
AM Peak Hour Basic Freeway Level of Service
PM Peak Hour Basic Freeway Level of Service
AM Peak Hour Ramp Merge Level of Service
PM Peak Hour Ramp Merge Level of Service
AM Peak Hour Ramp Diverge Level of Service
PM Peak Hour Ramp Diverge Level of Service
AM Peak Hour Weaving Section Level of Service
PM Peak Hour Weaving Section Level of Service
AM Peak Hour Signalized Intersection Level of Service
PM Peak Hour Signalized Intersection Level of Service
AM Peak Hour Unsignalized Intersection Level of Service
PM Peak Hour Unsignalized Intersection Level of Service

Notes:

1. Operational analysis is based on volumes supplied by stakeholder agencies in the data collection phase of Sub-Study 1 and supplemented with additional counts in the spring of 2013. Lane geometrics are based on aerial photography present at the time of data collection.
2. 7:30 - 8:30 AM Peak Hour; 4:45 - 5:45 PM Peak Hour
3. Worst case stop controlled approach Level of Service reported

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Existing Conditions Traffic Operations Analysis

I-229 Major Investment Corridor Study: Sub-Study 2 Sioux Falls, South Dakota

Date: June 2017

Figure: 3

Section 2.3 - Year 2035 No-Build Operational Results

Traffic forecasts for year 2035 No-Build condition were established as part of the overall I-229 MIS. The balanced set of year 2035 No-Build AM and PM peak volumes within the I-229 Exit 3 (Minnesota Avenue) study area is presented with the results of the future-year No-Build conditions analysis in *FIGURE 4*.

The 2035 No-Build conditions analysis incorporated two separate analyses, representing a 'Best Case' and 'Worst Case' scenario. The following tables and figures present the 2035 No-Build conditions 'Best Case' scenario operational LOS measures and represents corridor conditions reflective of existing geometry and the inherent capacity constraints this geometry would pose to future traffic demand.

The 'Worst Case' scenario looks at each intersection in isolation if the full demand would be able to reach the respective intersection due to upstream capacity improvements. However, this scenario may present higher delays than would actually occur if the upstream intersections were not improved. Refer to *APPENDIX C. 2035 NO-BUILD AND BUILD OPERATIONAL ANALYSIS TECHNICAL MEMORANDUM* for additional information on the two scenarios.

The 2035 No-Build analysis found that all freeway segments are expected to operate within the desirable threshold of LOS C in both the AM and PM peak hours within the I-229 Exit 3 (Minnesota Avenue) study area.

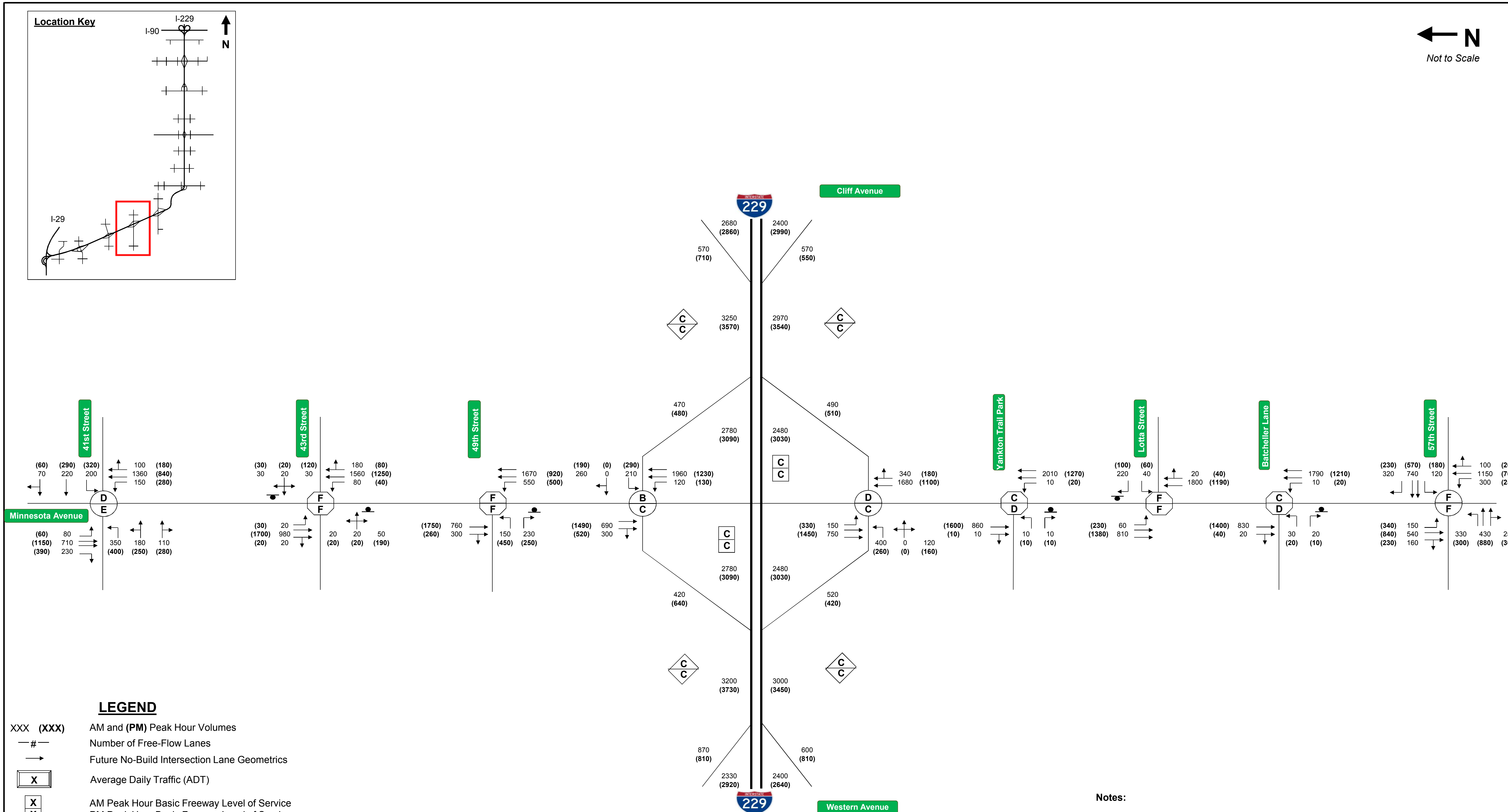
The future-year demand and changes to traffic patterns due to the expected surrounding infill development created operational challenges throughout the Minnesota Avenue corridor. Intersections that are expected to degrade beyond the acceptable threshold of LOS C or D, as applicable, are shown in *TABLE 2*.

Table 2. 2035 No-Build Conditions Deficient Locations Based on Operational Analysis

LOCATION	AM	PM
Minnesota Avenue and 41st Street		LOS E
Minnesota Avenue and 43rd Street	LOS F	LOS F
Minnesota Avenue and 49th Street	LOS F	LOS F
Minnesota Avenue and NB Ramp Terminal	LOS D	-
Minnesota Avenue and Lotta Street	LOS F	LOS F
Minnesota Avenue and 57th Street	LOS F	LOS F

Note: Acceptable threshold is LOS D for signalized non-ramp terminal intersections and LOS C for ramp terminal intersections and basic freeway, ramp junctions, and weave segments.

A detailed report of the future year 2035 No-Build conditions traffic operations can be found in *APPENDIX C. 2035 NO-BUILD AND BUILD OPERATIONAL ANALYSIS TECHNICAL MEMORANDUM*.



LEGEND

XXX (XXX) AM and **(PM)** Peak Hour Volumes

—#— Number of Free-Flow Lanes

Future No-Build Intersection Lane Geometrics

X Average Daily Traffic (ADT)

AM Peak Hour Basic Freeway Level of Service
PM Peak Hour Basic Freeway Level of Service

AM Peak Hour Ramp Merge Level of Service
PM Peak Hour Ramp Merge Level of Service

AM Peak Hour Ramp Diverge Level of Service
PM Peak Hour Ramp Diverge Level of Service

AM Peak Hour Weaving Section Level of Service
PM Peak Hour Weaving Section Level of Service

AM Peak Hour Signalized Intersection Level of Service
PM Peak Hour Signalized Intersection Level of Service

AM Peak Hour Unsignalized Intersection Level of Service
PM Peak Hour Unsignalized Intersection Level of Service

Notes:

1. Worst case stop controlled approach Level of Service reported

HRGreen

2035 No-Build "Best Case" Conditions Traffic Operations Analysis

I-229 Major Investment Corridor Study: Sub-Study 2
Minnesota Avenue Corridor Study
Sioux Falls, South Dakota

Date: June 2017

Figure: 4

CHAPTER 3 - CONCEPT DEVELOPMENT AND ANALYSIS

The transportation deficiencies identified in the Existing Conditions and 2035 No-Build Conditions analysis were taken into consideration along with input from the SAT to develop potential roadway improvement projects. A multi-step process was used to develop, analyze, and refine potential concepts in order to identify the recommended concepts for future consideration.

Section 3.1 - Preliminary Concept Development

Prior to development of the preliminary concepts, a Public Open House was held October 30, 2013 to introduce and receive feedback regarding the I-229 MIS. The Public Open House discussed the needs and goals for each individual corridor study and received feedback from the public. A Stakeholder Meeting was held on December 16, 2014 with businesses and landowners within the I-229 Exit 3 (Minnesota Avenue) study area to provide an update on the study and receive feedback regarding the corridor needs and considerations. A summary of the public involvement process and meeting notes can be found in ***APPENDIX H. PUBLIC INVOLVEMENT***.

The first step in the concept development phase was to identify preliminary concepts to address deficiencies identified in the Existing Conditions and 2035 No-Build conditions analysis. These concepts were developed with SAT input during concept workshops in December 2014 and July 2015. Initially, separate concepts were developed for the I-229 Exit 3 (Minnesota Avenue) interchange area and the Minnesota Avenue corridor. The initial set of preliminary concepts included the following.

I-229 Exit 3 (Minnesota Avenue) Interchange

- ***Minn-1.*** NE Ramp Realignment, SW Ramp Terminal
- ***Minn-2.*** NE Loop, NE & NW Ramp Realignment, SW Ramp Terminal
- ***Minn-2A.*** NE Loop, Aligned with 49th Street
- ***Minn-3.*** Partial Cloverleaf (Parclo), NE, NW & SW Ramp Realignment
- ***Minn-4.*** Parclo, NE Loop Align with 49th Street. Eliminate NW Ramp
- ***Minn-5.*** Diverging Diamond Interchange (DDI)
- ***Minn-6.*** DDI, South Shift
- ***Minn-7.*** DDI, NE Ramp Aligned with 49th Street
- ***Minn-8.*** Single Point Urban Interchange (SPUI)
- ***Minn-9.*** SPUI, NE Ramp Aligned with 49th Street
- ***Minn-10.*** SPUI, South Off-Set
- ***Minn-11.*** SPUI, South Off-Set (2)
- ***Minn-12.*** SPUI, South Off-Set (3)

- ***Minn-C1.*** 5-Lane Undivided with Access Closures
- ***Minn-C2.*** Unbalanced Lanes
- ***Minn-C3.*** Left Turns Off/No Left Turns On
- ***Minn-C4.*** 49th Street Right-in Right-out

Preliminary concept figures are shown in ***APPENDIX D1. PRELIMINARY CONCEPT FIGURES***.

Section 3.2 - Preliminary Concept Comparisons

The preliminary concepts were evaluated through a screening process in order to identify concepts to be carried forward for further analysis and refinement. The screening process consisted of criteria in four categories: Property Impacts, Traffic Operations, Environmental Review and Construction.

PROPERTY IMPACTS

An approximate footprint for each preliminary concept was developed by setting impact limits from the proposed improvements. ROW needs were identified using this impact line; impact areas on private property were considered a ROW acquisition. If the impact area intersected a structure, or rendered a parcel unusable in the opinion of the consultant (e.g. a large part of a parking lot was acquired), the entire structure or parcel was assumed an acquisition.

A unit price of $5 per square foot of acquisition area was applied to estimate the cost of property impacts. The total estimated cost of property impacts for a concept is the total impacted area multiplied by $5 per square foot plus the assessed value of structures impacted (from the Minnehaha County Assessor's website) multiplied by 1.5 (to estimate the fair market value of impacts).

Although not included in the assessment of property impacts for the concepts, the existing access control limits along I-229 at each of the corridor sub-study interchanges were researched at the request of the SAT and are depicted in a set of figures in ***APPENDIX I. EXISTING ACCESS CONTROL FIGURES***.

TRAFFIC OPERATIONS

The traffic operations assessment for each preliminary concept was developed using output from model runs of the Dynamic Traffic Assignment (DTA) model. The 2012 Existing Conditions calibrated DTA model was updated to reflect 2035 No-Build conditions and used as a baseline model to which output from each preliminary concept run was compared.

The Measures of Effectiveness (MOE's) from each concept run were compared to the No-Build MOE's and a percent change calculated between each concept and No-Build. The following MOEs were used to compare the concepts:

- Queues
- Delay

- Travel Time
- Throughput

MOE's were categorized by interchange areas where appropriate. Graphics highlighting these interchange areas, along with the DTA model sub-area, can be found in ***Appendix D3. DTA Model Interchange and Model Sub-areas***.

Environmental Review

A desktop review of available data was analyzed against the preliminary concepts. Items that could require further analysis at the time of future project initiation were identified for issues that separate project concepts. Later phases in potential project corridor planning will require environmental documentation if federal funds are used, and would require analysis of additional resources such as environmental justice and noise. The environmental review included the following elements:

- Archaeological and Historical Resources
- Wetlands and Waters
- Threatened and Endangered Species
- Section 4(f) and Section 6(f) Properties
- Floodplain
- Regulated Materials

Appendix D4. Environmental Constraints Maps identify constraints in the study area such as schools, bike trails, rivers, wetlands, parks, and floodplain.

Construction Costs

Construction costs included the following components: Bridge, Retaining Wall, Pavement (Interstate and Ramps; Municipal Street), Contingency (20 percent), and Property Impact categories. Pavement area costs are assumed to include curb, shoulder, median, sidewalk, and drainage items. For cost estimating purposes, all retaining walls were assumed to have a constant height of 12 feet over their entire estimated length. Relocation costs are not included in the ROW cost estimates.

Preliminary Concept Comparison

The comparative assessment of the preliminary concepts is summarized in ***Table 3***. Additional detail of this process and subsequent evaluation results may be found in ***Appendix D2. Preliminary Concepts Tech Memo***.

Table 3. Preliminary Concepts Composite Comparative Assessment

PRELIMINARY CONCEPT		TRAFFIC ASSESSMENT			ENVIRON-MENTAL IMPACT	COST	ROW (acre)
		QUEUES	DELAY	TRAVEL TIME			
Minn-1	NE Ramp Realignment, SW Ramp Terminal Improvements	Very Good	Very Good	Good	Medium/ potential 4(f)	$2,400,000	3.2
Minn-2	NE Loop, NE & NW Ramp Realignment, SW Ramp Terminal	Very Good	Good	Good	Medium/ potential 4(f)	$5,100,000	3.4
Minn-2A	NE Loop, Aligned with 49th Street	Good	Neutral	Neutral	Medium/ potential 4(f)	$3,900,000	3.2
Minn-3	Partial Cloverleaf (Parclo), NE, NW & SW Ramp Realignment	Very Good	Good	Neutral	High/ likely 4(f)/6(f)	$8,100,000	3.4
Minn-4	Parclo, NE Loop Align with 49th Street. Eliminate Ramp in NW Quadrant	Good	Neutral	Neutral	High/ likely 4(f)/6(f)	$6,900,000	3.2
Minn-5	Diverging Diamond Interchange (DDI)	Very Good	Very Good	Neutral	Low	$8,300,000	0.1
Minn-6	DDI, South Shift	Very Good	Very Good	Neutral	High/ likely 4(f)/6(f)	$10,000,000	0.1
Minn-7	DDI, NE Ramp Aligned with 49th Street	Very Good	Very Good	Good	High/ likely 4(f)/6(f)	$11,700,000	3.1
Minn-8	Single Point Urban Interchange (SPUI)	Very Good	Very Good	Poor	High/ likely 4(f)/6(f)	$11,800,000	0.1
Minn-9	SPUI, NE Ramp Aligned with 49th Street	Very Good	Very Good	Neutral	High/ likely 4(f)/6(f)	$13,900,000	3.2
Minn-10	SPUI, South Off-Set	Very Good	Good	Poor	High/ likely 4(f)/6(f)	$23,100,000	0.1
Minn-11	SPUI, South Off-Set (2)	Very Good	Good	Poor	High/ likely 4(f)/6(f)	$21,400,000	0
Minn-12	SPUI, South Off-Set (3)	Very Good	Good	Poor	High/ likely 4(f)/6(f)	$19,300,000	0.1
Minn-C1	5-Lane Undivided with Access Closures	Poor	Poor	Neutral	Low	$1,000,000	1.3
Minn-C2	Unbalanced Lanes	Poor	Poor	Neutral	Medium/ potential 4(f)	$2,300,000	1.8
Minn-C3	Left Turns Off/No Left Turns On	Neutral	Good	Poor	Low	$1,300,000	1.3
Minn-C4	49th Street Right-in Right-out	Very Good	Very Good	Good	Low	$1,600,000	1.5

The preliminary concepts and associated comparative assessment were presented to the businesses, landowners, and public at Stakeholder Meetings and Public Open House on June 1, 2015 and June 2, 2015, respectively. A summary of the public involvement process and meeting notes can be found in **APPENDIX H. PUBLIC INVOLVEMENT**.

Based on the preliminary concept comparison and public feedback, the concepts were screened through an SAT workshop in July 2015 to select concepts for further development. The concepts selected for further refinement and development are as follows:

I-90 Exit 3 (Minnesota Avenue) Interchange

- ***Minn-2.*** NE Loop, NE & NW Ramp Realignment, SW Ramp Terminal
- ***Minn-5.*** Diverging Diamond Interchange (DDI)
- ***Minn-8.*** Single Point Urban Interchange (SPUI)

Minnesota Avenue Corridor

- ***Minn-C1.*** 5-Lane Undivided with Access Closures
- ***Minn-C3.*** Left Turns Off/No Left Turns On
- ***Minn-C4.*** 49th Street Right-in Right-out
    - Applies to Minn-5 only

It was noted that Minn-C4 only applied to Minn-5 (DDI) due to the proximity of the northern crossover intersection and the 49th Street intersection. The separation between the two precluded the opportunity to provide signalized full access at the 49th Street intersection with Minnesota Avenue.

Section 3.3 - Determination of Alternative Scenarios and Refinement

The next step in the concept development and analysis process was to develop alternative scenarios by combining interchange concepts with corridor concepts.

Conclusions from the July 2015 SAT workshop had identified six concept combinations, joining Minn-2, -5, -8 with Minn-C1, Minn-C3/C4. However, subsequent SAT meetings and further refinement and analysis continued to revise the original concepts towards the alternative scenarios that were part of the final evaluated set of alternative scenarios. The following describes the evolution of the conceptual design to the alternative scenarios.

Additional traffic operations analysis and discussions with the City of Sioux Falls refined the original Minnesota Avenue corridor concepts to the following alternatives:

- ***Minn-C.*** 5/4-Lane divided with access closures
    - 5/4 lanes with raised median and access closures north of I-229

- 4 lanes with raised median and access closures south of I-229

- ***Minn-D.*** 6/4-Lane divided with access closures
  - 6 lanes with raised median and access closures north of I-229
  - 4 lanes with raised median and access closures south of I-229

The differences between Minn-C and Minn-D were contained within the Minnesota Avenue segment from 41st Street to the Big Sioux River Bridge. Minn-C exhibits a 4-lane cross-section with raised median, but incorporates a third southbound lane through the 49th Street intersection that is dropped at the interchange to accommodate PM peak period commuter traffic. Minn-D exhibits a 6-lane cross-section with raised median, providing 3 lanes in each direction between the interchange and 41st Street. South of the bridge, both corridors depicted the same set of improvements that focused on a 4-lane divided cross-section with access and intersection improvements. Elements of Minn-C3 and Minn-C4 were maintained where applicable in the two refined corridors.

In subsequent SAT discussions, it was determined that a narrow median be inserted in Minn-8C and Minn-8D to not allow southbound off-ramp traffic to cross Minnesota Avenue and enter into the northbound left-turn lanes to 49th Street. The conceptual design permitted southbound off-ramp right-turn lanes to enter mid-segment of the northbound intersection channelization to 49th Street and would be expected to create safety and operational issues within this short Minnesota Avenue segment. The median would restrict this direct movement across traffic and force off-ramp traffic wishing to travel west on 49th Street to either make a U-turn on Minnesota Avenue or travel west on 41st Street.

Based on these conclusions and turn restriction incorporated into Minn-8C and Minn-8D, it was determined that Minn-9 be brought forward as it provides a southbound off-ramp direct connection to 49th Street. Minn-9 also provides a comparable SPUI counterpart to Minn-2 that incorporates a direct connection to 49th Street.

Incorporating the refinements to Minn-8C, Minn-8D, the Minnesota Avenue corridor concepts, and revising Minn-9D, the following alternatives scenarios were identified for continued refinement and detailed analysis:

- ***Minn-2C.*** 5/4-Lane Divided Corridor with NE Quadrant Loop and NE Ramp aligned with 49th Street
  - Interchange Option: Minn-2
  - Corridor Option: Minn-C
- ***Minn-2D.*** 6/4- Lane Divided Corridor with NE Quadrant Loop and NE Ramp aligned with 49th Street
  - Interchange Option: Minn-2
  - Corridor Option: Minn-D
- ***Minn-5D.*** 6/4-Lane Divided Corridor with DDI
  - Interchange Option: Minn-5
  - Corridor Option: Minn-C

- ***Minn-8C.*** 5/4-Lane Divided Corridor with SPUI
    - Interchange Option: Minn-8
    - Corridor Option: Minn-C
- ***Minn-8D.*** 6/4-Lane Divided Corridor with SPUI
    - Interchange Option: Minn-8
    - Corridor Option: Minn-D
- ***Minn-9D.*** 6/4-Lane Divided Corridor with SPUI and NE Ramp aligned with 49th Street
    - Interchange Option: Minn-9
    - Corridor Option: Minn-D

Alternative scenario figures are shown in ***APPENDIX D5. ALTERNATIVE SCENARIO FIGURES***.

Section 3.4 - Analysis of Alternative Scenarios

Detailed quantitative analyses of the alternative scenarios were conducted to assist the SAT in identifying which alternatives would be recommended for consideration in future studies. The five analysis components below were later combined with additional criteria that were presented to the SAT for each of the alternative scenarios:

- Predictive Crash
- Traffic Operations
- Year of Failure
- Noise
- Constructability

PREDICTIVE CRASH ANALYSIS

A predictive crash analysis was conducted for freeway ramps and the ramp terminal intersections at each of the I-229 MIS sub-study locations. The predictive safety analysis was based on principles and methods contained within the ***Highway Safety Manual (HSM)***.

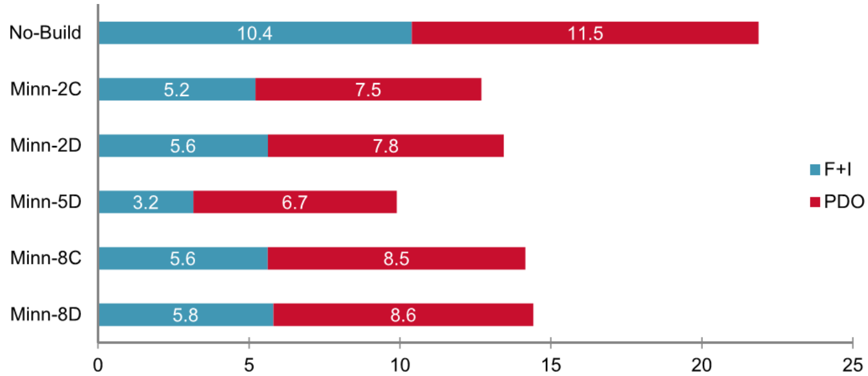
Two comparative analyses were developed for this sub-study, looking at the predicted crashes between:

- Existing Conditions (Year 2012) and Future No-Build Conditions (Year 2035), and
- No-Build and Build Conditions at I-229 Exit 3 (Minnesota Avenue) interchange

The predicted annual crash frequencies for the No-Build and Build alternative scenarios (from 2012 to 2035) are presented in ***TABLE 4***. The total predicted crashes were categorized between Fatal + Injury (F+I) and Property Damage Only (PDO) crashes.

The arterial intersection of 49th Street was included in all analysis scenarios, accounting for whether the intersection included a direct connection to the southbound off-ramp, to provide a similar comparison across all alternative scenarios.

Table 4. Minnesota Avenue Corridor 2012-2035 Predicted Build and No-Build Annual Crashes



Planning horizon crash cost savings were calculated for the No-Build conditions and alternative scenarios over the predictive crash analysis timeframe of 2012 to 2035. Crash cost savings of each alternative scenario when compared to the No-Build alternative are shown in ***TABLE 5***.

Table 5. Minnesota Avenue Corridor Planning Horizon Crash Cost Savings

ALTERNATIVE	TOTAL USER COST[1]	USER COST SAVINGS[2]
No-Build	$ 64,600,000	
Minn-2C	$ 32,000,000	$ 32,600,000
Minn-2D	$ 34,400,000	$ 30,200,000
Minn-5D	$ 20,000,000	$ 44,600,000
Minn-8C	$ 34,500,000	$ 30,100,000
Minn-8D	$35,600,000	$ 29,000,000

[1]Total User Cost – The discounted, monetized safety cost from the crashes totaled for all years in the period 2012-2035 (rounded to $100,000).
[2]User Cost Savings - The discounted, monetized safety benefit from the crashes reduced by a scenario (compared to a baseline of No-Build) totaled for all years in the period 2012-2035 (rounded to $100,000).

Overall, it was found that all alternative scenarios are expected to decrease crashes when compared to the No-Build alternative. This predicted decrease was consistent across both Fatal + Injury and PDO crashes, and reflected in the 'User Cost Savings' in ***TABLE 5***. Additional detail from the Predictive Crash Analysis can be found in ***APPENDIX E. PREDICTIVE SAFETY ANALYSIS***.

TRAFFIC OPERATIONS ANALYSIS

Traffic operations were analyzed for each alternative scenario using ***Highway Capacity Software 2010 (HCS 2010) Version 6.50***. A detailed report of the alternative scenario operations can be found in ***APPENDIX C. 2035 NO-BUILD AND BUILD OPERATIONAL ANALYSIS TECHNICAL MEMORANDUM***.

For all six alternative scenarios, the design features provide acceptable LOS C or better at all ramp terminal intersections and meet the operational goals of the study. The design also provides LOS D or better at the signalized intersections of 41st Street, 49th Street (in Minn-8C and Minn-8D), and Lotta Street.

The traffic operations LOS results with 2035 Build conditions traffic volumes are summarized in the following figures for each respective alternatives scenario:

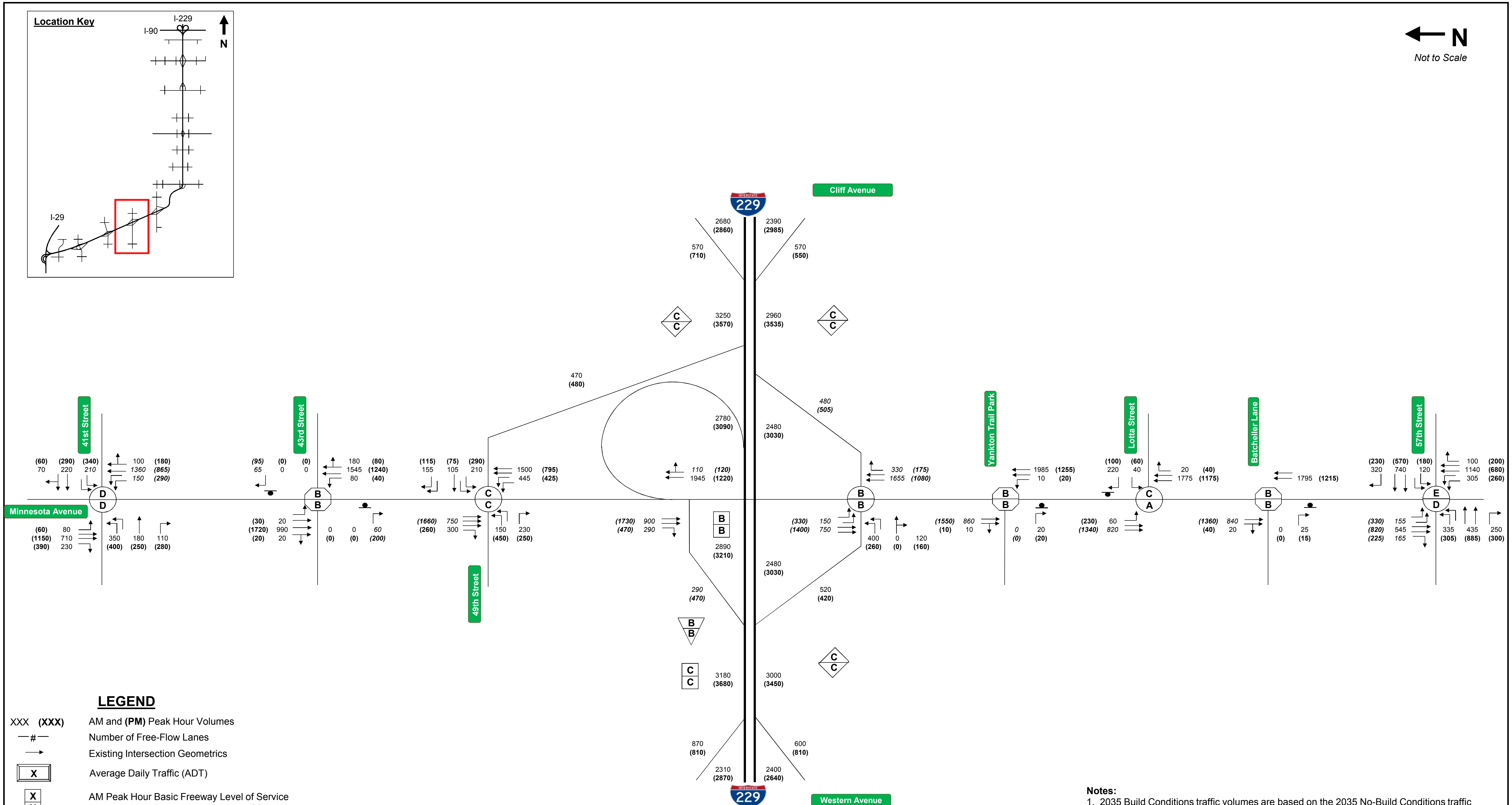
- ***Minn-2C.*** Figure 5
- ***Minn-2D.*** Figure 6
- ***Minn-5D.*** Figure 7
- ***Minn-8C.*** Figure 8
- ***Minn-8D.*** Figure 9
- ***Minn-9D.*** Figure 10

North of I-229, the primary Minnesota Avenue corridor operational constraints occurred at the 49th Street intersection and 41st Street intersection. It was found that at minimum, a third southbound lane was needed through the 49th Street intersection to accommodate the high PM peak hour demand. This layout is represented in the Minn-C type corridors. Minn-D corridors extended the third southbound lane between 41st Street and the southbound I-229 ramp terminal as well as adding third northbound lane. While this corridor is not necessarily needed to meet the operational goals of this study, it was developed to provide an alternative with continuous lanes between 41st Street, incorporate additional capacity, and to evaluate potential impacts of a 6-lane cross-section.

The improvements proposed at the Minnesota Avenue and 57th Street intersection as part of this study were not able to achieve a LOS D in the AM peak period. The proposed improvements focused on opportunities to increase capacity within the study area, thus were limited to the intersection. Dual left-turn lanes and right-turn lanes were added or maintained, but no additional through lanes were incorporated.

At this time, the City of Sioux Falls does not have long-term plans to widen either roadway through the intersection for additional through lanes. Further, the intersection operates in isolation from adjacent major intersections where logical lane drops would be available. Therefore, lanes would likely need to be carried to the next arterial intersection, typically 1-mile to the east (Cliff Avenue), west (Western Avenue), and south (69th Street), and would represent a significant investment outside of this project's study area. Upon discussions with the City of Sioux Falls and investigation of potential opportunities to construct additional through lanes on either Minnesota Avenue or 57th Street, it was concluded that the future-year traffic volumes would be monitored for future consideration.

Stop-controlled approach LOS was also improved with the inclusion of ¾ access or right-in right-out access along the Minnesota Avenue corridor. The lone exception occurred at 49th Street in the Minn-5D concept where LOS was measured at F due to the high southbound Minnesota Avenue and eastbound 49th Street right-turn demand. Adequate gaps in southbound traffic for this right-turn movement were not available, thus resulted in a LOS F measure.



LEGEND

XXX **(XXX)** AM and **(PM)** Peak Hour Volumes

—#— Number of Free-Flow Lanes

→ Existing Intersection Geometrics

X Average Daily Traffic (ADT)

X / X AM Peak Hour Basic Freeway Level of Service; PM Peak Hour Basic Freeway Level of Service

X / X AM Peak Hour Ramp Merge Level of Service; PM Peak Hour Ramp Merge Level of Service

X / X AM Peak Hour Ramp Diverge Level of Service; PM Peak Hour Ramp Diverge Level of Service

X / X AM Peak Hour Weaving Section Level of Service; PM Peak Hour Weaving Section Level of Service

X / X AM Peak Hour Signalized Intersection Level of Service; PM Peak Hour Signalized Intersection Level of Service

X / X AM Peak Hour Unsignalized Intersection Level of Service; PM Peak Hour Unsignalized Intersection Level of Service

Notes:

1. 2035 Build Conditions traffic volumes are based on the 2035 No-Build Conditions traffic volumes, derived from the Sioux Falls travel demand model. They have been adjusted, as needed, to reflect applicable turning movements within the respective Build scenario.
2. Worst case stop controlled approach Level of Service reported

HRGreen

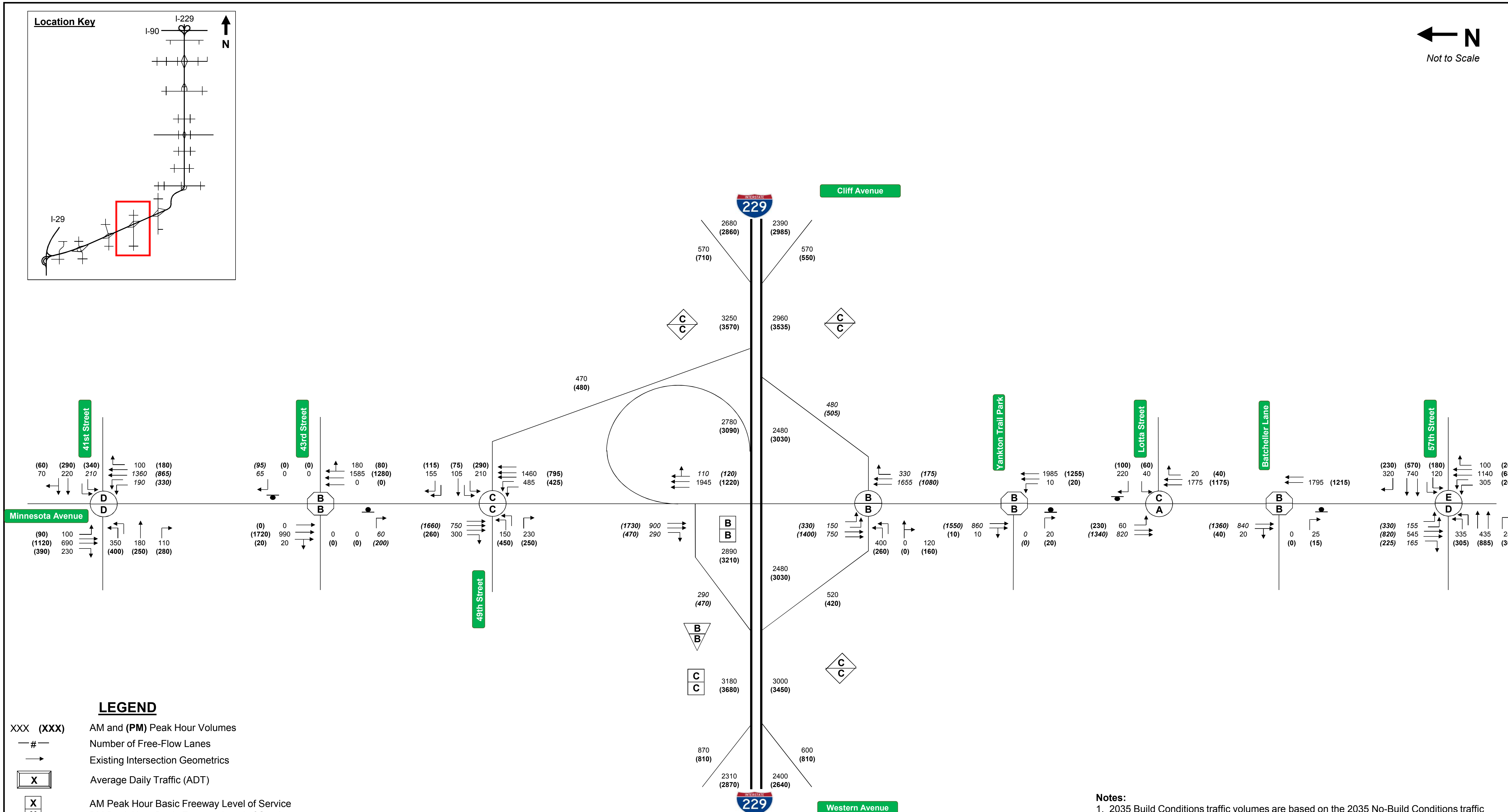
2035 Build Conditions Traffic Operations

Minn-2C

I-229 Major Investment Corridor Study: Sub-Study 2
Sioux Falls, South Dakota

Date: June 2017

Figure: 5



LEGEND

XXX **(XXX)**	AM and **(PM)** Peak Hour Volumes
—#—	Number of Free-Flow Lanes
→	Existing Intersection Geometrics
X	Average Daily Traffic (ADT)
X / X	AM Peak Hour Basic Freeway Level of Service PM Peak Hour Basic Freeway Level of Service
X / X	AM Peak Hour Ramp Merge Level of Service PM Peak Hour Ramp Merge Level of Service
X / X	AM Peak Hour Ramp Diverge Level of Service PM Peak Hour Ramp Diverge Level of Service
X / X	AM Peak Hour Weaving Section Level of Service PM Peak Hour Weaving Section Level of Service
X / X	AM Peak Hour Signalized Intersection Level of Service PM Peak Hour Signalized Intersection Level of Service
X / X	AM Peak Hour Unsignalized Intersection Level of Service PM Peak Hour Unsignalized Intersection Level of Service

Notes:
1. 2035 Build Conditions traffic volumes are based on the 2035 No-Build Conditions traffic volumes, derived from the Sioux Falls travel demand model. They have been adjusted, as needed, to reflect applicable turning movements within the respective Build scenario.
2. Worst case stop controlled approach Level of Service reported

HRGreen

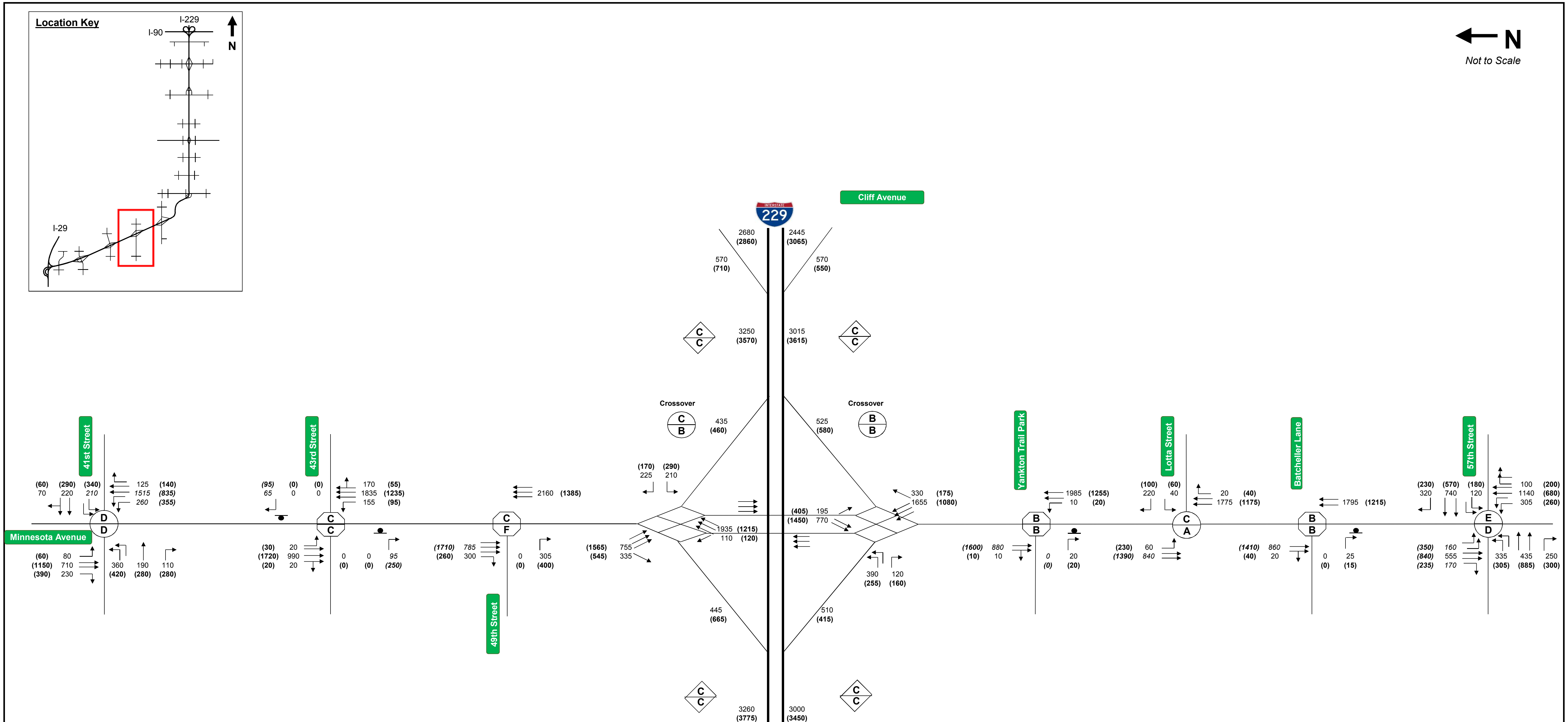
2035 Build Conditions Traffic Operations

Minn-2D

I-229 Major Investment Corridor Study: Sub-Study 2
Sioux Falls, South Dakota

Date: June 2017

Figure: 6



LEGEND

XXX (XXX)	AM and **(PM)** Peak Hour Volumes
—#—	Number of Free-Flow Lanes
→	Existing Intersection Geometrics
X	Average Daily Traffic (ADT)
X / X	AM Peak Hour Basic Freeway Level of Service PM Peak Hour Basic Freeway Level of Service
X / X	AM Peak Hour Ramp Merge Level of Service PM Peak Hour Ramp Merge Level of Service
X / X	AM Peak Hour Ramp Diverge Level of Service PM Peak Hour Ramp Diverge Level of Service
X / X	AM Peak Hour Weaving Section Level of Service PM Peak Hour Weaving Section Level of Service
X / X	AM Peak Hour Signalized Intersection Level of Service PM Peak Hour Signalized Intersection Level of Service
X / X	AM Peak Hour Unsignalized Intersection Level of Service PM Peak Hour Unsignalized Intersection Level of Service

Notes:
1. 2035 Build Conditions traffic volumes are based on the 2035 No-Build Conditions traffic volumes, derived from the Sioux Falls travel demand model. They have been adjusted, as needed, to reflect applicable turning movements within the respective Build scenario.
2. Worst case stop controlled approach Level of Service reported

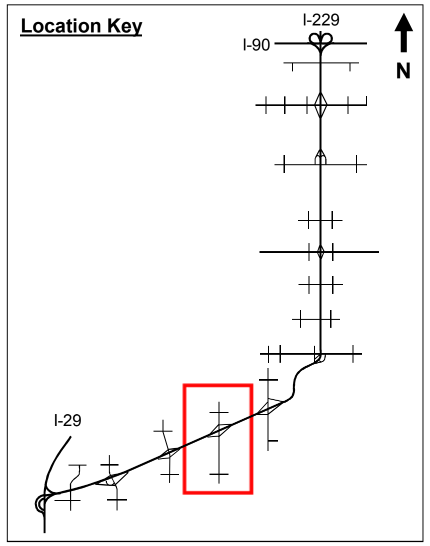
HRGreen

2035 Build Conditions Traffic Operations
Minn-5D

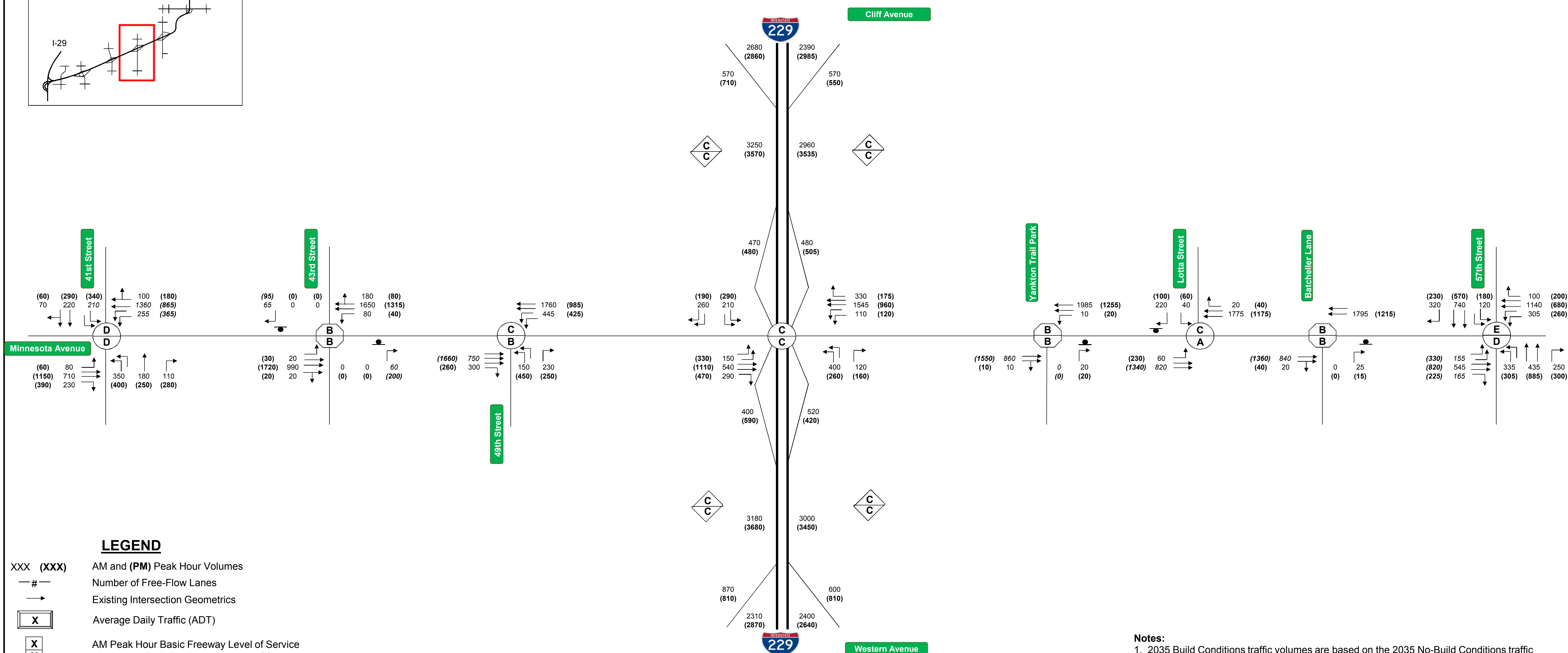
I-229 Major Investment Corridor Study: Sub-Study 2
Sioux Falls, South Dakota

Date: June 2017

Figure: 7



N
Not to Scale



LEGEND

XXX **(XXX)**	AM and **(PM)** Peak Hour Volumes
—#—	Number of Free-Flow Lanes
→	Existing Intersection Geometrics
X	Average Daily Traffic (ADT)
X / X	AM Peak Hour Basic Freeway Level of Service PM Peak Hour Basic Freeway Level of Service
X / X	AM Peak Hour Ramp Merge Level of Service PM Peak Hour Ramp Merge Level of Service
X / X	AM Peak Hour Ramp Diverge Level of Service PM Peak Hour Ramp Diverge Level of Service
X / X	AM Peak Hour Weaving Section Level of Service PM Peak Hour Weaving Section Level of Service
X / X	AM Peak Hour Signalized Intersection Level of Service PM Peak Hour Signalized Intersection Level of Service
X / X	AM Peak Hour Unsignalized Intersection Level of Service PM Peak Hour Unsignalized Intersection Level of Service

Notes:
1. 2035 Build Conditions traffic volumes are based on the 2035 No-Build Conditions traffic volumes, derived from the Sioux Falls travel demand model. They have been adjusted, as needed, to reflect applicable turning movements within the respective Build scenario.
2. Worst case stop controlled approach Level of Service reported

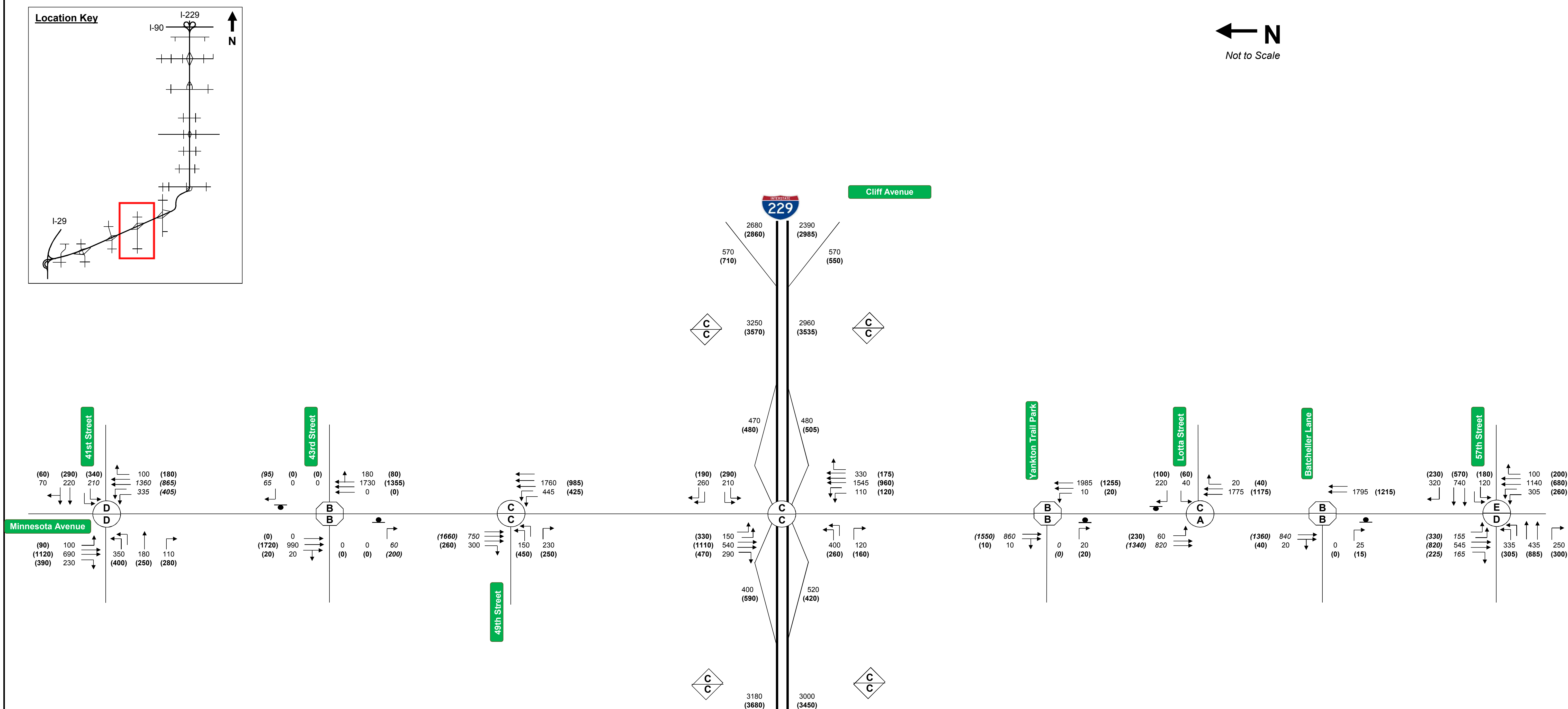
HRGreen

2035 Build Conditions Traffic Operations
Minn-8C

I-229 Major Investment Corridor Study: Sub-Study 2
Sioux Falls, South Dakota

Date: June 2017

Figure: 8



LEGEND

XXX (XXX)	AM and **(PM)** Peak Hour Volumes
—#—	Number of Free-Flow Lanes
→	Existing Intersection Geometrics
X	Average Daily Traffic (ADT)
X / X	AM Peak Hour Basic Freeway Level of Service PM Peak Hour Basic Freeway Level of Service
X / X	AM Peak Hour Ramp Merge Level of Service PM Peak Hour Ramp Merge Level of Service
X / X	AM Peak Hour Ramp Diverge Level of Service PM Peak Hour Ramp Diverge Level of Service
X / X	AM Peak Hour Weaving Section Level of Service PM Peak Hour Weaving Section Level of Service
X / X	AM Peak Hour Signalized Intersection Level of Service PM Peak Hour Signalized Intersection Level of Service
X / X	AM Peak Hour Unsignalized Intersection Level of Service PM Peak Hour Unsignalized Intersection Level of Service

Notes:

1. 2035 Build Conditions traffic volumes are based on the 2035 No-Build Conditions traffic volumes, derived from the Sioux Falls travel demand model. They have been adjusted, as needed, to reflect applicable turning movements within the respective Build scenario.
2. Worst case stop controlled approach Level of Service reported

HRGreen

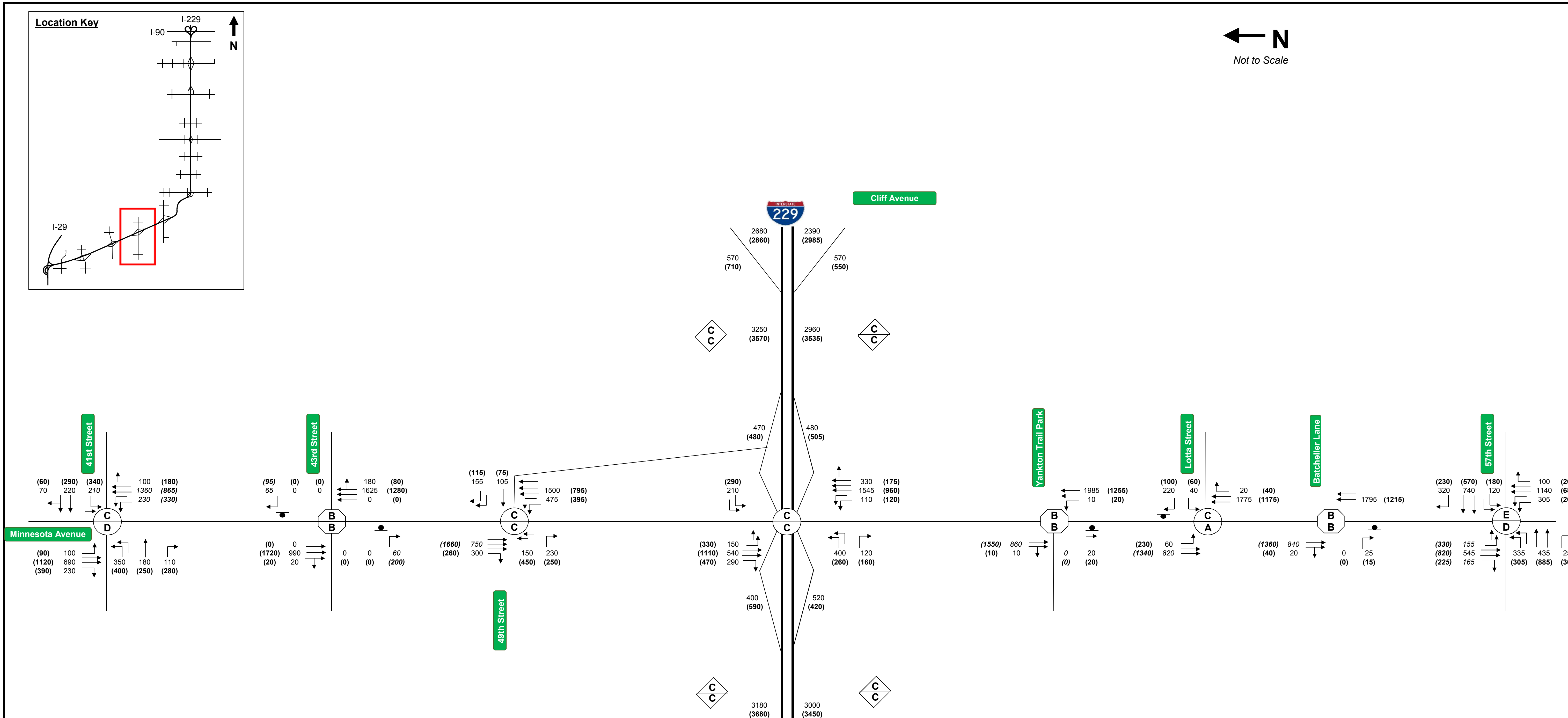
2035 Build Conditions Traffic Operations

Minn-8D

I-229 Major Investment Corridor Study: Sub-Study 2
Sioux Falls, South Dakota

Date: June 2017

Figure: 9



LEGEND

XXX **(XXX)** AM and **(PM)** Peak Hour Volumes

—#— Number of Free-Flow Lanes

Existing Intersection Geometrics

X Average Daily Traffic (ADT)

X / X AM Peak Hour Basic Freeway Level of Service / PM Peak Hour Basic Freeway Level of Service

X / X AM Peak Hour Ramp Merge Level of Service / PM Peak Hour Ramp Merge Level of Service

X / X AM Peak Hour Ramp Diverge Level of Service / PM Peak Hour Ramp Diverge Level of Service

X / X AM Peak Hour Weaving Section Level of Service / PM Peak Hour Weaving Section Level of Service

X / X AM Peak Hour Signalized Intersection Level of Service / PM Peak Hour Signalized Intersection Level of Service

X / X AM Peak Hour Unsignalized Intersection Level of Service / PM Peak Hour Unsignalized Intersection Level of Service

Notes:

1. 2035 Build Conditions traffic volumes are based on the 2035 No-Build Conditions traffic volumes, derived from the Sioux Falls travel demand model. They have been adjusted, as needed, to reflect applicable turning movements within the respective Build scenario.
2. Worst case stop controlled approach Level of Service reported

HRGreen

2035 Build Conditions Traffic Operations

Minn-9D

I-229 Major Investment Corridor Study: Sub-Study 2
Sioux Falls, South Dakota

Date: June 2017

Figure: 10

Year of Failure Analysis

A year of failure analysis was conducted for the alternative scenario interchanges in order to identify the year beyond the 2035 forecast Future / Design year (2035) when traffic operations fail to meet acceptable criteria. Projected traffic volumes beyond year 2035 were developed using straight-line extrapolation between year 2012 adjusted peak hour volumes and year 2035 adjusted peak hour volumes. Potential years of failure were evaluated in 5-year increments up to the identified year of failure.

The resulting year of failure for the No-Build and Build alternatives is shown in ***Table 6***.

Table 6. Minnesota Avenue Corridor Year of Failure

ALTERNATIVE	YEAR OF FAILURE
No-Build	Already Failing
Minn-2C	2045
Minn-2D	2045
Minn-5D	2060
Minn-8C	2040
Minn-8D	2060
Minn-9D	2045

Additional detail from the Year of Failure Analysis can be found in ***Appendix F. Year of Failure Analysis***.

Noise Analysis

A traffic noise analysis was conducted along the Minnesota Avenue corridor area of influence for the nine alternative scenarios. The analysis included traffic noise monitoring and modeling. HDR used the ***FHWA Traffic Noise Model (TNM), Version 2.5***, to evaluate projected traffic noise levels under both existing conditions and the alternative scenarios (Build alternatives). Basic model inputs are:

- Existing and Preliminary project concept and geometry
- 2012 and 2035 traffic volumes in the study area
- The operational speed for I-229: 65 miles per hour (mph); arterial streets: 30-45 mph

Traffic noise impacts were identified in accordance with SDDOT Noise Analysis and Abatement Guidance (July 13, 2011), which is intended to supplement FHWA traffic noise and abatement regulations and guidance. The Guidance provides procedures for noise studies and noise abatement measures to help protect the public health and welfare, to supply noise abatement criteria, and to establish requirements for traffic noise information to be given to those officials who have planning and zoning authority.

Noise abatement measures are considered when predicted traffic noise levels approach or exceed the Noise Abatement Criteria (NAC), or when the predicted traffic noise levels substantially exceed existing noise levels.

Table 7 shows the number of traffic noise impacts predicted under each alternative.

Table 7. Noise Impact Summary

ALTERNATIVE	APPROACH/ EXCEED NAC	SUBSTANTIALLY EXCEED	TOTAL RECEPTORS AFFECTED
Existing	2	0	2
Minn-2C	2	0	2
Minn-2D	1	0	1
Minn-5D	2	0	2
Minn-8C	2	0	2
Minn-8D	1	0	1
Minn-9D	*Not evaluated*	*Not evaluated*	*Not evaluated*

Due to the timeframe in which Minn-9D was brought forward compared to the other Build alternatives, it was not analyzed as part of this project's noise study. However, it could be assumed that results would be similar to the other alternatives, particularly Minn-2D and Minn-8D.

Potential noise abatement measures could be considered for all alternative scenarios. Further investigation into the feasibility and reasonability (noise reduction goal, cost-effectiveness, and viewpoints of benefited receptors) would need to occur once a preferred alternative is selected.

A detailed technical memorandum describing the noise analysis can be found in ***Appendix G. Sub-Study 2 Noise Study Technical Report***. This memo includes a discussion of the conceptual feasibility of noise mitigation options in areas where future noise levels exceed state and federal criteria.

CONSTRUCTABILITY

A constructability analysis was conducted for the alternative scenarios in order to assess potential construction phasing, maintenance of traffic, and general timeframe.

I-229 Exit 3 improvements are tied to Minnesota Avenue corridor improvements north of I-229 due to lane additions, lane drops, and other operational needs to meet the study goals. The existing Big Sioux River Bridge is maintained in all alternative scenarios and Minnesota Avenue corridor improvements south of the bridge are not tied to operational needs at the interchange. Therefore, the Big Sioux River Bridge provides a logical breakpoint in potential improvements. The improvements south of the Big Sioux River could be constructed in conjunction with the interchange improvements; however, it would not necessarily be paramount for the operational viability of the interchange.

Table 8 shows three constructability aspects reviewed as part of this study. The corridor south of the Big Sioux River Bridge is shown separately and could be constructed within the timeframe noted for the Interchange and Corridor North of I-229 segment.

Table 8. Constructability Analysis

ALTERNATIVE	MAINTENANCE OF TRAFFIC COMPLEXITY	ALLOWS FOR PHASED CONSTRUCTION	ESTIMATED CONSTRUCTION TIME FRAME (MONTHS)	
			Interchange and Corridor North of I-229	Corridor South of I-229
Minn-2C	Low	Yes	21	12
Minn-2D	Low	Yes	21	12
Minn-5D	High	Yes	24	12
Minn-8C	Medium	Yes	24	12
Minn-8D	Medium	Yes	24	12
Minn-9D	Medium	Yes	24	12

It is anticipated that all of the alternative scenarios will allow for phased construction. Further construction analysis would need to occur during future studies and continue through the design process.

Section 3.5 - Recommendation of Alternatives for Future Consideration

An evaluation matrix was developed to assess and compare the alternative scenarios using the following criteria categories:

- Driver/Public Perception
- Construction Impacts
- Traffic Operations & Safety
- Property Impacts
- Environmental
- Pedestrians
- Cost

During the preliminary concept comparison stage (***Section 3.2***) of this study, DTA model results were utilized to assess traffic operations. As the project transitioned to the concept refinement stage, traffic operations were also assessed using HCS 2010. HCS 2010 allowed the study team to develop a more refined and detailed design reflecting lane geometry and traffic signal operations. HCS 2010 also allows for the direct calculation of key traffic operations measures under a single-design volume set for each sub-study, which cannot be achieved using a DTA model. For these reasons, the traffic operations evaluation matrix reports an MOE summary of the HCS 2010 operations analysis.

The alternative scenarios evaluation matrix was reviewed with the SAT during a workshop in September 2016 to determine which alternative scenarios should be recommended to advance for future studies.

The evaluation matrix for the alternative scenarios is summarized as shown in ***TABLE 9***.

Based on the evaluation, five alternative scenarios are recommended to advance for future studies along with No-Build alternative:

- ***Minn-2C.*** 5/4-Lane Divided Corridor with NE Quadrant Loop and NE Ramp aligned with 49th Street
- ***Minn-2D.*** 6/4- Lane Divided Corridor with NE Quadrant Loop and NE Ramp aligned with 49th Street
- ***Minn-9D.*** 6/4-Lane Divided Corridor with SPUI and NE Ramp aligned with 49th Street

Minn-5D was not recommended to advance for future studies because it failed to meet a City of Sioux Falls' goal to provide full access at the 49th Street intersection. Due to the close proximity of 49th Street with the northern interchange crossover intersection, the 49th Street intersection could only be maintained as right-in right-out for 49th Street. The City of Sioux Falls has a long-term goal of extending 49th Street west from Minnesota Avenue to the existing 49th Street corridor in order to alleviate some of the demand and congestion on 41st Street by providing a parallel east/west connection. A less than full-access intersection at 49th Street and Minnesota Avenue would likely have a notable impact to the viability of 49th Street being an attractive parallel route for 41st Street traffic.

FIGURES 11 THROUGH 14 illustrate the alternative scenarios recommended to advance. ***FIGURE 14*** represents the Minnesota Avenue corridor south of the Big Sioux River Bridge that is applicable to each alternative scenario.

Table 9. Alternative Scenarios Evaluation Matrix
I-229/Minnesota Avenue Interchange/Corridor Construction

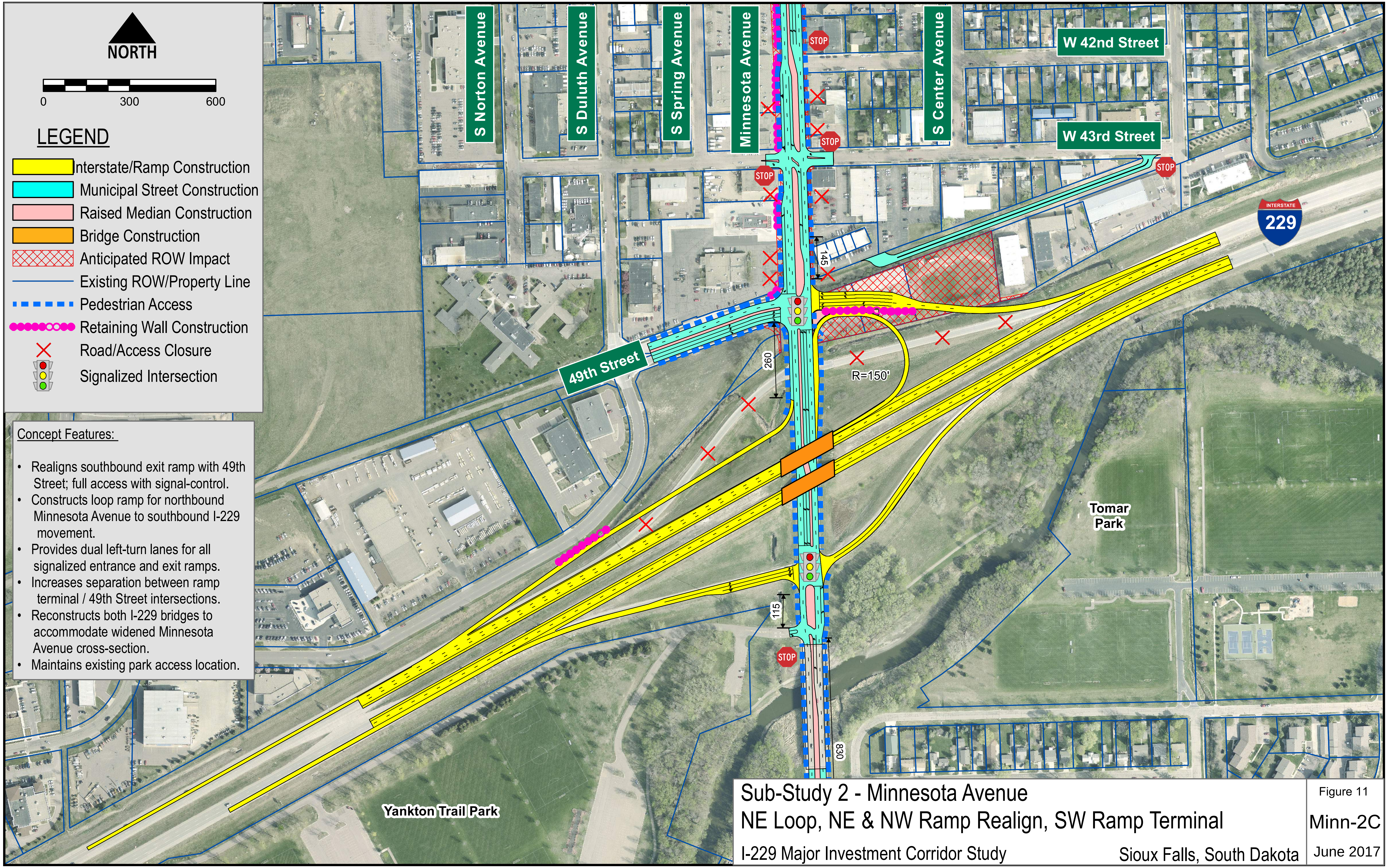
Sub-Study 2

Option	Description	Driver/ Public Perception	Construction Impacts		Traffic Operations & Safety												Property Impacts				Environmental	Pedestrians	Cost	Recommendation
		Driver familiarity/ expectancy	Maintenance of traffic during construction	Allows for phased construction	2035 Total interchange delay (Average AM/PM Peak)	Year of Failure[1]	2035 Traffic operations at northbound ramp terminal intersection		2035 Traffic operations at southbound ramp terminal intersection		2035 Traffic operations at Minnesota Ave. / 57th St.		2035 Traffic operations at Minnesota Ave. / 41st St.		Planning Horizon Crash Cost Savings[1,2]	Number of closed access points	Total residential acqusitions	Total business acquisitions	Total ROW Required (Acres)	Environmental Impacts	Pedestrian accomodations on both sides	Total cost (including ROW)	
					Sec/Veh	Year	LOS AM / PM	Intersection Delay AM / PM (sec)	LOS AM / PM	Intersection Delay AM / PM (sec)	LOS AM / PM	Intersection Delay AM / PM (sec)	LOS AM / PM	Intersection Delay AM / PM (sec)	M $							M $	
No-Build		Good	N/A	N/A	57.9	< 2035	E / C	76.2 / 23.4	C / B	22.7 / 14.8	F / F	86.9 / 93.2	E / F	60.5 / 99.2	-	N/A	N/A	N/A	N/A	Low	Yes	N/A	Advance
Minn-2C	Diamond w/loop; Dir. Connect to 49th St; 5/4-lane corridor	Good	Good	Yes	40.5	2045	B / B	17.1 / 19.6	C / C	28.1 / 31.2	E / D	68.8 / 49.2	D / D	38.6 / 43.5	$32.6	10	0	3	5.3	Medium	Yes	$37.5	Advance
Minn-2D	Diamond w/loop; Dir. Connect to 49th St; 6/4-lane corridor	Good	Good	Yes	40.2	2045	B / B	14.9 / 19.7	C / C	27.5 / 31.0	E / D	68.8 / 49.2	D / D	36.9 / 43.8	$30.1	10	0	4	6.3	Medium	Yes	$38.9	Advance
Minn-5D	DDI with 6/4-lane corridor; 49th RIRO	Fair	Fair	Yes	34.6	2060	B / B	16.9 / 16.3	C / B	28.1 / 17.6	E / D	71.8 / 49.5	D / D	37.4 / 52.7	$44.6	12	0	0	2.5	Low	Yes	$37.1	Eliminate
Minn-8C	SPUI with 5/4-lane corridor; 49th full access	Good	Fair	Yes	34.3	2040	C / C	34.6 / 33.9	N/A	N/A	E / D	66.7 / 47.5	D / D	39.1 / 48.4	$30.1	12	0	1	3.4	High	Yes	$40.9	Eliminate
Minn-8D	SPUI with 6/4-lane corridor; 49th full access	Good	Fair	Yes	30.7	2060	C / C	28.4 / 33.0	N/A	N/A	E / D	66.7 / 47.5	D / D	37.6 / 47.5	$29.0	12	0	1	3.7	High	Yes	$41.4	Eliminate
Minn-9D	SPUI with 6/4-lane corridor; Direct connection to 49th Street	Good	Fair	Yes	30.9	2045	C / C	24.8 / 31.7	C / C	34.0 / 33.0	E / D	66.7 / 47.5	C / D	34.3 / 46.2	Note 3	12	0	4	6.5	High	Yes	$42.9	Advance

[1]Year of Failure and Predictive Safety analysis include ramp terminal intersections and in general do not include non-ramp terminal intersections

[2]Planning Horizon Cost Savings - The discounted, monetized safety benefit from the crashes reduced by a scenario (compared to a baseline of No-Build) totaled for all years in the period 2012-2035

[3]Planning Horizon Cost Savings - See Appendix E Predictive Safety Analysis for qualitative assessment of predictive safety for Minn-9D



Concept Features:

- Realigns southbound exit ramp with 49th Street; full access with signal-control.
- Constructs loop ramp for northbound Minnesota Avenue to southbound I-229 movement.
- Provides dual left-turn lanes for all signalized entrance and exit ramps.
- Increases separation between ramp terminal / 49th Street intersections.
- Reconstructs both I-229 bridges to accommodate widened Minnesota Avenue cross-section.
- Maintains existing park access location.

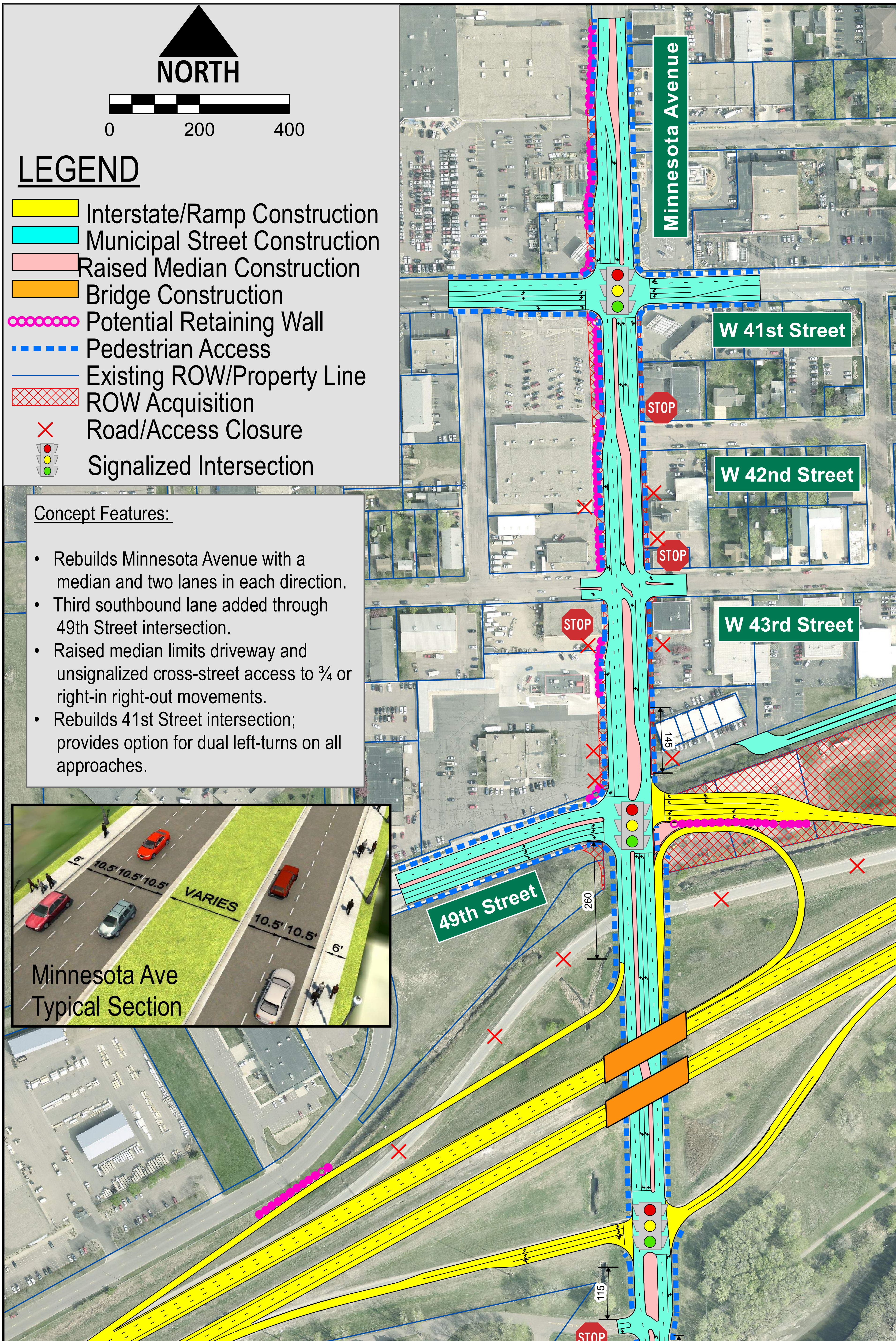
Sub-Study 2 - Minnesota Avenue
NE Loop, NE & NW Ramp Realign, SW Ramp Terminal

I-229 Major Investment Corridor Study — Sioux Falls, South Dakota

Figure 11

Minn-2C

June 2017



Sub-Study 2 - Minnesota Avenue

Minn-2: 41st Street to Yankton Trail Park Access

I-229 Major Investment Corridor Study

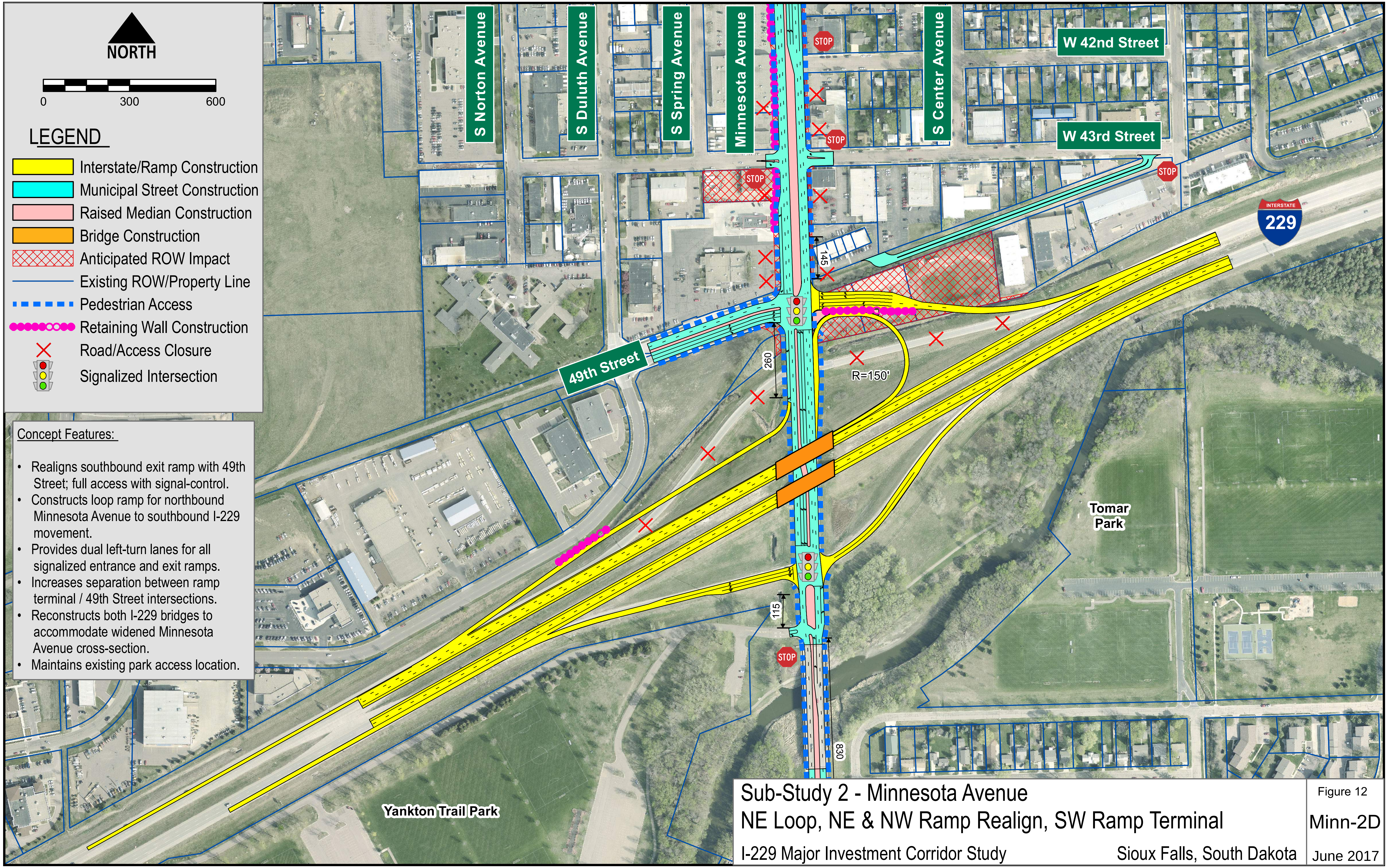
Sioux Falls, South Dakota

Figure 11 (cont.)

Minn-2C

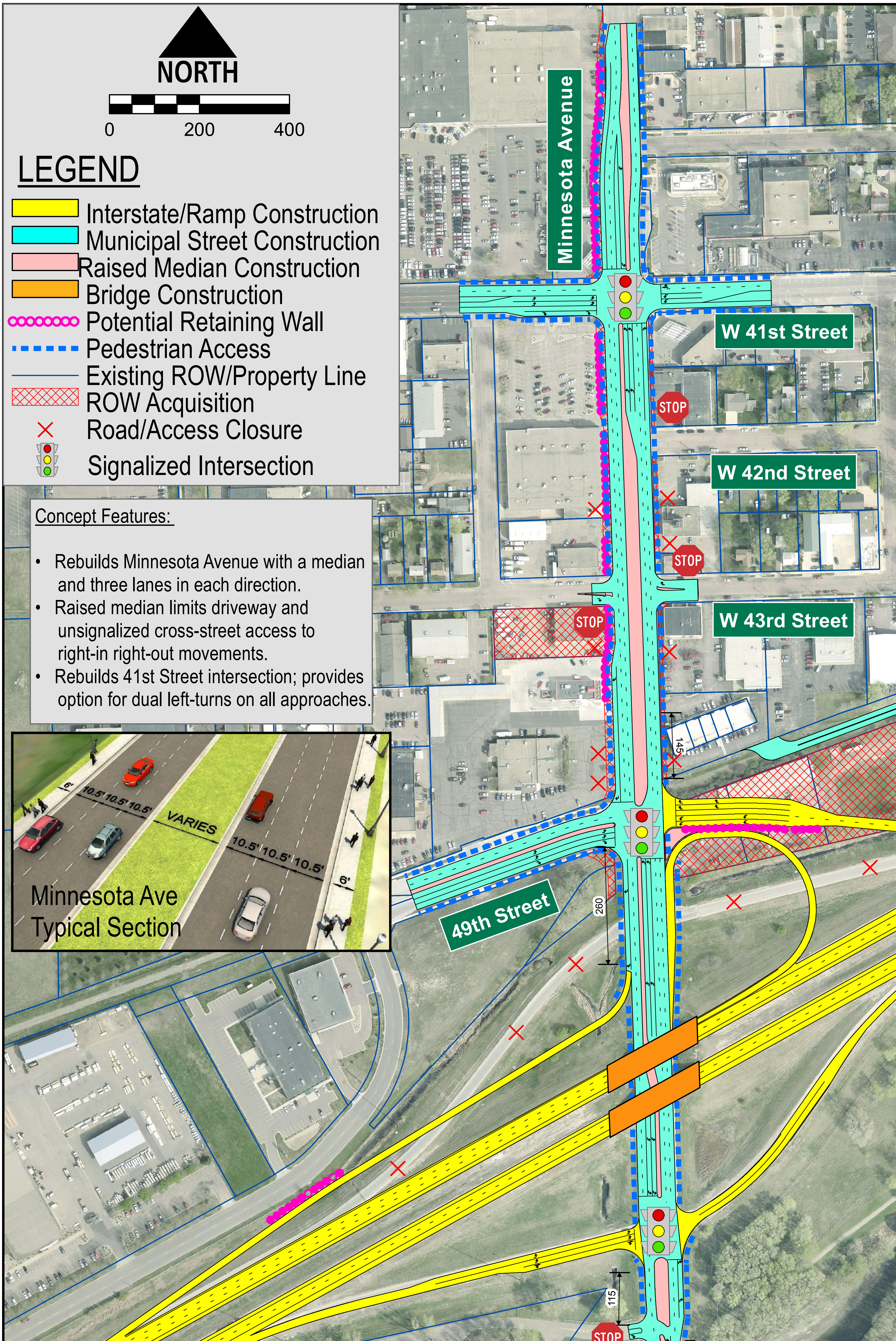
(North)

June 2017



Sub-Study 2 - Minnesota Avenue
NE Loop, NE & NW Ramp Realign, SW Ramp Terminal
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota

Figure 12
Minn-2D
June 2017



Sub-Study 2 - Minnesota Avenue

Minn-2: 41st Street to Yankton Trail Park Access

I-229 Major Investment Corridor Study

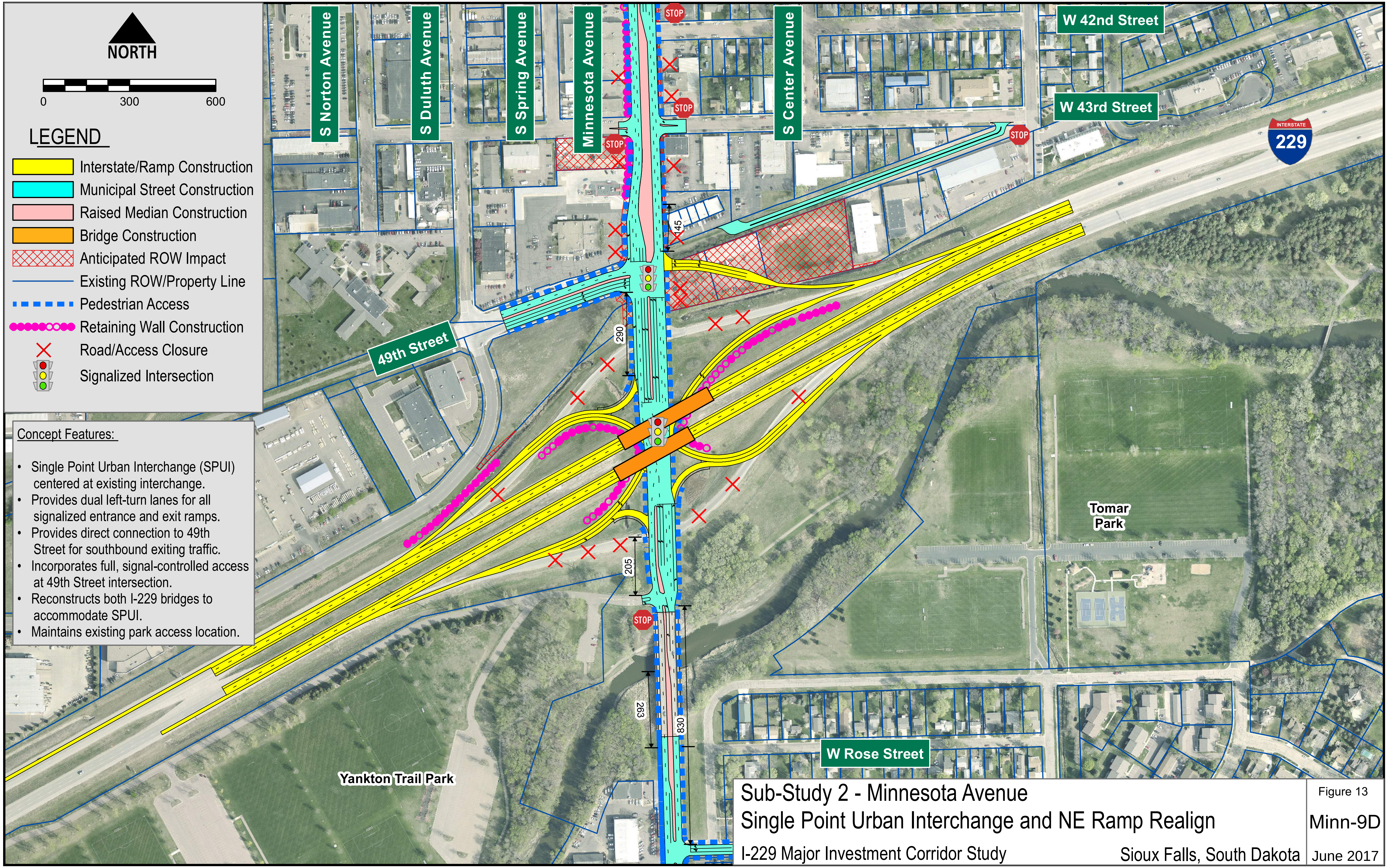
Sioux Falls, South Dakota

Figure 12 (cont.)

Minn-2D

(North)

June 2017



Concept Features:

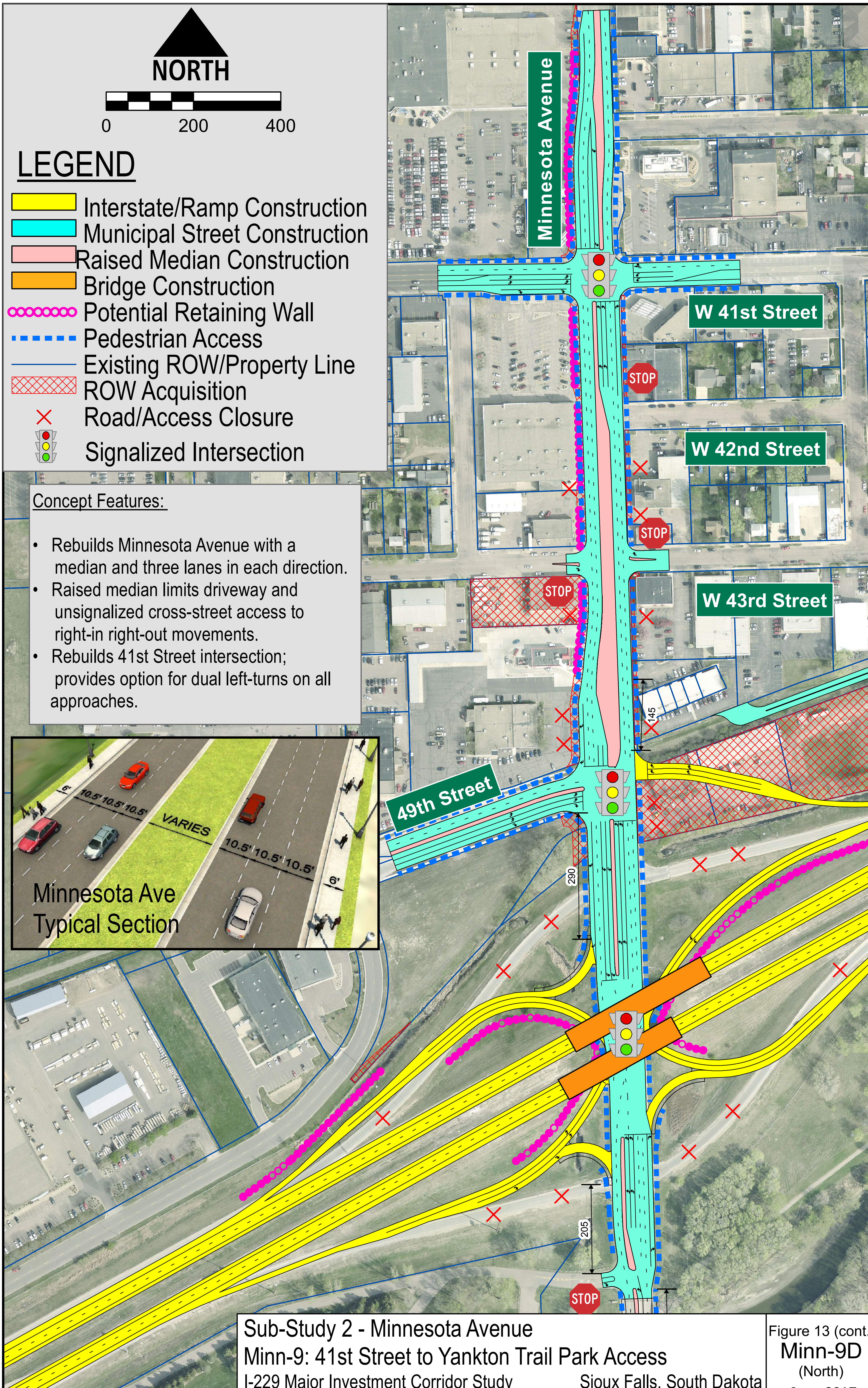
- Single Point Urban Interchange (SPUI) centered at existing interchange.
- Provides dual left-turn lanes for all signalized entrance and exit ramps.
- Provides direct connection to 49th Street for southbound exiting traffic.
- Incorporates full, signal-controlled access at 49th Street intersection.
- Reconstructs both I-229 bridges to accommodate SPUI.
- Maintains existing park access location.

Sub-Study 2 - Minnesota Avenue
Single Point Urban Interchange and NE Ramp Realign

I-229 Major Investment Corridor Study

Sioux Falls, South Dakota

Figure 13
Minn-9D
June 2017



Concept Features:

- Rebuilds Minnesota Avenue with a median and three lanes in each direction.
- Raised median limits driveway and unsignalized cross-street access to right-in right-out movements.
- Rebuilds 41st Street intersection; provides option for dual left-turns on all approaches.

Sub-Study 2 - Minnesota Avenue

Minn-9: 41st Street to Yankton Trail Park Access

I-229 Major Investment Corridor Study

Sioux Falls, South Dakota

Figure 13 (cont.)

Minn-9D

(North)

June 2017

Concept Features:

- Rebuilds Minnesota Avenue with a raised median and two lanes in each direction.
- Driveway and unsignalized cross-street access restricted to ¾ access or right-in right-out.
- Utilizes existing bridge over Big Sioux River.
- Signalizes Lotta Street intersection.
- Incorporate dual left-turn lanes and right-turn lane on all 57th Street intersection approaches.

Sub-Study 2 - Minnesota Avenue
All Concepts: Park Access to 57th Street
I-229 Major Investment Corridor Study | Sioux Falls, South Dakota

Figure 14
Minn-2C/2D/9D (South)
June 2017

CHAPTER 4 - SUMMARY AND NEXT STEPS

The I-229 Exit 3 (Minnesota Avenue) Crossroad Corridor Study:

- Identified existing and future traffic and safety issues and needs on the study area roadways.
- Developed reasonable improvement concept options and alternative scenarios to address the traffic and safety needs.
- Evaluated the benefits and drawbacks of each of the concept options and alternative scenarios.
- Identified alternatives scenarios for further consideration in future studies. The alternative scenarios are as follows:
    - ***Minn-2C.*** 5/4-Lane Divided Corridor with NE Quadrant Loop and NE Ramp aligned with 49th Street
    - ***Minn-2D.*** 6/4- Lane Divided Corridor with NE Quadrant Loop and NE Ramp aligned with 49th Street
    - ***Minn-9D.*** 6/4-Lane Divided Corridor with SPUI and NE Ramp aligned with 49th Street

These are the anticipated next steps for the projects associated with the I-229 Exit 3 (Minnesota Avenue) Crossroad Corridor Study:

- Refine the implementation timeframe and funding responsibility. Improvements to the interchange area were identified as a high priority.
- Add projects, as necessary, to the MPO fiscally constrained Long Range Transportation Plan.
- Fund individual projects in the State or City 5-Year Improvement Program.
- Prepare an Interchange Modification Justification Report for the I-229 Exit 3 (Minnesota Avenue) interchange.
- Prepare an environmental document for each project in accordance with National Environmental Policy Act and other applicable federal and state regulations. This step includes further design refinement and in-depth analysis of each option. The No-Build option will be considered along with the alternative scenarios identified in this Corridor Study.
- Select a preferred option for each project.
- Acquire right-of-way (where necessary).
- Complete final design plans.
- Construct project.

APPENDICES

APPENDIX A. METHODS AND ASSUMPTIONS FOR SUB-STUDY 2

APPENDIX B1. TRAFFIC CAPACITY ANALYSIS METHODOLOGIES

APPENDIX B2. EXISTING HCS 2010 REPORTS

APPENDIX C. 2035 NO-BUILD AND BUILD OPERATIONAL ANALYSIS TECHNICAL MEMORANDUM

APPENDIX D1. PRELIMINARY CONCEPT FIGURES

APPENDIX D2. PRELIMINARY CONCEPTS TECH MEMO

APPENDIX D3. DTA MODEL INTERCHANGE AND MODEL SUB-AREAS

APPENDIX D4. ENVIRONMENTAL CONSTRAINTS MAPS

APPENDIX D5. ALTERNATIVE SCENARIO FIGURES

APPENDIX E. PREDICTIVE SAFETY ANALYSIS

APPENDIX F. YEAR OF FAILURE ANALYSIS

APPENDIX G. SUB-STUDY 2 NOISE STUDY TECHNICAL REPORT

APPENDIX H. PUBLIC INVOLVEMENT

APPENDIX I. EXISTING ACCESS CONTROL FIGURES

APPENDIX A -

METHODS AND ASSUMPTIONS DOCUMENT

- **M&A AMENDMENT #2**
- **APPENDICES**
  - **CRASH PREDICTION ANALYSIS PROCEDURES FOR DIVERGING DIAMOND INTERCHANGE (DDI), SINGLE-POINT URBAN INTERCHANGE (SPUI), AND TWO-LANE LOOP RAMP**
  - **M&A AMENDMENT #1**
  - **ORIGINAL M&A**

I-229 Major Investment Corridor Study:

Sub-Study #2

Methods and Assumptions

To: Study Advisory Team (SDDOT, FHWA, City of Sioux Falls)

From: David Dougherty, HR Green
Courtney Sokol, HDR
Jon Markt, HDR

Subject: Methods and Assumptions, Sub-Study 2, Amendment 2

Date: November 4, 2015

1. Methods and Assumptions Cover Page

Methods and Assumptions Document

The original Methods and Assumptions document was developed as a summation of the Methods and Assumptions Meeting held on August 28, 2013 with representatives from the South Dakota Department of Transportation (SDDOT), Federal Highway Administration (FHWA), City of Sioux Falls, Sioux Falls MPO, HDR, and HR Green.

Amendment 1 includes changes to accommodate updated schedule, SAT team members, traffic forecasting methodology, and right-turn on red volumes, as discussed at the SAT meeting held on August 13, 2014.

Amendment 2 includes changes related to updated schedule, addition of Sub-Study 5 (Exit 7: Rice Street), year of failure analysis, and crash prediction analysis (safety) as discussed at the SAT meeting held on November 2, 2015. This document is intended to serve as a historical record of the process, dates, and decisions made by the study team representatives for the ***I-229 Major Investment Corridor Study: Sub-Study #2***.

2. Stakeholder Acceptance Page

The undersigned parties concur with Amendment 2 to this document.

SDDOT:	FHWA:
[signature]	[signature]
Signature	Signature
Planning Engineer	Planning/Civil Rights Specialist
Title	Title
11-10-2015	11/9/15
Date	Date

Notes:

(1) Participation on the Study Advisory Team and/or signing of this document does not constitute approval of the ***I-229 Major Investment Corridor Study: Sub-Study #2*** Final Report or conclusions.

(2) All members of the Study Advisory Team will accept this document as a guide and reference as the study progresses through the various stages of development. If there are any agreed upon changes to the assumptions in this document a revision will be created, endorsed and signed by all the signatories.

Amendment Notes

HDR

Meeting Minutes

Project: I-229 Major Investment Study (MIS)

Subject: Study Advisory Team (SAT) Meeting # 13

Date: Monday, November 2, 2015

Location: Online Meeting

Attendees:

Mike Behm – SDDOT	Travis Dressen, SDDOT
Craig Smith – SDDOT	Joel Gengler, SDDOT
Scott Jansen - SDDOT	Shannon Ausen – City of Sioux Falls
Jeff Brosz – SDDOT	Heath Hoftiezer – City of Sioux Falls
Kevin Goeden – SDDOT	Amber Gibson – SECOG/Sioux Falls MPO
Pete Longman - SDDOT	Jason Kjenstad - HDR
Andy Vandel – SDDOT	Jon Markt - HDR
Paul Nikolas -- SDDOT	Dave Meier - HDR
Steve Gramm – SDDOT	Courtney Sokol- HDR
Brad Remmich – SDDOT	Brian Ray - HDR
Christina Bennett -- SDDOT	
Ron McMahon - FHWA	
Mark Hoines, FHWA	

Online Meeting

SAT meeting #13 served the primary purpose of reviewing SAT comments on Methods and Assumptions updates pertaining to the Highway Safety Analysis and to review comments on a draft M&A document for Sub-Study 5 (Rice Street Corridor Study). The consultant team provided the M&A documents (Updates to Sub-studies 1-4, original for Sub-study 5) for SAT review on October 26th.

The four existing M&A documents (Sub-Studies 1-4) were primarily updated to reflect:

- An updated project schedule
- Addition of Sub-Study 5 (Exit 7: Rice Street)
- Addition of year of failure analysis
- Addition of crash prediction (safety) analysis

The original M&A for Sub-Study 5 addresses the Exit 7: Rice Street area in a similar manner as the Sub-Study 3 M&A addresses 10th Street and the Sub-Study 4 M&A addresses Benson Road, including the above bullet list of updates. The Sub-Study 5 M&A varies slightly from the Sub Study 3 & 4 M&A documents in section 8. Travel Forecast, which outlines changes that will be made in the Sub-Study 1-4 model based on direction from the City of Sioux Falls to support volume development along Rice Street.

Portions of the five M&A documents were highlighted in green to signify changes.

	Action Items	Responsibility
1	Submit SS1-5 Methods and Assumptions documents for signature	HDR
2	Update project website to include Sub-Study 5 and to identify study concepts eliminated from further consideration by SAT	HDR
3	Email blast to public meeting participants/stakeholders calling attention to updated website	HDR
4	Press Release	SDDOT
5	Add Year of Failure for No-Build at Louise and Cliff to Sub-Study 1 M&A	HDR
6	Update Sub-Study maps to improve street labeling and background local road legibility	HDR
7	Modify M&A documents to change reference to SD 100 to Veterans Memorial Parkway	HDR
8	Provide estimated staff-hours to correspond with supplemental scope previously provided to SDDOT	HDR/HR Green

1. Introductions
2. Review of Sub-Study 1, Amendment 2 M&A
   - HDR provided overview of Amendment 2 updates to the project schedule
   - City of Sioux Falls inquired about how to address the public, who is expecting updates from the study in late 2015 / early 2016.
     i. HDR noted that the public is not yet formally aware of the new Rice Street Sub-Study #5. Need to communicate to the public SAT desire to focus on Sub-Study #5 to "catch up" to status of other sub-studies, to conclude all sub-studies together.
     ii. SDDOT requested that the project website be updated to address this and an email blast to those in the project contact database.
     iii. City of Sioux Falls requested that SDDOT also send out a formal press release.
   - SDDOT requested the map on page 9 to be modified to include a label for Solberg Avenue.
   - Crash Prediction / Highway Safety Analysis
     i. FHWA inquired about the gap in mile markers.
        1. HDR clarified it excludes portion of I-229 between 26th Street ramps. This analysis applies to locations where there are proposed improvements. Similar rationale for why only Cliff southbound is identified - since there are no improvements recommended for northbound direction.
   - Data collection - no comments
   - Traffic operations - no comments
   - Travel forecasts - no comments

- Safety
    i. SDDOT asked about breakdown of crash type and severity.
        1. HDR will add bullet for defaults from HSM for crash type prediction. Defaults are not applicable to DDI and SPUI - these configurations will only have qualitative review.
    ii. No other comments from the SAT.
- SDDOT requested that the Year of Failure Analysis be added for No-Build at Louise and Cliff in the Sub-Study #1 M&A document.

3. Review of Sub-Study 2-4, Amendment 2 M&A
    - SDDOT requested that intersections that are to be analyzed in the individual sub-studies are labeled on the maps provided in the M&A documents.
    - SDDOT noted that reference to SD 100 is no longer valid and needs to be changed to Veterans Memorial Parkway. HDR will update in the M&A document(s).
4. Review of Sub-Study 5 M&A
    - Original Methods and Assumptions document.
    - SDDOT noted the error on page 7 – change "Benson" to "Rice".
    - FHWA requested the Sub-Study 5 map be adjusted to darken the local street line weights.
    - Need for the study:
        i. City of Sioux Falls advised that the need for the study should include noting the geographical constraints, including the rail line and its proximity to Rice Street improvements.
        ii. SDDOT added that the need for the study should include that pressure on this interchange will increase as development continues to the northeast related to construction of Veterans Memorial Parkway.
    - City of Sioux Falls asked if the DTA model has the Russell to Rice connection. HDR to confirm this connection is included. (Note: the 2035 DTA model will not be used in Sub-Study 5, but the question remains valid for confirmation of this connection in the 2035 macro model). – ***HDR confirmed that this connection is included in the DTA model.***
    - SDDOT noted that reference to SD 100 is no longer valid and needs to be changed to Veterans Memorial Parkway. HDR will update in the M&A document(s).
5. Other
    - SDDOT requested an estimate of staff-hours for review with the supplemental scope of services previously submitted by the consultant team.
    - City of Sioux Falls requested that the study website be updated before Thanksgiving. Website will identify concepts that were eliminated from further consideration by the SAT.

6. Next Steps:
   - Submit SS1-5 Methods and Assumptions documents for signature. Items addressed include:
     i. Add Year of Failure for No-Build at Louise and Cliff to Sub-Study 1 M&A.
     ii. Update Sub-Study maps to add more street labels and improve the legibility of background local roads.
     iii. Modify M&A documents to change reference to SD 100 to Veterans Memorial Parkway.
     iv. Add bullet for defaults from HSM for crash type prediction.
     v. Sub-Study #5: Error on page 7 – changed “Benson” to “Rice”.
     vi. Fix double-period errors in documents
   - Update project website to include Sub-Study 5 (HDR).
   - Email blast to public meeting participants/stakeholders (HDR).
   - Press Release (SDDOT).
   - HDR to provide estimated staff-hours associated with supplemental scope to SDDOT.

3. Introduction and Project Description

Project Background and Understanding

Sub-Study 2 is a component of the I-229 Major Investment Corridor Study and will analyze existing and future conditions at the I-229 interchange at Exit 3 (Minnesota Avenue) and along Minnesota Avenue from 41st Street to 57th Street. The study will conduct an interchange options study for the I-229 Exit 3 interchange.

Location

The I-229 Exit 3 interchange and Minnesota Avenue is located in the southeastern portion of the Sioux Falls metropolitan area. The interchange is approximately three miles east of the I-29/I-229 and seven miles south of the I-229/I-90 systems interchanges. I-229 Exit 2 (S Western Avenue) is one mile to the west and Exit 4 (Cliff Avenue) is one mile to the east. The Minnesota Avenue study limits include the intersections of 41st Street and 57th Street. The mainline study limits include Exit 2 through Exit 4.

An illustration of the Sub-Study 2 study area is shown in Section 4 (Study Area) of this report.

Need for Study

The study team has determined the following needs for this specific study:

- Congestion at the I-229 Exit 3 (Minnesota Avenue) interchange
- Congestion throughout the Minnesota Avenue corridor, between 41st Street and 57th Street (reflective of this study's project limits)
- Closely spaced interchanges throughout the I-229 corridor
- Additional traffic operational impacts to the I-229 Exit 3 interchange and Minnesota Avenue due to the extension of 49th Street to the west of Minnesota Avenue
- Future traffic growth within the study area and the impact to interchange operations
- Conclusions and recommendations from 41st Street Corridor Study
- Improved pedestrian and bicycle access and crossings

The alternatives analysis will incorporate work done on interchange alternatives from previous studies, including the Draft I-229 and Minnesota Avenue Interchange Justification Report, as well as introduce additional concepts. These additional concepts include, but are not limited to:

- Diverging Diamond Interchange
- Offset Single Point Interchange

Study Schedule

Date	Task/Event
March 2013	Notice to Proceed, Kickoff Meeting
July 2013	Methods & Assumptions Documentation
July 2013- August 2013	Baseline Conditions Analysis/ Data Collection
September 2013- October 2014	**Public Meeting #1** (Project Kickoff) **(Oct 2013)** Existing Traffic and Operations Analysis Project Future Conditions (No Build)
October 2014- October 2015	Conceptual Design of Reconfiguration Options for the I-229 Exit 3 Interchange Conceptual Design of Minnesota Avenue Corridor Improvements **Public Meeting #2** (Scenario Building Stage) **(June 2015)** **MPO Meeting (Scenario Building Presentation)** Determination of Interchange and Corridor Build Scenarios Traffic and Operations Analysis of Build Scenarios
November 2015 – July 2016*	Predictive Crash Analysis of Build Scenarios Noise Analysis of Build Scenarios Constructability Analysis of Build Scenarios Recommendations
August 2016- November 2016*	Sub-Study 2 Report Documentation **Public Meeting #3 (Draft Report Stage)** **MPO Meeting (Final Recommendations Presentation)**

*Schedule controlled by Sub-Study 5 schedule

Facilities Affected by the Study

Modifications to the I-229 Exit 3 interchange and Minnesota Avenue would have the potential to affect:

- The intersections on Minnesota Avenue near I-229
- The intersection configuration of Minnesota Avenue and 49th Street, with consideration to the extension of 49th Street to the west. This includes 2035 operations with an expanded 49th Street
- Adjacent perpendicular corridors to Minnesota Avenue, including 41st Street, 57th Street, and a future 49th Street.
- Adjacent parallel corridors providing access to I-229 at Exit 2 (Western Avenue) and Exit 4 (Cliff Avenue).

Previous Studies

The following previous studies will be reviewed during the course of this study:

- Direction 2035, Sioux Falls MPO Long-Range Transportation Plan (LRTP)
  - http://www.siouxfalls.org/~/media/Documents/planning/long-range/lrtp/2035_lrtp/adopted_lrtp_rev120210.pdf
- Sioux Falls Comprehensive Development Plan
  - http://www.siouxfalls.org/~/media/Documents/planning/shape_sf/chapters-maps/Chapter_1_r112111.pdf
- Sioux Falls Transit Development Plan 2011- 2015
  - http://www.siouxfalls.org/~/media/Documents/planning/long-range/2011_2015_Transit_Development_Plan.pdf
- 2007 Sioux Falls Bicycle Plan
  - http://www.siouxfalls.org/~/media/Documents/planning/transportation/bicycle/Bicycle_Plan_Final.pdf
- The Sioux Falls MPO Multi-Use Trail Study
  - http://www.siouxfallsmpo.org/documents/MPO/Planning_Documents/SiouxFallsMUTCS.pdf
- Sioux Falls Major Street and Access Management Plan
  - http://www.siouxfalls.org/~/media/Documents/planning/transportation/long-range/majorstreetplanmediumfinal%20pdf.pdf
- I-229 Exit 5 (26th Street) Crossroad Corridor Study
  - http://26thstreetcorridorstudy.com/
- 2010 Decennial Interstate Corridor Study and 2000 Decennial Interstate Study
- ITS Studies from City of Sioux Falls and SDDOT
- 49th Street Extension Study
- I-229 and Minnesota Avenue Interchange – Draft Interchange Justification Report
- 41st Street Corridor Study
- Costco Traffic Impact Study
- Scheels Traffic Impact Study
- Walmart Traffic Impact Study (85th Street and Minnesota Avenue)

Study Advisory Team Members

A Study Advisory Team has been formed to guide the study through completion. The Study Advisory Team is comprised of representative parties of the SDDOT, FHWA and City of Sioux Falls. Members of the Study Advisory Team are:

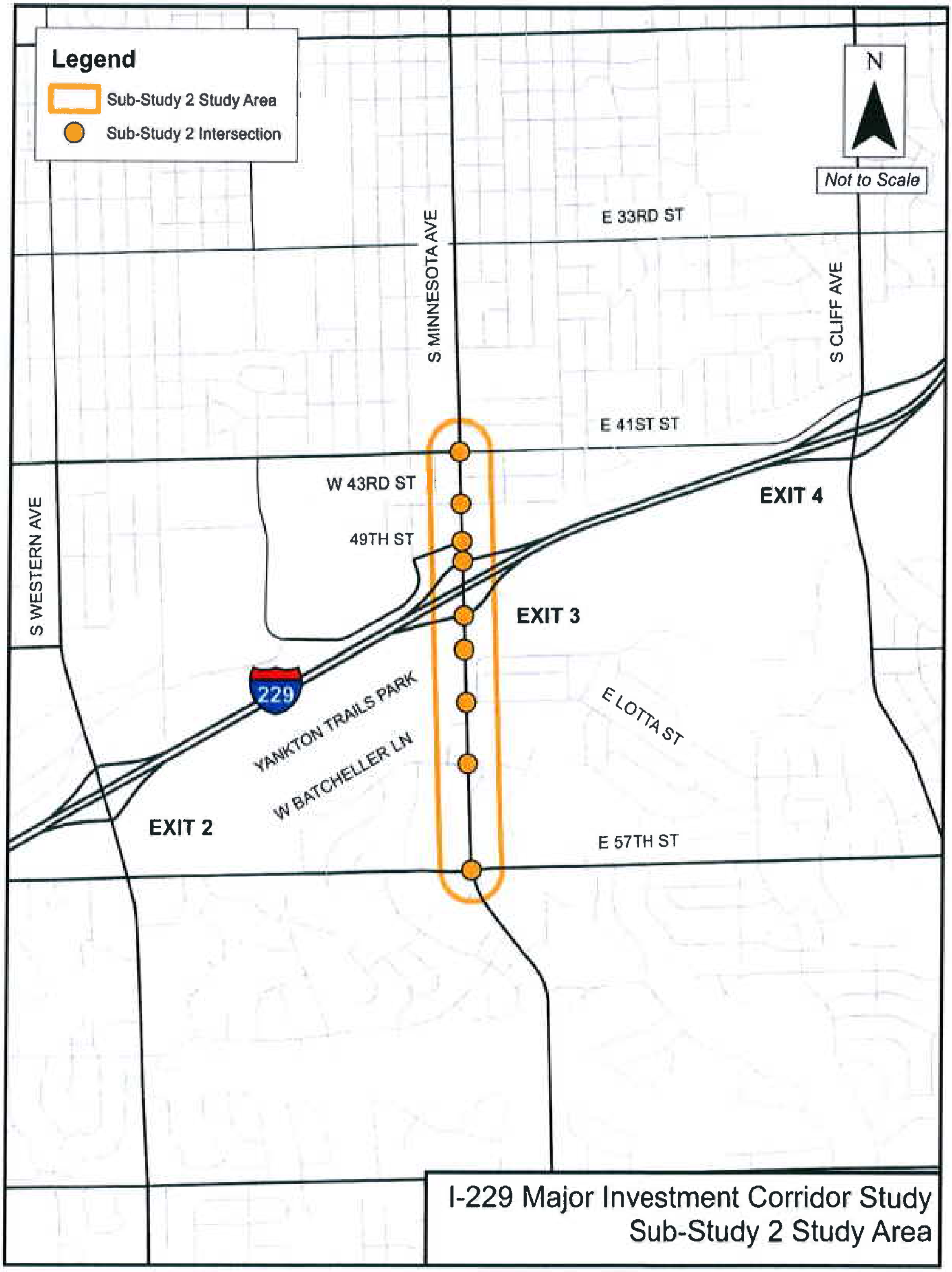
Shannon Ausen	City of Sioux Falls – Public Works
Mike Behm	SDDOT – Project Development
Christina Bennett	SDDOT – Operations Support
Jeff Brosz	SDDOT – Transportation Inventory Management
Andy Vandel	SDDOT – Project Development (Safety)
Joel Gengler	SDDOT – Right of Way
Amber Gibson	Sioux Falls MPO
Kevin Goeden	SDDOT – Bridge Design
Steve Gramm	SDDOT – Project Development (Planning)
Heath Hoftiezer	City of Sioux Falls – Public Works
Mark Hoines	FHWA
Dave Huft	SDDOT – Research
Bruce Hunt	FHWA
Scott Jansen	SDDOT – Mitchell Region
Captain Alan Welsh	South Dakota Highway Patrol
Ryan Kerkvliet	Sioux Falls MPO – Citizens Advisory Committee
Tom Lehmkuhl	SDDOT – Project Development (Environmental)
Pete Longman	SDDOT – Road Design
Ron McMahon	FHWA
Paul Nikolas	SDDOT – Road Design
Brad Remmich	SDDOT – Project Development (Planning)
Craig Smith	SDDOT – Mitchell Region

Additional team members may be added as the study progresses.

4. Study Area

The study area for Sub-Study 2 was defined by the Study Advisory Team and is illustrated in this report for documentation. The study area contains Minnesota Avenue from 41st Street to 57th Street. Freeway operations will be conducted during Sub-Study 1 and will also be reported in Sub-Study 2 for freeway locations from Exit 2 (Western Avenue) to Exit 4 (Cliff Avenue). The following graphic shows the study area and identifies each of the study intersections.

Sub-Study 2 Study Area



Minnesota Avenue Study Intersections:

- Minnesota Avenue & 57th Street*
- Minnesota Avenue & Batcheller Lane
- Minnesota Avenue & Lotta Street
- Minnesota Avenue & Yankton Trail Park Entrance
- Minnesota Avenue & I-229 Northbound Ramp Terminal*
- Minnesota Avenue & I-229 Southbound Ramp Terminal*
- Minnesota Avenue & 49th Street*
- Minnesota Avenue & 43rd Street
- Minnesota Avenue & 41st Street*

* Intersections denoted with an asterisk will be included in year of failure analysis.

The following Basic Freeway Segments will be analyzed in Sub-Study 1 and reported within Sub Study 2 (*See also Note 1 below for designated analysis areas as potential Freeway Weave Areas for segments including auxiliary lanes*):

- I-229 Northbound between Western Avenue (Exit 2) and Minnesota Avenue (Exit 3)
- I-229 Northbound between Minnesota Avenue (Exit 3) and Cliff Avenue (Exit 4)
- I-229 Southbound between Cliff Avenue (Exit 4) and Minnesota Avenue (Exit 3)
- I-229 Southbound between Minnesota Avenue (Exit 3) and Western Avenue (Exit 2)

[1] *Segments will be evaluated using Highway Capacity Manual (HCM) 2010 procedures to determine if the segment meets the criteria for a weave segment. If the segment meets the weave segment criteria the segment will be analyzed as a Freeway Weave Area and not a Basic Freeway Area*

Study Mainline Freeway Areas (Crash Prediction)

- I-229 Northbound & Southbound
  - Between mile marker 2.5 and mile marker 3.5

Study Service Interchange Areas (Crash Prediction)

- Exit 3: Minnesota Avenue

Study Intersections (Crash Prediction)

- Minnesota Avenue & I-229 Northbound Ramps*
- Minnesota Avenue & I-229 Southbound Ramps*
- Minnesota Avenue & 49th Street*

*Intersection is combined with adjacent intersections or split from a single intersection to form multiple intersections in some build alternatives

5. Analysis Years/Periods

This study will evaluate traffic during and for the following time periods:

Existing Conditions

Existing conditions analyses will be conducted for year 2012 volume conditions. Turning movement counts were collected at several study area intersections in 2012. Intersections that do not already have recent count data from 2012 will be counted by the City of Sioux Falls or HDR as part of this study as described in Section 6. For existing conditions the following time periods will be evaluated:

- Existing Conditions (Year 2012) – AM Peak Hour
- Existing Conditions (Year 2012) – PM Peak Hour

Future/ Design Conditions

Future/ Design conditions analyses will be conducted for year 2035 conditions. This horizon year matches the planning horizon of the current Sioux Falls LRTP. The Travel Demand Model was calibrated and updated in year 2009 for a base year 2008 and planning horizon of year 2035. Projected traffic volumes from the Sioux Falls MPO Travel Demand Model will be utilized to establish year 2035 volumes. For the design conditions the following time periods will be evaluated:

- Future/Design Conditions (Year 2035) – AM Peak Hour
- Future/Design Conditions (Year 2035) – PM Peak Hour

Interim Conditions Analysis

The City of Sioux Falls is currently planning to extend 49th Street west of Duluth Street to Western Avenue. It is anticipated that this extension will be complete prior to any proposed improvements from the I-229 Major Investment Corridor Study are implemented. Therefore, an interim analysis will be conducted incorporating the proposed 49th Street extension and associated improvements (signal timing, turn lanes, etc.). The City of Sioux Falls will provide the interim schedule for full build-out of the 49th Street extension to Western Avenue. Interim volumes will be developed from recent count data and horizon year 2035 traffic volumes. For the design conditions the following time periods will be evaluated:

- Interim Conditions (Year provided by City of Sioux Falls) – AM Peak Hour
- Interim Conditions (Year provided by City of Sioux Falls) – PM Peak Hour

Year of Failure Conditions Analysis

Year of failure analysis will be conducted (for denoted study area intersections) to identify the year beyond the Future / Design year (2035) when traffic operations fail to meet acceptable criteria. Projected traffic volumes beyond year 2035 will be developed using straight line extrapolation between year 2012 adjusted peak hour volumes and year 2035 adjusted peak hour volumes. Potential years of failure will be evaluated in 5-year increments up to the identified year of failure. Should traffic operations still meet acceptable criteria 30 years beyond the Future / Design year (2065), the year of failure will be identified as beyond 2065, but no additional traffic analysis will be conducted for years beyond 2065.

- Year of Failure Conditions (Year determined by analysis) – AM Peak Hour
- Year of Failure Conditions (Year determined by analysis) – PM Peak Hour

Volume data will be smoothed/balanced for the Existing and Future/Design Conditions using the Cube Voyager macroscopic model, with adjustments to raw model output based on post-processing techniques, as part of Sub-Study 1.

6. Data Collection

Existing traffic volume data for Sub-Study 2 will be provided by HDR, including existing arterial intersection turning movement count data, existing freeway data, and additional data as outlined below:

Existing Arterial Intersection Turning Movement Count Data
Minnesota Avenue intersection turning movement count data will be provided by HDR for the intersections identified within Sub-Study 2 study area.

Existing Freeway Data
Automated Traffic Recorded (ATR) data was provided for SDDOT Station #610, which is located between Exit 2 (Western Avenue) and Exit 3 (Minnesota Avenue). The ATR included hourly directional mainline I-229 freeway volumes from Sept 2012 to February 2013. In addition, ATR at Station #610 was provided in 15-minute increments from March 6 to April 21, 2013.

SDDOT supplied hourly ramp volume data from year 2012. Study intersection turning movement counts will be used to determine existing AM and PM peak hour ramp volumes and then smoothed/balanced along the I-229 corridor.

Additional Data Supplied by SDDOT and/or City of Sioux Falls

- Vehicle Classification Samples on I-229 Interstate
  - Supplied by SDDOT
- Crash History Geodatabase
  - Supplied by SDDOT
  - Includes crash records dated January 2008 to December 2012 (5 years)
- Roadway Design Standards
  - available online at: http://www.sddot.com/business/design/forms/roaddesign/Default.aspx
- Construction Plans for I-229
  - Supplied by SDDOT
- Construction Plans for Minnesota Avenue
  - Supplied by SDDOT
- GIS Base Mapping Data (parcels, parks, streets, rail, plats)
  - Supplied by City of Sioux Falls
- 2012 Aerial SID files
  - Supplied by City of Sioux Falls
- Corridor Studies
  - 41st Street Corridor Study
  - 49th Street Extension Study
- Traffic Impact Studies for Key Proposed Developments
  - Costco TIS supplied by City of Sioux Falls
  - Scheels TIS supplied by City of Sioux Falls
  - Walmart (85th Street and Minnesota Avenue) TIS supplied by City of Sioux

Falls

- MPO Travel Demand Model Files in Cube Voyager (Existing and Future)
    - Supplied by City of Sioux Falls
- Average daily traffic counts
    - Supplied by City of Sioux Falls

Data Collection Techniques
All data was collected and will be collected using standard field practices which consist of using cameras, digital count boards or tube counters.

7. Traffic Operations Analysis

Traffic Operations Analysis (Existing and Future No-Build)

1. Software
    a. Signalized Intersections
        i. Highway Capacity Software (HCS) Release 6.5 (2010 HCM Methodology) Streets Module
            1. Ramp terminal intersections meeting the interchange types defined in HCM Chapter 22 (Interchange Ramp Terminals) will be analyzed with the Interchanges section of the Streets Module.
            2. Analysis of a Diverging Diamond Interchange will follow the methodology outlined in the 'Analysis Procedures for Diverging Diamond Interchange (DDI)' memorandum, found in the Appendix. This memorandum was developed for the I-90 Exit 59 (La Crosse Street) Interchange Options Study but the methodology applies to analysis of other interchange locations.
    b. Basic Freeway, Ramp Junctions and Weave Areas
        i. HCS Release 6.5 (2010 HCM Methodology)
2. Operational Analysis Results
    a. Level of Service (LOS)
        i. Signalized Ramp Terminal Intersections (SDDOT's System)
            1. Intersections where geometry is modified because of project improvements
                a. Minimum allowable LOS – LOS 'C'
                    i. Individual movements will be allowed to operate at LOS 'D' but the overall intersection LOS shall be 'C' or better
            2. Other intersections (intersections within the study area that are not modified by project improvements)
                a. Minimum allowable LOS – LOS 'D'
                    i. Individual movements will be allowed to operate at LOS 'E' but the overall intersection LOS shall be 'D' or better
        ii. Signalized Non-Ramp Terminal Intersections (City of Sioux Fall's System)
            1. Minimum allowable LOS – LOS 'D'
        iii. Basic Freeway, Ramp Junctions and Weave Areas

1. Minimum allowable LOS – LOS 'C'

3. Variables
   a. Peak Hour Factor (PHF)
      i. Existing (year 2012) conditions analysis will use calculated PHFs from existing counts with a maximum value of 0.93.
      ii. Design year (year 2035) conditions analysis will use existing PHFs rounded up to the nearest 0.05 with a maximum value of 0.93.
         1. The increase in the PHF is to account for traffic growth that is likely to be spread throughout the peak periods.
   b. Saturation Flow Rate
      i. SDDOT Design Manual (Page 24, Chapter 15) requires the use of 1,800 vph in Sioux Falls. This value will be used for the signalized intersections and freeway locations within the study area.
   c. Traffic Signal Controllers
      i. Operational analysis will allow for both actuated and coordinated controllers.
   d. Left-Turn Phasing
      i. Protected, Permitted / Protected or Split Phasing will be allowed at intersections.
   e. Heaviest Lane Volume (Lane Utilization)
      i. Default HCS Streets Values used for ramp terminal / arterial intersections.
   f. Heavy Vehicle Percentage
      i. Study Intersections
         1. Use existing turning movement counts that included truck counts to determine arterial truck percentages.
      ii. Ramp Junctions and Weave Areas
         1. Use existing freeway counts that included truck counts to determine freeway truck percentages.
   g. Phase Change Intervals
      i. Existing (Year 2012) Conditions
         1. Existing signal timings will be used for phase change intervals during existing conditions.
      ii. Future No-Build (Year 2035) Conditions
         1. Existing signal timings will be used for phase change intervals of phases that exist at intersections that have no geometric change from existing conditions.
         2. Phase change intervals will be calculated for the following locations:
            a. New phases added at an intersection where geometry is unchanged from existing conditions
            b. All phases at an intersection where geometry is changed from existing conditions

            The calculated values will be based on methodologies presented in the *Institution of Transportation Engineers (ITE) Traffic Engineering Handbook*. The methodologies presented in the handbook use vehicle length and speed and the distance needed to track through the intersection to calculate phase change intervals.
   h. Speeds
      i. Arterials – Use posted speeds

   ii. Freeway – Use 85th percentile of collected spot speed data

i. Right Turn on Red Volume
   i. Existing (Year 2012) Conditions
      1. The number of vehicles turning right on red will be assumed to be zero for all locations initially based on the guidance in the 2010 Highway Capacity Manual.
      2. Intersections reporting LOS E or worse potentially related to right turn on red volume will be identified and presented to the SAT to decide if a right turn on red count is necessary.
      3. If a right turn on red count is deemed necessary, video recordings of existing peak hour traffic at the locations of interest will be used to count the number of vehicles turning right on red and incorporated into the HCS analysis at these locations.
   ii. Future No-Build (Year 2035) Conditions
      1. The number of vehicles turning right on red will be assumed to be zero for all locations that were not counted for right turn on red movements.
      2. For locations that were counted for right turn on red movements, the percentage of right turn on red volume of the total volume for the right turn movement in the existing condition will be multiplied by the future forecast right turn movement for each approach and incorporated into the HCS analysis at these locations.
      3. Intersections reporting LOS E or worse potentially related to right turn on red volume will be identified and presented to the SAT to decide if a right turn on red count is necessary.
      4. If a right turn on red count is deemed necessary, video recordings of existing peak hour traffic at the locations of interest will be used to count the number of vehicles turning right on red.
      5. Step 2 will be repeated for all locations where a right turn on red count was added by the SAT based on a projected future operating condition of LOS E or worse.
   iii. Future Build (Year 2035) Conditions
      1. The number of vehicles turning right on red will be assumed to be zero for all locations that were not counted for right turn on red movements
      2. For locations that were counted for right turn on red movements, the same projected right turn on red volume for Future No-Build (Year 2035) Conditions will be used, assuming the Future Build (Year 2035) Condition geometry remains similar to the Future No-Build (Year 2035) Condition geometry.

8. Travel Forecast

Existing (Year 2012) and Future Year (Year 2035) volumes developed during Sub-Study 1 will be used for the volumes within the study area for Sub-Study 2. The methodology for Travel Forecast was documented in the Sub-Study 1 Methods and Assumptions document.

9. Safety Issues

Crash data will be reviewed for the study area based on the Crash Geodatabase which includes crashes between January 2008 and December 2012. SDDOT's database will be the only database used in the calculation of crash rates and critical crash rates. The following information will be provided as a result of 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

Predictive crash analysis will be conducted for freeway segments, freeway ramps, ramp terminal intersections, and some arterial intersections with the limits described in the Sub-Study 1 & Sub-Study 2 Methods and Assumptions documents. Predictive crash analysis will be conducted using the following standard procedures / tools:

- All analysis types
    - For existing conditions:
        - Geometric information will be estimated from aerial photography using tools built in to Google Earth.
        - Average daily traffic counts, described in the data collection section of this document, will be utilized.
    - For build conditions:
        - Geometric information available from design files will be utilized. Geometric information not available at this level of design will be assumed to match existing conditions where practical.
        - Projected future daily volumes, described in the travel forecasting section of this document, will be utilized.
    - Calibration factors or South Dakota-specific Safety Performance Functions will not be used in place of default equations from the Enhanced Interchange Safety Analysis Tool (ISATe).
    - Existing crash data (2008 – 2012) will be used when forecasting expected crash frequency for the Existing and the Future No-Build Conditions using the Empirical Bayes method.
    - Existing crash data will not be used as a factor when predicting crash frequency for Future No-Build and Build Alternative Conditions for comparing these scenarios.
    - Computed crash prediction frequencies will be reported by crash type using default distributions included in the Highway Safety Manual where applicable.
- Freeway segments, freeway ramps, and traditional ramp terminal intersections
    - ISATe Build 06.10 will be used.
- Non-traditional ramps and ramp terminal intersections
    - Analysis will follow the methodology outlined in the 'Crash Prediction Analysis Procedures for Diverging Diamond Interchange (DDI), Single-Point

Urban Interchange (SPUI), and Two-Lane Loop Ramp' memorandum, found in the Appendix of this document.

- Arterial intersections
  - Methods from Chapter 12 of the Highway Safety Manual will be used.

Predictive crash analysis will forecast crash frequencies for Existing (Year 2012, for comparison to actual crashes), Future No-Build (Year 2035) and Future Build Alternative (Year 2035) conditions.

10. Selection of Measures of Effectiveness (MOE)

The main goals of this study are as follows:

1. Conduct an interchange and crossroad study for Exit 3 (Minnesota Avenue).
   a. Complete a Level of Service Analysis for both existing and future (2035) conditions at the I-229 Exit 3 Interchange and Minnesota Avenue within the study limits.
   b. Complete a safety analysis of the I-229 Exit 3 Interchange and Minnesota Avenue, within the study limits
   c. Complete a predictive safety analysis of interchange Exit 3 (Minnesota Avenue) for both existing and future (2035) conditions.
   d. Determine and recommend improvement options that will improve mobility and safety within the I-229 Exit 3 interchange and along Minnesota Avenue between, and including, 41st Street and 57th Street.
2. Create final products for use by the SDDOT and City of Sioux Falls which will guide them in the implementation of recommended improvements that will maximize the efficiency of the system.

To satisfy the study objectives, the following MOEs will be used to evaluate and compare the concepts:

- Minnesota Avenue Intersections: **LEVEL OF SERVICE (LOS)** and **INDIVIDUAL MOVEMENT DELAY**
- Minnesota Avenue Corridor: **LOS** and **TRAVEL SPEED**
- Ramp Terminal Intersections: **LEVEL OF SERVICE** and **INDIVIDUAL MOVEMENT DELAY**
- Freeway Segments, Ramp Junctions and Weave Areas: **LOS** and **DENSITY**

These statements are made assuming that the geometric improvements identified meet all AASHTO, SDDOT, and City of Sioux Falls guidelines. It is understood that all traffic analysis reporting will be completed using HCM 2010 Methodology.

11. FHWA Interstate Access Modification Policy Points

An Interchange Modification Justification Report (IMJR) will not be developed for the I-229 Exit 3 (Minnesota Avenue) interchange as part of this project.

12. Deviations/Justifications

No deviations from standards are currently known. If it is determined during the study that deviations are required, the methods and assumptions document will be amended prior to proceeding.

13. Conclusion

All sections contained in this document will guide the traffic data collection and traffic assessment for this study.

14. Appendices

The appendix includes the following:

- Methods and Assumptions Study Team Meeting Minutes (November 2, 2015)
- Analysis Procedures for Diverging Diamond Interchange (DDI)
- Crash Prediction Analysis Procedures for Diverging Diamond Interchange (DDI), Single-Point Urban Interchange (SPUI), and Two-Lane Loop Ramp

APPENDIX

Memo

Date: Wednesday, November 04, 2015

Project:

To: File

From: Rob Frazier, P.E.
Jon Markt, EIT

Subject: **RE: Crash Prediction Analysis Procedures for Diverging Diamond Interchange (DDI), Single-Point Urban Interchange (SPUI), and Two-Lane Loop Ramp**

Introduction

This document presents proposed methodologies for performing crash prediction for a Diverging Diamond Interchange (DDI), a Single-Point Urban Interchange (SPUI), and a two-lane loop ramp. The American Association of State Highway and Transportation Officials (AASHTO) Highway Safety Manual (HSM) provides a standard practice for safety analysis over a project's full life-cycle. The HSM can be faithfully implemented by a variety of tools including the Federal Highway Administration's (FHWA) Enhanced Interchange Safety Analysis Tool (ISATe). However, neither the HSM nor ISATe currently address the DDI, SPUI, or two-lane loop ramp configurations. In response to these shortcomings, a synthesis of recent and on-going research yielded these proposed methodologies to address crash prediction for the DDI, SPUI, and two-lane loop ramp.

Crash Prediction

Crash prediction is a method of assessing safety by applying a combination of Safety Performance Functions (SPFs) and Crash Modification Factors (CMFs) to a roadway facility to predict the number of crashes that are statistically likely to occur in an average year. Crash prediction relies on roadway and roadside geometry, traffic volumes, traffic control, and other safety related factors to forecast crash frequency. Crash prediction can be performed at the site level or at the project level. Site level crash prediction involves the use of SPFs or CMFs to predict crash frequency for an individual roadway segment or intersection. Project level crash prediction involves the use of a CMF to estimate the change in crash frequency for a group of sites that make up the project area. For example, consider the conversion of an at-grade intersection to a grade-separated interchange. The site level analysis would involve calculating crash frequency for the existing intersection and adjacent roadway segments and the calculation of crash frequency for the proposed roadway segments, ramps, and ramp terminal intersections related to the interchange. For a project level analysis of the same example, a single project level CMF would be used to estimate predicted crash frequency at the interchange, based on the existing crash frequency at the intersection.

In general, a project level assessment is more simple and easier to implement. Site level analyses provide greater detail and flexibility in both the analysis and presentation of the results.

The proposed methodology applies site level analysis where possible, using project level analysis only when necessary.

Diverging Diamond Interchange (DDI)

DDIs have only been in operation in North America since 2009. Considering that HSM methods rely on observed crash data for the development of SPFs and CMFs, the newness of the DDI has been a major factor in its absence from the HSM and consequently ISATe. Recently however, researchers have completed several in-depth safety evaluations of DDIs in Missouri. As an early adopter of DDIs, Missouri provides a good source for DDI crash data. The research has addressed both project level and site level analyses. Based on these studies, the proposed methodology is as follows:

1. Develop crash predictions for the freeway mainline for the No-Build and Build (DDI) conditions
2. Develop crash predictions for theoretical traditional diamond interchanges for the locations of the proposed DDI interchanges (predicted crashes for ramps and ramp terminals).
3. Develop site level crash predictions for the ramp and ramp terminals for the proposed DDI designs.
    a. Ramps – The ramp crash predictions will be based on the ramp geometry and will only be adjusted if specifically indicated by the research.
    b. Ramp Terminal Intersections – The ramp terminal crash predictions will be developed by applying CMFs from the research to the diamond ramp terminal predictions. Preliminary CMFs are:
        i. $CMF_{Fatal\&Injury} = 0.63$
        ii. $CMF_{PropertyDamageOnly} = 0.51$
4. As a check on the site level predictions, a project level analysis will also be prepared. This will use the project level research CMFs to modify the entire diamond interchange crash prediction to estimate the entire DDI interchange crash frequency. This value will be compared with the site level results before finalizing the crash predictions.

Crash type frequency will not be quantitatively predicted for the DDI ramp terminal intersections. A qualitative assessment will be provided for the trends in crash type associated with the DDI.

Single-Point Urban Interchange (SPUI)

The SPUI has a much longer history compared to the DDI, but a similarly limited research base pertaining to predictive safety. Research has begun on NCHRP Project 17-68 to develop SPFs and CMFs directly applicable to SPUIs, but the project is still on-going. The NCHRP Project 17-68 will have a significant crash data set (~100 intersections) to develop SPFs and CMFs. Investigations into other research concerning SPUIs and crash prediction have not produced any additional studies. However, some data concerning SPUIs has been made available by SDDOT (before and after study data for conversion from a traditional diamond interchange to a SPUI). Based on these studies, the proposed methodology is as follows:

1. Should NCHRP Project 17-68 results become available prior to March 2016

    a. Analyze the SPUI ramp terminal intersection based on methods / equations from NCHRP Project 17-68.
2. Should NCHRP Project 17-68 results not be available
    a. Perform crash prediction for a traditional diamond interchange with similar freeway mainline segment, freeway ramp segment, and ramp terminal interchange characteristics as the proposed SPUI.
    b. Combine site predicted crashes for the traditional diamond interchange to develop a project level estimate of crashes.
    c. Multiply the project level estimate of crashes for the traditional diamond by a project level CMF based on the available SDDOT data. The preliminary CMF is 0.63 for conversion of a traditional diamond interchange to a SPUI.

Should NCHRP Project 17-68 results not be available, crash type frequency will not be quantitatively predicted for the SPUI ramp terminal intersection. A qualitative assessment will be provided for the trends in crash type associated with the SPUI. Should NCHRP Project 17-68 results be available, recommendations from that project will be utilized to determine how to provide crash type frequency information.

Two-Lane Loop Ramp

Single-lane loop ramp safety is addressed at both the ramp segment and ramp terminal intersection level by the Highway Safety Manual, and most loop ramps are single-lane loop ramps. The previous reasoning may explain why developing SPFs and / or CMFs for two-lane loop ramps has not been a primary research direction based on our literature review. However, NCHRP Project 03-105 is on-going research and will attempt to improved roadway design guidance for single-lane and two-lane loop ramps. The project research plan was to collect safety data for single-lane and two-lane loop ramps, there may be an opportunity to use results of this project to address crash prediction for two-lane loop ramps. Based on this review of available research, the proposed methodology is as follows:

1. Should NCHRP Project 03-105 results become available prior to March 2016
    a. Analyze the two-lane loop ramp terminal intersection based on data, methods, equations, and findings from NCHRP Project 03-105.
2. Should NCHRP Project 03-105 results not be available
    a. Perform crash prediction for a two-lane ramp segment with tight curvature.
    b. Confirm that the crash prediction for a two-lane ramp segment with tight curvature produces reasonable crash prediction results. This will involve comparing the predicted number of single-vehicle and multi-vehicle crashes for the tight curvature ramp with a standard one-lane loop ramp. If comparison crash data is available for two-lane loop ramps that will also be considered.

M&A Amendment #1

HRGreen

I-229 Major Investment Corridor Study:
Sub-Study #2
Methods and Assumptions

To:	Study Advisory Team (SDDOT, FHWA, City of Sioux Falls)
From:	Ross Harris, HR Green
Subject:	Methods and Assumptions, Sub-Study 2, Amendment 1
Date:	August 28, 2014

1. Methods and Assumptions Cover Page

Methods and Assumptions Document

The original Methods and Assumptions document was developed as a summation of the Methods and Assumptions Meeting held on August 28, 2013 with representatives from the South Dakota Department of Transportation (SDDOT), Federal Highway Administration (FHWA), City of Sioux Falls, Sioux Falls MPO, HDR, and HR Green.

Amendment 1 includes changes to accommodate updated schedule, SAT team members, traffic forecasting methodology, and right-turn on red volumes, as discussed at the SAT meeting held on August 13, 2014. This document is intended to serve as a historical record of the process, dates, and decisions made by the study team representatives for the ***I-229 Major Investment Corridor Study: Sub-Study #2***.

2. Stakeholder Acceptance Page

The undersigned parties concur with Amendment 1 to this document.

SDDOT:	FHWA:
[signature]	[signature]
Signature	Signature
Data Analysis Engineer	Planning/Civil Rights Specialist
Title	Title
Sept. 3, 2014	9/5/14
Date	Date

Notes:

(1) Participation on the Study Advisory Team and/or signing of this document does not constitute approval of the ***I-229 Major Investment Corridor Study: Sub-Study #2*** Final Report or conclusions.

(2) All members of the Study Advisory Team will accept this document as a guide and reference as the study progresses through the various stages of development. If there are any agreed upon changes to the assumptions in this document a revision will be created, endorsed and signed by all the signatories.

Amendment Notes

Meeting Minutes

Project: I-229 MIS

Subject: Study Advisory Meeting #6, M&A SS1-SS4 Amendment 1

Date: Wednesday, August 13, 2014

Location: Web Meeting / Conference Call

Attendees:
Dave Meier, HDR
Courtney Sokol, HDR
Jon Markt, HDR
Jason Kjenstad, HDR
Brian Ray, HDR
Rich Laughlin, HDR
Ross Harris, HR Green
Jon Wiegand, HR Green
Shannon Ausen, City of Sioux Falls
Heath Hoftiezer, City of Sioux Falls
Amber Gibson, Sioux Falls MPO
Christina Bennett, SDDOT
Jeff Brosz, SDDOT
Joel Gengler, SDDOT
Kevin Goeden, SDDOT
Steve Gramm, SDDOT
Pete Longman, SDDOT
Paul Nikolas, SDDOT
Ron McMahon, FHWA
Mark Hoines, FHWA

	Topic	*Facilitator*
1	Introductions	Brian Ray
2	Dynamic Traffic Assignment (DTA) Model Review with FHWA	Jon Markt
3	Review Updated M&A Documents	Brian Ray
4	Next Steps	Brian Ray

	Action Items	*Responsibility*
1	Revise Methods and Assumptions Documents	HDR
2	Circulate Methods and Assumptions Documents	SDDOT
3	Develop Future Year 2035 No-Build Traffic Volumes	HDR
4	Analyze Future Year 2035 No-Build Traffic Volumes	HDR
5	Complete Future Year No-Build DTA Modeling	HDR
6	Start Identifying Solutions/ Conduct Solutions Development Workshop	HDR
7	Draft schedule/dates for concept workshop	HDR
8	Update website and send out postcards	HDR

1. Introductions (HDR, HR Green, City of Sioux Falls, Sioux Falls MPO, SDDOT, FHWA)
2. Dynamic Traffic Assignment (DTA) Model Review with FHWA
    - Recent DTA Model Updates

- HDR discussed the model development effort that had transpired since the previous SAT meeting and summarized the 2 sub-committee confrence calls with FHWA Resource Center.
    - First Meeting, May 22, 2014
        a. Discussed the study goals and framework
        b. Discussed details of Cube Avenue Model
        c. Discussed volume development (existing and future 2035 No Build)
        d. Action Items:
            i. Validation of queuing patterns in the base year model
            ii. Add discussion on convergence in the validation report
            iii. Start future year DTA modeling for 2035 No Build
    - Second Meeting, July 25, 2014
        a. Discussed update to the DTA model
        b. Discussed updates to the validation report
        c. Discussed future 2035 No Build volume development
        d. Action Items:
            i. Revise Method and Assumptions (M&A) Documents
            ii. Review model directionality assumptions
            iii. Circulate M&A Documents
            iv. Schedule SAT Meeting
- FHWA was in agreement with HDR that the development of the existing conditions DTA model had reached completion.
- Future no-build DTA modeling was initiated and networks and trip tables are currently under fine tuning.

3. Review Updated M&A Documents
    - Sub-Study 1
        - SDDOT noted the format of the Amended M&A needs to be modified so that it is not confused with original M&A
        - Study Schedule
            - Schedule shifted to extend Future Needs Analysis
            - SDDOT corrected the Public Meeting #1 date of October 2013 (not 2014)
        - Study Advisory Team Members
            - Updated based on edits received via SDDOT email on 8/5/14
        - Right Turn on Red Volume

      - HDR summarized the procedure utilized for estimating Right Turn on Red volumes used in the HCS analysis.
  - Travel Forecast
      - HDR summarized the process used to balance existing turning movement volumes, and the revised process to generate peak hour turning movement forecasts for the 2035 No Build (to be analyzed in HCS), including a traditional post-processing of macro model outputs (Cube Voyager), instead of DTA model outputs. FHWA Resource Center is in agreement with this process.
          a. SDDOT inquired about the peak hour percentage differences (existing conditions vs. macro model), and HDR clarified that the 2035 No Build peak hour volumes will be based on the peak hour/period (1 hour/2 hour) proportions from the existing conditions analysis.
      - The DTA model will be used for concept level screening, which matches the original study intent.
          a. City of Sioux Falls inquired about the use of AirSage data in the DTA model. HDR confirmed that the AirSage data is only used as a seed matrix for Origin-Destination estimation in the meso-scale modeling process.
  - Measures of Effectiveness
      - MOE's from the DTA model to be used in the concept level screening analysis will allow for alternative comparison in a relative manner.
- Sub-Study 2,3 and 4
  - Schedule
      - Similar revisions to those outlined and discussed in SS1.
  - Study Advisory Team Members
      - Similar revisions to those outlined and discussed in SS1.
  - Analysis Years/Periods
      - Similar revisions to those outlined and discussed in SS1.
      - SDDOT and FHWA confirmed that SS2, SS3, SS4 M&A documents may still refernce SS1 M&A, as the orignal had.
  - Right Turn on Red
      - Similar revisions to those outlined and discussed in SS1.

4. Next Steps
   - Updated M&A Documents (SS1, SS2, SS3, SS4)
   - Circulate M&A Documents for Signature

- Develop Future Year 2035 No-Build Traffic Volumes
- Analyze Future Year 2035 No-Build Traffic Volumes
- Complete Future Year No-Build DTA Modeling
  - Will involve addressing additional questions in the macro (static) model as pointed out by the FHWA Resource Center, and supplying an updated DTA Model Validation Report.
- Start Identifying Solutions
- Conduct Solutions Development Workshop
  - Additional SAT discussion regarding Stakeholder Meetings scheduled following the completion of the 2035 No-Build analysis. Target date for Stakeholder meetings is November 2014, ideally on a Monday/Tuesday, followed by Concept Workshop on Wednesday.
    - Conflict dates: November 18, 19, 20 (MPO meetings), November 11 (state holiday), and November 27, 28 (Thanksgiving)
    - HDR to provide draft schedule for concept workshop and potential dates
  - Additional SAT discussion regarding the next Public Meeting. SDDOT requested an update to the website informing the public that the next public meeting is targeted for "Early 2015". HDR will also send out postcards as a project update, explaining the long delay since the last public meeeting.

5. Adjourn

3. Introduction and Project Description

Project Background and Understanding

Sub-Study 2 is a component of the I-229 Major Investment Corridor Study and will analyze existing and future conditions at the I-229 interchange at Exit 3 (Minnesota Avenue) and along Minnesota Avenue from 41st Street to 57th Street. The study will conduct an interchange options study for the I-229 Exit 3 interchange.

Location

The I-229 Exit 3 interchange and Minnesota Avenue is located in the southeastern portion of the Sioux Falls metropolitan area. The interchange is approximately three miles east of the I-29/I-229 and seven miles south of the I-229/I-90 systems interchanges. I-229 Exit 2 (S Western Avenue) is one mile to the west and Exit 4 (Cliff Avenue) is one mile to the east. The Minnesota Avenue study limits include the intersections of 41st Street and 57th Street. The mainline study limits include Exit 2 through Exit 4.

An illustration of the Sub-Study 2 study area is shown in Section 4 (Study Area) of this report.

Need for Study

The study team has determined the following needs for this specific study:

- Congestion at the I-229 Exit 3 (Minnesota Avenue) interchange
- Congestion throughout the Minnesota Avenue corridor, between 41st Street and 57th Street (reflective of this study's project limits)
- Closely spaced interchanges throughout the I-229 corridor
- Additional traffic operational impacts to the I-229 Exit 3 interchange and Minnesota Avenue due to the extension of 49th Street to the west of Minnesota Avenue
- Future traffic growth within the study area and the impact to interchange operations
- Conclusions and recommendations from 41st Street Corridor Study
- Improved pedestrian and bicycle access and crossings

The alternatives analysis will incorporate work done on interchange alternatives from previous studies, including the Draft I-229 and Minnesota Avenue Interchange Justification Report, as well as introduce additional concepts. These additional concepts include, but are not limited to:

- Diverging Diamond Interchange
- Offset Single Point Interchange

Study Schedule

Date	Task/Event
March 2013	Notice to Proceed, Kickoff Meeting
July 2013	Methods & Assumptions Documentation
July 2013- August 2013	Baseline Conditions Analysis/ Data Collection
September 2013- October 2014	**Public Meeting #1** (Project Kickoff) **(Oct 2013)** Existing Traffic and Operations Analysis Project Future Conditions (No Build)
October 2014- May 2015	Conceptual Design of Reconfiguration Options for the I-229 Exit 3 Interchange Conceptual Design of Minnesota Avenue Corridor Improvements **Public Meeting #2** (Scenario Building Stage) **(Jan/Feb 2015)** **MPO Meeting (Scenario Building Presentation)** Determination of Interchange and Corridor Build Scenarios Traffic and Operations Analysis of Build Scenarios Noise Analysis of Build Scenarios Constructability Analysis of Build Scenarios Recommendations
May 2015- September 2015	Sub-Study 2 Report Documentation **Public Meeting #3 (Draft Report Stage)** **MPO Meeting (Final Recommendations Presentation)**

Facilities Affected by the Study

Modifications to the I-229 Exit 3 interchange and Minnesota Avenue would have the potential to affect:

- The intersections on Minnesota Avenue near I-229
- The intersection configuration of Minnesota Avenue and 49th Street, with consideration to the extension of 49th Street to the west. This includes 2035 operations with an expanded 49th Street
- Adjacent perpendicular corridors to Minnesota Avenue, including 41st Street, 57th Street, and a future 49th Street.
- Adjacent parallel corridors providing access to I-229 at Exit 2 (Western Avenue) and Exit 4 (Cliff Avenue).

Previous Studies

The following previous studies will be reviewed during the course of this study:

- Direction 2035, Sioux Falls MPO Long-Range Transportation Plan (LRTP)
    - http://www.siouxfalls.org/~/media/Documents/planning/long-range/lrtp/2035_lrtp/adopted_lrtp_rev120210.pdf
- Sioux Falls Comprehensive Development Plan
    - http://www.siouxfalls.org/~/media/Documents/planning/shape_sf/chapters-maps/Chapter_1_r112111.pdf
- Sioux Falls Transit Development Plan 2011- 2015
    - http://www.siouxfalls.org/~/media/Documents/planning/long-range/2011_2015_Transit_Development_Plan.pdf
- 2007 Sioux Falls Bicycle Plan
    - http://www.siouxfalls.org/~/media/Documents/planning/transportation/bicycle/Bicycle_Plan_Final.pdf
- The Sioux Falls MPO Multi-Use Trail Study
    - http://www.siouxfallsmpo.org/documents/MPO/Planning_Documents/SiouxFallsMUTCS.pdf
- Sioux Falls Major Street and Access Management Plan
    - http://www.siouxfalls.org/~/media/Documents/planning/transportation/long-range/majorstreetplanmediumfinal%20pdf.pdf
- I-229 Exit 5 (26th Street) Crossroad Corridor Study
    - http://26thstreetcorridorstudy.com/
- 2010 Decennial Interstate Corridor Study and 2000 Decennial Interstate Study
- ITS Studies from City of Sioux Falls and SDDOT
- 49th Street Extension Study
- I-229 and Minnesota Avenue Interchange – Draft Interchange Justification Report
- 41st Street Corridor Study
- Costco Traffic Impact Study
- Scheels Traffic Impact Study
- Walmart Traffic Impact Study (85th Street and Minnesota Avenue)

Study Advisory Team Members

A Study Advisory Team has been formed to guide the study through completion. The Study Advisory Team is comprised of representative parties of the SDDOT, FHWA and City of Sioux Falls. Members of the Study Advisory Team are:

Shannon Ausen	City of Sioux Falls – Public Works
Mike Behm	SDDOT – Project Development
Christina Bennett	SDDOT – Operations Support
Jeff Brosz	SDDOT – Transportation Inventory Management
Andy Vandel	SDDOT – Project Development (Safety)
Joel Gengler	SDDOT – Right of Way
Amber Gibson	Sioux Falls MPO
Kevin Goeden	SDDOT – Bridge Design
Steve Gramm	SDDOT – Project Development (Planning)
Heath Hoftiezer	City of Sioux Falls – Public Works
Mark Hoines	FHWA
Dave Huft	SDDOT – Research
Bruce Hunt	FHWA
Scott Jansen	SDDOT – Mitchell Region
Captain Alan Welsh	South Dakota Highway Patrol
Ryan Kerkvliet	Sioux Falls MPO – Citizens Advisory Committee
Tom Lehmkuhl	SDDOT – Project Development (Environmental)
Pete Longman	SDDOT – Road Design
Ron McMahon	FHWA
Paul Nikolas	SDDOT – Road Design
Brad Remmich	SDDOT – Project Development (Planning)
Craig Smith	SDDOT – Mitchell Region

Additional team members may be added as the study progresses.

4. Study Area

The study area for Sub-Study 2 was defined by the Study Advisory Team and is illustrated in this report for documentation. The study area contains Minnesota Avenue from 41st Street to 57th Street. Freeway operations will be conducted during Sub-Study 1 and will also be reported in Sub-Study 2 for freeway locations from Exit 2 (Western Avenue) to Exit 4 (Cliff Avenue). The following graphic shows the study area and identifies each of the study intersections.

Sub-Study 2 Study Area

Minnesota Avenue Study Intersections:

- Minnesota Avenue & 57th Street
- Minnesota Avenue & Batcheller Lane
- Minnesota Avenue & Lotta Street
- Minnesota Avenue & Yankton Trail Park Entrance
- Minnesota Avenue & I-229 Northbound Ramp Terminal
- Minnesota Avenue & I-229 Southbound Ramp Terminal
- Minnesota Avenue & 49th Street
- Minnesota Avenue & 43rd Street
- Minnesota Avenue & 41st Street

The following Basic Freeway Segments will be analyzed in Sub-Study 1 and reported within Sub Study 2 (*See also Note 1 below for designated analysis areas as potential Freeway Weave Areas for segments including auxiliary lanes*):

- I-229 Northbound between Western Avenue (Exit 2) and Minnesota Avenue (Exit 3)
- I-229 Northbound between Minnesota Avenue (Exit 3) and Cliff Avenue (Exit 4)
- I-229 Southbound between Cliff Avenue (Exit 4) and Minnesota Avenue (Exit 3)
- I-229 Southbound between Minnesota Avenue (Exit 3) and Western Avenue (Exit 2)

[1] *Segments will be evaluated using Highway Capacity Manual (HCM) 2010 procedures to determine if the segment meets the criteria for a weave segment. If the segment meets the weave segment criteria the segment will be analyzed as a Freeway Weave Area and not a Basic Freeway Area*

5. Analysis Years/Periods

This study will evaluate traffic during and for the following time periods:

Existing Conditions

Existing conditions analyses will be conducted for year 2012 volume conditions. Turning movement counts were collected at several study area intersections in 2012. Intersections that do not already have recent count data from 2012 will be counted by the City of Sioux Falls or HDR as part of this study as described in Section 6. For existing conditions the following time periods will be evaluated:

- Existing Conditions (Year 2012) – AM Peak Hour
- Existing Conditions (Year 2012) – PM Peak Hour

Future/ Design Conditions

Future/ Design conditions analyses will be conducted for year 2035 conditions. This horizon year matches the planning horizon of the current Sioux Falls LRTP. The Travel Demand Model was calibrated and updated in year 2009 for a base year 2008 and planning horizon of year 2035. Projected traffic volumes from the Sioux Falls MPO Travel Demand Model will be utilized to establish year 2035 volumes. For the design conditions the following time periods will be evaluated:

- Future/Design Conditions (Year 2035) – AM Peak Hour
- Future/Design Conditions (Year 2035) – PM Peak Hour

<u>Interim Conditions Analysis</u>

The City of Sioux Falls is currently planning to extend 49th Street west of Duluth Street to Western Avenue. It is anticipated that this extension will be complete prior to any proposed improvements from the I-229 Major Investment Corridor Study are implemented. Therefore, an interim analysis will be conducted incorporating the proposed 49th Street extension and associated improvements (signal timing, turn lanes, etc.). The City of Sioux Falls will provide the interim schedule for full build-out of the 49th Street extension to Western Avenue. Interim volumes will be developed from recent count data and horizon year 2035 traffic volumes. For the design conditions the following time periods will be evaluated:

- Interim Conditions (Year provided by City of Sioux Falls) – AM Peak Hour
- Interim Conditions (Year provided by City of Sioux Falls) – PM Peak Hour

Volume data will be smoothed/balanced for the Existing and Future/Design Conditions using the Cube Voyager macroscopic model, with adjustments to raw model output based on post-processing techniques, as part of Sub-Study 1.

6. Data Collection

Existing traffic volume data for Sub-Study 2 will be provided by HDR, including existing arterial intersection turning movement count data, existing freeway data, and additional data as outlined below:

<u>Existing Arterial Intersection Turning Movement Count Data</u>
Minnesota Avenue intersection turning movement count data will be provided by HDR for the intersections identified within Sub-Study 2 study area.

<u>Existing Freeway Data</u>
Automated Traffic Recorded (ATR) data was provided for SDDOT Station #610, which is located between Exit 2 (Western Avenue) and Exit 3 (Minnesota Avenue). The ATR included hourly directional mainline I-229 freeway volumes from Sept 2012 to February 2013. In addition, ATR at Station #610 was provided in 15-minute increments from March 6 to April 21, 2013.

SDDOT supplied hourly ramp volume data from year 2012. Study intersection turning movement counts will be used to determine existing AM and PM peak hour ramp volumes and then smoothed/balanced along the I-229 corridor.

<u>Additional Data Supplied by SDDOT and/or City of Sioux Falls</u>

- Vehicle Classification Samples on I-229 Interstate
  - Supplied by SDDOT
- Crash History Geodatabase
  - Supplied by SDDOT
  - Includes crash records dated January 2008 to December 2012 (5 years)
- Roadway Design Standards
  - available online at: http://www.sddot.com/business/design/forms/roaddesign/Default.aspx
- Construction Plans for I-229
  - Supplied by SDDOT

- Construction Plans for Minnesota Avenue
  - Supplied by SDDOT
- GIS Base Mapping Data (parcels, parks, streets, rail, plats)
  - Supplied by City of Sioux Falls
- 2012 Aerial SID files
  - Supplied by City of Sioux Falls
- Corridor Studies
  - 41st Street Corridor Study
  - 49th Street Extension Study
- Traffic Impact Studies for Key Proposed Developments
  - Costco TIS supplied by City of Sioux Falls
  - Scheels TIS supplied by City of Sioux Falls
  - Walmart (85th Street and Minnesota Avenue) TIS supplied by City of Sioux Falls
- MPO Travel Demand Model Files in Cube Voyager (Existing and Future)
  - Supplied by City of Sioux Falls

Data Collection Techniques
All data was collected and will be collected using standard field practices which consist of using cameras, digital count boards or tube counters.

7. Traffic Operations Analysis

Traffic Operations Analysis (Existing and Future No-Build)

1. Software
   a. Signalized Intersections
      i. Highway Capacity Software (HCS) Release 6.5 (2010 HCM Methodology) Streets Module
         1. Ramp terminal intersections meeting the interchange types defined in HCM Chapter 22 (Interchange Ramp Terminals) will be analyzed with the Interchanges section of the Streets Module.
         2. Analysis of a Diverging Diamond Interchange will follow the methodology outlined in the 'Analysis Procedures for Diverging Diamond Interchange (DDI)' memorandum, found in the Appendix. This memorandum was developed for the I-90 Exit 59 (La Crosse Street) Interchange Options Study but the methodology applies to analysis of other interchange locations.
   b. Basic Freeway, Ramp Junctions and Weave Areas
      i. HCS Release 6.5 (2010 HCM Methodology)
2. Operational Analysis Results
   a. Level of Service (LOS)
      i. Signalized Ramp Terminal Intersections (SDDOT's System)
         1. Intersections where geometry is modified because of project improvements
            a. Minimum allowable LOS – LOS 'C'

i. Individual movements will be allowed to operate at LOS 'D' but the overall intersection LOS shall be 'C' or better

2. Other intersections (intersections within the study area that are not modified by project improvements)
   a. Minimum allowable LOS – LOS 'D'
      i. Individual movements will be allowed to operate at LOS 'E' but the overall intersection LOS shall be 'D' or better

ii. Signalized Non-Ramp Terminal Intersections (City of Sioux Fall's System)
   1. Minimum allowable LOS – LOS 'D'

iii. Basic Freeway, Ramp Junctions and Weave Areas
   1. Minimum allowable LOS – LOS 'C'

3. Variables
   a. Peak Hour Factor (PHF)
      i. Existing (year 2012) conditions analysis will use calculated PHFs from existing counts with a maximum value of 0.90.
      ii. Design year (year 2035) conditions analysis will use existing PHFs rounded up to the nearest 0.05 with a maximum value of 0.90.
         1. The increase in the PHF is to account for traffic growth that is likely to be spread throughout the peak periods.
   b. Saturation Flow Rate
      i. SDDOT Design Manual (Page 24, Chapter 15) requires the use of 1,800 vph in Sioux Falls. This value will be used for the signalized intersections and freeway locations within the study area.
   c. Traffic Signal Controllers
      i. Operational analysis will allow for both actuated and coordinated controllers.
   d. Left-Turn Phasing
      i. Protected, Permitted / Protected or Split Phasing will be allowed at intersections.
   e. Heaviest Lane Volume (Lane Utilization)
      i. Default HCS Streets Values used for ramp terminal / arterial intersections.
   f. Heavy Vehicle Percentage
      i. Study Intersections
         1. Use existing turning movement counts that included truck counts to determine arterial truck percentages.
      ii. Ramp Junctions and Weave Areas
         1. Use existing freeway counts that included truck counts to determine freeway truck percentages.
   g. Phase Change Intervals
      i. Existing (Year 2012) Conditions
         1. Existing signal timings will be used for phase change intervals during existing conditions.
      ii. Future No-Build (Year 2035) Conditions
         1. Existing signal timings will be used for phase change intervals of phases that exist at intersections that have no geometric change from existing conditions.

2. Phase change intervals will be calculated for the following locations:
    a. New phases added at an intersection where geometry is unchanged from existing conditions
    b. All phases at an intersection where geometry is changed from existing conditions

    The calculated values will be based on methodologies presented in the *Institution of Transportation Engineers (ITE) Traffic Engineering Handbook*. The methodologies presented in the handbook use vehicle length and speed and the distance needed to track through the intersection to calculate phase change intervals.

h. Speeds
    i. Arterials – Use posted speeds
    ii. Freeway – Use 85th percentile of collected spot speed data

i. Right Turn on Red Volume
    i. Existing (Year 2012) Conditions
        1. The number of vehicles turning right on red will be assumed to be zero for all locations initially based on the guidance in the 2010 Highway Capacity Manual.
        2. Intersections reporting LOS E or worse potentially related to right turn on red volume will be identified and presented to the SAT to decide if a right turn on red count is necessary.
        3. If a right turn on red count is deemed necessary, video recordings of existing peak hour traffic at the locations of interest will be used to count the number of vehicles turning right on red and incorporated into the HCS analysis at these locations.
    ii. Future No-Build (Year 2035) Conditions
        1. The number of vehicles turning right on red will be assumed to be zero for all locations that were not counted for right turn on red movements.
        2. For locations that were counted for right turn on red movements, the percentage of right turn on red volume of the total volume for the right turn movement in the existing condition will be multiplied by the future forecast right turn movement for each approach and incorporated into the HCS analysis at these locations.
        3. Intersections reporting LOS E or worse potentially related to right turn on red volume will be identified and presented to the SAT to decide if a right turn on red count is necessary.
        4. If a right turn on red count is deemed necessary, video recordings of existing peak hour traffic at the locations of interest will be used to count the number of vehicles turning right on red.
        5. Step 2 will be repeated for all locations where a right turn on red count was added by the SAT based on a projected future operating condition of LOS E or worse.
    iii. Future Build (Year 2035) Conditions
        1. The number of vehicles turning right on red will be assumed to be zero for all locations that were not counted for right turn on red movements

2. For locations that were counted for right turn on red movements, the same projected right turn on red volume for Future No-Build (Year 2035) Conditions will be used, assuming the Future Build (Year 2035) Condition geometry remain similar to the Future No-Build (Year 2035) Condition geometry.

8. Travel Forecast

Existing (Year 2012) and Future Year (Year 2035) volumes developed during Sub-Study 1 will be used for the volumes within the study area for Sub-Study 2. The methodology for Travel Forecast was documented in the Sub-Study 1 Methods and Assumptions document.

9. Safety Issues

Crash data will be reviewed for the study area based on the Crash Geodatabase which includes crashes between January 2008 and December 2012. SDDOT's database will be the only database used in the calculation of crash rates and critical crash rates. The following information will be provided as a result of 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

10. Selection of Measures of Effectiveness (MOE)

The main goals of this study are as follows:

1. Conduct an interchange and crossroad study for Exit 3 (Minnesota Avenue).
    a. Complete a Level of Service Analysis for both existing and future (2035) conditions at the I-229 Exit 3 Interchange and Minnesota Avenue within the study limits.
    b. Complete a safety analysis of the I-229 Exit 3 Interchange and Minnesota Avenue, within the study limits
    c. Determine and recommend improvement options that will improve mobility and safety within the I-229 Exit 3 interchange and along Minnesota Avenue between, and including, 41st Street and 57th Street.
2. Create final products for use by the SDDOT and City of Sioux Falls which will guide them in the implementation of recommended improvements that will maximize the efficiency of the system.

To satisfy the study objectives, the following MOEs will be used to evaluate and compare the concepts:

- Minnesota Avenue Intersections: **LEVEL OF SERVICE (LOS)** and **INDIVIDUAL MOVEMENT DELAY**
- Minnesota Avenue Corridor: **LOS** and **TRAVEL SPEED**
- Ramp Terminal Intersections: **LEVEL OF SERVICE** and **INDIVIDUAL MOVEMENT**

DELAY

- Freeway Segments, Ramp Junctions and Weave Areas: **LOS** and **DENSITY**

These statements are made assuming that the geometric improvements identified meet all AASHTO, SDDOT, and City of Sioux Falls guidelines. It is understood that all traffic analysis reporting will be completed using HCM 2010 Methodology.

11. FHWA Interstate Access Modification Policy Points

An Interchange Modification Justification Report (IMJR) will not be developed for the I-229 Exit 3 (Minnesota Avenue) interchange as part of this project.

12. Deviations/Justifications

No deviations from standards are currently known. If it is determined during the study that deviations are required, the methods and assumptions document will be amended prior to proceeding.

13. Conclusion

All sections contained in this document will guide the traffic data collection and traffic assessment for this study.

14. Appendices

The appendix includes the following:

- Methods and Assumptions Study Team Meeting Minutes (August 28, 2013)
- Analysis Procedures for Diverging Diamond Interchange (DDI)

APPENDIX

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Meeting Notes

Subject: Study Advisory Team Meeting No. 3	
Client: South Dakota Department of Transportation	
Project: I-229 Major Investment Corridor Study	Project No: PL 0100(87) 3616 P, PCN 044K Contract 410545, WO PD-02-13 HDR Project No. 207030 Dept 00135
Meeting Date: August 28, 2013, 1:00-3:30PM	Meeting Location: Web Meeting: SDDOT Pierre Headquarters; SDDOT Sioux Falls Area Office; HDR Omaha & Sioux Falls; City of Sioux Falls; HR Green Des Moines & Sioux Falls
Notes by: David Meier,	

A Study Advisory Team Meeting for the I-229 Major Investment Corridor Study was held on August 28, 2013. Action items from the meeting are summarized below and discussion details follow. A list of participants and contact information is at the end of meeting notes.

Action Items

Item	Responsible
o Update M&A documents for SS 2, 3, & 4 and submit for signature.	HDR
o Revise mailing list limits per SAT comments & submit updated lists to SDDOT & City.	HDR
o Coordinate on Public Meeting room layout.	HDR/City
o Edit website as needed per additional SAT comments. Activate website 3 weeks from SAT #3.	HDR
o Determine whether a press conference will be held announcing Study/website.	SDDOT
o	
o	City
o Identify SDDOT staff for ITS interviews.	SDDOT

Comments based on the provided Agenda and PowerPoint Presentation:

1. **Introductions** (SDDOT, City, MPO, FHWA, HDR/HR Green)

2. **Draft Methods & Assumptions Documents – Sub-studies 2, 3, and 4**
   - **Sub-study 2**
     - **Section 3 -** The Need for Study subsection should note the need to consider findings of the 41st Street Corridor Study (City).
     - Study Schedule table shows September 2014 for completion, is there need to officially extend the project schedule? Yes (see Schedule section of SAT notes). ***Comment applies to all Sub-studies).***
     - Previously developed interchange modification alternatives need to be considered. Interim conditions (post-49th Street Extension and Costco opening) will need to be considered and interim improvements may be needed (City). FHWA is concerned regarding proximity of 49th St connection and existing interchange ramp terminals.
     - Need to review Costco Traffic Impact Study for interim improvements noted.
     - In Study Schedule table, reference to Sub-study 3 Report Documentation should be SS 2.

- Add 41st and Grange to list of Facilities Impacted by the Study.
- **Section 5** - FHWA has comments regarding differences noted between the described approach in the SS 2 M&A and the M&A document for Exit 5 (26th Street) for Section 5 and subsequent sections. If these differences can be addressed, there will be no need for FHWA to send the M&A documents to the Resource Center for review. ***Comment applies to all Sub-studies. FHWA comments were received on 9/3/13 from SDDOT. Responses to the FHWA comments are tabulated at the end of these notes.***
- **Section 6** - Add Scheel's Expansion Study and Wal Mart Traffic Impact Study to list of previous studies. ***The additions will also be made to the Previous Studies list in Section 3.***
- **Section 7** – HDR clarified that Synchro will not be used. ***Applies to all Sub-studies.***
- **Section 10** – The City commented that the Measures of Effectiveness description needs to clarify that Level of Service "D" will be the minimum criteria for individual intersection approaches, but not an entire intersection. ***Applies to all Sub-studies. Response to this comment will be located in Section 7 of the M&A documents, per FHWA comment.***
- **Section 11** – The City asked if FHWA Regional Office comments on the previously prepared draft IJR will need to be noted in the sub-study report. FHWA replied that is unknown at this time because alternatives are yet to be identified in Sub-study 2.
- **Section 14 (Appendix)** – The Diverging Diamond Interchange analysis procedure attached are the most current version of the procedure.

- **Sub-study 3**
  - **Section 3** - The City noted that there is a serious capacity issue with the existing interchange that extends the majority of the day. The M&A will be revised to note that congestion extends through off-peak periods.
  - Add the following to the Facilities Impacted by the Study:
    - 18th Street (parallel corridor)
    - Lowell Ave (perpendicular corridor)
  - Strike the SIMPCO Incident Management Plan from the Previous Studies section. ***Comment applies to all Sub-studies.***
  - **Section 4** - Study Area figure references Sub-study 2. ***Also applies to SS4 M&A.***

- **Sub-study 4**
  - **Section 4** - Study Area description needs to be replaced with SS 4 specific narrative.
  - Add Benson Rd Feasibility Study to the Previous Studies section.

3. Safety Analysis Technical Memorandum

- The slippery conditions noted in a significant number of reported crashes were mostly during winter weather (approximately 90%), but some were documented as wet pavement. This pattern was noted for the Cliff Ave to Louise Ave segment as well as the 26th Street area along I-229.
- Enhanced driver information during inclement weather was noted as a potential mitigation measure. The ITS recommendations section of the Sub-study 1 report will provide additional details on this recommendation.
- It was noted that the safety analysis findings may suggest review of snow removal operational procedures.
- Crashes associated with traffic congestion were found to be mostly located on ramps. SDDOT noted that right-turning traffic on the northbound 10th St exit ramp has been shifted onto the paved shoulder with pavement markings to provide additional storage. The southbound 10th St entrance ramp has been extended to provide more merging length upstream of the ramp gore.

4. Public Involvement Activities

- **Public Meeting**

- **The 1st Public meeting will be held on Wednesday October 30th from 5:30-7:00 pm at the Convention Center.**
- Press release to be placed in the Argus Leader 17 and 10 days in advance of the meeting. There will be no weekend advertisements due to substantial additional cost involved.
- Seating will be limited to about 150. Additional seating capacity may be needed for the 2nd public meeting, when mailings will include extended limits for Sub-studies 2, 3, and 4.
- The formal presentation will be kept brief and presented once. The presentation will be taped.
- HDR will coordinate with the City on the room layout for the public meeting.
- HDR Mailing list
  - Approximately 600 addressees on the current mailing list.
  - Check the ownership of the open area shown on the north side of I-229 just east of the I-29/I-229 system interchange and south of W 59th St.
  - HDR will send a coordination letter to addressees on the Exit 5 Study mailing list alerting them to the I-229 study.
  - Revise the mailing area to reduce the number of properties contacted west of Western Avenue and north of I-229.
  - Add the properties along both sides of Minnesota Ave extending south to E 57th St.
  - At 10th St, mailing list coverage will be extended to S Cliff Ave to the west and to S Sycamore Ave to the east.
  - Updated mailing lists will be sent to Steve Gramm and Shannon Ausen.
- Postcards will be used for the public meeting mailings.
- Message boards will be used to assist in advertising the public meeting. The City can provide some of the message boards to be used. FHWA does not object to placing message boards in the I-229 right of way for this purpose.

- **Draft Web site**
  - HDR has made updates to the website reflecting comments received to date. Additional comments should be sent to Jason Kjenstad.
  - SDDOT will consider conducting a press conference to announce the study and/or web site.
  - The website is to be activated at least two weeks prior to advertising for the October 30th public meeting and may be activated in three weeks from this SAT meeting (pending further SAT comments).

5. Origin-Destination Data

- HDR presented an overview of the cell phone-based O-D data gathered by AirSage that focused on the following objectives:
  - External to external patterns
  - Comparison of average weekday travel patterns to average weekend day and two special events days for which data was collected.
  - Comparison of the cell phone-based O-D data to the O-D matrix generated by the Sioux Falls area model.
- The O-D data presentation screens were provided as a part of the SAT meeting agenda file in pdf format.
- The data collection process involved approximately 100,000 device (cell phone) sightings per day and a total of 1.5 million unique devices logged. Of that total, 146,000 devices were assumed to be area resident phones, based on observed patterns. Based on a 446,000 person population for the data collection area, the calculated sampling rate was over 32 percent. The total trips per day identified averaged around 200,000. The SAT questioned the 446,000 population figure as far in excess of the metropolitan area (approximately 225,000 population). HDR will provide an explanation of the area covered for that population. ***Response: The 446,000 population is for the entire O-D study area that includes the Sioux Falls***

metropolitan area and the surrounding buffer area (shown on Exhibit 1 from the presentation following these notes) that was used to identify external trips.

- Each day of the week was found to have a typical pattern with Fridays having the peak number of trips and Sundays having the lowest number.
- Local versus regional traffic patterns were reviewed for I-29 south of Sioux Falls, which indicated that 84 percent of trips on I-29 had an origin or destination within the Sioux Falls metro area. The SAT requested that the local/regional patterns be reported for I-29 north of Sioux Falls and for I-90 east and west of Sioux Falls. ***Response: The O-D patterns for local and regional trips for I-29 north and I-90 east and west are shown on Exhibits 2, 3, and 4 following these notes.***
- For the average weekday vs. weekend day comparison, O-D patterns between most zones showed decreases of 15 to 50 percent, with exceptions being shopping area zones and the casino.
- Both the construction incident special event day and the winter weather special event day were found to have quantities of trips similar to the average week day.
- For the construction incident day vs. the average weekday comparison, most zones had variances of +/- 10 to 50 percent trips. The SAT asked if most of the variances were more likely +/- 20 to 30 percent. ***Response: Exhibit 5 following these notes labels the variance percentages for each zone.***
- The City has not reviewed the O-D data yet, but expects that it will prove helpful in improving O-D patterns built into the model.

6. **Project Schedule**
   - HDR advised the SAT that final reports for the sub-studies will likely be issued at the end of September 2014.

7. **Next Steps**
   - HDR will coordinate with the City on the room layout for the public meeting.

8. **Other Items** – No discussion
   - SDDOT advised that data collection for the ITS assessment task will involve interviewing identified DOT staff instead of reviewing previously developed ITS planning documents.
   - A presentation by IADOT staff regarding the Tri-State Incident Management Plan for the Sioux City metropolitan area will be given on Monday September 9th from 1-3 pm in the SDDOT Area Office. Steve Gramm will be attending.

Attendees:

Pierre		
Mark Hoines - FHWA	Steve Gramm – SDDOT	Joel Gengler - SDDOT
Ron McMahon - FHWA	Kevin Goeden - SDDOT	Brad Remmich - SDDOT
Jeff Brosz – SDDOT	Dave Huft - SDDOT	Nicole Frankl - SDDOT
Scott Jansen - SDDOT	Pete Longman - SDDOT	Christina Bennett - SDDOT
Tom Lehmkuhl - SDDOT	Terry Keller - SDDOT	
Sioux Falls		
Shannon Ausen – Sioux Falls	Heath Hoftiezer – Sioux Falls	Amber Gibson - SECOG
Craig Smith - SDDOT	Paul Nikolas - SDDOT	
Consultant Team		
David Meier - HDR	Brian Ray - HDR	Courtney Sokol - HDR
Mike Forsberg- HDR	Jason Kjenstad - HDR	Ross Harris – HR Green
Rick Laughlin - HDR	Jon Weigand – HR Green	Bill Moran – HR Green
Jon Markt - HDR		

Responses to FHWA Comments on M&A Documents for Sub-studies 2, 3, and 4 Received 9/3/13

Below are responses to FHWA comments on the I-229 M&A documents. The response regarding content of the M&A documents is noted in **bold text**.

Section	Comment	Response
Section 5 – Analysis Years/Periods	Add a note regarding factoring and balancing volumes.	***A note will be added that discusses the use of balanced volumes provided by the Cube Avenue mesoscopic model that is being utilized for the project.***
Section 7 – Traffic Operations Analysis	Why is Synchro being used on 26th Street but not on this study?	Traffic operations analysis results will be based on Highway Capacity Manual (HCM) 2010 methodologies, as was stipulated in the study scope. Currently, the most accurate tool to perform operational analysis using HCM 2010 methods is Highway Capacity Software (HCS) 2010. The use of Synchro would be redundant and provide no additional operational results. ***No revisions to the analysis tools section are planned for the I-229 M&A documents.***
Section 7 – Traffic Operations Analysis	List the allowable LOS similar to the 26th Street M&A.	***Allowable LOS criteria will be listed.***
Section 7 – Traffic Operations Analysis	The I-229 M&A documents say the analysis of future year conditions will use existing PHFs rounded up to the nearest 0.05 with a maximum of 0.90. The 26th Street document said the future year analysis would use 0.9.	Using the existing PHFs rounded up to the nearest 0.05 with a maximum of 0.90 will capture locations with high peaking characteristics within a 15-30 minute time span. Since the peaking characteristics are unlikely to become much more uniform across the peak hour in future year conditions, this approach is considered more conservative than using 0.90 at all locations. ***No revisions to the PHFs section are planned for the I-229 M&A documents.***
Section 7 – Traffic Operations Analysis	The 26th Street M&A document has more details concerning phase change interval values that will be used in the analysis.	The I-229 M&A documents state the use of the methodologies presented in the ITE Traffic Engineering Handbook instead of stating the red change interval in the M&A document, as in the 26th Street document. ***No revisions to the phase change interval section are planned for the I-229 M&A documents.***
Section 7 – Traffic Operations Analysis	The I-229 M&A documents state the use of the posted speed for arterial analysis. The 26th Street M&A states the use of 3 mph	Based on discussions with the developer of HCS, McTrans. Speed limit is used to compute Base FFS. FFS is only used as an input to

	above the posted speed for the FFS.	the ratio of the speed limit and is applied to an entire corridor. This ratio is used in the stop rate calculations for determining the Auto Perception Index Score for the arterial segment, not Level of Service. ***No revisions to the speeds section are planned for the I-229 M&A documents.***
Section 10 – Selection of Measures of Effectiveness	The arterial corridor segment MOEs for 26th Street also included delay as a reported MOE.	Delay is incorporated into the travel speed MOE. Based on Chapter 17 of the HCM, the travel speed reflects the factors that influence running time along the link and the delay incurred by through vehicles at the boundary intersection. HCS reports generated will be included in appendices of analysis submittals. These reports contain additional information such as delay for those interested in the relationship between travel speed and delay. ***No revisions to the arterial MOE bullet are planned for the I-229 M&A documents.***
Section 10 – Selection of Measures of Effectiveness	The 26th Street M&A also included a bullet regarding reported MOEs at ramp terminal intersections (LOS and Individual Movement Delay).	***A bullet will be added report MOEs at ramp terminal intersections. This will include LOS and Individual Movement Delay.***

OD Study Area

EXHIBIT 1

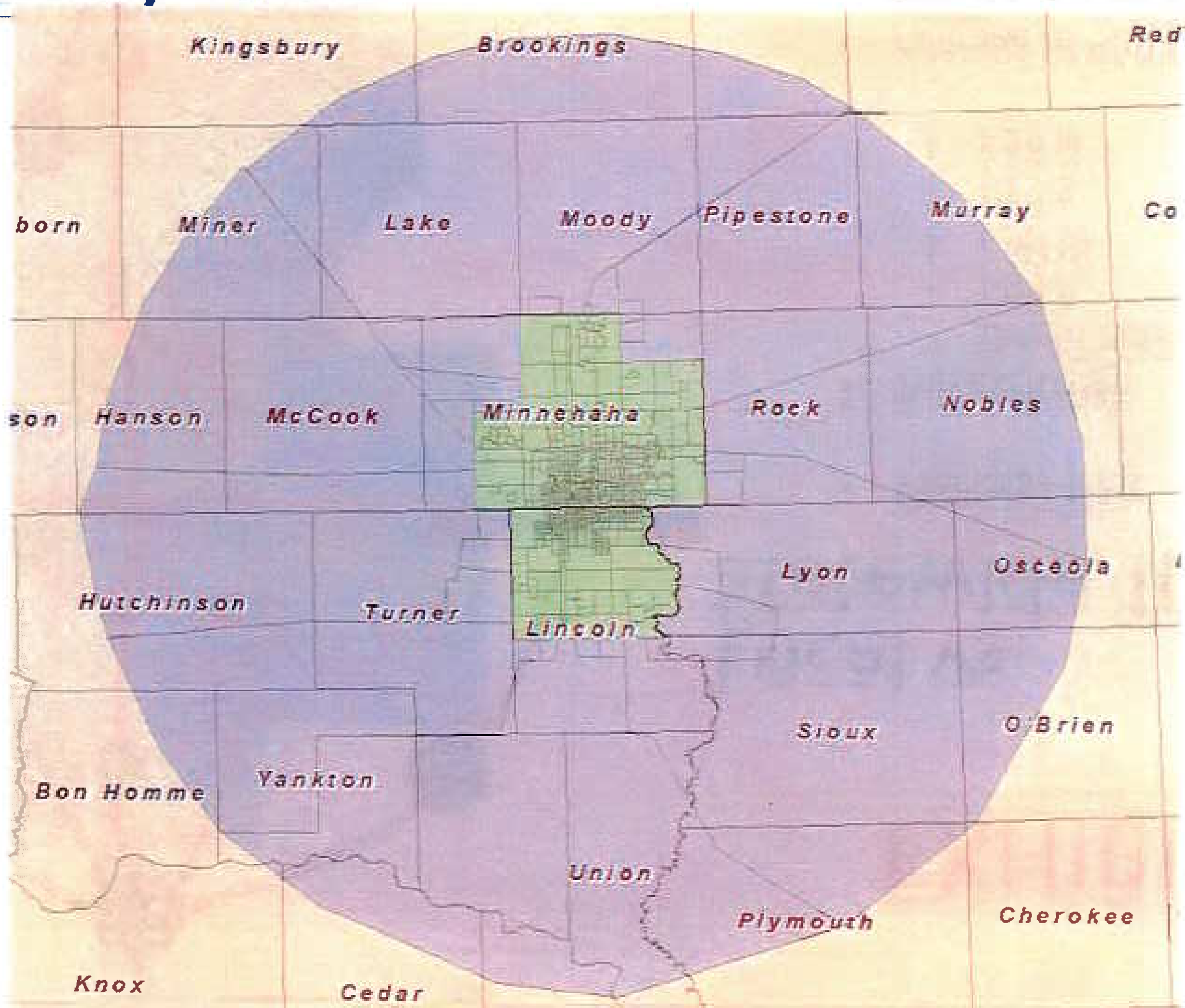
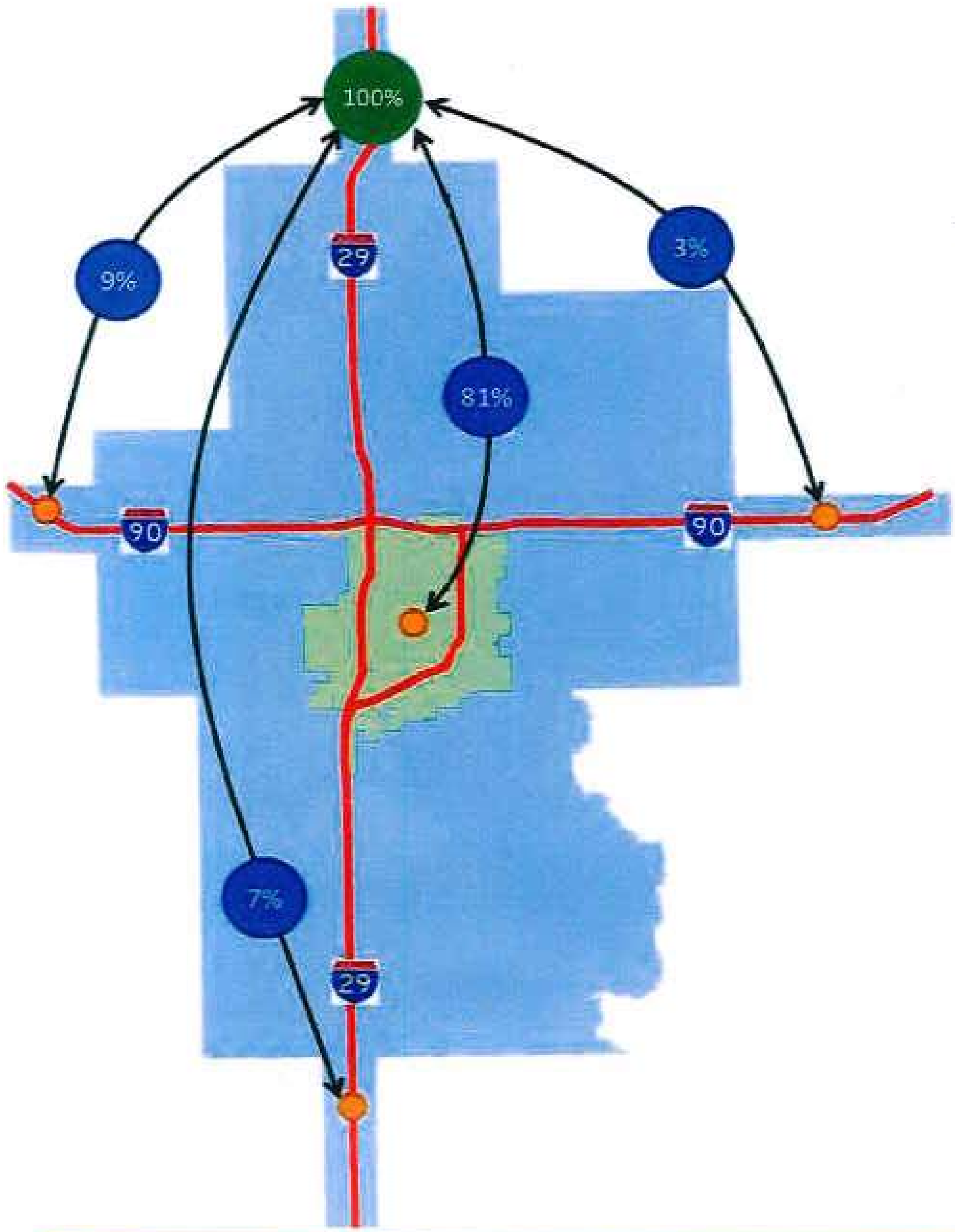


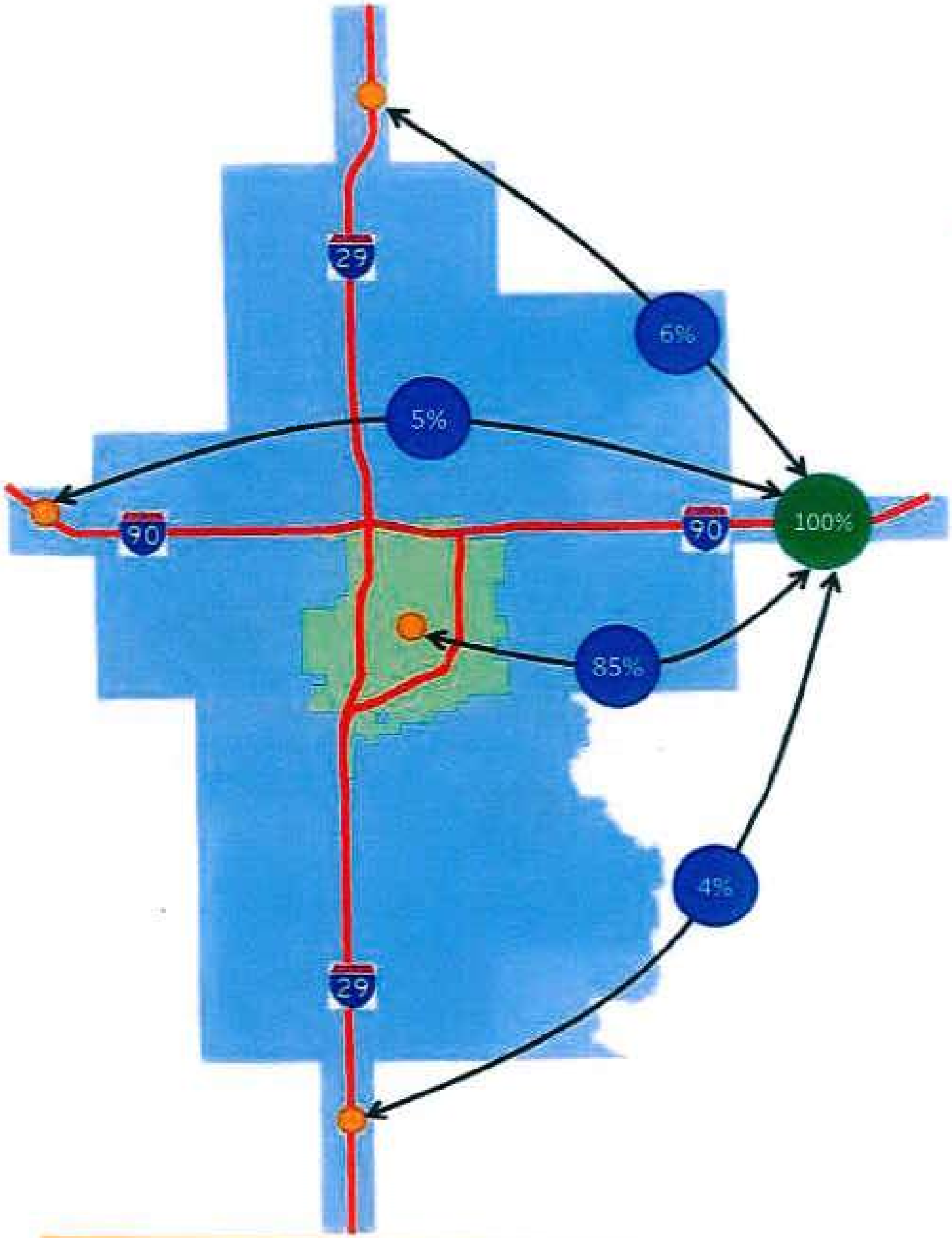
EXHIBIT 2



Local vs. Statewide Traffic

- Weekday Trips
- Trip exchange
  - Urban Core
  - I-90 E
  - I-90 W
  - I-29 S
  - I-29 N
- Average of bi-directional trips

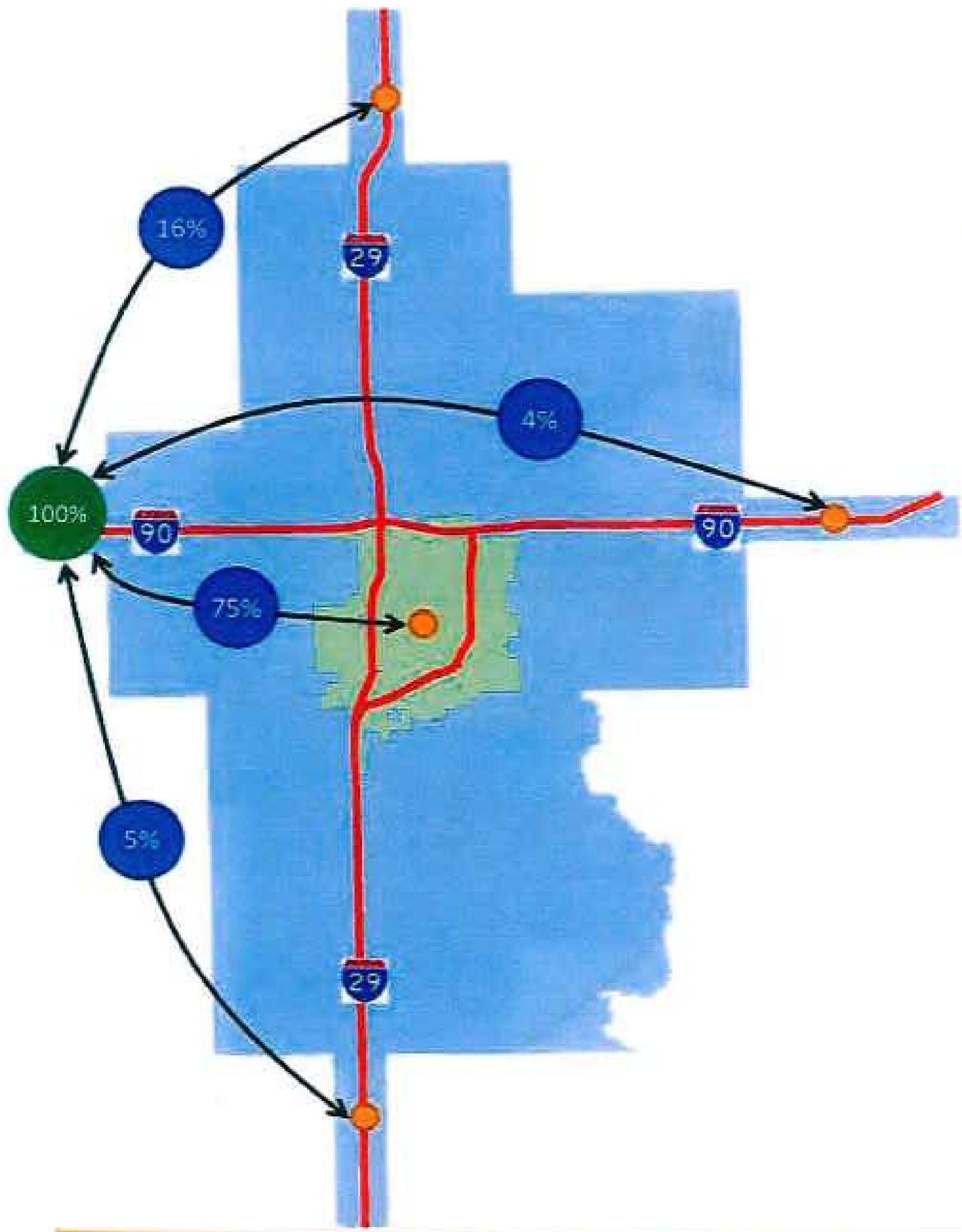
EXHIBIT 3



Local vs. Statewide Traffic

- Weekday Trips
- Trip exchange
  - Urban Core
  - I-90 E
  - I-90 W
  - I-29 S
  - I-29 N
- Average of bi-directional trips

EXHIBIT 4



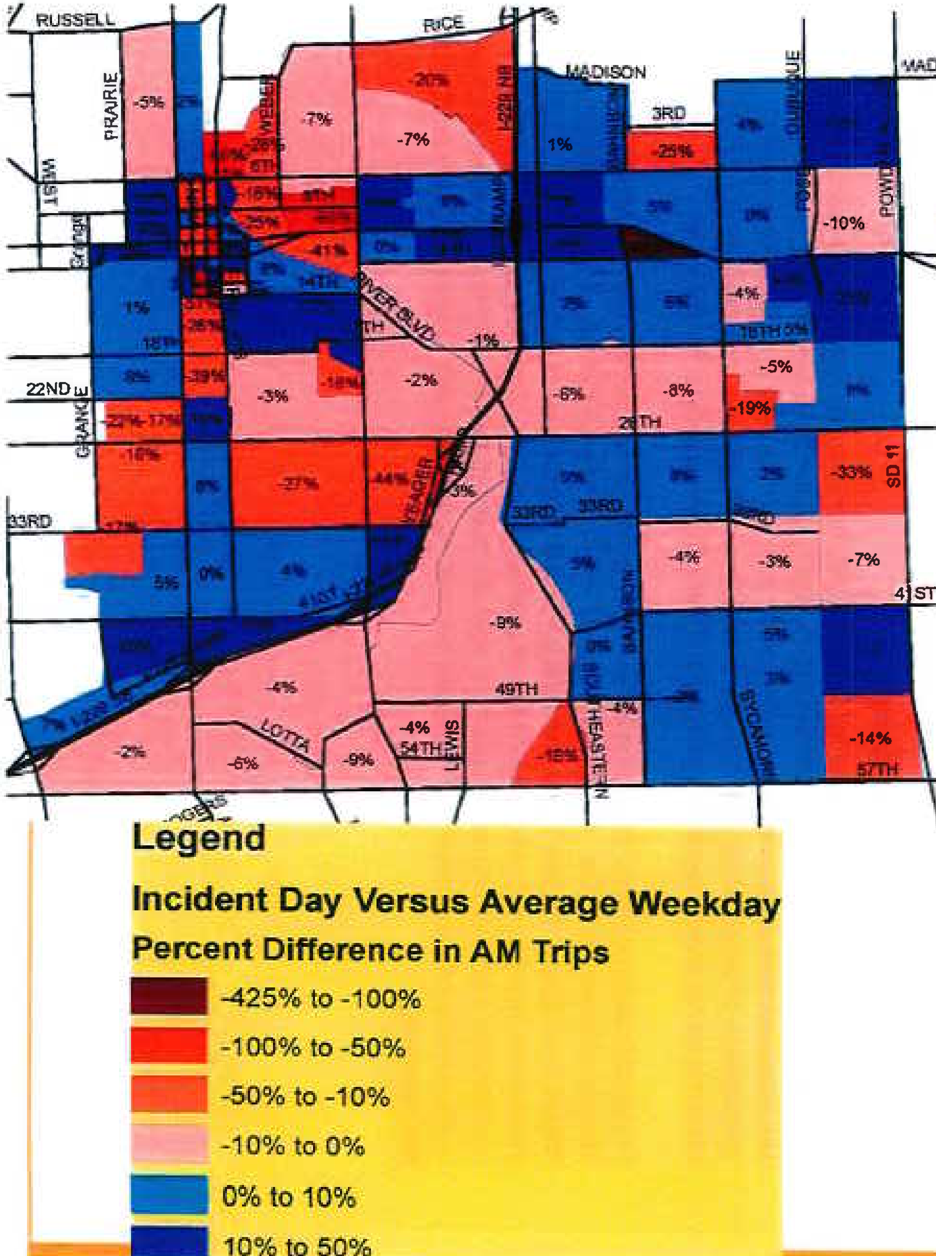
Local vs. Statewide Traffic

- Weekday Trips

- Trip exchange
  - Urban Core
  - I-90 E
  - I-90 W
  - I-29 S
  - I-29 N

- Average of bi-directional trips

EXHIBIT 5



Incident Day vs. Weekday Trips

- SB lane closure
- Increased Activity at Exits 4 (Cliff Ave) & 6 (10th St)
- Wednesday

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To: File			
From: Mike Forsberg, P.E.		Project: None	
CC:			
Date: August 5, 2013		Job No:	

RE: Highway Capacity Software Analysis Procedures for a Diverging Diamond Interchange (DDI)

Introduction

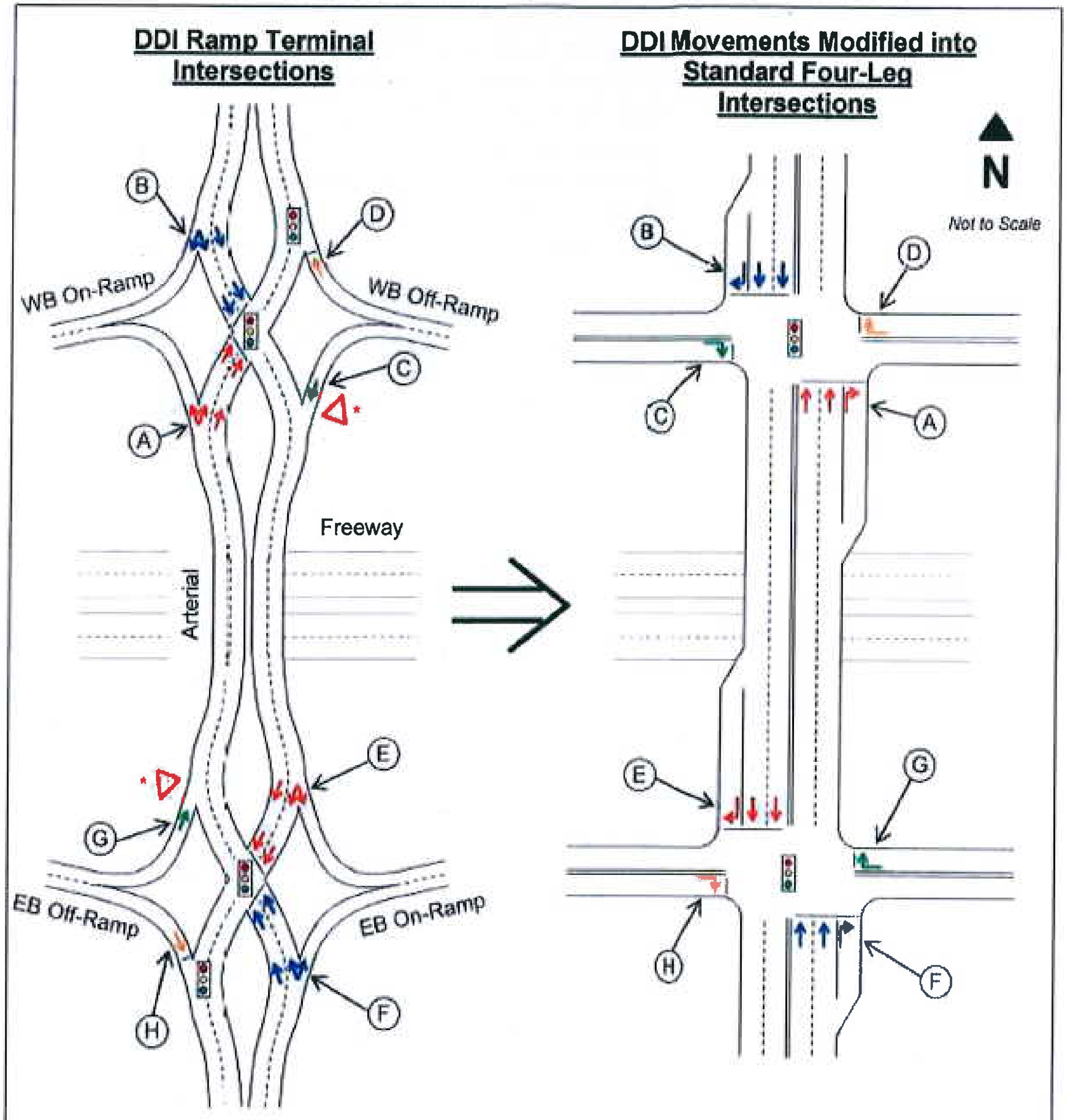
This document presents a proposed methodology for analyzing a Diverging Diamond Interchange (DDI) using Highway Capacity Software (HCS) 2010 Streets module. The Federal Highway Agency (FHWA) has indicated that HCS 2010 is the preferred traffic analysis tool for various projects within certain agencies. The procedures documented in this memorandum were developed in response to known challenges of analyzing DDIs in HCS 2010 based on discussions with the software developer, McTrans. HCS 2010 version 6.50 was utilized to develop this methodology.

Proposed DDI Analysis Methodology

The proposed analysis methodology for DDIs includes manipulation of the intersection movements at a DDI to analyze the ramp terminal intersections as standard four-leg intersections in HCS 2010. The proposed methodology involves manipulating the movements at the DDI ramp terminal intersections of the proposed DDI concept to conform to the analysis methodology of HCS 2010 while mimicking similar operational elements of the DDI ramp terminal intersection.

For simplification purposes, the methodology is presented for an arterial oriented north/south and freeway oriented east/west. The methodology for different orientations would be the same, but rotated accordingly. **Figure 1** expresses the proposed manipulation of the DDI ramp terminal movements into a format with standard four-leg intersections. The modified standard four-leg configuration shown in **Figure 1** would have split-phase operations for northbound and southbound traffic and allow for coordination of the ramp terminal intersections with signals north and south of the interchange.

Figure 1. Manipulation of DDI Movements into Standard Four-Leg Intersections



The following presents details of the proposed manipulation of intersection movements for the westbound ramp terminal intersection shown in **Figure 1** from the DDI configuration to a standard four-leg intersection configuration. Manipulation of intersection movements for the eastbound ramp terminal intersection would follow similar methodology.

- The DDI westbound ramp terminal intersection would operate as a two-phase signal. The northbound crossover movement (A) and westbound off-ramp left-turn movement (C) would travel through the intersection during the first phase (e.g., phase 2). The southbound crossover movement (B) and westbound off-ramp right-turn movement (D) would travel through the intersection during the second phase (e.g., phase 6).

- The two-phase operations of the DDI would be modified to two-phase operations with a four-leg intersection configuration. For example, at the westbound ramp terminal intersection:
  - The northbound crossover movement (A) of the DDI would be treated as a northbound through movement in the four-leg intersection configuration.
  - The northbound left-turn movement of the DDI in advance of the crossover would be treated as a northbound right-turn movement in the four-leg intersection configuration.
    - The value for right-turn-on-red (RTOR) for the northbound right turns would be set to zero. This assumes that all northbound right turns would only be able to turn during the northbound green signal indication. This assumption is conservative since these vehicles would be able to complete this turning maneuver during a northbound red signal indication in the DDI configuration, while the northbound queue of the crossover movement does not extend to the turning movement location. However, due to the unknown percentage of time that the northbound through movement would extend beyond the turning movement location, it is assumed that no vehicles would be able to turn right on red.
  - The southbound crossover movement (B) of the DDI would be treated as a southbound through movement in the four-leg intersection configuration.
  - The southbound right-turn movement of the DDI in advance of the crossover would be treated as a southbound right-turn movement in the four-leg intersection configuration.
    - The value for right-turn-on-red (RTOR) for the southbound right turns would be set to zero. This assumes that all southbound right turns would only be able to turn during the southbound green signal indication. This assumption is conservative since these vehicles would be able to complete this turning maneuver during a southbound red signal indication in the DDI configuration, while the southbound queue of the crossover movement does not extend to the turning movement location. However, due to the unknown percentage of time that the southbound through movement would extend beyond the turning movement location, it was assumed that no vehicles would be able to turn right on red.
  - The westbound off-ramp left-turn movement (C) of the DDI would be treated as an eastbound right-turn movement in the four-leg intersection configuration.
    - This movement would be treated as an eastbound right-turn movement at a signal with RTOR allowed. The value of RTOR would be based on the 'RTOR Reduction' factor shown in the HCM 2000 report obtained from Synchro traffic analysis software (Synchro would be used to code the modified four-leg configuration and obtain the RTOR value for this movement).
  - The westbound off-ramp right-turn movement (D) of the DDI would be treated as a westbound right-turn movement in the four-leg intersection configuration.

- RTOR for the westbound right-turn movement would likely be restricted in the DDI configuration for safety purposes; therefore, the RTOR of the westbound right-turn movement four-leg configuration would be set to '0'. For locations where the controlling agency would operate the westbound off-ramp right-turn movement (D) of the DDI with RTOR allowed, the value of RTOR would be based on the 'RTOR Reduction' factor shown in the HCM 2000 report obtained from Synchro.

- In the modified version of the four-leg intersection the northbound (A) and eastbound (C) movements would travel through the intersection during the same phase (e.g., phase 2). This would be consistent with the overlapping northbound crossover movement (A) and westbound off-ramp left-turn movement (C) of the DDI.
- In the modified version of the four-leg intersection the southbound (B) and westbound (D) movements would travel through the intersection during the same phase (e.g., phase 6). This would be consistent with the overlapping southbound crossover movement (B) and westbound off-ramp right-turn movement (D) of the DDI.

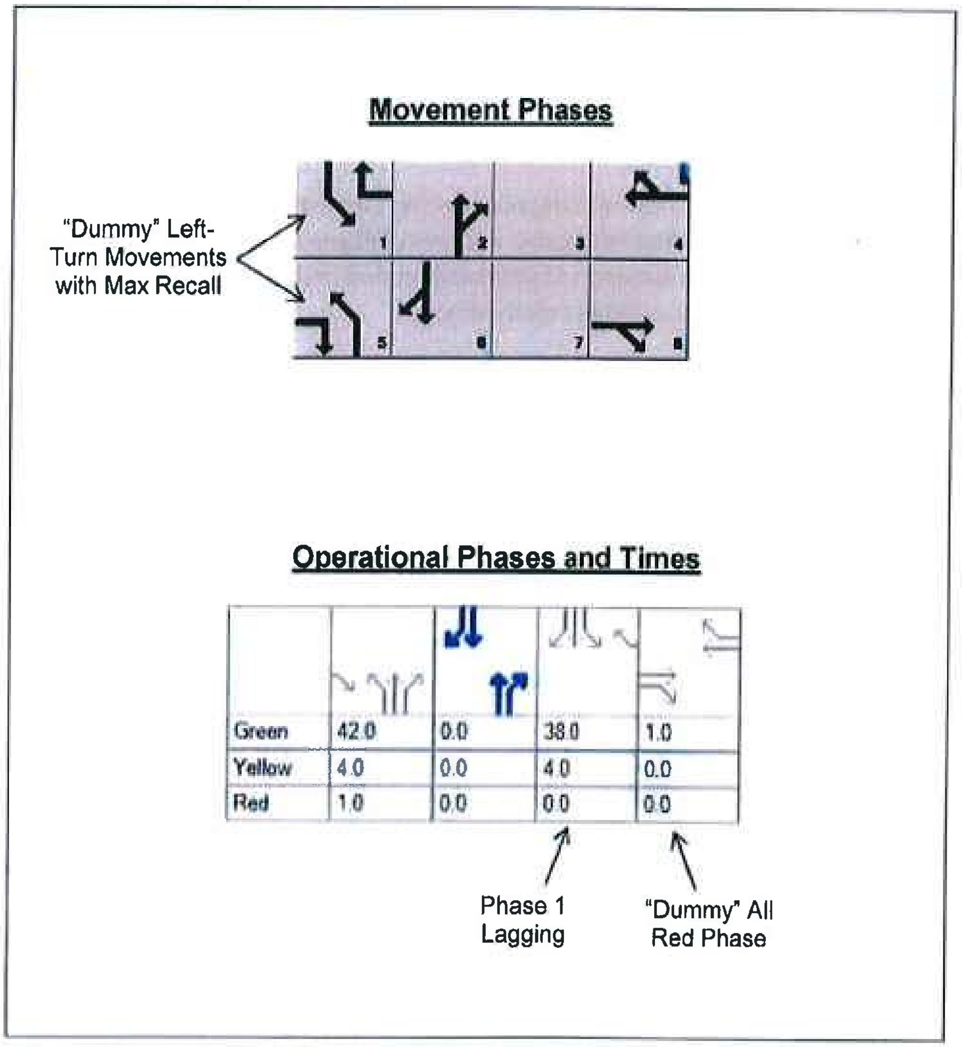
The following presents specific details of coding elements in HCS 2010 Streets to model the westbound ramp terminal intersection shown in **Figure 1** as a standard four-leg intersection of the DDI intersection. Manipulation of intersection movements for the eastbound ramp terminal intersection would follow similar methodology.

- To model split-phase operations for the arterial street (northbound and southbound movements) in HCS 2010 Streets, the following coding elements would be needed. Additionally, the diagrams shown in **Figure 2** supplement the coding elements listed below.
  - Artificial ("dummy") northbound and southbound left-turn movements would be added with protected phasing. These movements would not serve any of the DDI traffic. The added left-turn phases would be phase 5 for the northbound left-turn movement and phase 1 for the southbound left-turn movement (based on the previously mentioned example phasing of phases 2 and 6 for the northbound and southbound through movements, respectively).
  - The eastbound and westbound right-turn movements would be overlapped with the northbound and southbound left-turn movements.
  - The southbound left-turn movement would be set to a lagging left-turn phase so that the northbound and southbound left-turn movements would not need to have a green signal indication simultaneously.
  - The Recall Mode for the northbound and southbound left-turn movements would be set to 'Max'.
  - Eastbound and westbound phases (phases 8 and 4, respectively) would be required to be included to meet the criteria for signal timings in HCS 2010 Streets. This would include eastbound and westbound through movements with zero volume. These phases would have a green signal indication simultaneously for 1 second (the minimum time allowed for a phase). This effectively serves as the Red time for the previous split that serves southbound traffic. This 1 second phase for the eastbound and westbound approaches is labeled as "Dummy" All Red Phase in **Figure 2**. To counter the additional 1 second of green time given to the eastbound and westbound right-turn movements, each of these movements would be given an additional 0.5

seconds of "Start-Up Lost Time". Each of these right-turn movements would experience the extra 0.5 seconds of "Start-Up Lost Time" during the "Dummy" All Red Phase and during their normal phase of operation (Phase 1 or 5), totaling 1 second of additional "Start-Up Lost Time" over the course of 1 signal cycle for the eastbound and westbound right-turn movements.

  - The Demand for the northbound and southbound left-turn movements would be set to '1' in order for phases 1 and 5 to be given a green signal indication (otherwise, all of the time would be given to the phase where northbound and southbound traffic travel through the intersection simultaneously).

Figure 2. Sample HCS 2010 Streets Phasing for the Westbound Ramp Terminal Intersection



Green	42.0	0.0	38.0	1.0
Yellow	4.0	0.0	4.0	0.0
Red	1.0	0.0	0.0	0.0

- The following coding elements would also be included in HCS 2010 Streets to mimic the movements of the DDI.
  - The Arrival Type for the eastbound and westbound right-turn movements would be '3', representing random arrivals from the freeway. The Arrival Type for the

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northbound and southbound approaches would be '4', representing coordination of signals. However, the arrival patterns of the northbound and southbound movements would be dictated by the signal timings at upstream Intersections and the coded Arrival Type for the northbound and southbound approaches would not have any impact on the operations at these intersections.

- Phase 5 would operate with 4 seconds of yellow and 1 second of all red.
- Phase 1 would operate with 4 seconds of yellow and 0 seconds of all red (the all red time would be effectively given by the "Dummy" All Red Phase shown in **Figure 2**).
- The Phase Split time for the northbound left-turn movement (phases 5) would be set to the optimum phase split time for the northbound movement. The Phase Split time for the southbound left-turn movement (phases 5) would be set to the optimum phase split time for the northbound movement minus 1 second (to account for the 1 second "Dummy" All Red Phase). The combined split times for the northbound left-turn movement (phase 5), southbound left-turn movement (phase 1) and eastbound/westbound movements (phases 8/4) would equal the cycle length of the signal, leaving no remaining time for the overlapping phase where northbound and southbound through traffic would travel through the intersection simultaneously.
- The speed limit would be set to 25 mph to account for lower speeds through the crossover and channelized turn movements. The exception to this would be for the southbound approach that arrives from outside of the DDI and would be set to the speed limit of the Arterial Street.
- The Interchanges feature within HCS Streets would be used to update the Turning Radius for the turn movements based on the concept/design. This would account for the larger radii at the turning locations of the DDI. The Interchange Type within the Interchanges section does not include DDI as an option and would be set to Diamond.

As mentioned previously, the modified standard four-leg configuration would have split-phase operations at the ramp terminal intersections for northbound and southbound traffic and allow for coordination of the ramp terminal intersections with signals north and south of the interchange. The signal offset values at the ramp terminals would be based on the turn patterns at each intersection to maximize platooning of traffic through the two signals. Signal offsets at intersections adjacent to the ramp terminals would be based on the offsets established at the ramp terminal intersections.

Original M & A

I-229 Major Investment Corridor Study: Sub-Study #2 Methods and Assumptions

To: Study Advisory Team (SDDOT, FHWA, City of Sioux Falls)

From: Ross Harris, HR Green

Subject: Methods and Assumptions, Sub-Study 2

Date: October 7, 2013

1. Methods and Assumptions Cover Page

Methods and Assumptions Document

This Methods and Assumptions document was developed as a summation of the Methods and Assumptions Meeting held on August 28, 2013 with representatives from the South Dakota Department of Transportation (SDDOT), Federal Highway Administration (FHWA), City of Sioux Falls, Sioux Falls MPO, HDR, and HR Green. This document is intended to serve as a historical record of the process, dates, and decisions made by the study team representatives for the ***I-229 Major Investment Corridor Study: Sub-Study #2***.

2. Stakeholder Acceptance Page

The undersigned parties concur with the Methods and Assumptions for the ***I-229 Major Investment Corridor Study: Sub-Study #2*** as presented in this document.

SDDOT: [signature]
Signature
Data Analysis Engineer
Title
10-9-2013
Date

FHWA: [signature]
Signature
Planning/Civil Rights Specialist
Title
10-11-2013
Date

Notes:

(1) Participation on the Study Advisory Team and/or signing of this document does not constitute approval of the ***I-229 Major Investment Corridor Study: Sub-Study #2*** Final Report or conclusions.
(2) All members of the Study Advisory Team will accept this document as a guide and reference as the study progresses through the various stages of development. If there are any agreed upon changes to the assumptions in this document a revision will be created, endorsed and signed by all the signatories.

3. Introduction and Project Description

Project Background and Understanding

Sub-Study 2 is a component of the I-229 Major Investment Corridor Study and will analyze existing and future conditions at the I-229 interchange at Exit 3 (Minnesota Avenue) and along Minnesota Avenue from 41st Street to 57th Street. The study will conduct an interchange options study for the I-229 Exit 3 interchange.

Location

The I-229 Exit 3 interchange and Minnesota Avenue is located in the southeastern portion of the Sioux Falls metropolitan area. The interchange is approximately three miles east of the I-29/I-229 and seven miles south of the I-229/I-90 systems interchanges. I-229 Exit 2 (S Western Avenue) is one mile to the west and Exit 4 (Cliff Avenue) is one mile to the east. The Minnesota Avenue study limits include the intersections of 41st Street and 57th Street. The mainline study limits include Exit 2 through Exit 4.

An illustration of the Sub-Study 2 study area is shown in Section 4 (Study Area) of this report.

Need for Study

The study team has determined the following needs for this specific study:

- Congestion at the I-229 Exit 3 (Minnesota Avenue) interchange
- Congestion throughout the Minnesota Avenue corridor, between 41st Street and 57th Street (reflective of this study's project limits)
- Closely spaced interchanges throughout the I-229 corridor
- Additional traffic operational impacts to the I-229 Exit 3 interchange and Minnesota Avenue due to the extension of 49th Street to the west of Minnesota Avenue
- Future traffic growth within the study area and the impact to interchange operations
- Conclusions and recommendations from 41st Street Corridor Study
- Improved pedestrian and bicycle access and crossings

The alternatives analysis will incorporate work done on interchange alternatives from previous studies, including the Draft I-229 and Minnesota Avenue Interchange Justification Report, as well as introduce additional concepts. These additional concepts include, but are not limited to:

- Diverging Diamond Interchange
- Offset Single Point Interchange

Study Schedule

Date	Task/Event
March 2013	Notice to Proceed, Kickoff Meeting
July 2013	Methods & Assumptions Documentation
July 2013-August 2013	Baseline Conditions Analysis/ Data Collection
September 2013-October 2013	Existing Traffic and Operations Analysis Project Future Conditions (No Build)
November 2013-March 2014 [1]	Conceptual Design of Reconfiguration Options for the I-229 Exit 3 Interchange Conceptual Design of Minnesota Avenue Corridor Improvements **Public Meeting #2** (Scenario Building Stage) **(Jan/Feb 2014)** **MPO Meeting (Scenario Building Presentation)** Determination of Interchange and Corridor Build Scenarios Traffic and Operations Analysis of Build Scenarios Noise Analysis of Build Scenarios Constructability Analysis of Build Scenarios Recommendations
April 2014-September 2014 [1]	Sub-Study 2 Report Documentation **Public Meeting #3 (Draft Report Stage)** **MPO Meeting (Final Recommendations Presentation)**

[1] Dates may be subject to future review to adjust for data collection delay to date.
Note: The Study Schedule for Sub-Study 2 after August is expected to coincide with the Study Schedule for Sub-Study 1.

Facilities Affected by the Study

Modifications to the I-229 Exit 3 interchange and Minnesota Avenue would have the potential to affect:

- The intersections on Minnesota Avenue near I-229
- The intersection configuration of Minnesota Avenue and 49th Street, with consideration to the extension of 49th Street to the west. This includes 2035 operations with an expanded 49th Street
- Adjacent perpendicular corridors to Minnesota Avenue, including 41st Street, 57th Street, and a future 49th Street.
- Adjacent parallel corridors providing access to I-229 at Exit 2 (Western Avenue) and Exit 4 (Cliff Avenue).

Previous Studies

The following previous studies will be reviewed during the course of this study:

- Direction 2035, Sioux Falls MPO Long-Range Transportation Plan (LRTP)
  - http://www.siouxfalls.org/~/media/Documents/planning/long-range/lrtp/2035_lrtp/adopted_lrtp_rev120210.pdf
- Sioux Falls Comprehensive Development Plan
  - http://www.siouxfalls.org/~/media/Documents/planning/shape_sf/chapters-maps/Chapter_1_r112111.pdf
- Sioux Falls Transit Development Plan 2011- 2015
  - http://www.siouxfalls.org/~/media/Documents/planning/long-range/2011_2015_Transit_Development_Plan.pdf
- 2007 Sioux Falls Bicycle Plan
  - http://www.siouxfalls.org/~/media/Documents/planning/transportation/bicycle/Bicycle_Plan_Final.pdf
- The Sioux Falls MPO Multi-Use Trail Study
  - http://www.siouxfallsmpo.org/documents/MPO/Planning_Documents/SiouxFallsMUTCS.pdf
- Sioux Falls Major Street and Access Management Plan
  - http://www.siouxfalls.org/~/media/Documents/planning/transportation/long-range/majorstreetplanmediumfinal%20pdf.pdf
- I-229 Exit 5 (26th Street) Crossroad Corridor Study
  - http://26thstreetcorridorstudy.com/
- 2010 Decennial Interstate Corridor Study and 2000 Decennial Interstate Study
- ITS Studies from City of Sioux Falls and SDDOT
- 49th Street Extension Study
- I-229 and Minnesota Avenue Interchange – Draft Interchange Justification Report
- 41st Street Corridor Study
- Costco Traffic Impact Study
- Scheels Traffic Impact Study
- Walmart Traffic Impact Study (85th Street and Minnesota Avenue)

Study Advisory Team Members

A Study Advisory Team has been formed to guide the study through completion. The Study Advisory Team is comprised of representative parties of the SDDOT, FHWA and City of Sioux Falls. Members of the Study Advisory Team are:

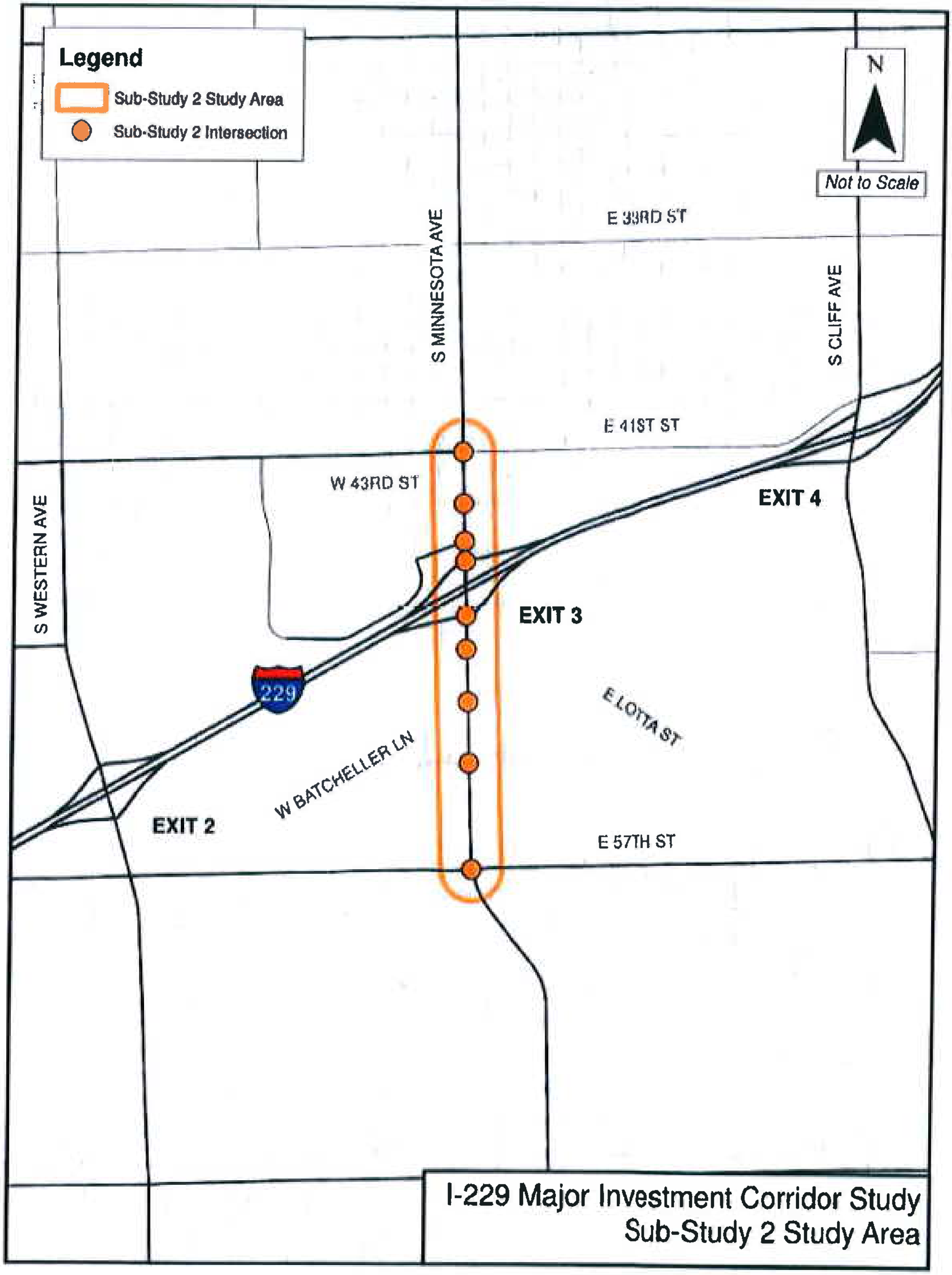
Shannon Ausen	City of Sioux Falls – Public Works
Mike Behm	SDDOT – Project Development
Christina Bennett	SDDOT – Operations Support
Jeff Brosz	SDDOT – Transportation Inventory Management
Nicole Frankl	SDDOT – Project Development (Safety)
Joel Gengler	SDDOT – Right of Way
Amber Gibson	Sioux Falls MPO
Kevin Goeden	SDDOT – Bridge Design
Steve Gramm	SDDOT – Project Development (Planning)
Heath Hoftiezer	City of Sioux Falls – Public Works
Mark Hoines	FHWA
Dave Huft	SDDOT – Research
Bruce Hunt	FHWA
Scott Jansen	SDDOT – Mitchell Region
Captain Kevin Joffer	South Dakota Highway Patrol
Rick Kiley	Sioux Falls MPO – Citizens Advisory Committee
Tom Lehmkuhl	SDDOT – Project Development (Environmental)
Pete Longman	SDDOT – Road Design
Ron McMahon	FHWA
Paul Nikolas	SDDOT – Road Design
Brad Remmich	SDDOT – Project Development (Planning)
Craig Smith	SDDOT – Mitchell Region

Additional team members may be added as the study progresses.

4. Study Area

The study area for Sub-Study 2 was defined by the Study Advisory Team and is illustrated in this report for documentation. The study area contains Minnesota Avenue from 41st Street to 57th Street. Freeway operations will be conducted during Sub-Study 1 and will also be reported in Sub-Study 2 for freeway locations from Exit 2 (Western Avenue) to Exit 4 (Cliff Avenue). The following graphic shows the study area and identifies each of the study intersections.

Sub-Study 2 Study Area



Minnesota Avenue Study Intersections:

- Minnesota Avenue & 57th Street
- Minnesota Avenue & Batcheller Lane
- Minnesota Avenue & Lotta Street
- Minnesota Avenue & Yankton Trail Park Entrance
- Minnesota Avenue & I-229 Northbound Ramp Terminal
- Minnesota Avenue & I-229 Southbound Ramp Terminal
- Minnesota Avenue & 49th Street
- Minnesota Avenue & 43rd Street
- Minnesota Avenue & 41st Street

The following Basic Freeway Segments will be analyzed in Sub-Study 1 and reported within Sub Study 2 (*See also Note 1 below for designated analysis areas as potential Freeway Weave Areas for segments including auxiliary lanes*):

- I-229 Northbound between Western Avenue (Exit 2) and Minnesota Avenue (Exit 3)
- I-229 Northbound between Minnesota Avenue (Exit 3) and Cliff Avenue (Exit 4)
- I-229 Southbound between Cliff Avenue (Exit 4) and Minnesota Avenue (Exit 3)
- I-229 Southbound between Minnesota Avenue (Exit 3) and Western Avenue (Exit 2)

[1] *Segments will be evaluated using Highway Capacity Manual (HCM) 2010 procedures to determine if the segment meets the criteria for a weave segment. If the segment meets the weave segment criteria the segment will be analyzed as a Freeway Weave Area and not a Basic Freeway Area*

5. Analysis Years/Periods

This study will evaluate traffic during and for the following time periods:

Existing Conditions

Existing conditions analyses will be conducted for year 2012 volume conditions. Turning movement counts were collected at several study area intersections in 2012. Intersections that do not already have recent count data from 2012 will be counted by the City of Sioux Falls or HDR as part of this study as described in Section 6. For existing conditions the following time periods will be evaluated:

- Existing Conditions (Year 2012) – AM Peak Hour
- Existing Conditions (Year 2012) – PM Peak Hour

Future/ Design Conditions

Future/ Design conditions analyses will be conducted for year 2035 conditions. This horizon year matches the planning horizon of the current Sioux Falls LRTP. The Travel Demand Model was calibrated and updated in year 2009 for a base year 2008 and planning horizon of year 2035. Projected traffic volumes from the Sioux Falls MPO Travel Demand Model will be utilized to establish year 2035 volumes. For the design conditions the following time periods will be evaluated:

- Future/Design Conditions (Year 2035) – AM Peak Hour
- Future/Design Conditions (Year 2035) – PM Peak Hour

Interim Conditions Analysis

The City of Sioux Falls is currently planning to extend 49th Street west of Duluth Street to Western Avenue. It is anticipated that this extension will be complete prior to any proposed improvements from the I-229 Major Investment Corridor Study are implemented. Therefore, an interim analysis will be conducted incorporating the proposed 49th Street extension and associated improvements (signal timing, turn lanes, etc.). The City of Sioux Falls will provide the interim schedule for full build-out of the 49th Street extension to Western Avenue. Interim volumes will be developed from recent count data and horizon year 2035 traffic volumes. For the design conditions the following time periods will be evaluated:

- Interim Conditions (Year provided by City of Sioux Falls) – AM Peak Hour
- Interim Conditions (Year provided by City of Sioux Falls) – PM Peak Hour

Volume data will be smoothed/balanced for the Existing and Future/Design Conditions using the Cube Avenue mesoscopic model.

6. Data Collection

Existing traffic volume data for Sub-Study 2 will be provided by HDR, including existing arterial intersection turning movement count data, existing freeway data, and additional data as outlined below:

Existing Arterial Intersection Turning Movement Count Data
Minnesota Avenue intersection turning movement count data will be provided by HDR for the intersections identified within Sub-Study 2 study area.

Existing Freeway Data
Automated Traffic Recorded (ATR) data was provided for SDDOT Station #610, which is located between Exit 2 (Western Avenue) and Exit 3 (Minnesota Avenue). The ATR included hourly directional mainline I-229 freeway volumes from Sept 2012 to February 2013. In addition, ATR at Station #610 was provided in 15-minute increments from March 6 to April 21, 2013.

SDDOT supplied hourly ramp volume data from year 2012. Study intersection turning movement counts will be used to determine existing AM and PM peak hour ramp volumes and then smoothed/balanced along the I-229 corridor.

Additional Data Supplied by SDDOT and/or City of Sioux Falls
- Vehicle Classification Samples on I-229 Interstate
  - Supplied by SDDOT
- Crash History Geodatabase
  - Supplied by SDDOT
  - Includes crash records dated January 2008 to December 2012 (5 years)
- Roadway Design Standards
  - available online at:
    http://www.sddot.com/business/design/forms/roaddesign/Default.aspx
- Construction Plans for I-229
  - Supplied by SDDOT
- Construction Plans for Minnesota Avenue

  - Supplied by SDDOT
- GIS Base Mapping Data (parcels, parks, streets, rail, plats)
  - Supplied by City of Sioux Falls
- 2012 Aerial SID files
  - Supplied by City of Sioux Falls
- Corridor Studies
  - 41st Street Corridor Study
  - 49th Street Extension Study
- Traffic Impact Studies for Key Proposed Developments
  - Costco TIS supplied by City of Sioux Falls
  - Scheels TIS supplied by City of Sioux Falls
  - Walmart (85th Street and Minnesota Avenue) TIS supplied by City of Sioux Falls
- MPO Travel Demand Model Files in Cube Voyager (Existing and Future)
  - Supplied by City of Sioux Falls

Data Collection Techniques

All data was collected and will be collected using standard field practices which consist of using cameras, digital count boards or tube counters.

7. Traffic Operations Analysis

Traffic Operations Analysis (Existing and Future No-Build)

1. Software
   a. Signalized Intersections
      i. Highway Capacity Software (HCS) Release 6.5 (2010 HCM Methodology) Streets Module
         1. Ramp terminal intersections meeting the interchange types defined in HCM Chapter 22 (Interchange Ramp Terminals) will be analyzed with the Interchanges section of the Streets Module.
         2. Analysis of a Diverging Diamond Interchange will follow the methodology outlined in the 'Analysis Procedures for Diverging Diamond Interchange (DDI)' memorandum, found in the Appendix. This memorandum was developed for the I-90 Exit 59 (La Crosse Street) Interchange Options Study but the methodology applies to analysis of other interchange locations.

   b. Basic Freeway, Ramp Junctions and Weave Areas
      i. HCS Release 6.5 (2010 HCM Methodology)
2. Operational Analysis Results
   a. Level of Service (LOS)
      i. Signalized Ramp Terminal Intersections (SDDOT's System)
         1. Intersections where geometry is modified because of project improvements
            a. Minimum allowable LOS – LOS 'C'
               i. Individual movements will be allowed to operate at LOS 'D' but the overall intersection LOS shall be 'C' or better

2. Other intersections (intersections within the study area that are not modified by project improvements)
    a. Minimum allowable LOS – LOS 'D'
        i. Individual movements will be allowed to operate at LOS 'E' but the overall intersection LOS shall be 'D' or better

ii. Signalized Non-Ramp Terminal Intersections (City of Sioux Fall's System)
    1. Minimum allowable LOS – LOS 'D'

iii. Basic Freeway, Ramp Junctions and Weave Areas
    1. Minimum allowable LOS – LOS 'C'

3. Variables
    a. Peak Hour Factor (PHF)
        i. Existing (year 2012) conditions analysis will use calculated PHFs from existing counts with a maximum value of 0.90.
        ii. Design year (year 2035) conditions analysis will use existing PHFs rounded up to the nearest 0.05 with a maximum value of 0.90.
            1. The increase in the PHF is to account for traffic growth that is likely to be spread throughout the peak periods.
    b. Saturation Flow Rate
        i. SDDOT Design Manual (Page 24, Chapter 15) requires the use of 1,800 vph in Sioux Falls. This value will be used for the signalized intersections and freeway locations within the study area.
    c. Traffic Signal Controllers
        i. Operational analysis will allow for both actuated and coordinated controllers.
    d. Left-Turn Phasing
        i. Protected, Permitted / Protected or Split Phasing will be allowed at intersections.
    e. Heaviest Lane Volume (Lane Utilization)
        i. Default HCS Streets Values used for ramp terminal / arterial intersections.
    f. Heavy Vehicle Percentage
        i. Study Intersections
            1. Use existing turning movement counts that included truck counts to determine arterial truck percentages.
        ii. Ramp Junctions and Weave Areas
            1. Use existing freeway counts that included truck counts to determine freeway truck percentages.
    g. Phase Change Intervals
        i. Existing (Year 2012) Conditions
            1. Existing signal timings will be used for phase change intervals during existing conditions.
        ii. Future No-Build (Year 2035) Conditions
            1. Existing signal timings will be used for phase change intervals of phases that exist at intersections that have no geometric change from existing conditions.
            2. Phase change intervals will be calculated for the following locations:
                a. New phases added at an intersection where geometry is unchanged from existing conditions

b. All phases at an intersection where geometry is changed from existing conditions

The calculated values will be based on methodologies presented in the *Institution of Transportation Engineers (ITE) Traffic Engineering Handbook*. The methodologies presented in the handbook use vehicle length and speed and the distance needed to track through the intersection to calculate phase change intervals.

h. Speeds
   i. Arterials – Use posted speeds
   ii. Freeway – Use 85th percentile of collected spot speed data

8. Travel Forecast

Existing (Year 2012) and Future Year (Year 2035) volumes developed during Sub-Study 1 will be used for the volumes within the study area for Sub-Study 2. The methodology for Travel Forecast was documented in the Sub-Study 1 Methods and Assumptions document.

9. Safety Issues

Crash data will be reviewed for the study area based on the Crash Geodatabase which includes crashes between January 2008 and December 2012. SDDOT's database will be the only database used in the calculation of crash rates and critical crash rates. The following information will be provided as a result of 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

10. Selection of Measures of Effectiveness (MOE)

The main goals of this study are as follows:

1. Conduct an interchange and crossroad study for Exit 3 (Minnesota Avenue).
   a. Complete a Level of Service Analysis for both existing and future (2035) conditions at the I-229 Exit 3 Interchange and Minnesota Avenue within the study limits.
   b. Complete a safety analysis of the I-229 Exit 3 Interchange and Minnesota Avenue, within the study limits
   c. Determine and recommend improvement options that will improve mobility and safety within the I-229 Exit 3 interchange and along Minnesota Avenue between, and including, 41st Street and 57th Street.
2. Create final products for use by the SDDOT and City of Sioux Falls which will guide them in the implementation of recommended improvements that will maximize the efficiency of the system.

To satisfy the study objectives, the following MOEs will be used to evaluate and compare the concepts:

- Minnesota Avenue Intersections: **LEVEL OF SERVICE (LOS)** and **INDIVIDUAL MOVEMENT DELAY**
- Minnesota Avenue Corridor: **LOS** and **TRAVEL SPEED**
- Ramp Terminal Intersections: **LEVEL OF SERVICE** and **INDIVIDUAL MOVEMENT DELAY**
- Freeway Segments, Ramp Junctions and Weave Areas: **LOS** and **DENSITY**

These statements are made assuming that the geometric improvements identified meet all AASHTO, SDDOT, and City of Sioux Falls guidelines. It is understood that all traffic analysis reporting will be completed using HCM 2010 Methodology.

11. FHWA Interstate Access Modification Policy Points

An Interchange Modification Justification Report (IMJR) will not be developed for the I-229 Exit 3 (Minnesota Avenue) interchange as part of this project.

12. Deviations/Justifications

No deviations from standards are currently known. If it is determined during the study that deviations are required, the methods and assumptions document will be amended prior to proceeding.

13. Conclusion

All sections contained in this document will guide the traffic data collection and traffic assessment for this study.

14. Appendices

The appendix includes the following:

- Methods and Assumptions Study Team Meeting Minutes (August 28, 2013)
- Analysis Procedures for Diverging Diamond Interchange (DDI)

APPENDIX

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Meeting Notes

Subject: Study Advisory Team Meeting No. 3	
Client: South Dakota Department of Transportation	
Project: I-229 Major Investment Corridor Study	Project No: PL 0100(87) 3616 P, PCN 044K Contract 410545, WO PD-02-13 HDR Project No. 207030 Dept 00135
Meeting Date: August 28, 2013, 1:00-3:30PM	Meeting Location: Web Meeting: SDDOT Pierre Headquarters; SDDOT Sioux Falls Area Office; HDR Omaha & Sioux Falls; City of Sioux Falls; HR Green Des Moines & Sioux Falls
Notes by: David Meier,	

A Study Advisory Team Meeting for the I-229 Major Investment Corridor Study was held on August 28, 2013. Action items from the meeting are summarized below and discussion details follow. A list of participants and contact information is at the end of meeting notes.

Action Items

Item	Responsible
o Update M&A documents for SS 2, 3, & 4 and submit for signature.	HDR
o Revise mailing list limits per SAT comments & submit updated lists to SDDOT & City.	HDR
o Coordinate on Public Meeting room layout.	HDR/City
o Edit website as needed per additional SAT comments. Activate website 3 weeks from SAT #3.	HDR
o Determine whether a press conference will be held announcing Study/website.	SDDOT
o	
o	City
o Identify SDDOT staff for ITS interviews.	SDDOT

Comments based on the provided Agenda and PowerPoint Presentation:

1. **Introductions** (SDDOT, City, MPO, FHWA, HDR/HR Green)

2. **Draft Methods & Assumptions Documents – Sub-studies 2, 3, and 4**
   - **Sub-study 2**
     - **Section 3** - The Need for Study subsection should note the need to consider findings of the 41st Street Corridor Study (City).
     - Study Schedule table shows September 2014 for completion, is there need to officially extend the project schedule? Yes (see Schedule section of SAT notes). ***Comment applies to all Sub-studies).***
     - Previously developed interchange modification alternatives need to be considered. Interim conditions (post-49th Street Extension and Costco opening) will need to be considered and interim improvements may be needed (City). FHWA is concerned regarding proximity of 49th St connection and existing interchange ramp terminals.
     - Need to review Costco Traffic Impact Study for interim improvements noted.
     - In Study Schedule table, reference to Sub-study 3 Report Documentation should be SS 2.

- Add 41st and Grange to list of Facilities Impacted by the Study.
- **Section 5** - FHWA has comments regarding differences noted between the described approach in the SS 2 M&A and the M&A document for Exit 5 (26th Street) for Section 5 and subsequent sections. If these differences can be addressed, there will be no need for FHWA to send the M&A documents to the Resource Center for review. ***Comment applies to all Sub-studies. FHWA comments were received on 9/3/13 from SDDOT. Responses to the FHWA comments are tabulated at the end of these notes.***
- **Section 6** - Add Scheel's Expansion Study and Wal Mart Traffic Impact Study to list of previous studies. ***The additions will also be made to the Previous Studies list in Section 3.***
- **Section 7** – HDR clarified that Synchro will not be used. ***Applies to all Sub-studies.***
- **Section 10** – The City commented that the Measures of Effectiveness description needs to clarify that Level of Service "D" will be the minimum criteria for individual intersection approaches, but not an entire intersection. ***Applies to all Sub-studies. Response to this comment will be located in Section 7 of the M&A documents, per FHWA comment.***
- **Section 11** – The City asked if FHWA Regional Office comments on the previously prepared draft IJR will need to be noted in the sub-study report. FHWA replied that is unknown at this time because alternatives are yet to be identified in Sub-study 2.
- **Section 14 (Appendix)** – The Diverging Diamond Interchange analysis procedure attached are the most current version of the procedure.

- **Sub-study 3**
  - **Section 3** - The City noted that there is a serious capacity issue with the existing interchange that extends the majority of the day. The M&A will be revised to note that congestion extends through off-peak periods.
  - Add the following to the Facilities Impacted by the Study:
    - 18th Street (parallel corridor)
    - Lowell Ave (perpendicular corridor)
  - Strike the SIMPCO Incident Management Plan from the Previous Studies section. ***Comment applies to all Sub-studies.***
  - **Section 4** - Study Area figure references Sub-study 2. ***Also applies to SS4 M&A.***

- **Sub-study 4**
  - **Section 4** - Study Area description needs to be replaced with SS 4 specific narrative.
  - Add Benson Rd Feasibility Study to the Previous Studies section.

3. Safety Analysis Technical Memorandum

- The slippery conditions noted in a significant number of reported crashes were mostly during winter weather (approximately 90%), but some were documented as wet pavement. This pattern was noted for the Cliff Ave to Louise Ave segment as well as the 26th Street area along I-229.
- Enhanced driver information during inclement weather was noted as a potential mitigation measure. The ITS recommendations section of the Sub-study 1 report will provide additional details on this recommendation.
- It was noted that the safety analysis findings may suggest review of snow removal operational procedures.
- Crashes associated with traffic congestion were found to be mostly located on ramps. SDDOT noted that right-turning traffic on the northbound 10th St exit ramp has been shifted onto the paved shoulder with pavement markings to provide additional storage. The southbound 10th St entrance ramp has been extended to provide more merging length upstream of the ramp gore.

4. Public Involvement Activities

- **Public Meeting**

- **The 1st Public meeting will be held on Wednesday October 30th from 5:30-7:00 pm at the Convention Center.**
- Press release to be placed In the Argus Leader 17 and 10 days in advance of the meeting. There will be no weekend advertisements due to substantial additional cost involved.
- Seating will be limited to about 150. Additional seating capacity may be needed for the 2nd public meeting, when mailings will include extended limits for Sub-studies 2, 3, and 4.
- The formal presentation will be kept brief and presented once. The presentation will be taped.
- HDR will coordinate with the City on the room layout for the public meeting.
- HDR Mailing list
  - Approximately 600 addressees on the current mailing list.
  - Check the ownership of the open area shown on the north side of I-229 just east of the I-29/I-229 system interchange and south of W 59th St.
  - HDR will send a coordination letter to addressees on the Exit 5 Study mailing list alerting them to the I-229 study.
  - Revise the mailing area to reduce the number of properties contacted west of Western Avenue and north of I-229.
  - Add the properties along both sides of Minnesota Ave extending south to E 57th St.
  - At 10th St, mailing list coverage will be extended to S Cliff Ave to the west and to S Sycamore Ave to the east.
  - Updated mailing lists will be sent to Steve Gramm and Shannon Ausen.
- Postcards will be used for the public meeting mailings.
- Message boards will be used to assist in advertising the public meeting. The City can provide some of the message boards to be used. FHWA does not object to placing message boards in the I-229 right of way for this purpose.

- **Draft Web site**
  - HDR has made updates to the website reflecting comments received to date. Additional comments should be sent to Jason Kjenstad.
  - SDDOT will consider conducting a press conference to announce the study and/or web site.
  - The website is to be activated at least two weeks prior to advertising for the October 30th public meeting and may be activated in three weeks from this SAT meeting (pending further SAT comments).

5. Origin-Destination Data

- HDR presented an overview of the cell phone-based O-D data gathered by AirSage that focused on the following objectives:
  - External to external patterns
  - Comparison of average weekday travel patterns to average weekend day and two special events days for which data was collected.
  - Comparison of the cell phone-based O-D data to the O-D matrix generated by the Sioux Falls area model.
- The O-D data presentation screens were provided as a part of the SAT meeting agenda file in pdf format.
- The data collection process involved approximately 100,000 device (cell phone) sightings per day and a total of 1.5 million unique devices logged. Of that total, 146,000 devices were assumed to be area resident phones, based on observed patterns. Based on a 446,000 person population for the data collection area, the calculated sampling rate was over 32 percent. The total trips per day identified averaged around 200,000. The SAT questioned the 446,000 population figure as far in excess of the metropolitan area (approximately 225,000 population). HDR will provide an explanation of the area covered for that population. ***Response: The 446,000 population is for the entire O-D study area that includes the Sioux Falls***

metropolitan area and the surrounding buffer area (shown on Exhibit 1 from the presentation following these notes) that was used to identify external trips.

- Each day of the week was found to have a typical pattern with Fridays having the peak number of trips and Sundays having the lowest number.
- Local versus regional traffic patterns were reviewed for I-29 south of Sioux Falls, which indicated that 84 percent of trips on I-29 had an origin or destination within the Sioux Falls metro area. The SAT requested that the local/regional patterns be reported for I-29 north of Sioux Falls and for I-90 east and west of Sioux Falls. ***Response: The O-D patterns for local and regional trips for I-29 north and I-90 east and west are shown on Exhibits 2, 3, and 4 following these notes.***
- For the average weekday vs. weekend day comparison, O-D patterns between most zones showed decreases of 15 to 50 percent, with exceptions being shopping area zones and the casino.
- Both the construction incident special event day and the winter weather special event day were found to have quantities of trips similar to the average week day.
- For the construction incident day vs. the average weekday comparison, most zones had variances of +/- 10 to 50 percent trips. The SAT asked if most of the variances were more likely +/- 20 to 30 percent. ***Response: Exhibit 5 following these notes labels the variance percentages for each zone.***
- The City has not reviewed the O-D data yet, but expects that it will prove helpful in improving O-D patterns built into the model.

6. **Project Schedule**
   - HDR advised the SAT that final reports for the sub-studies will likely be issued at the end of September 2014.

7. **Next Steps**
   - HDR will coordinate with the City on the room layout for the public meeting.

8. **Other Items** – No discussion
   - SDDOT advised that data collection for the ITS assessment task will involve interviewing identified DOT staff instead of reviewing previously developed ITS planning documents.
   - A presentation by IADOT staff regarding the Tri-State Incident Management Plan for the Sioux City metropolitan area will be given on Monday September 9th from 1-3 pm in the SDDOT Area Office. Steve Gramm will be attending.

Attendees:

Pierre		
Mark Hoines - FHWA	Steve Gramm – SDDOT	Joel Gengler - SDDOT
Ron McMahon - FHWA	Kevin Goeden - SDDOT	Brad Remmich - SDDOT
Jeff Brosz – SDDOT	Dave Huft - SDDOT	Nicole Frankl - SDDOT
Scott Jansen - SDDOT	Pete Longman - SDDOT	Christina Bennett - SDDOT
Tom Lehmkuhl - SDDOT	Terry Keller - SDDOT	
Sioux Falls		
Shannon Ausen – Sioux Falls	Heath Hoftiezer – Sioux Falls	Amber Gibson - SECOG
Craig Smith - SDDOT	Paul Nikolas - SDDOT	
Consultant Team		
David Meier - HDR	Brian Ray - HDR	Courtney Sokol - HDR
Mike Forsberg- HDR	Jason Kjenstad - HDR	Ross Harris – HR Green
Rick Laughlin - HDR	Jon Weigand – HR Green	Bill Moran – HR Green
Jon Markt - HDR		

Responses to FHWA Comments on M&A Documents for Sub-studies 2, 3, and 4 Received 9/3/13

Below are responses to FHWA comments on the I-229 M&A documents. The response regarding content of the M&A documents is noted in **bold text**.

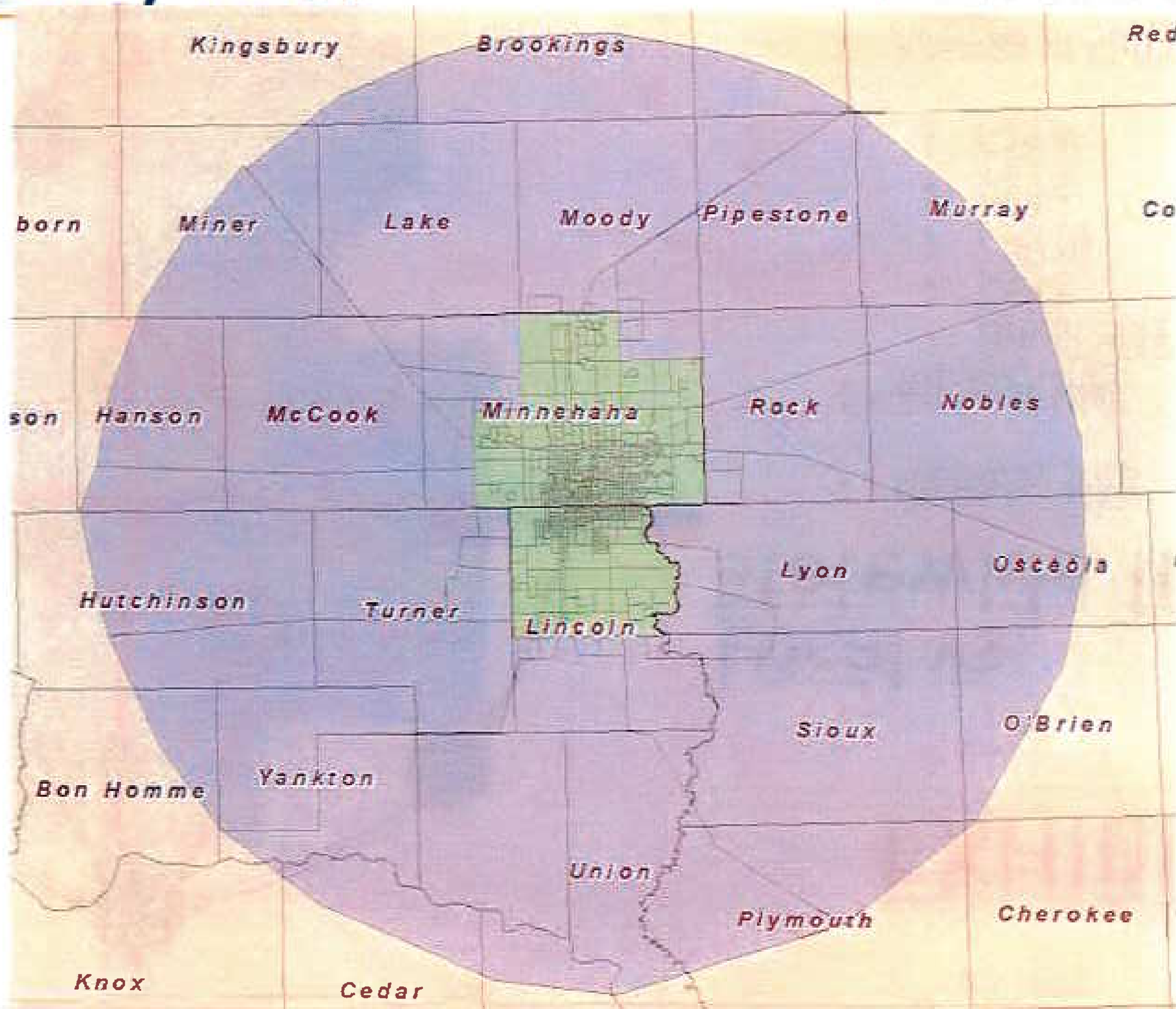
Section	Comment	Response
Section 5 – Analysis Years/Periods	Add a note regarding factoring and balancing volumes.	***A note will be added that discusses the use of balanced volumes provided by the Cube Avenue mesoscopic model that is being utilized for the project.***
Section 7 – Traffic Operations Analysis	Why is Synchro being used on 26th Street but not on this study?	Traffic operations analysis results will be based on Highway Capacity Manual (HCM) 2010 methodologies, as was stipulated in the study scope. Currently, the most accurate tool to perform operational analysis using HCM 2010 methods is Highway Capacity Software (HCS) 2010. The use of Synchro would be redundant and provide no additional operational results. ***No revisions to the analysis tools section are planned for the I-229 M&A documents.***
Section 7 – Traffic Operations Analysis	List the allowable LOS similar to the 26th Street M&A.	***Allowable LOS criteria will be listed.***
Section 7 – Traffic Operations Analysis	The I-229 M&A documents say the analysis of future year conditions will use existing PHFs rounded up to the nearest 0.05 with a maximum of 0.90. The 26th Street document said the future year analysis would use 0.9.	Using the existing PHFs rounded up to the nearest 0.05 with a maximum of 0.90 will capture locations with high peaking characteristics within a 15-30 minute time span. Since the peaking characteristics are unlikely to become much more uniform across the peak hour in future year conditions, this approach is considered more conservative than using 0.90 at all locations. ***No revisions to the PHFs section are planned for the I-229 M&A documents.***
Section 7 – Traffic Operations Analysis	The 26th Street M&A document has more details concerning phase change interval values that will be used in the analysis.	The I-229 M&A documents state the use of the methodologies presented in the ITE Traffic Engineering Handbook instead of stating the red change interval in the M&A document, as in the 26th Street document. ***No revisions to the phase change interval section are planned for the I-229 M&A documents.***
Section 7 – Traffic Operations Analysis	The I-229 M&A documents state the use of the posted speed for arterial analysis. The 26th Street M&A states the use of 3 mph	Based on discussions with the developer of HCS, McTrans. Speed limit is used to compute Base FFS. FFS is only used as an input to

	above the posted speed for the FFS.	the ratio of the speed limit and is applied to an entire corridor. This ratio is used in the stop rate calculations for determining the Auto Perception Index Score for the arterial segment, not Level of Service. ***No revisions to the speeds section are planned for the I-229 M&A documents.***
Section 10 – Selection of Measures of Effectiveness	The arterial corridor segment MOEs for 26th Street also included delay as a reported MOE.	Delay is incorporated into the travel speed MOE. Based on Chapter 17 of the HCM, the travel speed reflects the factors that influence running time along the link and the delay incurred by through vehicles at the boundary intersection. HCS reports generated will be included in appendices of analysis submittals. These reports contain additional information such as delay for those interested in the relationship between travel speed and delay. ***No revisions to the arterial MOE bullet are planned for the I-229 M&A documents.***
Section 10 – Selection of Measures of Effectiveness	The 26th Street M&A also included a bullet regarding reported MOEs at ramp terminal intersections (LOS and Individual Movement Delay).	***A bullet will be added report MOEs at ramp terminal intersections. This will include LOS and Individual Movement Delay.***

Original M & A

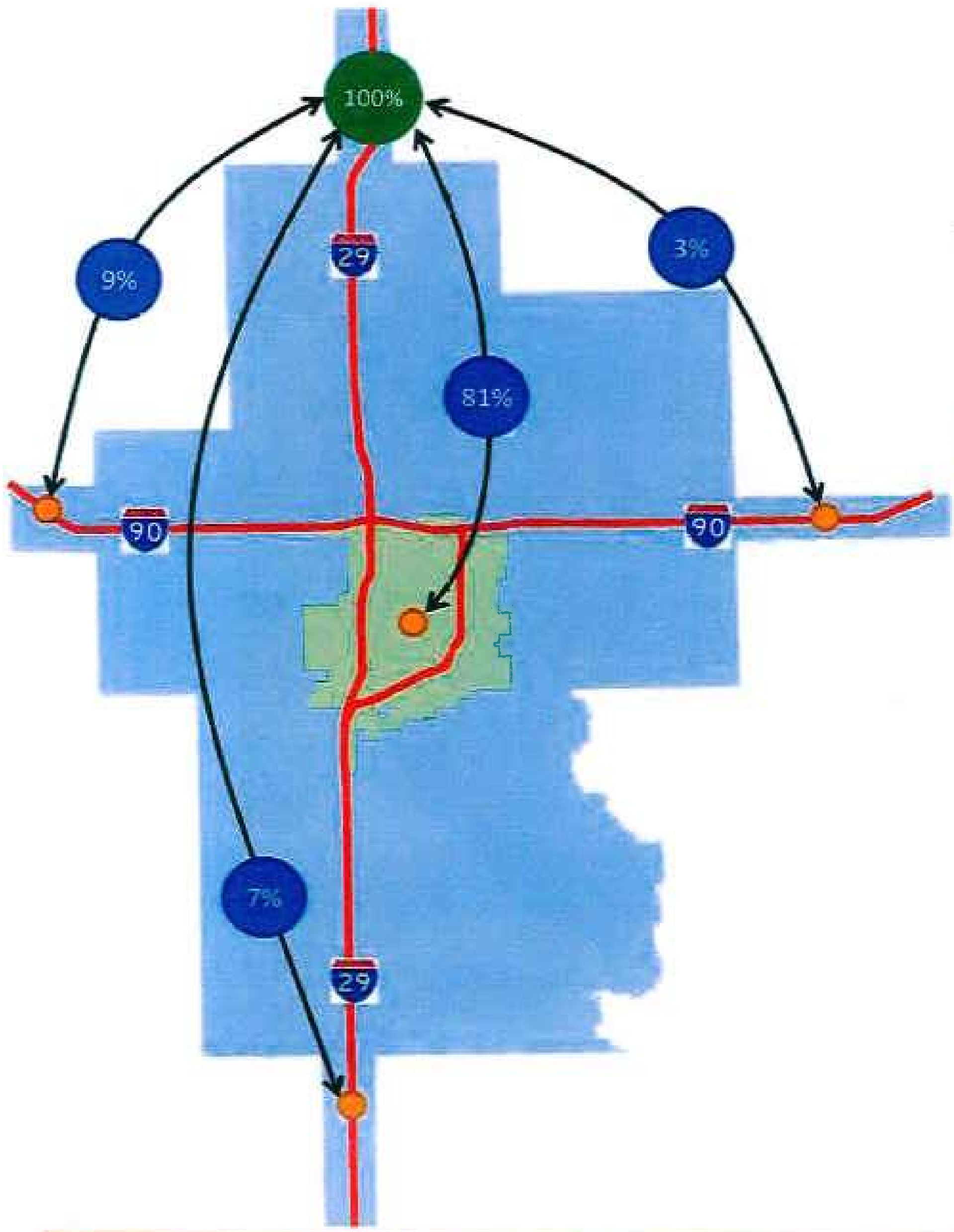
OD Study Area

EXHIBIT 1



Original M & A

EXHIBIT 2

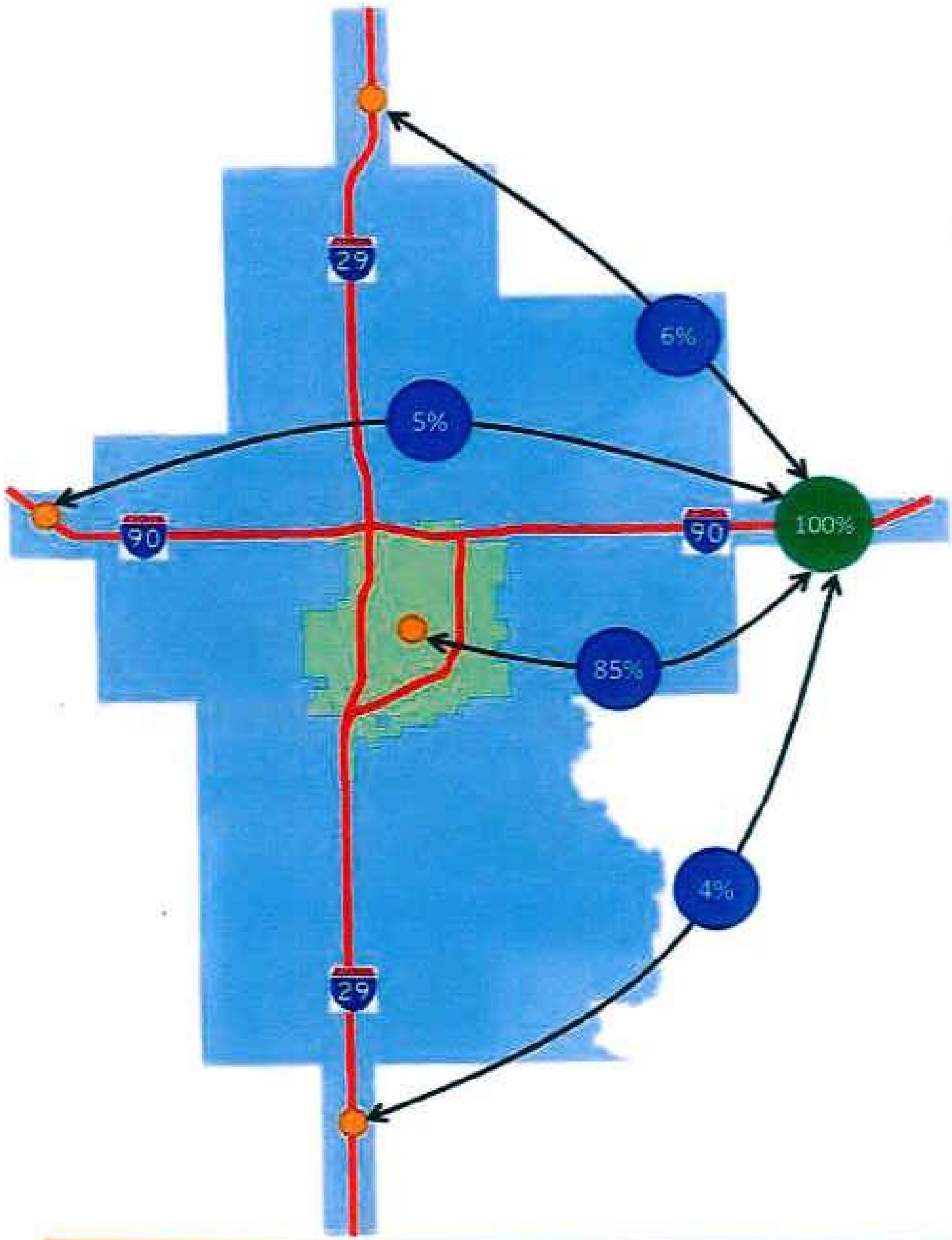


Local vs. Statewide Traffic

- Weekday Trips
- Trip exchange
  - Urban Core
  - I-90 E
  - I-90 W
  - I-29 S
  - I-29 N
- Average of bi-directional trips

Original M & A

EXHIBIT 3

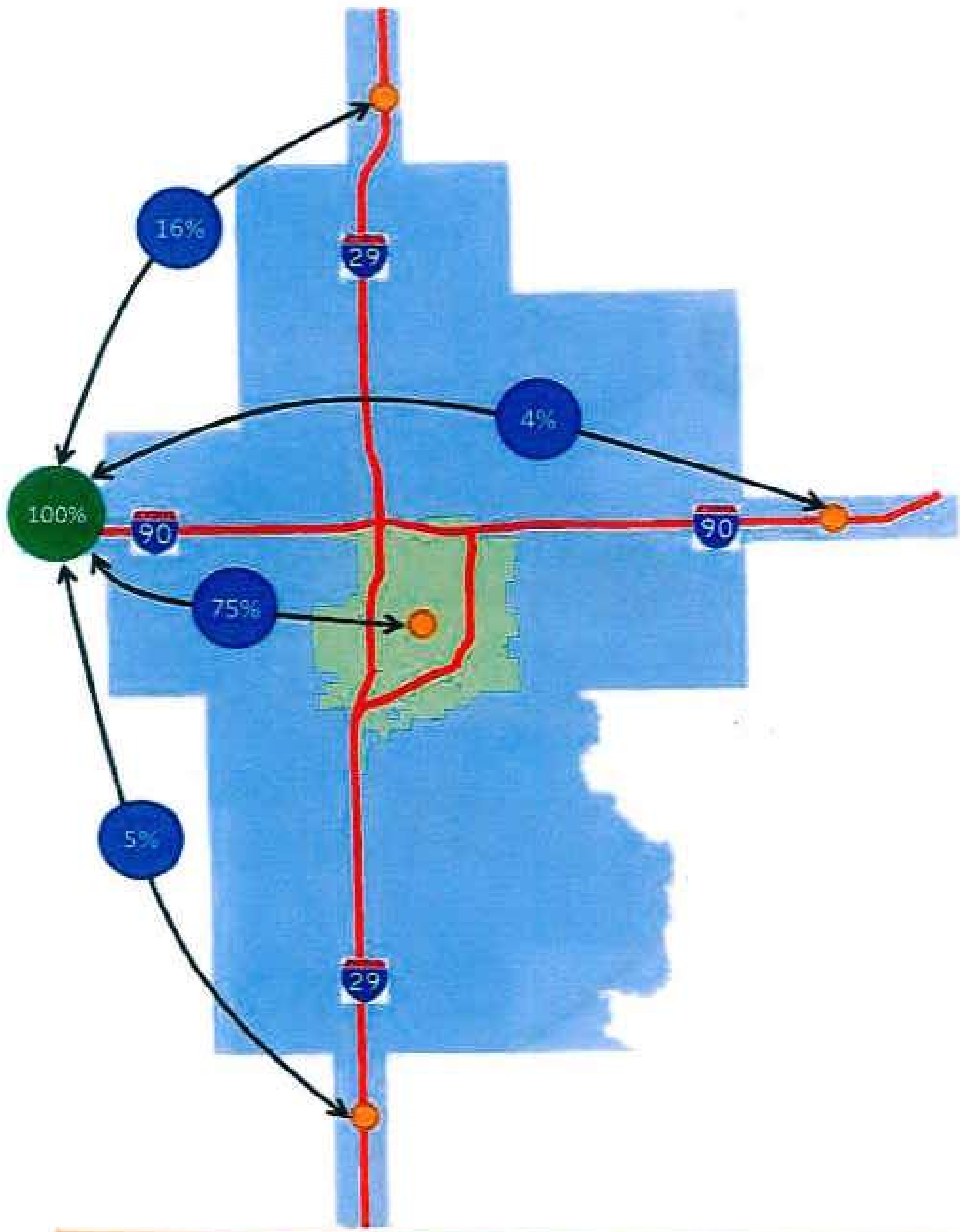


Local vs. Statewide Traffic

- Weekday Trips
- Trip exchange
  - Urban Core
  - I-90 E
  - I-90 W
  - I-29 S
  - I-29 N
- Average of bi-directional trips

Original M & A

EXHIBIT 4



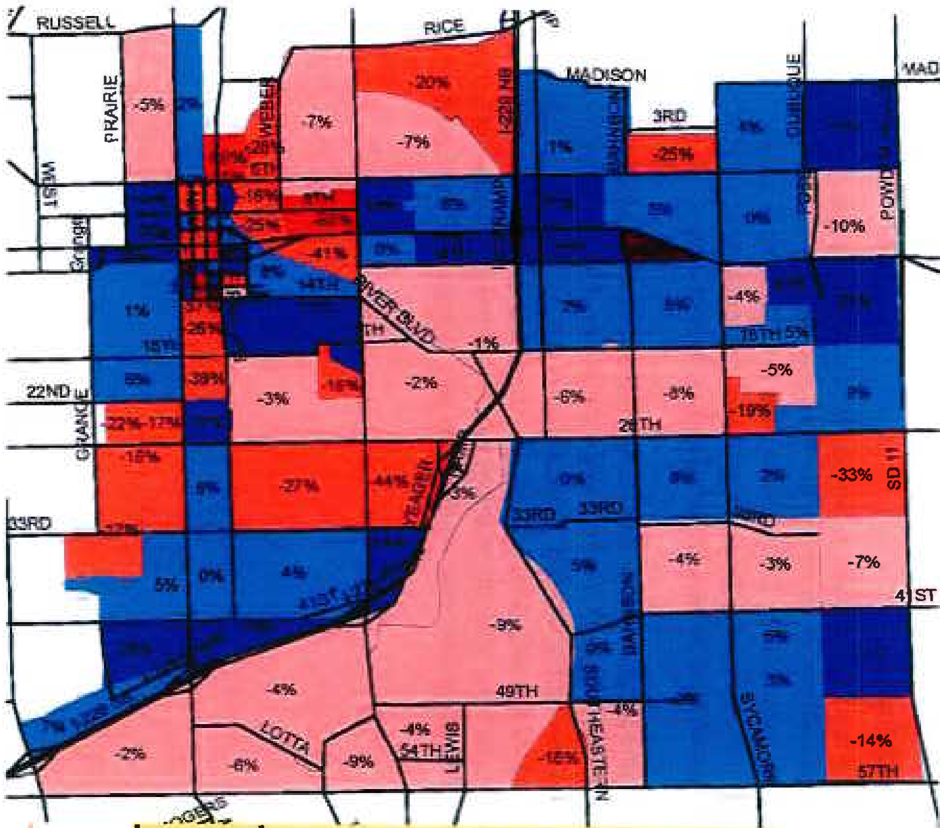
Local vs. Statewide Traffic

- Weekday Trips
- Trip exchange
  - Urban Core
  - I-90 E
  - I-90 W
  - I-29 S
  - I-29 N
- Average of bi-directional trips

EXHIBIT 5

Incident Day vs. Weekday Trips

- SB lane closure
- Increased Activity at Exits 4 (Cliff Ave) & 6 (10^{th} St)
- Wednesday



Legend

Incident Day Versus Average Weekday

Percent Difference in AM Trips

- -425% to -100%
- -100% to -50%
- -50% to -10%
- -10% to 0%
- 0% to 10%
- 10% to 50%

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To: File			
From: Mike Forsberg, P.E.		Project: None	
CC:			
Date: August 5, 2013		Job No:	

RE: Highway Capacity Software Analysis Procedures for a Diverging Diamond Interchange (DDI)

Introduction

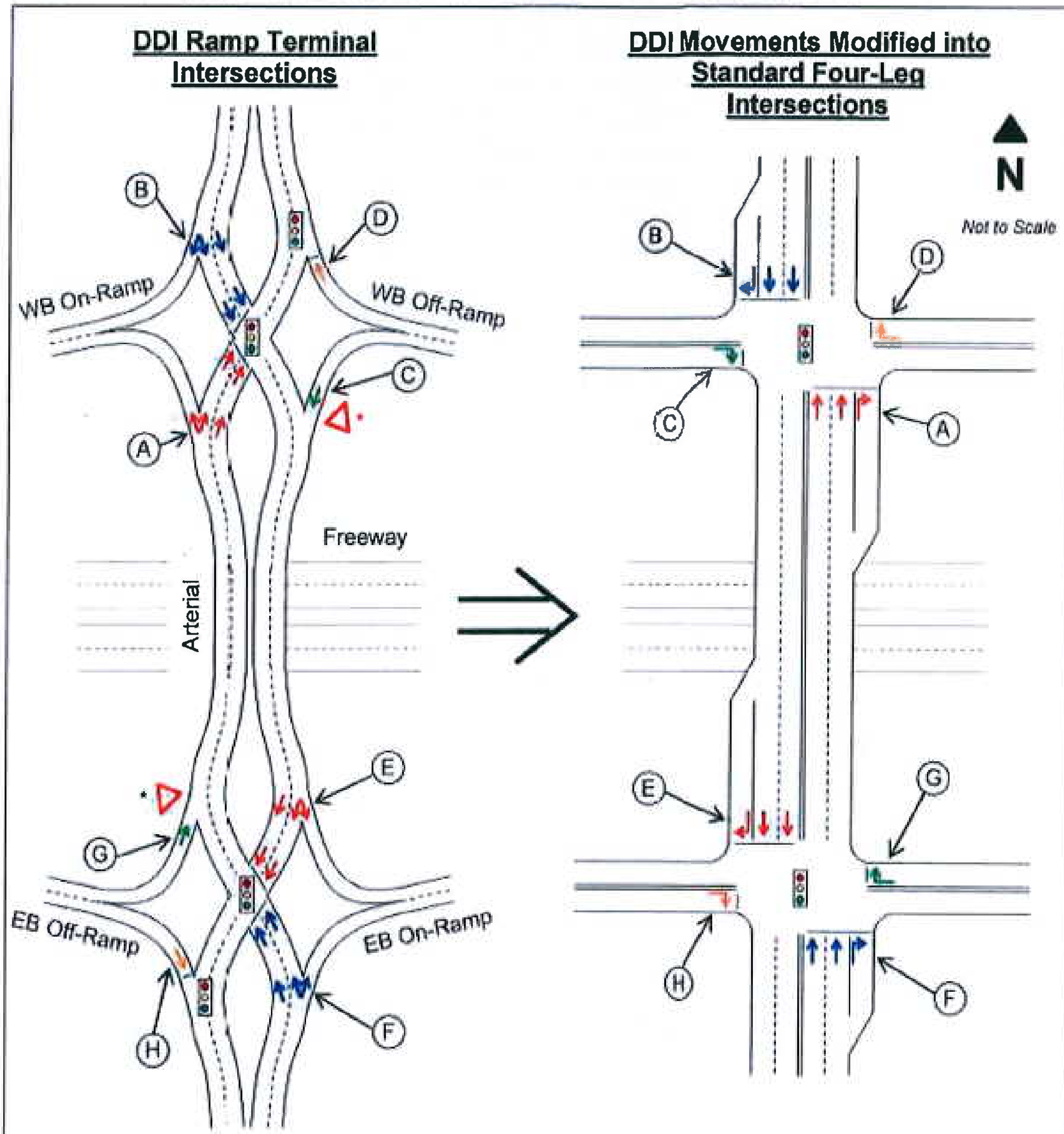
This document presents a proposed methodology for analyzing a Diverging Diamond Interchange (DDI) using Highway Capacity Software (HCS) 2010 Streets module. The Federal Highway Agency (FHWA) has indicated that HCS 2010 is the preferred traffic analysis tool for various projects within certain agencies. The procedures documented in this memorandum were developed in response to known challenges of analyzing DDIs in HCS 2010 based on discussions with the software developer, McTrans. HCS 2010 version 6.50 was utilized to develop this methodology.

Proposed DDI Analysis Methodology

The proposed analysis methodology for DDIs includes manipulation of the intersection movements at a DDI to analyze the ramp terminal intersections as standard four-leg intersections in HCS 2010. The proposed methodology involves manipulating the movements at the DDI ramp terminal intersections of the proposed DDI concept to conform to the analysis methodology of HCS 2010 while mimicking similar operational elements of the DDI ramp terminal intersection.

For simplification purposes, the methodology is presented for an arterial oriented north/south and freeway oriented east/west. The methodology for different orientations would be the same, but rotated accordingly. **Figure 1** expresses the proposed manipulation of the DDI ramp terminal movements into a format with standard four-leg intersections. The modified standard four-leg configuration shown in **Figure 1** would have split-phase operations for northbound and southbound traffic and allow for coordination of the ramp terminal intersections with signals north and south of the interchange.

Figure 1. Manipulation of DDI Movements into Standard Four-Leg Intersections



* Movement may also be signalized based on agency preference and number of lanes.

The following presents details of the proposed manipulation of intersection movements for the westbound ramp terminal intersection shown in **Figure 1** from the DDI configuration to a standard four-leg intersection configuration. Manipulation of intersection movements for the eastbound ramp terminal intersection would follow similar methodology.

- The DDI westbound ramp terminal intersection would operate as a two-phase signal. The northbound crossover movement (A) and westbound off-ramp left-turn movement (C) would travel through the intersection during the first phase (e.g., phase 2). The southbound crossover movement (B) and westbound off-ramp right-turn movement (D) would travel through the intersection during the second phase (e.g., phase 6).

- The two-phase operations of the DDI would be modified to two-phase operations with a four-leg intersection configuration. For example, at the westbound ramp terminal intersection:
  - The northbound crossover movement (A) of the DDI would be treated as a northbound through movement in the four-leg intersection configuration.
  - The northbound left-turn movement of the DDI in advance of the crossover would be treated as a northbound right-turn movement in the four-leg intersection configuration.
    - The value for right-turn-on-red (RTOR) for the northbound right turns would be set to zero. This assumes that all northbound right turns would only be able to turn during the northbound green signal indication. This assumption is conservative since these vehicles would be able to complete this turning maneuver during a northbound red signal indication in the DDI configuration, while the northbound queue of the crossover movement does not extend to the turning movement location. However, due to the unknown percentage of time that the northbound through movement would extend beyond the turning movement location, it is assumed that no vehicles would be able to turn right on red.
  - The southbound crossover movement (B) of the DDI would be treated as a southbound through movement in the four-leg intersection configuration.
  - The southbound right-turn movement of the DDI in advance of the crossover would be treated as a southbound right-turn movement in the four-leg intersection configuration.
    - The value for right-turn-on-red (RTOR) for the southbound right turns would be set to zero. This assumes that all southbound right turns would only be able to turn during the southbound green signal indication. This assumption is conservative since these vehicles would be able to complete this turning maneuver during a southbound red signal indication in the DDI configuration, while the southbound queue of the crossover movement does not extend to the turning movement location. However, due to the unknown percentage of time that the southbound through movement would extend beyond the turning movement location, it was assumed that no vehicles would be able to turn right on red.
  - The westbound off-ramp left-turn movement (C) of the DDI would be treated as an eastbound right-turn movement in the four-leg intersection configuration.
    - This movement would be treated as an eastbound right-turn movement at a signal with RTOR allowed. The value of RTOR would be based on the 'RTOR Reduction' factor shown in the HCM 2000 report obtained from Synchro traffic analysis software (Synchro would be used to code the modified four-leg configuration and obtain the RTOR value for this movement).
  - The westbound off-ramp right-turn movement (D) of the DDI would be treated as a westbound right-turn movement in the four-leg intersection configuration.

    - RTOR for the westbound right-turn movement would likely be restricted in the DDI configuration for safety purposes; therefore, the RTOR of the westbound right-turn movement four-leg configuration would be set to '0'. For locations where the controlling agency would operate the westbound off-ramp right-turn movement (D) of the DDI with RTOR allowed, the value of RTOR would be based on the 'RTOR Reduction' factor shown in the HCM 2000 report obtained from Synchro.
  - In the modified version of the four-leg intersection the northbound (A) and eastbound (C) movements would travel through the intersection during the same phase (e.g., phase 2). This would be consistent with the overlapping northbound crossover movement (A) and westbound off-ramp left-turn movement (C) of the DDI.
  - In the modified version of the four-leg intersection the southbound (B) and westbound (D) movements would travel through the intersection during the same phase (e.g., phase 6). This would be consistent with the overlapping southbound crossover movement (B) and westbound off-ramp right-turn movement (D) of the DDI.

The following presents specific details of coding elements in HCS 2010 Streets to model the westbound ramp terminal intersection shown in **Figure 1** as a standard four-leg intersection of the DDI intersection. Manipulation of intersection movements for the eastbound ramp terminal intersection would follow similar methodology.

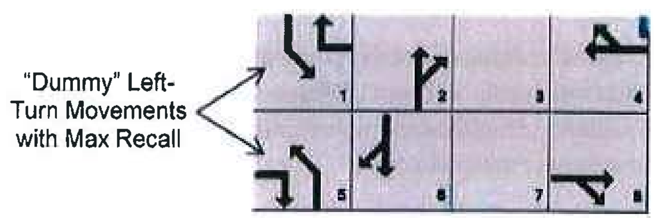
- To model split-phase operations for the arterial street (northbound and southbound movements) in HCS 2010 Streets, the following coding elements would be needed. Additionally, the diagrams shown in **Figure 2** supplement the coding elements listed below.
  - Artificial ("dummy") northbound and southbound left-turn movements would be added with protected phasing. These movements would not serve any of the DDI traffic. The added left-turn phases would be phase 5 for the northbound left-turn movement and phase 1 for the southbound left-turn movement (based on the previously mentioned example phasing of phases 2 and 6 for the northbound and southbound through movements, respectively).
  - The eastbound and westbound right-turn movements would be overlapped with the northbound and southbound left-turn movements.
  - The southbound left-turn movement would be set to a lagging left-turn phase so that the northbound and southbound left-turn movements would not need to have a green signal indication simultaneously.
  - The Recall Mode for the northbound and southbound left-turn movements would be set to 'Max'.
  - Eastbound and westbound phases (phases 8 and 4, respectively) would be required to be included to meet the criteria for signal timings in HCS 2010 Streets. This would include eastbound and westbound through movements with zero volume. These phases would have a green signal indication simultaneously for 1 second (the minimum time allowed for a phase). This effectively serves as the Red time for the previous split that serves southbound traffic. This 1 second phase for the eastbound and westbound approaches is labeled as "Dummy" All Red Phase in **Figure 2**. To counter the additional 1 second of green time given to the eastbound and westbound right-turn movements, each of these movements would be given an additional 0.5

seconds of "Start-Up Lost Time". Each of these right-turn movements would experience the extra 0.5 seconds of "Start-Up Lost Time" during the "Dummy" All Red Phase and during their normal phase of operation (Phase 1 or 5), totaling 1 second of additional "Start-Up Lost Time" over the course of 1 signal cycle for the eastbound and westbound right-turn movements.

- The Demand for the northbound and southbound left-turn movements would be set to '1' in order for phases 1 and 5 to be given a green signal indication (otherwise, all of the time would be given to the phase where northbound and southbound traffic travel through the intersection simultaneously).

Figure 2. Sample HCS 2010 Streets Phasing for the Westbound Ramp Terminal Intersection

Movement Phases



Operational Phases and Times

Green	42.0	0.0	38.0	1.0
Yellow	4.0	0.0	4.0	0.0
Red	1.0	0.0	0.0	0.0

Phase 1 Lagging

"Dummy" All Red Phase

- The following coding elements would also be included in HCS 2010 Streets to mimic the movements of the DDI.
  - The Arrival Type for the eastbound and westbound right-turn movements would be '3', representing random arrivals from the freeway. The Arrival Type for the

northbound and southbound approaches would be '4', representing coordination of signals. However, the arrival patterns of the northbound and southbound movements would be dictated by the signal timings at upstream Intersections and the coded Arrival Type for the northbound and southbound approaches would not have any impact on the operations at these intersections.

- Phase 5 would operate with 4 seconds of yellow and 1 second of all red.
- Phase 1 would operate with 4 seconds of yellow and 0 seconds of all red (the all red time would be effectively given by the "Dummy" All Red Phase shown in **Figure 2**).
- The Phase Split time for the northbound left-turn movement (phases 5) would be set to the optimum phase split time for the northbound movement. The Phase Split time for the southbound left-turn movement (phases 5) would be set to the optimum phase split time for the northbound movement minus 1 second (to account for the 1 second "Dummy" All Red Phase). The combined split times for the northbound left-turn movement (phase 5), southbound left-turn movement (phase 1) and eastbound/westbound movements (phases 8/4) would equal the cycle length of the signal, leaving no remaining time for the overlapping phase where northbound and southbound through traffic would travel through the intersection simultaneously.
- The speed limit would be set to 25 mph to account for lower speeds through the crossover and channelized turn movements. The exception to this would be for the southbound approach that arrives from outside of the DDI and would be set to the speed limit of the Arterial Street.
- The Interchanges feature within HCS Streets would be used to update the Turning Radius for the turn movements based on the concept/design. This would account for the larger radii at the turning locations of the DDI. The Interchange Type within the Interchanges section does not include DDI as an option and would be set to Diamond.

As mentioned previously, the modified standard four-leg configuration would have split-phase operations at the ramp terminal intersections for northbound and southbound traffic and allow for coordination of the ramp terminal intersections with signals north and south of the interchange. The signal offset values at the ramp terminals would be based on the turn patterns at each intersection to maximize platooning of traffic through the two signals. Signal offsets at intersections adjacent to the ramp terminals would be based on the offsets established at the ramp terminal intersections.

APPENDIX B1. TRAFFIC CAPACITY ANALYSIS METHODOLOGIES

Traffic operational analysis involves the development of input parameters, the use of traffic flow models to determine measures of effectiveness based on the inputs, and the evaluation of those measures of effectiveness. The input development requires information on levels of traffic, vehicle classification, facility geometry, signal timing data, and speed data. Many of these input parameters were identified and collected as described as part of the data collection efforts, while some required assumptions or processed data to develop the best input parameters for traffic analysis.

LEVEL OF SERVICE

After identifying the proper input data, level of service (LOS) analyses for the existing conditions were performed for the basic freeway segments, weave segments, freeway merge and diverge segments, and key intersections (including ramp terminal intersections) using procedures from the ***Highway Capacity Manual*** (***HCM***). Highway Capacity Software 2010 (HCS 2010) version 6.50, a computerized analytical tool based on the ***HCM***, was utilized for the freeway segment and intersection operational analysis. HCS 2010 is representative of macroscopic models that describe traffic flow in the aggregate and is based on deterministic relationships developed through past research on traffic flow.

The following sections further describe the methodologies used and the types of HCS analyses applied.

Basic Freeway Segment Level of Service

LOS analyses for the basic freeway elements were performed following Chapter 11 procedures (Basic Freeway Segments) of the ***HCM***. For freeway segments, LOS is defined in terms of traffic stream density, as shown in *TABLE 1*. By definition, basic freeway segments are segments of the freeway that are outside of the influence area of ramps or weaving sections. Per ***HCM*** definition, freeway ramps have an influence distance of 1,500 feet upstream or downstream of ramp junctions. The influence distance of a weaving section between ramp junctions varies based on geometry and volume. Only freeway segments outside of the influence area of ramp junctions and weaving sections were evaluated as basic freeway segments, unless noted otherwise.

Table 1. Freeway LOS Definitions

LOS	Density Range (pc/mi/ln*)
A	0-11
B	>11-18
C	>18-26
D	>26-35
E	>35-45
F	Demand exceeds capacity >45

** Passenger cars per mile per lane*

Weave Segment Level of Service

Weave segments were analyzed based on Chapter 12 procedures (Freeway Weaving Segments) of the ***HCM***. Weaving is defined as the crossing of two or more traffic streams traveling in the same direction. Weaving areas generally occur when a merge area is closely followed by a diverge area, or when an entrance ramp is closely followed by an exit ramp connected by an auxiliary lane. LOS for weaving operations is related to the average density of all vehicles in the section. For locations with weaving traffic, ramp-to-ramp flows were estimated based on the Sioux Falls travel demand model. Based on the assumed ramp-to-ramp flows, ramp-to-freeway, freeway-to-ramp, and freeway-to-freeway flows could be calculated using flow conservation from the balanced sub-area volume set. The density range for 'Freeway Weaving Segments' shown in ***TABLE 2*** was used when evaluating weaving segments bounded by entry/exit ramps.

Table 2. Weaving LOS Definitions

LOS	Density Range (pc/mi/ln*)	
	Freeway Weaving Segments	Weaving Segments on Multilane Highways or C-D Roadways
A	≤10	≤12
B	>10-20	>12-24
C	>20-28	>24-32
D	>28-35	>32-36
E	>35	>36
F	Demand Exceeds Capacity	Demand Exceeds Capacity

** Passenger cars per mile per lane*

Freeway Merge and Diverge Segment Level of Service

Freeway merge and diverge segments were analyzed based on ***HCM*** Chapter 13 procedures (Freeway Merge and Diverge Segments). Acceleration and deceleration length of a freeway merge or diverge segment is measured from the point at which the edges of the ramp and freeway lanes converge (gore) to the end of the taper segment connecting the ramp to the freeway. By definition, the LOS for a typical freeway merge or diverge segment is based on the average density of vehicles in the influence area (defined by the ***HCM*** as 1,500 feet upstream or downstream) of the ramp, as described in ***TABLE 3.***

Table 3. Freeway Merge and Diverge LOS Definitions

LOS	Density Range (pc/mi/ln*)
A	≤10
B	>10-20
C	>20-28
D	>28-35
E	>35
F	Demand Exceeds Capacity

** Passenger cars per mile per lane*

For this study, LOS C was determined to be the critical threshold for mainline and ramp locations.

Signalized Intersection Level of Service

Key signalized intersections were analyzed based on ***HCM*** Chapter 18 procedures (Signalized Intersections). LOS for signalized intersections is evaluated based on control delay per vehicle (in seconds per vehicle), shown in ***Table 4***. Control delay is the portion of the total delay attributed to traffic signal operation and includes initial deceleration delay, queue move-up time, stopped delay and final acceleration delay.

Table 4. Signalized Intersection LOS Definitions

Control Delay per Vehicle (s/veh*)	LOS by Volume-to-Capacity Ratio	
	v/c ≤ 1.0	v/c > 1.0
≤10	A	F
>10-20	B	F
>20-35	C	F
>35-55	D	F
>55-80	E	F
>80	F	F

** Seconds per vehicle*

Unsignalized Intersection Level of Service

Key unsignalized intersections were analyzed based on ***HCM*** Chapters 19 procedures (Two-Way Stop-Controlled Intersections). LOS for unsignalized intersections is evaluated based on control delay per vehicle (in seconds per vehicle), shown in ***Table 5***. For two-way stop-controlled intersections with stop control on the side-street, the LOS is measured separately for each individual movement. Results of the two-way stop controlled intersection analysis were reported as the worst-case stop-controlled approach.

Table 5. Unsignalized Intersection LOS Definitions

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

** Seconds per vehicle*

LOS ‘C’ is typically preferred for the average intersection operations during the peak period traffic conditions of a project horizon year (beyond 20 years from existing), though LOS ‘D’ has generally been considered acceptable. For this study, LOS ‘D’ was used as the worst allowable LOS for future year intersection operations when identifying proposed improvements.

APPENDIX B2 -

EXISTING CONDITIONS HCS 2010 REPORTS

6300 W. Old Village Place, Suite 100, Sioux Falls, SD, 57108
(605) 977-7740

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*JKM*	Highway/Direction of Travel	*I-229 Northbound*
Agency or Company	*HDR*	From/To	*Western Off-Ramp to On-Ramp*
Date Performed	*11/18/2013*	Jurisdiction	*Sioux Falls*
Analysis Time Period	*AM Peak*	Analysis Year	*2013*

Project Description *I-229 MIS*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1831*	veh/h	Peak-Hour Factor, PHF	*0.80*
AADT		veh/day	%Trucks and Buses, P_T	*7*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.966*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*69.0*	mph	FFS	*69.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)		
Operational (LOS)			Design (N)		
			Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1184*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S	*70.0*	mph	S		mph
D = v_p / S	*16.9*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*B*		Required Number of Lanes, N		

Glossary

N - Number of lanes
S - Speed
V - Hourly volume
D - Density
v_p - Flow rate
FFS - Free-flow speed
LOS - Level of service
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13
f_{LC} - Exhibit 11-9
f_p - Page 11-18
TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*JKM*	Highway/Direction of Travel	*I-229 Northbound*
Agency or Company	*HDR*	From/To	*Western Off-Ramp to On-Ramp*
Date Performed	*11/18/2013*	Jurisdiction	*Sioux Falls*
Analysis Time Period	*PM Peak*	Analysis Year	*2013*

Project Description *I-229 MIS*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1425*	veh/h	Peak-Hour Factor, PHF	*0.93*
AADT		veh/day	%Trucks and Buses, P_T	*7*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.966*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*69.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*69.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*793*	pc/h/ln
S	*70.0*	mph
D = v_p / S	*11.3*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	JKM
Agency/Company	HDR
Date Performed	11/18/2013
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-229 Northbound
Weaving Segment Location	Western Ave to Minnesota Ave
Analysis Year	2013

Project Description I-229 MIS

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	2870ft
Freeway free-flow speed, FFS	70 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2400
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	1418	0.80	7	0	1.5	1.2	0.966	1.00	1835
V_{RF}	481	0.80	2	0	1.5	1.2	0.990	1.00	607
V_{FR}	413	0.80	3	0	1.5	1.2	0.985	1.00	524
V_{RR}	78	0.80	2	0	1.5	1.2	0.990	1.00	98
V_{NW}	1933							V =	3064
V_W	1131								
VR	0.369								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc
Interchange density, ID	1.0 int/mi
Minimum RF lane changes, LC_{RF}	1 lc/pc
Minimum FR lane changes, LC_{FR}	1 lc/pc
Minimum RR lane changes, LC_{RR}	lc/pc
Minimum weaving lane changes, LC_{MIN}	1131 lc/h
Weaving lane changes, LC_W	1441 lc/h
Non-weaving lane changes, LC_{NW}	1376 lc/h
Total lane changes, LC_{ALL}	2817 lc/h
Non-weaving vehicle index, I_{NW}	555

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	2988 veh/h
Weaving segment capacity, c_w	6188 veh/h
Weaving segment v/c ratio	0.483
Weaving segment density, D	17.6 pc/mi/ln
Level of Service, LOS	B
Weaving intensity factor, W	0.223
Weaving segment speed, S	58.0 mph
Average weaving speed, S_W	60.0 mph
Average non-weaving speed, S_{NW}	57.0 mph
Maximum weaving length, L_{MAX}	6337 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	JKM
Agency/Company	HDR
Date Performed	11/18/2013
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-229 Northbound
Weaving Segment Location	Western Ave to Minnesota Ave
Analysis Year	2013

Project Description I-229 MIS

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	2870ft
Freeway free-flow speed, FFS	70 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2400
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	1113	0.93	8	0	1.5	1.2	0.962	1.00	1245
V_{RF}	726	0.93	2	0	1.5	1.2	0.990	1.00	788
V_{FR}	312	0.93	3	0	1.5	1.2	0.985	1.00	341
V_{RR}	37	0.93	2	0	1.5	1.2	0.990	1.00	40
V_{NW}	1285							V =	2414
V_W	1129								
VR	0.468								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc
Interchange density, ID	1.0 int/mi
Minimum RF lane changes, LC_{RF}	1 lc/pc
Minimum FR lane changes, LC_{FR}	1 lc/pc
Minimum RR lane changes, LC_{RR}	lc/pc
Minimum weaving lane changes, LC_{MIN}	1129 lc/h
Weaving lane changes, LC_W	1439 lc/h
Non-weaving lane changes, LC_{NW}	1242 lc/h
Total lane changes, LC_{ALL}	2681 lc/h
Non-weaving vehicle index, I_{NW}	369

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	2353 veh/h
Weaving segment capacity, c_w	4934 veh/h
Weaving segment v/c ratio	0.477
Weaving segment density, D	13.6 pc/mi/ln
Level of Service, LOS	B
Weaving intensity factor, W	0.214
Weaving segment speed, S	59.1 mph
Average weaving speed, S_W	60.3 mph
Average non-weaving speed, S_{NW}	58.0 mph
Maximum weaving length, L_{MAX}	7451 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*JKM*
Agency or Company	*HDR*
Date Performed	*11/18/2013*
Analysis Time Period	*AM Peak*

Site Information

Highway/Direction of Travel	*I-229 Northbound*
From/To	*Minnesota Off-Ramp to On-Ramp*
Jurisdiction	*Sioux Falls*
Analysis Year	*2013*

Project Description *I-229 MIS*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1899*	veh/h	Peak-Hour Factor, PHF	*0.80*
AADT		veh/day	%Trucks and Buses, P_T	*6*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1222*	pc/h/ln
S	*70.0*	mph
D = v_p / S	*17.5*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*JKM*	Highway/Direction of Travel	*I-229 Northbound*
Agency or Company	*HDR*	From/To	*Minnesota Off-Ramp to On-Ramp*
Date Performed	*11/18/2013*	Jurisdiction	*Sioux Falls*
Analysis Time Period	*PM Peak*	Analysis Year	*2013*

Project Description *I-229 MIS*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1839*	veh/h	Peak-Hour Factor, PHF	*0.93*
AADT		veh/day	%Trucks and Buses, P_T	*6*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
			Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1018*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*70.0*	mph	S	mph
D = v_p / S	*14.5*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary

N - Number of lanes
S - Speed
V - Hourly volume
D - Density
v_p - Flow rate
FFS - Free-flow speed
LOS - Level of service
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12
f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13
f_{LC} - Exhibit 11-9
f_p - Page 11-18
TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3

 HCS 2010[TM] Version 6.80 Generated: 2/1/2017 11:20 AM

FREEWAY WEAVING WORKSHEET

General Information

Analyst	JKM
Agency/Company	HDR
Date Performed	11/18/2013
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-229 Northbound
Weaving Segment Location	Minnesota Ave to Cliff Ave
Analysis Year	2013

Project Description I-229 MIS

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	3130ft
Freeway free-flow speed, FFS	70 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2400
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	1460	0.80	6	0	1.5	1.2	0.971	1.00	1880
V_{RF}	275	0.80	3	0	1.5	1.2	0.985	1.00	349
V_{FR}	439	0.80	3	0	1.5	1.2	0.985	1.00	557
V_{RR}	63	0.80	3	0	1.5	1.2	0.985	1.00	80
V_{NW}	1960							V =	2866
V_W	906								
VR	0.316								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc
Interchange density, ID	1.0 int/mi
Minimum RF lane changes, LC_{RF}	1 lc/pc
Minimum FR lane changes, LC_{FR}	1 lc/pc
Minimum RR lane changes, LC_{RR}	lc/pc
Minimum weaving lane changes, LC_{MIN}	906 lc/h
Weaving lane changes, LC_W	1231 lc/h
Non-weaving lane changes, LC_{NW}	1522 lc/h
Total lane changes, LC_{ALL}	2753 lc/h
Non-weaving vehicle index, I_{NW}	613

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	2797 veh/h
Weaving segment capacity, c_w	6405 veh/h
Weaving segment v/c ratio	0.437
Weaving segment density, D	16.1 pc/mi/ln
Level of Service, LOS	B
Weaving intensity factor, W	0.204
Weaving segment speed, S	59.4 mph
Average weaving speed, S_W	60.7 mph
Average non-weaving speed, S_{NW}	58.9 mph
Maximum weaving length, L_{MAX}	5757 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	JKM
Agency/Company	HDR
Date Performed	11/18/2013
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-229 Northbound
Weaving Segment Location	Minnesota Ave to Cliff Ave
Analysis Year	2013

Project Description I-229 MIS

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	3130ft
Freeway free-flow speed, FFS	70 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2400
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	1381	0.93	6	0	1.5	1.2	0.971	1.00	1529
V_{RF}	440	0.93	3	0	1.5	1.2	0.985	1.00	480
V_{FR}	458	0.93	3	0	1.5	1.2	0.985	1.00	500
V_{RR}	21	0.93	3	0	1.5	1.2	0.985	1.00	23
V_{NW}	1552							V =	2532
V_W	980								
VR	0.387								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc
Interchange density, ID	1.0 int/mi
Minimum RF lane changes, LC_{RF}	1 lc/pc
Minimum FR lane changes, LC_{FR}	1 lc/pc
Minimum RR lane changes, LC_{RR}	lc/pc
Minimum weaving lane changes, LC_{MIN}	980 lc/h
Weaving lane changes, LC_W	1305 lc/h
Non-weaving lane changes, LC_{NW}	1438 lc/h
Total lane changes, LC_{ALL}	2743 lc/h
Non-weaving vehicle index, I_{NW}	486

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	2474 veh/h
Weaving segment capacity, c_w	6020 veh/h
Weaving segment v/c ratio	0.411
Weaving segment density, D	14.2 pc/mi/ln
Level of Service, LOS	B
Weaving intensity factor, W	0.204
Weaving segment speed, S	59.6 mph
Average weaving speed, S_W	60.7 mph
Average non-weaving speed, S_{NW}	58.9 mph
Maximum weaving length, L_{MAX}	6536 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*JKM*
Agency or Company	*HDR*
Date Performed	*11/19/2013*
Analysis Time Period	*AM Peak*

Site Information

Highway/Direction of Travel	*I-229 Northbound*
From/To	*Cliff Off-Ramp to On-Ramp*
Jurisdiction	*Sioux Falls*
Analysis Year	*2013*

Project Description *I-229 MIS*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1735*	veh/h	Peak-Hour Factor, PHF	*0.80*
AADT		veh/day	%Trucks and Buses, P_T	*5*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]	*0.976*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*69.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*69.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1111*	pc/h/ln
S	*70.0*	mph
D = v_p / S	*15.9*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*JKM*
Agency or Company	*HDR*
Date Performed	*11/19/2013*
Analysis Time Period	*PM Peak*

Site Information

Highway/Direction of Travel	*I-229 Northbound*
From/To	*Cliff Off-Ramp to On-Ramp*
Jurisdiction	*Sioux Falls*
Analysis Year	*2013*

Project Description *I-229 MIS*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1821*	veh/h	Peak-Hour Factor, PHF	*0.93*
AADT		veh/day	%Trucks and Buses, P_T	*5*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.976*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*69.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*69.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1004*	pc/h/ln
S	*70.0*	mph
D = v_p / S	*14.3*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*JKM*
Agency or Company	*HDR*
Date Performed	*11/19/2013*
Analysis Time Period	*AM Peak*

Site Information

Highway/Direction of Travel	*I-229 Southbound*
From/To	*Cliff Off-Ramp to On-Ramp*
Jurisdiction	*Sioux Falls*
Analysis Year	*2013*

Project Description *I-229 MIS*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1916*	veh/h	Peak-Hour Factor, PHF	*0.80*
AADT		veh/day	%Trucks and Buses, P_T	*7*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.966*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*69.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*69.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1239*	pc/h/ln
S	*70.0*	mph
D = v_p / S	*17.7*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

- N - Number of lanes
- V - Hourly volume
- v_p - Flow rate
- LOS - Level of service
- DDHV - Directional design hour volume
- S - Speed
- D - Density
- FFS - Free-flow speed
- BFFS - Base free-flow speed

Factor Location

- E_R - Exhibits 11-10, 11-12
- E_T - Exhibits 11-10, 11-11, 11-13
- f_p - Page 11-18
- LOS, S, FFS, v_p - Exhibits 11-2, 11-3
- f_{LW} - Exhibit 11-8
- f_{LC} - Exhibit 11-9
- TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*JKM*	Highway/Direction of Travel	*I-229 Southbound*
Agency or Company	*HDR*	From/To	*Cliff Off-Ramp to On-Ramp*
Date Performed	*11/19/2013*	Jurisdiction	*Sioux Falls*
Analysis Time Period	*PM Peak*	Analysis Year	*2013*

Project Description *I-229 MIS*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1930*	veh/h	Peak-Hour Factor, PHF	*0.93*
AADT		veh/day	%Trucks and Buses, P_T	*7*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]	*0.966*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*69.0*	mph	FFS	*69.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)		
Operational (LOS)			Design (N)		
			Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1074*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S	*70.0*	mph	S		mph
D = v_p / S	*15.3*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*B*		Required Number of Lanes, N		

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	JKM
Agency/Company	HDR
Date Performed	11/18/2013
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-229 Southbound
Weaving Segment Location	Cliff Ave to Minnesota Ave
Analysis Year	2013

Project Description I-229 MIS

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	3120ft
Freeway free-flow speed, FFS	67 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2350
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	1639	0.80	6	0	1.5	1.2	0.971	1.00	2110
V_{RF}	429	0.80	3	0	1.5	1.2	0.985	1.00	544
V_{FR}	277	0.80	3	0	1.5	1.2	0.985	1.00	351
V_{RR}	99	0.80	3	0	1.5	1.2	0.985	1.00	126
V_{NW}	2236							V =	3131
V_W	895								
VR	0.286								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc
Interchange density, ID	1.0 int/mi
Minimum RF lane changes, LC_{RF}	1 lc/pc
Minimum FR lane changes, LC_{FR}	1 lc/pc
Minimum RR lane changes, LC_{RR}	lc/pc
Minimum weaving lane changes, LC_{MIN}	895 lc/h
Weaving lane changes, LC_W	1220 lc/h
Non-weaving lane changes, LC_{NW}	1574 lc/h
Total lane changes, LC_{ALL}	2794 lc/h
Non-weaving vehicle index, I_{NW}	698

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	3055 veh/h
Weaving segment capacity, c_w	6329 veh/h
Weaving segment v/c ratio	0.483
Weaving segment density, D	18.6 pc/mi/ln
Level of Service, LOS	B
Weaving intensity factor, W	0.207
Weaving segment speed, S	56.2 mph
Average weaving speed, S_W	58.1 mph
Average non-weaving speed, S_{NW}	55.5 mph
Maximum weaving length, L_{MAX}	5433 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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FREEWAY WEAVING WORKSHEET

General Information

Analyst JKM
Agency/Company HDR
Date Performed 11/18/2013
Analysis Time Period PM Peak

Site Information

Freeway/Dir of Travel I-229 Southbound
Weaving Segment Location Cliff Ave to Minnesota Ave
Analysis Year 2013

Project Description I-229 MIS

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	3120ft
Freeway free-flow speed, FFS	67 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2350
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	1559	0.93	6	0	1.5	1.2	0.971	1.00	1727
V_{RF}	519	0.93	3	0	1.5	1.2	0.985	1.00	566
V_{FR}	371	0.93	3	0	1.5	1.2	0.985	1.00	405
V_{RR}	27	0.93	3	0	1.5	1.2	0.985	1.00	29
V_{NW}	1756							V =	2727
V_W	971								
VR	0.356								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc
Interchange density, ID	1.0 int/mi
Minimum RF lane changes, LC_{RF}	1 lc/pc
Minimum FR lane changes, LC_{FR}	1 lc/pc
Minimum RR lane changes, LC_{RR}	lc/pc
Minimum weaving lane changes, LC_{MIN}	971 lc/h
Weaving lane changes, LC_W	1296 lc/h
Non-weaving lane changes, LC_{NW}	1475 lc/h
Total lane changes, LC_{ALL}	2771 lc/h
Non-weaving vehicle index, I_{NW}	548

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	2663 veh/h
Weaving segment capacity, c_w	6160 veh/h
Weaving segment v/c ratio	0.432
Weaving segment density, D	16.1 pc/mi/ln
Level of Service, LOS	B
Weaving intensity factor, W	0.206
Weaving segment speed, S	56.5 mph
Average weaving speed, S_W	58.1 mph
Average non-weaving speed, S_{NW}	55.6 mph
Maximum weaving length, L_{MAX}	6193 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*JKM*	Highway/Direction of Travel	*I-229 Southbound*
Agency or Company	*HDR*	From/To	*Minnesota Off-Ramp to On-Ramp*
Date Performed	*11/19/2013*	Jurisdiction	*Sioux Falls*
Analysis Time Period	*AM Peak*	Analysis Year	*2013*

Project Description *I-229 MIS*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2068*	veh/h	Peak-Hour Factor, PHF	*0.80*
AADT		veh/day	%Trucks and Buses, P_T	*5*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.976*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*69.0*	mph	FFS	*69.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
			Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1325*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*69.8*	mph	S	mph
D = v_p / S	*19.0*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary

N - Number of lanes S - Speed
V - Hourly volume D - Density
v_p - Flow rate FFS - Free-flow speed
LOS - Level of service BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits 11-10, 11-12 f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13 f_{LC} - Exhibit 11-9
f_p - Page 11-18 TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*JKM*	Highway/Direction of Travel	*I-229 Southbound*
Agency or Company	*HDR*	From/To	*Minnesota Off-Ramp to On-Ramp*
Date Performed	*11/19/2013*	Jurisdiction	*Sioux Falls*
Analysis Time Period	*PM Peak*	Analysis Year	*2013*

Project Description *I-229 MIS*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2078*	veh/h	Peak-Hour Factor, PHF	*0.93*
AADT		veh/day	%Trucks and Buses, P_T	*5*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.976*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*69.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*69.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1145*	pc/h/ln
S	*70.0*	mph
D = v_p / S	*16.4*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	JKM
Agency/Company	HDR
Date Performed	11/18/2013
Analysis Time Period	AM Peak

Site Information

Freeway/Dir of Travel	I-229 Southbound
Weaving Segment Location	Minnesota Ave to Western Ave
Analysis Year	2013

Project Description I-229 MIS

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	3220ft
Freeway free-flow speed, FFS	69 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2400
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	fp	v (pc/h)
V_{FF}	1264	0.80	8	0	1.5	1.2	0.962	1.00	1643
V_{RF}	359	0.80	3	0	1.5	1.2	0.985	1.00	455
V_{FR}	804	0.80	2	0	1.5	1.2	0.990	1.00	1015
V_{RR}	50	0.80	2	0	1.5	1.2	0.990	1.00	63
V_{NW}	1706							V =	3176
V_W	1470								
VR	0.463								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc
Interchange density, ID	1.0 int/mi
Minimum RF lane changes, LC_{RF}	1 lc/pc
Minimum FR lane changes, LC_{FR}	1 lc/pc
Minimum RR lane changes, LC_{RR}	lc/pc
Minimum weaving lane changes, LC_{MIN}	1470 lc/h
Weaving lane changes, LC_W	1800 lc/h
Non-weaving lane changes, LC_{NW}	1519 lc/h
Total lane changes, LC_{ALL}	3319 lc/h
Non-weaving vehicle index, I_{NW}	549

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	3097 veh/h
Weaving segment capacity, c_w	4986 veh/h
Weaving segment v/c ratio	0.621
Weaving segment density, D	19.0 pc/mi/ln
Level of Service, LOS	B
Weaving intensity factor, W	0.231
Weaving segment speed, S	55.8 mph
Average weaving speed, S_W	58.9 mph
Average non-weaving speed, S_{NW}	53.3 mph
Maximum weaving length, L_{MAX}	7395 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	JKM
Agency/Company	HDR
Date Performed	11/18/2013
Analysis Time Period	PM Peak

Site Information

Freeway/Dir of Travel	I-229 Southbound
Weaving Segment Location	Minnesota Ave to Western Ave
Analysis Year	2013

Project Description I-229 MIS

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	3
Weaving segment length, L_S	3220ft
Freeway free-flow speed, FFS	69 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2400
Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	1348	0.93	8	0	1.5	1.2	0.962	1.00	1507
V_{RF}	566	0.93	3	0	1.5	1.2	0.985	1.00	618
V_{FR}	730	0.93	2	0	1.5	1.2	0.990	1.00	793
V_{RR}	33	0.93	2	0	1.5	1.2	0.990	1.00	36
V_{NW}	1543							V =	2954
V_W	1411								
VR	0.478								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc
Interchange density, ID	1.0 int/mi
Minimum RF lane changes, LC_{RF}	1 lc/pc
Minimum FR lane changes, LC_{FR}	1 lc/pc
Minimum RR lane changes, LC_{RR}	lc/pc
Minimum weaving lane changes, LC_{MIN}	1411 lc/h
Weaving lane changes, LC_W	1741 lc/h
Non-weaving lane changes, LC_{NW}	1485 lc/h
Total lane changes, LC_{ALL}	3226 lc/h
Non-weaving vehicle index, I_{NW}	497

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	2879 veh/h
Weaving segment capacity, c_w	4831 veh/h
Weaving segment v/c ratio	0.596
Weaving segment density, D	17.5 pc/mi/ln
Level of Service, LOS	B
Weaving intensity factor, W	0.226
Weaving segment speed, S	56.4 mph
Average weaving speed, S_W	59.0 mph
Average non-weaving speed, S_{NW}	54.1 mph
Maximum weaving length, L_{MAX}	7566 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		**Site Information**	
Analyst	*JKM*	Highway/Direction of Travel	*I-229 Southbound*
Agency or Company	*HDR*	From/To	*Western Off-Ramp to On-Ramp*
Date Performed	*11/19/2013*	Jurisdiction	*Sioux Falls*
Analysis Time Period	*AM Peak*	Analysis Year	*2013*

Project Description *I-229 MIS*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1623*	veh/h	Peak-Hour Factor, PHF	*0.80*
AADT		veh/day	%Trucks and Buses, P_T	*7*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.966*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width		ft	f_{LW}		mph
Rt-Side Lat. Clearance		ft	f_{LC}		mph
Number of Lanes, N	*2*		TRD Adjustment		mph
Total Ramp Density, TRD		ramps/mi	FFS	*67.0*	mph
FFS (measured)	*67.0*	mph			
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
			Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1050*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*65.0*	mph	S	mph
D = v_p / S	*16.2*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*JKM*	Highway/Direction of Travel	*I-229 Southbound*
Agency or Company	*HDR*	From/To	*Western Off-Ramp to On-Ramp*
Date Performed	*11/19/2013*	Jurisdiction	*Sioux Falls*
Analysis Time Period	*PM Peak*	Analysis Year	*2013*

Project Description *I-229 MIS*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1914*	veh/h	Peak-Hour Factor, PHF	*0.93*
AADT		veh/day	%Trucks and Buses, P_T	*6*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.971*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*67.0*	mph	FFS	*67.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)		
Operational (LOS)			Design (N)		
			Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1060*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S	*65.0*	mph	S		mph
D = v_p / S	*16.3*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*B*		Required Number of Lanes, N		

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*JDW*
Agency/Co.	*HRG*
Date Performed	*11/3/14*
Analysis Time Period	*AM Peak*

Site Information

Intersection	*Minnesota Ave & 43rd St*
Jurisdiction	*Sioux Falls, SD*
Analysis Year	*2013*

Project Description *I-229 MIS - Minnesota Corridor*

East/West Street: *43rd Street* | North/South Street: *Minnesota Ave*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*75*	*1465*	*145*	*7*	*811*	*13*
Peak-Hour Factor, PHF	*0.80*	*0.80*	*0.80*	*0.80*	*0.80*	*0.80*
Hourly Flow Rate, HFR (veh/h)	*93*	*1831*	*181*	*8*	*1013*	*16*
Percent Heavy Vehicles	*3*	--	--	*3*	--	--
Median Type	*Two Way Left Turn Lane*					
RT Channelized			*0*			*0*
Lanes	*1*	*2*	*0*	*1*	*2*	*0*
Configuration	*L*	*T*	*TR*	*L*	*T*	*TR*
Upstream Signal		*1*			*1*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*6*	*6*	*31*	*13*	*6*	*13*
Peak-Hour Factor, PHF	*0.80*	*0.80*	*0.80*	*0.80*	*0.80*	*0.80*
Hourly Flow Rate, HFR (veh/h)	*7*	*7*	*38*	*16*	*7*	*16*
Percent Heavy Vehicles	*2*	*2*	*2*	*2*	*2*	*2*
Percent Grade (%)	*0*			*0*		
Flared Approach		*Y*			*Y*	
Storage		*1*			*1*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*L*		*LTR*			*LTR*	
v (veh/h)	*93*	*8*		*39*			*52*	
C (m) (veh/h)	*723*	*499*		*5*			*7*	
v/c	*0.13*	*0.02*		*7.80*			*7.43*	
95% queue length	*0.44*	*0.05*		*6.50*			*8.05*	
Control Delay (s/veh)	*10.7*	*12.3*		*4461*			*3918*	
LOS	*B*	*B*		*F*			*F*	
Approach Delay (s/veh)	--	--	*4461*			*3918*		
Approach LOS	--	--	*F*			*F*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*JDW*
Agency/Co.	*HRG*
Date Performed	*11/3/14*
Analysis Time Period	*PM Peak*

Site Information

Intersection	*Minnesota Ave & 43rd St*
Jurisdiction	*Sioux Falls, SD*
Analysis Year	*2013*

Project Description *I-229 MIS - Minnesota Corridor*

East/West Street: *43rd Street* — North/South Street: *Minnesota Ave*

Intersection Orientation: *North-South* — Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	32	1023	26	16	1552	17
Peak-Hour Factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Hourly Flow Rate, HFR (veh/h)	34	1099	27	17	1668	18
Percent Heavy Vehicles	3	--	--	3	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			0
Lanes	1	2	0	1	2	0
Configuration	L	T	TR	L	T	TR
Upstream Signal		1			1	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	4	4	164	26	4	22
Peak-Hour Factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Hourly Flow Rate, HFR (veh/h)	4	4	176	27	4	23
Percent Heavy Vehicles	2	2	2	2	2	2
Percent Grade (%)		0			0	
Flared Approach		Y			Y	
Storage		1			1	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	L		LTR			LTR	
v (veh/h)	34	17		54			184	
C (m) (veh/h)	423	610		91			344	
v/c	0.08	0.03		0.59			0.53	
95% queue length	0.26	0.09		2.75			3.00	
Control Delay (s/veh)	14.3	11.1		90.7			26.9	
LOS	B	B		F			D	
Approach Delay (s/veh)	--	--	90.7			26.9		
Approach LOS	--	--	F			D		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*JKM*
Agency/Co.	*HDR*
Date Performed	*11/13/2013*
Analysis Time Period	*AM Peak*

Site Information

Intersection	*Minnesota Ave & 49th St*
Jurisdiction	*Sioux Falls, SD*
Analysis Year	*2013*

Project Description *I-229 MIS - Minnesota Corridor*

East/West Street: *49th St* North/South Street: *Minnesota Ave*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*132*	*1679*			*817*	*38*
Peak-Hour Factor, PHF	*0.80*	*0.80*	*0.80*	*0.80*	*0.80*	*0.80*
Hourly Flow Rate, HFR (veh/h)	*164*	*2098*	*0*	*0*	*1021*	*47*
Percent Heavy Vehicles	*3*	--	--	*0*	--	--
Median Type	*Two Way Left Turn Lane*					
RT Channelized			*0*			*0*
Lanes	*1*	*2*	*0*	*0*	*2*	*0*
Configuration	*L*	*T*			*T*	*TR*
Upstream Signal		*1*			*1*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*6*		*64*			
Peak-Hour Factor, PHF	*0.80*	*0.80*	*0.80*	*0.80*	*0.80*	*0.80*
Hourly Flow Rate, HFR (veh/h)	*7*	*0*	*79*	*0*	*0*	*0*
Percent Heavy Vehicles	*2*	*0*	*2*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*1*	*0*	*1*	*0*	*0*	*0*
Configuration	*L*		*R*			

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*					*L*		*R*
v (veh/h)	*164*					*7*		*79*
C (m) (veh/h)	*687*					*156*		*667*
v/c	*0.24*					*0.04*		*0.12*
95% queue length	*0.93*					*0.14*		*0.40*
Control Delay (s/veh)	*11.9*					*29.2*		*11.1*
LOS	*B*					*D*		*B*
Approach Delay (s/veh)	--	--				*12.6*		
Approach LOS	--	--				*B*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JKM	Intersection	Minnesota Ave & 49th St
Agency/Co.	HDR	Jurisdiction	Sioux Falls, SD
Date Performed	11/13/2013	Analysis Year	2013
Analysis Time Period	PM Peak		

Project Description *I-229 MIS - Minnesota Corridor*

East/West Street: 49th St	North/South Street: Minnesota Ave
Intersection Orientation: North-South	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	49	1077			1720	22
Peak-Hour Factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Hourly Flow Rate, HFR (veh/h)	52	1158	0	0	1849	23
Percent Heavy Vehicles	3	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			0
Lanes	1	2	0	0	2	0
Configuration	L	T			T	TR
Upstream Signal		1			1	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	4		135			
Peak-Hour Factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Hourly Flow Rate, HFR (veh/h)	4	0	145	0	0	0
Percent Heavy Vehicles	2	0	2	0	0	0
Percent Grade (%)	0			0		
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	1	0	1	0	0	0
Configuration	L		R			

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L					L		R
v (veh/h)	52					4		145
C (m) (veh/h)	338					100		704
v/c	0.15					0.04		0.21
95% queue length	0.54					0.12		0.77
Control Delay (s/veh)	17.6					42.5		11.4
LOS	C					E		B
Approach Delay (s/veh)	--	--				12.3		
Approach LOS	--	--				B		

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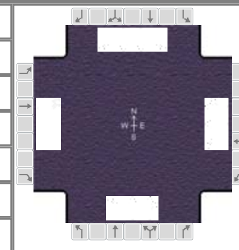
HCS 2010 Signalized Intersection Results Summary

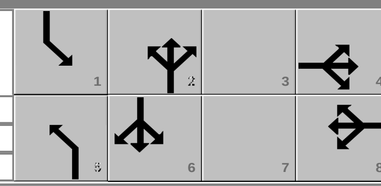
General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	JKM	Analysis Date	7/1/2013	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.80
Urban Street	Minnesota Ave	Analysis Year	2013	Analysis Period	1> 7:15
Intersection	Minnesota Ave & 41st St	File Name	Existing_Minnesota_AM.xus		
Project Description	Existing AM				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	346	194	101	132	220	57	150	1252	82	63	598	232

Signal Information			
Cycle, s	116.0	Reference Phase	2
Offset, s	51	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	10.4	36.1	3.8	13.5	24.0	0.0
Yellow	3.6	3.6	3.6	3.6	3.6	0.0
Red	1.0	2.3	2.3	2.1	2.5	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		10.0		10.0	1.2	4.0	1.3	3.0
Phase Duration, s		30.1		19.2	15.0	57.0	9.7	51.7
Change Period, (*Y+R c*), s		6.1		5.7	4.6	5.9	5.9	5.9
Max Allow Headway (*MAH*), s		4.2		4.2	4.2	0.0	4.2	0.0
Queue Clearance Time (*g s*), s		24.0		13.2	10.6		3.0	
Green Extension Time (*g e*), s		0.0		0.3	0.0	0.0	1.1	0.0
Phase Call Probability		1.00		1.00	1.00		0.92	
Max Out Probability		1.00		1.00	1.00		1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	324	269	154	165	166	161	186	823	814	79	748	239
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1681	1731	1627	1681	1765	1667	1664	1748	1714	1664	1664	1481
Queue Service Time (*g s*), s	22.0	16.9	9.6	11.2	10.7	11.0	8.6	51.1	51.1	1.0	17.6	11.3
Cycle Queue Clearance Time (*g c*), s	22.0	16.9	9.6	11.2	10.7	11.0	8.6	51.1	51.1	1.0	17.6	11.3
Green Ratio (*g/C*)	0.21	0.21	0.21	0.12	0.12	0.12	0.42	0.44	0.44	0.33	0.39	0.39
Capacity (*c*), veh/h	348	358	337	195	205	194	301	770	756	116	1312	584
Volume-to-Capacity Ratio (*X*)	0.932	0.751	0.457	0.845	0.811	0.832	0.616	1.068	1.078	0.679	0.570	0.409
Back of Queue (*Q*), ft/ln (95 th percentile)	453.2	323.4	177.5	254.4	246.4	242.7	135.4	939.2	924.9	117.7	271	179.7
Back of Queue (*Q*), veh/ln (95 th percentile)	17.8	12.7	7.1	10.0	9.7	9.7	5.3	36.7	37.0	4.6	10.6	7.0
Queue Storage Ratio (*RQ*) (95 th percentile)	3.02	0.32	0.18	1.45	0.25	0.25	1.08	0.67	0.68	1.18	0.27	1.80
Uniform Delay (d_1), s/veh	45.2	43.2	40.3	50.2	50.0	50.1	23.1	28.1	27.6	53.8	20.8	19.3
Incremental Delay (d_2), s/veh	31.2	8.5	1.0	24.3	18.7	22.4	1.8	43.2	46.9	10.6	1.8	2.1
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	76.4	51.7	41.2	74.5	68.7	72.5	24.9	71.3	74.5	64.4	22.6	21.4
Level of Service (LOS)	E	D	D	E	E	E	C	F	F	E	C	C

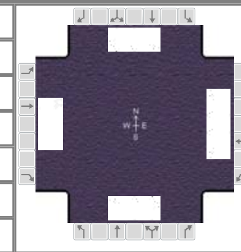
	EB		WB		NB		SB	
Approach Delay, s/veh / LOS	60.3	E	71.9	E	68.0	E	25.4	C
Intersection Delay, s/veh / LOS	56.1				E			

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	3.0	C	2.9	C	2.9	C
Bicycle LOS Score / LOS	1.1	A	0.9	A	2.0	B	1.4	A

 HCS 2010™ Streets Version 6.90 Generated: 2/1/2017 9:53:49 AM

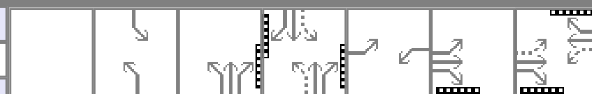
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	JKM	Analysis Date	7/1/2013	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.80
Urban Street	Minnesota Ave	Analysis Year	2013	Analysis Period	1> 7:15
Intersection	Minnesota Ave & 57th St	File Name	Existing_Minnesota_AM.xus		
Project Description	Existing AM				

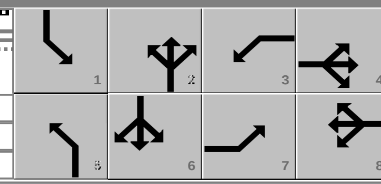


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	194	264	108	50	610	258	201	925	31	108	452	120

Signal Information			
Cycle, s	109.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	7.9	4.7	36.6	4.3	4.7	24.1
Yellow	4.0	0.0	3.9	4.0	4.0	4.3
Red	1.0	0.0	1.9	1.0	1.0	1.6



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	19.1	39.7	9.3	30.0	17.6	47.1	12.9	42.4
Change Period, ($Y+R_c$), s	5.0	5.9	5.0	5.9	5.0	5.8	5.0	5.8
Max Allow Headway (*MAH*), s	4.1	5.6	3.1	5.6	3.6	5.5	3.6	5.5
Queue Clearance Time (g_s), s	13.6	14.3	5.1	26.1	12.3	37.5	7.7	21.6
Green Extension Time (g_e), s	0.5	13.4	0.0	0.0	0.2	1.5	0.3	15.0
Phase Call Probability	1.00	1.00	0.85	1.00	1.00	1.00	0.98	1.00
Max Out Probability	0.12	0.39	1.00	1.00	0.94	1.00	0.00	0.49

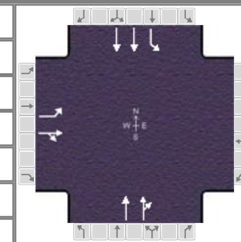
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	243	241	224	63	763	323	251	601	594	135	370	345
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1681	1765	1592	1681	1680	1496	1664	1748	1727	1664	1748	1621
Queue Service Time (g_s), s	11.6	11.9	12.3	3.1	24.1	23.3	10.3	35.5	35.5	5.7	19.5	19.6
Cycle Queue Clearance Time (g_c), s	11.6	11.9	12.3	3.1	24.1	23.3	10.3	35.5	35.5	5.7	19.5	19.6
Green Ratio (*g/C*)	0.37	0.31	0.31	0.26	0.22	0.22	0.47	0.38	0.38	0.41	0.34	0.34
Capacity (*c*), veh/h	283	548	494	299	743	331	371	662	654	202	586	544
Volume-to-Capacity Ratio (*X*)	0.857	0.441	0.453	0.209	1.026	0.975	0.677	0.908	0.908	0.668	0.631	0.634
Back of Queue (*Q*), ft/ln (95 th percentile)	236.8	221.7	206.8	57.6	515.6	460.2	189.3	616.5	597.5	105.5	325.1	300.8
Back of Queue (*Q*), veh/ln (95 th percentile)	9.3	8.7	8.3	2.3	20.3	18.1	7.4	24.1	23.9	4.1	12.7	12.0
Queue Storage Ratio (*RQ*) (95 th percentile)	1.89	0.22	0.21	0.38	0.52	3.07	1.89	0.62	0.61	0.70	0.10	0.09
Uniform Delay (d_1), s/veh	28.5	30.0	30.2	31.0	42.5	42.2	21.5	32.1	32.1	26.7	30.5	30.6
Incremental Delay (d_2), s/veh	12.9	1.0	1.1	0.1	39.9	42.9	3.2	16.9	17.1	2.6	1.8	2.0
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	41.5	31.0	31.3	31.2	82.4	85.1	24.6	48.9	49.2	29.4	32.3	32.5
Level of Service (LOS)	D	C	C	C	F	F	C	D	D	C	C	C
Approach Delay, s/veh / LOS	34.7	C		80.4	F		44.8	D		31.9	C	
Intersection Delay, s/veh / LOS	50.3						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.8	C	2.8	C	2.9	C	2.8	C
Bicycle LOS Score / LOS	1.1	A	1.4	A	1.7	A	1.2	A

 HCS 2010™ Streets Version 6.90 Generated: 2/1/2017 9:53:49 AM

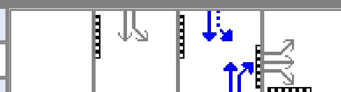
HCS 2010 Signalized Intersection Results Summary

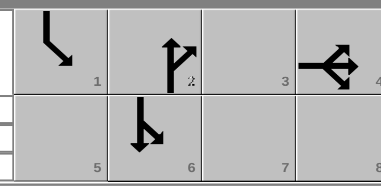
General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	JKM	Analysis Date	7/1/2013	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.80
Urban Street	Minnesota Ave	Analysis Year	2013	Analysis Period	1> 7:15
Intersection	Minnesota Ave & I-229…	File Name	Existing_Minnesota_AM.xus		
Project Description	Existing AM				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	390	0	101					1308	225	113	622	

Signal Information										
Cycle, s	116.0	Reference Phase	6							
Offset, s	100	Reference Point	Begin	Green	5.7	60.1	33.4	0.0	0.0	0.0
Uncoordinated	No	Simult. Gap E/W	On	Yellow	4.3	4.3	4.0	0.0	0.0	0.0
Force Mode	Fixed	Simult. Gap N/S	On	Red	1.0	1.6	1.6	0.0	0.0	0.0





Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4				2	1	6
Case Number		10.0				8.3	1.0	4.0
Phase Duration, s		39.0				66.0	11.0	77.0
Change Period, (*Y+R* *c*), s		5.6				5.9	5.3	5.9
Max Allow Headway (*MAH*), s		4.1				0.0	4.1	0.0
Queue Clearance Time (*g* *s*), s		35.4					7.5	
Green Extension Time (*g* *e*), s		0.0				0.0	0.0	0.0
Phase Call Probability		1.00					0.99	
Max Out Probability		1.00					1.00	

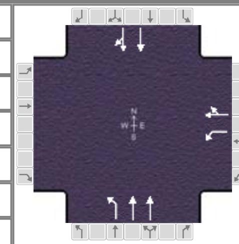
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14					2	12	1	6	
Adjusted Flow Rate (*v*), veh/h	488	126						949	967	141	778	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1664	1410						1851	1797	1664	1649	
Queue Service Time (*g* *s*), s	33.4	8.1						71.1	60.1	5.5	13.2	
Cycle Queue Clearance Time (*g* *c*), s	33.4	8.1						71.1	60.1	5.5	13.2	
Green Ratio (*g/C*)	0.29	0.29						0.52	0.52	0.58	0.61	
Capacity (*c*), veh/h	479	406						959	931	144	2021	
Volume-to-Capacity Ratio (*X*)	1.017	0.311						0.990	1.039	0.982	0.385	
Back of Queue (*Q*), ft/ln (95 th percentile)	685	127.6						816.9	913.8	265.9	193.5	
Back of Queue (*Q*), veh/ln (95 th percentile)	26.8	5.0						31.9	36.6	10.4	7.6	
Queue Storage Ratio (*RQ*) (95 th percentile)	5.48	0.13						0.25	0.29	2.13	0.28	
Uniform Delay (*d* *1*), s/veh	41.3	32.3						27.7	28.0	33.3	10.6	
Incremental Delay (*d* *2*), s/veh	45.5	0.4						13.4	27.0	62.0	0.5	
Initial Queue Delay (*d* *3*), s/veh	0.0	0.0						0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	86.8	32.7						41.0	54.9	95.3	11.1	
Level of Service (LOS)	F	C						D	F	F	B	

	EB		WB		NB		SB	
Approach Delay, s/veh / LOS	75.7	E	0.0		48.0	D	24.0	C
Intersection Delay, s/veh / LOS	46.6				D			

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.8	C	2.9	C	1.9	A	1.7	A
Bicycle LOS Score / LOS	1.5	A			2.1	B	1.2	A

HCS 2010 Signalized Intersection Results Summary

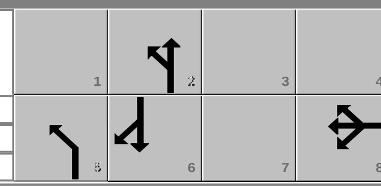
General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	JKM	Analysis Date	7/1/2013	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.80
Urban Street	Minnesota Ave	Analysis Year	2013	Analysis Period	1> 7:15
Intersection	Minnesota Ave & I-229…	File Name	Existing_Minnesota_AM.xus		
Project Description	Existing AM				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				150	0	226	113	1585			585	296

Signal Information			
Cycle, s	116.0	Reference Phase	2
Offset, s	5	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	5.8	68.9	25.2	0.0	0.0	0.0
Yellow	3.6	3.6	4.0	0.0	0.0	0.0
Red	1.0	2.2	1.7	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase				8	5	2		6
Case Number				10.0	1.0	4.0		8.3
Phase Duration, s				30.9	10.4	85.1		74.7
Change Period, (*Y+R* *c*), s				5.7	4.6	5.8		5.8
Max Allow Headway (*MAH*), s				4.2	4.1	0.0		0.0
Queue Clearance Time (*g* *s*), s				24.1	5.5			
Green Extension Time (*g* *e*), s				1.1	0.4	0.0		0.0
Phase Call Probability				1.00	0.99			
Max Out Probability				0.31	0.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement				3	8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h				188	283		140	1959			567	535
Adjusted Saturation Flow Rate (*s*), veh/h/ln				1664	1444		1664	1800			1682	1576
Queue Service Time (*g* *s*), s				11.5	22.1		3.5	46.3			30.1	31.8
Cycle Queue Clearance Time (*g* *c*), s				11.5	22.1		3.5	46.3			30.1	31.8
Green Ratio (*g/C*)				0.22	0.22		0.66	0.68			0.59	0.59
Capacity (*c*), veh/h				362	314		306	2461			999	936
Volume-to-Capacity Ratio (*X*)				0.519	0.901		0.456	0.796			0.567	0.571
Back of Queue (*Q*), ft/ln (95 th percentile)				212.8	371.4		46.5	487.2			431.3	462.6
Back of Queue (*Q*), veh/ln (95 th percentile)				8.3	14.5		1.8	19.0			16.8	18.5
Queue Storage Ratio (*RQ*) (95 th percentile)				1.70	0.37		0.37	0.70			0.31	0.34
Uniform Delay (*d* *1*), s/veh				40.0	44.2		14.9	14.9			19.9	25.4
Incremental Delay (*d* *2*), s/veh				1.2	20.3		0.1	0.3			1.8	1.9
Initial Queue Delay (*d* *3*), s/veh				0.0	0.0		0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh				41.2	64.5		15.0	15.2			21.7	27.4
Level of Service (LOS)				D	E		B	B			C	C

	EB		WB		NB		SB	
Approach Delay, s/veh / LOS	0.0		55.2	E	15.2	B	24.4	C
Intersection Delay, s/veh / LOS	23.1				C			

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.8	C	1.6	A	1.9	A
Bicycle LOS Score / LOS			1.3	A	2.2	B	1.4	A

 HCS 2010™ Streets Version 6.90 Generated: 2/1/2017 9:53:49 AM

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	JKM
Agency/Co.	HDR
Date Performed	11/13/2013
Analysis Time Period	AM Peak

Site Information

Intersection	Minnesota Ave & Batcheller Ln
Jurisdiction	Sioux Falls, SD
Analysis Year	2013

Project Description I-229 MIS - Minnesota Corridor

East/West Street: Batcheller Ln | North/South Street: Minnesota Ave

Intersection Orientation: North-South | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	6	1371			674	6
Peak-Hour Factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80
Hourly Flow Rate, HFR (veh/h)	7	1713	0	0	842	7
Percent Heavy Vehicles	3	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			0
Lanes	1	2	0	0	2	0
Configuration	L	T			T	TR
Upstream Signal		1			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	19		6			
Peak-Hour Factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80
Hourly Flow Rate, HFR (veh/h)	23	0	7	0	0	0
Percent Heavy Vehicles	2	0	2	0	0	0
Percent Grade (%)	0			0		
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L						LR	
v (veh/h)	7						30	
C (m) (veh/h)	778						298	
v/c	0.01						0.10	
95% queue length	0.03						0.33	
Control Delay (s/veh)	9.7						18.4	
LOS	A						C	
Approach Delay (s/veh)	--	--				18.4		
Approach LOS	--	--				C		

 HCS+™ Version 5.6 Generated: 2/1/2017 9:58 AM

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*JKM*
Agency/Co.	*HDR*
Date Performed	*11/13/2013*
Analysis Time Period	*PM Peak*

Site Information

Intersection	*Minnesota Ave & Batcheller Ln*
Jurisdiction	*Sioux Falls, SD*
Analysis Year	*2013*

Project Description *I-229 MIS - Minnesota Corridor*

East/West Street: *Batcheller Ln* | North/South Street: *Minnesota Ave*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	4	882			1166	32
Peak-Hour Factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Hourly Flow Rate, HFR (veh/h)	4	948	0	0	1253	34
Percent Heavy Vehicles	3	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			0
Lanes	1	2	0	0	2	0
Configuration	L	T			T	TR
Upstream Signal		1			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	12		4			
Peak-Hour Factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Hourly Flow Rate, HFR (veh/h)	12	0	4	0	0	0
Percent Heavy Vehicles	2	0	2	0	0	0
Percent Grade (%)	0			0		
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L						LR	
v (veh/h)	4						16	
C (m) (veh/h)	529						217	
v/c	0.01						0.07	
95% queue length	0.02						0.24	
Control Delay (s/veh)	11.9						22.9	
LOS	B						C	
Approach Delay (s/veh)	--	--				22.9		
Approach LOS	--	--				C		

 HCS+™ Version 5.6 Generated: 2/1/2017 9:59 AM

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*JKM*
Agency/Co.	*HDR*
Date Performed	*11/13/2013*
Analysis Time Period	*AM Peak*

Site Information

Intersection	*Minnesota Ave & Lotta St*
Jurisdiction	*Sioux Falls, SD*
Analysis Year	*2013*

Project Description *I-229 MIS - Minnesota Corridor*

East/West Street: *Lotta St* North/South Street: *Minnesota Ave*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*1377*	*13*	*57*	*667*	
Peak-Hour Factor, PHF	*0.80*	*0.80*	*0.80*	*0.80*	*0.80*	*0.80*
Hourly Flow Rate, HFR (veh/h)	*0*	*1721*	*16*	*71*	*833*	*0*
Percent Heavy Vehicles	*0*	*--*	*--*	*3*	*--*	*--*
Median Type	*Two Way Left Turn Lane*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*1*	*2*	*0*
Configuration		*T*	*TR*	*L*	*T*	
Upstream Signal		*0*			*1*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*13*		*156*
Peak-Hour Factor, PHF	*0.80*	*0.80*	*0.80*	*0.80*	*0.80*	*0.80*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*16*	*0*	*194*
Percent Heavy Vehicles	*0*	*0*	*0*	*2*	*0*	*2*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*1*	*0*	*1*
Configuration				*L*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*L*	*L*		*R*			
v (veh/h)		*71*	*16*		*194*			
C (m) (veh/h)		*354*	*99*		*350*			
v/c		*0.20*	*0.16*		*0.55*			
95% queue length		*0.74*	*0.55*		*3.20*			
Control Delay (s/veh)		*17.7*	*48.2*		*27.4*			
LOS		*C*	*E*		*D*			
Approach Delay (s/veh)	--	--	*28.9*					
Approach LOS	--	--	*D*					

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*JKM*
Agency/Co.	*HDR*
Date Performed	*11/13/2013*
Analysis Time Period	*PM Peak*

Site Information

Intersection	*Minnesota Ave & Lotta St*
Jurisdiction	*Sioux Falls, SD*
Analysis Year	*2013*

Project Description *I-229 MIS - Minnesota Corridor*

East/West Street: *Lotta St*

North/South Street: *Minnesota Ave*

Intersection Orientation: *North-South*

Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		868	26	163	1186	
Peak-Hour Factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Hourly Flow Rate, HFR (veh/h)	0	933	27	175	1275	0
Percent Heavy Vehicles	0	--	--	3	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			0
Lanes	0	2	0	1	2	0
Configuration		T	TR	L	T	
Upstream Signal		0			1	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				12		80
Peak-Hour Factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Hourly Flow Rate, HFR (veh/h)	0	0	0	12	0	86
Percent Heavy Vehicles	0	0	0	2	0	2
Percent Grade (%)	0			0		
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	1	0	1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		L	L		R			
v (veh/h)		175	12		86			
C (m) (veh/h)		706	148		584			
v/c		0.25	0.08		0.15			
95% queue length		0.97	0.26		0.51			
Control Delay (s/veh)		11.8	31.5		12.2			
LOS		B	D		B			
Approach Delay (s/veh)	--	--	14.6					
Approach LOS	--	--	B					

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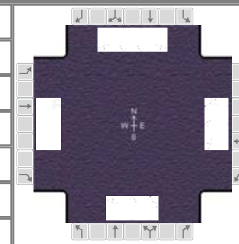
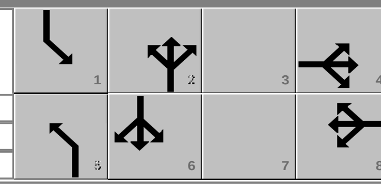
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	JKM	Analysis Date	7/1/2013	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM Peak	PHF	0.93
Urban Street	Minnesota Ave	Analysis Year	2013	Analysis Period	1> 4:30
Intersection	Minnesota Ave & 41st St	File Name	Existing_Minnesota_PM.xus		
Project Description	Existing PM				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	392	267	251	250	288	50	217	735	97	50	1084	386

Signal Information										
Cycle, s	128.0	Reference Phase	2							
Offset, s	43	Reference Point	Begin	Green	15.7	35.8	3.5	19.9	24.9	0.0
Uncoordinated	No	Simult. Gap E/W	On	Yellow	3.6	3.6	3.6	3.6	3.6	0.0
Force Mode	Fixed	Simult. Gap N/S	On	Red	1.0	2.3	2.3	2.1	2.5	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		10.0		10.0	1.2	4.0	1.3	3.0
Phase Duration, s		31.0		25.6	20.3	62.0	9.4	51.1
Change Period, (*Y+R* $_c$), s		6.1		5.7	4.6	5.9	5.9	5.9
Max Allow Headway (*MAH*), s		4.2		4.2	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s		26.9		21.9	15.5		2.0	
Green Extension Time (g_e), s		0.0		0.0	0.2	0.0	2.1	0.0
Phase Call Probability		1.00		1.00	1.00		0.85	
Max Out Probability		1.00		1.00	1.00		1.00	

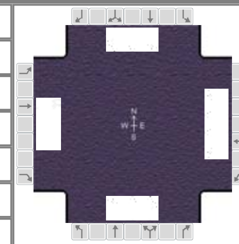
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	337	346	233	269	178	174	233	445	430	54	1166	370
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1681	1744	1521	1681	1765	1691	1664	1748	1688	1664	1664	1481
Queue Service Time (g_s), s	24.9	24.9	18.7	19.9	12.1	12.4	13.5	28.1	28.8	0.0	44.5	25.4
Cycle Queue Clearance Time (g_c), s	24.9	24.9	18.7	19.9	12.1	12.4	13.5	28.1	28.8	0.0	44.5	25.4
Green Ratio (*g/C*)	0.19	0.19	0.19	0.16	0.16	0.16	0.42	0.44	0.44	0.29	0.35	0.35
Capacity (*c*), veh/h	327	339	296	261	274	263	260	766	740	226	1175	523
Volume-to-Capacity Ratio (*X*)	1.031	1.019	0.788	1.030	0.650	0.661	0.896	0.581	0.581	0.238	0.992	0.707
Back of Queue (*Q*), ft/ln (95 th percentile)	573.8	576	321.5	487.4	246.9	240	273	455.9	445.4	67.7	709.9	370.2
Back of Queue (*Q*), veh/ln (95 th percentile)	22.6	22.7	12.9	19.2	9.7	9.6	10.7	17.8	17.8	2.6	27.7	14.5
Queue Storage Ratio (*RQ*) (95 th percentile)	3.83	0.58	0.33	2.79	0.25	0.24	2.18	0.33	0.33	0.68	0.71	3.70
Uniform Delay (d_1), s/veh	51.5	51.5	49.0	54.1	50.8	50.9	39.7	36.3	38.2	41.6	33.7	28.6
Incremental Delay (d_2), s/veh	58.0	53.7	13.2	63.6	5.3	6.0	17.9	2.0	2.1	0.5	24.3	7.8
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	109.5	105.2	62.3	117.7	56.1	56.9	57.7	38.3	40.3	42.1	58.0	36.4
Level of Service (LOS)	F	F	E	F	E	E	E	D	D	D	E	D
Approach Delay, s/veh / LOS	95.9		F	83.0		F	43.2		D	52.5		D
Intersection Delay, s/veh / LOS	63.9						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	3.1	C	2.9	C	2.9	C
Bicycle LOS Score / LOS	1.2	A	1.0	A	1.4	A	1.8	A

 HCS 2010™ Streets Version 6.90 Generated: 2/1/2017 10:02:13 AM

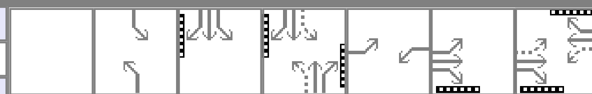
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	JKM	Analysis Date	7/1/2013	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM Peak	PHF	0.93
Urban Street	Minnesota Ave	Analysis Year	2013	Analysis Period	1> 4:30
Intersection	Minnesota Ave & 57th St	File Name	Existing_Minnesota_PM.xus		
Project Description	Existing PM				

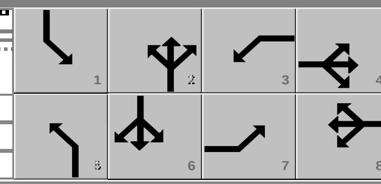


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	224	718	174	50	415	129	147	533	50	251	740	179

Signal Information			
Cycle, s	109.8	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	8.0	0.7	36.5	2.0	7.2	23.7
Yellow	4.0	4.0	3.9	4.0	4.0	4.3
Red	1.0	1.0	1.9	1.0	1.0	1.6



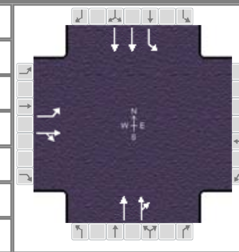
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	19.2	41.8	7.0	29.6	13.0	42.3	18.7	48.0
Change Period, (*Y+R* $_c$), s	5.0	5.9	5.0	5.9	5.0	5.8	5.0	5.8
Max Allow Headway (*MAH*), s	4.1	5.6	3.1	5.6	3.6	5.5	3.6	5.5
Queue Clearance Time (g_s), s	13.7	30.9	4.0	15.2	8.9	18.4	13.1	29.8
Green Extension Time (g_e), s	0.5	4.9	0.0	4.4	0.0	9.9	0.6	12.4
Phase Call Probability	1.00	1.00	0.81	1.00	0.99	1.00	1.00	1.00
Max Out Probability	0.13	0.85	1.00	0.98	1.00	0.66	0.00	0.41

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	241	496	463	54	446	139	158	318	309	269	510	475
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1681	1765	1645	1681	1680	1496	1664	1748	1695	1664	1748	1629
Queue Service Time (g_s), s	11.7	28.9	28.9	2.0	13.2	8.8	6.9	16.3	16.4	11.1	27.8	27.8
Cycle Queue Clearance Time (g_c), s	11.7	28.9	28.9	2.0	13.2	8.8	6.9	16.3	16.4	11.1	27.8	27.8
Green Ratio (*g/C*)	0.36	0.33	0.33	0.23	0.22	0.22	0.41	0.33	0.33	0.48	0.38	0.38
Capacity (*c*), veh/h	362	577	538	122	726	323	250	581	563	418	672	627
Volume-to-Capacity Ratio (*X*)	0.666	0.861	0.861	0.439	0.615	0.429	0.631	0.547	0.549	0.644	0.759	0.759
Back of Queue (*Q*), ft/ln (95 th percentile)	211.3	503	469.9	24.8	239.2	151.6	133.6	285.8	273.7	185.5	430.6	397.5
Back of Queue (*Q*), veh/ln (95 th percentile)	8.3	19.8	18.8	1.0	9.4	6.0	5.2	11.2	10.9	7.2	16.8	15.9
Queue Storage Ratio (*RQ*) (95 th percentile)	1.69	0.50	0.48	0.17	0.24	1.01	1.34	0.29	0.28	1.24	0.13	0.13
Uniform Delay (d_1), s/veh	27.5	34.6	34.6	39.6	38.9	37.2	25.1	29.9	29.9	20.3	29.4	29.4
Incremental Delay (d_2), s/veh	2.4	11.6	12.3	0.9	2.0	1.5	4.6	1.6	1.7	1.0	3.1	3.3
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	29.8	46.2	46.9	40.6	40.9	38.7	29.7	31.5	31.6	21.4	32.4	32.7
Level of Service (LOS)	C	D	D	D	D	D	C	C	C	C	C	C
Approach Delay, s/veh / LOS	43.2	D		40.4	D		31.2	C		30.2	C	
Intersection Delay, s/veh / LOS	36.1						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.8	C	2.8	C	3.0	C	2.8	C
Bicycle LOS Score / LOS	1.5	A	1.0	A	1.1	A	1.5	A

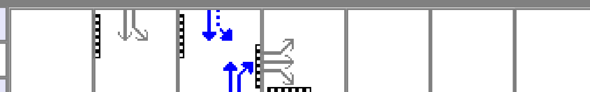
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	JKM	Analysis Date	7/1/2013	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM Peak	PHF	0.93
Urban Street	Minnesota Ave	Analysis Year	2013	Analysis Period	1> 4:30
Intersection	Minnesota Ave & I-229…	File Name	Existing_Minnesota_PM.xus		
Project Description	Existing PM				

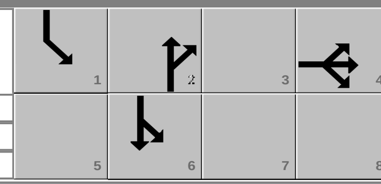


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	245	0	104					794	146	315	1252	

Signal Information			
Cycle, s	128.0	Reference Phase	6
Offset, s	89	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	13.1	75.1	23.1	0.0	0.0	0.0
Yellow	4.3	4.3	4.0	0.0	0.0	0.0
Red	1.0	1.6	1.6	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4				2	1	6
Case Number		10.0				8.3	1.0	4.0
Phase Duration, s		28.7				81.0	18.4	99.3
Change Period, (*Y+R* c), s		5.6				5.9	5.3	5.9
Max Allow Headway (*MAH*), s		6.1				0.0	4.1	0.0
Queue Clearance Time (*g* s), s		21.7					12.2	
Green Extension Time (*g* e), s		1.3				0.0	0.9	0.0
Phase Call Probability		1.00					1.00	
Max Out Probability		1.00					0.03	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14					2	12	1	6	
Adjusted Flow Rate (*v*), veh/h	263	112						518	493	338	1342	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1664	1410						1769	1678	1664	1744	
Queue Service Time (*g* s), s	19.7	9.0						26.4	22.0	10.2	16.1	
Cycle Queue Clearance Time (*g* c), s	19.7	9.0						26.4	22.0	10.2	16.1	
Green Ratio (*g/C*)	0.18	0.18						0.59	0.59	0.70	0.73	
Capacity (*c*), veh/h	300	254						1038	985	435	2546	
Volume-to-Capacity Ratio (*X*)	0.878	0.440						0.499	0.501	0.776	0.527	
Back of Queue (*Q*), ft/ln (95 th percentile)	386.5	152.9						334.7	315.1	156.9	164.1	
Back of Queue (*Q*), veh/ln (95 th percentile)	15.1	6.0						13.1	12.6	6.1	6.4	
Queue Storage Ratio (*RQ*) (95 th percentile)	3.09	0.15						0.10	0.10	1.25	0.23	
Uniform Delay (*d* 1), s/veh	51.1	46.7						15.5	15.5	14.2	4.8	
Incremental Delay (*d* 2), s/veh	22.2	2.6						1.4	1.5	2.5	0.4	
Initial Queue Delay (*d* 3), s/veh	0.0	0.0						0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	73.3	49.3						16.8	17.0	16.7	5.1	
Level of Service (LOS)	E	D						B	B	B	A	

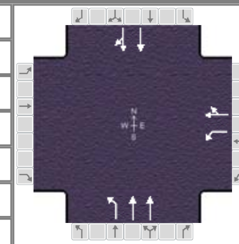
	EB		WB		NB		SB	
Approach Delay, s/veh / LOS	66.1	E	0.0		16.9	B	7.5	A
Intersection Delay, s/veh / LOS	17.8				B			

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.8	C	2.9	C	1.9	A	1.6	A
Bicycle LOS Score / LOS	1.1	A			1.3	A	1.9	A

 HCS 2010™ Streets Version 6.90 Generated: 2/1/2017 10:02:13 AM

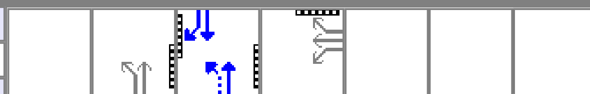
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	JKM	Analysis Date	7/1/2013	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM Peak	PHF	0.93
Urban Street	Minnesota Ave	Analysis Year	2013	Analysis Period	1> 4:30
Intersection	Minnesota Ave & I-229…	File Name	Existing_Minnesota_PM.xus		
Project Description	Existing PM				

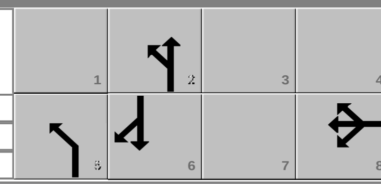


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				202	0	196	109	930			1365	490

Signal Information			
Cycle, s	128.0	Reference Phase	2
Offset, s	58	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	4.8	86.4	20.7	0.0	0.0	0.0
Yellow	3.6	3.6	4.0	0.0	0.0	0.0
Red	1.0	2.2	1.7	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase				8	5	2		6
Case Number				10.0	1.0	4.0		8.3
Phase Duration, s				26.4	9.4	101.6		92.2
Change Period, (*Y+R c*), s				5.7	4.6	5.8		5.8
Max Allow Headway (*MAH*), s				4.2	4.1	0.0		0.0
Queue Clearance Time (*g s*), s				20.5	4.7			
Green Extension Time (*g e*), s				0.2	0.2	0.0		0.0
Phase Call Probability				1.00	0.98			
Max Out Probability				1.00	0.02			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement				3	8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h				217	211		117	1000			981	1006
Adjusted Saturation Flow Rate (*s*), veh/h/ln				1664	1433		1664	1691			1842	1729
Queue Service Time (*g s*), s				16.1	18.5		2.7	33.6			70.8	46.9
Cycle Queue Clearance Time (*g c*), s				16.1	18.5		2.7	33.6			70.8	46.9
Green Ratio (*g/C*)				0.16	0.16		0.73	0.43			0.68	0.68
Capacity (*c*), veh/h				269	231		145	1466			1244	1167
Volume-to-Capacity Ratio (*X*)				0.808	0.911		0.808	0.682			0.788	0.862
Back of Queue (*Q*), ft/ln (95 th percentile)				316.7	349.3		126.9	523.1			476.5	340.6
Back of Queue (*Q*), veh/ln (95 th percentile)				12.4	13.6		5.0	20.4			18.6	13.6
Queue Storage Ratio (*RQ*) (95 th percentile)				2.53	0.35		1.01	0.75			0.34	0.25
Uniform Delay (*d 1*), s/veh				51.8	52.8		33.0	22.4			12.1	8.4
Incremental Delay (*d 2*), s/veh				15.8	34.9		8.1	2.0			0.8	1.5
Initial Queue Delay (*d 3*), s/veh				0.0	0.0		0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh				67.6	87.6		41.1	24.5			13.0	9.9
Level of Service (LOS)				E	F		D	C			B	A

	EB		WB		NB		SB	
Approach Delay, s/veh / LOS	0.0		77.4	E	26.2	C	11.4	B
Intersection Delay, s/veh / LOS	24.1				C			

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.8	C	1.6	A	1.9	A
Bicycle LOS Score / LOS			1.2	A	1.4	A	2.1	B

 HCS 2010™ Streets Version 6.90 Generated: 2/1/2017 10:02:13 AM

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	JKM
Agency/Co.	HDR
Date Performed	11/13/2013
Analysis Time Period	AM Peak

Site Information

Intersection	Minnesota Ave & Yankton Trails
Jurisdiction	Sioux Falls, SD
Analysis Year	2013

Project Description *I-229 MIS - Minnesota Corridor*

East/West Street: *Yankton Trails Park* — North/South Street: *Minnesota Ave*

Intersection Orientation: *North-South* — Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	6	1527			718	5
Peak-Hour Factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80
Hourly Flow Rate, HFR (veh/h)	7	1908	0	0	897	6
Percent Heavy Vehicles	3	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			0
Lanes	1	2	0	0	2	0
Configuration	L	T			T	TR
Upstream Signal		0			1	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	6		6			
Peak-Hour Factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80
Hourly Flow Rate, HFR (veh/h)	7	0	7	0	0	0
Percent Heavy Vehicles	2	0	2	0	0	0
Percent Grade (%)	0			0		
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	1	0	1	0	0	0
Configuration	L		R			

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L					L		R
v (veh/h)	7					7		7
C (m) (veh/h)	771					190		670
v/c	0.01					0.04		0.01
95% queue length	0.03					0.11		0.03
Control Delay (s/veh)	9.7					24.7		10.4
LOS	A					C		B
Approach Delay (s/veh)	--	--				17.6		
Approach LOS	--	--				C		

 HCS+TM Version 5.6 Generated: 2/1/2017 10:11 AM

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*JKM*	Intersection	*Minnesota Ave & Yankton Trails*
Agency/Co.	*HDR*	Jurisdiction	*Sioux Falls, SD*
Date Performed	*11/13/2013*	Analysis Year	*2013*
Analysis Time Period	*PM Peak*		

Project Description *I-229 MIS - Minnesota Corridor*

East/West Street: *Yankton Trails Park*	North/South Street: *Minnesota Ave*
Intersection Orientation: *North-South*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*12*	*936*			*1344*	*12*
Peak-Hour Factor, PHF	*0.93*	*0.93*	*0.93*	*0.93*	*0.93*	*0.93*
Hourly Flow Rate, HFR (veh/h)	*12*	*1006*	*0*	*0*	*1445*	*12*
Percent Heavy Vehicles	*3*	*--*	*--*	*0*	*--*	*--*
Median Type	*Two Way Left Turn Lane*					
RT Channelized			*0*			*0*
Lanes	*1*	*2*	*0*	*0*	*2*	*0*
Configuration	*L*	*T*			*T*	*TR*
Upstream Signal		*0*			*1*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*4*		*5*			
Peak-Hour Factor, PHF	*0.93*	*0.93*	*0.93*	*0.93*	*0.93*	*0.93*
Hourly Flow Rate, HFR (veh/h)	*4*	*0*	*5*	*0*	*0*	*0*
Percent Heavy Vehicles	*2*	*0*	*2*	*0*	*0*	*0*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*1*	*0*	*1*	*0*	*0*	*0*
Configuration	*L*		*R*			

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*					*L*		*R*
v (veh/h)	*12*					*4*		*5*
C (m) (veh/h)	*460*					*144*		*446*
v/c	*0.03*					*0.03*		*0.01*
95% queue length	*0.08*					*0.09*		*0.03*
Control Delay (s/veh)	*13.0*					*30.7*		*13.2*
LOS	*B*					*D*		*B*
Approach Delay (s/veh)	--	--				*21.0*		
Approach LOS	--	--				*C*		

 HCS+™ Version 5.6 Generated: 2/1/2017 10:12 AM

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*JDW*
Agency/Co.	*HRG*
Date Performed	*10/28/14*
Analysis Time Period	*PM Peak*

Site Information

Intersection	*Minnesota Ave & Batcheller Lan*
Jurisdiction	*Sioux Falls, SD*
Analysis Year	*2013*

Project Description *I-229 MIS - Minnesota Corridor*

East/West Street: *49th St* | North/South Street: *Minnesota Ave*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*6*	*1371*			*674*	*6*
Peak-Hour Factor, PHF	*0.93*	*0.93*	*0.93*	*0.93*	*0.93*	*0.93*
Hourly Flow Rate, HFR (veh/h)	*6*	*1474*	*0*	*0*	*724*	*6*
Percent Heavy Vehicles	*3*	--	--	*0*	--	--
Median Type	*Two Way Left Turn Lane*					
RT Channelized			*0*			*0*
Lanes	*1*	*2*	*0*	*0*	*2*	*0*
Configuration	*L*	*T*			*T*	*TR*
Upstream Signal		*1*			*1*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*19*	*0*	*6*			
Peak-Hour Factor, PHF	*0.93*	*0.93*	*0.93*	*0.93*	*0.93*	*0.93*
Hourly Flow Rate, HFR (veh/h)	*20*	*0*	*6*	*0*	*0*	*0*
Percent Heavy Vehicles	*2*	*0*	*2*	*0*	*0*	*0*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*0*	*0*
Configuration		*LTR*				

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*						*LTR*	
v (veh/h)	*6*						*26*	
C (m) (veh/h)	*1122*						*383*	
v/c	*0.01*						*0.07*	
95% queue length	*0.02*						*0.22*	
Control Delay (s/veh)	*8.2*						*15.1*	
LOS	*A*						*C*	
Approach Delay (s/veh)	--	--				*15.1*		
Approach LOS	--	--				*C*		

 HCS+[TM] Version 5.6 Generated: 2/1/2017 10:14 AM

APPENDIX C -

2035 NO-BUILD AND BUILD OPERATIONAL ANALYSIS TECHNICAL MEMORANDUM

2035 No-Build and Build Operational Analysis Technical Memorandum

Year 2035 Sub-Study 2 No-Build conditions operational analysis included the analysis of 4 signalized intersections, 5 unsignalized intersections, 2 basic freeway segments, and 4 weave segments. All locations were analyzed for the AM peak hour and PM peak hour using Highway Capacity Software (HCS) 2010.

The 2035 No-Build volumes are based on the Sioux Falls Metropolitan Planning Organization (MPO) travel demand model, reflective of fiscally constrained planned projects included in the 2035 Long Range Transportation Plan (LRTP). The LRTP includes capacity-related roadway segment improvements at a high-level and does not include intersection-level geometrics associated with the improvements. Thus, intersection-level geometrics were assumed for the No-Build condition where necessary in order to capture planned development within and around the I-229 Exit 3 (Minnesota Avenue) corridor study area.

2035 No-Build "Worst Case" Analysis Results

The 2035 No-Build analysis identified intersection capacity constraints along the Minnesota Avenue corridor. These constraints would limit or 'impede' the amount of traffic that would be able to proceed to the downstream intersection. In an effort to provide a conservative estimate of future No-Build traffic operations, a procedure was devised to ensure that each study area intersection received the full projected demand. This allowed the study team to assess the capacity needs at each intersection if the full demand was able to reach that intersection. Additional discussion on this methodology is provided in ***Appendix A*** of this memorandum.

Intersection LOS was reported for the condition where the No-Build geometry at each intersection experienced the full projected demand from the 2035 AM and PM peak hour volume sets, even though adjacent intersections under no-build conditions may not have sufficient capacity to convey all projected demand.

After meetings with the Study Advisory Team (SAT) and Federal Highway Administration (FHWA), it was decided that some of the No-Build analysis results may indicate higher projected delays than will actually be realized because not all capacity constraints may be eliminated at upstream intersections as assumed in the analysis. For instance, a roadway may have a future demand that warrants additional capacity, but if the hurdles to adding that capacity are insurmountable, then the roadway would not be widened and continue to meter traffic to downstream intersections. As the No-Build traffic analysis results potentially error on the side of higher traffic demand at all study area intersections, this analysis has been named the "Worst Case" scenario.

This Year 2035 conditions analysis found that portions of the freeway facilities operate worse than a desirable LOS of C or better throughout the study area. Ramp terminal intersections and arterials also show the LOS at a number of key intersections has degraded beyond the acceptable threshold of LOS D.

Table 1 highlights intersections that do not meet the project specific LOS thresholds.

Table 1. 2035 No-Build Conditions "Worst Case" Deficient Intersections based on Operational Analysis Results

LOCATION	AM	PM
Minnesota Avenue and 41st Street	LOS E	LOS F
Minnesota Avenue and 43rd Street	LOS F	LOS F
Minnesota Avenue and 49th Street	LOS F	LOS F
Minnesota Avenue and NB I-229 Ramp Terminal	LOS E	
Minnesota Avenue and Lotta Street	LOS F	LOS F
Minnesota Avenue and 57th Street	LOS F	LOS F

Note: Acceptable Threshold is LOS D for intersections and LOS C for freeway and ramps.

2035 No-Build "Best Case" Analysis Results

In addition to the "Worst Case" scenario, the SAT and FHWA commissioned HDR to perform a second No-Build traffic analysis where no capacity constraints were removed from the study area. As this scenario may potentially error on the side of lower traffic demand through the corridor, and thus lowers delay, this new variation on the No-Build traffic analysis has been named the "Best Case" scenario.

TABLE 2 shows the intersections that changed LOS between "Worst Case" and "Best Case" conditions.

Table 2. LOS Differences between 2035 No-Build "Worst Case" and "Best Case" Scenarios

LOCATION	AM Peak		PM Peak	
	"Worst Case" LOS	"Best Case" LOS	"Worst Case" LOS	"Best Case" LOS
Minnesota Avenue and 41st Street	E	D	F	E
Minnesota Avenue and SB I-229 Ramp Terminal	C	B	B	C
Minnesota Avenue and NB I-229 Ramp Terminal	E	D		

TABLE 3 highlights intersections that do not meet the project specific LOS thresholds in the "Best Case" 2035 No-Build conditions scenario.

Table 3. 2035 No-Build Conditions "Best Case" Deficient Intersections based on Operational Analysis Results

LOCATION	AM	PM
Minnesota Avenue and 41st Street		LOS E
Minnesota Avenue and 43rd Street	LOS F	LOS F
Minnesota Avenue and 49th Street	LOS F	LOS F
Minnesota Avenue and Lotta Street	LOS F	LOS F
Minnesota Avenue and 57th Street	LOS F	LOS F

No-Build "Worst Case" and "Best Case" Conditions Operational Results

The 2035 No-Build "Worst Case" lane geometrics and LOS results for all locations are shown in ***FIGURE 1***. The 2035 No-Build "Worst Case" HCS 2010 Reports can be found in ***APPENDIX B***.

The 2035 No-build "Best Case" lane geometrics and LOS results for all locations are shown in ***FIGURE 2***. The 2035 No-Build "Best Case" HCS 2010 Reports can be found in the ***APPENDIX C***.

Build Conditions Analysis Results

The 2035 Build condition used the same volumes as the 2035 No-Build condition. The 2035 Build alternative scenarios, noted below, were analyzed using HCS 2010 for the AM and PM peak hours.

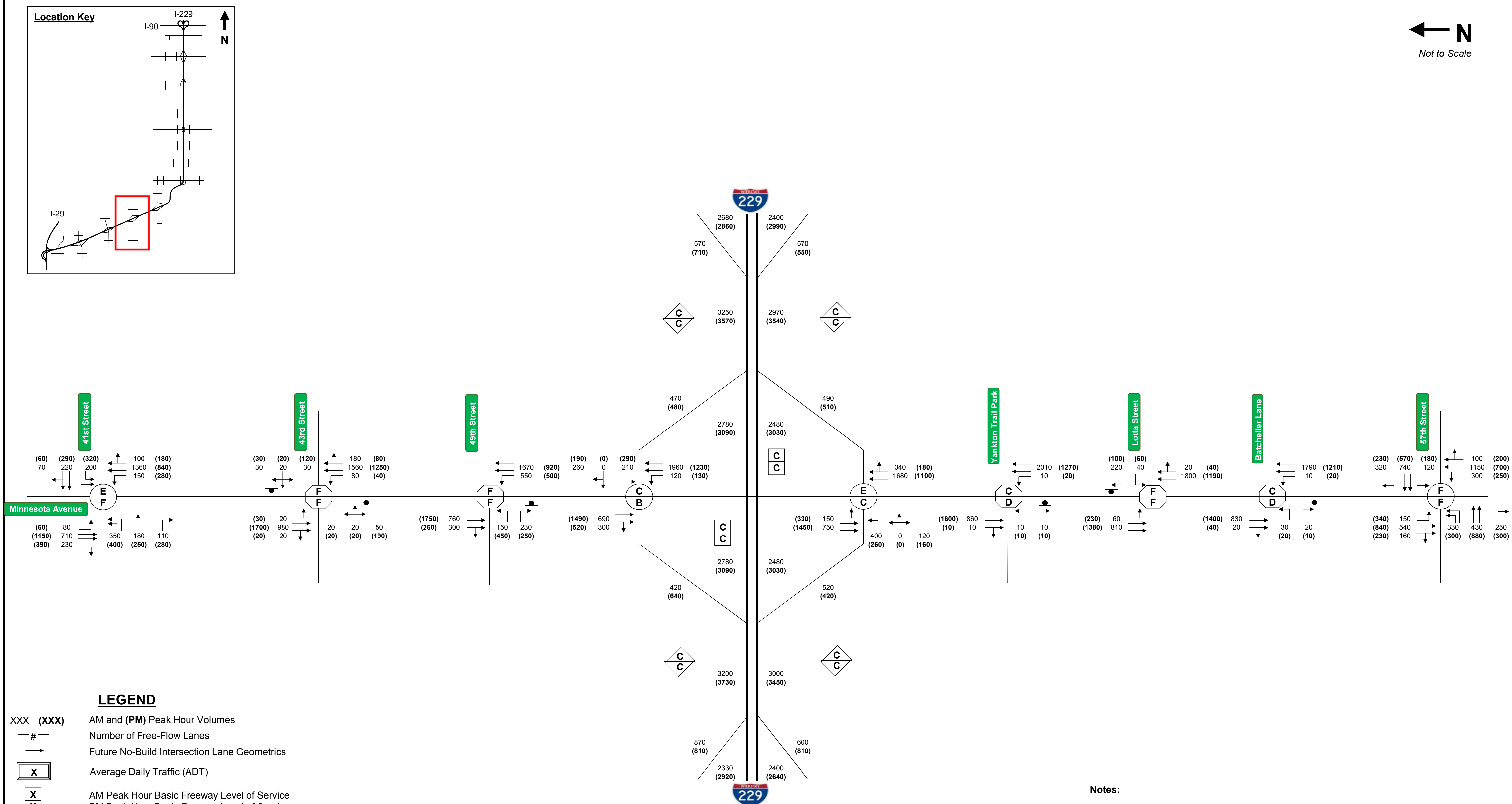
- ***Minn-2C.*** 5/4-Lane Divided Corridor with NE Quadrant Loop and NE Ramp aligned with 49th Street ***(FIGURE 3)***
- ***Minn-2D.*** 6/4- Lane Divided Corridor with NE Quadrant Loop and NE Ramp aligned with 49th Street ***(FIGURE 4)***
- ***Minn-5D.*** 6/4-Lane Divided Corridor with DDI ***(FIGURE 5)***
- ***Minn-8C.*** 5/4-Lane Divided Corridor with SPUI ***(FIGURE 6)***
- ***Minn-8D.*** 6/4-Lane Divided Corridor with SPUI ***(FIGURE 7)***
- ***Minn-9D.*** 6/4-Lane Divided Corridor with SPUI and NE Ramp aligned with 49th Street ***(FIGURE 8)***

TABLE 4 provides the LOS results for the six Build alternative scenarios.

Table 4. 2035 Build LOS Results for Alternative Scenarios

Alternative Scenario	Intersection (AM LOS/PM LOS)								
	41st Street	43rd Street	49th Street	I-229 SB Ramp Terminal	I-229 NB Ramp Terminal	Yankton Trail Park	Lotta Street	Batcheller Lane	57th Street
Minn-2C	D / D	B / B	RTI	C / C	B / B	B / B	C / A	B / B	E / D
Minn-2D	D / D	B / B	RTI	C / C	B / B	B / B	C / A	B / B	E / D
Minn-5D	D / D	C / C	C / F	C / B	B / B	B / B	C / A	B / B	E / D
Minn-8C	D / D	B / B	C / B	C / C	SPUI	B / B	C / A	B / B	E / D
Minn-8D	D / D	B / B	C / C	C / C	SPUI	B / B	C / A	B / B	E / D
Minn-9D	C / D	B / B	RTI	C / C	C / C	B / B	C / A	B / B	E / D

For all alternative scenarios, the ramp terminals operate at an acceptable LOS of C or better and the signalized arterial intersections operate at an acceptable threshold of LOS of D or better. The 2035 Build alternative scenario HCS 2010 Reports can be found in ***APPENDIX D***.



LEGEND

XXX (XXX)	AM and **(PM)** Peak Hour Volumes
—#—	Number of Free-Flow Lanes
→	Future No-Build Intersection Lane Geometrics
X	Average Daily Traffic (ADT)
X / X	AM Peak Hour Basic Freeway Level of Service PM Peak Hour Basic Freeway Level of Service
X / X	AM Peak Hour Ramp Merge Level of Service PM Peak Hour Ramp Merge Level of Service
X / X	AM Peak Hour Ramp Diverge Level of Service PM Peak Hour Ramp Diverge Level of Service
X / X	AM Peak Hour Weaving Section Level of Service PM Peak Hour Weaving Section Level of Service
X / X	AM Peak Hour Signalized Intersection Level of Service PM Peak Hour Signalized Intersection Level of Service
X / X	AM Peak Hour Unsignalized Intersection Level of Service PM Peak Hour Unsignalized Intersection Level of Service

Notes:

1. 2035 No-Build traffic volumes based on the Sioux Falls travel demand model. See report text for additional information on volume development.
2. Worst case stop controlled approach Level of Service reported

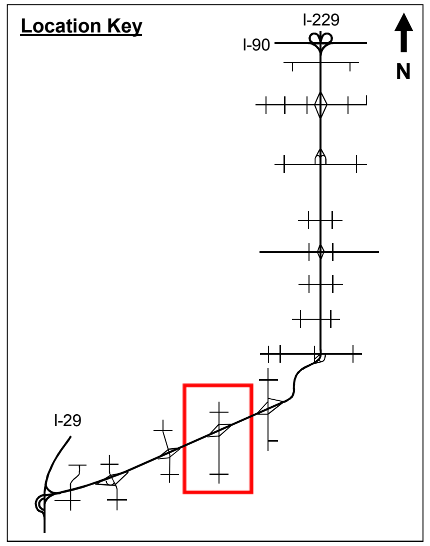
HRGreen

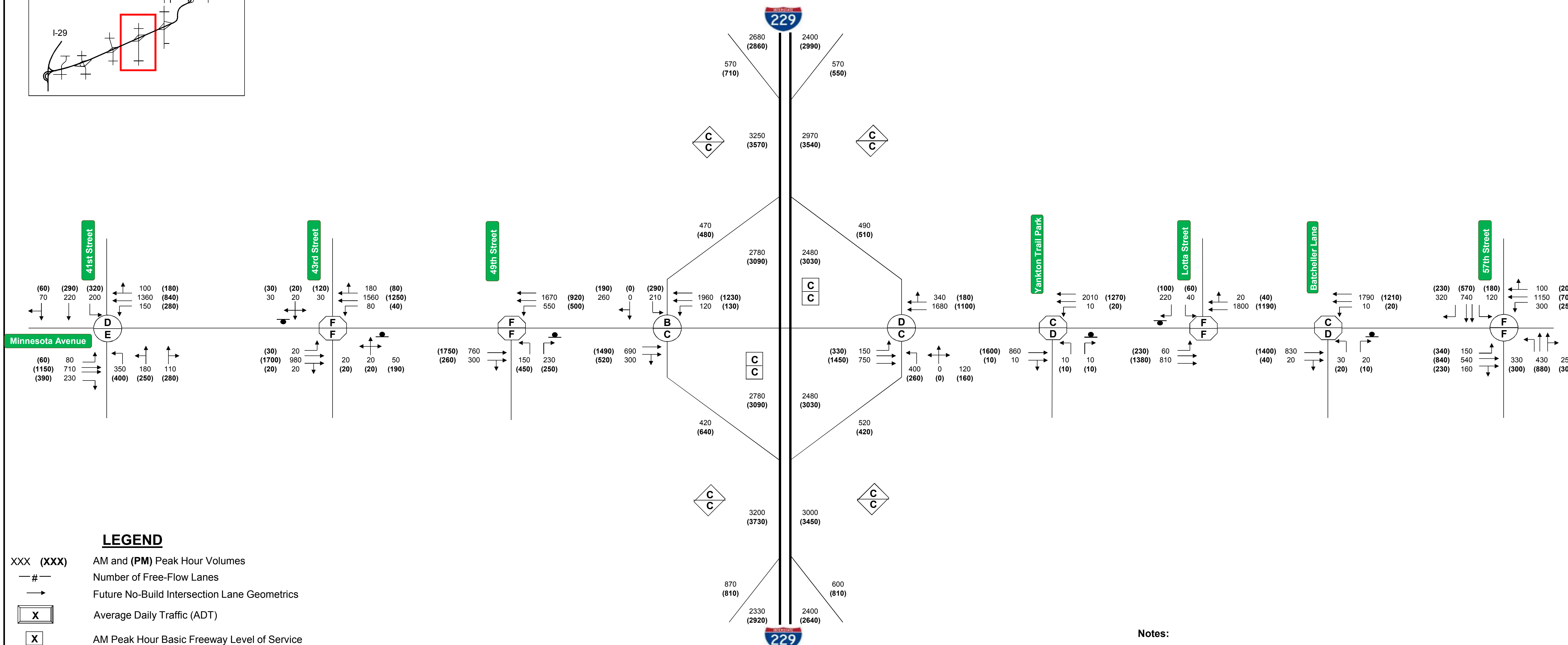
2035 No-Build "Worst Case" Conditions Traffic Operations Analysis

I-229 Major Investment Corridor Study: Sub-Study 2
Minnesota Avenue Corridor Study
Sioux Falls, South Dakota

Date
11/5/2014

Figure
1





LEGEND

- XXX (XXX) — AM and **(PM)** Peak Hour Volumes
- —#— — Number of Free-Flow Lanes
- → — Future No-Build Intersection Lane Geometrics
- X — Average Daily Traffic (ADT)
- X/X — AM Peak Hour Basic Freeway Level of Service / PM Peak Hour Basic Freeway Level of Service
- X/X — AM Peak Hour Ramp Merge Level of Service / PM Peak Hour Ramp Merge Level of Service
- X/X — AM Peak Hour Ramp Diverge Level of Service / PM Peak Hour Ramp Diverge Level of Service
- X/X — AM Peak Hour Weaving Section Level of Service / PM Peak Hour Weaving Section Level of Service
- X/X — AM Peak Hour Signalized Intersection Level of Service / PM Peak Hour Signalized Intersection Level of Service
- X/X — AM Peak Hour Unsignalized Intersection Level of Service / PM Peak Hour Unsignalized Intersection Level of Service

Notes:

1. Worst case stop controlled approach Level of Service reported

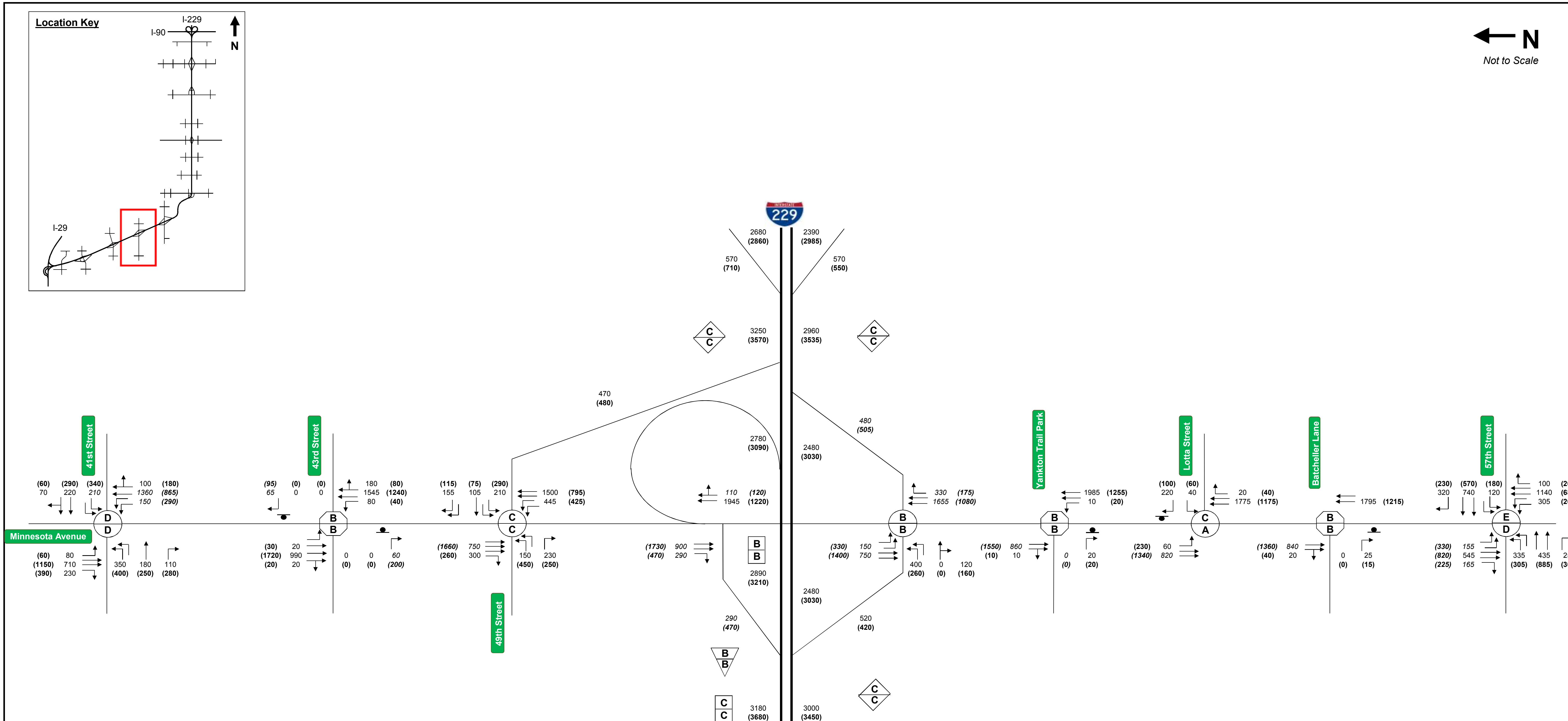
HRGreen

2035 No-Build "Best Case" Conditions Traffic Operations Analysis

I-229 Major Investment Corridor Study: Sub-Study 2
Minnesota Avenue Corridor Study
Sioux Falls, South Dakota

Date: 2/12/2015

Figure: 2



LEGEND

XXX (XXX)	AM and **(PM)** Peak Hour Volumes
—#—	Number of Free-Flow Lanes
→	Existing Intersection Geometrics
X	Average Daily Traffic (ADT)
X / X	AM Peak Hour Basic Freeway Level of Service PM Peak Hour Basic Freeway Level of Service
X / X	AM Peak Hour Ramp Merge Level of Service PM Peak Hour Ramp Merge Level of Service
X / X	AM Peak Hour Ramp Diverge Level of Service PM Peak Hour Ramp Diverge Level of Service
X / X	AM Peak Hour Weaving Section Level of Service PM Peak Hour Weaving Section Level of Service
X / X	AM Peak Hour Signalized Intersection Level of Service PM Peak Hour Signalized Intersection Level of Service
X / X	AM Peak Hour Unsignalized Intersection Level of Service PM Peak Hour Unsignalized Intersection Level of Service

Notes:
1. 2035 Build Conditions traffic volumes are based on the 2035 No-Build Conditions traffic volumes, derived from the Sioux Falls travel demand model. They have been adjusted, as needed, to reflect applicable turning movements within the respective Build scenario.
2. Worst case stop controlled approach Level of Service reported

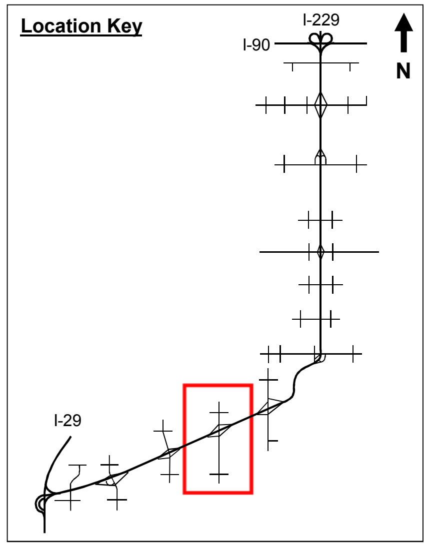
HRGreen

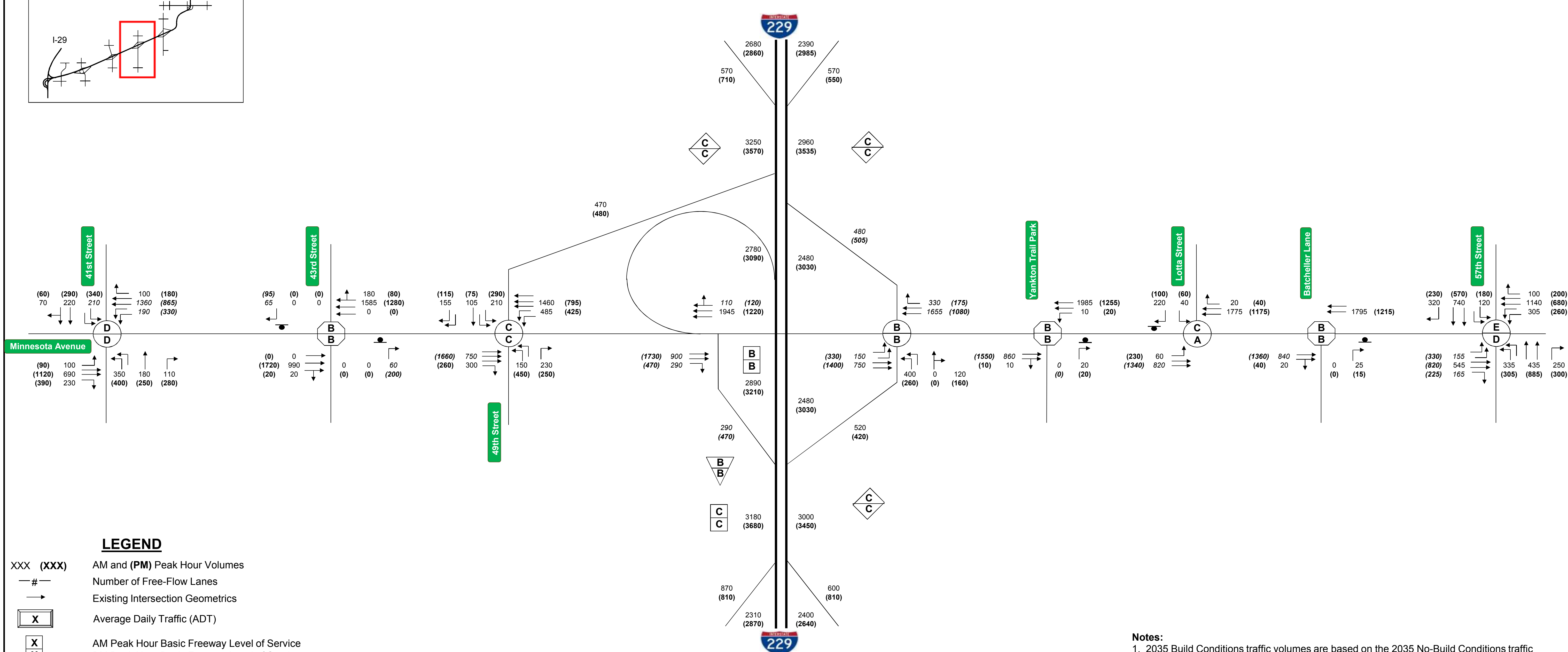
2035 Build Conditions Traffic Operations
Minn-2C

I-229 Major Investment Corridor Study: Sub-Study 2
Sioux Falls, South Dakota

Date 1/31/17

Figure 3





LEGEND

XXX **(XXX)** AM and **(PM)** Peak Hour Volumes

Number of Free-Flow Lanes

Existing Intersection Geometrics

Average Daily Traffic (ADT)

AM Peak Hour Basic Freeway Level of Service
PM Peak Hour Basic Freeway Level of Service

AM Peak Hour Ramp Merge Level of Service
PM Peak Hour Ramp Merge Level of Service

AM Peak Hour Ramp Diverge Level of Service
PM Peak Hour Ramp Diverge Level of Service

AM Peak Hour Weaving Section Level of Service
PM Peak Hour Weaving Section Level of Service

AM Peak Hour Signalized Intersection Level of Service
PM Peak Hour Signalized Intersection Level of Service

AM Peak Hour Unsignalized Intersection Level of Service
PM Peak Hour Unsignalized Intersection Level of Service

Notes:

1. 2035 Build Conditions traffic volumes are based on the 2035 No-Build Conditions traffic volumes, derived from the Sioux Falls travel demand model. They have been adjusted, as needed, to reflect applicable turning movements within the respective Build scenario.
2. Worst case stop controlled approach Level of Service reported

HRGreen

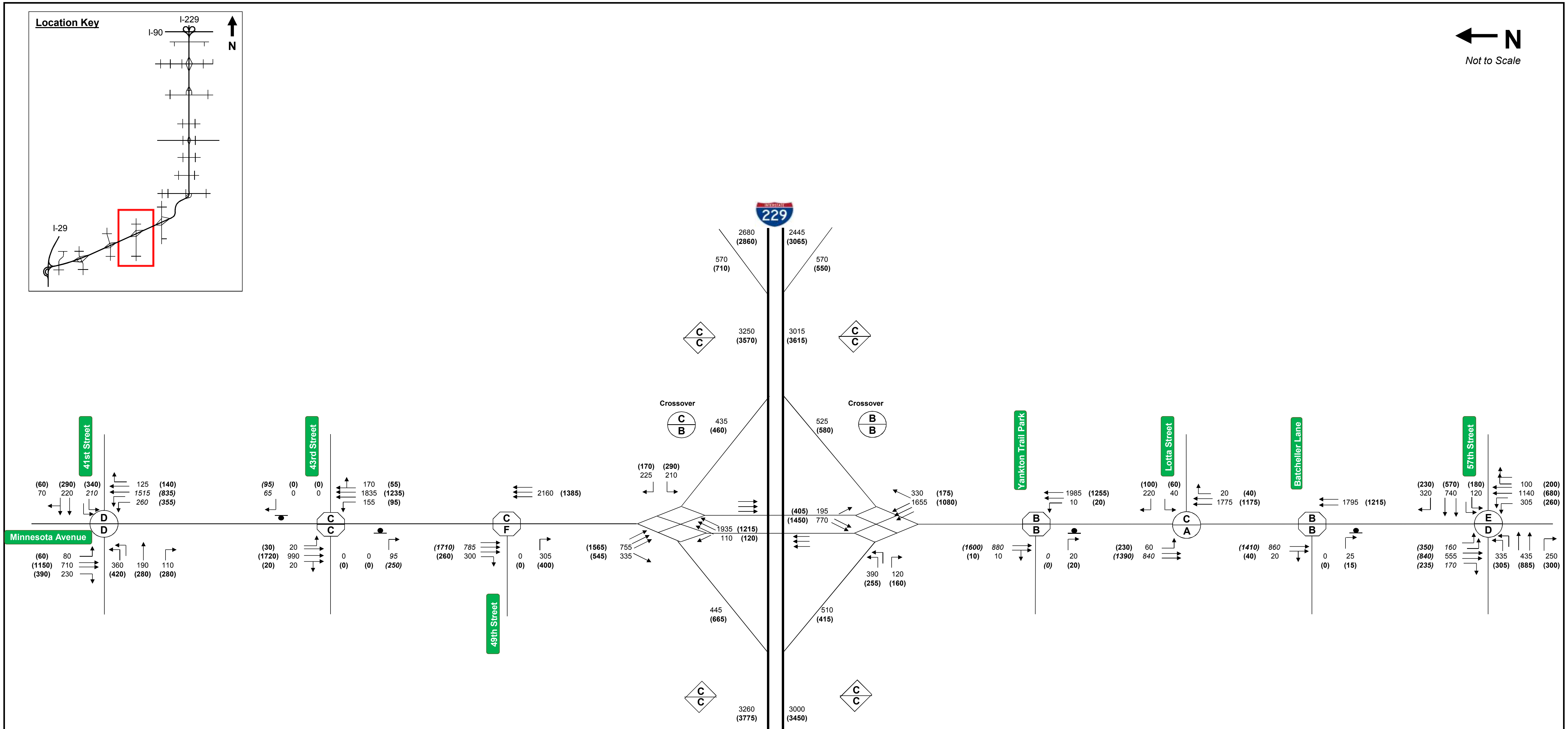
2035 Build Conditions Traffic Operations

Minn-2D

I-229 Major Investment Corridor Study: Sub-Study 2
Sioux Falls, South Dakota

Date 1/31/17

Figure 4



LEGEND

XXX **(XXX)** AM and **(PM)** Peak Hour Volumes

—#— Number of Free-Flow Lanes

→ Existing Intersection Geometrics

X Average Daily Traffic (ADT)

X/X AM Peak Hour Basic Freeway Level of Service / PM Peak Hour Basic Freeway Level of Service

X/X AM Peak Hour Ramp Merge Level of Service / PM Peak Hour Ramp Merge Level of Service

X/X AM Peak Hour Ramp Diverge Level of Service / PM Peak Hour Ramp Diverge Level of Service

X/X AM Peak Hour Weaving Section Level of Service / PM Peak Hour Weaving Section Level of Service

X/X AM Peak Hour Signalized Intersection Level of Service / PM Peak Hour Signalized Intersection Level of Service

X/X AM Peak Hour Unsignalized Intersection Level of Service / PM Peak Hour Unsignalized Intersection Level of Service

Notes:

1. 2035 Build Conditions traffic volumes are based on the 2035 No-Build Conditions traffic volumes, derived from the Sioux Falls travel demand model. They have been adjusted, as needed, to reflect applicable turning movements within the respective Build scenario.
2. Worst case stop controlled approach Level of Service reported

HRGreen

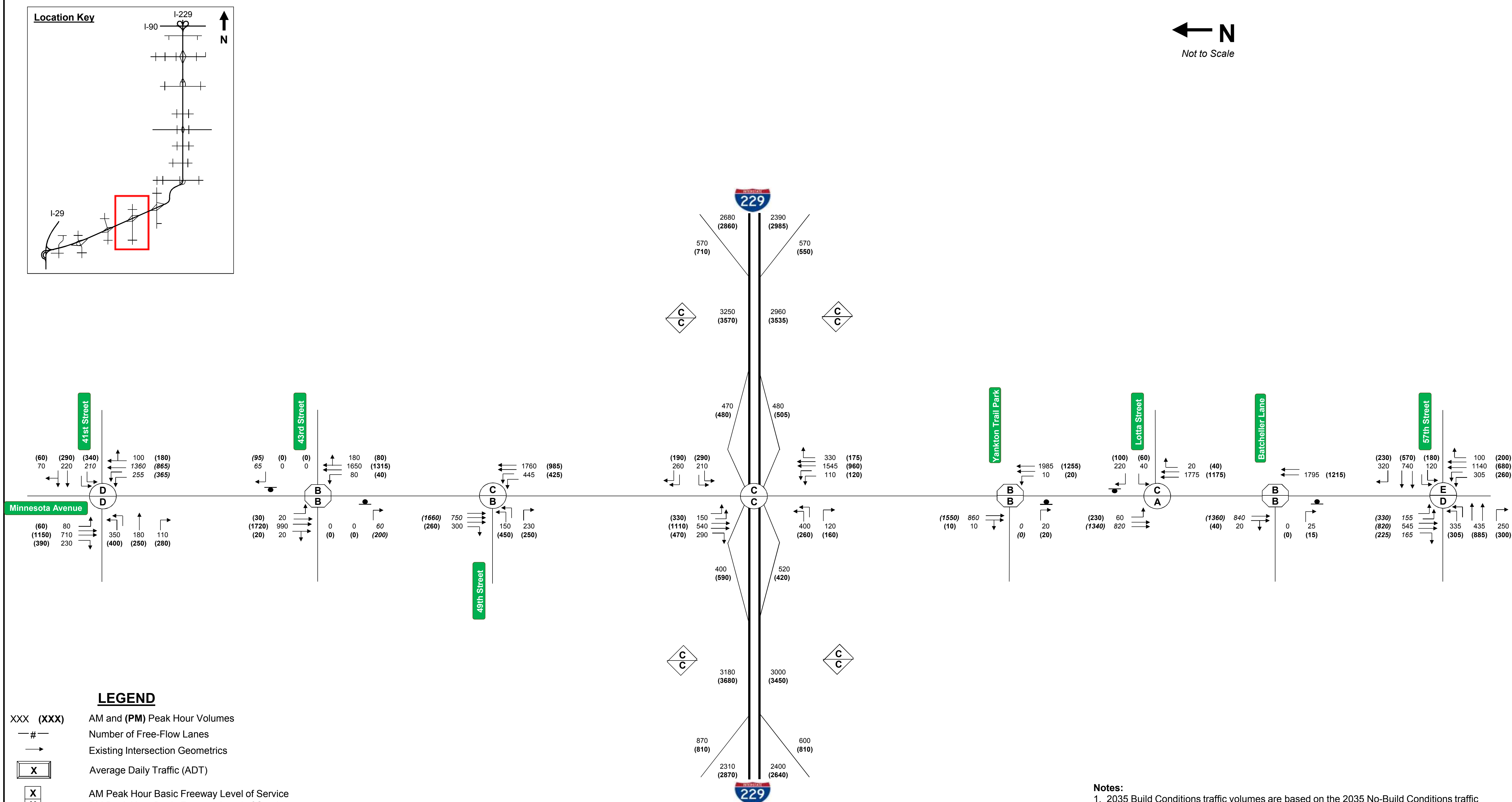
2035 Build Conditions Traffic Operations

Minn-5D

I-229 Major Investment Corridor Study: Sub-Study 2
Sioux Falls, South Dakota

Date: 1/31/17

Figure: 5



LEGEND

- XXX (XXX) — AM and **(PM)** Peak Hour Volumes
- —#— Number of Free-Flow Lanes
- → Existing Intersection Geometrics
- X — Average Daily Traffic (ADT)
- X / X — AM Peak Hour Basic Freeway Level of Service / PM Peak Hour Basic Freeway Level of Service
- X / X — AM Peak Hour Ramp Merge Level of Service / PM Peak Hour Ramp Merge Level of Service
- X / X — AM Peak Hour Ramp Diverge Level of Service / PM Peak Hour Ramp Diverge Level of Service
- X / X — AM Peak Hour Weaving Section Level of Service / PM Peak Hour Weaving Section Level of Service
- X / X — AM Peak Hour Signalized Intersection Level of Service / PM Peak Hour Signalized Intersection Level of Service
- X / X — AM Peak Hour Unsignalized Intersection Level of Service / PM Peak Hour Unsignalized Intersection Level of Service

Notes:

1. 2035 Build Conditions traffic volumes are based on the 2035 No-Build Conditions traffic volumes, derived from the Sioux Falls travel demand model. They have been adjusted, as needed, to reflect applicable turning movements within the respective Build scenario.
2. Worst case stop controlled approach Level of Service reported

HRGreen

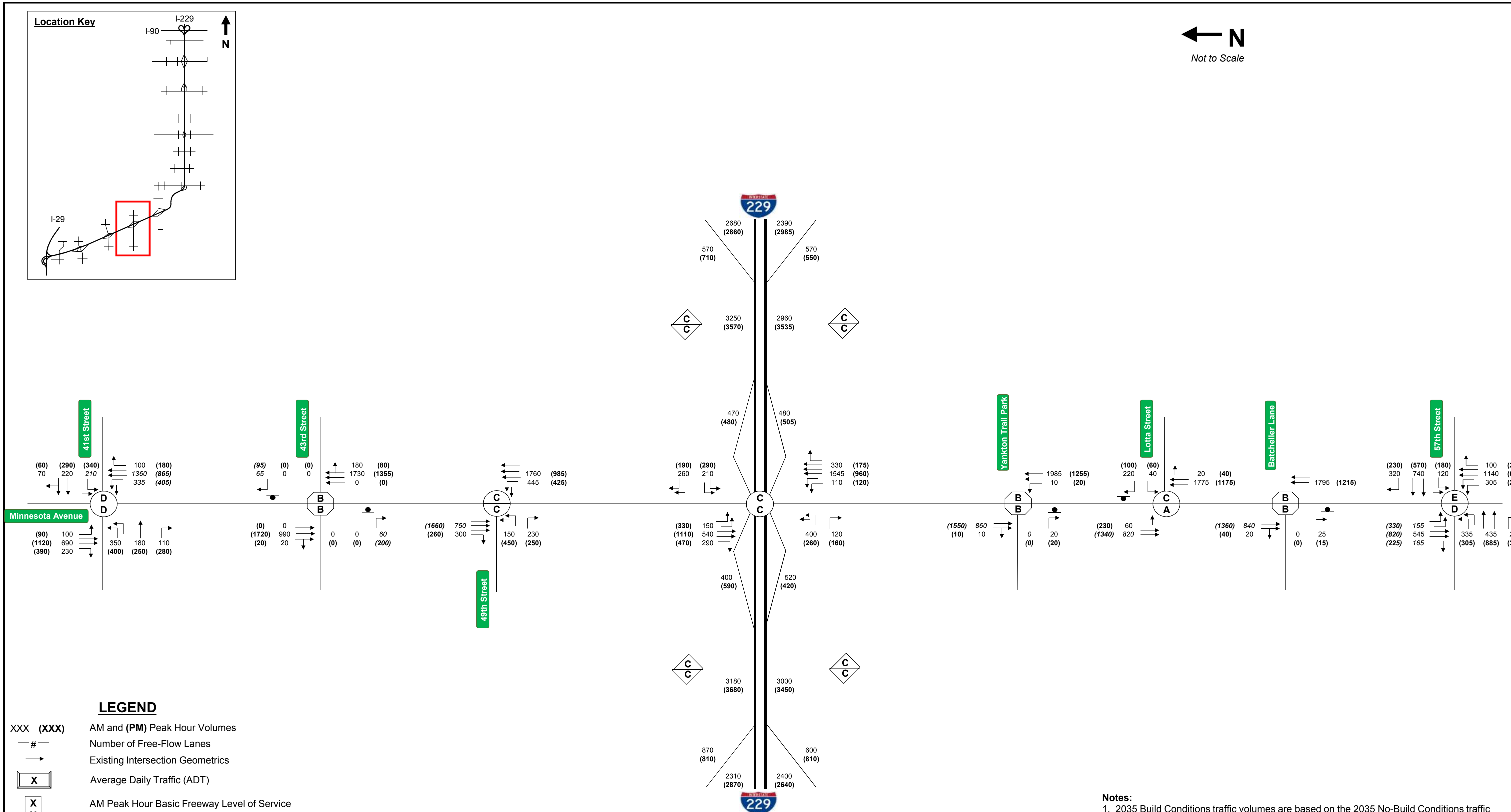
2035 Build Conditions Traffic Operations

Minn-8C

I-229 Major Investment Corridor Study: Sub-Study 2
Sioux Falls, South Dakota

Date: 1/31/17

Figure: 6



LEGEND

XXX **(XXX)** AM and **(PM)** Peak Hour Volumes

—#— Number of Free-Flow Lanes

Existing Intersection Geometrics

Average Daily Traffic (ADT)

AM Peak Hour Basic Freeway Level of Service
PM Peak Hour Basic Freeway Level of Service

AM Peak Hour Ramp Merge Level of Service
PM Peak Hour Ramp Merge Level of Service

AM Peak Hour Ramp Diverge Level of Service
PM Peak Hour Ramp Diverge Level of Service

AM Peak Hour Weaving Section Level of Service
PM Peak Hour Weaving Section Level of Service

AM Peak Hour Signalized Intersection Level of Service
PM Peak Hour Signalized Intersection Level of Service

AM Peak Hour Unsignalized Intersection Level of Service
PM Peak Hour Unsignalized Intersection Level of Service

Notes:
1. 2035 Build Conditions traffic volumes are based on the 2035 No-Build Conditions traffic volumes, derived from the Sioux Falls travel demand model. They have been adjusted, as needed, to reflect applicable turning movements within the respective Build scenario.
2. Worst case stop controlled approach Level of Service reported

HRGreen

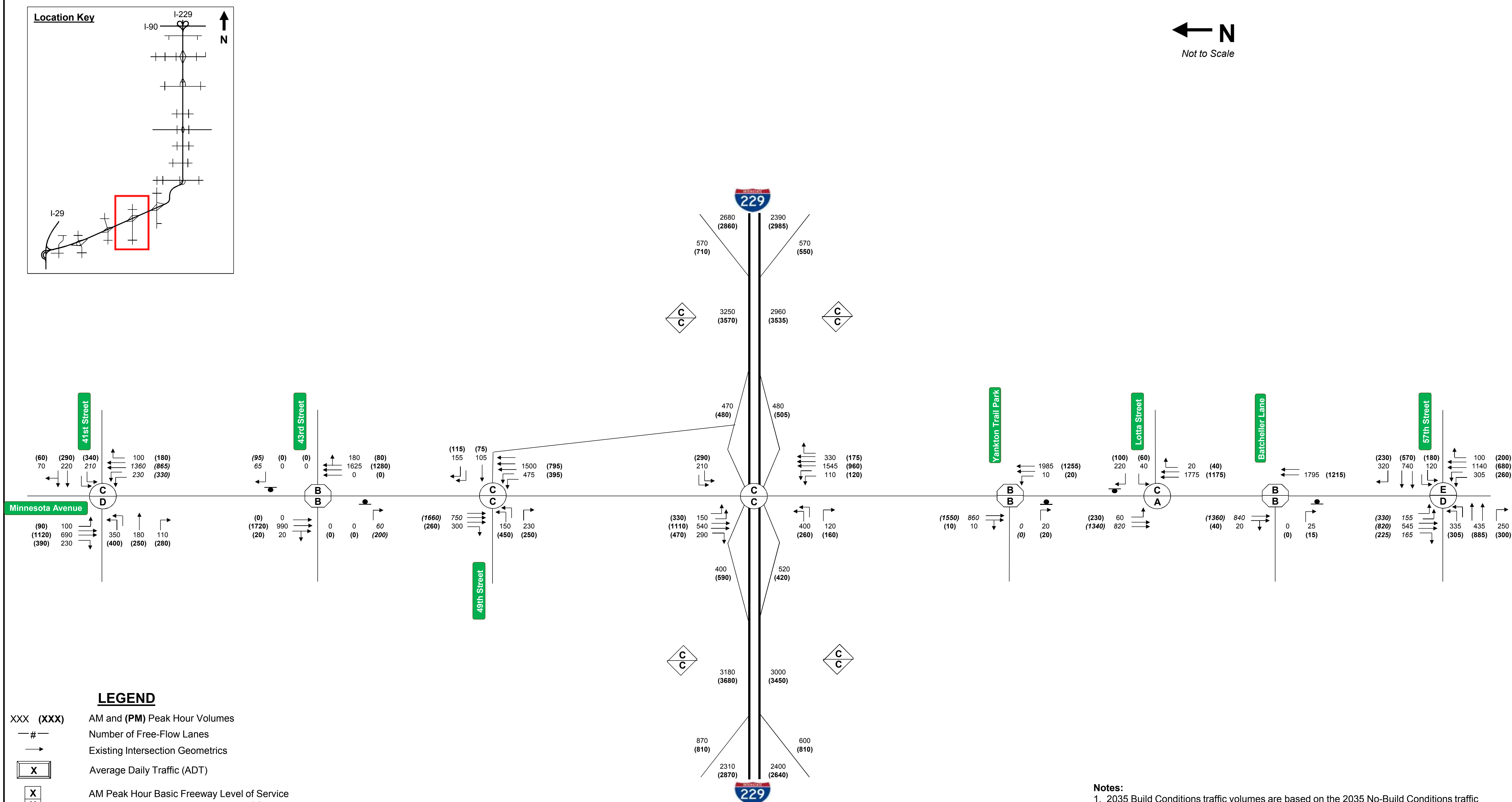
2035 Build Conditions Traffic Operations

Minn-8D

I-229 Major Investment Corridor Study: Sub-Study 2
Sioux Falls, South Dakota

Date 1/31/17

Figure 7



LEGEND

XXX **(XXX)** AM and **(PM)** Peak Hour Volumes

—#— Number of Free-Flow Lanes

→ Existing Intersection Geometrics

X Average Daily Traffic (ADT)

X / X AM Peak Hour Basic Freeway Level of Service / PM Peak Hour Basic Freeway Level of Service

X / X AM Peak Hour Ramp Merge Level of Service / PM Peak Hour Ramp Merge Level of Service

X / X AM Peak Hour Ramp Diverge Level of Service / PM Peak Hour Ramp Diverge Level of Service

X / X AM Peak Hour Weaving Section Level of Service / PM Peak Hour Weaving Section Level of Service

X / X AM Peak Hour Signalized Intersection Level of Service / PM Peak Hour Signalized Intersection Level of Service

X / X AM Peak Hour Unsignalized Intersection Level of Service / PM Peak Hour Unsignalized Intersection Level of Service

Notes:

1. 2035 Build Conditions traffic volumes are based on the 2035 No-Build Conditions traffic volumes, derived from the Sioux Falls travel demand model. They have been adjusted, as needed, to reflect applicable turning movements within the respective Build scenario.
2. Worst case stop controlled approach Level of Service reported

HRGreen

2035 Build Conditions Traffic Operations

Minn-9D

I-229 Major Investment Corridor Study: Sub-Study 2
Sioux Falls, South Dakota

Date 1/31/17

Figure 8

APPENDIX

APPENDIX A: 2035 "WORST CASE" NO-BUILD CONDITIONS ANALYSIS METHODOLOGY

APPENDIX B: 2035 "WORST CASE" NO-BUILD CONDITIONS ANALYSIS HCS 2010 RESULTS

APPENDIX C: 2035 "BEST CASE" NO-BUILD CONDITIONS ANALYSIS HCS 2010 RESULTS

APPENDIX D: 2035 BUILD ALTERNATIVE SCENARIOS ANALYSIS HCS 2010 RESULTS

Appendix A: 2035 "Worst Case" No-Build Conditions Analysis Methodology

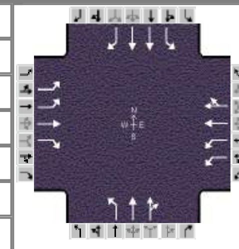
Common practice for No-Build conditions analyses is to analyze a subject intersection with the future projected traffic demand without modifications to geometry. This allows anticipated deficiencies in the No-Build condition to be identified. One difficulty in maintaining this practice is the software's treatment of adjacent intersections in a connected manner, such that if an upstream intersection has a failing movement (movement demand / movement capacity > 1.0) then the demand beyond the capacity threshold is not perpetuated to the downstream intersections. While this operation in the programming of the HCS 2010 software has benefits when conducting a multi-period analysis, the software does not provide a built-in feature to bypass this part of the computations. This results in a situation where intersections downstream of intersections with failing movements only experience a portion of the projected demand. In order to allow each intersection to reach its projected demand, the project team developed a method for isolating the traffic operations for groups of intersections that could all be analyzed in a single HCS 2010 file while still receiving all projected demand. This method is as follows:

1. Develop a master file for the corridor of interest, including all study intersections along the corridor. Master street files were developed sequentially from South to North and West to East.
2. Starting at the southernmost or westernmost intersection, check to see if the full southbound or westbound projected demand is received at the intersection.
3. If the full demand is not received, then separate the southernmost or westernmost intersection out as its own group (called "Group 1") by making multiple copies of the master corridor file. All intersections not in "Group 1" are currently in "Group 2".
4. Open the HCS file for "Group 1" and make necessary changes to non-"Group 1" intersections to get all projected demand to reach all "Group 1" intersections.
5. Report the LOS for the southernmost or westernmost intersection from the "Group 1" HCS file.
6. Open the HCS file for "Group 2".
7. Check the first "Group 2" intersection (southernmost or westernmost intersection in the group) to see if both major approaches to the subject intersection receive all projected demand.
8. If entirety of northbound or eastbound projected demand is not received at the first "Group 2" intersection, then make necessary changes to the "Group 1" intersection to allow all projected demand to reach the first "Group 2" intersection.
9. If entirety of southbound or eastbound projected demand is not received at the first "Group 2" intersection, then call that intersection "Group 2" and all intersections to the north or east of the intersection as "Group 3".
10. Both conditions from Step 8 and Step 9 may exist at any intersection internal to the corridor.
11. Repeat the process until a set number of groups is established (maximum number of groups is the number of intersections along the corridor) where each group only contains intersections that receive their full projected demand.
12. Report LOS results from the group file to which the intersection of interest belongs.

Appendix B: 2035 "Worst Case" No-Build Conditions Analysis HCS 2010 Results

HCS 2010 Signalized Intersection Results Summary

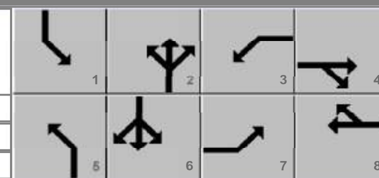
General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	GHM	Analysis Date	Feb 2, 2015	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Intersection	Minnesota Ave & 41st St	Analysis Year	2035	Analysis Period	1> 7:15
File Name	2035_NB_Minnesota_AM_WorstCase.xus				
Project Description	2035 NB AM				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	350	180	110	200	220	70	150	1360	100	80	710	230

Signal Information			
Cycle, s	130.0	Reference Phase	2
Offset, s	118	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	6.2	55.4	5.4	11.8	4.1	21.5
Yellow	3.6	3.6	3.6	3.6	0.0	3.6
Red	2.3	2.3	1.0	1.0	0.0	1.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	4.0	1.3	4.0	1.2	3.0
Phase Duration, s	26.1	30.2	16.4	20.5	10.0	71.3	12.1	73.4
Change Period, ($Y+R_c$), s	6.1	6.1	4.6	5.7	5.9	5.9	5.9	5.9
Max Allow Headway (*MAH*), s	3.6	3.6	3.2	4.2	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	17.9	16.4	11.2	14.1	2.0		6.0	
Green Extension Time (g_e), s	2.1	2.1	0.6	0.7	1.6	0.0	0.3	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		0.97	
Max Out Probability	0.00	0.00	0.00	0.20	1.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	412	212	74	235	163	157	157	762	751	94	835	222
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1632	1765	1496	1632	1765	1649	1664	1748	1711	1664	1664	1481
Queue Service Time (g_s), s	15.9	14.4	5.5	9.2	11.7	12.1	0.0	47.9	48.1	4.0	15.2	7.6
Cycle Queue Clearance Time (g_c), s	15.9	14.4	5.5	9.2	11.7	12.1	0.0	47.9	48.1	4.0	15.2	7.6
Green Ratio (*g/C*)	0.15	0.19	0.19	0.09	0.11	0.11	0.44	0.50	0.50	0.49	0.52	0.52
Capacity (*c*), veh/h	503	327	277	296	201	188	308	879	861	151	1723	767
Volume-to-Capacity Ratio (*X*)	0.819	0.647	0.267	0.794	0.812	0.837	0.509	0.867	0.872	0.622	0.485	0.290
Available Capacity (c_a), veh/h	1165	685	580	1416	289	270	312	879	861	654	1723	767
Back of Queue (*Q*), veh/ln (95th percentile)	10.8	10.8	3.6	7.0	9.8	9.7	6.4	24.5	23.9	3.1	8.5	4.5
Queue Storage Ratio (*RQ*) (95th percentile)	1.83	0.27	0.92	1.01	0.25	0.25	1.32	0.45	0.44	0.78	0.22	1.15
Uniform Delay (d_1), s/veh	53.2	49.0	3.4	57.9	56.2	56.4	32.3	23.7	23.0	29.6	12.1	10.9
Incremental Delay (d_2), s/veh	1.3	2.2	0.5	1.8	10.9	14.1	0.6	5.6	6.0	4.1	1.0	1.0
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	54.5	51.2	3.9	59.7	67.1	70.6	32.9	29.3	29.0	33.7	13.0	11.8
Level of Service (LOS)	D	D	A	E	E	E	C	C	C	C	B	B
Approach Delay, s/veh / LOS	48.1	D		65.0	E		29.5	C		14.5	B	
Intersection Delay, s/veh / LOS	33.3						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	3.0	C	2.6	B	3.1	C
Bicycle LOS Score / LOS	1.6	A	0.9	A	2.0	B	1.4	A

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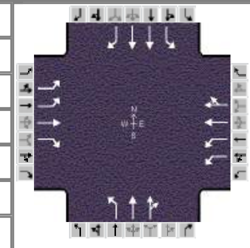
HCS 2010 Signalized Intersection Results Summary

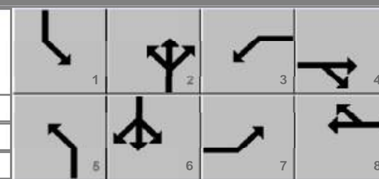
General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	GHM	Analysis Date	Feb 2, 2015	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM Peak	PHF	0.93
Intersection	Minnesota Ave & 41st St	Analysis Year	2035	Analysis Period	1> 4:30
File Name	2035_NB_Minnesota_PM_WorstCase.xus				
Project Description	2035 NB PM				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	400	250	280	320	290	60	280	840	180	60	1150	390

Signal Information			
Cycle, s	145.0	Reference Phase	2
Offset, s	130	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	22.3	37.8	12.2	18.3	0.7	28.1
Yellow	3.6	3.6	3.6	3.6	0.0	3.6
Red	1.0	2.3	2.3	1.0	0.0	1.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	4.0	1.2	4.0	1.3	3.0
Phase Duration, s	32.7	33.4	22.9	23.6	26.9	70.6	18.1	61.8
Change Period, ($Y+R_c$), s	6.0	6.0	4.6	5.7	4.6	5.9	5.9	5.9
Max Allow Headway (*MAH*), s	4.2	4.2	4.2	4.1	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s	20.0	23.6	17.0	17.2	22.7		2.0	
Green Extension Time (g_e), s	4.3	4.3	1.6	1.3	1.2	0.0	11.1	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		0.93	
Max Out Probability	0.00	0.00	0.00	0.00	0.00		0.00	

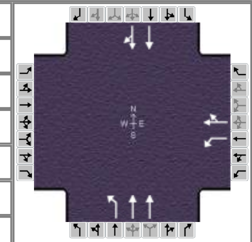
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	430	269	231	344	184	178	301	543	516	65	1237	373
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1632	1765	1496	1632	1765	1679	1664	1748	1657	1664	1664	1481
Queue Service Time (g_s), s	18.0	21.2	21.6	15.0	14.9	15.2	20.7	37.5	38.3	0.0	49.6	25.5
Cycle Queue Clearance Time (g_c), s	18.0	21.2	21.6	15.0	14.9	15.2	20.7	37.5	38.3	0.0	49.6	25.5
Green Ratio (*g/C*)	0.18	0.19	0.19	0.13	0.12	0.12	0.44	0.45	0.45	0.35	0.39	0.39
Capacity (*c*), veh/h	597	328	278	406	211	201	301	788	747	297	1336	595
Volume-to-Capacity Ratio (*X*)	0.720	0.820	0.832	0.848	0.872	0.889	0.999	0.690	0.690	0.217	0.925	0.627
Available Capacity (c_a), veh/h	1934	1042	883	2229	1192	1134	847	788	747	1374	1336	595
Back of Queue (*Q*), veh/ln (95th percentile)	12.1	15.1	13.5	10.7	11.7	11.6	18.6	23.4	23.1	3.3	27.9	19.4
Queue Storage Ratio (*RQ*) (95th percentile)	2.05	0.38	3.43	1.55	0.30	0.29	3.81	0.43	0.42	0.86	0.71	4.97
Uniform Delay (d_1), s/veh	55.8	56.7	56.9	62.2	62.7	62.9	45.2	35.5	37.6	40.5	31.7	51.6
Incremental Delay (d_2), s/veh	1.7	5.1	6.4	5.0	10.6	12.4	21.6	4.1	4.3	0.4	12.2	4.9
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	57.4	61.8	63.3	67.1	73.4	75.3	66.8	39.5	41.9	40.8	43.9	56.5
Level of Service (LOS)	E	E	E	E	E	E	E	D	D	D	D	E
Approach Delay, s/veh / LOS	60.1		E	70.8		E	46.5		D	46.6		D
Intersection Delay, s/veh / LOS	52.9						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	3.0	C	2.6	B	3.0	C
Bicycle LOS Score / LOS	2.0	B	1.1	A	1.6	A	1.9	A

 HCS 2010™ Streets Version 6.50 Generated: 5/18/2016 11:34:39 AM

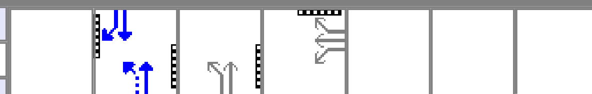
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	GHM	Analysis Date	Feb 2, 2015	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Intersection	Minnesota Ave & I-229 SB	Analysis Year	2035	Analysis Period	1> 7:15
File Name	2035_NB_Minnesota_AM_WorstCase.xus				
Project Description	2035 NB AM				

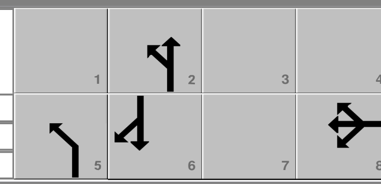


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				210	0	260	120	1960			690	300

Signal Information			
Cycle, s	130.0	Reference Phase	2
Offset, s	70	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	77.9	5.7	30.3	0.0	0.0	0.0
Yellow	3.6	3.6	4.0	0.0	0.0	0.0
Red	2.2	1.0	1.7	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase				8	5	2		6
Case Number				10.0	1.0	4.0		8.3
Phase Duration, s				36.0	10.3	94.0		83.7
Change Period, (*Y+Rc*), s				5.7	5.8	5.8		5.8
Max Allow Headway (*MAH*), s				4.2	4.1	0.0		0.0
Queue Clearance Time (*gs*), s				28.2	2.0			
Green Extension Time (*ge*), s				2.1	2.3	0.0		0.0
Phase Call Probability				1.00	0.99			
Max Out Probability				0.00	1.00			

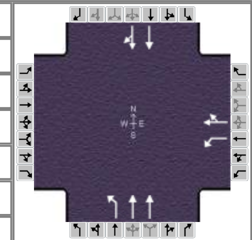
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement				3	8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h				247	306		121	1983			600	565
Adjusted Saturation Flow Rate (*s*), veh/h/ln				1648	1472		1599	1800			1740	1622
Queue Service Time (*gs*), s				17.6	26.2		0.0	45.3			57.7	25.1
Cycle Queue Clearance Time (*gc*), s				17.6	26.2		0.0	45.3			57.7	25.1
Green Ratio (*g/C*)				0.23	0.23		0.62	0.68			0.60	0.60
Capacity (*c*), veh/h				384	343		176	2444			1039	969
Volume-to-Capacity Ratio (*X*)				0.644	0.893		0.691	0.811			0.577	0.583
Available Capacity (*ca*), veh/h				638	570		179	2444			1039	969
Back of Queue (*Q*), veh/ln (95th percentile)				11.7	15.6		4.9	15.3			13.9	13.5
Queue Storage Ratio (*RQ*) (95th percentile)				2.40	0.40		1.00	0.56			0.25	0.25
Uniform Delay (*d1*), s/veh				45.0	48.3		54.6	10.7			13.1	13.3
Incremental Delay (*d2*), s/veh				1.8	9.9		1.3	0.4			1.9	2.1
Initial Queue Delay (*d3*), s/veh				0.0	0.0		0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh				46.8	58.2		55.9	11.0			15.0	15.4
Level of Service (LOS)				D	E		E	B			B	B
Approach Delay, s/veh / LOS	0.0			53.1	D		13.6	B		15.2	B	
Intersection Delay, s/veh / LOS	19.8						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.8	C	1.6	A	2.0	A
Bicycle LOS Score / LOS			1.4	A	2.5	B	1.4	A

 HCS 2010™ Streets Version 6.50 Generated: 5/17/2016 3:09:40 PM

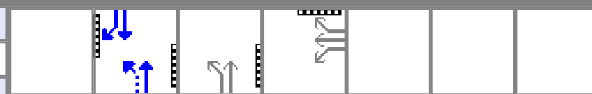
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	GHM	Analysis Date	Feb 2, 2015	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM Peak	PHF	0.93
Intersection	Minnesota Ave & I-229 SB	Analysis Year	2035	Analysis Period	1> 4:30
File Name	2035_NB_Minnesota_PM_WorstCase.xus				
Project Description	2035 NB PM				

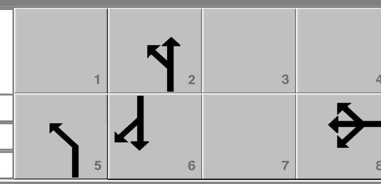


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				290	0	190	130	1230			1490	510

Signal Information			
Cycle, s	145.0	Reference Phase	2
Offset, s	35	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	92.4	6.4	30.1	0.0	0.0	0.0
Yellow	3.6	3.6	4.0	0.0	0.0	0.0
Red	2.2	1.0	1.7	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase				8	5	2		6
Case Number				10.0	1.0	4.0		8.3
Phase Duration, s				35.8	11.0	109.2		98.2
Change Period, (*Y+Rc*), s				5.7	5.8	5.8		5.8
Max Allow Headway (*MAH*), s				4.2	4.1	0.0		0.0
Queue Clearance Time (*gs*), s				28.0	7.2			
Green Extension Time (*ge*), s				2.0	0.0	0.0		0.0
Phase Call Probability				1.00	1.00			
Max Out Probability				0.00	1.00			

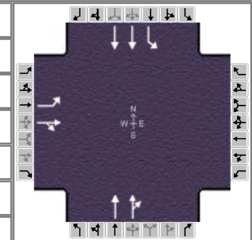
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement				3	8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h				312	204		140	1323			1062	1089
Adjusted Saturation Flow Rate (*s*), veh/h/ln				1689	1509		1612	1769			1844	1737
Queue Service Time (*gs*), s				26.0	18.0		5.2	34.8			145.0	83.1
Cycle Queue Clearance Time (*gc*), s				26.0	18.0		5.2	34.8			145.0	83.1
Green Ratio (*g/C*)				0.21	0.21		0.66	0.71			0.64	0.64
Capacity (*c*), veh/h				350	313		107	2524			1175	1108
Volume-to-Capacity Ratio (*X*)				0.891	0.653		1.301	0.524			0.903	0.983
Available Capacity (*ca*), veh/h				993	887		107	2524			1175	1108
Back of Queue (*Q*), veh/ln (95th percentile)				17.3	11.3		13.5	19.7			26.9	22.9
Queue Storage Ratio (*RQ*) (95th percentile)				3.54	0.29		2.76	0.72			0.49	0.42
Uniform Delay (*d1*), s/veh				55.9	52.7		69.0	17.5			14.1	10.4
Incremental Delay (*d2*), s/veh				7.8	2.3		168.5	0.4			4.1	11.7
Initial Queue Delay (*d3*), s/veh				0.0	0.0		0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh				63.7	55.0		237.5	18.0			18.2	22.2
Level of Service (LOS)				E	D		F	B			B	C
Approach Delay, s/veh / LOS	0.0			60.2	E		39.0	D		20.2	C	
Intersection Delay, s/veh / LOS	31.9						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.8	C	1.6	A	2.0	A
Bicycle LOS Score / LOS			1.3	A	1.7	A	2.3	B

 HCS 2010™ Streets Version 6.50 Generated: 5/17/2016 3:13:14 PM

HCS 2010 Signalized Intersection Results Summary

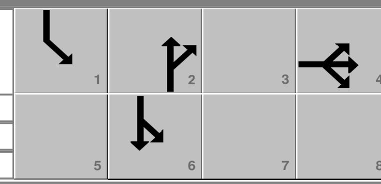
General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	GHM	Analysis Date	Feb 2, 2015	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Intersection	Minnesota Ave & I-229 NB	Analysis Year	2035	Analysis Period	1> 7:15
File Name	2035_NB_Minnesota_AM_WorstCase.xus				
Project Description	2035 NB AM				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	400	0	120					1680	340	150	750	

Signal Information			
Cycle, s	130.0	Reference Phase	6
Offset, s	34	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	5.7	78.1	29.4	0.0	0.0	0.0
Yellow	4.3	4.3	4.0	0.0	0.0	0.0
Red	1.0	1.6	1.6	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4				2	1	6
Case Number		10.0				8.3	1.0	4.0
Phase Duration, s		35.0				84.0	11.0	95.0
Change Period, (*Y+Rc*), s		5.6				5.9	5.3	5.9
Max Allow Headway (*MAH*), s		4.1				0.0	4.1	0.0
Queue Clearance Time (g_s), s		31.4					7.7	
Green Extension Time (g_e), s		0.0				0.0	0.0	0.0
Phase Call Probability		1.00					1.00	
Max Out Probability		1.00					1.00	

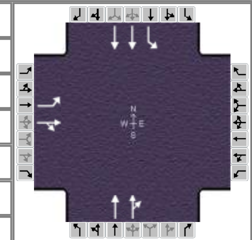
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14					2	12	1	6	
Adjusted Flow Rate (*v*), veh/h	471	54						1004	1036	176	882	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1741	1556						1833	1791	1620	1676	
Queue Service Time (g_s), s	29.4	3.6						115.2	61.5	5.7	11.9	
Cycle Queue Clearance Time (g_c), s	29.4	3.6						115.2	61.5	5.7	11.9	
Green Ratio (*g/C*)	0.23	0.23						0.60	0.60	0.66	0.69	
Capacity (*c*), veh/h	394	352						1101	1076	126	2298	
Volume-to-Capacity Ratio (*X*)	1.195	0.154						0.912	0.963	1.396	0.384	
Available Capacity (c_a), veh/h	394	352						1101	1076	126	2298	
Back of Queue (*Q*), veh/ln (95th percentile)	36.0	2.5						10.4	7.3	18.1	6.3	
Queue Storage Ratio (*RQ*) (95th percentile)	7.37	0.06						0.08	0.06	3.70	0.23	
Uniform Delay (d_1), s/veh	50.3	40.3						9.6	8.1	42.7	6.5	
Incremental Delay (d_2), s/veh	110.1	0.2						1.5	3.3	211.2	0.4	
Initial Queue Delay (d_3), s/veh	0.0	0.0						0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	160.4	40.5						11.1	11.3	253.9	6.9	
Level of Service (LOS)	F	D						B	B	F	A	
Approach Delay, s/veh / LOS	148.0	F		0.0			11.2	B		48.0	D	
Intersection Delay, s/veh / LOS	41.8						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.8	C	2.9	C	1.9	A	1.8	A
Bicycle LOS Score / LOS	1.4	A			2.4	B	1.4	A

 HCS 2010™ Streets Version 6.50 Generated: 5/17/2016 3:09:40 PM

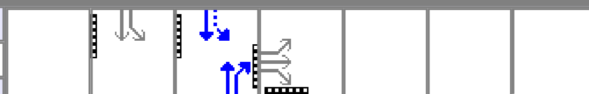
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	GHM	Analysis Date	Feb 2, 2015	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM Peak	PHF	0.93
Intersection	Minnesota Ave & I-229 NB	Analysis Year	2035	Analysis Period	1> 4:30
File Name	2035_NB_Minnesota_PM_WorstCase.xus				
Project Description	2035 NB PM				

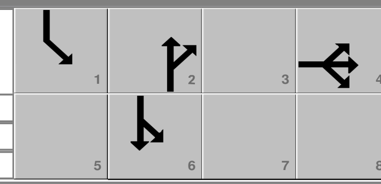


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	260	0	160					1100	180	330	1450	

Signal Information			
Cycle, s	145.0	Reference Phase	6
Offset, s	104	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	26.8	74.1	27.4	0.0	0.0	0.0
Yellow	4.3	4.3	4.0	0.0	0.0	0.0
Red	1.0	1.6	1.6	0.0	0.0	0.0



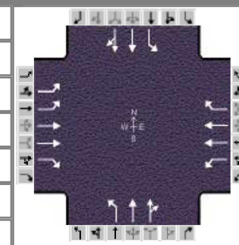
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4				2	1	6
Case Number		10.0				8.3	1.0	4.0
Phase Duration, s		33.0				80.0	32.1	112.0
Change Period, ($Y+R_c$), s		5.6				5.9	5.3	5.9
Max Allow Headway (*MAH*), s		6.1				0.0	4.1	0.0
Queue Clearance Time (g_s), s		25.6					25.9	
Green Extension Time (g_e), s		1.8				0.0	1.3	0.0
Phase Call Probability		1.00					1.00	
Max Out Probability		0.27					0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14					2	12	1	6	
Adjusted Flow Rate (*v*), veh/h	280	44						689	667	355	1559	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1674	1495						1861	1779	1709	1800	
Queue Service Time (g_s), s	23.6	3.6						67.2	51.4	23.9	29.7	
Cycle Queue Clearance Time (g_c), s	23.6	3.6						67.2	51.4	23.9	29.7	
Green Ratio (*g/C*)	0.19	0.19						0.51	0.51	0.71	0.73	
Capacity (*c*), veh/h	316	282						956	914	382	2635	
Volume-to-Capacity Ratio (*X*)	0.885	0.156						0.721	0.729	0.928	0.592	
Available Capacity (c_a), veh/h	420	375						956	914	764	2635	
Back of Queue (*Q*), veh/ln (95th percentile)	17.2	2.5						31.0	30.6	17.6	13.1	
Queue Storage Ratio (*RQ*) (95th percentile)	3.52	0.06						0.24	0.24	3.60	0.48	
Uniform Delay (d_1), s/veh	57.3	49.2						48.4	50.2	57.8	9.2	
Incremental Delay (d_2), s/veh	20.2	0.5						2.1	2.3	3.2	0.3	
Initial Queue Delay (d_3), s/veh	0.0	0.0						0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	77.5	49.7						50.5	52.5	61.0	9.5	
Level of Service (LOS)	E	D						D	D	E	A	
Approach Delay, s/veh / LOS	73.7	E		0.0			51.5	D		19.0	B	
Intersection Delay, s/veh / LOS	36.2						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.8	C	2.9	C	1.9	A	1.8	A
Bicycle LOS Score / LOS	1.0	A			1.6	A	2.1	B

 HCS 2010™ Streets Version 6.50 Generated: 5/17/2016 3:13:14 PM

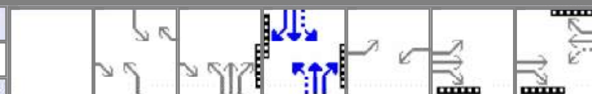
HCS 2010 Signalized Intersection Results Summary



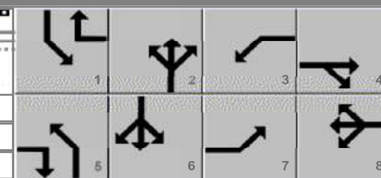
General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	GHM	Analysis Date	Feb 2, 2015	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Intersection	Minnesota Ave & 57th St	Analysis Year	2035	Analysis Period	1> 7:15
File Name	2035_NB_Minnesota_AM_WorstCase.xus				
Project Description	2035 NB AM				

Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	330	430	250	120	740	320	300	1150	100	150	540	160

Signal Information			
Cycle, s	130.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	12.4	5.9	31.2	5.0	7.0	36.8
Yellow	4.0	4.0	3.9	4.0	4.0	4.3
Red	1.0	1.0	1.9	1.0	1.0	1.6



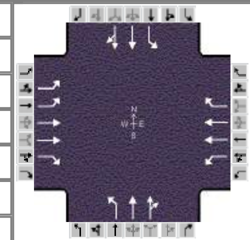
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	22.0	54.7	10.0	42.7	28.3	47.9	17.4	37.0
Change Period, (*Y+R$_c$*), s	5.0	5.9	5.0	5.9	5.0	5.8	5.0	5.8
Max Allow Headway (*MAH*), s	4.1	5.6	3.1	5.6	3.6	0.0	3.6	0.0
Queue Clearance Time (g_s), s	17.3	16.4	7.0	34.6	24.5		12.3	
Green Extension Time (g_e), s	0.0	18.3	0.0	2.2	0.0	0.0	0.1	0.0
Phase Call Probability	1.00	1.00	0.99	1.00	1.00		1.00	
Max Out Probability	1.00	0.40	1.00	1.00	1.00		0.65	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	388	506	202	141	871	226	353	743	727	176	407	381
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1632	1680	1496	1681	1680	1496	1664	1748	1698	1664	1748	1630
Queue Service Time (g_s), s	15.3	14.4	9.1	5.0	32.6	14.4	22.5	42.2	42.2	10.3	30.0	30.1
Cycle Queue Clearance Time (g_c), s	15.3	14.4	9.1	5.0	32.6	14.4	22.5	42.2	42.2	10.3	30.0	30.1
Green Ratio (*g/C*)	0.13	0.38	0.55	0.32	0.28	0.38	0.43	0.32	0.32	0.34	0.24	0.24
Capacity (*c*), veh/h	427	1261	829	304	951	565	361	567	551	214	420	392
Volume-to-Capacity Ratio (*X*)	0.910	0.401	0.244	0.465	0.916	0.400	0.979	1.311	1.321	0.826	0.970	0.972
Available Capacity (c_a), veh/h	427	1269	833	304	959	569	361	567	551	264	420	392
Back of Queue (*Q*), veh/ln (95th percentile)	12.1	9.7	5.5	2.4	21.6	9.0	19.0	61.2	60.8	8.3	23.5	22.3
Queue Storage Ratio (*RQ*) (95th percentile)	2.45	0.25	1.39	0.41	0.55	1.53	4.86	1.57	1.56	1.42	0.19	0.18
Uniform Delay (d_1), s/veh	55.7	29.9	14.9	34.8	45.1	29.6	38.0	43.9	43.9	35.3	49.0	48.6
Incremental Delay (d_2), s/veh	23.2	0.4	0.3	0.4	13.4	0.8	41.4	152.4	156.9	14.0	35.6	37.5
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	78.9	30.2	15.2	35.2	58.6	30.4	79.4	196.3	200.8	49.4	84.6	86.2
Level of Service (LOS)	E	C	B	D	E	C	E	F	F	D	F	F
Approach Delay, s/veh / LOS	44.7	D		50.8	D		175.5	F		78.8	E	
Intersection Delay, s/veh / LOS	99.1						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.8	C	2.9	C	3.1	C	3.2	C
Bicycle LOS Score / LOS	1.4	A	1.5	A	2.0	A	1.3	A

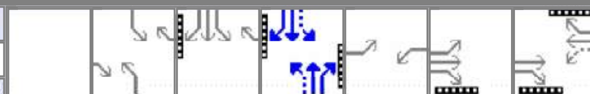
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	GHM	Analysis Date	Feb 2, 2015	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM Peak	PHF	0.93
Intersection	Minnesota Ave & 57th St	Analysis Year	2035	Analysis Period	1> 4:30
File Name	2035_NB_Minnesota_PM_WorstCase.xus				
Project Description	2035 NB PM				

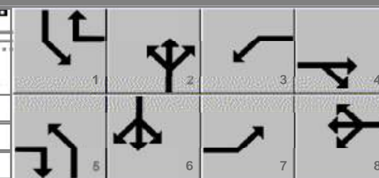


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	300	880	300	180	570	230	250	700	200	340	840	230

Signal Information			
Cycle, s	145.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	20.6	1.5	44.2	14.0	3.4	39.6
Yellow	4.0	0.0	3.9	4.0	0.0	4.3
Red	1.0	0.0	1.9	1.0	0.0	1.6



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	22.3	48.9	19.0	45.5	25.6	50.0	27.1	51.6
Change Period, ($Y+R_c$), s	5.0	5.9	5.0	5.9	5.0	5.8	5.0	5.8
Max Allow Headway (*MAH*), s	4.1	5.6	3.1	5.6	3.6	0.0	3.6	0.0
Queue Clearance Time (g_s), s	16.0	42.0	13.9	25.5	20.7		24.0	
Green Extension Time (g_e), s	1.3	1.0	0.0	11.0	0.2	0.0	0.0	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		1.00	
Max Out Probability	0.00	1.00	1.00	0.79	1.00		1.00	

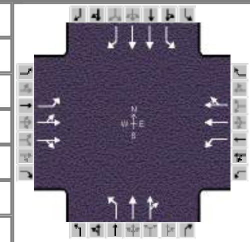
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	323	946	290	194	613	125	269	501	463	366	585	545
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1632	1680	1496	1681	1680	1496	1664	1748	1615	1664	1748	1626
Queue Service Time (g_s), s	14.0	40.0	19.7	11.9	23.5	7.6	18.7	40.4	40.4	22.0	46.1	46.1
Cycle Queue Clearance Time (g_c), s	14.0	40.0	19.7	11.9	23.5	7.6	18.7	40.4	40.4	22.0	46.1	46.1
Green Ratio (*g/C*)	0.12	0.30	0.44	0.37	0.27	0.43	0.45	0.31	0.31	0.46	0.32	0.32
Capacity (*c*), veh/h	391	996	652	214	918	636	284	534	494	321	555	517
Volume-to-Capacity Ratio (*X*)	0.826	0.950	0.445	0.903	0.668	0.196	0.946	0.938	0.938	1.140	1.053	1.055
Available Capacity (c_a), veh/h	1035	999	654	215	920	637	318	534	494	322	555	517
Back of Queue (*Q*), veh/ln (95th percentile)	10.0	26.1	11.5	11.3	15.3	5.0	18.1	28.7	27.1	29.1	33.0	31.0
Queue Storage Ratio (*RQ*) (95th percentile)	2.03	0.66	2.92	1.92	0.39	0.84	4.63	0.74	0.69	4.97	0.26	0.24
Uniform Delay (d_1), s/veh	62.3	50.0	28.6	38.2	46.9	26.1	44.4	49.0	49.0	51.9	38.1	37.2
Incremental Delay (d_2), s/veh	4.5	17.9	0.8	35.3	2.3	0.3	34.1	26.2	27.6	88.6	48.8	50.6
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	66.8	67.9	29.4	73.5	49.1	26.4	78.6	75.2	76.6	140.5	86.9	87.8
Level of Service (LOS)	E	E	C	E	D	C	E	E	E	F	F	F
Approach Delay, s/veh / LOS	60.5	E		51.1	D		76.5	E		100.3	F	
Intersection Delay, s/veh / LOS	74.0						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.9	C	3.1	C	3.1	C
Bicycle LOS Score / LOS	1.8	A	1.3	A	1.5	A	1.7	A

 HCS 2010™ Streets Version 6.50 Generated: 5/18/2016 11:34:39 AM

Appendix C: 2035 "Best Case" No-Build Conditions Analysis HCS 2010 Results

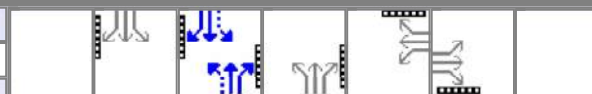
HCS 2010 Signalized Intersection Results Summary



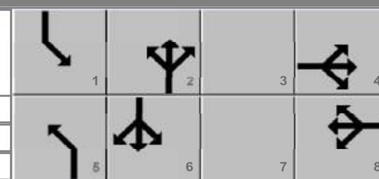
General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	GHM	Analysis Date	Oct 9, 2014	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Intersection	Minnesota Ave & 41st St	Analysis Year	2035	Analysis Period	1> 7:15
File Name	2035_NB_Minnesota_AM_BestCase.xus				
Project Description	2035 NB AM				

Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	350	180	110	200	220	70	150	1360	100	80	710	230

Signal Information			
Cycle, s	150.0	Reference Phase	2
Offset, s	114	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	7.1	55.2	5.9	24.4	29.2	0.0
Yellow	3.6	3.6	3.6	3.6	3.6	0.0
Red	2.3	2.3	1.0	2.1	2.5	0.0



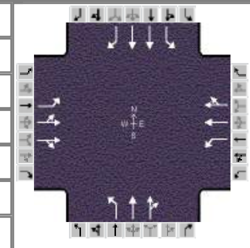
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		10.0		10.0	1.3	4.0	1.2	3.0
Phase Duration, s		35.3		30.1	10.5	71.6	13.0	74.1
Change Period, (*Y+R$_c$*), s		6.1		5.7	5.9	5.9	5.9	5.9
Max Allow Headway (*MAH*), s		4.2		4.2	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s		29.3		22.5	2.0		7.1	
Green Extension Time (g_e), s		0.5		1.9	2.1	0.0	0.1	0.0
Phase Call Probability		1.00		1.00	1.00		0.98	
Max Out Probability		1.00		0.01	1.00		0.99	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	309	249	140	235	163	157	153	745	734	94	835	222
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1681	1730	1611	1681	1765	1649	1664	1748	1711	1664	1664	1481
Queue Service Time (g_s), s	27.3	20.4	11.5	20.5	12.8	13.2	0.0	61.7	62.3	5.1	22.2	11.1
Cycle Queue Clearance Time (g_c), s	27.3	20.4	11.5	20.5	12.8	13.2	0.0	61.7	62.3	5.1	22.2	11.1
Green Ratio (*g/C*)	0.19	0.19	0.19	0.16	0.16	0.16	0.39	0.44	0.44	0.43	0.45	0.45
Capacity (*c*), veh/h	320	330	307	273	287	268	263	773	757	127	1516	675
Volume-to-Capacity Ratio (*X*)	0.964	0.756	0.455	0.861	0.568	0.586	0.584	0.964	0.969	0.742	0.551	0.330
Available Capacity (c_a), veh/h	345	355	331	452	474	443	269	773	757	188	1516	675
Back of Queue (*Q*), veh/ln (95th percentile)	21.4	14.9	8.4	14.5	9.9	9.6	8.2	35.1	34.7	4.2	12.8	6.8
Queue Storage Ratio (*RQ*) (95th percentile)	3.62	0.38	0.21	2.10	0.25	0.24	1.69	0.64	0.63	1.08	0.33	1.75
Uniform Delay (d_1), s/veh	60.2	57.4	53.8	61.2	58.0	58.1	46.8	36.2	35.5	36.2	20.4	18.2
Incremental Delay (d_2), s/veh	37.8	8.4	1.1	8.9	1.8	2.0	1.6	16.2	17.3	8.3	1.4	1.3
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	98.0	65.8	54.9	70.1	59.7	60.2	48.4	52.4	52.9	44.5	21.8	19.5
Level of Service (LOS)	F	E	D	E	E	E	D	D	D	D	C	B
Approach Delay, s/veh / LOS	77.9	E		64.2	E		52.2	D		23.2	C	
Intersection Delay, s/veh / LOS	50.0						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	3.1	C	2.9	C	2.9	C
Bicycle LOS Score / LOS	1.1	A	0.9	A	2.0	B	1.4	A

HCS 2010 Signalized Intersection Results Summary

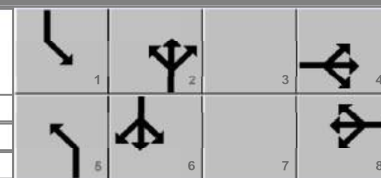
General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	GHM	Analysis Date	Oct 9, 2014	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM Peak	PHF	0.93
Intersection	Minnesota Ave & 41st St	Analysis Year	2035	Analysis Period	1> 4:30
File Name	2035_NB_Minnesota_PM_BestCase.xus				
Project Description	2035 NB PM				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	400	250	280	320	290	60	280	840	180	60	1150	390

Signal Information			
Cycle, s	145.0	Reference Phase	2
Offset, s	130	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	20.7	27.0	12.2	25.9	31.1	0.0
Yellow	3.6	3.6	3.6	3.6	3.6	0.0
Red	1.0	2.3	2.3	2.1	2.4	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		10.0		10.0	1.2	4.0	1.3	3.0
Phase Duration, s		37.1		31.6	25.3	58.2	18.1	51.0
Change Period, (Y+R_c), s		6.0		5.7	4.6	5.9	5.9	5.9
Max Allow Headway (*MAH*), s		4.2		4.2	4.2	0.0	4.2	0.0
Queue Clearance Time (g_s), s		30.1		25.5	21.1		2.0	
Green Extension Time (g_e), s		4.0		2.8	1.2	0.0	11.1	0.0
Phase Call Probability		1.00		1.00	1.00		0.93	
Max Out Probability		0.00		0.00	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	344	352	234	344	184	178	301	543	516	65	1237	373
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1681	1744	1498	1681	1765	1679	1664	1748	1657	1664	1664	1481
Queue Service Time (g_s), s	28.1	28.1	21.7	23.5	14.1	14.4	19.1	40.0	40.5	0.0	52.1	28.7
Cycle Queue Clearance Time (g_c), s	28.1	28.1	21.7	23.5	14.1	14.4	19.1	40.0	40.5	0.0	52.1	28.7
Green Ratio (*g/C*)	0.21	0.21	0.21	0.18	0.18	0.18	0.39	0.36	0.36	0.30	0.31	0.31
Capacity (*c*), veh/h	325	337	290	273	286	272	282	695	659	275	1196	532
Volume-to-Capacity Ratio (*X*)	1.058	1.043	0.808	1.262	0.642	0.655	1.069	0.783	0.783	0.235	1.034	0.701
Available Capacity (c_a), veh/h	937	972	835	1135	1192	1134	776	695	659	1352	1196	532
Back of Queue (*Q*), veh/ln (95th percentile)	22.7	22.7	13.5	29.7	10.7	10.5	16.9	25.2	24.6	3.6	34.6	16.1
Queue Storage Ratio (*RQ*) (95th percentile)	3.85	0.58	0.34	4.32	0.27	0.27	3.47	0.46	0.45	0.91	0.88	4.12
Uniform Delay (d_1), s/veh	58.5	58.5	55.9	60.7	56.8	56.9	41.9	40.2	42.0	45.4	37.8	31.7
Incremental Delay (d_2), s/veh	40.3	34.8	5.3	124.3	2.4	2.7	43.7	7.2	7.5	0.4	35.3	7.5
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	98.8	93.3	61.2	185.0	59.2	59.6	85.6	47.4	49.5	45.9	73.0	39.2
Level of Service (LOS)	F	F	E	F	E	E	F	D	D	D	F	D
Approach Delay, s/veh / LOS	87.3		F	120.6		F	56.6		E	64.4		E
Intersection Delay, s/veh / LOS	75.2						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	3.1	C	2.9	C	2.9	C
Bicycle LOS Score / LOS	1.3	A	1.1	A	1.6	A	1.9	A

 HCS 2010™ Streets Version 6.50 Generated: 5/18/2016 11:33:53 AM

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TWO-WAY STOP CONTROL SUMMARY

Analyst: GHM
Agency/Co.: HDR
Date Performed: 11/13/2013
Analysis Time Period: AM Peak
Intersection: Minnesota Ave & 49th St
Jurisdiction: Sioux Falls, SD
Units: U. S. Customary
Analysis Year: 2035
Project ID: I-229 MIS - Minnesota Corridor
East/West Street: 49th St
North/South Street: Minnesota Ave
Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	550	1670			760	300
Peak-Hour Factor, PHF	0.85	0.85			0.85	0.85
Hourly Flow Rate, HFR	647	1964			894	352
Percent Heavy Vehicles	3	--	--		--	--
Median Type/Storage	TWLTL			/ 1		
RT Channelized?						
Lanes	1	2			2	0
Configuration	L	T			T	TR
Upstream Signal?		Yes			Yes	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				150		230
Peak Hour Factor, PHF				0.85		0.85
Hourly Flow Rate, HFR				176		270
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes				1		1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	L					L		R
v (vph)	647					176		270
C(m) (vph)	597							651
v/c	1.08							0.41
95% queue length	19.01							2.04
Control Delay	87.3							14.4
LOS	F							B
Approach Delay								
Approach LOS								

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: GHM
Agency/Co.: HDR
Date Performed: 11/13/2013
Analysis Time Period: AM Peak
Intersection: Minnesota Ave & 49th St
Jurisdiction: Sioux Falls, SD
Units: U. S. Customary
Analysis Year: 2035
Project ID: I-229 MIS - Minnesota Corridor
East/West Street: 49th St
North/South Street: Minnesota Ave
Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	550	1670			760	300
Peak-Hour Factor, PHF	0.85	0.85			0.85	0.85
Peak-15 Minute Volume	162	491			224	88
Hourly Flow Rate, HFR	647	1964			894	352
Percent Heavy Vehicles	3	--	--		--	--
Median Type/Storage	TWLTL			/ 1		
RT Channelized?						
Lanes	1	2			2	0
Configuration	L	T			T	TR
Upstream Signal?		Yes			Yes	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				150		230
Peak Hour Factor, PHF				0.85		0.85
Peak-15 Minute Volume				44		68
Hourly Flow Rate, HFR				176		270
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
RT Channelized?						No
Lanes				1		1
Configuration				L		R

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

		Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2	Left-Turn	0	1800	3	0	116	30	225
	Through	1960	1800	4	84	116	30	225
S5	Left-Turn	0	1800	3	0	116	30	1170
	Through	710	1800	4	46	116	30	1170

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		
Shared ln volume, major rt vehicles:		
Sat flow rate, major th vehicles:		
Sat flow rate, major rt vehicles:		
Number of major street through lanes:		

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement		1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)		4.1					7.5		6.2
t(c,hv)		2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
P(hv)		3					2		2
t(c,g)				0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade				0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00					0.70		0.00
t(c,T):	1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c)	1-stage	4.2					6.8		6.2
	2-stage	4.2					5.8		6.2

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)	2.20					3.50		3.30
t(f,HV)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(HV)	3					2		2
t(f)	2.2					3.5		3.3

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog	1960	0	710	0

Total Saturation Flow Rate, s (vph)	3600	3600	3600	3600
Arrival Type	4	3	4	3
Effective Green, g (sec)	84	0	46	0
Cycle Length, C (sec)	116	116	116	116
Rp (from Exhibit 16-11)	1.333	1.000	1.333	1.000
Proportion vehicles arriving on green P	0.966	0.000	0.529	0.000
g(q1)	2.2	0.0	10.8	0.0
g(q2)	5.8	0.0	3.8	0.0
g(q)	7.9	0.0	14.6	0.0

Computation 2-Proportion of TWSC Intersection Time blocked

	Movement 2 V(t)	Movement 2 V(l,prot)	Movement 5 V(t)	Movement 5 V(l,prot)
alpha	0.350		0.350	
beta	0.741		0.741	
Travel time, t(a) (sec)	5.102		26.531	
Smoothing Factor, F	0.431		0.127	
Proportion of conflicting flow, f	1.000	1.000	1.000	1.000
Max platooned flow, V(c,max)	3559	0	3106	0
Min platooned flow, V(c,min)	2000	2000	2000	2000
Duration of blocked period, t(p)	82.6	0.0	13.9	0.0
Proportion time blocked, p	0.712		0.120	

Computation 3-Platoon Event Periods	Result
p(2)	0.712
p(5)	0.120
p(dom)	0.712
p(subo)	0.120
Constrained or unconstrained?	U

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Two-Stage Process Stage II
p(1)	0.880		
p(4)			
p(7)			
p(8)			
p(9)			
p(10)	0.228	0.880	0.288
p(11)			
p(12)	0.880		

Computation 4 and 5
Single-Stage Process

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x	1246					3346		623
s	3000					3000		3000
Px	0.880					0.228		0.880
V c,u,x	1006					4516		298
C r,x	678					1		740
C plat,x	597					0		651

Two-Stage Process

7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)					1070	2276		
s					3000	3000		
P(x)					0.880	0.288		
V(c,u,x)					806	489		
C(r,x)					400	582		
C(plat,x)					352	168		

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows		623
Potential Capacity		651
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		651
Probability of Queue free St.	1.00	0.59

Step 2: LT from Major St.	4	1
Conflicting Flows		1246
Potential Capacity		597
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		597
Probability of Queue free St.	1.00	0.00
Maj L-Shared Prob Q free St.		

Step 3: TH from Minor St.	8	11
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.00	0.00
Movement Capacity		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Conflicting Flows		3346
Potential Capacity		0
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	0.00	
Maj. L, Min T Adj. Imp Factor.	0.00	
Cap. Adj. factor due to Impeding mvmnt	0.00	0.00
Movement Capacity		0

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity	3	350
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.00	1.00
Movement Capacity	0	350
Probability of Queue free St.		1.00

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity	282	3
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	0.00
Movement Capacity	282	0

Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.00	0.00
Movement Capacity		

Result for 2 stage process:		
a	0.91	0.91
y		
C t		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Part 1 - First Stage		
Conflicting Flows		1070
Potential Capacity	2	352
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.00	1.00
Movement Capacity	0	352
Part 2 - Second Stage		
Conflicting Flows		2276
Potential Capacity	810	168
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.59	
Movement Capacity	474	
Part 3 - Single Stage		
Conflicting Flows		3346
Potential Capacity		0
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	0.00	
Maj. L, Min T Adj. Imp Factor.	0.00	
Cap. Adj. factor due to Impeding mvmnt	0.00	0.00
Movement Capacity		0
Results for Two-stage process:		
a	0.91	0.91
y		
C t		

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)				176		270
Movement Capacity (vph)						651
Shared Lane Capacity (vph)						

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7 L	8 T	9 R	10 L	11 T	12 R
C sep						651
Volume				176		270
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh						
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config	L					L		R
v (vph)	647					176		270
C(m) (vph)	597							651
v/c	1.08							0.41
95% queue length	19.01							2.04
Control Delay	87.3							14.4
LOS	F							B
Approach Delay								
Approach LOS								

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	0.00	1.00
v(il), Volume for stream 2 or 5		
v(i2), Volume for stream 3 or 6		
s(il), Saturation flow rate for stream 2 or 5		
s(i2), Saturation flow rate for stream 3 or 6		
P*(oj)		
d(M,LT), Delay for stream 1 or 4	87.3	
N, Number of major street through lanes		
d(rank,1) Delay for stream 2 or 5		

HCS+: Unsignalized Intersections Release 5.6

TWO-WAY STOP CONTROL SUMMARY

Analyst: GHM
Agency/Co.: HDR
Date Performed: 10/09/2014
Analysis Time Period: PM Peak
Intersection: Minnesota Ave & 49th St
Jurisdiction: Sioux Falls, SD
Units: U. S. Customary
Analysis Year: 2035
Project ID: I-229 MIS - Minnesota Corridor
East/West Street: 49th St
North/South Street: Minnesota Ave
Intersection Orientation: NS   Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	500	920			1750	260
Peak-Hour Factor, PHF	0.93	0.93			0.93	0.93
Hourly Flow Rate, HFR	537	989			1881	279
Percent Heavy Vehicles	3	--	--		--	--
Median Type/Storage	TWLTL			/ 1		
RT Channelized?						
Lanes	1	2			2	0
Configuration	L	T			T	TR
Upstream Signal?		Yes			Yes	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				450		250
Peak Hour Factor, PHF				0.93		0.93
Hourly Flow Rate, HFR				483		268
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes				1		1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	L					L		R
v (vph)	537					483		268
C(m) (vph)	234							555
v/c	2.29							0.48
95% queue length	42.60							2.61
Control Delay	629.2							17.4
LOS	F							C
Approach Delay								
Approach LOS								

HCS+: Unsignalized Intersections Release 5.6

Phone: Fax:
E-Mail:

TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: GHM
Agency/Co.: HDR
Date Performed: 10/09/2014
Analysis Time Period: PM Peak
Intersection: Minnesota Ave & 49th St
Jurisdiction: Sioux Falls, SD
Units: U. S. Customary
Analysis Year: 2035
Project ID: I-229 MIS - Minnesota Corridor
East/West Street: 49th St
North/South Street: Minnesota Ave
Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	500	920			1750	260
Peak-Hour Factor, PHF	0.93	0.93			0.93	0.93
Peak-15 Minute Volume	134	247			470	70
Hourly Flow Rate, HFR	537	989			1881	279
Percent Heavy Vehicles	3	--	--		--	--
Median Type/Storage	TWLTL			/ 1		
RT Channelized?						
Lanes	1	2			2	0
Configuration	L	T			T	TR
Upstream Signal?		Yes			Yes	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				450		250
Peak Hour Factor, PHF				0.93		0.93
Peak-15 Minute Volume				121		67
Hourly Flow Rate, HFR				483		268
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/		/
RT Channelized?						No
Lanes				1		1
Configuration				L		R

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

		Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2	Left-Turn	0	1800	3	0	128	30	225
	Through	1230	1800	4	96	128	30	225
S5	Left-Turn	0	1800	3	0	128	30	1170
	Through	1150	1800	4	45	128	30	1170

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		
Shared ln volume, major rt vehicles:		
Sat flow rate, major th vehicles:		
Sat flow rate, major rt vehicles:		
Number of major street through lanes:		

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement		1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)		4.1					7.5		6.2
t(c,hv)		2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
P(hv)		3					2		2
t(c,g)				0.20	0.20	0.10	0.20	0.20	0.10
Percent Grade				0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00					0.70		0.00
t(c,T):	1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c)	1-stage	4.2					6.8		6.2
	2-stage	4.2					5.8		6.2

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)	2.20					3.50		3.30
t(f,HV)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(HV)	3					2		2
t(f)	2.2					3.5		3.3

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog	1230	0	1150	0

Total Saturation Flow Rate, s (vph)	3600	3600	3600	3600
Arrival Type	4	3	4	3
Effective Green, g (sec)	96	0	45	0
Cycle Length, C (sec)	128	128	128	128
Rp (from Exhibit 16-11)	1.333	1.000	1.333	1.000
Proportion vehicles arriving on green P	1.000	0.000	0.469	0.000
g(q1)	0.0	0.0	21.7	0.0
g(q2)	0.0	0.0	16.1	0.0
g(q)	0.0	0.0	37.8	0.0

Computation 2-Proportion of TWSC Intersection Time blocked

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha	0.350		0.350	
beta	0.741		0.741	
Travel time, t(a) (sec)	5.102		26.531	
Smoothing Factor, F	0.431		0.127	
Proportion of conflicting flow, f	1.000	1.000	1.000	1.000
Max platooned flow, V(c,max)	0	0	3579	0
Min platooned flow, V(c,min)	2000	2000	2000	2000
Duration of blocked period, t(p)	0.0	0.0	39.0	0.0
Proportion time blocked, p	0.000		0.305	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.305
p(dom)	0.305
p(subo)	0.000
Constrained or unconstrained?	U

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Two-Stage Process Stage II
p(1)	0.695		
p(4)			
p(7)			
p(8)			
p(9)			
p(10)	0.695	0.695	1.000
p(11)			
p(12)	0.695		

Computation 4 and 5
Single-Stage Process

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x	2160					3588		1080
s	3000					3000		3000
Px	0.695					0.695		0.695
V c,u,x	1792					3846		238
C r,x	337					3		799
C plat,x	234					2		555

Two-Stage Process

	7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)					2020	1568		
s					3000	3000		
P(x)					0.695	1.000		
V(c,u,x)					1590	1568		
C(r,x)					153	157		
C(plat,x)					106	157		

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows		1080
Potential Capacity		555
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		555
Probability of Queue free St.	1.00	0.52

Step 2: LT from Major St.	4	1
Conflicting Flows		2160
Potential Capacity		234
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		234
Probability of Queue free St.	1.00	0.00
Maj L-Shared Prob Q free St.		

Step 3: TH from Minor St.	8	11
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.00	0.00
Movement Capacity		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Conflicting Flows		3588
Potential Capacity		2
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	0.00	
Maj. L, Min T Adj. Imp Factor.	0.00	
Cap. Adj. factor due to Impeding mvmnt	0.00	0.00
Movement Capacity		0

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity	98	117
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.00	1.00
Movement Capacity	0	117
Probability of Queue free St.		1.00

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity	93	98
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	0.00
Movement Capacity	93	0

Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.00	0.00
Movement Capacity		

Result for 2 stage process:		
a	0.91	0.91
y		
C t		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10

Part 1 - First Stage		
Conflicting Flows		2020
Potential Capacity	86	106
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.00	1.00
Movement Capacity	0	106

Part 2 - Second Stage		
Conflicting Flows		1568
Potential Capacity	687	157
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.52	
Movement Capacity	355	

Part 3 - Single Stage		
Conflicting Flows		3588
Potential Capacity		2
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	0.00	
Maj. L, Min T Adj. Imp Factor.	0.00	
Cap. Adj. factor due to Impeding mvmnt	0.00	0.00
Movement Capacity		0

Results for Two-stage process:		
a	0.91	0.91
y		
C t		

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)				483		268
Movement Capacity (vph)						555
Shared Lane Capacity (vph)						

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep						555
Volume				483		268
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh						
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

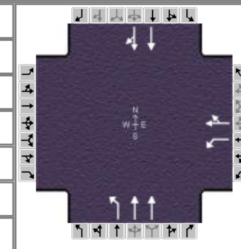
Movement	1	4	7	8	9	10	11	12
Lane Config	L					L		R
v (vph)	537					483		268
C(m) (vph)	234							555
v/c	2.29							0.48
95% queue length	42.60							2.61
Control Delay	629.2							17.4
LOS	F							C
Approach Delay								
Approach LOS								

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	0.00	1.00
v(il), Volume for stream 2 or 5		
v(i2), Volume for stream 3 or 6		
s(il), Saturation flow rate for stream 2 or 5		
s(i2), Saturation flow rate for stream 3 or 6		
P*(oj)		
d(M,LT), Delay for stream 1 or 4	629.2	
N, Number of major street through lanes		
d(rank,1) Delay for stream 2 or 5		

HCS 2010 Signalized Intersection Results Summary

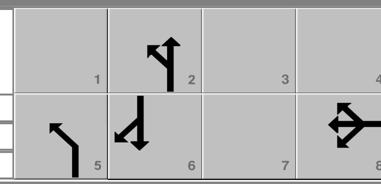
General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	GHM	Analysis Date	Oct 9, 2014	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Intersection	Minnesota Ave & I-229 SB	Analysis Year	2035	Analysis Period	1> 7:15
File Name	2035_NB_Minnesota_AM_BestCase.xus				
Project Description	2035 NB AM				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				210	0	260	120	1960			690	300

Signal Information			
Cycle, s	150.0	Reference Phase	2
Offset, s	7	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	6.3	93.4	34.3	0.0	0.0	0.0
Yellow	3.6	3.6	4.0	0.0	0.0	0.0
Red	1.0	2.2	1.7	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase				8	5	2		6
Case Number				10.0	1.0	4.0		8.3
Phase Duration, s				40.0	10.9	110.0		99.2
Change Period, ($Y+R_c$), s				5.7	4.6	5.8		5.8
Max Allow Headway (*MAH*), s				4.2	4.1	0.0		0.0
Queue Clearance Time (g_s), s				32.0	5.9			
Green Extension Time (g_e), s				2.2	0.4	0.0		0.0
Phase Call Probability				1.00	0.99			
Max Out Probability				0.00	0.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement				3	8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h				247	306		118	1926			600	565
Adjusted Saturation Flow Rate (*s*), veh/h/ln				1663	1486		1605	1800			1770	1648
Queue Service Time (g_s), s				20.2	30.0		3.9	38.0			70.2	23.2
Cycle Queue Clearance Time (g_c), s				20.2	30.0		3.9	38.0			70.2	23.2
Green Ratio (g/C)				0.23	0.23		0.68	0.69			0.62	0.62
Capacity (*c*), veh/h				380	339		185	2502			1101	1026
Volume-to-Capacity Ratio (*X*)				0.651	0.901		0.637	0.770			0.545	0.551
Available Capacity (c_a), veh/h				1245	1112		1021	2502			1101	1026
Back of Queue (*Q*), veh/ln (95th percentile)				13.4	17.6		3.4	9.9			15.5	11.9
Queue Storage Ratio (*RQ*) (95th percentile)				2.74	0.45		0.70	0.36			0.28	0.22
Uniform Delay (d_1), s/veh				52.4	56.2		31.5	7.2			14.1	10.8
Incremental Delay (d_2), s/veh				1.9	8.8		0.3	0.2			1.5	1.6
Initial Queue Delay (d_3), s/veh				0.0	0.0		0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh				54.3	65.0		31.8	7.4			15.6	12.4
Level of Service (LOS)				D	E		C	A			B	B

	EB		WB		NB		SB	
Approach Delay, s/veh / LOS	0.0		60.2	E	8.8	A	14.0	B
Intersection Delay, s/veh / LOS	18.0				B			

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.8	C	1.7	A	1.9	A
Bicycle LOS Score / LOS			1.4	A	2.5	B	1.4	A

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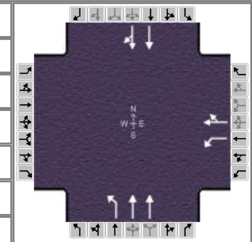
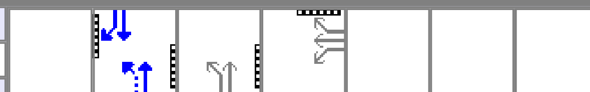
HCS 2010 Signalized Intersection Results Summary

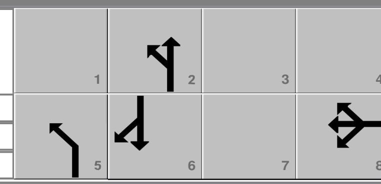
General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	GHM	Analysis Date	Oct 9, 2014	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM Peak	PHF	0.93
Intersection	Minnesota Ave & I-229 SB	Analysis Year	2035	Analysis Period	1> 4:30
File Name	2035_NB_Minnesota_PM_BestCase.xus				
Project Description	2035 NB PM				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				290	0	190	130	1230			1490	510



Signal Information									
Cycle, s	145.0	Reference Phase	2						
Offset, s	35	Reference Point	Begin	Green	92.4	6.4	30.1	0.0	0.0	0.0
Uncoordinated	No	Simult. Gap E/W	On	Yellow	3.6	3.6	4.0	0.0	0.0	0.0
Force Mode	Fixed	Simult. Gap N/S	On	Red	2.2	1.0	1.7	0.0	0.0	0.0



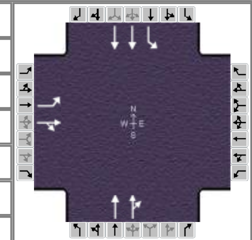
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase				8	5	2		6
Case Number				10.0	1.0	4.0		8.3
Phase Duration, s				35.8	11.0	109.2		98.2
Change Period, ($Y+R_c$), s				5.7	5.8	5.8		5.8
Max Allow Headway (*MAH*), s				4.2	4.1	0.0		0.0
Queue Clearance Time (g_s), s				28.0	7.2			
Green Extension Time (g_e), s				2.0	0.0	0.0		0.0
Phase Call Probability				1.00	1.00			
Max Out Probability				0.00	1.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement				3	8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h				312	204		140	1323			1021	1046
Adjusted Saturation Flow Rate (*s*), veh/h/ln				1689	1509		1612	1769			1846	1737
Queue Service Time (g_s), s				26.0	18.0		5.2	29.3			145.0	68.9
Cycle Queue Clearance Time (g_c), s				26.0	18.0		5.2	29.3			145.0	68.9
Green Ratio (*g/C*)				0.21	0.21		0.66	0.71			0.64	0.64
Capacity (*c*), veh/h				350	313		107	2524			1177	1108
Volume-to-Capacity Ratio (*X*)				0.891	0.653		1.301	0.524			0.868	0.944
Available Capacity (c_a), veh/h				993	887		107	2524			1177	1108
Back of Queue (*Q*), veh/ln (95th percentile)				17.3	11.3		13.6	15.9			23.9	18.0
Queue Storage Ratio (*RQ*) (95th percentile)				3.54	0.29		2.78	0.58			0.44	0.33
Uniform Delay (d_1), s/veh				55.9	52.7		69.7	12.7			15.3	10.5
Incremental Delay (d_2), s/veh				7.8	2.3		169.4	0.5			0.9	2.3
Initial Queue Delay (d_3), s/veh				0.0	0.0		0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh				63.7	55.0		239.1	13.2			16.2	12.7
Level of Service (LOS)				E	D		F	B			B	B
Approach Delay, s/veh / LOS	0.0			60.2	E		34.8	C		14.5	B	
Intersection Delay, s/veh / LOS	27.6						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.8	C	1.6	A	2.0	A
Bicycle LOS Score / LOS			1.3	A	1.7	A	2.3	B

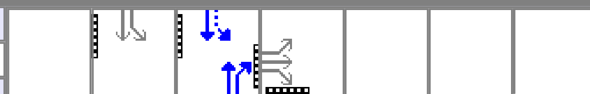
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	GHM	Analysis Date	Oct 9, 2014	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Intersection	Minnesota Ave & I-229 NB	Analysis Year	2035	Analysis Period	1> 7:15
File Name	2035_NB_Minnesota_AM_BestCase.xus				
Project Description	2035 NB AM				

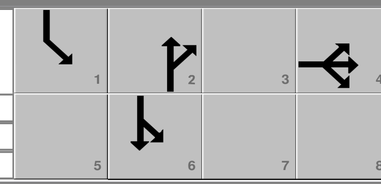


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	400	0	120					1680	340	150	750	

Signal Information			
Cycle, s	150.0	Reference Phase	6
Offset, s	43	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	14.1	90.7	28.4	0.0	0.0	0.0
Yellow	4.3	4.3	4.0	0.0	0.0	0.0
Red	1.0	1.6	1.6	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4				2	1	6
Case Number		10.0				8.3	1.0	4.0
Phase Duration, s		34.0				96.6	19.4	116.0
Change Period, ($Y+R_c$), s		5.6				5.9	5.3	5.9
Max Allow Headway (MAH), s		4.1				0.0	4.1	0.0
Queue Clearance Time (g_s), s		30.4					13.6	
Green Extension Time (g_e), s		0.0				0.0	0.5	0.0
Phase Call Probability		1.00					1.00	
Max Out Probability		1.00					0.00	

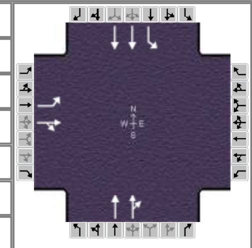
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14					2	12	1	6	
Adjusted Flow Rate (v), veh/h	471	54						1002	1035	176	882	
Adjusted Saturation Flow Rate (s), veh/h/ln	1774	1585						1830	1791	1631	1696	
Queue Service Time (g_s), s	28.4	4.3						150.0	77.3	11.6	32.2	
Cycle Queue Clearance Time (g_c), s	28.4	4.3						150.0	77.3	11.6	32.2	
Green Ratio (g/C)	0.19	0.19						0.60	0.60	0.71	0.45	
Capacity (c), veh/h	336	300						1106	1083	202	1534	
Volume-to-Capacity Ratio (X)	1.401	0.180						0.906	0.956	0.875	0.575	
Available Capacity (c_a), veh/h	336	300						1106	1083	436	1534	
Back of Queue (Q), veh/ln (95th percentile)	46.9	3.1						23.7	27.5	11.2	19.6	
Queue Storage Ratio (RQ) (95th percentile)	9.60	0.08						0.19	0.22	2.30	0.72	
Uniform Delay (d_1), s/veh	60.8	51.0						16.5	17.9	55.1	23.1	
Incremental Delay (d_2), s/veh	197.7	0.3						1.4	2.9	9.3	1.3	
Initial Queue Delay (d_3), s/veh	0.0	0.0						0.0	0.0	0.0	0.0	
Control Delay (d), s/veh	258.5	51.3						17.9	20.8	64.4	24.4	
Level of Service (LOS)	F	D						B	C	E	C	
Approach Delay, s/veh / LOS	237.1	F		0.0			19.4	B		31.0	C	
Intersection Delay, s/veh / LOS	54.3						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.8	C	2.9	C	1.9	A	1.7	A
Bicycle LOS Score / LOS	1.4	A			2.4	B	1.4	A

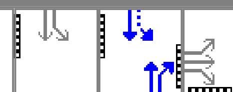
 HCS 2010™ Streets Version 6.50 Generated: 5/17/2016 3:07:38 PM

HCS 2010 Signalized Intersection Results Summary

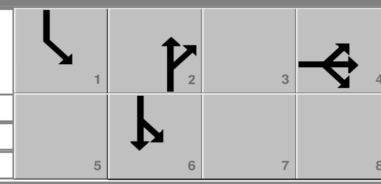
General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	GHM	Analysis Date	Oct 9, 2014	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM Peak	PHF	0.93
Intersection	Minnesota Ave & I-229 NB	Analysis Year	2035	Analysis Period	1> 4:30
File Name	2035_NB_Minnesota_PM_BestCase.xus				
Project Description	2035 NB PM				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	260	0	160					1100	180	330	1450	



Signal Information										
Cycle, s	145.0	Reference Phase	6							
Offset, s	104	Reference Point	Begin	Green	25.4	75.5	27.4	0.0	0.0	0.0
Uncoordinated	No	Simult. Gap E/W	On	Yellow	4.3	4.3	4.0	0.0	0.0	0.0
Force Mode	Fixed	Simult. Gap N/S	On	Red	1.0	1.6	1.6	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4				2	1	6
Case Number		10.0				8.3	1.0	4.0
Phase Duration, s		33.0				81.4	30.7	112.0
Change Period, ($Y+R_c$), s		5.6				5.9	5.3	5.9
Max Allow Headway (*MAH*), s		6.1				0.0	4.1	0.0
Queue Clearance Time (g_s), s		25.6					24.7	
Green Extension Time (g_e), s		1.8				0.0	1.3	0.0
Phase Call Probability		1.00					1.00	
Max Out Probability		0.27					0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14					2	12	1	6	
Adjusted Flow Rate (*v*), veh/h	280	44						689	667	343	1508	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1674	1495						1861	1779	1703	1800	
Queue Service Time (g_s), s	23.6	3.6						67.2	48.7	22.7	27.6	
Cycle Queue Clearance Time (g_c), s	23.6	3.6						67.2	48.7	22.7	27.6	
Green Ratio (*g/C*)	0.19	0.19						0.52	0.52	0.71	0.73	
Capacity (*c*), veh/h	316	282						976	933	367	2635	
Volume-to-Capacity Ratio (*X*)	0.885	0.156						0.707	0.715	0.934	0.572	
Available Capacity (c_a), veh/h	420	375						976	933	766	2635	
Back of Queue (*Q*), veh/ln (95th percentile)	17.2	2.5						28.8	28.9	17.5	12.5	
Queue Storage Ratio (*RQ*) (95th percentile)	3.52	0.06						0.23	0.23	3.59	0.46	
Uniform Delay (d_1), s/veh	57.3	49.2						39.1	42.0	57.0	8.7	
Incremental Delay (d_2), s/veh	20.2	0.5						2.3	2.5	4.3	0.3	
Initial Queue Delay (d_3), s/veh	0.0	0.0						0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	77.5	49.7						41.4	44.5	61.4	9.0	
Level of Service (LOS)	E	D						D	D	E	A	
Approach Delay, s/veh / LOS	73.7	E		0.0			42.9	D		18.7	B	
Intersection Delay, s/veh / LOS	33.1						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.8	C	2.9	C	1.9	A	1.8	A
Bicycle LOS Score / LOS	1.0	A			1.6	A	2.1	B

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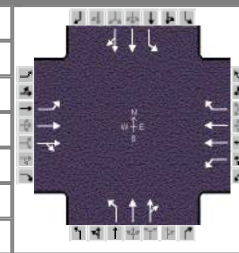
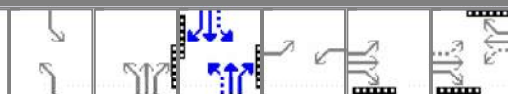
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	GHM	Analysis Date	Oct 9, 2014	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Intersection	Minnesota Ave & 57th St	Analysis Year	2035	Analysis Period	1> 7:15
File Name	2035_NB_Minnesota_AM_BestCase.xus				
Project Description	2035 NB AM				

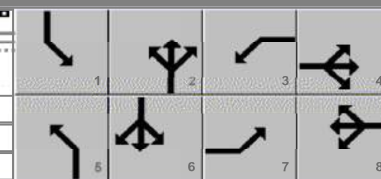


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	330	430	250	120	740	320	300	1150	100	150	540	160

Signal Information			
Cycle, s	150.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	13.7	5.4	45.2	10.9	4.1	44.0
Yellow	4.0	4.0	3.9	4.0	0.0	4.3
Red	1.0	1.0	1.9	1.0	0.0	1.6



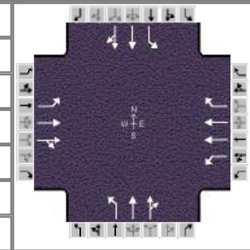
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	20.0	54.0	15.9	49.9	29.1	61.4	18.7	51.0
Change Period, ($Y+R_c$), s	5.0	5.9	5.0	5.9	5.0	5.8	5.0	5.8
Max Allow Headway (*MAH*), s	4.1	5.6	3.1	5.6	3.6	0.0	3.6	0.0
Queue Clearance Time (g_s), s	17.0	29.4	10.7	39.1	23.2		13.5	
Green Extension Time (g_e), s	0.0	13.1	0.2	4.9	1.0	0.0	0.3	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		1.00	
Max Out Probability	1.00	0.63	0.00	0.99	0.00		0.01	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	388	371	337	141	871	226	353	743	727	176	407	381
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1681	1765	1593	1681	1680	1496	1664	1748	1698	1664	1748	1630
Queue Service Time (g_s), s	15.0	27.1	27.4	8.7	37.1	18.9	21.2	55.6	55.6	11.5	27.8	27.3
Cycle Queue Clearance Time (g_c), s	15.0	27.1	27.4	8.7	37.1	18.9	21.2	55.6	55.6	11.5	27.8	27.3
Green Ratio (*g/C*)	0.40	0.32	0.32	0.37	0.29	0.29	0.48	0.37	0.37	0.39	0.30	0.30
Capacity (*c*), veh/h	239	565	510	261	985	439	396	648	629	200	526	491
Volume-to-Capacity Ratio (*X*)	1.624	0.657	0.661	0.542	0.884	0.515	0.892	1.147	1.156	0.881	0.774	0.776
Available Capacity (c_a), veh/h	239	577	521	575	1010	450	784	648	629	294	526	491
Back of Queue (*Q*), veh/ln (95th percentile)	40.1	18.0	16.7	6.5	23.5	11.6	13.8	53.6	53.3	9.4	15.6	14.0
Queue Storage Ratio (*RQ*) (95th percentile)	8.15	0.46	0.42	1.11	0.60	1.96	3.52	1.37	1.36	1.60	0.12	0.11
Uniform Delay (d_1), s/veh	38.2	43.9	44.0	35.6	50.6	44.1	31.6	47.2	47.2	44.7	31.1	29.1
Incremental Delay (d_2), s/veh	299.1	3.3	3.7	0.7	9.7	1.6	5.4	83.5	87.3	14.1	8.8	9.5
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	337.3	47.2	47.7	36.3	60.2	45.7	37.0	130.7	134.5	58.8	39.9	38.6
Level of Service (LOS)	F	D	D	D	E	D	D	F	F	E	D	D
Approach Delay, s/veh / LOS	150.1		F	54.9		D	114.1		F	42.8		D
Intersection Delay, s/veh / LOS	94.1						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.8	C	2.9	C	3.1	C	3.0	C
Bicycle LOS Score / LOS	1.4	A	1.5	A	2.0	A	1.3	A

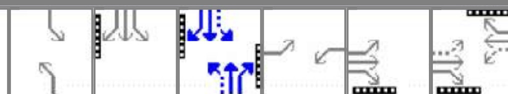
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HDR			Duration, h	0.25
Analyst	GHM	Analysis Date	Oct 9, 2014	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM Peak	PHF	0.93
Intersection	Minnesota Ave & 57th St	Analysis Year	2035	Analysis Period	1> 4:30
File Name	2035_NB_Minnesota_PM_BestCase.xus				
Project Description	2035 NB PM				

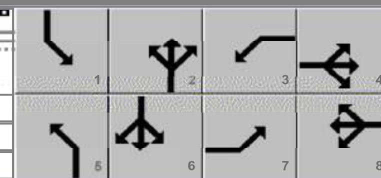


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	300	880	300	180	570	230	250	700	200	340	840	230

Signal Information			
Cycle, s	145.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	9.0	1.0	51.2	7.0	11.5	33.6
Yellow	4.0	4.0	3.9	4.0	4.0	4.3
Red	1.0	1.0	1.9	1.0	1.0	1.6



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	1.1	4.0	1.1	3.0	1.1	4.0	1.1	4.0
Phase Duration, s	28.5	56.0	12.0	39.5	14.0	57.0	20.0	63.0
Change Period, ($Y+R_c$), s	5.0	5.9	5.0	5.9	5.0	5.8	5.0	5.8
Max Allow Headway (MAH), s	4.1	5.6	3.1	5.6	3.6	0.0	3.6	0.0
Queue Clearance Time (g_s), s	22.4	52.1	9.0	26.9	11.0		17.0	
Green Extension Time (g_e), s	1.1	0.0	0.0	5.7	0.0	0.0	0.0	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		1.00	
Max Out Probability	0.00	1.00	1.00	0.97	1.00		1.00	

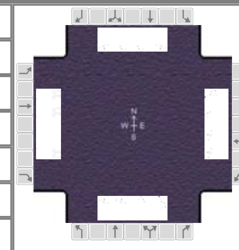
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	323	642	594	194	613	125	269	501	463	356	570	531
Adjusted Saturation Flow Rate (s), veh/h/ln	1681	1765	1622	1681	1680	1496	1664	1748	1615	1664	1748	1626
Queue Service Time (g_s), s	20.4	50.1	50.1	7.0	24.9	10.1	9.0	37.7	37.7	15.0	39.5	39.2
Cycle Queue Clearance Time (g_c), s	20.4	50.1	50.1	7.0	24.9	10.1	9.0	37.7	37.7	15.0	39.5	39.2
Green Ratio (g/C)	0.41	0.35	0.35	0.28	0.23	0.23	0.42	0.35	0.35	0.47	0.39	0.39
Capacity (c), veh/h	365	610	560	131	777	346	214	617	570	276	689	641
Volume-to-Capacity Ratio (X)	0.884	1.054	1.060	1.480	0.789	0.361	1.259	0.811	0.811	1.291	0.826	0.827
Available Capacity (c_a), veh/h	625	610	560	131	777	346	214	617	570	276	689	641
Back of Queue (Q), veh/ln (95th percentile)	13.9	40.6	38.5	17.8	16.5	7.0	19.7	24.8	23.3	27.3	22.3	20.7
Queue Storage Ratio (RQ) (95th percentile)	2.82	1.03	0.98	3.01	0.42	1.19	5.05	0.63	0.60	4.67	0.18	0.16
Uniform Delay (d_1), s/veh	35.3	47.5	47.5	49.5	52.4	46.7	43.1	42.5	42.5	38.8	29.9	29.0
Incremental Delay (d_2), s/veh	7.9	51.4	54.9	252.3	6.0	1.1	148.5	11.1	11.9	151.2	9.0	9.7
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	43.2	98.9	102.4	301.8	58.4	47.8	191.6	53.6	54.4	190.0	38.9	38.6
Level of Service (LOS)	D	F	F	F	E	D	F	D	D	F	D	D
Approach Delay, s/veh / LOS	88.7	F		107.6	F		84.0	F		75.7	E	
Intersection Delay, s/veh / LOS	87.3						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.8	C	2.9	C	3.1	C	2.9	C
Bicycle LOS Score / LOS	1.8	A	1.3	A	1.5	A	1.7	A

Appendix D: 2035 Build Alternative Scenarios Analysis HCS 2010 Results

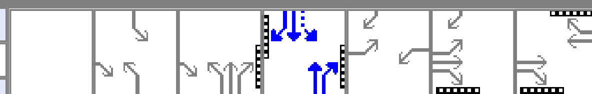
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Aug 10, 2015	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Minnesota Ave & 41st St	File Name	Minn-2_C_2035_AM_081616.xus		
Project Description	2035 AM - Build Minn-2				

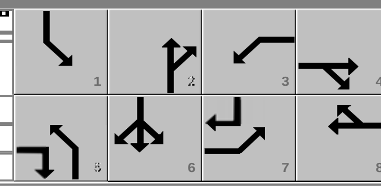


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	350	180	110	210	220	70	150	1360	100	80	710	230

Signal Information			
Cycle, s	115.0	Reference Phase	2
Offset, s	30	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Float	Simult. Gap N/S	On



Green	4.6	5.4	50.9	11.1	6.3	14.2
Yellow	3.0	0.0	4.0	3.0	0.0	4.0
Red	3.0	0.0	1.0	3.0	0.0	1.5



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	4.0	2.0	4.0	1.1	3.0
Phase Duration, s	23.4	26.1	17.1	19.7	16.0	61.2	10.6	55.9
Change Period, (*Y+R* $_c$), s	6.5	5.5	6.0	5.5	6.0	5.0	6.0	5.0
Max Allow Headway (*MAH*), s	3.5	4.2	3.5	4.2	3.5	0.0	3.5	0.0
Queue Clearance Time (g_s), s	16.2	14.9	10.5	12.6	8.1		5.6	
Green Extension Time (g_e), s	0.8	1.3	0.6	1.6	0.1	0.0	0.0	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		0.95	
Max Out Probability	0.10	0.49	0.00	0.18	1.00		1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	412	212	74	247	163	157	173	839	830	94	835	222
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1632	1765	1496	1632	1765	1649	1616	1748	1711	1664	1664	1481
Queue Service Time (g_s), s	14.2	12.9	4.4	8.5	10.3	10.6	6.1	53.5	55.0	3.6	17.8	6.5
Cycle Queue Clearance Time (g_c), s	14.2	12.9	4.4	8.5	10.3	10.6	6.1	53.5	55.0	3.6	17.8	6.5
Green Ratio (*g/C*)	0.15	0.18	0.27	0.10	0.12	0.12	0.09	0.49	0.49	0.48	0.44	0.59
Capacity (*c*), veh/h	481	316	397	315	219	204	280	854	836	129	1472	873
Volume-to-Capacity Ratio (*X*)	0.857	0.671	0.187	0.785	0.746	0.769	0.618	0.982	0.993	0.728	0.568	0.255
Back of Queue (*Q*), ft/ln (95 th percentile)	261.5	256.6	74.4	164.1	213.7	206.2	116.4	711.3	697.4	90.2	260.8	94.3
Back of Queue (*Q*), veh/ln (95 th percentile)	10.3	10.1	2.9	6.5	8.4	8.2	4.5	27.8	27.9	3.5	10.2	3.7
Queue Storage Ratio (*RQ*) (95 th percentile)	1.41	0.00	0.50	0.94	0.00	0.00	0.65	0.00	0.00	0.35	0.00	0.70
Uniform Delay (d_1), s/veh	47.9	44.0	32.6	50.8	48.6	48.8	53.3	20.3	19.8	27.2	16.8	8.1
Incremental Delay (d_2), s/veh	7.1	5.1	0.2	2.7	5.0	6.0	1.1	19.1	21.6	17.3	1.6	0.7
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	54.9	49.1	32.9	53.5	53.6	54.8	54.4	39.4	41.4	44.5	18.4	8.8
Level of Service (LOS)	D	D	C	D	D	D	D	D	D	D	B	A
Approach Delay, s/veh / LOS	50.8	D		53.9	D		41.7	D		18.7	B	
Intersection Delay, s/veh / LOS	38.6						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.0	C	3.0	C	2.6	B	3.0	C
Bicycle LOS Score / LOS	1.6	A	1.0	A	2.0	B	1.4	A

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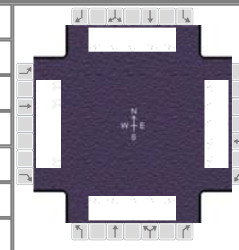
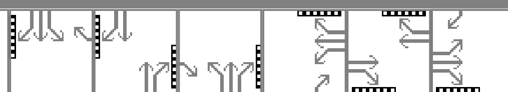
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Aug 10, 2015	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Minnesota Ave & 57th St	File Name	Minn-2_C_2035_AM_081616.xus		
Project Description	2035 AM - Build Minn-2				

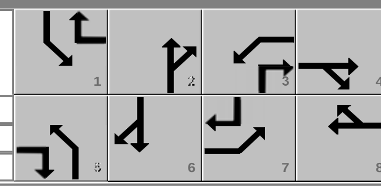


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	335	435	250	120	740	320	305	1140	100	155	545	165

Signal Information			
Cycle, s	145.1	Reference Phase	2
Offset, s	1	Reference Point	Begin
Uncoordinated	Yes	Simult. Gap E/W	Off
Force Mode	Fixed	Simult. Gap N/S	Off



Green	10.1	24.9	25.6	8.3	19.7	18.0
Yellow	3.5	4.5	3.5	3.5	4.0	3.5
Red	3.5	1.0	3.5	3.5	1.0	3.5



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	25.0	49.7	15.3	40.0	32.6	63.0	17.1	47.5
Change Period, ($Y+R_c$), s	7.0	7.0	7.0	5.0	7.0	7.0	7.0	5.5
Max Allow Headway (*MAH*), s	4.1	4.6	4.1	4.6	4.1	4.5	4.1	4.5
Queue Clearance Time (g_s), s	19.5	20.4	8.2	37.0	16.9	58.0	10.1	26.6
Green Extension Time (g_e), s	0.0	1.0	0.1	0.0	0.8	0.0	0.1	3.7
Phase Call Probability	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Max Out Probability	1.00	1.00	1.00	1.00	0.33	1.00	1.00	0.09

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	394	512	202	141	871	226	359	1341	118	182	641	159
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1632	1680	1496	1632	1680	1496	1616	1664	1481	1616	1664	1481
Queue Service Time (g_s), s	17.5	18.4	12.0	6.2	35.0	17.8	14.9	56.0	7.0	8.1	24.6	10.2
Cycle Queue Clearance Time (g_c), s	17.5	18.4	12.0	6.2	35.0	17.8	14.9	56.0	7.0	8.1	24.6	10.2
Green Ratio (*g/C*)	0.12	0.29	0.47	0.06	0.24	0.31	0.18	0.39	0.44	0.07	0.29	0.41
Capacity (*c*), veh/h	405	989	704	186	810	465	571	1284	656	225	963	612
Volume-to-Capacity Ratio (*X*)	0.974	0.517	0.287	0.759	1.074	0.486	0.629	1.045	0.179	0.809	0.666	0.259
Back of Queue (*Q*), ft/ln (95 th percentile)	362.7	309.6	98	128.5	746	246.4	263.3	1002.8	117.5	174.8	399.7	174
Back of Queue (*Q*), veh/ln (95 th percentile)	14.3	12.2	3.9	5.1	29.4	9.7	10.3	39.2	4.6	6.8	15.6	6.8
Queue Storage Ratio (*RQ*) (95 th percentile)	1.40	0.00	0.48	0.86	0.00	1.10	1.22	0.00	0.71	0.81	0.00	0.74
Uniform Delay (d_1), s/veh	63.3	42.6	6.8	67.4	55.1	1.3	55.3	44.6	24.5	66.5	45.4	28.0
Incremental Delay (d_2), s/veh	37.7	0.6	0.3	9.2	53.5	0.9	2.2	37.6	0.6	15.8	3.4	1.0
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	101.0	43.2	7.1	76.6	108.6	2.3	57.5	82.2	25.1	82.4	48.8	28.9
Level of Service (LOS)	F	D	A	E	F	A	E	F	C	F	D	C
Approach Delay, s/veh / LOS	57.1	E		85.5	F		73.6	E		51.8	D	
Intersection Delay, s/veh / LOS	68.8						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.1	C	3.1	C	3.2	C	3.2	C
Bicycle LOS Score / LOS	1.4	A	1.5	A	2.0	A	1.3	A

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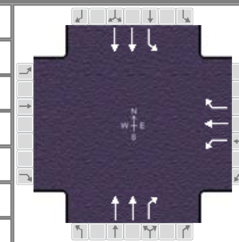
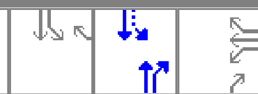
HCS 2010 Signalized Intersection Results Summary

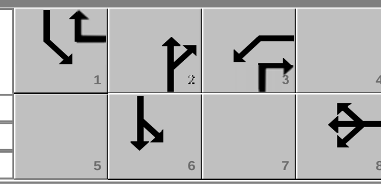
General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Aug 10, 2015	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Lotta	File Name	Minn-2_C_2035_AM_081616.xus		
Project Description	2035 AM - Build Minn-2				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				40	0	220		1775	20	60	820	

Signal Information										
Cycle, s	115.0	Reference Phase	2							
Offset, s	0	Reference Point	End	Green	4.5	73.0	21.0	0.0	0.0	0.0
Uncoordinated	No	Simult. Gap E/W	On	Yellow	3.5	4.5	3.5	0.0	0.0	0.0
Force Mode	Fixed	Simult. Gap N/S	On	Red	2.0	1.0	2.0	0.0	0.0	0.0





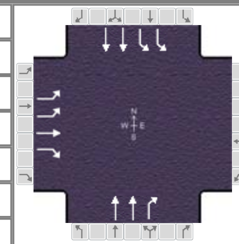
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase				8		2	1	6
Case Number				9.0		7.3	1.0	4.0
Phase Duration, s				26.5		78.5	10.0	88.5
Change Period, (*Y+R* c), s				5.5		5.5	5.5	5.5
Max Allow Headway (*MAH*), s				3.5		0.0	3.1	0.0
Queue Clearance Time (g_s), s				20.7			3.6	
Green Extension Time (g_e), s				0.3		0.0	0.1	0.0
Phase Call Probability				1.00			0.90	
Max Out Probability				0.82			0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement				3	8	18		2	12	1	6	
Adjusted Flow Rate (*v*), veh/h				47	0	259		2020	23	71	965	
Adjusted Saturation Flow Rate (*s*), veh/h/ln				1681	1765	1496		1664	1481	1664	1664	
Queue Service Time (g_s), s				2.7	0.0	18.7		64.9	0.3	1.6	14.8	
Cycle Queue Clearance Time (g_c), s				2.7	0.0	18.7		64.9	0.3	1.6	14.8	
Green Ratio (*g/C*)				0.18	0.18	0.22		0.63	0.82	0.69	0.72	
Capacity (*c*), veh/h				307	323	332		2112	1211	142	2401	
Volume-to-Capacity Ratio (*X*)				0.153	0.000	0.781		0.956	0.019	0.497	0.402	
Back of Queue (*Q*), ft/ln (95 th percentile)				52.2	0	309.4		650.1	2.7	59.3	212.7	
Back of Queue (*Q*), veh/ln (95 th percentile)				2.1	0.0	12.2		25.4	0.1	2.3	8.3	
Queue Storage Ratio (*RQ*) (95 th percentile)				0.05	0.00	2.06		0.00	0.02	0.40	0.00	
Uniform Delay (d_1), s/veh				39.5	0.0	42.1		19.5	1.9	29.7	7.5	
Incremental Delay (d_2), s/veh				0.1	0.0	7.6		2.8	0.0	0.9	0.5	
Initial Queue Delay (d_3), s/veh				0.0	0.0	0.0		0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh				39.6	0.0	49.7		22.3	1.9	30.6	8.0	
Level of Service (LOS)				D		D		C	A	C	A	
Approach Delay, s/veh / LOS	0.0			48.2	D		22.1	C		9.6	A	
Intersection Delay, s/veh / LOS	20.6						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.9	C	2.4	B	1.9	A
Bicycle LOS Score / LOS			1.0	A	2.2	B	1.3	A

HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Aug 10, 2015	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Minnesota Ave & I-229…	File Name	Minn-2_C_2035_AM_081616.xus		
Project Description	2035 AM - Build Minn-2				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	400	0	120					1655	330	150	750	

Signal Information				
Cycle, s	115.0	Reference Phase	2	
Offset, s	5	Reference Point	Begin	
Uncoordinated	No	Simult. Gap E/W	On	
Force Mode	Float	Simult. Gap N/S	On	

Green	8.7	68.0	19.8	0.0	0.0	0.0
Yellow	3.5	4.5	3.5	0.0	0.0	0.0
Red	3.0	1.0	3.0	0.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4				2	1	6
Case Number		9.0				7.3	2.0	4.0
Phase Duration, s		26.3				73.5	15.2	88.7
Change Period, (*Y+R* $_c$), s		6.5				5.5	6.5	5.5
Max Allow Headway (*MAH*), s		3.5				0.0	4.1	0.0
Queue Clearance Time (g_s), s		18.2					8.1	
Green Extension Time (g_e), s		1.6				0.0	0.7	0.0
Phase Call Probability		1.00					1.00	
Max Out Probability		0.00					0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14					2	12	1	6	
Adjusted Flow Rate (*v*), veh/h	471	0	54					1890	359	176	882	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1616	1633	1437					1800	1460	1616	1661	
Queue Service Time (g_s), s	16.2	0.0	3.7					46.1	5.9	6.1	7.9	
Cycle Queue Clearance Time (g_c), s	16.2	0.0	3.7					46.1	5.9	6.1	7.9	
Green Ratio (*g/C*)	0.17	0.17	0.17					0.59	0.59	0.08	0.65	
Capacity (*c*), veh/h	556	281	247					2130	864	244	2168	
Volume-to-Capacity Ratio (*X*)	0.846	0.000	0.219					0.888	0.415	0.724	0.407	
Back of Queue (*Q*), ft/ln (95 th percentile)	277	0	59.9					386.3	57.1	112.3	95.9	
Back of Queue (*Q*), veh/ln (95 th percentile)	10.8	0.0	2.4					15.1	2.2	4.4	3.7	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.62	0.00	0.24					0.00	0.44	0.56	0.00	
Uniform Delay (d_1), s/veh	46.1	0.0	41.0					12.4	3.5	49.6	3.4	
Incremental Delay (d_2), s/veh	2.3	0.0	0.3					1.5	0.3	3.2	0.5	
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0					0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	48.4	0.0	41.2					13.9	3.9	52.9	3.8	
Level of Service (LOS)	D		D					B	A	D	A	
Approach Delay, s/veh / LOS	47.7	D		0.0			12.3	B		12.0	B	
Intersection Delay, s/veh / LOS	17.1						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	3.0	C	2.4	B	2.2	B
Bicycle LOS Score / LOS	1.4	A			2.4	B	1.4	A

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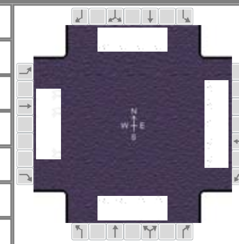
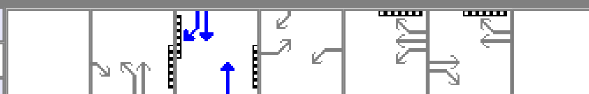
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Aug 10, 2015	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Minnesota Ave 49th St/I-…	File Name	Minn-2_C_2035_AM_081616.xus		
Project Description	2035 AM - Build Minn-2				

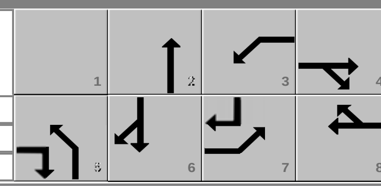


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	150	0	230	210	105	155	445	1500			750	300

Signal Information			
Cycle, s	115.0	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Float	Simult. Gap N/S	On



Green	20.5	42.9	8.4	2.7	16.6	0.0
Yellow	3.0	4.1	3.2	0.0	4.0	0.0
Red	3.4	1.4	3.4	0.0	1.4	0.0



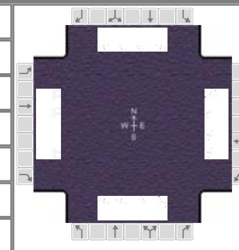
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2		6
Case Number	2.0	3.0	2.0	3.0	2.0	4.0		7.3
Phase Duration, s	15.0	22.0	17.7	24.7	26.9	75.3		48.4
Change Period, (*Y+R c*), s	6.6	5.4	6.6	5.4	6.4	5.5		5.5
Max Allow Headway (*MAH*), s	3.4	3.6	3.4	3.6	4.2	0.0		0.0
Queue Clearance Time (*g s*), s	8.1	18.6	10.6	9.7	19.5			
Green Extension Time (*g e*), s	0.4	0.0	0.5	1.1	1.0	0.0		0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00			
Max Out Probability	0.00	1.00	0.00	0.22	0.80			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h	176	0	271	247	124	182	511	1723			882	353
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1632	1649	1455	1616	1663	1241	1616	1777			1549	1459
Queue Service Time (*g s*), s	6.1	0.0	16.6	8.6	7.7	7.6	17.5	33.6			18.3	20.9
Cycle Queue Clearance Time (*g c*), s	6.1	0.0	16.6	8.6	7.7	7.6	17.5	33.6			18.3	20.9
Green Ratio (*g/C*)	0.07	0.14	0.32	0.10	0.17	0.17	0.18	0.61			0.37	0.45
Capacity (*c*), veh/h	240	238	469	313	279	416	576	2156			1732	651
Volume-to-Capacity Ratio (*X*)	0.736	0.000	0.577	0.789	0.443	0.438	0.888	0.799			0.509	0.542
Back of Queue (*Q*), ft/ln (95 th percentile)	117.1	0	265.8	164.1	146.8	107.7	238.4	299.7			286.6	304.7
Back of Queue (*Q*), veh/ln (95 th percentile)	4.6	0.0	10.5	6.4	5.7	4.2	9.3	11.7			11.2	11.9
Queue Storage Ratio (*RQ*) (95 th percentile)	0.25	0.00	0.56	0.67	0.00	0.44	0.68	0.00			0.00	1.00
Uniform Delay (*d 1*), s/veh	52.2	0.0	32.4	50.8	43.0	43.0	40.9	9.2			32.6	24.9
Incremental Delay (*d 2*), s/veh	2.7	0.0	1.4	2.8	0.7	0.4	4.9	1.2			0.8	2.5
Initial Queue Delay (*d 3*), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	54.9	0.0	33.8	53.5	43.7	43.4	45.8	10.4			33.4	27.4
Level of Service (LOS)	D		C	D	D	D	D	B			C	C
Approach Delay, s/veh / LOS	42.1	D		48.0	D		18.5	B		31.7	C	
Intersection Delay, s/veh / LOS	28.1						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.3	C	3.0	C	2.7	B	2.9	C
Bicycle LOS Score / LOS	1.2	A	1.4	A	2.4	B	1.2	A

HCS 2010 Signalized Intersection Results Summary

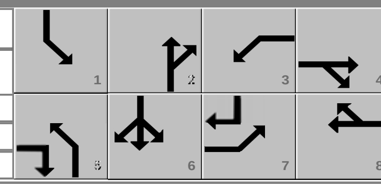
General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Aug 16, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM Peak	PHF	0.93
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 4:30
Intersection	Minnesota Ave & 41st St	File Name	Minn-2_C_2035_PM_081616.xus		
Project Description	2035 PM - Minn 2C				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	400	250	280	340	290	60	290	865	180	60	1150	390

Signal Information			
Cycle, s	113.0	Reference Phase	6
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	Off
Force Mode	Fixed	Simult. Gap N/S	On

Green	42.1	3.7	4.3	14.5	5.1	15.7
Yellow	4.0	4.0	3.0	4.0	0.0	3.0
Red	1.0	1.0	3.0	1.5	0.0	3.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	4.0	2.0	4.0	1.4	3.0
Phase Duration, s	26.9	25.2	21.7	20.0	19.0	55.8	10.3	47.1
Change Period, (*Y+R* $_c$), s	6.5	5.5	6.5	5.5	6.0	5.0	6.0	5.0
Max Allow Headway (*MAH*), s	3.5	4.3	3.5	4.1	3.5	0.0	3.5	0.0
Queue Clearance Time (g_s), s	15.7	18.6	14.3	13.7	12.6		2.0	
Green Extension Time (g_e), s	0.8	1.1	0.9	0.8	0.4	0.0	0.6	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		0.87	
Max Out Probability	0.13	0.54	1.00	0.16	0.50		0.14	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	430	269	231	366	184	178	310	553	526	65	1237	373
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1632	1765	1496	1632	1765	1679	1616	1748	1660	1664	1664	1481
Queue Service Time (g_s), s	13.7	16.6	14.5	12.3	11.5	11.7	10.6	28.6	28.4	0.0	41.9	15.4
Cycle Queue Clearance Time (g_c), s	13.7	16.6	14.5	12.3	11.5	11.7	10.6	28.6	28.4	0.0	41.9	15.4
Green Ratio (*g/C*)	0.18	0.17	0.29	0.13	0.13	0.13	0.11	0.45	0.45	0.41	0.37	0.55
Capacity (*c*), veh/h	588	307	432	440	227	216	372	785	746	189	1240	819
Volume-to-Capacity Ratio (*X*)	0.731	0.876	0.535	0.831	0.811	0.827	0.833	0.704	0.705	0.340	0.997	0.456
Back of Queue (*Q*), ft/ln (95 th percentile)	237.1	330.1	220.2	240	240.4	234.6	197.2	445.6	413.7	80.4	666.5	207.4
Back of Queue (*Q*), veh/ln (95 th percentile)	9.3	13.0	8.7	9.4	9.5	9.4	7.7	17.4	16.5	3.1	26.0	8.1
Queue Storage Ratio (*RQ*) (95 th percentile)	1.28	0.00	1.47	1.37	0.00	0.00	1.10	0.00	0.00	0.31	0.00	1.54
Uniform Delay (d_1), s/veh	40.4	42.2	31.0	47.6	47.9	48.0	49.2	24.5	24.1	45.1	28.4	11.3
Incremental Delay (d_2), s/veh	3.3	16.9	1.0	9.5	9.0	10.8	6.3	4.1	4.3	0.6	24.9	1.8
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	43.7	59.2	32.1	57.1	56.9	58.8	55.5	28.6	28.4	45.7	53.2	13.2
Level of Service (LOS)	D	E	C	E	E	E	E	C	C	D	D	B
Approach Delay, s/veh / LOS	45.3	D		57.5	E		34.5	C		44.0	D	
Intersection Delay, s/veh / LOS	43.5						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.0	C	3.0	C	2.6	B	3.1	C
Bicycle LOS Score / LOS	2.0	B	1.1	A	1.6	A	1.9	A

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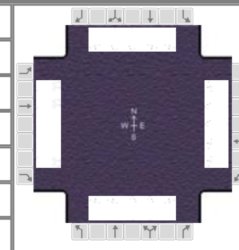
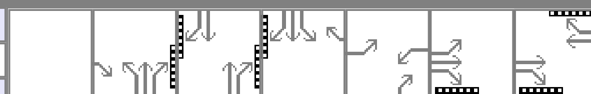
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Aug 16, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM Peak	PHF	0.93
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 4:30
Intersection	Minnesota Ave & 57th St	File Name	Minn-2_C_2035_PM_081616.xus		
Project Description	2035 PM - Minn 2C				

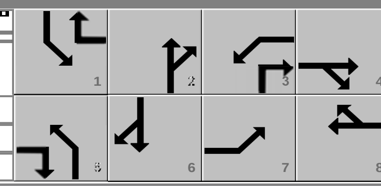


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	305	885	300	180	570	230	260	680	200	330	820	225

Signal Information			
Cycle, s	129.5	Reference Phase	2
Offset, s	83	Reference Point	Begin
Uncoordinated	Yes	Simult. Gap E/W	Off
Force Mode	Fixed	Simult. Gap N/S	Off



Green	14.0	17.0	17.2	10.2	5.9	33.8
Yellow	3.5	4.5	3.5	3.5	0.0	4.0
Red	3.5	1.0	3.5	3.5	0.0	1.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	23.0	44.7	17.2	38.8	21.0	43.5	24.2	46.6
Change Period, ($Y+R_c$), s	7.0	5.5	7.0	5.5	7.0	5.5	7.0	7.0
Max Allow Headway (*MAH*), s	4.1	4.6	4.1	4.6	4.1	4.6	4.1	4.5
Queue Clearance Time (g_s), s	14.7	37.7	9.5	23.5	12.9	27.8	15.9	34.4
Green Extension Time (g_e), s	1.4	1.5	0.7	3.7	1.1	3.6	1.3	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Max Out Probability	0.00	1.00	0.00	0.05	0.00	0.36	0.00	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	328	952	290	194	613	125	280	731	211	355	882	222
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1632	1680	1496	1632	1680	1496	1616	1664	1481	1616	1664	1481
Queue Service Time (g_s), s	12.7	35.7	18.4	7.5	21.5	7.2	10.9	25.8	13.5	13.9	32.4	15.8
Cycle Queue Clearance Time (g_c), s	12.7	35.7	18.4	7.5	21.5	7.2	10.9	25.8	13.5	13.9	32.4	15.8
Green Ratio (*g/C*)	0.12	0.30	0.41	0.08	0.26	0.39	0.11	0.29	0.37	0.13	0.31	0.31
Capacity (*c*), veh/h	404	1016	614	256	864	583	350	976	551	428	1018	453
Volume-to-Capacity Ratio (*X*)	0.811	0.936	0.472	0.755	0.709	0.214	0.798	0.749	0.383	0.828	0.866	0.489
Back of Queue (*Q*), ft/ln (95 th percentile)	232.4	589.9	272.8	148.6	356.1	51.4	207.8	422.8	124	239.5	506.3	248.4
Back of Queue (*Q*), veh/ln (95 th percentile)	9.2	23.2	10.7	5.9	14.0	2.0	8.1	16.5	4.8	9.4	19.8	9.7
Queue Storage Ratio (*RQ*) (95 th percentile)	0.89	0.00	1.33	0.99	0.00	0.23	0.97	0.00	0.75	1.11	0.00	1.06
Uniform Delay (d_1), s/veh	55.3	44.0	27.9	58.5	43.7	15.7	56.4	41.4	14.3	54.7	42.4	36.7
Incremental Delay (d_2), s/veh	4.0	15.0	0.7	4.5	1.9	0.2	4.2	5.3	2.0	3.5	8.4	3.1
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	59.2	59.0	28.6	62.9	45.6	15.9	60.5	46.7	16.3	58.2	50.8	39.8
Level of Service (LOS)	E	E	C	E	D	B	E	D	B	E	D	D
Approach Delay, s/veh / LOS	53.4		D	45.2		D	44.6		D	51.0		D
Intersection Delay, s/veh / LOS	49.2						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.1	C	3.1	C	3.3	C	3.1	C
Bicycle LOS Score / LOS	1.8	A	1.3	A	1.5	A	1.7	A

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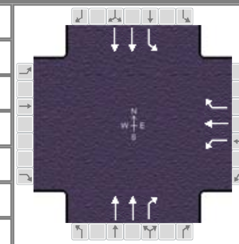
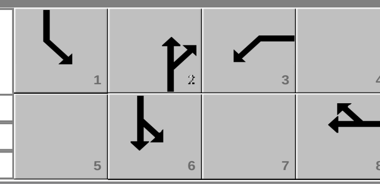
HCS 2010 Signalized Intersection Results Summary



General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Aug 16, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM Peak	PHF	0.93
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 4:30
Intersection	Lotta	File Name	Minn-2_C_2035_PM_081616.xus		
Project Description	2035 PM - Minn 2C				

Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				60	0	100		1175	40	230	1340	

Signal Information										
Cycle, s	113.0	Reference Phase	2							
Offset, s	0	Reference Point	End	Green	6.3	80.0	10.2	0.0	0.0	0.0
Uncoordinated	No	Simult. Gap E/W	On	Yellow	3.5	4.5	3.5	0.0	0.0	0.0
Force Mode	Fixed	Simult. Gap N/S	On	Red	2.0	1.0	2.0	0.0	0.0	0.0



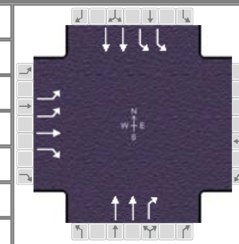
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase				8		2	1	6
Case Number				9.0		7.3	1.0	4.0
Phase Duration, s				15.7		85.5	11.8	97.3
Change Period, (*Y+R* $_c$), s				5.5		5.5	5.5	5.5
Max Allow Headway (*MAH*), s				3.4		0.0	3.1	0.0
Queue Clearance Time (g_s), s				10.0			5.9	
Green Extension Time (g_e), s				0.3		0.0	0.4	0.0
Phase Call Probability				1.00			1.00	
Max Out Probability				0.00			0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement				3	8	18		2	12	1	6	
Adjusted Flow Rate (*v*), veh/h				65	0	108		1243	42	247	1441	
Adjusted Saturation Flow Rate (*s*), veh/h/ln				1681	1765	1496		1664	1481	1664	1664	
Queue Service Time (g_s), s				4.1	0.0	8.0		19.7	1.0	3.9	9.5	
Cycle Queue Clearance Time (g_c), s				4.1	0.0	8.0		19.7	1.0	3.9	9.5	
Green Ratio (*g/C*)				0.09	0.09	0.09		0.71	0.71	0.78	0.81	
Capacity (*c*), veh/h				152	159	135		2354	1048	392	2703	
Volume-to-Capacity Ratio (*X*)				0.425	0.000	0.796		0.528	0.040	0.630	0.533	
Back of Queue (*Q*), ft/ln (95 th percentile)				80.7	0	143.9		234.4	12.3	82.4	70.6	
Back of Queue (*Q*), veh/ln (95 th percentile)				3.2	0.0	5.7		9.2	0.5	3.2	2.8	
Queue Storage Ratio (*RQ*) (95 th percentile)				0.08	0.00	0.96		0.00	0.08	0.55	0.00	
Uniform Delay (d_1), s/veh				48.6	0.0	50.4		7.7	5.0	8.7	1.6	
Incremental Delay (d_2), s/veh				0.7	0.0	4.0		0.5	0.0	0.5	0.6	
Initial Queue Delay (d_3), s/veh				0.0	0.0	0.0		0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh				49.3	0.0	54.4		8.3	5.0	9.2	2.2	
Level of Service (LOS)				D		D		A	A	A	A	

	EB		WB		NB		SB	
Approach Delay, s/veh / LOS	0.0		52.5	D	8.2	A	3.2	A
Intersection Delay, s/veh / LOS	7.9				A			

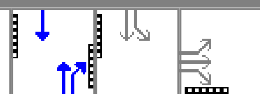
Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.9	C	2.4	B	1.8	A
Bicycle LOS Score / LOS			0.8	A	1.6	A	1.9	A

HCS 2010 Signalized Intersection Results Summary

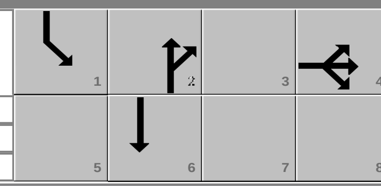


General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Aug 16, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM Peak	PHF	0.93
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 4:30
Intersection	Minnesota Ave & I-229…	File Name	Minn-2_C_2035_PM_081616.xus		
Project Description	2035 PM - Minn 2C				

Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	260	0	160					1080	175	330	1400	



Signal Information									
Cycle, s	113.0	Reference Phase	2						
Offset, s	40	Reference Point	Begin	Green	66.6	15.4	12.4	0.0	0.0	0.0
Uncoordinated	No	Simult. Gap E/W	Off	Yellow	4.5	3.5	3.5	0.0	0.0	0.0
Force Mode	Fixed	Simult. Gap N/S	Off	Red	1.0	3.0	3.0	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4				2	1	6
Case Number		9.0				7.3	2.0	4.0
Phase Duration, s		18.9				72.1	21.9	94.1
Change Period, (*Y+R* $_c$), s		6.5				5.5	6.5	6.5
Max Allow Headway (*MAH*), s		3.5				0.0	4.1	0.0
Queue Clearance Time (g_s), s		11.5					14.3	
Green Extension Time (g_e), s		0.9				0.0	1.1	0.0
Phase Call Probability		1.00					1.00	
Max Out Probability		0.00					0.01	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14					2	12	1	6	
Adjusted Flow Rate (*v*), veh/h	280	0	44					1144	165	355	1505	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1616	1633	1435					1693	1417	1616	1742	
Queue Service Time (g_s), s	9.5	0.0	3.2					27.1	8.1	12.3	19.0	
Cycle Queue Clearance Time (g_c), s	9.5	0.0	3.2					27.1	8.1	12.3	19.0	
Green Ratio (*g/C*)	0.11	0.11	0.11					0.59	0.59	0.14	0.77	
Capacity (*c*), veh/h	356	180	158					1996	836	442	2700	
Volume-to-Capacity Ratio (*X*)	0.786	0.000	0.279					0.573	0.198	0.803	0.558	
Back of Queue (*Q*), ft/ln (95 th percentile)	180.4	0	52					402.2	123.3	194.2	178	
Back of Queue (*Q*), veh/ln (95 th percentile)	7.0	0.0	2.1					15.7	4.8	7.6	7.0	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.40	0.00	0.21					0.00	0.95	0.97	0.00	
Uniform Delay (d_1), s/veh	49.0	0.0	46.2					18.8	15.3	52.6	4.9	
Incremental Delay (d_2), s/veh	2.4	0.0	0.6					1.0	0.4	1.2	0.3	
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0					0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	51.4	0.0	46.8					19.8	15.8	53.8	5.2	
Level of Service (LOS)	D		D					B	B	D	A	
Approach Delay, s/veh / LOS	50.8	D		0.0			19.3	B		14.5	B	
Intersection Delay, s/veh / LOS	19.6						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	3.0	C	2.5	B	2.2	B
Bicycle LOS Score / LOS	1.0	A			1.6	A	2.0	B

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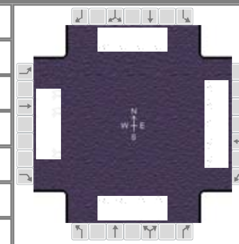
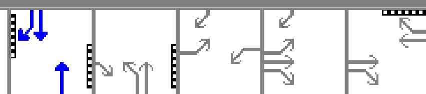
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Aug 16, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM Peak	PHF	0.93
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 4:30
Intersection	Minnesota Ave 49th St/I-…	File Name	Minn-2_C_2035_PM_081616.xus		
Project Description	2035 PM - Minn 2C				

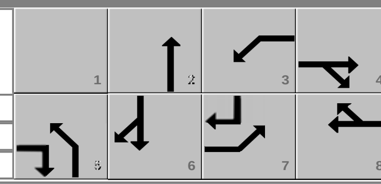


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	450	0	250	290	75	115	425	795			1660	260

Signal Information			
Cycle, s	113.0	Reference Phase	6
Offset, s	26	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	Off
Force Mode	Float	Simult. Gap N/S	Off



Green	44.0	17.8	13.5	5.7	8.1	0.0
Yellow	4.1	3.0	3.2	0.0	4.0	0.0
Red	1.4	3.4	3.4	0.0	1.4	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2		6
Case Number	2.0	3.0	2.0	3.0	2.0	4.0		7.3
Phase Duration, s	25.8	19.2	20.1	13.5	24.2	73.7		49.5
Change Period, (*Y+R* $_c$), s	6.6	5.4	6.6	5.4	6.4	6.4		5.5
Max Allow Headway (*MAH*), s	3.4	3.7	3.4	3.4	4.2	0.0		0.0
Queue Clearance Time (g_s), s	18.3	15.8	12.6	7.5	17.3			
Green Extension Time (g_e), s	0.9	0.0	0.9	0.5	0.5	0.0		0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00			
Max Out Probability	0.19	1.00	0.00	0.00	1.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h	484	0	269	312	81	124	451	844			1785	280
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1632	1649	1453	1616	1652	1236	1616	1654			1620	1442
Queue Service Time (g_s), s	16.3	0.0	13.8	10.6	5.4	5.5	15.3	12.3			39.2	10.2
Cycle Queue Clearance Time (g_c), s	16.3	0.0	13.8	10.6	5.4	5.5	15.3	12.3			39.2	10.2
Green Ratio (*g/C*)	0.17	0.12	0.28	0.12	0.07	0.07	0.16	0.60			0.39	0.56
Capacity (*c*), veh/h	554	201	406	386	119	178	508	1971			1895	807
Volume-to-Capacity Ratio (*X*)	0.873	0.000	0.662	0.807	0.679	0.696	0.889	0.428			0.942	0.347
Back of Queue (*Q*), ft/ln (95 th percentile)	294.2	0	175.2	199.5	107.2	81	257	171.4			448.7	69
Back of Queue (*Q*), veh/ln (95 th percentile)	11.6	0.0	6.9	7.8	4.2	3.2	10.0	6.7			17.5	2.7
Queue Storage Ratio (*RQ*) (95 th percentile)	0.62	0.00	0.37	0.81	0.00	0.33	0.73	0.00			0.00	0.23
Uniform Delay (d_1), s/veh	45.7	0.0	5.7	48.5	51.2	51.2	42.0	8.6			26.9	4.0
Incremental Delay (d_2), s/veh	8.7	0.0	3.5	2.5	3.6	2.6	12.0	0.5			4.0	0.4
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	54.4	0.0	9.2	51.0	54.8	53.9	54.0	9.1			30.9	4.3
Level of Service (LOS)	D		A	D	D	D	D	A			C	A
Approach Delay, s/veh / LOS	38.2	D		52.3	D		24.8	C		27.3	C	
Intersection Delay, s/veh / LOS	31.2						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.3	C	3.0	C	2.7	B	3.0	C
Bicycle LOS Score / LOS	1.7	A	1.3	A	1.6	A	1.6	A

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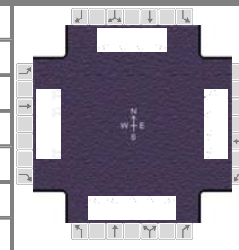
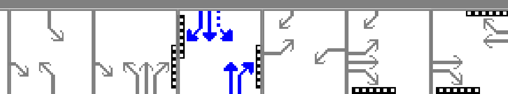
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Aug 16, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Minnesota Ave & 41st St	File Name	Minn-2_D_2035_AM_081616.xus		
Project Description	2035 AM - Build Minn-2D				

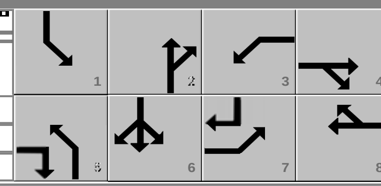


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	350	180	110	210	220	70	190	1360	100	100	690	230

Signal Information			
Cycle, s	115.0	Reference Phase	2
Offset, s	30	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Float	Simult. Gap N/S	On



Green	4.6	5.4	50.8	11.1	6.3	14.2
Yellow	3.0	0.0	4.0	3.0	0.0	4.0
Red	3.0	0.0	1.0	3.0	0.0	1.5



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	4.0	2.0	3.0	1.1	3.0
Phase Duration, s	23.4	26.1	17.1	19.7	16.0	61.2	10.6	55.8
Change Period, ($Y+R_c$), s	6.5	5.5	6.0	5.5	6.0	5.0	6.0	5.0
Max Allow Headway (*MAH*), s	3.5	4.2	3.5	4.2	3.5	0.0	3.5	0.0
Queue Clearance Time (g_s), s	16.2	14.9	10.5	12.6	9.7		6.6	
Green Extension Time (g_e), s	0.8	1.3	0.6	1.6	0.1	0.0	0.0	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		0.98	
Max Out Probability	0.10	0.49	0.00	0.18	1.00		1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	412	212	74	247	163	157	220	1575	100	118	812	222
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1632	1765	1496	1632	1765	1649	1616	1664	1481	1664	1664	1481
Queue Service Time (g_s), s	14.2	12.9	4.4	8.5	10.3	10.6	7.7	51.7	2.3	4.6	17.1	6.5
Cycle Queue Clearance Time (g_c), s	14.2	12.9	4.4	8.5	10.3	10.6	7.7	51.7	2.3	4.6	17.1	6.5
Green Ratio (*g/C*)	0.15	0.18	0.27	0.10	0.12	0.12	0.09	0.49	0.49	0.48	0.44	0.59
Capacity (*c*), veh/h	481	316	398	315	219	204	281	1627	724	136	1471	873
Volume-to-Capacity Ratio (*X*)	0.857	0.671	0.186	0.785	0.746	0.769	0.784	0.968	0.138	0.868	0.552	0.255
Back of Queue (*Q*), ft/ln (95 th percentile)	261.5	256.6	74.4	164.1	213.7	206.2	159.7	670	35.6	147.7	252.1	94.4
Back of Queue (*Q*), veh/ln (95 th percentile)	10.3	10.1	2.9	6.5	8.4	8.2	6.2	26.2	1.4	5.8	9.8	3.7
Queue Storage Ratio (*RQ*) (95 th percentile)	1.41	0.00	0.50	0.94	0.00	0.00	0.89	0.00	0.07	0.57	0.00	0.21
Uniform Delay (d_1), s/veh	47.9	44.0	32.6	50.8	48.6	48.8	53.1	20.9	8.1	27.4	16.7	8.1
Incremental Delay (d_2), s/veh	7.1	5.1	0.2	2.7	5.0	6.0	7.6	13.6	0.3	40.1	1.5	0.7
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	54.9	49.1	32.8	53.5	53.6	54.8	60.7	34.5	8.4	67.5	18.2	8.8
Level of Service (LOS)	D	D	C	D	D	D	E	C	A	E	B	A
Approach Delay, s/veh / LOS	50.8	D		53.9	D		36.2	D		21.4	C	
Intersection Delay, s/veh / LOS	36.9						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.1	C	3.0	C	2.6	B	3.0	C
Bicycle LOS Score / LOS	1.6	A	1.0	A	2.1	B	1.4	A

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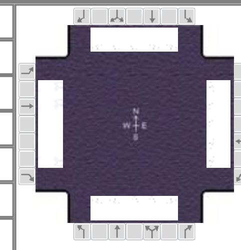
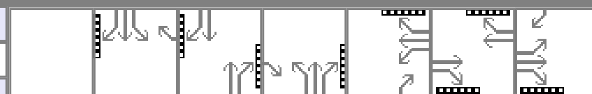
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Aug 16, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Minnesota Ave & 57th St	File Name	Minn-2_D_2035_AM_081616.xus		
Project Description	2035 AM - Build Minn-2D				

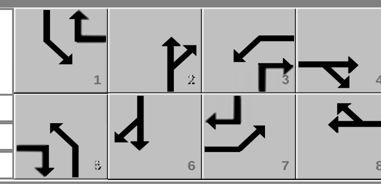


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	335	435	250	120	740	320	305	1140	100	155	545	165

Signal Information				
Cycle, s	145.1	Reference Phase	2
Offset, s	1	Reference Point	Begin
Uncoordinated	Yes	Simult. Gap E/W	Off
Force Mode	Fixed	Simult. Gap N/S	Off



Green	10.1	24.9	25.6	8.3	19.7	18.0
Yellow	3.5	4.5	3.5	3.5	4.0	3.5
Red	3.5	1.0	3.5	3.5	1.0	3.5



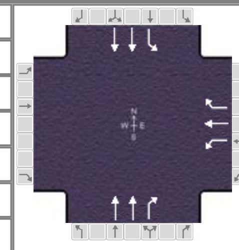
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	25.0	49.7	15.3	40.0	32.6	63.0	17.1	47.5
Change Period, (*Y+R c*), s	7.0	7.0	7.0	5.0	7.0	7.0	7.0	5.5
Max Allow Headway (*MAH*), s	4.1	4.6	4.1	4.6	4.1	4.5	4.1	4.5
Queue Clearance Time (*g s*), s	19.5	20.4	8.2	37.0	16.9	58.0	10.1	26.6
Green Extension Time (*g e*), s	0.0	1.0	0.1	0.0	0.8	0.0	0.1	3.7
Phase Call Probability	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Max Out Probability	1.00	1.00	1.00	1.00	0.33	1.00	1.00	0.09

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	394	512	202	141	871	226	359	1341	118	182	641	159
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1632	1680	1496	1632	1680	1496	1616	1664	1481	1616	1664	1481
Queue Service Time (*g s*), s	17.5	18.4	12.0	6.2	35.0	17.8	14.9	56.0	7.0	8.1	24.6	10.2
Cycle Queue Clearance Time (*g c*), s	17.5	18.4	12.0	6.2	35.0	17.8	14.9	56.0	7.0	8.1	24.6	10.2
Green Ratio (*g/C*)	0.12	0.29	0.47	0.06	0.24	0.31	0.18	0.39	0.44	0.07	0.29	0.41
Capacity (*c*), veh/h	405	989	704	186	810	465	571	1284	656	225	963	612
Volume-to-Capacity Ratio (*X*)	0.974	0.517	0.287	0.759	1.074	0.486	0.629	1.045	0.179	0.809	0.666	0.259
Back of Queue (*Q*), ft/ln (95 th percentile)	362.7	309.6	98	128.5	746	246.4	263.3	1002.8	117.5	174.8	399.7	174
Back of Queue (*Q*), veh/ln (95 th percentile)	14.3	12.2	3.9	5.1	29.4	9.7	10.3	39.2	4.6	6.8	15.6	6.8
Queue Storage Ratio (*RQ*) (95 th percentile)	1.40	0.00	0.48	0.86	0.00	1.10	1.22	0.00	0.71	0.81	0.00	0.74
Uniform Delay (*d 1*), s/veh	63.3	42.6	6.8	67.4	55.1	1.3	55.3	44.6	24.5	66.5	45.4	28.0
Incremental Delay (*d 2*), s/veh	37.7	0.6	0.3	9.2	53.5	0.9	2.2	37.6	0.6	15.8	3.4	1.0
Initial Queue Delay (*d 3*), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	101.0	43.2	7.1	76.6	108.6	2.3	57.5	82.2	25.1	82.4	48.8	28.9
Level of Service (LOS)	F	D	A	E	F	A	E	F	C	F	D	C
Approach Delay, s/veh / LOS	57.1	E		85.5	F		73.6	E		51.8	D	
Intersection Delay, s/veh / LOS	68.8						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.1	C	3.1	C	3.2	C	3.2	C
Bicycle LOS Score / LOS	1.4	A	1.5	A	2.0	A	1.3	A

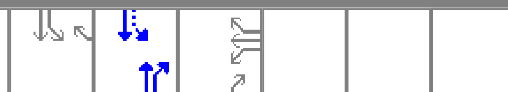
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Aug 16, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Lotta	File Name	Minn-2_D_2035_AM_081616.xus		
Project Description	2035 AM - Build Minn-2D				

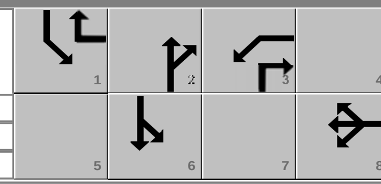


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				40	0	220		1775	20	60	820	

Signal Information				
Cycle, s	115.0	Reference Phase	2	
Offset, s	0	Reference Point	End	
Uncoordinated	No	Simult. Gap E/W	On	
Force Mode	Fixed	Simult. Gap N/S	On	



Green	4.5	73.0	21.0	0.0	0.0	0.0
Yellow	3.5	4.5	3.5	0.0	0.0	0.0
Red	2.0	1.0	2.0	0.0	0.0	0.0



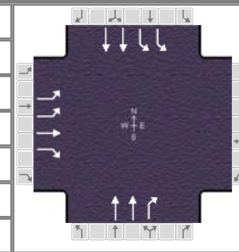
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase				8		2	1	6
Case Number				9.0		7.3	1.0	4.0
Phase Duration, s				26.5		78.5	10.0	88.5
Change Period, (*Y+R* $_c$), s				5.5		5.5	5.5	5.5
Max Allow Headway (*MAH*), s				3.5		0.0	3.1	0.0
Queue Clearance Time (g_s), s				20.7			3.6	
Green Extension Time (g_e), s				0.3		0.0	0.1	0.0
Phase Call Probability				1.00			0.90	
Max Out Probability				0.82			0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement				3	8	18		2	12	1	6	
Adjusted Flow Rate (*v*), veh/h				47	0	259		2032	23	71	965	
Adjusted Saturation Flow Rate (*s*), veh/h/ln				1681	1765	1496		1664	1481	1664	1664	
Queue Service Time (g_s), s				2.7	0.0	18.7		65.8	0.3	1.6	15.0	
Cycle Queue Clearance Time (g_c), s				2.7	0.0	18.7		65.8	0.3	1.6	15.0	
Green Ratio (*g/C*)				0.18	0.18	0.22		0.63	0.82	0.69	0.72	
Capacity (*c*), veh/h				307	323	332		2112	1211	140	2401	
Volume-to-Capacity Ratio (*X*)				0.153	0.000	0.781		0.962	0.019	0.503	0.402	
Back of Queue (*Q*), ft/ln (95 th percentile)				52.2	0	309.4		661.3	2.7	59.3	217.1	
Back of Queue (*Q*), veh/ln (95 th percentile)				2.1	0.0	12.2		25.8	0.1	2.3	8.5	
Queue Storage Ratio (*RQ*) (95 th percentile)				0.05	0.00	2.06		0.00	0.02	0.40	0.00	
Uniform Delay (d_1), s/veh				39.5	0.0	42.1		19.7	1.9	29.8	7.7	
Incremental Delay (d_2), s/veh				0.1	0.0	7.6		3.1	0.0	1.0	0.5	
Initial Queue Delay (d_3), s/veh				0.0	0.0	0.0		0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh				39.6	0.0	49.7		22.8	1.9	30.8	8.2	
Level of Service (LOS)				D		D		C	A	C	A	
Approach Delay, s/veh / LOS	0.0			48.2		D	22.6		C	9.7		A
Intersection Delay, s/veh / LOS			21.0						C			

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.9	C	2.4	B	1.9	A
Bicycle LOS Score / LOS			1.0	A	2.2	B	1.3	A

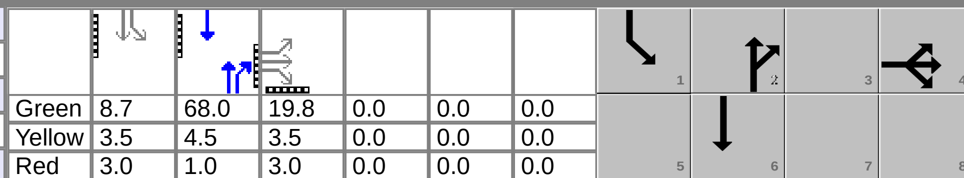
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Aug 16, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Minnesota Ave & I-229…	File Name	Minn-2_D_2035_AM_081616.xus		
Project Description	2035 AM - Build Minn-2D				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	400	0	120					1655	330	150	750	

Signal Information			
Cycle, s	115.0	Reference Phase	2
Offset, s	5	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Float	Simult. Gap N/S	On



Green	8.7	68.0	19.8	0.0	0.0	0.0
Yellow	3.5	4.5	3.5	0.0	0.0	0.0
Red	3.0	1.0	3.0	0.0	0.0	0.0

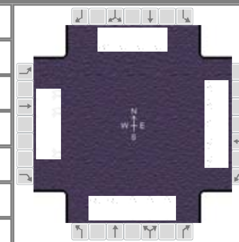
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4				2	1	6
Case Number		9.0				7.3	2.0	4.0
Phase Duration, s		26.3				73.5	15.2	88.7
Change Period, (*Y+R c*), s		6.5				5.5	6.5	5.5
Max Allow Headway (*MAH*), s		3.5				0.0	4.1	0.0
Queue Clearance Time (*g s*), s		18.2					8.1	
Green Extension Time (*g e*), s		1.6				0.0	0.7	0.0
Phase Call Probability		1.00					1.00	
Max Out Probability		0.00					0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14					2	12	1	6	
Adjusted Flow Rate (*v*), veh/h	471	0	54					1900	360	176	882	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1616	1633	1437					1800	1460	1616	1661	
Queue Service Time (*g s*), s	16.2	0.0	3.7					46.7	5.9	6.1	8.7	
Cycle Queue Clearance Time (*g c*), s	16.2	0.0	3.7					46.7	5.9	6.1	8.7	
Green Ratio (*g/C*)	0.17	0.17	0.17					0.59	0.59	0.08	0.64	
Capacity (*c*), veh/h	556	281	247					2130	864	244	2126	
Volume-to-Capacity Ratio (*X*)	0.846	0.000	0.219					0.892	0.417	0.724	0.415	
Back of Queue (*Q*), ft/ln (95 th percentile)	277	0	59.9					387.6	56.6	111.9	107.5	
Back of Queue (*Q*), veh/ln (95 th percentile)	10.8	0.0	2.4					15.1	2.2	4.4	4.2	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.62	0.00	0.24					0.00	0.44	0.56	0.00	
Uniform Delay (*d 1*), s/veh	46.1	0.0	41.0					12.4	3.5	49.4	3.8	
Incremental Delay (*d 2*), s/veh	2.3	0.0	0.3					1.5	0.3	3.2	0.5	
Initial Queue Delay (*d 3*), s/veh	0.0	0.0	0.0					0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	48.4	0.0	41.2					14.0	3.9	52.7	4.3	
Level of Service (LOS)	D		D					B	A	D	A	
Approach Delay, s/veh / LOS	47.7	D		0.0			12.4	B		12.3	B	
Intersection Delay, s/veh / LOS	17.2						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	3.0	C	2.4	B	2.2	B
Bicycle LOS Score / LOS	1.4	A			2.4	B	1.4	A

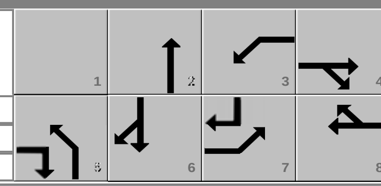
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Aug 16, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Minnesota Ave 49th St/I-…	File Name	Minn-2_D_2035_AM_081616.xus		
Project Description	2035 AM - Build Minn-2D				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	150	0	230	210	105	155	485	1460			750	300

Signal Information										
Cycle, s	115.0	Reference Phase	2							
Offset, s	0	Reference Point	Begin	Green	22.0	41.4	8.4	2.7	16.6	0.0
Uncoordinated	No	Simult. Gap E/W	On	Yellow	3.0	4.1	3.2	0.0	4.0	0.0
Force Mode	Float	Simult. Gap N/S	On	Red	3.4	1.4	3.4	0.0	1.4	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2		6
Case Number	2.0	3.0	2.0	3.0	2.0	4.0		7.3
Phase Duration, s	15.0	22.0	17.7	24.7	28.4	75.3		46.9
Change Period, (*Y+R* $_c$), s	6.6	5.4	6.6	5.4	6.4	5.5		5.5
Max Allow Headway (*MAH*), s	3.4	3.6	3.4	3.6	4.2	0.0		0.0
Queue Clearance Time (g_s), s	8.1	18.6	10.6	9.7	21.2			
Green Extension Time (g_e), s	0.4	0.0	0.5	1.1	0.8	0.0		0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00			
Max Out Probability	0.00	1.00	0.00	0.22	1.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h	176	0	271	247	124	182	559	1684			882	353
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1632	1649	1455	1616	1663	1241	1616	1614			1549	1459
Queue Service Time (g_s), s	6.1	0.0	16.6	8.6	7.7	7.6	19.2	16.7			18.4	21.0
Cycle Queue Clearance Time (g_c), s	6.1	0.0	16.6	8.6	7.7	7.6	19.2	16.7			18.4	21.0
Green Ratio (*g/C*)	0.07	0.14	0.34	0.10	0.17	0.17	0.19	0.61			0.36	0.43
Capacity (*c*), veh/h	240	238	488	313	279	416	617	2938			1673	632
Volume-to-Capacity Ratio (*X*)	0.736	0.000	0.555	0.789	0.443	0.438	0.906	0.573			0.527	0.558
Back of Queue (*Q*), ft/ln (95 th percentile)	117.1	0	260	164.1	146.8	107.7	257.3	157.1			286.9	303.7
Back of Queue (*Q*), veh/ln (95 th percentile)	4.6	0.0	10.2	6.4	5.7	4.2	10.1	6.1			11.2	11.9
Queue Storage Ratio (*RQ*) (95 th percentile)	0.25	0.00	0.55	0.67	0.00	0.44	0.74	0.00			0.00	1.00
Uniform Delay (d_1), s/veh	52.2	0.0	31.2	50.8	43.0	43.0	39.5	7.2			33.0	25.1
Incremental Delay (d_2), s/veh	2.7	0.0	1.0	2.8	0.7	0.4	6.2	0.3			0.9	2.8
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	54.9	0.0	32.2	53.5	43.7	43.4	45.7	7.5			33.9	27.9
Level of Service (LOS)	D		C	D	D	D	D	A			C	C
Approach Delay, s/veh / LOS	41.2	D		48.0	D		17.0	B		32.2	C	
Intersection Delay, s/veh / LOS	27.5						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.4	C	3.3	C	2.7	B	3.0	C
Bicycle LOS Score / LOS	1.2	A	1.4	A	1.7	A	1.2	A

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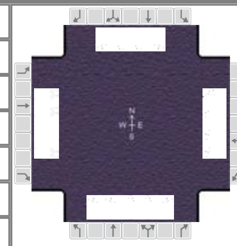
HCS 2010 Signalized Intersection Results Summary

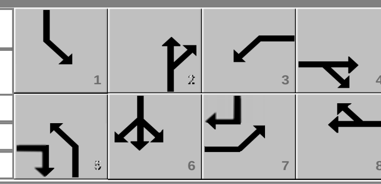
General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Aug 16, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM Peak	PHF	0.93
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 4:30
Intersection	Minnesota Ave & 41st St	File Name	Minn-2_D_2035_PM_081616.xus		
Project Description	2035 PM - Minn-2D				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	400	250	280	340	290	60	330	865	180	90	1120	390

Signal Information			
Cycle, s	113.0	Reference Phase	6
Offset, s	0	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	Off
Force Mode	Fixed	Simult. Gap N/S	On

Green	41.1	4.7	4.8	14.4	5.1	15.4
Yellow	4.0	4.0	3.0	4.0	0.0	3.0
Red	1.0	1.0	3.0	1.5	0.0	3.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	4.0	2.0	3.0	1.4	3.0
Phase Duration, s	26.5	25.0	21.4	19.9	20.5	55.8	10.8	46.1
Change Period, (*Y+R* $_c$), s	6.5	5.5	6.5	5.5	6.0	5.0	6.0	5.0
Max Allow Headway (*MAH*), s	3.5	4.3	3.5	4.1	3.5	0.0	3.5	0.0
Queue Clearance Time (g_s), s	15.8	18.6	14.4	13.7	14.2		2.0	
Green Extension Time (g_e), s	0.7	0.9	0.5	0.7	0.3	0.0	0.7	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		0.95	
Max Out Probability	0.33	0.96	1.00	0.35	1.00		0.35	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	430	269	231	366	184	178	355	930	156	97	1204	373
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1632	1765	1496	1632	1765	1679	1616	1664	1525	1664	1664	1481
Queue Service Time (g_s), s	13.8	16.6	14.3	12.4	11.5	11.7	12.2	24.2	6.7	0.0	40.7	15.9
Cycle Queue Clearance Time (g_c), s	13.8	16.6	14.3	12.4	11.5	11.7	12.2	24.2	6.7	0.0	40.7	15.9
Green Ratio (*g/C*)	0.18	0.17	0.30	0.13	0.13	0.13	0.13	0.45	0.45	0.41	0.36	0.54
Capacity (*c*), veh/h	577	304	450	431	225	214	415	1497	686	210	1210	800
Volume-to-Capacity Ratio (*X*)	0.746	0.883	0.514	0.849	0.816	0.832	0.856	0.621	0.227	0.460	0.995	0.466
Back of Queue (*Q*), ft/ln (95 th percentile)	241	337.9	216.9	246.5	245.1	239.6	231.4	367.4	145.1	122.1	653.7	215
Back of Queue (*Q*), veh/ln (95 th percentile)	9.5	13.3	8.5	9.7	9.6	9.6	9.0	14.4	5.8	4.8	25.5	8.4
Queue Storage Ratio (*RQ*) (95 th percentile)	1.30	0.00	1.45	1.41	0.00	0.00	1.29	0.00	0.29	0.47	0.00	0.48
Uniform Delay (d_1), s/veh	40.8	42.4	30.0	47.9	48.0	48.1	48.8	23.9	17.9	44.4	29.0	12.1
Incremental Delay (d_2), s/veh	4.3	19.7	0.9	12.6	11.1	13.2	9.9	1.6	0.6	1.0	24.7	1.9
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	45.2	62.1	30.9	60.5	59.1	61.3	58.7	25.6	18.6	45.4	53.7	14.1
Level of Service (LOS)	D	E	C	E	E	E	E	C	B	D	D	B
Approach Delay, s/veh / LOS	46.5		D	60.4		E	33.0		C	44.4		D
Intersection Delay, s/veh / LOS	43.8						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.1	C	3.0	C	2.6	B	3.1	C
Bicycle LOS Score / LOS	2.0	B	1.1	A	1.7	A	1.9	A

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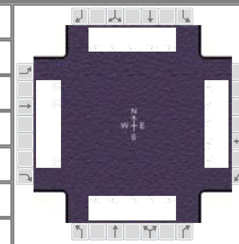
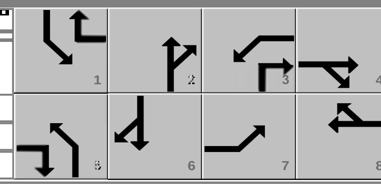
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Aug 16, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM Peak	PHF	0.93
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 4:30
Intersection	Minnesota Ave & 57th St	File Name	Minn-2_D_2035_PM_081616.xus		
Project Description	2035 PM - Minn-2D				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	305	885	300	180	570	230	260	680	200	330	820	225

Signal Information										
Cycle, s	129.5	Reference Phase	2							
Offset, s	83	Reference Point	Begin	Green	14.0	17.0	17.2	10.2	5.9	33.8
Uncoordinated	Yes	Simult. Gap E/W	Off	Yellow	3.5	4.5	3.5	3.5	0.0	4.0
Force Mode	Fixed	Simult. Gap N/S	Off	Red	3.5	1.0	3.5	3.5	0.0	1.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	23.0	44.7	17.2	38.8	21.0	43.5	24.2	46.6
Change Period, ($Y+R_c$), s	7.0	5.5	7.0	5.5	7.0	5.5	7.0	7.0
Max Allow Headway (*MAH*), s	4.1	4.6	4.1	4.6	4.1	4.6	4.1	4.5
Queue Clearance Time (g_s), s	14.7	37.7	9.5	23.5	12.9	27.8	15.9	34.4
Green Extension Time (g_e), s	1.4	1.5	0.7	3.7	1.1	3.6	1.3	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Max Out Probability	0.00	1.00	0.00	0.05	0.00	0.36	0.00	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	328	952	290	194	613	125	280	731	211	355	882	222
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1632	1680	1496	1632	1680	1496	1616	1664	1481	1616	1664	1481
Queue Service Time (g_s), s	12.7	35.7	18.4	7.5	21.5	7.2	10.9	25.8	13.5	13.9	32.4	15.8
Cycle Queue Clearance Time (g_c), s	12.7	35.7	18.4	7.5	21.5	7.2	10.9	25.8	13.5	13.9	32.4	15.8
Green Ratio (*g/C*)	0.12	0.30	0.41	0.08	0.26	0.39	0.11	0.29	0.37	0.13	0.31	0.31
Capacity (*c*), veh/h	404	1016	614	256	864	583	350	976	551	428	1018	453
Volume-to-Capacity Ratio (*X*)	0.811	0.936	0.472	0.755	0.709	0.214	0.798	0.749	0.383	0.828	0.866	0.489
Back of Queue (*Q*), ft/ln (95 th percentile)	232.4	589.9	272.8	148.6	356.1	51.4	207.8	422.8	124	239.5	506.3	248.4
Back of Queue (*Q*), veh/ln (95 th percentile)	9.2	23.2	10.7	5.9	14.0	2.0	8.1	16.5	4.8	9.4	19.8	9.7
Queue Storage Ratio (*RQ*) (95 th percentile)	0.89	0.00	1.33	0.99	0.00	0.23	0.97	0.00	0.75	1.11	0.00	1.06
Uniform Delay (d_1), s/veh	55.3	44.0	27.9	58.5	43.7	15.7	56.4	41.4	14.3	54.7	42.4	36.7
Incremental Delay (d_2), s/veh	4.0	15.0	0.7	4.5	1.9	0.2	4.2	5.3	2.0	3.5	8.4	3.1
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	59.2	59.0	28.6	62.9	45.6	15.9	60.5	46.7	16.3	58.2	50.8	39.8
Level of Service (LOS)	E	E	C	E	D	B	E	D	B	E	D	D
Approach Delay, s/veh / LOS	53.4	D		45.2	D		44.6	D		51.0	D	
Intersection Delay, s/veh / LOS	49.2						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.1	C	3.1	C	3.3	C	3.1	C
Bicycle LOS Score / LOS	1.8	A	1.3	A	1.5	A	1.7	A

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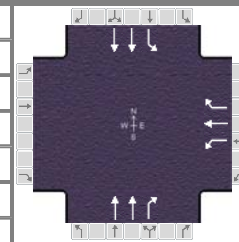
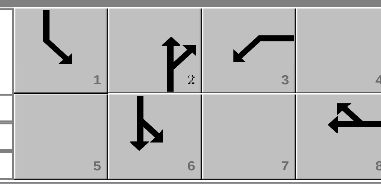
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Aug 16, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM Peak	PHF	0.93
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 4:30
Intersection	Lotta	File Name	Minn-2_D_2035_PM_081616.xus		
Project Description	2035 PM - Minn-2D				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h				60	0	100		1175	40	230	1340	

Signal Information									
Cycle, s	113.0	Reference Phase	2						
Offset, s	0	Reference Point	End	Green	6.3	80.0	10.2	0.0	0.0	0.0
Uncoordinated	No	Simult. Gap E/W	On	Yellow	3.5	4.5	3.5	0.0	0.0	0.0
Force Mode	Fixed	Simult. Gap N/S	On	Red	2.0	1.0	2.0	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase				8		2	1	6
Case Number				9.0		7.3	1.0	4.0
Phase Duration, s				15.7		85.5	11.8	97.3
Change Period, (*Y+R* c), s				5.5		5.5	5.5	5.5
Max Allow Headway (*MAH*), s				3.4		0.0	3.1	0.0
Queue Clearance Time (g_s), s				10.0			5.9	
Green Extension Time (g_e), s				0.3		0.0	0.4	0.0
Phase Call Probability				1.00			1.00	
Max Out Probability				0.00			0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement				3	8	18		2	12	1	6	
Adjusted Flow Rate (*v*), veh/h				65	0	108		1263	43	247	1441	
Adjusted Saturation Flow Rate (*s*), veh/h/ln				1681	1765	1496		1664	1481	1664	1664	
Queue Service Time (g_s), s				4.1	0.0	8.0		20.2	1.0	3.9	9.5	
Cycle Queue Clearance Time (g_c), s				4.1	0.0	8.0		20.2	1.0	3.9	9.5	
Green Ratio (*g/C*)				0.09	0.09	0.09		0.71	0.71	0.78	0.81	
Capacity (*c*), veh/h				152	159	135		2354	1048	386	2703	
Volume-to-Capacity Ratio (*X*)				0.425	0.000	0.796		0.537	0.041	0.641	0.533	
Back of Queue (*Q*), ft/ln (95 th percentile)				80.7	0	143.9		240	12.5	89.2	70.6	
Back of Queue (*Q*), veh/ln (95 th percentile)				3.2	0.0	5.7		9.4	0.5	3.5	2.8	
Queue Storage Ratio (*RQ*) (95 th percentile)				0.08	0.00	0.96		0.00	0.08	0.59	0.00	
Uniform Delay (d_1), s/veh				48.6	0.0	50.4		7.8	5.0	9.1	1.6	
Incremental Delay (d_2), s/veh				0.7	0.0	4.0		0.6	0.0	0.5	0.6	
Initial Queue Delay (d_3), s/veh				0.0	0.0	0.0		0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh				49.3	0.0	54.4		8.4	5.0	9.7	2.2	
Level of Service (LOS)				D		D		A	A	A	A	
Approach Delay, s/veh / LOS	0.0			52.5	D		8.2	A		3.3	A	
Intersection Delay, s/veh / LOS	8.0						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.9	C	2.4	B	1.8	A
Bicycle LOS Score / LOS			0.8	A	1.6	A	1.9	A

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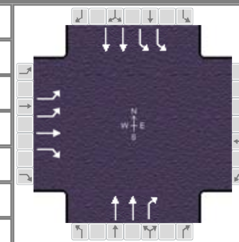
HCS 2010 Signalized Intersection Results Summary

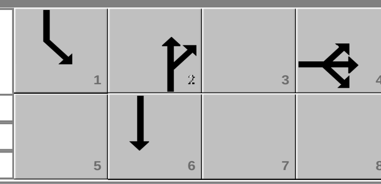
General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Aug 16, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM Peak	PHF	0.93
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 4:30
Intersection	Minnesota Ave & I-229…	File Name	Minn-2_D_2035_PM_081616.xus		
Project Description	2035 PM - Minn-2D				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	260	0	160					1080	175	330	1400	

Signal Information				
Cycle, s	113.0	Reference Phase	2	
Offset, s	40	Reference Point	Begin	
Uncoordinated	No	Simult. Gap E/W	Off	
Force Mode	Fixed	Simult. Gap N/S	Off	

Green	66.6	15.4	12.4	0.0	0.0	0.0
Yellow	4.5	3.5	3.5	0.0	0.0	0.0
Red	1.0	3.0	3.0	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4				2	1	6
Case Number		9.0				7.3	2.0	4.0
Phase Duration, s		18.9				72.1	21.9	94.1
Change Period, (*Y+R* c), s		6.5				5.5	6.5	6.5
Max Allow Headway (*MAH*), s		3.5				0.0	4.1	0.0
Queue Clearance Time (*g* s), s		11.5					14.3	
Green Extension Time (*g* e), s		0.9				0.0	1.1	0.0
Phase Call Probability		1.00					1.00	
Max Out Probability		0.00					0.01	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14					2	12	1	6	
Adjusted Flow Rate (*v*), veh/h	280	0	44					1161	168	355	1505	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1616	1633	1435					1695	1418	1616	1742	
Queue Service Time (*g* s), s	9.5	0.0	3.2					27.7	8.3	12.3	19.0	
Cycle Queue Clearance Time (*g* c), s	9.5	0.0	3.2					27.7	8.3	12.3	19.0	
Green Ratio (*g/C*)	0.11	0.11	0.11					0.59	0.59	0.14	0.77	
Capacity (*c*), veh/h	356	180	158					1999	836	442	2700	
Volume-to-Capacity Ratio (*X*)	0.786	0.000	0.279					0.581	0.201	0.803	0.558	
Back of Queue (*Q*), ft/ln (95 th percentile)	180.4	0	52					409.5	125.5	193.8	176.6	
Back of Queue (*Q*), veh/ln (95 th percentile)	7.0	0.0	2.1					16.0	4.9	7.6	6.9	
Queue Storage Ratio (*RQ*) (95 th percentile)	0.40	0.00	0.21					0.00	0.97	0.97	0.00	
Uniform Delay (*d* 1), s/veh	49.0	0.0	46.2					19.0	15.4	52.7	4.9	
Incremental Delay (*d* 2), s/veh	2.4	0.0	0.6					1.0	0.4	1.2	0.3	
Initial Queue Delay (*d* 3), s/veh	0.0	0.0	0.0					0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	51.4	0.0	46.8					20.0	15.8	53.8	5.2	
Level of Service (LOS)	D		D					B	B	D	A	

	EB		WB		NB		SB	
Approach Delay, s/veh / LOS	50.8	D	0.0		19.5	B	14.4	B
Intersection Delay, s/veh / LOS	19.7				B			

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	3.0	C	2.5	B	2.2	B
Bicycle LOS Score / LOS	1.0	A			1.6	A	2.0	B

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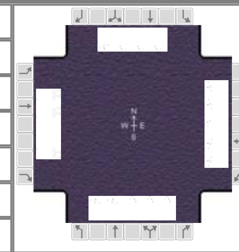
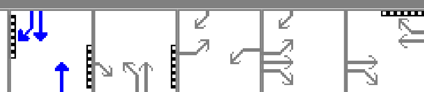
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Aug 16, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM Peak	PHF	0.93
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 4:30
Intersection	Minnesota Ave 49th St/I-…	File Name	Minn-2_D_2035_PM_081616.xus		
Project Description	2035 PM - Minn-2D				

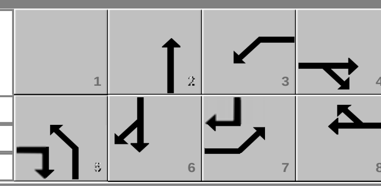


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	450	0	250	290	75	115	425	795			1660	260

Signal Information			
Cycle, s	113.0	Reference Phase	6
Offset, s	26	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	Off
Force Mode	Float	Simult. Gap N/S	Off



Green	43.9	17.9	13.5	5.7	8.1	0.0
Yellow	4.1	3.0	3.2	0.0	4.0	0.0
Red	1.4	3.4	3.4	0.0	1.4	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2		6
Case Number	2.0	3.0	2.0	3.0	2.0	4.0		7.3
Phase Duration, s	25.8	19.2	20.1	13.5	24.3	73.7		49.4
Change Period, ($Y+R_c$), s	6.6	5.4	6.6	5.4	6.4	6.4		5.5
Max Allow Headway (*MAH*), s	3.4	3.7	3.4	3.4	4.2	0.0		0.0
Queue Clearance Time (g_s), s	18.3	15.8	12.6	7.5	17.5			
Green Extension Time (g_e), s	0.9	0.0	0.9	0.5	0.5	0.0		0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00			
Max Out Probability	0.19	1.00	0.00	0.00	1.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h	484	0	269	312	81	124	457	855			1785	280
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1632	1649	1453	1616	1652	1236	1616	1546			1620	1442
Queue Service Time (g_s), s	16.3	0.0	13.8	10.6	5.4	5.5	15.5	7.9			39.3	10.2
Cycle Queue Clearance Time (g_c), s	16.3	0.0	13.8	10.6	5.4	5.5	15.5	7.9			39.3	10.2
Green Ratio (*g/C*)	0.17	0.12	0.28	0.12	0.07	0.07	0.16	0.60			0.39	0.56
Capacity (*c*), veh/h	554	201	408	386	119	178	513	2762			1888	804
Volume-to-Capacity Ratio (*X*)	0.873	0.000	0.659	0.807	0.679	0.696	0.892	0.310			0.946	0.348
Back of Queue (*Q*), ft/ln (95 th percentile)	294.2	0	174	199.5	107.2	81	260.1	112.7			447.8	69.3
Back of Queue (*Q*), veh/ln (95 th percentile)	11.6	0.0	6.8	7.8	4.2	3.2	10.2	4.4			17.5	2.7
Queue Storage Ratio (*RQ*) (95 th percentile)	0.62	0.00	0.37	0.81	0.00	0.33	0.74	0.00			0.00	0.23
Uniform Delay (d_1), s/veh	45.7	0.0	5.7	48.5	51.2	51.2	42.0	8.0			26.6	4.0
Incremental Delay (d_2), s/veh	8.7	0.0	3.4	2.5	3.6	2.6	12.2	0.2			4.3	0.4
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	54.4	0.0	9.1	51.0	54.8	53.9	54.3	8.2			30.9	4.3
Level of Service (LOS)	D		A	D	D	D	D	A			C	A
Approach Delay, s/veh / LOS	38.2	D		52.3	D		24.3	C		27.3	C	
Intersection Delay, s/veh / LOS	31.0						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.4	C	3.3	C	2.7	B	3.0	C
Bicycle LOS Score / LOS	1.7	A	1.3	A	1.2	A	1.6	A

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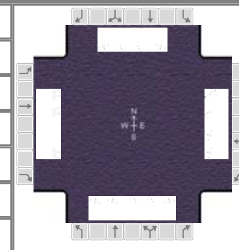
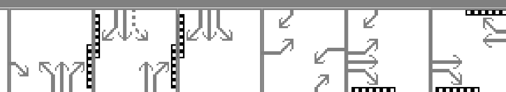
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Aug 16, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 4:30
Intersection	Minnesota Ave & 41st St	File Name	Minn-5-DDI_D_2035_AM.xus		
Project Description	2035 AM - Build Minn-5D				

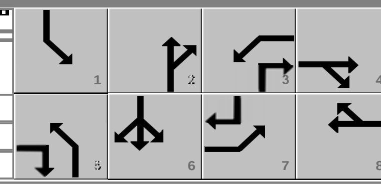


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	360	190	110	210	220	70	260	1515	125	80	710	230

Signal Information			
Cycle, s	125.1	Reference Phase	2
Offset, s	51	Reference Point	Begin
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	12.0	46.8	4.4	11.7	0.5	14.6
Yellow	3.0	4.0	3.0	3.0	3.5	4.0
Red	3.0	1.0	3.0	3.0	3.0	1.5



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	4.0	2.0	3.0	1.3	3.0
Phase Duration, s	24.8	27.1	17.7	20.1	18.0	69.8	10.4	62.2
Change Period, ($Y+R_c$), s	6.5	5.5	6.0	5.5	6.0	5.0	6.0	6.0
Max Allow Headway (*MAH*), s	3.5	4.2	3.5	4.2	3.5	4.1	4.1	4.1
Queue Clearance Time (g_s), s	17.9	17.0	11.3	13.9	13.2	63.8	4.5	20.9
Green Extension Time (g_e), s	0.3	0.7	0.5	0.7	0.0	0.9	0.2	4.4
Phase Call Probability	1.00	1.00	1.00	1.00	1.00	1.00	0.96	1.00
Max Out Probability	1.00	1.00	0.01	0.52	1.00	1.00	0.55	0.17

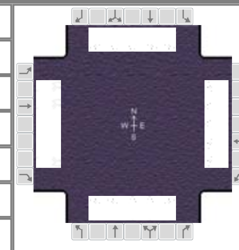
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	424	224	53	247	166	160	291	1698	101	94	835	220
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1632	1765	1496	1632	1765	1641	1616	1664	1481	1664	1664	1481
Queue Service Time (g_s), s	15.9	15.0	3.4	9.3	11.5	11.9	11.2	61.8	2.3	2.5	18.9	6.8
Cycle Queue Clearance Time (g_c), s	15.9	15.0	3.4	9.3	11.5	11.9	11.2	61.8	2.3	2.5	18.9	6.8
Green Ratio (*g/C*)	0.15	0.17	0.27	0.09	0.12	0.12	0.10	0.52	0.61	0.39	0.45	0.60
Capacity (*c*), veh/h	476	305	402	306	206	191	310	1724	906	118	1496	882
Volume-to-Capacity Ratio (*X*)	0.889	0.733	0.132	0.806	0.808	0.834	0.940	0.985	0.111	0.795	0.558	0.249
Back of Queue (*Q*), ft/ln (95 th percentile)	306.1	300.1	57.2	180.8	246.4	240.9	175.9	615	13.7	144.2	270.4	93.9
Back of Queue (*Q*), veh/ln (95 th percentile)	12.1	11.8	2.3	7.1	9.7	9.6	6.9	24.0	0.5	5.6	10.6	3.7
Queue Storage Ratio (*RQ*) (95 th percentile)	1.65	0.00	0.38	1.03	0.00	0.00	0.98	0.00	0.03	0.55	0.00	0.21
Uniform Delay (d_1), s/veh	52.4	49.0	34.7	55.6	53.9	54.1	54.2	18.9	2.7	57.9	17.6	8.5
Incremental Delay (d_2), s/veh	15.5	8.8	0.1	3.1	11.5	15.1	14.1	8.1	0.0	7.2	0.5	0.1
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	68.0	57.8	34.8	58.7	65.4	69.2	68.3	27.0	2.7	65.0	18.0	8.6
Level of Service (LOS)	E	E	C	E	E	E	E	C	A	E	B	A
Approach Delay, s/veh / LOS	62.2	E		63.6	E		31.5	C		20.1	C	
Intersection Delay, s/veh / LOS	37.4						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.1	C	3.0	C	2.6	B	3.0	C
Bicycle LOS Score / LOS	1.6	A	1.0	A	2.3	B	1.4	A

 HCS 2010™ Streets Version 6.90 Generated: 2/1/2017 2:18:03 PM

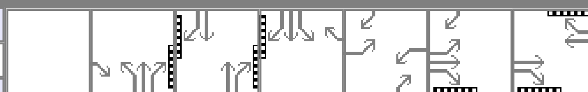
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Aug 16, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 4:30
Intersection	Minnesota Ave & 57th St	File Name	Minn-5-DDI_D_2035_AM.xus		
Project Description	2035 AM - Build Minn-5D				

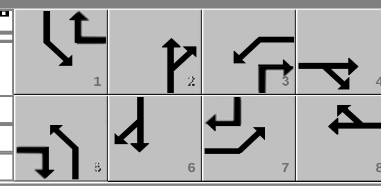


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	335	435	250	120	740	320	305	1140	100	160	555	170

Signal Information			
Cycle, s	140.1	Reference Phase	2
Offset, s	15	Reference Point	Begin
Uncoordinated	Yes	Simult. Gap E/W	Off
Force Mode	Fixed	Simult. Gap N/S	Off



Green	17.4	25.6	10.1	8.1	2.9	37.5
Yellow	3.5	4.5	3.5	3.5	3.5	4.0
Red	3.5	1.0	3.5	3.5	3.5	1.0



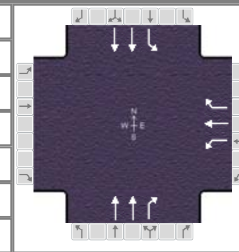
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	25.0	52.4	15.1	42.5	24.4	55.5	17.1	48.2
Change Period, (*Y+R* c), s	7.0	5.5	7.0	5.5	7.0	5.5	7.0	7.0
Max Allow Headway (*MAH*), s	4.1	4.6	4.1	4.6	4.1	4.5	4.1	4.5
Queue Clearance Time (g_s), s	18.8	18.8	8.0	38.1	17.3	52.0	10.0	26.1
Green Extension Time (g_e), s	0.0	0.5	0.2	0.0	0.1	0.0	0.1	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Max Out Probability	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	394	512	202	141	871	226	359	1341	118	188	652	164
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1632	1680	1496	1632	1680	1496	1616	1664	1481	1616	1664	1481
Queue Service Time (g_s), s	16.8	16.8	11.9	6.0	36.1	16.5	15.3	50.0	7.1	8.0	24.1	10.1
Cycle Queue Clearance Time (g_c), s	16.8	16.8	11.9	6.0	36.1	16.5	15.3	50.0	7.1	8.0	24.1	10.1
Green Ratio (*g/C*)	0.13	0.33	0.46	0.06	0.26	0.34	0.12	0.36	0.41	0.07	0.29	0.42
Capacity (*c*), veh/h	419	1124	687	189	887	503	402	1187	614	234	978	626
Volume-to-Capacity Ratio (*X*)	0.940	0.455	0.295	0.749	0.981	0.449	0.892	1.130	0.192	0.803	0.666	0.263
Back of Queue (*Q*), ft/ln (95 th percentile)	339.2	283.5	191.8	120.5	638.9	198.4	302	1129.8	83.9	169.2	390.6	170.6
Back of Queue (*Q*), veh/ln (95 th percentile)	13.4	11.2	7.6	4.7	25.2	7.8	11.8	44.1	3.3	6.6	15.3	6.7
Queue Storage Ratio (*RQ*) (95 th percentile)	1.30	0.00	0.94	0.80	0.00	0.88	1.40	0.00	0.51	0.79	0.00	0.73
Uniform Delay (d_1), s/veh	60.5	36.6	23.7	65.0	51.2	8.9	60.4	45.1	3.8	64.0	43.4	26.3
Incremental Delay (d_2), s/veh	29.3	0.3	0.3	6.1	25.6	0.8	20.5	69.5	0.7	12.5	3.3	0.9
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	89.8	36.9	24.0	71.1	76.9	9.7	80.9	114.6	4.5	76.5	46.7	27.2
Level of Service (LOS)	F	D	C	E	E	A	F	F	A	E	D	C
Approach Delay, s/veh / LOS	53.4	D		63.9	E		100.8	F		49.1	D	
Intersection Delay, s/veh / LOS	71.8						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.1	C	3.1	C	3.3	C	3.2	C
Bicycle LOS Score / LOS	1.4	A	1.5	A	2.0	A	1.3	A

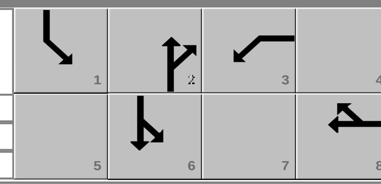
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Aug 16, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 4:30
Intersection	Lotta	File Name	Minn-5-DDI_D_2035_AM.xus		
Project Description	2035 AM - Build Minn-5D				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				40	0	220		1775	20	60	840	

Signal Information										
Cycle, s	91.0	Reference Phase	2							
Offset, s	0	Reference Point	End	Green	4.2	53.8	16.5	0.0	0.0	0.0
Uncoordinated	No	Simult. Gap E/W	On	Yellow	3.5	4.5	3.5	0.0	0.0	0.0
Force Mode	Fixed	Simult. Gap N/S	On	Red	2.0	1.0	2.0	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase				8		2	1	6
Case Number				9.0		7.3	1.0	4.0
Phase Duration, s				22.0		59.3	9.7	69.0
Change Period, (*Y+R c*), s				5.5		5.5	5.5	5.5
Max Allow Headway (*MAH*), s				3.5		0.0	3.1	0.0
Queue Clearance Time (g_s), s				17.6			3.4	
Green Extension Time (g_e), s				0.0		0.0	0.1	0.0
Phase Call Probability				1.00			0.83	
Max Out Probability				1.00			0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement				3	8	18		2	12	1	6	
Adjusted Flow Rate (*v*), veh/h				47	0	259		1936	22	70	987	
Adjusted Saturation Flow Rate (*s*), veh/h/ln				1681	1765	1496		1664	1481	1664	1664	
Queue Service Time (g_s), s				2.1	0.0	15.6		51.7	0.6	1.4	3.2	
Cycle Queue Clearance Time (g_c), s				2.1	0.0	15.6		51.7	0.6	1.4	3.2	
Green Ratio (*g/C*)				0.18	0.18	0.18		0.59	0.59	0.66	0.70	
Capacity (*c*), veh/h				305	320	271		1969	876	160	2322	
Volume-to-Capacity Ratio (*X*)				0.154	0.000	0.954		0.983	0.025	0.439	0.425	
Back of Queue (*Q*), ft/ln (95 th percentile)				40.2	0	346.8		489.9	7.1	38.1	31.1	
Back of Queue (*Q*), veh/ln (95 th percentile)				1.6	0.0	13.7		19.1	0.3	1.5	1.2	
Queue Storage Ratio (*RQ*) (95 th percentile)				0.04	0.00	2.31		0.00	0.05	0.25	0.00	
Uniform Delay (d_1), s/veh				31.4	0.0	36.9		18.1	7.7	21.1	1.1	
Incremental Delay (d_2), s/veh				0.1	0.0	41.9		3.4	0.0	0.6	0.4	
Initial Queue Delay (d_3), s/veh				0.0	0.0	0.0		0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh				31.5	0.0	78.8		21.5	7.7	21.7	1.5	
Level of Service (LOS)				C		E		C	A	C	A	
Approach Delay, s/veh / LOS	0.0			71.5	E		21.3	C		2.9	A	
Intersection Delay, s/veh / LOS	20.1						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.9	C	2.4	B	1.9	A
Bicycle LOS Score / LOS			1.0	A	2.2	B	1.4	A

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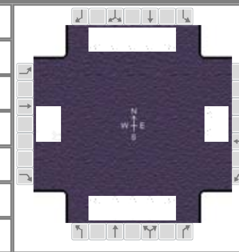
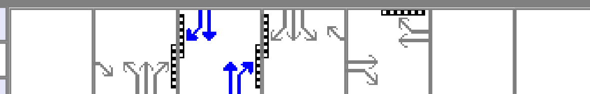
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Aug 16, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 4:30
Intersection	DDI North Crossover	File Name	Minn-5-DDI_D_2035_AM.xus		
Project Description	2035 AM - Build Minn-5D				

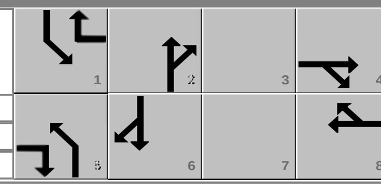


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		0	210		0	225	1	1935	110	1	755	335

Signal Information			
Cycle, s	91.0	Reference Phase	2
Offset, s	42	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	41.0	0.0	40.0	1.0	0.0	0.0
Yellow	4.0	0.0	4.0	0.0	0.0	0.0
Red	1.0	0.0	0.0	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		7.0		7.0	2.0	3.0	2.0	3.0
Phase Duration, s		1.0		1.0	46.0	46.0	44.0	44.0
Change Period, (*Y+R c*), s		0.0		0.0	5.0	5.0	4.0	4.0
Max Allow Headway (*MAH*), s		3.3		3.3	3.3	0.0	3.3	0.0
Queue Clearance Time (g_s), s		3.0		3.0	2.0		2.0	
Green Extension Time (g_e), s		0.0		0.0	0.0	0.0	3.8	0.0
Phase Call Probability		1.00		1.00	1.00		1.00	
Max Out Probability		1.00		1.00	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		4	14		8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h		0	247		0	265	1	2155	123	1	887	394
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1633	1425		1633	1427	1664	1616	1404	1664	1535	1450
Queue Service Time (g_s), s		0.0	0.5		0.0	0.5	0.0	40.1	5.7	0.0	9.8	16.0
Cycle Queue Clearance Time (g_c), s		0.0	0.5		0.0	0.5	0.0	40.1	5.7	0.0	9.8	16.0
Green Ratio (*g/C*)		0.01	0.46		0.01	0.45	0.45	0.45	0.45	0.44	0.44	0.44
Capacity (*c*), veh/h		18	642		18	627	750	2185	633	732	2024	637
Volume-to-Capacity Ratio (*X*)		0.000	0.385		0.000	0.422	0.001	0.986	0.194	0.002	0.438	0.618
Back of Queue (*Q*), ft/ln (95 th percentile)		0	146.3		0	163.3	0.7	575.4	89.1	0.7	139.4	206.2
Back of Queue (*Q*), veh/ln (95 th percentile)		0.0	5.7		0.0	6.4	0.0	22.5	3.5	0.0	5.4	8.1
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.15		0.00	0.16	0.00	0.00	0.00	0.00	0.00	1.37
Uniform Delay (d_1), s/veh		0.0	16.6		0.0	17.5	16.6	29.1	18.7	14.3	12.6	13.9
Incremental Delay (d_2), s/veh		0.0	0.1		0.0	0.2	0.0	10.3	0.3	0.0	0.5	3.5
Initial Queue Delay (d_3), s/veh		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh		0.0	16.8		0.0	17.7	16.6	39.4	19.0	14.3	13.1	17.4
Level of Service (LOS)			B			B	B	D	B	B	B	B

	EB		WB		NB		SB	
Approach Delay, s/veh / LOS	16.8	B	17.7	B	38.3	D	14.4	B
Intersection Delay, s/veh / LOS	28.1				C			

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.4	C	3.4	C	2.3	B	2.3	B
Bicycle LOS Score / LOS	0.9	A	0.9	A	1.8	A	1.2	A

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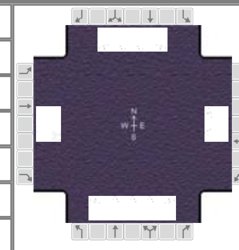
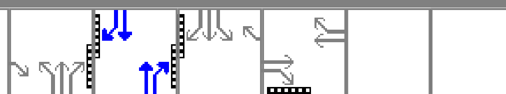
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Aug 16, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 4:30
Intersection	DDI South Crossover	File Name	Minn-5-DDI_D_2035_AM.xus		
Project Description	2035 AM - Build Minn-5D				

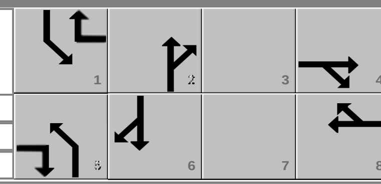


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		0	120		0	390	1	1655	330	1	770	195

Signal Information			
Cycle, s	91.0	Reference Phase	2
Offset, s	53	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	41.0	0.0	40.0	1.0	0.0	0.0
Yellow	4.0	0.0	4.0	0.0	0.0	0.0
Red	1.0	0.0	0.0	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		7.0		7.0	2.0	3.0	2.0	3.0
Phase Duration, s		1.0		1.0	46.0	46.0	44.0	44.0
Change Period, (*Y+R* $_c$), s		0.0		0.0	5.0	5.0	5.0	5.0
Max Allow Headway (*MAH*), s		3.6		3.6	3.2	0.0	3.3	0.0
Queue Clearance Time (g_s), s		3.0		3.0	2.0		2.0	
Green Extension Time (g_e), s		0.0		0.0	0.0	0.0	3.3	0.0
Phase Call Probability		1.00		1.00	1.00		1.00	
Max Out Probability		1.00		1.00	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		4	14		8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h		0	141		0	459	1	1820	363	1	904	229
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1633	1407		1633	1461	1664	1594	1444	1664	1640	1421
Queue Service Time (g_s), s		0.0	0.5		0.0	0.5	0.0	30.0	13.9	0.0	11.2	2.9
Cycle Queue Clearance Time (g_c), s		0.0	0.5		0.0	0.5	0.0	30.0	13.9	0.0	11.2	2.9
Green Ratio (*g/C*)		0.01	0.46		0.01	0.43	0.45	0.45	0.45	0.43	0.43	0.43
Capacity (*c*), veh/h		18	634		18	626	750	2155	651	713	1406	609
Volume-to-Capacity Ratio (*X*)		0.000	0.223		0.000	0.733	0.001	0.845	0.558	0.002	0.643	0.376
Back of Queue (*Q*), ft/ln (95 th percentile)		0	77.7		0	327	0.5	308.3	125	0.2	125.9	42.7
Back of Queue (*Q*), veh/ln (95 th percentile)		0.0	3.0		0.0	12.8	0.0	12.0	4.9	0.0	4.9	1.7
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.08		0.00	0.33	0.00	0.00	0.62	0.00	0.00	0.21
Uniform Delay (d_1), s/veh		0.0	15.3		0.0	21.7	11.0	20.2	13.0	4.2	7.0	3.7
Incremental Delay (d_2), s/veh		0.0	0.2		0.0	3.9	0.0	0.6	0.5	0.0	2.1	1.6
Initial Queue Delay (d_3), s/veh		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh		0.0	15.4		0.0	25.5	11.0	20.8	13.5	4.2	9.1	5.3
Level of Service (LOS)			B			C	B	C	B	A	A	A
Approach Delay, s/veh / LOS	15.4		B	25.5		C	19.6		B	8.3		A
Intersection Delay, s/veh / LOS	16.9						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.1	C	3.3	C	2.3	B	2.3	B
Bicycle LOS Score / LOS	0.7	A	1.2	A	1.8	A	1.4	A

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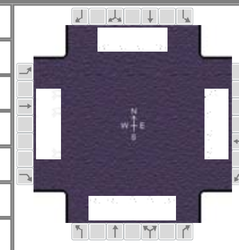
HCS 2010 Signalized Intersection Results Summary

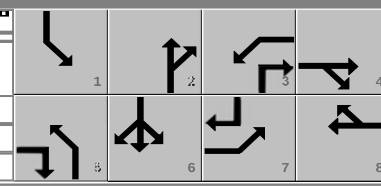
General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Aug 16, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.93
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 4:30
Intersection	Minnesota Ave & 41st St	File Name	Minn-5-DDI_D_2035_PM.xus		
Project Description	2035 PM - Build Minn-5D				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	420	280	280	340	290	60	355	835	140	60	1150	390

Signal Information			
Cycle, s	137.0	Reference Phase	6
Offset, s	51	Reference Point	Begin
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	18.5	16.1	29.9	17.5	4.7	21.8
Yellow	3.0	4.0	3.0	3.0	0.0	4.0
Red	3.0	1.0	3.0	3.0	0.0	1.5



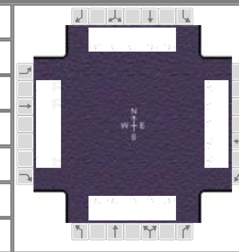
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	4.0	2.0	3.0	1.3	3.0
Phase Duration, s	28.2	32.0	23.5	27.3	24.5	45.5	35.9	57.0
Change Period, ($Y+R_c$), s	6.5	5.5	6.0	5.5	6.0	5.0	6.0	6.0
Max Allow Headway (*MAH*), s	3.5	4.2	3.5	4.2	3.5	4.1	4.1	4.1
Queue Clearance Time (g_s), s	20.5	24.7	17.1	15.7	17.7	36.9	2.0	52.8
Green Extension Time (g_e), s	1.2	1.8	0.4	0.0	0.7	3.6	8.5	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00
Max Out Probability	0.00	0.14	0.73	1.00	0.08	0.24	0.22	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	452	301	231	366	184	178	381	897	113	65	1237	373
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1632	1765	1496	1632	1765	1679	1616	1664	1525	1664	1664	1481
Queue Service Time (g_s), s	18.5	22.7	16.8	15.1	13.4	13.7	15.7	34.9	5.6	0.0	50.8	19.6
Cycle Queue Clearance Time (g_c), s	18.5	22.7	16.8	15.1	13.4	13.7	15.7	34.9	5.6	0.0	50.8	19.6
Green Ratio (*g/C*)	0.16	0.19	0.33	0.13	0.16	0.16	0.13	0.30	0.42	0.32	0.37	0.53
Capacity (*c*), veh/h	518	342	491	417	281	267	435	984	646	431	1239	787
Volume-to-Capacity Ratio (*X*)	0.871	0.881	0.471	0.876	0.655	0.668	0.876	0.911	0.174	0.150	0.998	0.474
Back of Queue (*Q*), ft/ln (95 th percentile)	318.3	426.3	264.4	287.9	268.1	259.6	254.8	494.2	52.7	73	792.8	255.2
Back of Queue (*Q*), veh/ln (95 th percentile)	12.5	16.8	10.4	11.3	10.6	10.4	10.0	19.3	2.1	2.8	31.0	10.0
Queue Storage Ratio (*RQ*) (95 th percentile)	1.72	0.00	1.76	1.65	0.00	0.00	1.42	0.00	0.11	0.28	0.00	0.57
Uniform Delay (d_1), s/veh	56.3	53.7	36.6	58.7	54.1	54.2	55.1	39.8	5.7	37.5	34.5	15.8
Incremental Delay (d_2), s/veh	3.9	12.5	0.7	13.1	5.4	6.2	6.5	6.6	0.1	0.1	25.1	0.4
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	60.2	66.2	37.3	71.8	59.5	60.4	61.6	46.4	5.8	37.6	59.6	16.2
Level of Service (LOS)	E	E	D	E	E	E	E	D	A	D	E	B
Approach Delay, s/veh / LOS	56.7	E		65.9	E		47.2	D		49.1	D	
Intersection Delay, s/veh / LOS	52.7						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.1	C	3.0	C	2.6	B	3.0	C
Bicycle LOS Score / LOS	2.1	B	1.1	A	1.6	A	1.9	A

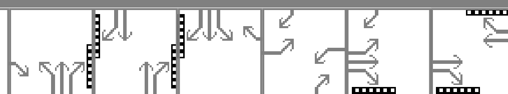
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Aug 16, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.93
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 4:30
Intersection	Minnesota Ave & 57th St	File Name	Minn-5-DDI_D_2035_PM.xus		
Project Description	2035 PM - Build Minn-5D				

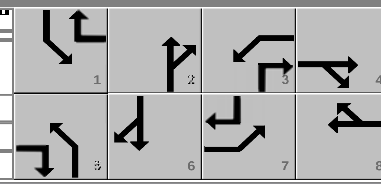


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	305	885	300	180	570	230	260	680	200	350	840	235

Signal Information			
Cycle, s	130.8	Reference Phase	2
Offset, s	15	Reference Point	Begin
Uncoordinated	Yes	Simult. Gap E/W	Off
Force Mode	Fixed	Simult. Gap N/S	Off



Green	14.1	16.9	18.2	10.2	5.9	33.9
Yellow	3.5	4.5	3.5	3.5	0.0	4.0
Red	3.5	1.0	3.5	3.5	0.0	1.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	23.2	44.8	17.2	38.9	21.1	43.5	25.2	47.6
Change Period, (*Y+R* $_c$), s	7.0	5.5	7.0	5.5	7.0	5.5	7.0	7.0
Max Allow Headway (*MAH*), s	4.1	4.5	4.1	4.6	4.1	4.6	4.1	4.5
Queue Clearance Time (g_s), s	14.8	38.1	9.6	23.7	13.0	28.1	16.8	35.6
Green Extension Time (g_e), s	1.4	1.2	0.7	3.6	1.1	3.6	1.4	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Max Out Probability	0.00	1.00	0.00	0.04	0.00	0.38	0.00	1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	328	952	239	194	613	110	280	731	215	376	903	220
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1632	1680	1496	1632	1680	1496	1616	1664	1481	1616	1664	1481
Queue Service Time (g_s), s	12.8	36.1	14.7	7.6	21.7	6.3	11.0	26.1	14.0	14.8	33.6	12.9
Cycle Queue Clearance Time (g_c), s	12.8	36.1	14.7	7.6	21.7	6.3	11.0	26.1	14.0	14.8	33.6	12.9
Green Ratio (*g/C*)	0.12	0.30	0.41	0.08	0.26	0.39	0.11	0.29	0.37	0.14	0.31	0.43
Capacity (*c*), veh/h	404	1010	612	256	858	590	350	967	546	450	1032	642
Volume-to-Capacity Ratio (*X*)	0.813	0.942	0.390	0.756	0.714	0.186	0.799	0.756	0.394	0.836	0.875	0.343
Back of Queue (*Q*), ft/ln (95 th percentile)	234.7	600.4	228.3	150.2	360.3	44.5	209.7	428.8	130.7	248.1	514.5	198.3
Back of Queue (*Q*), veh/ln (95 th percentile)	9.2	23.6	9.0	5.9	14.2	1.8	8.2	16.7	5.1	9.7	20.1	7.7
Queue Storage Ratio (*RQ*) (95 th percentile)	0.90	0.00	1.11	1.00	0.00	0.20	0.98	0.00	0.79	1.15	0.00	0.84
Uniform Delay (d_1), s/veh	55.8	44.6	27.2	59.0	44.3	15.3	56.9	42.2	14.2	54.8	42.7	24.6
Incremental Delay (d_2), s/veh	4.0	16.0	0.5	4.5	2.0	0.2	4.2	5.5	2.1	3.2	8.1	1.1
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	59.8	60.6	27.7	63.6	46.3	15.5	61.2	47.7	16.3	58.0	50.8	25.7
Level of Service (LOS)	E	E	C	E	D	B	E	D	B	E	D	C
Approach Delay, s/veh / LOS	55.3	E		46.3	D		45.3	D		48.9	D	
Intersection Delay, s/veh / LOS	49.5						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.1	C	3.1	C	3.3	C	3.2	C
Bicycle LOS Score / LOS	1.7	A	1.2	A	1.5	A	1.7	A

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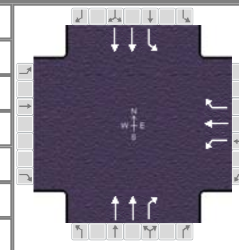
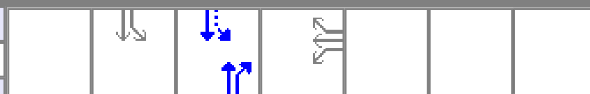
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Aug 16, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.93
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 4:30
Intersection	Lotta	File Name	Minn-5-DDI_D_2035_PM.xus		
Project Description	2035 PM - Build Minn-5D				

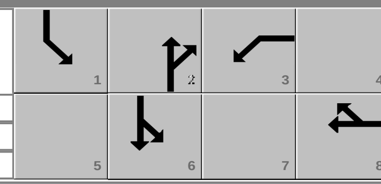


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h				60	0	100		1175	40	230	1390	

Signal Information			
Cycle, s	65.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	5.8	36.0	6.7	0.0	0.0	0.0
Yellow	3.5	4.5	3.5	0.0	0.0	0.0
Red	2.0	1.0	2.0	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase				8		2	1	6
Case Number				9.0		7.3	1.0	4.0
Phase Duration, s				12.2		41.5	11.3	52.8
Change Period, ($Y+R_c$), s				5.5		5.5	5.5	5.5
Max Allow Headway (*MAH*), s				3.4		0.0	3.1	0.0
Queue Clearance Time (g_s), s				6.5			5.5	
Green Extension Time (g_e), s				0.3		0.0	0.4	0.0
Phase Call Probability				0.96			0.99	
Max Out Probability				0.00			0.00	

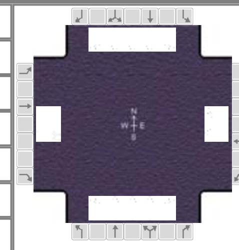
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement				3	8	18		2	12	1	6	
Adjusted Flow Rate (v), veh/h				65	0	108		1263	43	247	1493	
Adjusted Saturation Flow Rate (s), veh/h/ln				1681	1765	1496		1664	1481	1664	1664	
Queue Service Time (g_s), s				2.3	0.0	4.5		17.8	0.9	3.5	8.5	
Cycle Queue Clearance Time (g_c), s				2.3	0.0	4.5		17.8	0.9	3.5	8.5	
Green Ratio (*g/C*)				0.10	0.10	0.10		0.55	0.55	0.67	0.73	
Capacity (c), veh/h				173	182	154		1842	820	381	2422	
Volume-to-Capacity Ratio (X)				0.373	0.000	0.699		0.686	0.052	0.648	0.617	
Back of Queue (Q), ft/ln (95 th percentile)				42.6	0	75.7		207	10.4	68.2	39.3	
Back of Queue (Q), veh/ln (95 th percentile)				1.7	0.0	3.0		8.1	0.4	2.7	1.5	
Queue Storage Ratio (*RQ*) (95 th percentile)				0.04	0.00	0.50		0.00	0.07	0.45	0.00	
Uniform Delay (d_1), s/veh				27.2	0.0	28.2		10.4	6.7	12.1	1.8	
Incremental Delay (d_2), s/veh				0.5	0.0	2.1		1.3	0.1	0.2	0.3	
Initial Queue Delay (d_3), s/veh				0.0	0.0	0.0		0.0	0.0	0.0	0.0	
Control Delay (d), s/veh				27.7	0.0	30.3		11.8	6.7	12.3	2.1	
Level of Service (LOS)				C		C		B	A	B	A	

	EB		WB		NB		SB	
Approach Delay, s/veh / LOS	0.0		29.3	C	11.6	B	3.5	A
Intersection Delay, s/veh / LOS	8.2				A			

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.9	C	2.4	B	1.8	A
Bicycle LOS Score / LOS			0.8	A	1.6	A	1.9	A

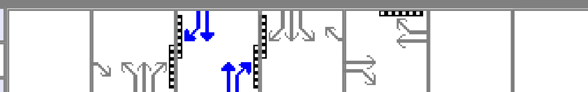
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information		
Agency	HRG			Duration, h	0.25	
Analyst	JDW	Analysis Date	Aug 16, 2016	Area Type	Other	
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.93	
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 4:30	
Intersection	DDI North Crossover	File Name	Minn-5-DDI_D_2035_PM.xus			
Project Description	2035 PM - Build Minn-5D					

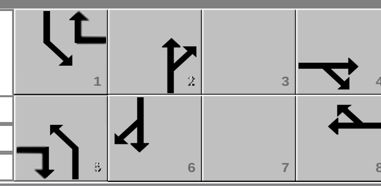


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		0	290		0	170	1	1215	120	1	1565	545

Signal Information			
Cycle, s	65.0	Reference Phase	2
Offset, s	42	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	24.0	0.0	31.0	1.0	0.0	0.0
Yellow	4.0	0.0	4.0	0.0	0.0	0.0
Red	1.0	0.0	0.0	0.0	0.0	0.0



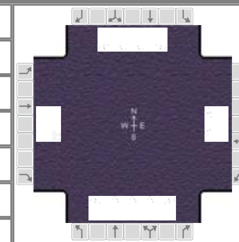
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		7.0		7.0	2.0	3.0	2.0	3.0
Phase Duration, s		1.0		1.0	29.0	29.0	35.0	35.0
Change Period, (*Y+R c*), s		0.0		0.0	5.0	5.0	4.0	4.0
Max Allow Headway (*MAH*), s		3.3		3.3	3.3	0.0	3.3	0.0
Queue Clearance Time (*g s*), s		3.0		3.0	2.0		2.0	
Green Extension Time (*g e*), s		0.0		0.0	0.0	0.0	8.6	0.0
Phase Call Probability		1.00		1.00	1.00		1.00	
Max Out Probability		1.00		1.00	0.00		0.08	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		4	14		8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h		0	312		0	183	1	1305	129	1	1682	586
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1633	1420		1633	1405	1664	1538	1399	1664	1554	1454
Queue Service Time (*g s*), s		0.0	0.5		0.0	0.5	0.0	18.0	5.9	0.0	16.4	20.6
Cycle Queue Clearance Time (*g c*), s		0.0	0.5		0.0	0.5	0.0	18.0	5.9	0.0	16.4	20.6
Green Ratio (*g/C*)		0.02	0.38		0.02	0.48	0.37	0.37	0.37	0.48	0.48	0.48
Capacity (*c*), veh/h		25	524		25	670	615	1703	517	794	2224	693
Volume-to-Capacity Ratio (*X*)		0.000	0.595		0.000	0.273	0.002	0.766	0.249	0.001	0.756	0.845
Back of Queue (*Q*), ft/ln (95 th percentile)		0	156.6		0	59.7	0.7	299	99.7	0.3	138.1	167.2
Back of Queue (*Q*), veh/ln (95 th percentile)		0.0	6.1		0.0	2.3	0.0	11.7	3.9	0.0	5.4	6.5
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.16		0.00	0.06	0.00	0.00	0.00	0.00	0.00	1.11
Uniform Delay (*d 1*), s/veh		0.0	16.6		0.0	10.2	19.8	27.2	23.1	8.9	9.2	9.9
Incremental Delay (*d 2*), s/veh		0.0	1.3		0.0	0.1	0.0	2.4	0.8	0.0	0.7	4.0
Initial Queue Delay (*d 3*), s/veh		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh		0.0	17.8		0.0	10.3	19.8	29.6	23.9	8.9	9.9	13.9
Level of Service (LOS)			B			B	B	C	C	A	A	B
Approach Delay, s/veh / LOS	17.8	B		10.3	B		29.1	C		11.0	B	
Intersection Delay, s/veh / LOS	17.6						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.4	C	3.4	C	2.2	B	2.2	B
Bicycle LOS Score / LOS	1.0	A	0.8	A	1.3	A	1.7	A

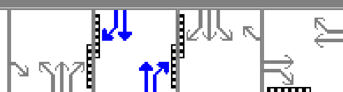
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Aug 16, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.93
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 4:30
Intersection	DDI South Crossover	File Name	Minn-5-DDI_D_2035_PM.xus		
Project Description	2035 PM - Build Minn-5D				

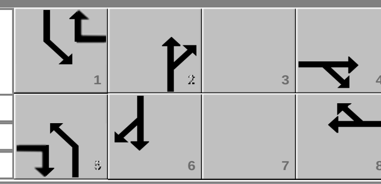


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		0	160		0	255	1	1080	175	1	1450	405

Signal Information			
Cycle, s	65.0	Reference Phase	2
Offset, s	53	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	23.0	0.0	32.0	1.0	0.0	0.0
Yellow	4.0	0.0	4.0	0.0	0.0	0.0
Red	1.0	0.0	0.0	0.0	0.0	0.0



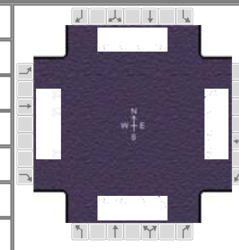
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		7.0		7.0	2.0	3.0	2.0	3.0
Phase Duration, s		1.0		1.0	28.0	28.0	36.0	36.0
Change Period, ($Y+R_c$), s		0.0		0.0	5.0	5.0	5.0	5.0
Max Allow Headway (*MAH*), s		3.7		3.7	3.2	0.0	3.3	0.0
Queue Clearance Time (g_s), s		3.0		3.0	2.0		2.0	
Green Extension Time (g_e), s		0.0		0.0	0.0	0.0	7.3	0.0
Phase Call Probability		1.00		1.00	1.00		1.00	
Max Out Probability		1.00		1.00	0.00		0.04	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		4	14		8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h		0	172		0	274	1	1160	188	1	1558	435
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1633	1404		1633	1416	1664	1532	1406	1664	1661	1435
Queue Service Time (g_s), s		0.0	0.5		0.0	0.5	0.0	12.5	4.6	0.0	28.9	7.9
Cycle Queue Clearance Time (g_c), s		0.0	0.5		0.0	0.5	0.0	12.5	4.6	0.0	28.9	7.9
Green Ratio (*g/C*)		0.02	0.36		0.02	0.48	0.35	0.35	0.35	0.48	0.48	0.48
Capacity (*c*), veh/h		25	497		25	675	589	1626	497	794	1584	685
Volume-to-Capacity Ratio (*X*)		0.000	0.346		0.000	0.406	0.002	0.714	0.378	0.001	0.983	0.636
Back of Queue (*Q*), ft/ln (95 th percentile)		0	77.7		0	96.7	0.3	148.8	62.3	0.2	238.1	81.6
Back of Queue (*Q*), veh/ln (95 th percentile)		0.0	3.0		0.0	3.8	0.0	5.8	2.4	0.0	9.3	3.2
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.08		0.00	0.10	0.00	0.00	0.31	0.00	0.00	0.41
Uniform Delay (d_1), s/veh		0.0	15.5		0.0	11.0	9.1	13.0	9.6	3.6	7.5	4.1
Incremental Delay (d_2), s/veh		0.0	0.4		0.0	0.1	0.0	1.8	1.5	0.0	14.1	2.7
Initial Queue Delay (d_3), s/veh		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh		0.0	15.9		0.0	11.2	9.1	14.8	11.1	3.6	21.6	6.9
Level of Service (LOS)			B			B	A	B	B	A	C	A
Approach Delay, s/veh / LOS	15.9		B	11.2		B	14.3		B	18.3		B
Intersection Delay, s/veh / LOS	16.3						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.1	C	3.3	C	2.2	B	2.2	B
Bicycle LOS Score / LOS	0.8	A	0.9	A	1.2	A	2.1	B

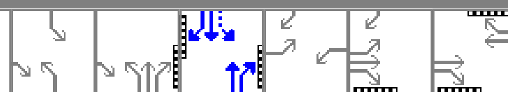
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Nov 4, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Minnesota Ave & 41st St	File Name	Minn-8_C_rev_2035_AM_110416.xus		
Project Description	2035 AM - Minn-8C revised				

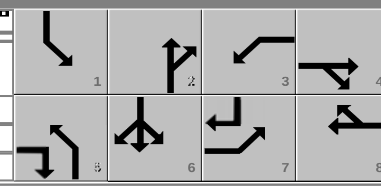


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	350	180	110	210	220	70	255	1360	100	80	710	230

Signal Information			
Cycle, s	130.0	Reference Phase	2
Offset, s	119	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Float	Simult. Gap N/S	On



Green	5.8	2.9	58.4	12.0	0.5	15.5
Yellow	3.0	3.0	4.0	3.0	3.5	4.0
Red	3.0	3.0	1.0	3.0	3.0	1.5



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	4.0	2.0	4.0	1.1	3.0
Phase Duration, s	25.0	28.0	18.0	21.0	20.6	72.2	11.8	63.4
Change Period, (*Y+R* $_c$), s	6.5	5.5	6.0	5.5	6.0	5.0	6.0	5.0
Max Allow Headway (*MAH*), s	3.5	4.2	3.5	4.2	3.5	0.0	3.5	0.0
Queue Clearance Time (g_s), s	18.0	16.3	11.7	14.0	13.9		6.0	
Green Extension Time (g_e), s	0.5	1.7	0.3	1.5	0.8	0.0	0.0	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		0.97	
Max Out Probability	0.98	0.11	0.20	0.29	0.00		1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	412	212	74	247	163	157	296	843	834	94	835	222
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1632	1765	1496	1632	1765	1649	1616	1748	1711	1664	1664	1481
Queue Service Time (g_s), s	16.0	14.3	4.6	9.7	11.7	12.0	11.9	54.9	56.5	4.0	19.7	7.3
Cycle Queue Clearance Time (g_c), s	16.0	14.3	4.6	9.7	11.7	12.0	11.9	54.9	56.5	4.0	19.7	7.3
Green Ratio (*g/C*)	0.14	0.17	0.29	0.09	0.12	0.12	0.11	0.52	0.52	0.49	0.45	0.59
Capacity (*c*), veh/h	463	306	427	301	211	197	364	904	885	149	1494	875
Volume-to-Capacity Ratio (*X*)	0.888	0.693	0.173	0.820	0.773	0.796	0.813	0.932	0.943	0.632	0.559	0.254
Back of Queue (*Q*), ft/ln (95 th percentile)	294.7	268	76.6	194.9	242.4	235.9	214.2	691.3	680.5	82.4	290	7.8
Back of Queue (*Q*), veh/ln (95 th percentile)	11.6	10.6	3.0	7.7	9.5	9.4	8.4	27.0	27.2	3.2	11.3	0.3
Queue Storage Ratio (*RQ*) (95 th percentile)	1.59	0.00	0.51	1.11	0.00	0.00	1.19	0.00	0.00	0.32	0.00	0.06
Uniform Delay (d_1), s/veh	51.7	46.8	32.4	57.9	55.5	55.7	62.9	19.0	19.0	29.4	18.3	9.0
Incremental Delay (d_2), s/veh	14.2	4.4	0.2	6.8	7.8	10.1	1.7	12.2	13.6	6.8	1.5	0.7
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	65.9	51.2	32.6	64.7	63.3	65.8	64.6	31.2	32.5	36.2	19.8	9.7
Level of Service (LOS)	E	D	C	E	E	E	E	C	C	D	B	A
Approach Delay, s/veh / LOS	57.9		E	64.6		E	36.8		D	19.2		B
Intersection Delay, s/veh / LOS	39.1						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.0	C	3.0	C	2.6	B	3.0	C
Bicycle LOS Score / LOS	1.6	A	1.0	A	2.1	B	1.4	A

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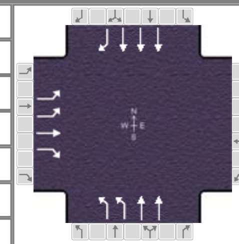
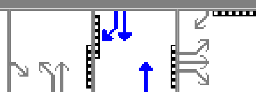
HCS 2010 Signalized Intersection Results Summary



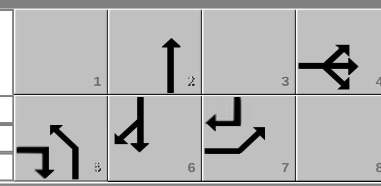
General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Nov 4, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Minn Ave & 49th St	File Name	Minn-8_C_rev_2035_AM_110416.xus		
Project Description	2035 AM - Minn-8C revised				

Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	150	0	230				445	1760			750	300

Signal Information			
Cycle, s	130.0	Reference Phase	2
Offset, s	88	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	23.1	67.9	20.5	0.0	0.0	0.0
Yellow	3.0	4.0	3.0	0.0	0.0	0.0
Red	3.5	1.5	3.5	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			5	2		6
Case Number		9.0			2.0	4.0		7.3
Phase Duration, s		27.0			29.6	103.0		73.4
Change Period, (*Y+R* c), s		6.5			6.5	5.5		5.5
Max Allow Headway (*MAH*), s		3.2			4.2	0.0		0.0
Queue Clearance Time (*g* s), s		21.9			21.8			
Green Extension Time (*g* e), s		0.0			1.3	0.0		0.0
Phase Call Probability		1.00			1.00			
Max Out Probability		1.00			0.36			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14				5	2			6	16
Adjusted Flow Rate (*v*), veh/h	176	0	271				515	2037			882	353
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1616	1633	1448				1616	1800			1558	1469
Queue Service Time (*g* s), s	6.3	0.0	19.9				19.8	49.6			13.1	8.8
Cycle Queue Clearance Time (*g* c), s	6.3	0.0	19.9				19.8	49.6			13.1	8.8
Green Ratio (*g/C*)	0.16	0.16	0.34				0.18	0.75			0.52	0.68
Capacity (*c*), veh/h	510	258	479				574	2700			2442	999
Volume-to-Capacity Ratio (*X*)	0.346	0.000	0.565				0.897	0.754			0.361	0.353
Back of Queue (*Q*), ft/ln (95 th percentile)	116.8	0	290.2				240.3	595.2			195.3	104
Back of Queue (*Q*), veh/ln (95 th percentile)	4.6	0.0	11.3				9.4	23.2			7.6	4.1
Queue Storage Ratio (*RQ*) (95 th percentile)	0.25	0.00	0.61				0.69	0.00			0.00	0.69
Uniform Delay (*d* 1), s/veh	48.8	0.0	35.3				43.1	13.8			15.8	4.8
Incremental Delay (*d* 2), s/veh	0.1	0.0	1.0				3.4	0.5			0.3	0.8
Initial Queue Delay (*d* 3), s/veh	0.0	0.0	0.0				0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	48.9	0.0	36.3				46.4	14.3			16.2	5.5
Level of Service (LOS)	D		D				D	B			B	A
Approach Delay, s/veh / LOS	41.3	D		0.0			20.8	C		13.1	B	
Intersection Delay, s/veh / LOS	20.7						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.3	C	3.0	C	1.9	A	2.9	C
Bicycle LOS Score / LOS	1.2	A			2.6	B	1.2	A

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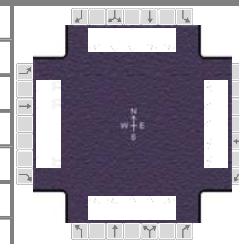
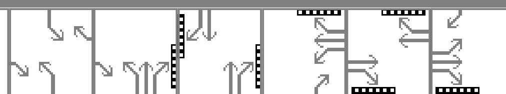
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Nov 4, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Minnesota Ave & 57th St	File Name	Minn-8_C_rev_2035_AM_110416.xus		
Project Description	2035 AM - Minn-8C revised				

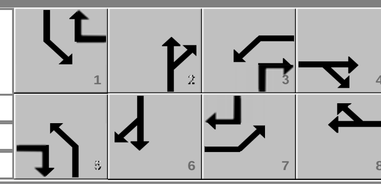


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	335	435	250	120	740	320	305	1140	100	155	545	165

Signal Information			
Cycle, s	143.5	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	10.0	1.3	47.7	8.2	19.8	18.0
Yellow	3.5	3.5	4.5	3.5	4.0	3.5
Red	3.5	3.5	1.0	3.5	1.0	3.5



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	25.0	49.8	15.2	40.0	25.3	61.5	17.0	53.2
Change Period, ($Y+R_c$), s	7.0	7.0	7.0	5.0	7.0	5.5	7.0	5.5
Max Allow Headway (*MAH*), s	4.4	4.4	4.1	4.6	4.1	4.5	4.1	4.5
Queue Clearance Time (g_s), s	19.2	20.1	8.1	37.0	17.6	58.0	10.0	24.9
Green Extension Time (g_e), s	0.0	1.6	0.1	0.0	0.7	0.0	0.1	11.6
Phase Call Probability	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Max Out Probability	1.00	1.00	1.00	1.00	0.49	1.00	1.00	0.62

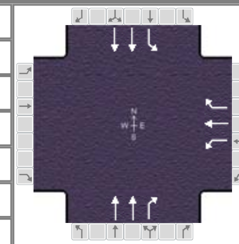
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	394	512	202	141	871	226	359	1341	118	182	641	159
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1632	1680	1496	1632	1680	1496	1616	1664	1481	1616	1664	1481
Queue Service Time (g_s), s	17.2	18.1	12.9	6.1	35.0	17.5	15.6	56.0	6.8	8.0	22.9	9.4
Cycle Queue Clearance Time (g_c), s	17.2	18.1	12.9	6.1	35.0	17.5	15.6	56.0	6.8	8.0	22.9	9.4
Green Ratio (*g/C*)	0.13	0.30	0.43	0.06	0.24	0.31	0.13	0.39	0.45	0.07	0.33	0.46
Capacity (*c*), veh/h	409	1002	637	187	819	469	413	1298	662	226	1106	678
Volume-to-Capacity Ratio (*X*)	0.963	0.511	0.318	0.756	1.063	0.481	0.869	1.033	0.178	0.807	0.580	0.234
Back of Queue (*Q*), ft/ln (95 th percentile)	355.1	304.8	207.4	126.8	728.4	243.1	292.1	975	111.2	172.3	363.6	93
Back of Queue (*Q*), veh/ln (95 th percentile)	14.0	12.0	8.2	5.0	28.7	9.6	11.4	38.1	4.3	6.7	14.2	3.6
Queue Storage Ratio (*RQ*) (95 th percentile)	1.37	0.00	1.01	0.85	0.00	1.08	1.36	0.00	0.67	0.80	0.00	0.40
Uniform Delay (d_1), s/veh	62.4	41.7	27.4	66.7	54.3	1.3	61.4	43.8	23.8	65.8	39.6	11.2
Incremental Delay (d_2), s/veh	34.8	0.5	0.3	8.8	49.4	0.9	12.4	33.9	0.2	15.4	0.8	0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	97.3	42.2	27.7	75.5	103.7	2.3	73.8	77.7	24.0	81.2	40.4	11.4
Level of Service (LOS)	F	D	C	E	F	A	E	F	C	F	D	B
Approach Delay, s/veh / LOS	59.2		E	82.0		F	73.5		E	43.3		D
Intersection Delay, s/veh / LOS				66.7						E		

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.1	C	3.1	C	3.2	C	3.2	C
Bicycle LOS Score / LOS	1.4	A	1.5	A	2.0	A	1.3	A

 HCS 2010™ Streets Version 6.90 Generated: 2/1/2017 3:35:02 PM

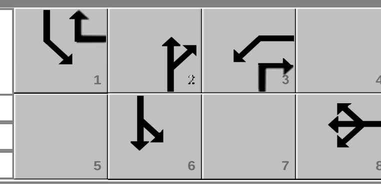
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Nov 4, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Lotta	File Name	Minn-8_C_rev_2035_AM_110416.xus		
Project Description	2035 AM - Minn-8C revised				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				40	0	220		1775	20	60	820	

Signal Information										
Cycle, s	130.0	Reference Phase	2							
Offset, s	0	Reference Point	Begin	Green	4.6	85.1	23.8	0.0	0.0	0.0
Uncoordinated	No	Simult. Gap E/W	On	Yellow	3.5	4.5	3.5	0.0	0.0	0.0
Force Mode	Fixed	Simult. Gap N/S	On	Red	2.0	1.0	2.0	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase				8		2	1	6
Case Number				9.0		7.3	1.0	4.0
Phase Duration, s				29.3		90.6	10.1	100.7
Change Period, (*Y+R* c), s				5.5		5.5	5.5	5.5
Max Allow Headway (*MAH*), s				3.5		0.0	3.1	0.0
Queue Clearance Time (*g* s), s				23.3			3.7	
Green Extension Time (*g* e), s				0.5		0.0	0.1	0.0
Phase Call Probability				1.00			0.92	
Max Out Probability				0.02			0.00	

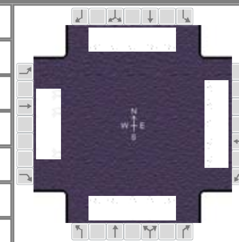
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement				3	8	18		2	12	1	6	
Adjusted Flow Rate (*v*), veh/h				47	0	259		2034	23	71	965	
Adjusted Saturation Flow Rate (*s*), veh/h/ln				1681	1765	1496		1664	1481	1664	1664	
Queue Service Time (*g* s), s				3.1	0.0	21.3		70.6	0.3	1.7	15.7	
Cycle Queue Clearance Time (*g* c), s				3.1	0.0	21.3		70.6	0.3	1.7	15.7	
Green Ratio (*g/C*)				0.18	0.18	0.22		0.65	0.84	0.71	0.73	
Capacity (*c*), veh/h				307	323	327		2178	1241	137	2437	
Volume-to-Capacity Ratio (*X*)				0.153	0.000	0.792		0.934	0.018	0.514	0.396	
Back of Queue (*Q*), ft/ln (95 th percentile)				59.7	0	337.1		719.3	2.8	67.3	224.1	
Back of Queue (*Q*), veh/ln (95 th percentile)				2.4	0.0	13.3		28.1	0.1	2.6	8.8	
Queue Storage Ratio (*RQ*) (95 th percentile)				0.06	0.00	2.25		0.00	0.02	0.45	0.00	
Uniform Delay (*d* 1), s/veh				44.6	0.0	48.0		19.9	1.7	31.5	7.6	
Incremental Delay (*d* 2), s/veh				0.1	0.0	5.5		2.1	0.0	1.0	0.4	
Initial Queue Delay (*d* 3), s/veh				0.0	0.0	0.0		0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh				44.7	0.0	53.5		22.1	1.7	32.5	8.0	
Level of Service (LOS)				D		D		C	A	C	A	
Approach Delay, s/veh / LOS	0.0			52.1		D	21.8		C	9.7		A
Intersection Delay, s/veh / LOS	20.9						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.9	C	2.4	B	1.9	A
Bicycle LOS Score / LOS			1.0	A	2.2	B	1.3	A

 HCS 2010™ Streets Version 6.90 Generated: 2/1/2017 3:35:02 PM

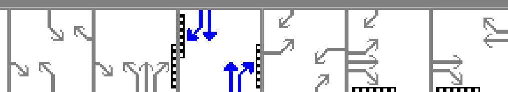
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Nov 4, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	SPUI - Minn Ave & I-229	File Name	Minn-8_C_rev_2035_AM_110416.xus		
Project Description	2035 AM - Minn-8C revised				

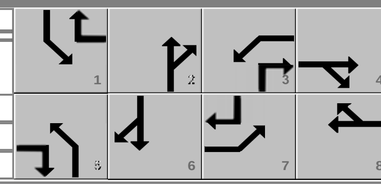


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	400	0	120	210	0	260	110	1545	330	150	540	290

Signal Information			
Cycle, s	130.0	Reference Phase	2
Offset, s	66	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	Off
Force Mode	Float	Simult. Gap N/S	On



Green	12.0	4.8	59.6	16.0	5.6	10.5
Yellow	3.5	0.0	4.0	3.5	0.0	0.0
Red	3.5	0.0	3.5	3.5	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	28.6	16.1	23.0	10.5	23.8	72.0	19.0	67.1
Change Period, (*Y+R* $_c$), s	7.0	0.0	7.0	0.0	7.0	7.5	7.0	7.5
Max Allow Headway (*MAH*), s	3.1	3.4	3.1	3.4	3.1	0.0	3.1	0.0
Queue Clearance Time (g_s), s	20.5	12.7	11.4	12.5	6.8		8.7	
Green Extension Time (g_e), s	1.1	0.0	0.6	0.0	0.2	0.0	0.4	0.0
Phase Call Probability	1.00	0.99	1.00	1.00	1.00		1.00	
Max Out Probability	0.00	1.00	0.00	1.00	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	471	0	141	247	0	306	126	1776	379	176	635	341
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1616	1633	1417	1616	1633	1256	1616	1800	1476	1616	1640	1466
Queue Service Time (g_s), s	18.5	0.0	10.7	9.4	0.0	10.5	4.8	63.7	11.7	6.7	12.5	13.3
Cycle Queue Clearance Time (g_c), s	18.5	0.0	10.7	9.4	0.0	10.5	4.8	63.7	11.7	6.7	12.5	13.3
Green Ratio (*g/C*)	0.17	0.12	0.25	0.12	0.08	0.17	0.13	0.50	0.62	0.09	0.46	0.62
Capacity (*c*), veh/h	536	202	358	398	132	435	418	1785	914	298	1505	916
Volume-to-Capacity Ratio (*X*)	0.877	0.000	0.394	0.621	0.000	0.704	0.303	0.995	0.415	0.592	0.422	0.373
Back of Queue (*Q*), ft/ln (95 th percentile)	309.5	0	173.6	177.7	0	219	81.9	766.8	95.2	123.5	189.3	127
Back of Queue (*Q*), veh/ln (95 th percentile)	12.1	0.0	6.8	6.9	0.0	8.6	3.2	30.0	3.7	4.8	7.4	5.0
Queue Storage Ratio (*RQ*) (95 th percentile)	0.69	0.00	0.39	0.39	0.00	0.49	0.38	0.00	0.38	0.35	0.00	0.36
Uniform Delay (d_1), s/veh	52.9	0.0	40.3	54.1	0.0	50.6	54.1	26.1	6.8	54.3	15.0	9.9
Incremental Delay (d_2), s/veh	1.9	0.0	0.3	0.6	0.0	4.3	0.5	10.1	0.4	0.6	0.8	1.1
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	54.8	0.0	40.6	54.7	0.0	55.0	54.6	36.2	7.2	55.0	15.8	10.9
Level of Service (LOS)	D		D	D		D	D	D	A	D	B	B
Approach Delay, s/veh / LOS	51.5	D		54.9	D		32.4	C		20.4	C	
Intersection Delay, s/veh / LOS	34.6						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.1	C	3.1	C	3.0	C	2.9	C
Bicycle LOS Score / LOS	1.5	A	1.4	A	2.4	B	1.4	A

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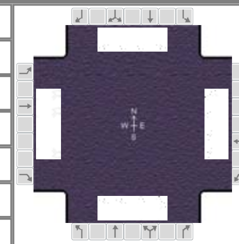
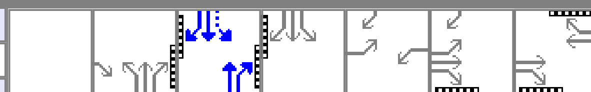
HCS 2010 Signalized Intersection Results Summary

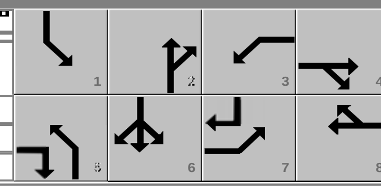
General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Nov 4, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM Peak	PHF	0.93
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Minnesota Ave & 41st St	File Name	Minn-8_C_rev_2035_PM_081616.xus		
Project Description	2035 PM - Build Minn-8C revised				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	400	250	280	340	290	60	365	865	180	60	1150	390

Signal Information										
Cycle, s	115.0	Reference Phase	6							
Offset, s	64	Reference Point	Begin	Green	15.0	33.8	4.4	14.0	2.5	16.8
Uncoordinated	No	Simult. Gap E/W	On	Yellow	3.0	4.0	3.0	3.0	0.0	4.0
Force Mode	Float	Simult. Gap N/S	On	Red	3.0	1.0	3.0	3.0	0.0	1.5





Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	4.0	2.0	4.0	1.3	3.0
Phase Duration, s	22.5	24.8	20.0	22.3	21.0	59.8	10.4	49.2
Change Period, (*Y+R* $_c$), s	6.5	5.5	6.0	5.5	6.0	5.0	6.0	6.0
Max Allow Headway (*MAH*), s	3.2	3.2	3.2	3.2	3.2	0.0	3.2	0.0
Queue Clearance Time (g_s), s	17.0	19.2	14.7	13.7	15.7		2.0	
Green Extension Time (g_e), s	0.0	0.1	0.0	0.8	0.0	0.0	1.7	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		0.87	
Max Out Probability	1.00	1.00	1.00	0.96	1.00		1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	430	269	231	366	184	178	390	553	526	65	1237	373
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1632	1765	1496	1632	1765	1679	1616	1748	1660	1664	1664	1481
Queue Service Time (g_s), s	15.0	17.2	14.8	12.7	11.4	11.7	13.7	24.2	25.3	0.0	42.3	16.9
Cycle Queue Clearance Time (g_c), s	15.0	17.2	14.8	12.7	11.4	11.7	13.7	24.2	25.3	0.0	42.3	16.9
Green Ratio (*g/C*)	0.14	0.17	0.30	0.12	0.15	0.15	0.13	0.48	0.48	0.31	0.38	0.51
Capacity (*c*), veh/h	454	296	446	397	258	245	422	833	791	249	1250	763
Volume-to-Capacity Ratio (*X*)	0.947	0.908	0.518	0.920	0.714	0.728	0.925	0.664	0.664	0.259	0.989	0.489
Back of Queue (*Q*), ft/ln (95 th percentile)	318.3	382.1	233.8	274.9	239.2	232.8	274.3	349	352	68.2	663.1	231
Back of Queue (*Q*), veh/ln (95 th percentile)	12.5	15.0	9.2	10.8	9.4	9.3	10.7	13.6	14.1	2.7	25.9	9.0
Queue Storage Ratio (*RQ*) (95 th percentile)	1.72	0.00	1.56	1.57	0.00	0.00	1.52	0.00	0.00	0.26	0.00	1.71
Uniform Delay (d_1), s/veh	49.1	47.0	33.5	49.9	46.8	46.9	49.9	16.9	18.5	33.8	28.5	14.1
Incremental Delay (d_2), s/veh	28.9	28.8	0.5	25.9	7.5	8.8	22.0	3.4	3.5	0.2	23.0	2.2
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	78.0	75.8	34.0	75.8	54.3	55.8	72.0	20.2	22.0	34.0	51.4	16.3
Level of Service (LOS)	E	E	C	E	D	E	E	C	C	C	D	B
Approach Delay, s/veh / LOS	66.4		E	65.5		E	34.6		C	42.9		D
Intersection Delay, s/veh / LOS	48.4						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.0	C	3.0	C	2.6	B	3.0	C
Bicycle LOS Score / LOS	2.0	B	1.1	A	1.7	A	1.9	A

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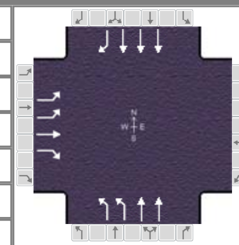
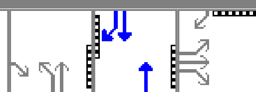
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Nov 4, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM Peak	PHF	0.93
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Minn Ave & 49th St	File Name	Minn-8_C_rev_2035_PM_081616.xus		
Project Description	2035 PM - Build Minn-8C revised				

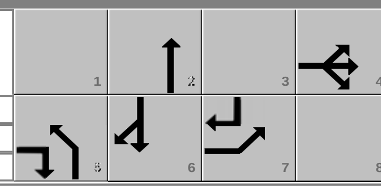


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	450	0	250				425	985			1660	260

Signal Information			
Cycle, s	115.0	Reference Phase	6
Offset, s	100	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Float	Simult. Gap N/S	On



Green	18.1	58.1	20.3	0.0	0.0	0.0
Yellow	3.0	4.0	3.0	0.0	0.0	0.0
Red	3.5	1.5	3.5	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			5	2		6
Case Number		9.0			2.0	4.0		7.3
Phase Duration, s		26.8			24.6	88.2		63.6
Change Period, (*Y+R* $_c$), s		6.5			6.5	5.5		5.5
Max Allow Headway (*MAH*), s		3.2			4.2	0.0		0.0
Queue Clearance Time (g_s), s		19.6			17.0			
Green Extension Time (g_e), s		0.7			1.1	0.0		0.0
Phase Call Probability		1.00			1.00			
Max Out Probability		1.00			0.35			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14				5	2			6	16
Adjusted Flow Rate (*v*), veh/h	484	0	269				452	1048			1785	280
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1616	1633	1440				1616	1683			1623	1443
Queue Service Time (g_s), s	16.7	0.0	17.6				15.0	12.6			23.4	2.8
Cycle Queue Clearance Time (g_c), s	16.7	0.0	17.6				15.0	12.6			23.4	2.8
Green Ratio (*g/C*)	0.18	0.18	0.33				0.16	0.72			0.51	0.68
Capacity (*c*), veh/h	570	288	483				508	2421			2462	984
Volume-to-Capacity Ratio (*X*)	0.849	0.000	0.557				0.890	0.433			0.725	0.284
Back of Queue (*Q*), ft/ln (95 th percentile)	298.5	0	256.9				204.1	165.4			183.3	27.3
Back of Queue (*Q*), veh/ln (95 th percentile)	11.7	0.0	10.0				8.0	6.5			7.2	1.1
Queue Storage Ratio (*RQ*) (95 th percentile)	0.63	0.00	0.54				0.58	0.00			0.00	0.18
Uniform Delay (d_1), s/veh	45.9	0.0	31.4				33.4	5.3			10.3	1.7
Incremental Delay (d_2), s/veh	8.9	0.0	0.6				8.8	0.4			0.5	0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0				0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	54.8	0.0	32.0				42.2	5.7			10.8	1.9
Level of Service (LOS)	D		C				D	A			B	A
Approach Delay, s/veh / LOS	46.7	D		0.0			16.7	B		9.6	A	
Intersection Delay, s/veh / LOS	18.5						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.3	C	3.0	C	1.9	A	2.9	C
Bicycle LOS Score / LOS	1.7	A			1.7	A	1.6	A

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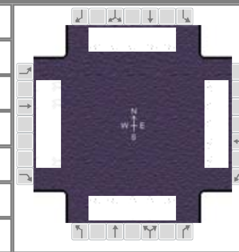
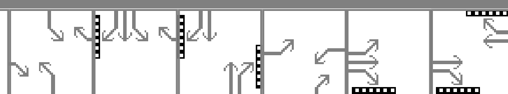
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Nov 4, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM Peak	PHF	0.93
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Minnesota Ave & 57th St	File Name	Minn-8_C_rev_2035_PM_081616.xus		
Project Description	2035 PM - Build Minn-8C revised				

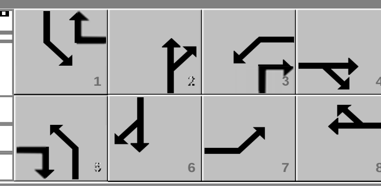


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	305	885	300	180	570	230	260	680	200	330	820	225

Signal Information				
Cycle, s	120.7	Reference Phase	2	
Offset, s	56	Reference Point	Begin	
Uncoordinated	Yes	Simult. Gap E/W	On	
Force Mode	Fixed	Simult. Gap N/S	On	



Green	13.5	3.1	33.1	9.9	5.4	31.3
Yellow	3.5	0.0	4.5	3.5	0.0	4.0
Red	3.5	0.0	1.0	3.5	0.0	1.0



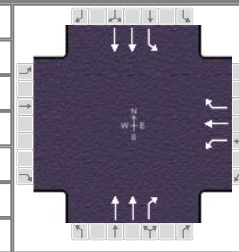
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	22.3	41.7	16.9	36.3	20.5	38.6	23.6	41.6
Change Period, ($Y+R_c$), s	7.0	5.5	7.0	5.5	7.0	5.5	7.0	5.5
Max Allow Headway (*MAH*), s	4.1	4.6	4.1	4.6	4.1	4.5	4.1	4.5
Queue Clearance Time (g_s), s	13.8	35.6	9.0	22.2	12.2	26.8	14.9	32.6
Green Extension Time (g_e), s	1.4	0.0	0.8	8.5	1.2	0.0	1.5	3.3
Phase Call Probability	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Max Out Probability	0.00	1.00	0.00	0.03	0.00	1.00	0.00	0.83

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	328	952	290	194	613	125	280	731	211	355	882	222
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1632	1680	1496	1632	1680	1496	1616	1664	1481	1616	1664	1481
Queue Service Time (g_s), s	11.8	33.6	17.2	7.0	20.2	6.7	10.2	24.8	12.9	12.9	30.6	14.9
Cycle Queue Clearance Time (g_c), s	11.8	33.6	17.2	7.0	20.2	6.7	10.2	24.8	12.9	12.9	30.6	14.9
Green Ratio (*g/C*)	0.13	0.30	0.41	0.08	0.25	0.39	0.11	0.27	0.36	0.14	0.30	0.30
Capacity (*c*), veh/h	416	1007	616	269	855	586	362	912	528	445	997	444
Volume-to-Capacity Ratio (*X*)	0.788	0.945	0.471	0.720	0.717	0.213	0.772	0.801	0.399	0.798	0.884	0.499
Back of Queue (*Q*), ft/ln (95 th percentile)	217.9	566.7	256	136.9	334.2	1.6	194.9	406.9	207.3	224	474.8	227
Back of Queue (*Q*), veh/ln (95 th percentile)	8.6	22.3	10.1	5.4	13.2	0.1	7.6	15.9	8.1	8.7	18.5	8.9
Queue Storage Ratio (*RQ*) (95 th percentile)	0.84	0.00	1.25	0.91	0.00	0.01	0.91	0.00	1.26	1.04	0.00	0.97
Uniform Delay (d_1), s/veh	51.3	41.5	26.0	54.3	41.2	24.4	52.3	40.9	29.3	50.6	40.5	35.0
Incremental Delay (d_2), s/veh	3.4	16.8	0.7	3.6	1.4	0.2	3.5	5.3	0.6	2.8	6.9	0.9
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	54.7	58.3	26.7	57.9	42.6	24.7	55.8	46.2	29.9	53.5	47.4	35.8
Level of Service (LOS)	D	E	C	E	D	C	E	D	C	D	D	D
Approach Delay, s/veh / LOS	51.7	D		43.4	D		45.6	D		47.1	D	
Intersection Delay, s/veh / LOS	47.5						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.1	C	3.1	C	3.2	C	3.1	C
Bicycle LOS Score / LOS	1.8	A	1.3	A	1.5	A	1.7	A

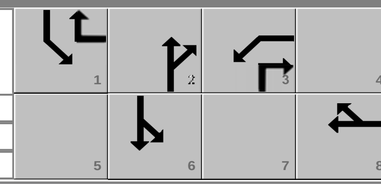
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Nov 4, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM Peak	PHF	0.93
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Lotta	File Name	Minn-8_C_rev_2035_PM_081616.xus		
Project Description	2035 PM - Build Minn-8C revised				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				60	0	100		1175	40	230	1340	

Signal Information										
Cycle, s	115.0	Reference Phase	2							
Offset, s	0	Reference Point	End	Green	6.3	82.4	9.8	0.0	0.0	0.0
Uncoordinated	No	Simult. Gap E/W	On	Yellow	3.5	4.5	3.5	0.0	0.0	0.0
Force Mode	Fixed	Simult. Gap N/S	On	Red	2.0	1.0	2.0	0.0	0.0	0.0



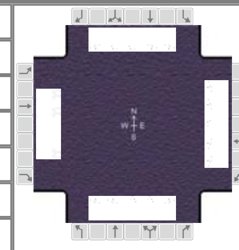
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase				8		2	1	6
Case Number				9.0		7.3	1.0	4.0
Phase Duration, s				15.3		87.9	11.8	99.7
Change Period, (*Y+R* $_c$), s				5.5		5.5	5.5	5.5
Max Allow Headway (*MAH*), s				3.4		0.0	3.1	0.0
Queue Clearance Time (g_s), s				9.7			5.9	
Green Extension Time (g_e), s				0.1		0.0	0.4	0.0
Phase Call Probability				1.00			1.00	
Max Out Probability				0.25			0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement				3	8	18		2	12	1	6	
Adjusted Flow Rate (*v*), veh/h				65	0	108		1243	42	247	1441	
Adjusted Saturation Flow Rate (*s*), veh/h/ln				1681	1765	1496		1664	1481	1664	1664	
Queue Service Time (g_s), s				4.2	0.0	7.7		19.4	0.7	3.9	11.3	
Cycle Queue Clearance Time (g_c), s				4.2	0.0	7.7		19.4	0.7	3.9	11.3	
Green Ratio (*g/C*)				0.08	0.08	0.14		0.72	0.80	0.79	0.82	
Capacity (*c*), veh/h				143	150	209		2385	1187	396	2726	
Volume-to-Capacity Ratio (*X*)				0.452	0.000	0.514		0.521	0.036	0.625	0.528	
Back of Queue (*Q*), ft/ln (95 th percentile)				83	0	133.3		227.6	6.5	76.2	84.4	
Back of Queue (*Q*), veh/ln (95 th percentile)				3.3	0.0	5.2		8.9	0.3	3.0	3.3	
Queue Storage Ratio (*RQ*) (95 th percentile)				0.08	0.00	0.89		0.00	0.04	0.51	0.00	
Uniform Delay (d_1), s/veh				50.1	0.0	45.8		7.4	2.3	8.0	1.9	
Incremental Delay (d_2), s/veh				0.8	0.0	0.7		0.5	0.0	0.4	0.5	
Initial Queue Delay (d_3), s/veh				0.0	0.0	0.0		0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh				50.9	0.0	46.6		7.9	2.4	8.4	2.4	
Level of Service (LOS)				D		D		A	A	A	A	
Approach Delay, s/veh / LOS	0.0			48.2	D		7.7	A		3.3	A	
Intersection Delay, s/veh / LOS	7.5						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.9	C	2.4	B	1.8	A
Bicycle LOS Score / LOS			0.8	A	1.6	A	1.9	A

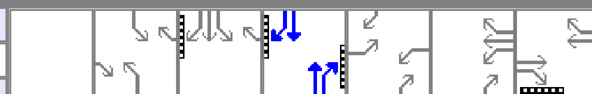
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Nov 4, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM Peak	PHF	0.93
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	SPUI - Minn Ave & I-229	File Name	Minn-8_C_rev_2035_PM_081616.xus		
Project Description	2035 PM - Build Minn-8C revised				

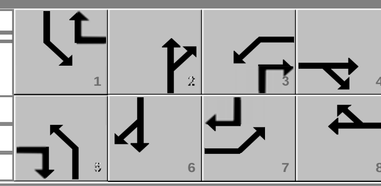


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	260	0	160	290	0	190	120	960	175	330	1110	470

Signal Information			
Cycle, s	115.0	Reference Phase	6
Offset, s	40	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Float	Simult. Gap N/S	On



Green	6.9	0.6	52.7	12.1	1.2	13.0
Yellow	3.5	3.5	4.5	3.5	0.0	0.0
Red	3.5	3.5	3.0	3.5	0.0	0.0



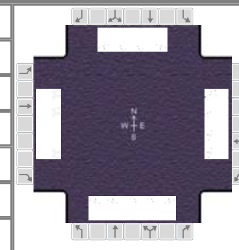
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	19.1	13.0	20.3	14.2	13.9	60.2	21.5	67.8
Change Period, ($Y+R_c$), s	7.0	0.0	7.0	0.0	7.0	7.5	7.0	7.5
Max Allow Headway (*MAH*), s	3.1	3.3	3.1	3.3	3.1	0.0	3.1	0.0
Queue Clearance Time (g_s), s	11.7	15.0	12.9	9.7	6.4		14.2	
Green Extension Time (g_e), s	0.4	0.0	0.4	0.4	0.0	0.0	0.3	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	0.98		1.00	
Max Out Probability	0.02	1.00	0.02	0.51	1.00		0.80	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	280	0	172	312	0	204	127	1017	185	355	1194	505
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1616	1633	1420	1616	1633	1243	1616	1679	1422	1616	1702	1494
Queue Service Time (g_s), s	9.7	0.0	13.0	10.9	0.0	7.7	4.4	29.8	9.5	12.2	31.2	25.3
Cycle Queue Clearance Time (g_c), s	9.7	0.0	13.0	10.9	0.0	7.7	4.4	29.8	9.5	12.2	31.2	25.3
Green Ratio (*g/C*)	0.11	0.11	0.17	0.12	0.12	0.25	0.06	0.46	0.57	0.13	0.52	0.63
Capacity (*c*), veh/h	341	185	245	374	201	620	193	1539	817	407	1786	941
Volume-to-Capacity Ratio (*X*)	0.820	0.000	0.701	0.834	0.000	0.330	0.657	0.661	0.227	0.872	0.668	0.537
Back of Queue (*Q*), ft/ln (95 th percentile)	184.1	0	222.5	204.8	0	106.3	83.1	464.5	207	195.1	440	393.4
Back of Queue (*Q*), veh/ln (95 th percentile)	7.2	0.0	8.7	8.0	0.0	4.2	3.2	18.1	8.1	7.6	17.2	15.4
Queue Storage Ratio (*RQ*) (95 th percentile)	0.41	0.00	0.49	0.46	0.00	0.24	0.39	0.00	0.83	0.56	0.00	1.12
Uniform Delay (d_1), s/veh	50.4	0.0	44.8	49.8	0.0	35.3	51.7	30.9	17.1	43.6	22.9	17.0
Incremental Delay (d_2), s/veh	2.9	0.0	7.3	4.2	0.0	0.1	3.0	1.9	0.5	8.3	1.3	1.4
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	53.3	0.0	52.1	53.9	0.0	35.4	54.7	32.8	17.7	52.0	24.2	18.4
Level of Service (LOS)	D		D	D		D	D	C	B	D	C	B
Approach Delay, s/veh / LOS	52.8	D		46.6	D		32.8	C		27.6	C	
Intersection Delay, s/veh / LOS	34.0						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.1	C	3.1	C	3.0	C	2.9	C
Bicycle LOS Score / LOS	1.2	A	1.3	A	1.6	A	2.2	B

 HCS 2010™ Streets Version 6.90 Generated: 2/1/2017 3:48:53 PM

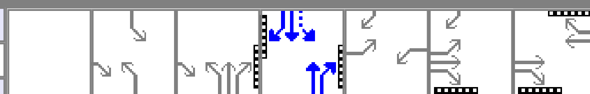
HCS 2010 Signalized Intersection Results Summary



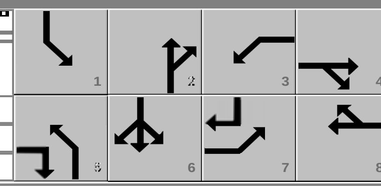
General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Aug 16, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Minnesota Ave & 41st St	File Name	Minn-8_D_rev_2035_AM_110316.xus		
Project Description	2035 AM - Minn-8D revised				

Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	350	180	110	210	220	70	335	1360	100	100	690	230

Signal Information			
Cycle, s	130.0	Reference Phase	2
Offset, s	119	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Float	Simult. Gap N/S	On



Green	6.0	6.5	54.5	12.0	0.5	15.5
Yellow	3.0	3.0	4.0	3.0	3.5	4.0
Red	3.0	3.0	1.0	3.0	3.0	1.5



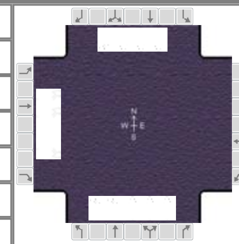
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	4.0	2.0	3.0	1.1	3.0
Phase Duration, s	25.0	28.0	18.0	21.0	24.5	72.0	12.0	59.5
Change Period, (*Y+R c*), s	6.5	5.5	6.0	5.5	6.0	5.0	6.0	5.0
Max Allow Headway (*MAH*), s	3.5	4.2	3.5	4.2	3.5	0.0	3.5	0.0
Queue Clearance Time (g_s), s	18.0	16.3	11.7	14.0	17.5		7.3	
Green Extension Time (g_e), s	0.5	1.7	0.3	1.5	1.0	0.0	0.0	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		0.99	
Max Out Probability	0.98	0.11	0.20	0.29	0.00		1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	412	212	74	247	163	157	390	1581	100	118	812	222
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1632	1765	1496	1632	1765	1649	1616	1664	1481	1664	1664	1481
Queue Service Time (g_s), s	16.0	14.3	4.4	9.7	11.7	12.0	15.5	52.1	2.4	5.3	20.7	8.1
Cycle Queue Clearance Time (g_c), s	16.0	14.3	4.4	9.7	11.7	12.0	15.5	52.1	2.4	5.3	20.7	8.1
Green Ratio (*g/C*)	0.14	0.17	0.32	0.09	0.12	0.12	0.14	0.52	0.52	0.47	0.42	0.56
Capacity (*c*), veh/h	463	306	472	301	211	197	460	1715	763	161	1395	831
Volume-to-Capacity Ratio (*X*)	0.888	0.693	0.157	0.820	0.773	0.796	0.848	0.922	0.131	0.732	0.582	0.267
Back of Queue (*Q*), ft/ln (95 th percentile)	294.7	268	73.1	194.9	242.4	235.9	277.6	598.5	38.1	123.7	310.4	122.3
Back of Queue (*Q*), veh/ln (95 th percentile)	11.6	10.6	2.9	7.7	9.5	9.4	10.8	23.4	1.5	4.8	12.1	4.8
Queue Storage Ratio (*RQ*) (95 th percentile)	1.59	0.00	0.49	1.11	0.00	0.00	1.39	0.00	0.08	0.48	0.00	0.27
Uniform Delay (d_1), s/veh	51.7	46.8	29.7	57.9	55.5	55.7	59.7	17.0	8.1	29.4	21.2	10.8
Incremental Delay (d_2), s/veh	14.2	4.4	0.2	6.8	7.8	10.1	3.0	8.4	0.3	14.5	1.8	0.8
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	65.9	51.2	29.9	64.7	63.3	65.8	62.7	25.4	8.4	43.9	23.0	11.6
Level of Service (LOS)	E	D	C	E	E	E	E	C	A	D	C	B
Approach Delay, s/veh / LOS	57.6	E		64.6	E		31.6	C		22.9	C	
Intersection Delay, s/veh / LOS	37.6						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.1	C	3.0	C	2.6	B	3.0	C
Bicycle LOS Score / LOS	1.6	A	1.0	A	2.2	B	1.4	A

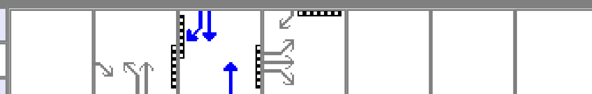
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Aug 16, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Minn Ave & 49th St	File Name	Minn-8_D_rev_2035_AM_110316.xus		
Project Description	2035 AM - Minn-8D revised				

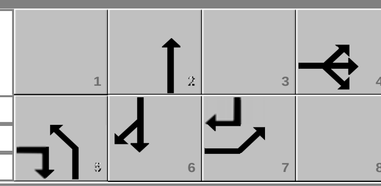


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	150	0	230				445	1760			750	260

Signal Information			
Cycle, s	130.0	Reference Phase	2
Offset, s	88	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	24.3	66.7	20.5	0.0	0.0	0.0
Yellow	3.0	4.0	3.0	0.0	0.0	0.0
Red	3.5	1.5	3.5	0.0	0.0	0.0



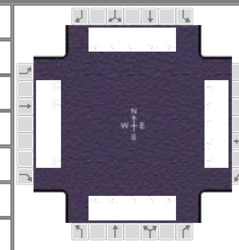
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			5	2		6
Case Number		9.0			2.0	4.0		7.3
Phase Duration, s		27.0			30.8	103.0		72.2
Change Period, ($Y+R_c$), s		6.5			6.5	5.5		5.5
Max Allow Headway (*MAH*), s		3.2			4.2	0.0		0.0
Queue Clearance Time (g_s), s		21.6			22.1			
Green Extension Time (g_e), s		0.0			2.3	0.0		0.0
Phase Call Probability		1.00			1.00			
Max Out Probability		1.00			0.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14				5	2			6	16
Adjusted Flow Rate (*v*), veh/h	176	0	271				517	2043			917	318
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1616	1633	1448				1616	1670			1561	1460
Queue Service Time (g_s), s	6.3	0.0	19.6				20.1	31.9			13.8	7.8
Cycle Queue Clearance Time (g_c), s	6.3	0.0	19.6				20.1	31.9			13.8	7.8
Green Ratio (*g/C*)	0.16	0.16	0.34				0.19	0.75			0.51	0.67
Capacity (*c*), veh/h	510	258	493				605	3756			2402	979
Volume-to-Capacity Ratio (*X*)	0.346	0.000	0.549				0.854	0.544			0.382	0.325
Back of Queue (*Q*), ft/ln (95 th percentile)	116.9	0	285.8				302.4	434.6			203.6	93.5
Back of Queue (*Q*), veh/ln (95 th percentile)	4.6	0.0	11.2				11.8	17.0			8.0	3.7
Queue Storage Ratio (*RQ*) (95 th percentile)	0.25	0.00	0.60				0.86	0.00			0.00	0.62
Uniform Delay (d_1), s/veh	48.8	0.0	34.3				50.6	13.1			16.4	4.8
Incremental Delay (d_2), s/veh	0.1	0.0	0.8				2.1	0.3			0.4	0.7
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0				0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	48.9	0.0	35.1				52.7	13.4			16.7	5.5
Level of Service (LOS)	D		D				D	B			B	A
Approach Delay, s/veh / LOS	40.5	D		0.0			21.3	C		13.8	B	
Intersection Delay, s/veh / LOS	21.2						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.4	C	3.3	C	1.9	A	2.9	C
Bicycle LOS Score / LOS	1.2	A			1.9	A	1.1	A

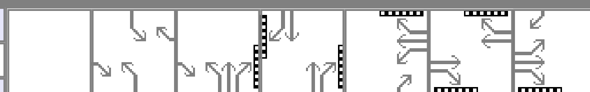
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Aug 16, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Minnesota Ave & 57th St	File Name	Minn-8_D_rev_2035_AM_110316.xus		
Project Description	2035 AM - Minn-8D revised				

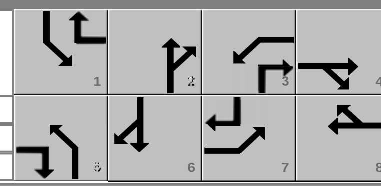


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	335	435	250	120	740	320	305	1140	100	155	545	165

Signal Information			
Cycle, s	143.7	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	10.2	1.2	47.8	8.2	19.8	18.0
Yellow	3.5	3.5	4.5	3.5	4.0	3.5
Red	3.5	3.5	1.0	3.5	1.0	3.5



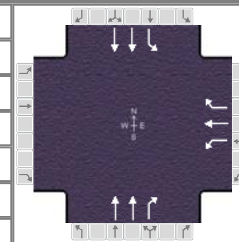
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	25.0	49.8	15.2	40.0	25.4	61.5	17.2	53.3
Change Period, (*Y+R* $_c$), s	7.0	7.0	7.0	5.0	7.0	5.5	7.0	5.5
Max Allow Headway (*MAH*), s	4.4	4.4	4.1	4.6	4.1	4.5	4.1	4.5
Queue Clearance Time (g_s), s	19.3	20.1	8.1	37.0	17.7	58.0	10.1	25.4
Green Extension Time (g_e), s	0.0	1.5	0.1	0.0	0.7	0.0	0.1	11.5
Phase Call Probability	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Max Out Probability	1.00	1.00	1.00	1.00	0.50	1.00	1.00	0.64

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	394	512	202	141	871	226	359	1341	118	186	652	162
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1632	1680	1496	1632	1680	1496	1616	1664	1481	1616	1664	1481
Queue Service Time (g_s), s	17.3	18.1	12.9	6.1	35.0	17.5	15.7	56.0	6.9	8.1	23.4	9.5
Cycle Queue Clearance Time (g_c), s	17.3	18.1	12.9	6.1	35.0	17.5	15.7	56.0	6.9	8.1	23.4	9.5
Green Ratio (*g/C*)	0.13	0.30	0.43	0.06	0.24	0.31	0.13	0.39	0.45	0.07	0.33	0.46
Capacity (*c*), veh/h	409	1001	636	187	818	470	413	1297	662	229	1108	679
Volume-to-Capacity Ratio (*X*)	0.964	0.511	0.318	0.757	1.064	0.480	0.869	1.034	0.178	0.810	0.589	0.238
Back of Queue (*Q*), ft/ln (95 th percentile)	355.8	305.3	207.8	126.9	729.5	243.3	292.5	977.6	111.5	176.4	370.3	95
Back of Queue (*Q*), veh/ln (95 th percentile)	14.0	12.0	8.2	5.0	28.7	9.6	11.4	38.2	4.4	6.9	14.5	3.7
Queue Storage Ratio (*RQ*) (95 th percentile)	1.37	0.00	1.01	0.85	0.00	1.08	1.36	0.00	0.68	0.82	0.00	0.40
Uniform Delay (d_1), s/veh	62.5	41.8	27.4	66.7	54.3	1.3	61.5	43.8	23.9	65.8	39.8	11.3
Incremental Delay (d_2), s/veh	35.1	0.5	0.3	8.8	49.8	0.9	12.4	34.2	0.2	15.9	0.8	0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	97.6	42.3	27.8	75.6	104.1	2.2	73.9	78.1	24.0	81.7	40.6	11.5
Level of Service (LOS)	F	D	C	E	F	A	E	F	C	F	D	B
Approach Delay, s/veh / LOS	59.3		E	82.3		F	73.8		E	43.5		D
Intersection Delay, s/veh / LOS	66.9						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.1	C	3.1	C	3.2	C	3.2	C
Bicycle LOS Score / LOS	1.4	A	1.5	A	2.0	A	1.3	A

HCS 2010 Signalized Intersection Results Summary

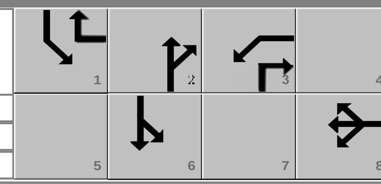
General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Aug 16, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Lotta	File Name	Minn-8_D_rev_2035_AM_110316.xus		
Project Description	2035 AM - Minn-8D revised				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				40	0	220		1775	20	60	820	

Signal Information				
Cycle, s	130.0	Reference Phase	2	
Offset, s	0	Reference Point	Begin	
Uncoordinated	No	Simult. Gap E/W	On	
Force Mode	Fixed	Simult. Gap N/S	On	

Green	4.6	85.1	23.8	0.0	0.0	0.0
Yellow	3.5	4.5	3.5	0.0	0.0	0.0
Red	2.0	1.0	2.0	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase				8		2	1	6
Case Number				9.0		7.3	1.0	4.0
Phase Duration, s				29.3		90.6	10.1	100.7
Change Period, (*Y+R c*), s				5.5		5.5	5.5	5.5
Max Allow Headway (*MAH*), s				3.5		0.0	3.1	0.0
Queue Clearance Time (*g s*), s				23.3			3.7	
Green Extension Time (*g e*), s				0.5		0.0	0.1	0.0
Phase Call Probability				1.00			0.93	
Max Out Probability				0.02			0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement				3	8	18		2	12	1	6	
Adjusted Flow Rate (*v*), veh/h				47	0	259		2044	23	72	982	
Adjusted Saturation Flow Rate (*s*), veh/h/ln				1681	1765	1496		1664	1481	1664	1664	
Queue Service Time (*g s*), s				3.1	0.0	21.3		71.6	0.3	1.7	16.0	
Cycle Queue Clearance Time (*g c*), s				3.1	0.0	21.3		71.6	0.3	1.7	16.0	
Green Ratio (*g/C*)				0.18	0.18	0.22		0.65	0.84	0.71	0.73	
Capacity (*c*), veh/h				307	323	327		2178	1240	136	2437	
Volume-to-Capacity Ratio (*X*)				0.153	0.000	0.792		0.939	0.019	0.529	0.403	
Back of Queue (*Q*), ft/ln (95 th percentile)				59.7	0	337		730.3	2.8	68.5	227.3	
Back of Queue (*Q*), veh/ln (95 th percentile)				2.4	0.0	13.3		28.5	0.1	2.7	8.9	
Queue Storage Ratio (*RQ*) (95 th percentile)				0.06	0.00	2.25		0.00	0.02	0.46	0.00	
Uniform Delay (*d 1*), s/veh				44.6	0.0	48.0		20.1	1.7	31.9	7.6	
Incremental Delay (*d 2*), s/veh				0.1	0.0	5.5		2.3	0.0	1.0	0.4	
Initial Queue Delay (*d 3*), s/veh				0.0	0.0	0.0		0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh				44.7	0.0	53.5		22.4	1.7	32.9	8.0	
Level of Service (LOS)				D		D		C	A	C	A	

	EB		WB		NB		SB	
Approach Delay, s/veh / LOS	0.0		52.1	D	22.1	C	9.7	A
Intersection Delay, s/veh / LOS	21.0				C			

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.9	C	2.4	B	1.9	A
Bicycle LOS Score / LOS			1.0	A	2.2	B	1.3	A

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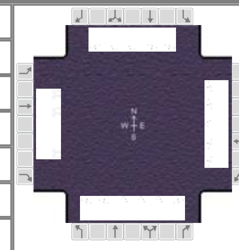
HCS 2010 Signalized Intersection Results Summary

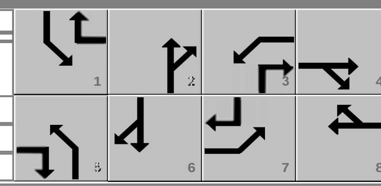
General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Aug 16, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	SPUI - Minn Ave & I-229	File Name	Minn-8_D_rev_2035_AM_110316.xus		
Project Description	2035 AM - Minn-8D revised				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	400	0	120	210	0	260	110	1545	330	150	540	290

Signal Information			
Cycle, s	130.0	Reference Phase	2
Offset, s	66	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	Off
Force Mode	Float	Simult. Gap N/S	On

Green	12.0	4.8	59.6	16.0	5.6	10.5
Yellow	3.5	0.0	4.0	3.5	0.0	0.0
Red	3.5	0.0	3.5	3.5	0.0	0.0



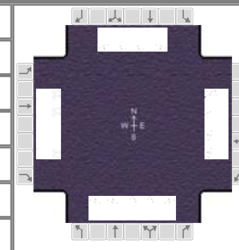
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	28.6	16.1	23.0	10.5	23.8	71.9	19.0	67.1
Change Period, (*Y+R* $_c$), s	7.0	0.0	7.0	0.0	7.0	7.5	7.0	7.5
Max Allow Headway (*MAH*), s	3.1	3.4	3.1	3.4	3.1	0.0	3.1	0.0
Queue Clearance Time (g_s), s	20.5	12.7	11.4	12.5	6.7		8.9	
Green Extension Time (g_e), s	1.1	0.0	0.6	0.0	0.2	0.0	0.4	0.0
Phase Call Probability	1.00	0.99	1.00	1.00	1.00		1.00	
Max Out Probability	0.00	1.00	0.00	1.00	0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	471	0	141	247	0	306	127	1784	381	182	655	352
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1616	1633	1417	1616	1633	1256	1616	1643	1476	1616	1643	1469
Queue Service Time (g_s), s	18.5	0.0	10.7	9.4	0.0	10.5	4.7	33.5	11.7	6.9	13.0	13.7
Cycle Queue Clearance Time (g_c), s	18.5	0.0	10.7	9.4	0.0	10.5	4.7	33.5	11.7	6.9	13.0	13.7
Green Ratio (*g/C*)	0.17	0.12	0.25	0.12	0.08	0.17	0.13	0.50	0.62	0.09	0.46	0.62
Capacity (*c*), veh/h	536	202	358	398	132	435	418	2444	914	298	1507	917
Volume-to-Capacity Ratio (*X*)	0.877	0.000	0.394	0.621	0.000	0.704	0.304	0.730	0.417	0.610	0.434	0.383
Back of Queue (*Q*), ft/ln (95 th percentile)	309.5	0	173.6	177.7	0	219	80.3	358.4	94.2	127	194.7	126.2
Back of Queue (*Q*), veh/ln (95 th percentile)	12.1	0.0	6.8	6.9	0.0	8.6	3.1	14.0	3.7	5.0	7.6	4.9
Queue Storage Ratio (*RQ*) (95 th percentile)	0.69	0.00	0.39	0.39	0.00	0.49	0.37	0.00	0.38	0.36	0.00	0.36
Uniform Delay (d_1), s/veh	52.9	0.0	40.3	54.1	0.0	50.6	53.0	19.9	6.7	54.2	15.2	9.8
Incremental Delay (d_2), s/veh	1.9	0.0	0.3	0.6	0.0	4.3	0.5	0.5	0.4	0.7	0.8	1.1
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	54.8	0.0	40.6	54.7	0.0	55.0	53.5	20.4	7.1	54.9	16.0	10.9
Level of Service (LOS)	D		D	D		D	D	C	A	D	B	B
Approach Delay, s/veh / LOS	51.5	D		54.9	D		20.0	C		20.5	C	
Intersection Delay, s/veh / LOS	28.4						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.2	C	3.4	C	3.0	C	2.9	C
Bicycle LOS Score / LOS	1.5	A	1.4	A	1.8	A	1.4	A

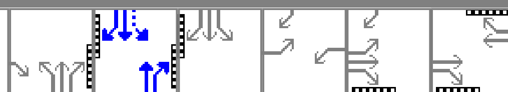
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Nov 3, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.93
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Minnesota Ave & 41st St	File Name	Minn-8_D_rev_2035_PM_110316.xus		
Project Description	2035 PM - Minn-8D revised				

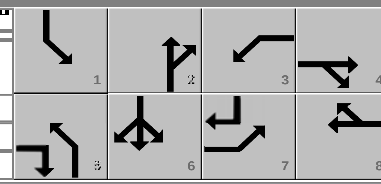


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	400	250	280	340	290	60	405	865	180	90	1120	390

Signal Information			
Cycle, s	120.0	Reference Phase	6
Offset, s	81	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	18.1	34.0	4.8	14.5	3.0	17.1
Yellow	3.0	4.0	3.0	3.0	0.0	4.0
Red	3.0	1.0	3.0	3.0	0.0	1.5



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	4.0	2.0	3.0	1.3	3.0
Phase Duration, s	23.5	25.6	20.5	22.6	24.1	63.1	10.8	49.8
Change Period, (*Y+R c*), s	6.5	5.5	6.0	5.5	6.0	5.0	6.0	6.0
Max Allow Headway (*MAH*), s	3.2	3.2	3.2	3.2	3.2	0.0	3.2	0.0
Queue Clearance Time (*g s*), s	17.6	19.9	15.3	14.2	18.0		2.0	
Green Extension Time (*g e*), s	0.0	0.2	0.0	0.8	0.1	0.0	1.6	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		0.96	
Max Out Probability	1.00	1.00	1.00	0.98	1.00		1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	430	269	231	366	184	178	435	930	156	97	1204	373
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1632	1765	1496	1632	1765	1679	1616	1664	1481	1664	1664	1481
Queue Service Time (*g s*), s	15.6	17.9	15.0	13.3	12.0	12.2	16.0	16.8	4.9	0.0	43.1	18.1
Cycle Queue Clearance Time (*g c*), s	15.6	17.9	15.0	13.3	12.0	12.2	16.0	16.8	4.9	0.0	43.1	18.1
Green Ratio (*g/C*)	0.14	0.17	0.32	0.12	0.14	0.14	0.15	0.48	0.48	0.31	0.37	0.51
Capacity (*c*), veh/h	462	296	476	394	252	240	486	1611	717	263	1215	751
Volume-to-Capacity Ratio (*X*)	0.930	0.909	0.486	0.927	0.731	0.745	0.896	0.578	0.218	0.368	0.991	0.497
Back of Queue (*Q*), ft/ln (95 th percentile)	320.4	393	236	285.8	250.2	243.6	310.5	212.2	75.2	110.3	682	248.8
Back of Queue (*Q*), veh/ln (95 th percentile)	12.6	15.5	9.3	11.3	9.9	9.7	12.1	8.3	2.9	4.3	26.6	9.7
Queue Storage Ratio (*RQ*) (95 th percentile)	1.73	0.00	1.57	1.63	0.00	0.00	0.89	0.00	0.15	0.42	0.00	0.55
Uniform Delay (*d 1*), s/veh	50.9	49.0	33.0	52.2	49.2	49.3	53.3	11.8	5.8	34.9	30.6	15.4
Incremental Delay (*d 2*), s/veh	25.1	28.6	0.3	27.4	8.6	10.1	16.1	1.3	0.6	0.3	23.7	2.3
Initial Queue Delay (*d 3*), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	76.0	77.6	33.3	79.6	57.8	59.5	69.5	13.1	6.4	35.2	54.3	17.7
Level of Service (LOS)	E	E	C	E	E	E	E	B	A	D	D	B
Approach Delay, s/veh / LOS	65.9	E		69.2	E		28.5	C		45.1	D	
Intersection Delay, s/veh / LOS	47.5						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.1	C	3.0	C	2.6	B	3.0	C
Bicycle LOS Score / LOS	2.0	B	1.1	A	1.7	A	1.9	A

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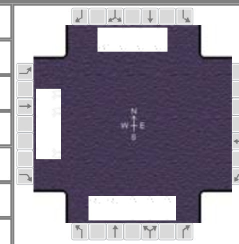
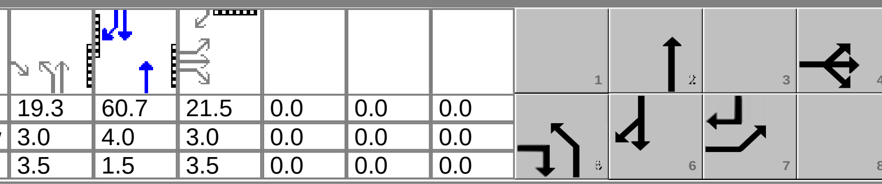
HCS 2010 Signalized Intersection Results Summary

General Information				**Intersection Information**	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Nov 3, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.93
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Minn Ave & 49th St	File Name	Minn-8_D_rev_2035_PM_110316.xus		
Project Description	2035 PM - Minn-8D revised				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	450	0	250				425	985			1660	260

Signal Information										
Cycle, s	120.0	Reference Phase	6							
Offset, s	100	Reference Point	Begin	Green	19.3	60.7	21.5	0.0	0.0	0.0
Uncoordinated	No	Simult. Gap E/W	On	Yellow	3.0	4.0	3.0	0.0	0.0	0.0
Force Mode	Float	Simult. Gap N/S	On	Red	3.5	1.5	3.5	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			5	2		6
Case Number		9.0			2.0	4.0		7.3
Phase Duration, s		28.0			25.8	92.0		66.2
Change Period, (*Y+R* *c*), s		6.5			6.5	5.5		5.5
Max Allow Headway (*MAH*), s		3.2			3.2	0.0		0.0
Queue Clearance Time (*g* *s*), s		20.1			18.5			
Green Extension Time (*g* *e*), s		1.3			0.8	0.0		0.0
Phase Call Probability		1.00			1.00			
Max Out Probability		0.09			0.03			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14				5	2			6	16
Adjusted Flow Rate (*v*), veh/h	484	0	269				457	1059			1785	280
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1616	1633	1443				1616	1567			1630	1445
Queue Service Time (*g* *s*), s	17.3	0.0	18.1				16.5	12.4			30.3	4.3
Cycle Queue Clearance Time (*g* *c*), s	17.3	0.0	18.1				16.5	12.4			30.3	4.3
Green Ratio (*g/C*)	0.18	0.18	0.34				0.16	0.72			0.51	0.69
Capacity (*c*), veh/h	579	292	492				519	3388			2475	990
Volume-to-Capacity Ratio (*X*)	0.836	0.000	0.546				0.881	0.313			0.721	0.282
Back of Queue (*Q*), ft/ln (95 th percentile)	297.8	0	263.7				276.9	191.5			330	43
Back of Queue (*Q*), veh/ln (95 th percentile)	11.6	0.0	10.3				10.8	7.5			12.9	1.7
Queue Storage Ratio (*RQ*) (95 th percentile)	0.63	0.00	0.56				0.79	0.00			0.00	0.29
Uniform Delay (*d* *1*), s/veh	47.6	0.0	32.2				46.5	8.5			17.3	2.7
Incremental Delay (*d* *2*), s/veh	4.8	0.0	0.4				6.6	0.2			0.5	0.2
Initial Queue Delay (*d* *3*), s/veh	0.0	0.0	0.0				0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	52.3	0.0	32.5				53.2	8.7			17.8	2.9
Level of Service (LOS)	D		C				D	A			B	A
Approach Delay, s/veh / LOS	45.2	D		0.0			22.1	C		15.8	B	
Intersection Delay, s/veh / LOS	23.1						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.4	C	3.3	C	1.9	A	2.9	C
Bicycle LOS Score / LOS	1.7	A			1.3	A	1.6	A

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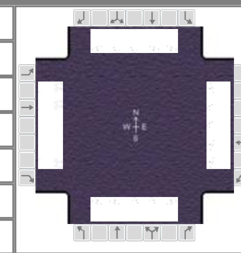
HCS 2010 Signalized Intersection Results Summary

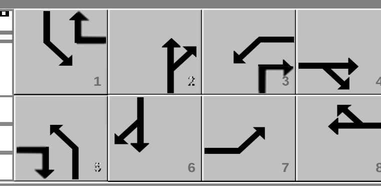
General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Nov 3, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.93
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Minnesota Ave & 57th St	File Name	Minn-8_D_rev_2035_PM_110316.xus		
Project Description	2035 PM - Minn-8D revised				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	305	885	300	180	570	230	260	680	200	330	820	225

Signal Information			
Cycle, s	120.7	Reference Phase	2
Offset, s	56	Reference Point	Begin
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	13.5	3.1	33.1	9.9	5.4	31.3
Yellow	3.5	0.0	4.5	3.5	0.0	4.0
Red	3.5	0.0	1.0	3.5	0.0	1.0



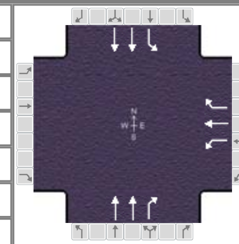
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	22.3	41.7	16.9	36.3	20.5	38.6	23.6	41.6
Change Period, (*Y+R* c), s	7.0	5.5	7.0	5.5	7.0	5.5	7.0	5.5
Max Allow Headway (*MAH*), s	4.1	4.6	4.1	4.6	4.1	4.5	4.1	4.5
Queue Clearance Time (g_s), s	13.8	35.6	9.0	22.2	12.2	26.8	14.9	32.6
Green Extension Time (g_e), s	1.4	0.0	0.8	8.5	1.2	0.0	1.5	3.3
Phase Call Probability	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Max Out Probability	0.00	1.00	0.00	0.03	0.00	1.00	0.00	0.83

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	328	952	290	194	613	125	280	731	211	355	882	222
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1632	1680	1496	1632	1680	1496	1616	1664	1481	1616	1664	1481
Queue Service Time (g_s), s	11.8	33.6	17.2	7.0	20.2	6.7	10.2	24.8	12.9	12.9	30.6	14.9
Cycle Queue Clearance Time (g_c), s	11.8	33.6	17.2	7.0	20.2	6.7	10.2	24.8	12.9	12.9	30.6	14.9
Green Ratio (*g/C*)	0.13	0.30	0.41	0.08	0.25	0.39	0.11	0.27	0.36	0.14	0.30	0.30
Capacity (*c*), veh/h	416	1007	616	269	855	586	362	912	528	445	997	444
Volume-to-Capacity Ratio (*X*)	0.788	0.945	0.471	0.720	0.717	0.213	0.772	0.801	0.399	0.798	0.884	0.499
Back of Queue (*Q*), ft/ln (95 th percentile)	217.9	566.7	256	136.9	334.2	1.6	194.9	406.9	207.3	224.1	475	227.1
Back of Queue (*Q*), veh/ln (95 th percentile)	8.6	22.3	10.1	5.4	13.2	0.1	7.6	15.9	8.1	8.8	18.6	8.9
Queue Storage Ratio (*RQ*) (95 th percentile)	0.84	0.00	1.25	0.91	0.00	0.01	0.91	0.00	1.26	1.04	0.00	0.97
Uniform Delay (d_1), s/veh	51.3	41.5	26.0	54.3	41.2	24.4	52.3	40.9	29.3	50.6	40.5	35.0
Incremental Delay (d_2), s/veh	3.4	16.8	0.7	3.6	1.4	0.2	3.5	5.3	0.6	2.8	7.0	0.9
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	54.7	58.3	26.7	57.9	42.6	24.7	55.8	46.2	29.9	53.5	47.4	35.8
Level of Service (LOS)	D	E	C	E	D	C	E	D	C	D	D	D
Approach Delay, s/veh / LOS	51.7	D		43.4	D		45.6	D		47.1	D	
Intersection Delay, s/veh / LOS	47.5						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.1	C	3.1	C	3.2	C	3.1	C
Bicycle LOS Score / LOS	1.8	A	1.3	A	1.5	A	1.7	A

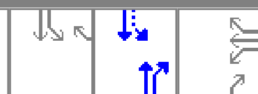
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Nov 3, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.93
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Lotta	File Name	Minn-8_D_rev_2035_PM_110316.xus		
Project Description	2035 PM - Minn-8D revised				

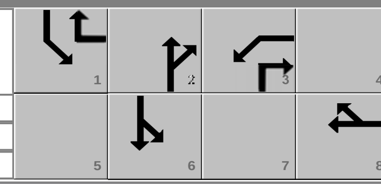


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				60	0	100		1175	40	230	1340	

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	6.4	86.8	10.3	0.0	0.0	0.0
Yellow	3.5	4.5	3.5	0.0	0.0	0.0
Red	2.0	1.0	2.0	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase				8		2	1	6
Case Number				9.0		7.3	1.0	4.0
Phase Duration, s				15.8		92.3	11.9	104.2
Change Period, (*Y+R c*), s				5.5		5.5	5.5	5.5
Max Allow Headway (*MAH*), s				3.4		0.0	3.1	0.0
Queue Clearance Time (g_s), s				10.0			6.0	
Green Extension Time (g_e), s				0.3		0.0	0.4	0.0
Phase Call Probability				1.00			1.00	
Max Out Probability				0.00			0.00	

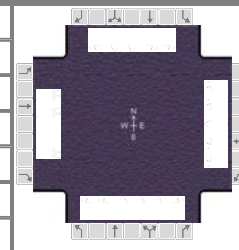
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement				3	8	18		2	12	1	6	
Adjusted Flow Rate (*v*), veh/h				65	0	108		1263	43	247	1441	
Adjusted Saturation Flow Rate (*s*), veh/h/ln				1681	1765	1496		1664	1481	1664	1664	
Queue Service Time (g_s), s				4.4	0.0	8.0		20.3	0.7	4.0	9.6	
Cycle Queue Clearance Time (g_c), s				4.4	0.0	8.0		20.3	0.7	4.0	9.6	
Green Ratio (*g/C*)				0.09	0.09	0.14		0.72	0.81	0.79	0.82	
Capacity (*c*), veh/h				144	151	208		2406	1198	389	2737	
Volume-to-Capacity Ratio (*X*)				0.448	0.000	0.516		0.525	0.036	0.636	0.526	
Back of Queue (*Q*), ft/ln (95 th percentile)				86.9	0	139.7		238.6	6.7	85.9	68.6	
Back of Queue (*Q*), veh/ln (95 th percentile)				3.4	0.0	5.5		9.3	0.3	3.4	2.7	
Queue Storage Ratio (*RQ*) (95 th percentile)				0.09	0.00	0.93		0.00	0.04	0.57	0.00	
Uniform Delay (d_1), s/veh				52.2	0.0	47.9		7.4	2.3	8.4	1.5	
Incremental Delay (d_2), s/veh				0.8	0.0	0.7		0.5	0.0	0.4	0.5	
Initial Queue Delay (d_3), s/veh				0.0	0.0	0.0		0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh				53.0	0.0	48.6		7.9	2.3	8.8	2.0	
Level of Service (LOS)				D		D		A	A	A	A	

	EB		WB		NB		SB	
Approach Delay, s/veh / LOS	0.0		50.3	D	7.7	A	3.0	A
Intersection Delay, s/veh / LOS	7.5				A			

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.9	C	2.4	B	1.8	A
Bicycle LOS Score / LOS			0.8	A	1.6	A	1.9	A

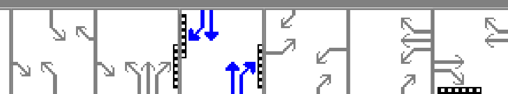
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Nov 3, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.93
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	SPUI - Minn Ave & I-229	File Name	Minn-8_D_rev_2035_PM_110316.xus		
Project Description	2035 PM - Minn-8D revised				

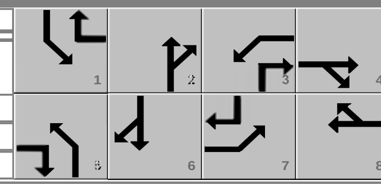


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	260	0	160	290	0	190	120	960	175	330	1110	470

Signal Information			
Cycle, s	120.0	Reference Phase	6
Offset, s	40	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Float	Simult. Gap N/S	On



Green	15.1	0.4	64.1	12.6	1.2	5.0
Yellow	3.5	0.0	4.0	3.5	0.0	0.0
Red	3.5	0.0	3.5	3.5	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	19.6	5.0	20.9	6.2	22.5	72.0	22.1	71.6
Change Period, ($Y+R_c$), s	7.0	0.0	7.0	0.0	7.0	7.5	7.0	7.5
Max Allow Headway (*MAH*), s	3.1	3.3	3.1	3.3	3.1	0.0	3.1	0.0
Queue Clearance Time (g_s), s	12.2	7.0	13.3	8.2	6.2		14.7	
Green Extension Time (g_e), s	0.5	0.0	0.5	0.0	0.2	0.0	0.4	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		1.00	
Max Out Probability	0.00	1.00	0.00	1.00	0.00		0.36	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	280	0	172	312	0	204	129	1032	188	355	1194	505
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1616	1633	1421	1616	1633	1244	1616	1564	1425	1616	1709	1499
Queue Service Time (g_s), s	10.2	0.0	5.0	11.3	0.0	6.2	4.2	17.8	8.1	12.7	34.0	28.2
Cycle Queue Clearance Time (g_c), s	10.2	0.0	5.0	11.3	0.0	6.2	4.2	17.8	8.1	12.7	34.0	28.2
Green Ratio (*g/C*)	0.11	0.04	0.17	0.12	0.05	0.18	0.13	0.54	0.65	0.13	0.53	0.64
Capacity (*c*), veh/h	341	68	243	373	85	442	417	2525	931	407	1827	959
Volume-to-Capacity Ratio (*X*)	0.821	0.000	0.709	0.836	0.000	0.462	0.309	0.409	0.202	0.872	0.653	0.527
Back of Queue (*Q*), ft/ln (95 th percentile)	190.8	0	231.9	208.5	0	124.2	79.6	269.3	177.6	203.6	499	498.7
Back of Queue (*Q*), veh/ln (95 th percentile)	7.5	0.0	9.1	8.1	0.0	4.9	3.1	10.5	6.9	8.0	19.5	19.5
Queue Storage Ratio (*RQ*) (95 th percentile)	0.42	0.00	0.52	0.46	0.00	0.28	0.37	0.00	0.71	0.58	0.00	1.42
Uniform Delay (d_1), s/veh	52.6	0.0	46.9	52.0	0.0	44.2	44.9	20.1	11.4	46.3	27.0	21.2
Incremental Delay (d_2), s/veh	1.9	0.0	7.9	2.1	0.0	0.3	1.6	0.4	0.4	7.6	1.2	1.4
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	54.5	0.0	54.8	54.0	0.0	44.5	46.5	20.6	11.9	53.9	28.2	22.5
Level of Service (LOS)	D		D	D		D	D	C	B	D	C	C
Approach Delay, s/veh / LOS	54.6	D		50.3	D		21.8	C		31.2	C	
Intersection Delay, s/veh / LOS	33.0						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.2	C	3.4	C	3.0	C	2.9	C
Bicycle LOS Score / LOS	1.2	A	1.3	A	1.2	A	2.2	B

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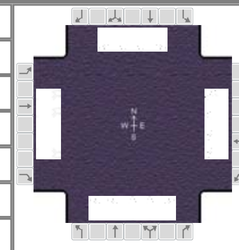
HCS 2010 Signalized Intersection Results Summary

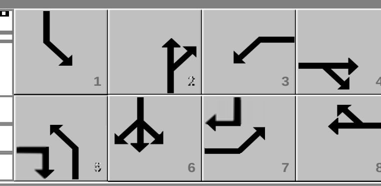
General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Nov 3, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Minnesota Ave & 41st St	File Name	Minn-9_D_2035_AM_110316.xus		
Project Description	2035 AM - Minn-9D				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	350	180	110	210	220	70	230	1360	100	100	690	230

Signal Information			
Cycle, s	130.0	Reference Phase	2
Offset, s	119	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Float	Simult. Gap N/S	On

Green	6.0	1.2	59.8	12.0	0.5	15.5
Yellow	3.0	3.0	4.0	3.0	3.5	4.0
Red	3.0	3.0	1.0	3.0	3.0	1.5



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	4.0	2.0	3.0	1.1	3.0
Phase Duration, s	25.0	28.0	18.0	21.0	19.2	72.0	12.0	64.8
Change Period, ($Y+R_c$), s	6.5	5.5	6.0	5.5	6.0	5.0	6.0	5.0
Max Allow Headway (*MAH*), s	3.5	4.2	3.5	4.2	3.5	0.0	3.5	0.0
Queue Clearance Time (g_s), s	18.0	16.3	11.7	14.0	12.5		6.9	
Green Extension Time (g_e), s	0.5	1.7	0.3	1.5	0.7	0.0	0.0	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		0.99	
Max Out Probability	0.98	0.11	0.20	0.29	0.00		1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	412	212	74	247	163	157	262	1547	98	118	812	222
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1632	1765	1496	1632	1765	1649	1616	1664	1481	1664	1664	1481
Queue Service Time (g_s), s	16.0	14.3	4.7	9.7	11.7	12.0	10.5	47.3	1.2	4.9	18.2	7.0
Cycle Queue Clearance Time (g_c), s	16.0	14.3	4.7	9.7	11.7	12.0	10.5	47.3	1.2	4.9	18.2	7.0
Green Ratio (*g/C*)	0.14	0.17	0.27	0.09	0.12	0.12	0.10	0.52	0.52	0.51	0.46	0.60
Capacity (*c*), veh/h	463	306	411	301	211	197	328	1715	763	173	1531	892
Volume-to-Capacity Ratio (*X*)	0.888	0.693	0.181	0.820	0.773	0.796	0.799	0.902	0.128	0.681	0.530	0.249
Back of Queue (*Q*), ft/ln (95 th percentile)	294.7	268	78.1	194.9	242.4	235.9	203.2	491.9	19.9	105.9	268.4	101.8
Back of Queue (*Q*), veh/ln (95 th percentile)	11.6	10.6	3.1	7.7	9.5	9.4	7.9	19.2	0.8	4.1	10.5	4.0
Queue Storage Ratio (*RQ*) (95 th percentile)	1.59	0.00	0.52	1.11	0.00	0.00	1.02	0.00	0.04	0.41	0.00	0.23
Uniform Delay (d_1), s/veh	51.7	46.8	33.4	57.9	55.5	55.7	62.7	14.4	4.1	27.3	17.1	8.4
Incremental Delay (d_2), s/veh	14.2	4.4	0.2	6.8	7.8	10.1	2.2	6.7	0.3	9.3	1.3	0.7
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	65.9	51.2	33.6	64.7	63.3	65.8	65.0	21.0	4.4	36.6	18.4	9.0
Level of Service (LOS)	E	D	C	E	E	E	E	C	A	D	B	A

	EB		WB		NB		SB	
Approach Delay, s/veh / LOS	58.0	E	64.6	E	26.2	C	18.4	B
Intersection Delay, s/veh / LOS	34.3				C			

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.1	C	3.0	C	2.6	B	3.0	C
Bicycle LOS Score / LOS	1.6	A	1.0	A	2.1	B	1.4	A

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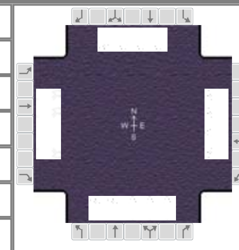
HCS 2010 Signalized Intersection Results Summary

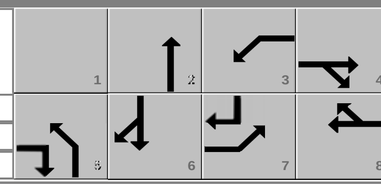
General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Nov 3, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Minn Ave & 49th St	File Name	Minn-9_D_2035_AM_110316.xus		
Project Description	2035 AM - Minn-9D				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	150	0	230	0	105	155	550	1655			750	300

Signal Information			
Cycle, s	130.0	Reference Phase	2
Offset, s	88	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Float	Simult. Gap N/S	On

Green	25.3	41.7	0.0	17.5	21.5	0.0
Yellow	3.0	4.0	3.0	3.0	4.0	0.0
Red	3.5	1.5	3.5	3.5	1.5	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2		6
Case Number	2.0	3.0	2.0	3.0	2.0	4.0		7.3
Phase Duration, s	24.0	51.0	0.0	27.0	31.8	79.0		47.2
Change Period, (*Y+R* $_c$), s	6.5	5.5	6.5	5.5	6.5	5.5		5.5
Max Allow Headway (*MAH*), s	3.1	3.3	0.0	3.3	3.2	0.0		0.0
Queue Clearance Time (g_s), s	8.5	15.6		10.7	24.0			
Green Extension Time (g_e), s	0.2	1.2	0.0	1.1	1.3	0.0		0.0
Phase Call Probability	1.00	1.00		1.00	1.00			
Max Out Probability	0.00	0.00		0.02	0.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h	176	0	271	0	124	182	563	1693			882	353
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1616	1633	1448	1664	1667	1244	1616	1634			1558	1469
Queue Service Time (g_s), s	6.5	0.0	13.6	0.0	8.7	8.6	22.0	34.9			19.6	20.2
Cycle Queue Clearance Time (g_c), s	6.5	0.0	13.6	0.0	8.7	8.6	22.0	34.9			19.6	20.2
Green Ratio (*g/C*)	0.13	0.35	0.54		0.17	0.17	0.19	0.57			0.32	0.46
Capacity (*c*), veh/h	435	572	789	1	276	411	629	2772			1499	669
Volume-to-Capacity Ratio (*X*)	0.406	0.000	0.343	0.000	0.448	0.443	0.894	0.611			0.589	0.528
Back of Queue (*Q*), ft/ln (95 th percentile)	127.7	0	200	0	183.1	130.5	335	493.2			290.8	251
Back of Queue (*Q*), veh/ln (95 th percentile)	5.0	0.0	7.8	0.0	7.2	5.1	13.1	19.3			11.4	9.8
Queue Storage Ratio (*RQ*) (95 th percentile)	0.27	0.00	0.42	0.00	0.18	0.52	0.96	0.00			0.00	1.67
Uniform Delay (d_1), s/veh	51.5	0.0	16.6	0.0	48.9	48.9	50.2	26.3			33.4	18.8
Incremental Delay (d_2), s/veh	2.8	0.0	0.1	0.0	5.2	3.4	3.8	0.6			1.4	2.4
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	54.3	0.0	16.7	0.0	54.1	52.3	54.0	26.9			34.8	21.1
Level of Service (LOS)	D		B		D	D	D	C			C	C
Approach Delay, s/veh / LOS	31.5		C	53.0		D	33.7		C	30.9		C
Intersection Delay, s/veh / LOS	34.0						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.4	C	3.3	C	2.6	B	3.0	C
Bicycle LOS Score / LOS	1.2	A	1.0	A	1.9	A	1.2	A

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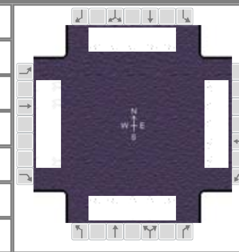
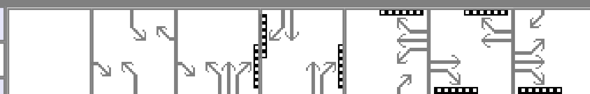
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Nov 3, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Minnesota Ave & 57th St	File Name	Minn-9_D_2035_AM_110316.xus		
Project Description	2035 AM - Minn-9D				

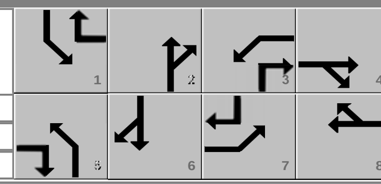


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	335	435	250	120	740	320	305	1140	100	155	545	165

Signal Information			
Cycle, s	143.5	Reference Phase	2
Offset, s	0	Reference Point	Begin
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	10.0	1.3	47.7	8.2	19.8	18.0
Yellow	3.5	3.5	4.5	3.5	4.0	3.5
Red	3.5	3.5	1.0	3.5	1.0	3.5



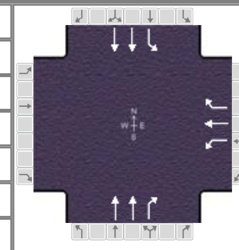
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	25.0	49.8	15.2	40.0	25.3	61.5	17.0	53.2
Change Period, ($Y+R_c$), s	7.0	7.0	7.0	5.0	7.0	5.5	7.0	5.5
Max Allow Headway (*MAH*), s	4.4	4.4	4.1	4.6	4.1	4.5	4.1	4.5
Queue Clearance Time (g_s), s	19.2	20.1	8.1	37.0	17.6	58.0	10.0	24.9
Green Extension Time (g_e), s	0.0	1.6	0.1	0.0	0.7	0.0	0.1	11.6
Phase Call Probability	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Max Out Probability	1.00	1.00	1.00	1.00	0.49	1.00	1.00	0.62

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	394	512	202	141	871	226	359	1341	118	182	641	159
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1632	1680	1496	1632	1680	1496	1616	1664	1481	1616	1664	1481
Queue Service Time (g_s), s	17.2	18.1	12.9	6.1	35.0	17.5	15.6	56.0	6.8	8.0	22.9	9.4
Cycle Queue Clearance Time (g_c), s	17.2	18.1	12.9	6.1	35.0	17.5	15.6	56.0	6.8	8.0	22.9	9.4
Green Ratio (*g/C*)	0.13	0.30	0.43	0.06	0.24	0.31	0.13	0.39	0.45	0.07	0.33	0.46
Capacity (*c*), veh/h	409	1002	637	187	819	469	413	1298	662	226	1106	678
Volume-to-Capacity Ratio (*X*)	0.963	0.511	0.318	0.756	1.063	0.481	0.869	1.033	0.178	0.807	0.580	0.234
Back of Queue (*Q*), ft/ln (95 th percentile)	355.1	304.8	207.4	126.8	728.4	243.1	292.1	975	111.2	172.3	363.6	93
Back of Queue (*Q*), veh/ln (95 th percentile)	14.0	12.0	8.2	5.0	28.7	9.6	11.4	38.1	4.3	6.7	14.2	3.6
Queue Storage Ratio (*RQ*) (95 th percentile)	1.37	0.00	1.01	0.85	0.00	1.08	1.36	0.00	0.67	0.80	0.00	0.40
Uniform Delay (d_1), s/veh	62.4	41.7	27.4	66.7	54.3	1.3	61.4	43.8	23.8	65.8	39.6	11.2
Incremental Delay (d_2), s/veh	34.8	0.5	0.3	8.8	49.4	0.9	12.4	33.9	0.2	15.4	0.8	0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	97.3	42.2	27.7	75.5	103.7	2.3	73.8	77.7	24.0	81.2	40.4	11.4
Level of Service (LOS)	F	D	C	E	F	A	E	F	C	F	D	B
Approach Delay, s/veh / LOS	59.2	E		82.0	F		73.5	E		43.3	D	
Intersection Delay, s/veh / LOS	66.7						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.1	C	3.1	C	3.2	C	3.2	C
Bicycle LOS Score / LOS	1.4	A	1.5	A	2.0	A	1.3	A

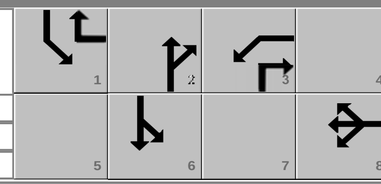
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Nov 3, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Lotta	File Name	Minn-9_D_2035_AM_110316.xus		
Project Description	2035 AM - Minn-9D				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				40	0	220		1775	20	60	820	

Signal Information										
Cycle, s	130.0	Reference Phase	2							
Offset, s	0	Reference Point	Begin	Green	4.6	85.1	23.8	0.0	0.0	0.0
Uncoordinated	No	Simult. Gap E/W	On	Yellow	3.5	4.5	3.5	0.0	0.0	0.0
Force Mode	Fixed	Simult. Gap N/S	On	Red	2.0	1.0	2.0	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase				8		2	1	6
Case Number				9.0		7.3	1.0	4.0
Phase Duration, s				29.3		90.6	10.1	100.7
Change Period, (*Y+R c*), s				5.5		5.5	5.5	5.5
Max Allow Headway (*MAH*), s				3.5		0.0	3.1	0.0
Queue Clearance Time (g_s), s				23.3			3.7	
Green Extension Time (g_e), s				0.5		0.0	0.1	0.0
Phase Call Probability				1.00			0.92	
Max Out Probability				0.02			0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement				3	8	18		2	12	1	6	
Adjusted Flow Rate (*v*), veh/h				47	0	259		2046	23	71	965	
Adjusted Saturation Flow Rate (*s*), veh/h/ln				1681	1765	1496		1664	1481	1664	1664	
Queue Service Time (g_s), s				3.1	0.0	21.3		71.7	0.3	1.7	17.2	
Cycle Queue Clearance Time (g_c), s				3.1	0.0	21.3		71.7	0.3	1.7	17.2	
Green Ratio (*g/C*)				0.18	0.18	0.22		0.65	0.84	0.71	0.73	
Capacity (*c*), veh/h				307	323	327		2178	1241	135	2437	
Volume-to-Capacity Ratio (*X*)				0.153	0.000	0.792		0.939	0.019	0.521	0.396	
Back of Queue (*Q*), ft/ln (95 th percentile)				59.7	0	337.1		731.4	2.8	68.3	254.8	
Back of Queue (*Q*), veh/ln (95 th percentile)				2.4	0.0	13.3		28.6	0.1	2.7	10.0	
Queue Storage Ratio (*RQ*) (95 th percentile)				0.06	0.00	2.25		0.00	0.02	0.46	0.00	
Uniform Delay (d_1), s/veh				44.6	0.0	48.0		20.1	1.7	32.4	8.8	
Incremental Delay (d_2), s/veh				0.1	0.0	5.5		2.3	0.0	1.0	0.4	
Initial Queue Delay (d_3), s/veh				0.0	0.0	0.0		0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh				44.7	0.0	53.5		22.4	1.7	33.4	9.2	
Level of Service (LOS)				D		D		C	A	C	A	

	EB		WB		NB		SB	
Approach Delay, s/veh / LOS	0.0		52.1	D	22.2	C	10.8	B
Intersection Delay, s/veh / LOS	21.4				C			

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.9	C	2.4	B	1.9	A
Bicycle LOS Score / LOS			1.0	A	2.2	B	1.3	A

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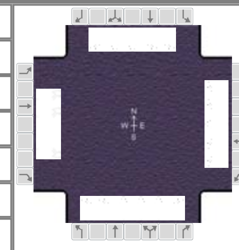
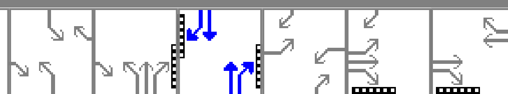
HCS 2010 Signalized Intersection Results Summary

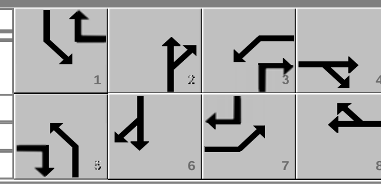


General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Nov 3, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	AM Peak	PHF	0.85
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	SPUI - Minn Ave & I-229	File Name	Minn-9_D_2035_AM_110316.xus		
Project Description	2035 AM - Minn-9D				

Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	400	0	120	210	0	0	110	1545	330	150	540	290



Signal Information										
Cycle, s	130.0	Reference Phase	2	Green	12.0	6.0	64.0	16.0	5.6	4.9
Offset, s	66	Reference Point	Begin	Yellow	3.5	0.0	4.0	3.5	0.0	0.0
Uncoordinated	No	Simult. Gap E/W	Off	Red	3.5	0.0	3.5	3.5	0.0	0.0
Force Mode	Float	Simult. Gap N/S	On							



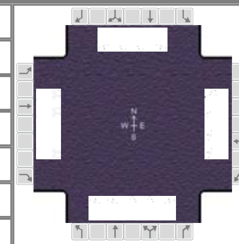
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	28.6	10.5	23.0	4.9	25.0	77.5	19.0	71.5
Change Period, ($Y+R_c$), s	7.0	0.0	7.0	0.0	7.0	7.5	7.0	7.5
Max Allow Headway (*MAH*), s	3.1	3.4	3.1	0.0	3.1	0.0	3.1	0.0
Queue Clearance Time (g_s), s	20.5	12.5	11.4		6.9		8.5	
Green Extension Time (g_e), s	1.1	0.0	0.6	0.0	0.2	0.0	0.4	0.0
Phase Call Probability	1.00	0.99	1.00		1.00		1.00	
Max Out Probability	0.00	1.00	0.00		0.00		0.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	471	0	141	247	0	0	127	1785	381	176	635	341
Adjusted Saturation Flow Rate (s), veh/h/ln	1616	1633	1417	1616	1633	1225	1616	1643	1476	1616	1640	1466
Queue Service Time (g_s), s	18.5	0.0	10.5	9.4	0.0	0.0	4.9	29.3	9.0	6.5	13.1	14.6
Cycle Queue Clearance Time (g_c), s	18.5	0.0	10.5	9.4	0.0	0.0	4.9	29.3	9.0	6.5	13.1	14.6
Green Ratio (g/C)	0.17	0.08	0.22	0.12	0.04	0.13	0.14	0.54	0.66	0.09	0.49	0.66
Capacity (c), veh/h	536	132	311	398	62	319	448	2655	977	298	1615	965
Volume-to-Capacity Ratio (X)	0.877	0.000	0.454	0.621	0.000	0.000	0.284	0.672	0.390	0.592	0.393	0.354
Back of Queue (Q), ft/ln (95 th percentile)	309.5	0	182.6	177.7	0	0	82.3	301.5	74.1	116.2	199.7	215.4
Back of Queue (Q), veh/ln (95 th percentile)	12.1	0.0	7.1	6.9	0.0	0.0	3.2	11.8	2.9	4.5	7.8	8.4
Queue Storage Ratio (RQ) (95 th percentile)	0.69	0.00	0.41	0.39	0.00	0.00	0.38	0.00	0.30	0.33	0.00	0.62
Uniform Delay (d_1), s/veh	52.9	0.0	44.0	54.1	0.0	0.0	54.4	15.7	4.5	51.3	15.7	11.4
Incremental Delay (d_2), s/veh	1.9	0.0	0.4	0.6	0.0	0.0	0.4	0.4	0.3	0.6	0.6	0.8
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	54.8	0.0	44.4	54.7	0.0	0.0	54.8	16.0	4.8	51.9	16.3	12.3
Level of Service (LOS)	D		D	D			D	B	A	D	B	B
Approach Delay, s/veh / LOS	52.4		D	54.7		D	16.3		B	20.6		C
Intersection Delay, s/veh / LOS	24.8						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.2	C	3.4	C	3.0	C	2.9	C
Bicycle LOS Score / LOS	1.5	A	0.9	A	1.8	A	1.4	A

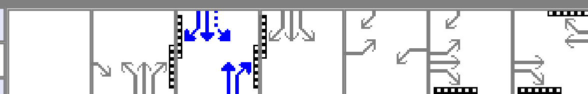
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Nov 4, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM Peak	PHF	0.93
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Minnesota Ave & 41st St	File Name	Minn-9_D_2035_PM_110416.xus		
Project Description	2035 PM - Minn-9D				

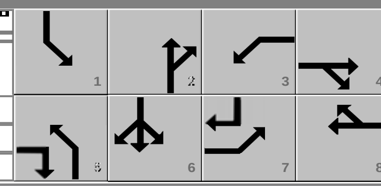


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	400	250	280	340	290	60	330	865	180	90	1120	390

Signal Information			
Cycle, s	105.0	Reference Phase	6
Offset, s	79	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Float	Simult. Gap N/S	On



Green	12.5	28.3	4.7	13.0	3.5	14.5
Yellow	3.0	4.0	3.0	3.0	0.0	4.0
Red	3.0	1.0	3.0	3.0	0.0	1.5



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	4.0	2.0	3.0	1.3	3.0
Phase Duration, s	22.5	23.5	19.0	20.0	18.5	51.8	10.7	44.0
Change Period, (*Y+R c*), s	6.5	5.5	6.0	5.5	6.0	5.0	6.0	6.0
Max Allow Headway (*MAH*), s	4.2	4.2	4.2	4.2	4.2	0.0	4.2	0.0
Queue Clearance Time (*g s*), s	15.5	17.6	13.6	12.8	13.4		2.0	
Green Extension Time (*g e*), s	0.5	0.3	0.0	0.3	0.0	0.0	2.1	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		0.94	
Max Out Probability	1.00	1.00	1.00	1.00	1.00		1.00	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	430	269	231	366	184	178	353	925	155	97	1204	373
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1632	1765	1496	1632	1765	1679	1616	1664	1481	1664	1664	1481
Queue Service Time (*g s*), s	13.5	15.6	13.6	11.6	10.5	10.8	11.4	23.8	7.6	0.0	38.0	15.7
Cycle Queue Clearance Time (*g c*), s	13.5	15.6	13.6	11.6	10.5	10.8	11.4	23.8	7.6	0.0	38.0	15.7
Green Ratio (*g/C*)	0.15	0.17	0.29	0.12	0.14	0.14	0.12	0.45	0.45	0.30	0.36	0.51
Capacity (*c*), veh/h	497	302	434	404	243	231	385	1484	661	246	1205	762
Volume-to-Capacity Ratio (*X*)	0.865	0.890	0.533	0.905	0.757	0.771	0.917	0.623	0.235	0.393	0.999	0.490
Back of Queue (*Q*), ft/ln (95 th percentile)	263	346.9	220.4	253.4	235.2	230	249.3	373.2	136.9	106.2	619.4	213.3
Back of Queue (*Q*), veh/ln (95 th percentile)	10.4	13.7	8.7	10.0	9.3	9.2	9.7	14.6	5.3	4.2	24.2	8.3
Queue Storage Ratio (*RQ*) (95 th percentile)	1.42	0.00	1.47	1.45	0.00	0.00	1.22	0.00	0.27	0.41	0.00	0.47
Uniform Delay (*d 1*), s/veh	43.4	42.6	31.3	45.4	43.6	43.7	48.5	25.6	8.6	36.1	27.1	13.1
Incremental Delay (*d 2*), s/veh	12.3	24.4	1.1	23.3	12.8	14.7	23.1	1.7	0.7	1.0	25.7	2.2
Initial Queue Delay (*d 3*), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	55.7	66.9	32.4	68.7	56.3	58.4	71.7	27.3	9.3	37.2	52.9	15.4
Level of Service (LOS)	E	E	C	E	E	E	E	C	A	D	D	B
Approach Delay, s/veh / LOS	53.1	D		63.1	E		36.3	D		43.6	D	
Intersection Delay, s/veh / LOS	46.2						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.1	C	3.0	C	2.6	B	3.0	C
Bicycle LOS Score / LOS	2.0	B	1.1	A	1.7	A	1.9	A

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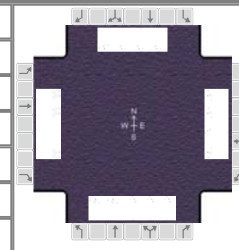
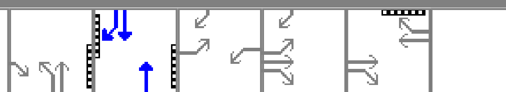
HCS 2010 Signalized Intersection Results Summary

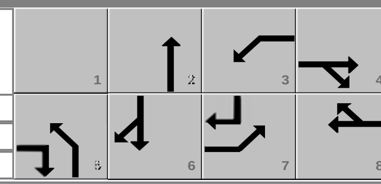
General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Nov 4, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM Peak	PHF	0.93
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Minn Ave & 49th St	File Name	Minn-9_D_2035_PM_110416.xus		
Project Description	2035 PM - Minn-9D				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	450	0	250	0	75	115	500	910			1660	260

Signal Information										
Cycle, s	105.0	Reference Phase	6							
Offset, s	85	Reference Point	Begin	Green	15.5	40.4	0.0	17.8	7.3	0.0
Uncoordinated	No	Simult. Gap E/W	On	Yellow	3.0	4.0	3.0	3.0	4.0	0.0
Force Mode	Float	Simult. Gap N/S	On	Red	3.5	1.5	3.5	3.5	1.5	0.0



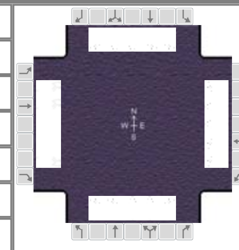


Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2		6
Case Number	2.0	3.0	2.0	3.0	2.0	4.0		7.3
Phase Duration, s	24.3	37.1	0.0	12.8	22.0	67.9		45.9
Change Period, (*Y+R* $_c$), s	6.5	5.5	6.5	5.5	6.5	5.5		5.5
Max Allow Headway (*MAH*), s	3.1	3.3	0.0	3.3	3.2	0.0		0.0
Queue Clearance Time (g_s), s	17.4	15.3		7.1	16.6			
Green Extension Time (g_e), s	0.4	0.7	0.0	0.2	0.0	0.0		0.0
Phase Call Probability	1.00	1.00		1.00	1.00			
Max Out Probability	0.95	0.17		0.95	1.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2			6	16
Adjusted Flow Rate (*v*), veh/h	484	0	269	0	81	124	465	847			1785	280
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1616	1633	1435	1664	1651	1235	1616	1541			1610	1437
Queue Service Time (g_s), s	15.4	0.0	13.3	0.0	5.0	5.1	14.6	2.3			38.1	11.3
Cycle Queue Clearance Time (g_c), s	15.4	0.0	13.3	0.0	5.0	5.1	14.6	2.3			38.1	11.3
Green Ratio (*g/C*)	0.17	0.30	0.45		0.07	0.07	0.15	0.59			0.38	0.55
Capacity (*c*), veh/h	548	492	644	2	115	172	477	2746			1857	796
Volume-to-Capacity Ratio (*X*)	0.883	0.000	0.417	0.000	0.700	0.717	0.975	0.308			0.961	0.351
Back of Queue (*Q*), ft/ln (95 th percentile)	284.7	0	195	0	97.2	73.7	199	27.9			494.2	168.3
Back of Queue (*Q*), veh/ln (95 th percentile)	11.1	0.0	7.6	0.0	3.8	2.9	7.8	1.1			19.3	6.6
Queue Storage Ratio (*RQ*) (95 th percentile)	0.60	0.00	0.41	0.00	0.10	0.29	0.57	0.00			0.00	1.12
Uniform Delay (d_1), s/veh	42.6	0.0	19.6	0.0	47.8	47.8	20.8	1.9			35.1	12.9
Incremental Delay (d_2), s/veh	11.6	0.0	0.2	0.0	2.9	2.1	30.6	0.2			5.0	0.3
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	54.2	0.0	19.8	0.0	50.6	49.9	51.5	2.1			40.1	13.2
Level of Service (LOS)	D		B		D	D	D	A			D	B
Approach Delay, s/veh / LOS	41.9	D		50.2	D		19.6	B		36.5	D	
Intersection Delay, s/veh / LOS	33.0						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.4	C	3.3	C	2.5	B	2.9	C
Bicycle LOS Score / LOS	1.7	A	0.8	A	1.3	A	1.6	A

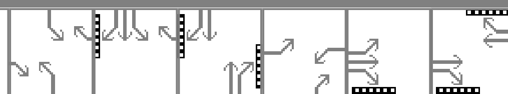
HCS 2010 Signalized Intersection Results Summary



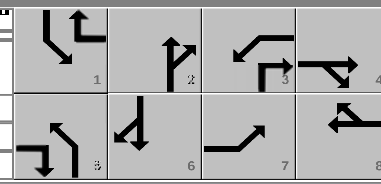
General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Nov 4, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM Peak	PHF	0.93
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Minnesota Ave & 57th St	File Name	Minn-9_D_2035_PM_110416.xus		
Project Description	2035 PM - Minn-9D				

Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	305	885	300	180	570	230	260	680	200	330	820	225

Signal Information			
Cycle, s	120.7	Reference Phase	2
Offset, s	56	Reference Point	Begin
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	13.5	3.1	33.1	9.9	5.4	31.3
Yellow	3.5	0.0	4.5	3.5	0.0	4.0
Red	3.5	0.0	1.0	3.5	0.0	1.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	22.3	41.7	16.9	36.3	20.5	38.6	23.6	41.6
Change Period, ($Y+R_c$), s	7.0	5.5	7.0	5.5	7.0	5.5	7.0	5.5
Max Allow Headway (*MAH*), s	4.1	4.6	4.1	4.6	4.1	4.5	4.1	4.5
Queue Clearance Time (g_s), s	13.8	35.6	9.0	22.2	12.2	26.8	14.9	32.6
Green Extension Time (g_e), s	1.4	0.0	0.8	8.5	1.2	0.0	1.5	3.3
Phase Call Probability	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Max Out Probability	0.00	1.00	0.00	0.03	0.00	1.00	0.00	0.83

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	328	952	290	194	613	125	280	731	211	355	882	222
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1632	1680	1496	1632	1680	1496	1616	1664	1481	1616	1664	1481
Queue Service Time (g_s), s	11.8	33.6	17.2	7.0	20.2	6.7	10.2	24.8	12.9	12.9	30.6	14.9
Cycle Queue Clearance Time (g_c), s	11.8	33.6	17.2	7.0	20.2	6.7	10.2	24.8	12.9	12.9	30.6	14.9
Green Ratio (*g/C*)	0.13	0.30	0.41	0.08	0.25	0.39	0.11	0.27	0.36	0.14	0.30	0.30
Capacity (*c*), veh/h	416	1007	616	269	855	586	362	912	528	445	997	444
Volume-to-Capacity Ratio (*X*)	0.788	0.945	0.471	0.720	0.717	0.213	0.772	0.801	0.399	0.798	0.884	0.499
Back of Queue (*Q*), ft/ln (95 th percentile)	217.9	566.7	256	136.9	334.2	1.6	194.9	406.9	207.3	224.4	475.6	227.4
Back of Queue (*Q*), veh/ln (95 th percentile)	8.6	22.3	10.1	5.4	13.2	0.1	7.6	15.9	8.1	8.8	18.6	8.9
Queue Storage Ratio (*RQ*) (95 th percentile)	0.84	0.00	1.25	0.91	0.00	0.01	0.91	0.00	1.26	1.04	0.00	0.97
Uniform Delay (d_1), s/veh	51.3	41.5	26.0	54.3	41.2	24.4	52.3	40.9	29.3	50.6	40.5	35.0
Incremental Delay (d_2), s/veh	3.4	16.8	0.7	3.6	1.4	0.2	3.5	5.3	0.6	2.8	7.0	0.9
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	54.7	58.3	26.7	57.9	42.6	24.7	55.8	46.2	29.9	53.5	47.5	35.9
Level of Service (LOS)	D	E	C	E	D	C	E	D	C	D	D	D
Approach Delay, s/veh / LOS	51.7		D	43.4		D	45.6		D	47.2		D
Intersection Delay, s/veh / LOS	47.5						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.1	C	3.1	C	3.2	C	3.1	C
Bicycle LOS Score / LOS	1.8	A	1.3	A	1.5	A	1.7	A

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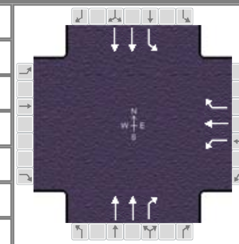
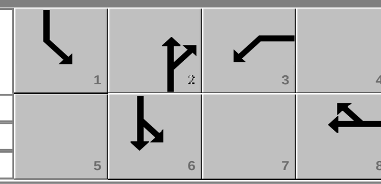
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Nov 4, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM Peak	PHF	0.93
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	Lotta	File Name	Minn-9_D_2035_PM_110416.xus		
Project Description	2035 PM - Minn-9D				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				60	0	100		1175	40	230	1340	

Signal Information											
Cycle, s	105.0	Reference Phase	2								
Offset, s	0	Reference Point	End	Green	6.0	77.4	9.6	0.0	0.0	0.0
Uncoordinated	No	Simult. Gap E/W	On	Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Force Mode	Fixed	Simult. Gap N/S	On	Red	0.0	0.0	0.0	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase				8		2	1	6
Case Number				9.0		7.3	1.0	4.0
Phase Duration, s				13.6		81.4	10.0	91.4
Change Period, (*Y+R* $_c$), s				4.0		4.0	4.0	4.0
Max Allow Headway (*MAH*), s				3.4		0.0	3.1	0.0
Queue Clearance Time (g_s), s				9.4			5.3	
Green Extension Time (g_e), s				0.3		0.0	0.4	0.0
Phase Call Probability				0.99			1.00	
Max Out Probability				0.00			0.00	

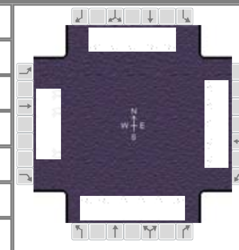
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement				3	8	18		2	12	1	6	
Adjusted Flow Rate (*v*), veh/h				65	0	108		1263	43	247	1441	
Adjusted Saturation Flow Rate (*s*), veh/h/ln				1681	1765	1496		1664	1481	1664	1664	
Queue Service Time (g_s), s				3.8	0.0	7.4		16.9	0.8	3.3	13.8	
Cycle Queue Clearance Time (g_c), s				3.8	0.0	7.4		16.9	0.8	3.3	13.8	
Green Ratio (*g/C*)				0.09	0.09	0.09		0.74	0.74	0.81	0.83	
Capacity (*c*), veh/h				154	162	137		2452	1091	413	2768	
Volume-to-Capacity Ratio (*X*)				0.418	0.000	0.783		0.515	0.039	0.599	0.520	
Back of Queue (*Q*), ft/ln (95 th percentile)				74.4	0	132.5		186.9	9.4	54.9	104.2	
Back of Queue (*Q*), veh/ln (95 th percentile)				2.9	0.0	5.2		7.3	0.4	2.1	4.1	
Queue Storage Ratio (*RQ*) (95 th percentile)				0.07	0.00	0.88		0.00	0.06	0.37	0.00	
Uniform Delay (d_1), s/veh				45.0	0.0	46.7		5.9	3.7	6.3	2.7	
Incremental Delay (d_2), s/veh				0.7	0.0	3.7		0.5	0.0	0.3	0.4	
Initial Queue Delay (d_3), s/veh				0.0	0.0	0.0		0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh				45.7	0.0	50.3		6.3	3.8	6.6	3.1	
Level of Service (LOS)				D		D		A	A	A	A	

	EB		WB		NB		SB	
Approach Delay, s/veh / LOS	0.0		48.6	D	6.2	A	3.7	A
Intersection Delay, s/veh / LOS	7.2				A			

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.9	C	2.4	B	1.8	A
Bicycle LOS Score / LOS			0.8	A	1.6	A	1.9	A

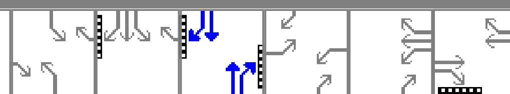
HCS 2010 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	HRG			Duration, h	0.25
Analyst	JDW	Analysis Date	Nov 4, 2016	Area Type	Other
Jurisdiction	Sioux Falls, SD	Time Period	PM Peak	PHF	0.93
Urban Street	Minnesota Ave	Analysis Year	2035	Analysis Period	1> 7:15
Intersection	SPUI - Minn Ave & I-229	File Name	Minn-9_D_2035_PM_110416.xus		
Project Description	2035 PM - Minn-9D				

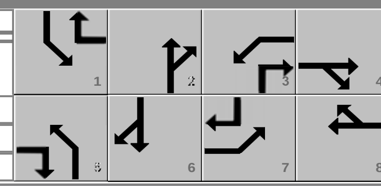


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	260	0	160	290	0	0	120	960	175	330	1110	470

Signal Information			
Cycle, s	105.0	Reference Phase	6
Offset, s	40	Reference Point	Begin
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Float	Simult. Gap N/S	On



Green	6.8	6.7	47.7	11.1	1.1	10.0
Yellow	3.5	0.0	4.5	3.5	0.0	0.0
Red	3.5	0.0	3.0	3.5	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	18.1	10.0	19.3	11.1	13.8	55.2	20.5	61.9
Change Period, (*Y+R* c), s	7.0	0.0	7.0	0.0	7.0	7.5	7.0	7.5
Max Allow Headway (*MAH*), s	3.1	3.3	3.1	0.0	3.1	0.0	3.1	0.0
Queue Clearance Time (*g* s), s	10.9	12.0	11.9		6.0		13.1	
Green Extension Time (*g* e), s	0.3	0.0	0.4	0.0	0.0	0.0	0.4	0.0
Phase Call Probability	1.00	0.99	1.00		0.98		1.00	
Max Out Probability	0.36	1.00	0.15		1.00		0.33	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h	280	0	172	312	0	0	129	1032	188	355	1194	505
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1616	1633	1416	1616	1633	1225	1616	1554	1419	1616	1688	1483
Queue Service Time (*g* s), s	8.9	0.0	10.0	9.9	0.0	0.0	4.0	18.1	8.5	11.1	30.5	26.8
Cycle Queue Clearance Time (*g* c), s	8.9	0.0	10.0	9.9	0.0	0.0	4.0	18.1	8.5	11.1	30.5	26.8
Green Ratio (*g/C*)	0.11	0.10	0.16	0.12	0.11	0.23	0.07	0.45	0.57	0.13	0.52	0.62
Capacity (*c*), veh/h	343	156	227	377	173	574	210	2119	811	416	1750	926
Volume-to-Capacity Ratio (*X*)	0.815	0.000	0.757	0.827	0.000	0.000	0.613	0.487	0.232	0.853	0.682	0.546
Back of Queue (*Q*), ft/ln (95 th percentile)	173.1	0	219	191.6	0	0	74.2	275.9	183.8	157.4	401.2	473.4
Back of Queue (*Q*), veh/ln (95 th percentile)	6.8	0.0	8.6	7.5	0.0	0.0	2.9	10.8	7.2	6.1	15.7	18.5
Queue Storage Ratio (*RQ*) (95 th percentile)	0.38	0.00	0.49	0.43	0.00	0.00	0.35	0.00	0.74	0.45	0.00	1.35
Uniform Delay (*d* 1), s/veh	45.9	0.0	42.1	45.3	0.0	0.0	46.7	24.3	15.0	41.4	24.1	23.0
Incremental Delay (*d* 2), s/veh	5.9	0.0	12.3	5.5	0.0	0.0	1.4	0.7	0.6	3.0	0.7	0.8
Initial Queue Delay (*d* 3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	51.8	0.0	54.5	50.8	0.0	0.0	48.1	24.9	15.6	44.4	24.9	23.8
Level of Service (LOS)	D		D	D			D	C	B	D	C	C
Approach Delay, s/veh / LOS	52.8	D		50.8	D		25.9	C		28.0	C	
Intersection Delay, s/veh / LOS	31.7						C					

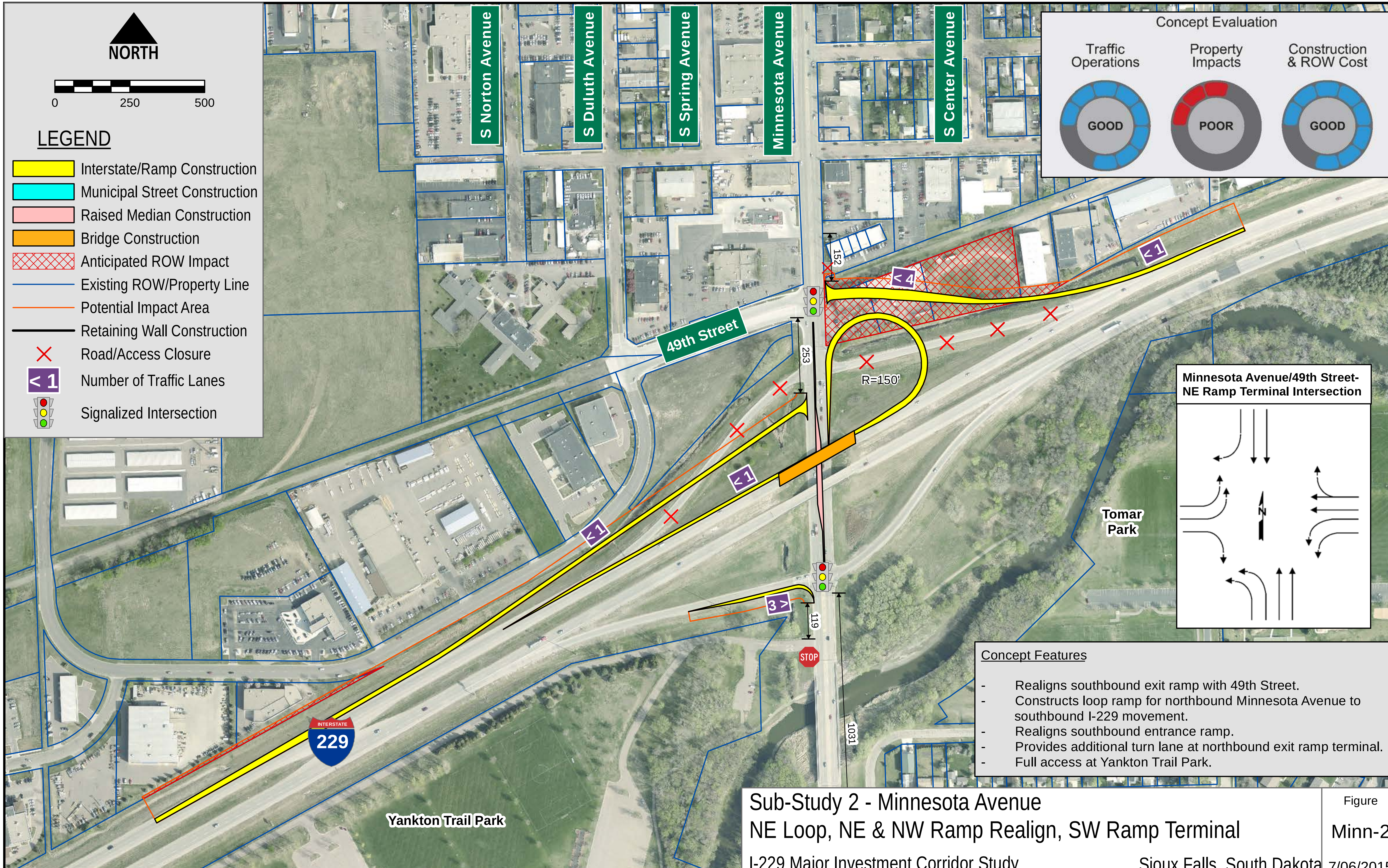
Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.2	C	3.4	C	3.0	C	2.9	C
Bicycle LOS Score / LOS	1.2	A	1.0	A	1.2	A	2.2	B

 HCS 2010™ Streets Version 6.90 Generated: 2/1/2017 3:17:12 PM

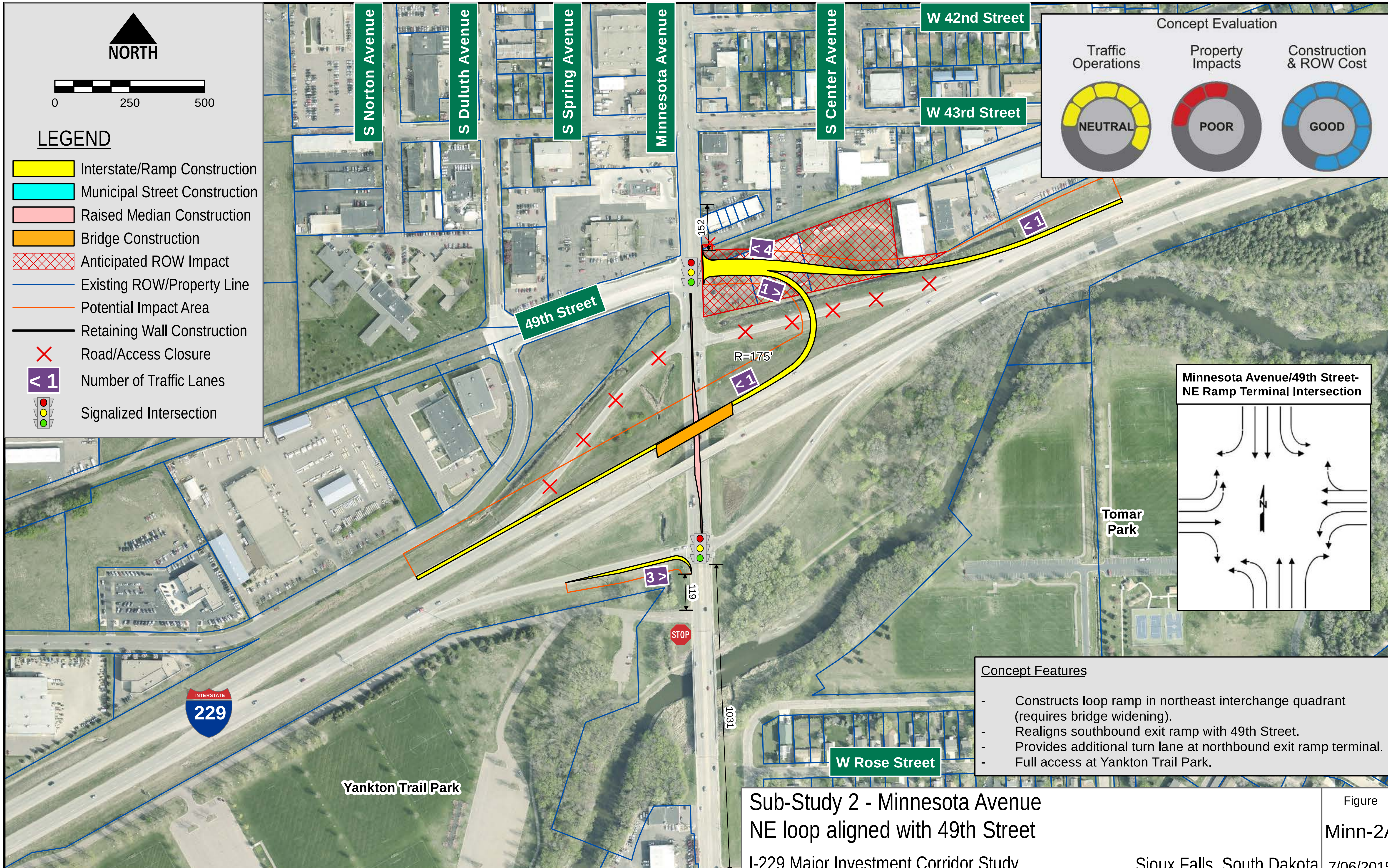
APPENDIX D1 -

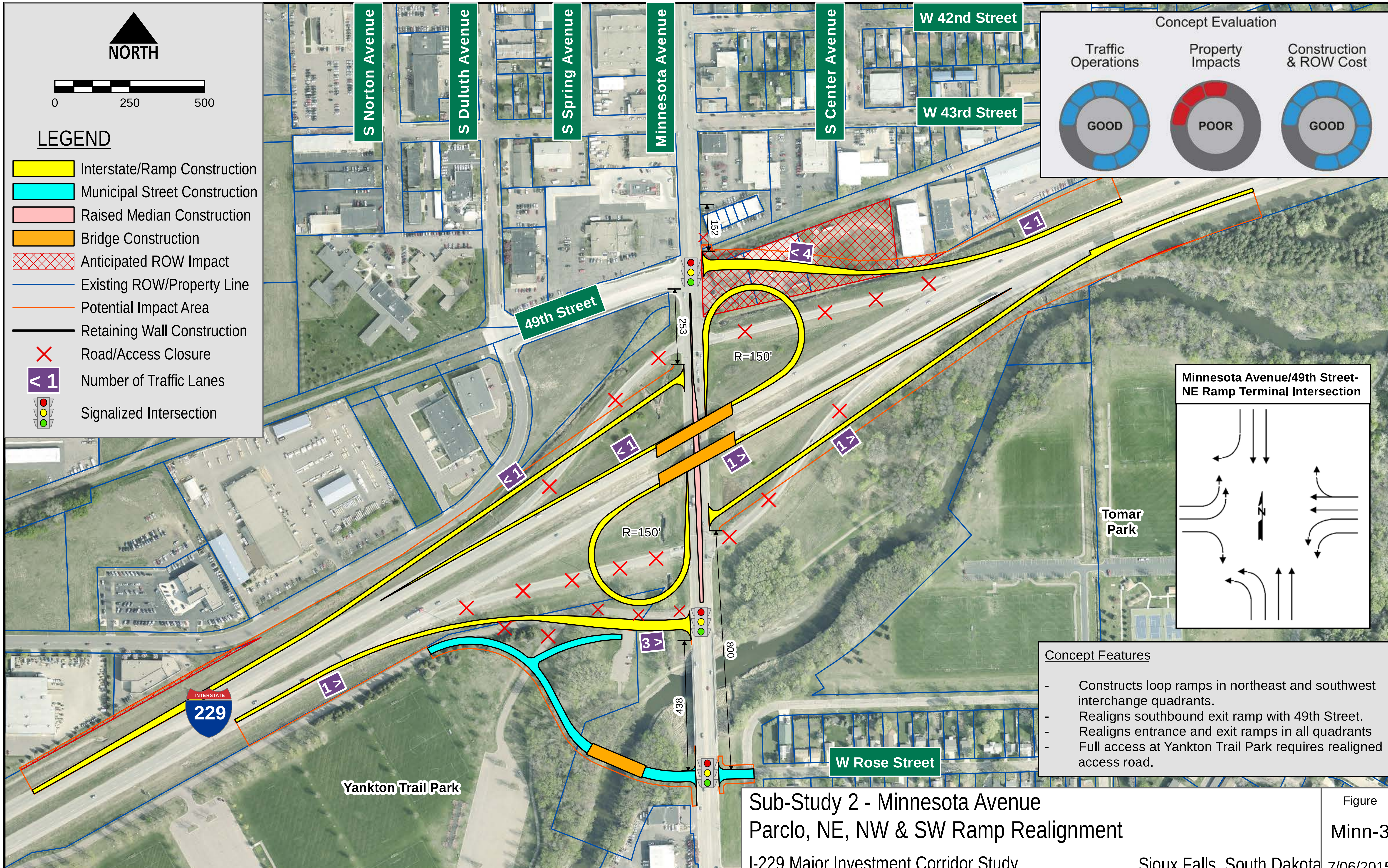
PRELIMINARY CONCEPT FIGURES

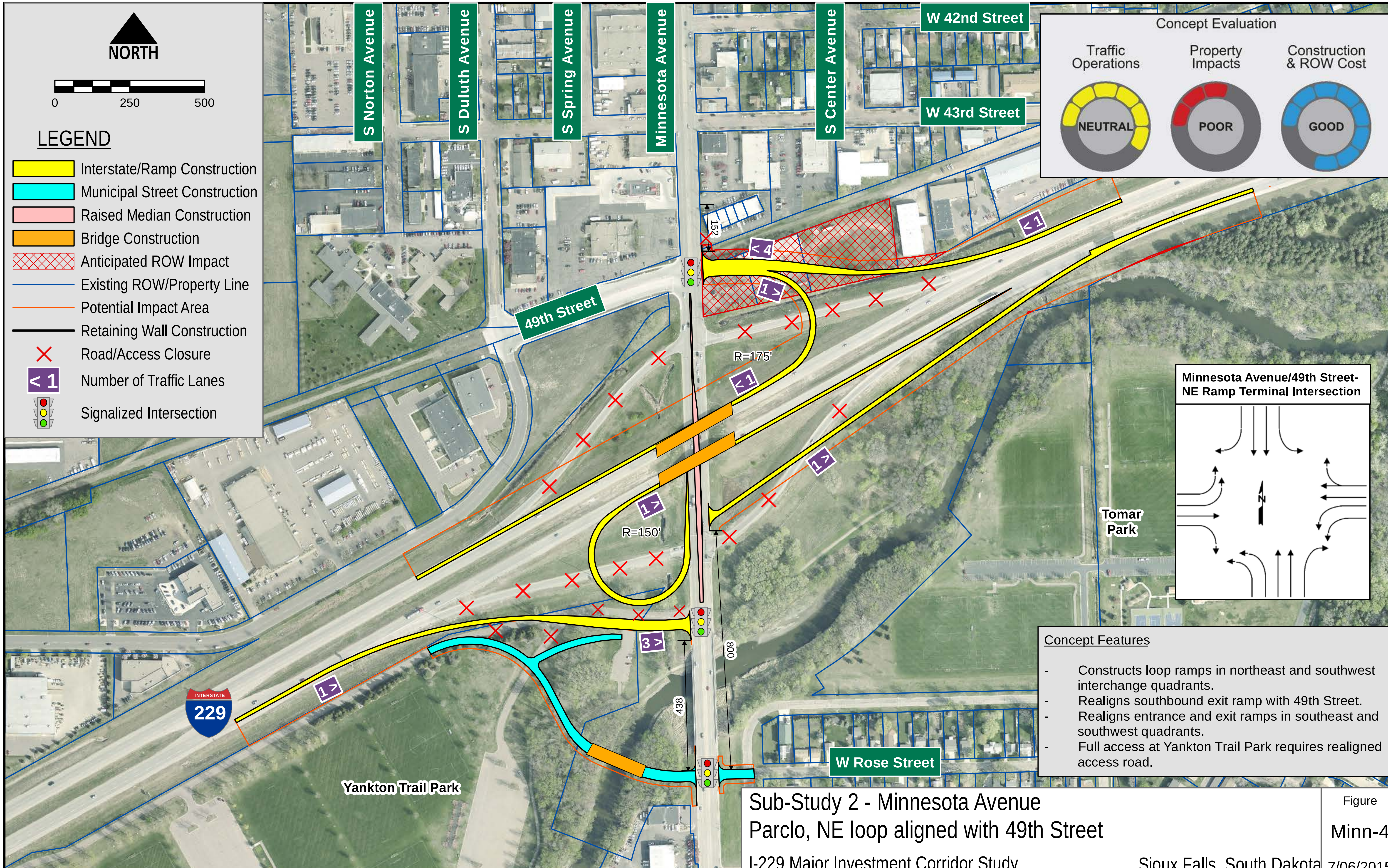

NORTH
0
250
500
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Bridge Construction
Anticipated ROW Impact
Existing ROW/Property Line
Potential Impact Area
Retaining Wall Construction
Road/Access Closure
< 1
Number of Traffic Lanes
Signalized Intersection
S Norton Avenue
S Duluth Avenue
S Spring Avenue
Minnesota Avenue
S Center Avenue
49th Street
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
NEUTRAL
POOR
VERY GOOD
152
114
119
1031
< 4
< 1
3 >
STOP
Minnesota Avenue/49th Street-NE Ramp Terminal Intersection
N
Tomar Park
INTERSTATE
229
Yankton Trail Park
Concept Features
- Realigns southbound exit ramp with 49th Street.
- Provides additional turn lane at northbound exit ramp terminal.
- Full access at Yankton Trail Park.
Sub-Study 2 - Minnesota Avenue
NE Ramp Realignment, SW Ramp Terminal
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Minn-1
7/06/2015

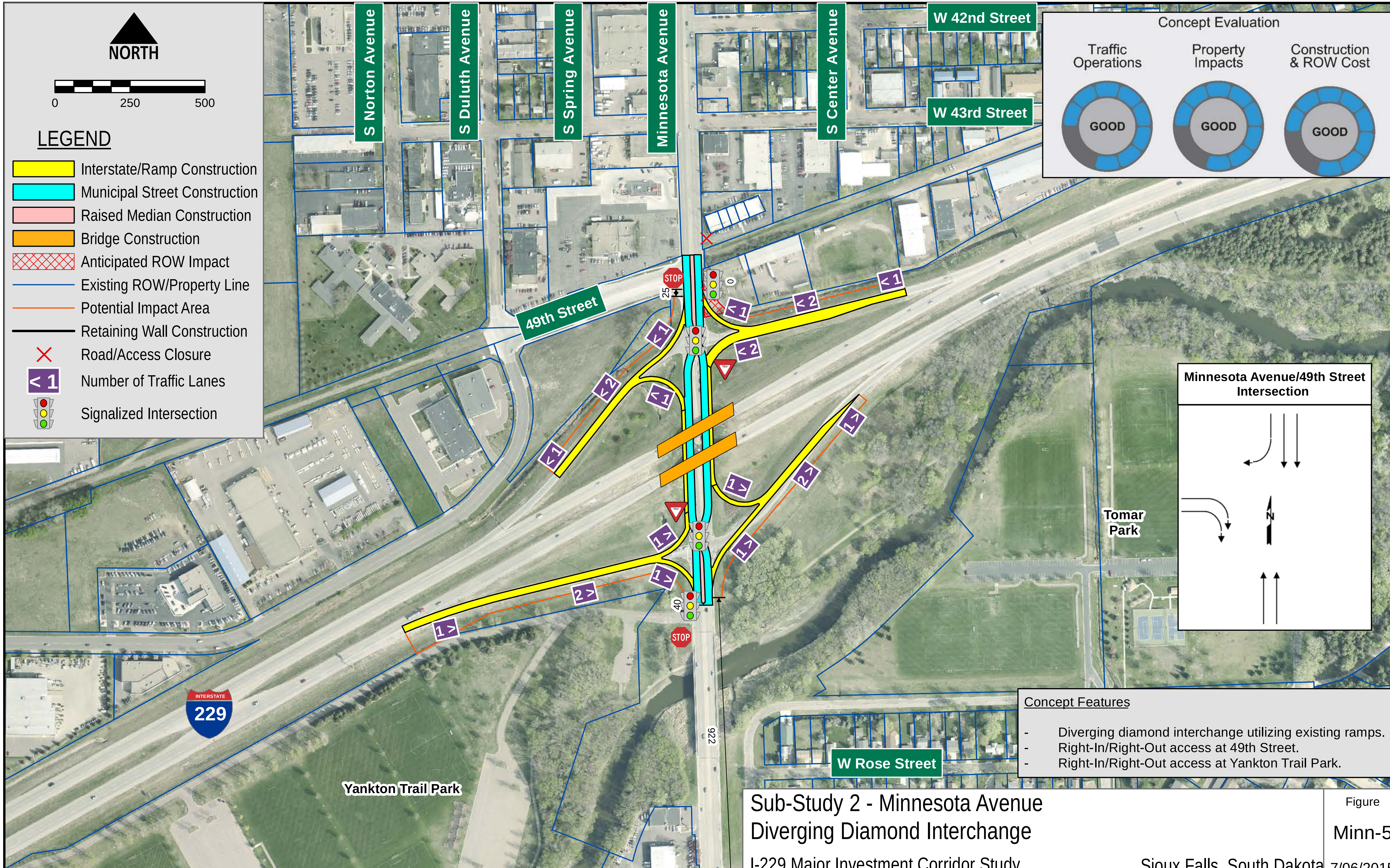


NORTH
0
250
500
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Bridge Construction
Anticipated ROW Impact
Existing ROW/Property Line
Potential Impact Area
Retaining Wall Construction
Road/Access Closure
< 1
Number of Traffic Lanes
Signalized Intersection
S Norton Avenue
S Duluth Avenue
S Spring Avenue
Minnesota Avenue
S Center Avenue
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
GOOD
POOR
GOOD
49th Street
152
253
119
1031
R=150'
< 4
< 1
< 1
< 1
3 >
STOP
INTERSTATE
229
Tomar Park
Yankton Trail Park
Minnesota Avenue/49th Street-
NE Ramp Terminal Intersection
N
Concept Features
- Realigns southbound exit ramp with 49th Street.
- Constructs loop ramp for northbound Minnesota Avenue to southbound I-229 movement.
- Realigns southbound entrance ramp.
- Provides additional turn lane at northbound exit ramp terminal.
- Full access at Yankton Trail Park.
Sub-Study 2 - Minnesota Avenue
NE Loop, NE & NW Ramp Realign, SW Ramp Terminal
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Minn-2
7/06/2015


NORTH
0
250
500
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Bridge Construction
Anticipated ROW Impact
Existing ROW/Property Line
Potential Impact Area
Retaining Wall Construction
Road/Access Closure
< 1 Number of Traffic Lanes
Signalized Intersection
S Norton Avenue
S Duluth Avenue
S Spring Avenue
Minnesota Avenue
S Center Avenue
W 42nd Street
W 43rd Street
49th Street
W Rose Street
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
NEUTRAL
POOR
GOOD
152
< 4
1 >
< 1
R=175'
3 >
119
1031
STOP
INTERSTATE
229
Minnesota Avenue/49th Street-
NE Ramp Terminal Intersection
Tomar Park
Yankton Trail Park
Concept Features
- Constructs loop ramp in northeast interchange quadrant (requires bridge widening).
- Realigns southbound exit ramp with 49th Street.
- Provides additional turn lane at northbound exit ramp terminal.
- Full access at Yankton Trail Park.
Sub-Study 2 - Minnesota Avenue
NE loop aligned with 49th Street
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Minn-2A
7/06/2015


NORTH
0
250
500
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Bridge Construction
Anticipated ROW Impact
Existing ROW/Property Line
Potential Impact Area
Retaining Wall Construction
Road/Access Closure
Number of Traffic Lanes
Signalized Intersection
S Norton Avenue
S Duluth Avenue
S Spring Avenue
Minnesota Avenue
S Center Avenue
W 42nd Street
W 43rd Street
49th Street
W Rose Street
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
GOOD
POOR
GOOD
152
253
R=150'
R=150'
438
808
< 4
< 1
< 1
< 1
1 >
1 >
1 >
3 >
229
Tomar Park
Yankton Trail Park
Minnesota Avenue/49th Street-NE Ramp Terminal Intersection
Concept Features
- Constructs loop ramps in northeast and southwest interchange quadrants.
- Realigns southbound exit ramp with 49th Street.
- Realigns entrance and exit ramps in all quadrants
- Full access at Yankton Trail Park requires realigned access road.
Sub-Study 2 - Minnesota Avenue
Parclo, NE, NW & SW Ramp Realignment
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Minn-3
7/06/2015


NORTH
0
250
500
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Bridge Construction
Anticipated ROW Impact
Existing ROW/Property Line
Potential Impact Area
Retaining Wall Construction
Road/Access Closure
Number of Traffic Lanes
Signalized Intersection
S Norton Avenue
S Duluth Avenue
S Spring Avenue
Minnesota Avenue
S Center Avenue
W 42nd Street
W 43rd Street
49th Street
W Rose Street
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
NEUTRAL
POOR
GOOD
152
< 4
1 >
< 1
R=175'
R=150'
3 >
438
800
INTERSTATE
229
Yankton Trail Park
Tomar Park
Minnesota Avenue/49th Street-NE Ramp Terminal Intersection
Concept Features
- Constructs loop ramps in northeast and southwest interchange quadrants.
- Realigns southbound exit ramp with 49th Street.
- Realigns entrance and exit ramps in southeast and southwest quadrants.
- Full access at Yankton Trail Park requires realigned access road.
Sub-Study 2 - Minnesota Avenue
Parclo, NE loop aligned with 49th Street
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Minn-4
7/06/2015



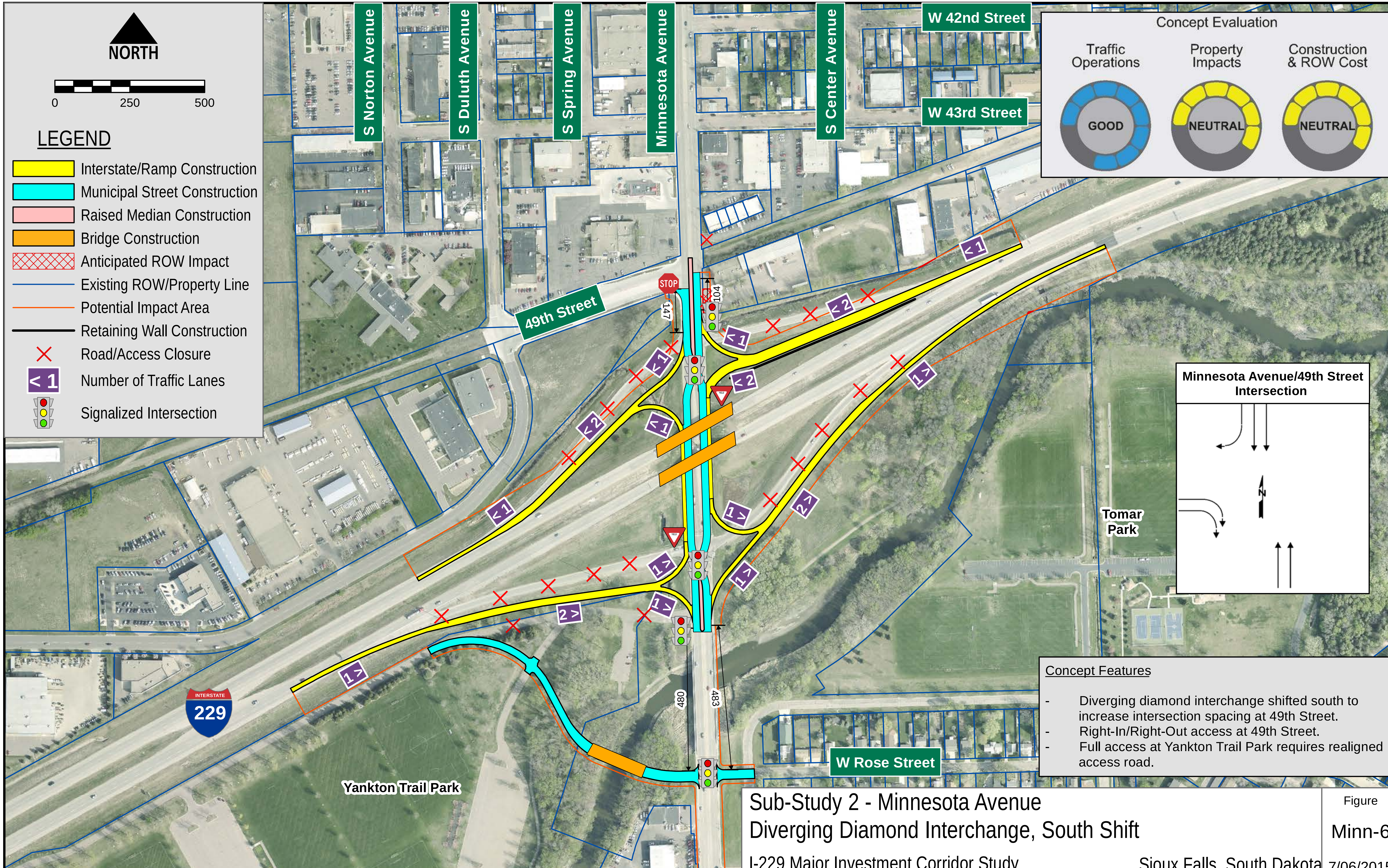
Sub-Study 2 - Minnesota Avenue Diverging Diamond Interchange

I-229 Major Investment Corridor Study

Sioux Falls, South Dakota

Figure Minn-5

7/06/2015



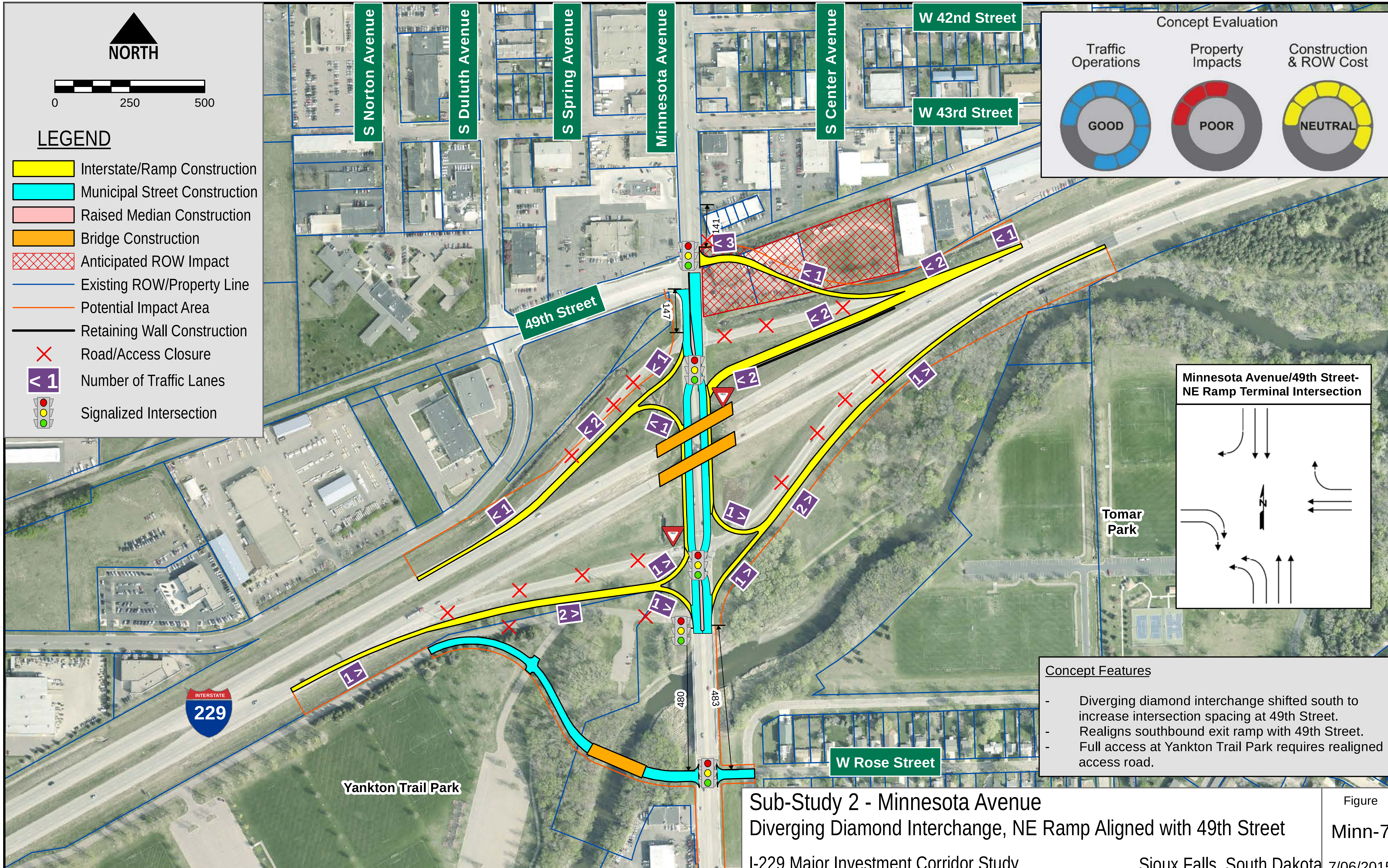
Sub-Study 2 - Minnesota Avenue
Diverging Diamond Interchange, South Shift

I-229 Major Investment Corridor Study

Sioux Falls, South Dakota

Figure Minn-6

7/06/2015



Sub-Study 2 - Minnesota Avenue

Diverging Diamond Interchange, NE Ramp Aligned with 49th Street

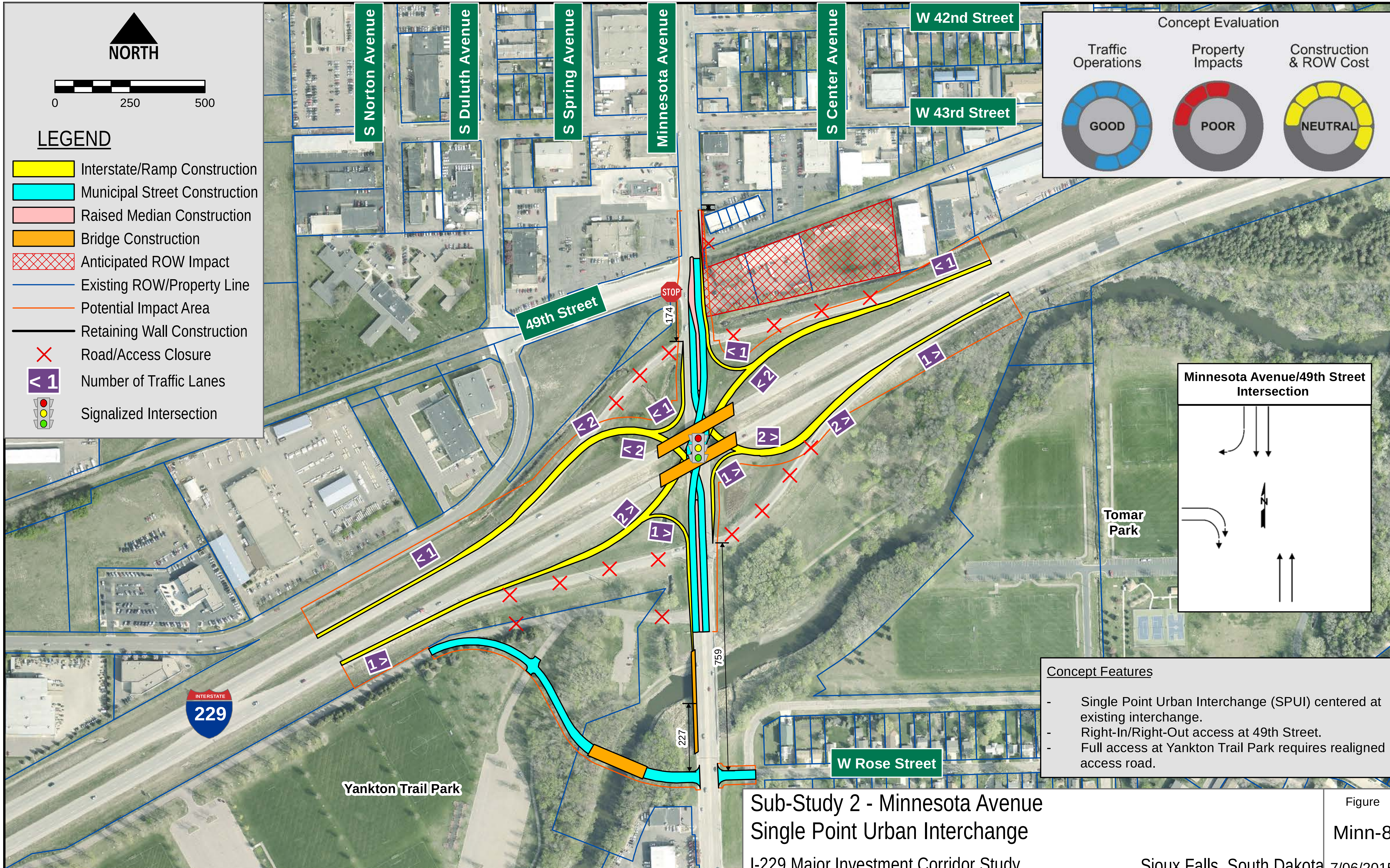
I-229 Major Investment Corridor Study

Sioux Falls, South Dakota

Figure

Minn-7

7/06/2015



Concept Features

- Single Point Urban Interchange (SPUI) centered at existing interchange.
- Right-In/Right-Out access at 49th Street.
- Full access at Yankton Trail Park requires realigned access road.

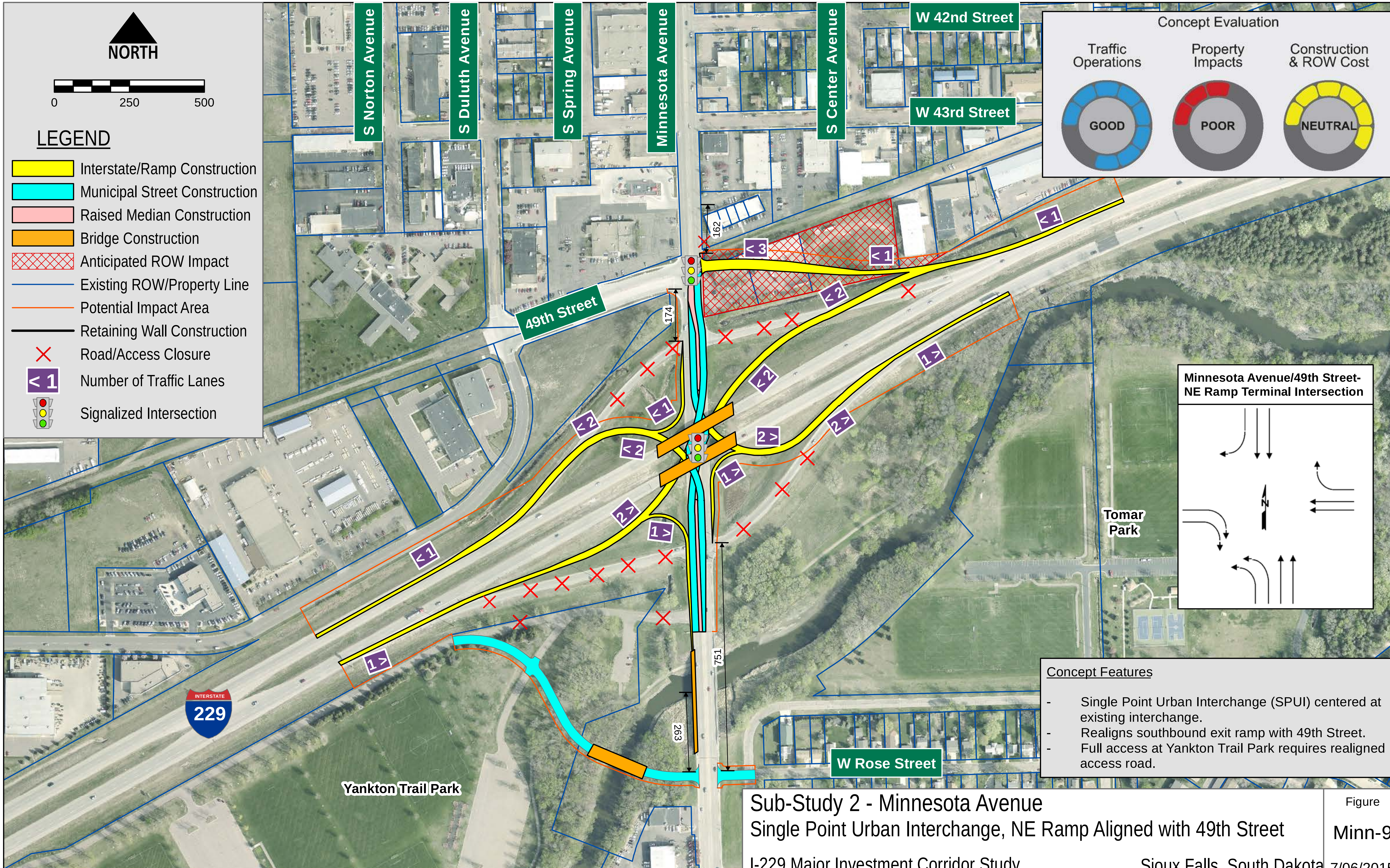
Sub-Study 2 - Minnesota Avenue Single Point Urban Interchange

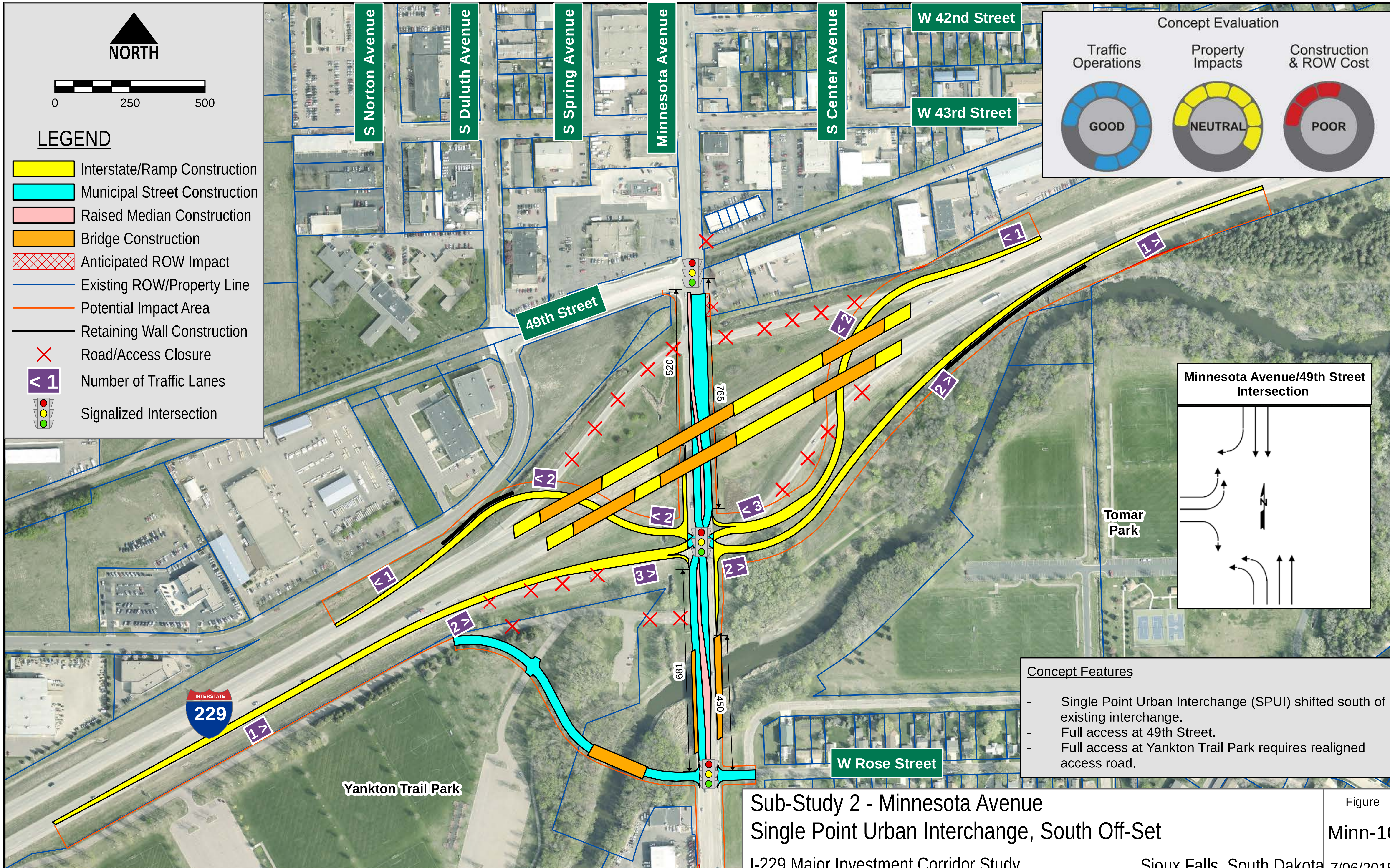
I-229 Major Investment Corridor Study

Sioux Falls, South Dakota

Figure Minn-8

7/06/2015


NORTH
0
250
500
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Bridge Construction
Anticipated ROW Impact
Existing ROW/Property Line
Potential Impact Area
Retaining Wall Construction
Road/Access Closure
Number of Traffic Lanes
Signalized Intersection
S Norton Avenue
S Duluth Avenue
S Spring Avenue
Minnesota Avenue
S Center Avenue
W 42nd Street
W 43rd Street
49th Street
W Rose Street
Tomar Park
Yankton Trail Park
INTERSTATE
229
162
174
751
263
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
GOOD
POOR
NEUTRAL
Minnesota Avenue/49th Street-
NE Ramp Terminal Intersection
Concept Features
- Single Point Urban Interchange (SPUI) centered at existing interchange.
- Realigns southbound exit ramp with 49th Street.
- Full access at Yankton Trail Park requires realigned access road.
Sub-Study 2 - Minnesota Avenue
Single Point Urban Interchange, NE Ramp Aligned with 49th Street
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Minn-9
7/06/2015



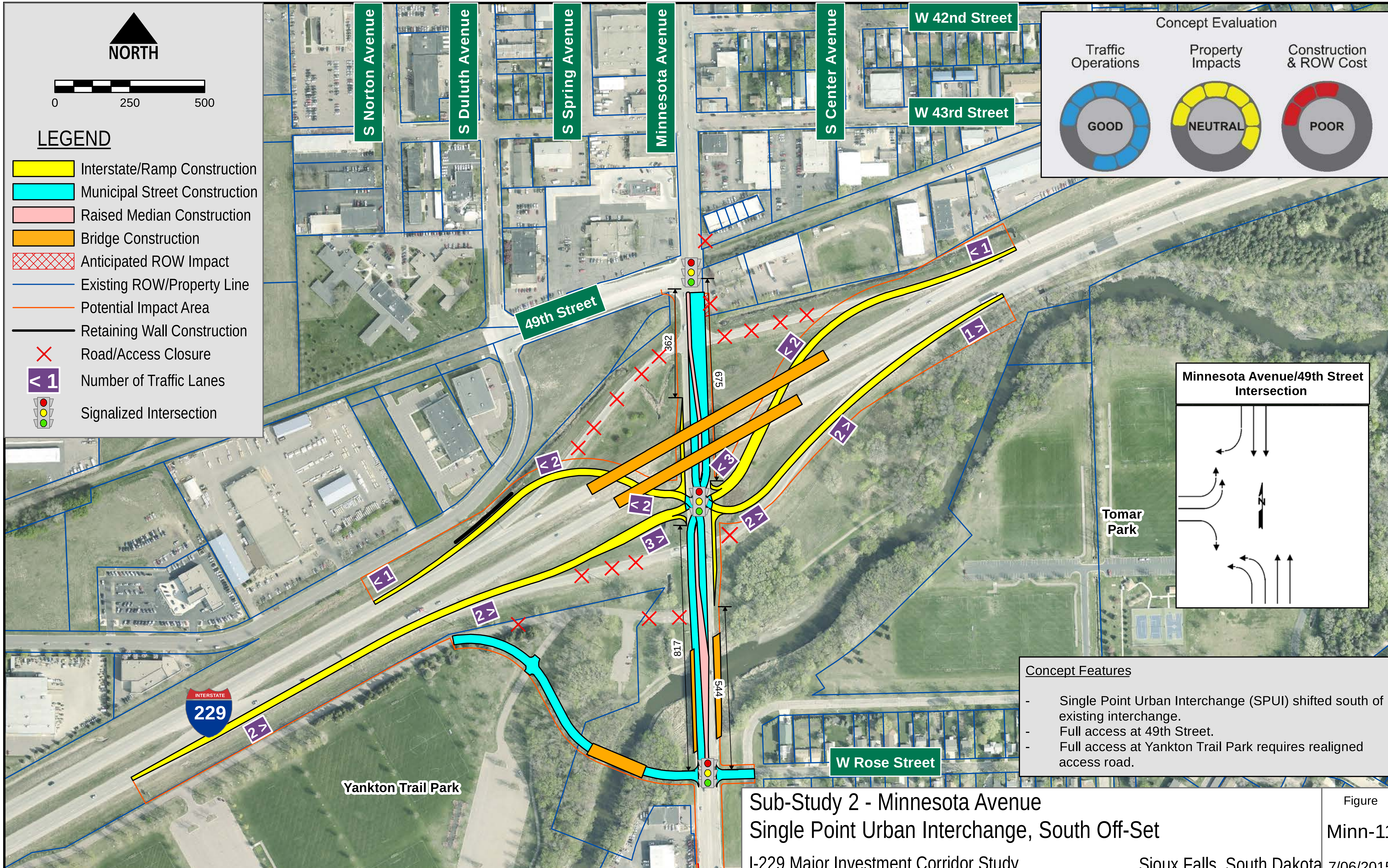
Sub-Study 2 - Minnesota Avenue
Single Point Urban Interchange, South Off-Set

I-229 Major Investment Corridor Study

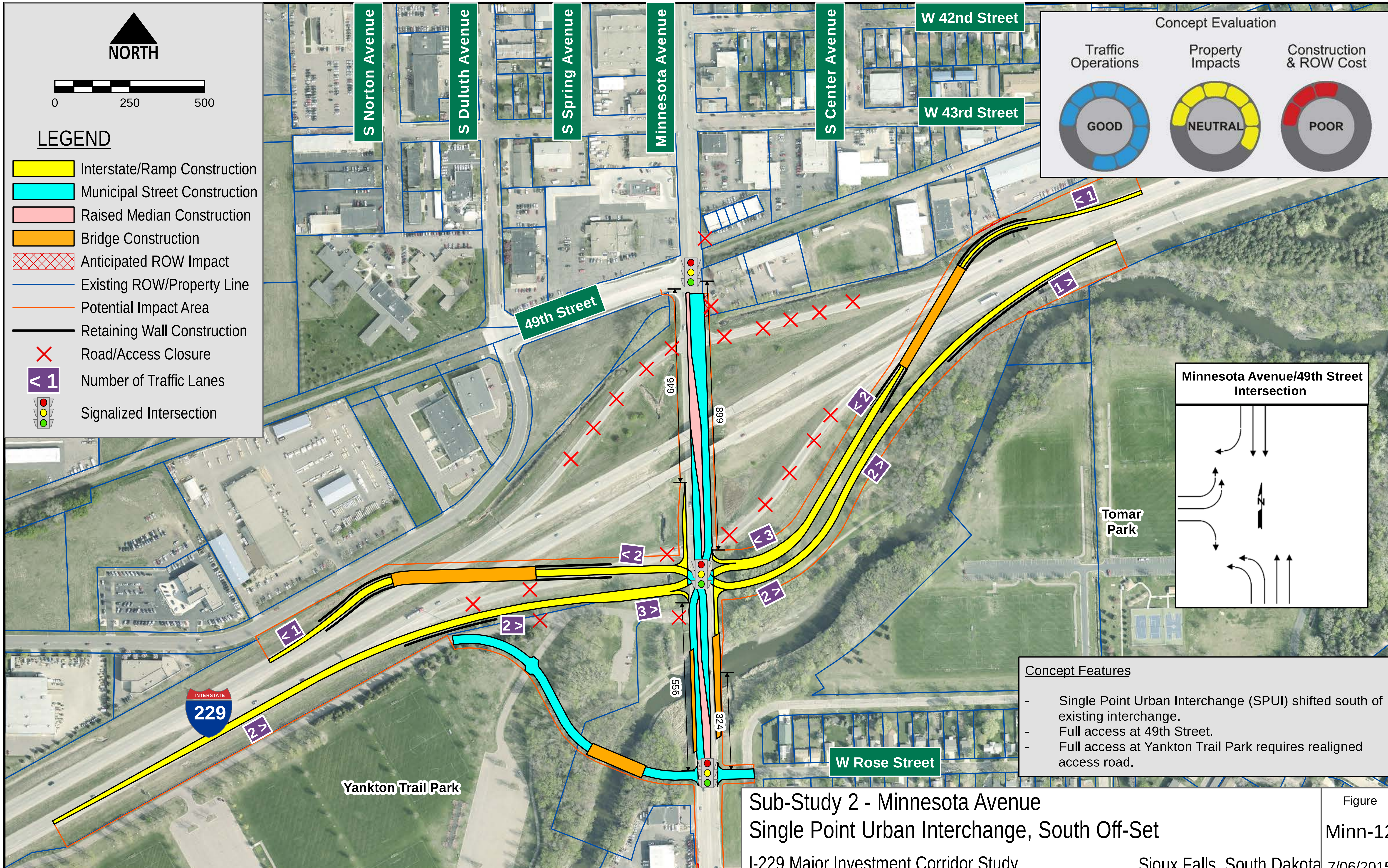
Sioux Falls, South Dakota

Figure Minn-10

7/06/2015



Sub-Study 2 - Minnesota Avenue
Single Point Urban Interchange, South Off-Set
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure Minn-11
7/06/2015

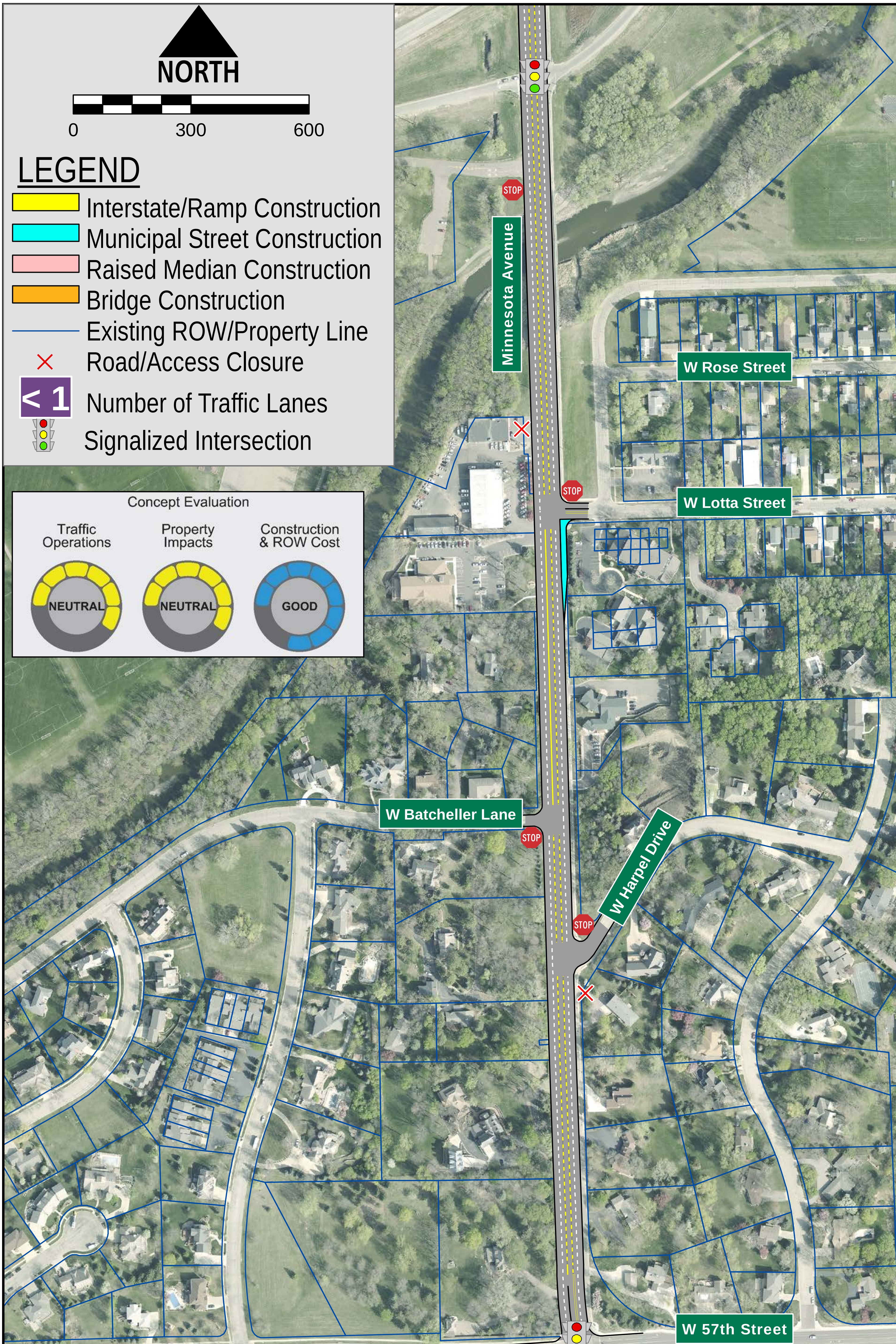


NORTH
0
250
500
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Bridge Construction
Anticipated ROW Impact
Existing ROW/Property Line
Potential Impact Area
Retaining Wall Construction
Road/Access Closure
Number of Traffic Lanes
Signalized Intersection
S Norton Avenue
S Duluth Avenue
S Spring Avenue
Minnesota Avenue
S Center Avenue
W 42nd Street
W 43rd Street
49th Street
W Rose Street
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
GOOD
NEUTRAL
POOR
Minnesota Avenue/49th Street Intersection
Tomar Park
Yankton Trail Park
INTERSTATE
229
646
669
556
324
Concept Features
- Single Point Urban Interchange (SPUI) shifted south of existing interchange.
- Full access at 49th Street.
- Full access at Yankton Trail Park requires realigned access road.
Sub-Study 2 - Minnesota Avenue
Single Point Urban Interchange, South Off-Set
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Minn-12
7/06/2015

Sub-Study 2 - Minnesota Avenue
5-Lane Undivided
I-229 Major Investment Corridor Study

Sioux Falls, South Dakota

Figure
Minn-C1
(North)
7/06/2015

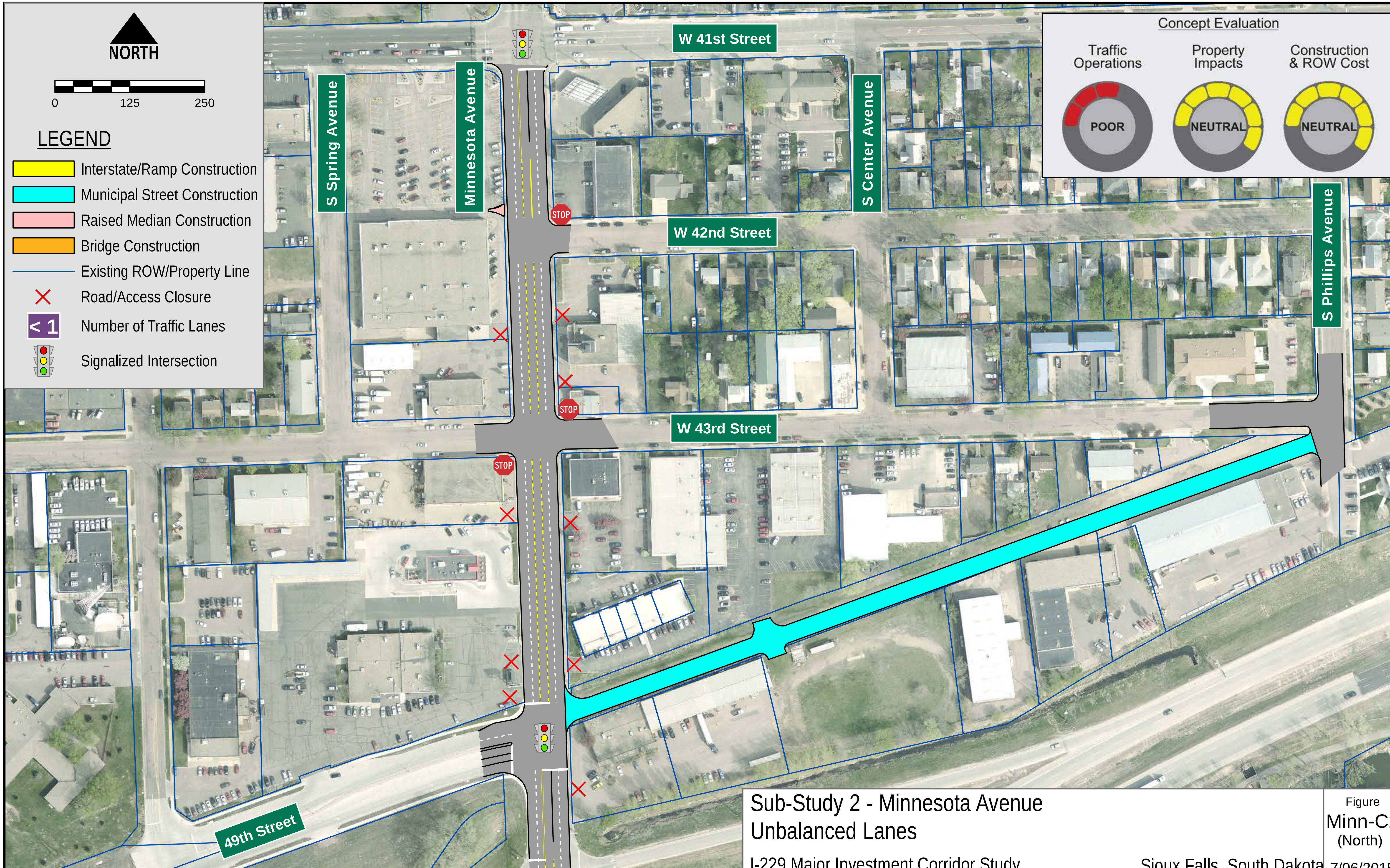


Sub-Study 2 - Minnesota Avenue
5-Lane Undivided

I-229 Major Investment Corridor Study

Sioux Falls, South Dakota

Figure
Minn-C1
(South)
7/06/2015



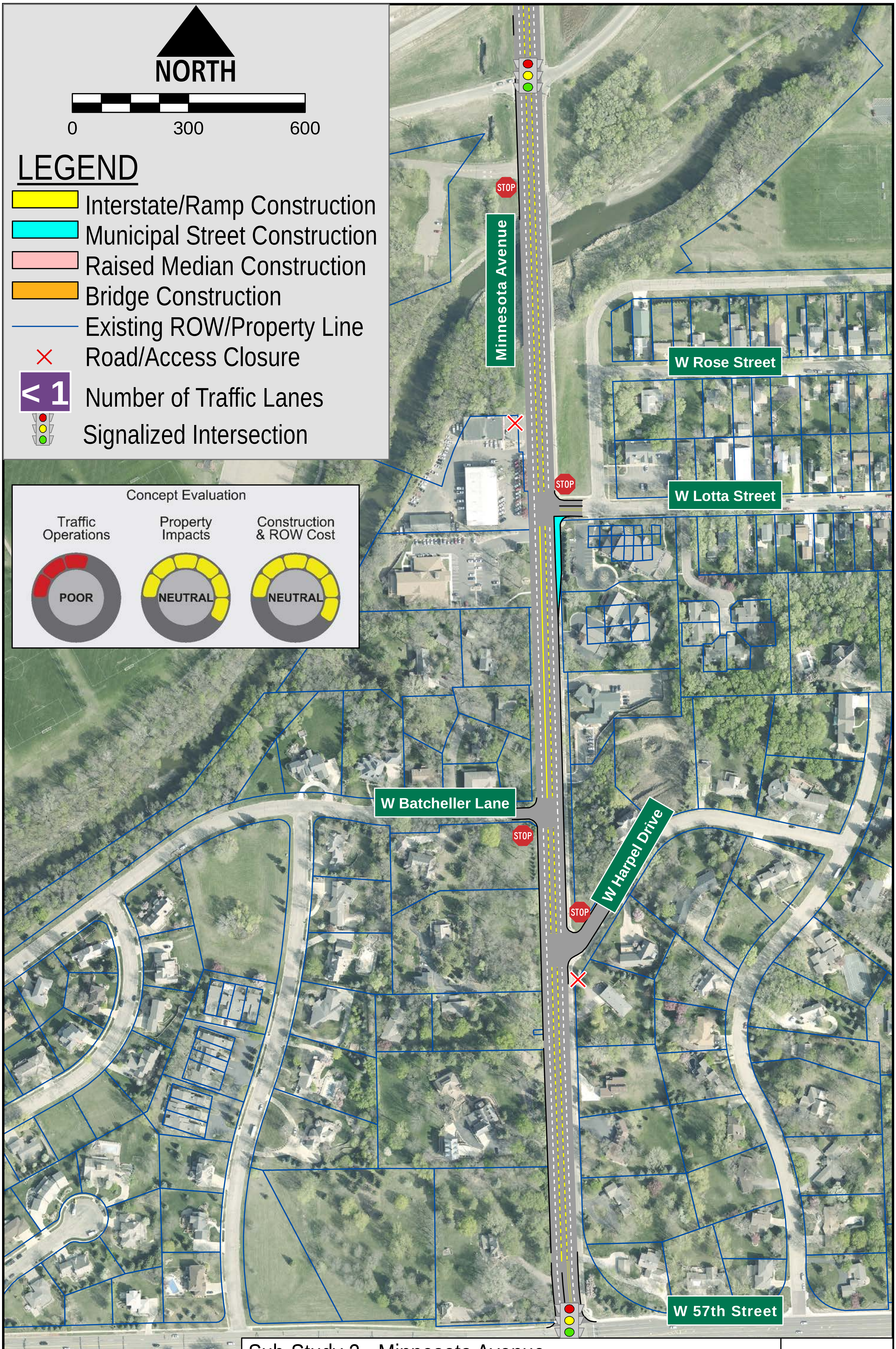
Sub-Study 2 - Minnesota Avenue
Unbalanced Lanes

I-229 Major Investment Corridor Study

Sioux Falls, South Dakota

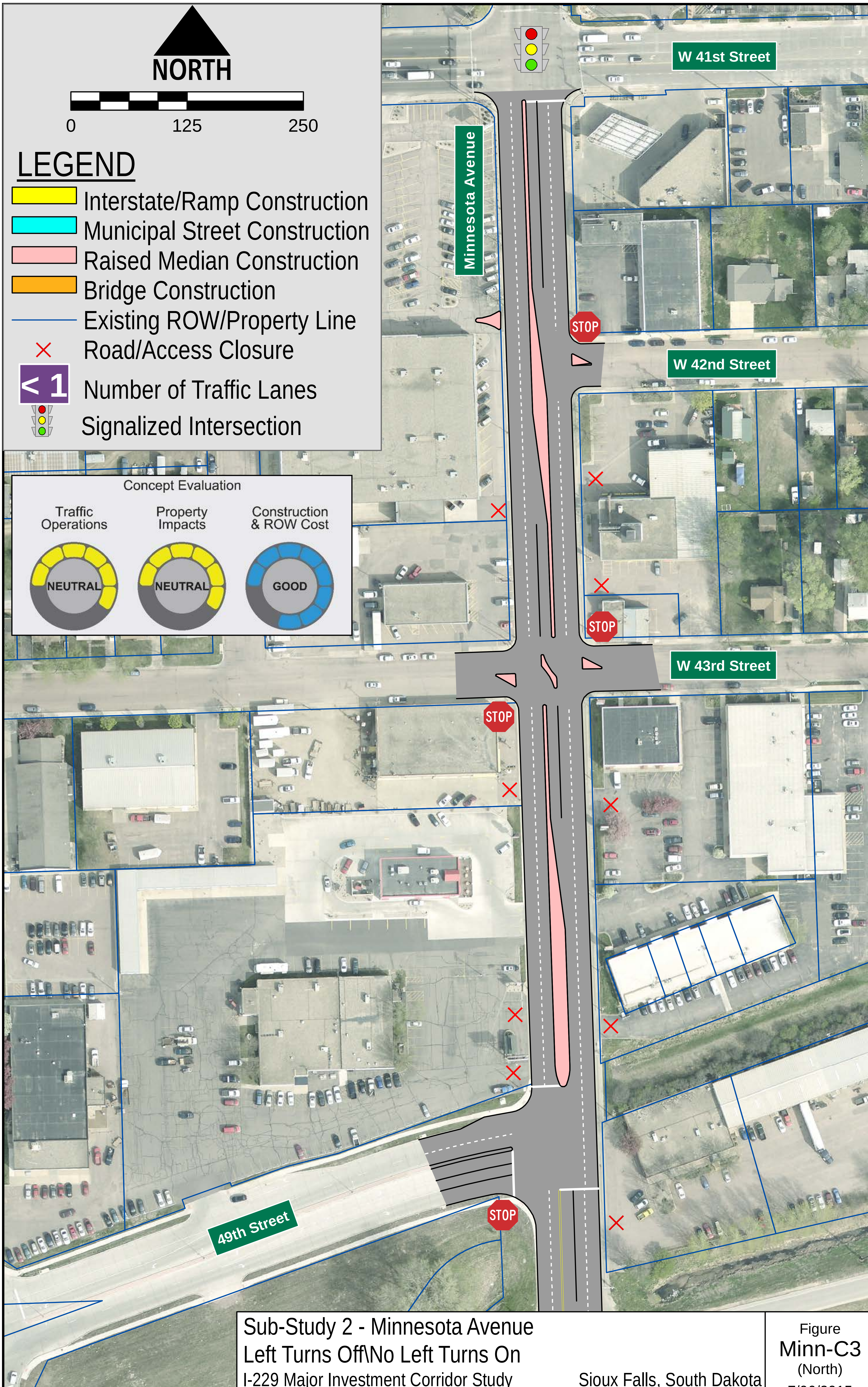
Figure Minn-C2 (North)

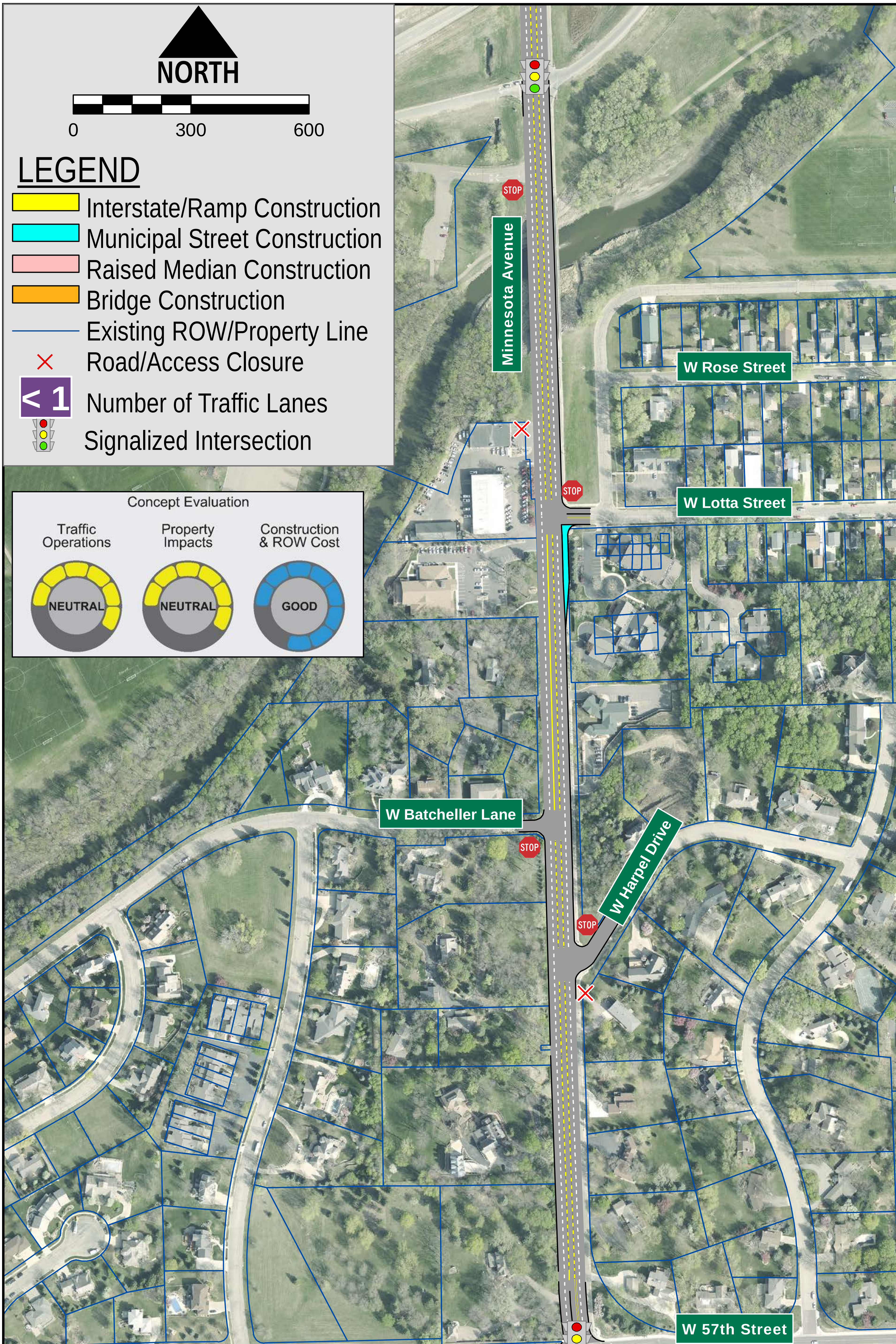
7/06/2015



Sub-Study 2 - Minnesota Avenue
Unbalanced Lanes
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota

Figure
Minn-C2
(South)
7/06/2015


NORTH
0
125
250
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Bridge Construction
Existing ROW/Property Line
Road/Access Closure
< 1
Number of Traffic Lanes
Signalized Intersection
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
NEUTRAL
NEUTRAL
GOOD
W 41st Street
Minnesota Avenue
STOP
W 42nd Street
STOP
W 43rd Street
STOP
49th Street
STOP
Sub-Study 2 - Minnesota Avenue
Left Turns Off\No Left Turns On
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Minn-C3
(North)
7/06/2015



Sub-Study 2 - Minnesota Avenue

Left Turns Off\No Left Turns On

I-229 Major Investment Corridor Study

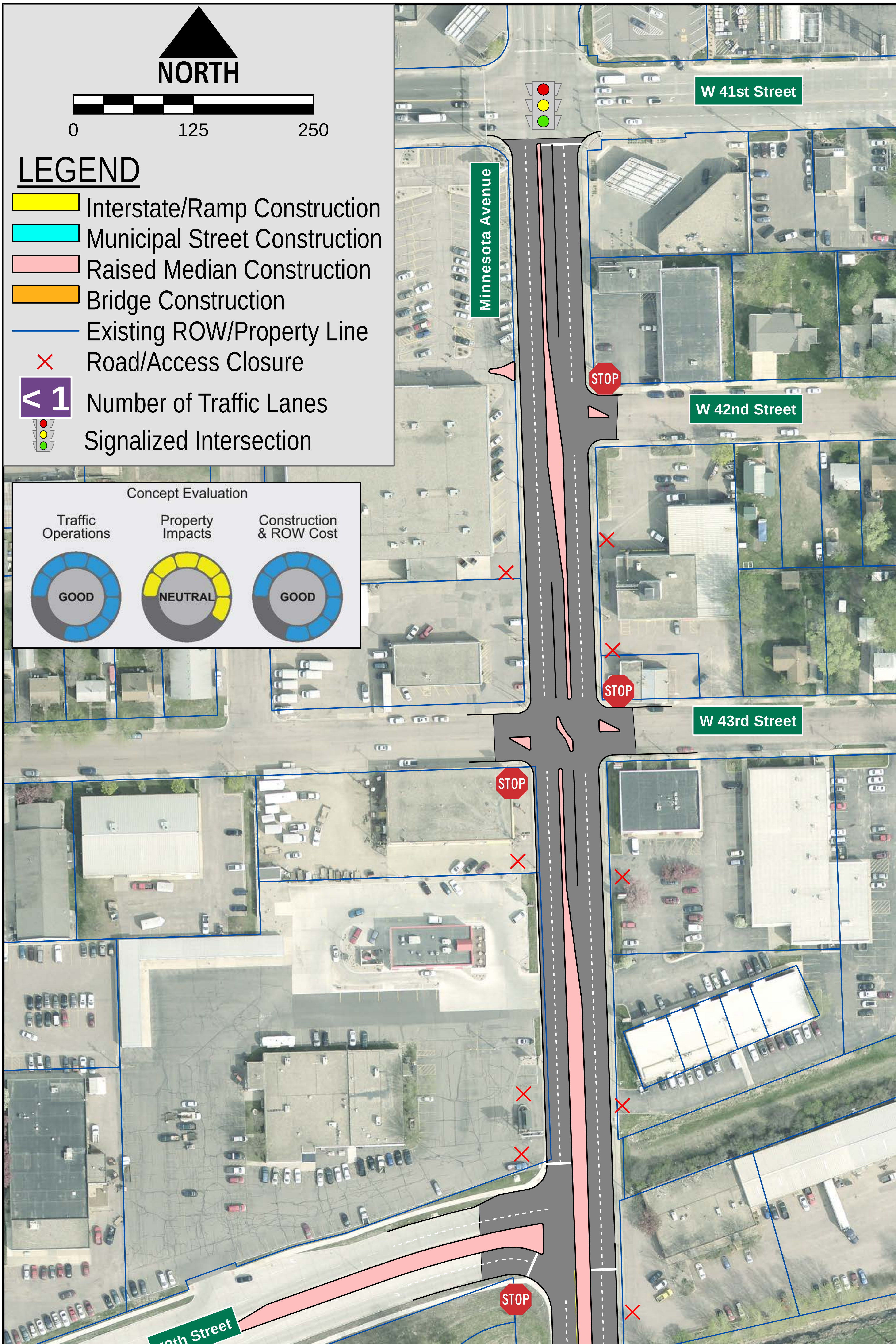
Sioux Falls, South Dakota

Figure

Minn-C3

(South)

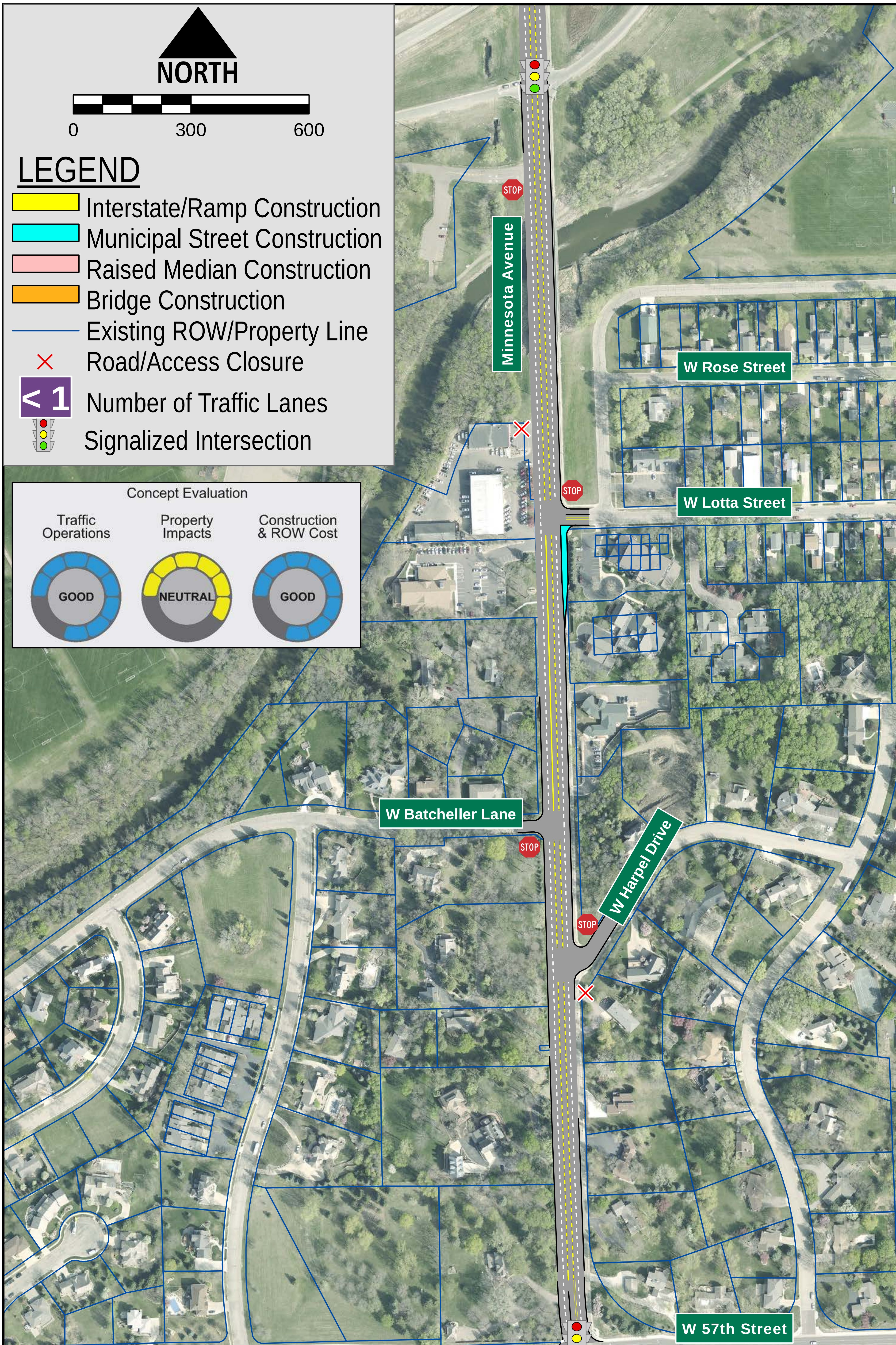
7/06/2015



Sub-Study 2 - Minnesota Avenue
49th Street RIRO
I-229 Major Investment Corridor Study

Sioux Falls, South Dakota

Figure
Minn-C4
(North)
7/06/2015



Sub-Study 2 - Minnesota Avenue
49th Street RIRO
I-229 Major Investment Corridor Study

Sioux Falls, South Dakota

Figure
Minn-C4
(South)
7/06/2015

APPENDIX D2 -

PRELIMINARY CONCEPTS TECH MEMO

Technical Memo

To: Steve Gramm, Study Advisory Team	
From: HDR, HR Green	Project: I-229 Major Investment Study
CC: file	
Date: 8/27/15	Job No: 207030

RE: Draft Preliminary Concepts – Minnesota Corridor (Sub-study 2)

This memo serves as an interim deliverable for the Preliminary Concepts developed from the December 2014 and July 2015 Concept Workshop for the Minnesota Corridor (Sub-Study 2). The content provided in this memo will be incorporated into the final draft of the Sub-Study 2 report, and as such is referenced to the headings of other sections in the ultimate report deliverable (not yet available). Figure and table numbers will change in the final version of the Sub-Study 2 report.

Preliminary Concepts – Minnesota Corridor and Interchanges

The Minnesota Corridor portion of the Preliminary Concept Matrix was developed following the December 2014 Concept Workshop to document Study Advisory Team (SAT) decisions and serves as a road map for the development of concepts identified during the workshop. A comments column has been added to allow notes regarding evolution of the concepts from the workshop to be explained. The Preliminary Concept Matrix is shown in ***TABLE 1***.

The concepts depicted in ***ATTACHMENT A*** following this memorandum have had one or the other of the following actions determined by the SAT, as documented in the Concept Matrix:

- Develop comparative data for preliminary concept screening
- Eliminate from further development due to anticipated impacts, but will be shown at the second public meeting to note that the concept was identified and received initial consideration.

Table 1. Preliminary Concept Matrix

I-229 Major Investment Study - Preliminary Concept Matrix

Type
SPUI = Single Point
TD = Tight Diamond
DDI = Diverging Diamond
Par = Parclo
TSD = Tight Split Diamond
CFI = Continuous Flow Intersection

Concept Workshop Decision
Develop = Develop for public meeting
Show = Show public / No further development
Eliminate = Do not show public / No further development

Concept ID	Type / Details Description	Workshop Decision	Development Items		Comments
			Traffic Assessment	ROW/Environ /Cost	
Minnesota Avenue Interchange					
Minn-1	NE Ramp Realignment, SW Ramp Terminal Improvements (Option 1A)	Develop	X	X	-Modified to include additional capacity for the NB exit ramp
Minn-2	NE Loop, NE & NW Ramp Realign, SW Ramp Term Improve (Option 2A)	Develop	X	X	-Modified to include capacity improvements at the NB exit ramp terminal
Minn-3	Parclo, NE, NW & SW Ramp Realignment (Option 2B)	Develop	X	X	-Added variation with SB entrance loop ramp aligned with 49th St providing NB and SB Minnesota Ave and 49th St access
Minn-4	Parclo, NE loop align with 49th St, Elim NW quad ramp (Option 2B Variation)	Develop	X	X	-Modified ramp terminal spacing in new Minn 3 and eliminated northwest quadrant entrance ramp -Developed 49th St ramp alignment
Minn-5	DDI (Option 3A)	Develop		X	-Minn-5 (Option 3A) was not modified from the original concept presented
Minn-6	DDI, South shift (Option 3B)	Develop	X	X	-Updated to maintain 100-foot min distance from end of ramp terminal radius return to end of radius return at nearest intersection (49th St)
	DDI (Option 3C)	Eliminate			-Eliminated from further consideration
Minn-7	DDI, NE Ramp split with 49th St connection (Option 3D)	Develop	X	X	-NE ramp aligned with 49th
Minn-8	SPUI, 49th St RIRO (Option 4A)	Develop	X	X	-Minn-8 (Option 4A) was not modified from the original concept presented
Minn-9	SPUI, NE Ramp split with 49th St connection, 49th St RIRO (Option 4B)	Develop		X	-Minn-9 (Option 4B) was not modified from the original concept presented
	SPUI, 49th Realignment (Option 4C)	Eliminate			-Eliminated from further consideration
Minn-10	SPUI, South shift, cross-under ramps	Develop	X	X	-Developed to include an offset SPUI with the SB entrance and exit ramps under new mainline bridges
Minn-11	SPUI, South shift, cross-under ramps with consolidated I-229 bridges	Develop		X	-Developed to include an offset SPUI with the SB entrance and exit ramps under new mainline bridges
Minn-12	SPUI, South shift, cross-over ramps	Develop			-Developed to include an offset SPUI with the SB entrance and exit flyover ramps over mainline
Minn-Var	Relocated park entrance/Rose St extension/Lotta St closure	Develop (1)	X	X	-Appears in DDI (Minn 6 and 7), Parclo (Minn 3 and 4) and SPUI South Shift concepts (Minn 10, 11, and 12)
Minnesota Avenue Corridor					
Minn-C1	5-Lane undivided with driveway closures	Develop		X	-Developed with proposed access closure locations
Minn-C2	Unbalanced lanes, 41st St & 49th St	Develop	X (2)	X	-Developed with unbalanced lanes (one-way) in the WB direction along the abandoned railroad right-of-way east of Minnesota Avenue -Align with the existing WB lanes of 49th Street to the west of Minnesota Avenue
Minn-C3	Left turns off Minn Ave / No left turns onto Minn Ave (3/4 access), 41st to 49th	Develop	X	X	-Developed allowing left turns from Minnesota Avenue onto the side roads while eliminating left turn lanes from the side roads onto Minnesota Avenue -This will be done with channelization and raised medians
Minn-C4	49th St Right-in / Right-out (RIRO)	Develop		X	-Developed allowing right turns only to and from 49th Street at Minnesota Avenue

Footnotes
(1) Combine with relevant Minn Ave interchange & corridor concepts
(2) Analyzed in conjunction with interchange improvements

Preliminary Concepts Comparative Data

The I-229 Major Investment Study scope identified the following four types of data to be developed for each preliminary concept identified for further consideration:

- Property Impacts
- Traffic Operations
- Environmental Review
- Construction and Property Impact Costs

This comparative data will be used in combination with public input to screen the concepts and identify “Build Scenarios” for further refinement. The remainder of this technical memorandum will describe the approach applied to preparing the comparative data and will document the comparative data for each concept.

Property Impacts

An approximate footprint for each preliminary concept was developed by setting impact limits based on the following criteria:

- 15 feet behind the back of curb
- 25-foot offset from ramp pavement (from back of curb or edge of shoulder)
- 100 feet from edge of I-229 shoulder pavement
- 5 feet behind retaining walls

The criteria that resulted in the greatest offset from a given roadway set the impact limit for that roadway.

The portion of each property parcel intersected by the impact limits that was inside of the impact limit was assumed to be an acquisition. If an acquisition impacted a structure, or rendered a parcel unusable in the opinion of the consultant (i.e. a large part of a parking lot was acquired), the entire structure or parcel was assumed to be an acquisition.

A unit price of $5 per square foot of acquisition area was applied to estimate the cost of property impacts. The total estimated cost of property impacts for a concept is the total impacted area times $5 per square foot plus the assessed value of structures impacted (from the Minnehaha County Assessor’s website) times 1.5 (to estimate the fair market value of impacts).

The estimated property impact areas (in acres) and costs are included in the tabulation of estimated construction costs later in this memorandum.

Traffic Operations Assessment

The traffic operations assessment for each preliminary concept was developed using output from model runs of the Dynamic Traffic Assignment (DTA) model. The 2012 Existing Conditions calibrated DTA model was updated to reflect 2035 No-Build conditions and used as a baseline model to which output from each preliminary concept run was compared.

A concept DTA model run was performed for each “unique” concept, in other words, for concepts that appear to the model to be virtually identical, no independent run was made.

The following Measures of Effectiveness (MOEs) were extracted from the model runs:

- Total queues in the interchange area
- Delay in the interchange area
- Delay in the subarea
- Travel times for select O-D pairs
- Travel time on I-229 (used in lieu of Queue-to-ramp-length ratio)

The MOE’s from each concept run were compared to the No-Build MOE’s and a percent change calculated between each concept and No-Build.

MOE’s that compare concepts within an “interchange area” are based on a selection of model links within a consistent boundary. Illustrations of the interchange area are shown in ***ATTACHMENT B***.

Concepts that were not explicitly modeled were classified based on the DTA model output of similar concepts.

Next, the MOE’s were grouped into the following categories:

- Queues
- Delay
- Travel Time

Both AM and PM comparison percentages and a composite qualitative rating are shown for each of the concepts in ***TABLE 2***. Composite ratings are based on consideration of both AM and PM comparison percentages. The subjective classifications are:

- Very Good
- Good
- Neutral
- Poor

Context of DTA Traffic Assessment Results

The MOE's from the DTA model output are indicators of how effective a particular concept may be at improving traffic conditions, but may need further explanation of what may appear to be a worsening of traffic conditions compared to the No-Build.

- In some of the modeled interchange concepts, the impact of increased demand levels between Build and No-Build concepts yielded worse traffic operations for the Build than the No-Build in the interchange area. In the DTA model, an improved interchange may provide needed capacity which triggers vehicles to shift from a congested parallel corridor to a route through the improved interchange.
  In this example, the No-Build provides no additional capacity at the interchange, and vehicles will avoid it, whereas in the Build model, traffic is now shifted to the interchange. Though the Build condition may provide a level of congestion relief compared to the No-Build model (in terms of control delay in seconds per vehicle) that congestion relief may not be reflected in the traffic-volume related MOEs provided by the DTA model (such as overall vehicle minutes of delay).
  Upcoming phases of this study will further examine the Build concepts to verify that each Build concept advanced to the alternatives analysis stage provides adequate LOS using Highway Capacity Manual 2010 procedures, which are more suited to assessing the level of congestion in the interchange area.
- In some of the modeled corridor concepts, because model runs were conducted for each concept in isolation, some capacity constraints did result in comparisons to No-Build traffic conditions that appear worse than would be the case if the concept were implemented in logical combination with associated improvements. These instances will be noted in the results.
- The DTA model structure first includes the generation of traffic demand by the Sioux Falls regional (macro) travel demand model, and assigns traffic through the subarea using a dynamic procedure. The DTA model subarea is shown in ***ATTACHMENT C***. The level of traffic demand from the macro model does not consider intersection-level sensitivity to congestion.
  By contrast, the DTA model does consider intersection-level congestion. If the DTA model sees capacity constraints, then that traffic accumulates extreme levels of delay and cannot get to the downstream links (vehicles are stuck in the network at the end of simulation period).
  The DTA model is also extremely sensitive to peaking characteristics, whereas the regional macro model is blind to peaking within the 2-hour peak period. Therefore, the macro model results are representative of average conditions within the 2-hour period, but the DTA model results capture impacts of the worst part of the peak that influences the rest of the 2-hour period.
  In certain Build scenarios the macro model may have generated more traffic volume due to the proposed improvement with a preferred route through the interchange improvements. This additional volume is more than the DTA model can serve through the intersections along that route due to the combination of intersection-level congestion

and peaking. The DTA model attempts to optimize vehicle routing to minimize individual vehicle delay, but the optimal routing may still lead to more network-wide delay than the No-Build model because of the different distributions of traffic demand between the two scenarios.

For the reasons outlined above, less than favorable results in the traffic assessment comparative data in ***TABLE 2*** should not be treated as fatal flaws.

The following additional notes are referenced from the MOE's shown in ***TABLE 2***:

1. MOE's show degraded performance compared to No-Build; see first explanation item above.
2. Corridor improvement effectiveness limited by lack of available upstream capacity; see second explanation item above.
3. MOE's show degraded performance compared to No-Build, see third explanation item above.

Table 2. Preliminary Concept 2035 Conditions DTA Traffic Assessment Comparative Data

Queues

Interchange Area Total Queue Length		Queues		Subjective
Concept ID	Description	AM	PM	Classification
Minn-1	NE Ramp Realignment, SW Ramp Terminal Improvements (Option 1A)	-76%	-58%	Very Good
Minn-2	NE Loop, NE & NW Ramp Realign, SW Ramp Term Improve (Option 2A)	-70%	-63%	Very Good
Minn-3	Parclo, NE, NW & SW Ramp Realignment (Option 2B)	-46%	-39%	Very Good
Minn-4	Parclo, NE loop align wi 49th St, Elim NW quad ramp (Option 2B Variation)	-42%	24% [1]	Good
Minn-6	DDI, South shift (Option 3B)	-78%	-70%	Very Good
Minn-7	DDI, NE Ramp split with 49th St connection (Option 3D)	-91%	-75%	Very Good
Minn-8	SPUI, 49th St RIRO (Option 4A)	-89%	-50%	Very Good
Minn-9	SPUI, NE Ramp split with 49th St connection, 49th St RIRO (Option 4B)	-89%	-70%	Very Good
Minn-10	SPUI, South shift	-70%	-40%	Very Good
Minn-C2	Unbalanced lanes, 41st St & 49th St	-9%	175% [2]	Poor
Minn-C3	Left turns off Minn Ave / No left turns onto Minn Ave (3/4 access), 41st to 49th	26% [2]	78% [2]	Poor

Delay

Interchange Area Delay (veh-min)		Delay, veh-min		Subjective
Concept ID	Description	AM	PM	Classification
Minn-1	NE Ramp Realignment, SW Ramp Terminal Improvements (Option 1A)	-70%	-54%	Very Good
Minn-2	NE Loop, NE & NW Ramp Realign, SW Ramp Term Improve (Option 2A)	-63%	-50%	Very Good
Minn-3	Parclo, NE, NW & SW Ramp Realignment (Option 2B)	-34%	-38%	Very Good
Minn-4	Parclo, NE loop align wi 49th St, Elim NW quad ramp (Option 2B Variation)	-43%	19% [1]	Good
Minn-6	DDI, South shift (Option 3B)	-76%	-64%	Very Good
Minn-7	DDI, NE Ramp split with 49th St connection (Option 3D)	-88%	-65%	Very Good
Minn-8	SPUI, 49th St RIRO (Option 4A)	-86%	-44%	Very Good
Minn-9	SPUI, NE Ramp split with 49th St connection, 49th St RIRO (Option 4B)	-87%	-63%	Very Good
Minn-10	SPUI, South shift	-67%	-39%	Very Good
Minn-C2	Unbalanced lanes, 41st St & 49th St	-7%	129% [2]	Poor
Minn-C3	Left turns off Minn Ave / No left turns onto Minn Ave (3/4 access), 41st to 49th	29% [2]	49% [2]	Poor

Overall Subarea Delay (min)		Delay, min		Subjective
Concept ID	Description	AM	PM	Classification
Minn-1	NE Ramp Realignment, SW Ramp Terminal Improvements (Option 1A)	-4%	-4%	Neutral
Minn-2	NE Loop, NE & NW Ramp Realign, SW Ramp Term Improve (Option 2A)	1%	3%	Neutral
Minn-3	Parclo, NE, NW & SW Ramp Realignment (Option 2B)	8% [3]	-1%	Neutral
Minn-4	Parclo, NE loop align wi 49th St, Elim NW quad ramp (Option 2B Variation)	4%	4%	Neutral
Minn-6	DDI, South shift (Option 3B)	-1%	12% [3]	Neutral
Minn-7	DDI, NE Ramp split with 49th St connection (Option 3D)	0%	-2%	Neutral
Minn-8	SPUI, 49th St RIRO (Option 4A)	-11%	0%	Good
Minn-9	SPUI, NE Ramp split with 49th St connection, 49th St RIRO (Option 4B)	1%	-4%	Neutral
Minn-10	SPUI, South shift	0%	7% [3]	Neutral
Minn-C2	Unbalanced lanes, 41st St & 49th St	-1%	23% [2]	Poor
Minn-C3	Left turns off Minn Ave / No left turns onto Minn Ave (3/4 access), 41st to 49th	-5%	3%	Neutral

Table 2. Preliminary Concept 2035 Conditions DTA Traffic Assessment Comparative Data (continued)

Travel Time

Interstate Through Trips

Concept ID	Description	Travel Time AM	Travel Time PM	Subjective Classification
Minn-1	NE Ramp Realignment, SW Ramp Terminal Improvements (Option 1A)	-1%	-3%	Neutral
Minn-2	NE Loop, NE & NW Ramp Realign, SW Ramp Term Improve (Option 2A)	0%	-3%	Neutral
Minn-3	Parclo, NE, NW & SW Ramp Realignment (Option 2B)	-1%	-3%	Neutral
Minn-4	Parclo, NE loop align wi 49th St, Elim NW quad ramp (Option 2B Variation)	-1%	-3%	Neutral
Minn-6	DDI, South shift (Option 3B)	0%	-3%	Neutral
Minn-7	DDI, NE Ramp split with 49th St connection (Option 3D)	-1%	-3%	Neutral
Minn-8	SPUI, 49th St RIRO (Option 4A)	-1%	-2%	Neutral
Minn-9	SPUI, NE Ramp split with 49th St connection, 49th St RIRO (Option 4B)	-1%	-3%	Neutral
Minn-10	SPUI, South shift	0%	-3%	Neutral
Minn-C2	Unbalanced lanes, 41st St & 49th St	1%	5% [2]	Neutral
Minn-C3	Left turns off Minn Ave / No left turns onto Minn Ave (3/4 access), 41st to 49th	0%	-2%	Neutral

Through on Minnesota Corridor

Concept ID	Description	Travel Time AM	Travel Time PM	Subjective Classification
Minn-1	NE Ramp Realignment, SW Ramp Terminal Improvements (Option 1A)	-10%	-13%	Good
Minn-2	NE Loop, NE & NW Ramp Realign, SW Ramp Term Improve (Option 2A)	-13%	-13%	Good
Minn-3	Parclo, NE, NW & SW Ramp Realignment (Option 2B)	30% [1]	-6%	Poor
Minn-4	Parclo, NE loop align wi 49th St, Elim NW quad ramp (Option 2B Variation)	-15%	-12%	Good
Minn-6	DDI, South shift (Option 3B)	-24%	-11%	Good
Minn-7	DDI, NE Ramp split with 49th St connection (Option 3D)	-27%	-12%	Good
Minn-8	SPUI, 49th St RIRO (Option 4A)	-27%	-8%	Good
Minn-9	SPUI, NE Ramp split with 49th St connection, 49th St RIRO (Option 4B)	-33%	-14%	Good
Minn-10	SPUI, South shift	-33%	-17%	Good
Minn-C2	Unbalanced lanes, 41st St & 49th St	6% [2]	-2%	Neutral
Minn-C3	Left turns off Minn Ave / No left turns onto Minn Ave (3/4 access), 41st to 49th	15% [2]	2%	Poor

49th/Cliff to/from 33rd/Minnesota

Concept ID	Description	Travel Time AM	Travel Time PM	Subjective Classification
Minn-1	NE Ramp Realignment, SW Ramp Terminal Improvements (Option 1A)	-7%	-5%	Good
Minn-2	NE Loop, NE & NW Ramp Realign, SW Ramp Term Improve (Option 2A)	-4%	-4%	Neutral
Minn-3	Parclo, NE, NW & SW Ramp Realignment (Option 2B)	-12%	-1%	Good
Minn-4	Parclo, NE loop align wi 49th St, Elim NW quad ramp (Option 2B Variation)	-14%	2%	Good
Minn-6	DDI, South shift (Option 3B)	7% [1]	-3%	Neutral
Minn-7	DDI, NE Ramp split with 49th St connection (Option 3D)	-11%	2%	Neutral
Minn-8	SPUI, 49th St RIRO (Option 4A)	13% [1]	30% [1]	Poor
Minn-9	SPUI, NE Ramp split with 49th St connection, 49th St RIRO (Option 4B)	-10%	4%	Neutral
Minn-10	SPUI, South shift	17% [1]	2%	Poor
Minn-C2	Unbalanced lanes, 41st St & 49th St	0%	3%	Neutral
Minn-C3	Left turns off Minn Ave / No left turns onto Minn Ave (3/4 access), 41st to 49th	1%	5%	Neutral

Costco to/from 33rd/Minnesota

Concept ID	Description	Travel Time AM	Travel Time PM	Subjective Classification
Minn-1	NE Ramp Realignment, SW Ramp Terminal Improvements (Option 1A)	1%	-3%	Neutral
Minn-2	NE Loop, NE & NW Ramp Realign, SW Ramp Term Improve (Option 2A)	1%	-3%	Neutral
Minn-3	Parclo, NE, NW & SW Ramp Realignment (Option 2B)	0%	2%	Neutral
Minn-4	Parclo, NE loop align wi 49th St, Elim NW quad ramp (Option 2B Variation)	26% [1]	8% [1]	Poor
Minn-6	DDI, South shift (Option 3B)	58%	0%	Poor
Minn-7	DDI, NE Ramp split with 49th St connection (Option 3D)	-2%	5%	Neutral
Minn-8	SPUI, 49th St RIRO (Option 4A)	100%	58%	Poor
Minn-9	SPUI, NE Ramp split with 49th St connection, 49th St RIRO (Option 4B)	21%	16%	Poor
Minn-10	SPUI, South shift	95% [1]	-1%	Poor
Minn-C2	Unbalanced lanes, 41st St & 49th St	16% [2]	2%	Poor
Minn-C3	Left turns off Minn Ave / No left turns onto Minn Ave (3/4 access), 41st to 49th	-1%	0%	Neutral

Environmental Review

To analyze potential resources within the Study Area, a desktop review of available data was analyzed against the project concepts, in addition to review of aerial imagery of the I-229 corridor. Items that could require further analysis at the time of future project initiation were identified for issues which separate project concepts. Later phases in potential project corridor planning will require environmental documentation if federal funds are used, and would require analysis of additional resources such as environmental justice, noise, etc.

Archaeological and Historical Resources

APPROACH

A record search was completed by the SD Archaeological Research Center. The area which encompasses a particular preliminary roadway concept was reviewed for potential historic and cultural resources. Historic and cultural resources are regulated under Section 106 of the National Historic Preservation Act, and may require consultation with the South Dakota Department of Transportation (SDDOT) and the South Dakota State Historic Preservation Office (SHPO).

The record search identified record sites and cultural surveys that were completed within the study area. Known sites that were listed as eligible for the National Register of Historic Places (NRHP) include three bridges and two railroad beds. Additionally, one unevaluated Native American stone circle is located within the study area. Shapefiles of these sites were imported into ArcGIS and compared against preliminary concepts to determine the potential for impacts to cultural resources. The known sites are not located within the area potentially affected by Sub-Study 2.

LIMITATIONS

Early in project planning, the City of Sioux Falls (City) should work with SDDOT to coordinate its intent to proceed with a particular roadway improvement project, and request that the SDDOT advise the City on the applicability of Section 106, the need to identify consulting parties, and for a Class I cultural resource literature search. When appropriate, the City should anticipate that a Class III identification effort will be conducted, including identification of archaeological, architectural, and traditional cultural properties subject to the effects of the project. When historic properties are identified, the City should anticipate that avoidance or mitigation of adverse effects to such properties may be required.

Wetlands and Waters of the U.S.

APPROACH

The National Wetlands Inventory (NWI) and aerial imagery were reviewed within the study area to determine potential project impacts. The Big Sioux River and its tributaries are located within the study area and cross the I-229 corridor three times. There are also several wetlands located adjacent to the I-229 corridor. Because the NWI provides an estimate of wetlands based on soil type and aerial photography, these boundaries are utilized as guidance for identifying wetland areas and delineation would be required for each project.

LIMITATIONS

Wetlands and other waters of the US will need to be considered for each project as the State and City want to move the project from planning stages to construction. Early in project planning, an onsite wetland delineation of the study area is recommended to confirm the boundaries of wetlands and other waters of the U.S. within the study area and to coordinate with USACE to determine jurisdiction.

Threatened and Endangered Species

APPROACH

Fish and wildlife species listed under the Federal Endangered Species Act (ESA) would need to be considered for each project. The list of species identified for Minnehaha was identified from US Fish and Wildlife Service (USFWS) information. Four threatened, endangered, or proposed species exist in Minnehaha County. These include the rufa red knot (threatened); Topeka shiner (endangered); western prairie fringed orchid (threatened); and northern long-eared bat (proposed endangered).

To identify the potential for threatened and endangered species to be present in an area, aerial imagery was used to identify potential habitat located within the project corridor. The study area is highly developed with commercial, industrial, and residential activities. Undeveloped areas are generally limited to areas associated with the Big Sioux River. Additionally, there is some cropland in the northern portion of the corridor. Habitat for the western prairie fringed orchid is not believed to occur within most of the study area due to lack of native habitat. Habitat for the Topeka shiner is found within the Big Sioux River and its tributaries, and the I-229 corridor crosses the river in multiple places. Typically within the City, the USFWS has noted for previous projects that the Topeka shiner is not anticipated to occur within these stretches of the Big Sioux River. Habitat for the rufa red knot is limited to sandy or gravel shorelines associated with the Big Sioux River. Potential habitat associated with the northern long-eared bat in the Study Area includes riparian areas and bridges along the Big Sioux River.

LIMITATIONS

Consultation with USFWS would be required to determine which ESA-listed species have the potential to occur within each Study Area. Coordination with SD Game, Fish, and Parks would be recommended regarding impacts to state-listed sensitive species.

Section 4(f) and Section 6(f) Properties

APPROACH

The Department of Transportation Act (DOT Act) of 1966 included a special provision – Section 4(f) – which is intended to protect publicly owned parks, recreational areas, wildlife and waterfowl refuges, or public and private historical sites. Similarly, Section 6(f) protects state and locally sponsored projects that were funded as part of the Land and Water Conservation Fund (LWCF).

The LWCF website was reviewed to identify the use of Section 6(f) grants in the Study Area. Publicly owned parks and recreation areas are present within the Study Area. Public spaces within the City of Sioux Falls that have received LWCF grant money are subject to Section 6(f) regulations. The Big Sioux Trail, a recreational trail, also received LWCF grant money for portions of the trail. Additionally, if the projects proposed in these alternatives receive Federal Highway Administration (FHWA) funds, the projects will be subject to Section 4(f) consultation.

LIMITATIONS

There have been several grants received at a variety of the City parks. Areas within the Project corridor that could impact City parks or recreational trails would need to be further reviewed to determine potential for a Section 6(f) impact. Due to the use of LWCF grants, it is recommended that consultation occur early with each project to determine the location of improvements to determine whether the park area impacted will be subject to Section 6(f) regulations.

Floodplain

APPROACH

The City has been a participating member of the Federal Emergency Management Agency (FEMA) Flood Insurance Program since 1979. The current Minnehaha County Flood Insurance Study (FIS) that includes the City and incorporated areas is dated September 2, 2009. The project area contains FEMA-designated zones for the Big Sioux River.

LIMITATIONS

If any projects would involve areas associated with the Big Sioux River, a floodplain permit may be required if the floodplain would be encroached upon. A Floodplain Development Application would be completed for the project and the City would obtain a Floodplain Development Permit.

Regulated Materials

APPROACH

The SD Department of National Resources (SDDENR) Environmental Events Database website was reviewed for the Project Area to identify any areas that could be of concern for project concepts.

LIMITATIONS

Information for hazardous material should be reviewed at the time of a proposed project to identify any potential new hazards that may have occurred from the time of the study to a project.

The environmental review findings for the I-229 corridor and interchange concepts are summarized in ***TABLE 3***.

Environmental constraints for the I-229 corridor are shown in ***ATTACHMENT D***.

Note, a noise assessment will be included at later stage of the study.

Table 3. Preliminary Concepts Environmental Review

Concept ID	Description	Environmental Comparative Data					Environmental Summary	
		Wetlands	T&E	4(f) and 6(f) Properties	Cultural	Other	Anticipated Impact Level	Comments
Minn-1	NE Ramp Realignment, SW Ramp Terminal Improvements (Option 1A)	Potential impacts to drainage ditch wetlands on NE side of roadway	Potential tree removal could impact northern long-eared bat if trees are removed during summer maternity season.	If RR bed is eligible for NRHP, it would be 4(f) if FHWA funds are used. Minn 1-Minn 3 have similar impacts to RR bed.	Former RR bed should be evaluated for potential eligibility.	1 structure to be removed	Medium/ potential 4(f)	Less impacts than Option 2. Potential wetland impacts. Potential northern long-eared bat impacts if trees are impacted in summer maternity season.
Minn-2	NE Loop, NE & NW Ramp Realign, SW Ramp Term Improve (Option 2A)	Potential wetland impacts on both sides of roadway.	Potential impacts to northern long-eared bat if trees are removed during summer maternity season. Bridge could be potential bat habitat and should be reviewed.	If RR bed is eligible for NRHP, it would be 4(f) if FHWA funds are used. Minn 1-Minn 3 have similar impacts to RR bed.	Former RR bed should be evaluated for potential eligibility.	1 structure to be removed	Medium/ potential 4(f)	More impacts than Minn-1 and 2A. Potential wetland impacts. Potential northern long-eared bat impacts if trees are impacted. Bridge should be reviewed for bat habitat.
Minn -2A	NE Loop, Aligned with 49th Street	Potential impacts to drainage ditch wetlands on NE side of roadway.	Potential impacts to northern long-eared bat if trees are removed during summer maternity season. Bridges could be potential bat habitat and should be reviewed.	If RR bed is eligible for NRHP, it would be 4(f) if FHWA funds are used. Minn 1-Minn 3 have similar impacts to RR bed.	Former RR bed should be evaluated for potential eligibility.	1 structure to be removed	Medium/ potential 4(f)	Slightly less impacts than Minn-2. Potential weltand impacts. Bridge should be reviewed for potential bat habitat.
Minn-3	Parclo, NE, NW & SW Ramp Realignment (Option 2B)	New construction over Big Sioux River	Potential impacts to northern long-eared bat if trees are removed during summer maternity season. Bridges could be potential bat habitat and should be reviewed.	Impacts Yankton Trail Park (would be 6(f) and may be 4(f) if FHWA funds are used). Minn 3 & Minn 4 have similar impacts.	Structure and former RR bed should be reviewed for historic eligibility	Floodplain present. Structure to be removed	**High/ likely 4(f)/6(f) impacts**	Section 6(f) impacts and also 4(f) impacts if FHWA funds are used. Structure removal. Potential northern long-eared bat impacts if trees are impacted. Bridges should be reviewed for potential bat habitat.
Minn-4	Parclo, NE loop align wi 49th St, Elim NW quad ramp (Option 2B Variation)	New construction over Big Sioux River	Potential impacts to northern long-eared bat if trees are removed during summer maternity season. Bridges could be potential bat habitat and should be reviewed.	Impacts Yankton Trail Park (would be 6(f) and may be 4(f) if FHWA funds are used). If RR bed is eligible for NRHP, it would be 4(f) if FHWA funds are used. Minn 3 & Minn 4 have similar impacts.	Structure and former RR bed should be reviewed for historic eligibility	Floodplain present. Structure to be removed	**High/ likely 4(f)/6(f) impacts**	Section 6(f) impacts and also 4(f) impacts if FHWA funds are used. Structure removal. Potential northern long-eared bat impacts if trees are impacted. Bridges should be reviewed for potential bat habitat.
Minn-5	DDI (Option 3A)		Potential impacts to northern long-eared bat if trees are removed during summer maternity season. Bridges could be potential bat habitat and should be reviewed.	Appears to avoid 4(f)/6(f) properties			**Low**	Potential northern long-eared bat impacts if trees are impacted. Bridge should be reviewed for potential bat habitat. Avoids 4(f)/6(f) properties
Minn-6	DDI, South shift (Option 3B)	New construction over Big Sioux River	Potential impacts to northern long-eared bat if trees are removed during summer maternity season. Bridges could be potential bat habitat and should be reviewed.	Impacts Yankton Trail Park (would be 6(f) and may be 4(f) if FHWA funds are used). No RR bed impacts.		Floodplain present.	**High/ likely 4(f)/6(f) impacts**	Slightly less impacts than 3 & 4.Section 6(f) impacts and also 4(f) impacts if FHWA funds are used. Potential northern long-eared bat impacts if trees are impacted. Bridges should be reviewed for potential bat habitat. New bridge would be constructed.
Minn-7	DDI, NE Ramp split with 49th St connection (Option 3D)	New construction over Big Sioux River	Potential impacts to northern long-eared bat if trees are removed during summer maternity season. Bridges could be potential bat habitat and should be reviewed.	Impacts Yankton Trail Park (would be 6(f) and may be 4(f) if FHWA funds are used). If RR bed is eligible for NRHP, it would be 4(f) if FHWA funds are used.	Structure and RR bed should be reviewed for historic eligibility	Floodplain present. Structure to be removed	**High/ likely 4(f)/6(f) impacts**	Highest level of potential impacts. Section 6(f) impacts and also 4(f) impacts if FHWA funds are used. Structure removal.Potential northern long-eared bat impacts if trees are impacted. Bridges should be reviewed for potential bat habitat. New bridge construction.
Minn-8	SPUI, 49th St RIRO (Option 4A)	Potential wetland impacts	Potential impacts to northern long-eared bat if trees are removed during summer maternity season. Bridges could be potential bat habitat and should be reviewed.	Impacts Yankton Trail Park (would be 6(f) and may be 4(f) if FHWA funds are used). If RR bed is eligible for NRHP, it would be 4(f) if FHWA funds are used. Less RR bed impacts than Minn-7	Minor impacts to former RR bed. Should be reviewed for historic eligibility.		**High/ likely 4(f)/6(f) impacts**	Slightly less impacts than Minn-7. Section 6(f) impacts and also 4(f) impacts if FHWA funds are used. Potential northern long-eared bat impacts if trees are impacted. Bridge should be reviewed for potential bat habitat. New bridge construction.

Table 3. Preliminary Concepts Environmental Review (continued)

Concept ID	Description	Environmental Comparative Data					Environmental Summary	
		Wetlands	T&E	4(f) and 6(f) Properties	Cultural	Other	Anticipated Impact Level	Comments
Minn-9	SPUI, NE Ramp split with 49th St connection, 49th St RIRO (Option 4B)	Potential wetland impacts	Potential impacts to northern long-eared bat if trees are removed during summer maternity season. Bridges could be potential bat habitat and should be reviewed.	Impacts Yankton Trail Park (no 6(f); but would be 4(f) if FHWA funds are used). If RR bed is eligible for NRHP, it would be 4(f) if FHWA funds are used.	Should be reviewed for historic eligibility.	Floodplain present.	High/ likely 4(f)/6(f) impacts	Similar impacts to 8. Section 6(f) impacts and also 4(f) impacts if FHWA funds are used. Potential northern long-eared bat impacts if trees are impacted. Bridge should be reviewed for potential bat habitat. New bridge construction.
Minn-10	SPUI, South shift	New construction over Big Sioux River, Potential wetland impacts	Potential impacts to northern long-eared bat if trees are removed during summer maternity season. Bridges could be potential bat habitat and should be reviewed.	Impacts Yankton Trail Park (would be 6(f) and may be 4(f) if FHWA funds are used). No RR bed impacts.		Floodplain present.	High/ likely 4(f)/6(f) impacts	Higher level of potential impacts. Section 6(f) impacts and also 4(f) impacts if FHWA funds are used.Potential northern long-eared bat impacts if trees are impacted. Bridge should be reviewed for potential bat habitat. Structure removal.
Minn-11	SPUI, South shift	New construction over Big Sioux River	Potential impacts to northern long-eared bat if trees are removed during summer maternity season. Bridges could be potential bat habitat and should be reviewed.	Impacts Yankton Trail Park (would be 6(f) and may be 4(f) if FHWA funds are used). No RR bed impacts.		Floodplain present.	High/ likely 4(f)/6(f) impacts	Higher level of potential impacts.Section 6(f) impacts and also 4(f) impacts if FHWA funds are used. Potential northern long-eared bat impacts if trees are impacted. Bridge should be reviewed for potential bat habitat. New bridge construction.
Minn-12	SPUI, South shift	New construction over Big Sioux River	Potential impacts to northern long-eared bat with tree removal	Impacts Yankton Trail Park (would be 6(f) and may be 4(f) if FHWA funds are used). No RR bed impacts.		Floodplain present.	High/ likely 4(f)/6(f) impacts	Higher level of potential impacts. Section 6(f) impacts and also 4(f) impacts if FHWA funds are used. Potential northern long-eared bat impacts if trees are impacted. New bridge construction.
Minn-C1	5-Lane undivided with driveway closures	Crosses Big Sioux River, no impacts if on existing road	Potential impacts to northern long-eared bat if trees are removed	Bike path and parks present, appears to have no impacts if construction is within road ROW		Floodplain present; change in access points along corridor	Low	Minimal impacts.
Minn-C2	Unbalanced lanes, 41st St & 49th St	Crosses Big Sioux River, no impacts if on existing road	Potential impacts to northern long-eared bat if trees are removed	Bike path and parks present, appears to have no impacts if construction is within road ROW. If RR bed is historic, would be 4(f) if FHWA funds are used.		Floodplain present; change in access points along corridor	Medium/ potential 4(f)	Potential wetland impacts. If RR bed is historic, 4(f) impacts. Change in access points that could impact traffic patterns should be analyzed in a future phase.
Minn-C3	Left turns off Minn Ave / No left turns onto Minn Ave (3/4 access), 41st to 49th	Crosses Big Sioux River, no impacts if on existing road	Potential impacts to northern long-eared bat if trees are removed	Bike path and parks present, appears to have no impacts if construction is within road ROW		Change in access points along corridor	Low	Minimal impacts. Change in access points that could impact traffic patterns should be analyzed in a future phase.
Minn-C4	49th St RIRO	Crosses Big Sioux River, no impacts if on existing road	Potential impacts to northern long-eared bat if trees are removed	Bike path and parks present, appears to have no impacts if construction is within road ROW		Change in access points along corridor	Low	Minimal impacts. Change in access points that could create minor impacts to traffic patterns should be analyzed in a future phase.

Construction Costs

In preparing estimates of construction costs for the preliminary concepts, quantities were developed for the following items and the unit costs shown in parenthesis were applied to the quantities:

- Bridge deck area ($180 or $270/SF tangent or curved bridge)
- Retaining wall length ($600/LF)
- Interstate / ramp / street pavement area ($20/SF)

Pavement area costs are assumed to include curb, shoulder, median, sidewalk, and drainage items. For cost estimating purposes, all retaining walls were assumed to have a constant height of 12 feet over their entire estimated length.

The pavement unit costs applied were developed from unit prices computed from the following awarded local projects:

- 57th/Western (2013) — $5.3 million total, $21.81/SF
- Russell Street (2013) — $15 million total, $18.94/SF
- I-90/Cliff Ave Interchange (2013) — $15.8 million total, $25.61/SF (includes bridge costs)
- Cliff Ave, 61st to 85th (2015) — $8.9 million total, $16.91/SF

Estimated construction costs and property impacts costs for the preliminary concepts are shown in ***TABLE 4***.

Relocation costs are not included in the ROW cost estimates.

Preliminary Concepts Composite Comparative Assessment

The four types of data compiled for the Preliminary Concepts is shown in ***TABLE 5***, along with the qualitative classification for each measure.

Table 4. Preliminary Concepts Estimated Costs

Concept ID	Description	Bridge		Retaining Wall		Interstate & Ramps		Municipal Street		Contingency		Property Impacts		Total Cost
		Area (ft^2)	Cost	Length (ft)	Cost	Area (ft^2)	Cost	Area (ft^2)	Cost	%	Cost	Area (acre)	Cost	
Minn-1	NE Ramp Realignment, SW Ramp Terminal Improvements (Option 1A)	0	$0	0	$0	33,825	$676,500	0	$0	20%	$135,300	3.2	$1,553,276	$2,400,000
Minn-2	NE Loop, NE & NW Ramp Realign, SW Ramp Term Improve (Option 2A)	4,000	$720,000	0	$0	111,040	$2,220,800	0	$0	20%	$444,160	3.4	$1,689,911	$5,100,000
Minn-3	Parclo, NE, NW & SW Ramp Realignment (Option 2B)	8,000	$1,440,000	0	$0	205,365	$4,107,300	0	$0	20%	$821,460	3.4	$1,703,321	$8,100,000
Minn-4	Parclo, NE loop align wi 49th St, Elim NW quad ramp (Option 2B Variation)	8,000	$1,440,000	0	$0	158,490	$3,169,800	0	$0	20%	$633,960	3.2	$1,566,686	$6,900,000
Minn-5	DDI (Option 3A)	23,290	$4,192,200	0	$0	80,200	$1,604,000	85,175	$1,703,500	20%	$661,500	0.1	$77,340	$8,300,000
Minn-6	DDI, South shift (Option 3B)	23,290	$4,192,200	0	$0	123,320	$2,466,400	112,320	$2,246,400	20%	$942,560	0.1	$57,285	$10,000,000
Minn-7	DDI, NE Ramp split with 49th St connection (Option 3D)	23,290	$4,192,200	0	$0	135,370	$2,707,400	112,320	$2,246,400	20%	$990,760	3.1	$1,480,526	$11,700,000
Minn-8	SPUI, 49th St RIRO (Option 4A)	32,550	$5,859,000	0	$0	133,300	$2,666,000	108,920	$2,178,400	20%	$968,880	0.1	$57,150	$11,800,000
Minn-9	SPUI, NE Ramp split with 49th St connection, 49th St RIRO (Option 4B)	32,550	$5,859,000	0	$0	159,350	$3,187,000	108,920	$2,178,400	20%	$1,073,080	3.2	$1,548,581	$13,900,000
Minn-10	SPUI, South shift	74,000	$13,320,000	890	$534,000	226,340	$4,526,800	152,260	$3,045,200	20%	$1,621,200	0.1	$41,295	$23,100,000
Minn-11	SPUI, South shift	79,090	$14,236,200	250	$150,000	145,500	$2,910,000	143,620	$2,872,400	20%	$1,186,480	0.0	$24,540	$21,400,000
Minn-12	SPUI, South shift	44,930	$8,087,400	4663	$2,797,800	175,150	$3,503,000	148,620	$2,972,400	20%	$1,854,640	0.1	$36,930	$19,300,000
Minn-Var	Relocated park entrance/Rose St extension/Lotta St closure	7,410	$1,333,800	0	$0	0	$0	35,510	$710,200	20%	$142,040	0.0	$0	$2,200,000
Minn-C1	5-Lane undivided with driveway closures	0	$0	0	$0	0	$0	4,700	$94,000	20%	$18,800	1.3	$877,770	$1,000,000
Minn-C2	Unbalanced lanes, 41st St & 49th St	0	$0	0	$0	0	$0	44,600	$892,000	20%	$178,400	1.8	$1,150,905	$2,300,000
Minn-C3	Left turns off Minn Ave / No left turns onto Minn Ave (3/4 access), 41st to 49th	0	$0	0	$0	0	$0	15,770	$315,400	20%	$63,080	1.3	$877,770	$1,300,000
Minn-C4	49th St RIRO	0	$0	0	$0	0	$0	22,750	$455,000	20%	$91,000	1.5	$969,420	$1,600,000

Table 5. Preliminary Concepts Composite Comparative Assessment

Preliminary Concept		Traffic Assessment			Environmental Impact	Cost	ROW (acre)
		Queues	Delay	Travel Time			
Minn-1	NE Ramp Realignment, SW Ramp Terminal Improvements (Option 1A)	Very Good	Very Good	Good	Medium/ potential 4(f)	$2,400,000	3.2
Minn-2	NE Loop, NE & NW Ramp Realign, SW Ramp Term Improve (Option 2A)	Very Good	Good	Good	Medium/ potential 4(f)	$5,100,000	3.4
Minn-2A	NE Loop, Aligned with 49th Street	Good	Neutral	Neutral	Medium/ potential 4(f)	$3,900,000	3.2
Minn-3	Parclo, NE, NW & SW Ramp Realignment (Option 2B)	Very Good	Good	Neutral	High/ likely 4(f)/6(f)	$8,100,000	3.4
Minn-4	Parclo, NE loop align wi 49th St, Elim NW quad ramp (Option 2B Variation)	Good	Neutral	Neutral	High/ likely 4(f)/6(f)	$6,900,000	3.2
Minn-5	DDI (Option 3A)	Very Good	Very Good	Neutral	Low	$8,300,000	0.1
Minn-6	DDI, South shift (Option 3B)	Very Good	Very Good	Neutral	High/ likely 4(f)/6(f)	$10,000,000	0.1
Minn-7	DDI, NE Ramp split with 49th St connection (Option 3D)	Very Good	Very Good	Good	High/ likely 4(f)/6(f)	$11,700,000	3.1
Minn-8	SPUI, 49th St RIRO (Option 4A)	Very Good	Very Good	Poor	High/ likely 4(f)/6(f)	$11,800,000	0.1
Minn-9	SPUI, NE Ramp split with 49th St connection, 49th St RIRO (Option 4B)	Very Good	Very Good	Neutral	High/ likely 4(f)/6(f)	$13,900,000	3.2
Minn-10	SPUI, South shift	Very Good	Good	Poor	High/ likely 4(f)/6(f)	$23,100,000	0.1
Minn-11	SPUI, South shift	Very Good	Good	Poor	High/ likely 4(f)/6(f)	$21,400,000	0
Minn-12	SPUI, South shift	Very Good	Good	Poor	High/ likely 4(f)/6(f)	$19,300,000	0.1
Minn-C1	5-Lane undivided with driveway closures	Poor	Poor	Neutral	Low	$1,000,000	1.3
Minn-C2	Unbalanced lanes, 41st St & 49th St	Poor	Poor	Neutral	Medium/ potential 4(f)	$2,300,000	1.8
Minn-C3	Left turns off Minn Ave / No left turns onto Minn Ave (3/4 access), 41st to 49th	Neutral	Good	Poor	Low	$1,300,000	1.3
Minn-C4	49th St RIRO	Very Good	Very Good	Good	Low	$1,600,000	1.5

Preliminary Concept Screening Workshop Decision Matrix

The following tabulations record SAT decisions at the workshop on July 9, 2015. The purpose of the workshop was to screen preliminary concepts and formulate Build alternatives for the next phase of study. Action items and comments are noted for each of the concepts. *TABLE 6* illustrates the completed preliminary concepts phase of the I-229 Major Investment Study.

Type of Interchange:

- SPUI = Single Point
- TD = Tight Diamond
- DDI = Diverging Diamond
- Par = Parclo
- TSD = Tight Split Diamond
- CFI = Continuous Flow Intersection

Screening Workshop Decision:

- **CARRY AHEAD** = Conceptual profile development, noise analysis, HCS traffic analysis, updated costs/impacts, constructability review
- **ELIMINATE** = No further development
- **DEFER** = No further development in this study. Will be further considered in NEPA phase for specific project

Table 6. Preliminary Concept Screening Workshop Decision Matrix- Minnesota Corridor

Concept ID	Type / Details Description	Workshop Decision	Action Items	Comments
Minnesota Avenue Interchange				
Minn-1	NE Ramp Realignment, SW Ramp Terminal Improvements (Option 1A)	Eliminate		- Concern for creating similar poor driver expectation conditions as the adjacent Cliff Avenue interchange with closely spaced, successive left turn movements to the southbound on-ramp and 49th Street. - Same property and environmental impacts as Minn-2 with less traffic carrying capacity. - With the shift of the southbound off ramp to align with 49th, the traffic signal is also eliminated at the southbound on-ramp causing traffic operations concerns for what would be an unprotected left from NB Minnesota to the SB on-ramp.
Minn-2	NE Loop, NE & NW Ramp Realign, SW Ramp Term Improve (Option 2A)	Carry Ahead	- Examine the loop entrance ramp configuration to begin the auxiliary lane at loop and merge SB diagonal on-ramp into the auxiliary lane. - 3/4 access at park entrance. Extend median only as far as needed to prevent lefts out. - Evaluate the need for dual SB Minnesota to NB on-ramp left turns. With new bridges, the opening can be modified and left turn lane storage improved for this movement.	- Replace SB I-229 bridge instead of widening because of bridge age. - Modify SB loop ramp to look like Cliff-2 to perpetuate the trail on the E side of Cliff eliminating the conflicting free movement with Pedestrians introducing and maintain pedestrians crossing with a signal. - NB bridge replacement probably needed to enable loop ramp to work. May need deeper superstructure for longer spans over widened Minnesota Ave. Need to evaluate whether segment of I-229 ML profile modification is needed. - City OK with no left turn access out of park entrance but need left turn access in. -Note that while the exhibit shows a new I-229 southbound bridge, cost included only widening.
Minn-2A	NE Loop, Aligned with 49th Street	Eliminate		-The DTA modeling indicates expected poor performance of the loop configuration aligned with the 49th intersection and a high level review of turning movements also indicates a congested intersection with operation concerns.

Table 6. Preliminary Concept Screening Workshop Decision Matrix- Minnesota Corridor (continued)

Concept ID	Type / Details Description	Workshop Decision	Action Items	Comments
Minn-3	Parclo, NE, NW & SW Ramp Realignment	Eliminate		- Minn-3 has greater environmental impacts, 4(f)/6(f) impacts, higher cost, concern for floodplain issues associated with a new river crossing and unfavorable park access modifications; while at the same time Minn-2 could be modified to address potential traffic capacity concerns addressed by loop in the SW quadrant for less cost and less environmental impacts. No room to widen the mainline footprint at the pinch point where the river is immediately adjacent to the alignment near the merge point of the NB on-ramp.
Minn-4	Parclo, NE loop align with 49th St, Elim NW quad ramp	Eliminate		- Combination of reasons associated with Minn-2A and Minn-3
Minn-5	DDI	Carry Ahead	- Modify to get 100' access control from ramps to park access. Seek to decrease cross-over spacing to achieve separation. Explore ability to slightly shift park access south within the ROW and provide 3/4 access. -Provide 3/4 access at the park.	- Minnesota Ave may not be ideal candidate for DDI, but through volumes on Minnesota Ave do not preclude. - 49th St RIRO is probably fatal flaw for City. May need to write full access need into P&N.
Minn-6	DDI, South shift	Eliminate		-Shifting the interchange south did not achieve enough separation from 49th Street to provide full traffic movements while at the same time necessitated relocating the park access with increased environmental impacts.
Minn-7	DDI, NE Ramp split with 49th St connection	Eliminate		- The increased impacts to the park associated with the park access relocation and potential floodplain/environmental impacts with the expanded footprint of the NB on-ramp, combined with the added ROW impacts in the NE quadrant makes this alternative less favorable than Minn-5. Even with the redistribution of traffic at 49th afforded by the direct ramp connection, there is caution the NB to WB lefts are too close to the cross-over intersection to be viable and those lefts likely would need to be eliminated upon further traffic analysis.
Minn-8	SPUI, 49th St RIRO	Carry Ahead	- Modify to get 3/4 access to existing park entrance. - Eliminate off-ramp right turn auxiliary lanes. This typically is a yield condition. See if this would preserve the property in the NE quadrant - Examine ability to achieve full access at 49th by either establishing parallel left turn lanes (as opposed to back to back) or by widening out (shifting west) the southbound lanes to create space for the NB to WB lefts at 49th.	- DOT does not typically add lane for SPUI free right from exit ramp - The successive exit strategy of Minn-9 could be brought back in should the above stated refinements prove unsuccessful to establish full access at 49th.
Minn-9	SPUI, NE Ramp split with 49th St connection, 49th St RIRO	Eliminate		- Additional impacts to property in the NE quadrant than Minn-8 with refinements.
Minn-10	SPUI, South shift, cross-under ramps	Eliminate	- Add trail 6(f) impacts to Prelim Concepts Memo	- Additional impacts to the park and floodplain in combination with undesirable ramp geometry and expensive mainline reconstruction with multiple bridges.
Minn-11	SPUI, South shift, cross-under ramps with consolidated I-229 bridges	Eliminate	- Add trail 6(f) impacts to Prelim Concepts Memo	- Park impacts combined with the very long, expensive bridges
Minn-12	SPUI, South shift, cross-over ramps	Eliminate	- Add trail 6(f) impacts to Prelim Concepts Memo	- This configuration is typical of offset single point design where the ramps go over mainline. However in this particular configuration with the cross-road under, the grades are not conducive to this configuration and the layout has the greatest impacts to the park and floodplain of all alternatives. The trail along the river is also impacted.

Table 6. Preliminary Concept Screening Workshop Decision Matrix- Minnesota Corridor (continued)

Concept ID	Type / Details Description	Workshop Decision	Action Items	Comments
Minnesota Avenue Corridor				
Minn-C1	5-Lane undivided with driveway closures	Carry Ahead		
Minn-C2	Unbalanced lanes, 41st St & 49th St	Eliminate		
Minn-C3	Left turns off Minn Ave / No left turns onto Minn Ave (3/4 access), 41st to 49th	Carry Ahead		- 3/4 access at 43rd and full access at 49th. - No median needed S of interchange. - Leave in NB right turn lane at Lotta because of crash experience & City right turn lane policy.
Minn-C4	49th St Right-in / Right-out (RIRO)	Carry Ahead		- Only to be used with Minn-5

Minnesota Corridor Build Scenarios

Six build scenarios have been defined for the Minnesota corridor, which include a combination of interchange concepts and corridor concepts:

- Minn-2 + Minn-C1
- Minn-2 + Minn-C3/ 4
- Minn-5 + Minn-C1
- Minn-5 + Minn-C3/ 4
- Minn-8 + Minn-C1
- Minn-8 + Minn-C3/ 4

Attachment A – Preliminary Concept Figures

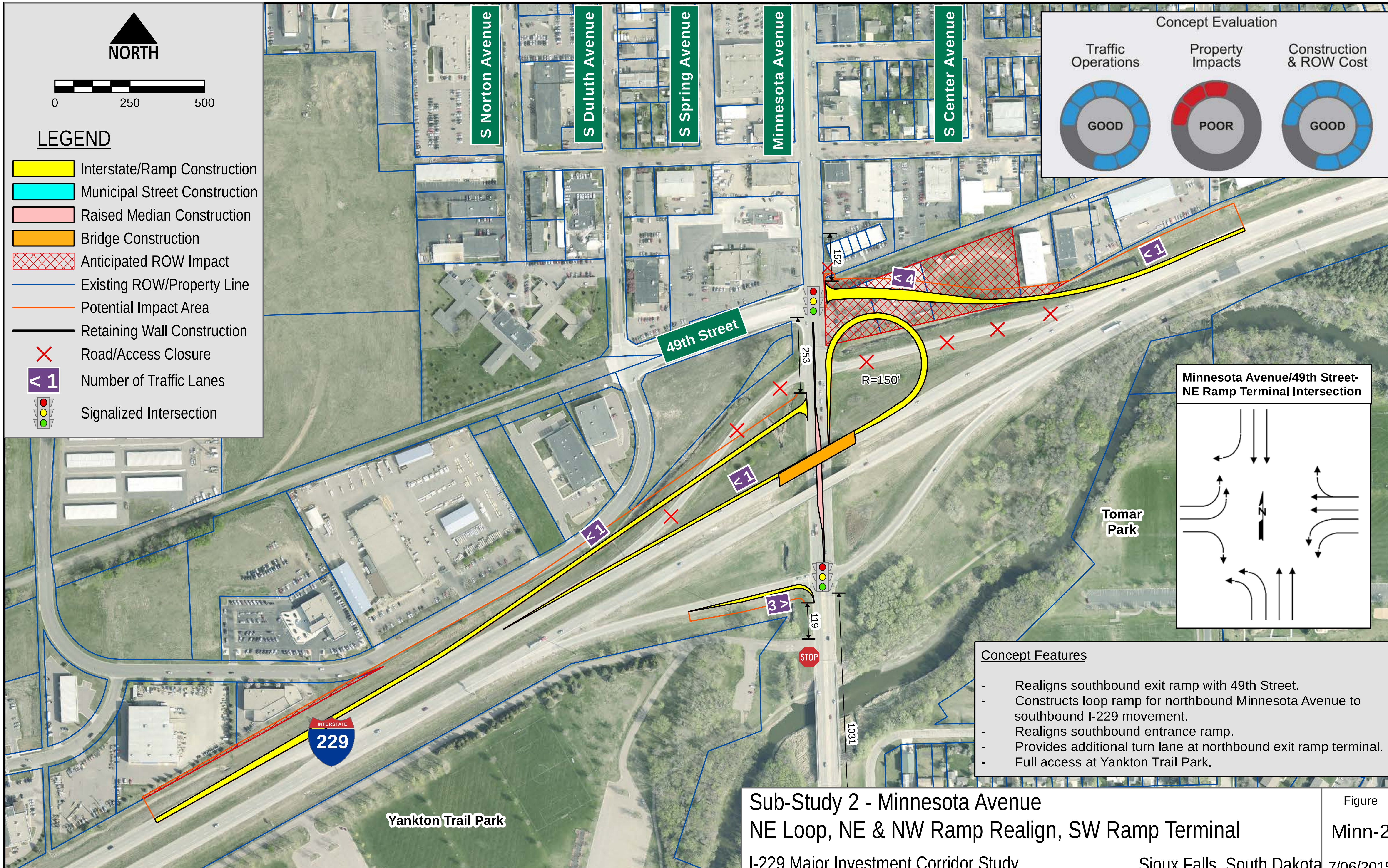
Sub-Study 2 - Minnesota Avenue
NE Ramp Realignment, SW Ramp Terminal

I-229 Major Investment Corridor Study

Sioux Falls, South Dakota

Figure Minn-1

7/06/2015



Concept Features

- Realigns southbound exit ramp with 49th Street.
- Constructs loop ramp for northbound Minnesota Avenue to southbound I-229 movement.
- Realigns southbound entrance ramp.
- Provides additional turn lane at northbound exit ramp terminal.
- Full access at Yankton Trail Park.

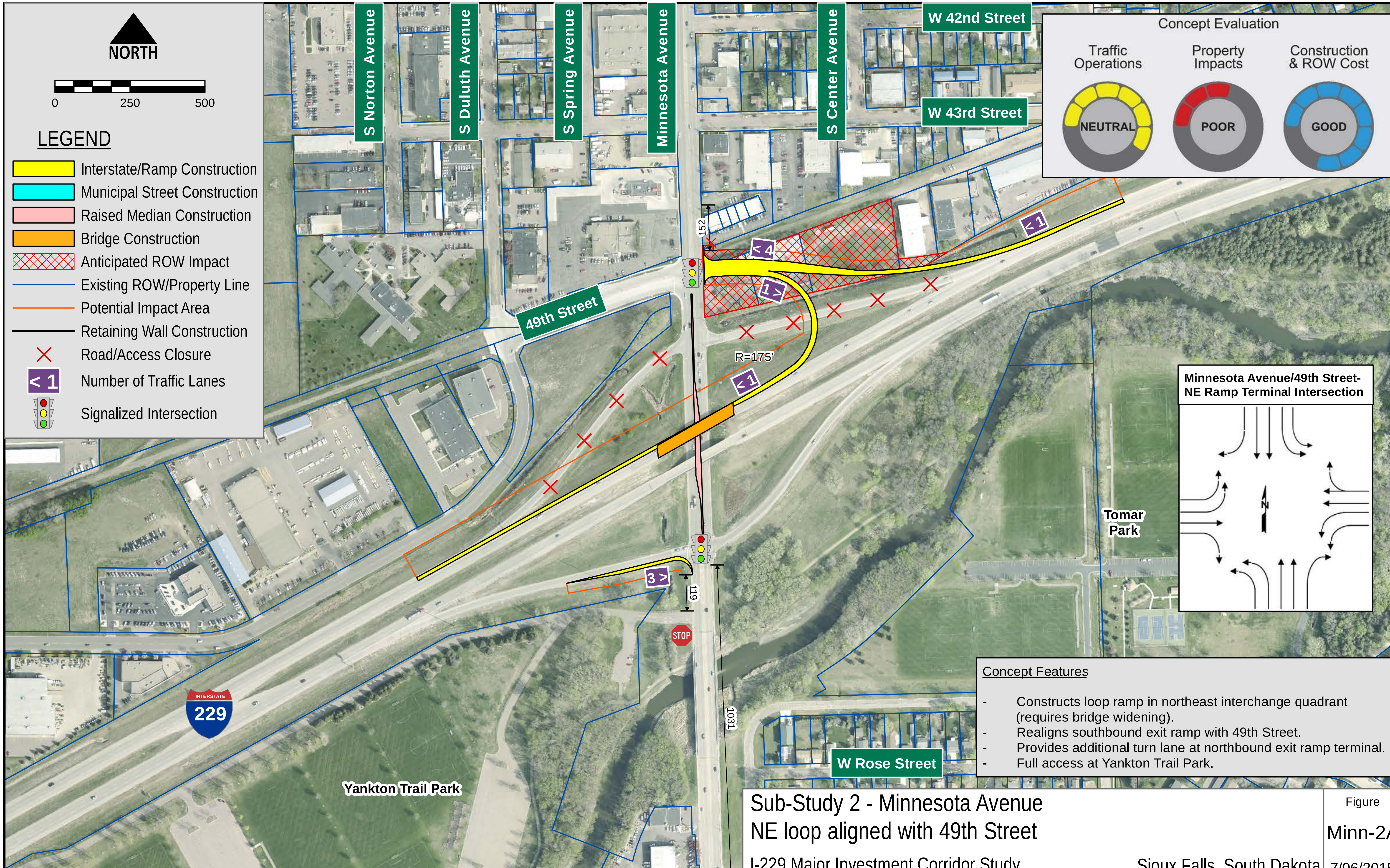
Sub-Study 2 - Minnesota Avenue
NE Loop, NE & NW Ramp Realign, SW Ramp Terminal

I-229 Major Investment Corridor Study

Sioux Falls, South Dakota

Figure Minn-2

7/06/2015



Concept Features

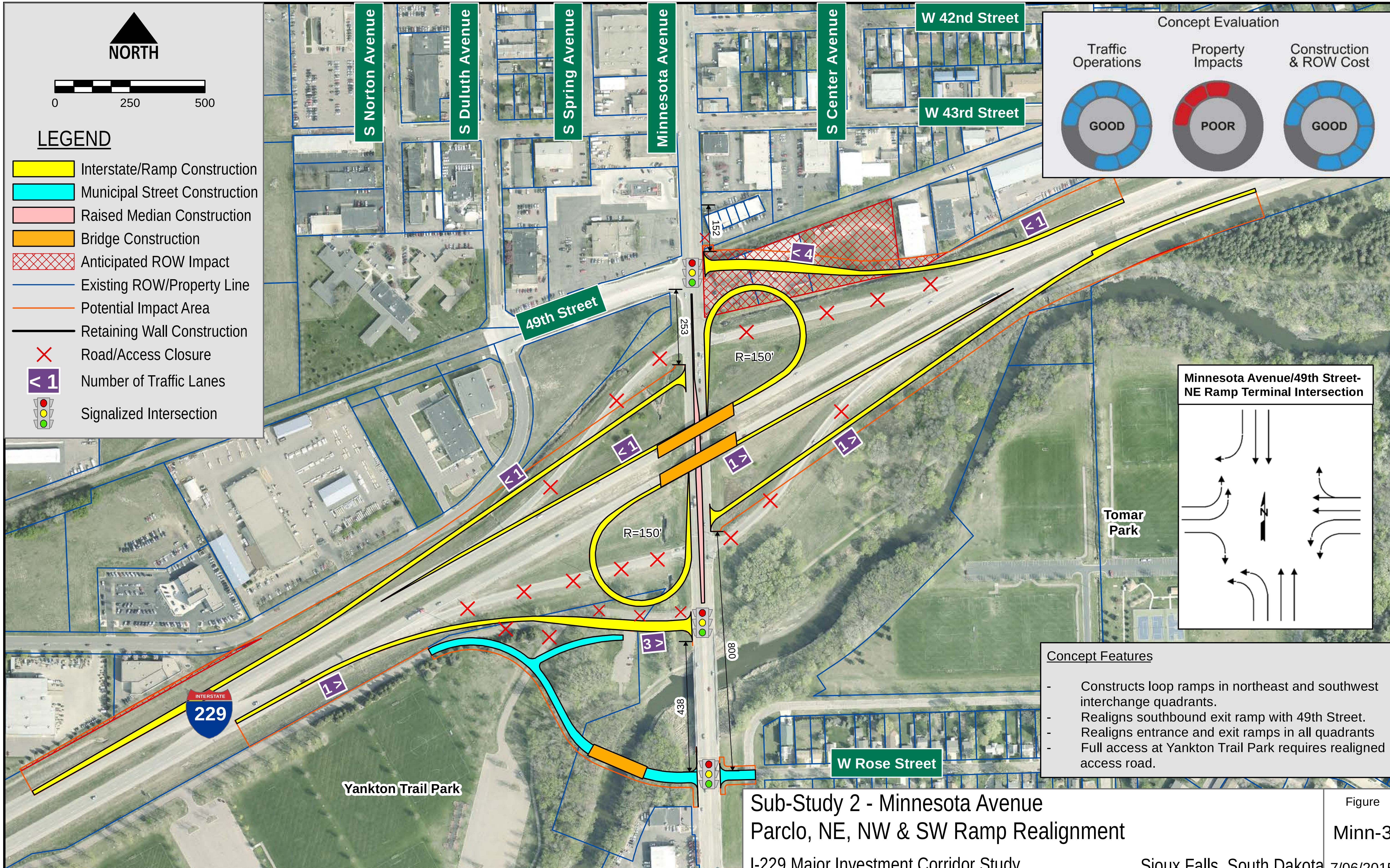
- Constructs loop ramp in northeast interchange quadrant (requires bridge widening).
- Realigns southbound exit ramp with 49th Street.
- Provides additional turn lane at northbound exit ramp terminal.
- Full access at Yankton Trail Park.

Sub-Study 2 - Minnesota Avenue
NE loop aligned with 49th Street

I-229 Major Investment Corridor Study

Sioux Falls, South Dakota

Figure
Minn-2A
7/06/2015



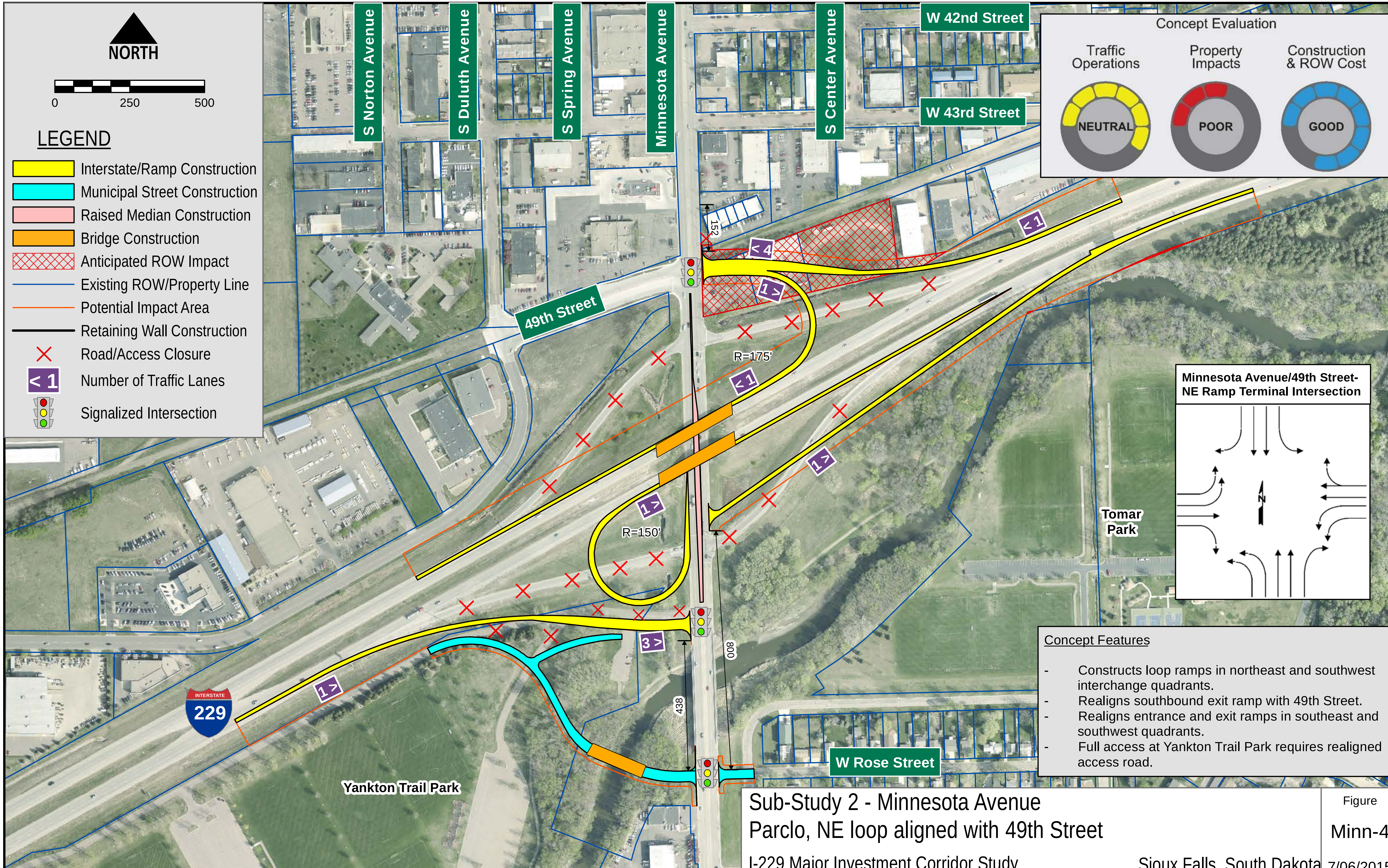
Sub-Study 2 - Minnesota Avenue
Parclo, NE, NW & SW Ramp Realignment

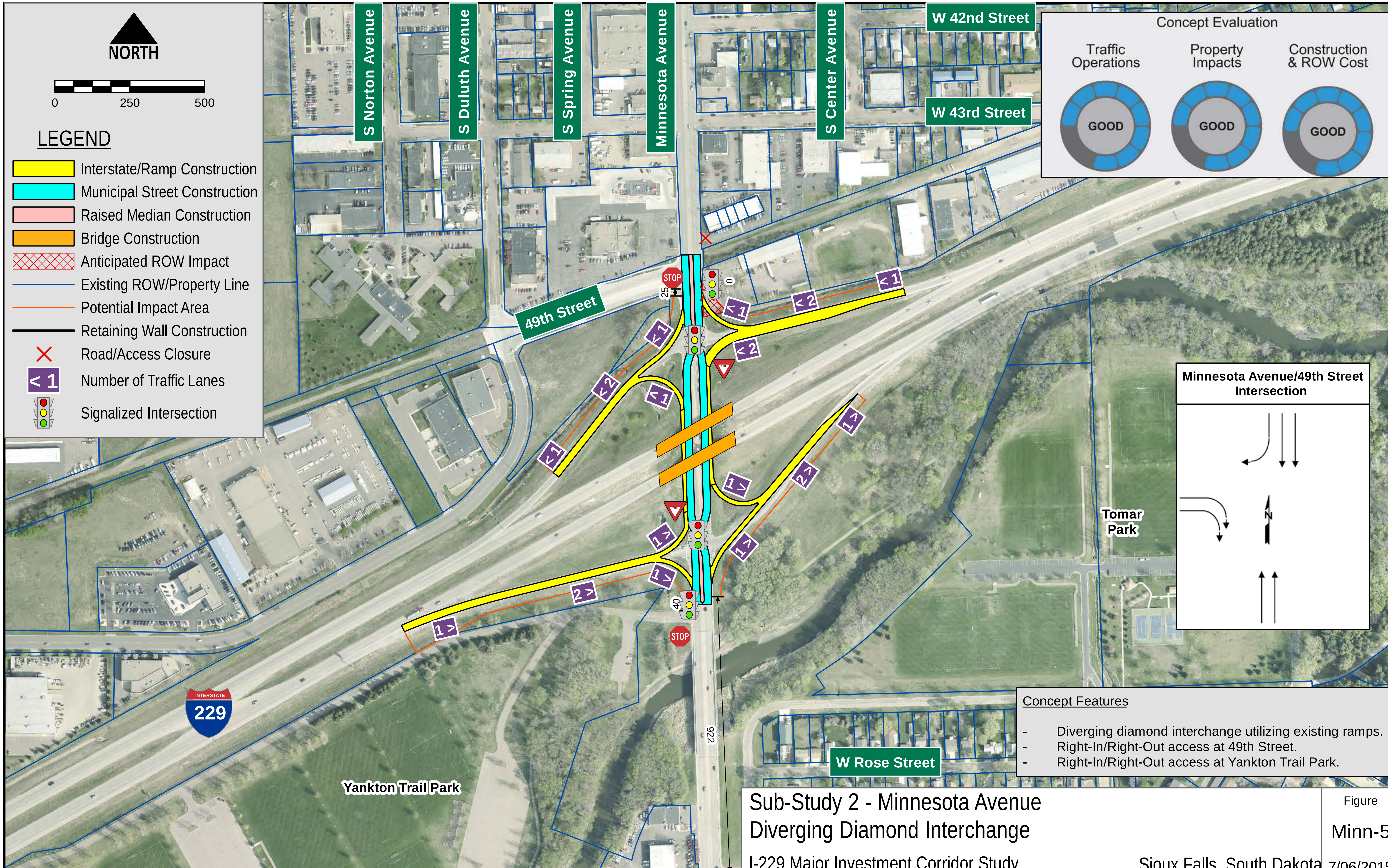
I-229 Major Investment Corridor Study

Sioux Falls, South Dakota

Figure Minn-3

7/06/2015


NORTH
0
250
500
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Bridge Construction
Anticipated ROW Impact
Existing ROW/Property Line
Potential Impact Area
Retaining Wall Construction
Road/Access Closure
< 1
Number of Traffic Lanes
Signalized Intersection
S Norton Avenue
S Duluth Avenue
S Spring Avenue
Minnesota Avenue
S Center Avenue
W 42nd Street
W 43rd Street
49th Street
W Rose Street
Concept Evaluation
Traffic Operations
NEUTRAL
Property Impacts
POOR
Construction & ROW Cost
GOOD
152
< 4
1 >
< 1
R=175'
R=150'
3 >
438
800
INTERSTATE
229
Tomar Park
Yankton Trail Park
Minnesota Avenue/49th Street-NE Ramp Terminal Intersection
Concept Features
- Constructs loop ramps in northeast and southwest interchange quadrants.
- Realigns southbound exit ramp with 49th Street.
- Realigns entrance and exit ramps in southeast and southwest quadrants.
- Full access at Yankton Trail Park requires realigned access road.
Sub-Study 2 - Minnesota Avenue
Parclo, NE loop aligned with 49th Street
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Minn-4
7/06/2015



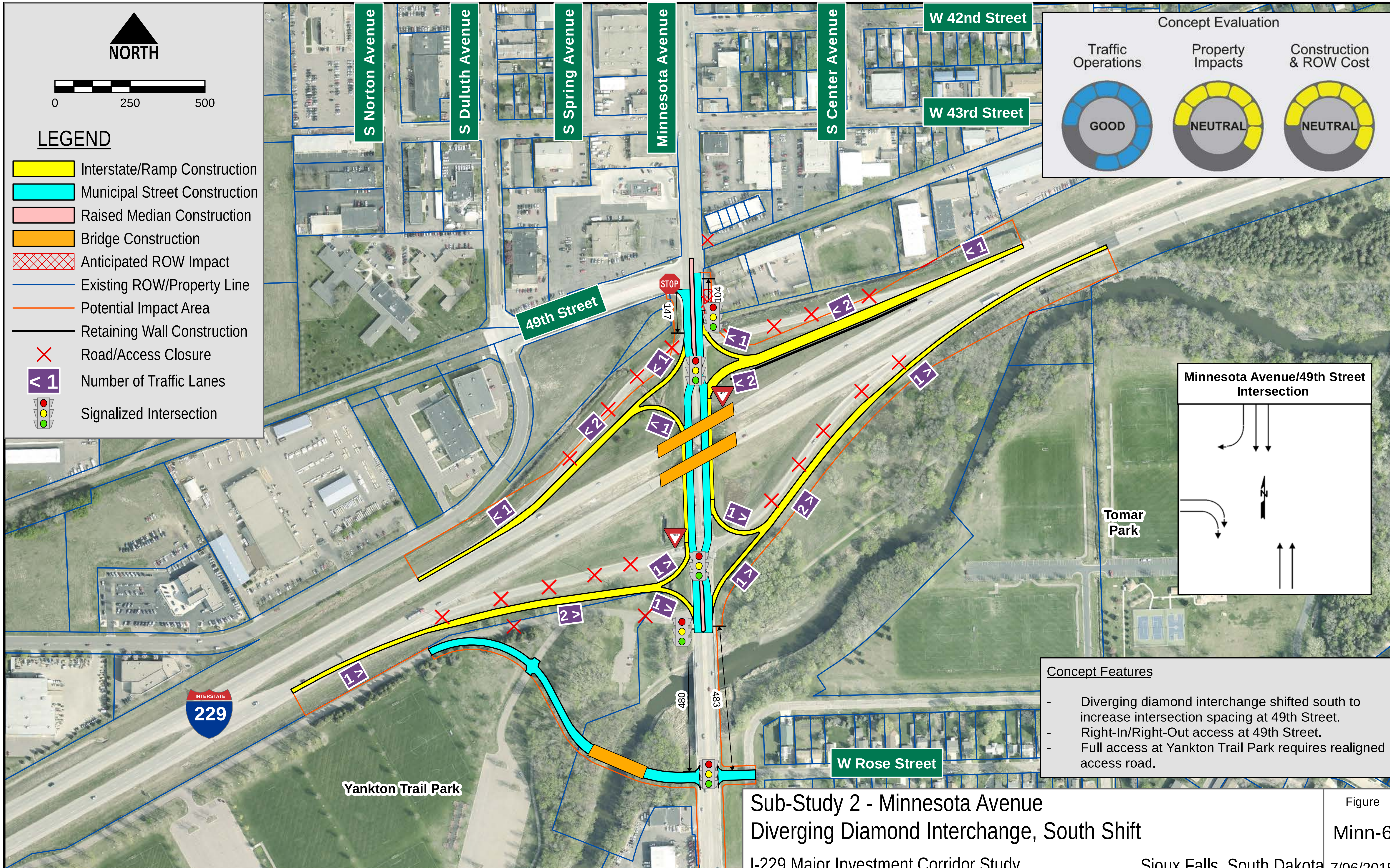
Sub-Study 2 - Minnesota Avenue Diverging Diamond Interchange

I-229 Major Investment Corridor Study

Sioux Falls, South Dakota

Figure Minn-5

7/06/2015



Concept Features

- Diverging diamond interchange shifted south to increase intersection spacing at 49th Street.
- Right-In/Right-Out access at 49th Street.
- Full access at Yankton Trail Park requires realigned access road.

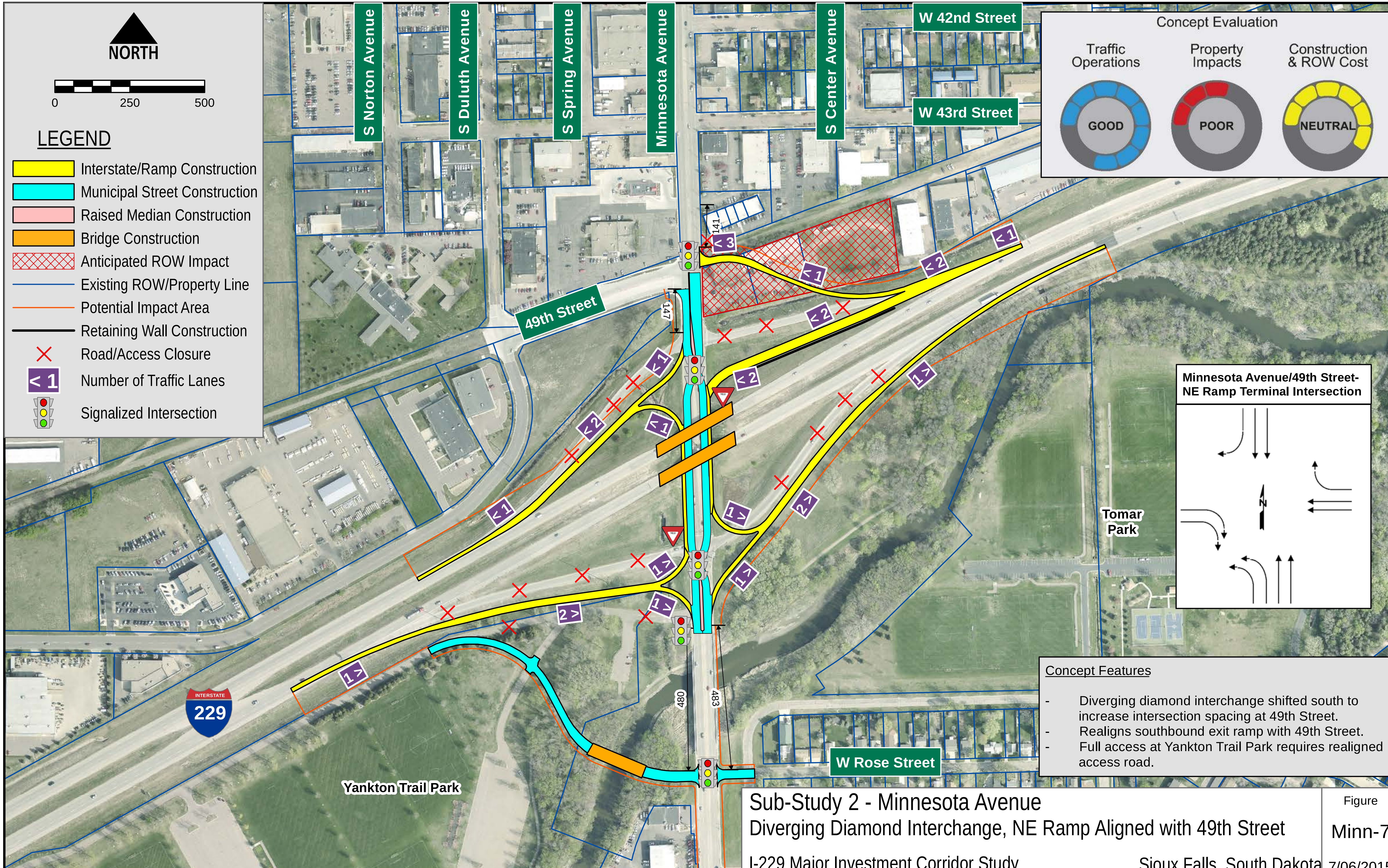
Sub-Study 2 - Minnesota Avenue
Diverging Diamond Interchange, South Shift

I-229 Major Investment Corridor Study

Sioux Falls, South Dakota

Figure
Minn-6

7/06/2015



Sub-Study 2 - Minnesota Avenue

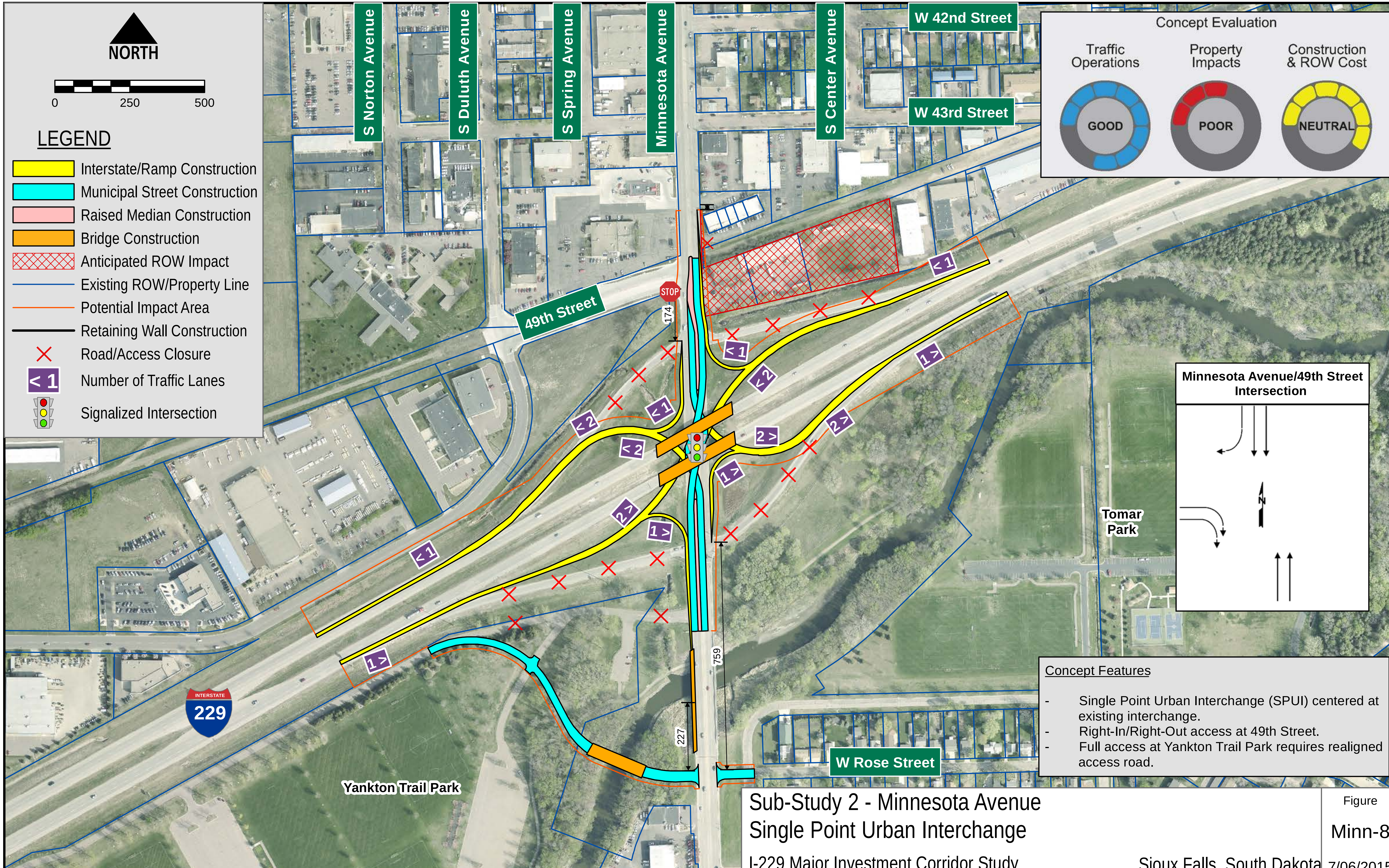
Diverging Diamond Interchange, NE Ramp Aligned with 49th Street

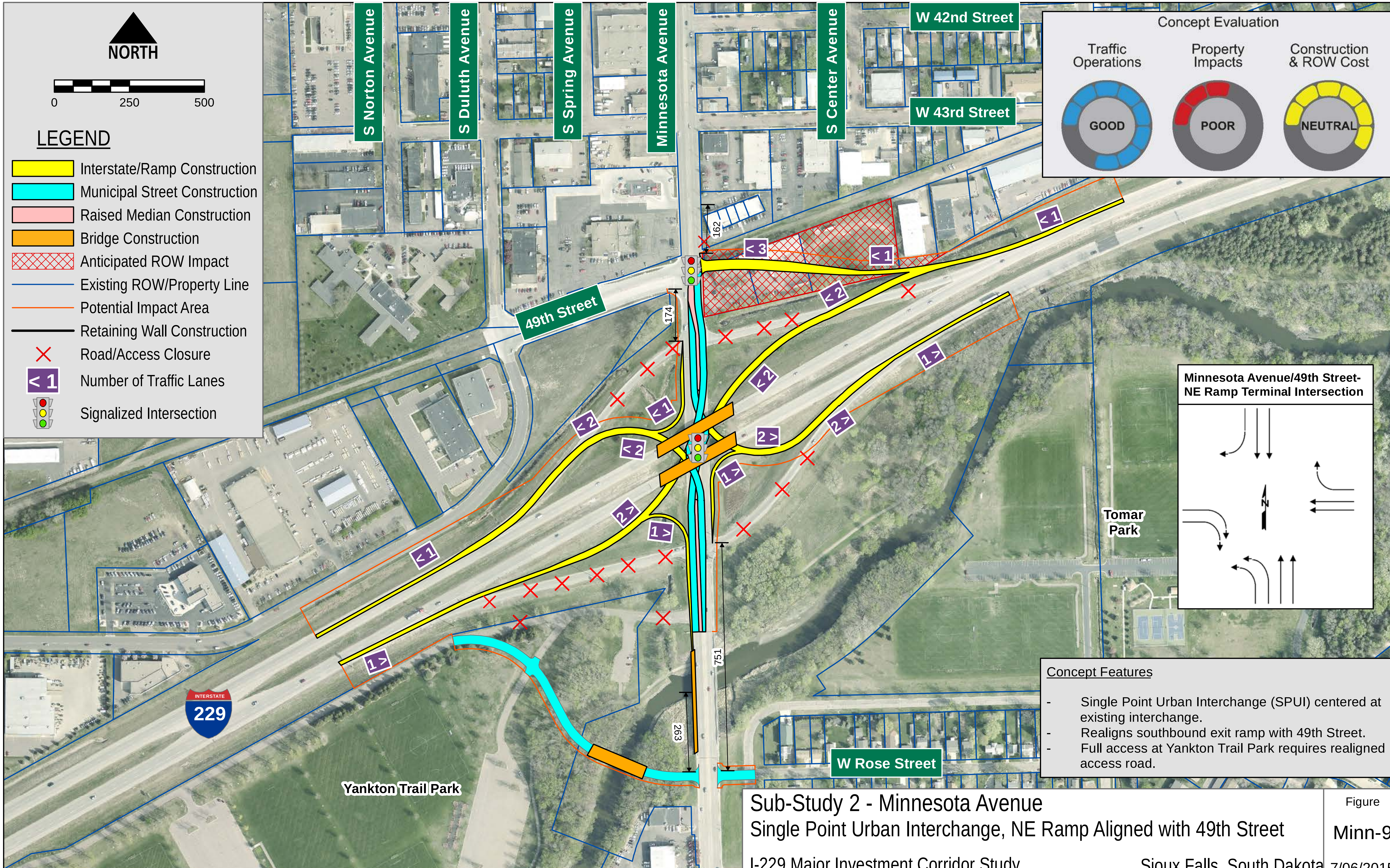
I-229 Major Investment Corridor Study

Sioux Falls, South Dakota

Figure Minn-7

7/06/2015


NORTH
0
250
500
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Bridge Construction
Anticipated ROW Impact
Existing ROW/Property Line
Potential Impact Area
Retaining Wall Construction
Road/Access Closure
Number of Traffic Lanes
Signalized Intersection
S Norton Avenue
S Duluth Avenue
S Spring Avenue
Minnesota Avenue
S Center Avenue
W 42nd Street
W 43rd Street
49th Street
W Rose Street
Tomar Park
Yankton Trail Park
229
174
759
227
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
GOOD
POOR
NEUTRAL
Minnesota Avenue/49th Street Intersection
Concept Features
- Single Point Urban Interchange (SPUI) centered at existing interchange.
- Right-In/Right-Out access at 49th Street.
- Full access at Yankton Trail Park requires realigned access road.
Sub-Study 2 - Minnesota Avenue
Single Point Urban Interchange
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Minn-8
7/06/2015



Sub-Study 2 - Minnesota Avenue

Single Point Urban Interchange, NE Ramp Aligned with 49th Street

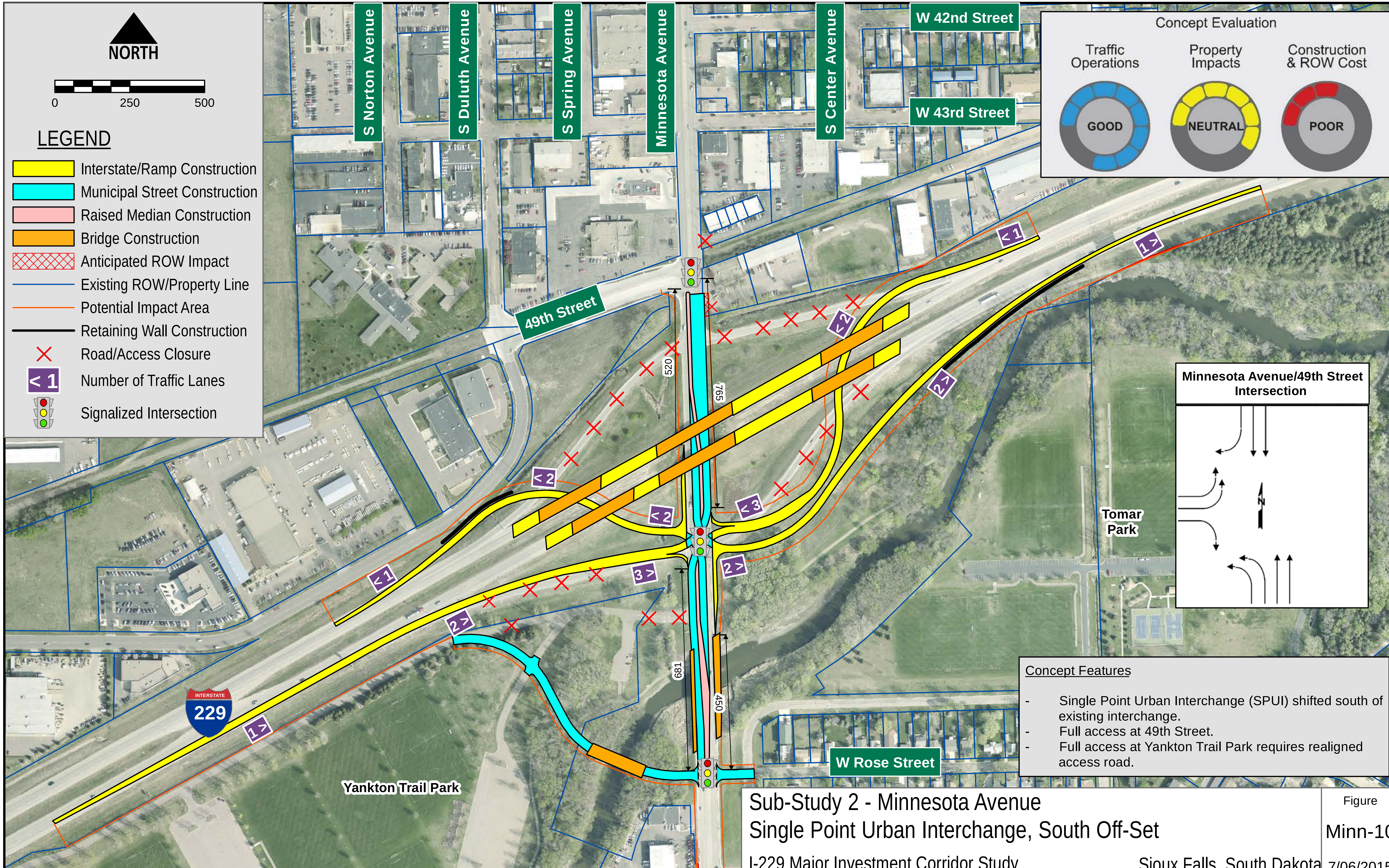
I-229 Major Investment Corridor Study

Sioux Falls, South Dakota

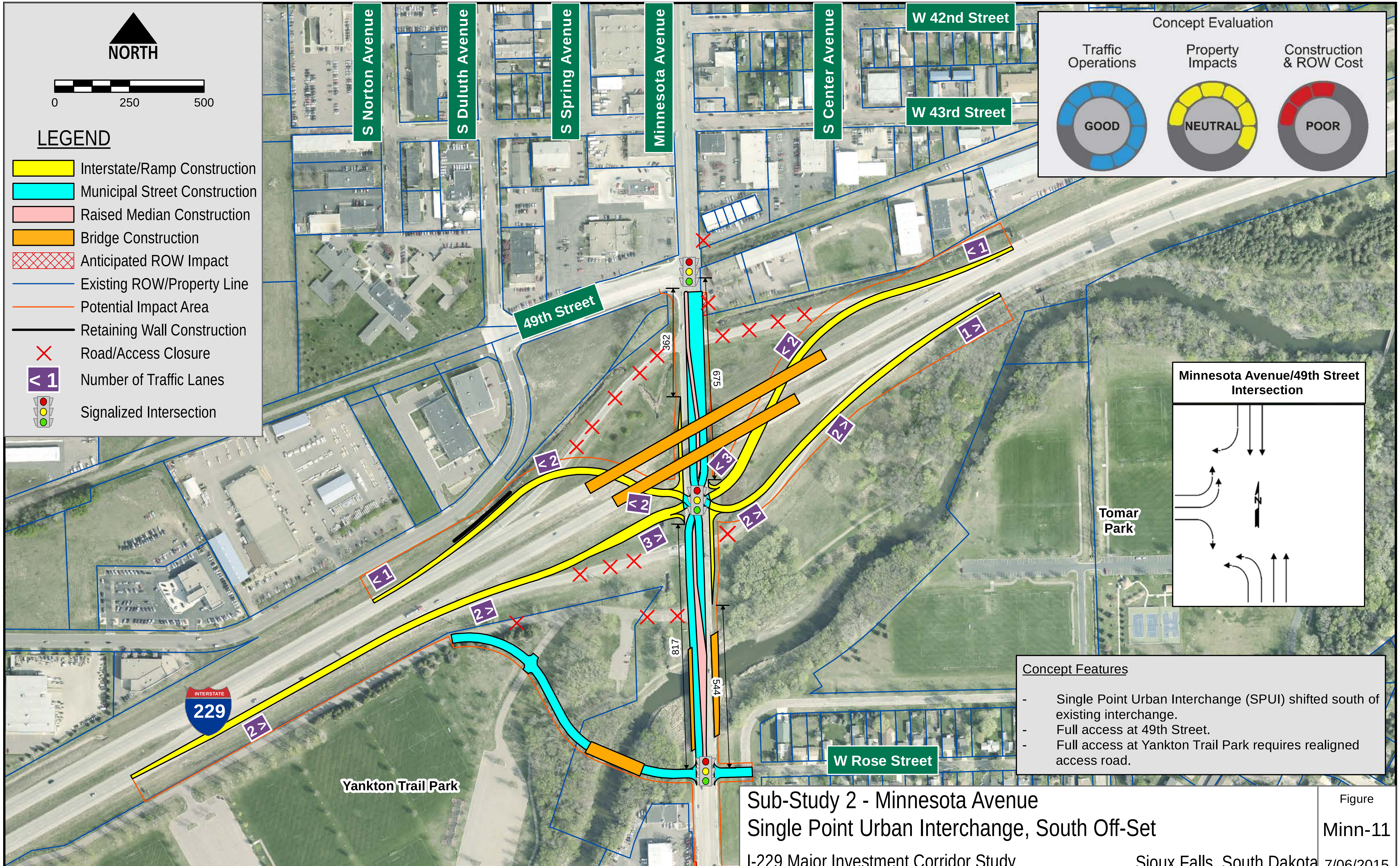
Figure

Minn-9

7/06/2015



NORTH
0
250
500
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Bridge Construction
Anticipated ROW Impact
Existing ROW/Property Line
Potential Impact Area
Retaining Wall Construction
Road/Access Closure
Number of Traffic Lanes
Signalized Intersection
S Norton Avenue
S Duluth Avenue
S Spring Avenue
Minnesota Avenue
S Center Avenue
W 42nd Street
W 43rd Street
49th Street
W Rose Street
Tomar Park
Yankton Trail Park
229
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
GOOD
NEUTRAL
POOR
Minnesota Avenue/49th Street Intersection
520
765
681
450
Concept Features
- Single Point Urban Interchange (SPUI) shifted south of existing interchange.
- Full access at 49th Street.
- Full access at Yankton Trail Park requires realigned access road.
Sub-Study 2 - Minnesota Avenue
Single Point Urban Interchange, South Off-Set
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Minn-10
7/06/2015



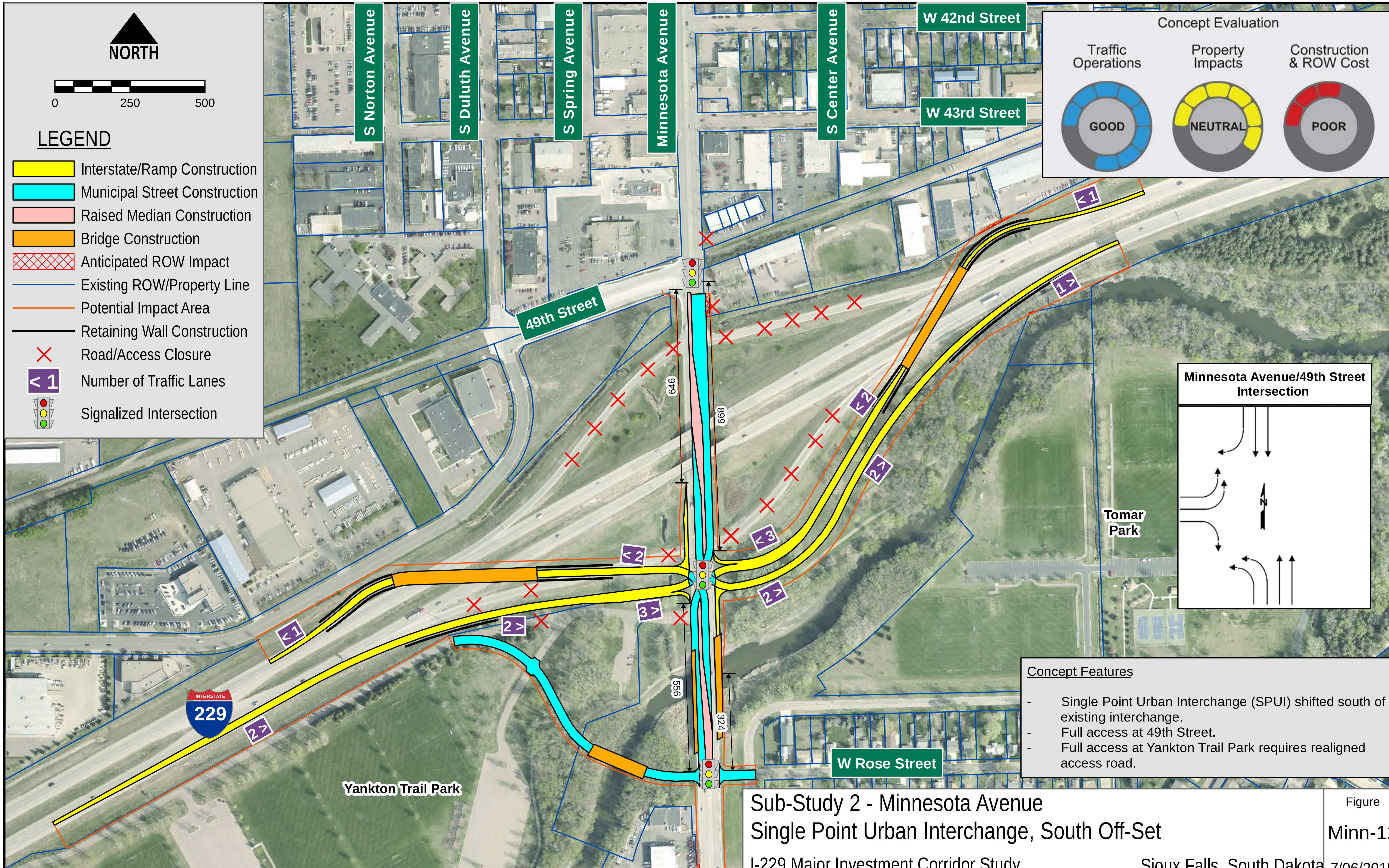
Sub-Study 2 - Minnesota Avenue
Single Point Urban Interchange, South Off-Set

I-229 Major Investment Corridor Study

Sioux Falls, South Dakota

Figure Minn-11

7/06/2015



Concept Features

- Single Point Urban Interchange (SPUI) shifted south of existing interchange.
- Full access at 49th Street.
- Full access at Yankton Trail Park requires realigned access road.

Sub-Study 2 - Minnesota Avenue
Single Point Urban Interchange, South Off-Set

I-229 Major Investment Corridor Study

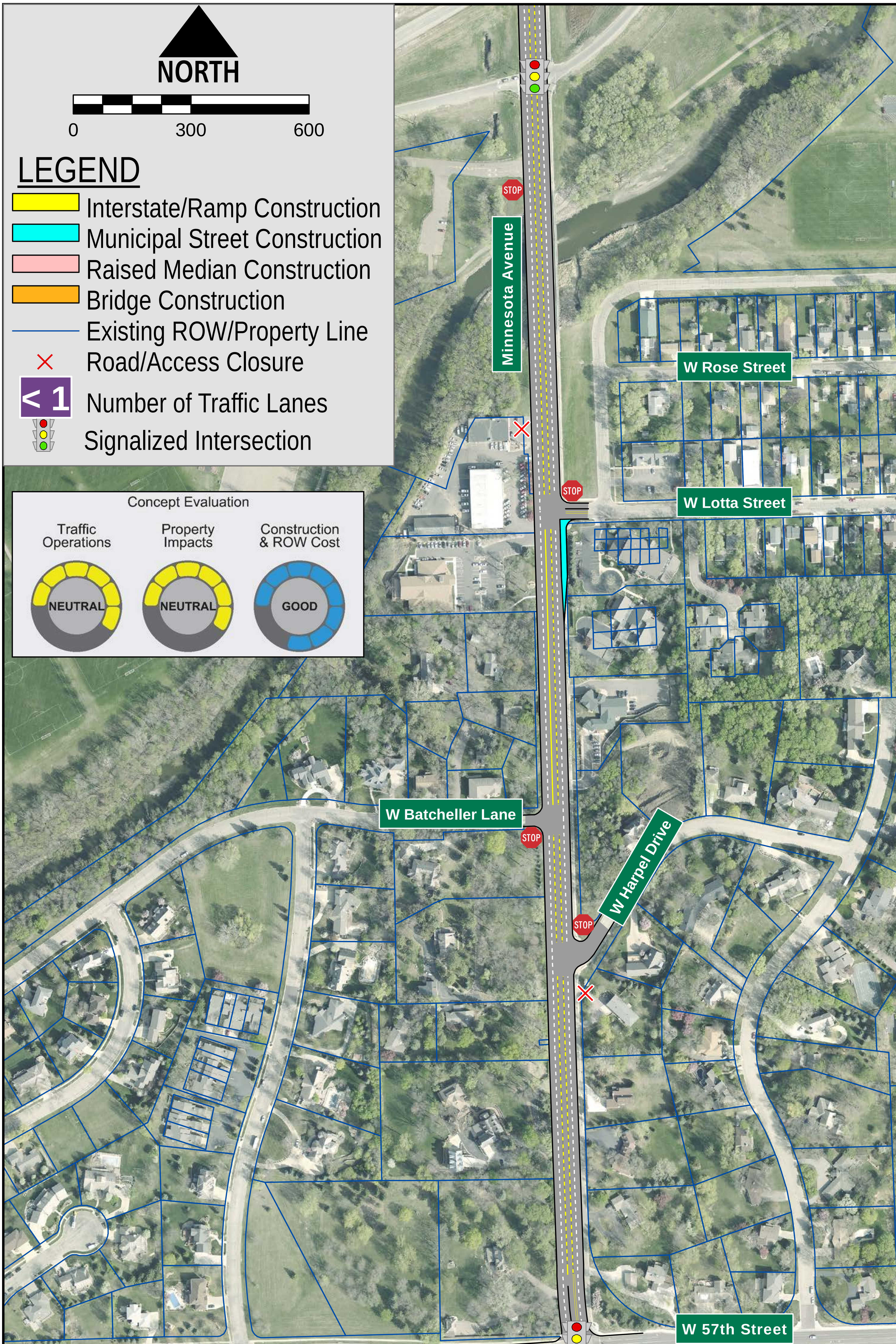
Sioux Falls, South Dakota

Figure
Minn-12

7/06/2015

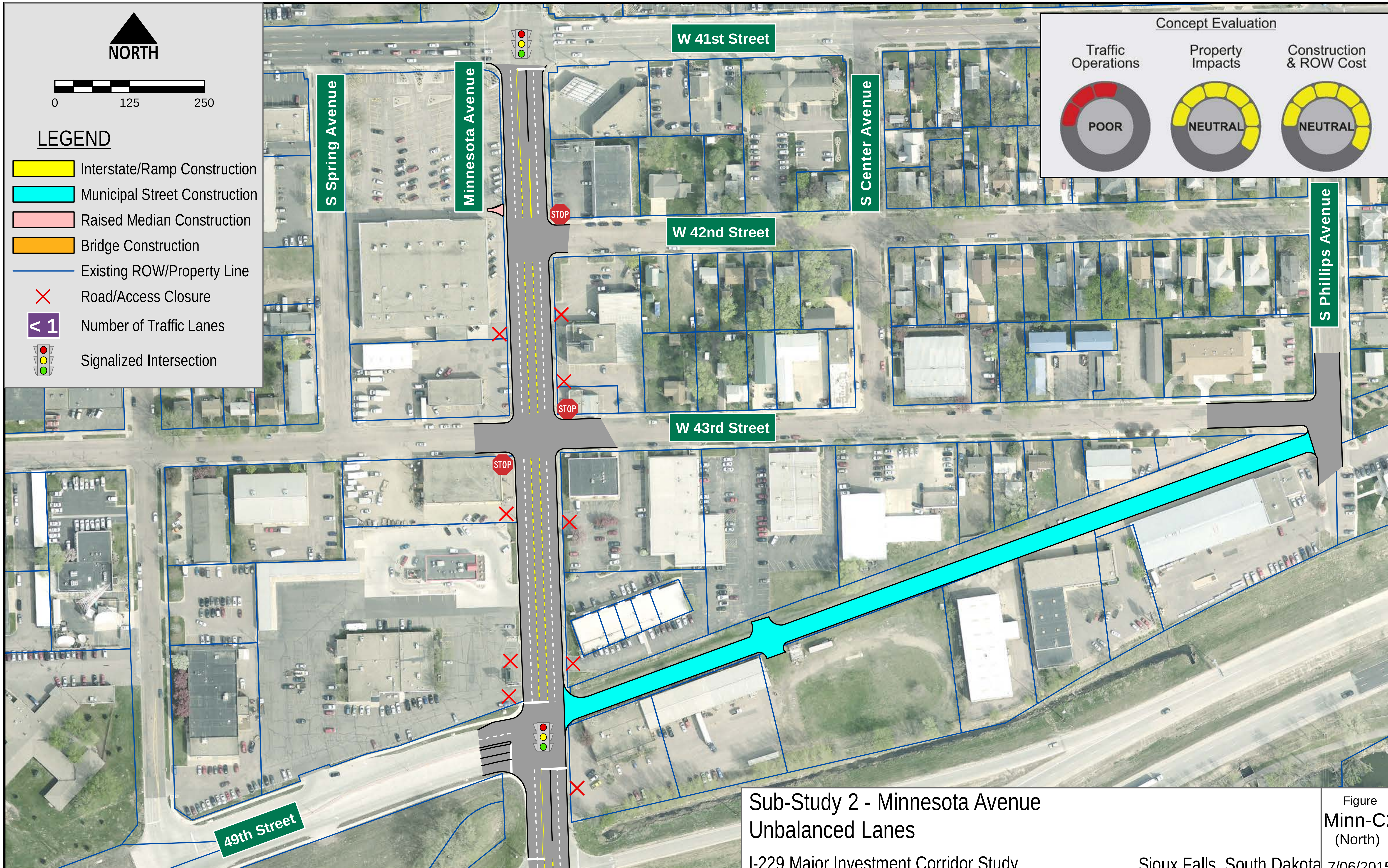
Sub-Study 2 - Minnesota Avenue
5-Lane Undivided
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota

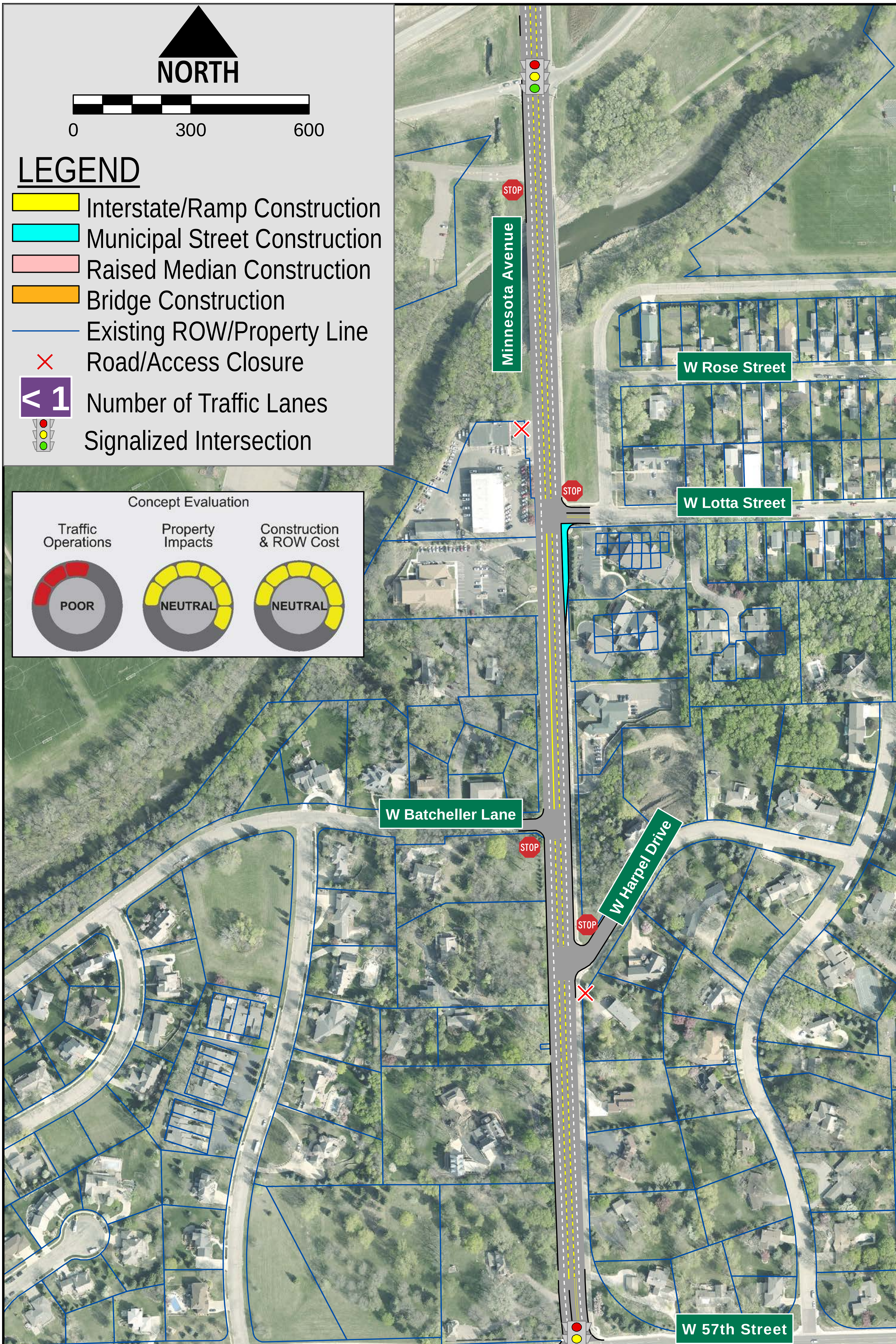
Figure
Minn-C1
(North)
7/06/2015



Sub-Study 2 - Minnesota Avenue
5-Lane Undivided
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota

Figure
Minn-C1
(South)
7/06/2015

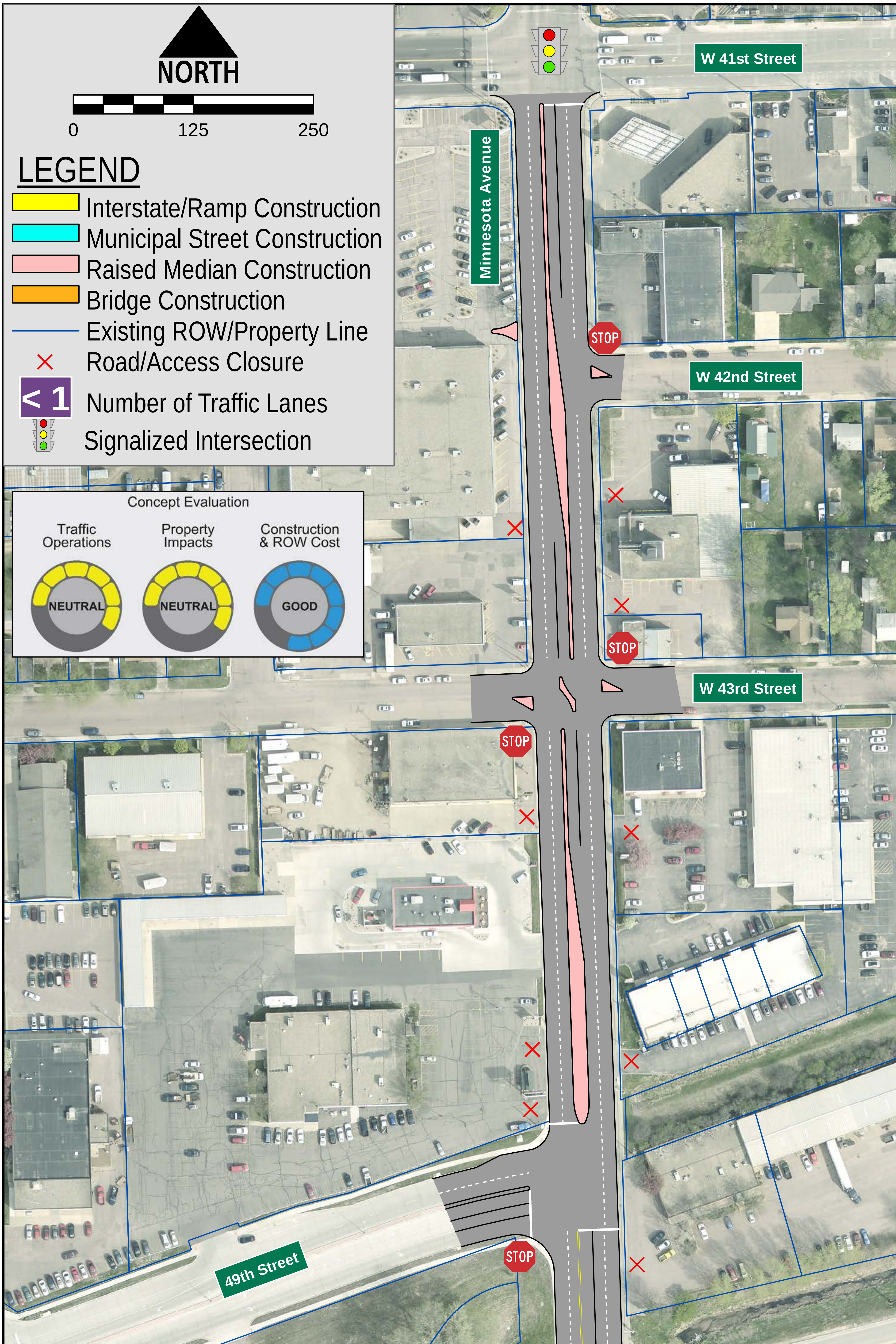

NORTH
0
125
250
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Bridge Construction
Existing ROW/Property Line
Road/Access Closure
< 1
Number of Traffic Lanes
Signalized Intersection
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
POOR
NEUTRAL
NEUTRAL
W 41st Street
W 42nd Street
W 43rd Street
49th Street
S Spring Avenue
Minnesota Avenue
S Center Avenue
S Phillips Avenue
STOP
STOP
STOP
Sub-Study 2 - Minnesota Avenue
Unbalanced Lanes
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Minn-C2
(North)
7/06/2015



Sub-Study 2 - Minnesota Avenue
Unbalanced Lanes
I-229 Major Investment Corridor Study

Sioux Falls, South Dakota

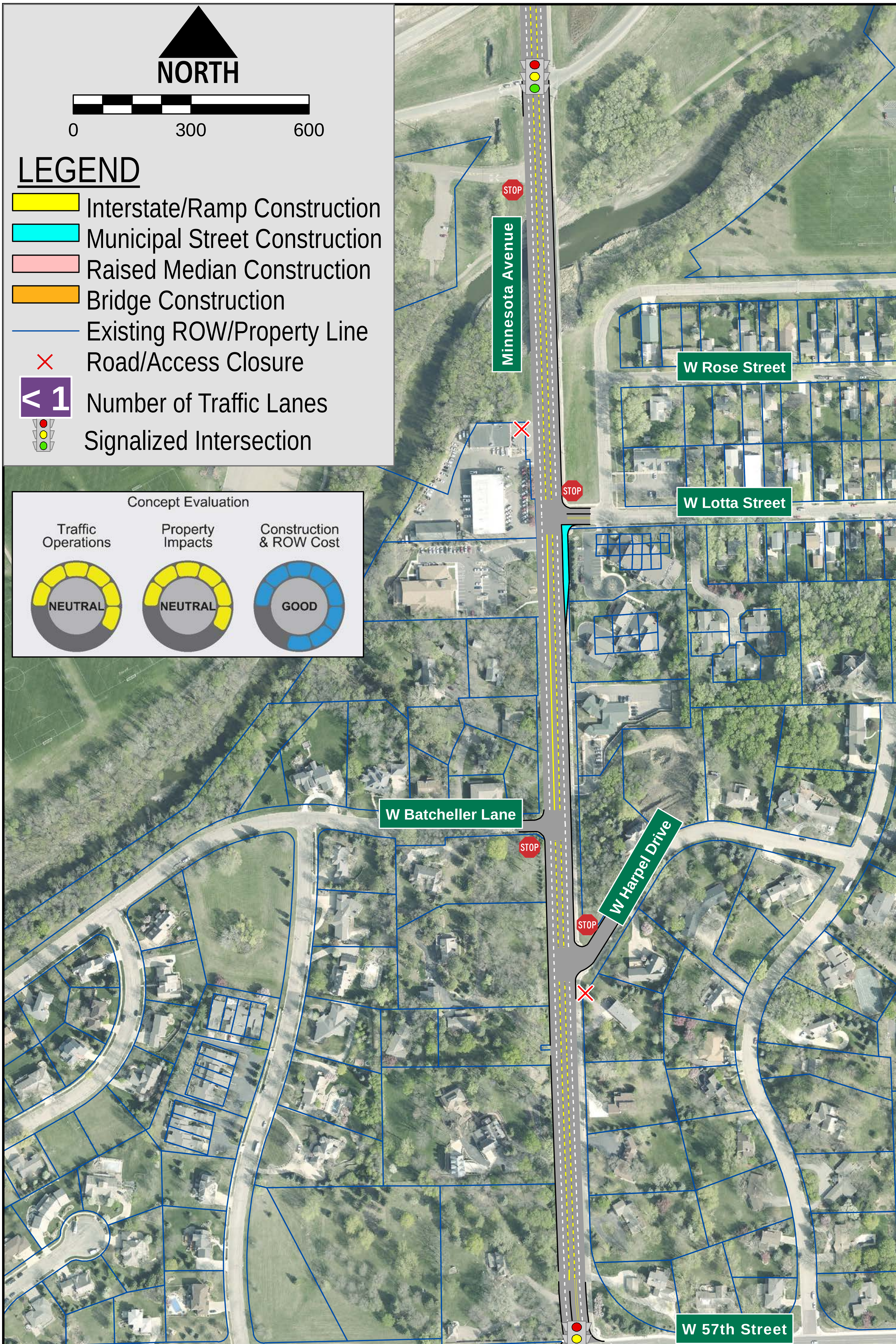
Figure
Minn-C2
(South)
7/06/2015



Sub-Study 2 - Minnesota Avenue
Left Turns Off\No Left Turns On
I-229 Major Investment Corridor Study

Sioux Falls, South Dakota

Figure
Minn-C3
(North)
7/06/2015



Sub-Study 2 - Minnesota Avenue

Left Turns Off\No Left Turns On

I-229 Major Investment Corridor Study

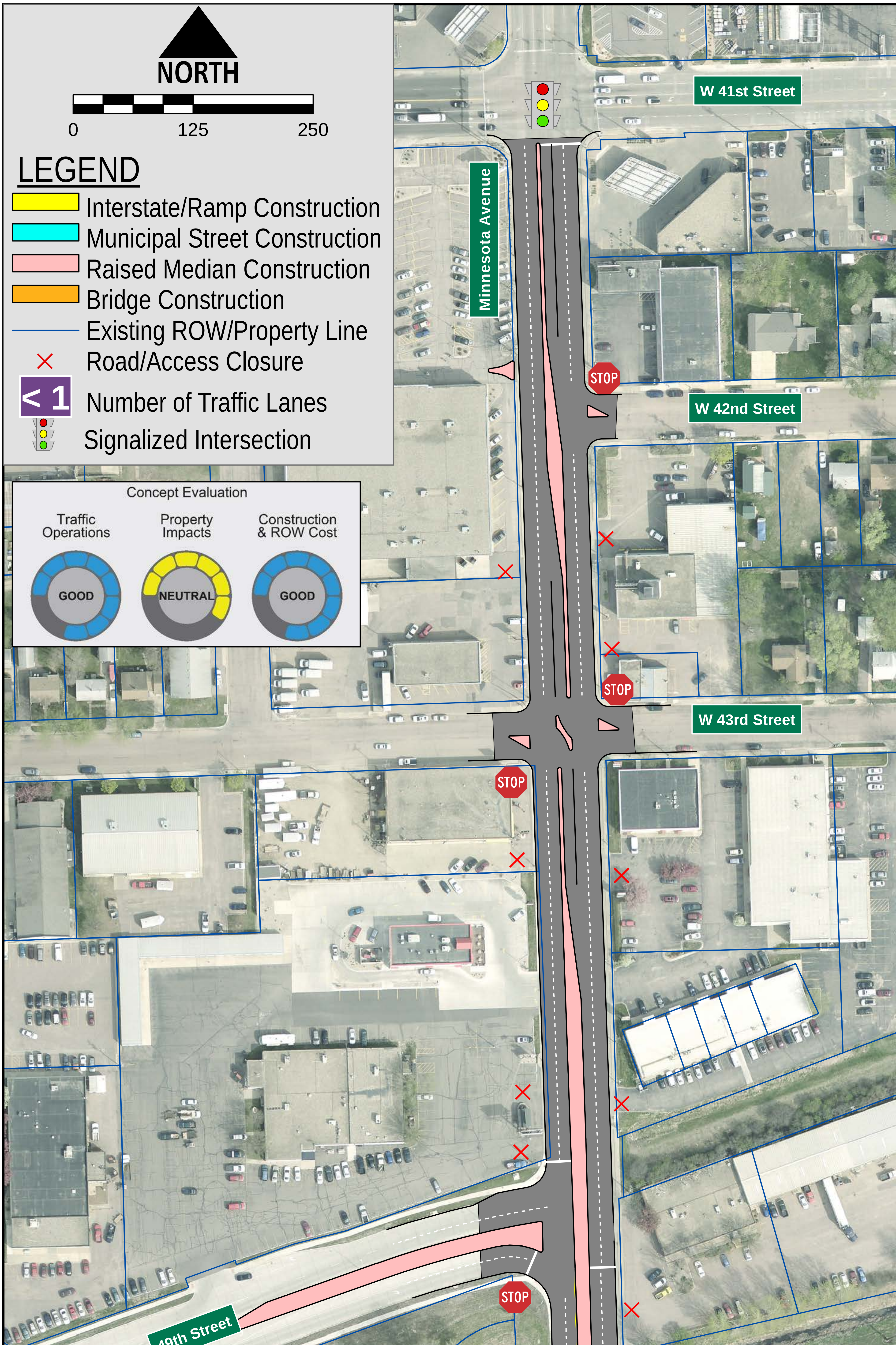
Sioux Falls, South Dakota

Figure

Minn-C3

(South)

7/06/2015



Sub-Study 2 - Minnesota Avenue
49th Street RIRO
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota

Figure
Minn-C4
(North)
7/06/2015

Sub-Study 2 - Minnesota Avenue

49th Street RIRO

I-229 Major Investment Corridor Study

Sioux Falls, South Dakota

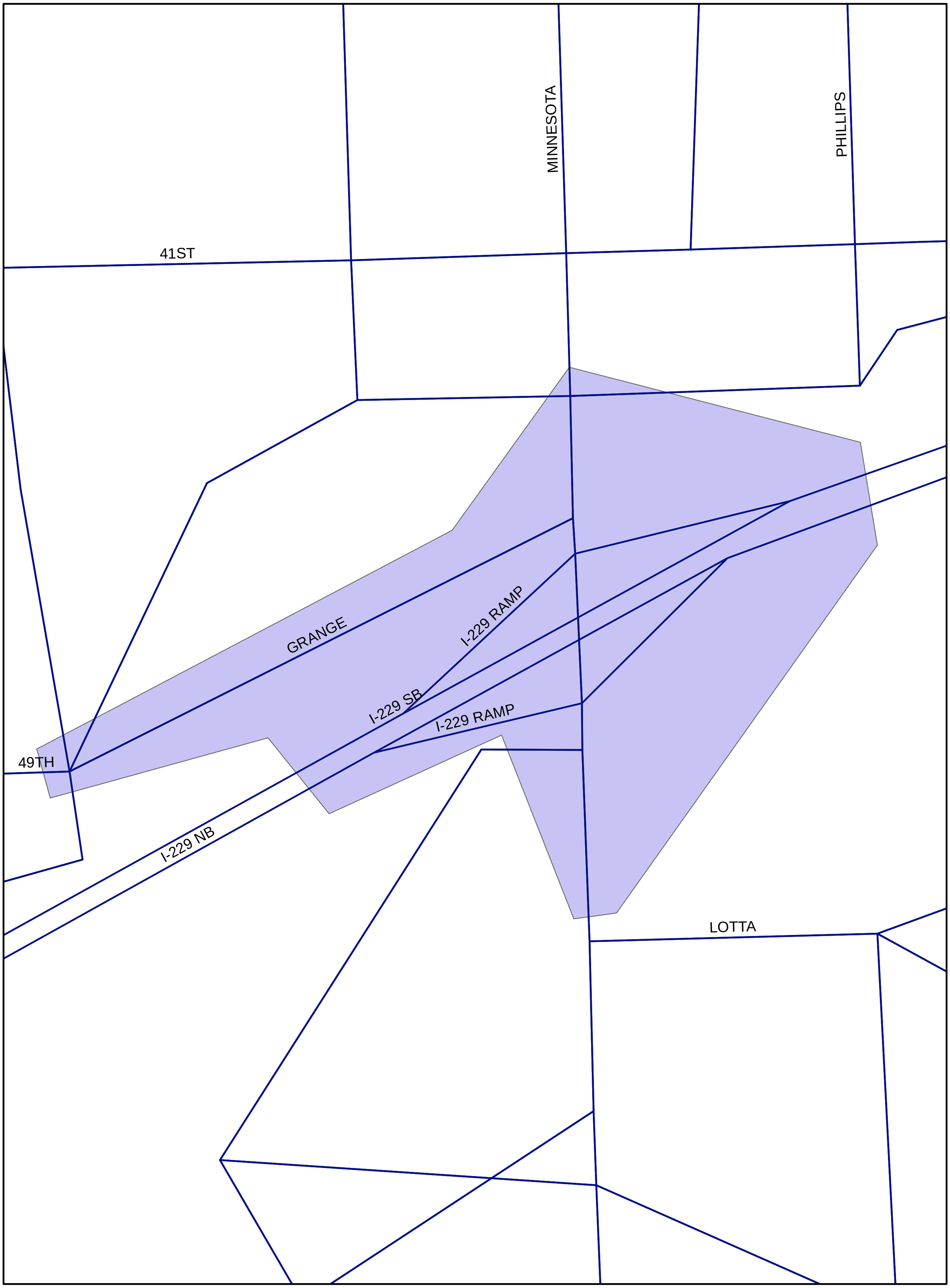
Figure Minn-C4 (South)

7/06/2015

Attachment B-

DTA Model Interchange Area Definitions

Sub-Study 2 - Minnesota Corridor - Interchange Area



Attachment C-

DTA Model Subarea

Attachment D-

Environmental Constraints Map

I-229 MIS CORRIDOR STUDY

I-229 CORRIDOR STUDY
MAP OVERVIEW

DATE 7/8/2015

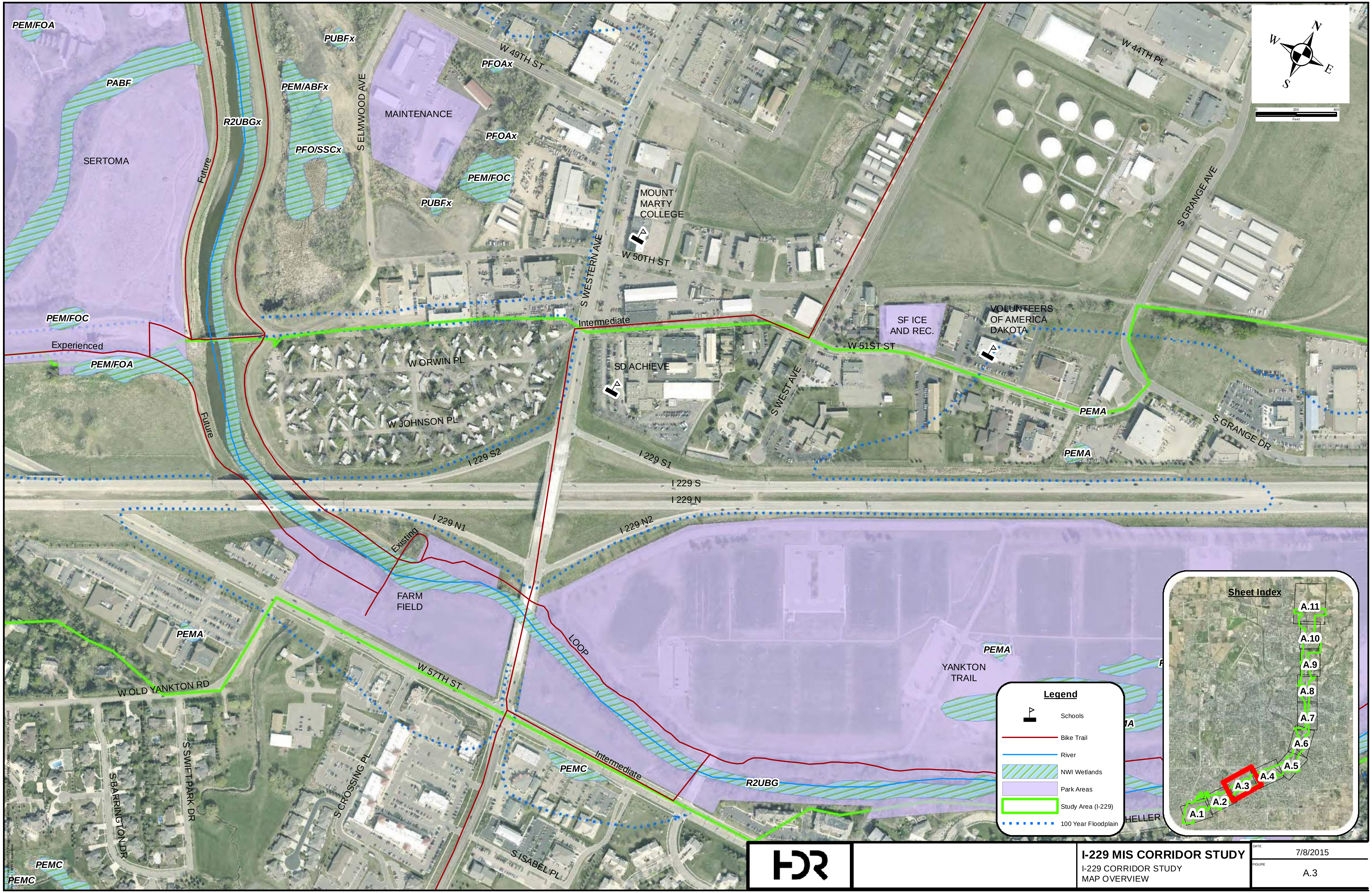
FIGURE A.1

HDR

I-229 MIS CORRIDOR STUDY
I-229 CORRIDOR STUDY
MAP OVERVIEW

DATE 7/8/2015

FIGURE A.2



I-229 MIS CORRIDOR STUDY

I-229 CORRIDOR STUDY
MAP OVERVIEW

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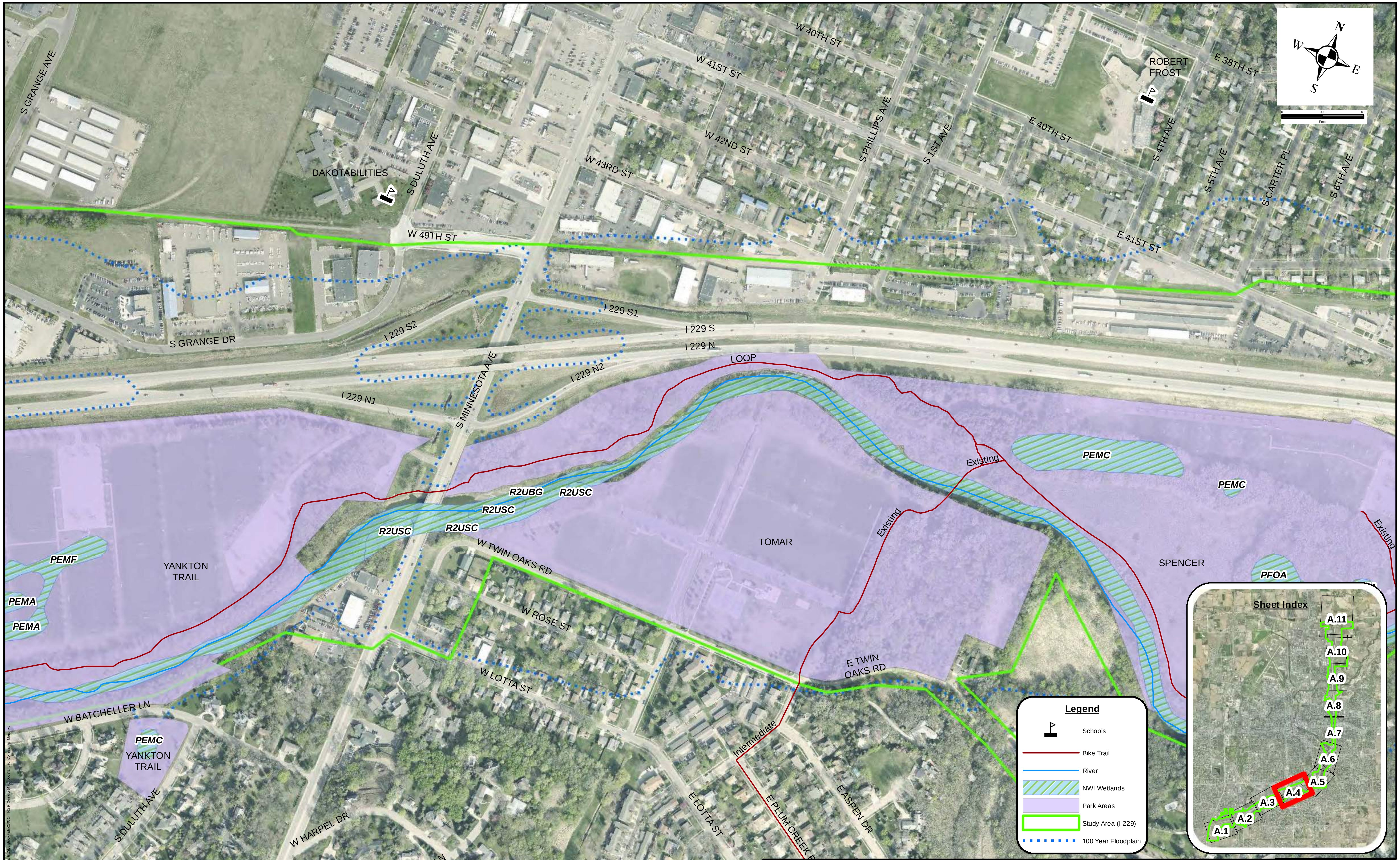
FIGURE A.3

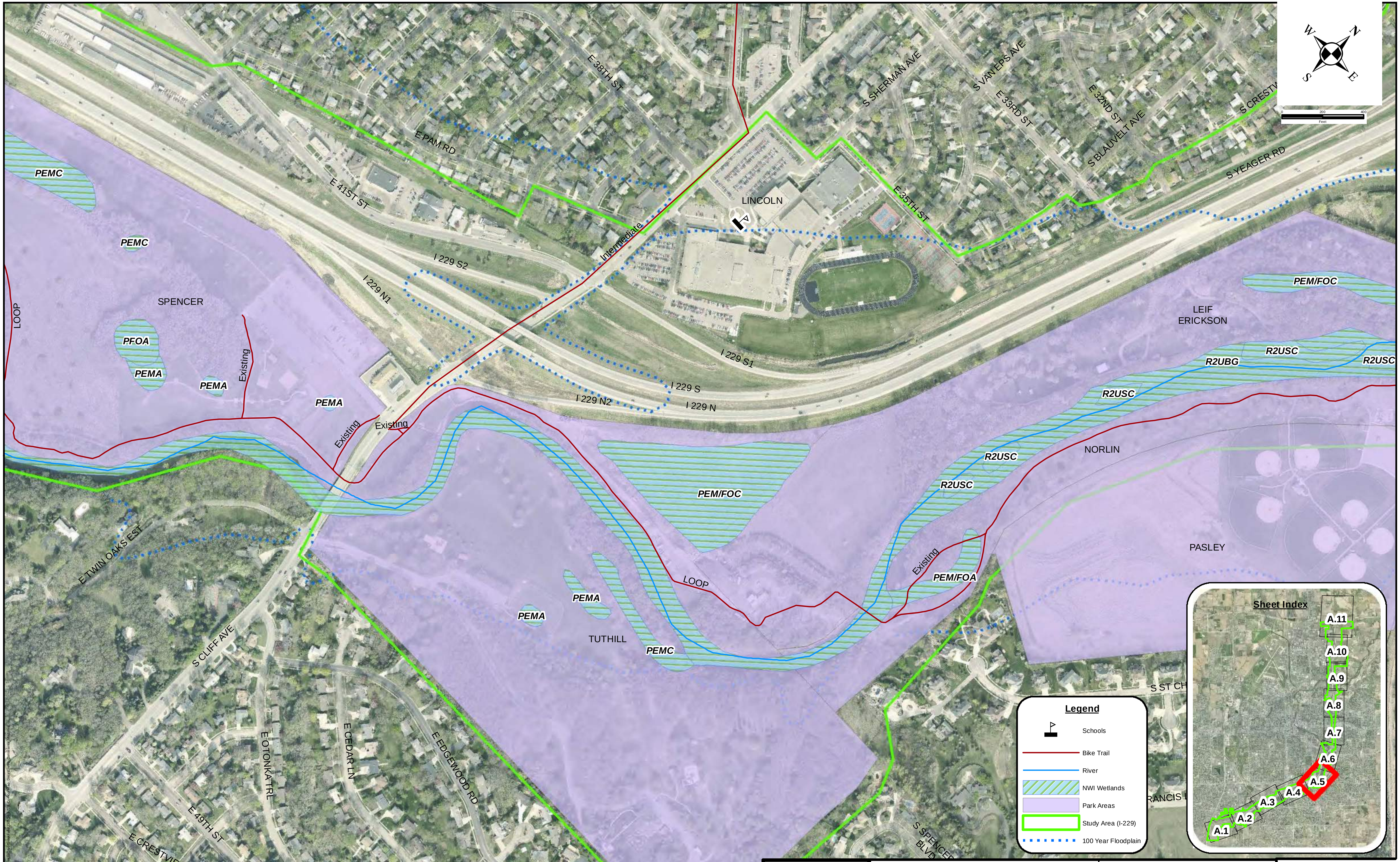


HDR

I-229 MIS CORRIDOR STUDY
I-229 CORRIDOR STUDY
MAP OVERVIEW

DATE 7/8/2015

FIGURE A.4



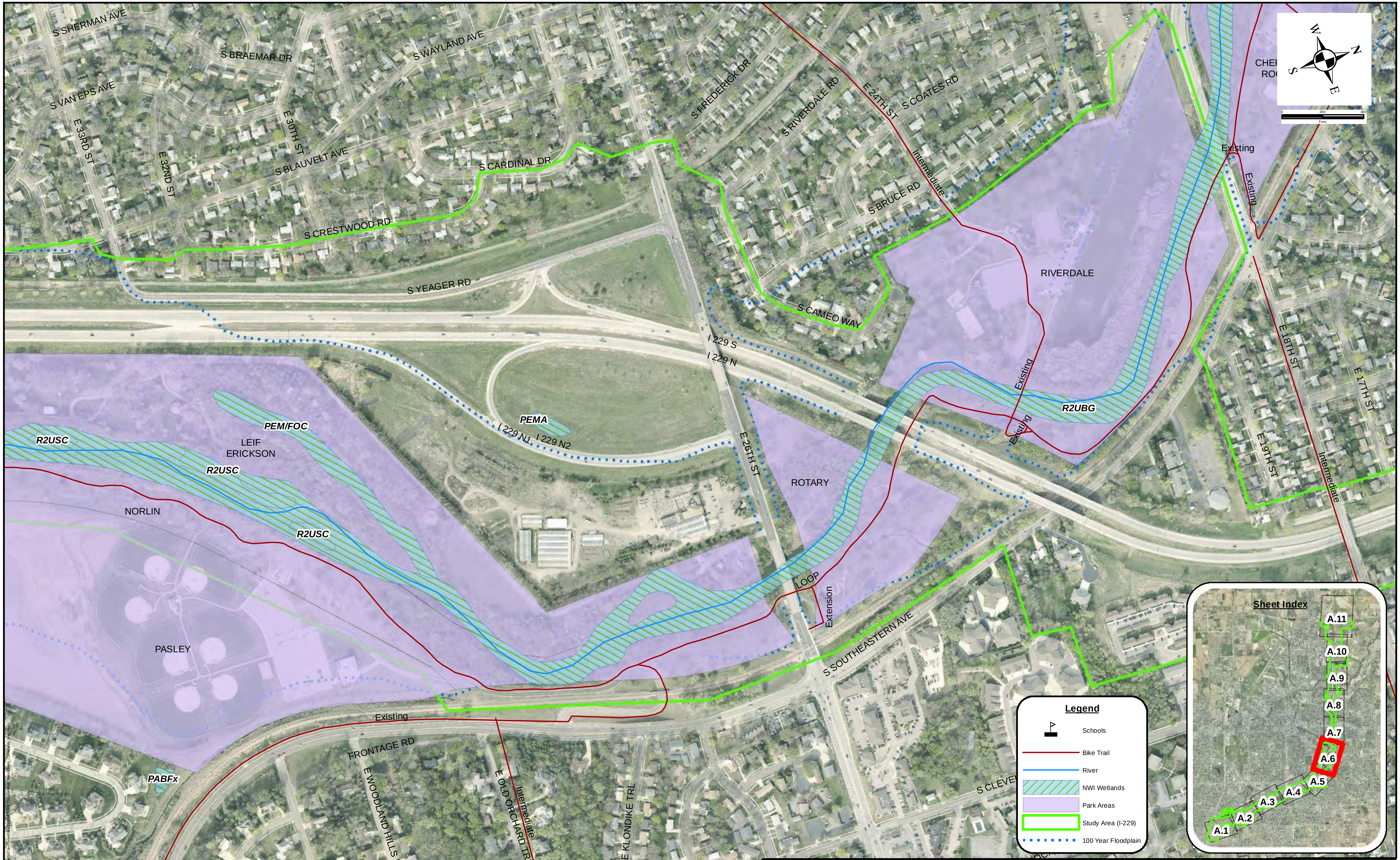
HDR

I-229 MIS CORRIDOR STUDY

I-229 CORRIDOR STUDY
MAP OVERVIEW

DATE 7/8/2015

FIGURE A.5



FDR

I-229 MIS CORRIDOR STUDY

I-229 CORRIDOR STUDY
MAP OVERVIEW

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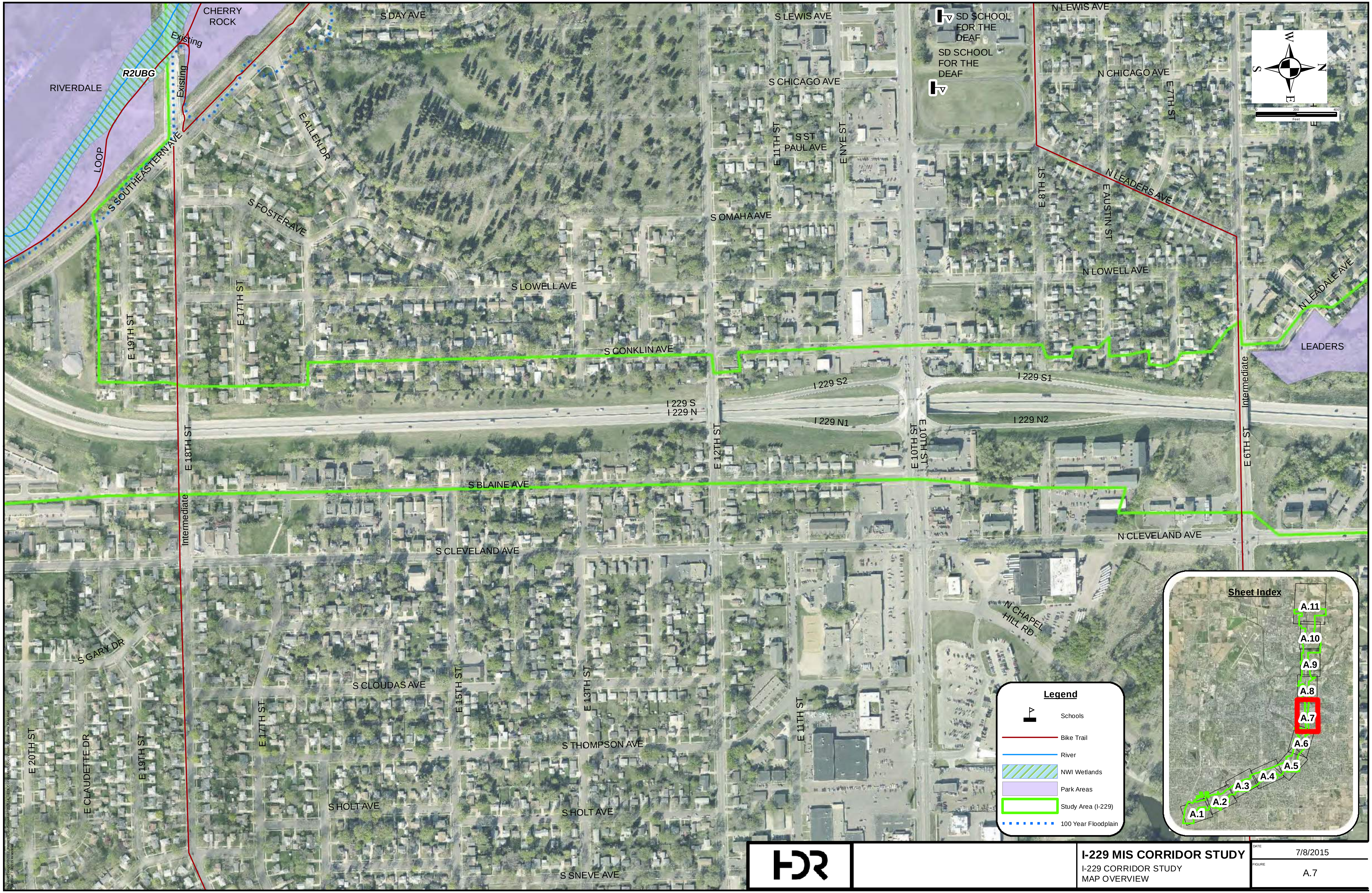
FIGURE A.6


CHERRY ROCK
RIVERDALE
R2UBG
Existing
Existing
LOOP
S SOUTHEASTERN AVE
S DAY AVE
E ALLEN DR
S FOSTER AVE
S LEWIS AVE
S CHICAGO AVE
E 11TH ST
S ST PAUL AVE
E NYE ST
SD SCHOOL FOR THE DEAF
SD SCHOOL FOR THE DEAF
N LEWIS AVE
N CHICAGO AVE
E 7TH ST
N LEADERS AVE
E 8TH ST
E AUSTIN ST
S OMAHA AVE
S LOWELL AVE
N LOWELL AVE
N LEADALE AVE
E 19TH ST
E 17TH ST
S CONKLIN AVE
LEADERS
Intermediate
I 229 S2
I 229 S1
I 229 S
I 229 N
I 229 N1
I 229 N2
E 18TH ST
E 12TH ST
E 10TH ST
E 10TH ST
E 6TH ST
S BLAINE AVE
Intermediate
S CLEVELAND AVE
N CLEVELAND AVE
N CHAPEL HILL RD
S GARY DR
S CLOUDAS AVE
E 15TH ST
E 13TH ST
E 17TH ST
E 11TH ST
E 20TH ST
E CLAUDETTE DR
E 19TH ST
S THOMPSON AVE
S HOLT AVE
S HOLT AVE
S SNEVE AVE
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A.1
HDR
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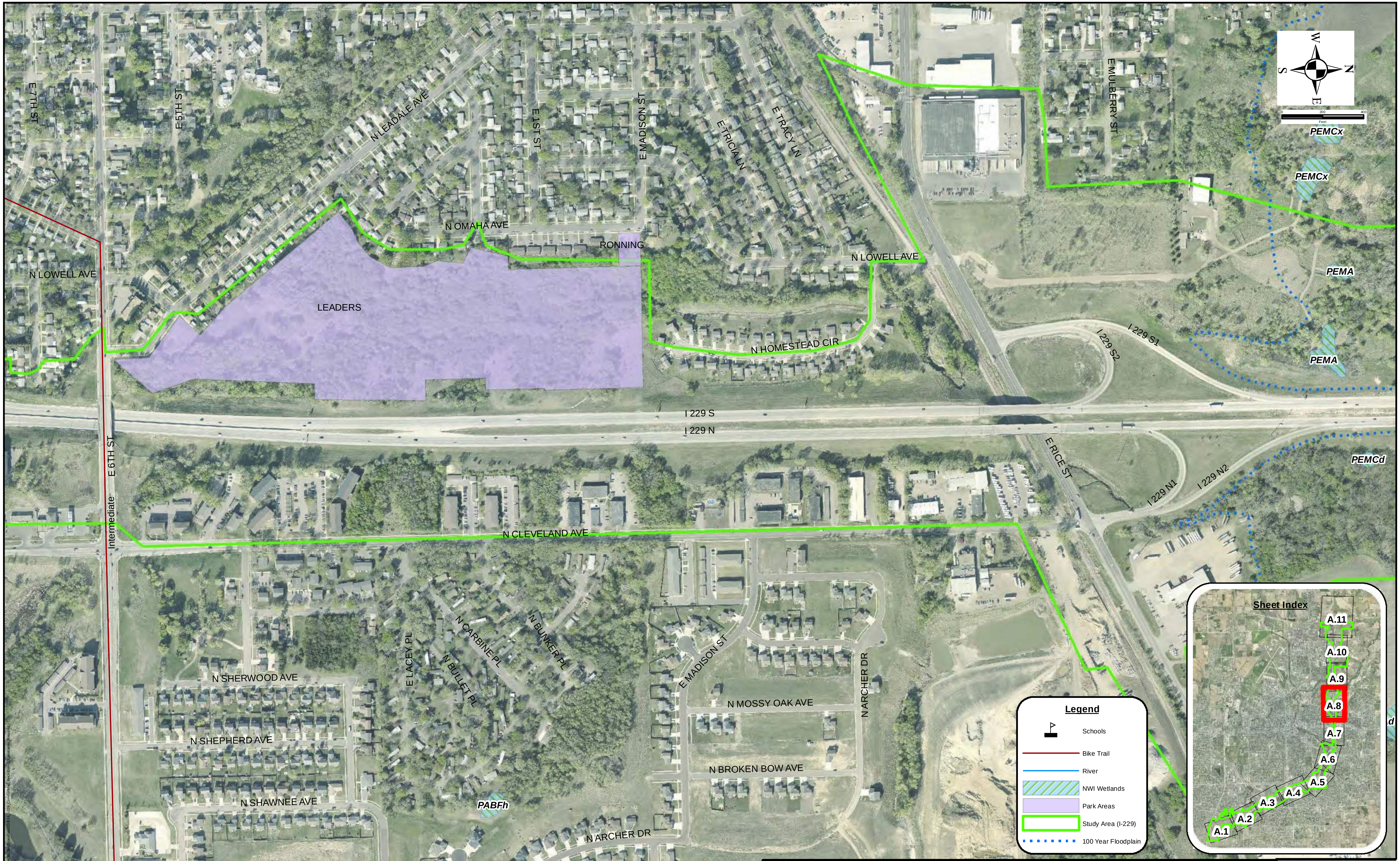
I-229 CORRIDOR STUDY
MAP OVERVIEW
7/8/2015
A.7



HDR

I-229 MIS CORRIDOR STUDY

I-229 CORRIDOR STUDY
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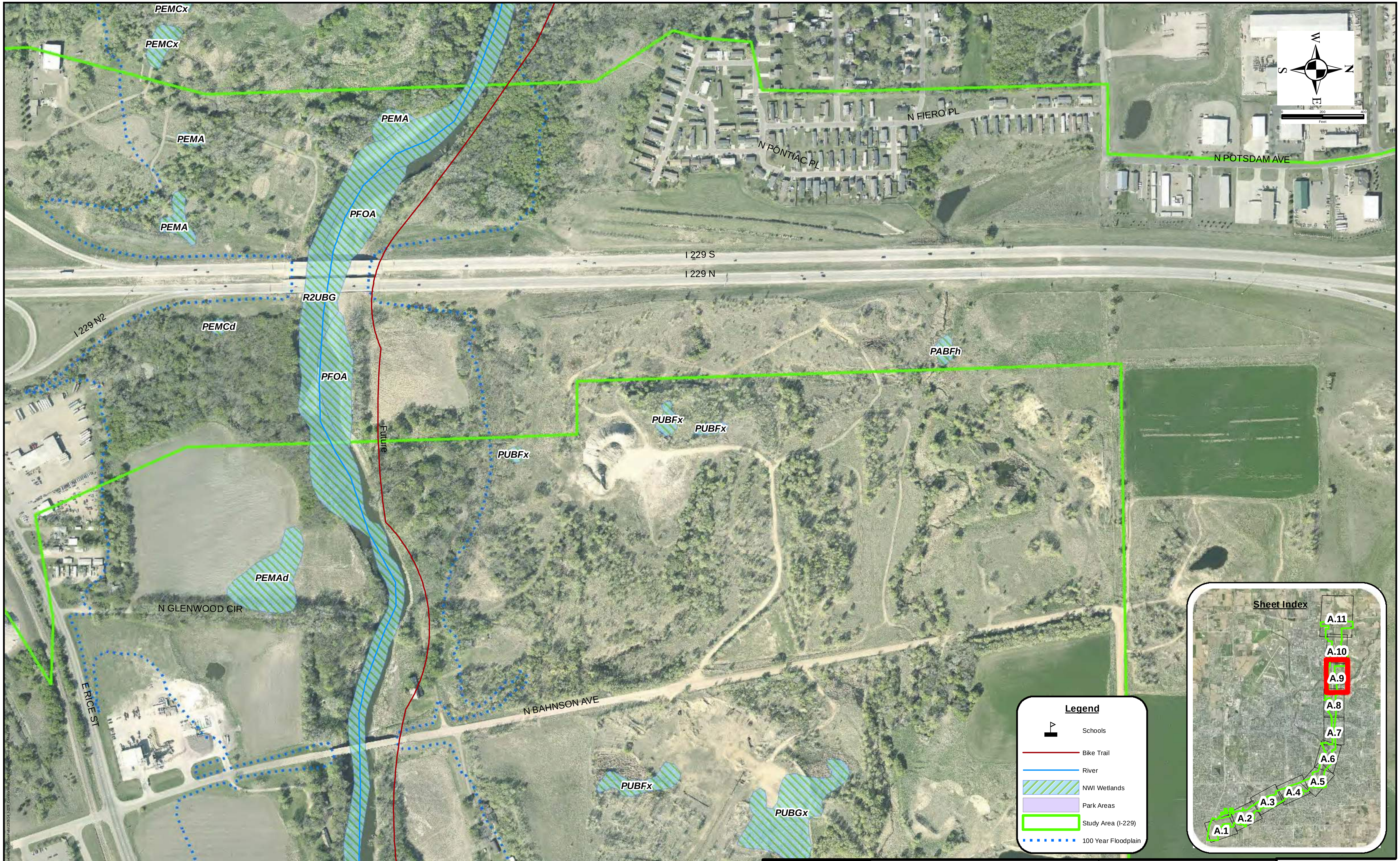
FIGURE A.8



I-229 MIS CORRIDOR STUDY

I-229 CORRIDOR STUDY
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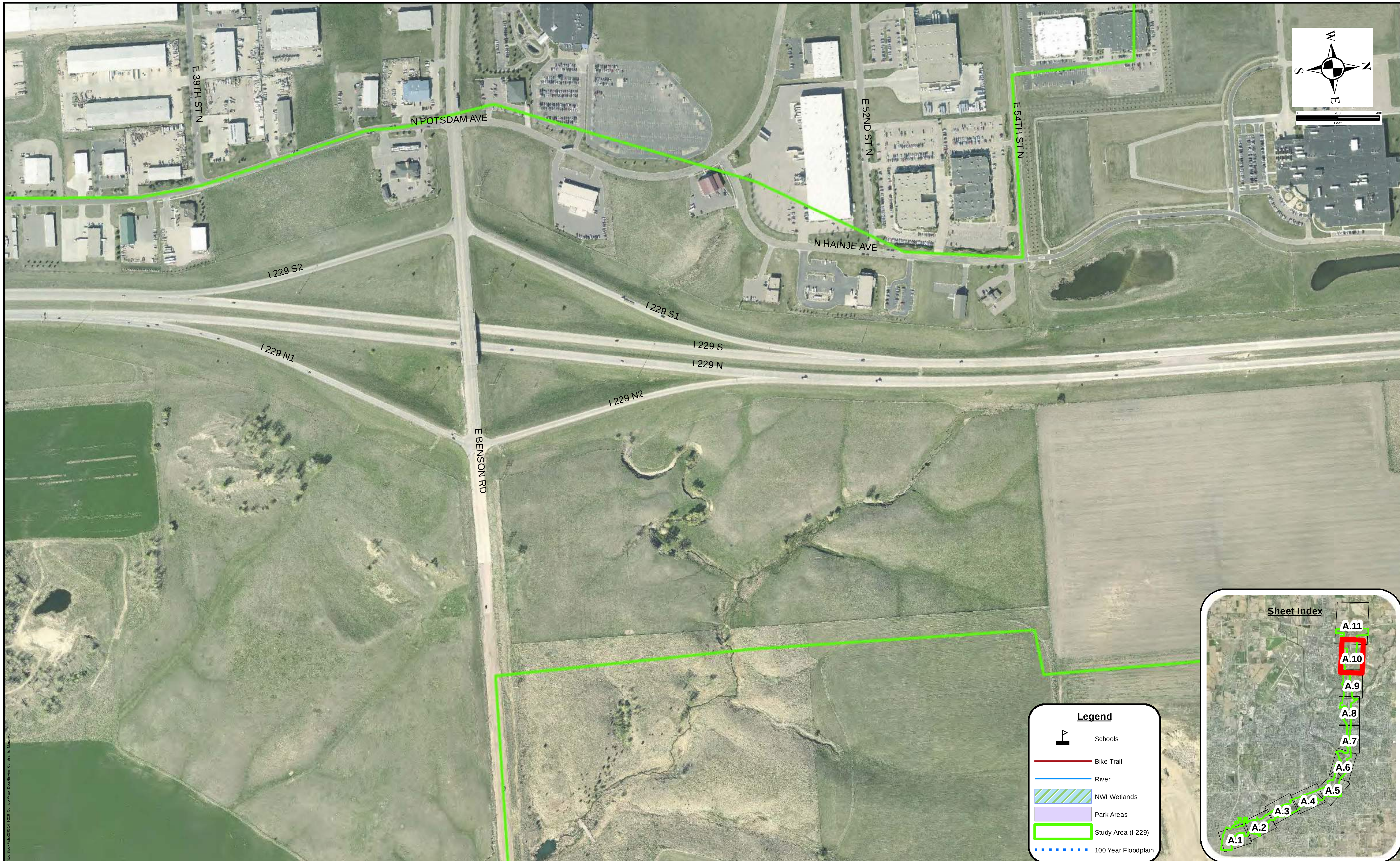
FIGURE A.9



HDR

I-229 MIS CORRIDOR STUDY

I-229 CORRIDOR STUDY
MAP OVERVIEW

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FIGURE A.10

HDR

I-229 MIS CORRIDOR STUDY

I-229 CORRIDOR STUDY
MAP OVERVIEW

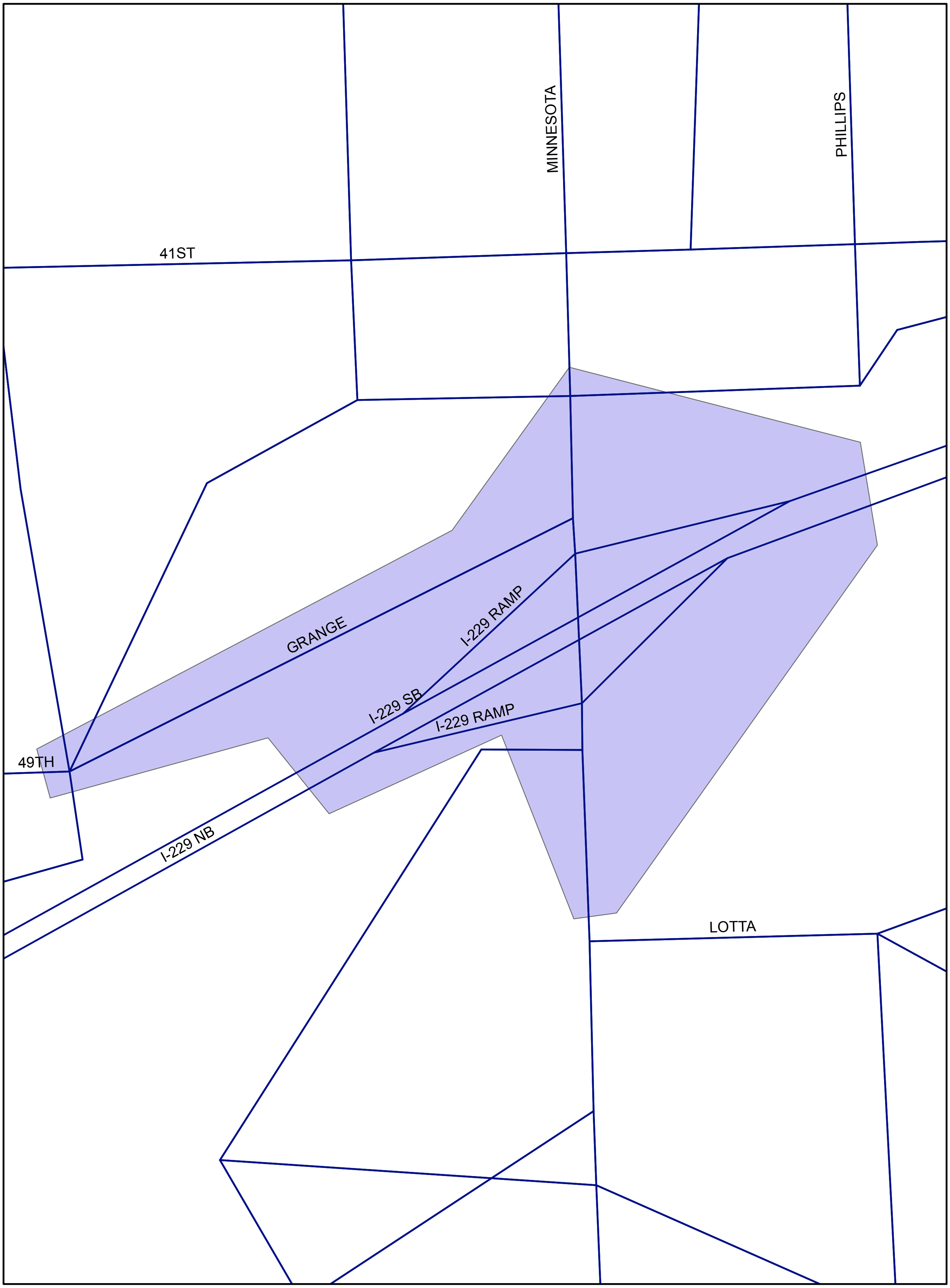
DATE 7/8/2015

FIGURE A.11

APPENDIX D3 -

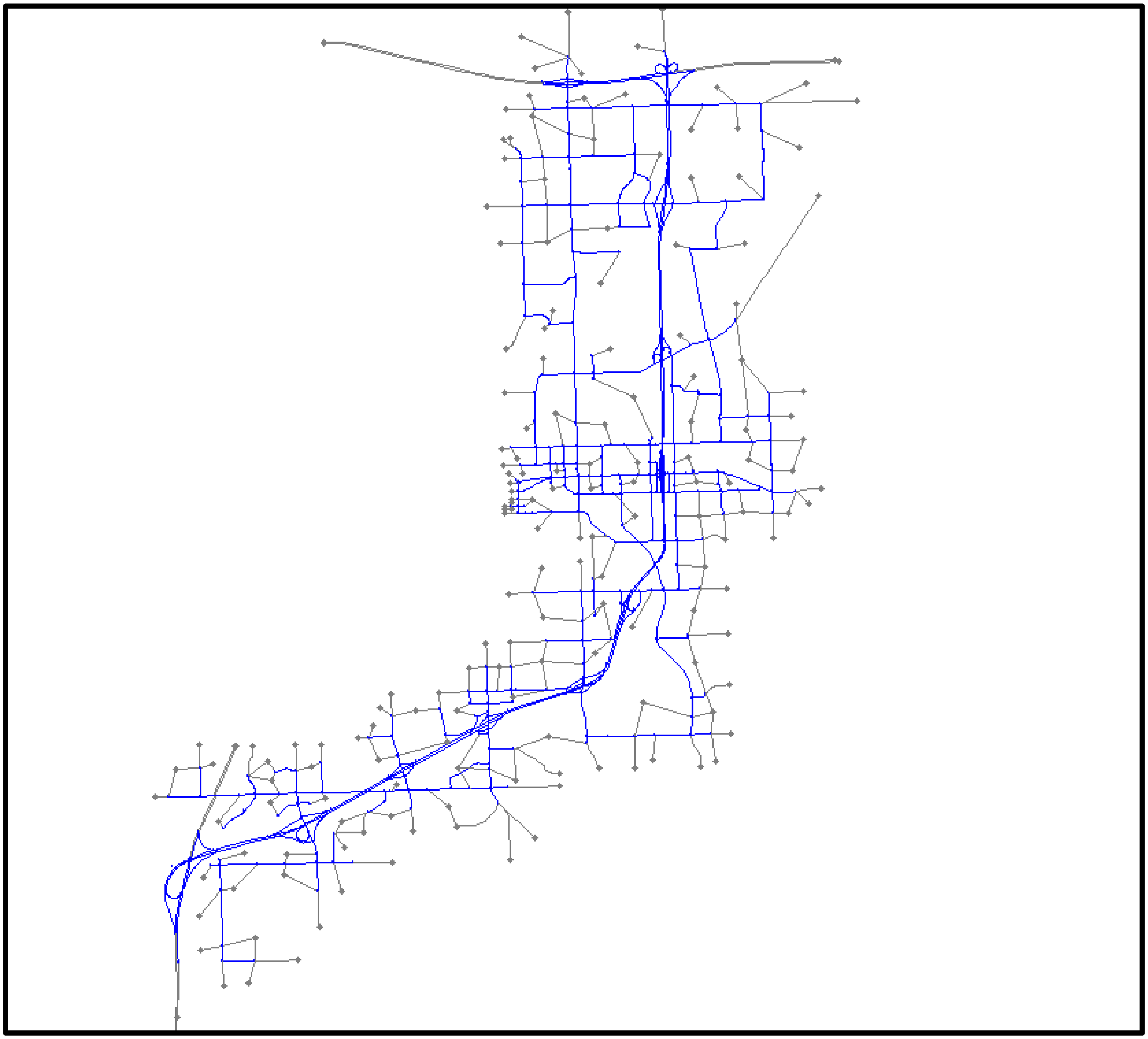
DTA MODEL INTERCHANGE AND MODEL SUBAREAS

Sub-Study 2 - Minnesota Corridor - Interchange Area



Attachment C-

DTA Model Subarea



hdrinc.com 6300 W. Old Village Place, Suite 100, Sioux Falls, SD, 57108
(605) 977-7740

APPENDIX D4 -

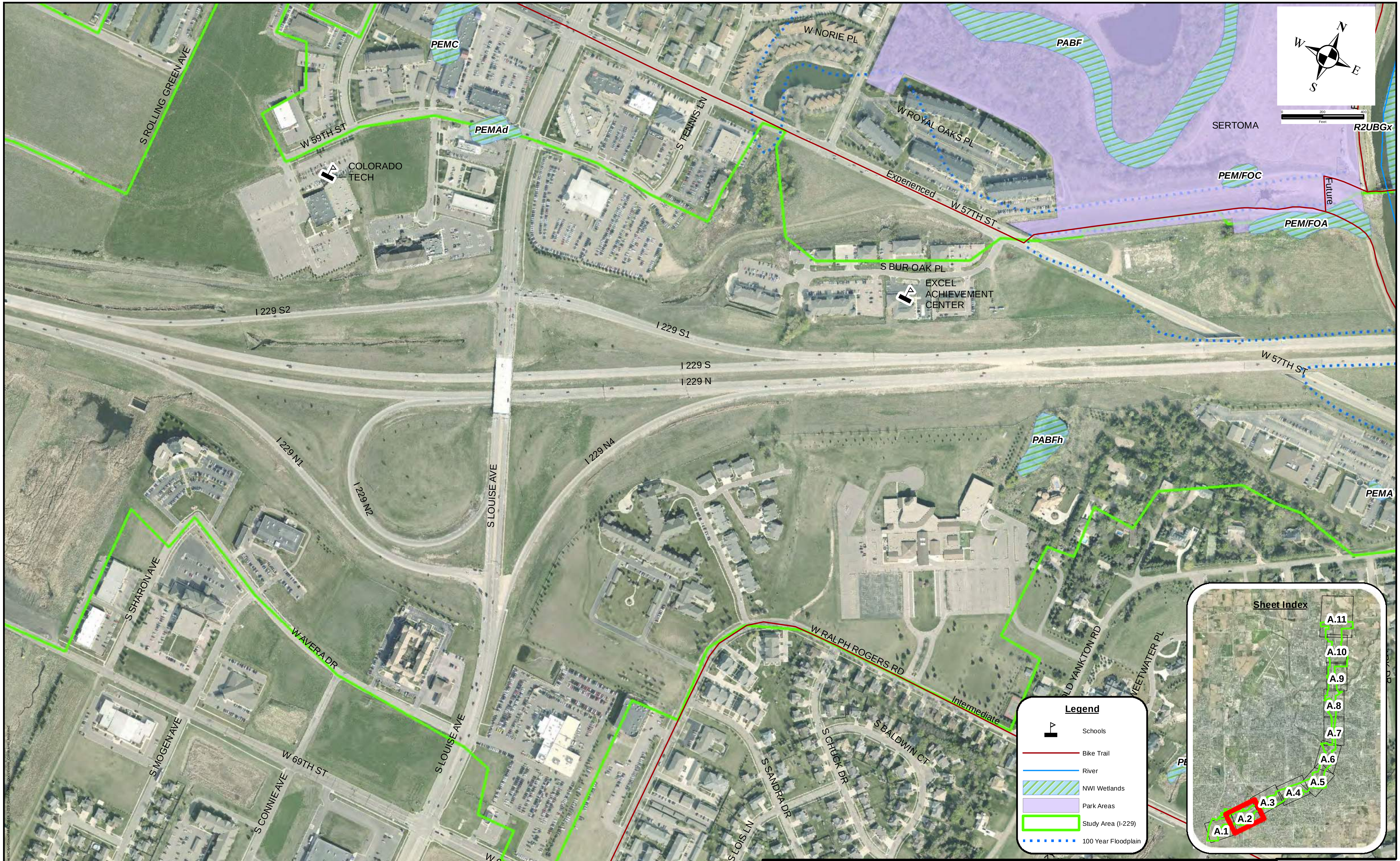
ENVIRONMENTAL CONSTRAINTS MAPS

HDR

I-229 MIS CORRIDOR STUDY
I-229 CORRIDOR STUDY
MAP OVERVIEW

DATE 7/8/2015

FIGURE A.1



HDR

I-229 MIS CORRIDOR STUDY

I-229 CORRIDOR STUDY
MAP OVERVIEW

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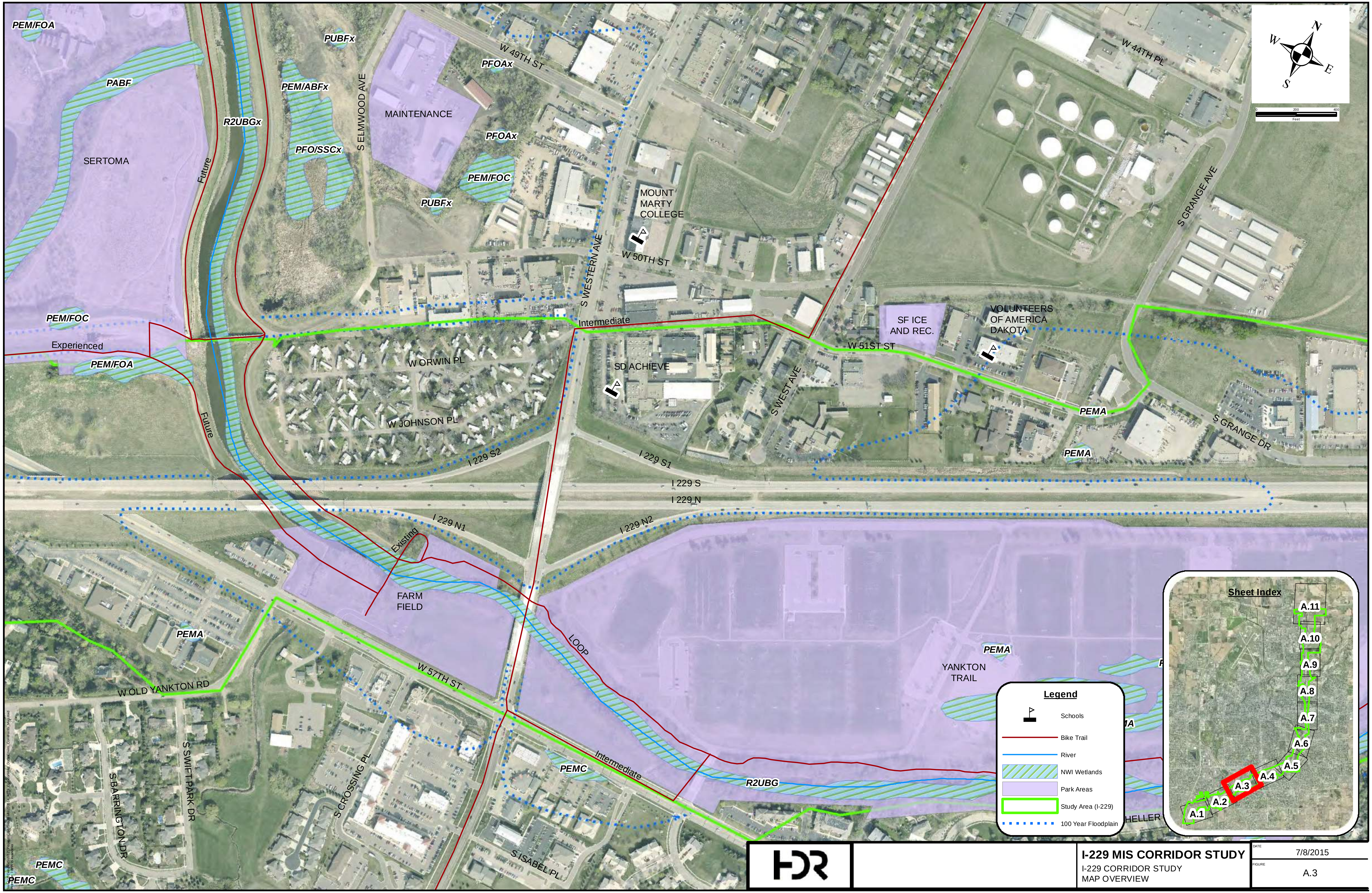
FIGURE A.2


PEM/FOA
PUBFx
W 49TH ST
PFOAx
PABF
PEM/ABFx
MAINTENANCE
R2UBGx
S ELMWOOD AVE
PFOAx
PFO/SSCx
SERTOMA
PEM/FOC
Future
PUBFx
MOUNT
MARTY
COLLEGE
W 44TH PL
S GRANGE AVE
S WESTERN AVE
W 50TH ST
PEM/FOC
Intermediate
SF ICE
AND REC.
VOLUNTEERS
OF AMERICA
DAKOTA
Experienced
W 51ST ST
PEM/FOA
W ORWIN PL
SD ACHIEVE
S WEST AVE
PEMA
W JOHNSON PL
Future
S GRANGE DR
PEMA
I 229 S2
I 229 S1
I 229 S
I 229 N
I 229 N1
I 229 N2
Existing
FARM
FIELD
PEMA
LOOP
PEMA
YANKTON
TRAIL
W 57TH ST
W OLD YANKTON RD
S SWIFT PARK DR
S BARRINGTON DR
S CROSSING PL
PEMC
Intermediate
R2UBG
HELLER
S ISABEL PL
PEMC
PEMC
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E
S
W
Feet
HDR
I-229 MIS CORRIDOR STUDY
I-229 CORRIDOR STUDY
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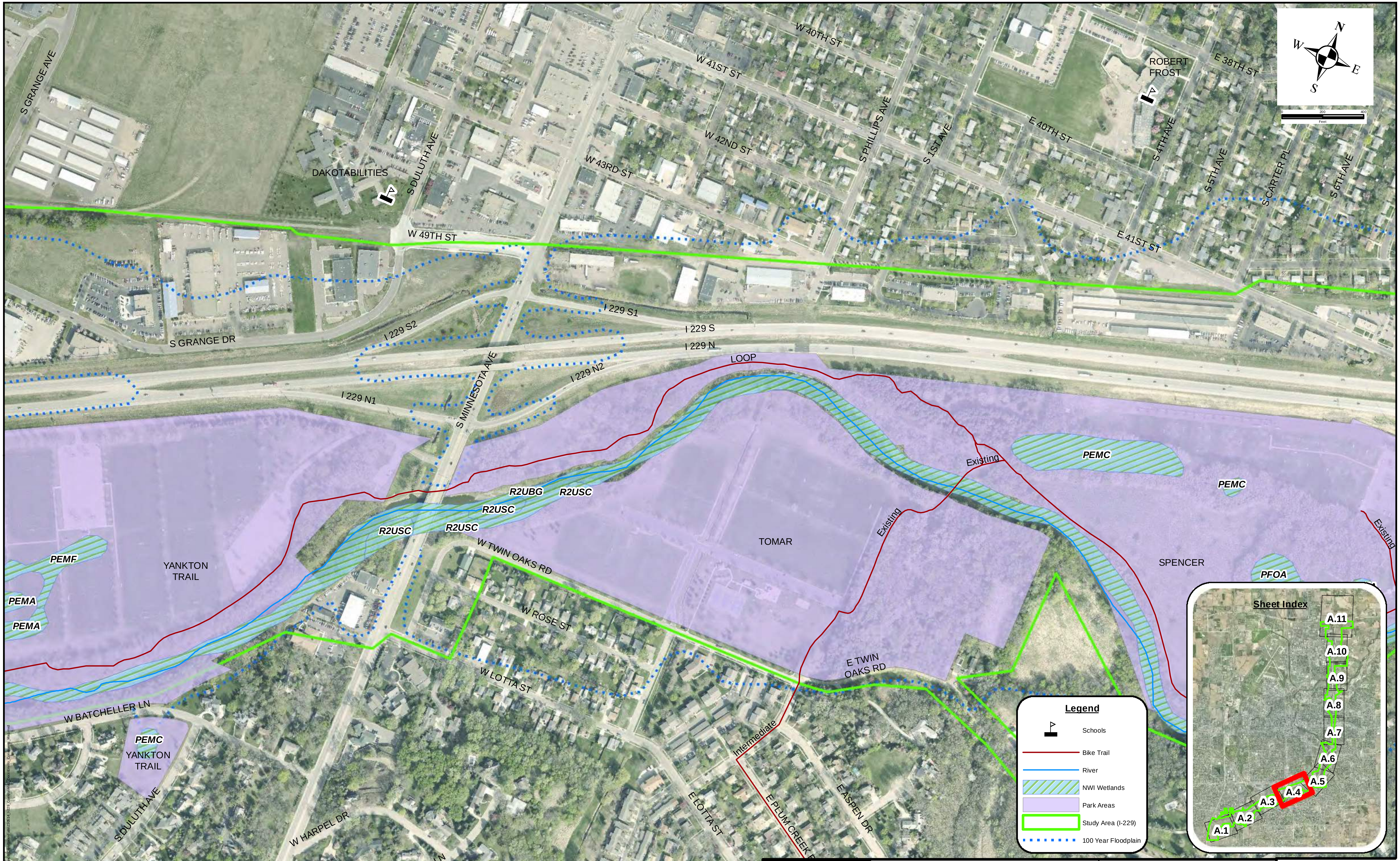
7/8/2015
FIGURE
A.3



HDR

I-229 MIS CORRIDOR STUDY

I-229 CORRIDOR STUDY
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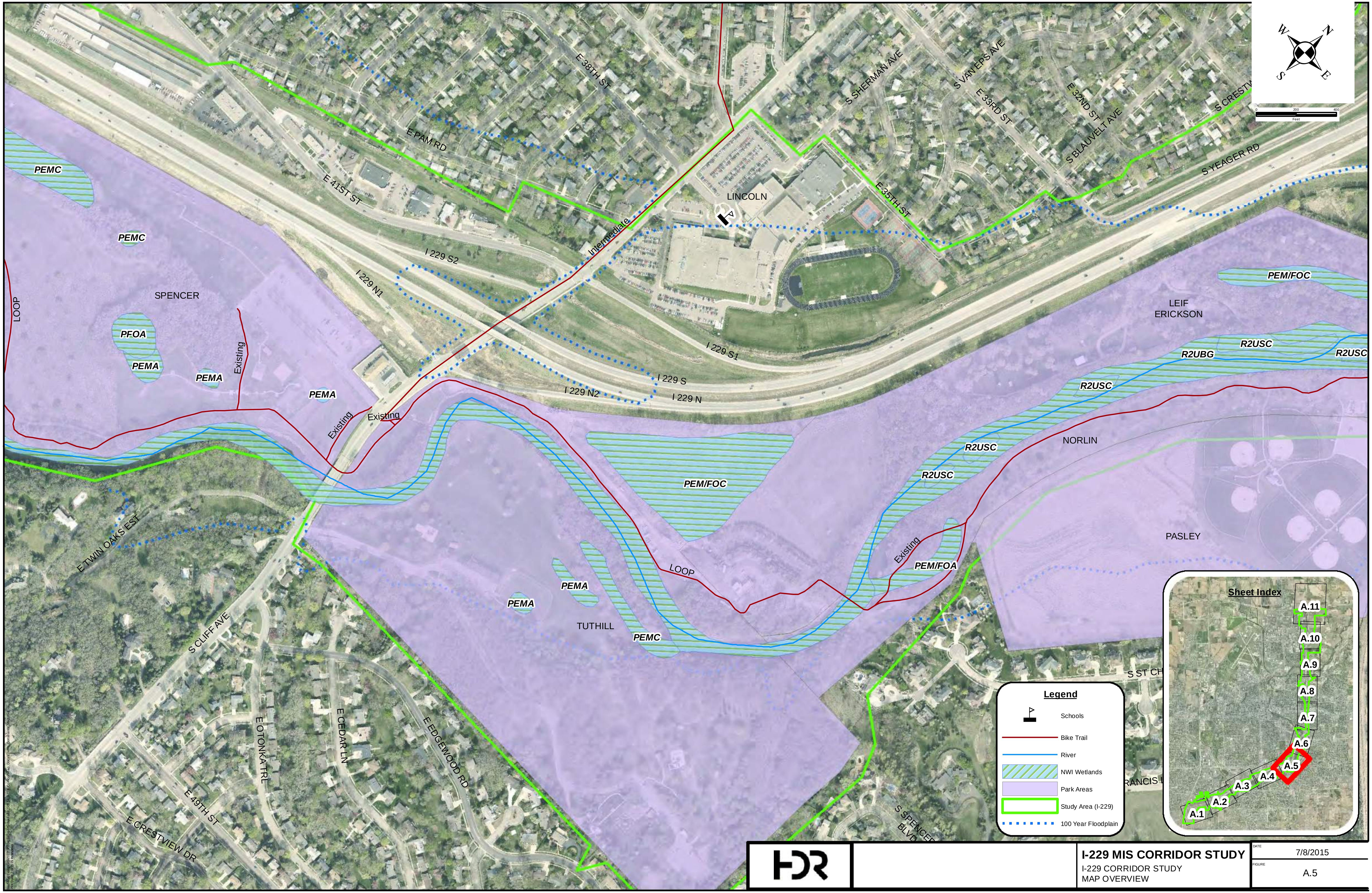
FIGURE A.4


W
N
S
E
0
200
400
Feet
E 38TH ST
S SHERMAN AVE
S VAN EPS AVE
E 33RD ST
E 32ND ST
S BLAUVELT AVE
S CRESTW
S YEAGER RD
E PAM RD
E 41ST ST
LINCOLN
E 35TH ST
Intermediate
I 229 S2
I 229 N1
I 229 S1
I 229 S
I 229 N2
I 229 N
PEMC
PEMC
SPENCER
LOOP
PFOA
PEMA
PEMA
PEMA
Existing
Existing
Existing
PEM/FOC
LEIF
ERICKSON
R2USC
R2UBG
R2USC
R2USC
R2USC
R2USC
NORLIN
PEM/FOC
PASLEY
Existing
PEM/FOA
LOOP
PEMA
PEMA
TUTHILL
PEMC
E TWIN OAKS EST
S CLIFF AVE
E OTONKA TRL
E CEDAR LN
E EDGEWOOD RD
E 49TH ST
E CRESTVIEW DR
S ST CH
RANCIS
S SPENCER
BLVD
Legend
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HDR
I-229 MIS CORRIDOR STUDY
I-229 CORRIDOR STUDY
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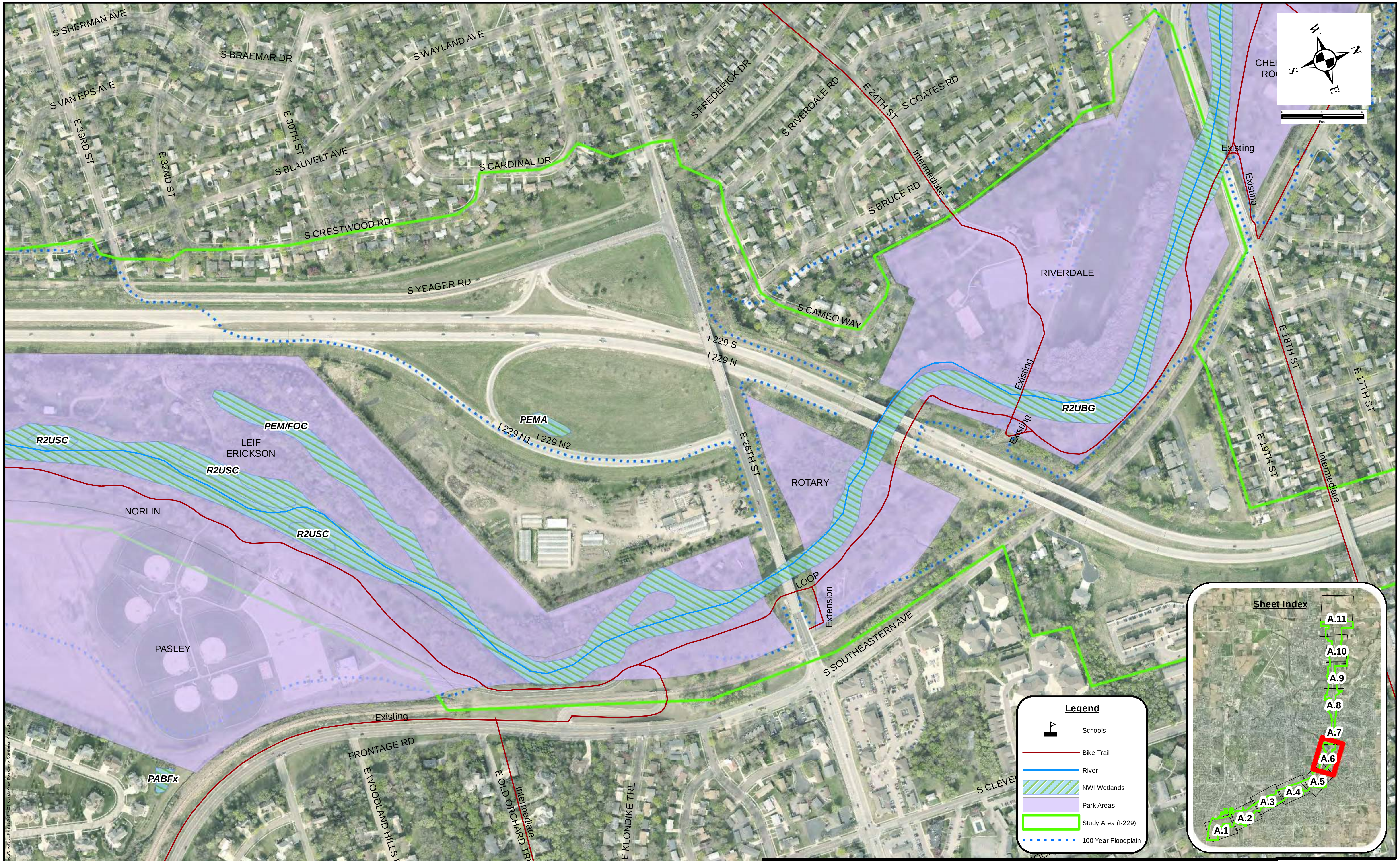
FIGURE
A.5



HDR

I-229 MIS CORRIDOR STUDY

I-229 CORRIDOR STUDY
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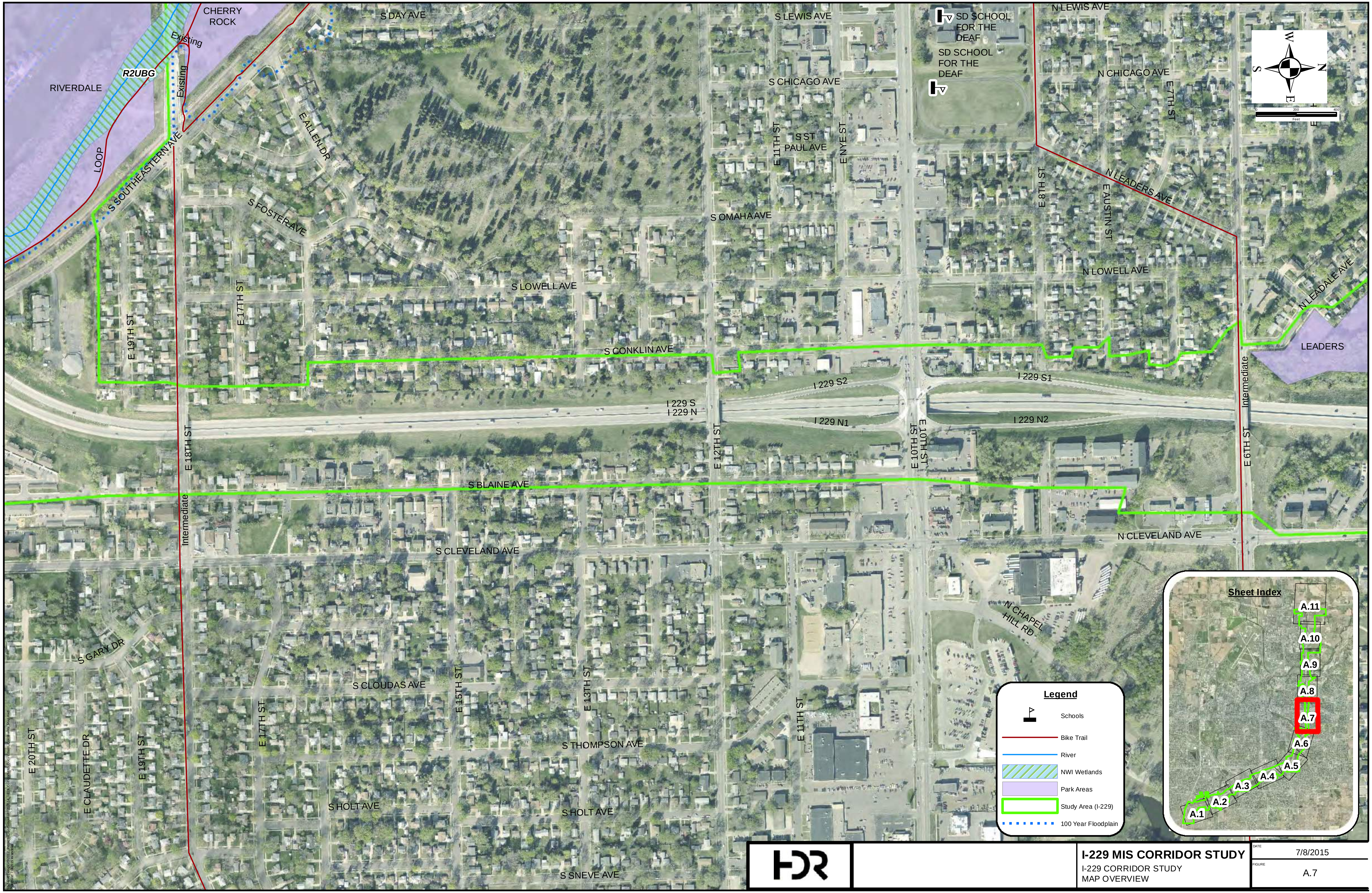
FIGURE A.6



S DAY AVE
S LEWIS AVE
SD SCHOOL FOR THE DEAF
SD SCHOOL FOR THE DEAF
N LEWIS AVE
CHERRY ROCK
RIVERDALE
R2UBG
Existing
Existing
LOOP
S SOUTHEASTERN AVE
E ALLEN DR
S CHICAGO AVE
N CHICAGO AVE
E 7TH ST
E 11TH ST
S ST PAUL AVE
E NYE ST
E 8TH ST
E AUSTIN ST
N LEADERS AVE
S FOSTER AVE
S OMAHA AVE
S LOWELL AVE
N LOWELL AVE
N LEADALE AVE
E 17TH ST
E 19TH ST
S CONKLIN AVE
LEADERS
Intermediate
I 229 S2
I 229 S1
I 229 S
I 229 N
I 229 N1
I 229 N2
E 18TH ST
E 12TH ST
E 10TH ST
E 10TH ST
E 6TH ST
S BLAINE AVE
Intermediate
S CLEVELAND AVE
N CLEVELAND AVE
N CHAPEL HILL RD
S GARY DR
S CLOUDAS AVE
E 15TH ST
E 13TH ST
E 17TH ST
E 11TH ST
E 20TH ST
E CLAUDETTE DR
E 19TH ST
S THOMPSON AVE
S HOLT AVE
S HOLT AVE
S SNEVE AVE
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A.7

HDR

I-229 MIS CORRIDOR STUDY
I-229 CORRIDOR STUDY
MAP OVERVIEW

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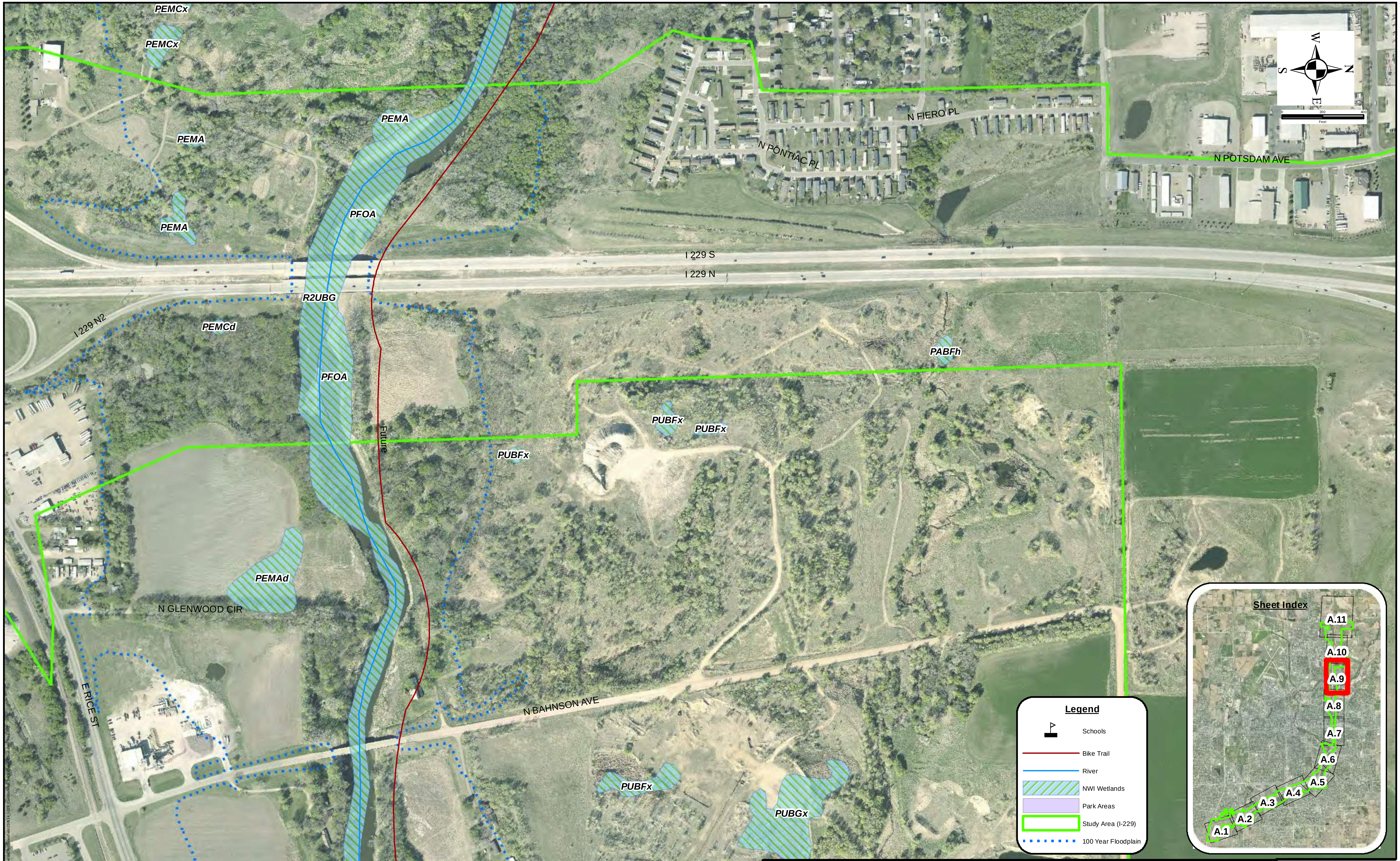
FIGURE A.8



HDR

I-229 MIS CORRIDOR STUDY

I-229 CORRIDOR STUDY
MAP OVERVIEW

DATE 7/8/2015

FIGURE A.9

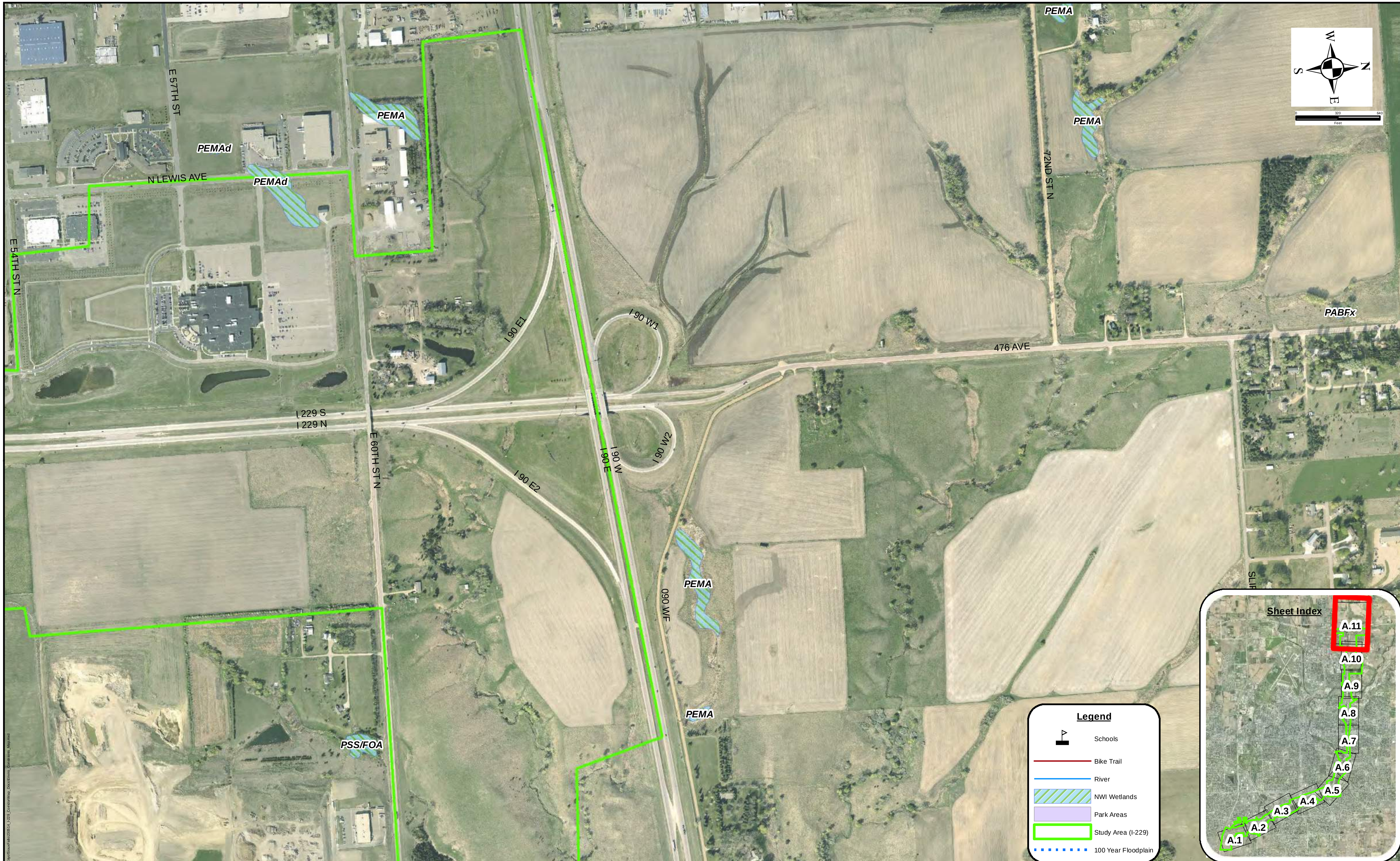
HDR

I-229 MIS CORRIDOR STUDY

I-229 CORRIDOR STUDY
MAP OVERVIEW

DATE 7/8/2015

FIGURE A.10



HDR

I-229 MIS CORRIDOR STUDY

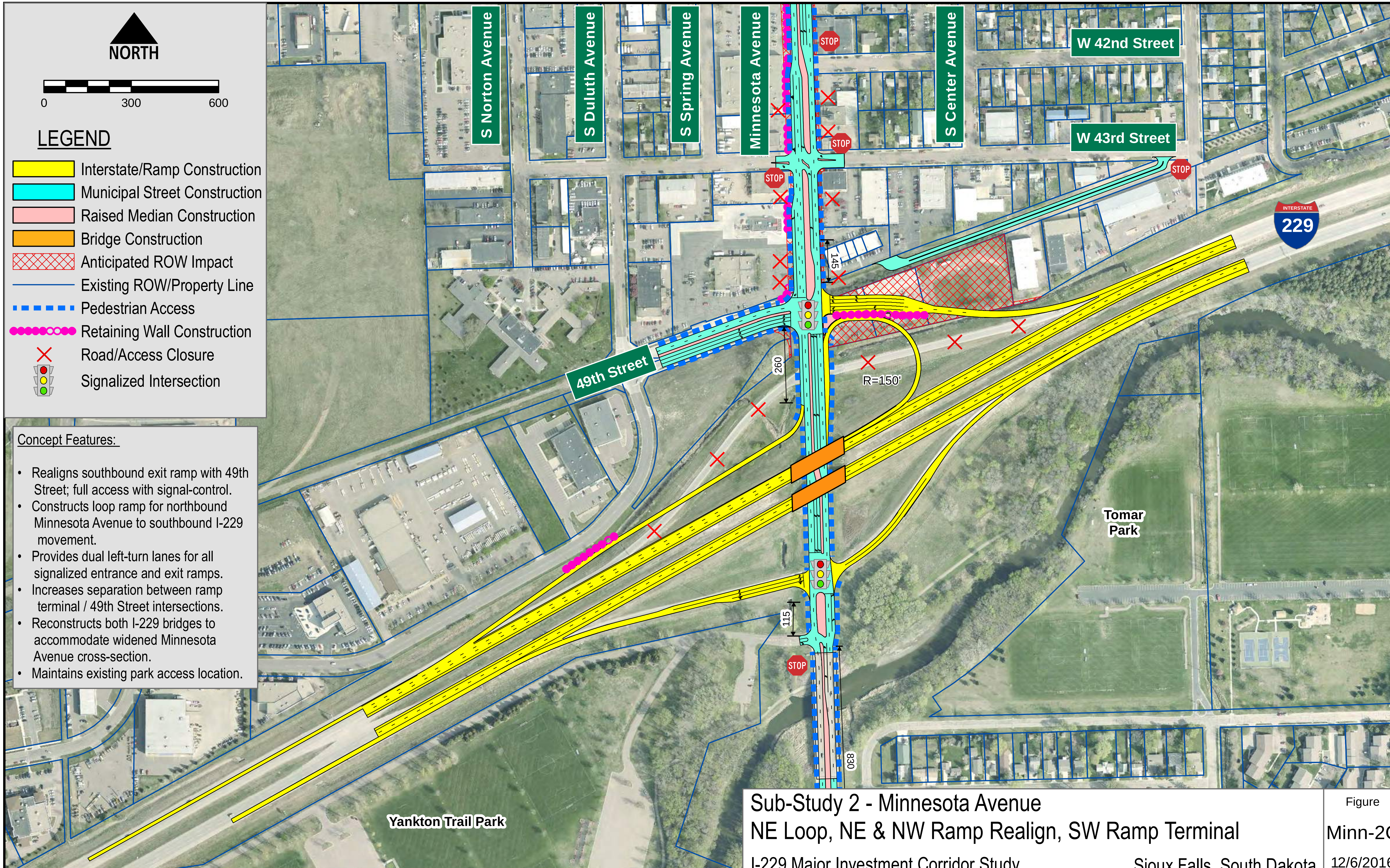
I-229 CORRIDOR STUDY
MAP OVERVIEW

DATE 7/8/2015

FIGURE A.11

APPENDIX D5 -

BUILD ALTERNATIVE SCENARIO FIGURES



Concept Features:

- Realigns southbound exit ramp with 49th Street; full access with signal-control.
- Constructs loop ramp for northbound Minnesota Avenue to southbound I-229 movement.
- Provides dual left-turn lanes for all signalized entrance and exit ramps.
- Increases separation between ramp terminal / 49th Street intersections.
- Reconstructs both I-229 bridges to accommodate widened Minnesota Avenue cross-section.
- Maintains existing park access location.

Sub-Study 2 - Minnesota Avenue

NE Loop, NE & NW Ramp Realign, SW Ramp Terminal

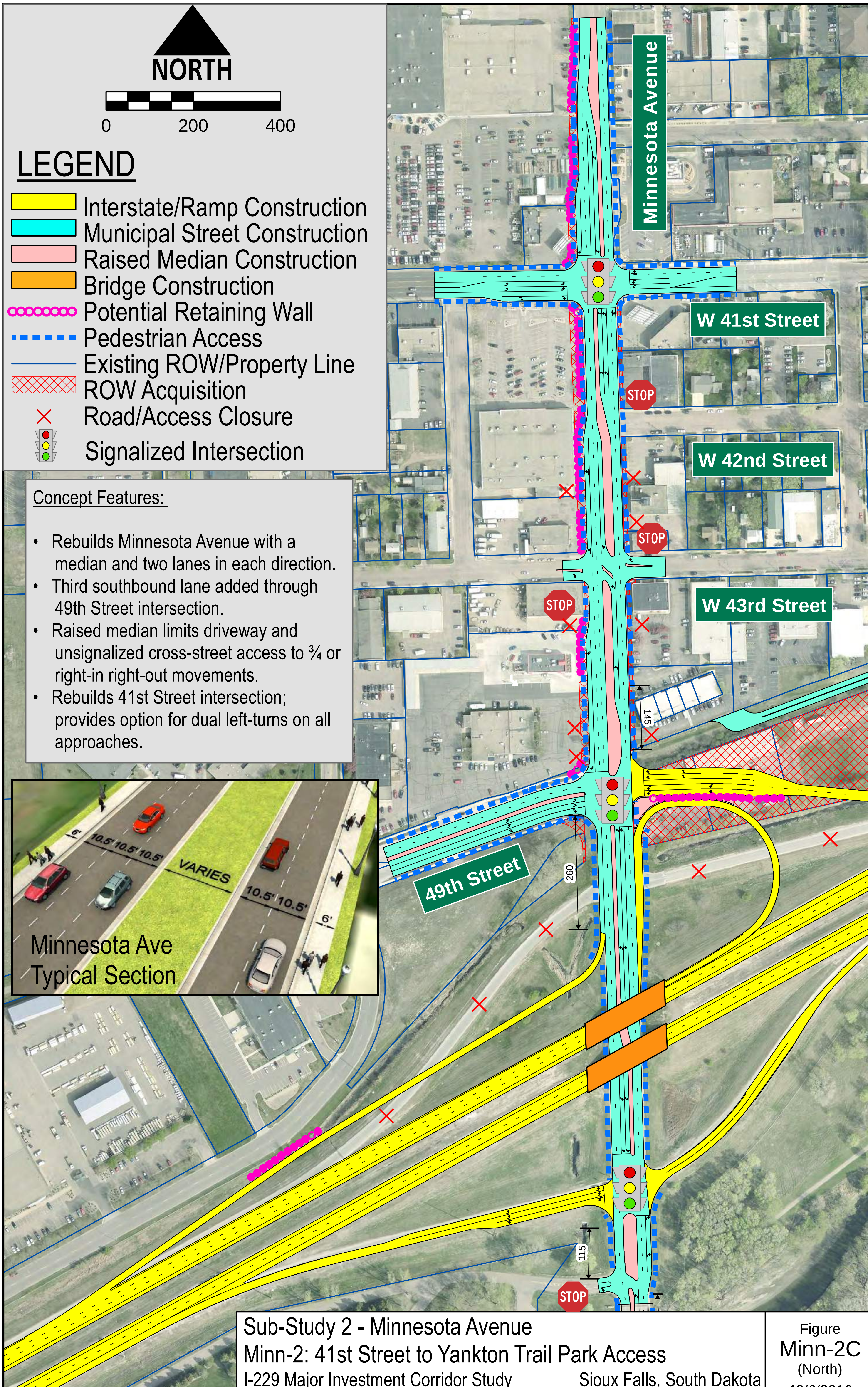
I-229 Major Investment Corridor Study

Sioux Falls, South Dakota

Figure

Minn-2C

12/6/2016

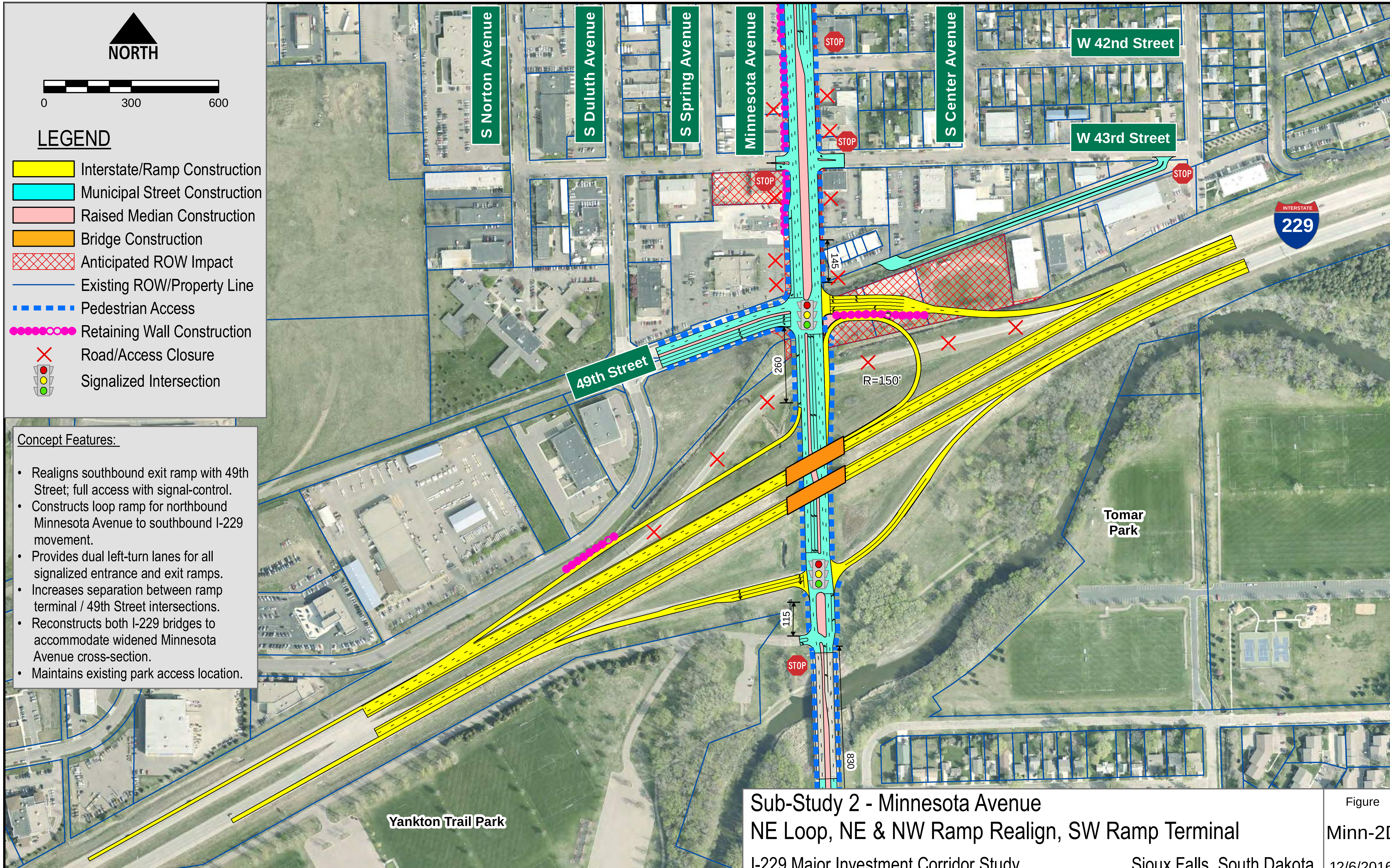


Concept Features:

- Rebuilds Minnesota Avenue with a median and two lanes in each direction.
- Third southbound lane added through 49th Street intersection.
- Raised median limits driveway and unsignalized cross-street access to ¾ or right-in right-out movements.
- Rebuilds 41st Street intersection; provides option for dual left-turns on all approaches.

Sub-Study 2 - Minnesota Avenue
Minn-2: 41st Street to Yankton Trail Park Access
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota

Figure
Minn-2C
(North)
12/6/2016



Concept Features:

- Realigns southbound exit ramp with 49th Street; full access with signal-control.
- Constructs loop ramp for northbound Minnesota Avenue to southbound I-229 movement.
- Provides dual left-turn lanes for all signalized entrance and exit ramps.
- Increases separation between ramp terminal / 49th Street intersections.
- Reconstructs both I-229 bridges to accommodate widened Minnesota Avenue cross-section.
- Maintains existing park access location.

Sub-Study 2 - Minnesota Avenue

NE Loop, NE & NW Ramp Realign, SW Ramp Terminal

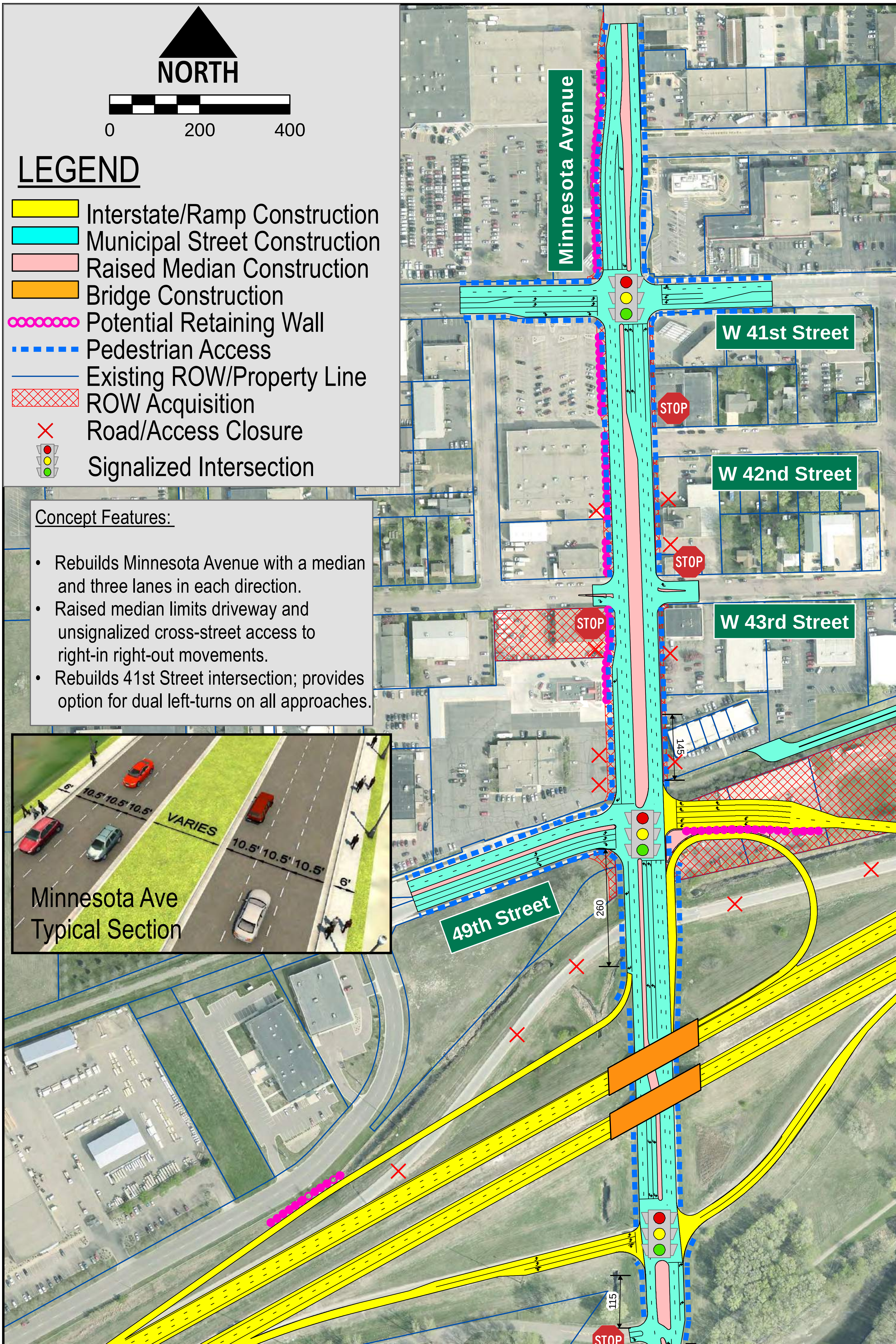
I-229 Major Investment Corridor Study

Sioux Falls, South Dakota

Figure

Minn-2D

12/6/2016



Concept Features:

- Rebuilds Minnesota Avenue with a median and three lanes in each direction.
- Raised median limits driveway and unsignalized cross-street access to right-in right-out movements.
- Rebuilds 41st Street intersection; provides option for dual left-turns on all approaches.

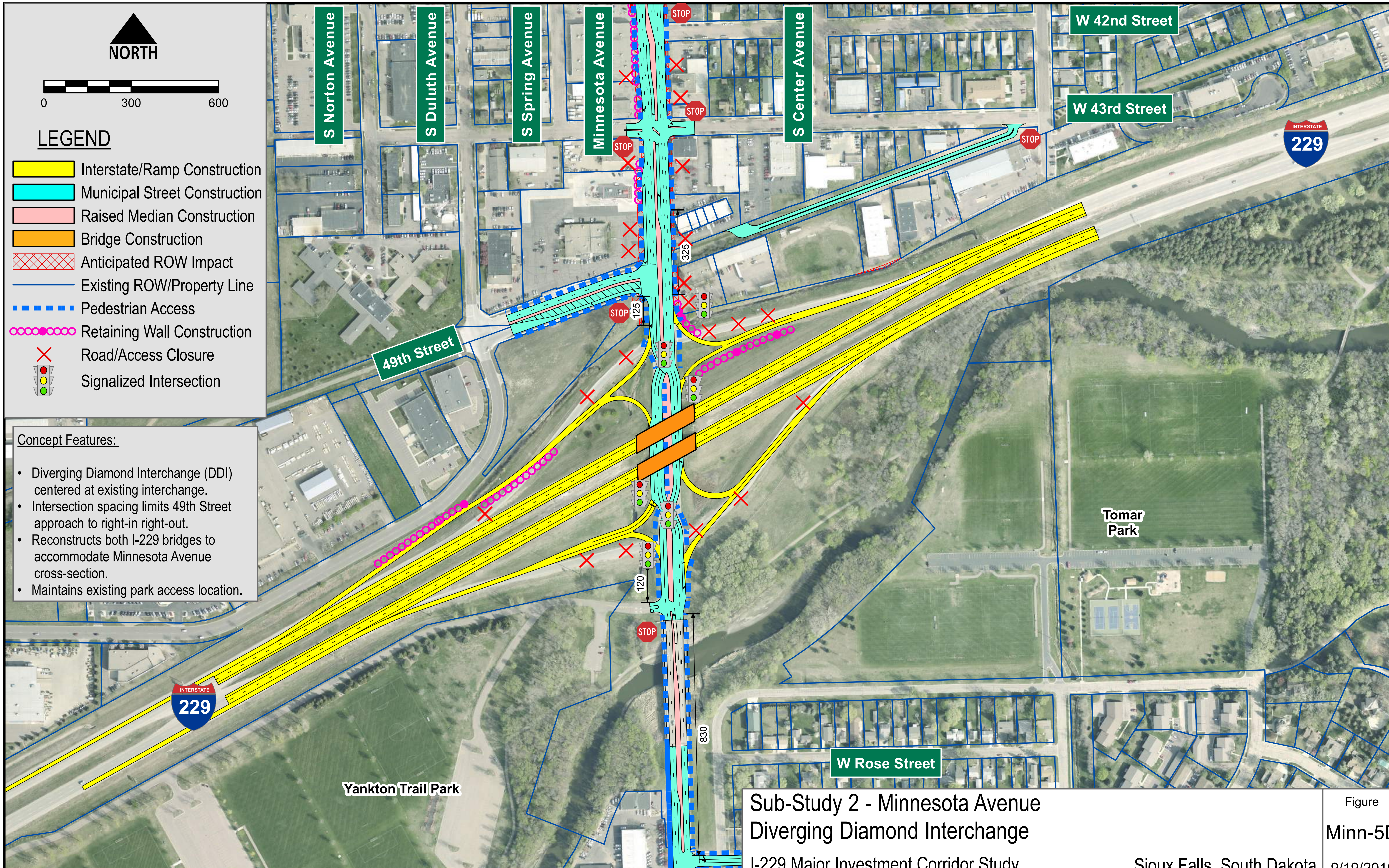
Sub-Study 2 - Minnesota Avenue

Minn-2: 41st Street to Yankton Trail Park Access

I-229 Major Investment Corridor Study | Sioux Falls, South Dakota

Figure Minn-2D (North)

12/6/2016

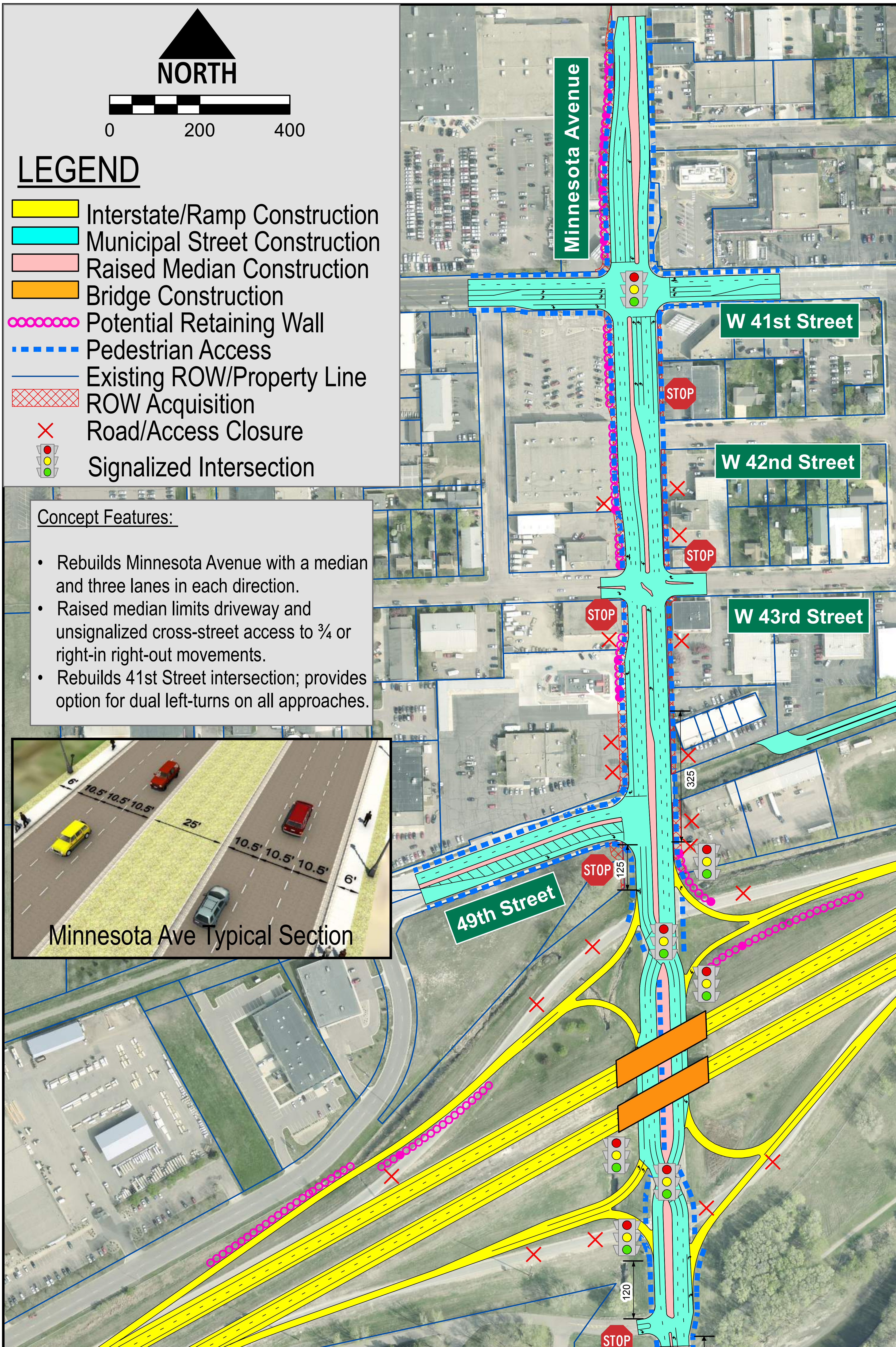


Sub-Study 2 - Minnesota Avenue
Diverging Diamond Interchange

I-229 Major Investment Corridor Study

Sioux Falls, South Dakota

Figure
Minn-5D
9/19/2016



Concept Features:

- Rebuilds Minnesota Avenue with a median and three lanes in each direction.
- Raised median limits driveway and unsignalized cross-street access to ¾ or right-in right-out movements.
- Rebuilds 41st Street intersection; provides option for dual left-turns on all approaches.

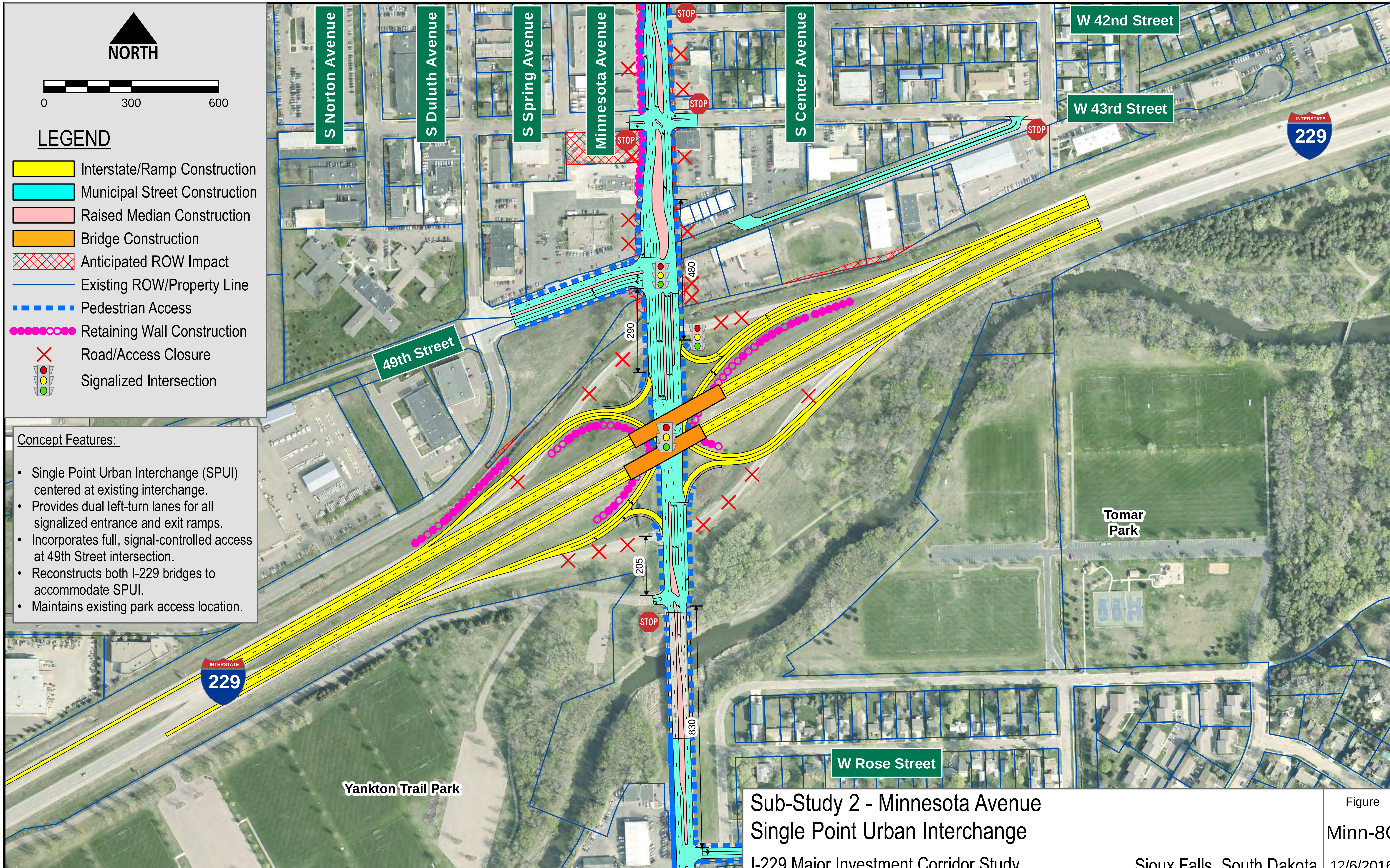
Sub-Study 2 - Minnesota Avenue

Minn-5: 41st Street to Yankton Trail Park Access

I-229 Major Investment Corridor Study — Sioux Falls, South Dakota

Figure Minn-5D (North)

9/19/2016

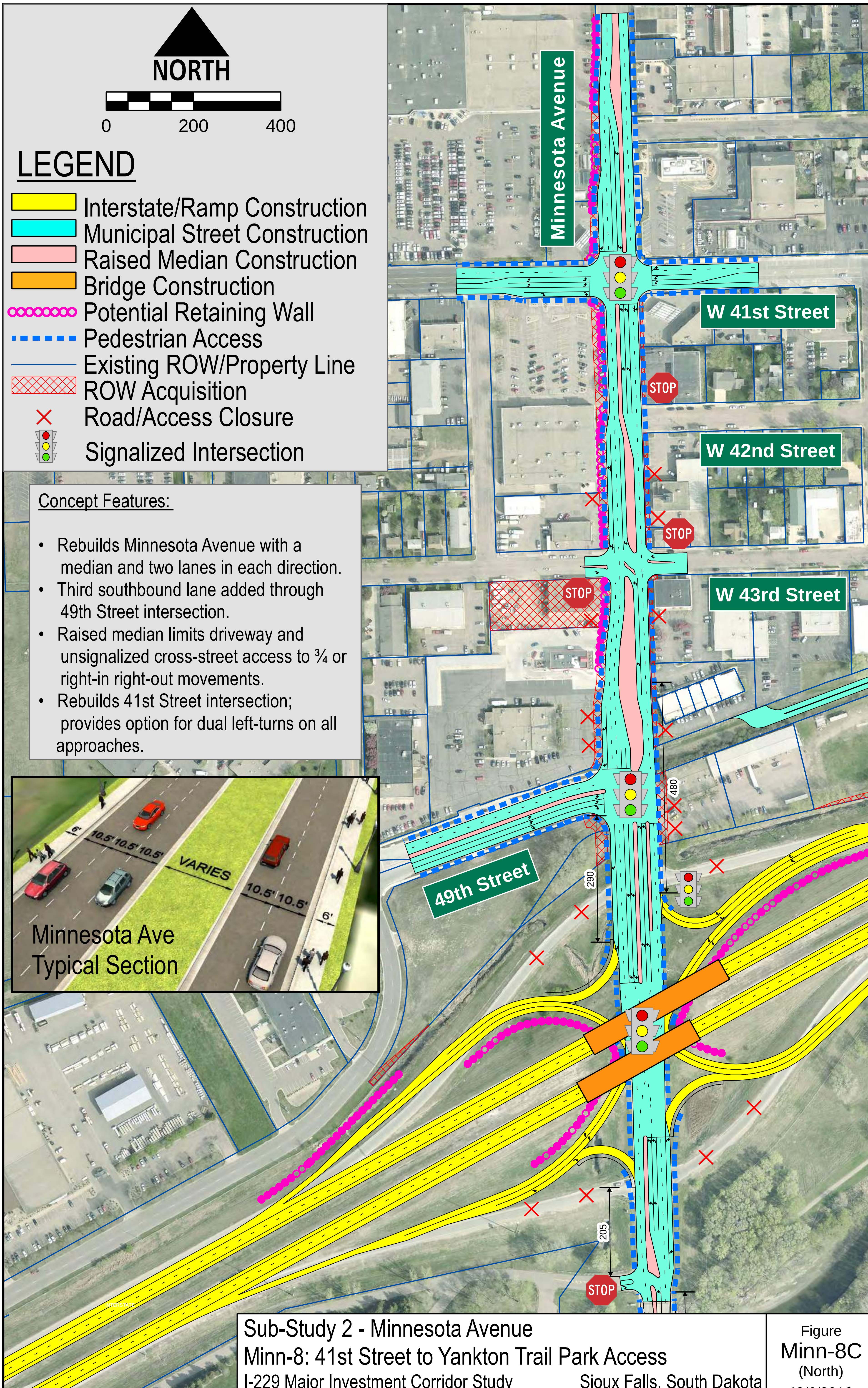


Sub-Study 2 - Minnesota Avenue
Single Point Urban Interchange

I-229 Major Investment Corridor Study

Sioux Falls, South Dakota

Figure
Minn-8C
12/6/2016



Concept Features:

- Rebuilds Minnesota Avenue with a median and two lanes in each direction.
- Third southbound lane added through 49th Street intersection.
- Raised median limits driveway and unsignalized cross-street access to ¾ or right-in right-out movements.
- Rebuilds 41st Street intersection; provides option for dual left-turns on all approaches.

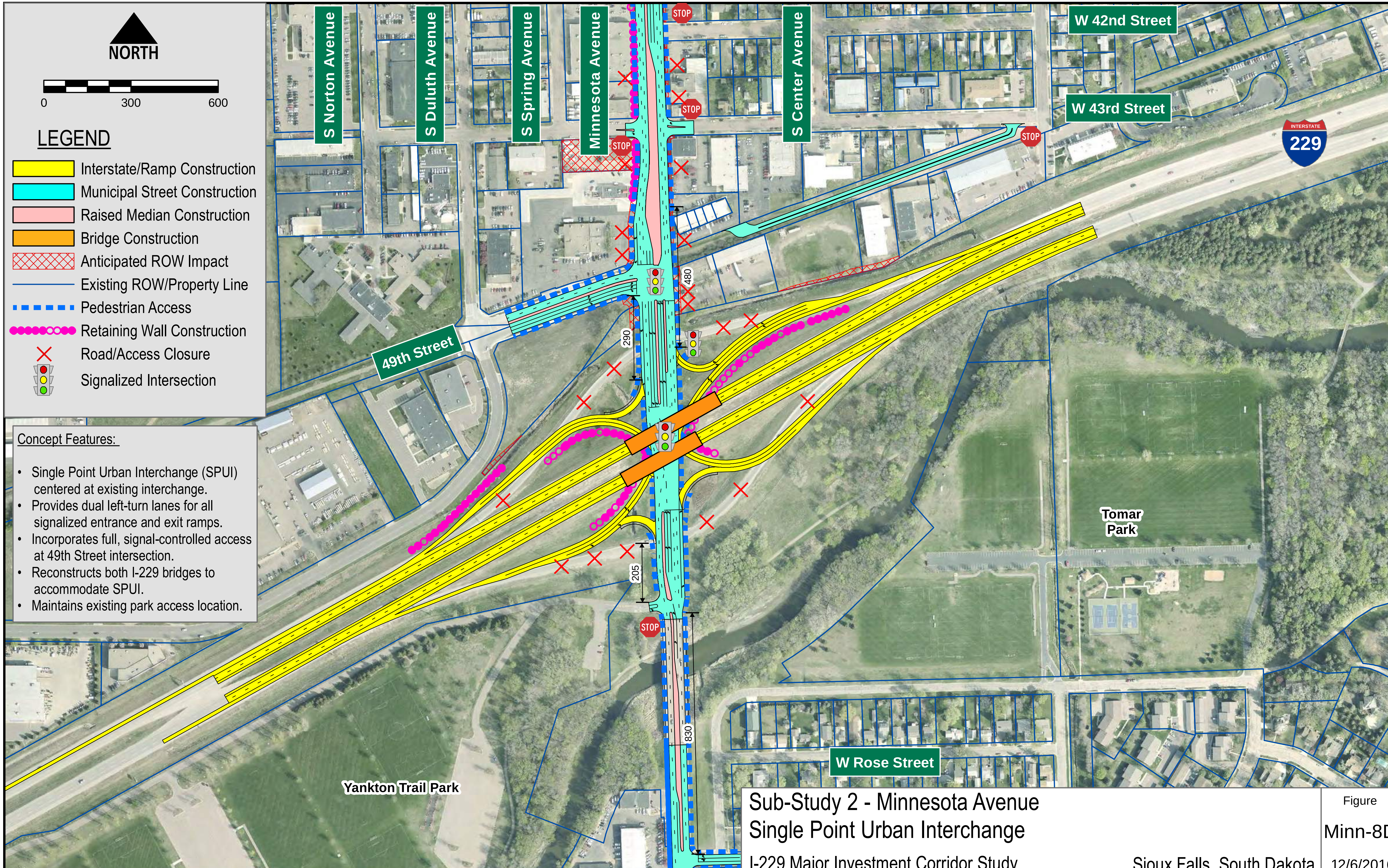
Sub-Study 2 - Minnesota Avenue

Minn-8: 41st Street to Yankton Trail Park Access

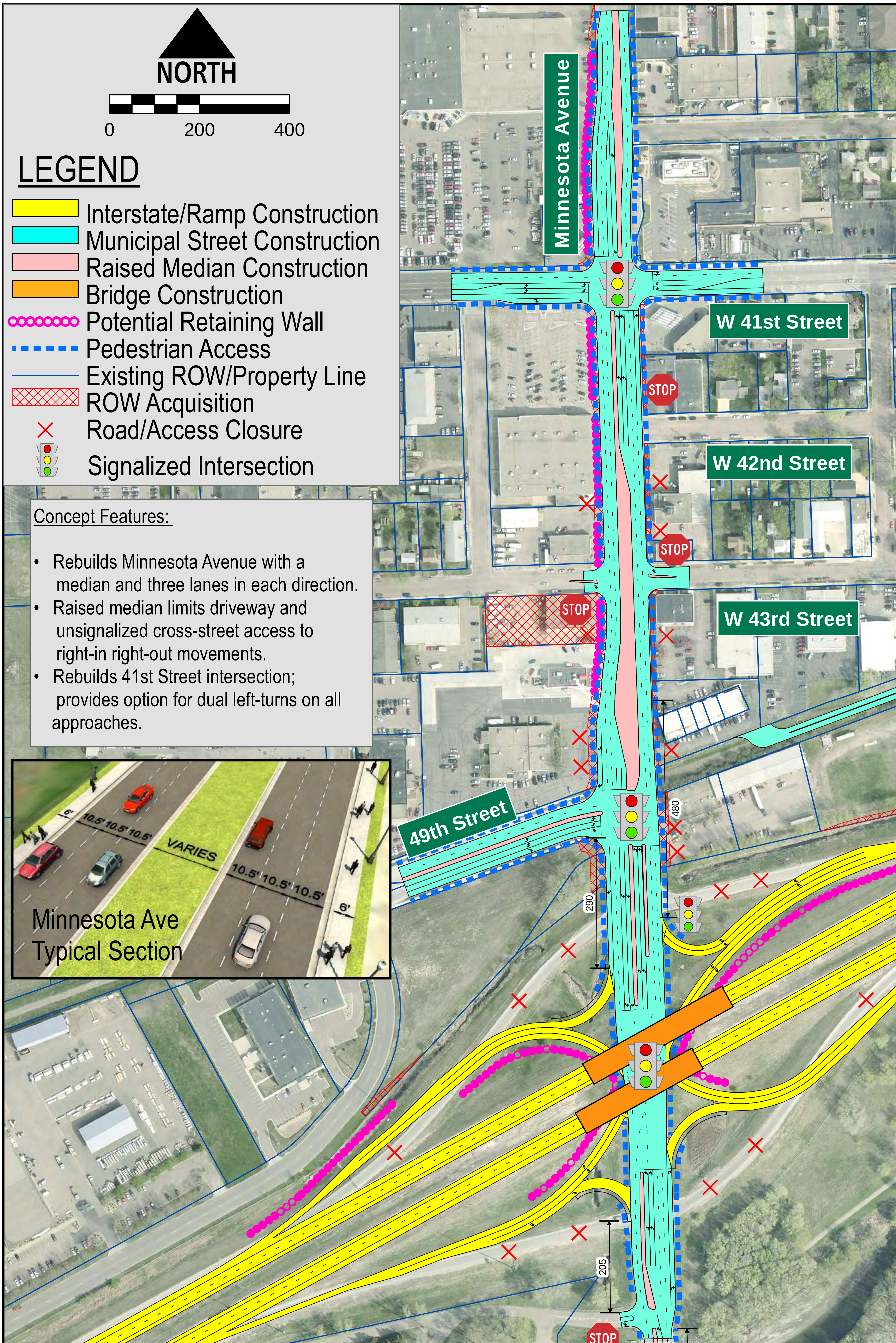
I-229 Major Investment Corridor Study — Sioux Falls, South Dakota

Figure Minn-8C (North)

12/6/2016



Sub-Study 2 - Minnesota Avenue
Single Point Urban Interchange
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Minn-8D
12/6/2016

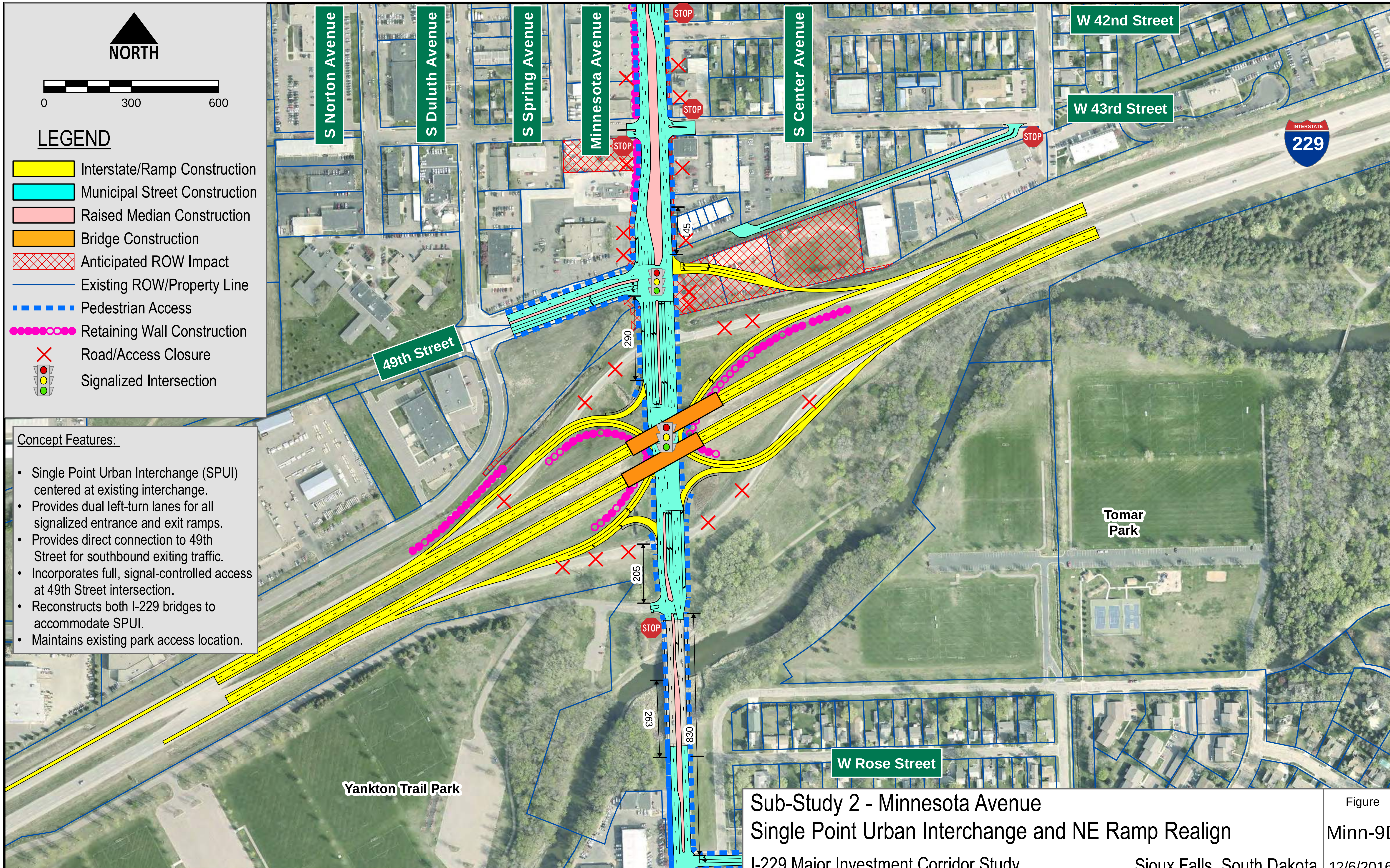


Sub-Study 2 - Minnesota Avenue

Minn-8: 41st Street to Yankton Trail Park Access

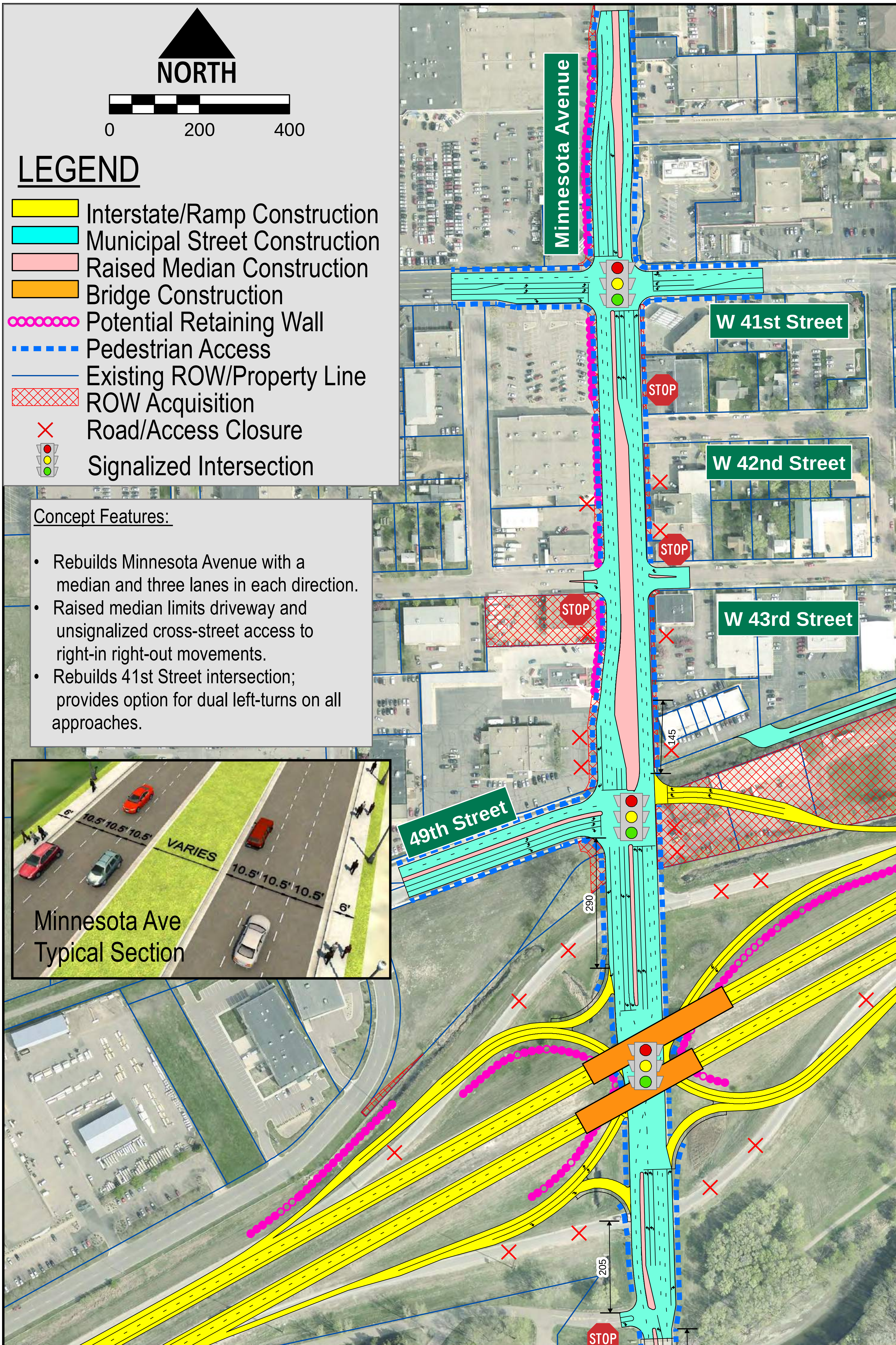
I-229 Major Investment Corridor Study | Sioux Falls, South Dakota

Figure Minn-8D (North) 12/6/2016



Sub-Study 2 - Minnesota Avenue
Single Point Urban Interchange and NE Ramp Realign
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota

Figure
Minn-9D
12/6/2016



Sub-Study 2 - Minnesota Avenue

Minn-9: 41st Street to Yankton Trail Park Access

I-229 Major Investment Corridor Study

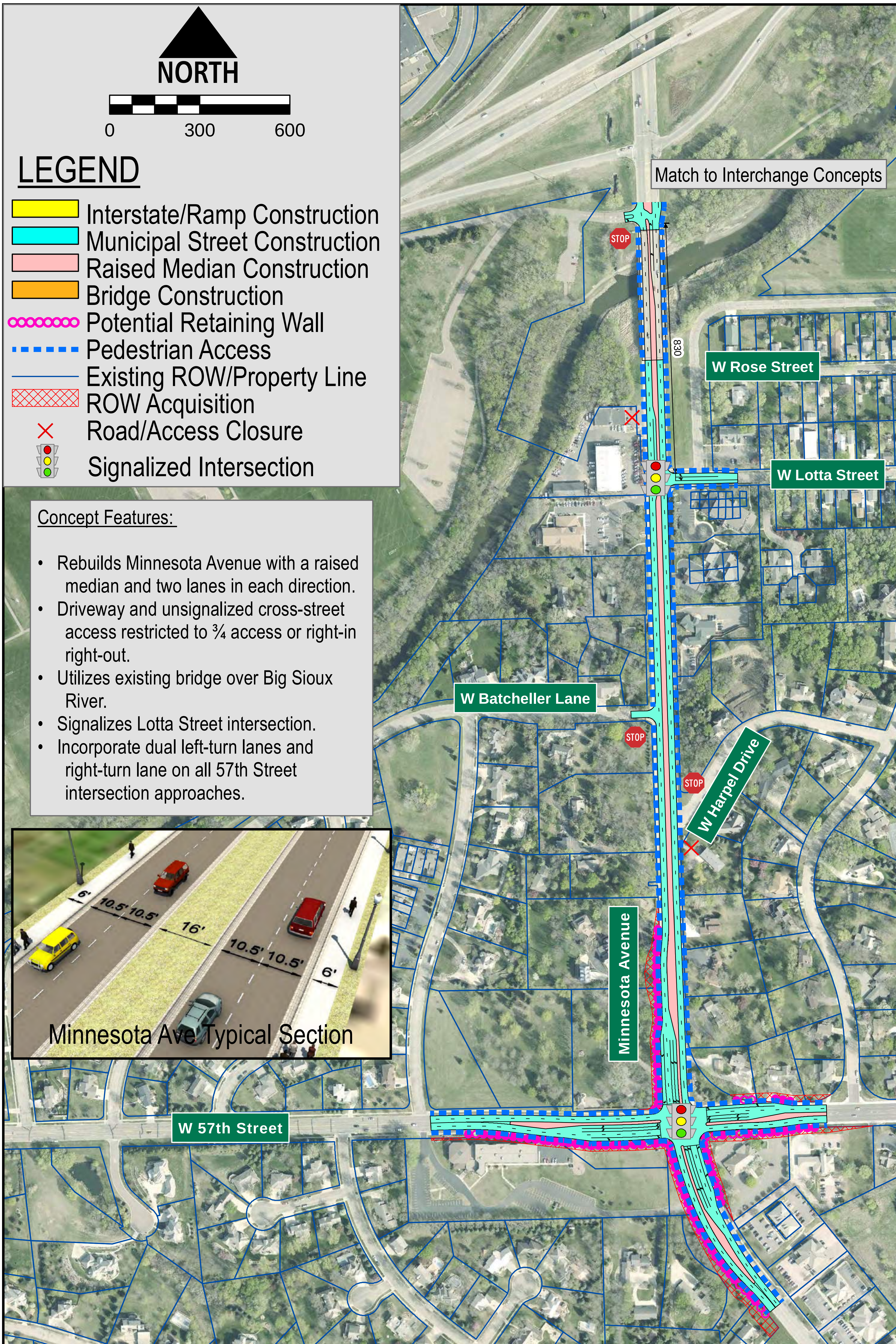
Sioux Falls, South Dakota

Figure

Minn-9D

(North)

12/6/2016



Concept Features:

- Rebuilds Minnesota Avenue with a raised median and two lanes in each direction.
- Driveway and unsignalized cross-street access restricted to ¾ access or right-in right-out.
- Utilizes existing bridge over Big Sioux River.
- Signalizes Lotta Street intersection.
- Incorporate dual left-turn lanes and right-turn lane on all 57th Street intersection approaches.

Sub-Study 2 - Minnesota Avenue
All Concepts: Park Access to 57th Street
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota

Figure
Minn-2/5/8/9
(South C/D)
12/6/2016

APPENDIX E -

PREDICTIVE SAFETY ANALYSIS TECH MEMO

Appendix E. Predictive Safety Analysis

This memorandum presents a summary of the methodology and findings for the predicted safety performance analysis for the Existing, No-Build and Build conditions for the I-229 MIS.

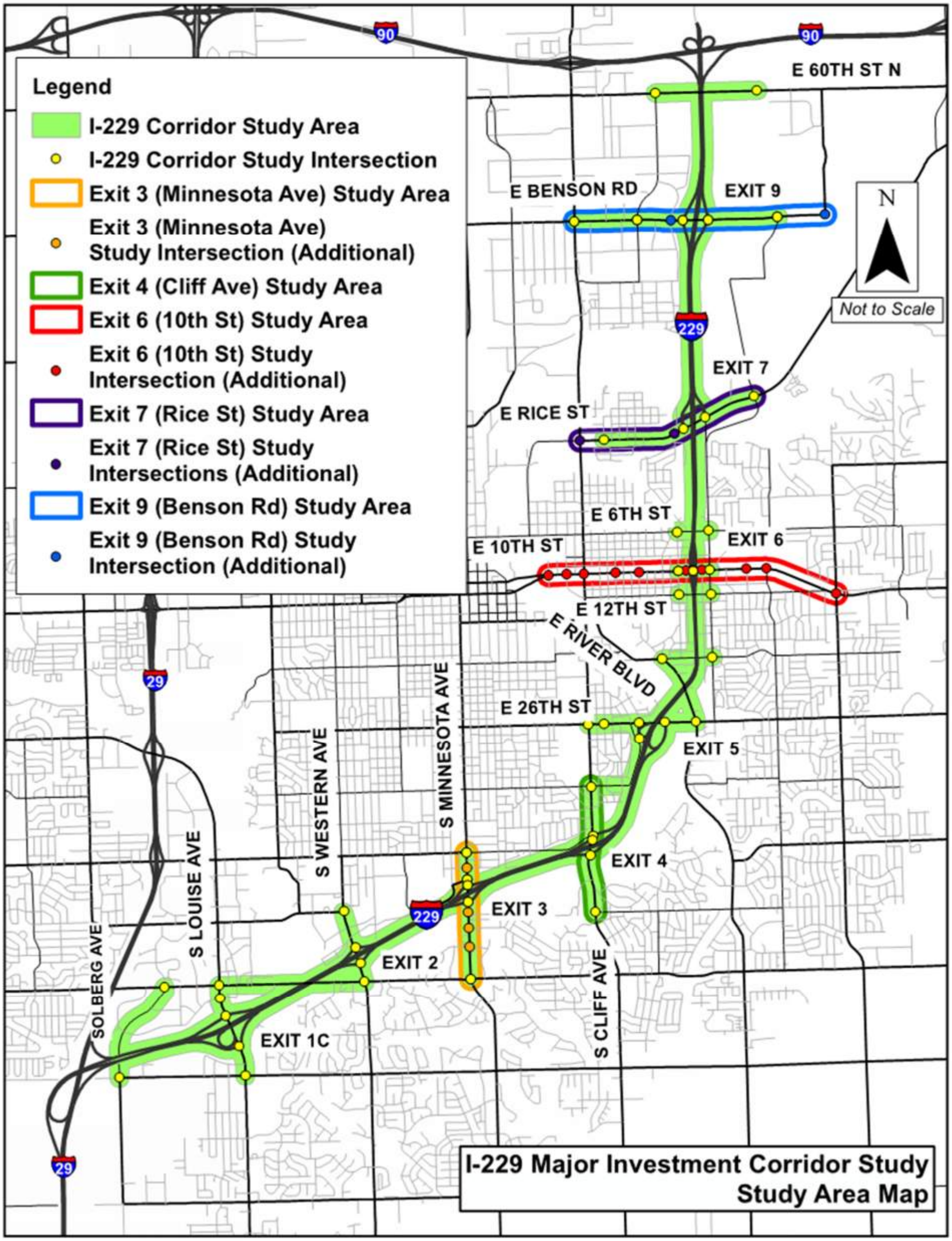
The I-229 MIS has been separated into individual sub-studies. The sub-studies include:

- I-229 Corridor Study
- Minnesota Avenue Corridor Study (Exit 3)
- 10th Street Corridor Study (Exit 6)
- Benson Road Corridor Study (Exit 9)
- Rice Street Corridor Study (Exit 7)
- Cliff Avenue Corridor Study (Exit 4)

A map illustrating the overall study areas for each of the sub-studies is shown in ***Figure 1***. The study limits for the predictive safety analysis differ slightly. In general, the predictive safety analysis limits for the I-229 Corridor Study are focused on the freeway area impacted by the corridor concepts (26th Street to 10th Street) and the remaining sub-studies focus on their respective ramps and ramp terminals. The analysis limits for each sub-study will be detailed later in this memorandum.

The predictive safety analysis presented in this memorandum is based on the principles and methods of the Highway Safety Manual (HSM) as discussed in detail below. It presents a comparative analysis of the predicted crashes anticipated between the Existing (Year 2012) condition and the Future No-Build (Year 2035) condition, as well as a comparative analysis between No-Build and Build alternatives for each sub-study. The Build alternatives to be analyzed for this study will be described later in this memorandum. The results are intended to help guide the selection of the alternatives moving forward to the alternatives analysis stage of planning.

Figure 1. I-229 MIS Study Area Map



Methodology

Predictive safety analysis was completed using the American Association of State Highway and Transportation Officials (AASHTO) HSM methods, including the National Cooperative Highway Research Program (NCHRP) Report 17-45 methods for evaluating freeways and interchanges (now part of the HSM as a supplemental volume published in 2014). FHWA supports, and in many cases now requires, the use of HSM methods for the evaluation of proposed freeway facility improvements, including new or modified Interstate access. According to the HSM preface:

“The focus of the HSM is to provide quantitative information for decision making. The HSM assembles currently available information and methodologies on measuring, estimating, and evaluating roadways in terms of crash frequency (number of crashes per year) and crash severity (level of injures due to crashes). The HSM presents tools and methodologies for consideration of ‘safety’ across the range of highway activities …”

The HSM goes on to describe a primary benefit of the predictive method, “The predictive method provides a quantitative measure of expected crash frequency under both existing conditions and conditions which have not yet occurred. This allows proposed roadway conditions to be quantitatively assessed …” (HSM, 2010)

HSM-based crash predictions are developed using safety performance functions (SPFs) for specific facility types. The SPFs predict crash frequency for a variety of freeway types with direct consideration of factors of crash risk exposure (e.g. daily traffic volumes and segment lengths). However, crash prediction by SPF alone is limited to facilities with geometric and traffic control features that match a theoretical base condition for that facility type. To overcome this limitation to SPF applicability, crash modification factors (CMFs) are used to make adjustments to the initial SPF results to account for differences between the actual geometric and traffic control conditions and the theoretical base condition. CMFs are multiplicative factors. Thus, if a CMF greater than 1 is combined with an SPF the resulting number of predicted crashes will increase over the original SPF-based crash prediction. Conversely, a CMF less than 1 it will decrease the number of predicted crashes. For example, if an outside shoulder width is less than the assumed 10-foot base condition, then a CMF of greater than 1 is applied to adjust the SPF results for the segment.

The HSM methodology has been in development for many years and is rapidly advancing; however, there are still many limitations where the available tools do not yet offer SPFs and/or CMFs for certain conditions. Where this is the case, recent research and crash data were also considered to overcome analysis limitations. Crash prediction methods beyond the scope of the HSM that were deemed necessary for the I-229 MIS study were agreed upon in the project Methods and Assumptions document and are described later in this section.

Facilities, Segmentation and Data Inputs

The HSM allows for crash prediction to be conducted at the project level or site-specific level. A site-specific analysis parses the project study area into individual homogenous elements, such as, freeway segments, ramp segments, and ramp terminal intersections. The I-229 MIS crash prediction area was segmented into 38 mainline freeway segments, 24 ramp segments, 11 ramp terminal intersections, and 4 arterial intersections. The segmentation will be provided as a digital appendix.

Crash prediction requires geometric and operational inputs to accurately compute the SPFs and apply the correct CMFs. These inputs include information such as segment length, daily traffic volume, ramp locations, merge distances, and horizontal curvature. The geometric inputs were primarily obtained from the conceptual design files and aerial photography. The traffic volume data was based on traffic counts provided by SDDOT and design year volume forecasts from the 2035 Sioux Falls Travel Demand Model.

I-229 Mainline Segments, Entrance and Exit Ramps, and Ramp Terminals

The I-229 mainline segments, entrance and exit ramps, and ramp terminals were evaluated using HSM methods implemented using the Enhanced Interchange Safety Analysis Tools (ISATe) version j software provided by FHWA. The ISATe analysis files are provided as a digital appendix for all freeway, ramp, and ramp terminal intersection sites that were reviewed.

The ISATe does have limitations however. Specifically, the ISATe ramp terminal method does not address Single-Point Urban Interchanges (SPUIs) or Diverging Diamond Interchanges (DDIs). It only predicts crashes for a variety of more typical diamond and partial cloverleaf interchange ramp terminals. Therefore, it was necessary to develop an estimate for an "operationally-similar" diamond interchange design and then use CMFs from HDR's "Crash Prediction Analysis Procedures for Diverging Diamond Interchange (DDI), Single-Point Urban Interchange (SPUI), and Two-Lane Loop Ramp" memo dated November 4th, 2015 to modify the results to estimate the predictions for a SPUI and DDI design. Based on available SDDOT data, the preliminary CMF for conversion of a traditional diamond interchange to a SPUI is 0.63 for ramp terminal intersection crashes. Based on research done in Missouri on safety evaluations of DDIs, the preliminary CMF for conversion of a traditional diamond interchange to a DDI is 0.37 for Fatal + Injury (F+I) crashes at ramp terminal intersections and 0.49 for Property Damage Only (PDO) crashes at ramp terminal intersections.

Cross Street Segments

Crashes within an interchange's functional area can be almost entirely predicted by evaluating the crashes from the freeway, freeway ramps, and ramp terminal intersections. However, some crashes near the interchange may be due to roadway segment characteristics of the arterial cross street. If these segment-related crashes are to be included, then HSM methods for urban and suburban arterials need to be applied. In this study, the primary area for crash prediction evaluation was focused on the interchange, and no arterial segment crashes were evaluated between scenarios.

Arterial Intersections

Some arterial intersections were included when the sub-study concepts involved realigning ramps to arterial intersections. Therefore, to make a fair comparison, the predictive safety analysis included the impacted arterial intersection for all sub-study concepts, including

No-Build. Methods from Chapter 12 of the HSM were used for analyzing arterial intersections. The analysis files for the 4 arterial intersections analyzed are provided as a digital appendix.

Calibration Factors

According to the HSM, “the predictive models were developed from the most complete and consistent data sets available.” However, the report also recommends that the equations be calibrated for each jurisdiction because “the general level of crash frequencies may vary substantially from one jurisdiction to another.” However, SDDOT has not yet conducted the extensive analyses required to develop a complete set of HSM related calibration factors. Therefore, using the national HSM equations is proposed as the best approach for this current analysis.

Empirical Bayes Approach: Considering Historical Crash Data

The HSM method includes an optional step called the Empirical Bayes (EB) approach, which combines “the estimate from a predictive model with observed crash data to obtain a more reliable estimate of the expected average crash frequency.” (HSM, 2010) Essentially, the historical crash data is used to adjust the future crash prediction. Typically, the EB method is only used when it can be applied equally to all of the alternatives under consideration. Thus the improvements being considered must be moderate, so that the historical crash data is reasonable to consider for the conditions being compared. When major alignment or traffic control changes are proposed (such as the proposed SPUI’s or DDI’s), it is not used because “there is typically a small difference in the results obtained from the predictive method when it is used with and without the EB Method.” Therefore, “if the EB Method is not applied consistently, such differences will likely introduce a small bias in the comparison of expected crash frequency among alternatives.” (HSM Supplement, 2014) Therefore, the results are presented with the EB method adjustment when comparing Existing to No-Build conditions and without the EB method adjustment when comparing No-Build to the Build alternatives.

Planning Horizon Cost Savings

Planning horizon cost savings were calculated for the Build alternatives. The planning horizon cost savings is the discounted, monetized safety benefit from the crashes reduced by a scenario (compared to a baseline of No-Build) totaled for all years in the period 2012-2035. This shows how much money is saved (or loss) from a safety standpoint for each alternative.

Analysis Results

The predicted number of crashes were compared for the Existing (Year 2012) and No-Build (Year 2035) conditions to see the effect on safety of the unimproved I-229 corridor with increased traffic volumes. This comparison of Existing and No-Build conditions comprises the entire crash prediction area for all six sub-studies, allowing adjacent interchanges to be compared for differences in predicted future crash frequency.

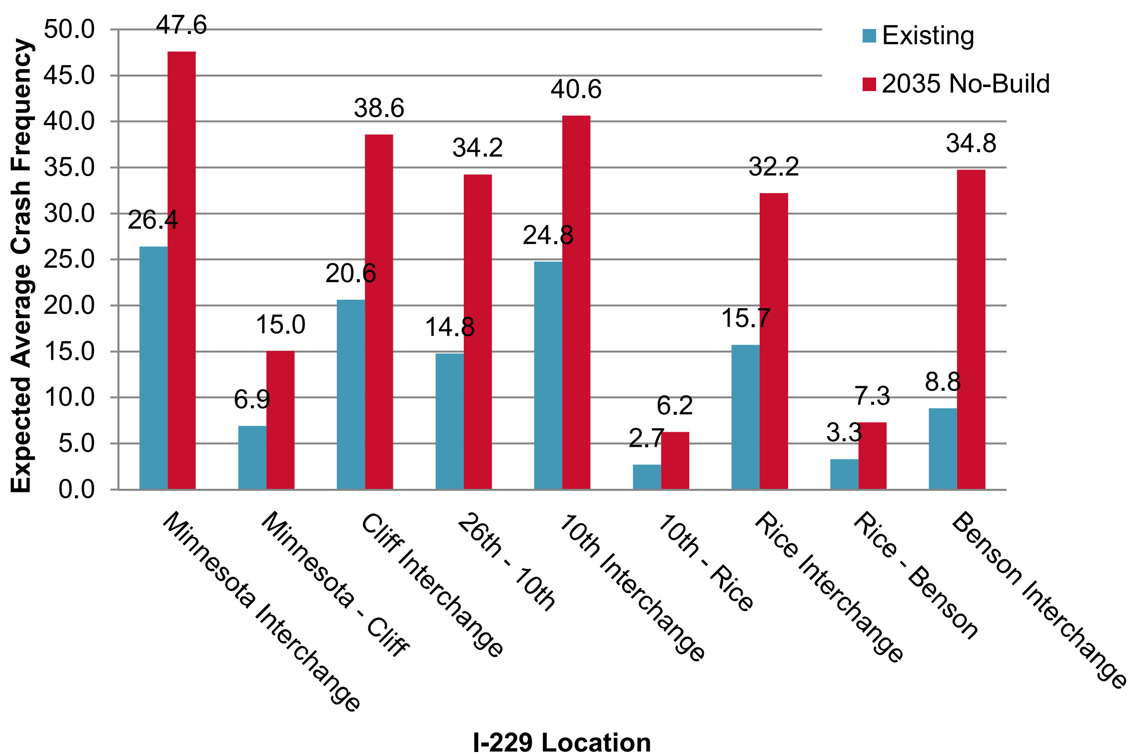
In a similar fashion, Build alternatives for each sub-study were evaluated and the predicted number of crashes was established for the 2012 to 2035 analysis period. The Build alternative crash predictions were then compared to the No-Build crash prediction for subject interchange. Hence, the results of the crash predictions for Build alternatives are presented by sub-study.

Existing vs. No-Build

The first stage of the crash prediction analysis was to compare the safety impact of anticipated traffic volume growth over the study horizon. The predicted annual crash frequencies for the Existing (Year 2012) and No-Build (Year 2035) conditions are presented in ***Table 1***. For the comparison of the Existing and No-Build conditions, historical crash data was applied using the EB method adjustment.

As expected, crashes predicted for each location along I-229 increase because of the increase in traffic volume. Notably, the I-229 interchange areas experience higher levels of existing crashes than the connecting freeway segments. By 2035, those interchange areas all have nearly doubled in annual crashes. Particularly, the Benson Road interchange shows the highest increase in annual predicted crashes at 26 additional crashes per year.

Table 1: Expected Average Crash Frequency – Existing vs. 2035 No-Build



No-Build vs. Build Alternatives

I-229 Corridor Study

STUDY AREA

The ISATe analysis limits for the I-229 Corridor Study focus on the I-229 freeway portion from 26th Street to 10th Street. The analysis limits for the I-229 Corridor Study are shown in ***Figure 2***.

Figure 2: I-229 Corridor ISATe Analysis Limits

Source: Google Earth, December 2016

ALTERNATIVES

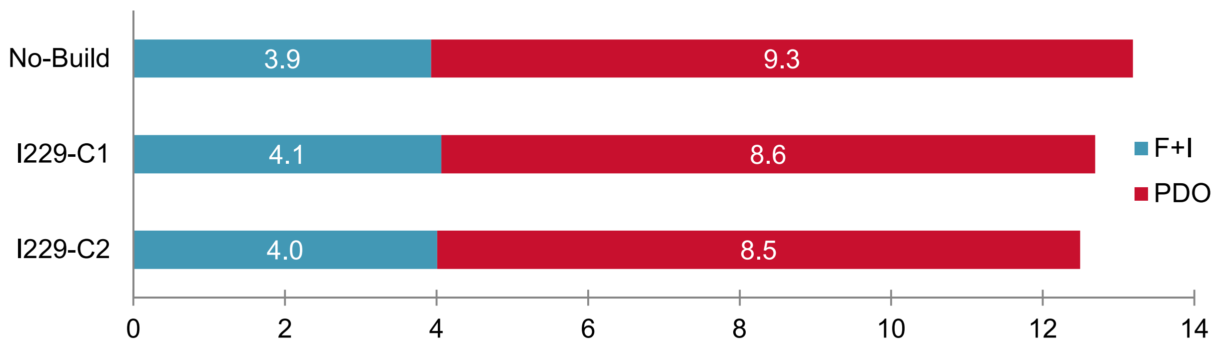
The alternatives to be analyzed for the I-229 Corridor Study are:

- I229-NB
    - No-Build
- I229-C1
    - 6-Lanes, From 26th St to 10th St
- I229-C2
    - 6-Lanes, From 26th St to 10th St
    - 65 MPH Improved Horizontal Curves

BUILD AND NO-BUILD CRASH FREQUENCY COMPARISON

The predicted annual crash frequencies for the No-Build and Build alternatives (2012 to 2035) are presented in ***Table 2*** along with the breakdown of Fatal + Injury (F+I) and Property Damage Only (PDO) crashes.

Table 2: I-229 Corridor 2012-2035 Predicted Build and No-Build Annual Crashes



The resulting total number of annual predicted crashes is slightly lower for both Build alternatives The Build alternatives result in a 4-5% decrease in total crashes and a 7-8% decrease in PDO crashes, but a 2-3% increase in F+I crashes. The cost for an F+I crash is high so this results in a negative cost savings, which is shown below in ***Table 3***.

Planning horizon crash cost savings were calculated for the Build alternatives and are shown in ***Table 3***.

Table 3: I-229 Corridor Planning Horizon Crash Cost Savings

Alternative	Total User Cost[1]	User Cost Savings[2]
No-Build	$ 24,600,000	$ -
I229-C1	$ 25,200,000	$ (600,000)
I229-C2	$ 24,900,000	$ (300,000)

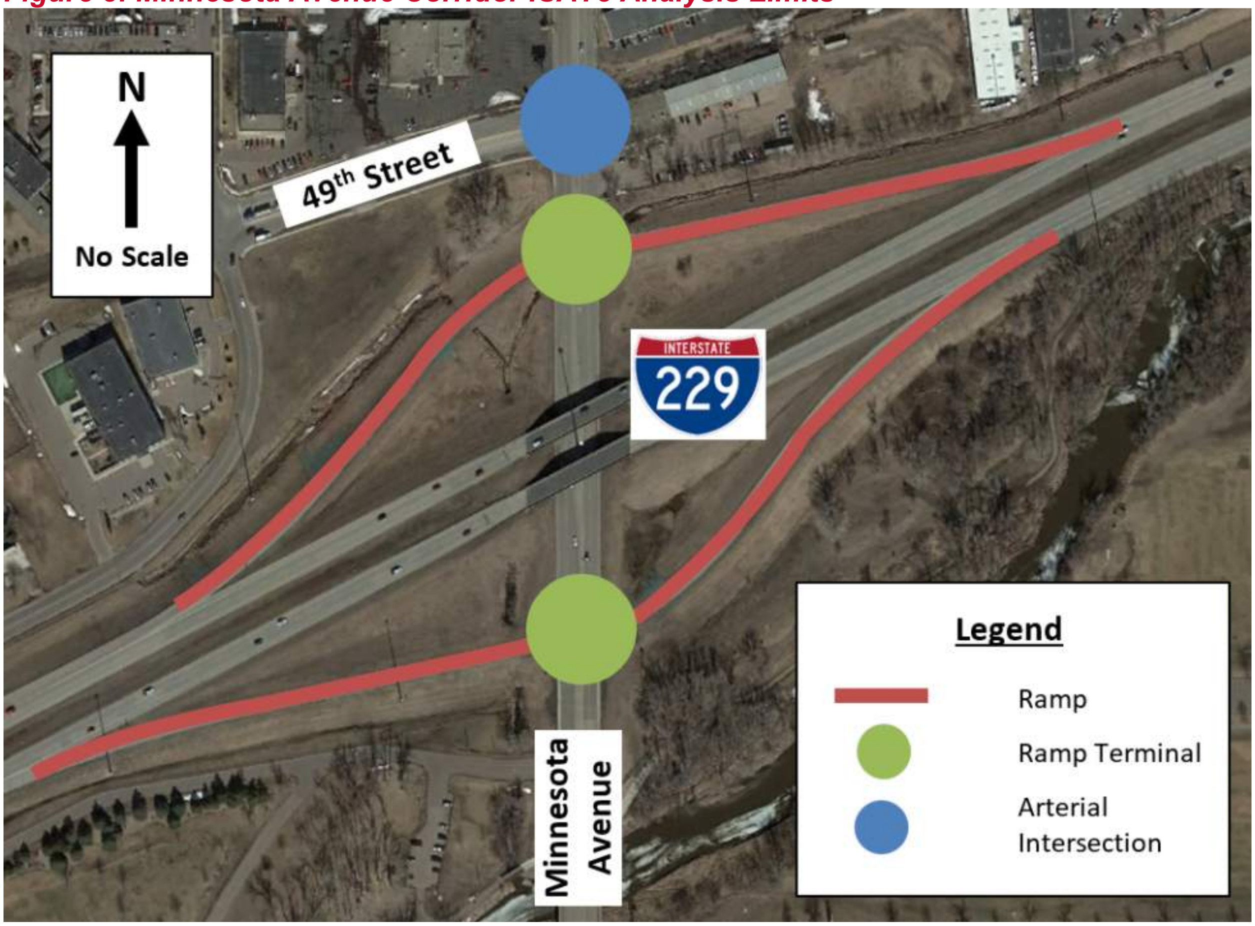
[1]Total User Cost – The discounted, monetized safety benefit from the crashes totaled for all years in the period 2012-2035 (rounded to $100,000).
[2]User Cost Savings - The discounted, monetized safety benefit from the crashes reduced by a scenario (compared to a baseline of No-Build) totaled for all years in the period 2012-2035 (rounded to $100,000).

Minnesota Avenue Corridor Study

STUDY AREA

The ISATe analysis limits for the Minnesota Avenue Corridor Study focus on the I-229 ramps, the ramp terminals, and the arterial intersection of Minnesota Avenue and 49th Street. The arterial intersection was included in the analysis because some of the Build alternatives involve realigning the I-229 westbound off-ramp to 49th Street. The analysis limits for the Minnesota Avenue Corridor Study are shown in ***Figure 3***.

Figure 3: Minnesota Avenue Corridor ISATe Analysis Limits



Source: Google Earth, December 2016

ALTERNATIVES

The alternatives to be analyzed for the Minnesota Avenue Corridor Study are:

- Minn-NB
  - No-Build Interchange Configuration and Corridor Configuration
- Minn-2C
  - Realigns SB exit ramp with 49th Street; full access with signal-control.
  - Constructs loop ramp for NB Minnesota Ave to SB I-229.
  - Provides dual left-turn lanes for all signalized entrance and exit ramps.

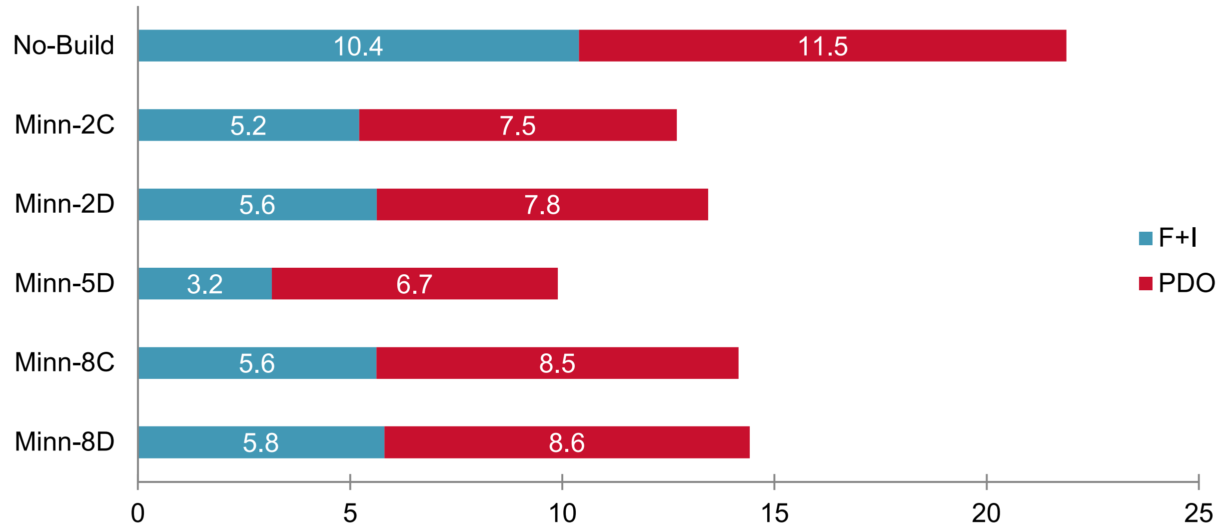
    - Increases separation between ramp terminal / 49th Street intersections.
    - Rebuilds Minnesota Avenue with a median and two lanes in each direction.
    - Third southbound lane added through 49th Street intersection.
- Minn-2D
    - Same as Minn-2C except rebuilds Minnesota Avenue with a median and three lanes in each direction.
- Minn-5D
    - Replaces Diamond Interchange with Diverging Diamond Interchange (DDI) configuration.
- Minn-8C
    - Replaces Diamond Interchange with Single Point Urban Interchange (SPUI) centered at existing interchange.
    - Provides dual-left turn lanes for all signalized entrance and exit ramps.
    - Incorporates full, signal-controlled access at 49th Street intersection.
    - Rebuilds Minnesota Avenue with a median and two lanes in each direction.
    - Third southbound lane added through 49th Street intersection.
- Minn-8D
    - Same as Minn-8C except rebuilds Minnesota Avenue with a median and three lanes in each direction.
- Minn-9D (Qualitative Analysis Only)
    - Same as Minn-8D except SB I-229 through and right-turn movements are provided direct connection to 49th Street.

BUILD AND NO-BUILD CRASH FREQUENCY COMPARISON

The predicted annual crash frequencies for the No-Build and Build alternatives (2012 to 2035) are presented in ***Table 4*** along with the breakdown of Fatal + Injury (F+I) and Property Damage Only (PDO) crashes.

The resulting total number of annual predicted crashes is lower for all the Build alternatives when compared to No-Build, with the DDI alternative expecting the least amount of crashes. The alternatives result in a 34-55% decrease in total crashes, with a 44-70% decrease in F+I crashes and 26-41% decrease in PDO crashes. Minn-9D is an alternative that was originally screened out prior to the concept refinement stage. As concept refinement progressed, Minn-9D was reconsidered and reinstated as a Build alternative. Shortly following the reinstatement of Minn-9D, the overall I-229 MIS entered into the final reporting stage of the project. The project team determined that a full crash prediction analysis of Minn-9D would not provide additional value to study recommendations. The project team's qualitative assessment of Minn-9D is that the concept would likely result in slightly fewer predicted crashes than Minn-8C and Minn-8D. That qualitative assessment is based on quantitative evaluation of very similar concepts at the Cliff Avenue interchange (Cliff-6 and Cliff-7).

Table 4: Minnesota Ave Corridor 2012-2035 Predicted Build and No-Build Annual Crashes



Planning horizon crash cost savings were calculated for the Build alternatives and are shown in ***Table 5***.

Table 5: Minnesota Avenue Corridor Planning Horizon Crash Cost Savings

Alternative	Total User Cost[1]	User Cost Savings[2]
No-Build	$ 64,600,000	$ -
Minn-2C	$ 32,000,000	$ 32,600,000
Minn-2D	$ 34,400,000	$ 30,100,000
Minn-5D	$ 20,000,000	$ 44,600,000
Minn-8C	$ 34,500,000	$ 30,100,000
Minn-8D	$ 35,600,000	$ 29,000,000

[1]Total User Cost – The discounted, monetized safety benefit from the crashes totaled for all years in the period 2012-2035 (rounded to $100,000).
[2]User Cost Savings - The discounted, monetized safety benefit from the crashes reduced by a scenario (compared to a baseline of No-Build) totaled for all years in the period 2012-2035 (rounded to $100,000).

10th Street Corridor Study

STUDY AREA

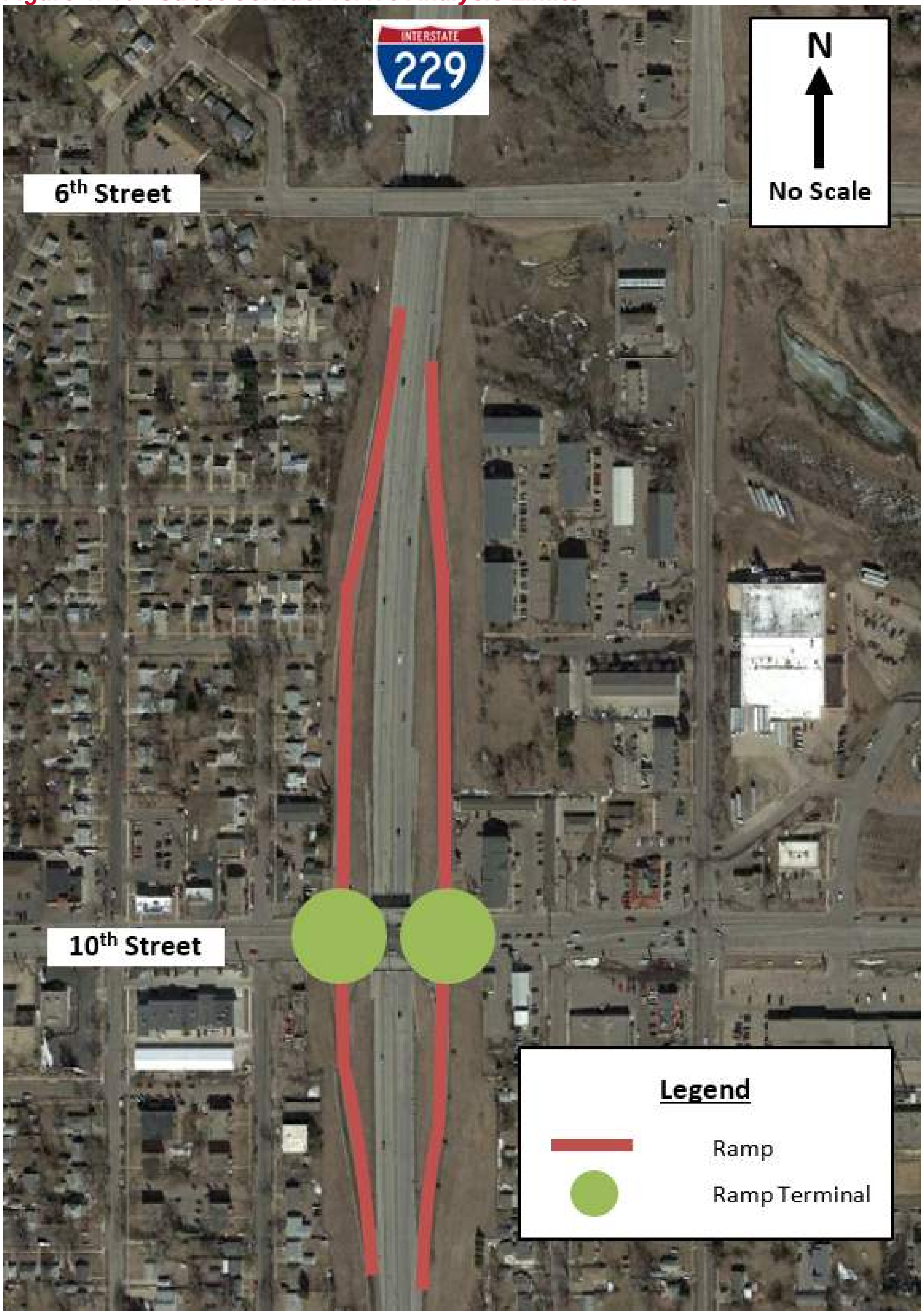
The ISATe analysis limits for the 10th Street Corridor Study focus on the I-229 ramps and the ramp terminals. For the Tight Split Diamond alternative, the proposed 6th Street ramp terminals were also included in the analysis. Because they are new intersections, no arterial intersection was included for the other alternatives. The analysis limits for the 10th Street Corridor Study are shown in ***Figure 4***.

ALTERNATIVES

The alternatives to be analyzed for the 10th Street Corridor Study are:

- 10th-NB
    - No-Build Interchange Configuration and Corridor Configuration

Figure 4: 10th Street Corridor ISATe Analysis Limits



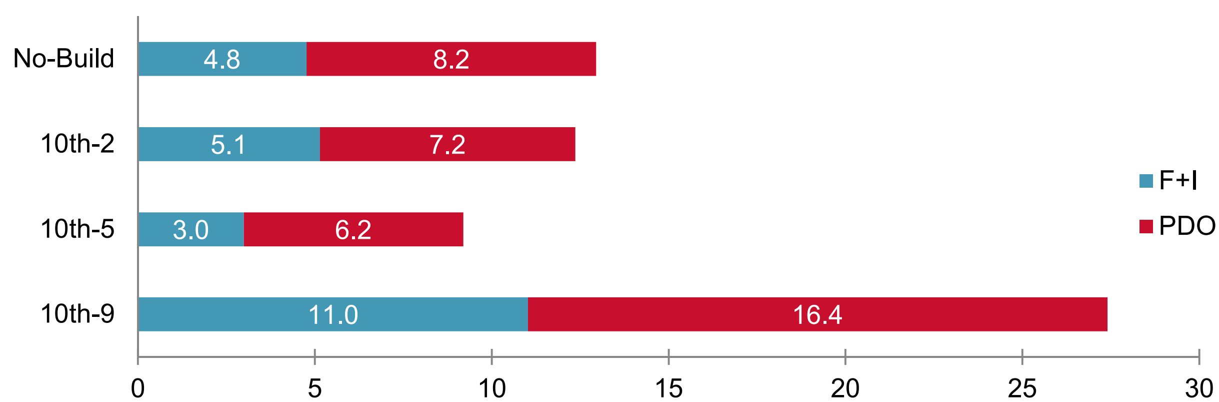
Source: Google Earth, December 2016

- 10th-2
  - Perpetuates Single Point Urban Interchange (SPUI) configuration.
  - Provides dual left-turn lanes for all entrance and exit ramps.
  - Rebuilds 10th Street with a median and three lanes in each direction through the interchange.
- 10th-5
  - Replaces Single Point Urban Interchange (SPUI) configuration with Diverging Diamond Interchange (DDI) configuration.
  - Eliminates left-turn movements on 10th Street by crossing 10th Street traffic to the left side between the ramp terminal intersections.
  - Rebuilds 10th Street with a median and three lanes in each direction through the interchange.
- 10th-9
  - Replaces Single Point Urban Interchange (SPUI) configuration with Tight Split Diamond Interchange (TSD) configuration with I-229 ramp connections to both 10th Street and 6th Street.
  - Provides dual left-turn lanes for all entrance and exit ramps except the NB entrance ramp.
  - Adds traffic signals at new ramp intersections with 6th Street.
- 10th-Var (Qualitative Analysis Only)
  - Unconstrained SB Entrance & NB Exit Ramps

BUILD AND NO-BUILD CRASH FREQUENCY COMPARISON

The predicted annual crash frequencies for the No-Build and Build alternatives (2012 to 2035) are presented in ***Table 6*** along with the breakdown of Fatal + Injury (F+I) and Property Damage Only (PDO) crashes.

Table 6: 10th Street Corridor 2012-2035 Predicted Build and No-Build Annual Crashes



The resulting total number of annual predicted crashes is 5% less for the SPUI alternative, 29% less for the DDI alternative, and 131% more for TSD alternative. Even though the total number of crashes is less for the SPUI alternative, the F+I crashes is slightly higher. The cost for an F+I crash is high so this results in a negative cost savings, which is shown below in ***Table 7***. 10th-9 results in a significant increase in crashes because the Tight Split Diamond alternative adds more exposure and conflict points from the addition of two new ramp terminals at 6th Street and two new collector-distributor roads between 10th Street and 6th Street. The 10th-Var concept would add a minor amount of crashes to 10th-2 and 10th-5 mainly due to added exposure from additional ramp length.

Planning horizon crash cost savings were calculated for the Build alternatives and are shown in ***Table 7***.

Table 7: 10th Street Corridor Planning Horizon Crash Cost Savings

Alternative	Total User Cost[1]	User Cost Savings[2]
No-Build	$ 30,000,000	$ -
10th-2	$ 31,900,000	$ (2,000,000)
10th-5	$ 19,100,000	$ 10,900,000
10th-9	$ 67,800,000	$ (37,900,000)

[1]Total User Cost – The discounted, monetized safety benefit from the crashes totaled for all years in the period 2012-2035 (rounded to $100,000).
[2]User Cost Savings - The discounted, monetized safety benefit from the crashes reduced by a scenario (compared to a baseline of No-Build) totaled for all years in the period 2012-2035 (rounded to $100,000).

Benson Road Corridor Study

STUDY AREA

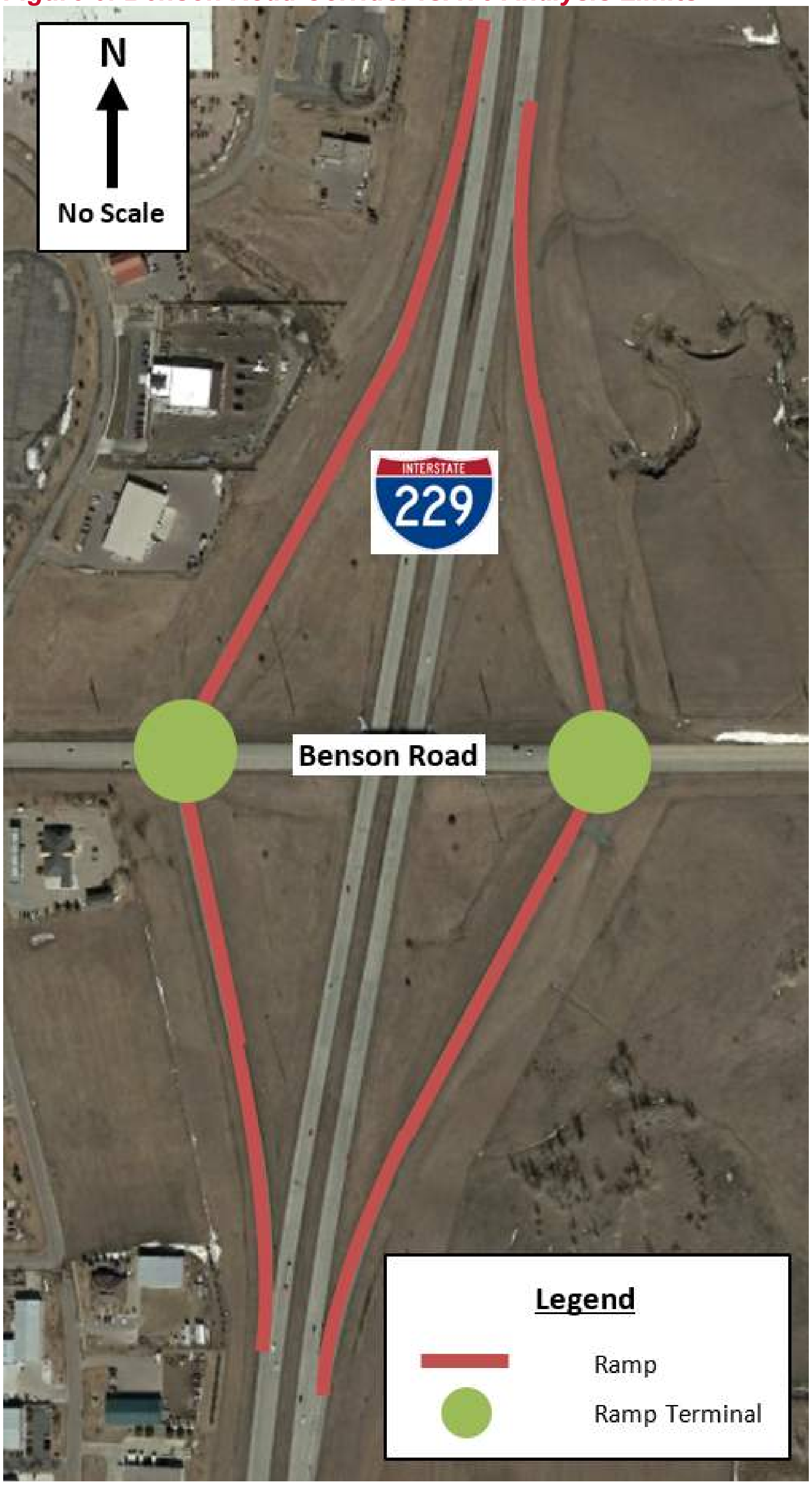
The ISATe analysis limits for the Benson Road Corridor Study focus on the I-229 ramps and the ramp terminals. The analysis limits for the Benson Road Corridor Study are shown in ***Figure 5***.

ALTERNATIVES

The alternatives to be analyzed for the Benson Road Corridor Study are:

- Benson-NB
  - No-Build Interchange Configuration and Corridor Configuration
- Benson-1A
  - 30 MPH 2-lane loop for NB I-229 to WB Benson Road.
  - Realign I-229 NB off ramp.
  - Dual right-turn lane and free right-turn movement for EB Benson Road to SB I-229.
  - Raised median on Benson Road with left-turn lanes.
- Benson-1B
  - Same as Benson-1A except single (instead of dual) right-turn lane and free right-turn movement for EB Benson Road to SB I-229.

Figure 5: Benson Road Corridor ISATe Analysis Limits



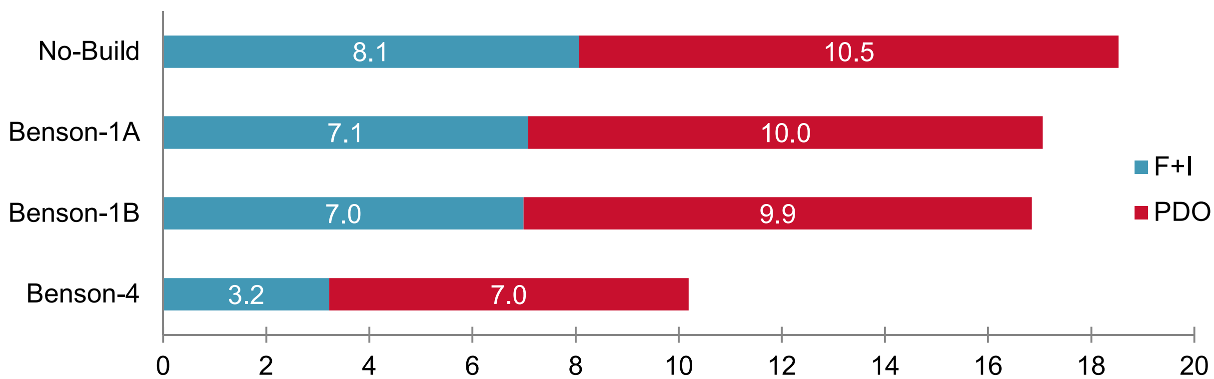
Source: Google Earth, December 2016

- Benson-4
    - o Diverging Diamond Interchange (DDI) configuration.
    - o Realign W I-229 ramps to maximize separation distance to Potsdam Avenue.
    - o Right-turn lane and 2-lane free right-turn movement for EB Benson Road to SB I-229.

BUILD AND NO-BUILD CRASH FREQUENCY COMPARISON

The predicted annual crash frequencies for the No-Build and Build alternatives (2012 to 2035) are presented in ***Table 8*** along with the breakdown of Fatal + Injury (F+I) and Property Damage Only (PDO) crashes.

Table 8: Benson Road Corridor 2012-2035 Predicted Build and No-Build Annual Crashes



The resulting total number of annual predicted crashes is 8-9% less for the loop ramp alternatives and 45% less for the DDI alternative. The resulting annual PDO crashes is 5-6% less for the loop ramp alternatives and 33% less for the DDI alternative. The biggest safety benefit is in the F+I crashes, which is 12-13% less for the loop ramp alternatives and 60% less for the DDI alternative.

Planning horizon crash cost savings were calculated for the Build alternatives and are shown in ***Table 9***.

Table 9: Benson Road Corridor Planning Horizon Crash Cost Savings

Alternative	Total User Cost[1]	User Cost Savings[2]
No-Build	$ 47,400,000	$ -
Benson-1A	$ 41,600,000	$ 5,800,000
Benson-1B	$ 41,000,000	$ 6,300,000
Benson-4	$ 19,500,000	$ 27,800,000

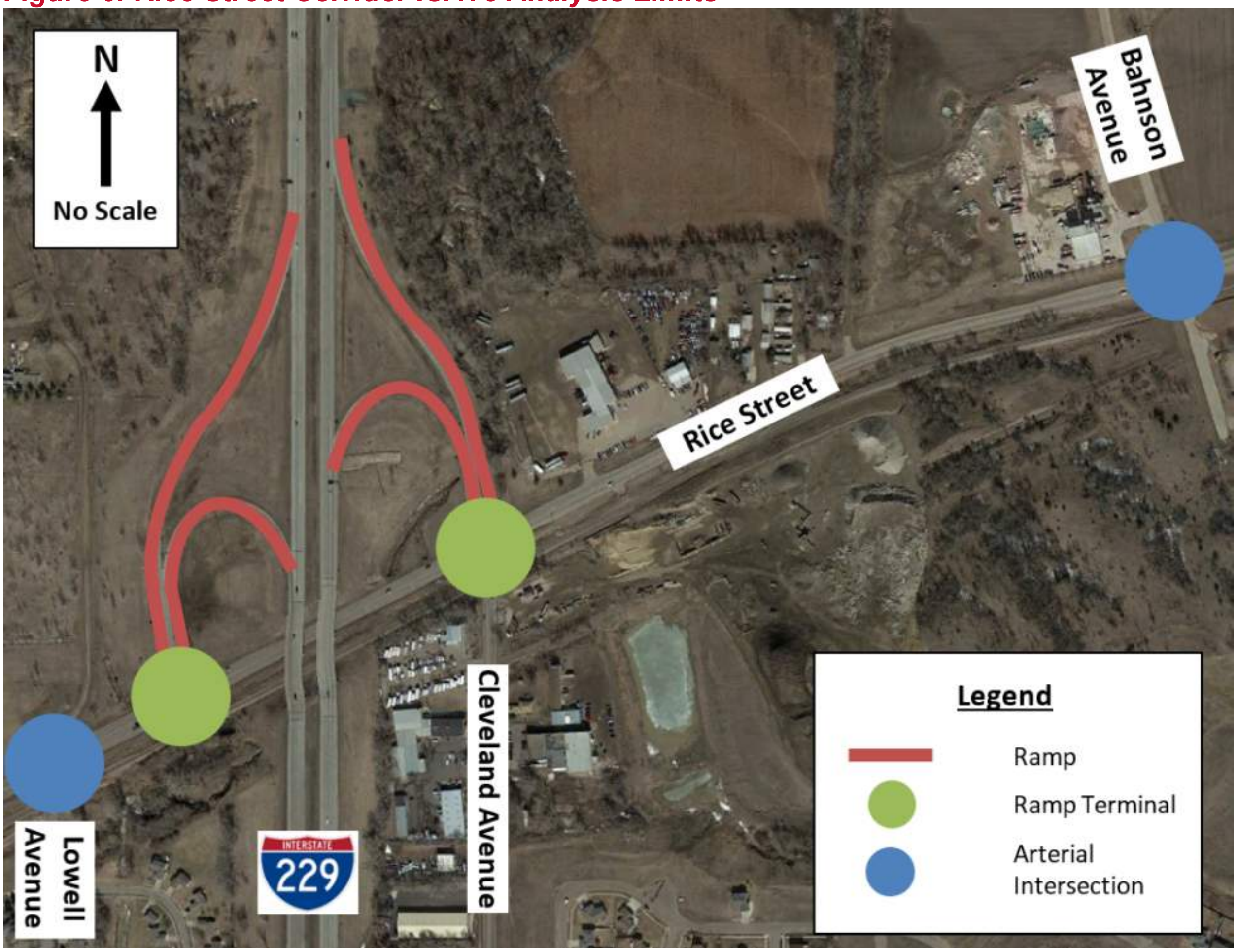
[1]Total User Cost – The discounted, monetized safety benefit from the crashes totaled for all years in the period 2012-2035 (rounded to $100,000).
[2]User Cost Savings - The discounted, monetized safety benefit from the crashes reduced by a scenario (compared to a baseline of No-Build) totaled for all years in the period 2012-2035 (rounded to $100,000).

Rice Street Corridor Study

STUDY AREA

The ISATe analysis limits for the Rice Street Corridor Study focus on the I-229 ramps, the ramp terminals, and the arterial intersections of Rice Street/Bahnson Avenue and Rice Street/Lowell Avenue. The arterial intersections were included in the analysis because Rice-3C involves realigning Cleveland Avenue to Bahnson Avenue and the I-229 SB Ramps to Lowell Avenue. The analysis limits for the Rice Street Corridor Study are shown in ***Figure 6***.

Figure 6: Rice Street Corridor ISATe Analysis Limits



Source: Google Earth, December 2016

ALTERNATIVES

The alternatives to be analyzed for the Rice Street Corridor Study are:

- Rice-NB
    - No-Build Interchange Configuration and Corridor Configuration
- Rice-2
    - Perpetuates Folded Diamond Interchange configuration.

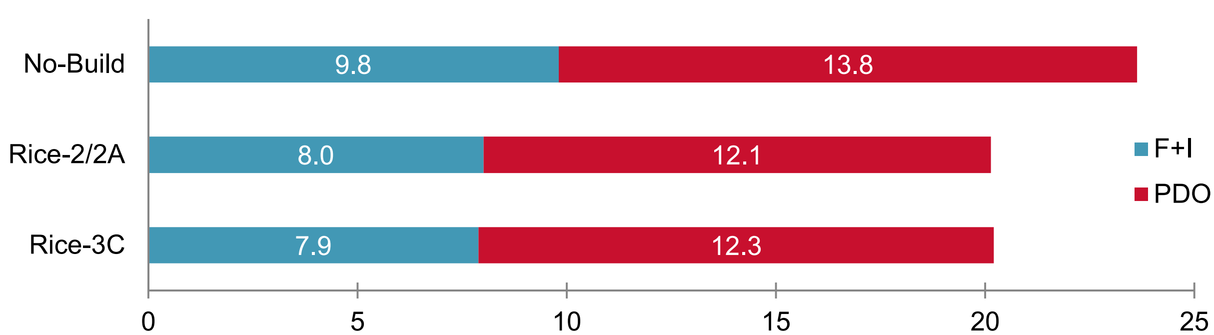
  - Rebuilds Rice Street with a median and three lanes in each direction through the interchange.
  - Provides additional turn bays and storage length at the Rice Street/Cleveland Avenue/NB I-229 off ramp and Rice Street/Bahnson Avenue intersections.
- Rice-2A
  - Same as Rice-2 except shifts and rebuilds Rice Street north of its current alignment to avoid impacts to BNSF Railroad Right-of-Way.
- Rice-3C
  - Replaces Folded Diamond Interchange with an improved geometrics Folded Diamond Interchange configuration.
  - Aligns SB I-229 ramps with Lowell Avenue and improves geometrics at NB I-229 ramps.
  - Rebuilds Rice Street with a median and three lanes in each direction through the interchange.
  - Separates conflicting traffic movements at Cleveland Avenue and the NB I-229 ramp terminal intersection by realigning Cleveland Avenue on a shifted alignment with a two-way left-turn lane and two lanes in each direction.
  - Provides a grade separated crossing of Cleveland Avenue over the BNSF Railroad.
  - Provides additional turn bays and storage length at the Rice Street/NB I-229 off ramp and Rice Street/Bahnson Avenue/Cleveland Avenue intersections.

Rice-2 and Rice-2A are treated the same for the predictive safety analysis because they comprise of the same cross section. The only difference between the two alternatives is that Rice-2A is shifted to the north.

BUILD AND NO-BUILD CRASH FREQUENCY COMPARISON

The predicted annual crash frequencies for the No-Build and Build alternatives (2012 to 2035) are presented in ***Table 10*** along with the breakdown of Fatal + Injury (F+I) and Property Damage Only (PDO) crashes.

Table 10: Rice Street Corridor 2012-2035 Predicted Build and No-Build Annual Crashes



The resulting total number of annual predicted crashes is lower for all the Build alternatives. The Build alternatives result in a 14-15% decrease in total crashes, an 11-12% decrease in PDO crashes, and an 18-20% decrease in F+I crashes. It should be noted that the results for Rice-3C do not take into effect the safety benefit of removing two railroad at-grade crossings that result from realigning Cleveland Avenue to Bahnson Avenue. Analysis of the Rice-3C option also does not include an estimate of the change in crashes on Rice Street and Cleveland Avenue due to the significant increase in travel distance between Cleveland Avenue and the Northbound I-229 ramps.

Planning horizon crash cost savings were calculated for the Build alternatives and are shown in ***Table 11***.

Table 11: Rice Street Corridor Planning Horizon Crash Cost Savings

Alternative	Total User Cost[1]	User Cost Savings[2]
No-Build	$ 58,700,000	$ -
Rice-2/2A	$ 48,300,000	$ 10,400,000
Rice-3c	$ 47,900,000	$ 10,800,000

[1]Total User Cost – The discounted, monetized safety benefit from the crashes totaled for all years in the period 2012-2035 (rounded to $100,000).
[2]User Cost Savings - The discounted, monetized safety benefit from the crashes reduced by a scenario (compared to a baseline of No-Build) totaled for all years in the period 2012-2035 (rounded to $100,000).

Cliff Avenue Corridor Study

STUDY AREA

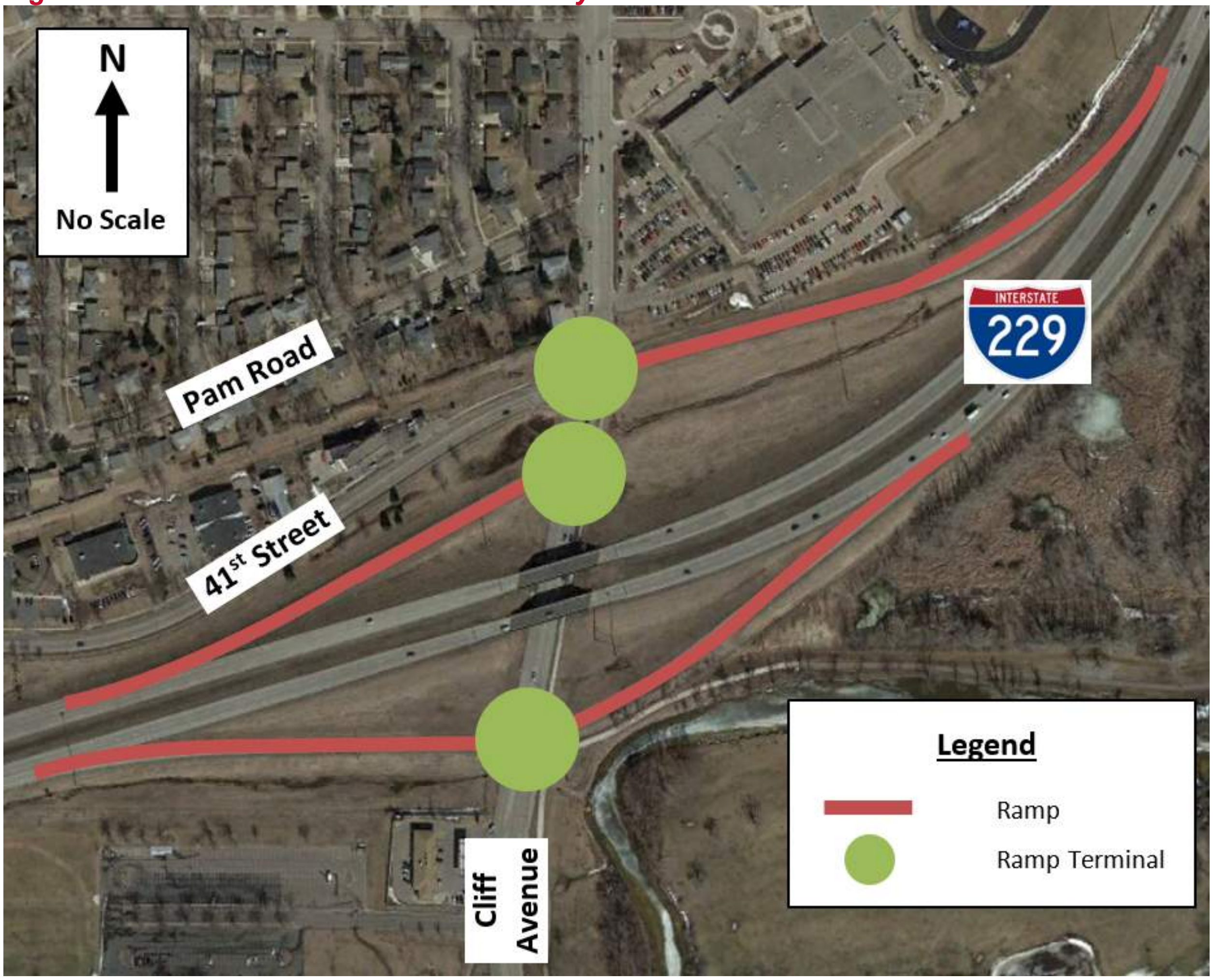
The ISATe analysis limits for the Cliff Avenue Corridor Study focus on the I-229 ramps, the ramp terminals, and the arterial intersection of Cliff Avenue and 41st Street. 41st Street is aligned with the I-229 southbound off-ramp for all the alternatives except Cliff-6. 41st Street is realigned to Pam Road in Cliff-6 so Cliff Avenue and 41st Street is analyzed as an arterial intersection. For the other alternatives, 41st Street is analyzed in ISATe as a non-ramp public street leg that is present at the north ramp terminal. The intersection of Cliff Avenue and Pam Road was not analyzed because the existing number of crashes is very low. Therefore, the predicted crashes for this intersection would be negligible. The analysis limits for the Cliff Avenue Corridor Study are shown in ***Figure 7***.

ALTERNATIVES

The alternatives to be analyzed for the Cliff Avenue Corridor Study are:

- Cliff-NB
  - No-Build Interchange Configuration and Corridor Configuration
- Cliff-1
  - Adds a loop on ramp from NB Cliff Avenue to SB I-229.
  - Realigns SB Cliff Avenue to SB I-229 directional ramp.
  - Provides additional turn bays, storage length, and raised median at the Cliff Avenue/E 41st Street/SB I-229 off ramp terminal intersection.

Figure 7: Cliff Avenue Corridor ISATe Analysis Limits



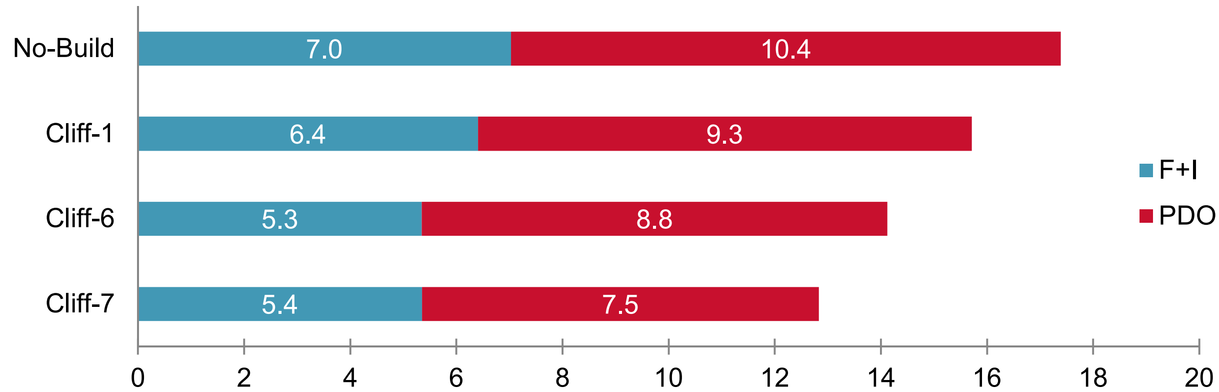
Source: Google Earth, December 2016

- Cliff-6
  - Replaces Diamond Interchange with Single Point Urban Interchange (SPUI)
  - Rebuilds Cliff Avenue with a median and two lanes in each direction.
  - Realigns the E 41st Street/Cliff Avenue intersection north to Pam Road.
- Cliff-7
  - Same as Cliff-6 except SB I-229 through and right movements utilize existing intersection location at Cliff Avenue.

BUILD AND NO-BUILD CRASH FREQUENCY COMPARISON

The predicted annual crash frequencies for the No-Build and Build alternatives (2012 to 2035) are presented in ***Table 12*** along with the breakdown of Fatal + Injury (F+I) and Property Damage Only (PDO) crashes.

Table 12: Cliff Avenue Corridor 2012-2035 Predicted Build and No-Build Annual Crashes



The resulting total number of annual predicted crashes is lower for all the Build alternatives, with Cliff-7 showing the least amount of crashes. The Build alternatives result in a 10-26% decrease in total crashes, a 10-28% decrease in PDO crashes, and a 9-24% decrease in F+I crashes.

Planning horizon crash cost savings were calculated for the Build alternatives and are shown in ***Table 13***.

Table 13: Cliff Avenue Corridor Planning Horizon Crash Cost Savings

Alternative	Total User Cost[1]	User Cost Savings[2]
No-Build	$ 42,900,000	$ -
Cliff-1	$ 39,100,000	$ 3,800,000
Cliff-6	$ 32,900,000	$ 10,100,000
Cliff-7	$ 32,600,000	$ 10,400,000

[1]Total User Cost – The discounted, monetized safety benefit from the crashes totaled for all years in the period 2012-2035 (rounded to $100,000).
[2]User Cost Savings - The discounted, monetized safety benefit from the crashes reduced by a scenario (compared to a baseline of No-Build) totaled for all years in the period 2012-2035 (rounded to $100,000).

Conclusions

Based on the preceding HSM analysis, the following conclusions can be drawn for the entire I-229 MIS study:

- Crashes predicted for each location along I-229 increase for the No-Build (Year 2035) condition compared to the Existing (Year 2012) condition because of the increase in traffic volume. Notably, the I-229 interchange areas experience higher levels of existing crashes than the connecting freeway segments.
- For the I-229 Corridor Study, both Build alternatives decrease the total number of crashes. However, the fatal and injury crashes increase slightly so there is an increase in user cost.
- For the 10th Street Corridor Study, the SPUI and DDI alternatives decrease the total number of crashes. However, the fatal and injury crashes increase slightly for the SPUI alternative so there is an increase in user cost. The Tight Split

Diamond alternative increases the total number of crashes 131% because it adds two new ramp terminals at 6th Street and two new collector-distributor roads between 10th Street and 6th Street.

- For the remaining corridor studies (Minnesota Avenue, Benson Road, Rice Street, Cliff Avenue), all Build alternatives decrease crashes compared to their respective No-Build alternatives.
- If the alternatives with the highest safety benefit for all sub-studies were chosen, the entire I-229 corridor would see approximately $104 million in user cost savings.

The safety evaluation, along with traffic operations, environmental impacts, property impacts, and construction and right-of-way cost, helped select alternatives and prioritize the phasing of each sub-study.

APPENDIX F -

YEAR OF FAILURE ANALYSIS TECH MEMO

Appendix F. Year of Failure Analysis

This technical memorandum documents the Year of Failure analysis for the I-229 Major Investment Study (MIS), serving as part of the overall documentation for the I-229 MIS project. The content provided in ***Appendix B1. Traffic Capacity Analysis Methodologies*** *should be referenced to supplement the content in this memorandum.*

The purpose of the I-229 MIS is to develop a comprehensive plan for improvements needed along I-229, its interchanges, and its cross streets through a horizon year of 2035. While proposed improvement projects recommended by the study were designed to meet operational and design criteria by 2035, elements of existing and proposed corridor infrastructure have service lives beyond 20-30 years after initial construction. The year of failure analysis is one type of analysis that considers conditions beyond the horizon year.

A year of failure analysis helps decision makers roughly assess how long after the design or horizon year a proposed interchange design will operate acceptably. The longer the interchange operates sufficiently, the longer down the road the interchange will have prior to additional investments to deal with future capacity constraints.

This memorandum presents a summary of the methodology and findings for the year of failure analysis for the No-Build and Build alternatives for the I-229 MIS. The Build alternatives to be analyzed for this study will be described later in this memorandum. The results are intended to help guide the selection of the alternatives moving forward to the alternatives analysis stage of planning.

Study Area

The I-229 MIS has been separated into individual sub-studies. The sub-studies include:

- I-229 Corridor Study
- Minnesota Avenue Corridor Study (Exit 3)
- 10th Street Corridor Study (Exit 6)
- Benson Road Corridor Study (Exit 9)
- Rice Street Corridor Study (Exit 7)
- Cliff Avenue Corridor Study (Exit 4)

A map illustrating the overall study areas for each of the sub-studies is shown in ***Figure 1***. For the year of failure analysis, the area of study was reduced to the interchanges. For the I-229 Corridor Study, the year of failure analysis limits focus on two interchanges that do not have their own sub-study: Louise Avenue and Western Avenue. The remaining sub-studies, focus on their respective interchanges. The analysis does not include identifying year of failure for I-229 freeway segments. The first signalized intersection beyond each interchange ramp terminal was also included to model the arrival flow profile approaching the ramp terminal intersections.

Methodology

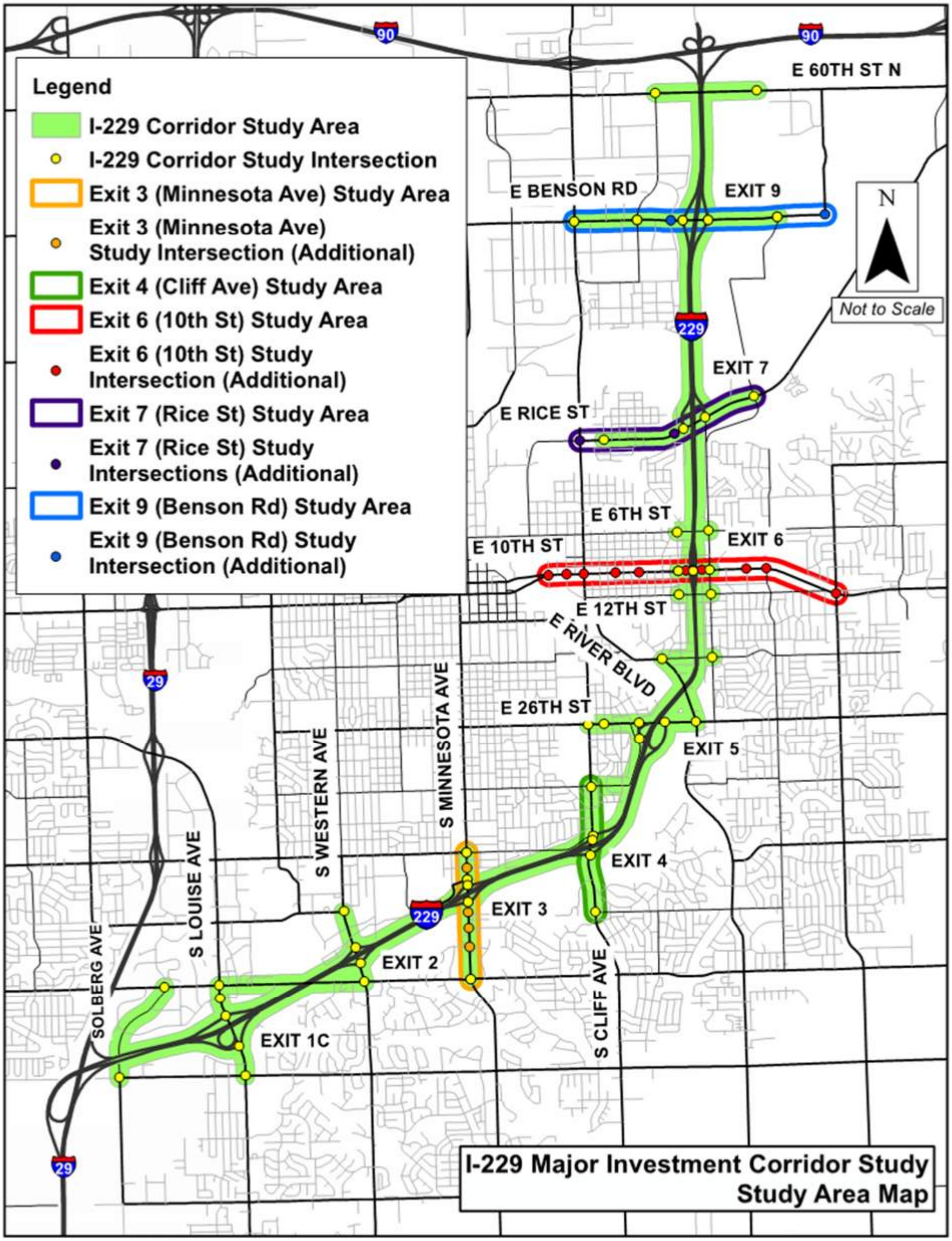
Volume Development

Traffic volumes were developed for the AM and PM peak hours on each cross street and each intersection within the study area until year of failure was identified. Volumes were developed for up to 30 years beyond the project future/design year (Year 2035) and at 5-year increments. The volumes beyond 2035 were linearly extrapolated using existing year (Year 2012) and future year (Year 2035) volumes. The traffic volume data was based on traffic counts provided by SDDOT and design year volume forecasts from the 2035 Sioux Falls Travel Demand Model.

Year of Failure Criteria

For the year of failure analysis, LOS ‘D’ was used as the worst allowable LOS for future year ramp terminal intersection operations. The interchange alternatives were considered failing when one of the ramp terminals was projected to operate at an average intersection LOS ‘E’ or ‘F’ or an intersection turning movement was projected to operate at LOS ‘F’.

Figure 1. I-229 MIS Study Area Map



Analysis Results

I-229 Corridor Study

Alternatives

The alternatives to be analyzed for the I-229 Corridor Study are:

- Louise-NB
  - Louise No-Build Interchange
- Western-NB
  - Western No-Build Interchange

Year of Failure Results

The resulting year of failure for the I-229 Corridor Study alternatives is shown in ***Table 1***.

Table 1 – I-229 Corridor Year of Failure

Alternative	Year of Failure
Louise-NB	Beyond 2065
Western-NB	2040

Minnesota Avenue Corridor Study

Alternatives

The alternatives to be analyzed for the Minnesota Avenue Corridor Study are:

- Minn-NB
  - No-Build Interchange Configuration and Corridor Configuration
- Minn-2C
  - Realigns SB exit ramp with 49th Street; full access with signal-control.
  - Constructs loop ramp for NB Minnesota Ave to SB I-229.
  - Provides dual left-turn lanes for all signalized entrance and exit ramps.
  - Increases separation between ramp terminal / 49th Street intersections.
  - Rebuilds Minnesota Avenue with a median and two lanes in each direction.
  - Third southbound lane added through 49th Street intersection.
- Minn-2D
  - Same as Minn-2C except rebuilds Minnesota Avenue with a median and three lanes in each direction.
- Minn-5D
  - Replaces Diamond Interchange with Diverging Diamond Interchange (DDI) configuration.

- Minn-8C
    - Replaces Diamond Interchange with Single Point Urban Interchange (SPUI) centered at existing interchange.
    - Provides dual-left turn lanes for all signalized entrance and exit ramps.
    - Incorporates full, signal-controlled access at 49th Street intersection.
    - Rebuilds Minnesota Avenue with a median and two lanes in each direction.
    - Third southbound lane added through 49th Street intersection.
- Minn-8D
    - Same as Minn-8C except rebuilds Minnesota Avenue with a median and three lanes in each direction.
- Minn-9D
    - Same as Minn-8D except SB I-229 through and right-turn movements are provided direct connection to 49th Street.

Year of Failure Results

The resulting year of failure for the No-Build and Build alternatives is shown in ***Table 2***.

Table 2 – Minnesota Avenue Corridor Year of Failure

Alternative	Year of Failure
Minn-NB	Earlier than 2035
Minn-2C	2045
Minn-2D	2045
Minn-5D	2060
Minn-8C	2040
Minn-8D	2060
Minn-9D	2045

10th Street Corridor Study

Alternatives

The alternatives to be analyzed for the 10th Street Corridor Study are:

- 10th-NB
    - No-Build Interchange Configuration and Corridor Configuration
- 10th-2
    - Perpetuates Single Point Urban Interchange (SPUI) configuration.
    - Provides dual left-turn lanes for all entrance and exit ramps.
    - Rebuilds 10th Street with a median and three lanes in each direction through the interchange.

- 10th-5
  - Replaces Single Point Urban Interchange (SPUI) configuration with Diverging Diamond Interchange (DDI) configuration.
  - Eliminates left-turn movements on 10th Street by crossing 10th Street traffic to the left side between the ramp terminal intersections.
  - Rebuilds 10th Street with a median and three lanes in each direction through the interchange.
- 10th-9
  - Replaces Single Point Urban Interchange (SPUI) configuration with Tight Split Diamond Interchange (TSD) configuration with I-229 ramp connections to both 10th Street and 6th Street.
  - Provides dual left-turn lanes for all entrance and exit ramps except the NB entrance ramp.
  - Adds traffic signals at new ramp intersections with 6th Street.

Year of Failure Results

The resulting year of failure for the No-Build and Build alternatives is shown in ***Table 3***.

Table 3 – 10th Street Corridor Year of Failure

Alternative	Year of Failure
10th-NB	Earlier than 2035
10th-2	Beyond 2065
10th-5	Beyond 2065
10th-9	Beyond 2065

Benson Road Corridor Study

Alternatives

The alternatives to be analyzed for the Benson Road Corridor Study are:

- Benson-NB
  - No-Build Interchange Configuration and Corridor Configuration
- Benson-1A
  - 30 MPH 2-lane loop for NB I-229 to WB Benson Road.
  - Realign I-229 NB off ramp.
  - Dual right-turn lane and free right-turn movement for EB Benson Road to SB I-229.
  - Raised median on Benson Road with left-turn lanes.
- Benson-1B
  - Same as Benson-1A except single (instead of dual) right-turn lane and free right-turn movement for EB Benson Road to SB I-229.

- Benson-4
    - Diverging Diamond Interchange (DDI) configuration.
    - Realign W I-229 ramps to maximize separation distance to Potsdam Avenue.
    - Right-turn lane and 2-lane free right-turn movement for EB Benson Road to SB I-229.

Year of Failure Results

The resulting year of failure for the No-Build and Build alternatives is shown in ***Table 4***.

Table 4 – Benson Road Corridor Year of Failure

Alternative	Year of Failure
Benson-NB	Earlier than 2035
Benson-1A	2050
Benson-1B	2050
Benson-4	2045

Rice Street Corridor Study

Alternatives

The alternatives to be analyzed for the Rice Street Corridor Study are:

- Rice-NB
    - No-Build Interchange Configuration and Corridor Configuration
- Rice-2
    - Perpetuates Folded Diamond Interchange configuration.
    - Rebuilds Rice Street with a median and three lanes in each direction through the interchange.
    - Provides additional turn bays and storage length at the Rice Street/Cleveland Avenue/NB I-229 off ramp and Rice Street/Bahnson Avenue intersections.
- Rice-2A
    - Same as Rice-2 except shifts and rebuilds Rice Street north of its current alignment to avoid impacts to BNSF Railroad Right-of-Way.
- Rice-3C
    - Replaces Folded Diamond Interchange with an improved geometrics Folded Diamond Interchange configuration.
    - Aligns SB I-229 ramps with Lowell Avenue and improves geometrics at NB I-229 ramps.
    - Rebuilds Rice Street with a median and three lanes in each direction through the interchange.

- Separates conflicting traffic movements at Cleveland Avenue and the NB I-229 ramp terminal intersection by realigning Cleveland Avenue on a shifted alignment with a two-way left-turn lane and two lanes in each direction.
- Provides a grade separated crossing of Cleveland Avenue over the BNSF Railroad.
- Provides additional turn bays and storage length at the Rice Street/NB I-229 off ramp and Rice Street/Bahnson Avenue/Cleveland Avenue intersections.

Year of Failure Results

The resulting year of failure for the No-Build and Build alternatives is shown in ***Table 5***.

Table 5 – Rice Street Corridor Year of Failure

Alternative	Year of Failure
Rice-NB	Earlier than 2035
Rice-2	2045
Rice-2A	2045
Rice-3C	2045

Cliff Avenue Corridor Study

Alternatives

The alternatives to be analyzed for the Cliff Avenue Corridor Study are:

- Cliff-NB
  - No-Build Interchange Configuration and Corridor Configuration
- Cliff-1
  - Adds a loop on ramp from NB Cliff Avenue to SB I-229.
  - Realigns SB Cliff Avenue to SB I-229 directional ramp.
  - Provides additional turn bays, storage length, and raised median at the Cliff Avenue/E 41st Street/SB I-229 off ramp terminal intersection.
- Cliff-6
  - Replaces Diamond Interchange with Single Point Urban Interchange (SPUI)
  - Rebuilds Cliff Avenue with a median and two lanes in each direction.
  - Realigns the E 41st Street/Cliff Avenue intersection north to Pam Road.
- Cliff-7
  - Same as Cliff-6 except SB I-229 through and right movements utilize existing intersection location at Cliff Avenue.

Year of Failure Results

The resulting year of failure for the No-Build and Build alternatives is shown in ***Table 6***.

Table 6 – Cliff Avenue Corridor Year of Failure

Alternative	Year of Failure
Cliff-NB	Earlier than 2035
Cliff-1	2050
Cliff-6	2055
Cliff-7	2045

Conclusion

The year of failure analysis, along with safety impacts, environmental impacts, property impacts, construction and right-of-way cost, and other traffic operations, helped screen alternatives and prioritize the phasing of each sub-study. Between the two interchanges in the I-229 Corridor Study (Louise Avenue and Western Avenue), Western Avenue is the next interchange after 2035 that will need to be addressed for operational issues.

APPENDIX G -

SUB-STUDY 2 NOISE STUDY TECHNICAL REPORT

Noise Study Technical Report

I-229 Major Investment Corridor Study

Sub-Study #2

Sioux Falls, South Dakota

HDR Project Number: 207030

December 2016

I-229 Major Investment Corridor Study (Sub-Study #2)

NOISE STUDY TECHNICAL REPORT

EXECUTIVE SUMMARY

The South Dakota Department of Transportation (SDDOT) initiated this study in order to address the current and future transportation needs along the entire I-229 corridor. Sub-Study #2 assesses existing and future conditions along the Minnesota Avenue Corridor, which includes a combination of interchange concepts and corridor concepts (the Project). Five (5) Build Alternatives were evaluated as part of Sub-Study #2.

On behalf of SDDOT, and as part of the environmental documentation, HDR Engineering, Inc. (HDR) performed a traffic noise analysis along the Minnesota Avenue corridor's area of influence for the proposed improvements. The analysis included traffic noise monitoring and modeling. HDR used the FHWA Traffic Noise Model (TNM), Version 2.5, to evaluate projected traffic noise levels under the "Build" alternatives. If applicable, traffic noise impacts were identified in accordance with SDDOT Noise Analysis and Abatement Guidance (July 13, 2011). In areas where future noise levels exceed state and federal criteria, the conceptual feasibility of noise mitigation options is discussed if warranted.

Traffic noise levels were evaluated for the existing conditions and future Build Alternatives 2C, 2D, 5D, 8C, and 8D at 70 receptors in the Project area. There are 2 traffic noise impacts predicted under the Existing Alternative; 2 impacts predicted under Future Build Alternatives 2C, 5D, and 8C; 1 impact predicted under Future Build Alternatives 2D and 8D.

Table of Contents

1.Introduction

The South Dakota Department of Transportation (SDDOT) initiated this study in order to address the current and future transportation needs along the entire I-229 corridor. Sub-Study #2 assesses existing and future conditions along the Minnesota Avenue Corridor, which includes a combination of interchange concepts and corridor concepts (the Project). Five (5) Build Alternatives were evaluated as part of Sub-Study #2. Figure 1 shows the project area.

The study fulfills the following objectives:

1. Complete a traffic level of service analysis for both existing and future (2035) conditions on the I-229 mainline, select interchanges and crossroads.
2. Complete a safety analysis of I-229 mainline, interchanges and crossroads.
3. Identify locations on I-229 not in compliance with current design standards under both the current and forecasted future traffic conditions.
4. Determine the effects of incidents on traffic operations within the I-229 corridor's area of influence.
5. Develop a long range plan consisting of feasible solutions to address the portions of the Interstate System that fail to meet current design standards, traffic level of service expectations, and/or have identifiable safety concerns under both the current and forecasted future traffic conditions.
6. Create final products for use by the SDDOT which will guide the Department in the implementation of recommended improvements that will maximize the efficiency of the system.

Five (5) Build Alternatives were evaluated as part of Sub-Study #2.

1. **2C:** Realigns southbound exit ramp with 49th Street; constructs loop ramp for northbound Minnesota Avenue to southbound I-229 movement; provides dual left-turn lanes for all signalized entrance and exit ramps, Minnesota Avenue improvements
2. **2D:** Realigns southbound exit ramp with 49th Street; constructs loop ramp for northbound Minnesota Avenue to southbound I-229 movement; provides dual left-turn lanes for all signalized entrance and exit ramps, Minnesota Avenue improvements
3. **5D:** Diverging Diamond Interchange centered at existing interchange; intersection spacing limits 49th Street approach to right-in right-out; Minnesota Avenue improvements
4. **8C:** Single Point Urban Interchange centered at existing interchange; provides dual left-turn lanes for all signalized entrance and exit ramps; Minnesota Avenue improvements
5. **8D:** Single Point Urban Interchange centered at existing interchange; provides dual left-turn lanes for all signalized entrance and exit ramps; Minnesota Avenue

HDR Engineering, Inc. (HDR) performed a highway traffic noise analysis for SDDOT in support of the Project, as part of the environmental documentation. The analysis is based on the SDDOT Noise Analysis and Abatement Guidance (July 13, 2011). Results of the analysis are presented in this report.

2. Nature of Noise

Noise is defined as unwanted or excessive sound. Sound becomes unwanted when it interferes with normal activities, such as sleep, work, speech, or recreation. Vehicle noise is a combination of the noise produced by the engine, exhaust, and tires. Noise levels from highway traffic are affected by three factors: (1) the volume of the traffic, (2) the speed of the traffic, and (3) the number of trucks in the flow of traffic. Generally, traffic noise increases commensurate with these three factors.

Noise is measured in decibels (dB) – a logarithmic scale. Because human hearing is not equally sensitive to all frequencies of sound, certain frequencies are given more “weight.” The A-weighted scale corresponds to the sensitivity range for human hearing. Therefore, noise levels are measured in dBA, the A-weighted sound level in decibels. When noise levels change 3-dBA, the change is considered barely perceptible to human hearing. However, a 5-dBA change in noise level is clearly noticeable. A 10-dBA change in noise levels is perceived as a doubling or halving of noise loudness, while a 20-dBA change is considered a dramatic change in loudness. Table 1 shows noise levels associated with common, everyday sources and helps the reader more fully understand the magnitude of noise levels discussed in this report.

Table 1: Common Noise Sources and Levels

Sound Pressure Level (dB)	Typical Sources
120	Jet aircraft takeoff at 100 feet
110	Same aircraft at 400 feet
90	Motorcycle at 400 feet
80	Garbage disposal
70	City street corner
60	Conversational speech
50	Typical office
40	Living room (without TV)
30	Quiet bedroom at night

Source: Environmental Impact Assessment Handbook, ed. by Rau and Wooten, 1980

Figure 1: Project Location

3.SDDOT Noise Analysis and Abatement Guidance

The updated (July 13, 2011) SDDOT Noise Analysis and Abatement Guidance (Guidance), upon which this analysis is based, is intended to supplement FHWA traffic noise and abatement regulations and guidance. The Guidance provides procedures for noise studies and noise abatement measures to help protect the public health and welfare, to supply noise abatement criteria, and to establish requirements for traffic noise information to be given to those officials who have planning and zoning authority.

The Guidance contains noise abatement criteria that are based on the Leq(h), which is used to analyze traffic noise levels and identify noise impacts. The Leq is defined as the equivalent, steady-state sound level that, in a stated period of time, contains the same acoustic energy as the time-varying sound level during the same period. Therefore, for the purposes of this analysis, Leq can be considered the average sound level and Leq(h) can be considered the average sound level occurring over a one-hour time period. It is representative of the overall (average) traffic-generated noise level expressed on an hourly basis.

Land uses are assigned to an activity category based on the type of activities occurring in each area (i.e. picnic areas, churches, commercial land, and undeveloped land). Activity Categories are then ordered based on their sensitivity to traffic noise levels. NAC are assigned to each Activity Category. These NAC represent the maximum traffic noise levels that allow uninterrupted land use within each Activity Category. Table 2 summarizes noise abatement criteria corresponding to various land use activity categories. Activity categories and related traffic noise impacts are determined based on the actual land use in a given area.

Table 2: Noise Abatement Criteria

23 CFR 772 Noise Abatement Criteria [Hourly A-Weighted Sound Level, decibels (dBA)]			
Activity Category	**Leq(h)**	**Evaluation Location**	**Activity Description**
A	57	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve as an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67	Exterior	Residential
C	67	Exterior	Active sports areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools television studios, trails and trail crossings
D	52	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recordings studios, schools, and television studios.
E	72	Exterior	Hotels, motels, office, restaurant/bars, and other developed lands, properties or activities not included in A-D or F.
F	--	--	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical) and warehousing
G	--	--	Undeveloped lands that are not permitted

Highway traffic noise impacts occur when the predicted traffic noise levels for the design year approach (reach 1 decibel less than) or equal/exceed the NAC contained in 23 CFR 772 (Table 2), or when the predicted traffic noise levels substantially exceed the existing noise levels by 15 dBA, even though the predicted levels may not exceed the NAC.

4. Noise Prediction Method

Traffic noise levels were determined by using the FHWA Traffic Noise Model (TNM), Version 2.5. Basic model inputs are:

- Preliminary project concept and geometry
- 2035 traffic volumes in the Project Area (Appendix A)
- The operational speed for I-229: 65 miles per hour (mph); arterial streets: 30-40 mph

The traffic volume used for this analysis is the AM Peak Hourly Volume (PHV) traffic. Traffic data was provided in a February 2015 HDR Technical Memo. Traffic volumes for the future “Build” condition were assumed to be the same as the future “No-Build” volumes.

5. Adjacent Land Use

Seventy (70) receptors were identified in the project area. The I-229 Minnesota Avenue corridor is located east of I-29 in the Sioux Falls metropolitan area. The Minnesota Avenue Corridor study limits include an approximately 1.2 mile section of Minnesota Avenue from 41st Street to 57th Street and intersection improvements at 41st Street, 49th Street and 57th Street.

Land use immediately adjacent to this Project is a combination of commercial/retail, active recreation areas, churches and residential. If no exterior areas of frequent human use are present at the commercial/retail locations, no further noise analysis is required. Figures located in Appendix B provide an aerial view of the project area.

6. Model Validation

Existing traffic noise levels were measured in the field and then compared against computer modeling results to verify the accuracy of the computer model. When modeled and measured levels are within + or – 3 dBA of one another, this indicates that the model is within the accepted level of accuracy.

6.1. Field Testing Procedure

On November 2, 2015, HDR staff measured traffic noise levels at representative sites throughout the project corridor. Traffic noise measurements were conducted in accordance with the FHWA-PD-96-046 Measurement of Highway Related Noise (May 1996). The average meteorological conditions were reported as shown in Table 3 below.

Table 3: Meteorological Conditions

Temperature	≅ 61 °F
Humidity	≅ 62%
Wind	< 12 mph
Conditions	Partly Cloudy
Barometric Pressure	≅ 29.81 inches

6.2. Instrumentation

Traffic noise monitoring was conducted using a Larson Davis 824 Sound Level Meter (SLM). Table 4 summarizes the instruments used to collect the data for this noise analysis report.

Table 4: Noise Analysis Instrumentation Summary

Instrument	Make	Model	Serial Number
Sound Analyzer 1	Larson Davis	824	824A2636
Calibrator	Larson Davis	CAL200	3722

6.3. Field Measurement Methods

The SLM was programmed to compute the Leq(h). The following procedures were used for noise monitoring:

- The duration of the Leq(h) measurements was 15 minutes.
- The SLM was calibrated before and after monitoring. No significant calibration drifts were detected.
- The microphone was mounted on a tripod 5 feet above the ground.
- The microphone was covered with a windscreen.

6.4. Field Measurement Locations

Table 5 describes the location of the validation site in the project corridor.

Table 5: Noise Validation Location Summary

Measurement Location	Description
L	≈ 130' east of S Minnesota Ave

The validation location is shown in Appendix B, and is within 195 feet of the nearest roadway outside lane.

6.5. Model Validation Results

The measured and modeled noise level for the validation measurement site is presented in Table 6. The predicted and measured data is within the acceptable + or – 3 dBA tolerance; therefore, the model is considered to be validated.

Table 6: Model Validation Results

Measurement Location	Leq(h)(dBA)		
	Measured	Modeled	Difference
L	62.8	60.2	-2.6

7. Traffic Noise Prediction

HDR used the FHWA TNM, Version 2.5, to evaluate future traffic noise levels at noise sensitive receptors within the limits of the Project. The TNM model accounts for the elevation differences and the proposed roadway alignment in relation to the noise-sensitive sites. Table 7 lists the NAC, existing Leq(h), and the future (2035) modeled Leq(h) for both the "Existing" and "Build" alternatives. Noise receptor locations are shown in Appendix B.

Table 7: Predicted Noise Levels at Receptors

Receptor ID	Land Use	NAC dB(A)	Hourly Leq(h) dBA										
			2012 Existing	2035 Build					Difference between Existing/Build				
				2C	2D	5D	8C	8D	2C	2D	5D	8C	8D
Shaded cells indicate noise levels that exceed the NAC													
336	C	66	61.1	62.0	62.0	62.0	60.9	60.9	0.9	0.9	0.9	-0.2	-0.2
337	C	66	60.6	61.6	61.7	61.7	60.6	60.6	1.0	1.1	1.1	0.0	0.0
338	C	66	60.1	61.2	61.2	61.2	60.4	60.4	1.1	1.1	1.1	0.3	0.3
339	C	66	60.6	61.7	61.7	61.7	61.4	61.4	1.1	1.1	1.1	0.8	0.8
340	C	66	61.3	62.5	62.5	62.4	62.2	62.2	1.2	1.2	1.1	0.9	0.9
341	C	66	67.6	64.8	64.7	64.0	64.5	64.6	-2.8	-2.9	-3.6	-3.1	-3.0
342	D	51	43.9	43.9	44.0	45.9	44.0	43.9	0.0	0.1	2.0	0.1	0.0
343	B	66	60.9	60.7	60.7	60.8	60.9	60.5	-0.2	-0.2	-0.1	0.0	-0.4
344	B	66	58.6	59.0	59.0	59.1	59.1	58.7	0.4	0.4	0.5	0.5	0.1
345	B	66	59.8	59.5	59.7	59.9	59.8	59.7	-0.3	-0.1	0.1	0.0	-0.1
346	B	66	58.4	58.6	58.7	58.9	58.8	58.5	0.2	0.3	0.5	0.4	0.1
347	B	66	58.0	58.4	58.5	58.6	58.5	58.3	0.4	0.5	0.6	0.5	0.3
348	B	66	57.7	58.2	58.3	58.4	58.3	58.1	0.5	0.6	0.7	0.6	0.4
349	B	66	57.3	57.9	58.1	58.1	58.0	57.8	0.6	0.8	0.8	0.7	0.5
350	B	66	59.4	59.5	59.8	60.2	59.8	59.9	0.1	0.4	0.8	0.4	0.5
351	B	66	58.4	58.9	59.1	59.5	59.2	59.1	0.5	0.7	1.1	0.8	0.7
371	B	66	60.5	61.5	61.6	61.6	61.5	61.4	1.0	1.1	1.1	1.0	0.9
372	B	66	59.9	61.2	61.2	61.3	61.3	61.2	1.3	1.3	1.4	1.4	1.3
2148	B	66	59.5	59.5	59.5	59.5	60.3	59.5	0.0	0.0	0.0	0.8	0.0
2149	B	66	55.9	55.7	55.7	55.8	56.7	55.7	-0.2	-0.2	-0.1	0.8	-0.2
2150	B	66	60.9	62.1	62.1	62.1	62.8	62.1	1.2	1.2	1.2	1.9	1.2
2151	B	66	60.0	59.2	59.2	59.2	60.1	59.2	-0.8	-0.8	-0.8	0.1	-0.8
2152	B	66	64.3	63.6	63.6	63.6	64.5	63.6	-0.7	-0.7	-0.7	0.2	-0.7
2153	B	66	62.2	59.6	59.6	59.7	60.5	59.6	-2.6	-2.6	-2.5	-1.7	-2.6
2154	B	66	56.4	55.3	55.3	55.3	56.4	55.3	-1.1	-1.1	-1.1	0.0	-1.1
2155	B	66	53.8	53.5	53.5	53.6	54.2	53.5	-0.3	-0.3	-0.2	0.4	-0.3
2156	B	66	58.4	56.4	56.4	56.4	57.0	56.4	-2.0	-2.0	-2.0	-1.4	-2.0
2157	B	66	53.5	52.9	52.9	53.0	53.7	52.9	-0.6	-0.6	-0.5	0.2	-0.6
2158	B	66	59.4	57.1	57.1	57.1	57.7	57.1	-2.3	-2.3	-2.3	-1.7	-2.3
2159	B	66	60.4	57.5	57.5	57.6	58.2	57.5	-2.9	-2.9	-2.8	-2.2	-2.9
2160	B	66	56.6	55.3	55.3	55.3	55.9	55.3	-1.3	-1.3	-1.3	-0.7	-1.3
2161	B	66	63.0	60.2	60.2	60.2	60.7	60.3	-2.8	-2.8	-2.8	-2.3	-2.7
2162	B	66	64.5	63.7	63.7	63.7	63.9	63.7	-0.8	-0.8	-0.8	-0.6	-0.8
2163	B	66	64.1	65.0	65.0	65.0	64.9	64.9	0.9	0.9	0.9	0.8	0.8
2164	B	66	62.4	63.5	63.5	63.5	63.4	63.4	1.1	1.1	1.1	1.0	1.0
2165	B	66	60.0	61.2	61.2	61.2	61.1	61.1	1.2	1.2	1.2	1.1	1.1

Receptor ID	Land Use	NAC dB(A)	Hourly Leq(h) dBA										
			2012 Existing	2035 Build					Difference between Existing/Build				
				2C	2D	5D	8C	8D	2C	2D	5D	8C	8D
Shaded cells indicate noise levels that exceed the NAC													
2166	B	66	65.9	66.0	65.9	66.0	66.2	65.9	0.1	0.0	0.1	0.3	0.0
2167	B	66	65.3	65.2	65.1	65.2	65.4	65.1	-0.1	-0.2	-0.1	0.1	-0.2
2168	B	66	64.9	64.6	64.6	64.6	64.9	64.6	-0.3	-0.3	-0.3	0.0	-0.3
2169	B	66	57.7	58.8	58.8	58.8	58.9	58.8	1.1	1.1	1.1	1.2	1.1
2170	B	66	56.2	56.9	56.9	56.9	57.2	57.0	0.7	0.7	0.7	1.0	0.8
2171	B	66	55.6	56.1	56.1	56.1	56.4	56.1	0.5	0.5	0.5	0.8	0.5
2172	B	66	56.5	56.4	56.4	56.4	56.8	56.3	-0.1	-0.1	-0.1	0.3	-0.2
2173	B	66	56.5	56.3	56.3	56.4	56.8	56.3	-0.2	-0.2	-0.1	0.3	-0.2
2174	B	66	63.9	64.6	64.6	64.6	65.1	64.6	0.7	0.7	0.7	1.2	0.7
2175	B	66	60.9	61.0	61.0	61.0	61.5	60.9	0.1	0.1	0.1	0.6	0.0
2176	B	66	57.7	57.5	57.5	57.5	57.9	57.4	-0.2	-0.2	-0.2	0.2	-0.3
2177	B	66	54.8	55.4	55.4	55.4	55.6	55.3	0.6	0.6	0.6	0.8	0.5
2178	B	66	58.4	58.2	58.2	58.3	58.6	58.1	-0.2	-0.2	-0.1	0.2	-0.3
2179	B	66	54.4	54.5	54.6	54.6	55.0	54.5	0.1	0.2	0.2	0.6	0.1
2180	B	66	53.6	53.9	54.0	54.0	54.4	53.9	0.3	0.4	0.4	0.8	0.3
2181	B	66	53.6	54.0	54.0	54.1	54.4	54.0	0.4	0.4	0.5	0.8	0.4
2182	B	66	53.6	54.0	54.0	54.1	54.4	54.0	0.4	0.4	0.5	0.8	0.4
2183	B	66	55.3	55.2	55.3	55.4	55.8	55.3	-0.1	0.0	0.1	0.5	0.0
2184	B	66	55.4	55.2	55.2	55.4	55.8	55.3	-0.2	-0.2	0.0	0.4	-0.1
2185	B	66	56.0	55.4	55.4	55.5	56.0	55.4	-0.6	-0.6	-0.5	0.0	-0.6
2186	B	66	61.8	62.0	62.0	62.0	62.6	62.1	0.2	0.2	0.2	0.8	0.3
2187	B	66	55.6	55.2	55.2	55.4	55.2	55.2	-0.4	-0.4	-0.2	-0.4	-0.4
2188	B	66	58.8	59.0	59.0	59.0	58.6	59.0	0.2	0.2	0.2	-0.2	0.2
2189	B	66	56.6	56.9	56.9	56.8	56.5	57.0	0.3	0.3	0.2	-0.1	0.4
2190	B	66	55.9	56.5	56.4	56.4	56.2	56.6	0.6	0.5	0.5	0.3	0.7
2191	B	66	59.0	59.3	59.3	58.9	59.3	59.6	0.3	0.3	-0.1	0.3	0.6
2192	B	66	57.9	58.4	58.3	58.0	58.4	58.7	0.5	0.4	0.1	0.5	0.8
2193	B	66	56.5	57.2	57.2	57.0	57.3	57.5	0.7	0.7	0.5	0.8	1.0
2194	B	66	56.1	56.9	56.9	56.7	56.9	57.2	0.8	0.8	0.6	0.8	1.1
2195	B	66	59.2	59.5	59.5	59.5	60.0	59.7	0.3	0.3	0.3	0.8	0.5
2196	B	66	53.9	54.5	54.5	54.5	55.4	54.7	0.6	0.6	0.6	1.5	0.8
2197	B	66	61.8	63.0	63.0	63.0	63.6	63.2	1.2	1.2	1.2	1.8	1.4
2198	C	66	67.1	68.7	68.7	68.7	68.5	68.4	1.6	1.6	1.6	1.4	1.3
2199	D	51	42.9	44.7	44.7	44.7	44.7	44.7	1.8	1.8	1.8	1.8	1.8

8. Noise Impact Analysis

Noise abatement measures are considered when predicted traffic noise levels approach or exceed the NAC, or when the predicted traffic noise levels substantially exceed existing noise levels. As shown in Table 8, there are 2 traffic noise impacts predicted under the Existing Alternative; 2 impacts predicted under Future Build Alternatives 2C, 5D, and 8C; 1 impact predicted under Future Build Alternatives 2D and 8D.

Table 8: Impact Summary

Alternative	Approach/ Exceed NAC	Substantially Exceed	Total Receptors Affected
Existing	2	0	2
Build – 2C	2	0	2
Build – 2D	1	0	1
Build – 5D	2	0	2
Build – 8C	2	0	2
Build – 8D	1	0	1

8.1. Traffic Noise Impacts

8.1.1. Alternative 2C

The difference between the existing 2012 and the predicted 2035 Build noise levels range from -2.9 to +1.8 dBA. The difference in noise levels can be accounted for by the increase in traffic between the existing and build alternatives as well as any changes in geometry (moving lanes/traffic away from receptors can result in lower noise levels). Results of this analysis indicate that 2 traffic noise impacts are predicted to occur as a result of Alternative 2C.

8.1.2. Alternative 2D

The difference between the existing 2012 and the predicted 2035 Build noise levels range from -2.9 to +1.8 dBA. The difference in noise levels can be accounted for by the increase in traffic between the existing and build alternatives as well as any changes in geometry (moving lanes/traffic away from receptors can result in lower noise levels). Results of this analysis indicate that 1 traffic noise impacts are predicted to occur as a result of Alternative 2D.

8.1.3. Alternative 5D

The difference between the existing 2012 and the predicted 2035 Build noise levels range from -2.8 to +11.3 dBA. The difference in noise levels can be accounted for by the increase in traffic between the existing and build alternatives as well as any changes in geometry (moving lanes/traffic away from receptors can result in lower noise levels). Results of this analysis indicate that 2 traffic noise impacts are predicted to occur as a result of Alternative 5D.

8.1.4. Alternative 8C

The difference between the existing 2012 and the predicted 2035 Build noise levels range from -2.2 to +1.8 dBA. The difference in noise levels can be accounted for by the increase in traffic between the existing and build alternatives as well as any changes in geometry (moving lanes/traffic away from receptors can result in lower noise levels). Results of this analysis indicate that 2 traffic noise impacts are predicted to occur as a result of Alternative 8C.

8.1.5. Alternative 8D

The difference between the existing 2012 and the predicted 2035 Build noise levels range from -2.9 to +1.8 dBA. The difference in noise levels can be accounted for by the increase in traffic between the existing and build alternatives as well as any changes in geometry (moving lanes/traffic away from receptors can result in lower noise levels). Results of this analysis indicate that 1 traffic noise impacts are predicted to occur as a result of Alternative 8D.

9. Noise Abatement Measures

Per the scope for this sub-study, "in areas where future noise levels exceed state and federal criteria (23 CFR, Part 772 and the SDDOT noise policy), noise mitigation options will be identified and the conceptual feasibility of those options will be described. A detailed analysis of the cost reasonability of noise mitigation options will not be conducted at the corridor study phase. In addition, this task excludes specific public involvement for noise mitigation features such as providing ballots to owners and tenants of impacted properties."

Impacts are predicted as a result of all of the Build alternatives. Potential traffic noise abatement measures that could be considered for Build Alternatives 2C, 2D, 5D, 8C and 8D are listed below, along with reasons why some are considered infeasible.

1. Modifying the proposed horizontal and/or vertical alignments of the roadway
    - *Several different alignments are under investigation*
2. Traffic management measures (e.g. modify speed limits and restrict truck traffic)
    - *Impractical given the type of road in question*
3. Construction of noise barriers along or within the ROW
    - *Potentially possible; to be discussed further in Section 9.1.*
4. Acquisition of property rights for construction of noise barriers
    - *Potentially possible; would be investigated further in final design.*
5. Acquisition of property to serve as a buffer zone
    - *Prohibitively expensive*

9.1. Discussion of Feasibility of Noise Barriers (based on SDDOT Guidance)

All of the following conditions must be met in order for noise abatement to be considered feasible. Failure to achieve any single element of feasibility will result in the noise abatement measure being deemed not feasible. Further investigation into feasibility and reasonability (noise reduction goal, cost-effectiveness, viewpoints of benefited receptors) would need to occur once a preferred alternative is selected.

Feasibility

When a traffic noise impact is identified on a project, noise abatement will be considered and evaluated for engineering and acoustical feasibility.

- **Engineering feasibility:**
  - Safety: An abatement measure will be deemed not feasible if it causes an excessive restriction of sight distance, continuous shadow resulting in icing or snow accumulation on driving lanes, or severe drainage problems associated either with the barrier or flood-prone areas.
  - Barrier height: The design of each proposed barrier will be considered on an individual basis when determining barrier height. The designed height of any proposed barrier may be adjusted based on feasibility and reasonableness considerations. Due to safety concerns, SDDOT will generally not construct barriers higher than 20 feet.
  - Topography: If the topography is such that an abatement measure cannot be built, then it will be deemed not feasible.
  - Drainage and utilities: A noise abatement measure is not feasible if access to drainage and utilities cannot be maintained.
  - Maintenance of the abatement measure, maintenance access to adjacent properties, and access to adjacent properties: A noise abatement measure is not feasible if access to the abatement measure, side streets, driveways, ramps, etc., cannot be maintained.

- **Acoustic Feasibility:** A noise abatement measure is considered acoustically feasible when a minimum of 60 percent of front-row receptors directly behind the noise wall (noise wall must extend entirely across receptor's property line) achieve a 5 dBA noise reduction.

To be most effective, a noise barrier must be long and continuous to prevent sounds from passing around the ends in a manner that reduces or compromises the noise reduction provided by the noise barrier. It must also be solid, with few, if any, holes, cracks or openings. The majority of the impacts with each proposed alternative occur along I-229. There is sufficient right-of-way for noise barriers that are continuously long-enough with no breaks or openings to be designed. Noise barriers shielding many of the impacted receptors along I-229 are potentially feasible. Further detailed analysis would need to be performed when a preferred alternative has been chosen to further examine individual noise barrier feasibility and reasonableness.

Noise barriers shielding the impacted receptors along the crossroads are unlikely to be feasible because a lack of sufficient right-of-way to construct many of the noise barriers and lack of access control would create too many openings in the noise barrier to allow access to driveways and cross-streets.

10. Construction Noise and Vibration

Construction of the Project would result in temporary noise and vibration increases within the Project area. The evaluation and control of construction noise and vibration must be considered along with traffic noise. This Project is bordered by commercial and residential receptors for which impacts from construction noise and vibration are a concern.

The following are basic categories for mitigation measures for construction noise. Due to the interrelatedness of construction noise and vibration, some of these measures will also apply for vibration resulting from construction activities.

Design Considerations: Design considerations include measures in the plans and specifications to minimize or eliminate adverse impacts. The proposed changes and their proximity to noise sensitive receptors were considered during design.

Community Awareness: It is important for people to be made aware of the possible inconvenience construction can cause, and to know its approximate duration so they can plan their activities accordingly. It is SDDOT's policy to submit such Project information to all local news media.

Source Control: Source control involves reducing noise impacts from construction by controlling the noise emissions at their source. This can be accomplished by specifying proper muffler systems, either as a requirement in the plans and specifications on this Project or through an established local noise ordinance requiring mufflers. Contractors generally maintain proper muffler systems on their equipment to ensure efficient operation and to minimize noise for the benefit of their own personnel as well as the adjacent receptors.

Site Control: Site control involves the specification of certain areas where extra precautions should be taken to minimize construction noise. One way to reduce construction noise impacts at sensitive receptors is to operate stationary equipment, such as air compressors or generators, as far away from the sensitive receptors as possible. Another method might be placing a temporary noise barrier in front of the equipment. As a general rule, good coordination between the project engineer, the contractor and the affected receptors is less confusing, less likely to increase the cost of the project ,and provides a more personal approach to work out ways to minimize construction noise impacts in the more noise-sensitive areas.

Time and Activity Constraints: Limiting working hours on a construction site can be very beneficial during the hours of sleep or on Sundays and holidays. However, most construction activities do not occur at night and usually not on Sundays. Exceptions due to weather, schedule, and time-related phases of construction could occur. Enforcement of such constraints could be handled through a general city or county ordinance, either listing the exceptions or granting them on a case-by-case basis.

11. Information for Local Officials

Local officials will be provided with information on noise compatible planning techniques that can be used to prevent future highway traffic noise impacts. To assist local officials within whose jurisdiction a Type I highway project is located, SDDOT will provide information on future noise levels for each Activity Category located along the project. This is accomplished by providing a copy of the noise analysis report to the local official. The local official will also be provided with an estimation of future noise levels at various distances from the highway (Appendix B Noise Contours).

12. Conclusion

Traffic noise levels were evaluated for the existing conditions and future Build Alternatives 2C, 2D, 5D, 8C, and 8D at 70 receptors in the Project area. There are 2 traffic noise impacts predicted under the Existing Alternative; 2 impacts predicted under Future Build Alternatives 2C, 5D, and 8C; 1 impact predicted under Future Build Alternatives 2D and 8D.

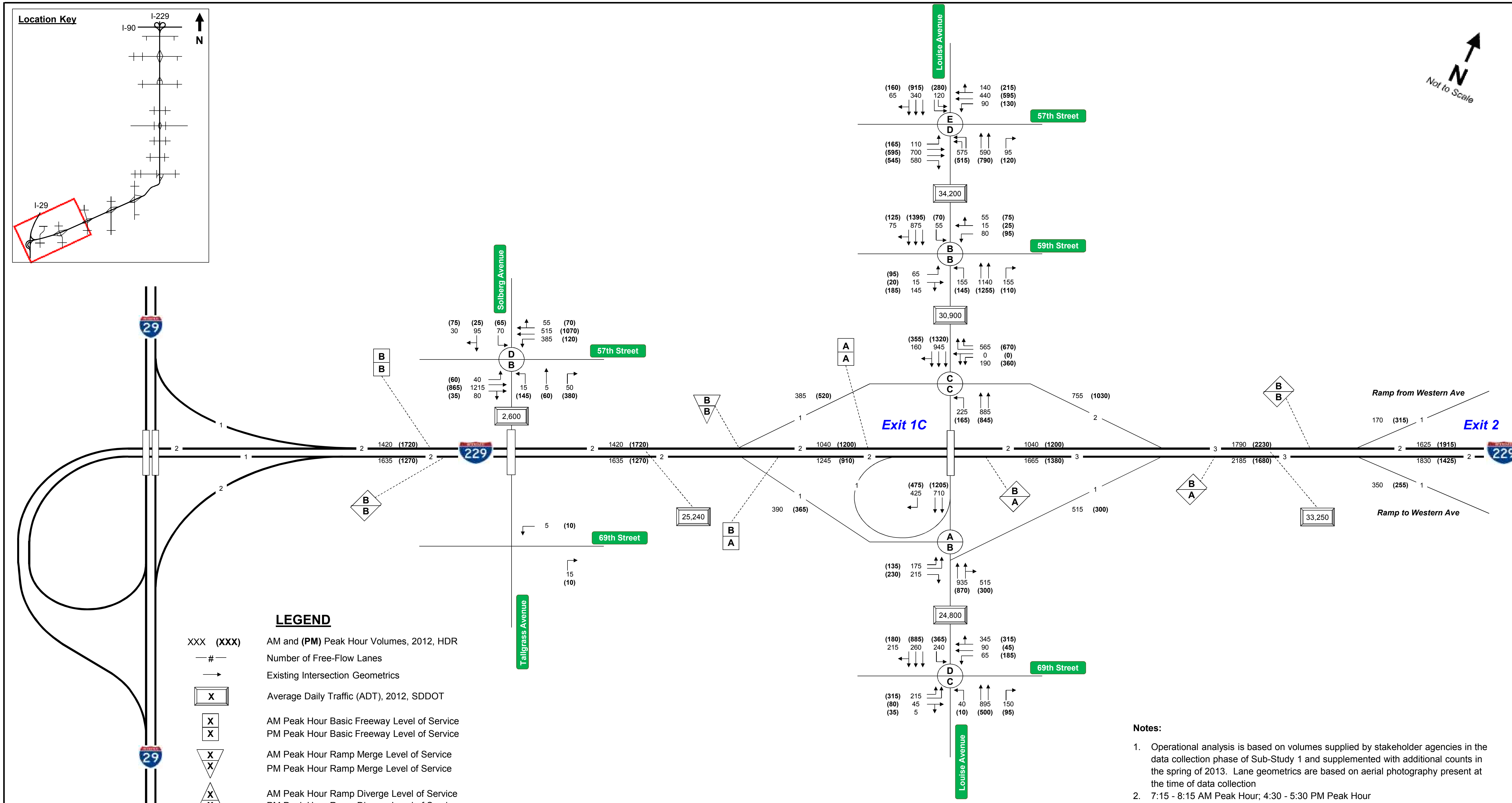
13. References

South Dakota Department of Transportation, "Noise Analysis and Abatement Guidance," July 13, 2011.

Federal Highway Administration (FHWA), "Procedures for Abatement of Highway Traffic Noise and Construction Noise," July 13, 2011.

Methods for evaluation and control of construction noise were taken from the FHWA Special Report – "Highway Construction Noise: Measurement, Prediction and Mitigation."

Appendix A
Traffic Volumes



LEGEND

XXX (XXX) — AM and **(PM)** Peak Hour Volumes, 2012, HDR

—#— Number of Free-Flow Lanes

→ Existing Intersection Geometrics

X — Average Daily Traffic (ADT), 2012, SDDOT

X / X — AM Peak Hour Basic Freeway Level of Service / PM Peak Hour Basic Freeway Level of Service

X / X — AM Peak Hour Ramp Merge Level of Service / PM Peak Hour Ramp Merge Level of Service

X / X — AM Peak Hour Ramp Diverge Level of Service / PM Peak Hour Ramp Diverge Level of Service

X / X — AM Peak Hour Weaving Section Level of Service / PM Peak Hour Weaving Section Level of Service

X / X — AM Peak Hour Signalized Intersection Level of Service / PM Peak Hour Signalized Intersection Level of Service

X / X — AM Peak Hour Unsignalized Intersection Level of Service / PM Peak Hour Unsignalized Intersection Level of Service

Notes:

1. Operational analysis is based on volumes supplied by stakeholder agencies in the data collection phase of Sub-Study 1 and supplemented with additional counts in the spring of 2013. Lane geometrics are based on aerial photography present at the time of data collection
2. 7:15 - 8:15 AM Peak Hour; 4:30 - 5:30 PM Peak Hour
3. Worst case stop controlled approach Level of Service reported

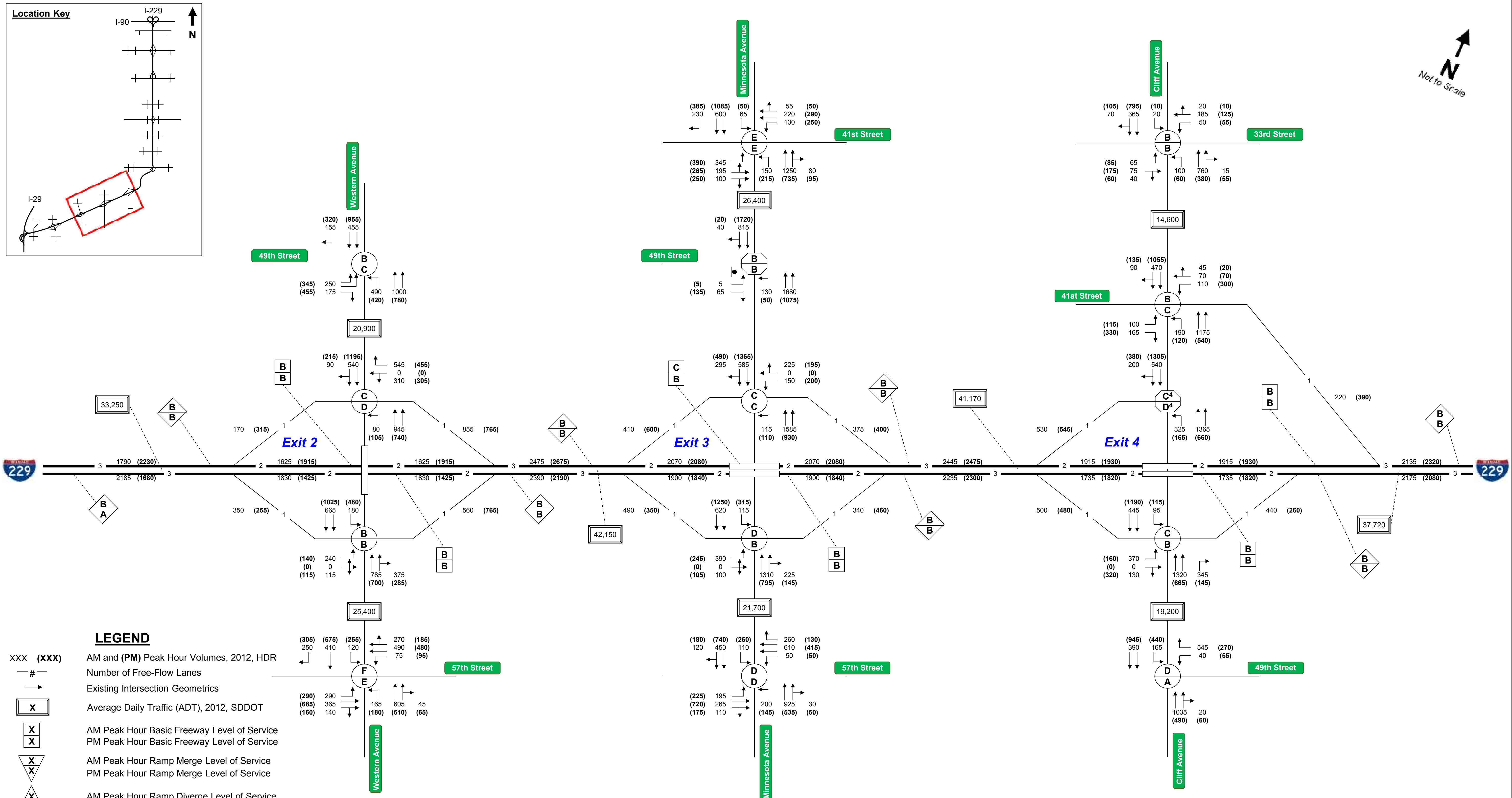
HDR

Existing Conditions Traffic Operations Analysis

I-229 Major Investment Corridor Study: Sub-Study 1
Sioux Falls, South Dakota

Date
03/05/2014

Figure
1 of 5



LEGEND

XXX (XXX)	AM and **(PM)** Peak Hour Volumes, 2012, HDR
—#—	Number of Free-Flow Lanes
→	Existing Intersection Geometrics
X (box)	Average Daily Traffic (ADT), 2012, SDDOT
X / X (square)	AM Peak Hour Basic Freeway Level of Service PM Peak Hour Basic Freeway Level of Service
X / X (inverted triangle)	AM Peak Hour Ramp Merge Level of Service PM Peak Hour Ramp Merge Level of Service
X / X (triangle)	AM Peak Hour Ramp Diverge Level of Service PM Peak Hour Ramp Diverge Level of Service
X / X (diamond)	AM Peak Hour Weaving Section Level of Service PM Peak Hour Weaving Section Level of Service
X / X (circle)	AM Peak Hour Signalized Intersection Level of Service PM Peak Hour Signalized Intersection Level of Service
X / X (hexagon)	AM Peak Hour Unsignalized Intersection Level of Service PM Peak Hour Unsignalized Intersection Level of Service

Notes:

1. Operational analysis is based on volumes supplied by stakeholder agencies in the data collection phase of Sub-Study 1 and supplemented with additional counts in the spring of 2013. Lane geometries are based on aerial photography present at the time of data collection
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3. Worst case stop controlled approach Level of Service reported

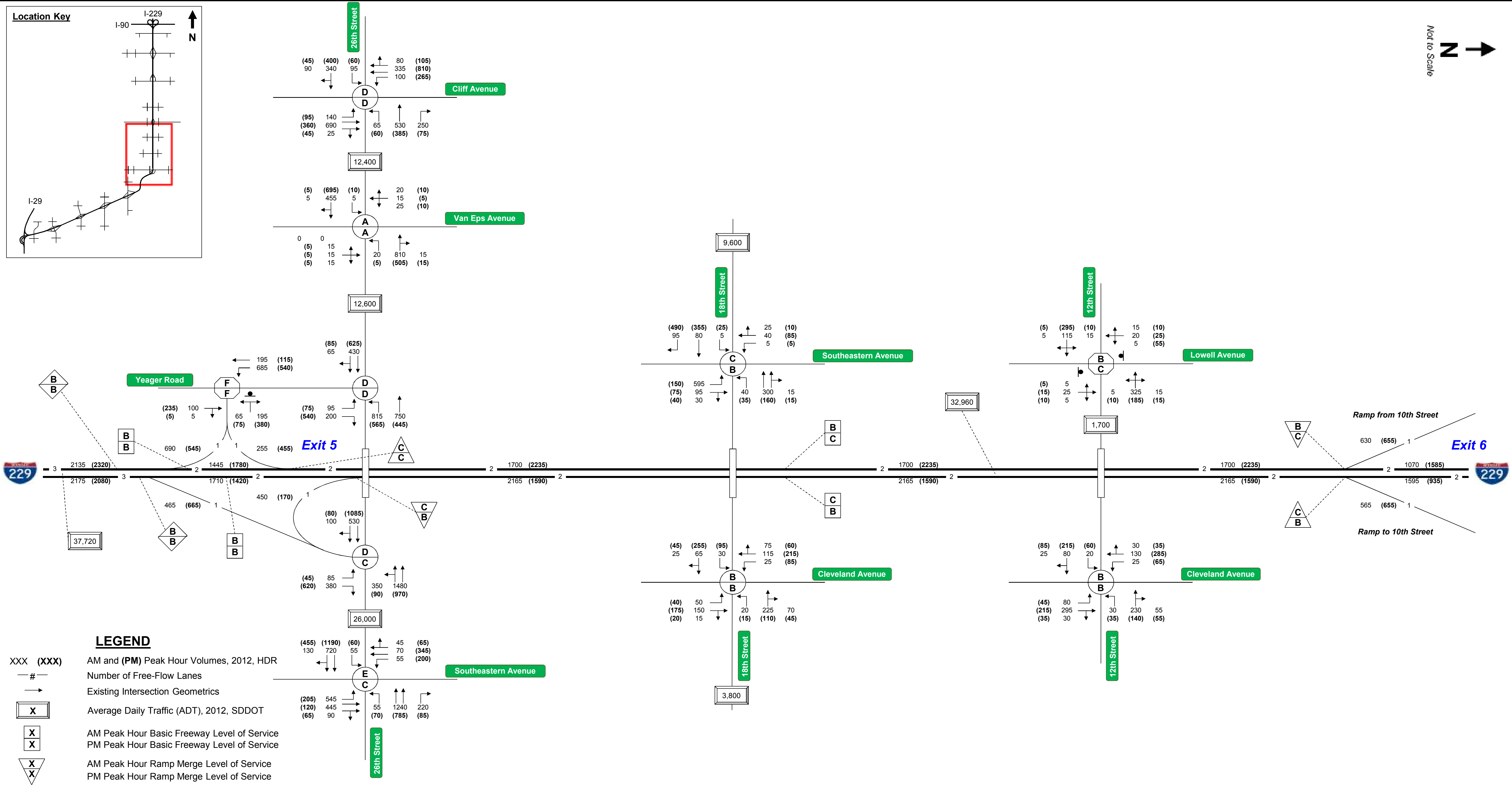
HDR

Existing Conditions Traffic Operations Analysis

I-229 Major Investment Corridor Study: Sub-Study 1
Sioux Falls, South Dakota

Date
03/05/2014

Figure
2 of 5



LEGEND

XXX **(XXX)**	AM and **(PM)** Peak Hour Volumes, 2012, HDR
—#—	Number of Free-Flow Lanes
→	Existing Intersection Geometrics
X	Average Daily Traffic (ADT), 2012, SDDOT
X / X	AM Peak Hour Basic Freeway Level of Service PM Peak Hour Basic Freeway Level of Service
X / X	AM Peak Hour Ramp Merge Level of Service PM Peak Hour Ramp Merge Level of Service
X / X	AM Peak Hour Ramp Diverge Level of Service PM Peak Hour Ramp Diverge Level of Service
X / X	AM Peak Hour Weaving Section Level of Service PM Peak Hour Weaving Section Level of Service
X / X	AM Peak Hour Signalized Intersection Level of Service PM Peak Hour Signalized Intersection Level of Service
X / X	AM Peak Hour Unsignalized Intersection Level of Service PM Peak Hour Unsignalized Intersection Level of Service

Notes:

1. Operational analysis is based on volumes supplied by stakeholder agencies in the data collection phase of Sub-Study 1 and supplemented with additional counts in the spring of 2013. Lane geometrics are based on aerial photography present at the time of data collection
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3. Worst case stop controlled approach Level of Service reported

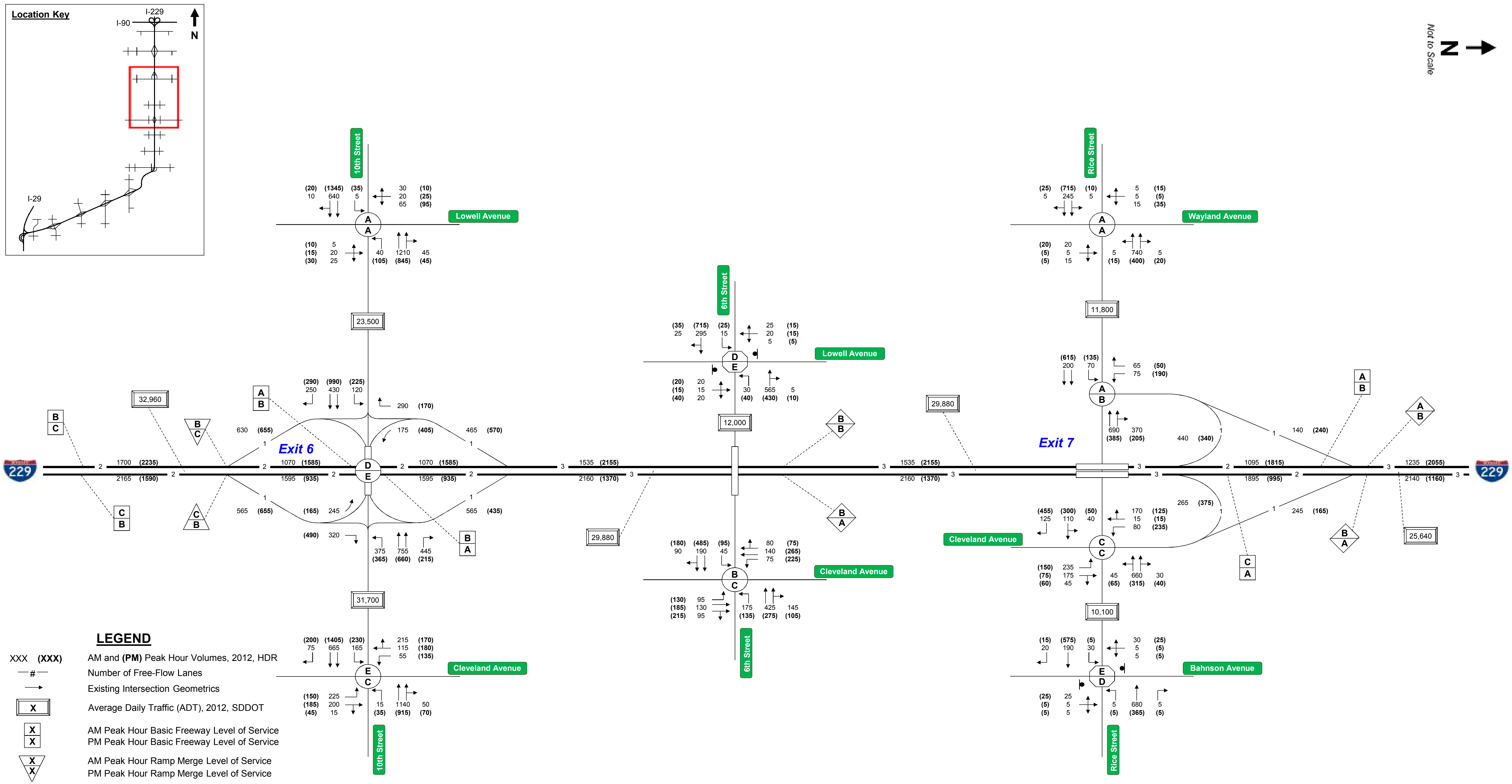
HDR

Existing Conditions Traffic Operations Analysis

I-229 Major Investment Corridor Study: Sub-Study 1
Sioux Falls, South Dakota

Date
03/05/2014

Figure
3 of 5



LEGEND

XXX (XXX)	AM and **(PM)** Peak Hour Volumes, 2012, HDR
—#—	Number of Free-Flow Lanes
→	Existing Intersection Geometrics
X	Average Daily Traffic (ADT), 2012, SDDOT
X / X	AM Peak Hour Basic Freeway Level of Service PM Peak Hour Basic Freeway Level of Service
X / X	AM Peak Hour Ramp Merge Level of Service PM Peak Hour Ramp Merge Level of Service
X / X	AM Peak Hour Ramp Diverge Level of Service PM Peak Hour Ramp Diverge Level of Service
X / X	AM Peak Hour Weaving Section Level of Service PM Peak Hour Weaving Section Level of Service
X / X	AM Peak Hour Signalized Intersection Level of Service PM Peak Hour Signalized Intersection Level of Service
X / X	AM Peak Hour Unsignalized Intersection Level of Service PM Peak Hour Unsignalized Intersection Level of Service

Notes:

1. Operational analysis is based on volumes supplied by stakeholder agencies in the data collection phase of Sub-Study 1 and supplemented with additional counts in the spring of 2013. Lane geometrics are based on aerial photography present at the time of data collection
2. 7:15 - 8:15 AM Peak Hour; 4:30 - 5:30 PM Peak Hour
3. Worst case stop controlled approach Level of Service reported

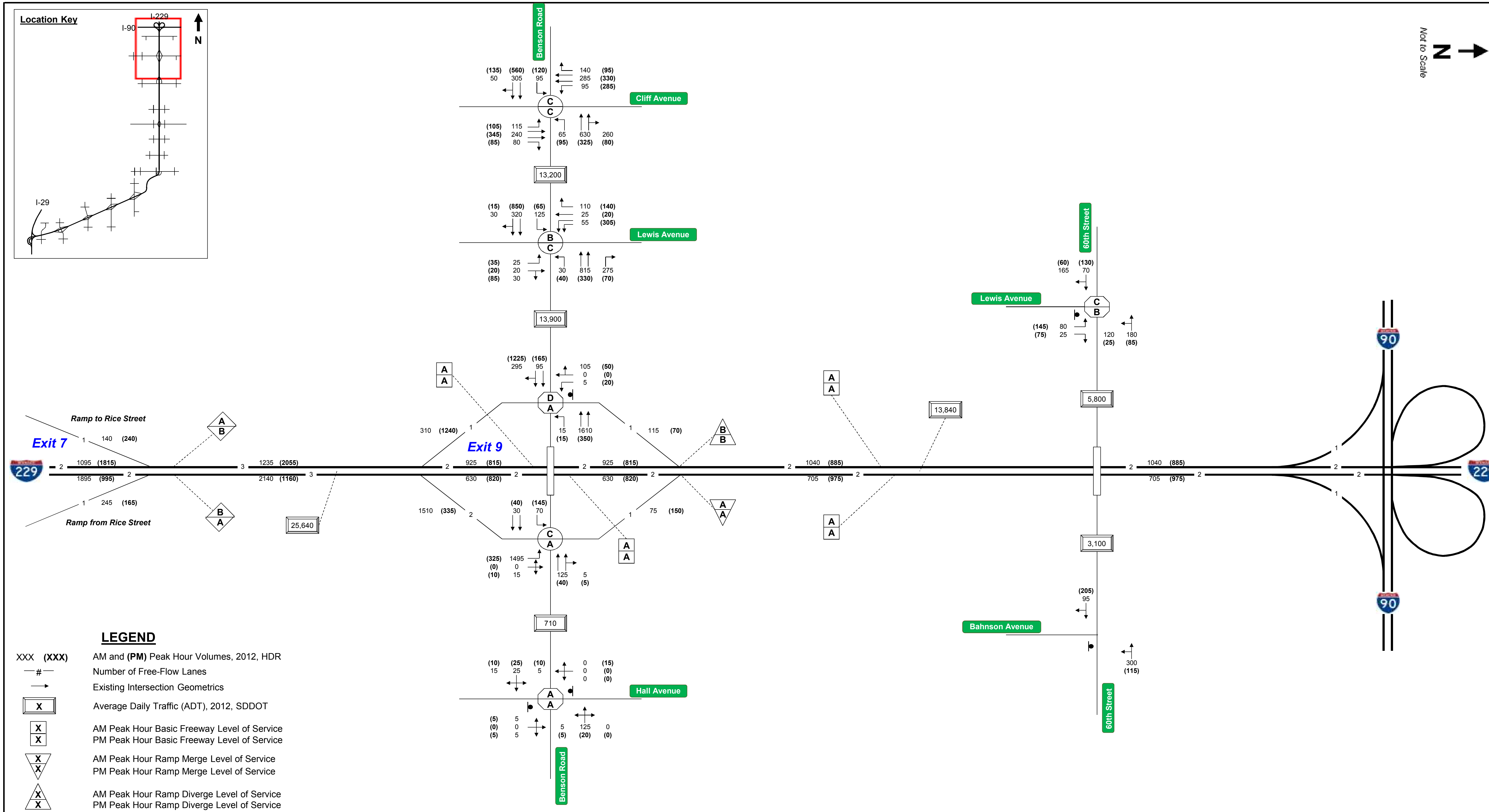
HDR

Existing Conditions Traffic Operations Analysis

I-229 Major Investment Corridor Study: Sub-Study 1
Sioux Falls, South Dakota

Date
03/05/2014

Figure
4 of 5



LEGEND

XXX (XXX)	AM and **(PM)** Peak Hour Volumes, 2012, HDR
—#—	Number of Free-Flow Lanes
→	Existing Intersection Geometrics
X (box)	Average Daily Traffic (ADT), 2012, SDDOT
X / X (square)	AM Peak Hour Basic Freeway Level of Service PM Peak Hour Basic Freeway Level of Service
X / X (inverted triangle)	AM Peak Hour Ramp Merge Level of Service PM Peak Hour Ramp Merge Level of Service
X / X (triangle)	AM Peak Hour Ramp Diverge Level of Service PM Peak Hour Ramp Diverge Level of Service
X / X (diamond)	AM Peak Hour Weaving Section Level of Service PM Peak Hour Weaving Section Level of Service
X / X (circle)	AM Peak Hour Signalized Intersection Level of Service PM Peak Hour Signalized Intersection Level of Service
X / X (hexagon)	AM Peak Hour Unsignalized Intersection Level of Service PM Peak Hour Unsignalized Intersection Level of Service

Notes:

1. Operational analysis is based on volumes supplied by stakeholder agencies in the data collection phase of Sub-Study 1 and supplemented with additional counts in the spring of 2013. Lane geometrics are based on aerial photography present at the time of data collection
2. 7:15 - 8:15 AM Peak Hour; 4:30 - 5:30 PM Peak Hour
3. Worst case stop controlled approach Level of Service reported

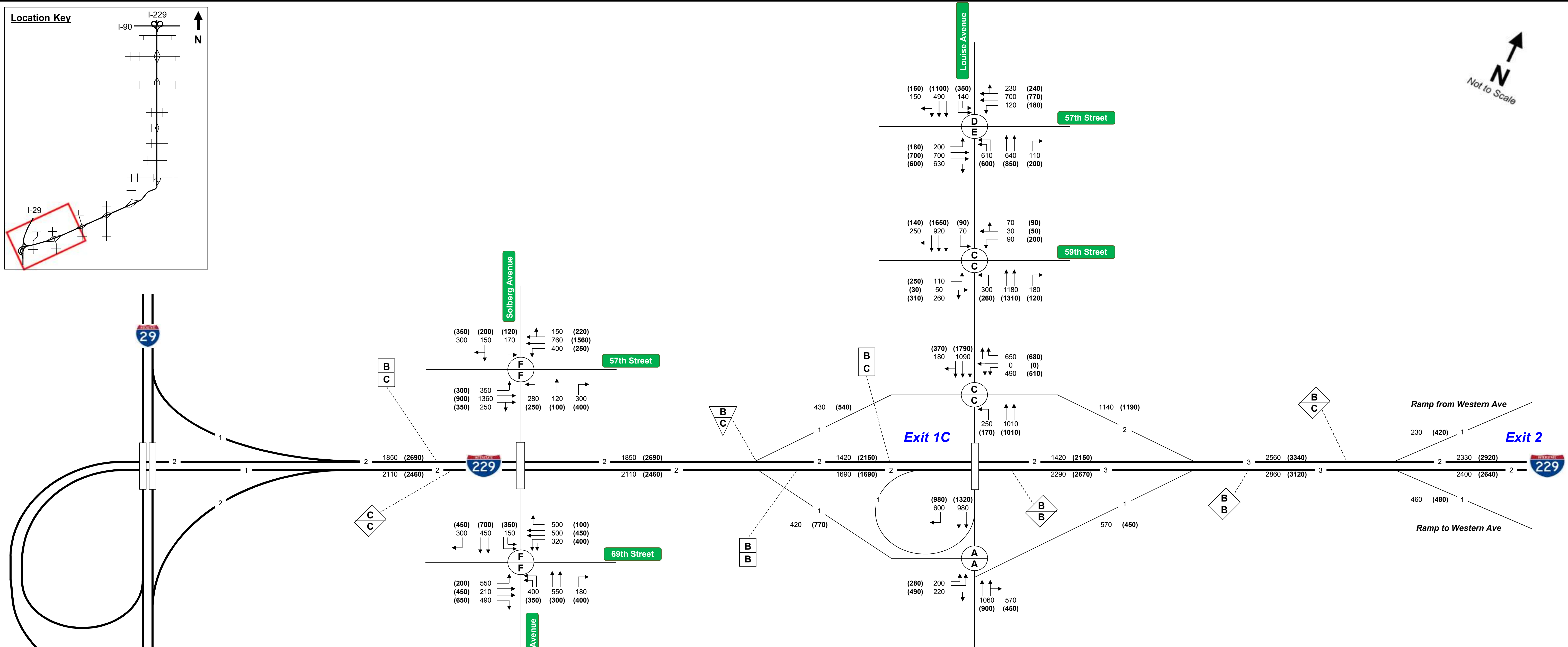
HDR

Existing Conditions Traffic Operations Analysis

I-229 Major Investment Corridor Study: Sub-Study 1
Sioux Falls, South Dakota

Date
03/05/2014

Figure
5 of 5



LEGEND

XXX **(XXX)**	AM and **(PM)** Peak Hour Volumes
—#—	Number of Free-Flow Lanes
→	Future No-Build Intersection Lane Geometrics
X / X (square)	AM Peak Hour Basic Freeway Level of Service PM Peak Hour Basic Freeway Level of Service
X / X (inverted triangle)	AM Peak Hour Ramp Merge Level of Service PM Peak Hour Ramp Merge Level of Service
X / X (triangle)	AM Peak Hour Ramp Diverge Level of Service PM Peak Hour Ramp Diverge Level of Service
X / X (diamond)	AM Peak Hour Weaving Section Level of Service PM Peak Hour Weaving Section Level of Service
X / X (circle)	AM Peak Hour Signalized Intersection Level of Service PM Peak Hour Signalized Intersection Level of Service
X / X (hexagon)	AM Peak Hour Unsignalized Intersection Level of Service PM Peak Hour Unsignalized Intersection Level of Service

Notes:

1. Worst case stop controlled approach Level of Service reported
2. Intersection LOS was reported for the condition where each intersection experienced the full projected demand, even though adjacent intersections under no-build conditions may not have sufficient capacity to convey all projected demand.

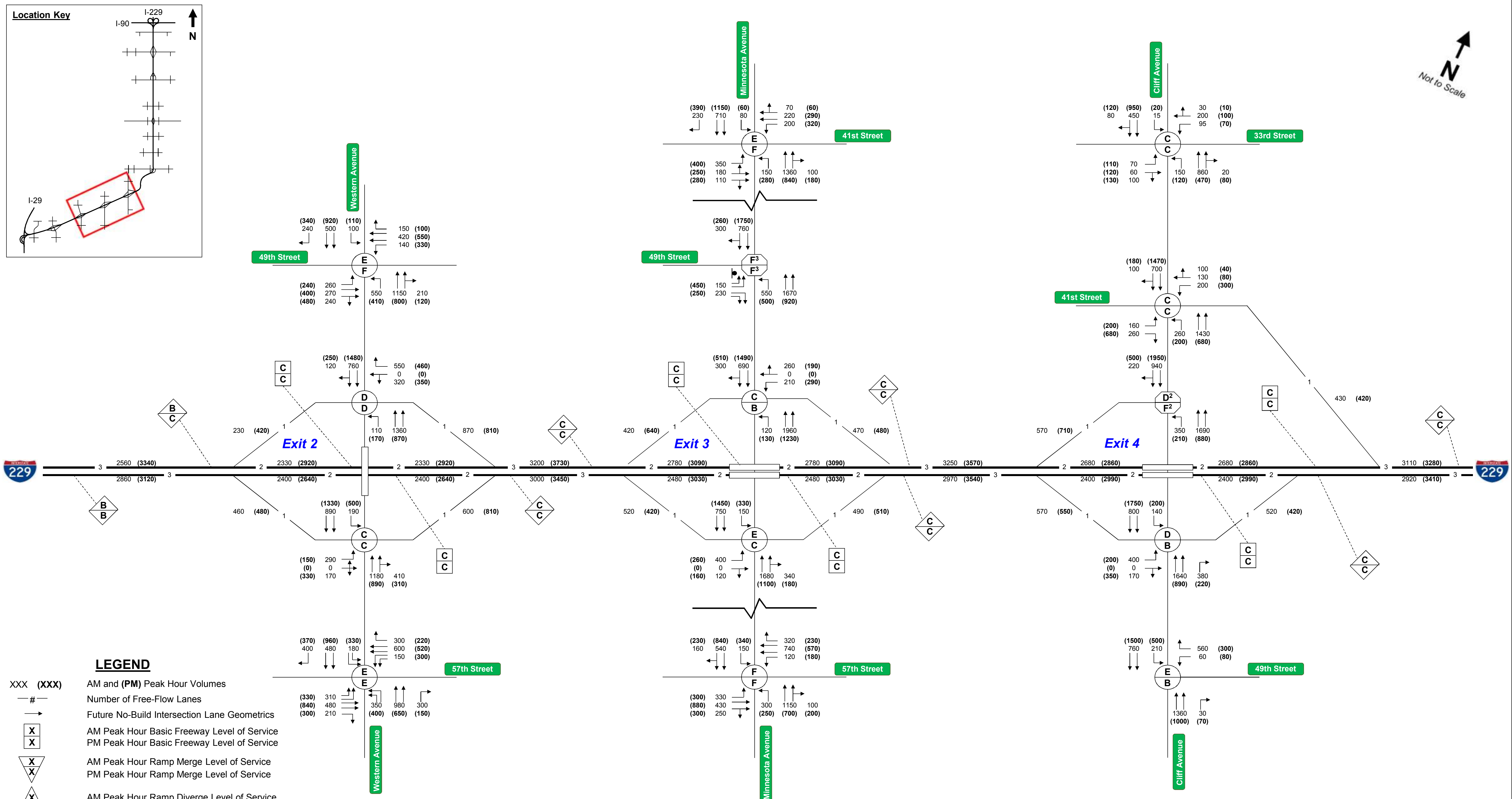
HDR

2035 No-Build "Worst Case" Conditions Traffic Operations Analysis

I-229 Major Investment Corridor Study: Sub-Study 1
I-229 Corridor Study
Sioux Falls, South Dakota

Date
11/5/2014

Figure
1



LEGEND

XXX **(XXX)**	AM and **(PM)** Peak Hour Volumes
—#—	Number of Free-Flow Lanes
→	Future No-Build Intersection Lane Geometrics
X / X (square)	AM Peak Hour Basic Freeway Level of Service PM Peak Hour Basic Freeway Level of Service
X / X (inverted triangle)	AM Peak Hour Ramp Merge Level of Service PM Peak Hour Ramp Merge Level of Service
X / X (triangle)	AM Peak Hour Ramp Diverge Level of Service PM Peak Hour Ramp Diverge Level of Service
X / X (diamond)	AM Peak Hour Weaving Section Level of Service PM Peak Hour Weaving Section Level of Service
X / X (circle)	AM Peak Hour Signalized Intersection Level of Service PM Peak Hour Signalized Intersection Level of Service
X / X (hexagon)	AM Peak Hour Unsignalized Intersection Level of Service PM Peak Hour Unsignalized Intersection Level of Service

Notes:

1. Worst case stop controlled approach Level of Service reported
2. Worst case stop controlled movement Level of Service reported
3. Level of Service reported from HCS 2010 analysis using a single left-turn lane and a single right-turn lane due to limitations of HCS 2010 software.
4. Intersection LOS was reported for the condition where each intersection experienced the full projected demand, even though adjacent intersections under no-build conditions may not have sufficient capacity

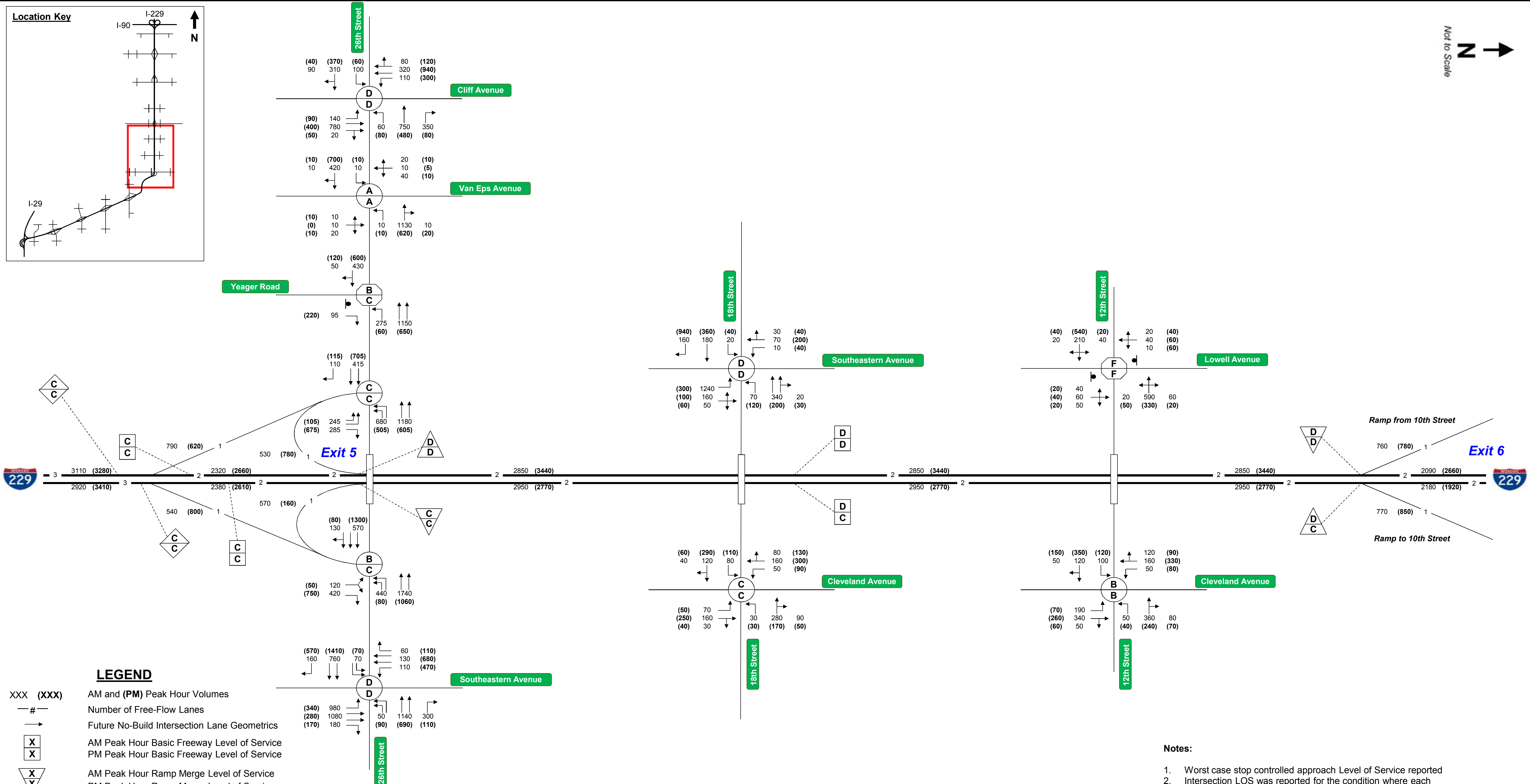
HDR

2035 No-Build "Worst Case" Conditions Traffic Operations Analysis

I-229 Major Investment Corridor Study: Sub-Study 1
I-229 Corridor Study
Sioux Falls, South Dakota

Date
11/5/2014

Figure
2



LEGEND

XXX (**XXX**)	AM and **(PM)** Peak Hour Volumes
—#—	Number of Free-Flow Lanes
→	Future No-Build Intersection Lane Geometrics
X/X (box)	AM Peak Hour Basic Freeway Level of Service PM Peak Hour Basic Freeway Level of Service
X/X (inverted triangle)	AM Peak Hour Ramp Merge Level of Service PM Peak Hour Ramp Merge Level of Service
X/X (triangle)	AM Peak Hour Ramp Diverge Level of Service PM Peak Hour Ramp Diverge Level of Service
X/X (diamond)	AM Peak Hour Weaving Section Level of Service PM Peak Hour Weaving Section Level of Service
X/X (circle)	AM Peak Hour Signalized Intersection Level of Service PM Peak Hour Signalized Intersection Level of Service
X/X (octagon)	AM Peak Hour Unsignalized Intersection Level of Service PM Peak Hour Unsignalized Intersection Level of Service

Notes:

1. Worst case stop controlled approach Level of Service reported
2. Intersection LOS was reported for the condition where each intersection experienced the full projected demand, even though adjacent intersections under no-build conditions may not have sufficient capacity to convey all projected demand.

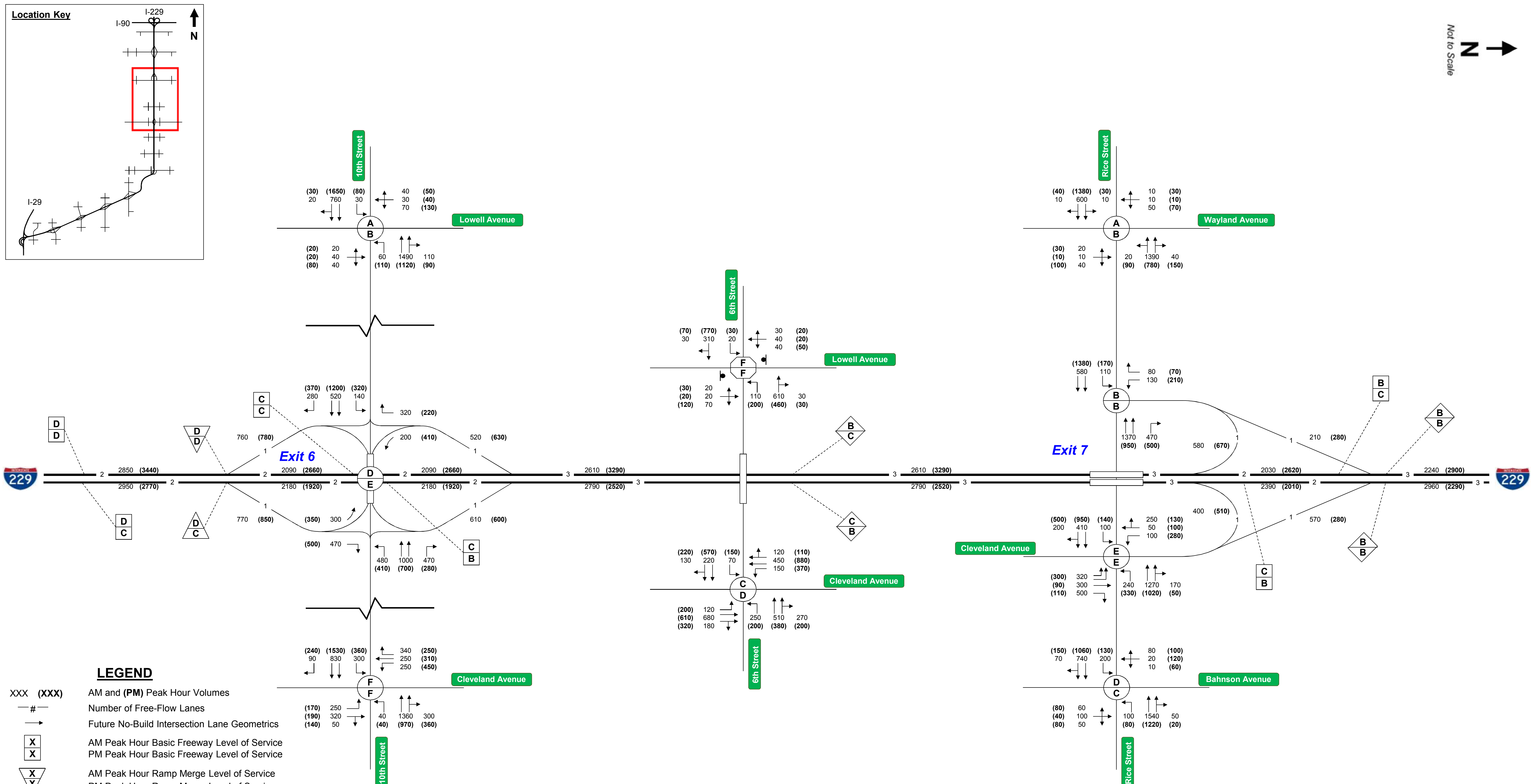
HDR

2035 No-Build "Worst Case" Conditions Traffic Operations Analysis

I-229 Major Investment Corridor Study: Sub-Study 1
I-229 Corridor Study
Sioux Falls, South Dakota

Date
11/5/2014

Figure
3



LEGEND

XXX **(XXX)** AM and **(PM)** Peak Hour Volumes

—#— Number of Free-Flow Lanes

→ Future No-Build Intersection Lane Geometrics

AM Peak Hour Basic Freeway Level of Service
PM Peak Hour Basic Freeway Level of Service

AM Peak Hour Ramp Merge Level of Service
PM Peak Hour Ramp Merge Level of Service

AM Peak Hour Ramp Diverge Level of Service
PM Peak Hour Ramp Diverge Level of Service

AM Peak Hour Weaving Section Level of Service
PM Peak Hour Weaving Section Level of Service

AM Peak Hour Signalized Intersection Level of Service
PM Peak Hour Signalized Intersection Level of Service

AM Peak Hour Unsignalized Intersection Level of Service
PM Peak Hour Unsignalized Intersection Level of Service

Notes:

1. Worst case stop controlled approach Level of Service reported
2. Intersection LOS was reported for the condition where each intersection experienced the full projected demand, even though adjacent intersections under no-build conditions may not have sufficient capacity to convey all projected demand.

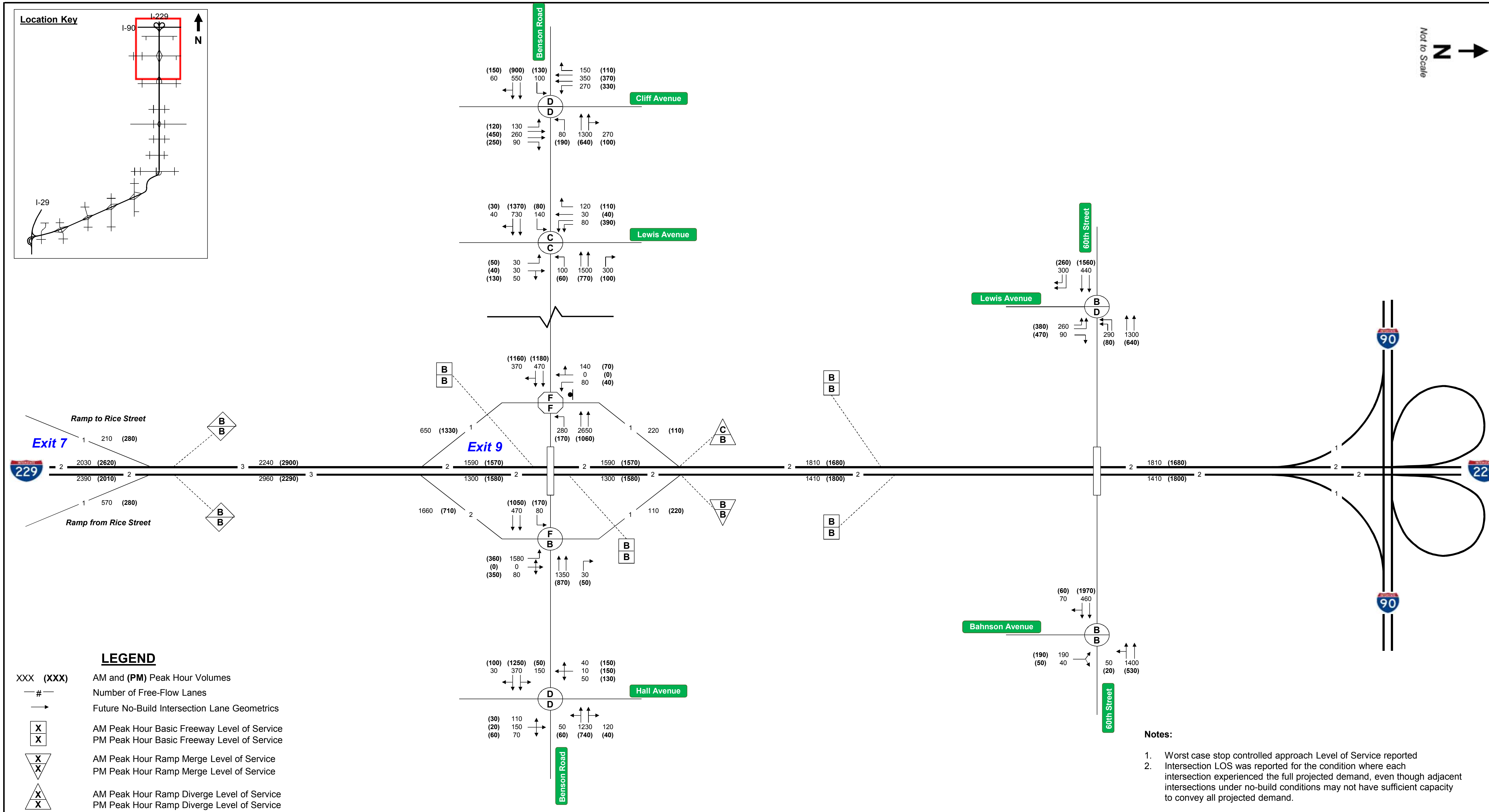
HDR

2035 No-Build "Worst Case" Conditions Traffic Operations Analysis

I-229 Major Investment Corridor Study: Sub-Study 1
I-229 Corridor Study
Sioux Falls, South Dakota

Date
11/5/2014

Figure
4



LEGEND

XXX (XXX)	AM and (PM) Peak Hour Volumes
—#—	Number of Free-Flow Lanes
→	Future No-Build Intersection Lane Geometrics
X / X	AM Peak Hour Basic Freeway Level of Service PM Peak Hour Basic Freeway Level of Service
X / X	AM Peak Hour Ramp Merge Level of Service PM Peak Hour Ramp Merge Level of Service
X / X	AM Peak Hour Ramp Diverge Level of Service PM Peak Hour Ramp Diverge Level of Service
X / X	AM Peak Hour Weaving Section Level of Service PM Peak Hour Weaving Section Level of Service
X / X	AM Peak Hour Signalized Intersection Level of Service PM Peak Hour Signalized Intersection Level of Service
X / X	AM Peak Hour Unsignalized Intersection Level of Service PM Peak Hour Unsignalized Intersection Level of Service

Notes:

1. Worst case stop controlled approach Level of Service reported
2. Intersection LOS was reported for the condition where each intersection experienced the full projected demand, even though adjacent intersections under no-build conditions may not have sufficient capacity to convey all projected demand.

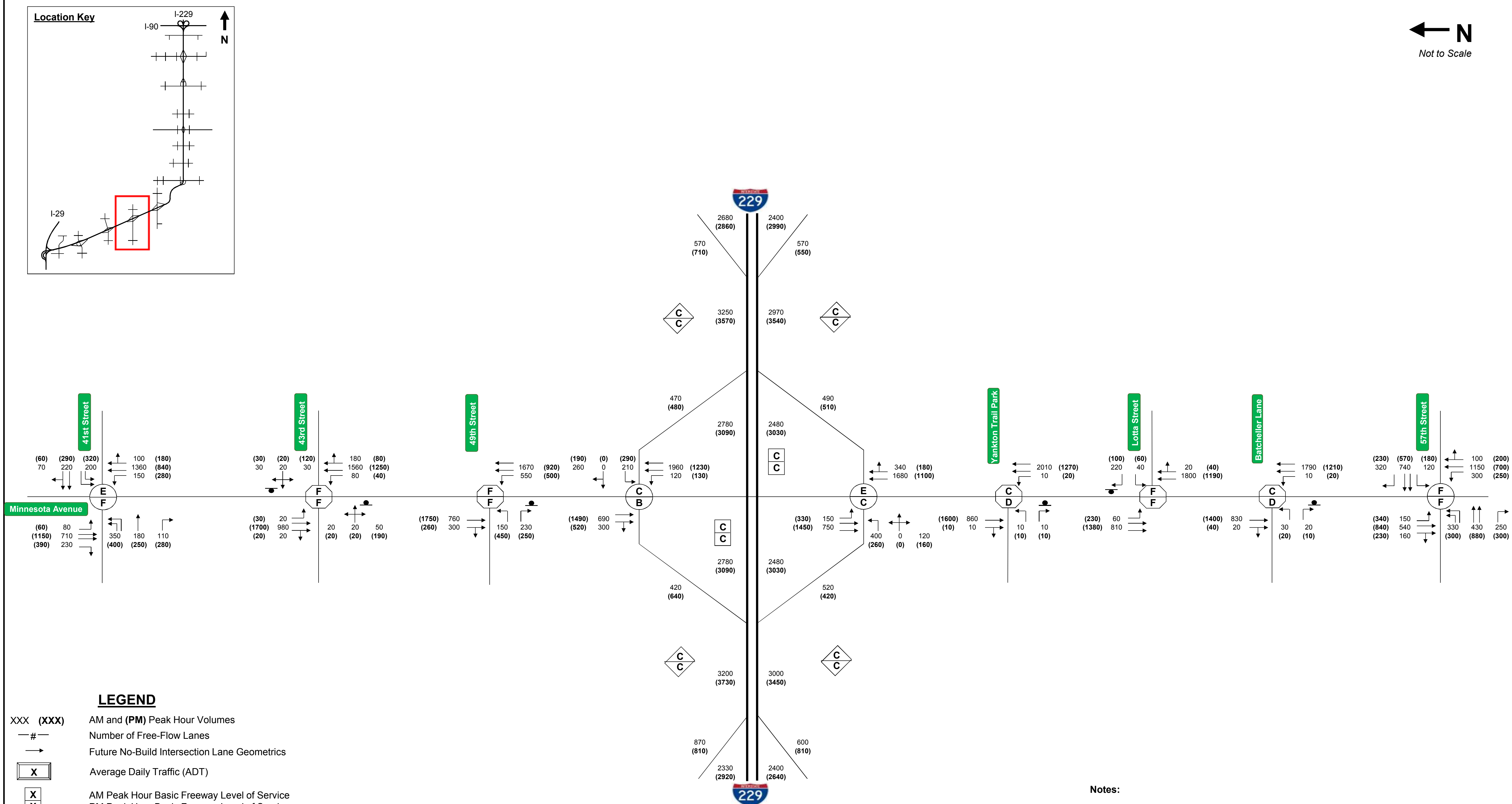
HDR

2035 No-Build "Worst Case" Conditions Traffic Operations Analysis

I-229 Major Investment Corridor Study: Sub-Study 1
I-229 Corridor Study
Sioux Falls, South Dakota

Date
11/5/2014

Figure
5



LEGEND

XXX (XXX) AM and (PM) Peak Hour Volumes

—#— Number of Free-Flow Lanes

Future No-Build Intersection Lane Geometrics

Average Daily Traffic (ADT)

AM Peak Hour Basic Freeway Level of Service
PM Peak Hour Basic Freeway Level of Service

AM Peak Hour Ramp Merge Level of Service
PM Peak Hour Ramp Merge Level of Service

AM Peak Hour Ramp Diverge Level of Service
PM Peak Hour Ramp Diverge Level of Service

AM Peak Hour Weaving Section Level of Service
PM Peak Hour Weaving Section Level of Service

AM Peak Hour Signalized Intersection Level of Service
PM Peak Hour Signalized Intersection Level of Service

AM Peak Hour Unsignalized Intersection Level of Service
PM Peak Hour Unsignalized Intersection Level of Service

Notes:

1. 2035 No-Build traffic volumes based on the Sioux Falls travel demand model. See report text for additional information on volume development.
2. Worst case stop controlled approach Level of Service reported

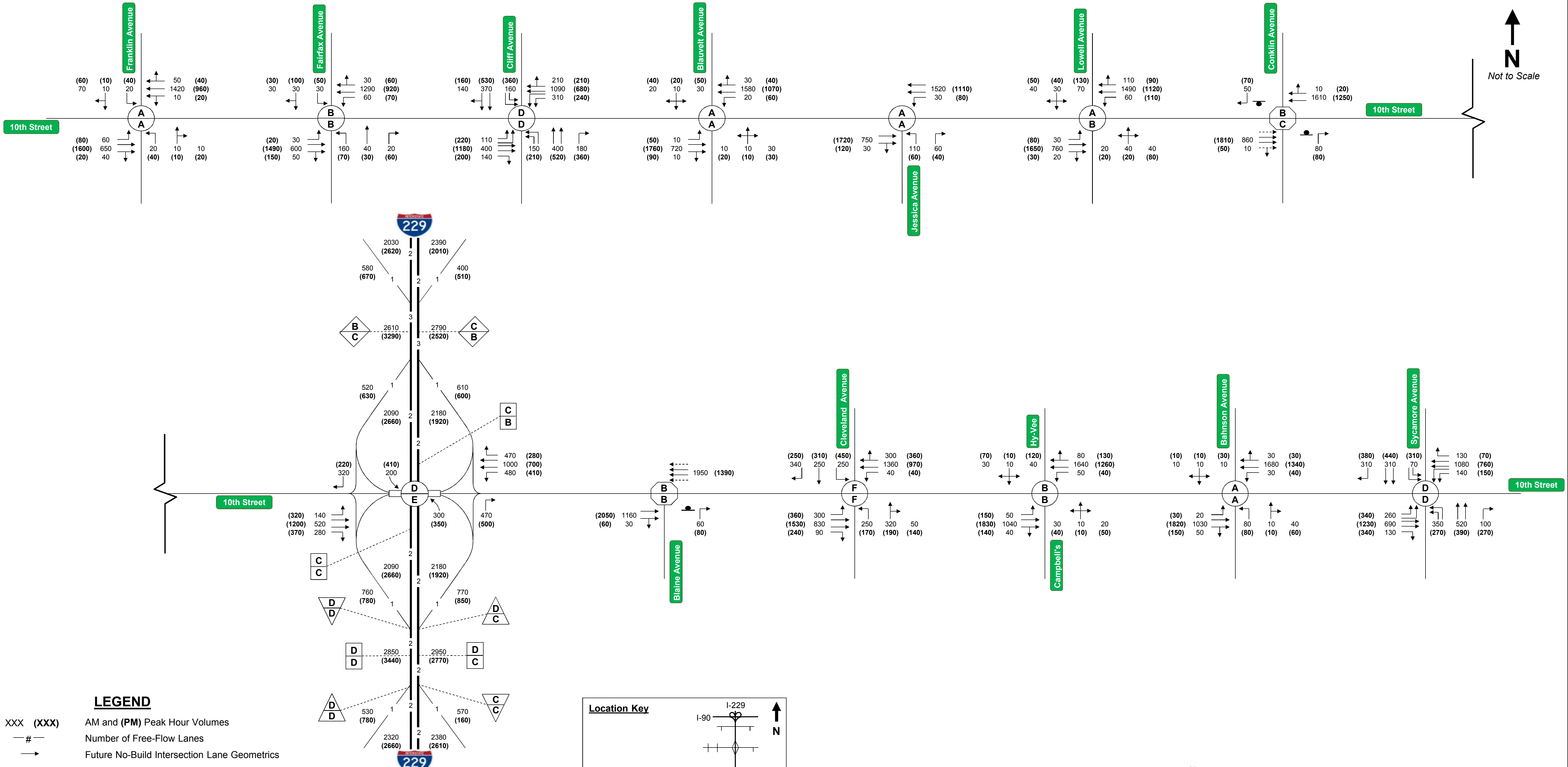
HRGreen

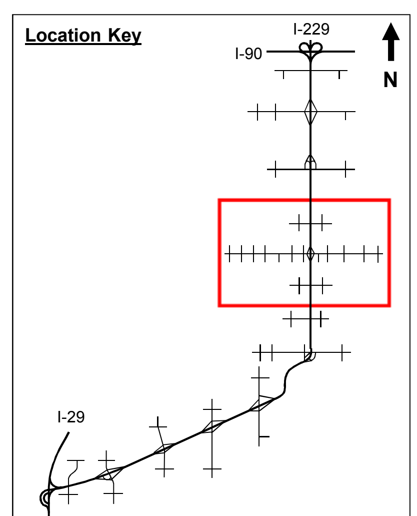
2035 No-Build "Worst Case" Conditions Traffic Operations Analysis

I-229 Major Investment Corridor Study: Sub-Study 2
Minnesota Avenue Corridor Study
Sioux Falls, South Dakota

Date 11/5/2014

Figure 6





LEGEND

XXX (XXX)	AM and **(PM)** Peak Hour Volumes
—#—	Number of Free-Flow Lanes
→	Future No-Build Intersection Lane Geometrics
X / X (square)	AM Peak Hour Basic Freeway Level of Service PM Peak Hour Basic Freeway Level of Service
X / X (inverted triangle)	AM Peak Hour Ramp Merge Level of Service PM Peak Hour Ramp Merge Level of Service
X / X (triangle)	AM Peak Hour Ramp Diverge Level of Service PM Peak Hour Ramp Diverge Level of Service
X / X (diamond)	AM Peak Hour Weaving Section Level of Service PM Peak Hour Weaving Section Level of Service
X / X (circle)	AM Peak Hour Signalized Intersection Level of Service PM Peak Hour Signalized Intersection Level of Service
X / X (octagon)	AM Peak Hour Unsignalized Intersection Level of Service PM Peak Hour Unsignalized Intersection Level of Service

Notes:

1. Worst case stop controlled approach Level of Service reported
2. Intersection LOS was reported for the condition where each intersection experienced the full projected demand, even though adjacent intersections under no-build conditions may not have sufficient capacity to convey all projected demand.

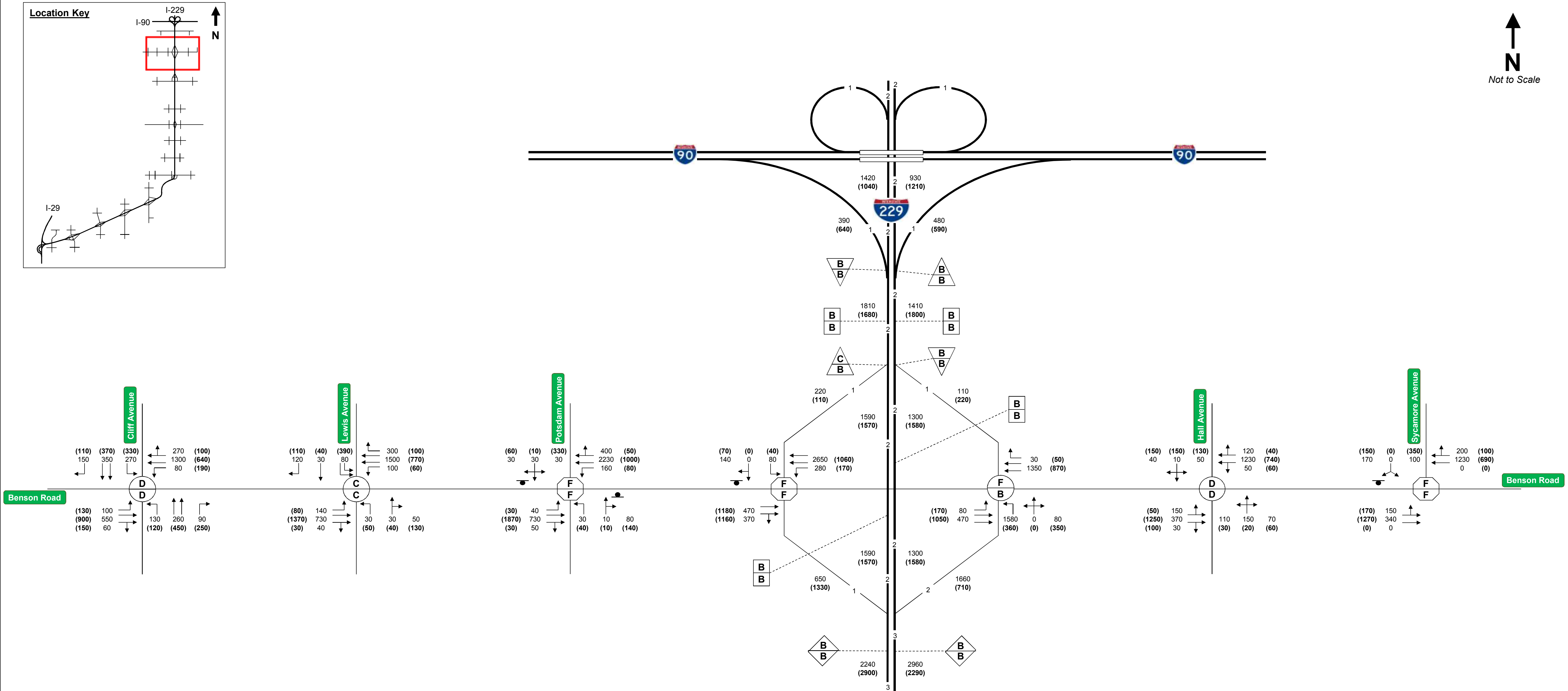
HDR

2035 No-Build "Worst Case" Conditions Traffic Operations Analysis

I-229 Major Investment Corridor Study: Sub-Study 3
10th Street Corridor Study
Sioux Falls, South Dakota

Date
11/5/2014

Figure
7



LEGEND

XXX (XXX)	AM and **(PM)** Peak Hour Volumes
—#—	Number of Free-Flow Lanes
→	Future No-Build Intersection Lane Geometrics
X / X (square)	AM Peak Hour Basic Freeway Level of Service PM Peak Hour Basic Freeway Level of Service
X / X (inverted triangle)	AM Peak Hour Ramp Merge Level of Service PM Peak Hour Ramp Merge Level of Service
X / X (triangle)	AM Peak Hour Ramp Diverge Level of Service PM Peak Hour Ramp Diverge Level of Service
X / X (diamond)	AM Peak Hour Weaving Section Level of Service PM Peak Hour Weaving Section Level of Service
X / X (circle)	AM Peak Hour Signalized Intersection Level of Service PM Peak Hour Signalized Intersection Level of Service
X / X (octagon)	AM Peak Hour Unsignalized Intersection Level of Service PM Peak Hour Unsignalized Intersection Level of Service

Notes:

1. Worst case stop controlled approach Level of Service reported
2. Intersection LOS was reported for the condition where each intersection experienced the full projected demand, even though adjacent intersections under no-build conditions may not have sufficient capacity to convey all projected demand.

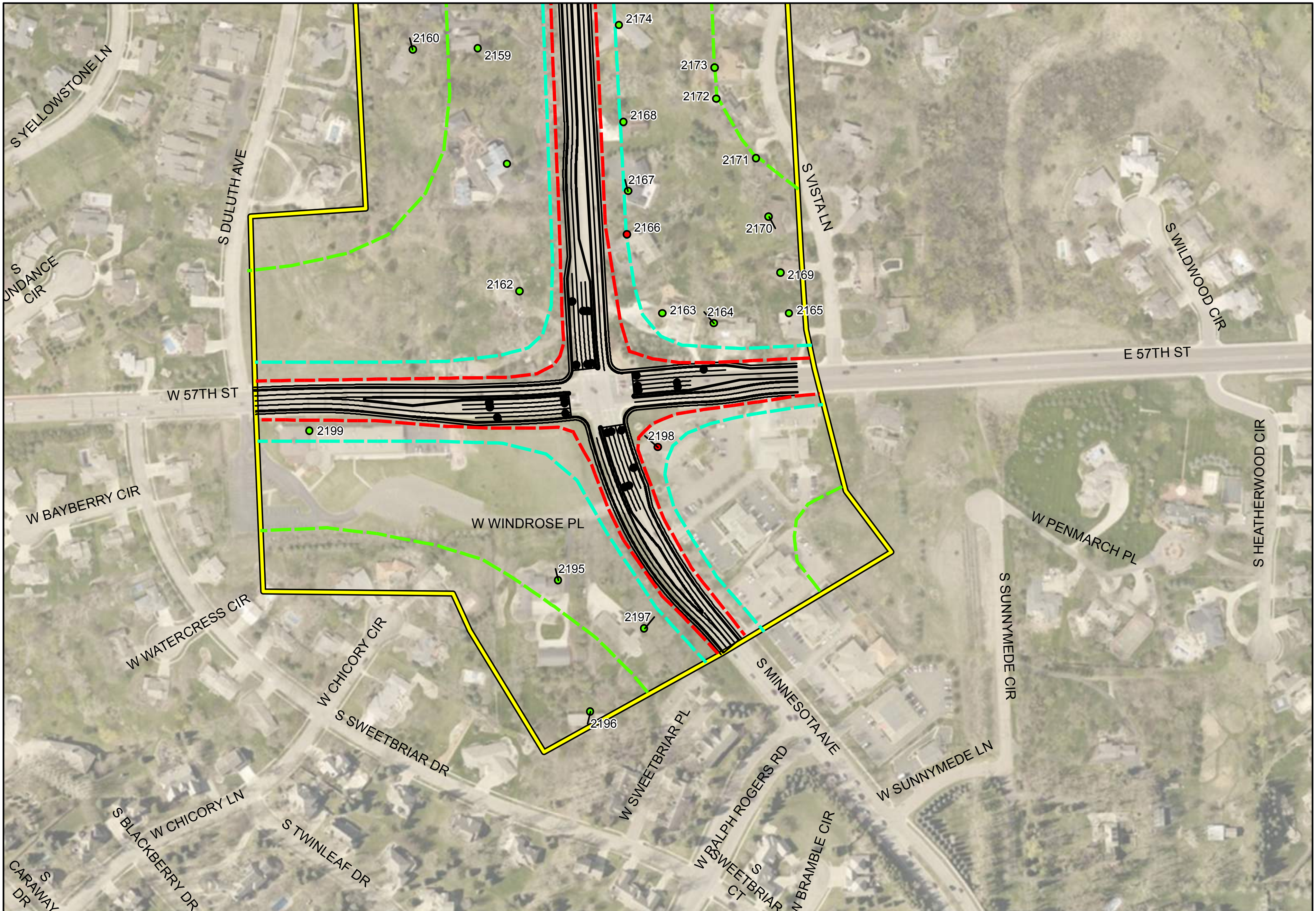
HDR

2035 No-Build "Worst Case" Conditions Traffic Operations Analysis

I-229 Major Investment Corridor Study: Sub-Study 4
Benson Road Corridor Study
Sioux Falls, South Dakota

Date
11/5/2014

Figure
8

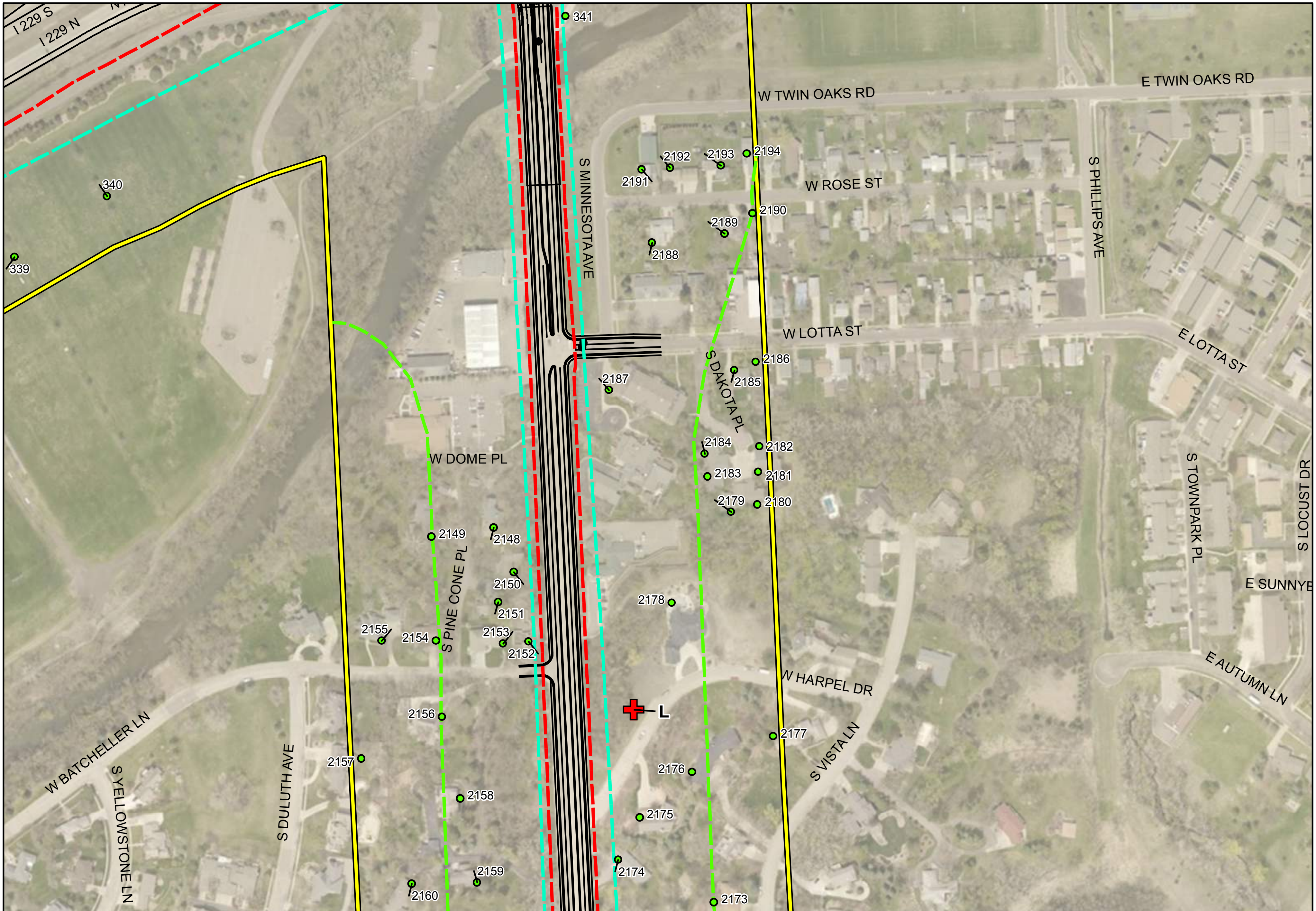


Legend

- Non-Impacted Receptor
- Impacted Receptor
- Noise Monitoring Location
- 56 dBA Contour Line
- 66 dBA Contour Line
- 71 dBA Contour Line
- Noise Study
- Sub-Study 2 Concept Linework Alternative 2C

HDR

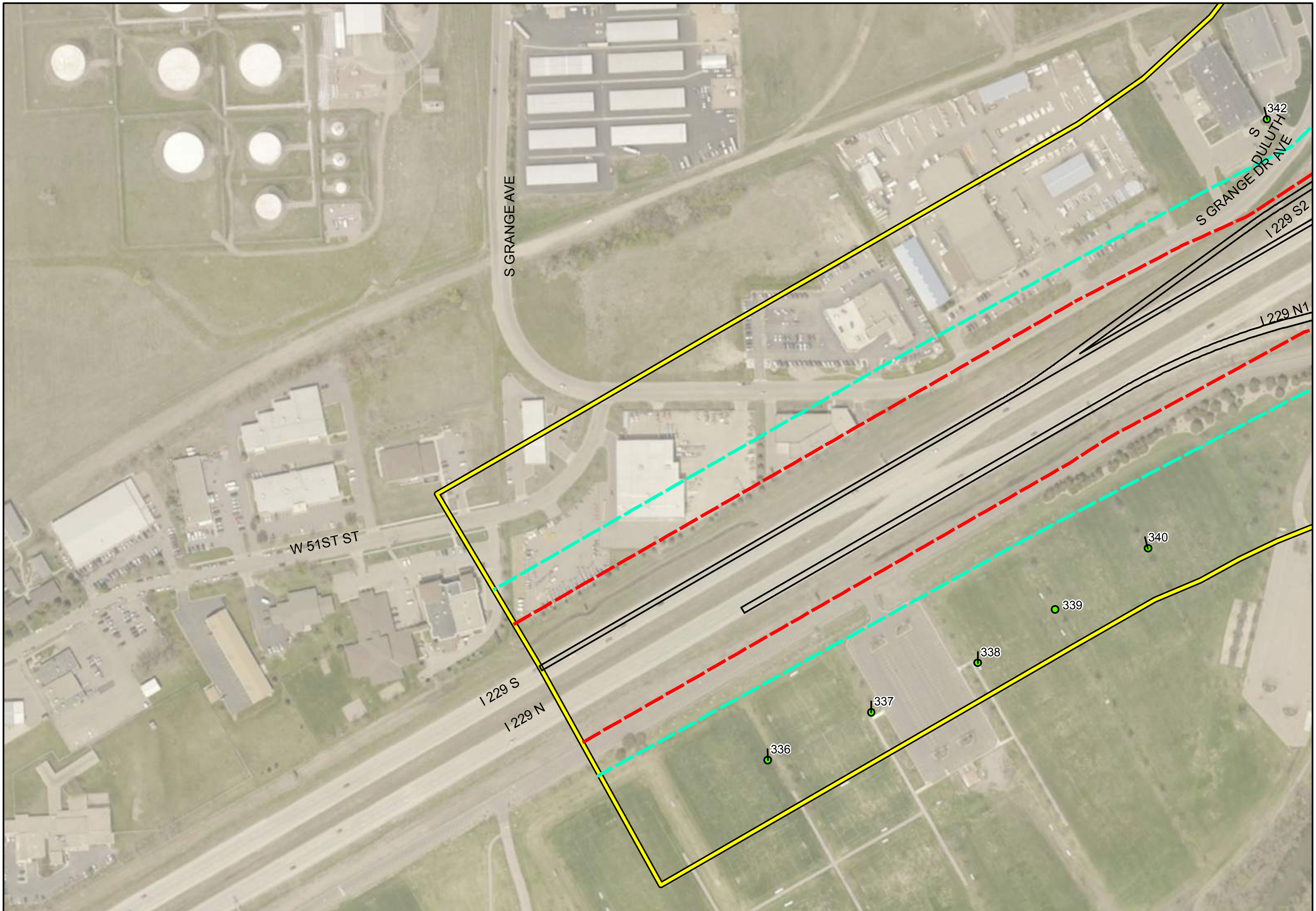
I-229 Major Investment Corridor Study
Sub-Study #2
Noise Contour Figures
Proposed Alternative 2C



Legend

- Non-Impacted Receptor
- Impacted Receptor
- Noise Monitoring Location
- 56 dBA Contour Line
- 66 dBA Contour Line
- 71 dBA Contour Line
- Noise Study
- Sub-Study 2 Concept Linework Alternative 2C

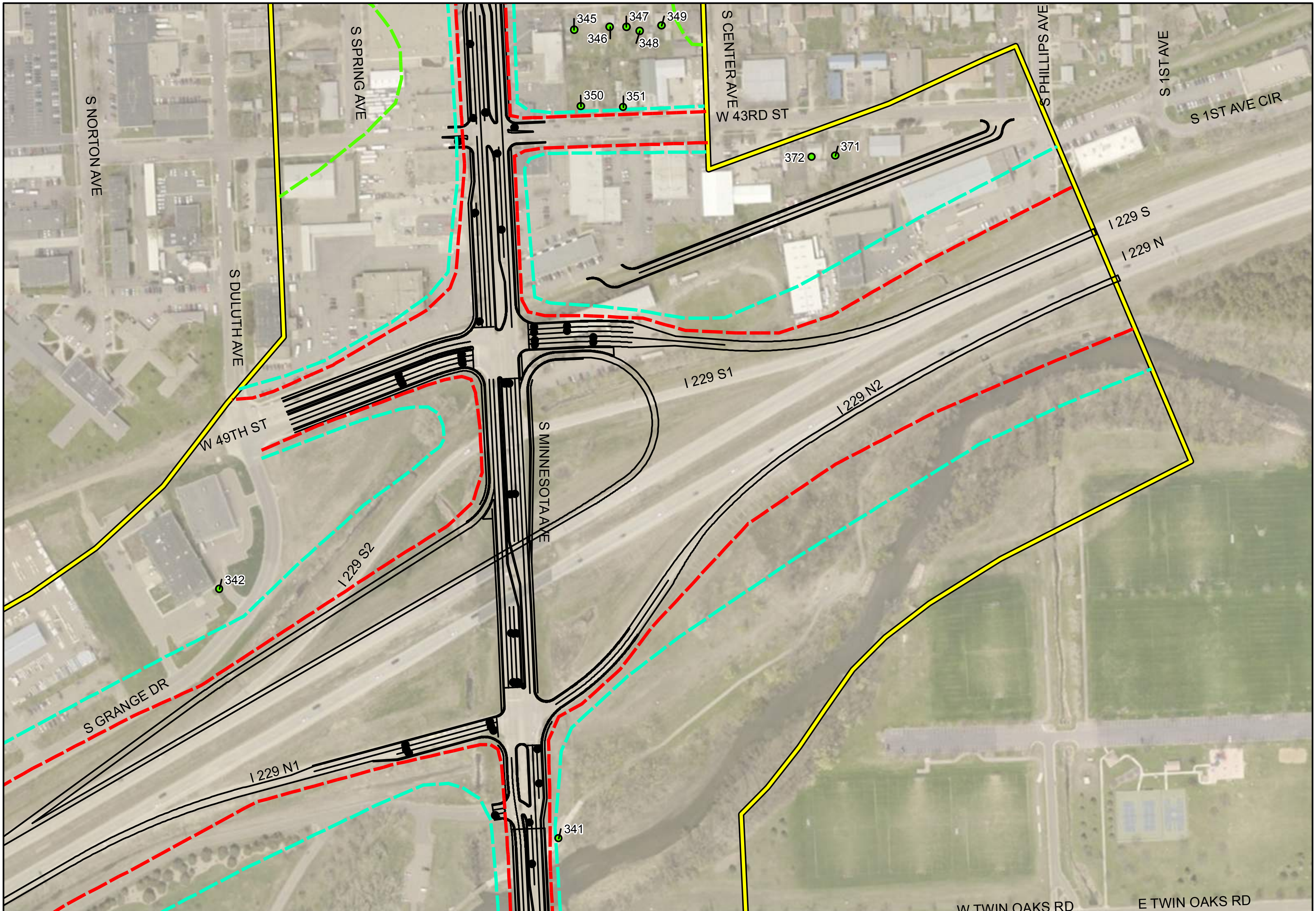
I-229 Major Investment Corridor Study
Sub-Study #2
Noise Contour Figures
Proposed Alternative 2C



Legend

- Non-Impacted Receptor
- Impacted Receptor
- Noise Monitoring Location
- 56 dBA Contour Line
- 66 dBA Contour Line
- 71 dBA Contour Line
- Noise Study
- Sub-Study 2 Concept Linework Alternative 2C

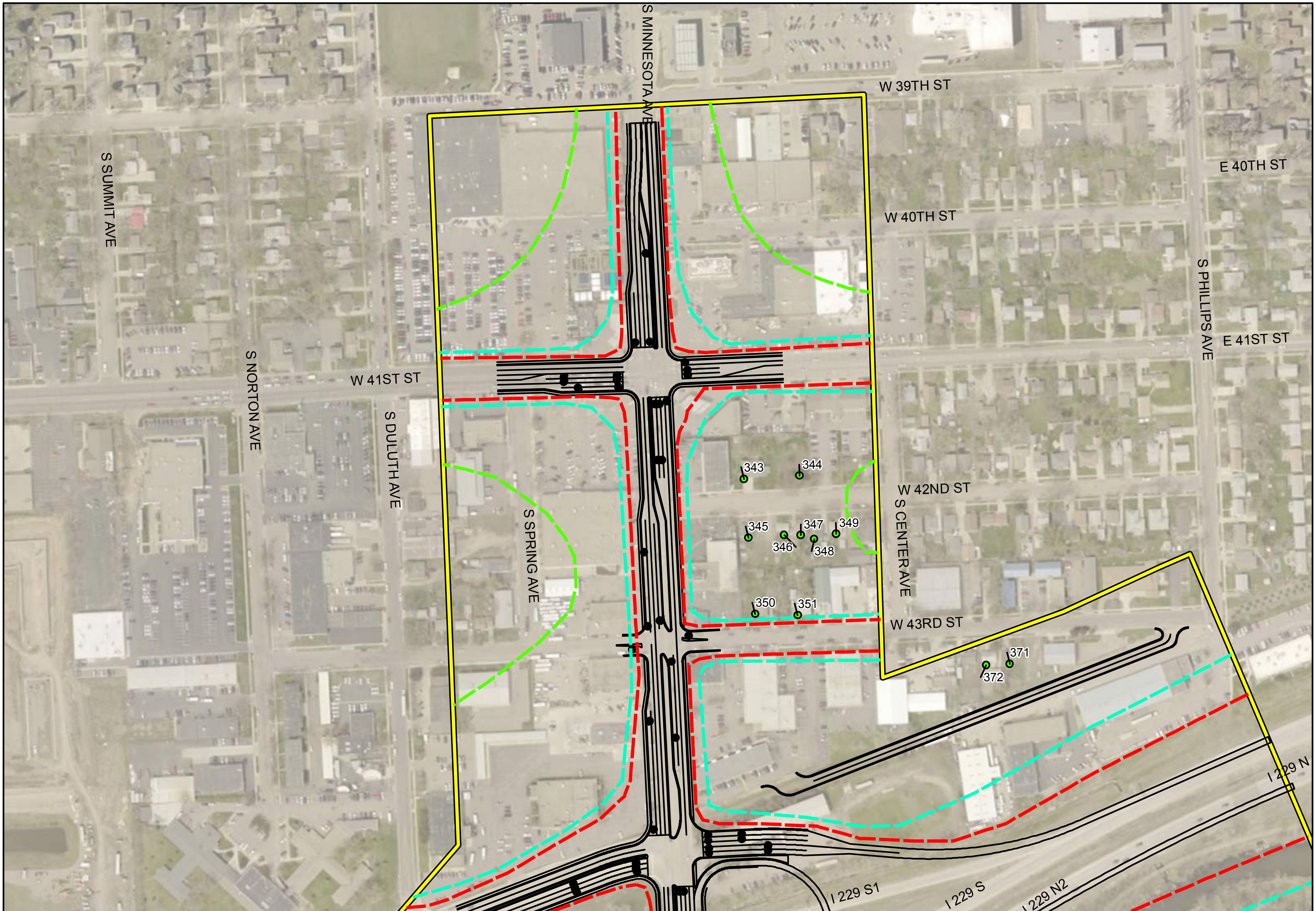
I-229 Major Investment Corridor Study
Sub-Study #2
Noise Contour Figures
Proposed Alternative 2C

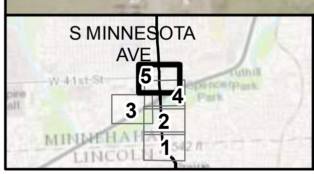


Legend

- Non-Impacted Receptor
- Impacted Receptor
- Noise Monitoring Location
- 56 dBA Contour Line
- 66 dBA Contour Line
- 71 dBA Contour Line
- Noise Study
- Sub-Study 2 Concept Linework Alternative 2C

I-229 Major Investment Corridor Study
Sub-Study #2
Noise Contour Figures
Proposed Alternative 2C

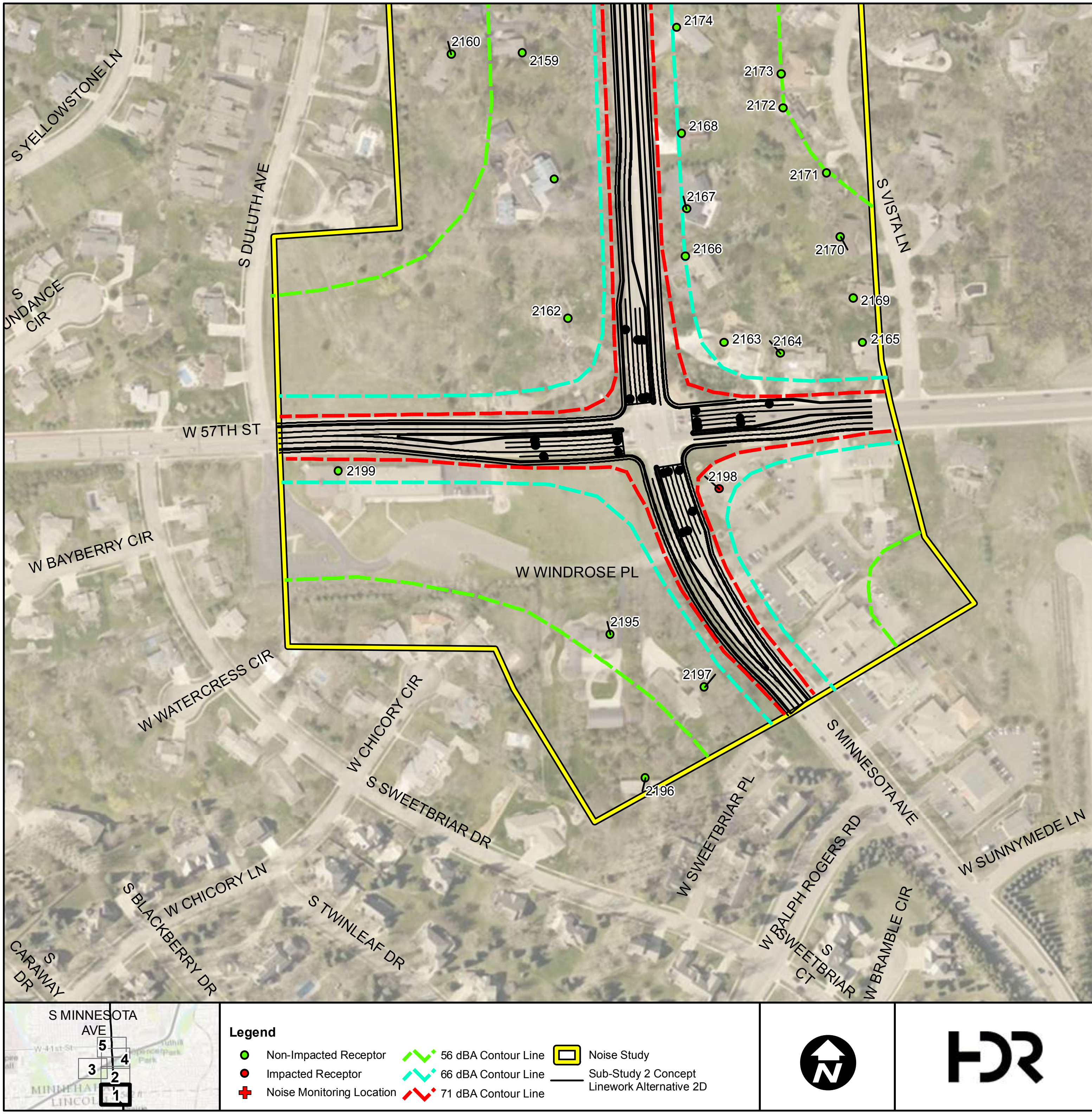




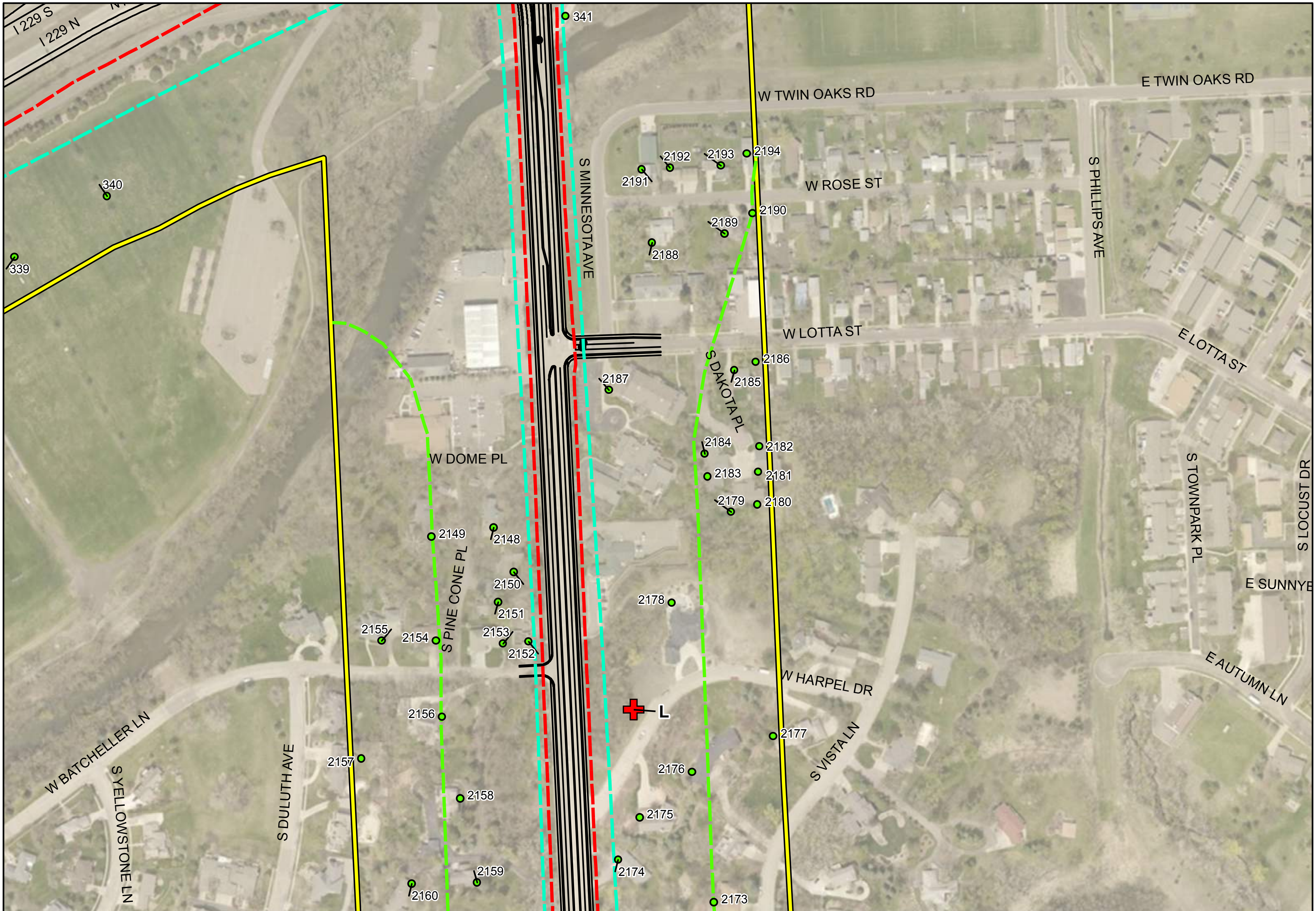
Legend

- Non-Impacted Receptor
- Impacted Receptor
- Noise Monitoring Location
- 56 dBA Contour Line
- 66 dBA Contour Line
- 71 dBA Contour Line
- Noise Study
- Sub-Study 2 Concept Linework Alternative 2C

I-229 Major Investment Corridor Study
Sub-Study #2
Noise Contour Figures
Proposed Alternative 2C



I-229 Major Investment Corridor Study
Sub-Study #2
Noise Contour Figures
Proposed Alternative 2D



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I-229 Major Investment Corridor Study
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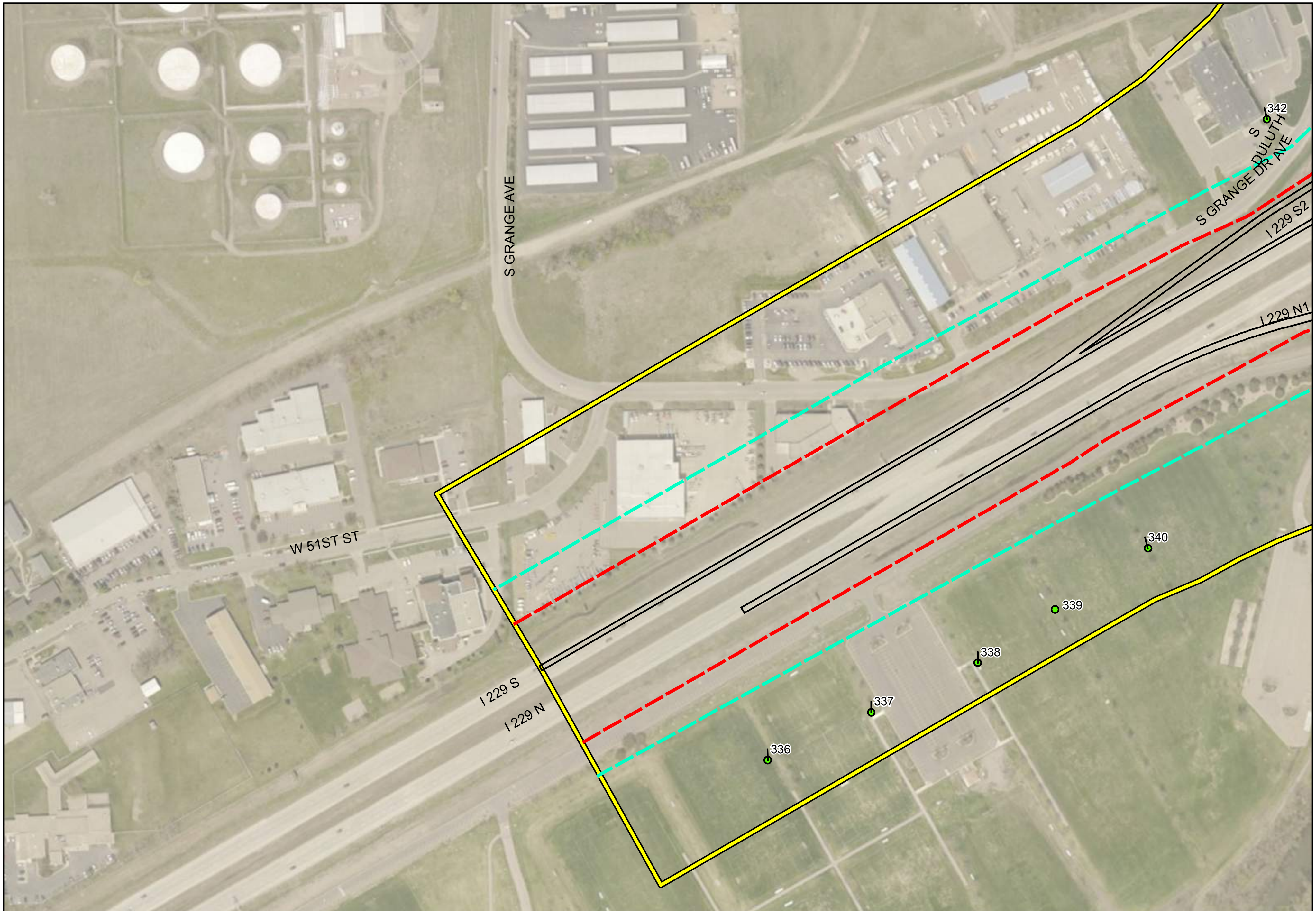

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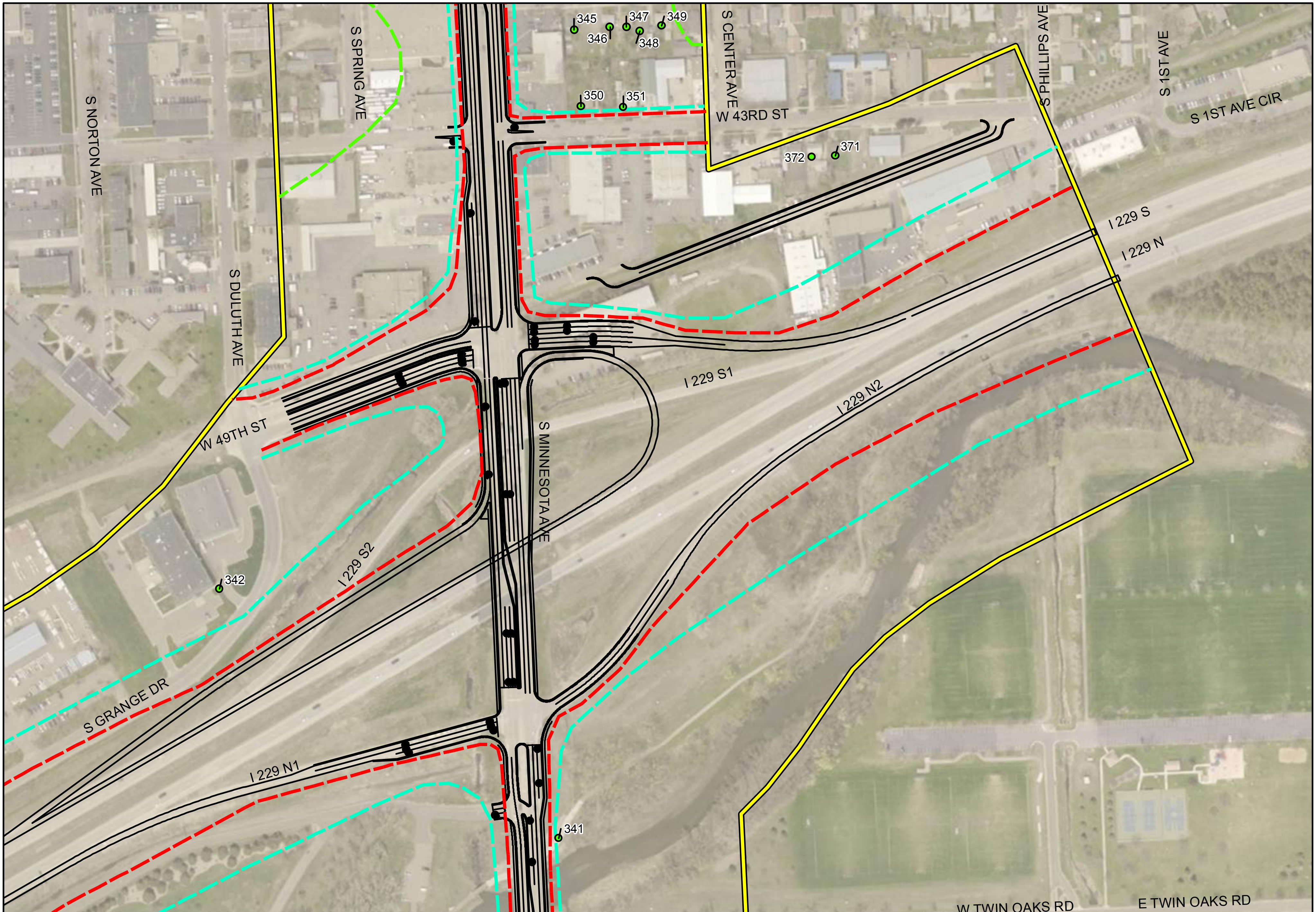

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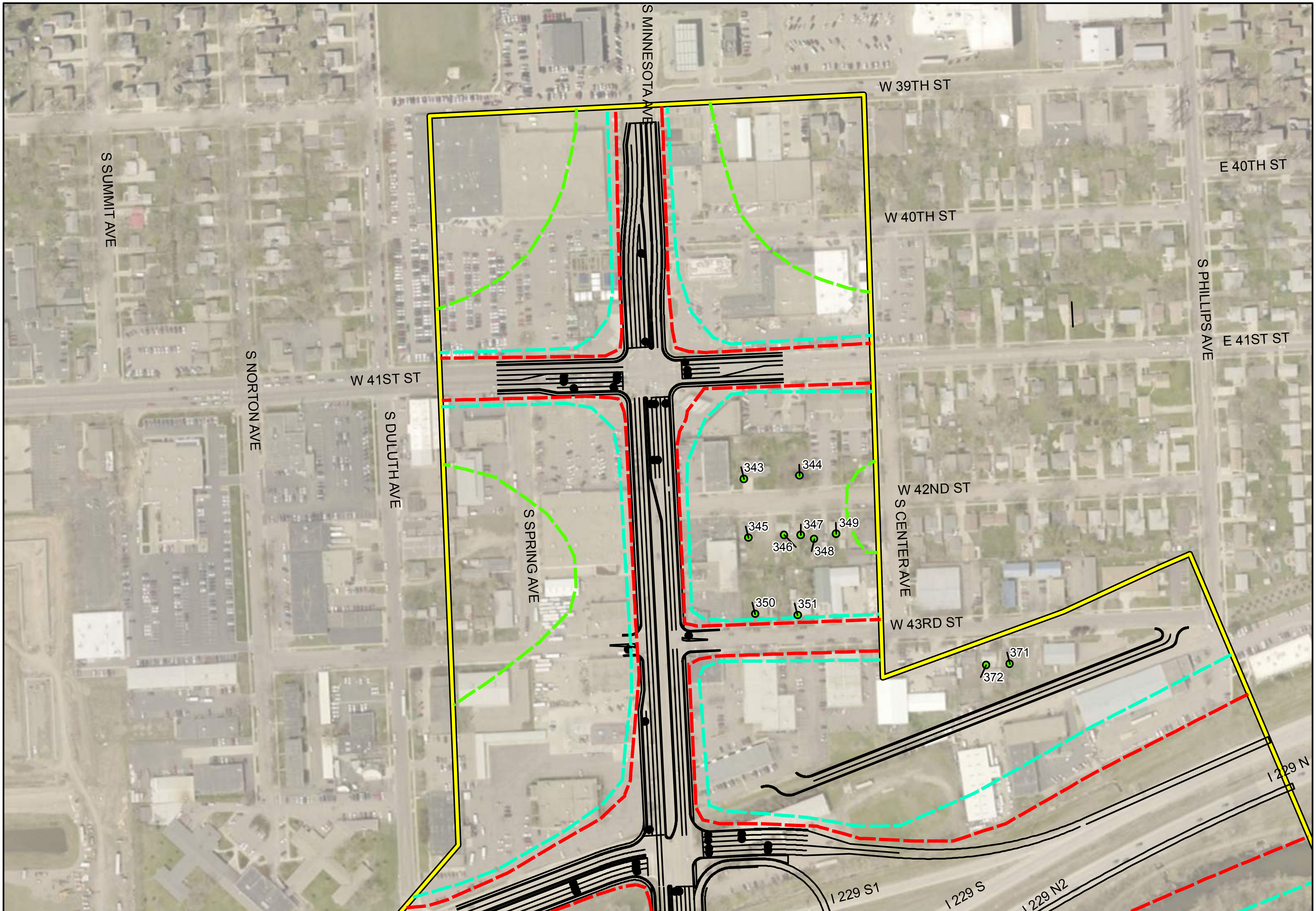

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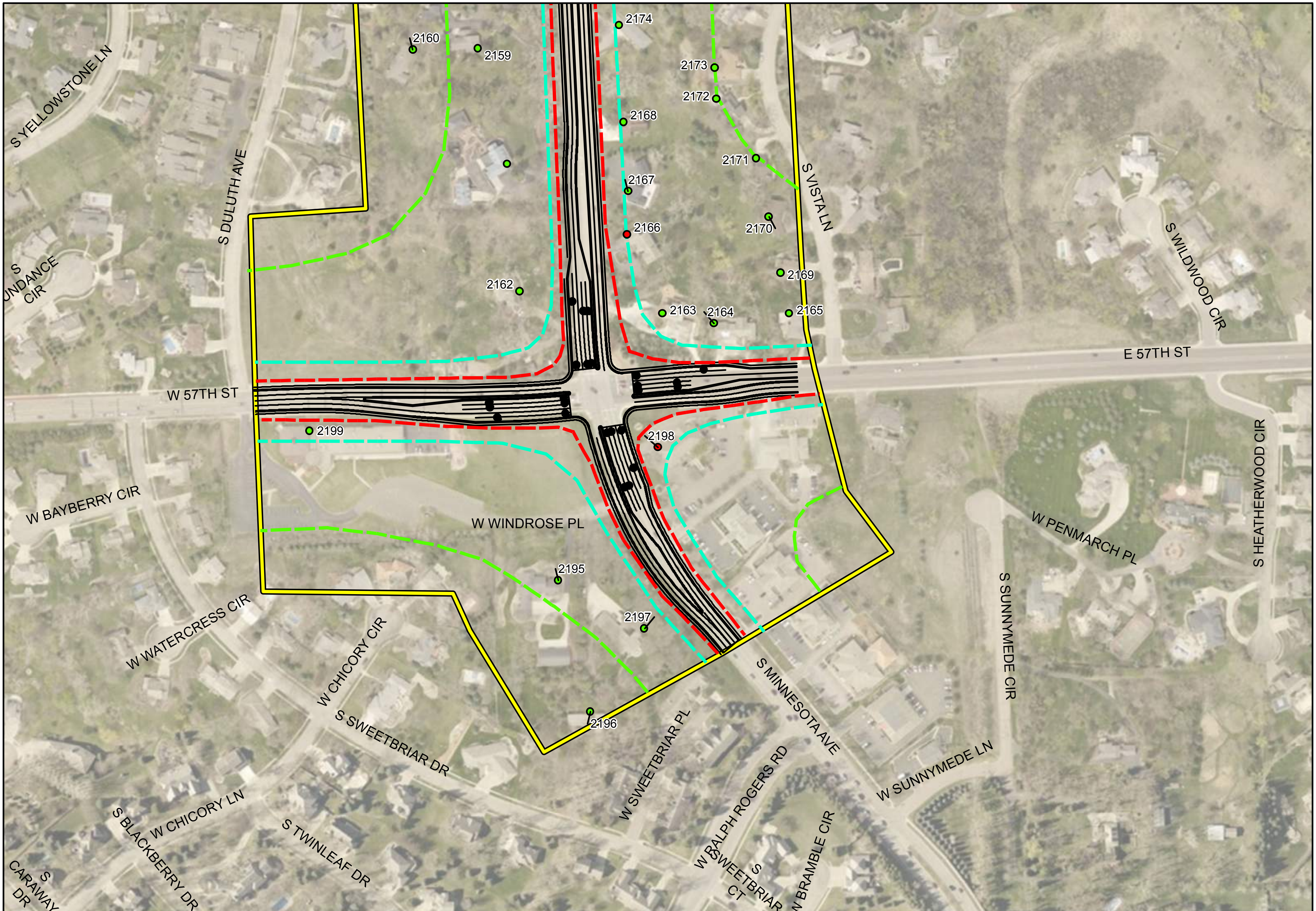

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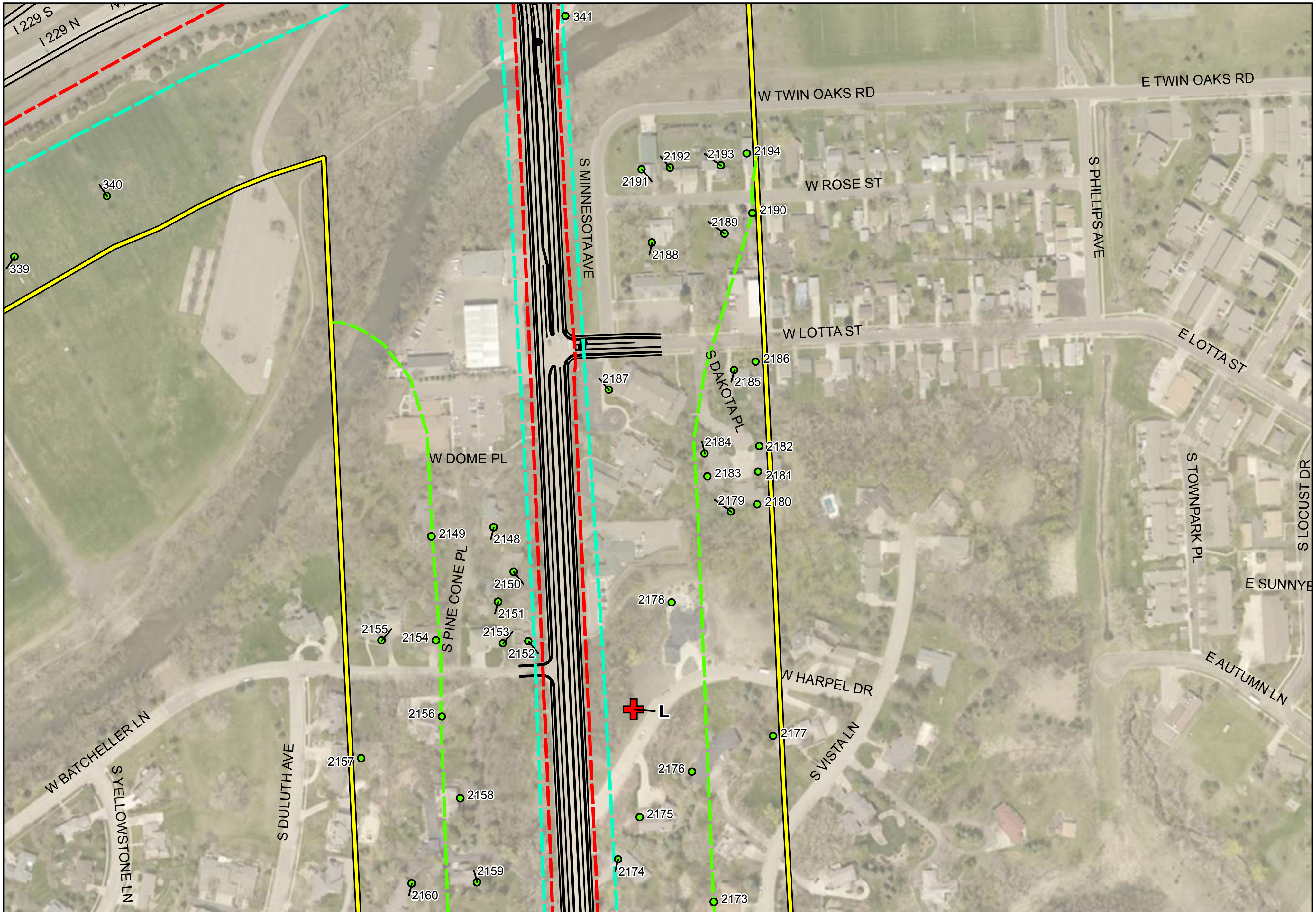

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I-229 Major Investment Corridor Study
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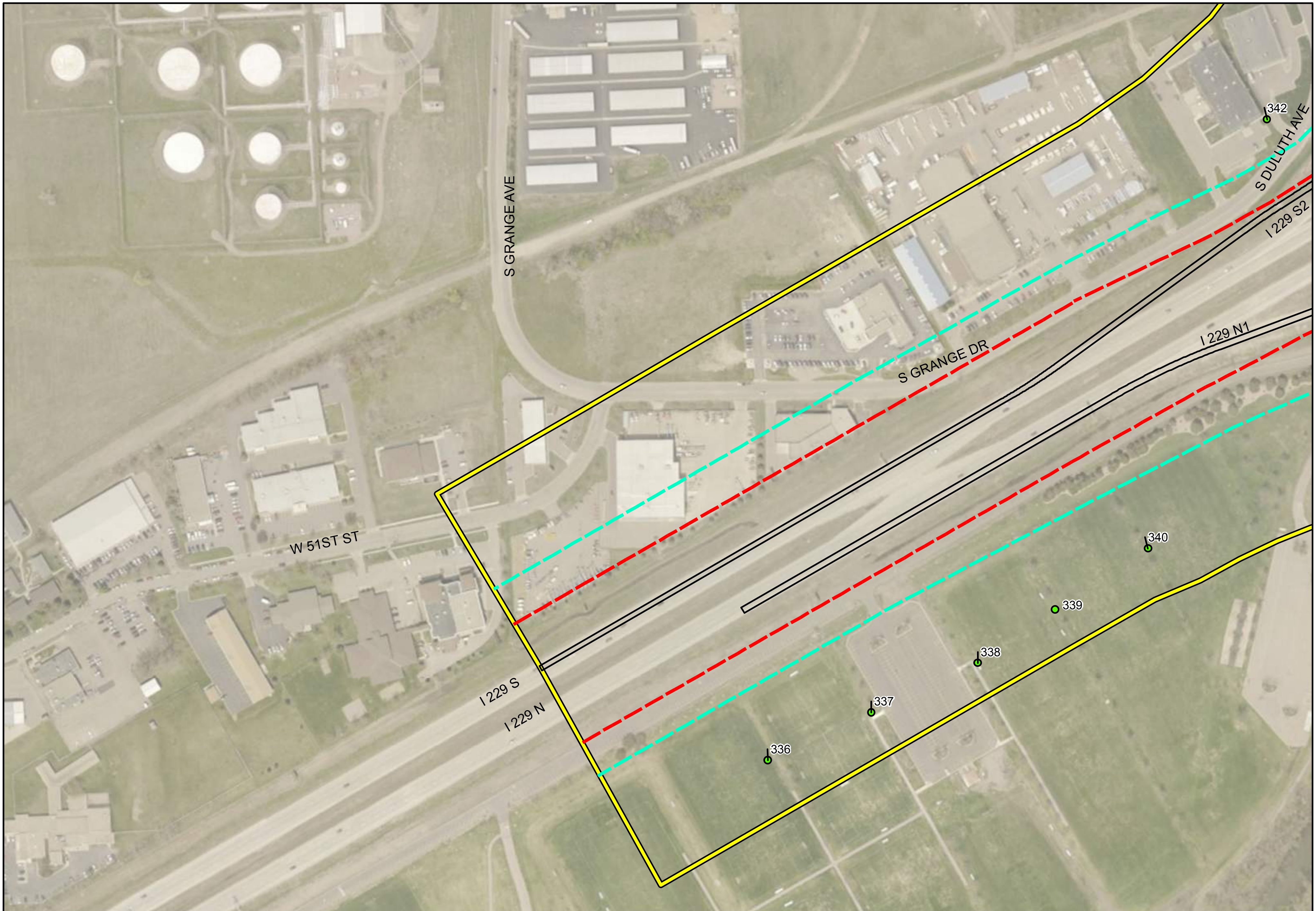

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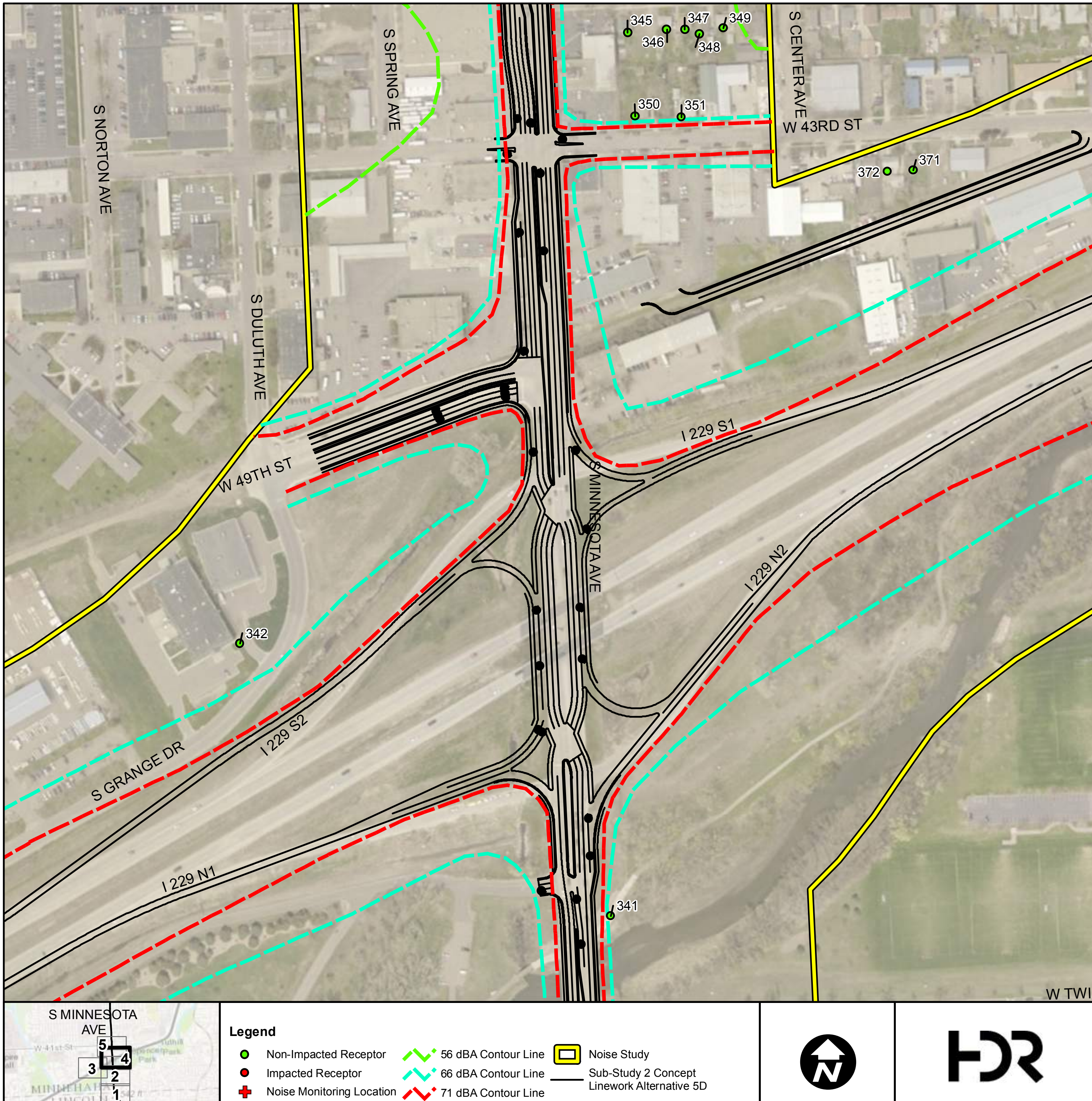

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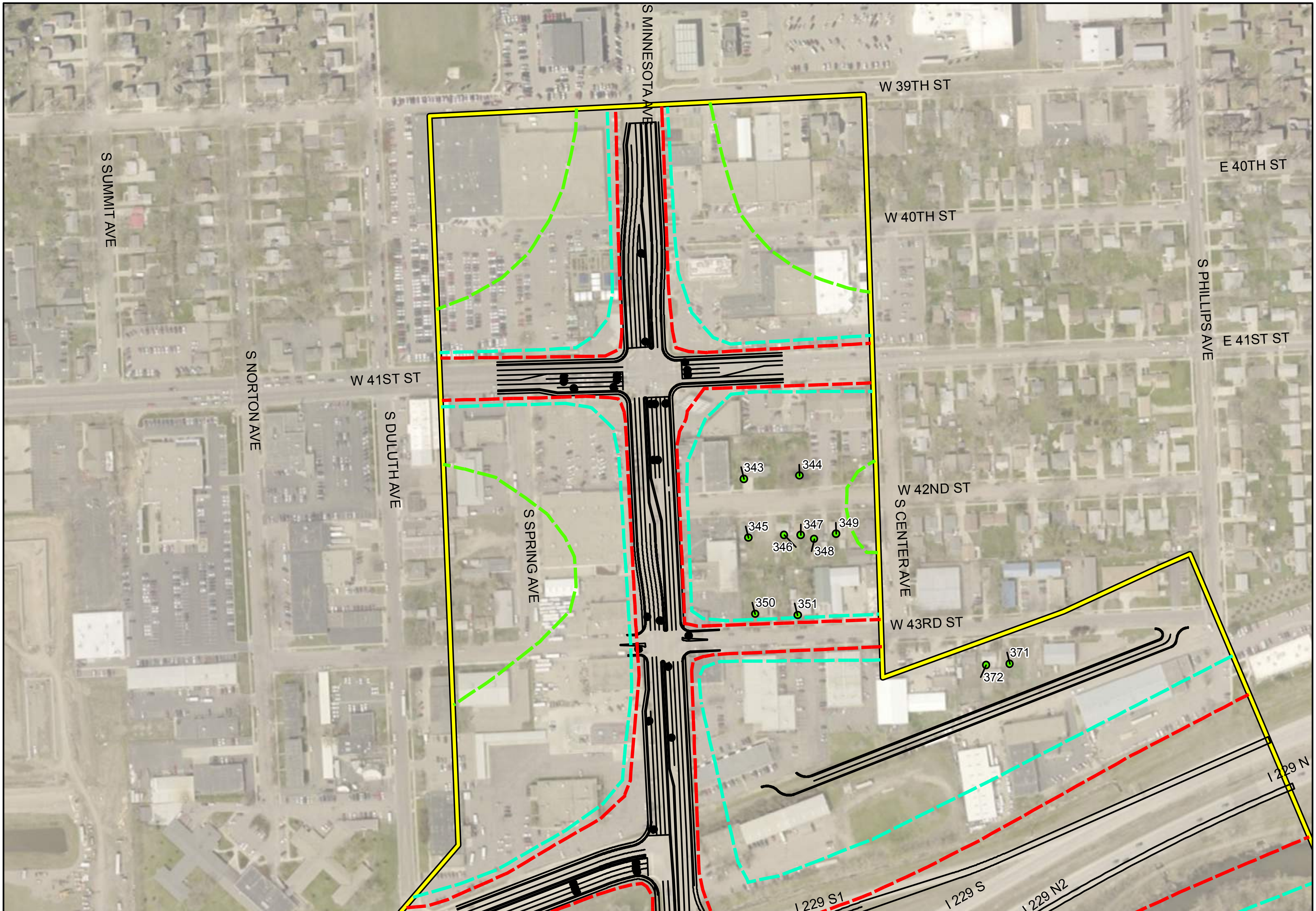

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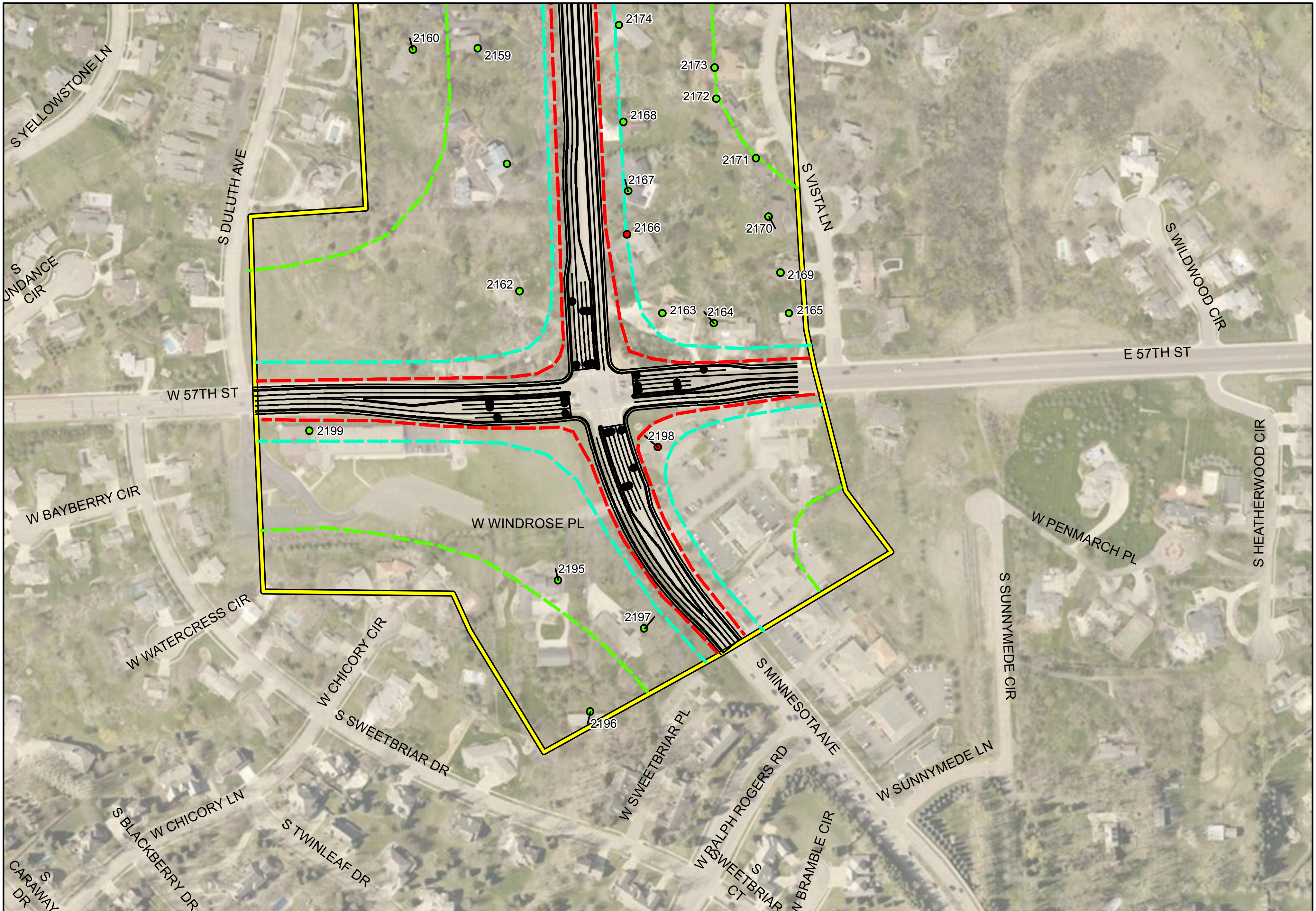

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I-229 Major Investment Corridor Study
Sub-Study #2
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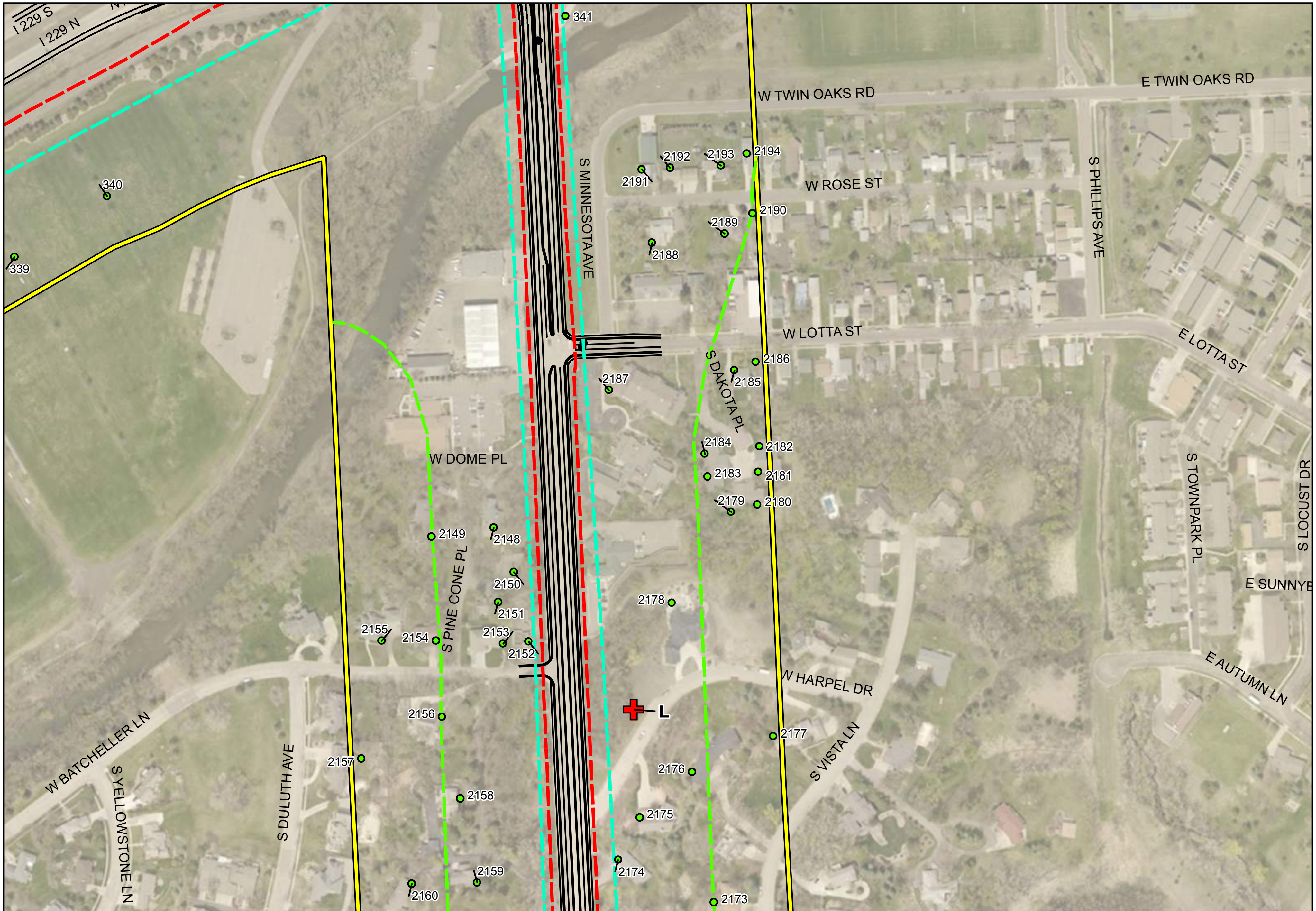

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I-229 Major Investment Corridor Study
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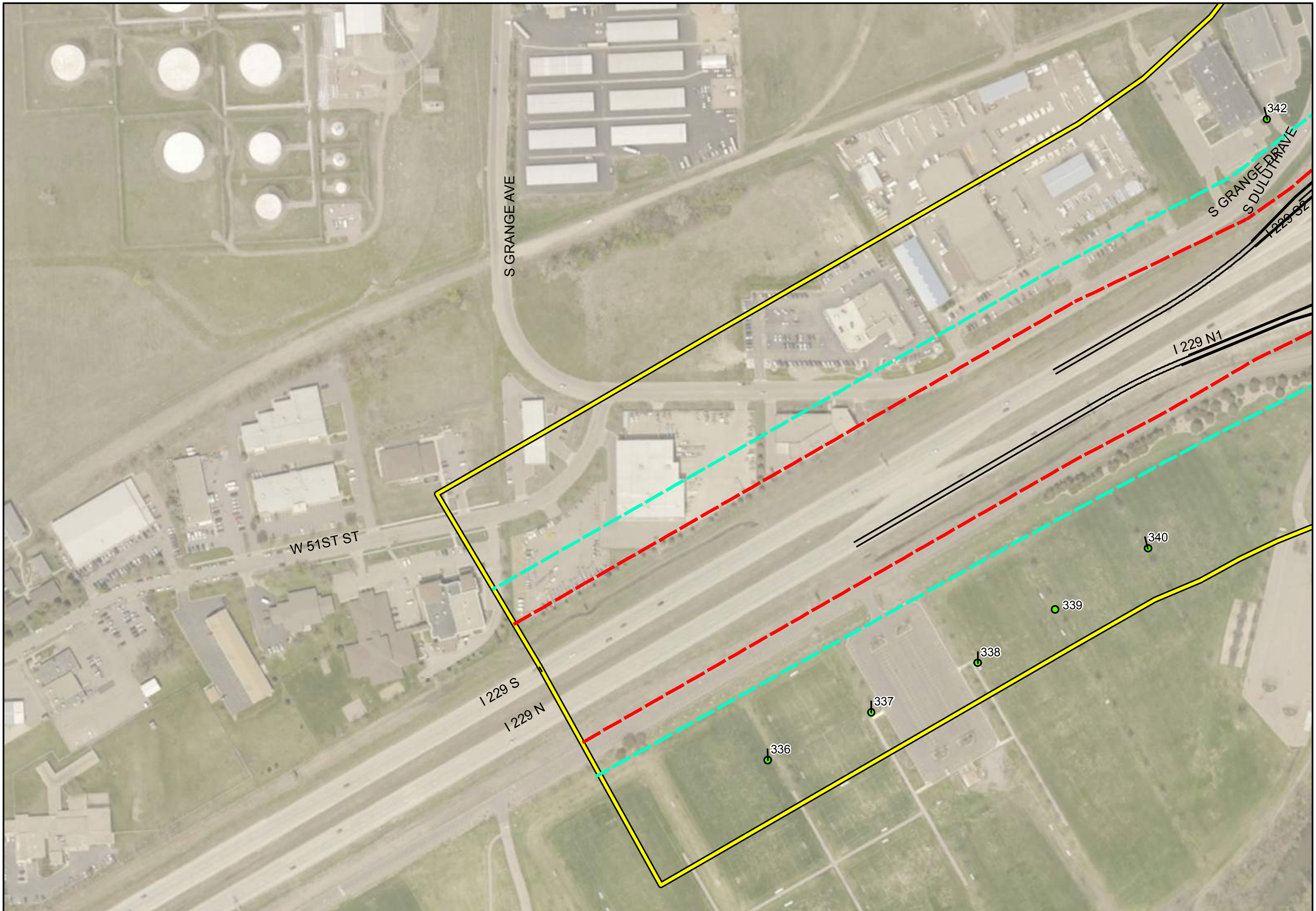
Proposed Alternative 8C



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I-229 Major Investment Corridor Study
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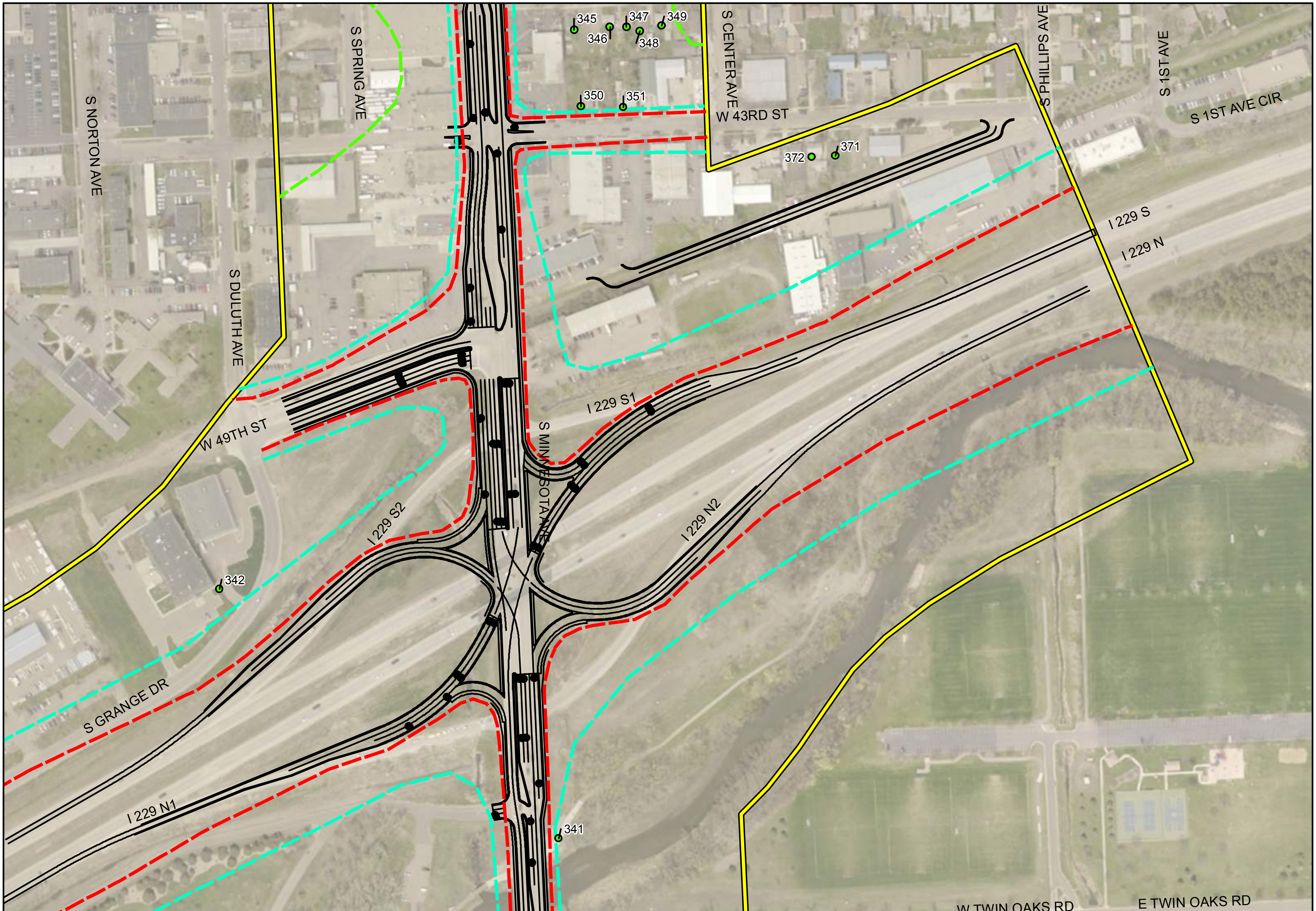

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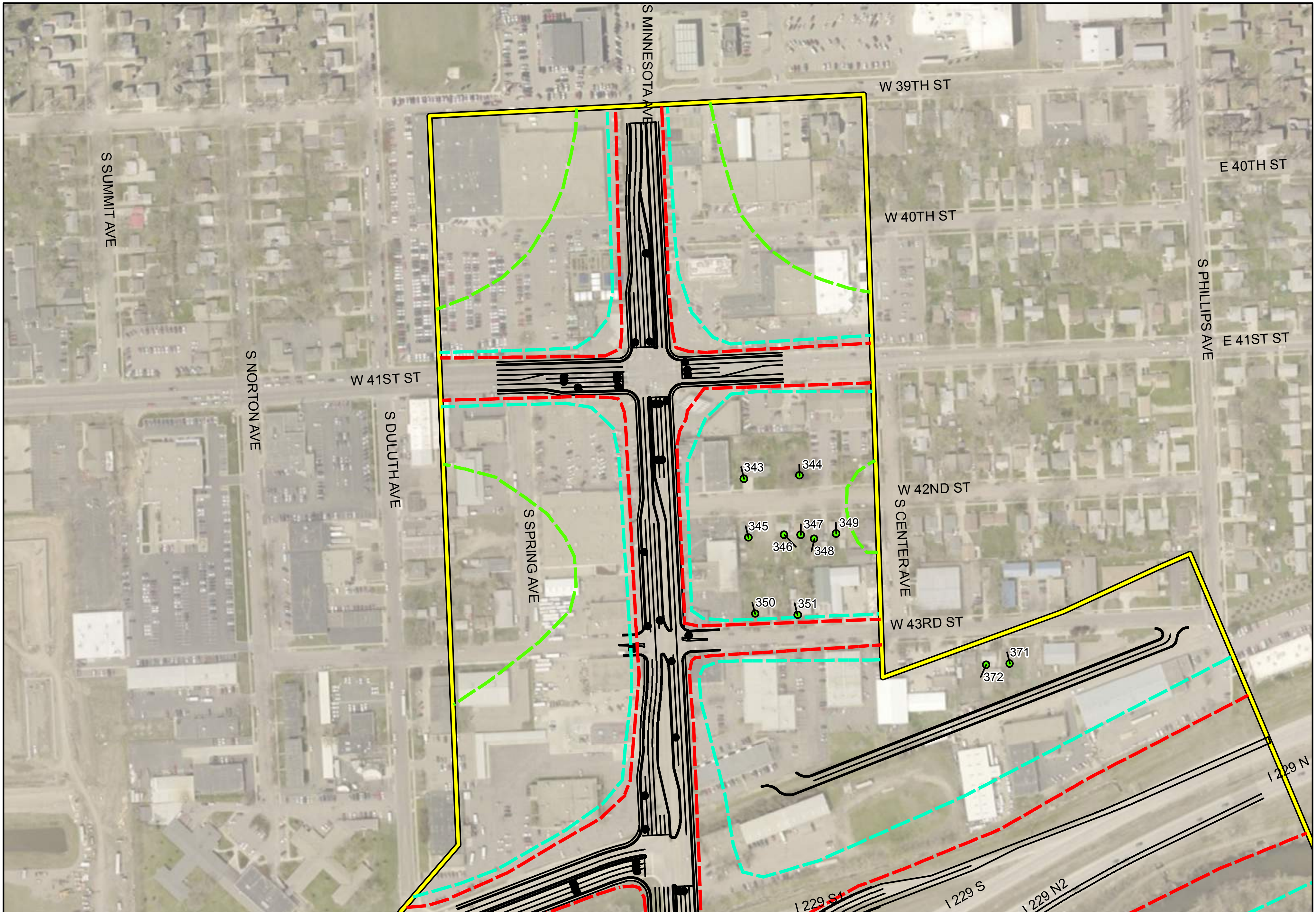

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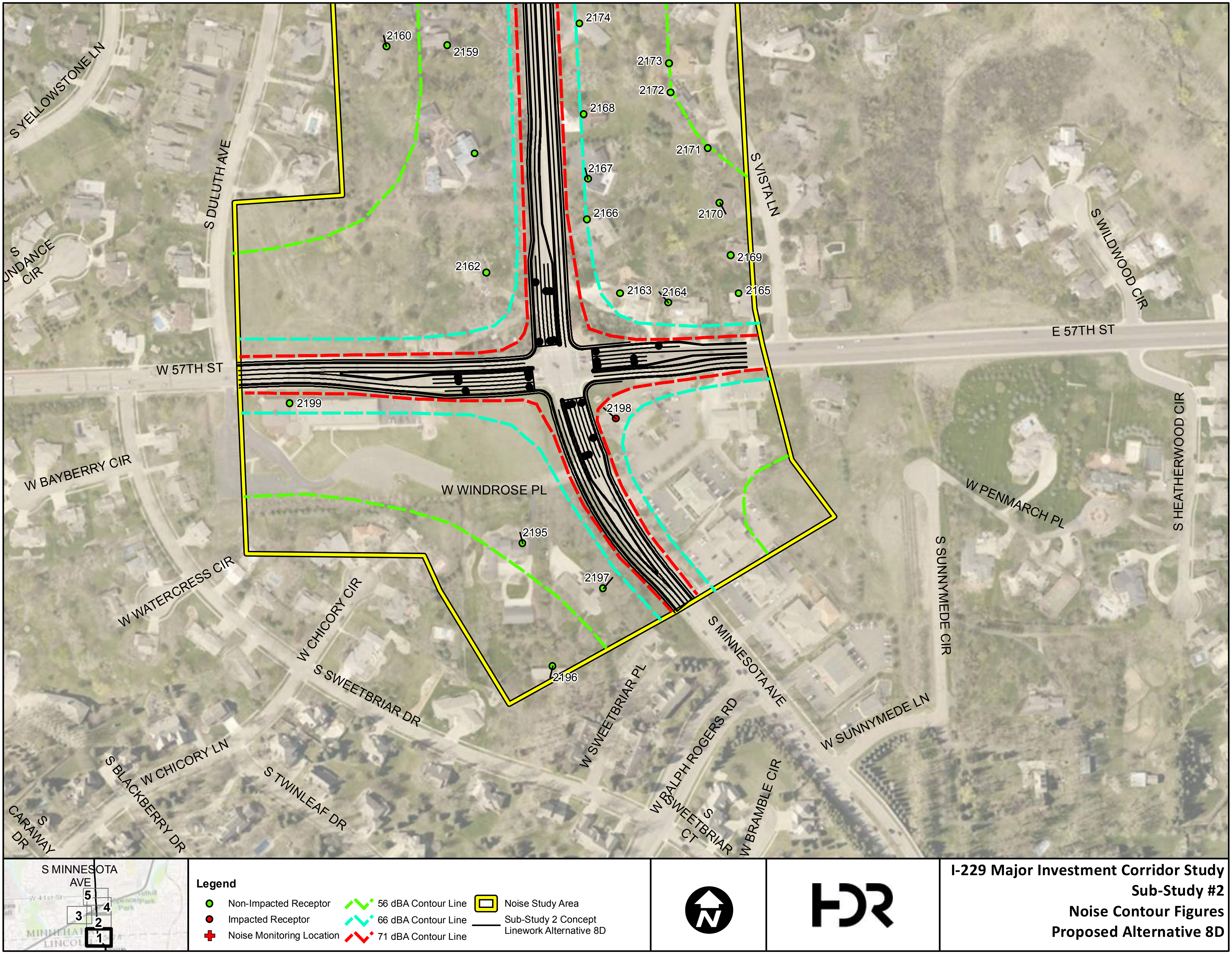

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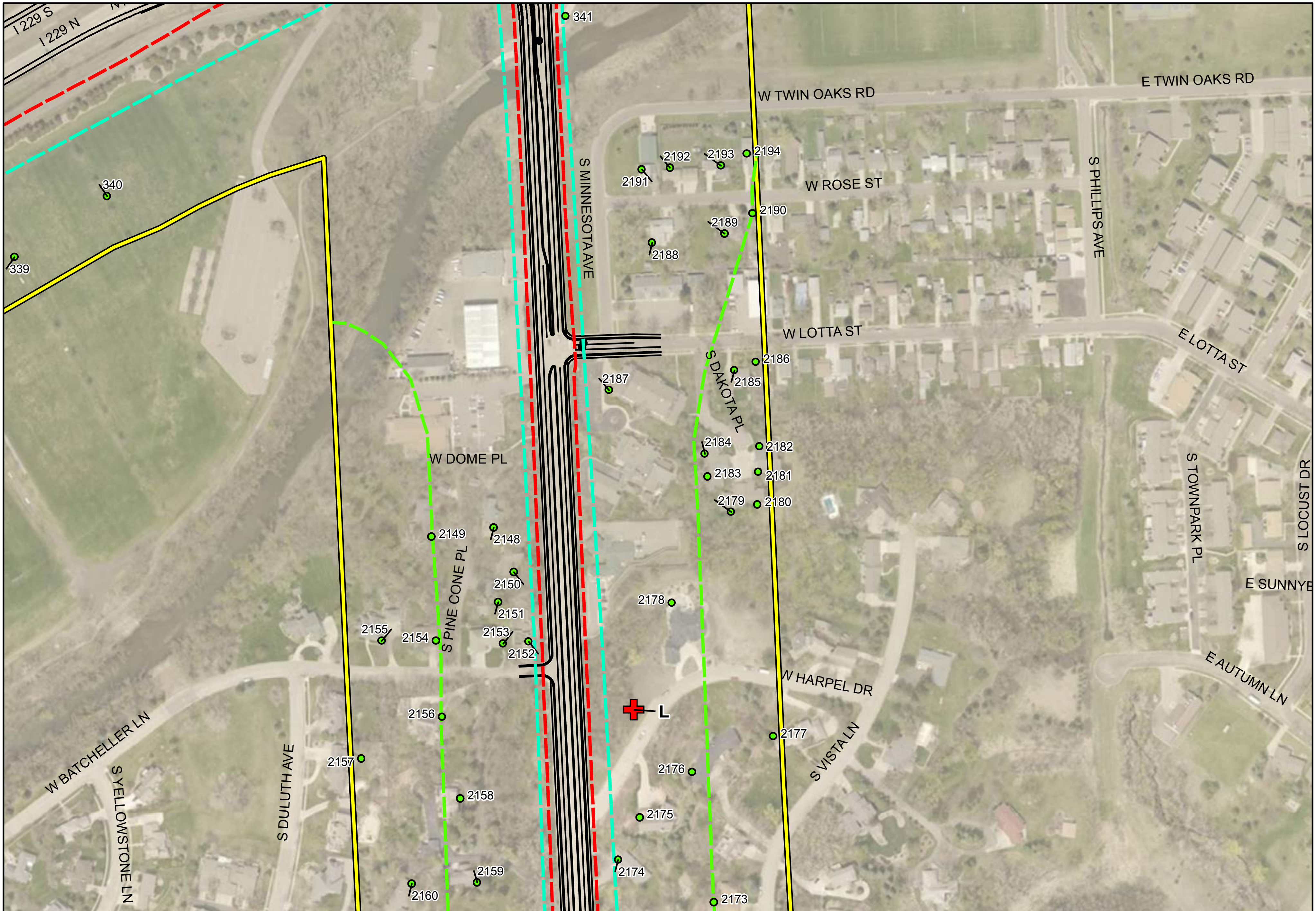

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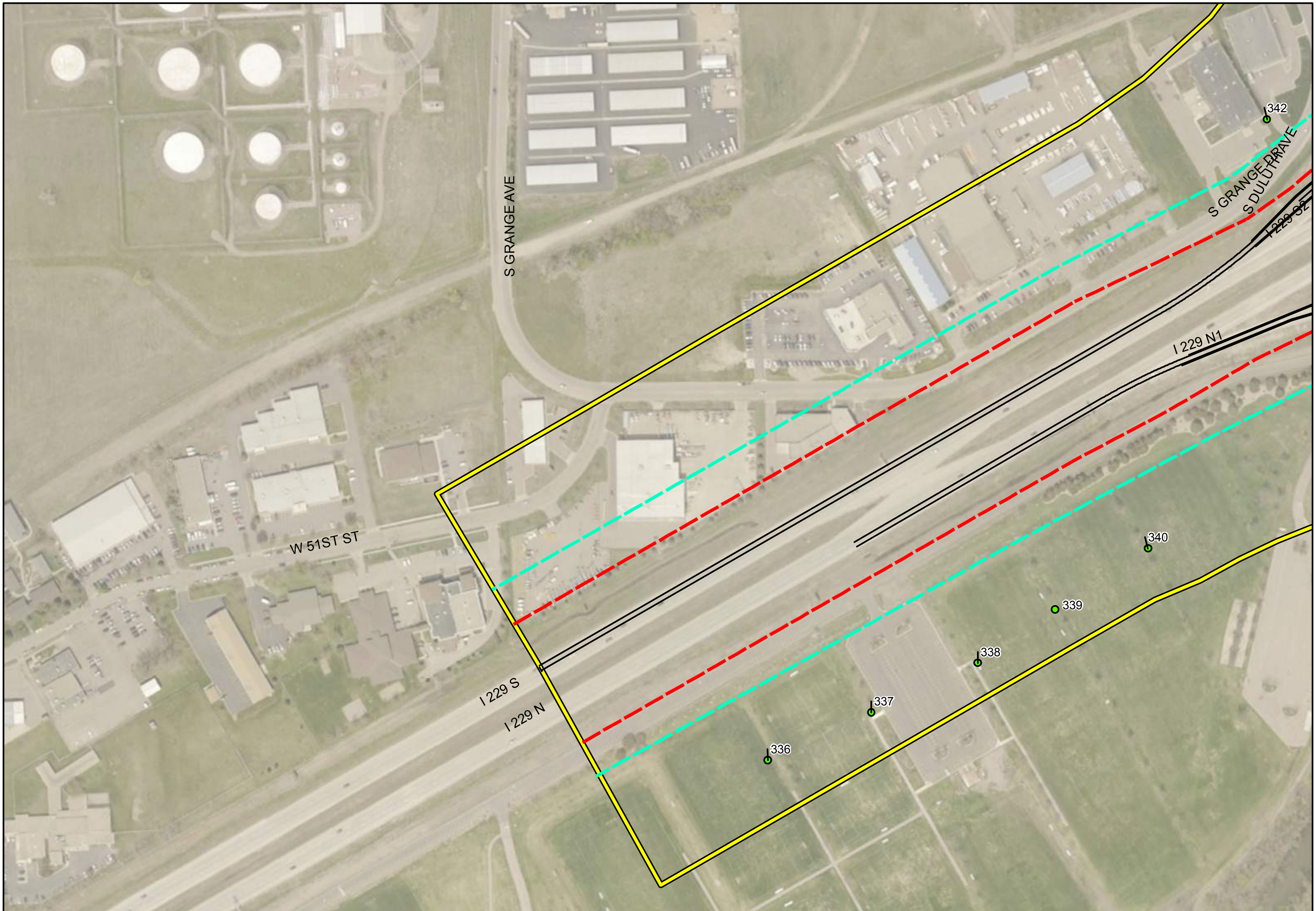

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I-229 Major Investment Corridor Study
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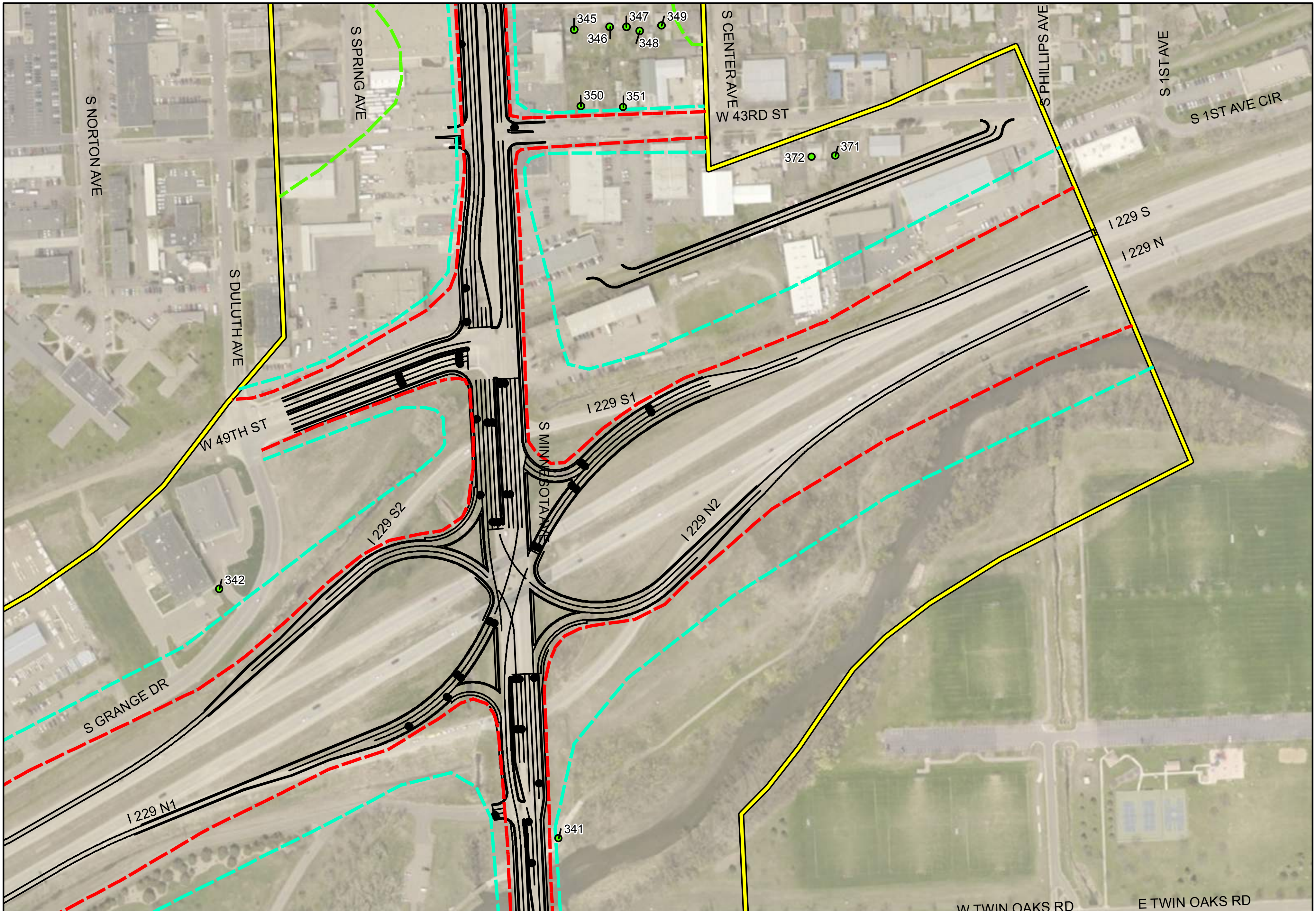

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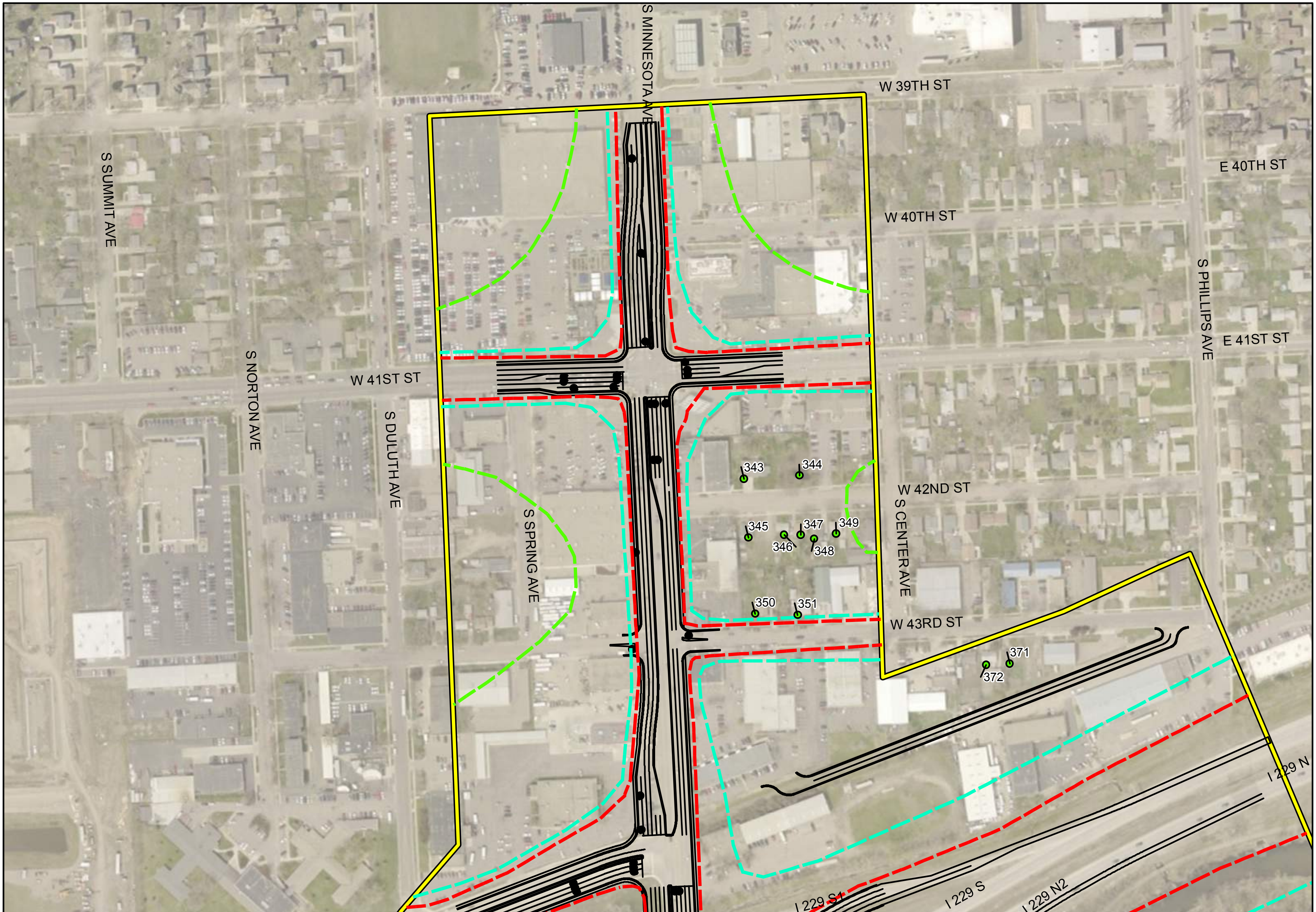

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HDR

I-229 Major Investment Corridor Study
Sub-Study #2
Noise Contour Figures
Proposed Alternative 8D

Appendix B
Figures

Appendix H. Public Involvement

The general public and public agencies were involved throughout the study process, with public meetings, landowner meetings, a website, and other techniques.

Public meetings

Public Meeting #1

The first Public Open House was held on October 30th, 2013. This meeting included an overview presentation describing the drivers of the I-229 Major Investment Corridor Study, types of findings the study will eventually result in, how to get/stay involved in the study, schedule, and next steps. Meeting notes, sign-in sheets, public comments, and PowerPoint slides from this open house can be found in the ***Appendix***.

Public Meeting #2

The second Public Open House meetings were held on June 1st and 2nd, 2015. A presentation at the meeting provided a summary of study efforts to date, including the 2035 No-Build peak hour level of service results, conceptual ideas for I-229 mainline and interchange improvements and next steps in the study. Meeting notes, sign-in sheets, public comments, and PowerPoint slides from this open house can be found in the ***Appendix***.

Cliff Avenue and Rice Street Public Meetings

The Cliff Avenue and Rice Street crossroad corridors were originally a part of the I-229 Corridor Study. During the development of the analysis of the potential concepts, it was determined to separate these corridors into their own sub-studies. The first Public Open House for these two corridors was held on June 22nd, 2016. A presentation at the meeting provided a summary of study efforts to date, including the 2035 No-Build peak hour level of service results, conceptual ideas for I-229 mainline and interchange improvements and next steps in the study. Meeting notes, sign-in sheets, public comments, and PowerPoint slides from this open house can be found in the ***Appendix***.

Public Meeting #3

The third Public Open House (and second for the Cliff Avenue and Rice Street crossroad corridors) was held on December 6th, 2016. A presentation at the meeting provided a summary of study efforts to date, including the alternative scenario evaluation results, alternative scenarios recommended for further consideration. Meeting notes, sign-in sheets, public comments, and PowerPoint slides from this open house can be found in the ***Appendix***.

Business/Landowner Group Meetings

Business/landowner group meetings were held on the following dates for the following sub-studies:

- I-229 Exit 3 (Minnesota Avenue) Crossroad Corridor Study
  - Stakeholder Meeting #1 – December 16th, 2014

- Stakeholder Meeting #2 – December 6th, 2016

- I-229 Exit 4 (Cliff Avenue) Crossroad Corridor Study
  - Stakeholder Meeting #1 – June 22nd, 2016
  - Stakeholder Meeting #2 – December 5th, 2016
- I-229 Exit 6 (10th Street) Crossroad Corridor Study
  - Stakeholder Meeting #1 – December 16th, 2014
  - Stakeholder Meeting #2 – December 5th, 2016
- I-229 Exit 7 (Rice Street) Crossroad Corridor Study
  - Stakeholder Meeting #1 – June 22nd, 2016
  - Stakeholder Meeting #2 – December 6th, 2016
- I-229 Exit 9 (Benson Road) Crossroad Corridor Study
  - Stakeholder Meeting #1 – December 15th, 2014
  - Stakeholder Meeting #2 – December 5th, 2016

All of the meetings were designed to allow landowners within the study area to discuss specific issues regarding their properties with study staff. In addition, several meetings were held with individual landowners where specific improvement options, and the associated impacts of those options, were discussed. Meeting notes, sign-in sheets, public comments, and PowerPoint slides from all the meetings can be found in the ***APPENDIX***.

Study Advisory Team

The Study Advisory Team, comprised of representatives of the Federal Highway Administration, South Dakota Department of Transportation, City of Sioux Falls, and the Sioux Falls Metropolitan Planning Organization, met periodically during the study to guide the study process and provide agency input. Members of the Study Advisory Team are shown in ***TABLE 1***.

Table 1. Study Advisory Team Members

NAME	AGENCY
Shannon Ausen	City of Sioux Falls – Public Works
Mike Behm	SDDOT – Project Development
Christina Bennett	SDDOT – Operations Support
Jeff Brosz	SDDOT – Transportation Inventory Management
Andy Vandel	SDDOT – Project Development (Safety)
Joel Gengler	SDDOT – Right of Way
Amber Gibson	Sioux Falls MPO
Kevin Goeden	SDDOT – Bridge Design
Steve Gramm	SDDOT – Project Development (Planning)
Heath Hoftiezer	City of Sioux Falls – Public Works
Mark Hoines	FHWA

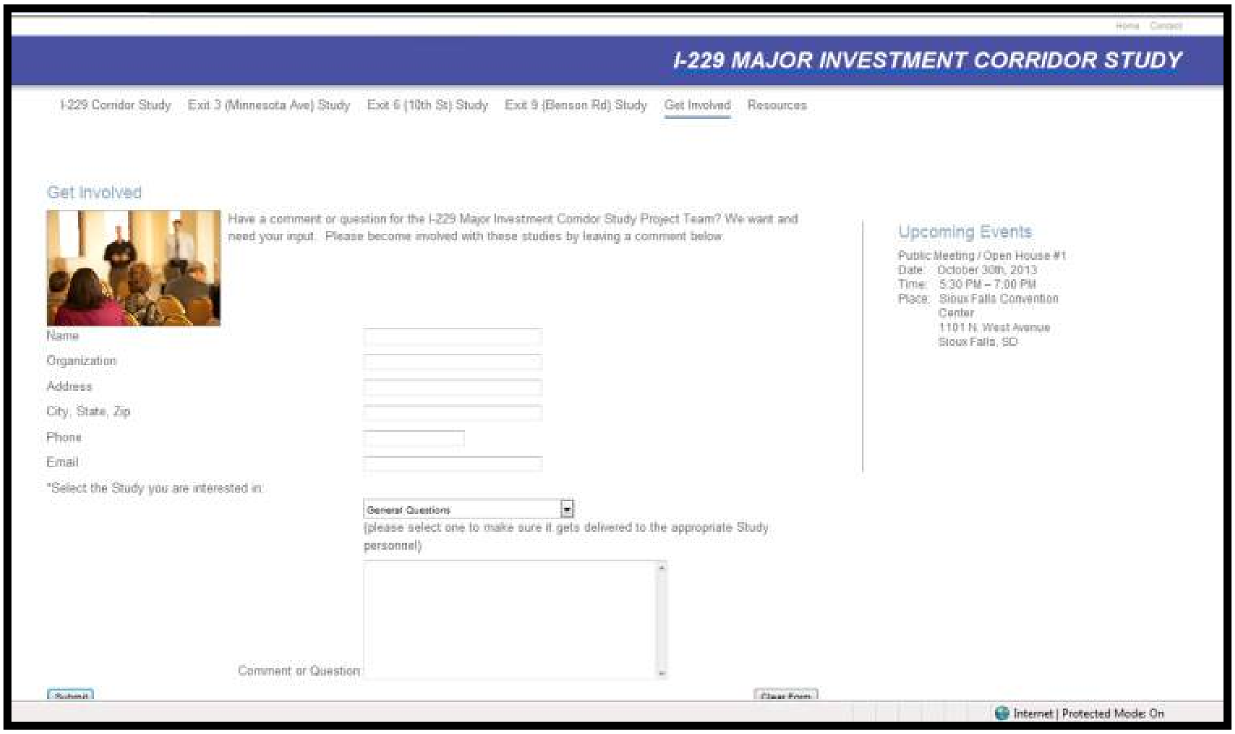
Dave Huft	SDDOT – Research
Bruce Hunt	FHWA
Scott Jansen	SDDOT – Mitchell Region
Captain Alan Welsh	South Dakota Highway Patrol
Ryan Kerkvliet	Sioux Falls MPO – Citizens Advisory Committee
Tom Lehmkuhl	SDDOT – Project Development (Environmental)
Pete Longman	SDDOT – Road Design
Ron McMahon	FHWA
Paul Nikolas	SDDOT – Road Design
Brad Remmich	SDDOT – Project Development (Planning)
Craig Smith	SDDOT – Mitchell Region

Website

A study provided easy access to information and documents prepared as part of the study. The website address was: WWW.I229STUDY.COM

The website provided project updates throughout the course of the study.

The "***Get Involved***" page provided opportunity for website visitors to submit a project comment or question.



The "***Resources***" page included links to relevant ongoing transportation studies in the area, as well as previously written documents referred to as part of the I-229 MIS.

MPO Meetings

The study team met with the Sioux Falls MPO in November 2013 and May 2015. The meetings on November 13th and 14th, 2013 followed Public Meeting #1, and the meetings on May 20th and 21st, 2015 followed Public Meeting #2. The formal presentations given at these MPO meetings were the same meeting materials as discussed at the public meetings.

APPENDIX -

PUBLIC MEETING #1 – OCTOBER 30TH, 2013

- **MEETING NOTES**
- **SIGN-IN SHEETS**
- **COMMENTS**
- **POWERPOINT SLIDES**

HDR | ONE COMPANY *Many Solutions*℠

Meeting Notes

Subject:	I229 MIS Public Open House #1		
Client:	SDDOT		
Project:	I229 Corridor Study	Project No:	207030
Meeting Date:	October 30th, 2013	Meeting Location:	Sioux Falls Convention Center
Notes by:	HDR		

Debrief Record: The following notes were provided by study participants to members of the study team during the meeting while reviewing the various open house displays.

1.) Many comments around providing better crossings for ped's and bike's along the I229 corridor. They find it very hard to get from one side to the other since most interchanges only have sidewalk on one side. Connections directly to the bike trail would be great.
2.) Several comments on how poor the 26th Street Interchange is and that the SB off/on ramp is so short it causes accidents and many people slide off of the road due to the tight SB on ramp curve.
3.) A few members heard a desire to finish the 49th Street extension as they believe it is long overdue.
4.) Interstate users believe that aux. lanes from 10th Street to 26th Street should be implemented soon.
5.) The interchange at 10th Street and the proximity of Cleveland Avenue is not good; this area doesn't work because one intersection backs up the other. Need to figure out something different at Cleveland.
6.) Many believe the I229 corridor needs to be 3 lanes in each direction to handle the traffic that we will see in the future.
7.) A few noted that placing a half interchange at 60th Street north would dramatically improve access to the industrial park and would reduce congestion at Benson Road.
8.) Folks from the SF Bike Club indicated that they would not use 10th Street as a bike route due to the driveway access. Rather have a route on 6th Street or 12th Street or both.
9.) Encourage the industrial park businesses to stagger shifts to reduce peaks in the traffic along the interstate.
10.) Maintain Access to businesses along Minnesota; don't place a median that will take away half of my traffic.
11.) Build the bridge over the BSR east of Hwy 11 on the 57th Street alignment so everyone doesn't have to enter the east side of the City on SD 42 which will reduce congestion on 10th Street.
12.) Lower the speed limit on I229 to 55 mph.
13.) Interested in the placement of variable speed limits on I229, have seen these in other locations and area easy to follow.
14.) SB on Ramp at 10th does not work well due to the structure in such close proximity.
15.) Summer mowing practices may need to be modified to insure grass is kept shorter to improve sight from ramp to interstate as vehicle merges with mainline from the on-ramp.
16.) Horizontal curves between 10th and 26th can be a problem during winter events.
17.) Conflicting comments heard regarding noise walls, some folks say they are needed and believe they need to be built soon and others felt that it would make their home "feel like a prison" to have a noise wall in their backyard and that the noise isn't that bad.
18.) An auxiliary lane is needed along SB I-229 between Louise Avenue and the I-29 NB ramp.
19.) On I-29, there needs to be a third lane / auxiliary lane between I-229 and 57th Street (Outside of Study Area).

20.) Need an interchange on I-29 @ 85th Street to allow for southern Sioux Falls to continue growing. (Outside of Study Area).
21.) Would like a crossing of I-229 for 33rd Street.
22.) Removing Yeager Road would be bad for 26th Street between I-229 and Cliff Avenue.
23.) There was concern over the elevation for the future 26th Street. There's also a "dip" in 26th Street at the old railroad bridge that they hope will be fixed with the new interchange.

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Sioux Falls, SD 57108

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SIGN IN SHEET

CITY OF SIOUX FALLS PUBLIC WORKS — Providing a Better Quality of Life for You!

Subject:	I-229 Major Investment Corridor Study – Public Open House #1
Client:	City of Sioux Falls / South Dakota Department of Transportation
Project:	PL 0100(87) 3616P, PCN 044K — Project No: 207030
Meeting Date:	Wednesday, Oct 30th, 2013 5:30 – 7:00 PM — Meeting Location: Sioux Falls Convention Center

Please print clearly. Thank you.

	NAME/REPRESENTING	ADDRESS	BEST CONTACT PHONE	E-MAIL
1	Chad Huwe / City of SF		367-8601	chuwe@siouxfalls.org
2	Manny Steele Dist 12		335-7036	barbmanny78@gmail.com
3	Nick mentele		770-8856	nickmentele@yahoo
4	Jim Entenman			
5	Stacy DuChene		221-2647	sduchene@lwgreen.com
6	Trent Swanson	100 N Phillips #901 SF SD 57104-6725	335-4962	trents@cutlerlawfirm.com
7	Stephanie Logue	6300 S. Old Village Pl St	977-8104	Stephanie.logue@hdrinc.com
8	Allen Bindert	47120 85th SF	605-368-2114	
9	Jack Mallek	4705 Yellowstone	335-5596	
10	Gail Brown	6500 Tallgrass	357-4780	
11	Craig Lloyd	6904 S Westfield	376-5834	Craig@LloydCompanies.com
12	Marv Schlechter	809 Day Ave	336-6874	
13	Mike Kuno	724 W Cascade St	413.5874	
14	Rodney McClure	1800 W 22nd St	332-7290	
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SIGN IN SHEET

South Dakota DOT — Connecting South Dakota and the Nation
CITY OF SIOUX FALLS PUBLIC WORKS — Providing a Better Quality of Life for You!
HDR

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	NAME/REPRESENTING	ADDRESS	BEST CONTACT PHONE	E-MAIL
1	Rich Schwanke VFW	3601 S Minnesota SF		Jmbliss688@aol.com
2	Butch Haugen VFW	3601 S. Minn. SFSD	605-553-5518	bhaugen@gmail.com
3	Mike Behm SDDOT	700 E Broadway Pierre SD	605 773 4423	MichaelBehm@state.sd.us
4	Brad Remmich SDDOT	" "	605-773-3093	bradley.remmich@state.sd.us
5	Thomas Hein	6100 E Hein Place SF	605-361-8400	
6	Christina Bennett	Pierre SD 700 E Broadway Ave	605-773-4759	christina.bennett@state.sd.us
7	Ross Harris	5525 Merle Hay Rd STE 200	515-278-2913	rharris@hrgreen.com
8	Steve Hoff	6300 S. Old Village Sioux Falls, SD	605-977-7740	steve.hoff@hdrinc.com
9	Kent Scribner	1505 S. Kiwanis, # 244 SF, SD 57105	605-338-0966	akscrib@yahoo.com
10	Brad Hicks	604 S. Conklin SF SD 57103		
11	Bill + Carol Kollis	3217 W. Zephyr Pl S.F. SD.		
12	Larry Karstan	2504 E. 19th	338-4760	
13	Chris Parsley	7801 W 66th	319-389-1507	CMPARSLEY@GMAIL.com
14	Brent Hamilton	4301 S. Majestic View	605-553-3868	
15	Jerry + Jackie Nash	2105 Tricia Lane	605-338-1970	
16	Julie Christianson	1705 S Riverdale	605-338-3260	bigkahuna@sio.midco.net
17	Robert Leonhardt	2001 S. Cardinal Dr	605-331-5074	
18	Mark Miller	3905 S Jolly SF 57103		
19	Mark Hoines	116 E. Dakota		

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1	Steve Gramm	700 E Broadway Ave Pierre	605-773-6641	Steve.gramm@state.sd.us
2	Jim Stalzer	5909 W Bristol Dr	605-366-5874	rep.stalzer@state.sd.us
3	Ruth Smith Gordon Smith	3500 E 60th St N 57104	605-940-4943	—
4	Amber Gibson SECOG	500 N Western Ave Ste 100 SF SD 57104	605-367-5390	amber@secog.org
5	Mike Holm	1309 E North St		mHolm@cidinc.net
6	Joan Storer	3900 W Avera Dr	605 322-4573	joan.storer@avera.org
7	Dennis Weldreyer	5510 Shadowood Pl.	605-351 0219	dweldreyer@lincolncounty.sd.org
8	Josh Larson	2208 S Sheffield	605-205-0016	joshuadavid@hotmail.com
9	George Hahn	647 S. Main	360-6639	SF SD 57104
10	Arvie Wulf	1600 S Gray Goose	335-1897	AMWULF@SVTV.com
11	Glenda Broad	944 S. Holt Ave	940-6380	cribstein@sio.midco.net
12	Phil Gundvaldson	1800 E. Arrowhead Pkwy	929-8190	philg@infrastructuredg.com
13	Bob Bohm	3600 S Duluth Ave	334 4220	robert.bohm@dakotabilities.org
14	Mike Murphy / SF YMCA	2411 S. Carter Pl.	360-7414	camp@siouxfallsymca.org
15	Duane A.			duane@hss.com
16	Brian Ray	8404 Indian Hills Drive Omaha NE	402 399 1000	brian.ray@hdrinc.com
17				
18				
19				

SIGN IN SHEET

Subject:	I-229 Major Investment Corridor Study – Public Open House #1
Client:	City of Sioux Falls / South Dakota Department of Transportation
Project:	PL 0100(87) 3616P, PCN 044K — Project No: 207030
Meeting Date:	Wednesday, Oct 30th, 2013 5:30 – 7:00 PM — Meeting Location: Sioux Falls Convention Center

Please print clearly. Thank you.

	NAME/REPRESENTING	ADDRESS	BEST CONTACT PHONE	E-MAIL
1	Joel W Gengler SDDOT	700 E Broadway Ave, Pierre SD	605-773-3746	—
2	Pete Longman SDDOT	700 E Broadway Ave Pierre	605-773-6488	-
3	Vicki Melrose	601 S. Jelfel Ave, SFSD 5[illegible]		
4	Rex Rolfing	SFSD		
5	Gerald Teunissen	SF, SD		
6	James Unruh	HDR SF, SD		
7	Sam Trebilcock	City of SF	367-8890	
8	Heath Hoftiezer	City of SF		
9	Jon Wiegand	HR Green		
10	Bill Moran	HR Green		
11	Cheryl Rath	SFSD		
12	Clint Kolda	7605 W. Regina St SF		dakotacyclist@gmail.com
13	Steven [illegible]	500 Sunnymede Cir SF		
14	Rick Kiley	1108 N. West Ave Sioux Falls	605-361-7785	kiley@southdakotasafety.org
15	Ernie Otten	46787 273rd St		
16	Tom Sweetman	PO Box 2320 SFSD 57101	605 366 5746	thomasrsweetman@gmail.com
17	Greg Borus	5915 S. Westfield	321-5514	
18	[illegible]	616 E. Wiswell Pl.	376-4056	
19	Marshall Lawra	1710 S. Southeastern Ave	334-7979	glawrs@sio.midco.net

SIGN IN SHEET

Subject:	I-229 Major Investment Corridor Study – Public Open House #1		
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Please print clearly. Thank you.

	NAME/REPRESENTING	ADDRESS	BEST CONTACT PHONE	E-MAIL
1	Mary & Jack Mortenson	2116 S. Crestwood Rd	605-321-0509	mary@sparklight.org
2				
3				
4				
5				
6				
7				
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I-229 Major Investment Corridor Study

PL 0100 (87) 3616P, PCN 044K

WE WANT TO KNOW WHAT YOU THINK! What are your concerns? What issues does the study team need to overcome with this project? What problems do you foresee? Please submit your comments before Nov 8th, 2013 to:

Mail: *HDR Engineering, Inc.*
ATTN: Jason Kjenstad
6300 S. Old Village Place, Suite 100
Sioux Falls, SD 57108-2102

E-mail: *Jason.Kjenstad@hdrinc.com*

Fax: *605-977-7747*

Very informational when asked questions while looking at the boards. Excited to See the progress take place

(optional)
Name: ______________________ Address: ______________________

Phone: ______________________ Email: ______________________

I-229 Major Investment Corridor Study

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6300 S. Old Village Place, Suite 100
Sioux Falls, SD 57108-2102

E-mail: *Jason.Kjenstad@hdrinc.com*

Fax: *605-977-7747*

(optional)
Name: Jim Stalzer

Phone: 605-366-5874

Address: 5909 W Bristol Dr 57106

Email: jim.stalzer@gmail.com

I-229 Major Investment Corridor Study

PL 0100 (87) 3616P, PCN 044K

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Fax: *605-977-7747*

Very informational when asked questions while looking at the boards. Excited to see the progress take place

(optional)
Name: ______ Address: ______
Phone: ______ Email: ______

Kjenstad, Jason

From:	BlueMail@bluehost.com
Sent:	Wednesday, October 16, 2013 3:05 PM
To:	email@i229study.com
Subject:	Message from BlueMail

Your BlueMail form has been completed, following are the results:

Field	**Value**
Name	Chris Parsley
Org	Falls Area Bicyclists, President
Address2	7001 W 66th St
CSZ	Sioux Falls, SD 57106
Phone2	319-389-1507
Email2	cmparsley@gmail.com
Study2	I-229 Corridor Study
Comments	According to item 2, consider that bicycles operate as vehicles and make sure that the I229 crossings are safe for bicyclists. I would also ask that a pedestrian crossing be considered from South Phillips over I229 and connecting to the multi use path on the other side.
redirect2	http://www.i229study.com/thank-you.html

Kjenstad, Jason

From: Chris Parsley <cmparsley@gmail.com>
Sent: Wednesday, October 30, 2013 5:33 PM
To: Kjenstad, Jason
Subject: I229 MIS

Some of my concerns involve getting pedestrians and bicyclists over I229 safely. I have not seen anything in the plan that addresses this issue.

Kjenstad, Jason

From: BlueMail@bluehost.com
Sent: Sunday, October 27, 2013 7:23 PM
To: email@i229study.com
Subject: Message from BlueMail

Your BlueMail form has been completed, following are the results:

Field	**Value**
Name	Jonathan Keill
Org	N/A
Address2	1515 S Glendale Ave
CSZ	Sioux Falls, SD 57105-1417
Phone2	(605) 321-2517
Email2	jjkeill@hotmail.com
Study2	I-229 Corridor Study
Comments	I've lived in Sioux Falls my whole life and am planning in the near future to relocate to the Twin Cities to attend a graduate program at the University of Minnesota in urban planning and design. After reviewing this study (as well as having seen the city and its traffic grow by leaps and bounds in the 25 years I've lived here), I have several ideas as to how we can possibly create new or reconfigure existing exits along the I-229 corridor. A few of these would require "hybrid" exits so-to-speak...but seeing how well the freeway systems work in the Twin Cities, I believe we would be able to maximize efficiency in traffic flow along the corridor for decades to come (not to mention a couple of ideas for the stretch of I-29 from I-229 to 41st St). These would provide increased access to the Empire/Empire East and the Interstate Crossing Business Park. I don't have professional software or anything with which I can already provide detailed plans...however, I would enjoy being able to meet with or talk to someone about my ideas and see if there is a plausibility aspect to them. Granted, I also am not very privy to things like costs or right-of-way, but having an analytical and mathematical mind, I feel I am able to see how things could be improved in a number of ways. I'd love to hear back from someone just to offer some proposals. Thank you for your time!
redirect2	http://www.i229study.com/thank-you.html

- Jason met w/ Jon Keill - Shared ideas for on/off ramps to 57th near I229 Underpass
- wants a connection for 69th to I29
- nothing really new between Western and Rice
- Interested in Benson - 60th - I229/I90 Junction

Kjenstad, Jason

From: Thomas Hein <theinmail@gmail.com>
Sent: Monday, November 04, 2013 9:38 AM
To: Kjenstad, Jason
Cc: Jeff R. Mindt; Shally Rogen; Brian Sather (gdentltd@hotmail.com); Eric & Mary Stormo (estormo@uswest.net)
Subject: I-229 Major Investment Corridor Study

Jason,
This email is in regards to your meeting on October 30th, 2013.
Please be advised that I own, with four other partners, the property call Minnesota Crossing located on the corner of 43rd and Minnesota Ave.
I am extremely concerned that you and your planning group are going to attempt to take our accesses away from the building located at 3508 S Minnesota Ave., just north of the Taylor Oil building.

I am hoping, with advance notice, your engineering team can design an appropriate exit on I-229 and Minnesota Ave so that you will be able to keep and maintain the integrity of my real estate access points. This real estate truly enhances its value because of the customers traveling south and approaching my strip mall as well as those customers coming from the South traveling North.
Lets make sure that we work toward the common goal of keeping both those access directions open from both north and south and not try to consider a median in the middle of the road way to eliminate 1/2 of our customer base.

Please be sure to forward all design concepts that you are discussing or considering so that we may include our input to find a win win solution.
I will watch for your reply and acknowledgement that you will provide me with all concept drawings that you are considering.

Thanks for your help in advance.
Tom Hein

Kjenstad, Jason

From:	BlueMail@bluehost.com
Sent:	Wednesday, November 06, 2013 5:06 PM
To:	email@i229study.com
Subject:	Message from BlueMail

Your BlueMail form has been completed, following are the results:

Field	**Value**
Name	Robin Solberg-Versluys
Org	
Address2	1205 S Gordon Dr
CSZ	Sioux Falls SD 57110
Phone2	605-331-5015
Email2	robin.versluys@gmail.com
Study2	I-229 Exit 9 (Benson Rd) Study
Comments	I work in the Industrial Park area and have noticed how bad the traffic is on East Benson getting on I229 South. I take E54th St N to Lewis Avenue then south to Benson. There are two lanes that turn left (east) on to Benson Rd off Lewis. However, there is approximately 1/2 mile for everyone from the two lanes to merge together into one lane to get onto I229 south. If someone is nice enough to let you in to the lane, you need to be very careful as the people in front of you are usually stopping for others that need to be let in. I can only imagine how many accidents or close calls there have been in this area. The second part of the problem is there is a street closer to the exit (Potsdam Ave) in which you have other people trying to get onto Benson. I think it would be more beneficial if there were two lanes to turn south onto I229 and merge prior to entering I229 (similar to the exit on the Benson and I29, and 12th and I29), and possibly a stop light on Potsdam to help those travelers get onto Benson. There are two lanes getting off of I229 onto Benson and i think the traffic would flow a lot better if the other side (south bound exit) would have two lanes also. Thank you, Robin Solberg-Versluys
redirect2	http://www.i229study.com/thank-you.html

Kjenstad, Jason

From: Mark Miller <mark.miller@sio.midco.net>
Sent: Sunday, November 17, 2013 9:56 AM
To: Kjenstad, Jason
Subject: I-229 Corridor Study

I live in south Sioux Falls and work by Sanford Research in northern Sioux Falls. I know the traffic well on 229. Traffic is solid during peak commute times. People are becoming more impatient and careless with their driving habits. I notice cars weaving between traffic, cutting off other drivers while jockeying for a better position for the Benson Road exit. That exit is overwhelmed during rush hours. Last week there was a accident on the ramp, causing traffic to backup in the 2 outside lanes of 229 all the way down to the Rice Street exit. The other problem is traffic merging on Benson to go south on 229. Again, impatient drivers and dangerous driving decisions.

Here are my suggestions:
- put in a half-diamond interchange at 229 and 60th Street N. This will alleviate the load on Benson tremendously. Without question this would be my first choice. It would be the most cost effective development to address the traffic congestion at Benson.
- widen 229 to four lanes. The reality is that traffic is bad now and is going to get worse as the north industrial parks continue to develop. Completing Hwy 100 is a long ways out and will not provide relief in time.

Kjenstad, Jason

From:	BlueMail@bluehost.com
Sent:	Sunday, December 01, 2013 7:52 PM
To:	email@i229study.com
Subject:	Message from BlueMail

Your BlueMail form has been completed, following are the results:

Field	Value
Name	Michael Christensen
Org	
Address2	1813 S Purdue Ave
CSZ	Sioux Falls, SD, 57106
Phone2	605-929-8923
Email2	mytzpyk@gmail.com
Study2	I-229 Corridor Study
Comments	Please include Cliff Ave in the study: because the Cliff Ave interchange is so similar to the Minnesota Ave interchange I am surprised that it is not being included in this study. I understand there may be vehicular factors that logically cause its exclusion, however the issues faced by pedestrians and bicyclists are the same as Minnesota Ave interchange. Consider bike & pedestrian crash data in your analysis, please. Minnesota Ave & Cliff Ave proximity to bike trail: please recognize and plan to include better movement or access from north of I-229 to the bike trail south of I-229. I-229 blocks a major path of desire for non-motorized access to the city's best and more frequently used park feature. Fix it. Add width to the outside lanes on Minnesota Ave. Add better sidewalk visibility and controls. Bridges: add pedestrian bridges over I-229 south from West Ave, south from Phillips Ave, and east from 35th St. Itâ€™s hard for me to believe justification exists for the pedestrian bridge west from Teem Drive over I-29 that doesnâ€™t exists for any of these three possibilities.
redirect2	http://www.i229study.com/thank-you.html

Kjenstad, Jason

From:	BlueMail@bluehost.com
Sent:	Monday, December 02, 2013 8:08 PM
To:	email@i229study.com
Subject:	Message from BlueMail

Your BlueMail form has been completed, following are the results:

Field	**Value**
Name	Art Holden
Org	
Address2	705 W Victory Ln
CSZ	Sioux Falls
Phone2	6053713928
Email2	art@thundergeeks.com
Study2	I-229 Corridor Study
Comments	Please take active transportation options seriously in this study. Investments in pedestrian and cycling infrastructure have been proven to increase property values, spur economic growth, and enhance public health. I think a pedestrian bridge on South Phillips toward Tomar park would connect a large portion of central Sioux Falls to the trail and park system. I believe this would be heavily used and very valuable to the citizens of Sioux Falls. Thank you for the opportunity to voice my opinions.
redirect2	http://www.i229study.com/thank-you.html

I-229 Major Investment Corridor Study
Public Open House
October 30th, 2013 – 5:30 pm to 7:00 pm

Study Advisory Partners

Advisory Agencies

South Dakota Department of Transportation (SDDOT)

South Dakota Highway Patrol

City of Sioux Falls

Sioux Falls Metropolitan Planning Organization (MPO)

Federal Highway Administration (FHWA)

Consultant Team

HDR Engineering, Inc.

HR Green, Inc.

CITILABS

airsage

The power of where and when

Primary Contacts

SDDOT Project Manager
Steve Gramm, PE
Project Development, Data Analysis Engineer
Steve.gramm@state.sd.us
Phone: 605-773-6641

City of Sioux Falls Project Manager
Shannon Ausen, PE
Traffic Engineering Division
sausen@siouxfalls.org
Phone: 605-367-8607

CONSULTANT - Public Involvement Lead
Jason Kjenstad, PE
HDR Engineering, Sioux Falls
Jason.Kjenstad@hdrinc.com
Phone: 605-977-7740

Study Area Map

I-229 Corridor Study

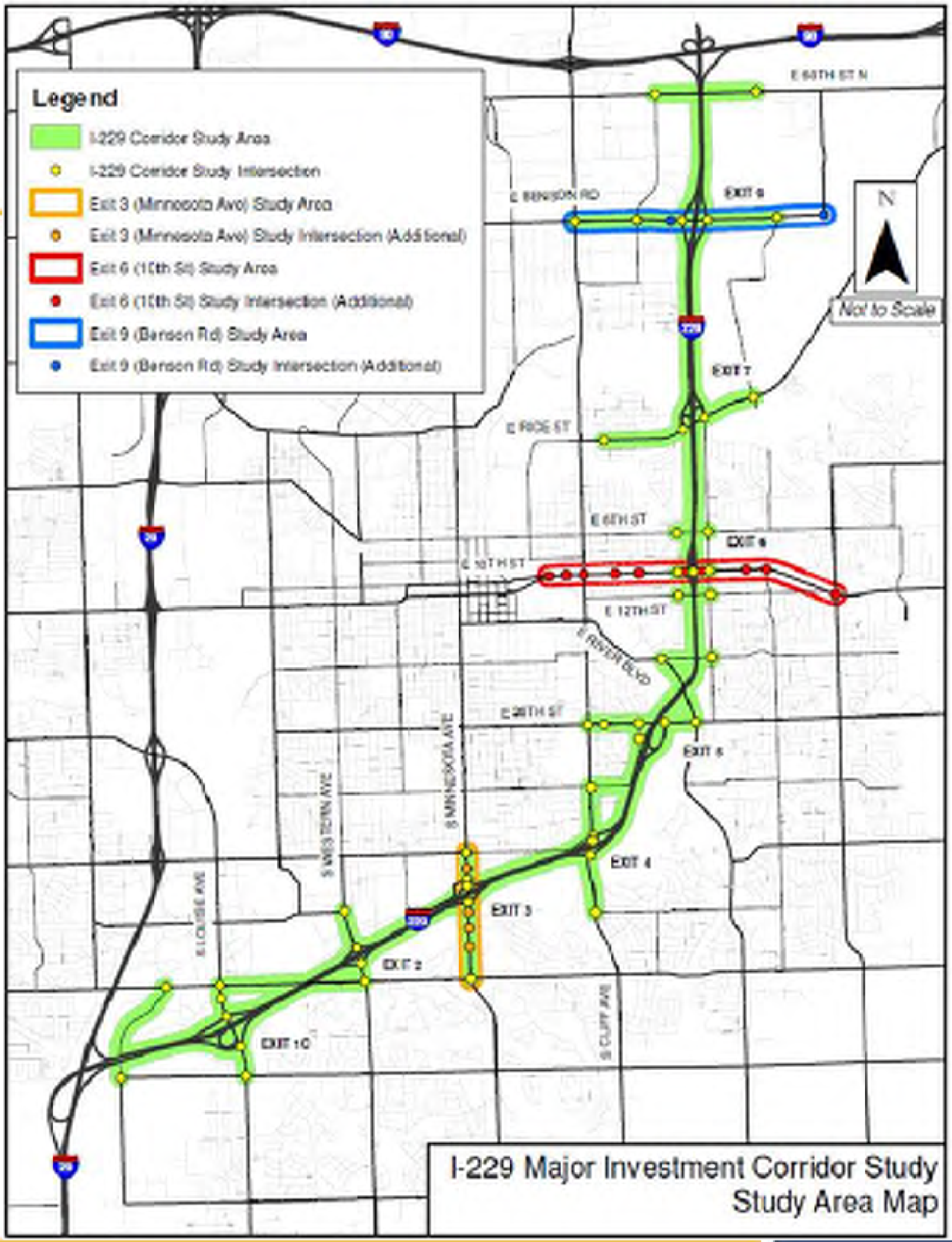
Solberg Avenue Overpass
to
60th Street N. Overpass

Additional Studies

Exit 3 – Minnesota Ave

Exit 6 – 10th Street

Exit 9 – Benson Road



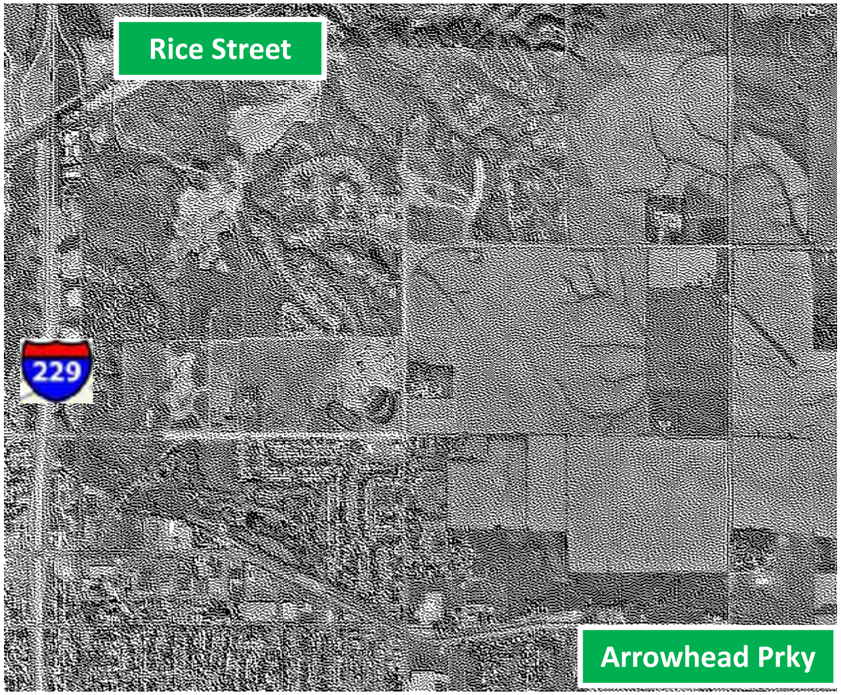
What is Driving this Study?

Louise Avenue Area – 1990's

Louise Avenue Area – 2010's

What is Driving this Study?

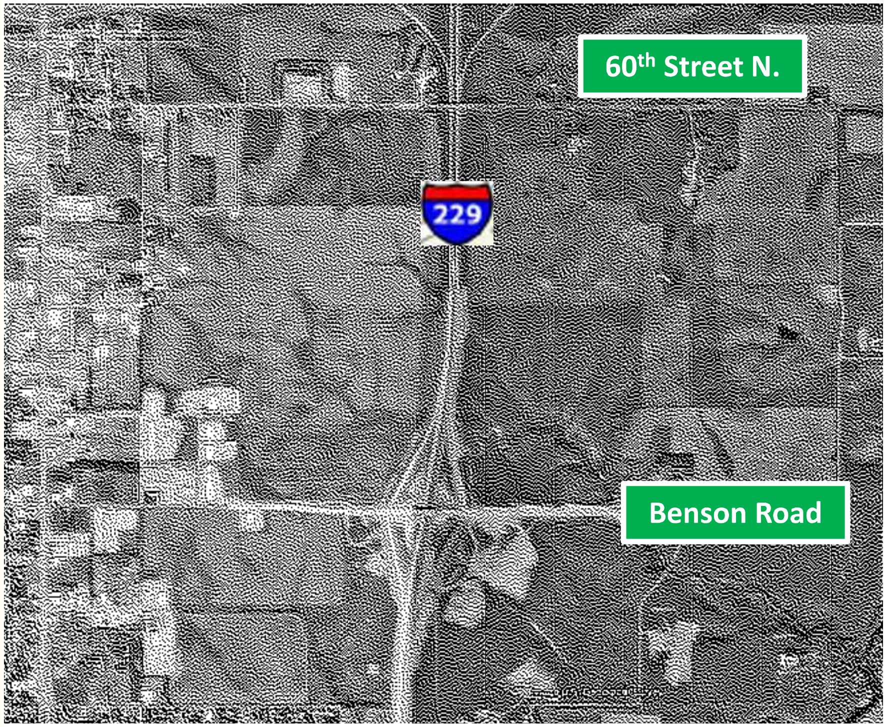
10th Street Area – 1990's



10th Street Area – 2010's

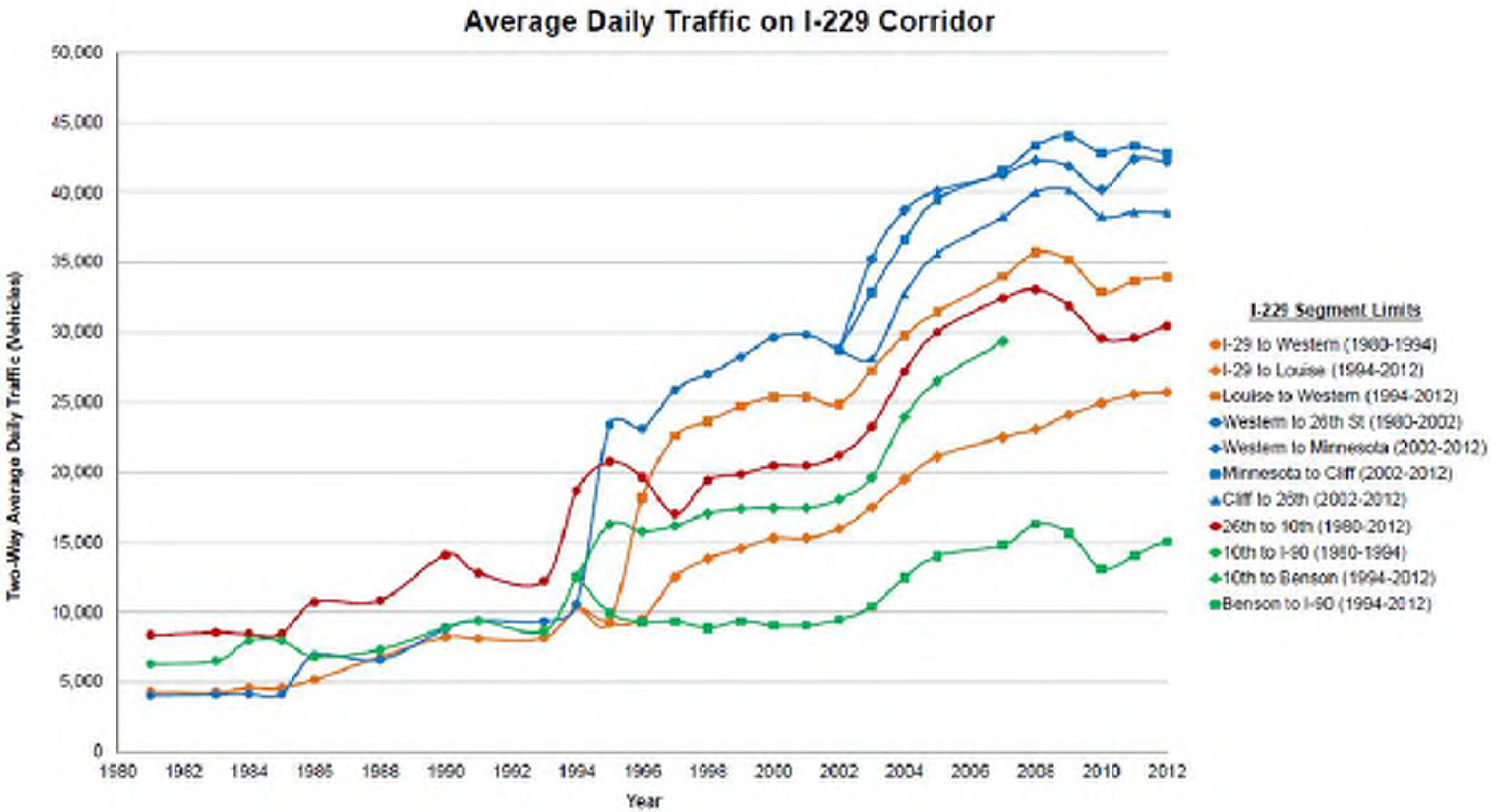
What is Driving this Study?

Benson Rd Street Area – 1990's



Benson Rd Street Area – 2010's

What is Driving this Study?



Historic Traffic Growth

What Should the Study Tell Us?

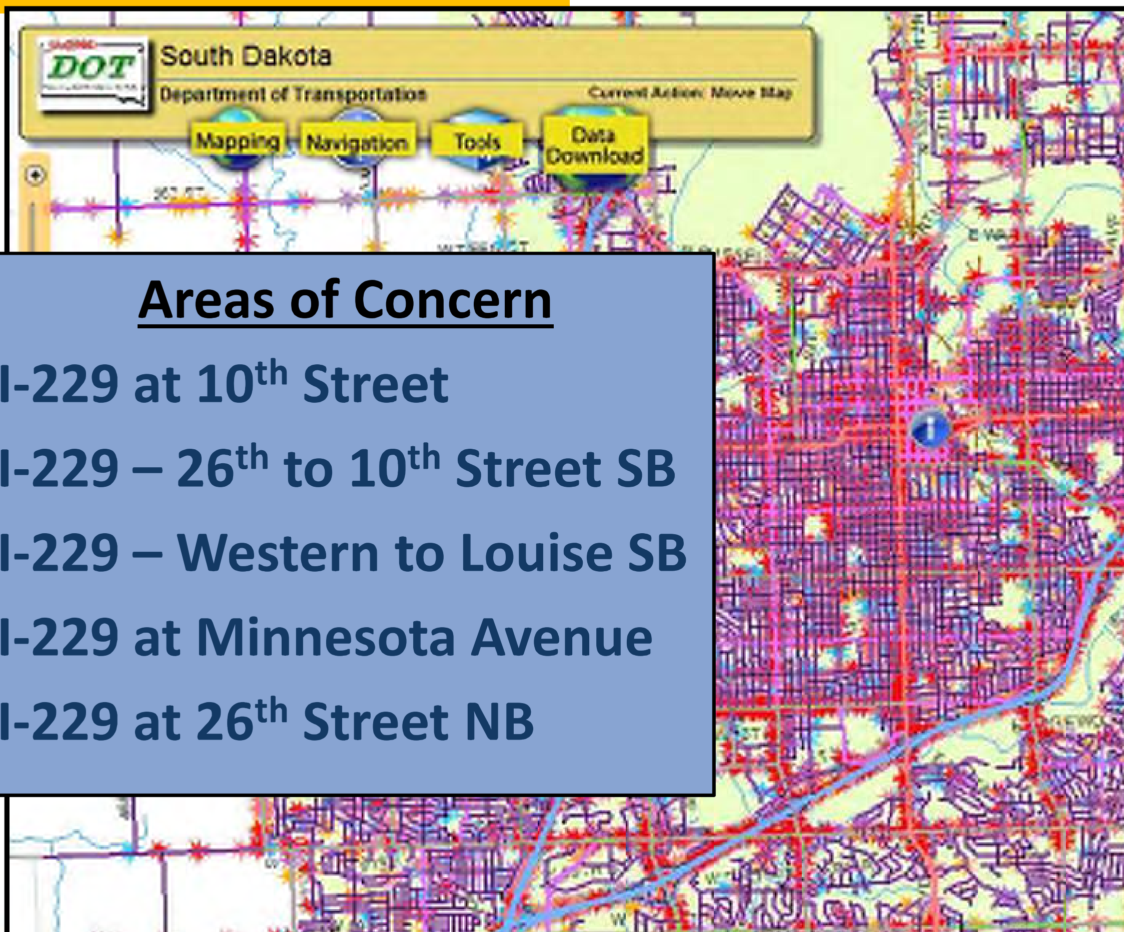
- **Traffic Capacity**

Traffic Analysis Locations

- I-229 Mainline
- I-229 Ramps
- Interchange Intersections
- Crossroad Intersections

What Should the Study Tell Us?

- Traffic Capacity
- **Traffic Safety**



Areas of Concern

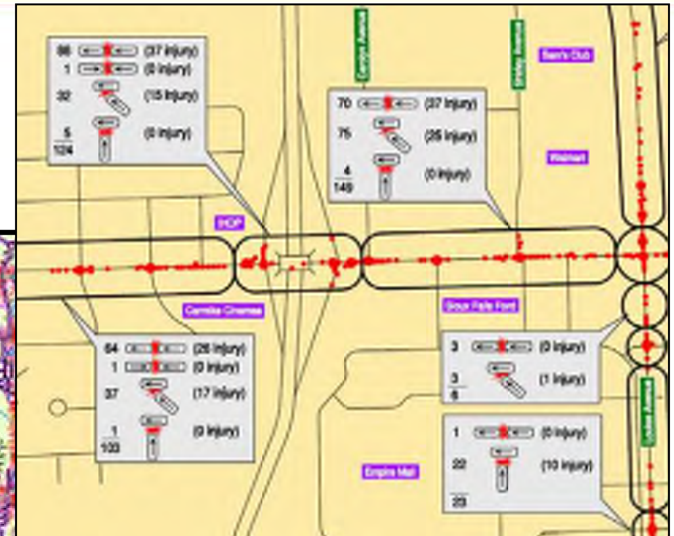
I-229 at 10th Street

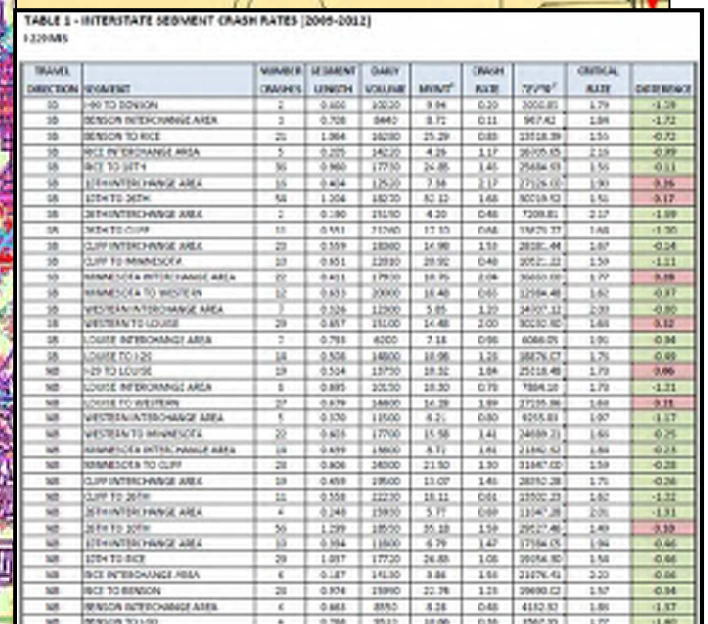
I-229 – 26th to 10th Street SB

I-229 – Western to Louise SB

I-229 at Minnesota Avenue

I-229 at 26th Street NB



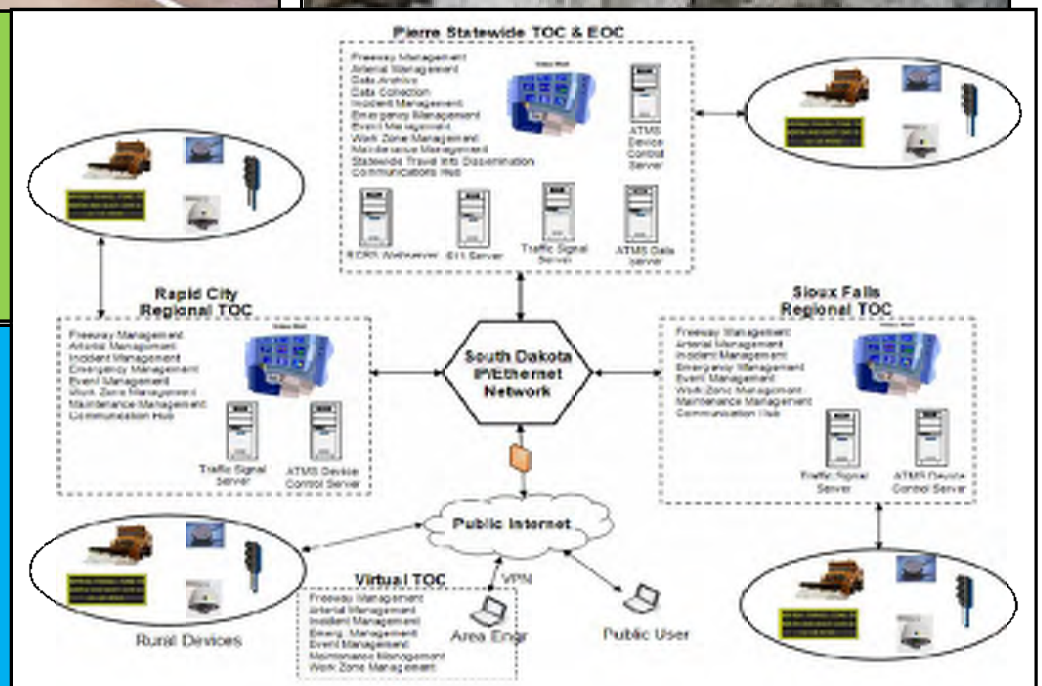


What Should the Study Tell Us?

- Traffic Capacity
- Traffic Safety
- **Incident Management**

Incident Management Study Goals

- Development of Base Mapping for Detours along I-229
- Begin discussions on Communication Activities



Traffic Incident Management Partners

- Law Enforcement
- Fire and Rescue
- Medical Services
- Public Safety Communications
- Traffic Information Media
- SDDOT, City of Sioux Falls, and others

What Should the Study Tell Us?

- Traffic Capacity
- Traffic Safety
- Incident Management
- **Short & Long Term Planning**

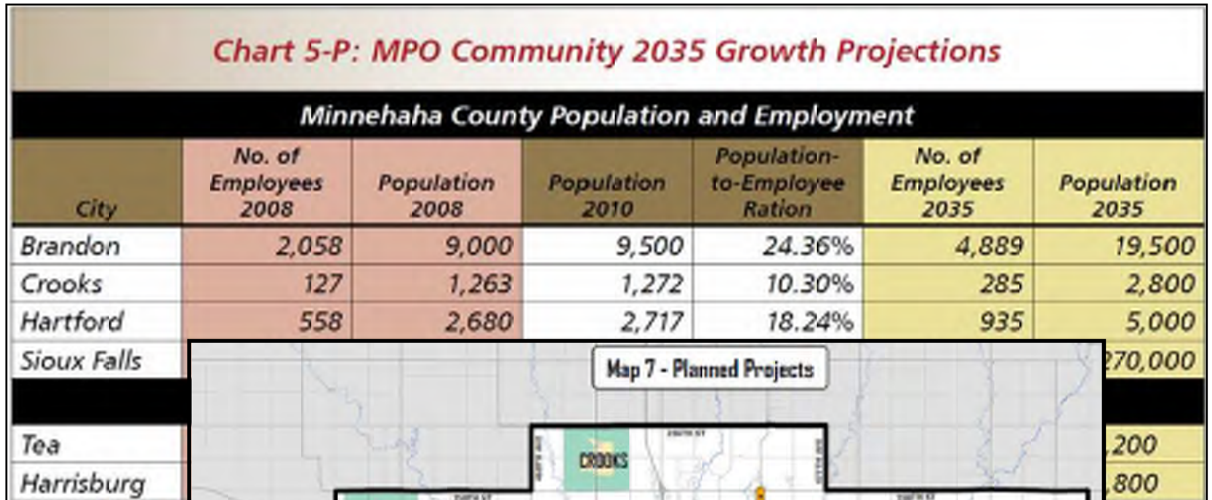
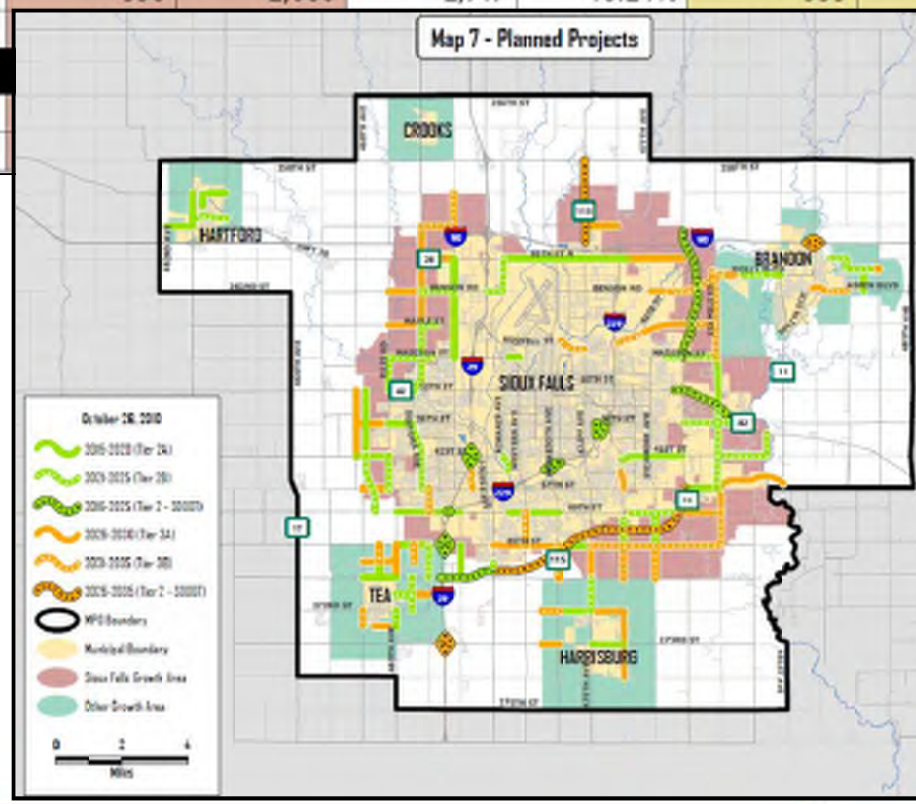
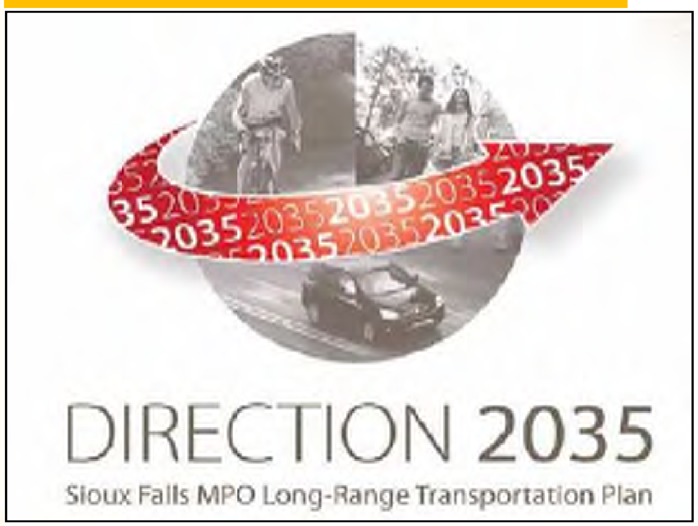


Chart 5-P: MPO Community 2035 Growth Projections

Minnehaha County Population and Employment

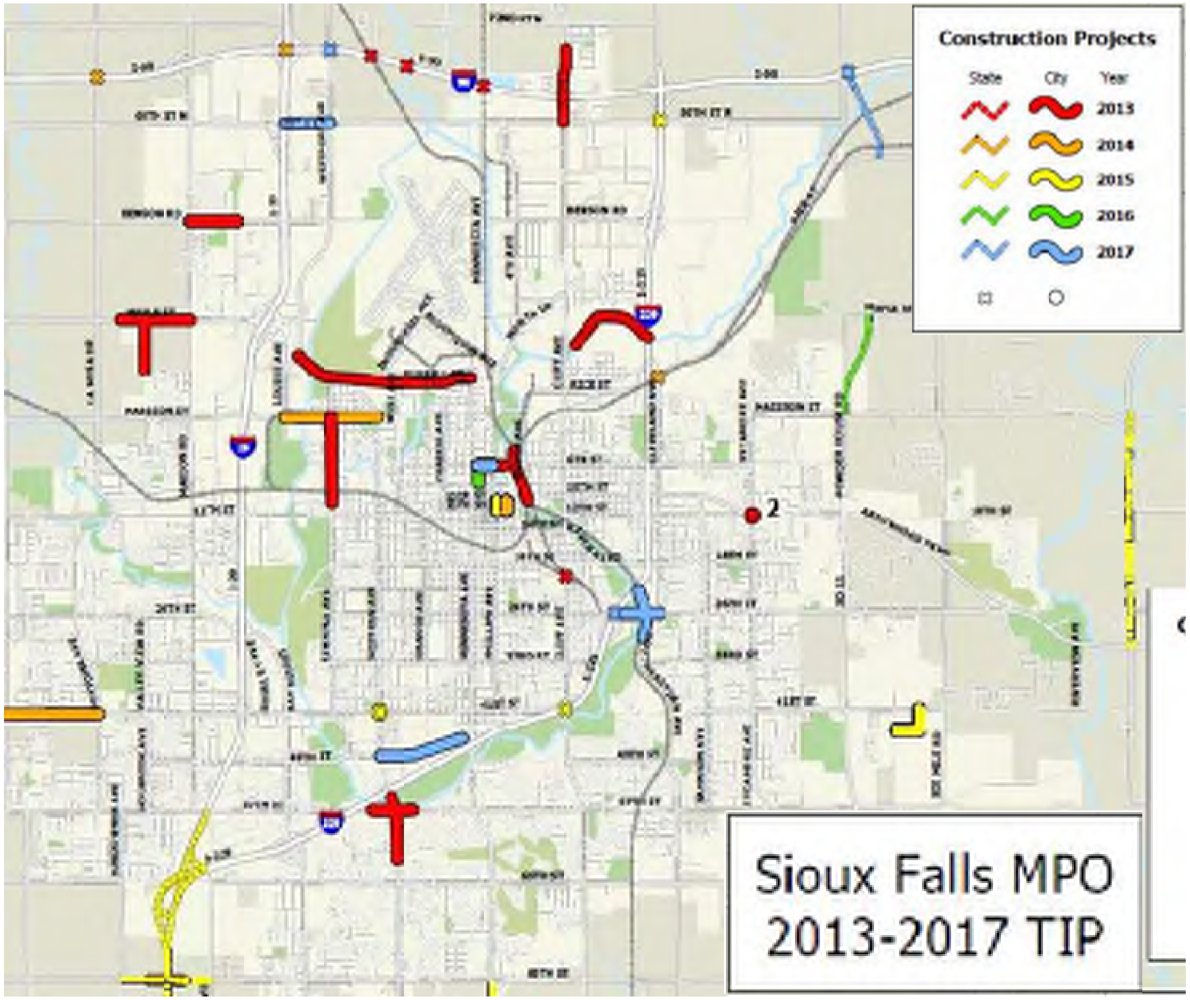
City	No. of Employees 2008	Population 2008	Population 2010	Population-to-Employee Ration	No. of Employees 2035	Population 2035
Brandon	2,058	9,000	9,500	24.36%	4,889	19,500
Crooks	127	1,263	1,272	10.30%	285	2,800
Hartford	558	2,680	2,717	18.24%	935	5,000
Sioux Falls	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Tea	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Harrisburg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]





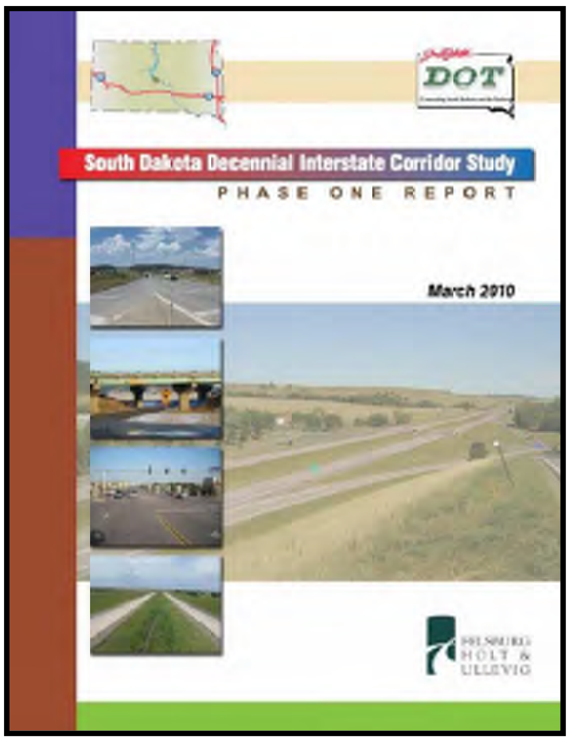
What Should the Study Tell Us?

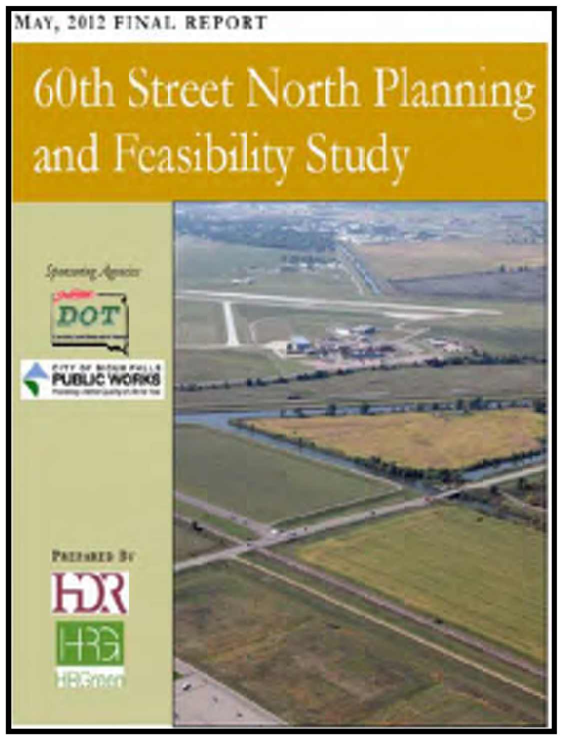
- Traffic Capacity
- Traffic Safety
- Incident Management
- Short & Long Term Planning
- **Coordinated Implementation**

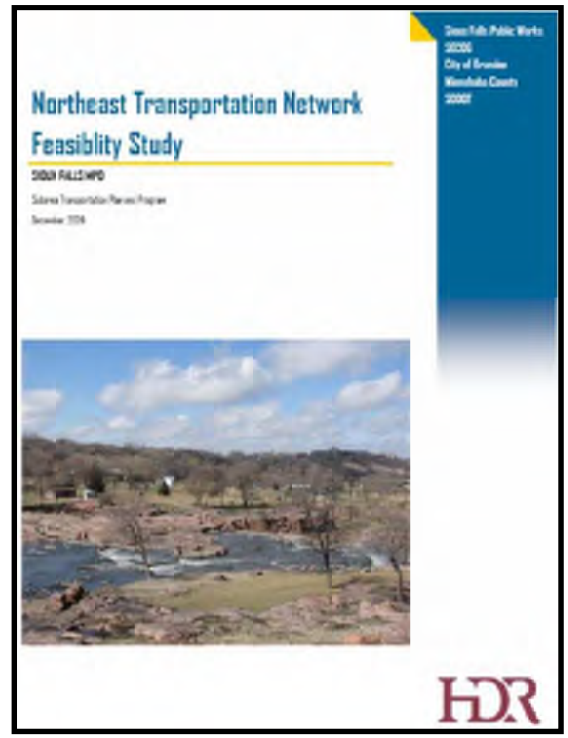


Why Additional Studies?

- Previous Planning Studies have indicated that Exit 3 (Minnesota Avenue), Exit 6 (10th Street), and Exit 9 (Benson Road) will need improvements along with possible crossroad corridor improvements.







Exit 3 (Minnesota Avenue)

Crossroad Study Goals

- Reduce traffic congestion
- Evaluate interchange options
- Integrate plans for the 49th Street Extension with the interchange options developed
- Improve pedestrian and bike access to the Big Sioux River Pathway
- Improve safety for corridor users
- Improve vehicle safety to Yankton Trail Park

Exit 6 (10th Street)

Crossroad Study Goals

- Reduce traffic congestion
- Develop Corridor Growth Plan to meet traffic demands but minimizing impacts to developed properties
- Improve pedestrian mobility
- Improve safety for corridor users
- Identify improvements to the interchange as well as the 10th Street and Cleveland Ave intersection

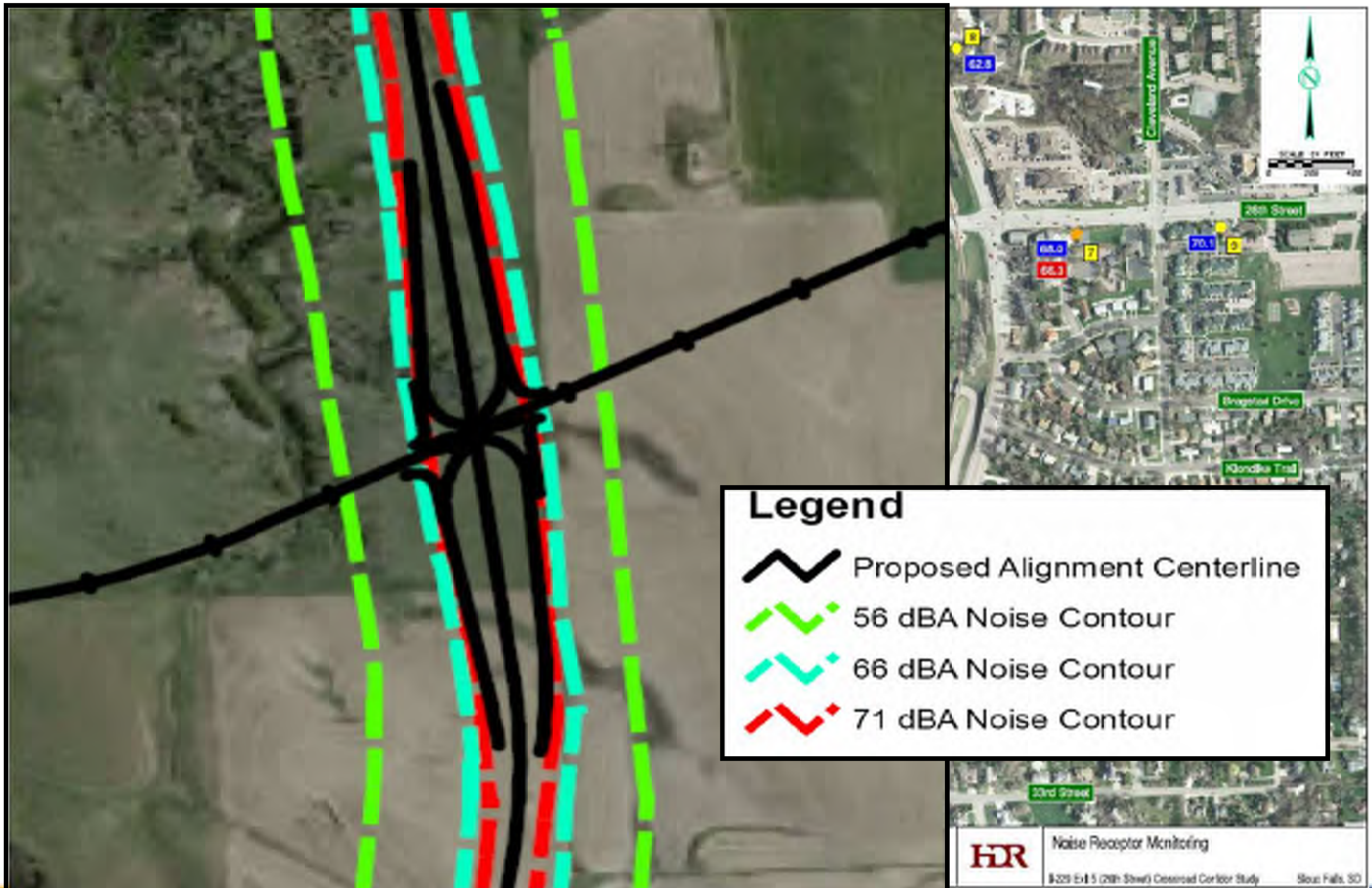
Exit 9 (Benson Road)

Crossroad Study Goals

- Reduce traffic congestion at NB on/off interchange ramp terminal
- Develop Corridor Growth Plan to meet traffic demands from development taking place east of I-229
- Improve pedestrian mobility
- Make recommendations to improve corridor intersections
- Develop interchange alternatives to meet future traffic demands

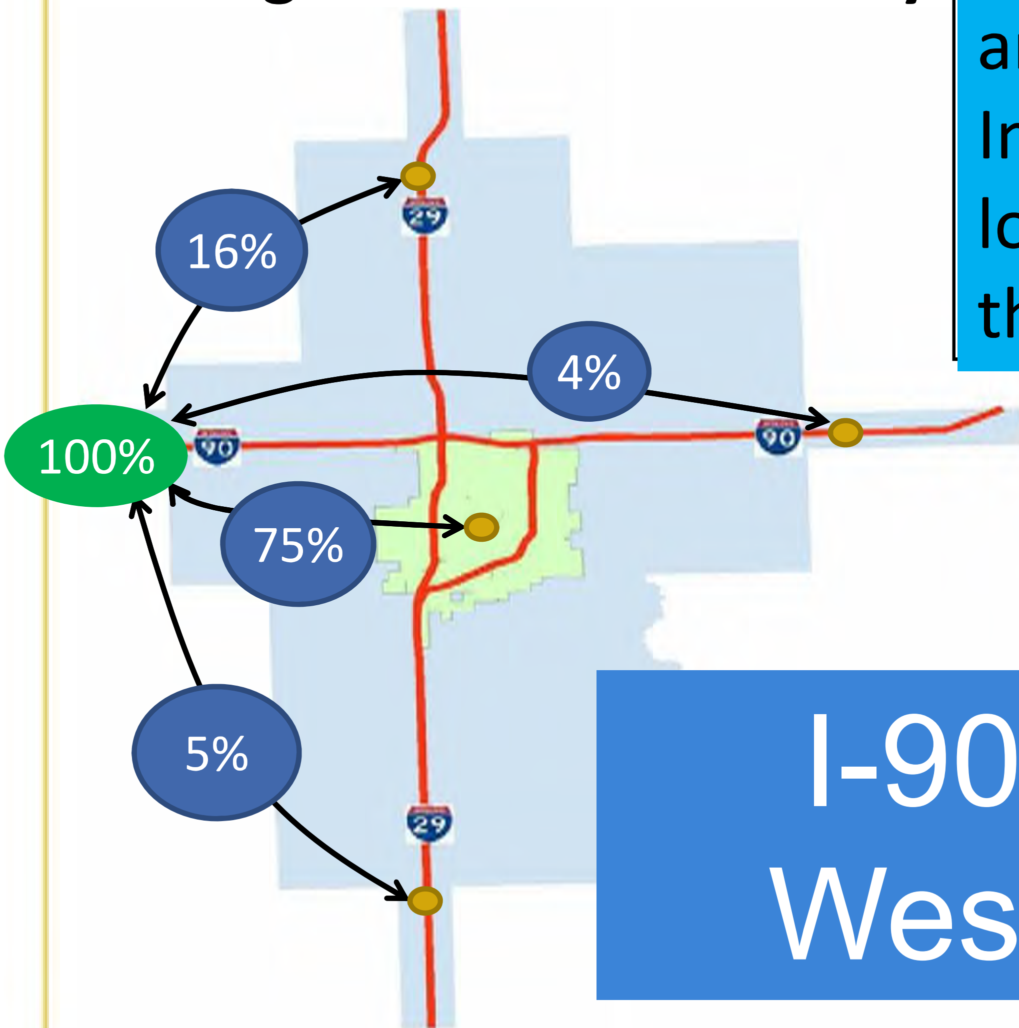
Other Study Activities?

- **Noise Data Collection**



Other Study Activities?

- **Origin-Destination Study**



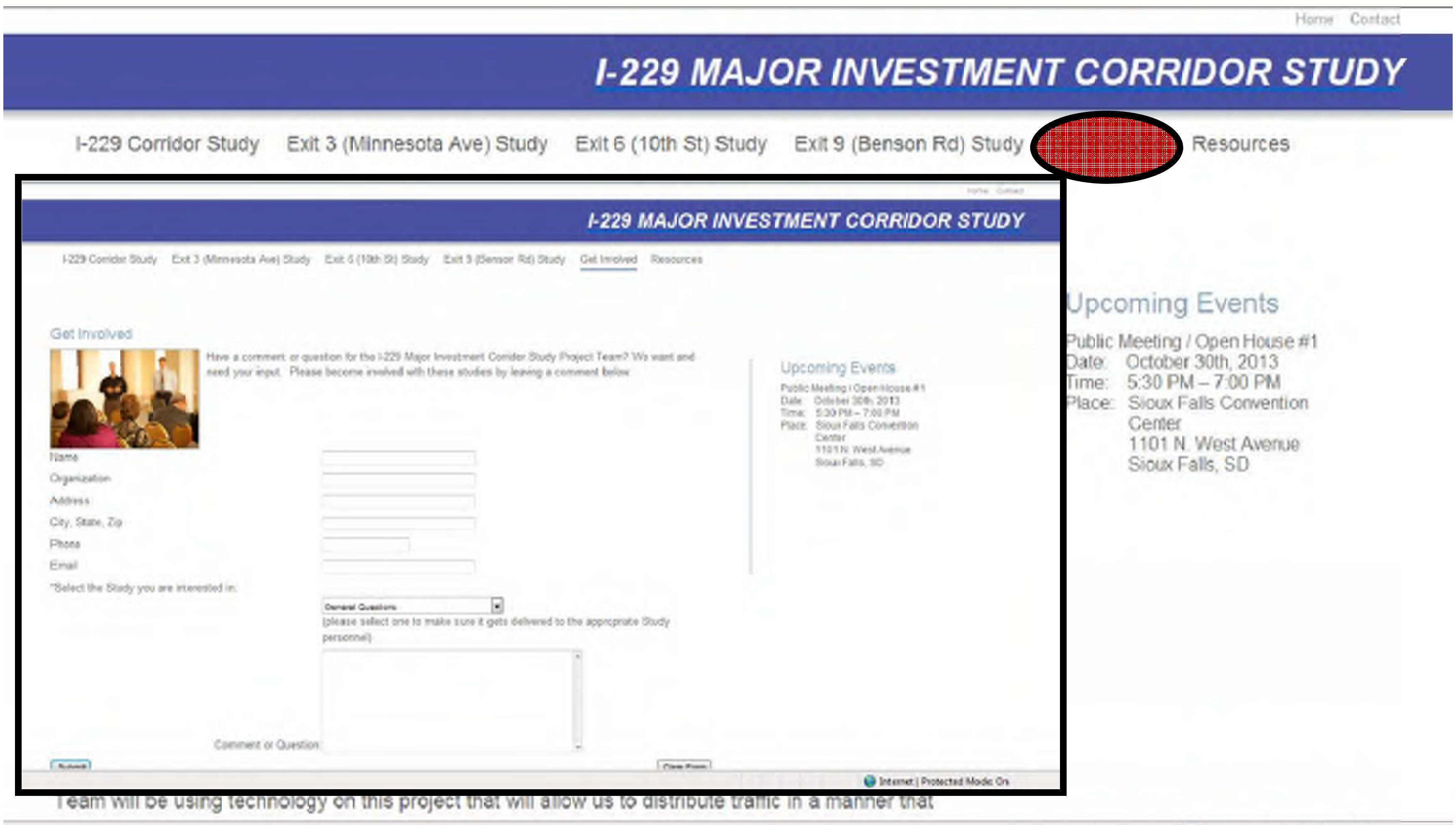
What is the amount of state and regional traffic on the Interstate system versus local traffic in and around the study area?

I-90 West

Methodology:
1.) Airsage collects signaling data from cell phone towers as your smartphone constantly communicates.
2.) This cell phone technology can locate a phone spatially at a given time of day.
3.) This data is being recorded 24 hours a day – 7 days a week.
4.) This “Technology” allows for anonymous and aggregated data meaning it only that knows that it is a phone, nothing more.
5.) Data sets are provided indicating time and location for us to determine travel demand *(keep in mind this is only a sample size of the overall population but allows us to estimate travel patterns better)*

Project Website

WWW.I229STUDY.COM



Project Schedule

TIMELINE OF EVENTS

YEAR 2013

April 2013 – Study Began

May / October 2013 – Data Collection & Traffic Model Building

October 30th, 2013 – *Public Open House #1*

November 2013 / March 2014 – Complete Traffic Assessment and Develop Alternatives for Improvements

YEAR 2014

March / April 2014 - *Public / Stakeholder Meetings*

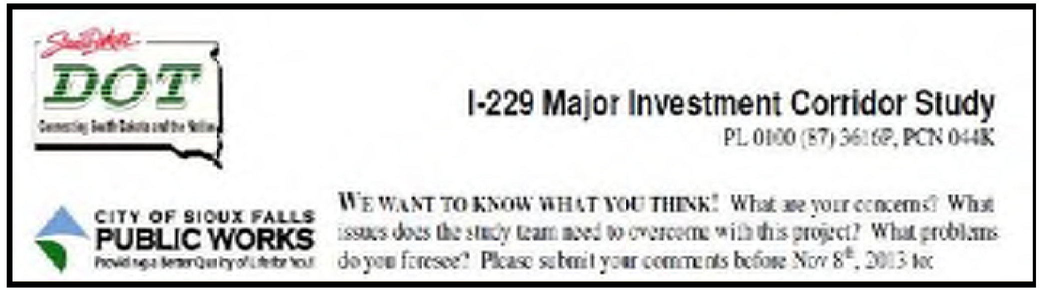
April / July 2014 – Refine Alternatives & Produce Draft Reports

August 2014 – *Public Meeting (Final)*

October 2014 – Complete Study

Next Steps

(1.) Take public comments on concerns you have regarding I-229 Study Areas



I-229 Major Investment Corridor Study

PL 0100 (87) 361&P, PCN 044K

WE WANT TO KNOW WHAT YOU THINK! What are your concerns? What issues does the study team need to overcome with this project? What problems do you foresee? Please submit your comments before Nov 8th, 2013 to:

(2.) Complete Traffic Assessment and begin to develop base alternatives to mitigate the capacity issues identified

(3.) Begin noise monitoring along corridor this fall

Before You Leave Please...

SIGN IN SHEET

Subject	I-229 Major Investment Corridor Study – Public Open House #1
Client	City of Sioux Falls / South Dakota Department of Transportation
Project	PL 0100(87) 3616P, PCN 044K
Meeting Date	Wednesday, Oct 30th, 2013 5:30 – 7:00 PM

Please print clearly. Thank you.

	NAME/REPRESENTING	ADDRESS	BEST CONTACT PHONE	E-MAIL
1				
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Please Sign In!

CITY OF SIOUX FALLS PUBLIC WORKS
Providing a Better Quality of Life for You!

I-229 Major Investment Corridor Study
PL 0100 (87) 3616P, PCN 044K

WE WANT TO KNOW WHAT YOU THINK! What are your concerns? What issues does the study team need to overcome with this project? What problems do you foresee? Please submit your comments before Nov 8th, 2013 to:

Mail: *HDR Engineering, Inc.*
ATTN: Jason Kjenstad
6300 S. Old Village Place, Suite 100
Sioux Falls, SD 57108-2102

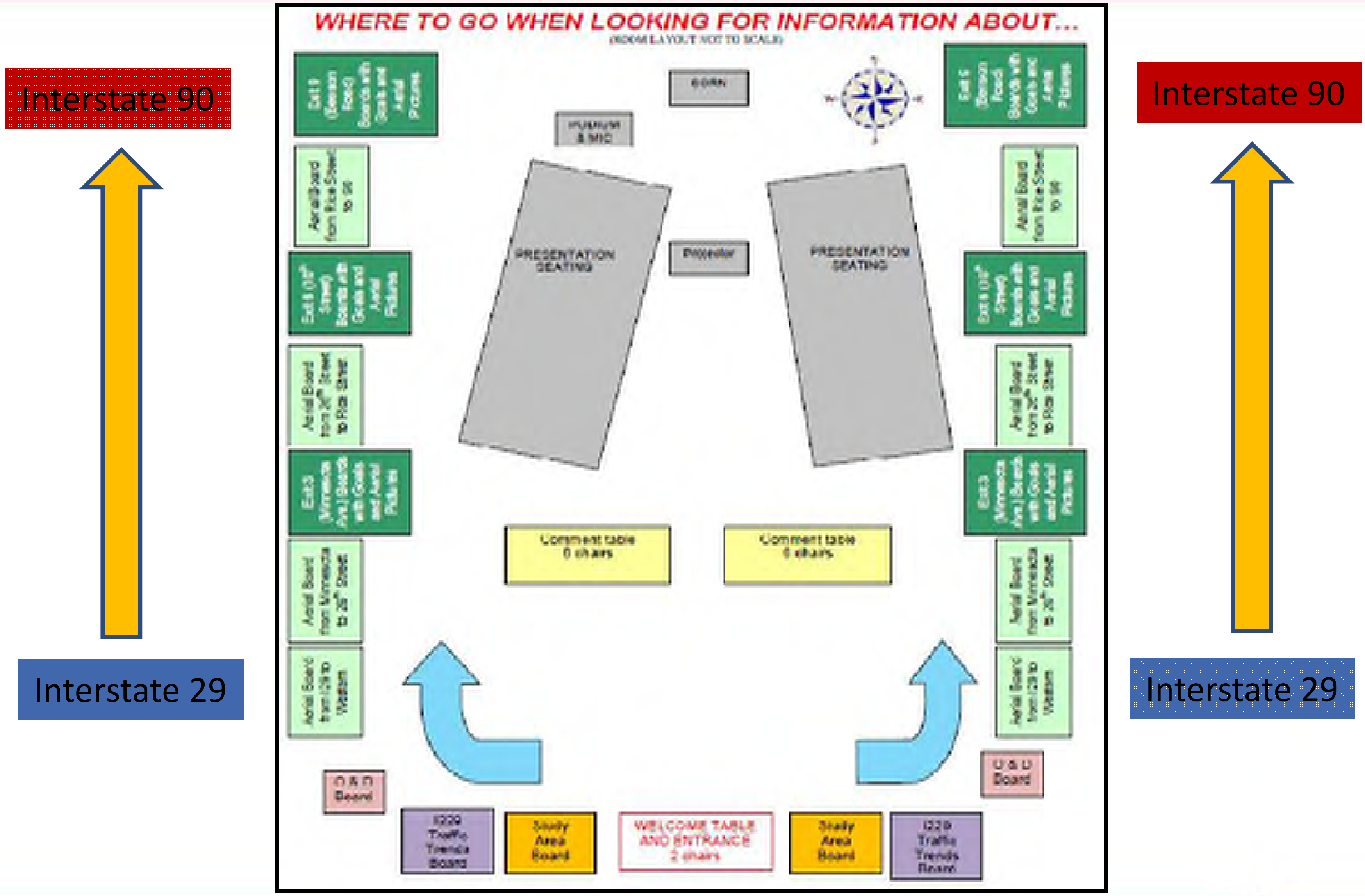
E-mail: *Jason.Kjenstad@hdrinc.com*

Fax: *605-977-7747*

(optional)
Name: ______ Address: ______
Phone: ______ Email: ______

Leave a Comment or Suggestion!!!!

Room Layout



Interstate 90
Interstate 29
WHERE TO GO WHEN LOOKING FOR INFORMATION ABOUT...
PRESENTATION SEATING
PRESENTATION SEATING
Study Area Board
WELCOME TABLE AND ENTRANCE
Study Area Board
Interstate 90
Interstate 29

Thanks for Attending!

WWW.I229STUDY.COM

APPENDIX -

PUBLIC MEETINGS #2 – JUNE 1ST & 2ND, 2015

MINNESOTA AVENUE

JUNE 1ST, 2015

- SIGN-IN SHEETS
- POWERPOINT SLIDES
- MEETING NOTES (SEE END OF PUBLIC MEETINGS #2 APPENDIX)
- COMMENTS (SEE END OF PUBLIC MEETINGS #2 APPENDIX)

Note: actual attendance count was 53 people (including 15 women)

Sign In Sheet

Subject I-229 Major Investment Corridor Study – Informational Meeting for Minnesota Avenue Sub-Study

Client City of Sioux Falls/South Dakota Department of Transportation

Project PL 0100(87) 3516P, PCN 044K **Project No.:** 207030

Meeting Date Monday June 1st, 2015 5:00 PM **Meeting Location:** Sioux Falls Convention Center

Please print clearly. Thank you.

	Name	Address	Best Contact Phone	Email
1	Ray Kirlin	3209 S. Lincoln	334-2411	kirlin.r@dtzero.com
2	Pan + Stauder	3000 S. Sunnymede	332-6509	
3	Ron McMahon	116 E. Dakota Ave, Pierre	776-1009	ron.mcmahon@dot.gov
4	John Shelso	2800 W 23rd St. SF, SD	605-951-2970	jhshelso@earthlink.net
5	Trev Buwan	1501 W Winterwood Dr		
6	Art Holden	705 W Victoria Ln SF 57108	605-371-3428	artholden67@gmail.com
7	Bruce Danielson	110 Box 464 SF 57101		
8	Bob Lobham	3600 S Duluth	334-4220	robert.lobham@dakotababilities.org
9	Guy Roger	5415 S. Westward	321-5514	g boris@aol.com
10	David Heinold	205 S. Menlo Ave.	219-363-5768	d-heinold@gmail.com
11	Kevin Nyberg	330 W. 41st, 57105	605 3314088	knyberg@nybergsace.com
12	Susan Hoover	606 E 21st St	332 5319	sah @ mtarc.net
13	Gerald Teunissen	808 Jane Lane SF-SD	366-1979	gerald@benderco.com
14	Kurt Greffe	605 E 21st 57105	3326035	KJG324@yahoo.com
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Sign In Sheet

Subject I-229 Major Investment Corridor Study – Informational Meeting for Minnesota Avenue Sub-Study

Client City of Sioux Falls/South Dakota Department of Transportation

Project PL 0100(67) 3616P, PCN 044K **Project No.:** 207030

Meeting Date Monday, June 1st, 2015 5:00 PM **Meeting Location:** Sioux Falls Convention Center

Please print clearly. Thank you.

	Name	Address	Best Contact Phone	Email
1	Brad Remmich	SDDOT		
2	Craig Smith	SDDOT	995-3300	craig.smith@state.sd.us
3	Steve Gramm	SDDOT	773-6641	steve.gramm@state.sd.us
4	[illegible]		605-521-9281	[illegible]
5	Dave Rowe	Empire Bldg Cat	321-9823	DaveinSiouxFalls [illegible].com
6	Sara Bertsch	Argus Leader	605-331-2831	
7	Jon Wiegand	HR Green		jwiegand@hrgreen.com
8	Amber Gibson	SECOG	367-5390	amber@secog.org
9	Kevin Kriese	Boen & Associates	336-0425	KevinK@BoenAssociates.com
10	James Unruh	HDR	977-7766	james.unruh@hdrinc.com
11	Trevor Preston	5700 S Church Drive		Trevorhockey@sio.midco.net
12	Gregg Johnson	6801 E. Split Rock Cr	332-8166	grjohnson@sio.midco.net
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Sign In Sheet

Subject I-229 Major Investment Corridor Study – Informational Meeting for Minnesota Avenue Sub-Study

Client City of Sioux Falls/South Dakota Department of Transportation

Project PL 0100(87) 3618P, PCN 044K **Project No.:** 207030

Meeting Date Monday, June 1st, 2015 5:00 PM **Meeting Location:** Sioux Falls Convention Center

Please print clearly. Thank you.

	Name	Address	Best Contact Phone	Email
1	Jo Wahle			
2	Stan Schmidt Wanna	3214 W Zepher Pl. #1		Stan@goingbeyondwords.com
3	Kay Gollesch	LifeScape		kay.gollesch@lifescapesd.org
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Sign In Sheet

Subject I-229 Major Investment Corridor Study – Informational Meeting for Minnesota Avenue Sub-Study

Client City of Sioux Falls/South Dakota Department of Transportation

Project PL 0100(87) 3818P, PCN 044K **Project No.:** 207000

Meeting Date Monday, June 1st, 2015 5:00 PM **Meeting Location:** Sioux Falls Convention Center

Please print clearly. Thank you.

	Name	Address	Best Contact Phone	Email
1	Pete Longman	SDDOT	773-6488	pete.longman@state.sd.us
2	Jason Kjenstad	HDR	605-977-7755	jason.kjenstad@hdrinc.com
3	Christina Bennett	SDDOT	(605)773-4759	Christina.Bennett@state.sd.us
4	Paul Nikolas	SDDOT	60-367-5680	paul.nikolas@state.sd.us
5	Al Schoenemen	1801 W 50th St SF 57105	605 370 1189	al.schoeneman@schoenemans.com
6	Thomas Hein	6100 E Hein Place SF SD 57110	605-361-8490	Theinmail@gmail.com
7	Travis Dressen	SDDOT - SF Area	605-367-5680	travis.dressen@state.sd.us
8	Ross Harris	HR Green 5525 Merle Hay Rd. Johnston, IA 50131	515-657-5263	rharris@hrgreen.com
9	Michael Carlson	1813 S Prairie Ave	605 929 8923	[illegible] @gmail.com
10	Audrey James	27002 Split Creek Ct	605.929-7514	audreyjames@borderstates.net
11	Joe James	27002 Split Creek Ct S Falls	605-366-5328	jjames@borderstates.net
12	Chris Parsley	7001 W 66th St SF SD	319-389-1507	[illegible]@gmail.com
13	Lori Buschene	3710 S Southeastern Ave #A Sioux Falls SD	507.360.5554	buschene@midco.net
14	West Valley Dale Froehlich	6 So La Chatera SF, SD 57105	605-201-9810	dalefroehlich@gmail.com
15	Nancy Preston	5700 S. Chuck Drive		
16	Alex Cannady	1510 W. 57th St	231-7620	alex.cannady@siouxfallsgolf.com
17	Kathy & Jerry Phillips	5100 S. Swift Park Dr	940-2448	[illegible]@yahoo.com
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Interstate 229 Major Investment Study

Exit 3 – Minnesota Avenue Sub-study

Informational Meeting
June 1st, 2015
5:00 pm to 7:00 pm

HDR

HRGreen

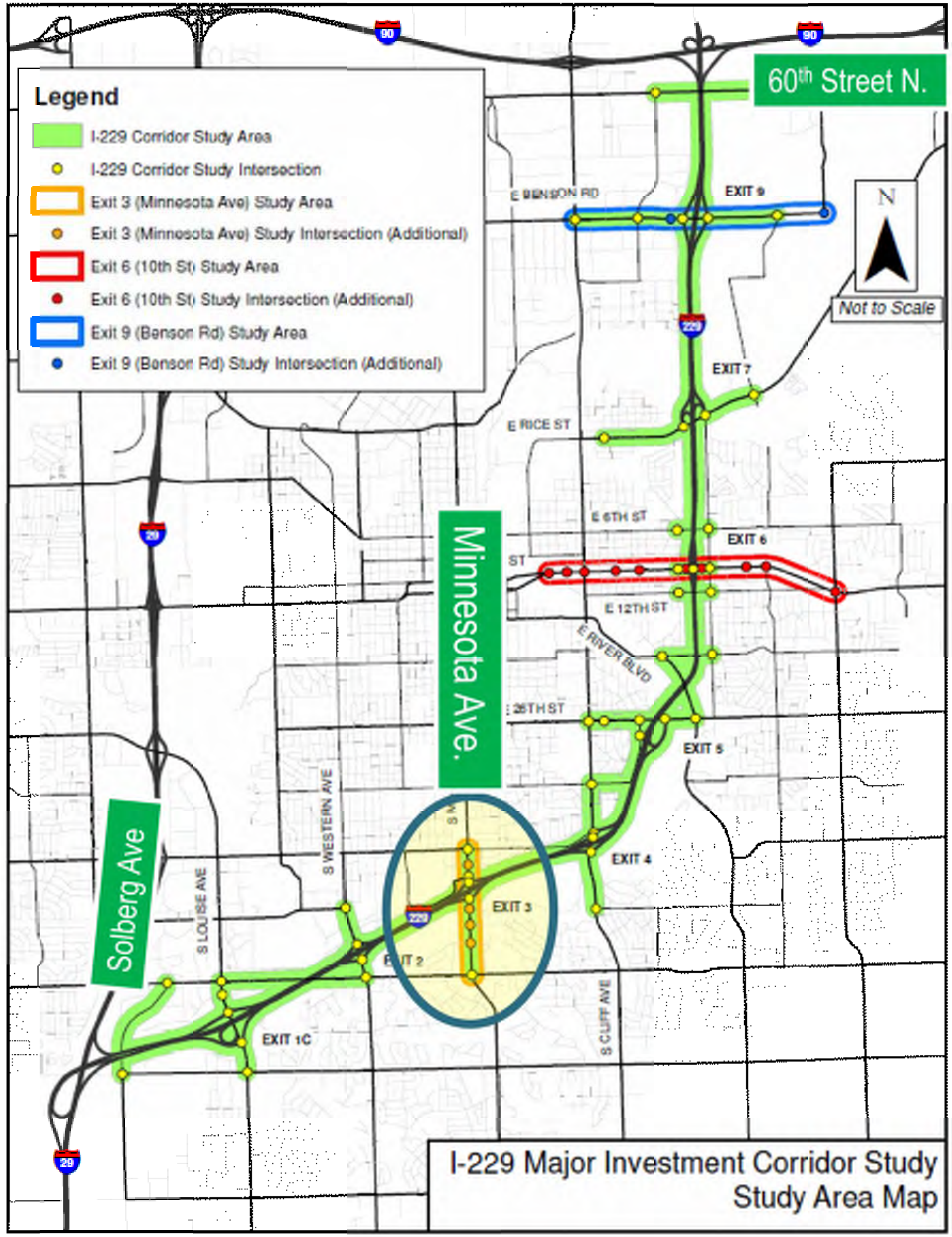
Study Area Map

I-229 Corridor Study

Solberg Avenue Overpass
to
60th Street N. Overpass

Meeting will focus on:

Exit 3 – Minnesota Ave



Study Advisory Partners

South Dakota Department of Transportation (SDDOT)

South Dakota Highway Patrol

City of Sioux Falls

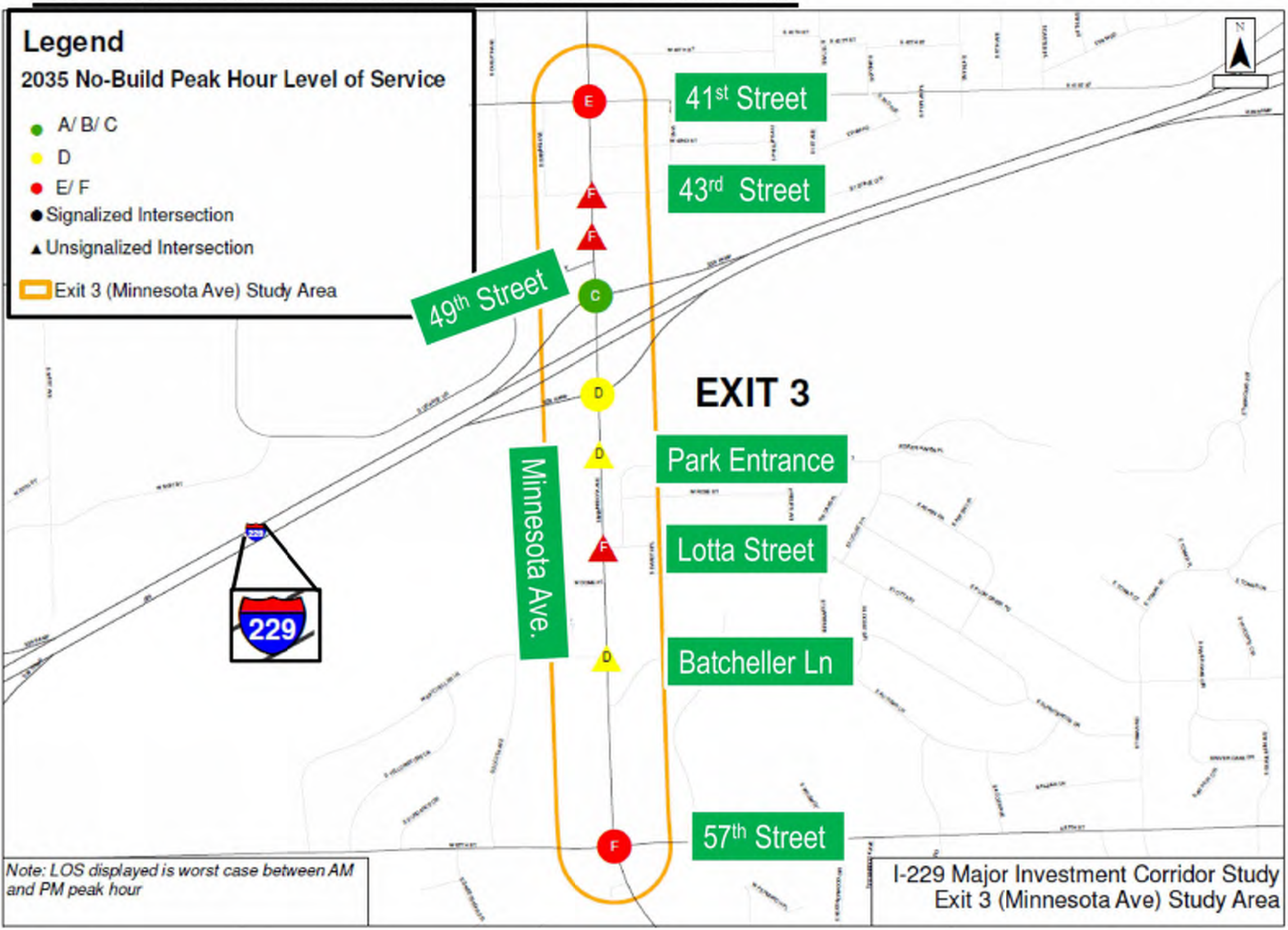
Sioux Falls Metropolitan Planning Organization (MPO)

Federal Highway Administration (FHWA)

Exit 3 (Minnesota Avenue) Crossroad Study Goals

- Reduce traffic congestion
- Evaluate interchange options
- Integrate plans for the 49th Street Extension with the interchange options developed
- Improve pedestrian and bike access to the Big Sioux River Pathway
- Improve safety for corridor users
- Improve vehicle safety to Yankton Trail Park

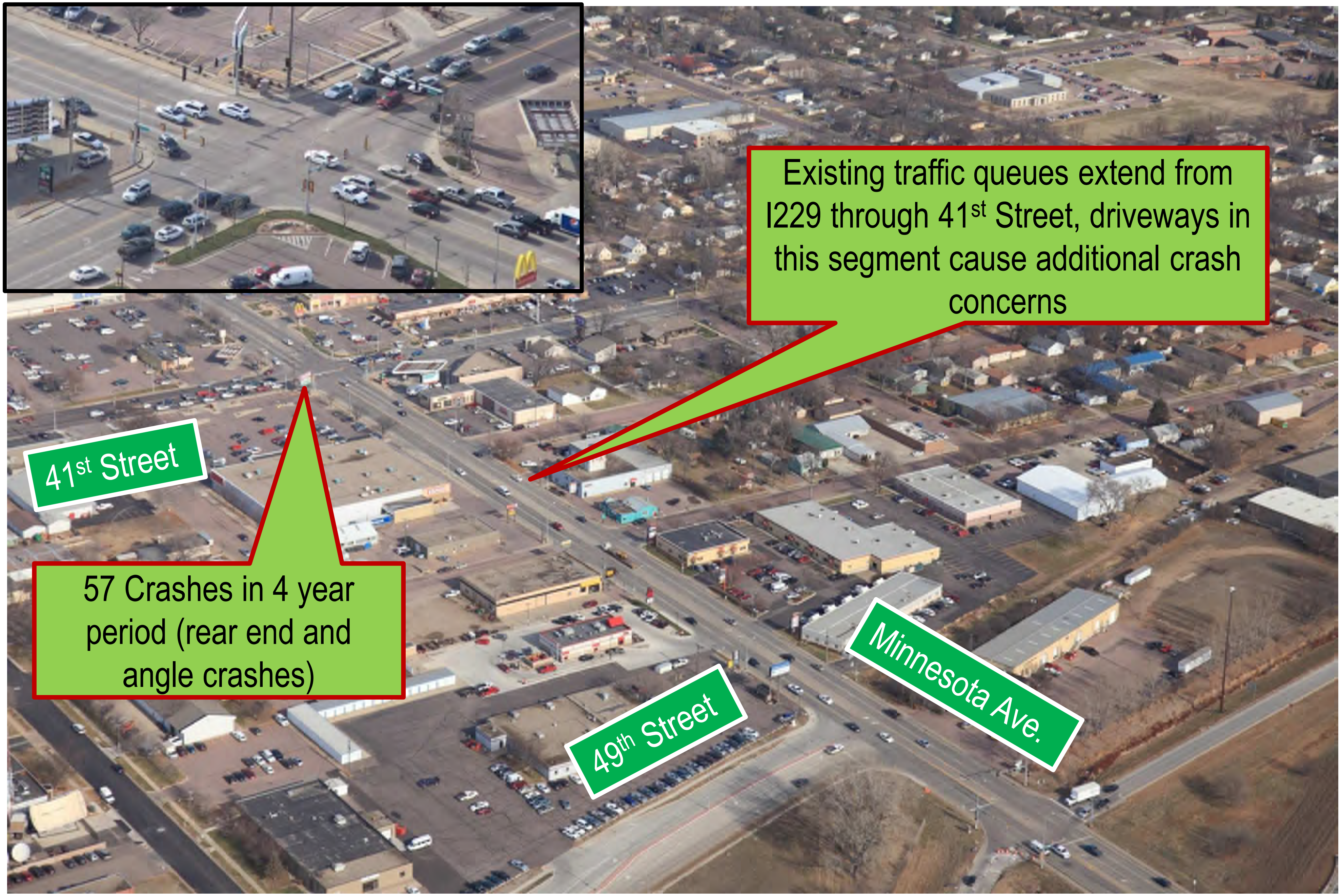
Minnesota Avenue Corridor Overview



Minnesota Avenue Corridor Overview

Minnesota Avenue Corridor Overview

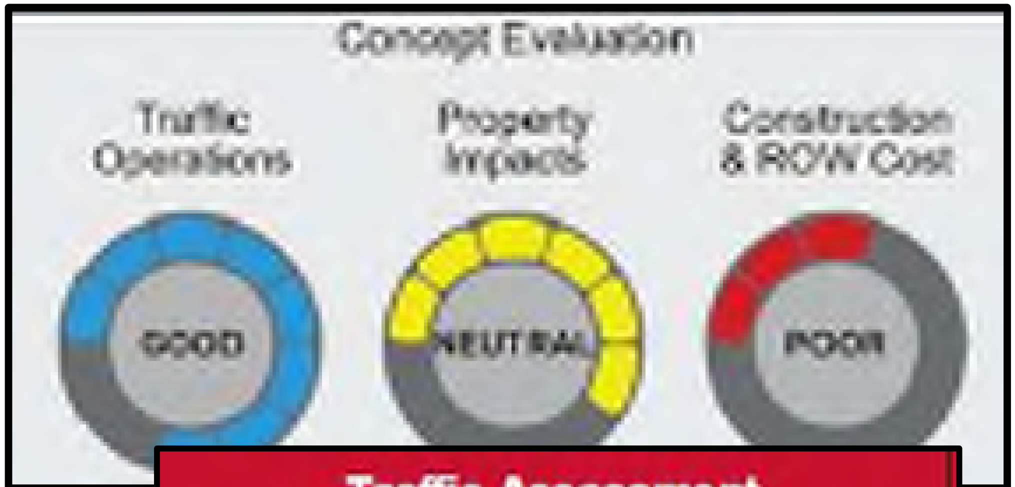
Minnesota Avenue Corridor Overview



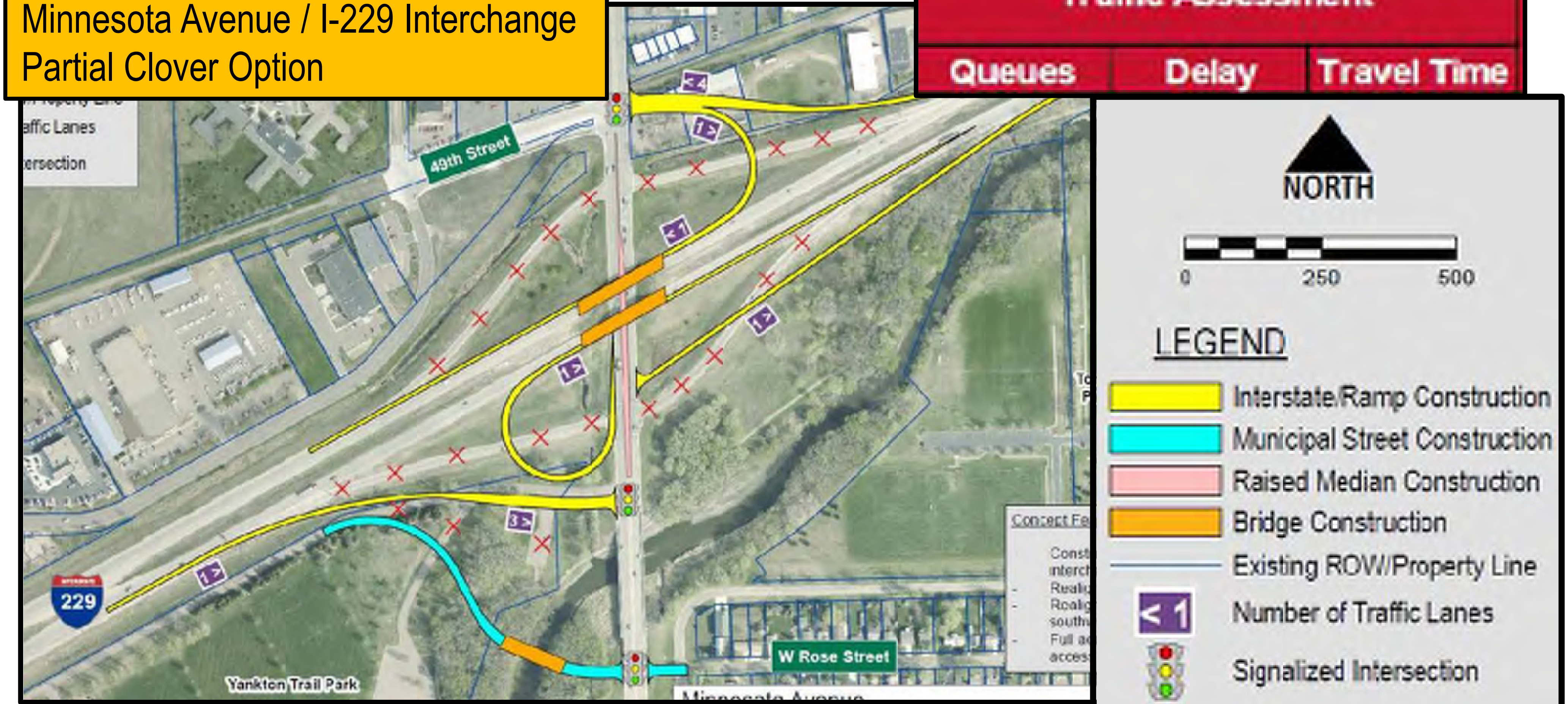
Conceptual Ideas for Minnesota Avenue

What you will be able to see tonight:

- 13 Interchange Conceptual Options
- 4 Corridor Options
- Access Changes to Yankton Trail Park
- Conceptual Options to improve safety



Minnesota Avenue / I-229 Interchange
Partial Clover Option



Conceptual Ideas for Minnesota Avenue

What you will be able to see tonight:

- 13 Interchange Conceptual Options
- 4 Corridor Options
- Access Changes to Yankton Trail Park
- Conceptual Options to improve safety

Minnesota Avenue – Raised Median with ¾ Movements when possible

Concept Evaluation

Traffic Operations	Property Impacts	Construction & ROW Cost

LEGEND

- Interstate/Ramp Construction
- Municipal Street Construction
- Raised Median Construction
- Bridge Construction
- Existing ROW/Property Line
- < 1 Number of Traffic Lanes
- Signalized Intersection

Next Steps for Minnesota Avenue

- **Finalize Composite Comparison Matrix**
  - Traffic Assessment
  - Environmental Screening
  - ROW Impacts
  - Overall Costs
  - Public Involvement Support
- **Complete additional Traffic Operations analysis on a reduced number of options based on the screening activities**
- **Develop Priority Phasing Plan for I-229 Corridor and Sub-Study Corridor**
- **Schedule and Conduct next public meeting**

PROJECT CONTACTS:

Jason Kjenstad – HDR Engineering, Inc.
605-977-7740 or jason.kjenstad@hdrinc.com

Ross Harris– HR Green, Inc.
515-657-5263 or rharris@hrgreen.com

Shannon Ausen – City of Sioux Falls
605-367-8607 or sausen@siouxfalls.org

Steve Gramm – SDDOT Project Development
605-773-6641 or steve.gramm@state.sd.us

Interstate 229 Major Investment Study

Exit 3 – Minnesota Avenue Sub-Study

Thanks for Attending!!!!!

HDR

HRGreen

10TH STREET

JUNE 1ST, 2015

- **SIGN-IN SHEETS**
- **POWERPOINT SLIDES**
- **MEETING NOTES (SEE END OF PUBLIC MEETINGS #2 APPENDIX)**
- **COMMENTS (SEE END OF PUBLIC MEETINGS #2 APPENDIX)**

Note: actual attendance count was 31 people (including 8 women)

Sign In Sheet

Subject I-229 Major Investment Corridor Study – Informational Meeting for 10th Street Sub-Study

Client City of Sioux Falls/South Dakota Department of Transportation

Project PL 0100(87) 3616P, PCN 044K **Project No.:** 207030

Meeting Date Monday, June 1st, 2015 7:30 PM **Meeting Location:** Sioux Falls Convention Center

Please print clearly. Thank you.

	Name	Address	Best Contact Phone	Email
1	Amber Gibson	SECOG	605 367 5390	amber@secog.org
2	Brad Remmich	SDDOT		
3	Greg Boe	5415 S Western SF		
4	Travis Dressen	SDDOT - SF Area	605 367 5680	travis.dressen@state.sd.us
5	Chuck Gustafson	705 E Ridge Rd SF SD	332-1000	cgustafson@mac.com
6	Hersh Patel	2610 10th Street	731 776 1476	[illegible]@super8siouxfalls.com
7	Bob Bohm	3600 S Dakota Ave	605 334 4926	robert.bohm@[illegible]abilities.org
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CITY OF SIOUX FALLS
PUBLIC WORKS
Providing a Better Quality of Life for You

Sign In Sheet

Subject I-229 Major Investment Corridor Study -- Informational Meeting for 10th Street Sub-Study
Client City of Sioux Falls/South Dakota Department of Transportation
Project PL 0100(87) 3818P, PCN 041K **Project No.:** 207030
Meeting Date Monday, June 1st, 2015 7:30 PM **Meeting Location:** Sioux Falls Convention Center

Please print clearly. Thank you.

	Name	Address	Best Contact Phone	Email
1	Pete Longman	SDDOT	773-6488	pete.longman@state.sd.us
2	Steve Gramm	SDDOT	773-6641	steve.gramm@state.sd.us
3	Paul Nikolas	SDDOT	367-5680	paul.nikolas@state.sd.us
4	Colin Moriarty	Gage Bros	336.118	cmoriarty@gagebrothers.com
5	[signature]	840 S. Day	338-6900	—
6	Lodermeier Family LLC Barbara Anderson	840 S. Day SF 57103	338-6900	amandad840@aol.com
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Sign In Sheet

Subject I-229 Major Investment Corridor Study – Informational Meeting for 10th Street Sub-Study
Client City of Sioux Falls/South Dakota Department of Transportation
Project PL 0100(87) 3818P, PCN 044K **Project No.:** 207030
Meeting Date Monday, June 1st, 2015 7:30 PM **Meeting Location:** Sioux Falls Convention Center

Please print clearly. Thank you.

	Name	Address	Best Contact Phone	Email
1	Tom Kelley	Gage Brothers	605 336 8150	
2	Dave Nelson	3413 Southern Cir.	366-7308	
3	Jason Kjenstad	HDR	605-977-7740	jason.kjenstad@hdrinc.com
4	Mark Eliason	101 S Cleveland	605-338-6271	MEliason@sio.midco.net
5	Ron McMahon	116 E Dakota Ave South Pierre	605-776-1009	ron.mcmahon@dot.gov
6	Christina Bennett	SDDOT	605-773-4759	Christina.Bennett@state.sd.us
7	Gary Busselman	7201 E Madison St SF SD 57110	605-351-5001	gary@garybuss.com
8	Edith Smith	Gage Brothers	605336 1180	esmith@gagebrothers.com
9	Sharon Fix	101 S. Cleveland Ave	(605) 338-8151	fixdds@midconetwork.com
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Interstate 229 Major Investment Study

Exit 6 – 10th Street Sub-Study

Informational Meeting
June 1st, 2015
7:30 pm to 9:00 pm

HDR

HRGreen

Study Area Map

I-229 Corridor Study

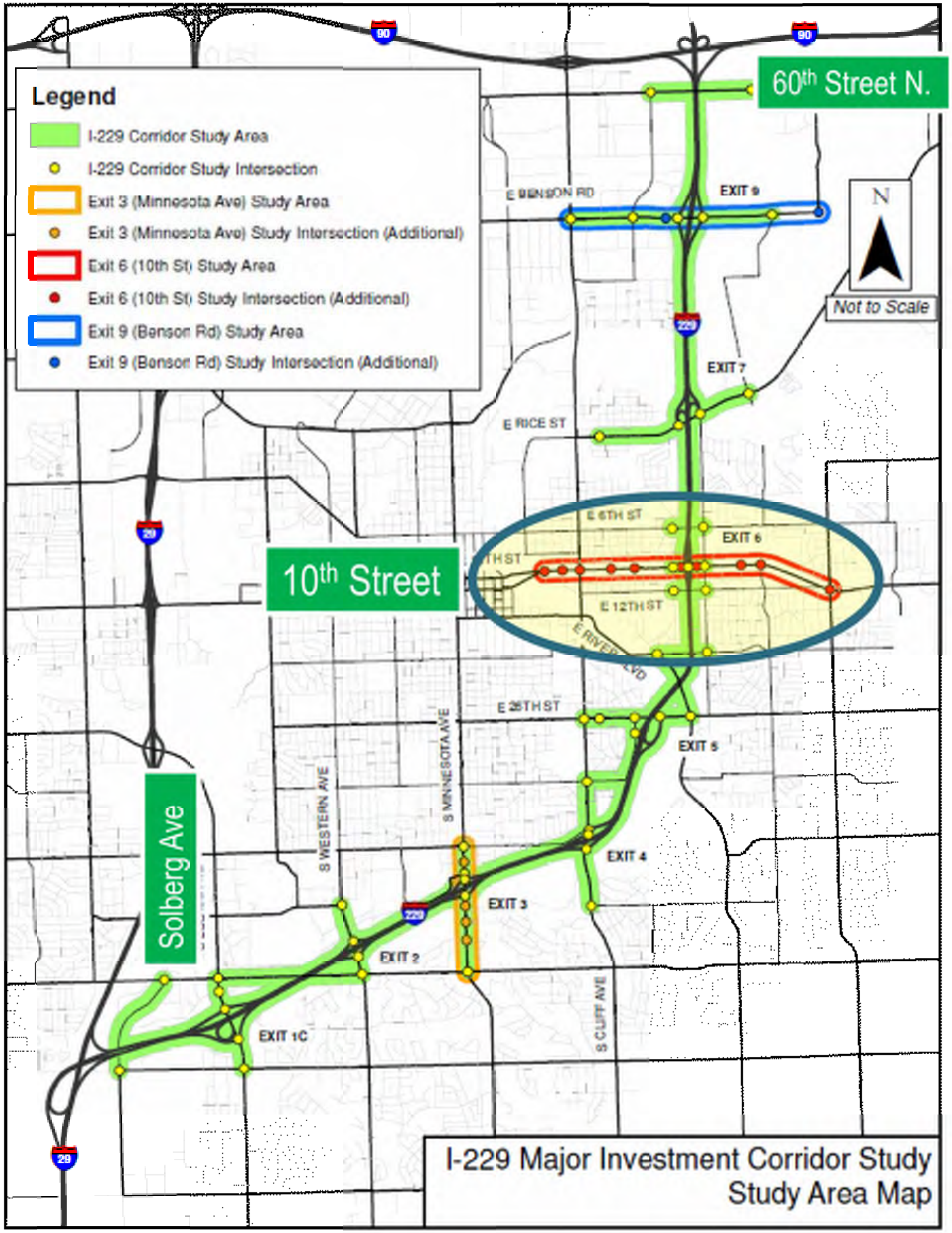
Solberg Avenue Overpass

to

60th Street N. Overpass

Meeting will focus on:

Exit 6 – 10th Street



Study Advisory Partners

South Dakota Department of Transportation (SDDOT)

South Dakota Highway Patrol

City of Sioux Falls

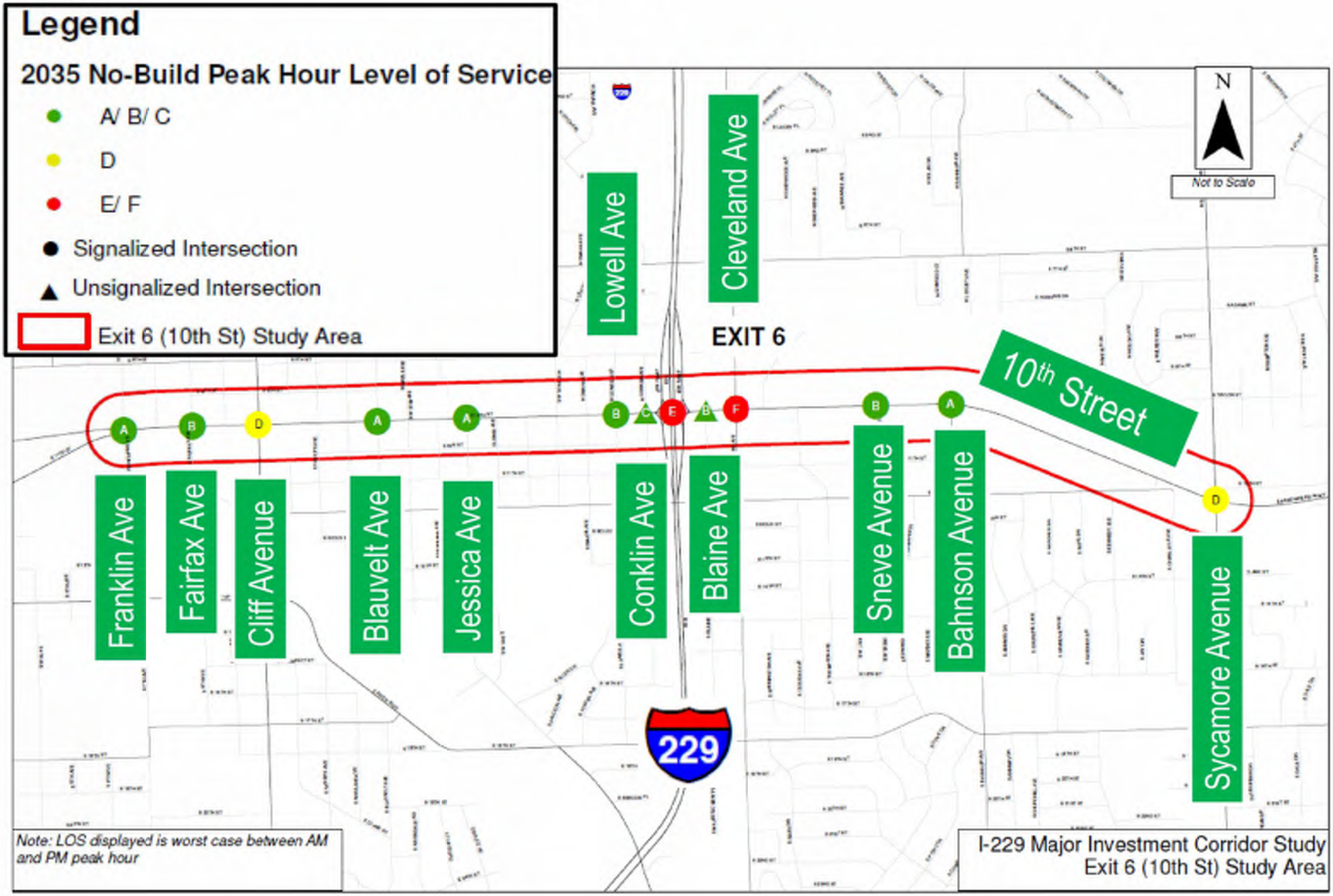
Sioux Falls Metropolitan Planning Organization (MPO)

Federal Highway Administration (FHWA)

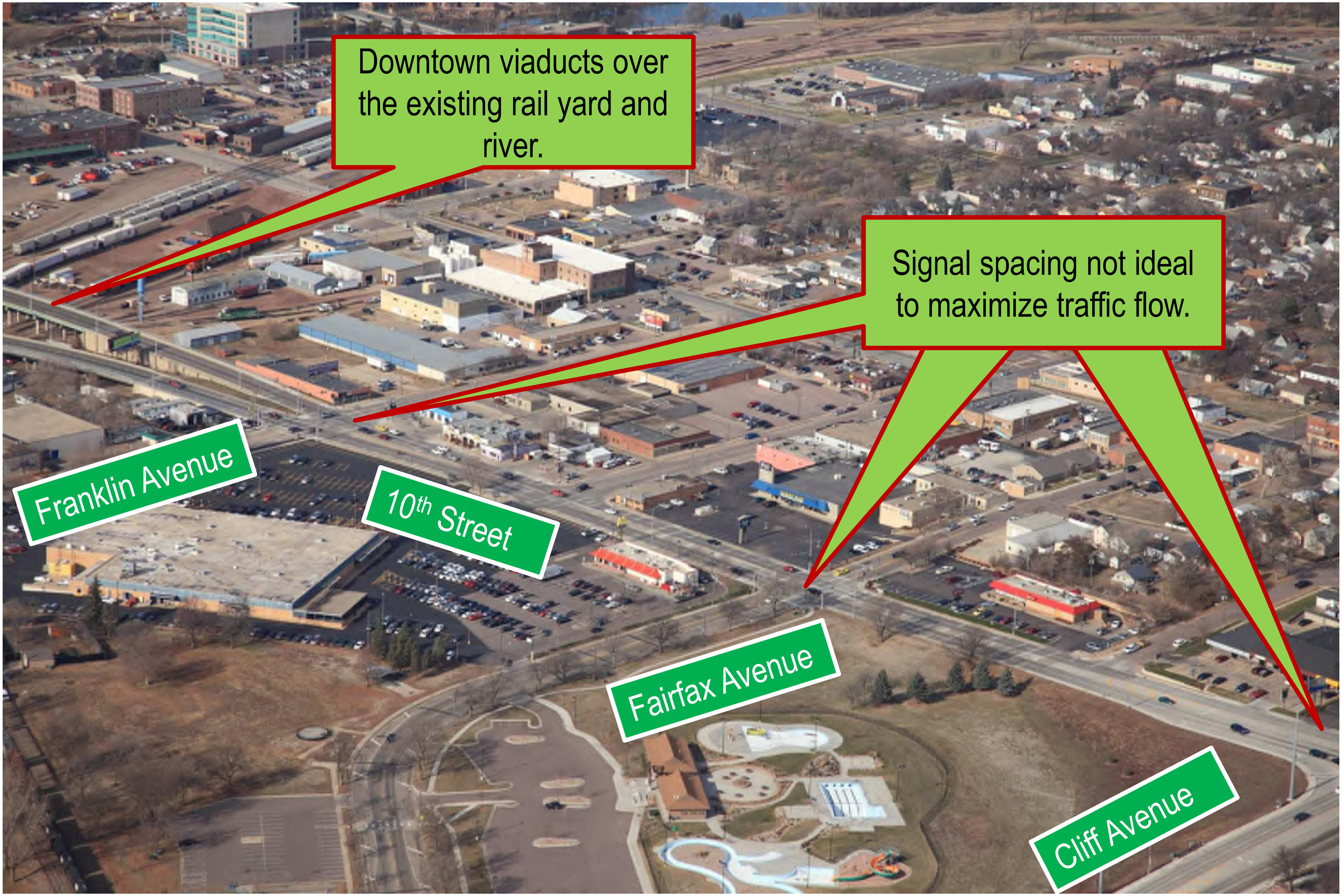
Exit 6 (10th Street) Crossroad Study Goals

- Reduce traffic congestion
- Develop Corridor Growth Plan to meet traffic demands but minimizing impacts to developed properties
- Improve pedestrian mobility
- Improve safety for corridor users
- Identify improvements to the interchange as well as the 10th Street and Cleveland Ave intersection

10th Street Corridor Overview

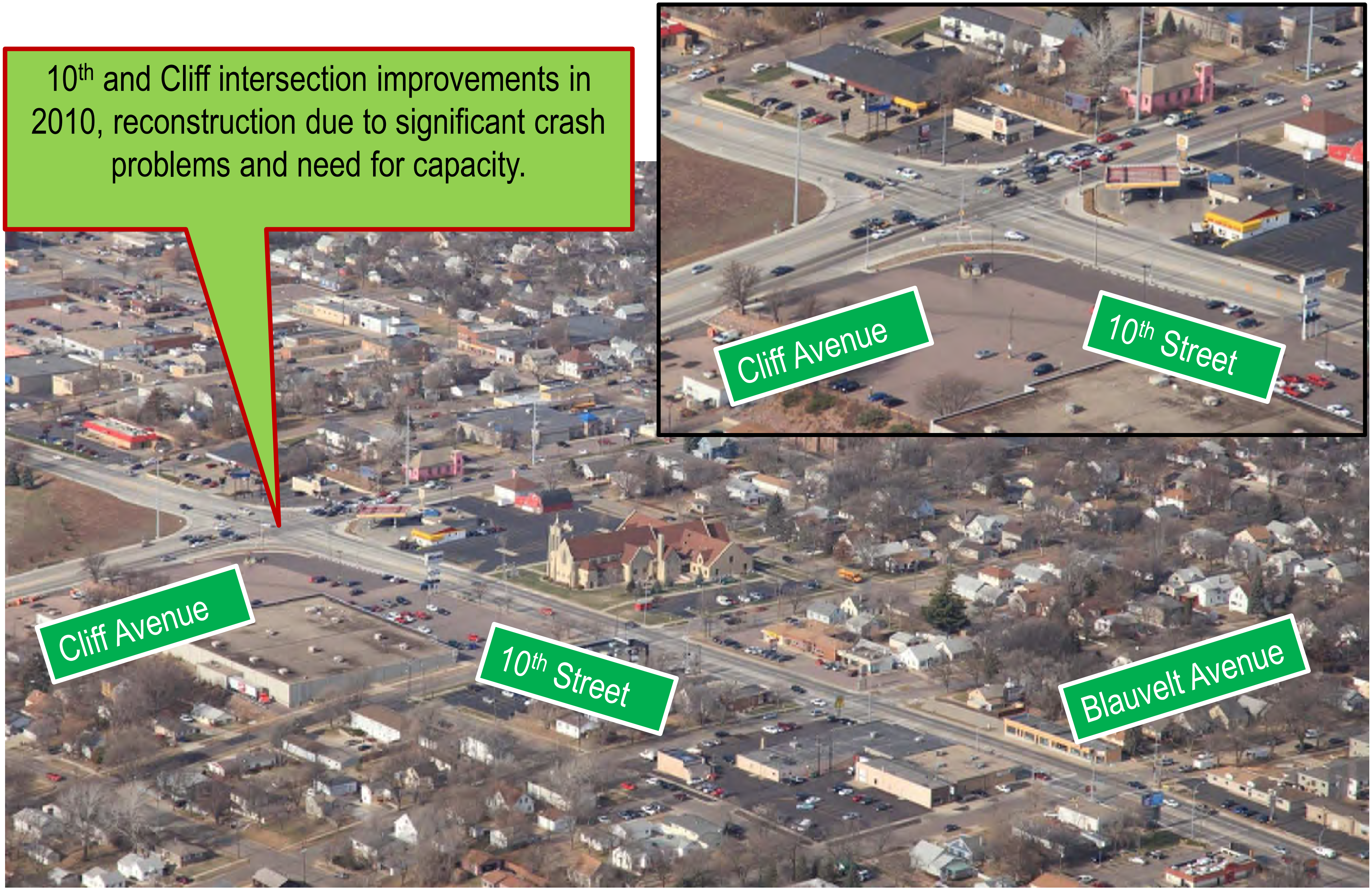


10th Street Corridor Overview



10th Street Corridor Overview

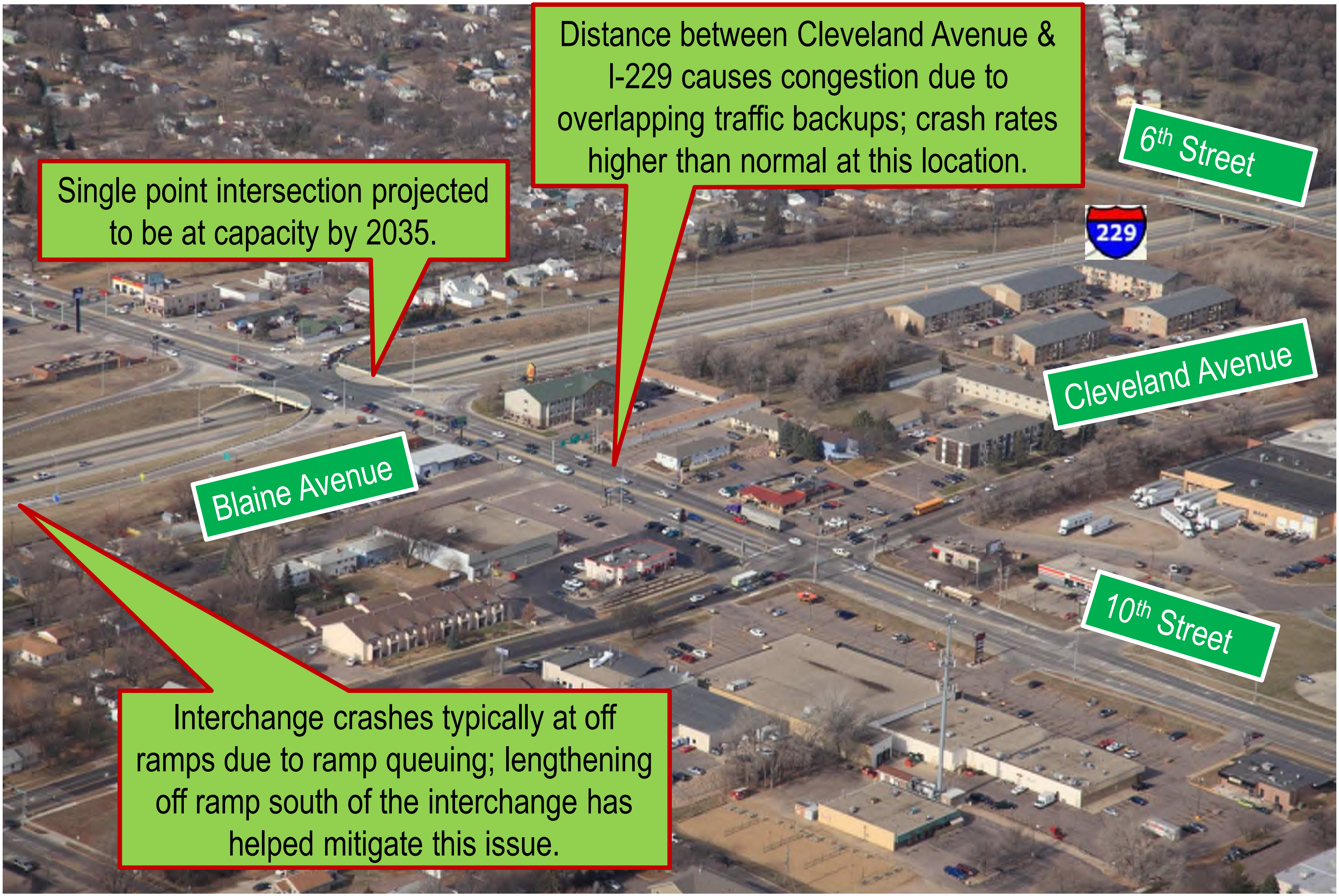
10th and Cliff intersection improvements in 2010, reconstruction due to significant crash problems and need for capacity.



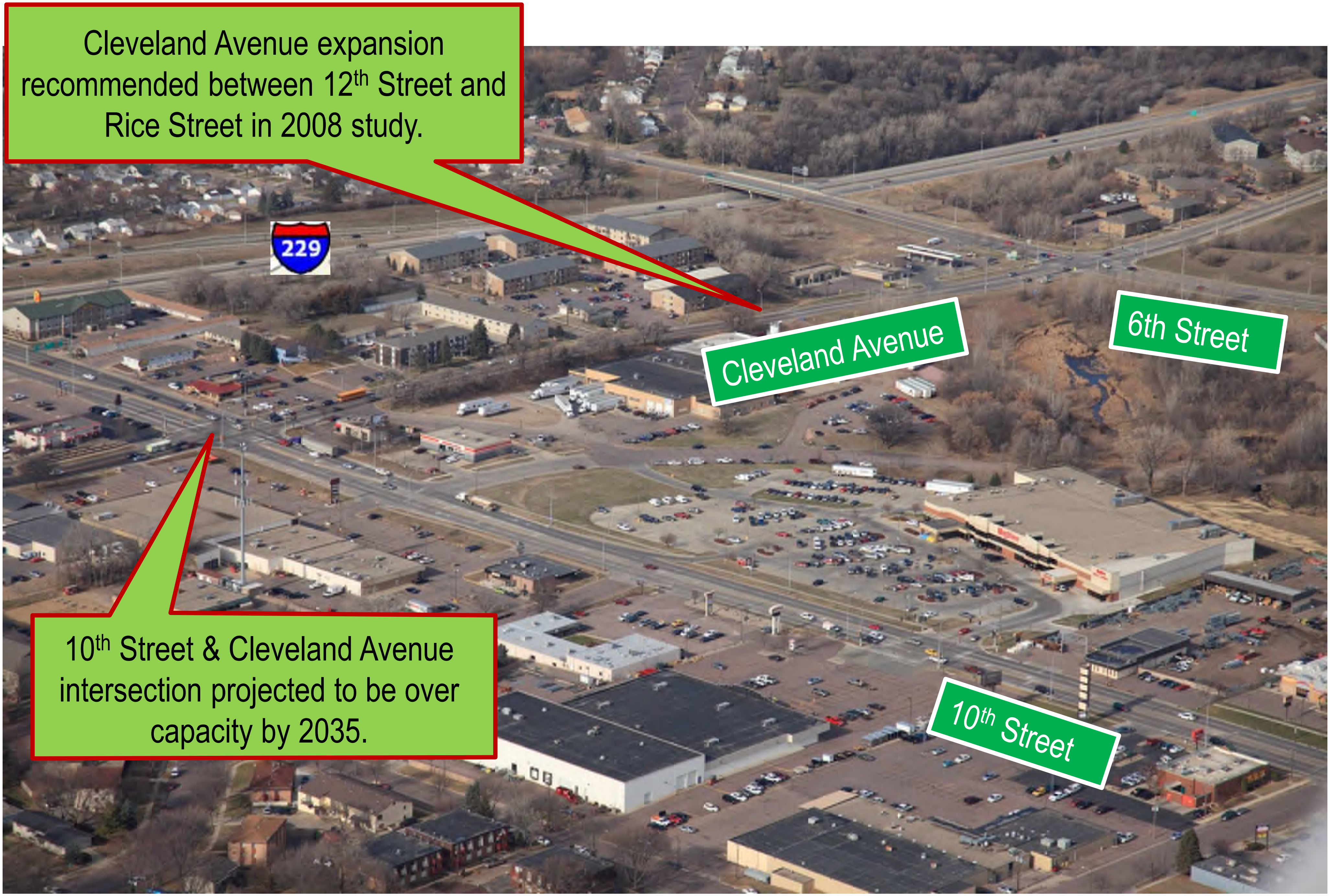
10th Street Corridor Overview

10th Street Corridor Overview

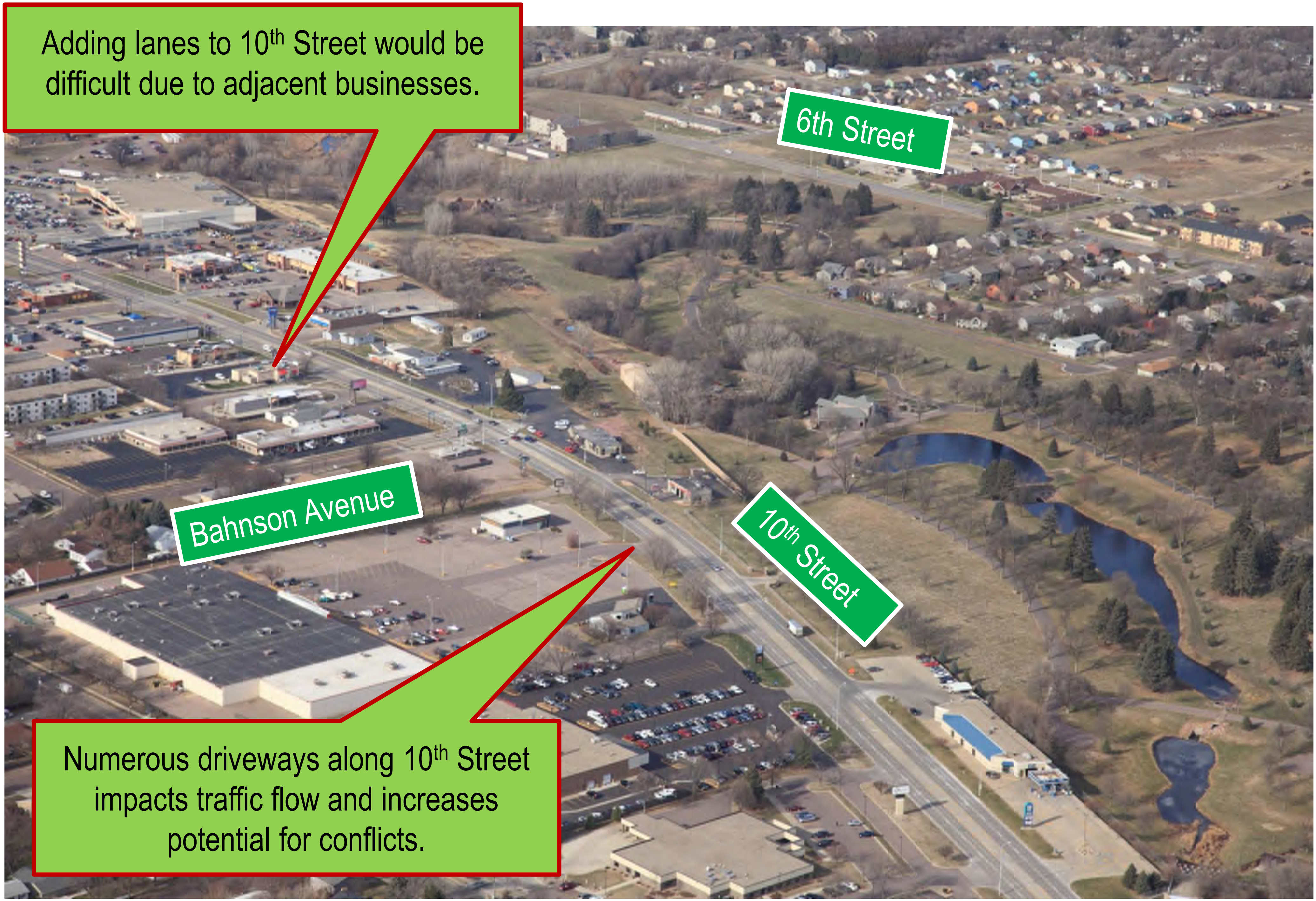
10th Street Corridor Overview



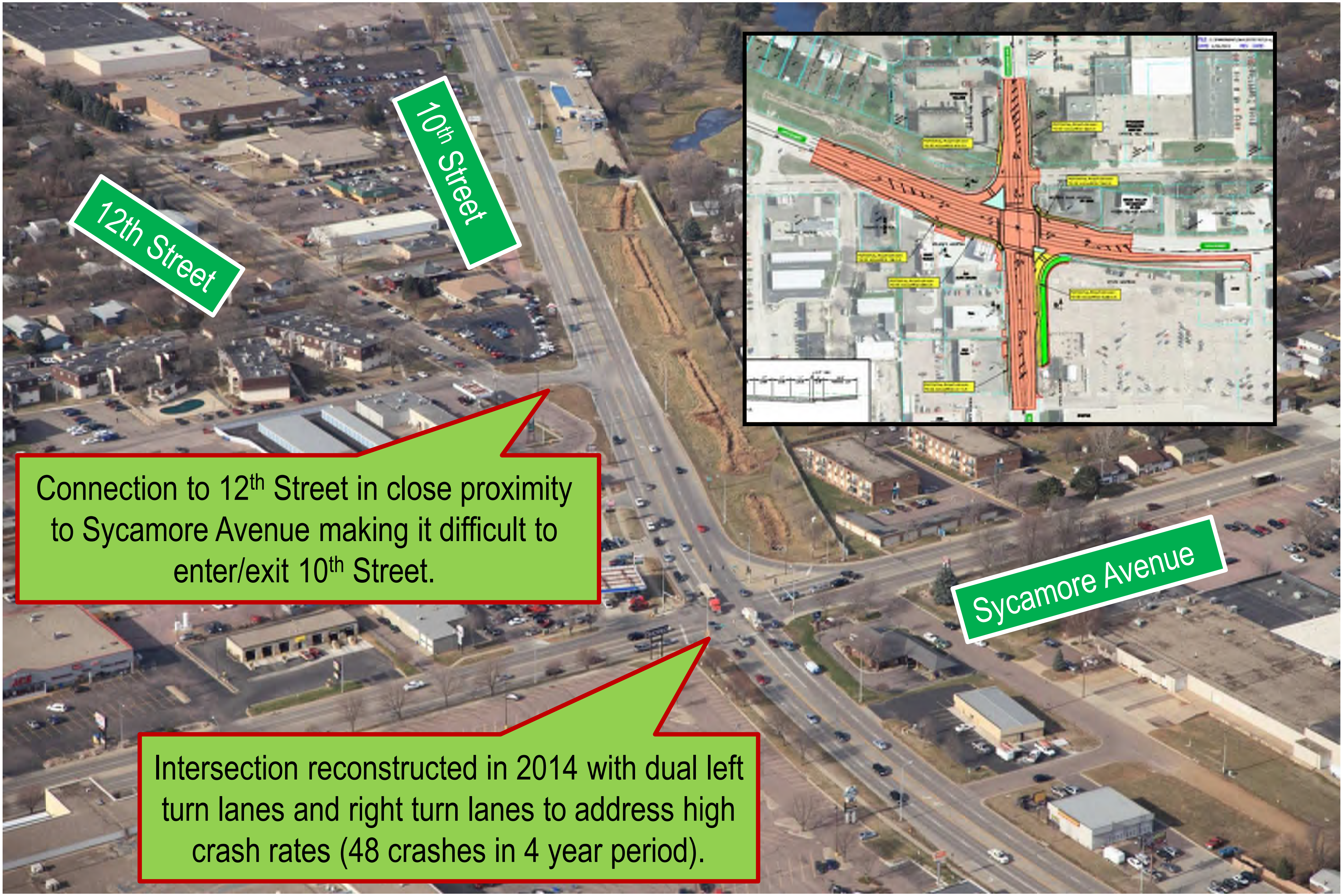
10th Street Corridor Overview



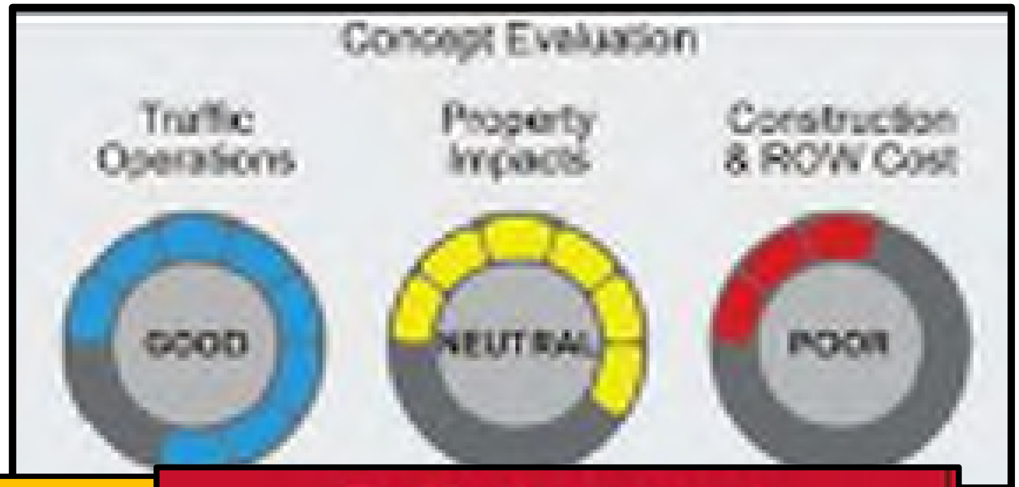
10th Street Corridor Overview



10th Street Corridor Overview



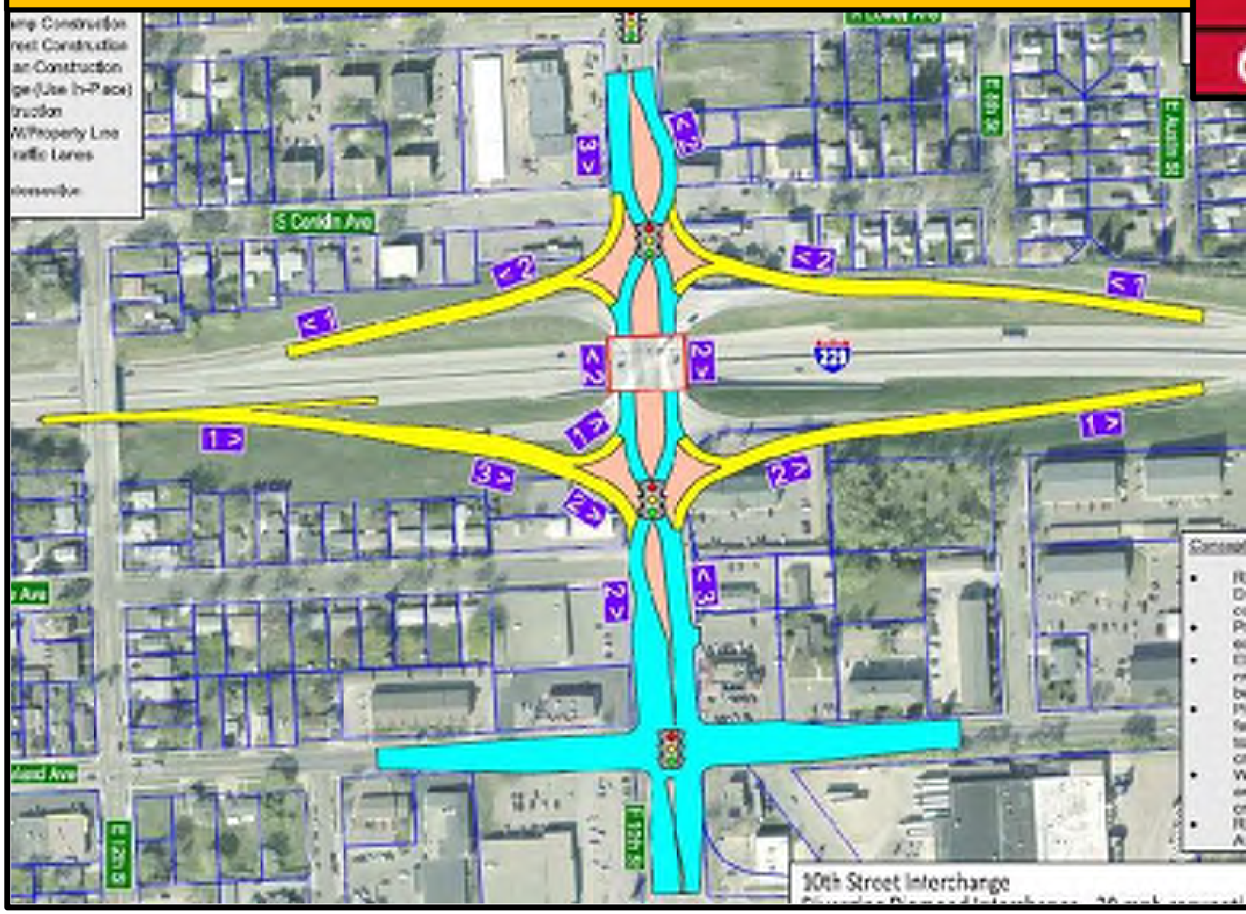
Conceptual Ideas for 10th Street Corridor



What you will be able to see tonight:

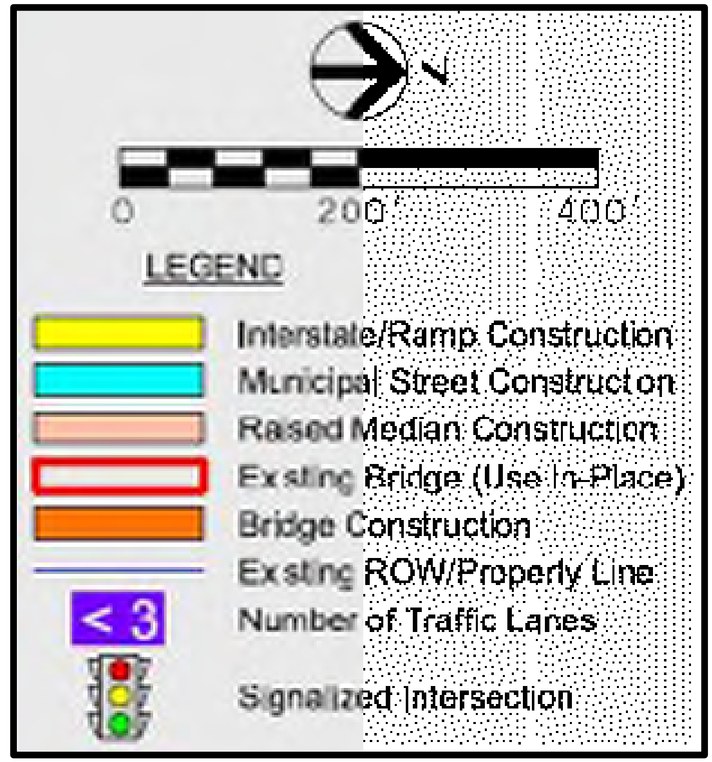
- 8 Interchange Conceptual Options
- 4 Corridor Options
- Median Changes or Driveway Closures to Improve Safety

10th Street / I-229 Interchange Diverging Diamond Option



Traffic Assessment

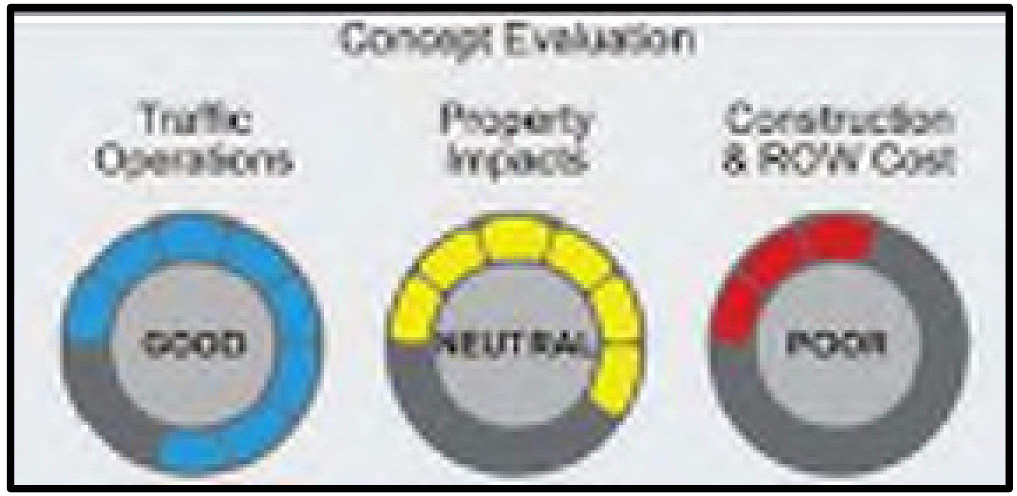
Queues	Delay	Travel Time

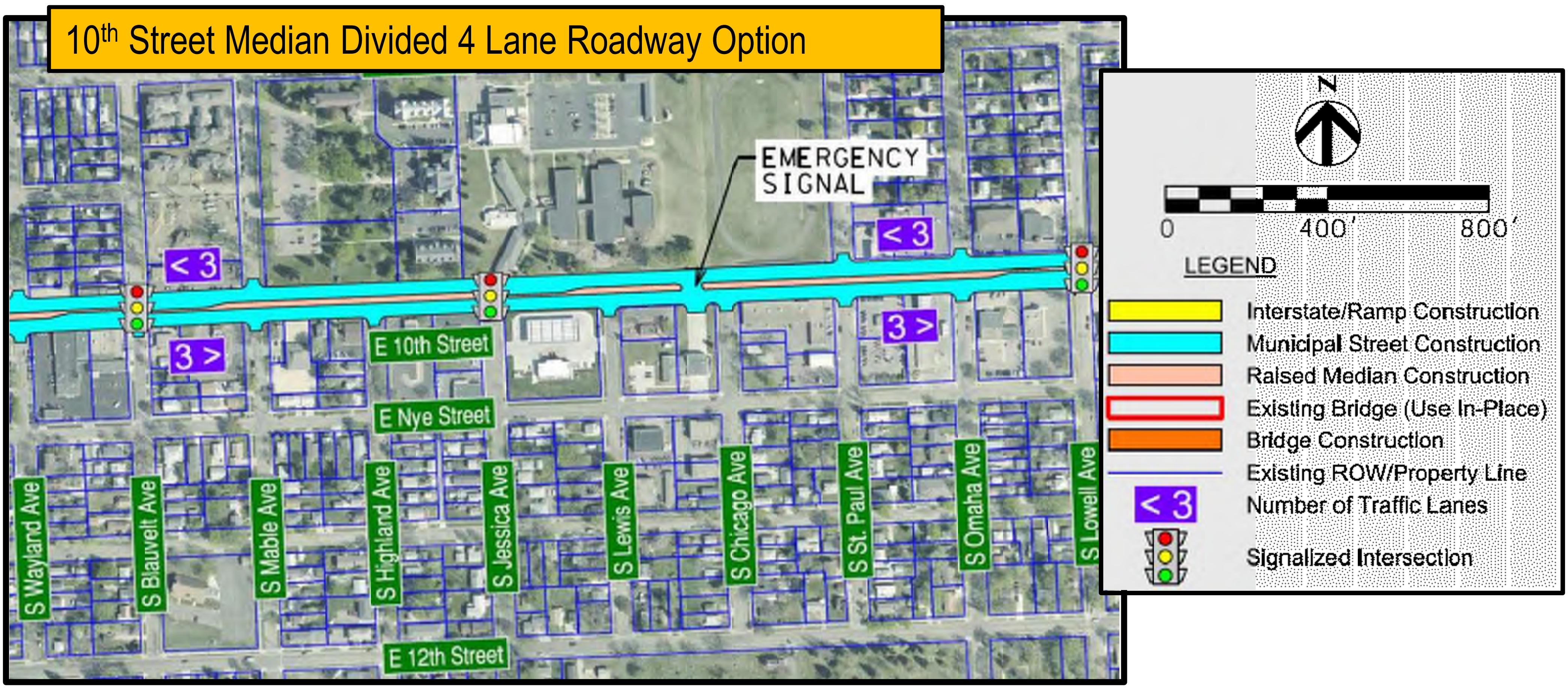


Conceptual Ideas for 10th Street Corridor

What you will be able to see tonight:

- **8 Interchange Conceptual Options**
- **4 Corridor Options**
- **Median Changes or Driveway Closures to Improve Safety**





Next Steps for 10th Street

- **Finalize Composite Comparison Matrix**
  - Traffic Assessment
  - Environmental Screening
  - ROW Impacts
  - Overall Costs
  - Public Involvement Support

- **Complete additional Traffic Operations analysis on a reduced number of options based on the screening activities**

- **Develop Priority Phasing Plan for I-229 Corridor and Sub-Study Corridor**

- **Schedule and Conduct next public meeting**

PROJECT CONTACTS:

Jason Kjenstad – HDR Engineering, Inc.
605-977-7740 or jason.kjenstad@hdrinc.com

Chris Malmberg – HDR Engineering, Inc.
402-399-4959 or chris.malmberg@hdrinc.com

Shannon Ausen – City of Sioux Falls
605-367-8607 or sausen@siouxfalls.org

Steve Gramm – SDDOT Project Development
605-773-6641 or steve.gramm@state.sd.us

Interstate 229 Major Investment Study
Exit 6 – 10th Street Sub-Study

Thanks for Attending!!!!!

HRGreen

Benson Road

June 2nd, 2015

- Sign-In Sheets
- PowerPoint Slides
- Meeting Notes (See End of Public Meetings #2 Appendix)
- Comments (See End of Public Meetings #2 Appendix)

Note: Actual attendance count was 20 people (including 6 women)

Sign In Sheet

Subject I-229 Major Investment Corridor Study – Informational Meeting for Benson Road Sub-Study

Client City of Sioux Falls/South Dakota Department of Transportation

Project PL 0100(87) 3616P, PCN 044K **Project No.:** 207030

Meeting Date Tuesday, June 2nd, 2015 5:00 PM **Meeting Location:** Sioux Falls Convention Center

Please print clearly. Thank you.

	Name	Address	Best Contact Phone	Email
1	Pete Longman	SD DOT	773-6488	pete.longman@state.sd.us
2	Ron McMahon	FHWA	776-1009	ron.mcmahon@dot.gov
3	Sara Bertsch	Argus Leader		sbertsch@argusleader.com
4	Kay Gollesch	LifeScape	[illegible]	kay.gollesch@lifescapesd.org
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Sign In Sheet

Subject I-229 Major Investment Corridor Study – Informational Meeting for Benson Road Sub-Study

Client City of Sioux Falls/South Dakota Department of Transportation

Project PL 0100(57) 3616P, PCN 044K **Project No.:** 207030

Meeting Date Tuesday, June 2nd, 2015 5:00 PM **Meeting Location:** Sioux Falls Convention Center

Please print clearly. Thank you.

	Name	Address	Best Contact Phone	Email
1	Amber Gibson	SECOG	605-367-5390	amber@secog.org
2	Doug Brockhouse	Bender Commercial	605-728-5800	dbrock@bendercre.com
3	Travis Dressen	SDDOT - SF Area	605-367-5680	travis.dressen@state.sd.us
4	Kurt Griffin	[illegible] E 21st 57105	812 6035	[illegible]@yahoo.com
5	Rick Kovaba	Sioux Falls	521-6076	
6	Jason Kjenstad	HDR	605-977-7740	jason.kjenstad@hdrinc.com
7	Rush Smith	3500 E 54th St W	605-940-4443	
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Sign In Sheet

Subject I-229 Major Investment Corridor Study – Informational Meeting for Benson Road Sub-Study

Client City of Sioux Falls/South Dakota Department of Transportation

Project PL 0100(67) 3010P, PCN 044K **Project No.:** 207030

Meeting Date Tuesday, June 2nd, 2015 5:00 PM **Meeting Location:** Sioux Falls Convention Center

Please print clearly. Thank you.

	Name	Address	Best Contact Phone	Email
1	Christina Bennett	SDDOT	605-773-4759	Christina.Bennett@state.sd.us
2	Chad Hartman	Sioux Falls	605-334-3204	Chad.hartman@myrl andreysprings.com
3	Rick Vander Haar	3408 N Poldun Ave	605-366-1111	eoale@midcnetwork.com
4	Steve Gramm	SDDOT	773-6641	Steve.gramm@state.sd.us
5	Shannon Schultz	Minnehaha County H.D.	367-4316	sschultz@minnehahacounty.org
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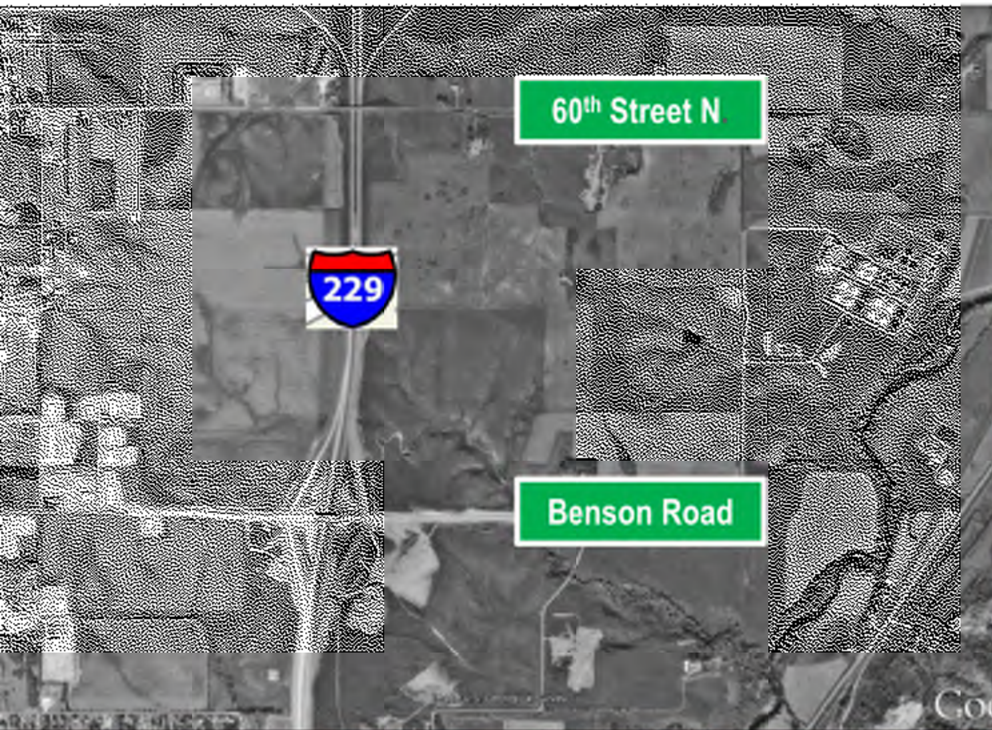


Interstate 229 Major Investment Study

Exit 9 – Benson Rd Sub-Study

Informational Meeting
June 2nd, 2015
5:00 pm to 6:30 pm

HDR

HRGreen

Study Area Map

I-229 Corridor Study

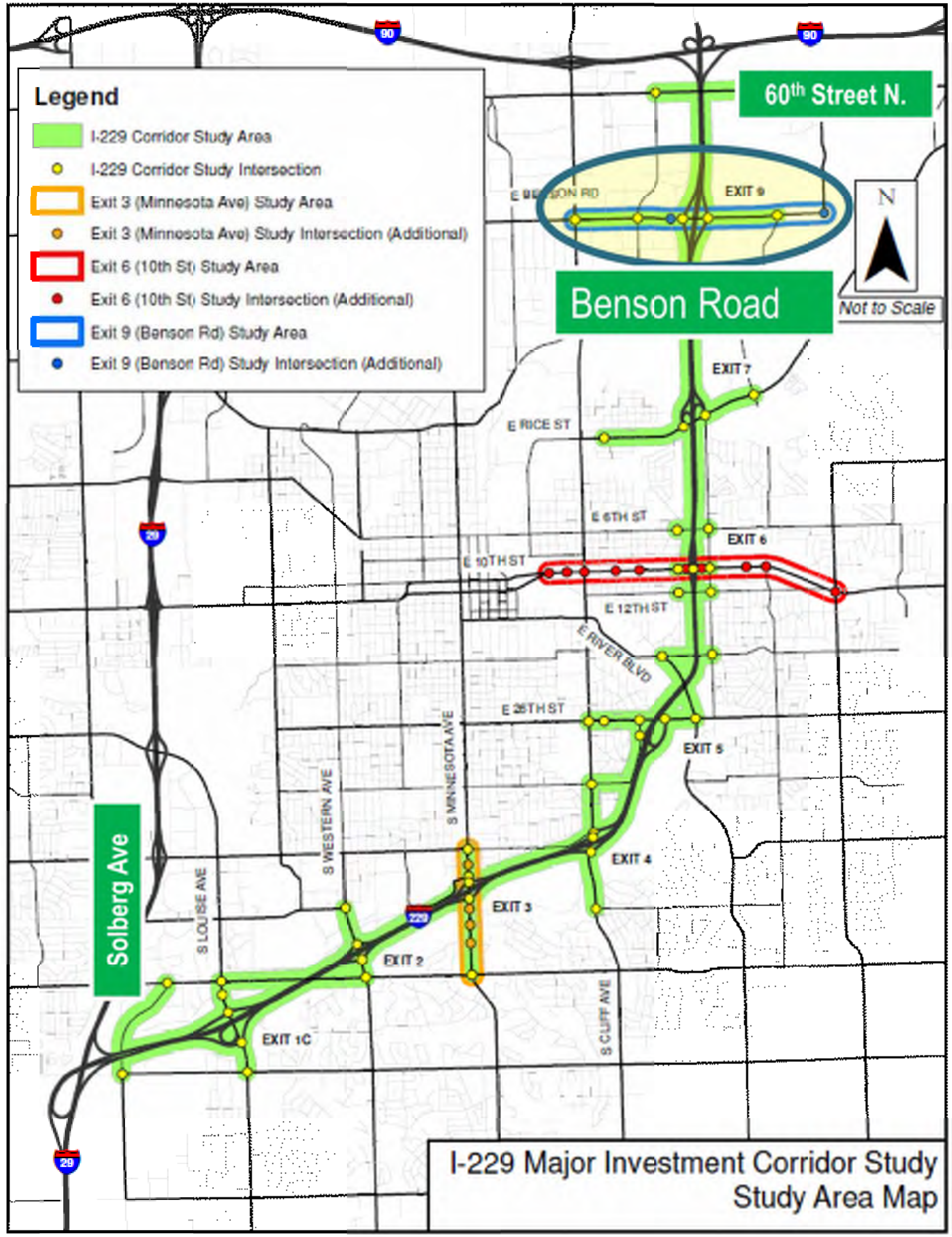
Solberg Avenue Overpass

to

60th Street N. Overpass

Meeting will focus on:

Exit 9 – Benson Road



Study Advisory Partners

South Dakota Department of Transportation (SDDOT)

South Dakota Highway Patrol

City of Sioux Falls

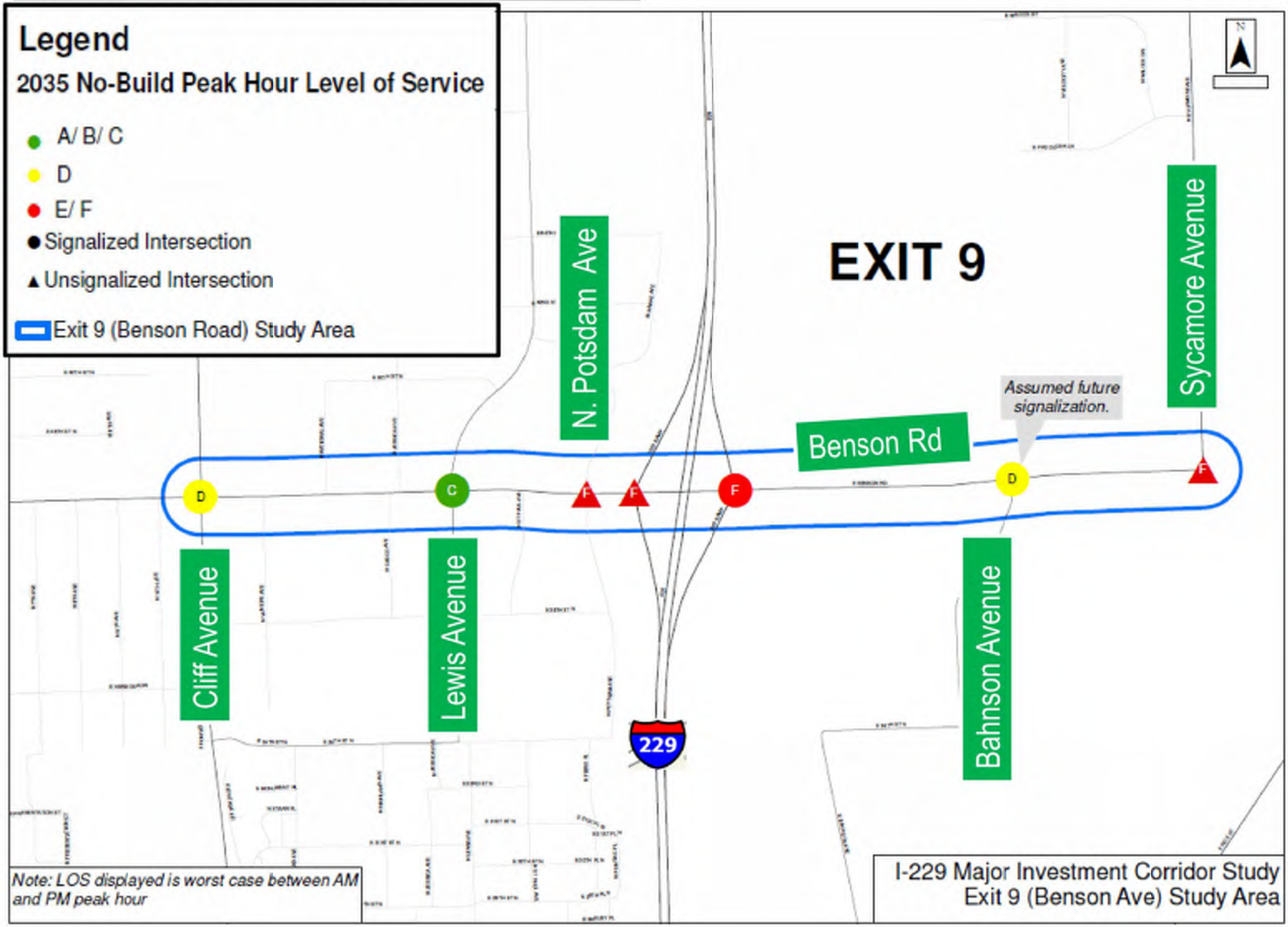
Sioux Falls Metropolitan Planning Organization (MPO)

Federal Highway Administration (FHWA)

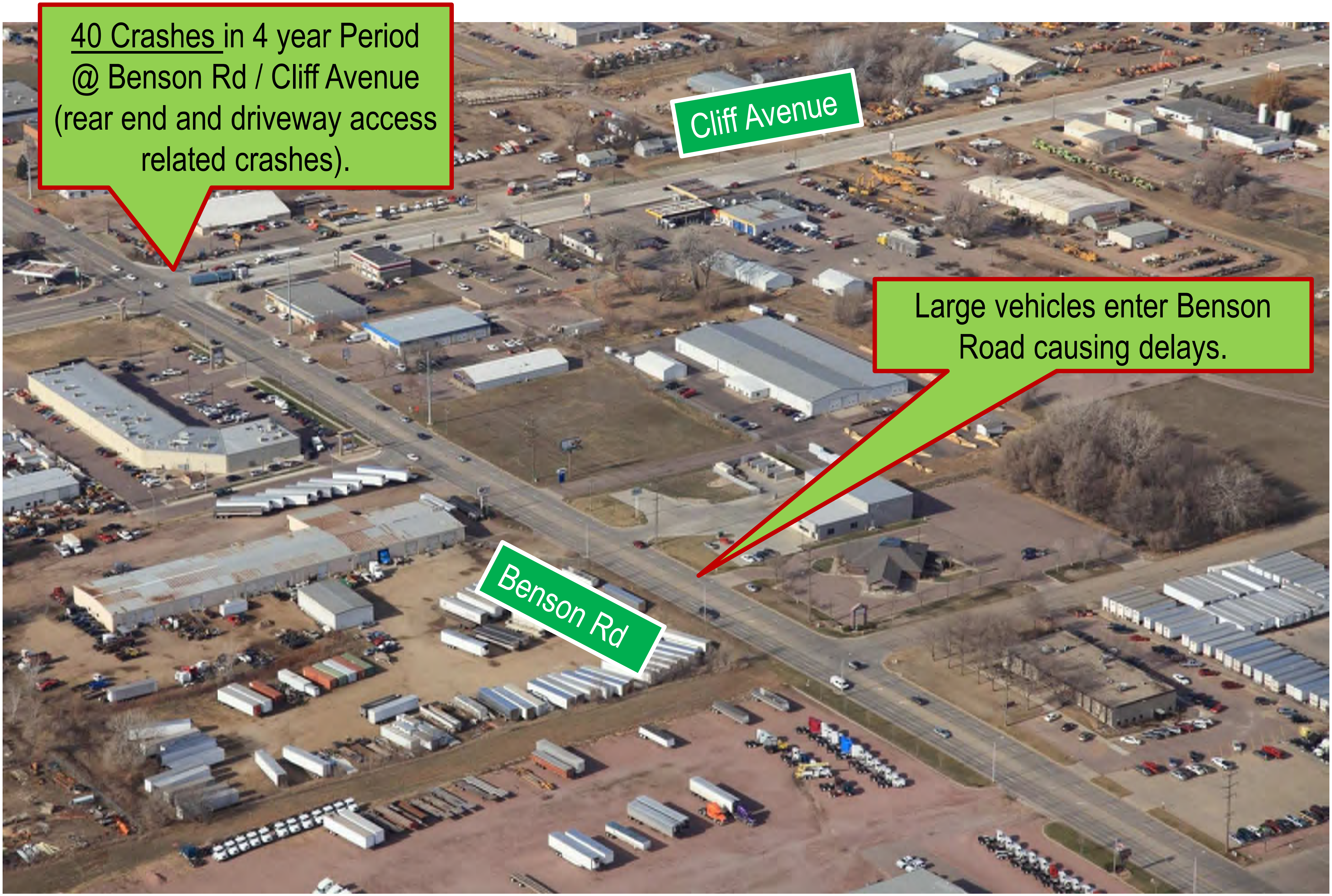
Exit 9 (Benson Road) Crossroad Study Goals

- Reduce traffic congestion at NB on/off interchange ramp terminal
- Develop Corridor Growth Plan to meet traffic demands from development taking place east of I-229
- Improve pedestrian mobility
- Make recommendations to improve corridor intersections
- Develop interchange alternatives to meet future traffic demands

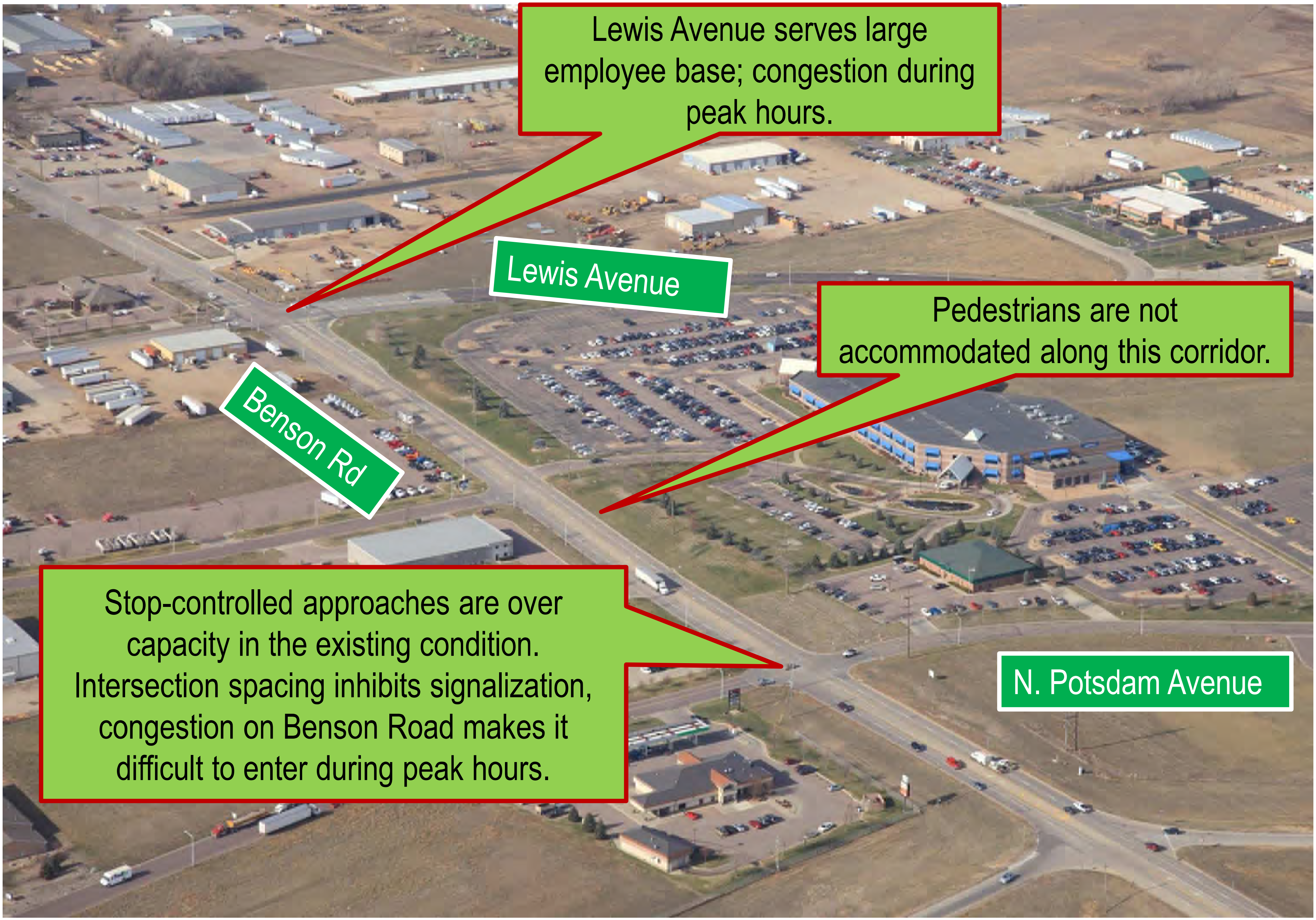
Benson Rd Corridor Overview



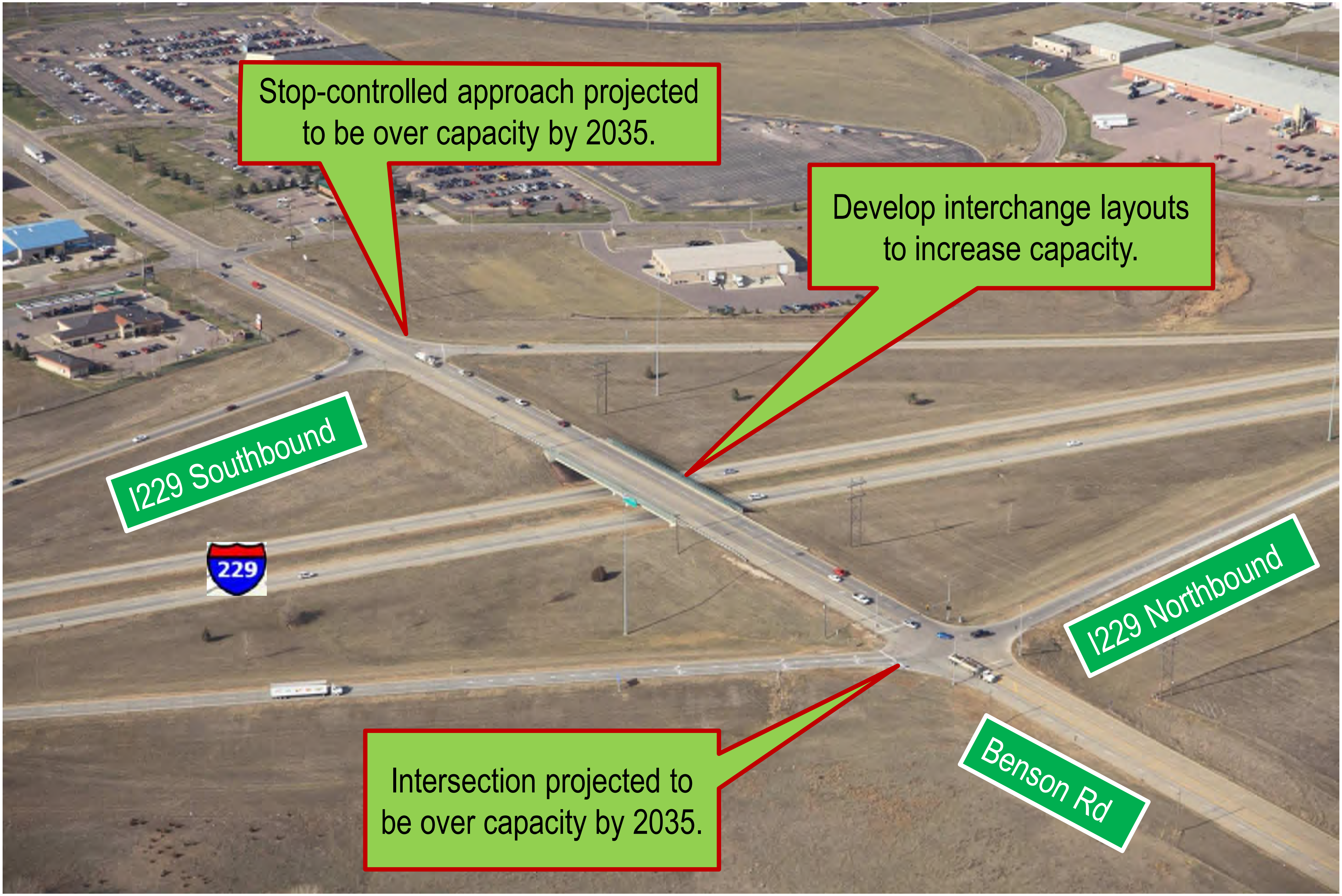
Benson Rd Corridor Overview



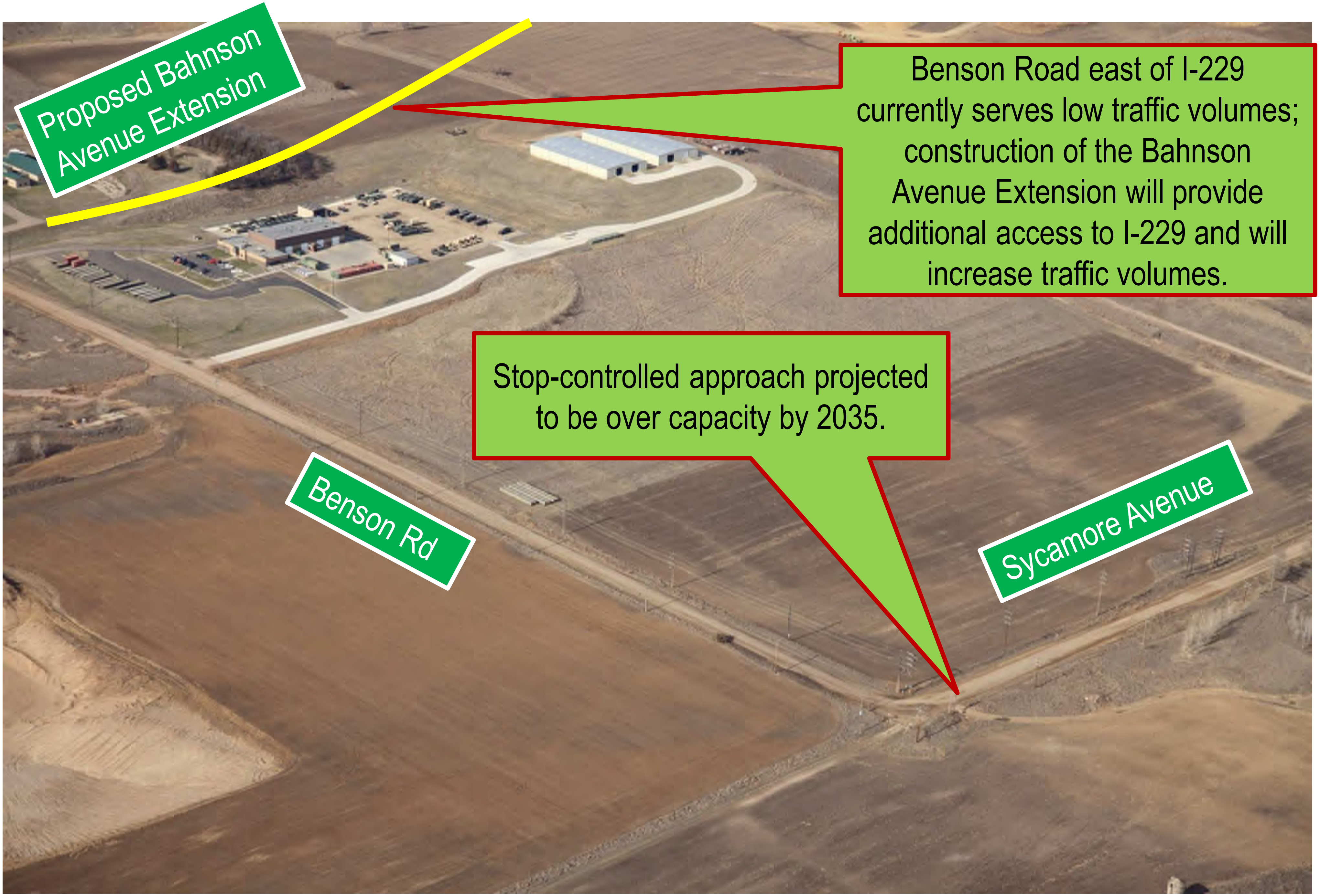
Benson Rd Corridor Overview



Benson Rd Corridor Overview



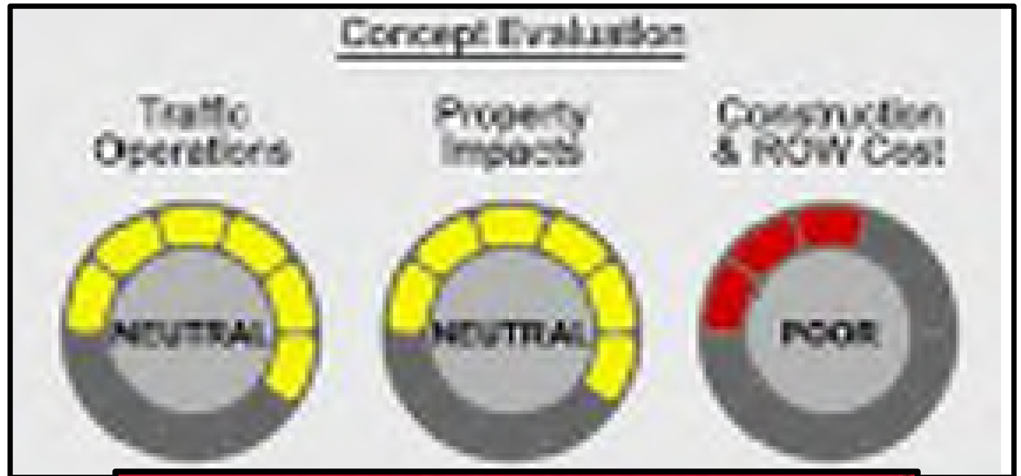
Benson Rd Corridor Overview



Conceptual Ideas for Benson Road

What you will be able to see tonight:

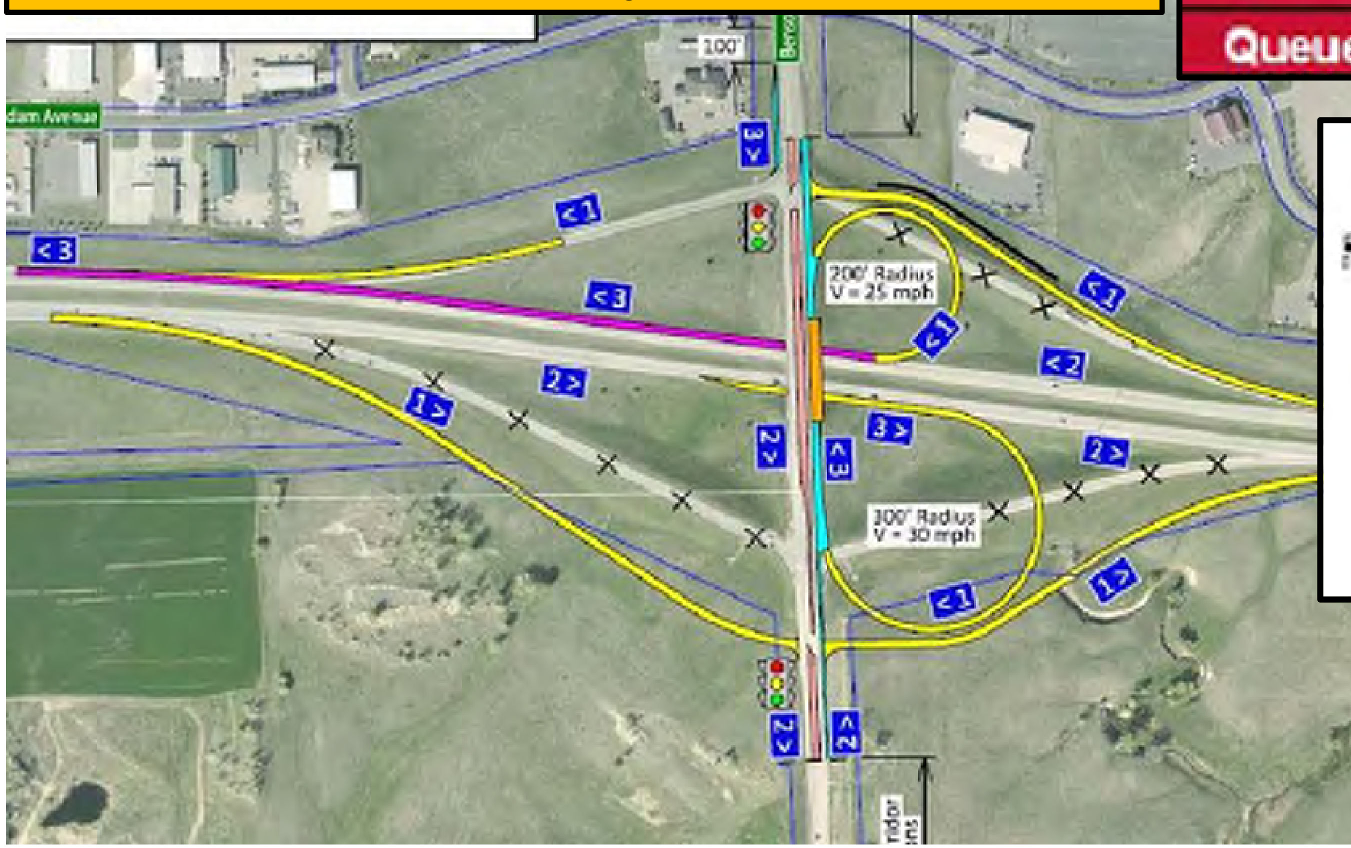
- 4 Interchange Conceptual Options
- 1 Corridor Option

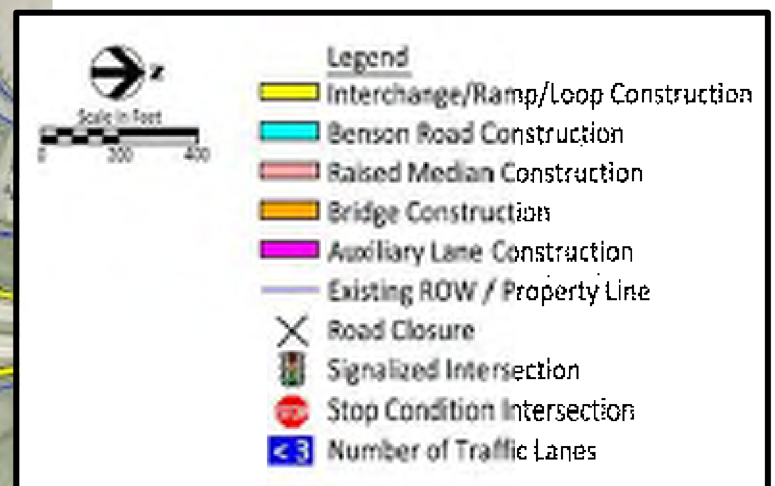


Traffic Assessment

Queues	Delay	Travel Time

Benson Road / I-229 Interchange Folded Diamond Option

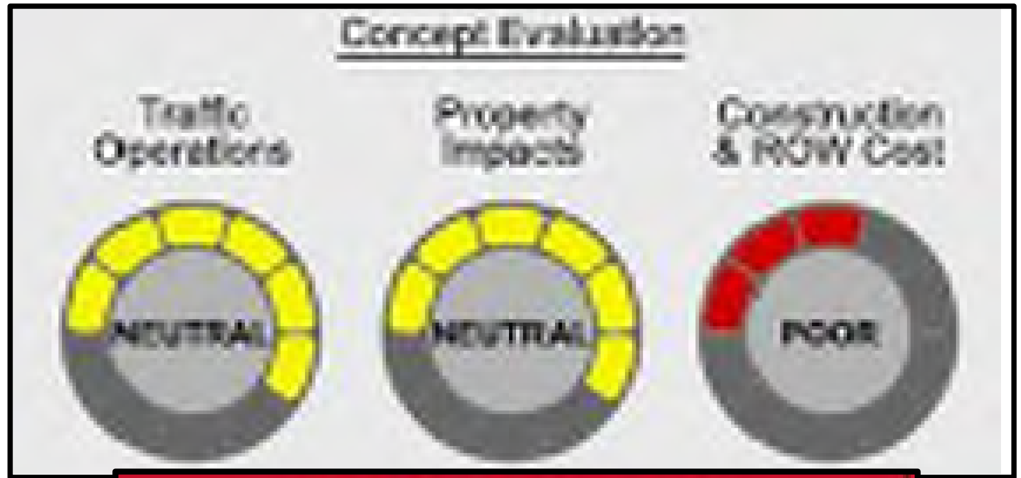




Conceptual Ideas for Benson Road

What you will be able to see tonight:

- 4 Interchange Conceptual Options
- 1 Corridor Option



Traffic Assessment

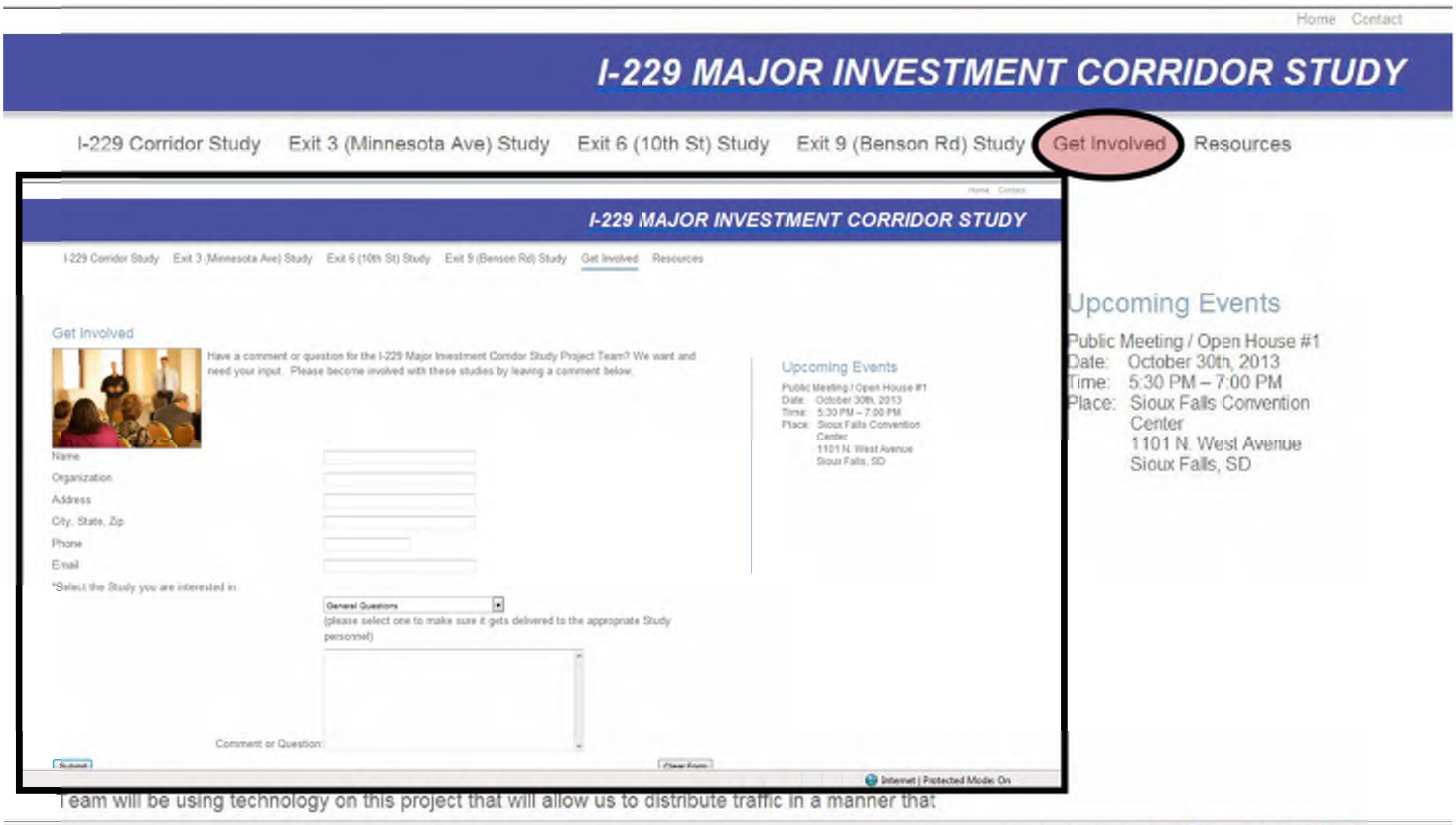
Queues	Delay	Travel Time

Benson Road Median Divided Section from Lewis to I-229

Next Steps for Benson Rd

- **Finalize Composite Comparison Matrix**
  - Traffic Assessment
  - Environmental Screening
  - ROW Impacts
  - Overall Costs
  - Public Involvement Support
- **Complete additional Traffic Operations analysis on a reduced number of options based on the screening activities**
- **Develop Priority Phasing Plan for I-229 Corridor and Sub-Study Corridor**
- **Schedule and Conduct next public meeting**

[WWW.I229STUDY.COM](http://www.i229study.com)



PROJECT CONTACTS:

Jason Kjenstad – HDR Engineering, Inc.
605-977-7740 or jason.kjenstad@hdrinc.com

James Unruh – HDR Engineering, Inc.
605-977-7740 or james.unruh@hdrinc.com

Shannon Ausen – City of Sioux Falls
605-367-8607 or sausen@siouxfalls.org

Steve Gramm – SDDOT Project Development
605-773-6641 or steve.gramm@state.sd.us

Interstate 229 Major Investment Study

Exit 9 – Benson Rd Sub-Study

Thanks for Attending!!!!!

HRGreen

I-229 Mainline

June 2nd, 2015

- Sign-In Sheets
- PowerPoint Slides
- Meeting Notes (See End of Public Meetings #2 Appendix)
- Comments (See End of Public Meetings #2 Appendix)

Note: Actual Attendance count was 18 people (including 7 women)

Sign In Sheet

Subject I-229 Major Investment Corridor Study – Informational Meeting for I-229 Mainline Sub-Study 1
Client City of Sioux Falls/South Dakota Department of Transportation
Project PL 0100(87) 3615P PCN 044K **Project No.:** 207030
Meeting Date Tuesday, June 2nd, 2015 7:00 PM **Meeting Location:** Sioux Falls Convention Center

Please print clearly. Thank you.

	Name	Address	Best Contact Phone	Email
1	Steve Gramm	SDDOT 700 E. Broadway	773-6641	steve.gramm@state.sd.us
2	Amber Gibson	SECOG	367-5390	amber@secog.org
3	Jo Wahle			
4	Jason Kjenstad	HDR	605-977-7740	
5	James Unruh	HDR		
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CITY OF SIOUX FALLS PUBLIC WORKS

Sign In Sheet

Subject I-229 Major Investment Corridor Study – Informational Meeting for I-229 Mainline Sub Study 1

Client City of Sioux Falls/South Dakota Department of Transportation

Project PL 0100(87) 3616P, PCN 044K **Project No.:** 207030

Meeting Date Tuesday, June 2nd, 2015 7:00 PM **Meeting Location:** Sioux Falls Convention Center

Please print clearly. Thank you.

	Name	Address	Best Contact Phone	Email
1	Ron McMahon	FHWA	776-1009	ron.mcmahon@dot.gov
2	Pete Longman	SDDOT	773-6488	pete.longman@state.sd.us
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Interstate 229 Major Investment Study

Mainline I-229 Sub-Study 1

Informational Meeting
June 2nd, 2015
7:00 pm to 8:30 pm

HRGreen

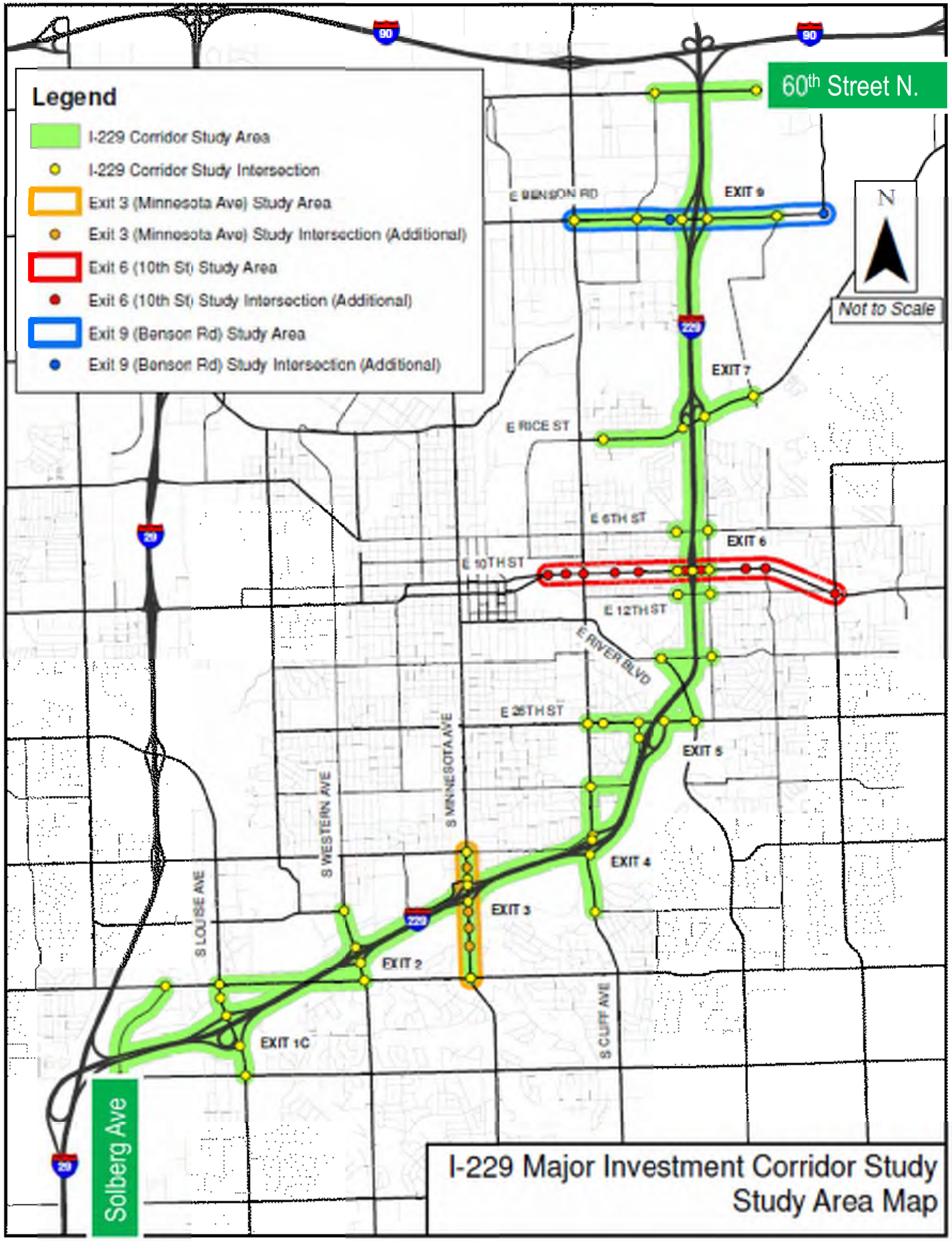
Study Area Map

I-229 Corridor Study

Solberg Avenue Overpass

to

60th Street N. Overpass



Study Advisory Partners

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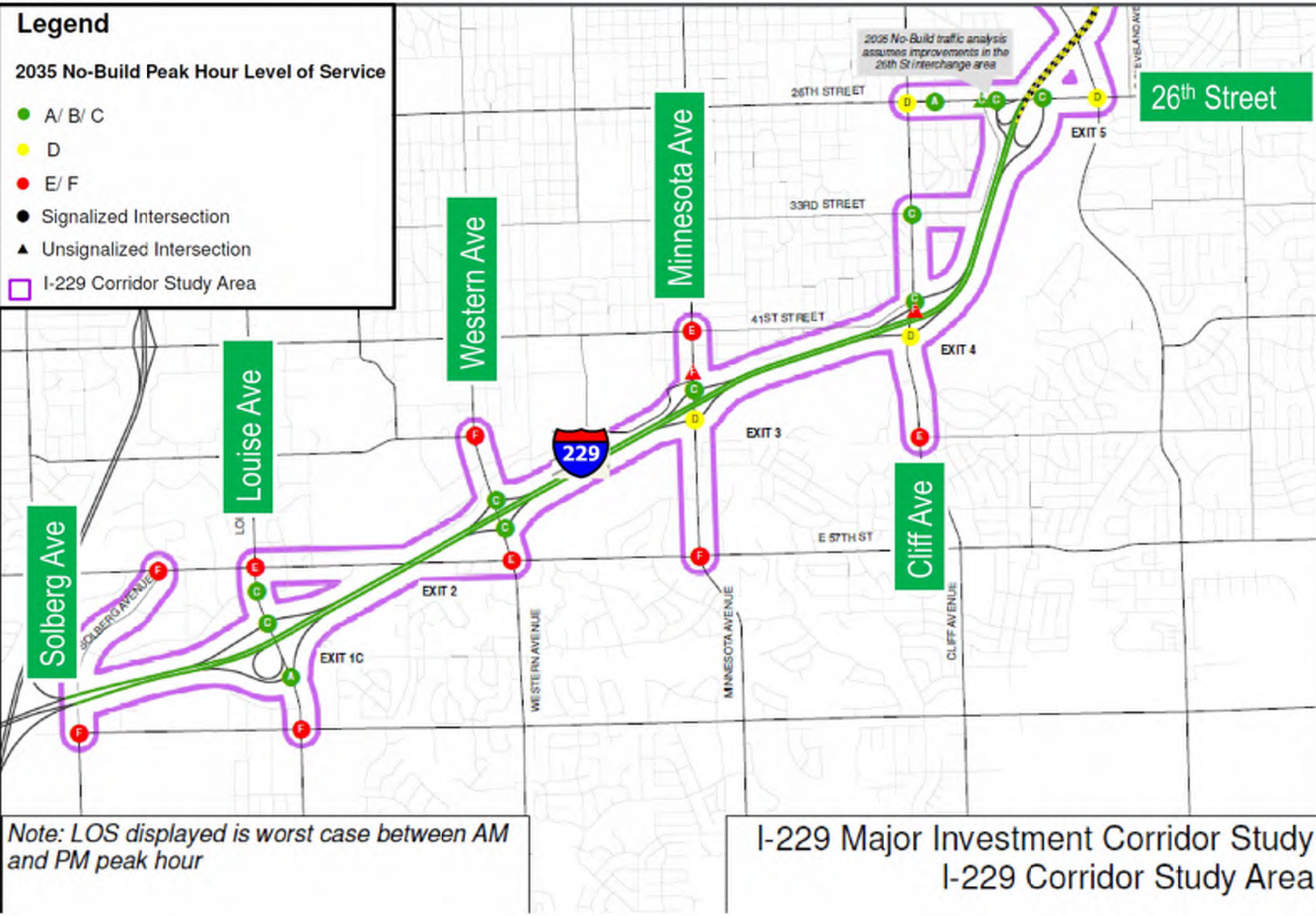
South Dakota Highway Patrol

City of Sioux Falls

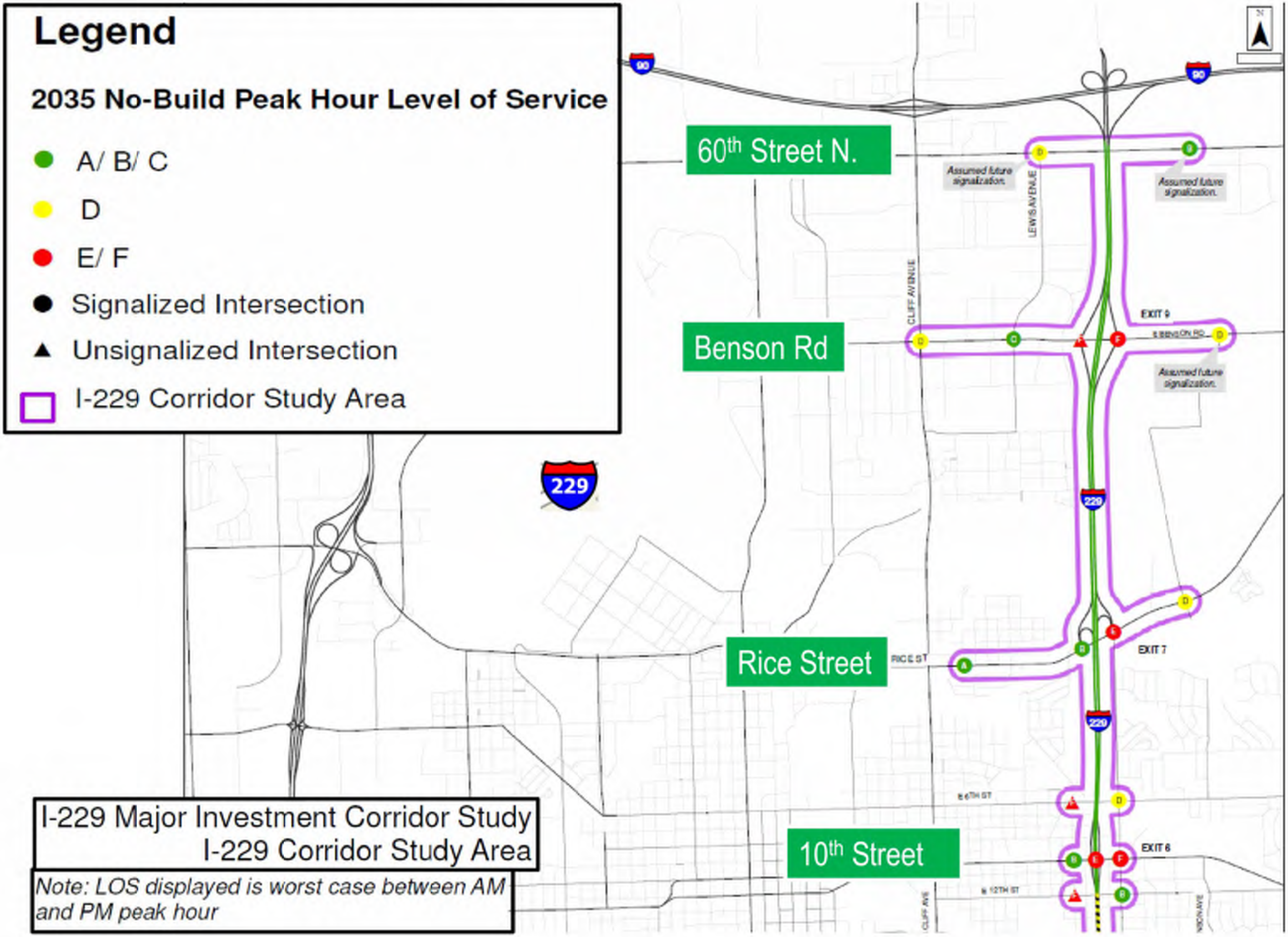
Sioux Falls Metropolitan Planning Organization (MPO)

Federal Highway Administration (FHWA)

I-229 Corridor Overview



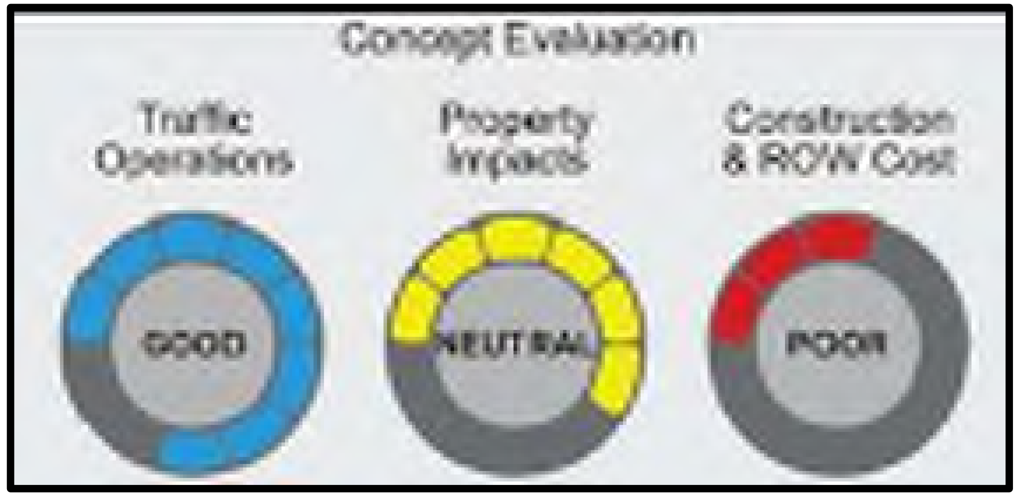
I-229 Corridor Overview

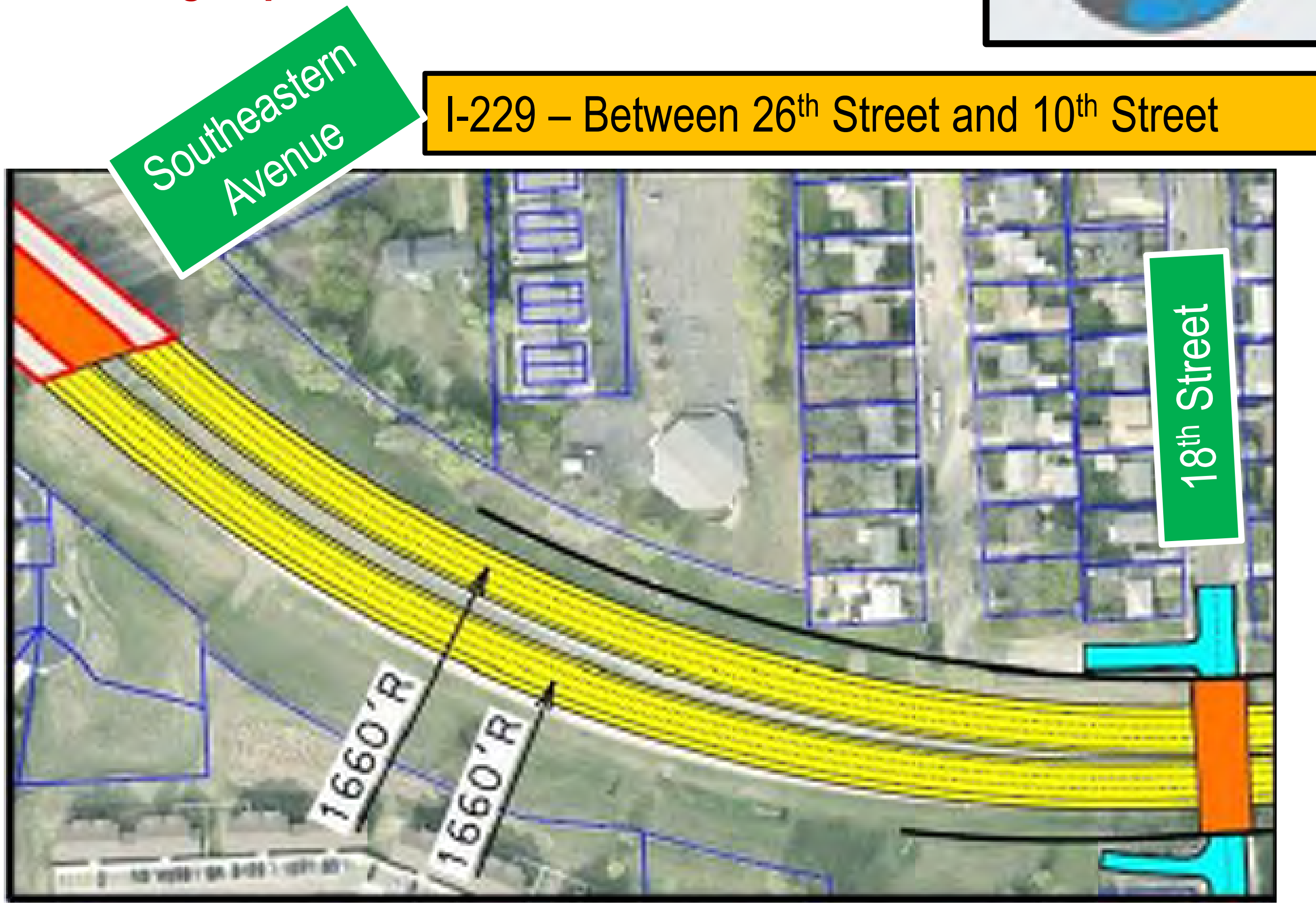


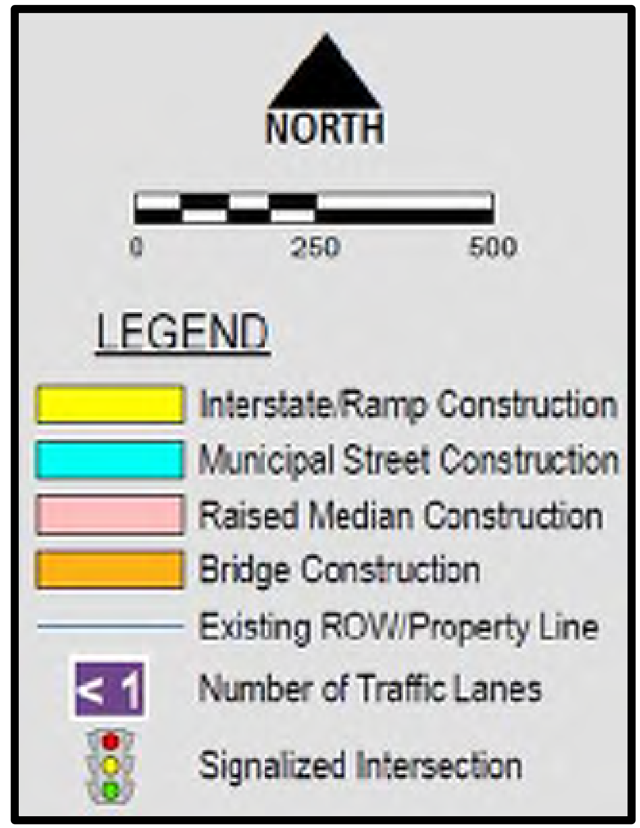
Conceptual Ideas for I-229 Mainline

What you will be able to see tonight:

- Additional 3rd Lane between 26th Street and 10th Street
- Modify design radius to allow for 65 mph design speed



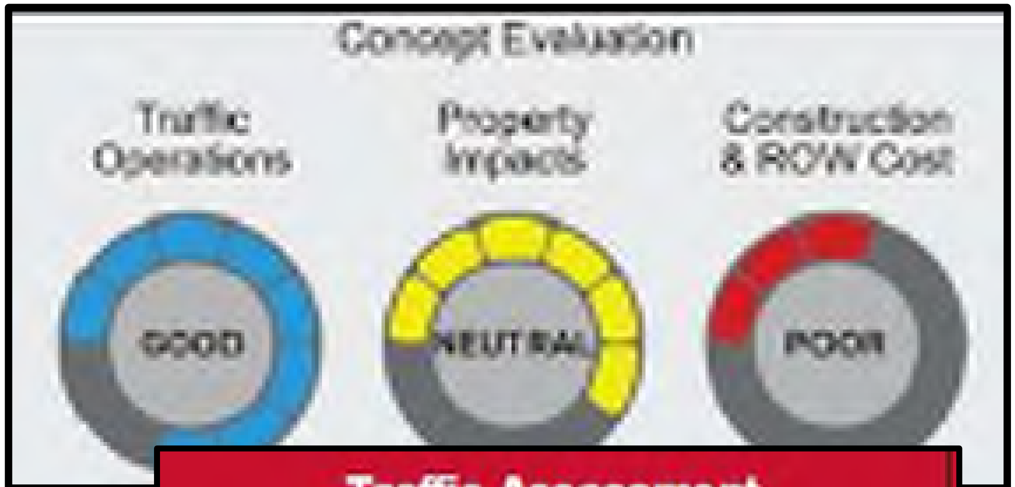




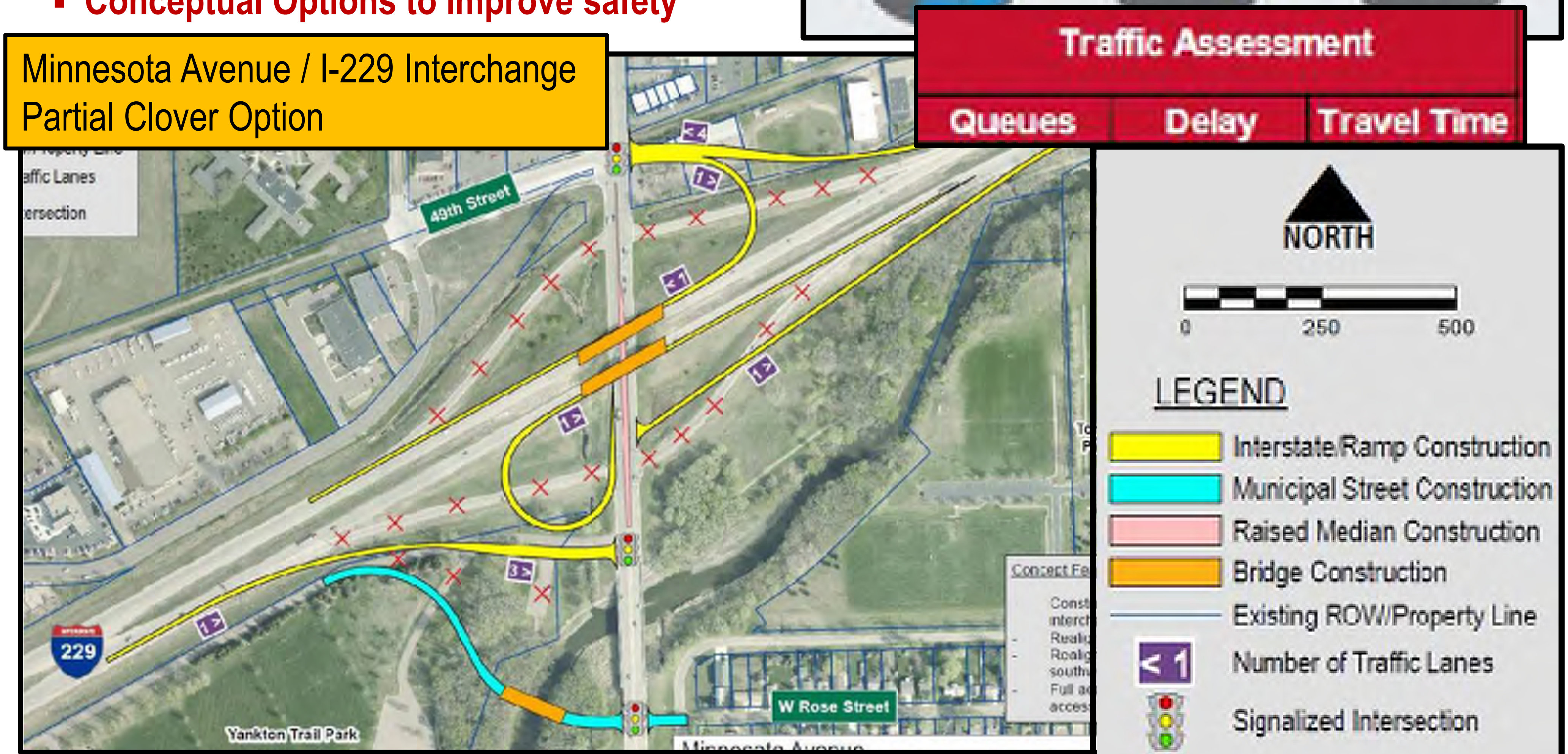
Conceptual Ideas for Minnesota Avenue

What you will be able to see tonight:

- 13 Interchange Conceptual Options
- 4 Corridor Options
- Access Changes to Yankton Trail Park
- Conceptual Options to improve safety



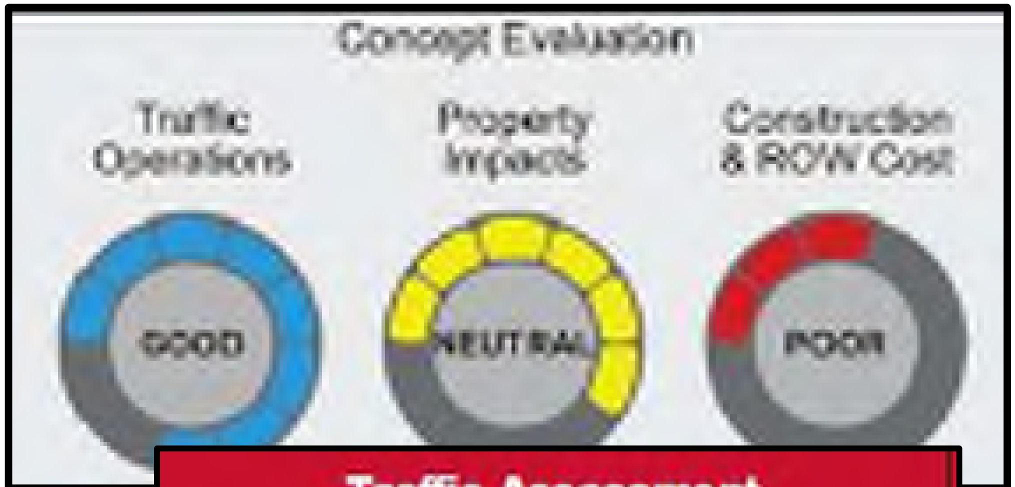
Minnesota Avenue / I-229 Interchange
Partial Clover Option



Conceptual Ideas for Cliff Avenue

What you will be able to see tonight:

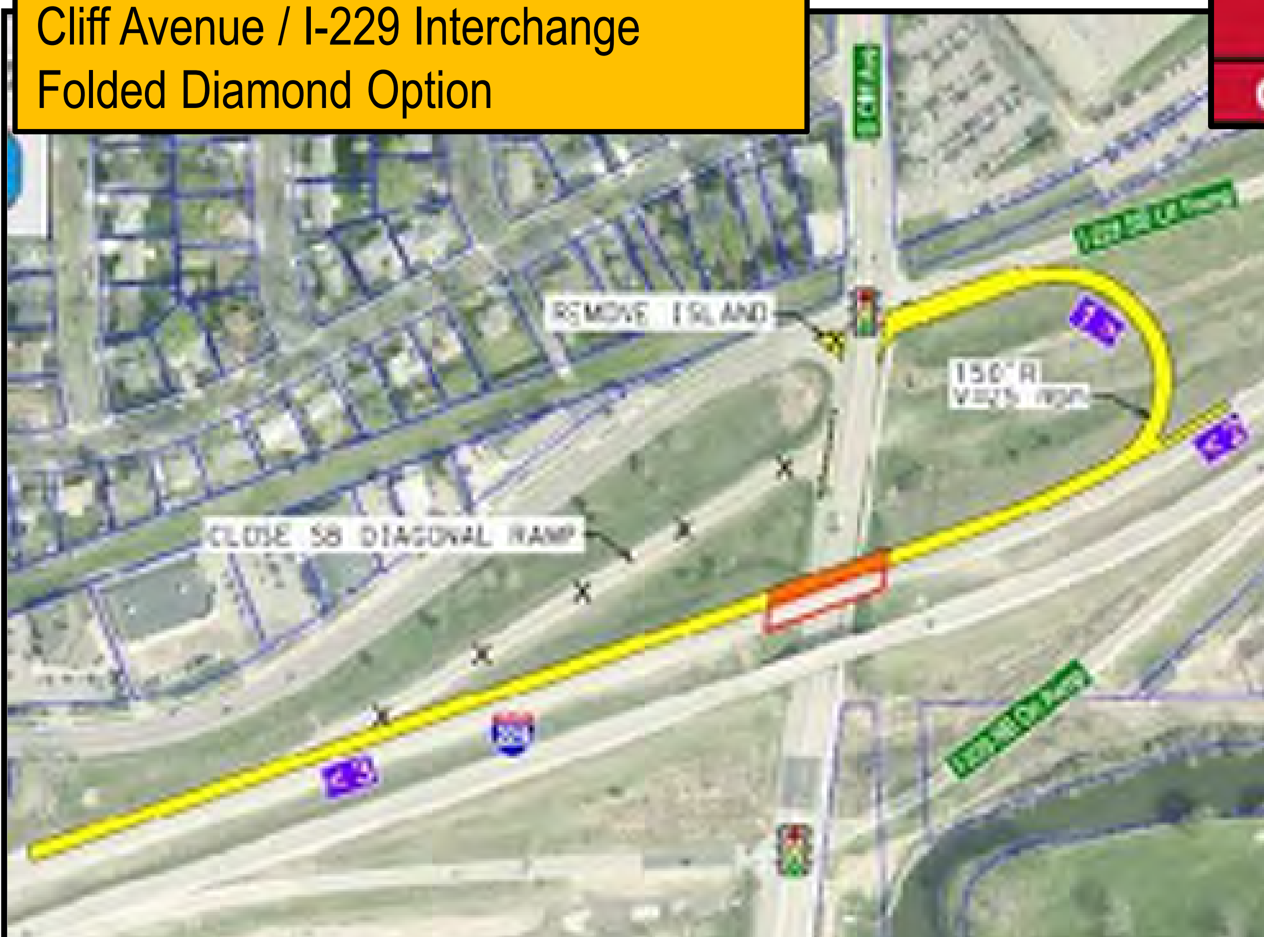
- 3 Interchange Conceptual Options

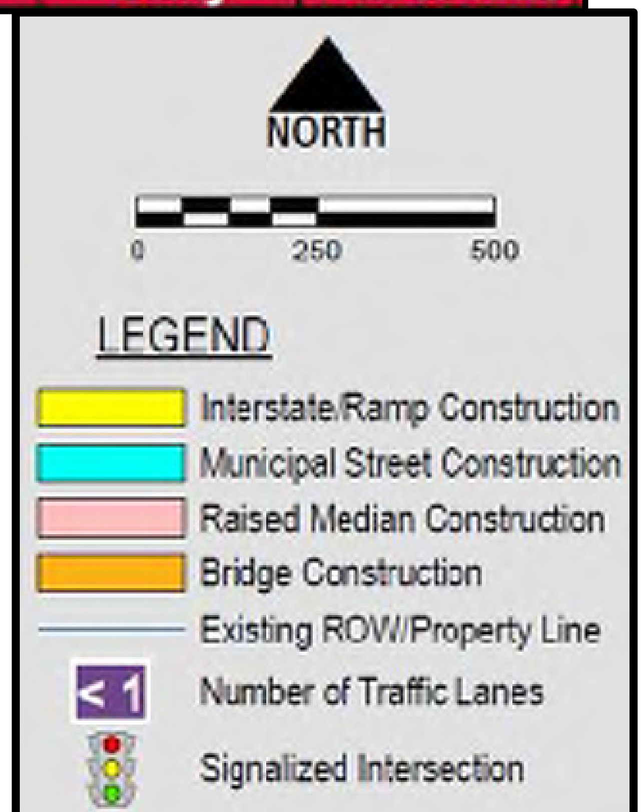


Traffic Assessment

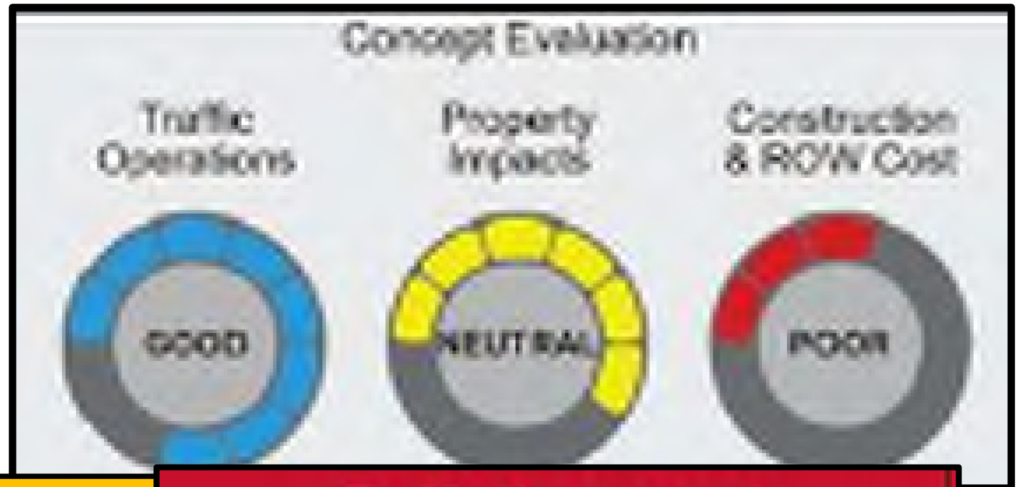
Queues | Delay | Travel Time

Cliff Avenue / I-229 Interchange
Folded Diamond Option





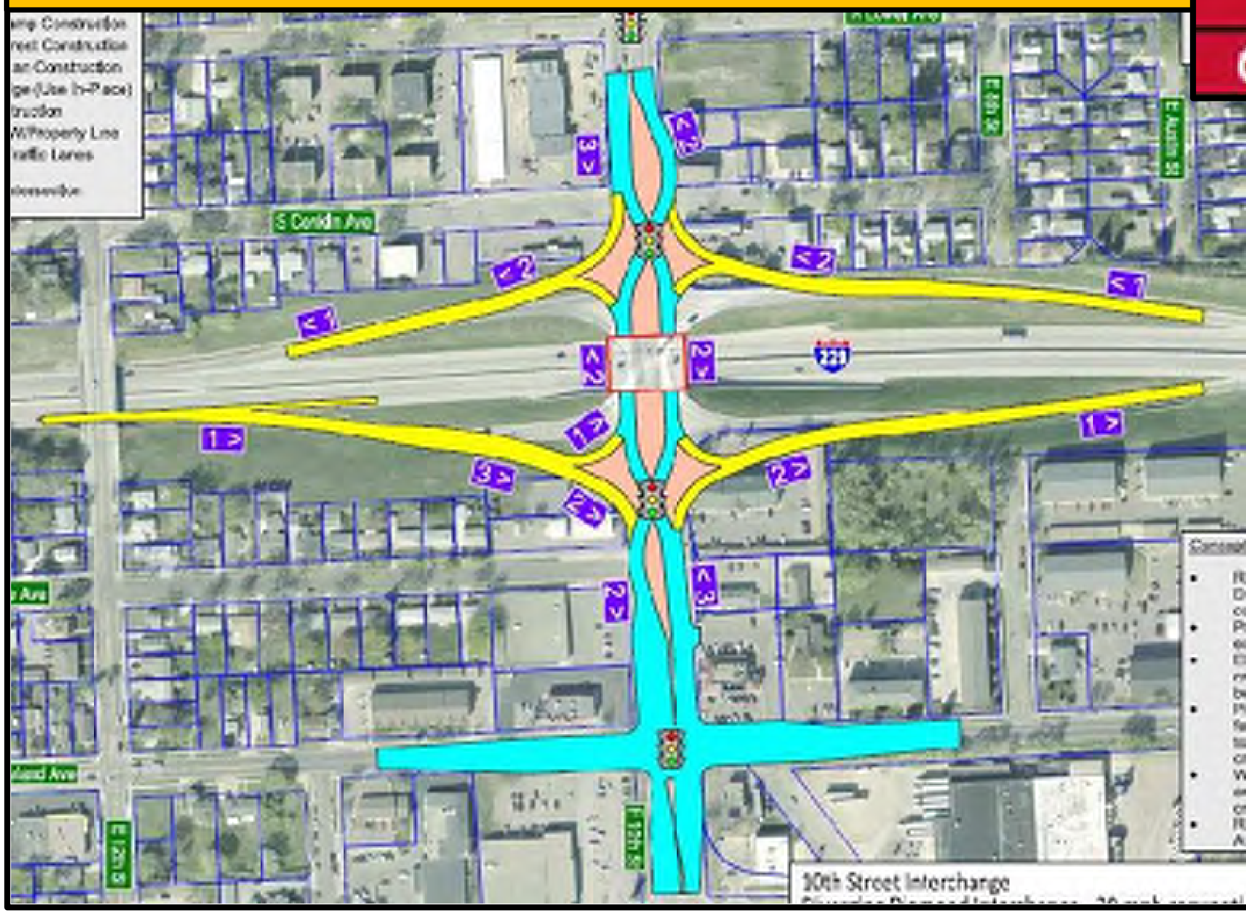
Conceptual Ideas for 10th Street Corridor



What you will be able to see tonight:

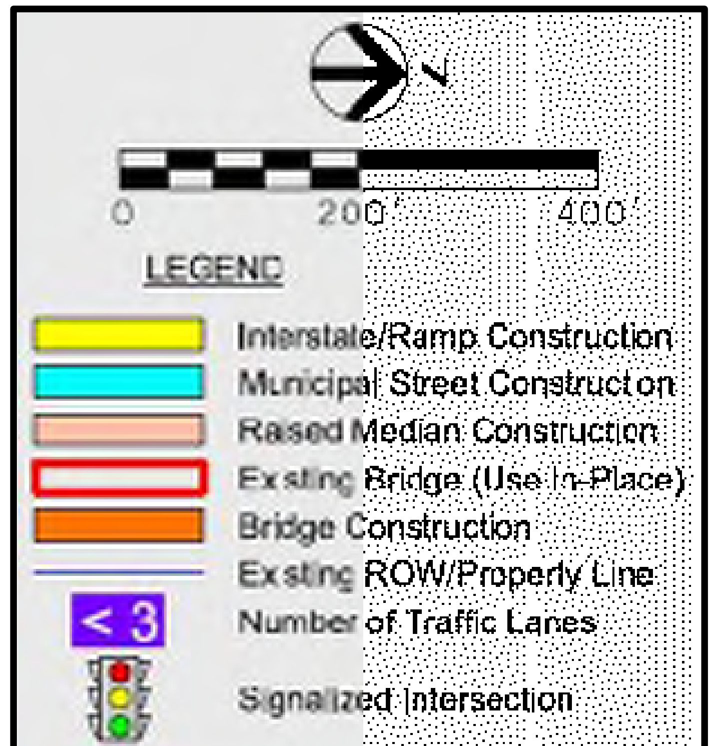
- 8 Interchange Conceptual Options
- 4 Corridor Options
- Median Changes or Driveway Closures to Improve Safety

10th Street / I-229 Interchange Diverging Diamond Option



Traffic Assessment

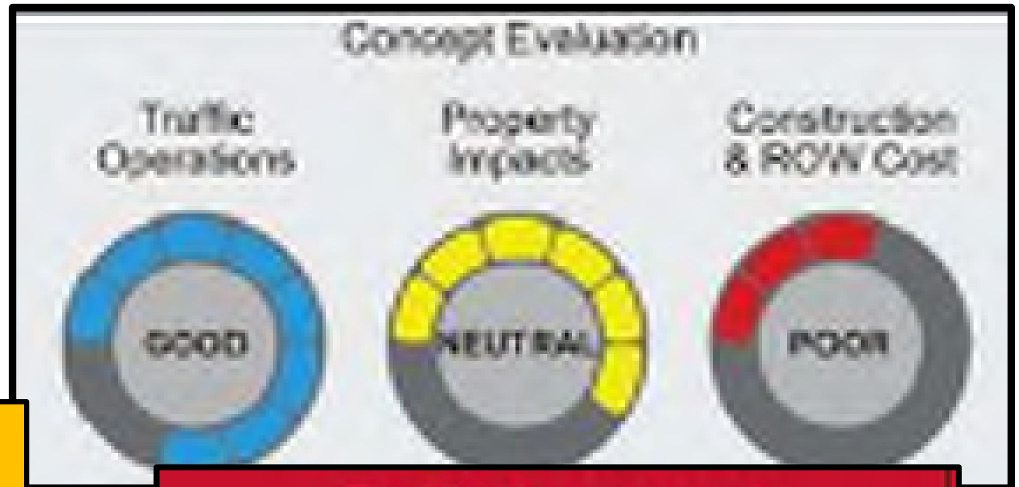
Queues | Delay | Travel Time



Conceptual Ideas for Rice Street Interchange

What you will be able to see tonight:

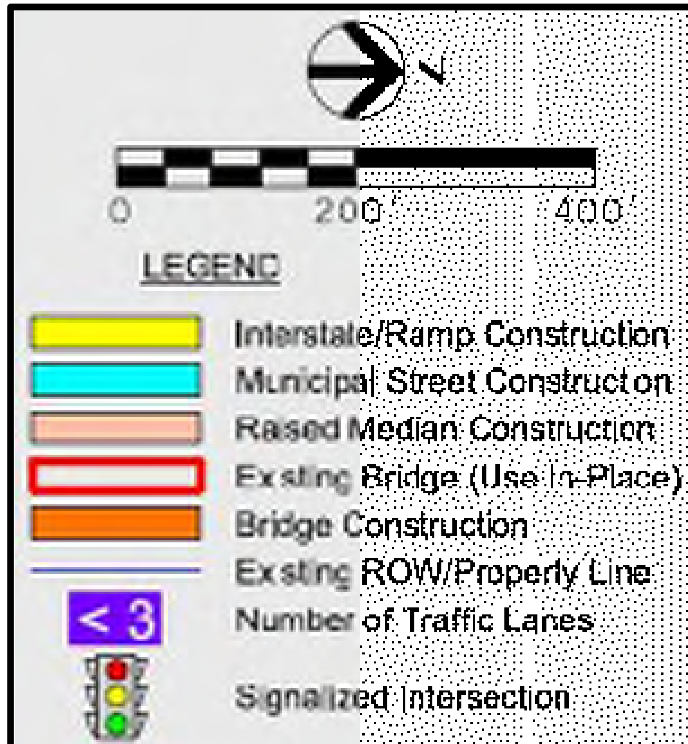
- 1 Interchange Conceptual Options



Rice Street / I-229 Interchange Folded Diamond Improvements

Traffic Assessment

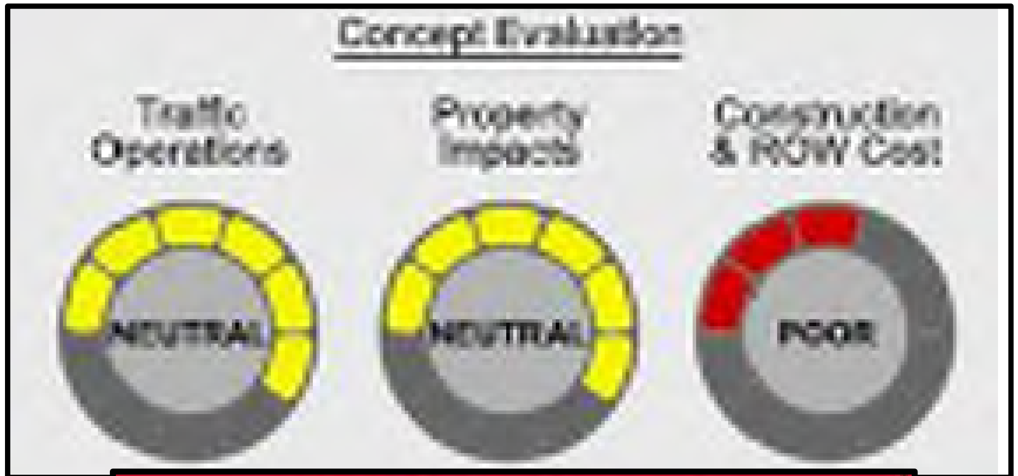
Queues	Delay	Travel Time



Conceptual Ideas for Benson Road

What you will be able to see tonight:

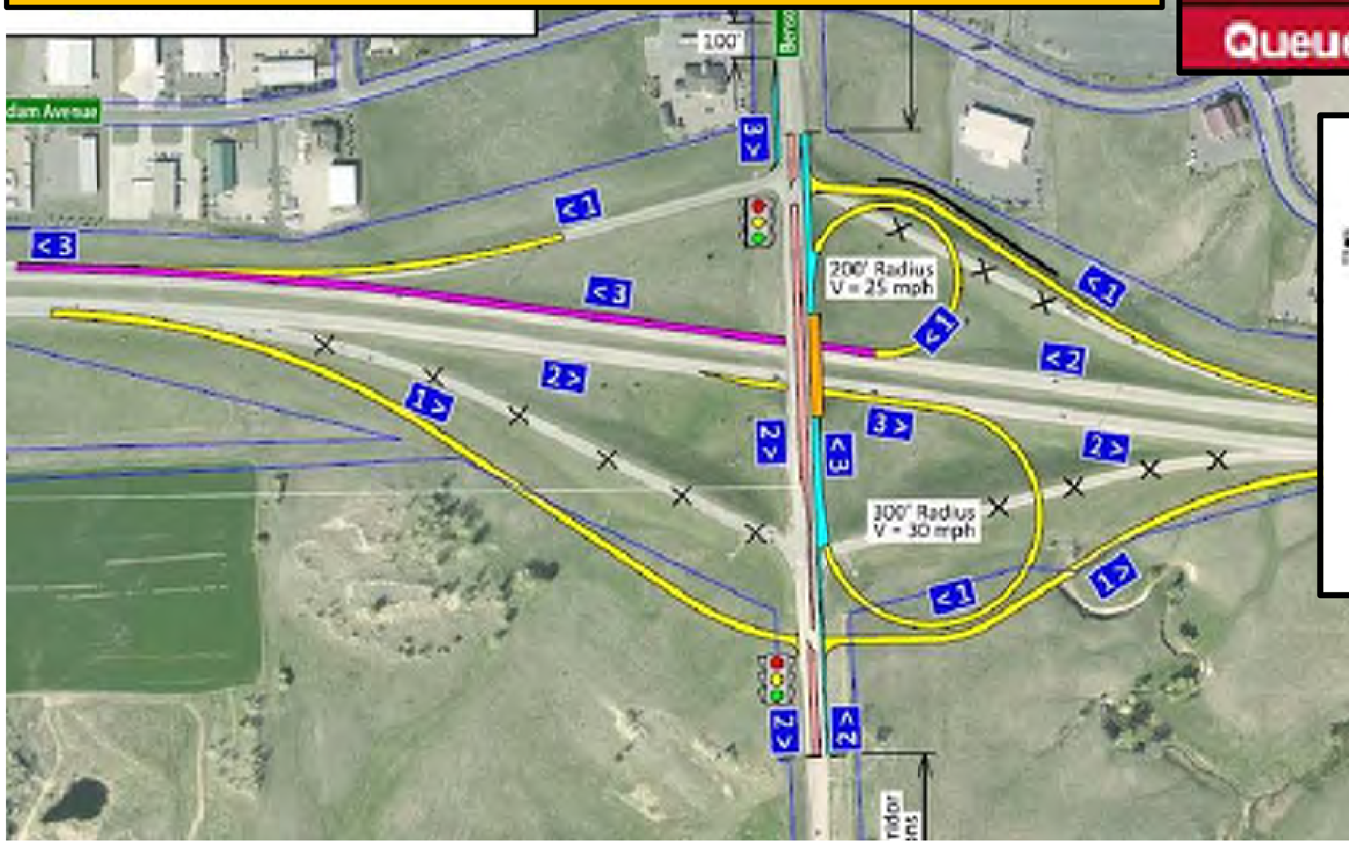
- **4 Interchange Conceptual Options**
- **1 Corridor Option**

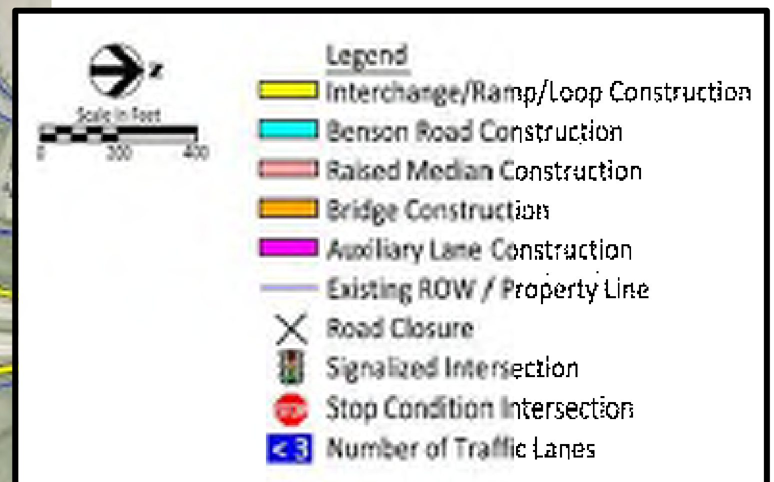


Traffic Assessment

Queues	Delay	Travel Time

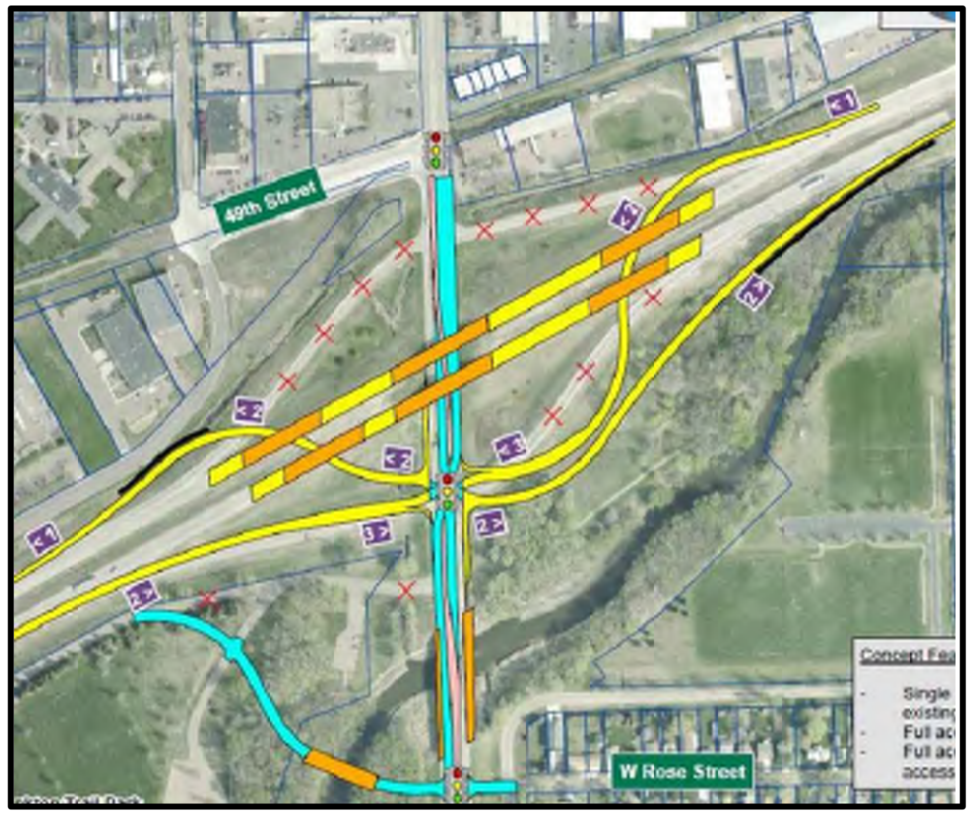
Benson Road / I-229 Interchange Folded Diamond Option



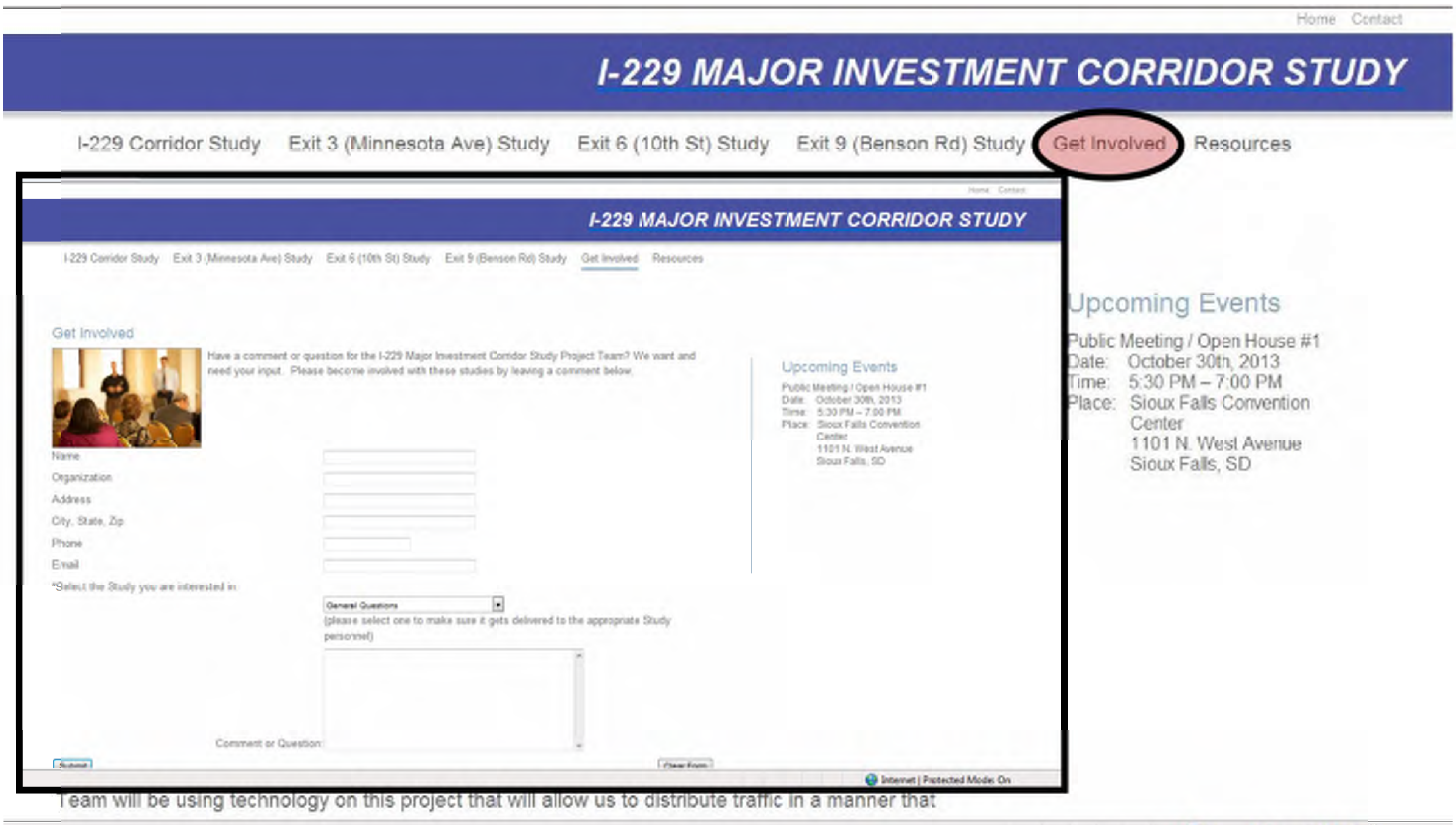


Next Steps for I-229

- Finalize Conceptual Options for all Sub-Studies
- Review Public Comments
- Complete additional Traffic Operations analysis on a reduced number of options based on the screening activities
- Develop Priority Phasing Plan for I-229 Corridor and Sub-Study Corridor
- Determine what "ITS" applications could improve the I-229 corridor safety
- Schedule and Conduct next public meeting



WWW.I229STUDY.COM



PROJECT CONTACTS:

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Dave Meier – HDR Engineering, Inc.
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Shannon Ausen – City of Sioux Falls
605-367-8607 or sausen@siouxfalls.org

Steve Gramm – SDDOT Project Development
605-773-6641 or steve.gramm@state.sd.us

Interstate 229 Major Investment Study

Mainline I-229 Sub-Study 1

Thanks for Attending!!!!!

HDR

HRGreen

MEETING NOTES

Memo

Date:	Tuesday, June 02, 2015
Project:	I229 MIS Public Meeting Debriefing Summary
To:	Project Study Advisory Team (SAT)
From:	HDR
Subject:	***Debriefing Summary / Meeting Comments***

Sub-Study 1 - I-229 Corridor:

- Mixture of interchange types confuses drivers. Should apply consistency in upgrading existing interchanges.
- Re ITS – Whatever advance information that can be provided to drivers via ITS features is a good thing.
- Concern about pavement noise. The I-229 pavement seems to generate a lot of noise.

Sub-Study 2 - Minnesota Ave:

- Prefer concepts with NO median on Minnesota north of 49th St.
- Don't see anything in the concepts shown that will improve operations on Minnesota outside the interchange area, particularly at 41st St and 57th St.
- Need to look at the sources of traffic congestion beyond the study limits.
- There were no operations problems on Minnesota until the traffic signals were added at the I-229 interchange ramps.
- Additional bicycle access across the I-229 corridor would be better if NOT on Minnesota.
- What about offsetting the school start time to avoid the morning peak period?
- Prefer interchange concepts without the traffic signals at the ramp terminals.
- Keep pedestrian and bike access separate from Minnesota Ave (off-alignment). Possibly aligned with Phillips or maybe with Duluth, Center or Spring. An overpass is preferred to an underpass.
- Improve bicycle/pedestrian access across I-229 on Minnesota and provide connection to Phillips corridor north of I-229.
- Like Minn-9 best. OK with right-turning traffic yield to pedestrians.
- Like the relocated Yankton Trails Park access concept with full access. Right-in/right-out for park access would not be good. Rose St connection to east as shown will not work – too steep a grade.
- Southbound ramp terminal intersection offset from 49th St is better – worried about ramp to/from 49th traffic speeding if the approaches are lined up.
- Post No Right Turn on Red for right turns onto of from ramp terminals to enhance safety of bike/pedestrian crossings.
- Significant population living northwest of 49th and Duluth that would benefit from improved pedestrian access.
- Believe there are issues with the railroad ROW easements that place limitations on use.
- Railroad ROW is not wide enough for street width shown on the Minn-C2 concept.
- 49th St should be perpendicular to Minnesota Ave. A horizontal curve to set up a 90-degree intersection would limit speeds on 49th and the ramps. Also have concern for angle of turn for trucks from eastbound 49th to southbound Minnesota.

- Like Minn-9 concept best except for park entrance right-in/out. Relocate the park access, but connect it to the existing trail parking lot to minimize impacts on forested area of park along river. Use the pavement from the existing drive from Minnesota for replacement trail parking.
- Relocated park access impacts Frisbee's drive.
- Need to provide pedestrian/bicycle connectivity between Minnesota Ave, Yankton Trail Park and Tomar Park.
- One person suggested studying a roundabout at Phillips with the 49th extension east alternative.
- One person commented that they preferred the loop ramps that remove left turns from Minnesota.

Sub-Study 3 - 10th Street:

- Potential noise issues with split diamond concepts due to added one way ramp connectors.

Sub-Study 4 – Benson Road:

- Need only one set of ramps (half interchange) at 60th St N.
- SPUI interchange at 10th St and elsewhere have worked well. Is it a potential concept at Benson Rd?
- During peak periods traffic on Benson Rd typically lets traffic from Potsdam onto Benson Rd.
- If concrete casting plant (Gage Bros. Concrete) relocates to the Benson Rd area, beams up to 120 feet long may be transported onto I-229 at the Benson Rd interchange. Plant relocation could involve up to 60 trailers/day for all products shipped and materials received. Intrigued by DDI concept.
- Concern that none of concepts shown have features to address strong eastbound to southbound right turns onto I-229 entrance ramp. Dual right turn with two-lane ramp for some distance may be needed.
- Prefer that Benson Rd interchange get big capacity increase and do nothing at 60th St N. 60th St N has good I-229 trail crossing potential if there are no interchange ramps.
- 54th St N would be a good new I-229 trail crossing corridor.
- Minimal pedestrian use is expected along the Benson Road corridor due to the commercial and industrial land use in the area.

COMMENTS

Comment 01

Sioux Falls, SD 57108-2102

Benson: improve flow EB Benson → SB 229
If + when Interchange comes to 60th N, will NEED alternative
Bike/Ped Crossing eg @ 54th N.

Consider Rail to Trail 26th → MN → West (49th St)

Comment 02

Please evaluate dual lanes for SB movement from eastbound Benson. Very poor LOS at PM peak. The affects Potsdam and Lewis Intersections.
At least increase radius if leaving on ramp right turns at one lane.

Comment 03

*10th St. Corridor
I think there needs to be more attention paid to providing safe, convenient, and accessible access for bicycle, pedestrian, and public transportation users. More traffic lanes does not produce less congestion. There needs to be a more profound design that accommodates non-motorized transportation ~~mode~~ users. I-229 is a major barrier that has been identified as troublesome for getting people who walk, bike, or ride the bus.
(optional) Name: Address:
Phone: Email:
I really like the concept of the diverging diamond on 10th St. as well as the service road access that would connect 10th & 6th St. I believe that the idea that 10th & 6th can be parallel urban arterials that provide safe, convenient, and timely travel to-and-from downtown ~~in terms~~ is great in terms of east-west travel.

Comment 04

6300 S. Old Village Place, Suite 100
Sioux Falls, SD 57108-2102
Fax: 605-977-7747

Need to include other modes of Transit in the evaluations!

Long-Term: Rail to Trail along 49th St all the way to Cliff / 26th would be Brilliant!

Any MN Exit that dumps onto 49th St will Turn it into an Extension of the freeway + Prevent Other uses

Any Freeway access from 6th or 12th will ↑↑↑ Traffic on these Streets & complete the Bike/Pedestrian BLOCK from crossing except at large, High Speed intersections

(optional)

Comment 05

I think there needs to be a major consideration of the impacts to the entire Minnesota Ave. corridor to downtown/airport. Need to consider impacts to the ability to safely and conveniently bike, walk, and riding the bus. While I think bicycle/pedestrian access across I-229 should be first-and-foremost, ~~publ~~ access to public transportation needs to be seriously considered in

(optional)
Name: an area that doesn't already Address: have fixed route service

Phone: available to them. Otherwise Email: they are left with a singular option of ~~vehicle~~ single occupant vehicle trips, which I do not believe that any of the concepts address lessening the impacts of ~~traffic~~ future traffic congestion. There needs to be more of a focus on increasing bike/ped/transit access.

Comment 06

RE: I-229 Corridor Study – Minnesota Ave Interchange

As a volunteer member of the American Heart Association Advocacy Committee I strongly encourage this I-229 corridor study consider all roadway users (motorized and not) equally as it seeks to improve the way people move in and around the corridor. Interstates within cities have repeatedly proven to be significant barriers to the free movement of people. This is as true in Sioux Falls as it is in cities all over the world.

The American Heart Association identifies living actively as an important factor in preventing heart disease and preserving heart health. The possibility of active living is greatly enhanced by removing barriers to movement. Public roads and public spaces that are safe for the most vulnerable users are of primary importance.

I am particularly mindful of the southernmost portion of I-229 as it stands as a wall cutting the southern core of the city off from major pathways of desire: the river, the parks, the bike path. Directing these pathways of desire to traffic dense Western Ave, Minnesota Ave and Cliff Ave presents significant challenges to users. A person need only navigate these three interchanges a few times, counting the conflicts that present themselves before realizing these spaces were not meant for users who choose to power themselves.

Please rework the Minnesota Ave interchange seeking to give an equal level of safety to all roadway users, motorized and not. Use it then as a model throughout the city.

Comment 07

I am concerned for the ability of all citizens to safely cross I-229, including cyclists and pedestrians who are trying to access the Multi-Use trail from the growing southern Sioux Falls neighborhoods. Please keep this in mind at the Minnesota Ave interchange. Thank you for the opportunity to comment

---

Comment 08

Comments I would like to see some sort of bike/pedestrian bridge over/under I-229 near the Yankton Trails Park area. Getting from south Sioux Falls via bicycle is terribly difficult. Thank you

---

Comment 09

Comments Please include me in any future planning around 10th Street. I am a commercial property owner around 10th and Cleveland, so I am particularly interested in any future plans. I appreciate your making this public and inclusive.

Comment 10

Something that I feel needs to be addressed concerning the I-229 corridor is the unsafe traffic conditions at Cliff Avenue on the north side of I-229. The current traffic light set-up forces northbound drivers to risk their lives to get on westbound I-229. The main problem for this is the amount of traffic going southbound, and the timing of the lights. The traffic heading south through the intersection is going downhill and generally driving rather faster than the speed limit. The traffic coming off I-229 and turning south on Cliff Avenue is usually going pretty fast too, as the green light is short, and no one wants to wait. Additionally, eastbound traffic on 41st street turning south on Cliff Avenue faces only a yield sign. Knowing that the southbound traffic is heavy and fast when southbound Cliff Avenue or westbound 41st Street have a green light, the eastbound 41st Street traffic turning south has a brief window to gun it and head south on Cliff Avenue. Sitting in the northbound Cliff Avenue turning lane, waiting to turn west onto the westbound I-229 on ramp becomes a crap-shoot. It's unsafe to turn across the two lanes of southbound Cliff Avenue when Cliff Avenue has a south green light, or when westbound traffic off I-229 has a green light, or when both those lanes have a red light, and the southbound traffic coming off 41st Street speeds south s during the brief window of time when only northbound Cliff Avenue has the green light. When it's busy, especially before and after school, and after 5:00, there is no safe time to turn left from Cliff Avenue onto the I-229 on-ramp.Consequently, every car taking that route has to gun it, and hope the southbound traffic hits the brakes. This situation is clearly unsafe now. As traffic grows, it will get worse. A simple fix, for now, would be to time the lights a little different, or at least a little longer, and add a red light in place of the yield controlling southbound Cliff Avenue traffic from 41st Street. When all southbound and westbound traffic has a red light, those cars headed for southbound I-229 would have a safe, clear path. Time the light long enough to allow 6 cars to get through. Another, simple way to improve the traffic situation would be to widen the lane where traffic turns south onto Cliff Avenue from 41st Street. If that lane were twice as wide, 41st Street traffic trying to get on the on-ramp for I-229 south could do so without having to pull into the right lane of southbound Cliff Avenue. That lane should still have the traffic light in place of the yield sign. It wouldn't take much of a traffic study to see the issues at that intersection. Spending a half hour observing at 7:30 a.m. on a school day would tell you all you need to know.

Comment 11

Thanks for the reply. To be honest, I poked around a lot in the site I sent the message from, but did not see the part you link here. It looks interesting and it looks like it's designed to alleviate the exact problem I wrote about. Some questions- Would there be another lane added where the loop comes onto SB I-229, so that I'm not trying to merge into 65 mph (ha ha- wish they were going that slow) traffic while accelerating up a hill on a curve? What would be the purpose of the retaining walls shown between I-229 and the existing SB on-ramp? Is there a time frame yet on when this work will be started?

APPENDIX -

CLIFF AVENUE AND RICE STREET PUBLIC MEETINGS – JUNE 22ND, 2016

RICE STREET

JUNE 22ND, 2016

- MEETING NOTES
- SIGN-IN SHEETS
- COMMENTS
- POWERPOINT SLIDES

Meeting Minutes

Project:	I-229 Major Investment Corridor Study, PL 0100(87) 3616P, PCN 044K
Subject:	Stakeholder Meeting – Sub-study 5 – Rice Street Exit 7
Date:	Wednesday, June 22, 2016
Location:	Sioux Falls Convention Center Conference Room 6
Attendees:	See Attached Sign In Sheet – 8 Participants

Comments & responses noted:

1. Trucking firm on North side Rice, east of I-229 (Kunkel Truck Lines)
   - Concern for Eastbound truck ingress to property.
   - What is the purpose of the proposed median? Response: Median is the preferred treatment for arterials carrying more than 20,000 veh/day (City)
   - Are the proposed corridor improvements similar to W 12^{th} Street near I-29? Response: Yes (City)
   - Will the railroad have one track or two? Response: BNSF has not indicated how many tracks there may be in the future. They have not ruled out the potential for expansion.
   - Business owns both existing drives on the north side of Rice St. An adjacent business to the east (Eastgate Towing) also has access to Rice St via the eastern of the two drives.
   - The proposed backage road would require 15-20 feet of embankment.
   - Existing security at the drives is provided by security cameras only. The business intends to add gates. Proposed widening on Rice St will make it more difficult for the business to position the gates.

2. Business southeast corner of Bahnson Ave (Myrl & Roy's Paving)
   - Recommend that project planners expect more railroad traffic.
   - Recommend consideration of eastbound in-bound trucks queueing when trains are in the crossing. Response: It is expected that the number of unit trains/day will remain about the same but local trains could increase to 3-4 per day (City).
   - The Cleveland realignment option is a step backward because it inhibits direct access to I-229.

3. Gravel Company – East side of Cleveland
   - When the railroad crossing is blocked, there will be no way out of our business if a median is built on Cleveland.

4. Proposed improvements on Rice St will increase speeds on Rice and create more problems with slow turning trucks. Response: Satisfying both commuter and industrial traffic is a challenge.

5. Between 4:00 – 4:30 pm, trucks waiting for a gap in Rice St traffic to turn out block the railroad crossing.

6. A railroad grade separation is needed.

7. What is the timeline for construction of Rice St improvements? Response: the I-229 study will include recommendations to prioritize improvements over a time span of more than 20 years. Widening Cleveland Ave to a 5-lane roadway is anticipated to be a near term project (City).

8. Eastbound right turn lane has been considered to allow westbound left lane to be added, but it is needed to hold traffic when railroad crossing is blocked.

9. Why is that more important than queuing traffic waiting for left turn traffic in the morning?

10. The railroad track should be realigned south to its original alignment farther south of Rice St.

11. The mine pit south of Rice St is now used mostly for recycling and has an indefinite remaining life.

12. Not opposed to realignment of Cleveland Ave if it can be shifted farther west or south toward the residential development.

13. When will SD-100 be constructed to Rice Street? Response: In about two years.

14. Why do the I-229 bridges need to be redone before improvements along Rice St?

15. On Concept Rice-5, would a roundabout be located where the ramps intersect Rice St? Response: A signalized intersection similar to the one at I-229 and 10th St would be located at the ramp terminals.

16. What is the benefit of the proposed median? Response: Vehicle crash mitigation and reduction of turning movement conflicts.

17. Have studies been conducted regarding the safety of U-turns? Response: 57th & Southeastern project has been the source of some complaints about u-turns. 12th Street is working OK. A 30% reduction in crashes has been determined by analysis of previous median construction projects (City).

18. Senior driver comment – Medians cause confusion because drivers often cannot exit an adjacent property the same way they entered it.

19. Do not see a lot of semi-trailer trucks on Rice St west of I-229.

20. Business West Side of Cleveland South of Rice
    - Have been operating since 1991. Have only 70 employees, who may go on-site to service customers.
    - There are truck operations in and out of the site.
    - The site contains 50 storage spaces for customer RV's and campers storage.
    - Customers like that the storage spaces are close to I-229 access ramps.

DOT   CITY OF SIOUX FALLS PUBLIC WORKS   HDR

Sign In Sheet

Subject I-229 Major Investment Corridor Study – Public Meeting for Rice Street Sub-Study

Client City of Sioux Falls/South Dakota Department of Transportation

Project PL 0100(87) 3616P, PCN 044K   **Project No.:** 207030

Meeting Date Wednesday, June 22, 2016 5:00 PM   **Meeting Location:** Sioux Falls Convention Center

Please print clearly. Thank you.

	Name	Address	Best Contact Phone	Email
1	Brad Remmich	Pierre	773-3093	bradley.remmich@state.sd.us
2	Brigitte Fawells	1208 N Lowell ave	605-310-7930	
3	Steve Gramm	700 E. Broadway Ave	773-6641	Steve.gramm@state.sd.us
4	Jason Kjenstad	6300 S. Old Village Pl	977-7740	jason.kjenstad@hdrinc.com
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Sign In Sheet

Subject I-229 Major Investment Corridor Study – Public Meeting for Rice Street Sub-Study

Client City of Sioux Falls/South Dakota Department of Transportation

Project PL 0100(87) 3616P, PCN 044K **Project No.:** 207030

Meeting Date Wednesday, June 22, 2016 5:00 PM **Meeting Location:** Sioux Falls Convention Center

Please print clearly. Thank you.

	Name	Address	Best Contact Phone	Email
1	Andy Vandel	Pierre	773-4421	andy.vandel@state.sd.us
2	Jason Kjenstad	HDR	605-977-7740	jason.kjenstad@hdrinc.com
3	Josh Callahan	1501 N. Cleveland Ave Sioux Falls	605-521-6586	josh.callahan@smpsecurity.com
4	TROY MILLER	SIOUX FALLS	605-553-8729	TMILLER@SIOUXFALLS.ORG
5	Colleen Adler	1301 N. Lowell Ave SF 57103	339-2630	ca47dakota@gmail.com
6	Jackie Nash	2100 Tricia Lane 57103	338-1870	jackie830n@yahoo.com
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Sign In Sheet

Subject I-229 Major Investment Corridor Study – Public Meeting for Rice Street Sub-Study

Client City of Sioux Falls/South Dakota Department of Transportation

Project PL 0100(87) 3616P, PCN 044K **Project No.:** 207030

Meeting Date Wednesday, June 22, 2016 5:00 PM **Meeting Location:** Sioux Falls Convention Center

Please print clearly. Thank you.

	Name	Address	Best Contact Phone	Email
1	PETE LONGMAN	700 EAST Broadway – PIERRE	773-6488	pete.longman@state.sd.us
2	Christina Bennett	700 E Broadway-Pierre	773-4759	Christina.Bennett@state.sd.us
3	Tom Lehmkuhl	700 E. Broadway	773.3721	tom.lehmkuhl@state.sd.us
4	DEAN DELASHMUTT	1207 N VIOLET PL	496 1108	
5	Dhan Khapangi	1000 N Broken Bow Ave	605 360 3544	
6	Jesse Callahan	1501 N Cleveland Ave	334 9357	info@smpsecurity.com
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R3B
LOOKS good
FOR CLEVELAND

Comment Card

I-229 Major Investment Corridor Study – Rice Street Sub-Study

Public Open House

PL 0100(87) 3616P, PCN 044K

June 22, 2016

Comments:

FUTURE: 4 LANES - HMMM?

RICE ST - C2

MEDIAN BETWEEN JESSICA & WAYLAND: (AND TO SAVE MONEY),

REDO DRAINAGE ON JESSICA - REMOVE MERIDIAN

RICE ST-1 TRUCKING FIRM RATHER INCONVIENCED FOR TRIPS

NORTH BOUND. SOUTH BOUND IS "DO-ABLE" BACK ACCESS ACCESSABLE TO I-229?

Name: DEAN DELASHMUTT Address: 1207 N VIOLET PL

Phone: 605 496 1108 E-mail:

For your comments to be considered, please return by July 7, 2016.
Comments can also be e-mailed to: sausen@siouxfalls.org

Interstate 229 Major Investment Study

Exit 7 – Rice Street

Public Meeting
June 22nd, 2016
5:00 pm to 6:30 pm

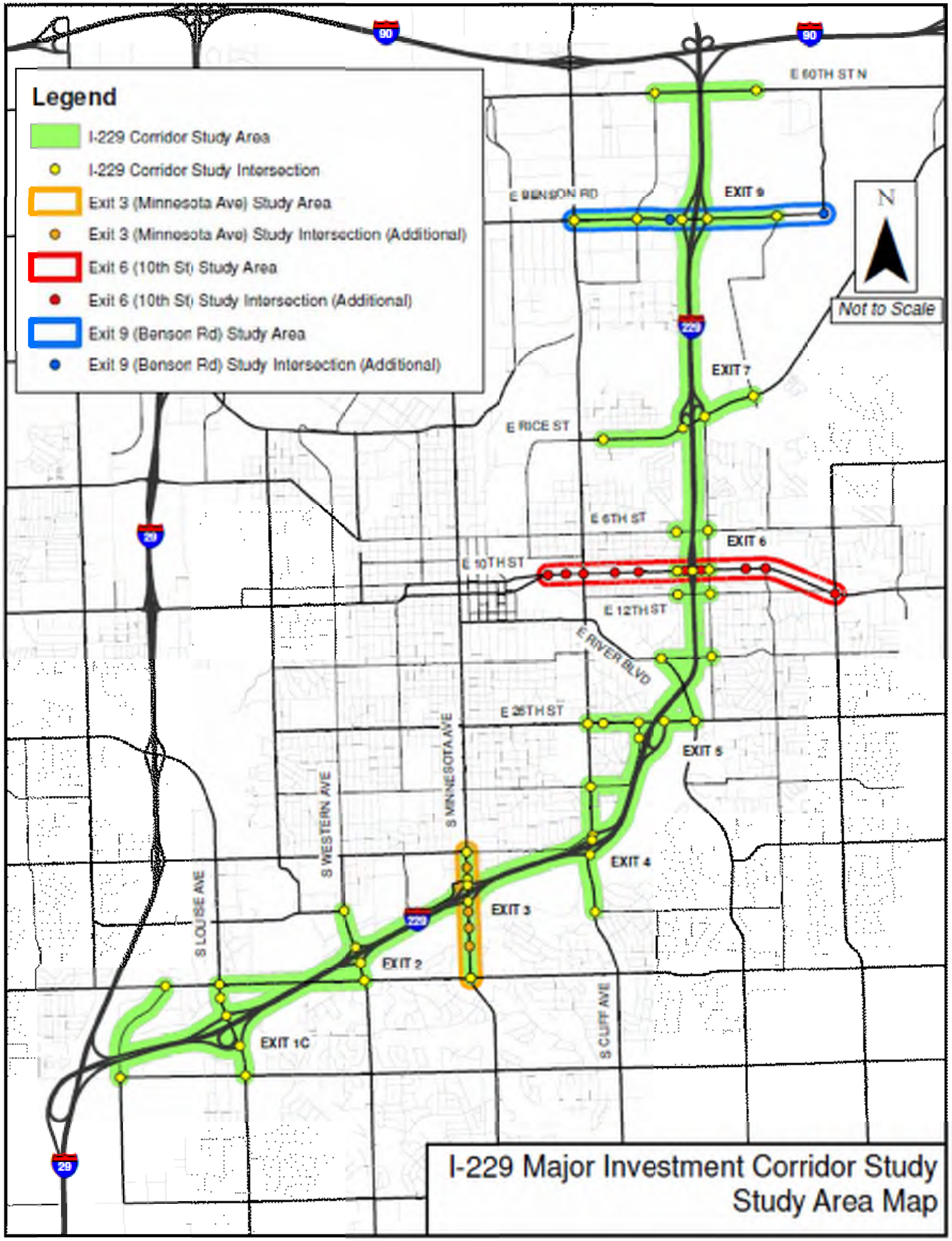
Study Area Map

I-229 Corridor Study

Solberg Avenue Overpass
to
60th Street N. Overpass

Additional Studies

Exit 3 – Minnesota Ave
Exit 6 – 10th Street
Exit 9 – Benson Road
Added Exit 4 – Cliff Avenue
Added Exit 7 – Rice Street



Study Advisory Partners

South Dakota Department of Transportation (SDDOT)

South Dakota Highway Patrol

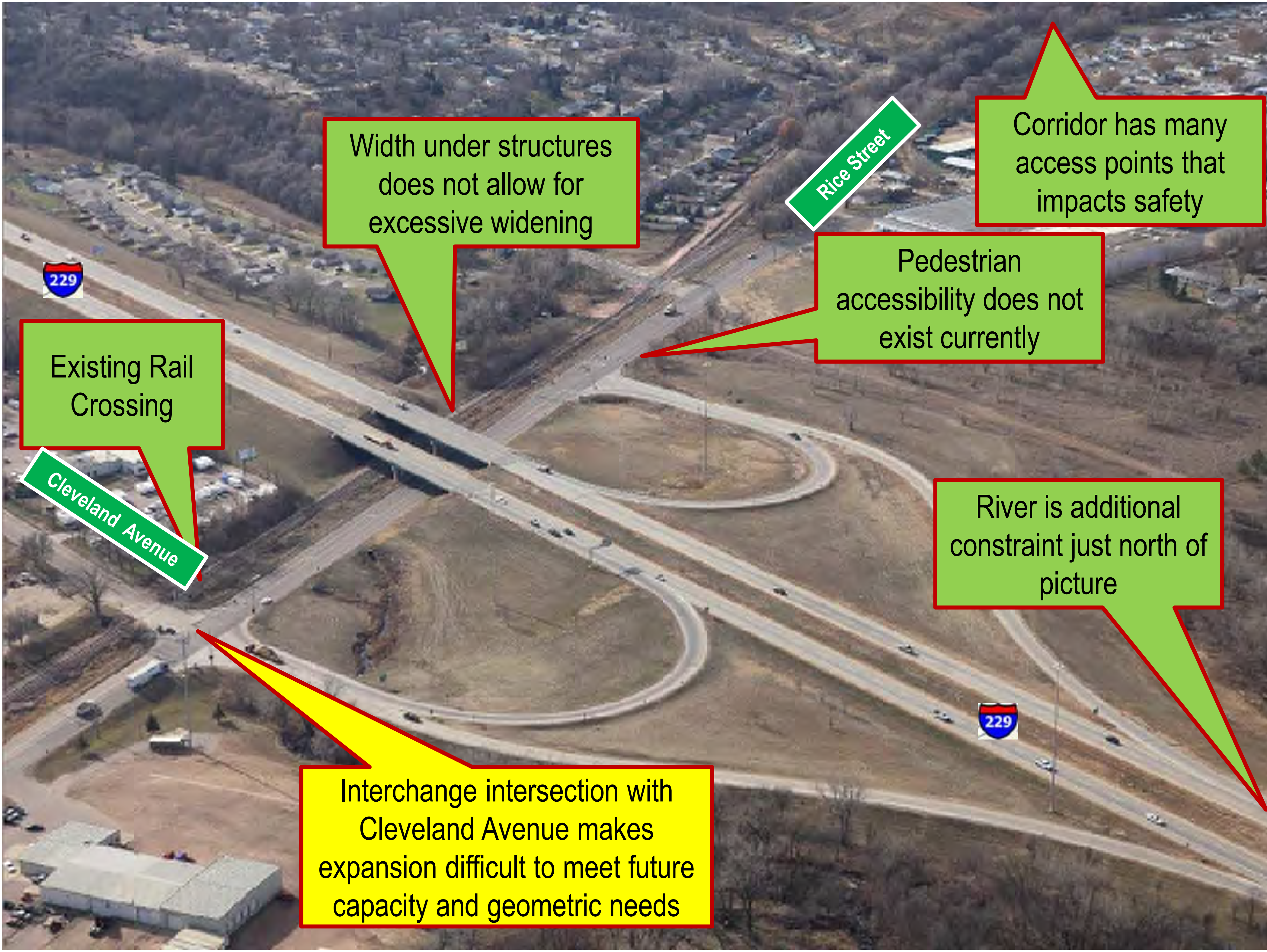
City of Sioux Falls

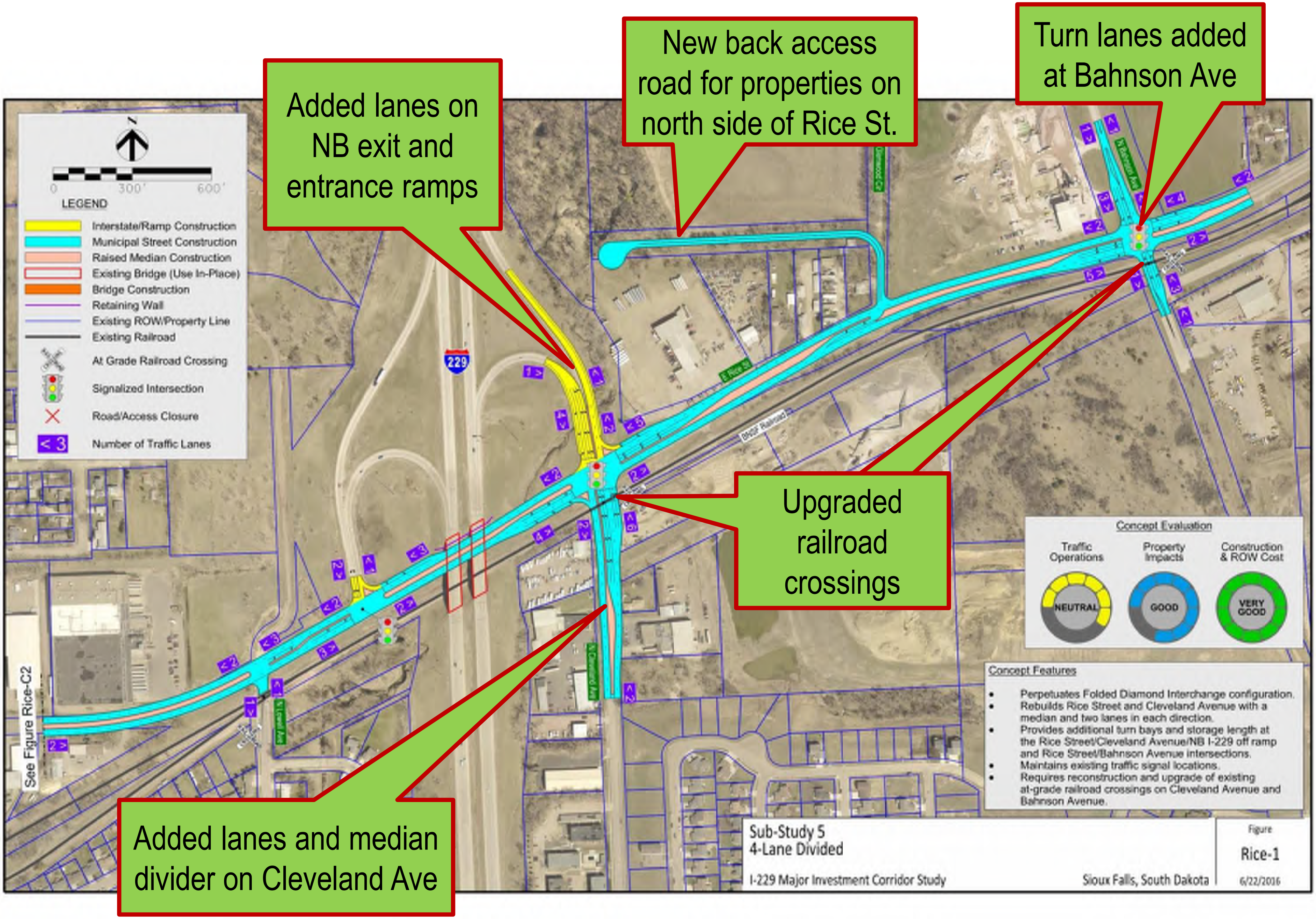
Sioux Falls Metropolitan Planning Organization (MPO)

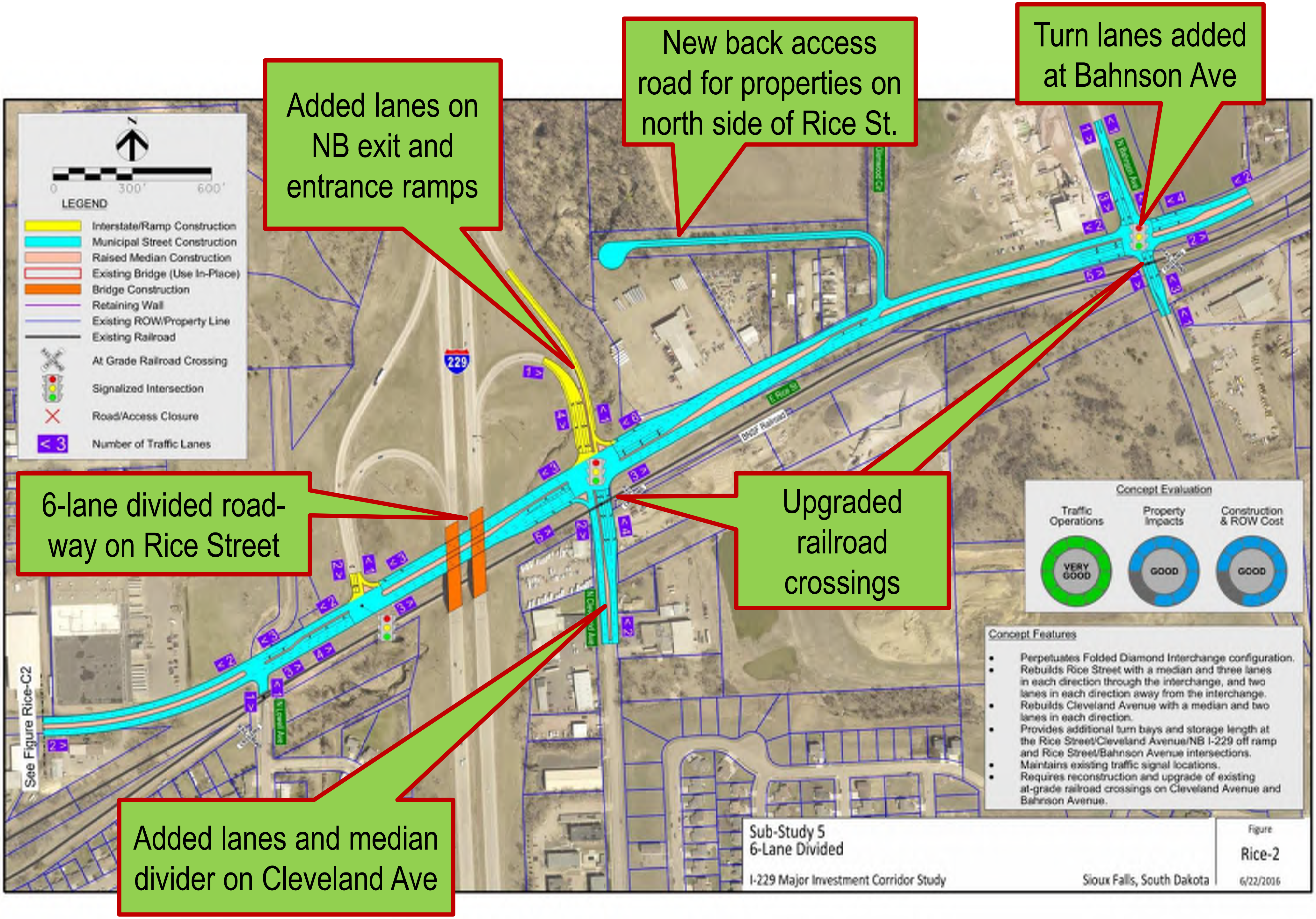
Federal Highway Administration (FHWA)

Exit 7 (Rice Street) Crossroad Study Goals

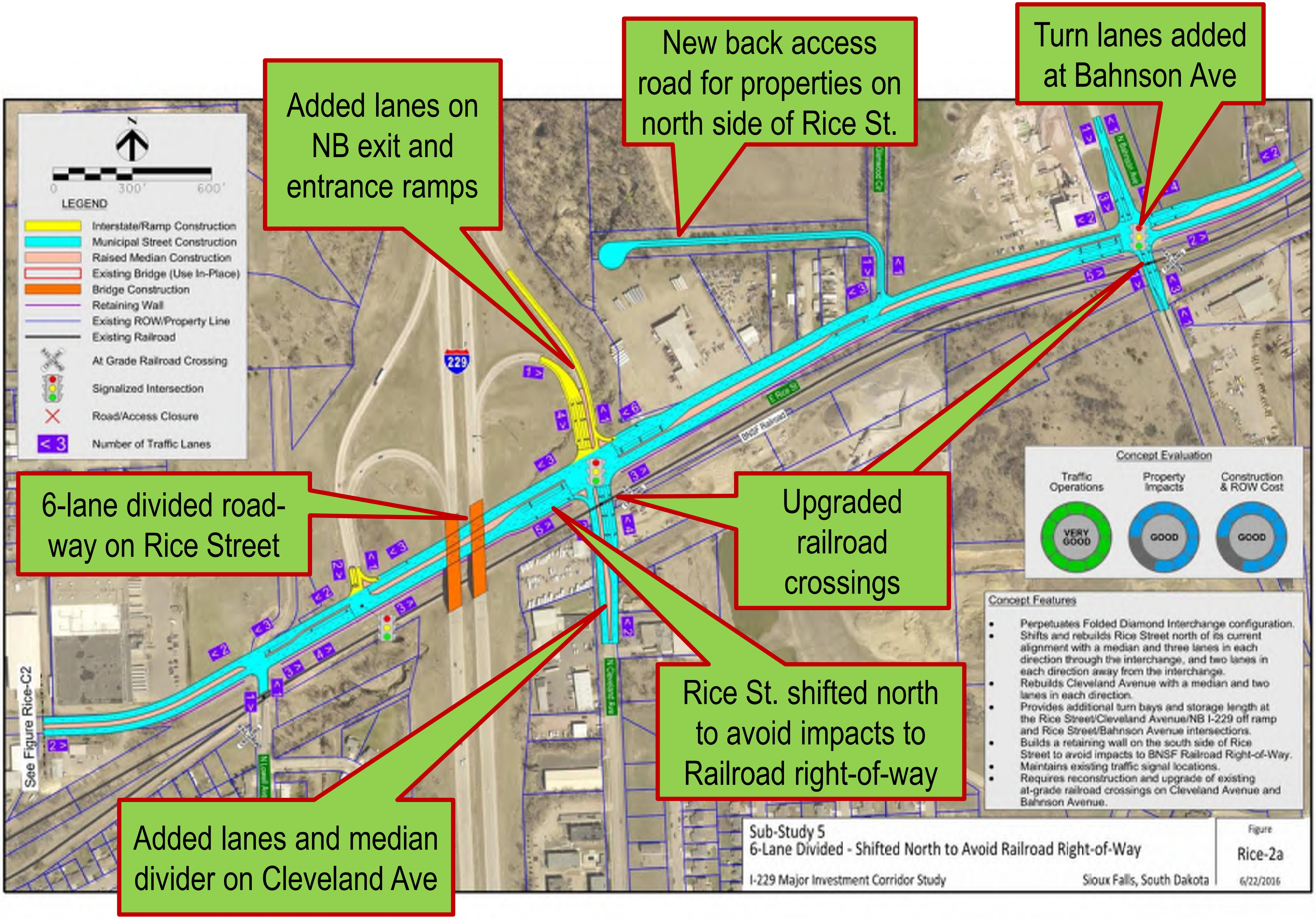
- Reduce traffic congestion
- Provide and Interchange that will meet the future capacity requirements
- Improve pedestrian mobility
- Improve safety for corridor users

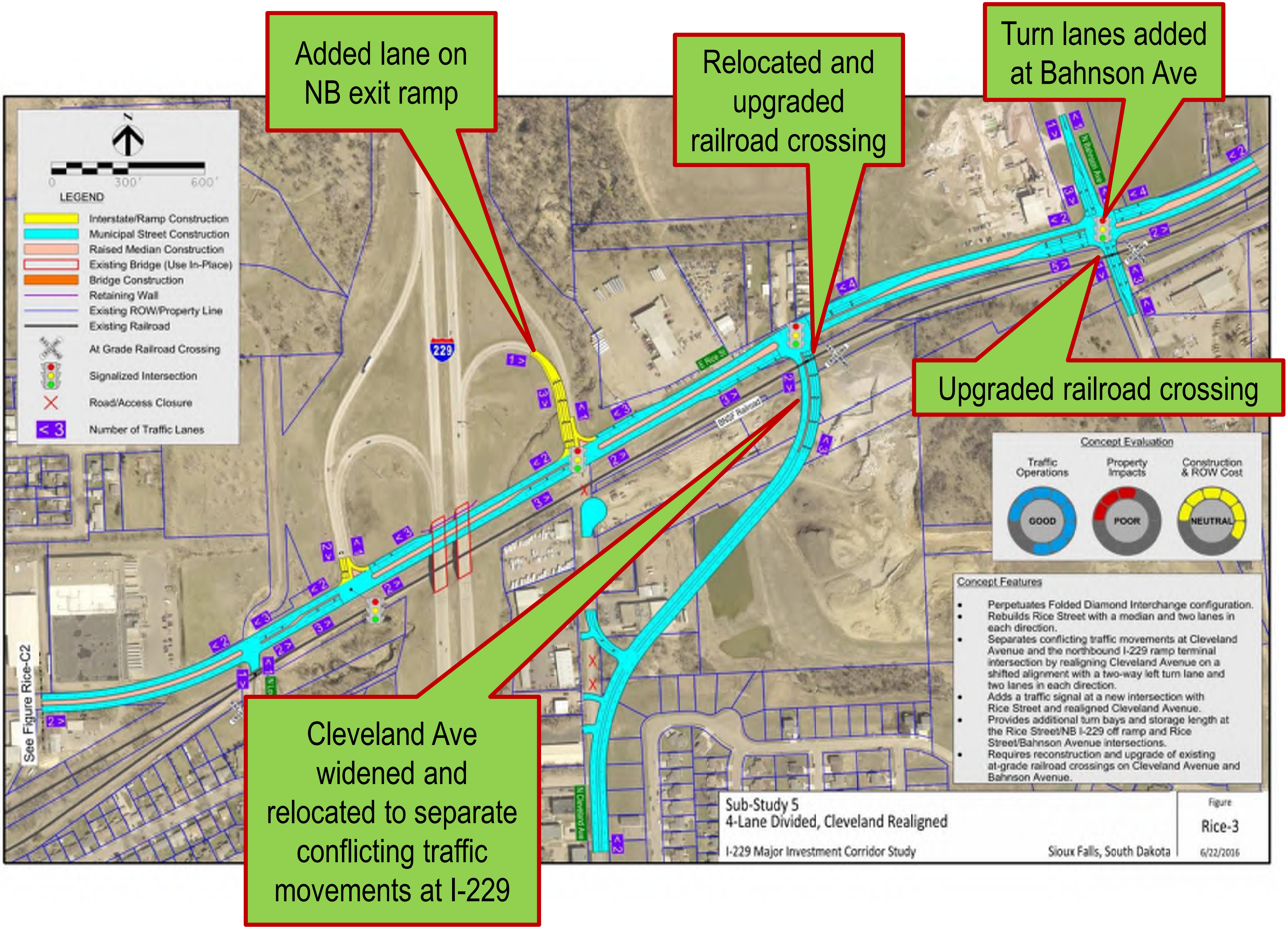

Rice Street
Corridor has many access points that impacts safety
Width under structures does not allow for excessive widening
Pedestrian accessibility does not exist currently
229
Existing Rail Crossing
Cleveland Avenue
River is additional constraint just north of picture
229
Interchange intersection with Cleveland Avenue makes expansion difficult to meet future capacity and geometric needs

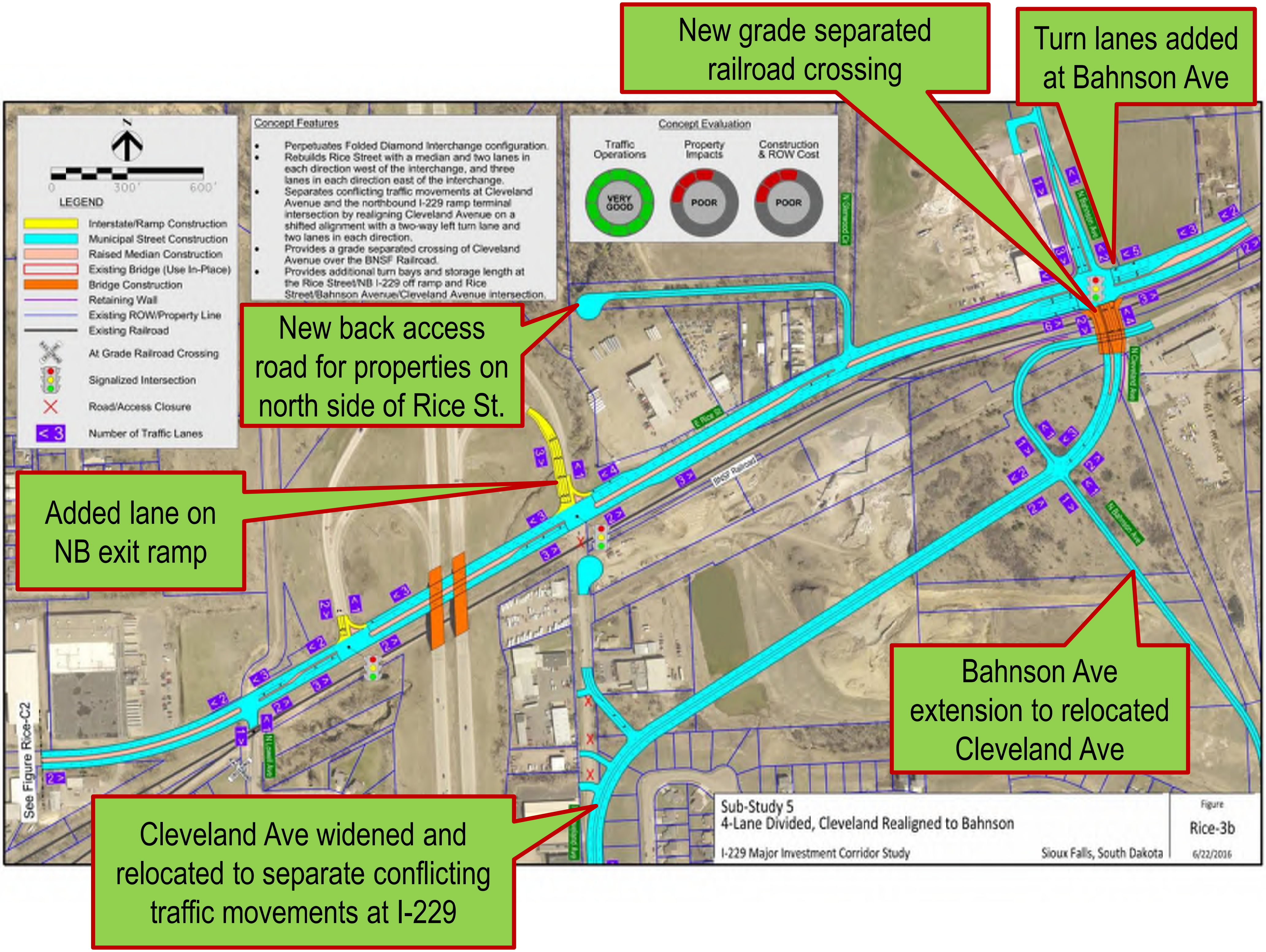

Added lanes on NB exit and entrance ramps
New back access road for properties on north side of Rice St.
Turn lanes added at Bahnson Ave
Upgraded railroad crossings
Added lanes and median divider on Cleveland Ave
0 300' 600'
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Existing Bridge (Use In-Place)
Bridge Construction
Retaining Wall
Existing ROW/Property Line
Existing Railroad
At Grade Railroad Crossing
Signalized Intersection
Road/Access Closure
Number of Traffic Lanes
229
E Rice St
BNSF Railroad
N Cleveland Ave
N Bahnson Ave
See Figure Rice-C2
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
NEUTRAL
GOOD
VERY GOOD
Concept Features
• Perpetuates Folded Diamond Interchange configuration.
• Rebuilds Rice Street and Cleveland Avenue with a median and two lanes in each direction.
• Provides additional turn bays and storage length at the Rice Street/Cleveland Avenue/NB I-229 off ramp and Rice Street/Bahnson Avenue intersections.
• Maintains existing traffic signal locations.
• Requires reconstruction and upgrade of existing at-grade railroad crossings on Cleveland Avenue and Bahnson Avenue.
Sub-Study 5
4-Lane Divided
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Rice-1
6/22/2016



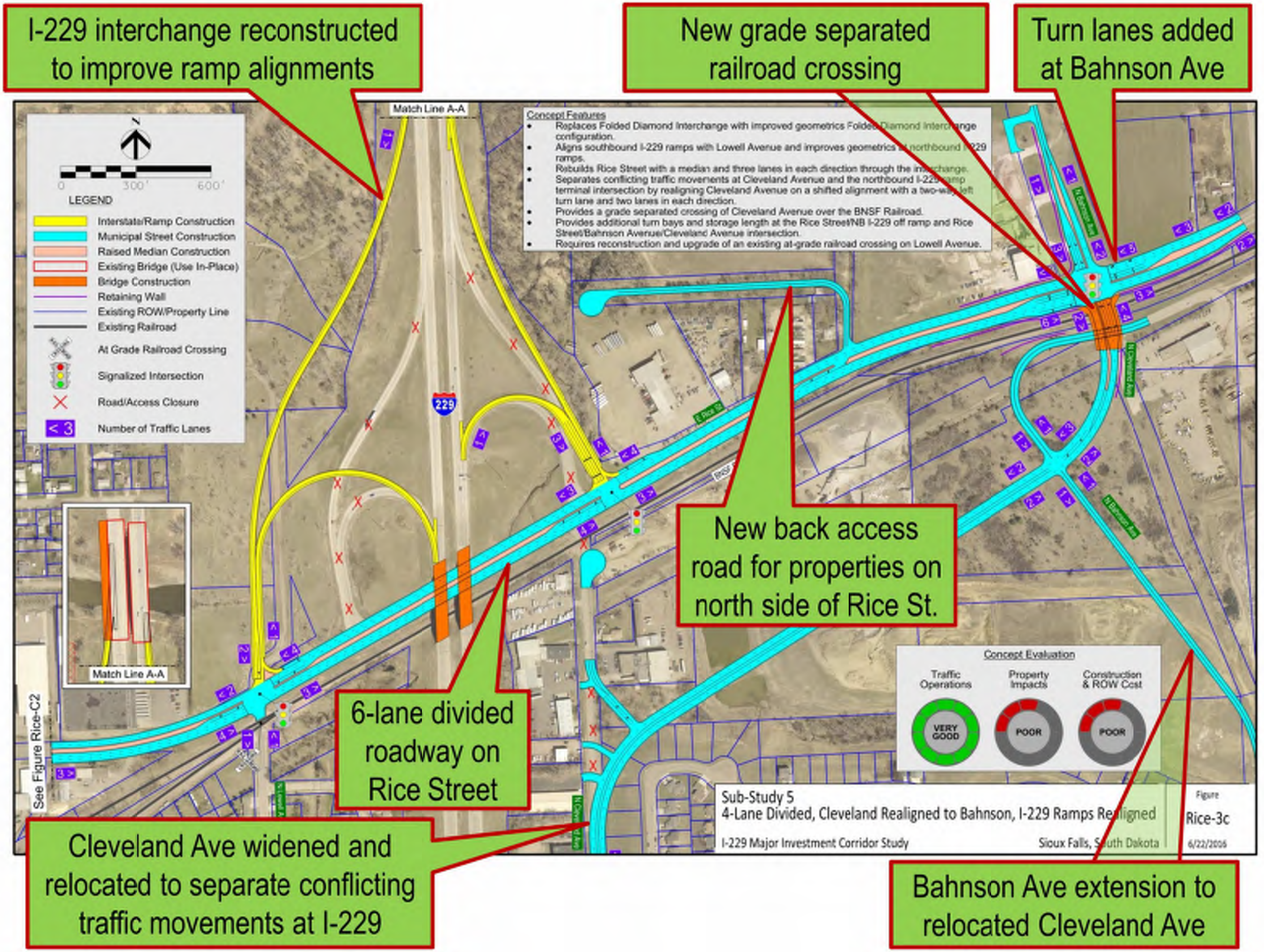
Added lanes on NB exit and entrance ramps
New back access road for properties on north side of Rice St.
Turn lanes added at Bahnson Ave
6-lane divided road-way on Rice Street
Upgraded railroad crossings
Added lanes and median divider on Cleveland Ave
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Existing Bridge (Use In-Place)
Bridge Construction
Retaining Wall
Existing ROW/Property Line
Existing Railroad
At Grade Railroad Crossing
Signalized Intersection
Road/Access Closure
Number of Traffic Lanes
0 300' 600'
229
E Rice St
BNSF Railroad
See Figure Rice-C2
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
VERY GOOD
GOOD
GOOD
Concept Features
Perpetuates Folded Diamond Interchange configuration.
Rebuilds Rice Street with a median and three lanes in each direction through the interchange, and two lanes in each direction away from the interchange.
Rebuilds Cleveland Avenue with a median and two lanes in each direction.
Provides additional turn bays and storage length at the Rice Street/Cleveland Avenue/NB I-229 off ramp and Rice Street/Bahnson Avenue intersections.
Maintains existing traffic signal locations.
Requires reconstruction and upgrade of existing at-grade railroad crossings on Cleveland Avenue and Bahnson Avenue.
Sub-Study 5
6-Lane Divided
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Rice-2
6/22/2016


Added lanes on NB exit and entrance ramps
New back access road for properties on north side of Rice St.
Turn lanes added at Bahnson Ave
6-lane divided road-way on Rice Street
Upgraded railroad crossings
Rice St. shifted north to avoid impacts to Railroad right-of-way
Added lanes and median divider on Cleveland Ave
0 300' 600'
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Existing Bridge (Use In-Place)
Bridge Construction
Retaining Wall
Existing ROW/Property Line
Existing Railroad
At Grade Railroad Crossing
Signalized Intersection
Road/Access Closure
Number of Traffic Lanes
229
E Rice St
BNSF Railroad
N Cleveland Ave
N Bahnson Ave
See Figure Rice-C2
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
VERY GOOD
GOOD
GOOD
Concept Features
• Perpetuates Folded Diamond Interchange configuration.
• Shifts and rebuilds Rice Street north of its current alignment with a median and three lanes in each direction through the interchange, and two lanes in each direction away from the interchange.
• Rebuilds Cleveland Avenue with a median and two lanes in each direction.
• Provides additional turn bays and storage length at the Rice Street/Cleveland Avenue/NB I-229 off ramp and Rice Street/Bahnson Avenue intersections.
• Builds a retaining wall on the south side of Rice Street to avoid impacts to BNSF Railroad Right-of-Way.
• Maintains existing traffic signal locations.
• Requires reconstruction and upgrade of existing at-grade railroad crossings on Cleveland Avenue and Bahnson Avenue.
Sub-Study 5
6-Lane Divided - Shifted North to Avoid Railroad Right-of-Way
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Rice-2a
6/22/2016

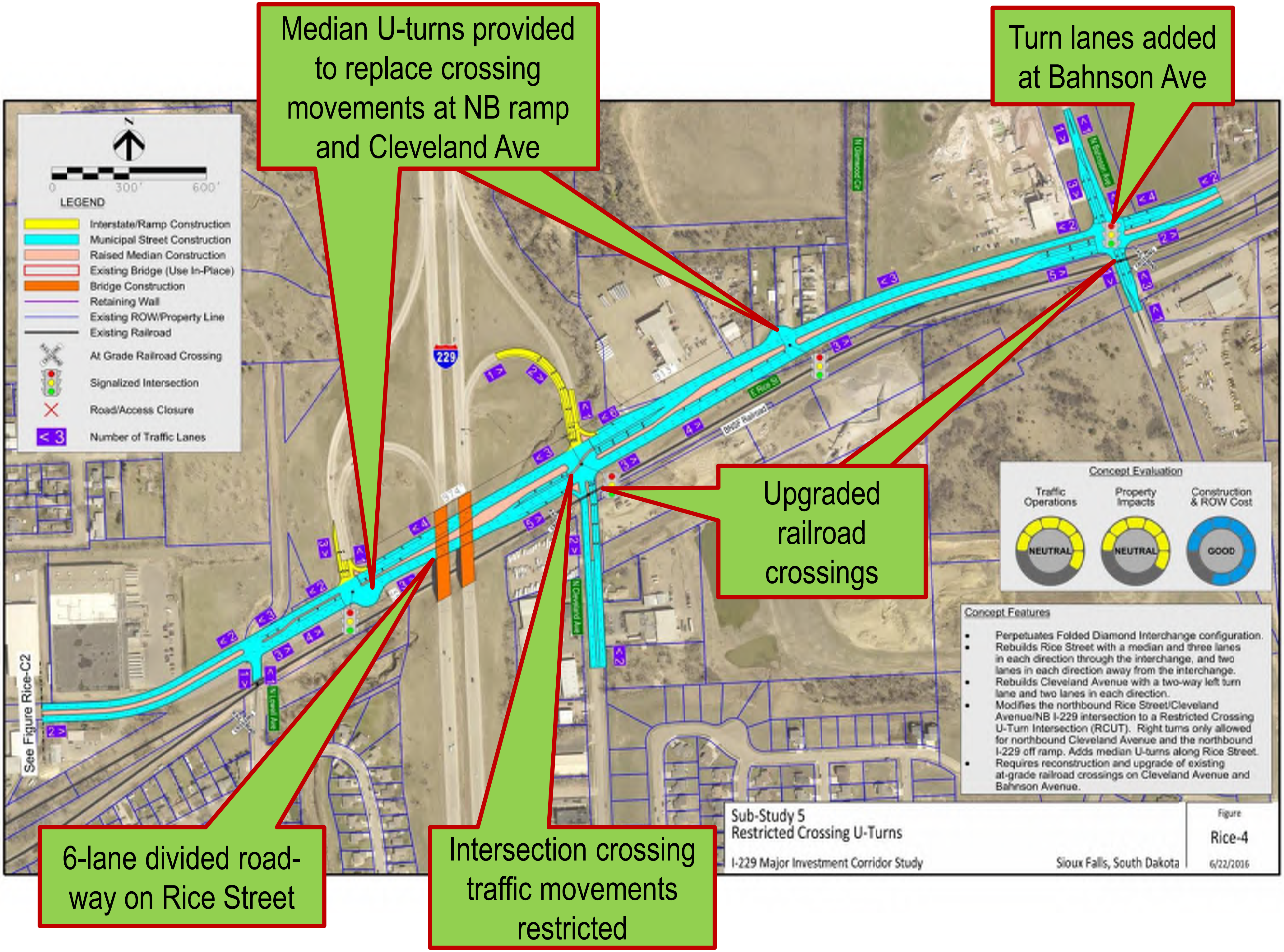

Added lane on NB exit ramp
Relocated and upgraded railroad crossing
Turn lanes added at Bahnson Ave
Upgraded railroad crossing
Cleveland Ave widened and relocated to separate conflicting traffic movements at I-229
0 300' 600'
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Existing Bridge (Use In-Place)
Bridge Construction
Retaining Wall
Existing ROW/Property Line
Existing Railroad
At Grade Railroad Crossing
Signalized Intersection
Road/Access Closure
Number of Traffic Lanes
229
E Rice St
BNSF Railroad
See Figure Rice-C2
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
GOOD
POOR
NEUTRAL
Concept Features
• Perpetuates Folded Diamond Interchange configuration.
• Rebuilds Rice Street with a median and two lanes in each direction.
• Separates conflicting traffic movements at Cleveland Avenue and the northbound I-229 ramp terminal intersection by realigning Cleveland Avenue on a shifted alignment with a two-way left turn lane and two lanes in each direction.
• Adds a traffic signal at a new intersection with Rice Street and realigned Cleveland Avenue.
• Provides additional turn bays and storage length at the Rice Street/NB I-229 off ramp and Rice Street/Bahnson Avenue intersections.
• Requires reconstruction and upgrade of existing at-grade railroad crossings on Cleveland Avenue and Bahnson Avenue.
Sub-Study 5
4-Lane Divided, Cleveland Realigned
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Rice-3
6/22/2016



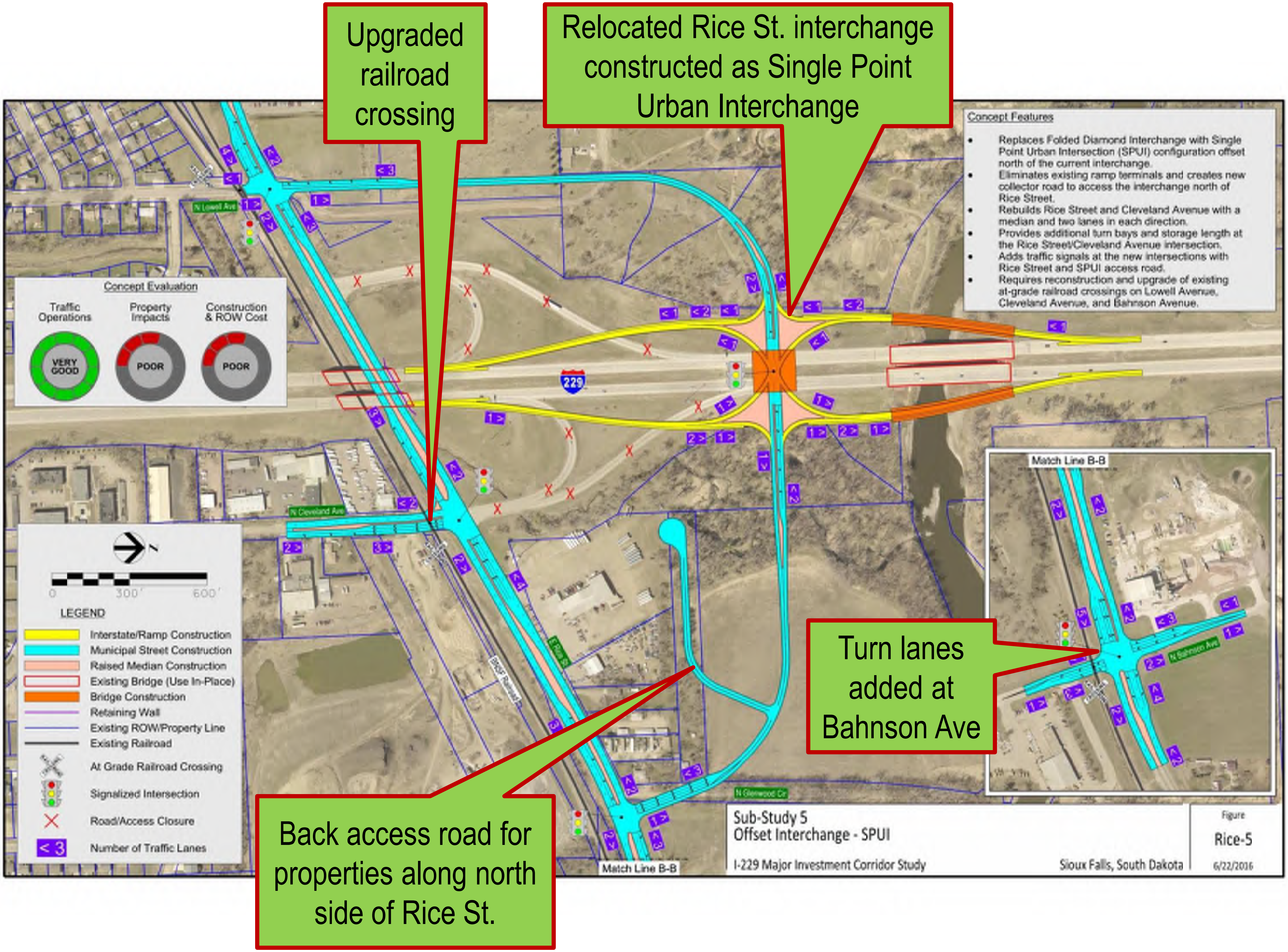
New grade separated railroad crossing
Turn lanes added at Bahnson Ave
LEGEND
0 300' 600'
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Existing Bridge (Use In-Place)
Bridge Construction
Retaining Wall
Existing ROW/Property Line
Existing Railroad
At Grade Railroad Crossing
Signalized Intersection
Road/Access Closure
Number of Traffic Lanes
Concept Features
Perpetuates Folded Diamond Interchange configuration.
Rebuilds Rice Street with a median and two lanes in each direction west of the interchange, and three lanes in each direction east of the interchange.
Separates conflicting traffic movements at Cleveland Avenue and the northbound I-229 ramp terminal intersection by realigning Cleveland Avenue on a shifted alignment with a two-way left turn lane and two lanes in each direction.
Provides a grade separated crossing of Cleveland Avenue over the BNSF Railroad.
Provides additional turn bays and storage length at the Rice Street/NB I-229 off ramp and Rice Street/Bahnson Avenue/Cleveland Avenue intersection.
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
VERY GOOD
POOR
POOR
New back access road for properties on north side of Rice St.
Added lane on NB exit ramp
Bahnson Ave extension to relocated Cleveland Ave
Cleveland Ave widened and relocated to separate conflicting traffic movements at I-229
See Figure Rice-C2
BNSF Railroad
E Rice St
Sub-Study 5
4-Lane Divided, Cleveland Realigned to Bahnson
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Rice-3b
6/22/2016



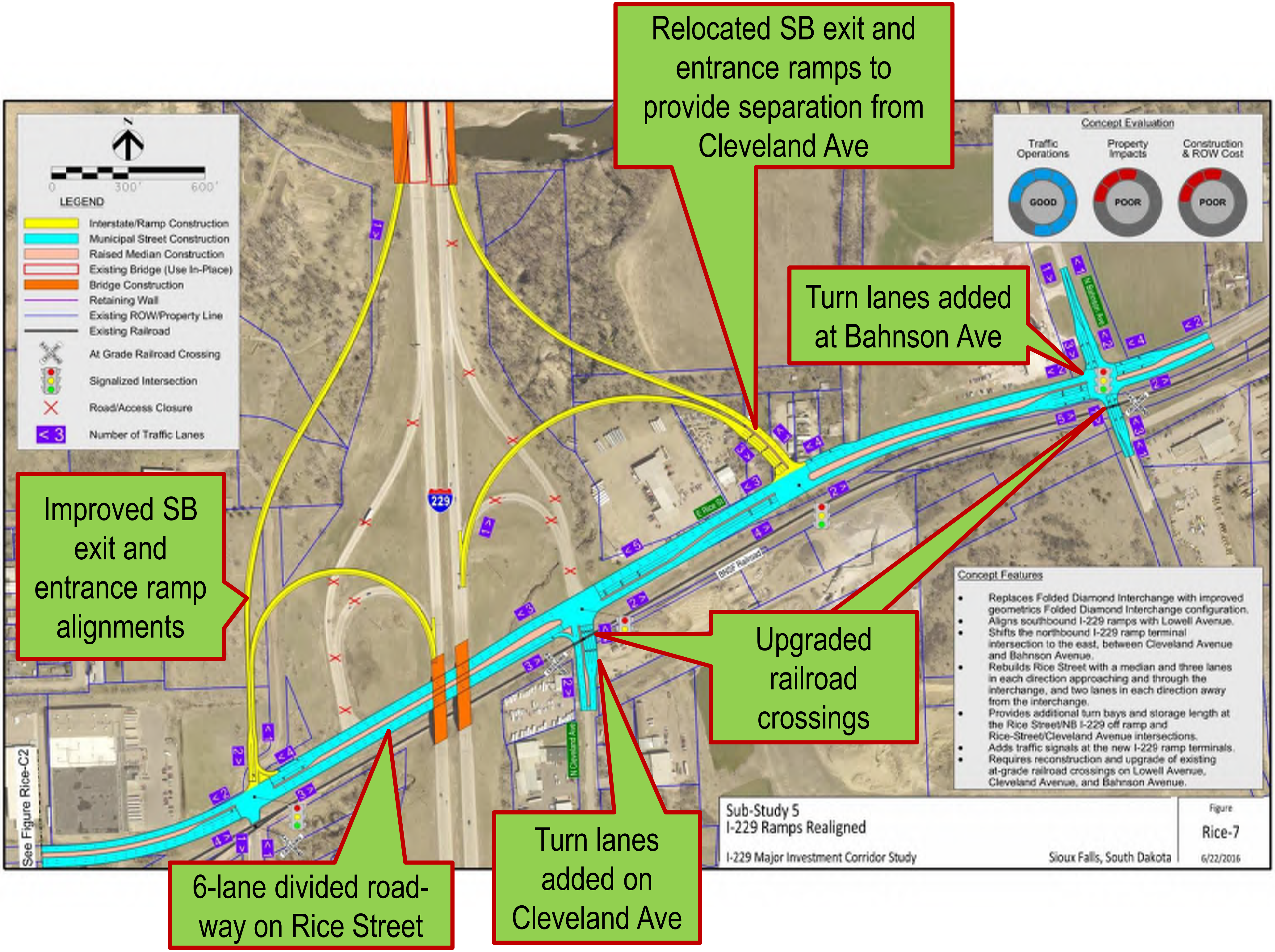
I-229 interchange reconstructed to improve ramp alignments
New grade separated railroad crossing
Turn lanes added at Bahnson Ave
Match Line A-A
Concept Features
• Replaces Folded Diamond Interchange with improved geometrics Folded Diamond Interchange configuration.
• Aligns southbound I-229 ramps with Lowell Avenue and improves geometrics at northbound I-229 ramps.
• Rebuilds Rice Street with a median and three lanes in each direction through the interchange.
• Separates conflicting traffic movements at Cleveland Avenue and the northbound I-229 ramp terminal intersection by realigning Cleveland Avenue on a shifted alignment with a two-way left turn lane and two lanes in each direction.
• Provides a grade separated crossing of Cleveland Avenue over the BNSF Railroad.
• Provides additional turn bays and storage length at the Rice Street/NB I-229 off ramp and Rice Street/Bahnson Avenue/Cleveland Avenue intersection.
• Requires reconstruction and upgrade of an existing at-grade railroad crossing on Lowell Avenue.
0 300' 600'
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Existing Bridge (Use In-Place)
Bridge Construction
Retaining Wall
Existing ROW/Property Line
Existing Railroad
At Grade Railroad Crossing
Signalized Intersection
Road/Access Closure
Number of Traffic Lanes
229
New back access road for properties on north side of Rice St.
Match Line A-A
See Figure Rice-C2
6-lane divided roadway on Rice Street
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
VERY GOOD
POOR
POOR
Sub-Study 5
4-Lane Divided, Cleveland Realigned to Bahnson, I-229 Ramps Realigned
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Rice-3c
6/22/2016
Cleveland Ave widened and relocated to separate conflicting traffic movements at I-229
Bahnson Ave extension to relocated Cleveland Ave



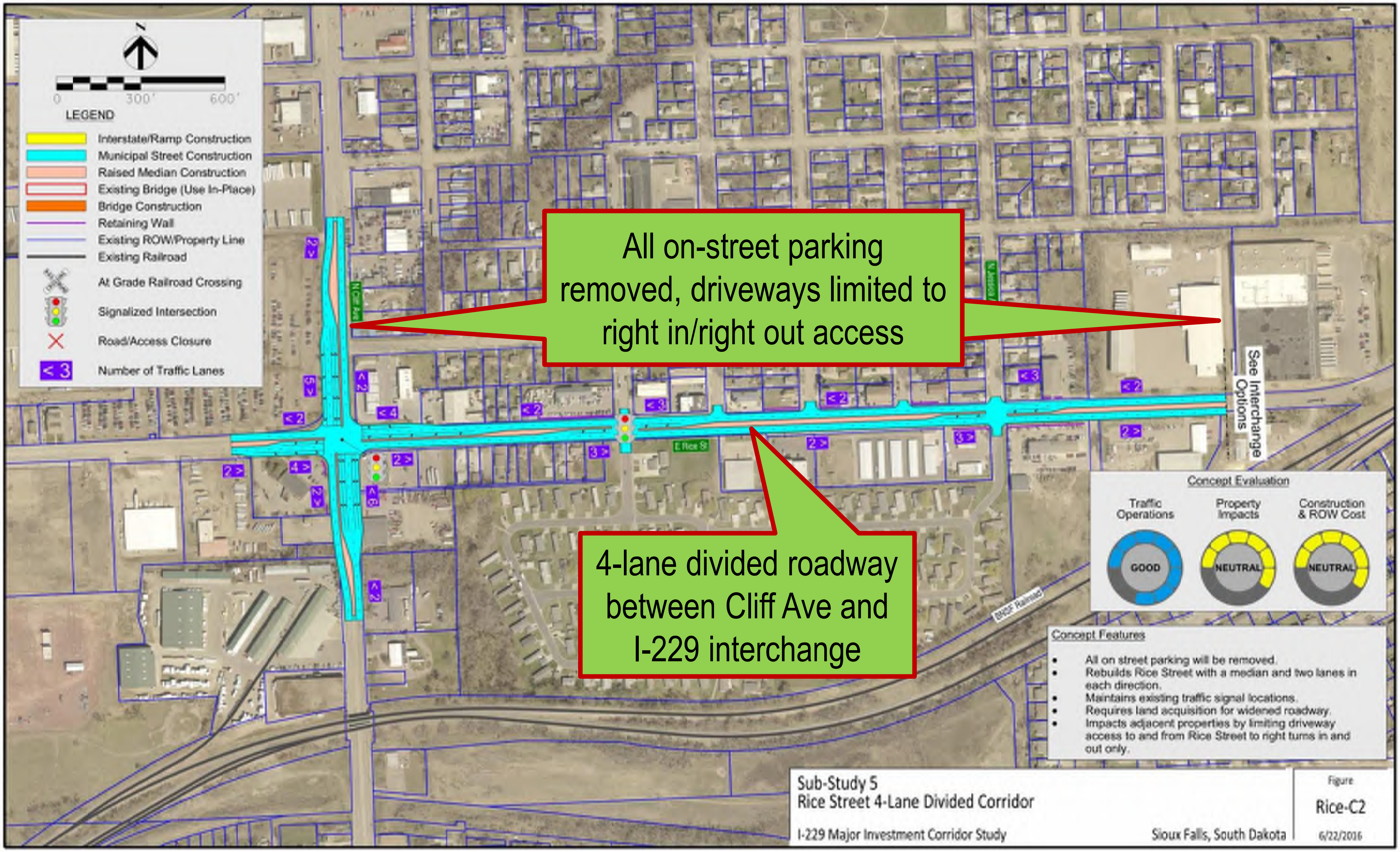
Median U-turns provided to replace crossing movements at NB ramp and Cleveland Ave
Turn lanes added at Bahnson Ave
Upgraded railroad crossings
6-lane divided road-way on Rice Street
Intersection crossing traffic movements restricted
0 300' 600'
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Existing Bridge (Use In-Place)
Bridge Construction
Retaining Wall
Existing ROW/Property Line
Existing Railroad
At Grade Railroad Crossing
Signalized Intersection
Road/Access Closure
Number of Traffic Lanes
229
E Rice St
BNSF Railroad
N Cleveland Ave
See Figure Rice-C2
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
NEUTRAL
NEUTRAL
GOOD
Concept Features
• Perpetuates Folded Diamond Interchange configuration.
• Rebuilds Rice Street with a median and three lanes in each direction through the interchange, and two lanes in each direction away from the interchange.
• Rebuilds Cleveland Avenue with a two-way left turn lane and two lanes in each direction.
• Modifies the northbound Rice Street/Cleveland Avenue/NB I-229 intersection to a Restricted Crossing U-Turn Intersection (RCUT). Right turns only allowed for northbound Cleveland Avenue and the northbound I-229 off ramp. Adds median U-turns along Rice Street.
• Requires reconstruction and upgrade of existing at-grade railroad crossings on Cleveland Avenue and Bahnson Avenue.
Sub-Study 5
Restricted Crossing U-Turns
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Rice-4
6/22/2016



Upgraded railroad crossing
Relocated Rice St. interchange constructed as Single Point Urban Interchange
Concept Features
Replaces Folded Diamond Interchange with Single Point Urban Intersection (SPUI) configuration offset north of the current interchange.
Eliminates existing ramp terminals and creates new collector road to access the interchange north of Rice Street.
Rebuilds Rice Street and Cleveland Avenue with a median and two lanes in each direction.
Provides additional turn bays and storage length at the Rice Street/Cleveland Avenue intersection.
Adds traffic signals at the new intersections with Rice Street and SPUI access road.
Requires reconstruction and upgrade of existing at-grade railroad crossings on Lowell Avenue, Cleveland Avenue, and Bahnson Avenue.
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
VERY GOOD
POOR
POOR
N Lowell Ave
N Cleveland Ave
229
Match Line B-B
N Bahnson Ave
Turn lanes added at Bahnson Ave
0
300'
600'
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Existing Bridge (Use In-Place)
Bridge Construction
Retaining Wall
Existing ROW/Property Line
Existing Railroad
At Grade Railroad Crossing
Signalized Intersection
Road/Access Closure
Number of Traffic Lanes
N Glenwood Cir
Back access road for properties along north side of Rice St.
Match Line B-B
Sub-Study 5
Offset Interchange - SPUI
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Rice-5
6/22/2016



Relocated SB exit and entrance ramps to provide separation from Cleveland Ave
Turn lanes added at Bahnson Ave
Improved SB exit and entrance ramp alignments
Upgraded railroad crossings
6-lane divided roadway on Rice Street
Turn lanes added on Cleveland Ave
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Existing Bridge (Use In-Place)
Bridge Construction
Retaining Wall
Existing ROW/Property Line
Existing Railroad
At Grade Railroad Crossing
Signalized Intersection
Road/Access Closure
Number of Traffic Lanes
0 300' 600'
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
GOOD
POOR
POOR
Concept Features
• Replaces Folded Diamond Interchange with improved geometrics Folded Diamond Interchange configuration.
• Aligns southbound I-229 ramps with Lowell Avenue.
• Shifts the northbound I-229 ramp terminal intersection to the east, between Cleveland Avenue and Bahnson Avenue.
• Rebuilds Rice Street with a median and three lanes in each direction approaching and through the interchange, and two lanes in each direction away from the interchange.
• Provides additional turn bays and storage length at the Rice Street/NB I-229 off ramp and Rice-Street/Cleveland Avenue intersections.
• Adds traffic signals at the new I-229 ramp terminals.
• Requires reconstruction and upgrade of existing at-grade railroad crossings on Lowell Avenue, Cleveland Avenue, and Bahnson Avenue.
Sub-Study 5
I-229 Ramps Realigned
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Rice-7
6/22/2016
See Figure Rice-C2
229



0 300' 600'
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Existing Bridge (Use In-Place)
Bridge Construction
Retaining Wall
Existing ROW/Property Line
Existing Railroad
At Grade Railroad Crossing
Signalized Intersection
Road/Access Closure
Number of Traffic Lanes
All on-street parking removed, driveways limited to right in/right out access
4-lane divided roadway between Cliff Ave and I-229 interchange
See Interchange Options
E Rice St
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
GOOD
NEUTRAL
NEUTRAL
Concept Features
• All on street parking will be removed.
• Rebuilds Rice Street with a median and two lanes in each direction.
• Maintains existing traffic signal locations.
• Requires land acquisition for widened roadway.
• Impacts adjacent properties by limiting driveway access to and from Rice Street to right turns in and out only.
Sub-Study 5
Rice Street 4-Lane Divided Corridor
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Rice-C2
6/22/2016

PROJECT CONTACTS:

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605-977-7740 or jason.kjenstad@hdrinc.com

Dave Meier – HDR Engineering, Inc.
402-399-1068 or Dave.Meier@hdrinc.com

Shannon Ausen – City of Sioux Falls
605-367-8607 or sausen@siouxfalls.org

Steve Gramm – SDDOT Project Development
605-773-6641 or steve.gramm@state.sd.us

Interstate 229 Major Investment Study

Exit 7 – Rice Street

Thanks for Attending!!!!!

HDR

Cliff Avenue

June 22nd, 2016

- Meeting Notes
- Sign-In Sheets
- Comments
- PowerPoint Slides

Meeting Minutes

Project:	I-229 Major Investment Corridor Study, PL 0100(87) 3616P, PCN 044K
Subject:	Stakeholder Meeting and Public Meeting– Sub-study 6 – Cliff Avenue Exit 4
Date:	Wednesday, June 22, 2016
Location:	Sioux Falls Convention Center Conference Room 6
Attendees:	See Attached Sign In Sheet – 8 Participants

Follow-up discussion items included:

1. What about pedestrian access along Cliff Ave? Response: Providing pedestrian access along both sides of Cliff Ave is being proposed.

2. For Concept Cliff-4, why are property impacts shown described as “neutral”? The impacts look severe along Pam Rd.

3. Resident on Pam Rd – Proposed concepts will add noise to neighborhood.

4. Lincoln High School – Like Concepts Cliff-4 and Cliff-8 that include the 41st St relocation aligned with an entrance to the high school and signalized access to Cliff Ave. About half of the high school related traffic is to and from the south.

5. South 10th/38th St Resident – Parents can’t get in to Lincoln High School to pick up children. They park in the neighborhood west of Cliff Ave and the students cross Cliff Ave at random locations.

6. Lincoln High School – Adding a median on Cliff Ave will force school traffic into the school driveway loop. The school bus stop location was moved to 38th & S 10th from its previous location on Cliff Ave in recent years to help direct students to the designated pedestrian crossing on Cliff Ave.

7. Lincoln High School was asked if the existing Cliff Ave pedestrian crossing functions acceptably. The high school responded that some confusion has been noted. Operations are better in the morning peak period than the afternoon peak. It was noted that nearby residents hear vehicle screeching tires at night when the pedestrian crossing is activated. A comment was made that relocating the crossing to 38th St would help. The City noted that Lincoln High School and the City did discuss locating the crossing at the 38th St intersection before the existing midblock location was selected.

8. Will widening Cliff Ave bring more traffic? Response: Traffic volumes on Cliff Ave are approximately 15,000 vehicles/day north of I-229 and about 20,000 vehicles/day between the I-229 ramp terminal intersections. Traffic volumes have been consistent over the last five years.

9. Will it be possible to reduce truck traffic on Cliff Ave? Response: Cliff Ave is a designated truck route and that designation is unlikely to be removed.

10. What is the timeline for completion of the I-229 study? Response: Stakeholder and public comments will be reviewed followed by screening and some refinement of the concepts. A priority plan for potential projects will be the final study step. The study should wrap up in late 2016.

11. Lincoln High School – The high school prefers Concept Cliff-4, but would prefer that the proposed 41st St realignment be modified to stay south of the high school property line.

12. A right turn lane for southbound traffic at the park entrance south of the Cliff Ave bridge over the Big Sioux River is needed.

13. Although Cliff Ave has two southbound through lanes to the East 49th St intersection, drivers treat Cliff Ave as single lane going southbound up the hill toward East 49th. Response: Plans exist to extend a four lane section on Cliff Ave south of East 49th St.

14. Who owns the old railroad right of way? Response: The City owns the former railroad property.

15. Why is the connection from Pam Rd to South 10th Ave shown on Concept Cliff-6? Response: The purpose of the proposed connection is local street continuity and access to properties unaffected by the proposed realignment of East 41st St.

16. Consider using the old railroad right of way for street improvements instead of widening on 41st St. Response: Widening on 41st St is proposed to add lane capacity near Cliff Ave because the existing right of way along 41st St is wider than the former railroad right of way.

CITY OF SIOUX FALLS PUBLIC WORKS
Providing a Better Quality of Life for You!

Sign In Sheet

Subject I-229 Major Investment Corridor Study – Public Meeting for Cliff Avenue Sub-Study
Client City of Sioux Falls/South Dakota Department of Transportation
Project PL 0100(87) 3616P, PCN 044K   **Project No.:** 207030
Meeting Date Wednesday, June 22, 2016 7:00 PM   **Meeting Location:** Sioux Falls Convention Center

Please print clearly. Thank you.

	Name	Address	Best Contact Phone	Email
1	Christina Bennett	700 E Broadway Ave Pierre	773-4757	Christina.Bennett@state.sd.us
2	Andy Vandel	Pierre	773-4421	andy.vandel@state.sd.us
3	Pete Longman	Pierre	773-6488	pete.longman@state.sd.us
4	Dean Delashmutt	1207 N Violet Pl. Sioux Falls		
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CITY OF SIOUX FALLS PUBLIC WORKS

HDR

Sign In Sheet

Subject I-229 Major Investment Corridor Study – Public Meeting for Cliff Avenue Sub-Study

Client City of Sioux Falls/South Dakota Department of Transportation

Project PL 0100(87) 3616P, PCN 044K **Project No.:** 207030

Meeting Date Wednesday, June 22, 2016 7:00 PM **Meeting Location:** Sioux Falls Convention Center

Please print clearly. Thank you.

	Name	Address	Best Contact Phone	Email
1	Steve Gramm	700 E. Broadway Ave	773-6641	steve.gramm@state.sd.us
2	Jason Kjergsted	6700 S. Old Village Pl, SF, SD	977-7740	jason.kjergsted@hdrinc.com
3	Paul Nikolas	5316 W 60th St. N SF, SD	367-5680	paul.nikolas@state.sd.us
4	Rob Leonhardt	2001 Cardinal Dr	331-5074	
5	Courtney & Jerry Helke	3709 S. Slaten Park Dr.	376-8286	Helkes@sio.midco.net
6	Evelyn Stalheim	905 E. Ram Rd	605-376-2022	evs@sio.midco.net
7	Jud Peterson	1109 S Lance		
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Comment Card

I-229 Major Investment Corridor Study – Cliff Avenue Sub-Study

Public Open House

PL 0100(87) 3616P, PCN 044K

June 22, 2016

Comments:

CLIFF 8 has The Best Concept Because TRAFFIC STREAM IS DRAWN FURTHER AWAY FROM LINCOLN H.S. The Signal AT The School is A very good idea.

Cancel → Suggestion use OLD RR, meeting 41ST, STRAIGHTEN 41ST To ABOUT 9th.

Name: Dean DeLashmutt

Address: 1207 N Violet PL 57103

Phone: 605 496 1108

E-mail:

For your comments to be considered, please return by July 7, 2016.
Comments can also be e-mailed to: sausen@siouxfalls.org

Comment Card

I-229 Major Investment Corridor Study – Cliff Avenue Sub-Study

Public Open House

PL 0100(87) 3616P, PCN 044K

June 22, 2016

Comments:

CLIFF 8 has The Best Concepts Because TRAFFIC STREAM is DRAWN FURTHER AWAY FROM LINCOLN H.S. The Signal AT The School is A very good idea.

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Comments can also be e-mailed to: sausen@siouxfalls.org

Interstate 229 Major Investment Study

Exit 4 – Cliff Avenue

Public Meeting
June 22nd, 2016
7:00 pm to 8:30 pm

HDR

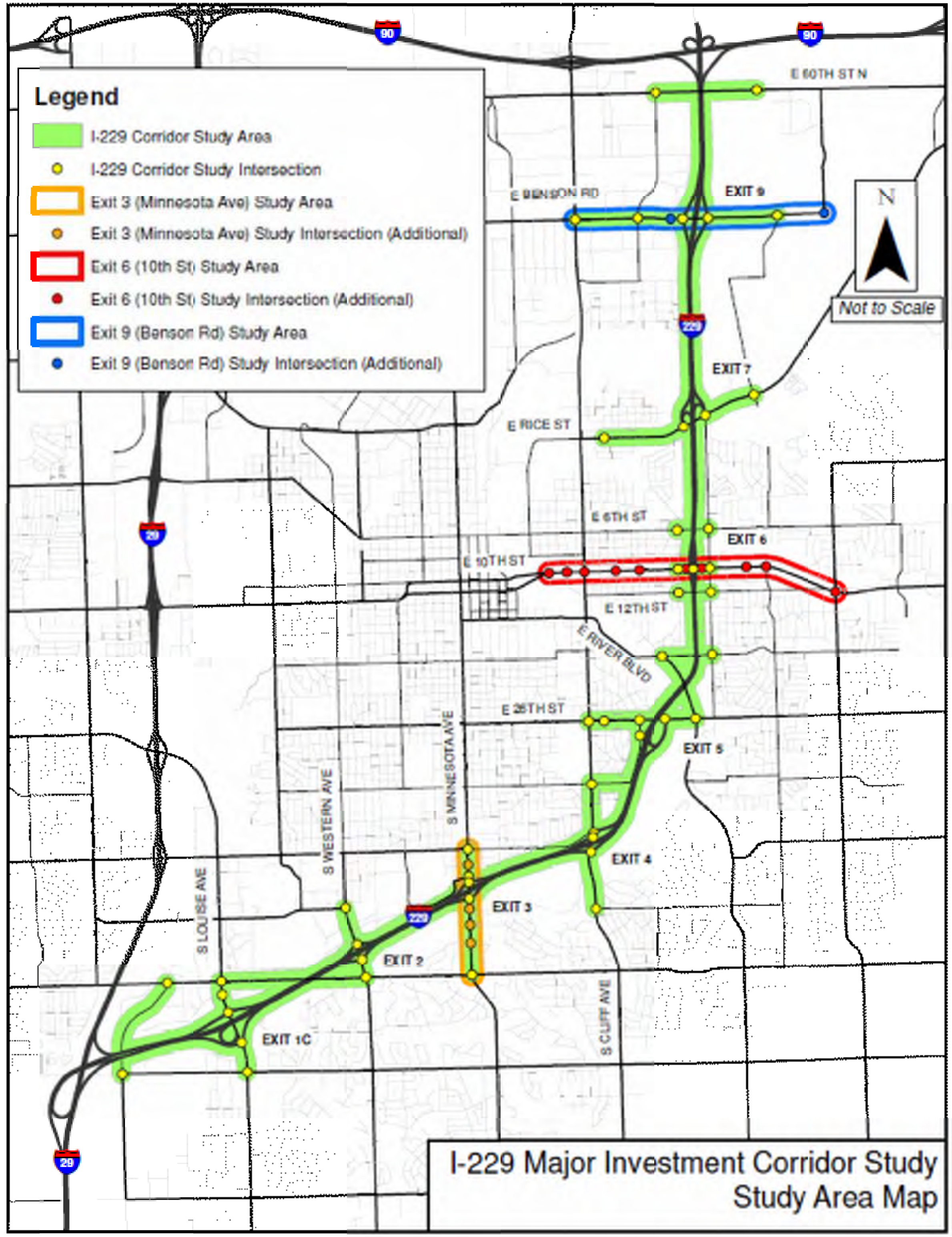
Study Area Map

I-229 Corridor Study

Solberg Avenue Overpass
to
60th Street N. Overpass

Additional Studies

Exit 3 – Minnesota Ave
Exit 6 – 10th Street
Exit 9 – Benson Road
Added Exit 4 – Cliff Avenue
Added Exit 7 – Rice Street



Study Advisory Partners

South Dakota Department of Transportation (SDDOT)

South Dakota Highway Patrol

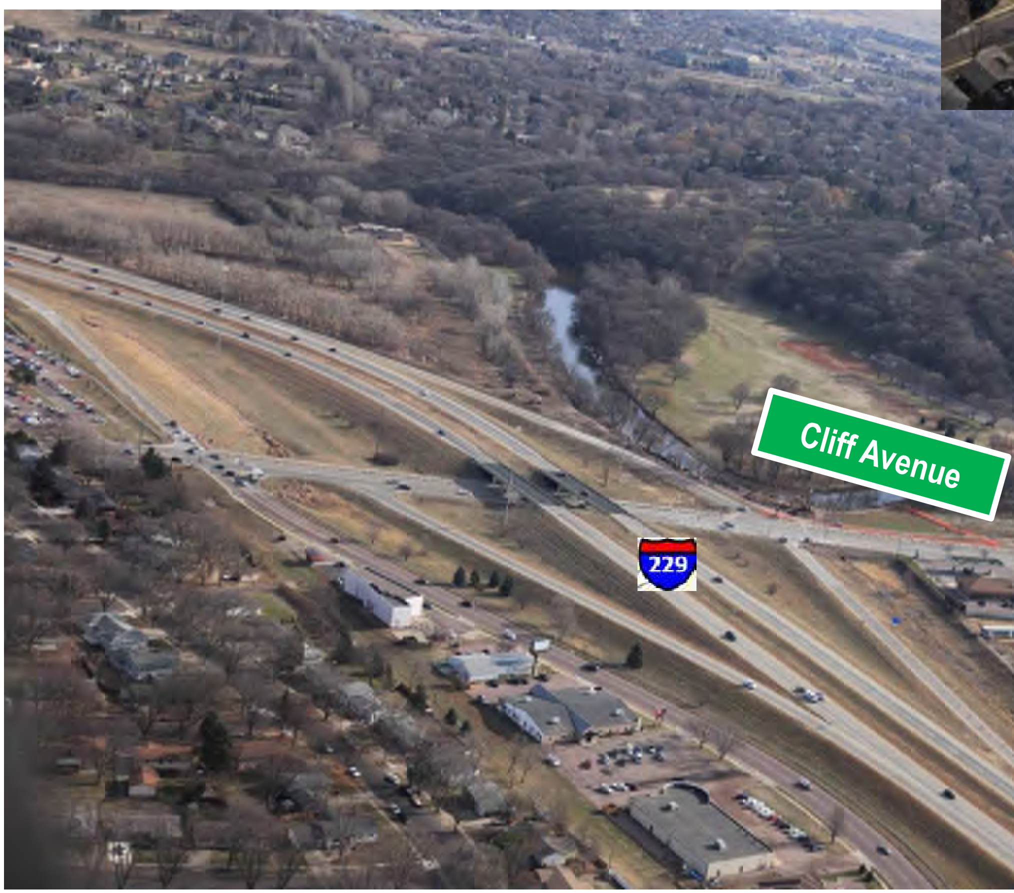
City of Sioux Falls

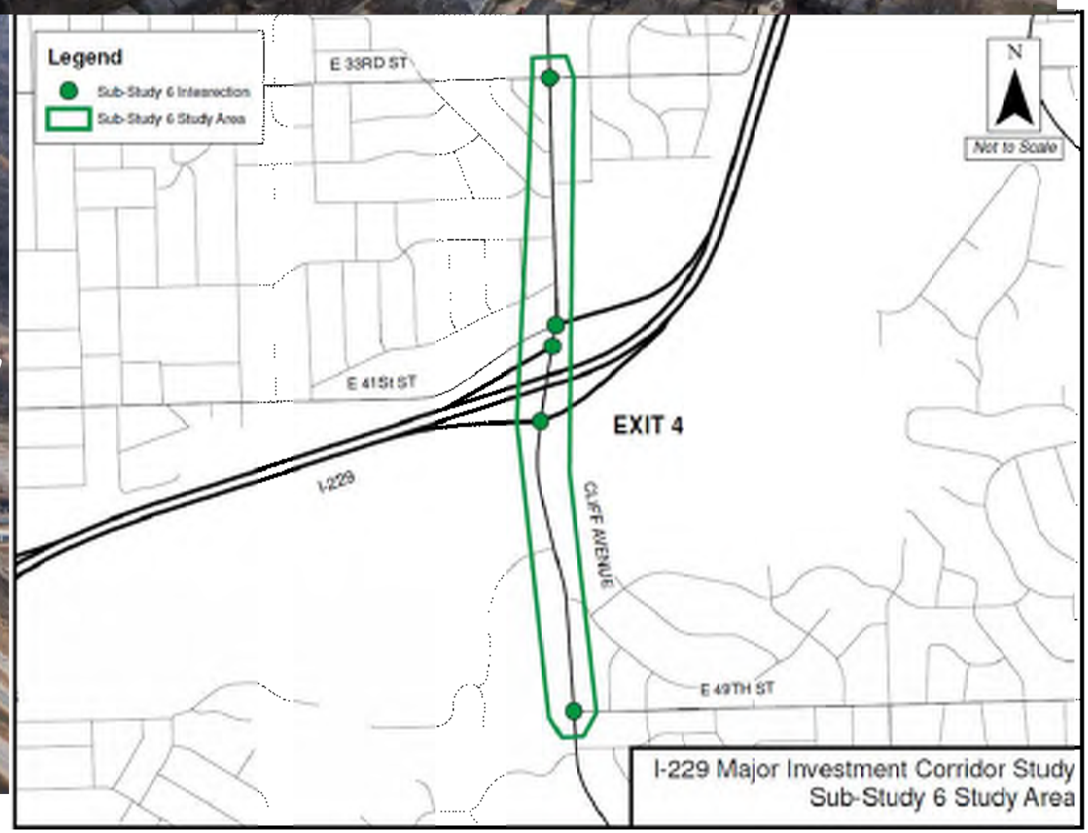
Sioux Falls Metropolitan Planning Organization (MPO)

Federal Highway Administration (FHWA)

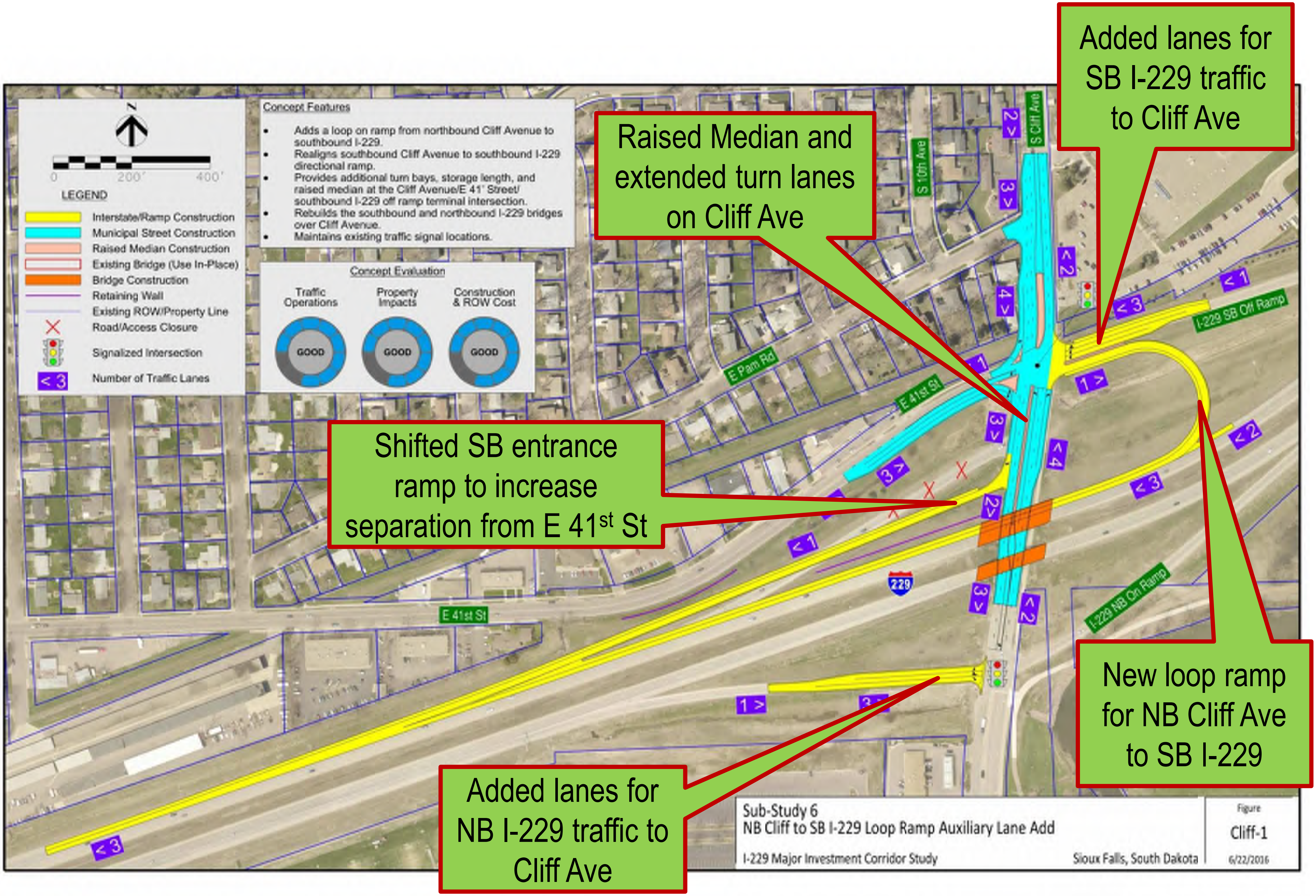
Exit 4 (Cliff Avenue) Sub - Study Goals

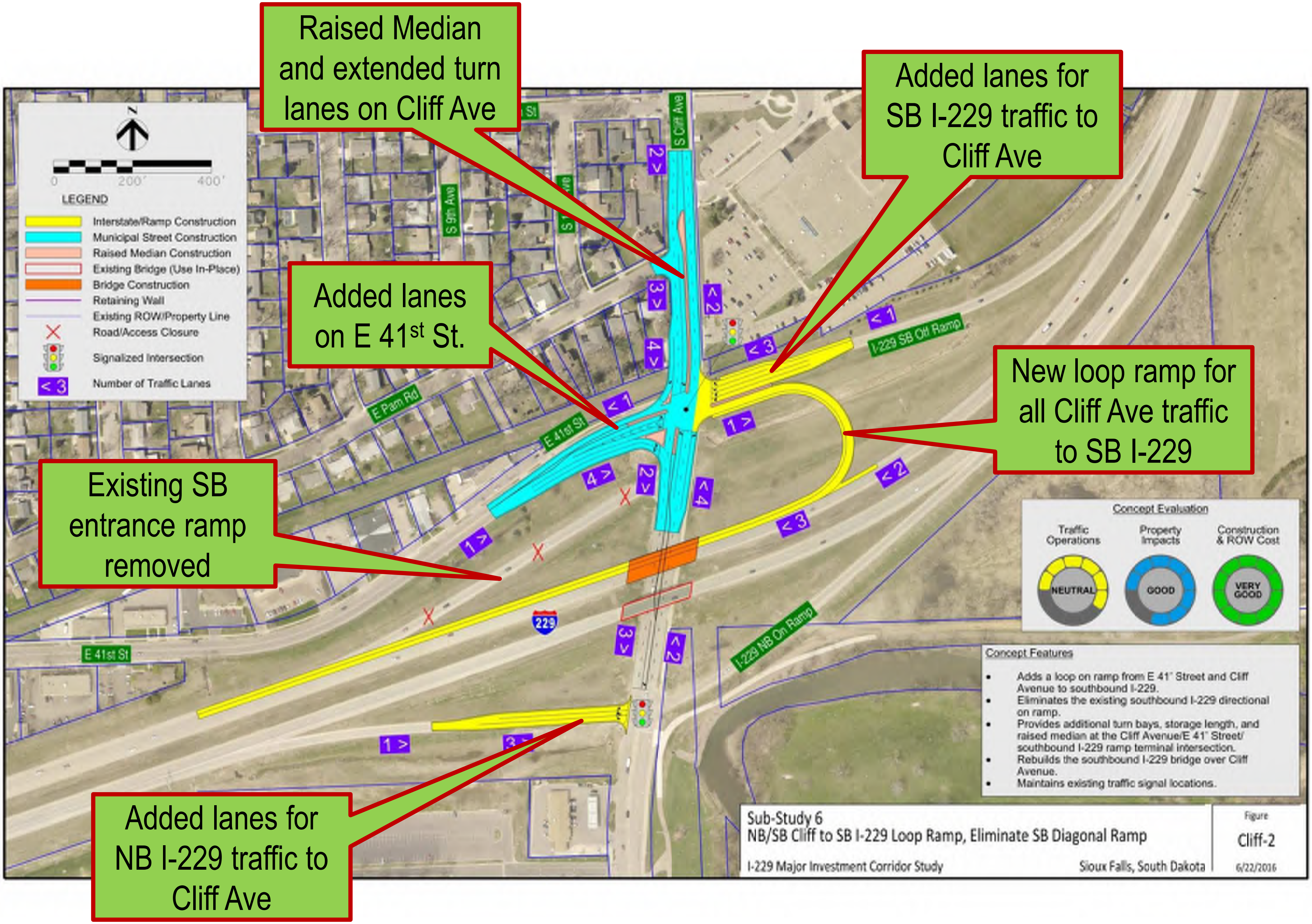
- Reduce traffic congestion
- Develop new geometrics to improve capacity at 41st Street and Interchange
- Improve pedestrian mobility
- Improve safety for corridor users

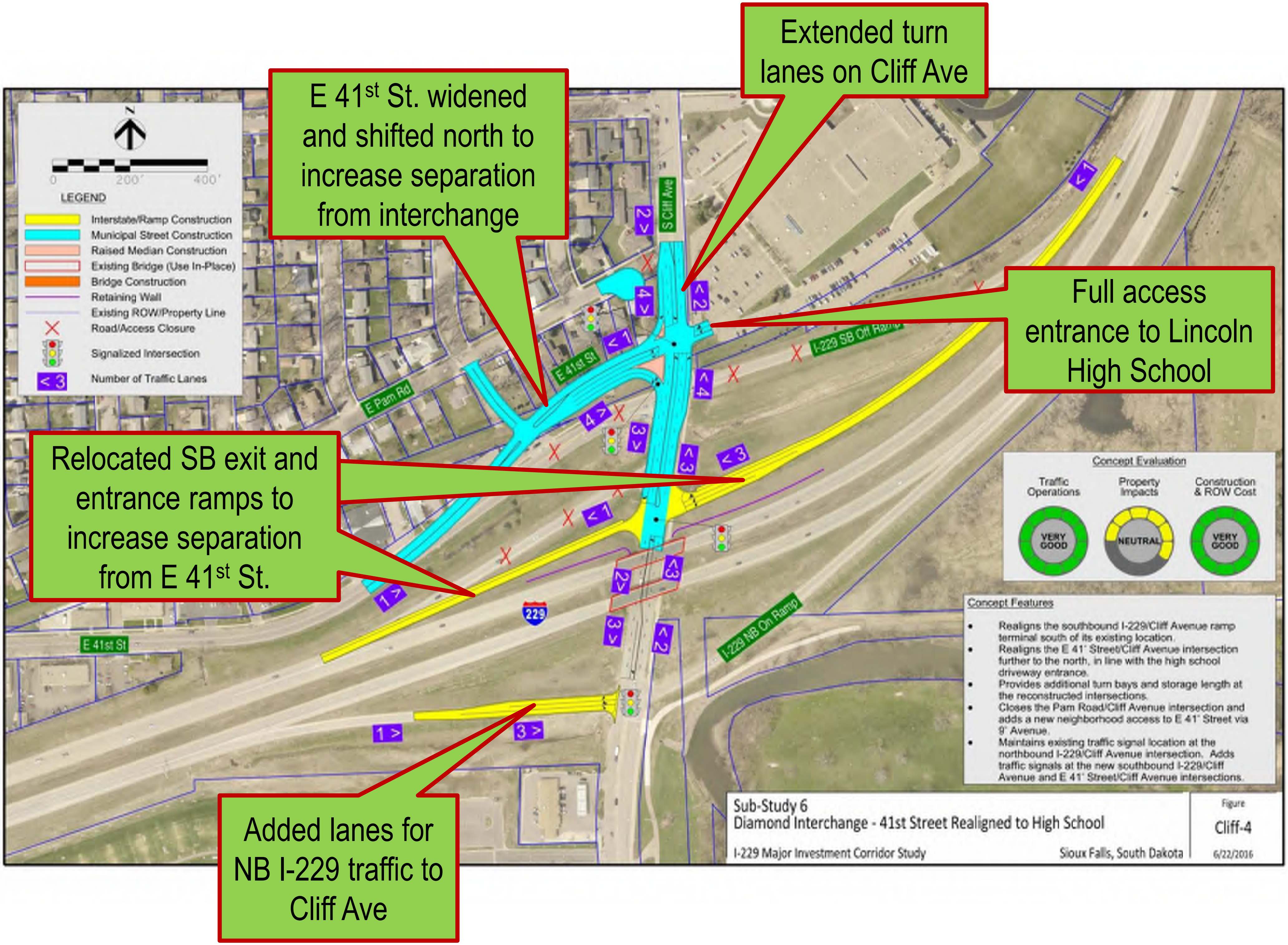




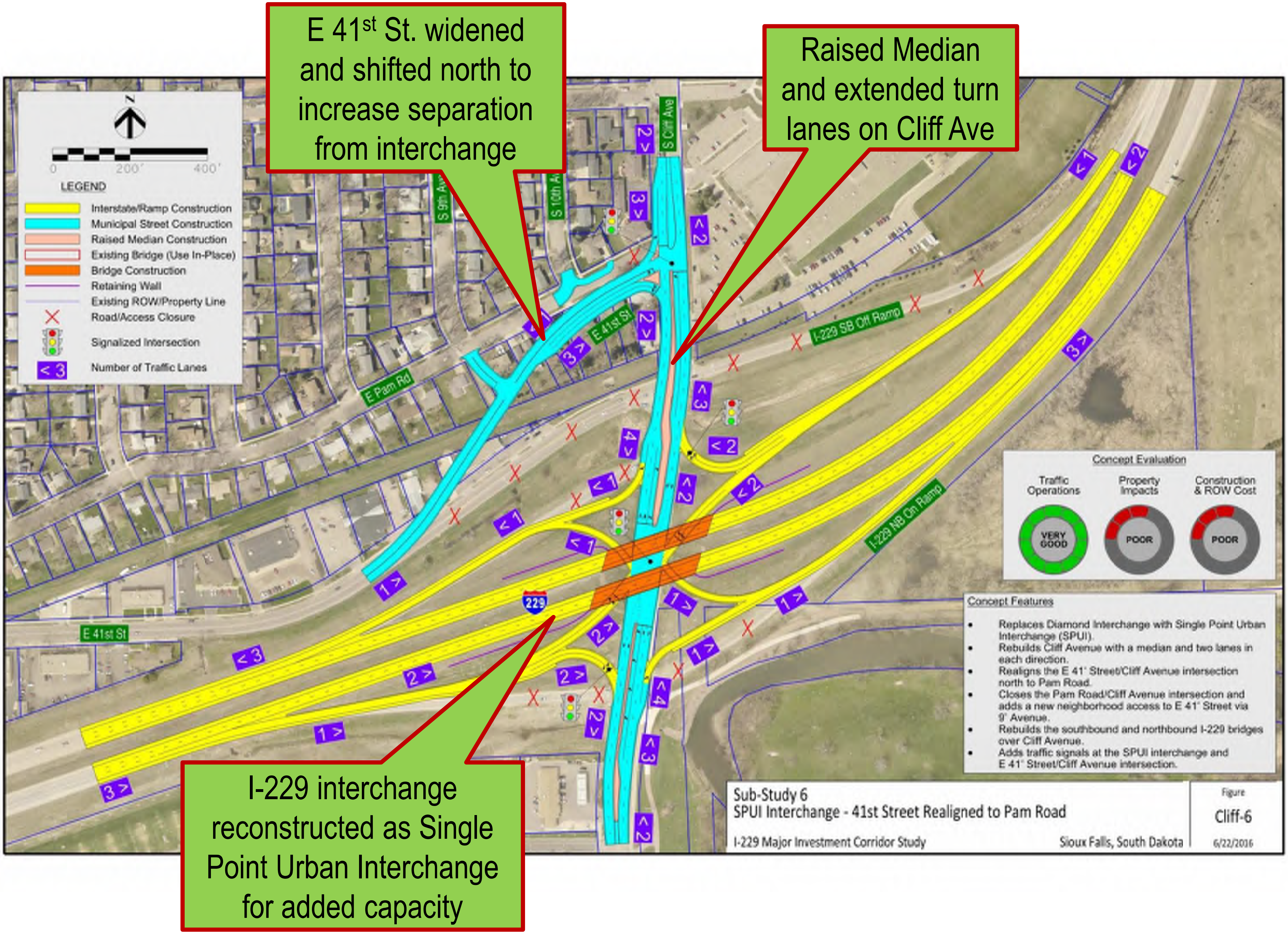

Access to Park close to interchange makes it difficult to exit during peak hour periods
Cliff Avenue
Turn Lane short and few gaps exist to complete left turn movement
229
Cliff Avenue
High Right Turn Volume in the PM Peak Hour
Congestion due to close proximity of 41st Street to I229 SB ON Ramp


Added lanes for SB I-229 traffic to Cliff Ave
Raised Median and extended turn lanes on Cliff Ave
Shifted SB entrance ramp to increase separation from E 41st St
New loop ramp for NB Cliff Ave to SB I-229
Added lanes for NB I-229 traffic to Cliff Ave
N
0 200' 400'
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Existing Bridge (Use In-Place)
Bridge Construction
Retaining Wall
Existing ROW/Property Line
Road/Access Closure
Signalized Intersection
Number of Traffic Lanes
Concept Features
Adds a loop on ramp from northbound Cliff Avenue to southbound I-229.
Realigns southbound Cliff Avenue to southbound I-229 directional ramp.
Provides additional turn bays, storage length, and raised median at the Cliff Avenue/E 41st Street/southbound I-229 off ramp terminal intersection.
Rebuilds the southbound and northbound I-229 bridges over Cliff Avenue.
Maintains existing traffic signal locations.
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
GOOD
GOOD
GOOD
S Cliff Ave
S 10th Ave
E Pam Rd
E 41st St
I-229 SB Off Ramp
I-229 NB On Ramp
229
Sub-Study 6
NB Cliff to SB I-229 Loop Ramp Auxiliary Lane Add
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Cliff-1
6/22/2016

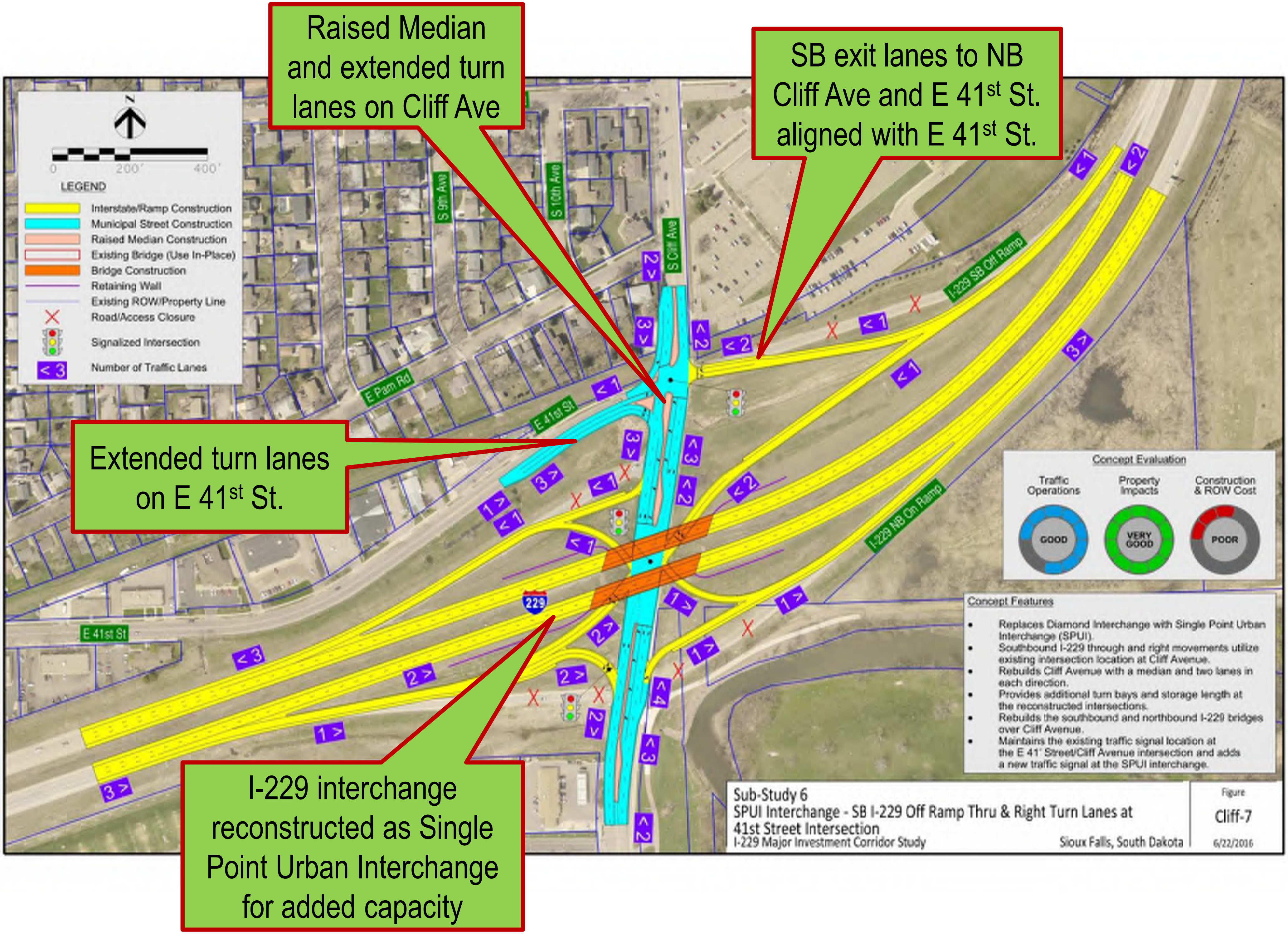

Raised Median and extended turn lanes on Cliff Ave
Added lanes for SB I-229 traffic to Cliff Ave
Added lanes on E 41st St.
New loop ramp for all Cliff Ave traffic to SB I-229
Existing SB entrance ramp removed
Added lanes for NB I-229 traffic to Cliff Ave
N
0 200' 400'
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Existing Bridge (Use In-Place)
Bridge Construction
Retaining Wall
Existing ROW/Property Line
Road/Access Closure
Signalized Intersection
Number of Traffic Lanes
S Cliff Ave
S 9th Ave
E Pam Rd
E 41st St
I-229 SB Off Ramp
I-229 NB On Ramp
229
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
NEUTRAL
GOOD
VERY GOOD
Concept Features
• Adds a loop on ramp from E 41st Street and Cliff Avenue to southbound I-229.
• Eliminates the existing southbound I-229 directional on ramp.
• Provides additional turn bays, storage length, and raised median at the Cliff Avenue/E 41st Street/southbound I-229 ramp terminal intersection.
• Rebuilds the southbound I-229 bridge over Cliff Avenue.
• Maintains existing traffic signal locations.
Sub-Study 6
NB/SB Cliff to SB I-229 Loop Ramp, Eliminate SB Diagonal Ramp
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Cliff-2
6/22/2016

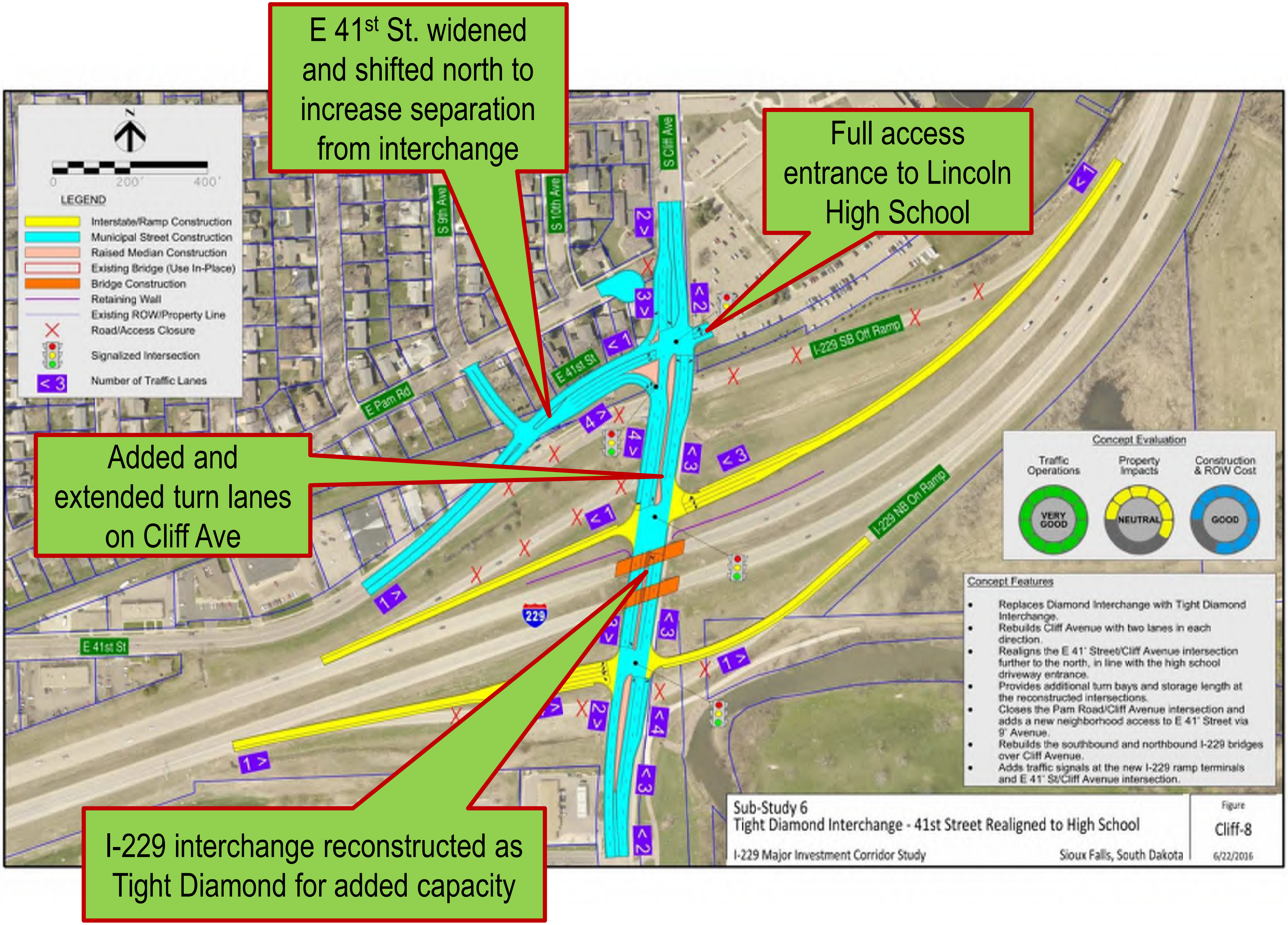


E 41st St. widened and shifted north to increase separation from interchange
Extended turn lanes on Cliff Ave
Full access entrance to Lincoln High School
Relocated SB exit and entrance ramps to increase separation from E 41st St.
Added lanes for NB I-229 traffic to Cliff Ave
N
0 200' 400'
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Existing Bridge (Use In-Place)
Bridge Construction
Retaining Wall
Existing ROW/Property Line
Road/Access Closure
Signalized Intersection
Number of Traffic Lanes
S Cliff Ave
E 41st St
E Pam Rd
I-229 SB Off Ramp
I-229 NB On Ramp
229
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
VERY GOOD
NEUTRAL
VERY GOOD
Concept Features
• Realigns the southbound I-229/Cliff Avenue ramp terminal south of its existing location.
• Realigns the E 41st Street/Cliff Avenue intersection further to the north, in line with the high school driveway entrance.
• Provides additional turn bays and storage length at the reconstructed intersections.
• Closes the Pam Road/Cliff Avenue intersection and adds a new neighborhood access to E 41st Street via 9th Avenue.
• Maintains existing traffic signal location at the northbound I-229/Cliff Avenue intersection. Adds traffic signals at the new southbound I-229/Cliff Avenue and E 41st Street/Cliff Avenue intersections.
Sub-Study 6
Diamond Interchange - 41st Street Realigned to High School
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Cliff-4
6/22/2016



E 41st St. widened and shifted north to increase separation from interchange
Raised Median and extended turn lanes on Cliff Ave
I-229 interchange reconstructed as Single Point Urban Interchange for added capacity
N
0 200' 400'
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Existing Bridge (Use In-Place)
Bridge Construction
Retaining Wall
Existing ROW/Property Line
Road/Access Closure
Signalized Intersection
Number of Traffic Lanes
S Cliff Ave
S 9th Ave
S 10th Ave
E 41st St
E Pam Rd
I-229 SB Off Ramp
I-229 NB On Ramp
229
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
VERY GOOD
POOR
POOR
Concept Features
• Replaces Diamond Interchange with Single Point Urban Interchange (SPUI).
• Rebuilds Cliff Avenue with a median and two lanes in each direction.
• Realigns the E 41st Street/Cliff Avenue intersection north to Pam Road.
• Closes the Pam Road/Cliff Avenue intersection and adds a new neighborhood access to E 41st Street via 9th Avenue.
• Rebuilds the southbound and northbound I-229 bridges over Cliff Avenue.
• Adds traffic signals at the SPUI interchange and E 41st Street/Cliff Avenue intersection.
Sub-Study 6
SPUI Interchange - 41st Street Realigned to Pam Road
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Cliff-6
6/22/2016


Raised Median and extended turn lanes on Cliff Ave
SB exit lanes to NB Cliff Ave and E 41st St. aligned with E 41st St.
Extended turn lanes on E 41st St.
I-229 interchange reconstructed as Single Point Urban Interchange for added capacity
N
0
200'
400'
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Existing Bridge (Use In-Place)
Bridge Construction
Retaining Wall
Existing ROW/Property Line
Road/Access Closure
Signalized Intersection
Number of Traffic Lanes
S 9th Ave
S 10th Ave
S Cliff Ave
E Pam Rd
E 41st St
I-229 SB Off Ramp
I-229 NB On Ramp
229
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
GOOD
VERY GOOD
POOR
Concept Features
• Replaces Diamond Interchange with Single Point Urban Interchange (SPUI).
• Southbound I-229 through and right movements utilize existing intersection location at Cliff Avenue.
• Rebuilds Cliff Avenue with a median and two lanes in each direction.
• Provides additional turn bays and storage length at the reconstructed intersections.
• Rebuilds the southbound and northbound I-229 bridges over Cliff Avenue.
• Maintains the existing traffic signal location at the E 41' Street/Cliff Avenue intersection and adds a new traffic signal at the SPUI interchange.
Sub-Study 6
SPUI Interchange - SB I-229 Off Ramp Thru & Right Turn Lanes at 41st Street Intersection
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Cliff-7
6/22/2016



E 41st St. widened and shifted north to increase separation from interchange
Full access entrance to Lincoln High School
Added and extended turn lanes on Cliff Ave
I-229 interchange reconstructed as Tight Diamond for added capacity
N
0 200' 400'
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Existing Bridge (Use In-Place)
Bridge Construction
Retaining Wall
Existing ROW/Property Line
Road/Access Closure
Signalized Intersection
Number of Traffic Lanes
S Cliff Ave
S 9th Ave
S 10th Ave
E 41st St
E Pam Rd
I-229 SB Off Ramp
I-229 NB On Ramp
229
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
VERY GOOD
NEUTRAL
GOOD
Concept Features
• Replaces Diamond Interchange with Tight Diamond Interchange.
• Rebuilds Cliff Avenue with two lanes in each direction.
• Realigns the E 41st Street/Cliff Avenue intersection further to the north, in line with the high school driveway entrance.
• Provides additional turn bays and storage length at the reconstructed intersections.
• Closes the Pam Road/Cliff Avenue intersection and adds a new neighborhood access to E 41st Street via 9th Avenue.
• Rebuilds the southbound and northbound I-229 bridges over Cliff Avenue.
• Adds traffic signals at the new I-229 ramp terminals and E 41st St/Cliff Avenue intersection.
Sub-Study 6
Tight Diamond Interchange - 41st Street Realigned to High School
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Cliff-8
6/22/2016

PROJECT CONTACTS:

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Brian Ray– HDR Engineering, Inc.
402-548-5066 or Brian.Ray@hdrinc.com

Shannon Ausen – City of Sioux Falls
605-367-8607 or sausen@siouxfalls.org

Steve Gramm – SDDOT Project Development
605-773-6641 or steve.gramm@state.sd.us

Interstate 229 Major Investment Study
Exit 4 – Cliff Avenue

Thanks for Attending!!!!!

APPENDIX -

PUBLIC MEETING #3 – DECEMBER 6TH, 2016

- SIGN-IN SHEETS
- COMMENTS
- POWERPOINT SLIDES
- MEETING NOTES (SEE STAKEHOLDER MEETINGS #2 APPENDIX)

Sign In Sheet

Subject I-229 Major Investment Corridor Study – Public Meeting
Client City of Sioux Falls/South Dakota Department of Transportation
Project PL 0100(87) 3616P, PCN 044K **Project No.:** 207030
Meeting Date Tuesday, December 6th, 2016 6:00 PM **Meeting Location:** Sioux Falls Convention Center

Please print clearly. Thank you.

	Name	Address	Best Contact Phone	Email
1	Bruce Wichters	3226 S Sorcerer Tr	605-254-4375	
2	Lee Miller	905 E. 34th St.	605-310-9643	
3	Mark Elrason	101 S Cleveland	605-338-6221	
4	Pete Longman	SDDOT Pierre	773-6488	
5	Joe Boyt	2533 E Harriet Lea	206-484-2698	
6	Jo Wahle		605-351-0658	
7	Luke Henriksen	2200 S Shaw Aves 57106	605 321-5040	
8	Riley Hosman	Brandon, SD	951-5391	rhos1205@gmail.com
9	Bob Bohm	1116 S 4th Ave	605 334 4220	
10	Gerald Teunissen	808 Jana Lane	605-366-1979	gerald@benderco.com
11	Judy Mickalowski		605-521-6345	
12	Carson Bower	25225 474th Ave Garretson SD	605-594-6431	
13	Joe Parente	3512 S Alpine SF		
14	Mark Meyer	1504 W. Mosby ST SF	605 275 2667	
15	Travis Krebs	2405 S Glendale Av	605 254 8651	
16	Sharon Fix	301 N. Marquette Ave 57110	605-335-6001	
17	Jon Smith	941 S Grandview 57103	334-5869	jdsmith@sio.midco.net
18	Allan Kostboth	1205 E. 38th St. 57105	940-2721	kostboth@sio.midco.net
19	Dennis Olsen	2608 E Winston Cir 57108	978-3980	dennis.olsen@medvantx.com
20	Dale Froehlich	West Valley Chateau 6 So Le SF, SD 57105	201-9810	

Sign In Sheet

Subject I-229 Major Investment Corridor Study – Public Meeting

Client City of Sioux Falls/South Dakota Department of Transportation

Project PL 0100(87) 3616P, PCN 044K **Project No.:** 207030

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	Name	Address	Best Contact Phone	Email
1	Steve Gramm	700 E. Broadway Ave.	773-6641	steve.gramm@state.sd.us
2	Dean DeLaSamutt	1207 N Violet Pl	4961108	
3	Paul Nikolas	5314 W 60th St. N.	367-5680	Paul.Nikolas@state.sd.us
4	Brad Remmich	SDDot – Pierre	773-3093	bradley.remmich@state.sd.us
5	Sarah Schafer	117 E Twin Oaks Pl #53	338-5741	—
6	gary busselman	7201G Madison ST Sioux Falls SD 57110	605 334 5692	gary@garybuss;com
7	Bruce Card	4815 E Harvest Hill Dr. S F SD 57110	605-261-1627	bcard@amerstest.com
8	Amber Gibson	500 N Western Ave Ste 100 SFSD 57104	605-367-5390	amber@secog.org
9	Bart Brost	48005 Oak Trail Pl SF, SD 57108	605-310-8628	brostbart@showplacewood.com
10	Lanny Bleum	6300 E 26th SF SD 57110	605 332-7391	
11	Kim Blackburn	2708 S 10	940-7508	FryinPanmrsguy@hotmail.c
12	Mark Skadsen	25952 476th Ave	351-9512	
13	Jason Kjenstad	6300 S. Old Village Pl Suite 100	977-7740	jason.kjenstad@hdrinc.com
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Sign In Sheet

Subject I-229 Major Investment Corridor Study – Public Meeting
Client City of Sioux Falls/South Dakota Department of Transportation
Project PL 0100(87) 3616P, PCN 044K **Project No.:** 207030
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Please print clearly. Thank you.

	Name	Address	Best Contact Phone	Email
1	Shannon Ausen	224 W 9th St SF SD	367-8607	sausen@siouxfalls.gov
2	Jason Kjenstad	6900 S. Old Village Pl Suite 100 SF SD	977-7740	jason.kjenstad@hdrinc.com
3	Mark Hoines	116 E. Dakota Ave Pierre, SD	776-1010	mark.hoines@dot.gov
4	Steve Painter	4101 S. Western	359-8525	
5	Andy Vandel	SDDOT Pierre	773-4421	andy.vandel@state.sd.us
6	Jeff Hanssen	3101 W. Auburn Hills Ct	310-6280	jeff.hanssen@kneipgroup.com
7	Charlie Kneip	3066 W. Pontiac Sioux Falls	359-9451	charles.kneip@kneipgroup.com
8	Mitch Brandner	830 E 41st St, SF SD.	605-366-2404	mitch.brandner@gmail.com
9	Josh Larson	2208 S Sheffield SF SD	605-271-1609	joshuadavid@hotmail.com
10	Debi Schafer	2300 S Jefferson SF SD	605 310 2698	—
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

I-229 Major Investment Corridor Study

PL 0100 (87) 3616P, PCN 044K

South Dakota DOT — Connecting South Dakota and the Nation

CITY OF SIOUX FALLS PUBLIC WORKS — Providing a Better Quality of Life for You!

WE WANT TO KNOW WHAT YOU THINK! What are your concerns? What issues does the study team need to overcome with this project? What problems do you foresee? Please submit your comments before December 22, 2016 to:

Mail: *HDR Engineering, Inc.*
ATTN: Jason Kjenstad
6300 S. Old Village Place, Suite 100
Sioux Falls, SD 57108-2102

E-mail: *Jason.Kjenstad@hdrinc.com*

Fax: *605-977-7747*

Very much like improved pedestrian/bike access on all options. Of the 3 current options, Cliff 1 + 7 have less property owner impact (good). Cliff 7 appears to have less impact on affordable housing. Cliff 6 would feed Lincoln H.S. traffic right onto 41ST - probably not a good idea. Intersection of Cliff + 41ST at LHS would be a real mess 7:30-9 AM + 3-4:15 pm (current LHS busiest times. It's already not a favorite time/place for bus + paratransit drivers + commuters.

(optional)
Name: Wendy Butler-Boyesen
Address: 1104 E. Pam Rd.
Phone: 605-906-1203
Email: wbutlerboyesen@gmail.com

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E-mail: *Jason.Kjenstad@hdrinc.com*

Fax: *605-977-7747*

Website very useful → advertise on marquee sign please!

Thanks for making considerations for cyclists!

(optional)
Name: Riley Hosman
Address: 1205 Parkview blvd, Brandon
Phone: 951-5391
Email: rhos1205@gmail.com

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E-mail: *Jason.Kjenstad@hdrinc.com*

Fax: *605-977-7747*

DONT INSTALL A DIVIDED Median ON Bacon Prevents Left turns FROM the SOUTH

(optional) Name: CHRIS RANS

Address: 3412 N. POTSDAM

Phone: 338-9110

Email: CHRIS@SUNKOTA CONSTRUCTION.com

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Sioux Falls, SD 57108-2102

E-mail: *Jason.Kjenstad@hdrinc.com*

Fax: *605-977-7747*

Divider (median) along Minn from 41st south makes no sense. Will not improve safety. Will negatively impact retail business. How will access be maintained during construction and long term. NO GOOD ACCESS TO STAPLES / Dollar Tree

(optional) Name: Dave McElroy

Address: 3310 S Minn Ave

Phone: 605-338-9515

Email: mcelroy.dave@gmail.com

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ATTN: Jason Kjenstad
6300 S. Old Village Place, Suite 100
Sioux Falls, SD 57108-2102

E-mail: *Jason.Kjenstad@hdrinc.com*

Fax: *605-977-7747*

DO NOT INSTALL A RAISED Median ON BENSON to ELIMINATE LEFT Turns From the SOUTH

(optional) Name: CHRIS RAWS

Address: 3412 N. POTSDAM AVE.

Phone: 338-9110

Email: CHRIS@ SUNKOTA CONSTRUCTION AVE.

I-229 Major Investment Corridor Study

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Sioux Falls, SD 57108-2102

E-mail: *Jason.Kjenstad@hdrinc.com*

Fax: *605-977-7747*

Like Mn Ave 2D
" 10 st 2 B/C
" Bensoy 1A — Suggest doing Southbound Ramp prior to worrying about NB Ramp
" Rice 3C — no need to move SB 229 Ramp
" Cliff 1

(optional) Name: Lanny Bogan

Address: 6300 E 26th St

Phone: 332-7391

Email: SQDAS@SiouxMidco.net

Kjenstad, Jason

From: Gary Busselman <gary@garybuss.com>
Sent: Wednesday, December 07, 2016 5:27 PM
To: Kjenstad, Jason
Cc: Nancy Busselman
Subject: I-229 E 10th St Exit COMMENT

I-229 Major Investment Corridor Study
HDR Engineering Inc
ATT: Jason Kjenstad
6300 S. Old Village Place, Suite 100
Sioux Falls SD 57108-2102

Jason.Kjenstad@hdrinc.com

Fax: 605-977-7747

December 7, 2016

RE: 2700 & 2704 E 10th St
Loss of either of the two approaches or the front parking/pass through will amount to a virtual condemnation and will likely result in an inverse condemnation action. Either buy my property or don't damage it so I can't use it as is or sell it to somebody else.

Gary Busselman
STEM LLC
7201 E Madison St
Sioux Falls, SD 57110
605-334-5692
gary@garybuss.com

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Sioux Falls, SD 57108-2102

E-mail: *Jason.Kjenstad@hdrinc.com*

Fax: *605-977-7747*

I have a tenant in 3508 S. Minesota Ave.
Access off of Minesota Ave & being able to turn
onto 43rd St. when heading S. on Minesota Ave to
access the business is important to the rentability
of these businesses and customer access.

...: Jeff Mindt
...: 360-6108

Address: 801 E. 38th St. SF, SD 57105
Email: jmindt68@gmail.com

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6300 S. Old Village Place, Suite 100
Sioux Falls, SD 57108-2102

E-mail: *Jason.Kjenstad@hdrinc.com*

Fax: *605-977-7747*

No Build -
Keep 43rd Street open to Minnesota Ave for N + S Bound traffic
No median

(optional) Name: Tom Hein

Address:

Phone: 361-8400

Email: theinmail@gmail.com

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6300 S. Old Village Place, Suite 100
Sioux Falls, SD 57108-2102

E-mail: *Jason.Kjenstad@hdrinc.com*

Fax: *605-977-7747*

No Build
Keep 43rd Street open to Minnesota Ave for N + S bound Traffic
No Median.

(optional)
Name: Mary Hein
Address:
Phone: 361-8400
Email: theinmail@gmail.com

I-229 Major Investment Corridor Study

PL 0100 (87) 3616P, PCN 044K

www.i229study.com

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6300 S. Old Village Place, Suite 100
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E-mail: *Jason.Kjenstad@hdrinc.com*

Fax: *605-977-7747*

December 7, 2016

RE: 2700 & 2704 E 10th St

Loss of either of the two approaches or the front parking/pass through will amount to a virtual condemnation and will likely result in an inverse condemnation action. Either buy my property or don't damage it so I can't use it as is or sell it to somebody else.

(optional) Name: Gary Busselman STEM LLC

Address: 7201 E Madison St Sioux Falls, SD 57110

Phone:

Email: 605-334-5692 gary@garybuss.com

I-229 Major Investment Corridor Study

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6300 S. Old Village Place, Suite 100
Sioux Falls, SD 57108-2102

E-mail: *Jason.Kjenstad@hdrinc.com*

Fax: *605-977-7747*

I think your design which hooks up with 49th ST going west makes most sense.

(optional)
Name: Mary Montoya
4809 S Twin Ridge Rd
Sioux Falls, SD 57108

Address:

Phone:

Email: mary.montoya@sio.midco.net

Kjenstad, Jason

From:	Robert Reitz <tooferguy007@gmail.com>
Sent:	Monday, December 19, 2016 9:39 AM
To:	Tom Hein; Kjenstad, Jason
Cc:	Shally Rogen; Jeff R. Mindt; Eric & Mary Stormo; Brian Sather
Subject:	Re: I229 and Minnesota Layouts

Please consider access to Minnesota Crossing {3508 S Minnesota Ave} for southbound traffic on Minnesota Ave by narrowing the island to permit a left turn lane for entry to the middle access on the above mentioned property. Otherwise we strongly suggest NO BUILD!

On Tue, Dec 13, 2016 at 8:25 AM, Tom Hein <theinmail@gmail.com> wrote:
Please review DOT options below for destroying our property and access. Be sure to complete the I-229 Major Investment Corridor Study 'We want to know what you think" card and return it to HDR Engineering or Jason.Kjenstad@hdrinc.com with your thoughts. I highly encourage to have a **"No Build"** option which leaves our access points and does not provide a median to prevent our south bound customers from getting into our property.
Please reply.
Thanks,
Tom

---------- Forwarded message ----------
From: **Kjenstad, Jason** <Jason.Kjenstad@hdrinc.com>
Date: Fri, Dec 9, 2016 at 6:04 AM
Subject: Fwd: I229 and Minnesota Layouts
To: Thomas Hein <theinmail@gmail.com>

FYI Tom

Jason Kjenstad 605 360 6595

Begin forwarded message:

> **From:** "Kjenstad, Jason" <Jason.Kjenstad@hdrinc.com>
> **To:** "jmbliss628@aol.com" <jmbliss628@aol.com>
> **Cc:** "Kjenstad, Jason" <Jason.Kjenstad@hdrinc.com>
> **Subject: I229 and Minnesota Layouts**
>
> FYI Rich
>
> **Jason Kjenstad,** PE, LSIT
>
> *Vice President – Dakota's & Wyoming Transportation Operations Manager*
>
> **HDR**
>
> 6300 South Old Village Place
> Suite 100

I-229 Major Investment Corridor Study
HDR Engineering Inc
ATT: Jason Kjenstad
6300 S. Old Village Place, Suite 100
Sioux Falls SD 57108-2102

Jason.Kjenstad@hdrinc.com

Fax: 605-977-7747

December 7, 2016

RE: 2700 & 2704 E 10th St
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Gary Busselman

Gary Busselman
STEM LLC
7201 E Madison St
Sioux Falls, SD 57110
605-334-5692
gary@garybuss.com

Kjenstad, Jason

From: Brian Sather <gdentltd@hotmail.com>
Sent: Monday, December 19, 2016 2:00 PM
To: Kjenstad, Jason; Jeff R. Mindt; Tom Hein; Shally Rogen; Eric & Mary Stormo; Bob Reitz

Subject: I-229 Major Investment Corridor Study

As one of the owners of property at 3508 S. Minnesota Ave.(#108), I recommend a left turn from a turning lane for southbound traffic into the only remaining access opening on the north side. Also, there is no adequate access in these plans to the south of the building for delivery vehicles, trash haulers, and employees. If these concerns can not be corrected, I recommend a "No Build" as the option.

Brian Sather
gdentltd@hotmail.com

Kjenstad, Jason

From: Malmberg, Chris
Sent: Thursday, December 22, 2016 7:40 AM
To: Meier, Dave; Kjenstad, Jason
Subject: FW: Fryn' Pan Family Restaurant

Didn't know if this made it to you.

Chris Malmberg, PE, ENV SP
D 402.399.4959 **M** 402.212.8136

hdrinc.com/follow-us

From: Stan Mitzel [mailto:smitzel@frynpan.net]
Sent: Wednesday, December 21, 2016 3:50 PM
To: sausen@siouxfalls.org; steve.gramm@state.sd.us; Malmberg, Chris
Cc: Dave Stukel; Rick Weisser
Subject: Fryn' Pan Family Restaurant

Shannon,

I was just looking at the proposed project of the 10 th street corridor as it affects my business at 10th and Cleveland; If we are forced to move because the improvements are causing detrimental effects, I think a good relocation for us would be to take over the old Godfathers building along with the bank lot to the east. This would provide enough parking for us and a suitable location to make our business viable. It seems these lots have been continually vacant the last few years. Just thought I would share my thoughts as this project is very concerning to myself and partners and we would like to know where we stand sooner rather than later.

Thanks for your time,

Stan Mitzel
Fryn' Pan Family Restaurant
3215 S. Carolyn Ave
Sioux Falls, SD 57106
Office: 605.361.7804
Cell: 605.201.5141
Fax: 605.361.7921
smitzel@frynpan.net

INTERSTATE 229 MAJOR INVESTMENT STUDY

Informational Meeting

December 6th, 2016
6:00 pm to 8:00 pm

HDR HRGreen

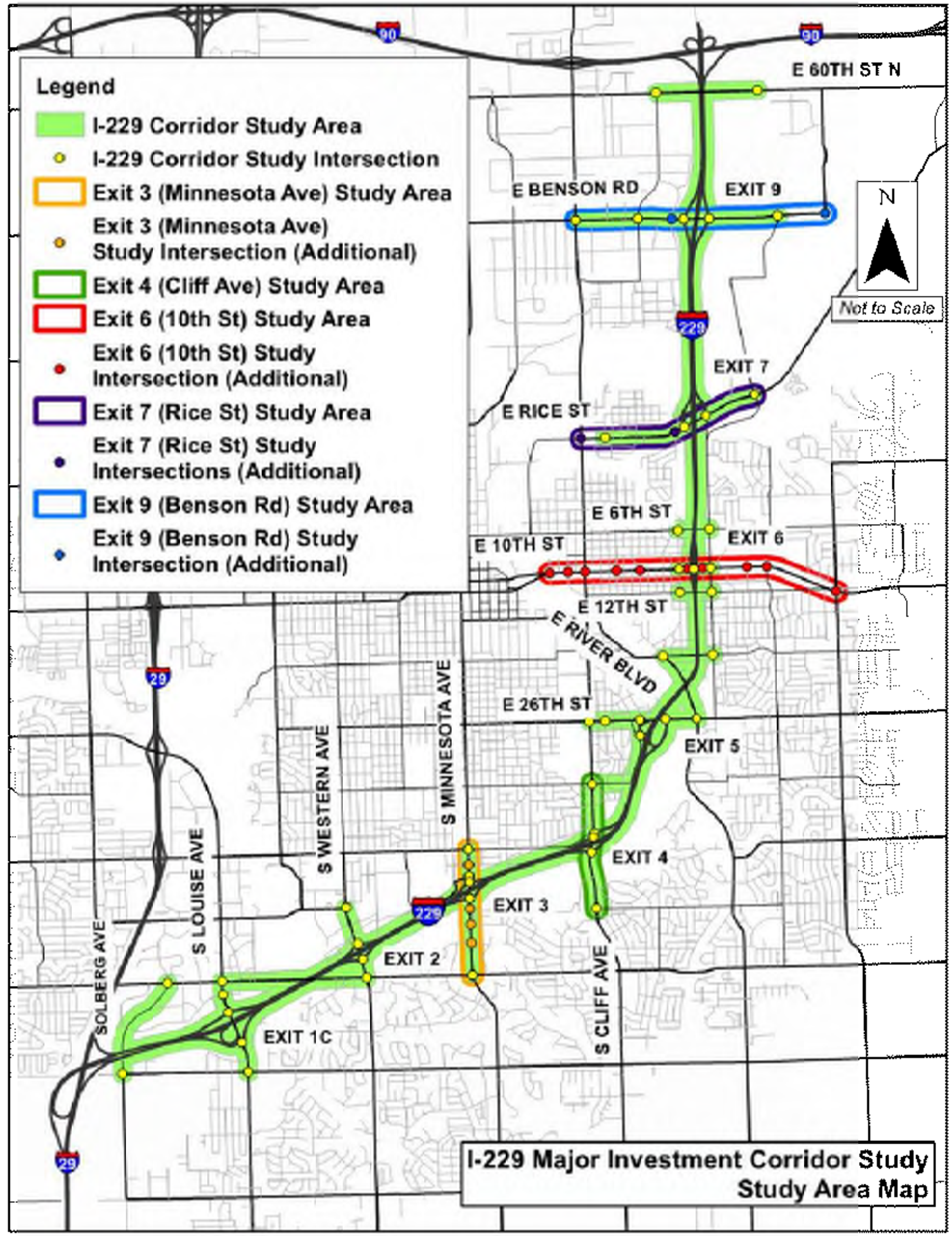
STUDY AREA MAP

I-229 Corridor Study

Solberg Avenue Overpass to 60th Street N Overpass

Meeting will focus on:

- Minnesota Avenue
- Cliff Avenue
- 10th Street
- Rice Street
- Benson Road



STUDY ADVISORY PARTNERS

South Dakota Department of Transportation (SDDOT)

South Dakota Highway Patrol

City of Sioux Falls

Sioux Falls Metropolitan Planning Organization (MPO)

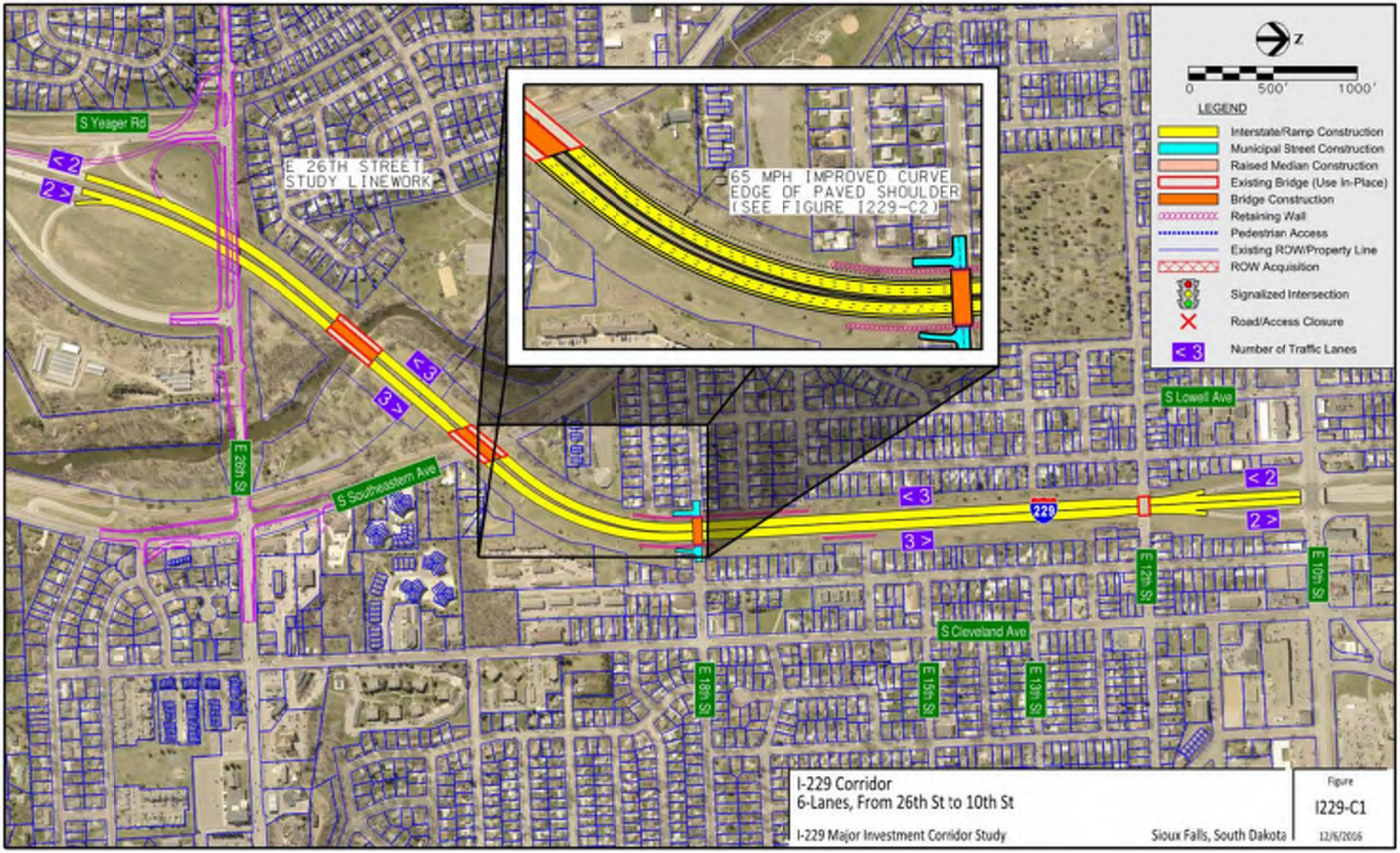
Federal Highway Administration (FHWA)

PRESENTATION AGENDA

- Recommended I-229 Corridor Improvement Concepts
- Interchange/Cross Road Sub-studies
  - Concept Evaluation Process
  - Concept Evaluation Results
  - Concepts Recommended for Further Consideration in Future Phases
- Next Steps

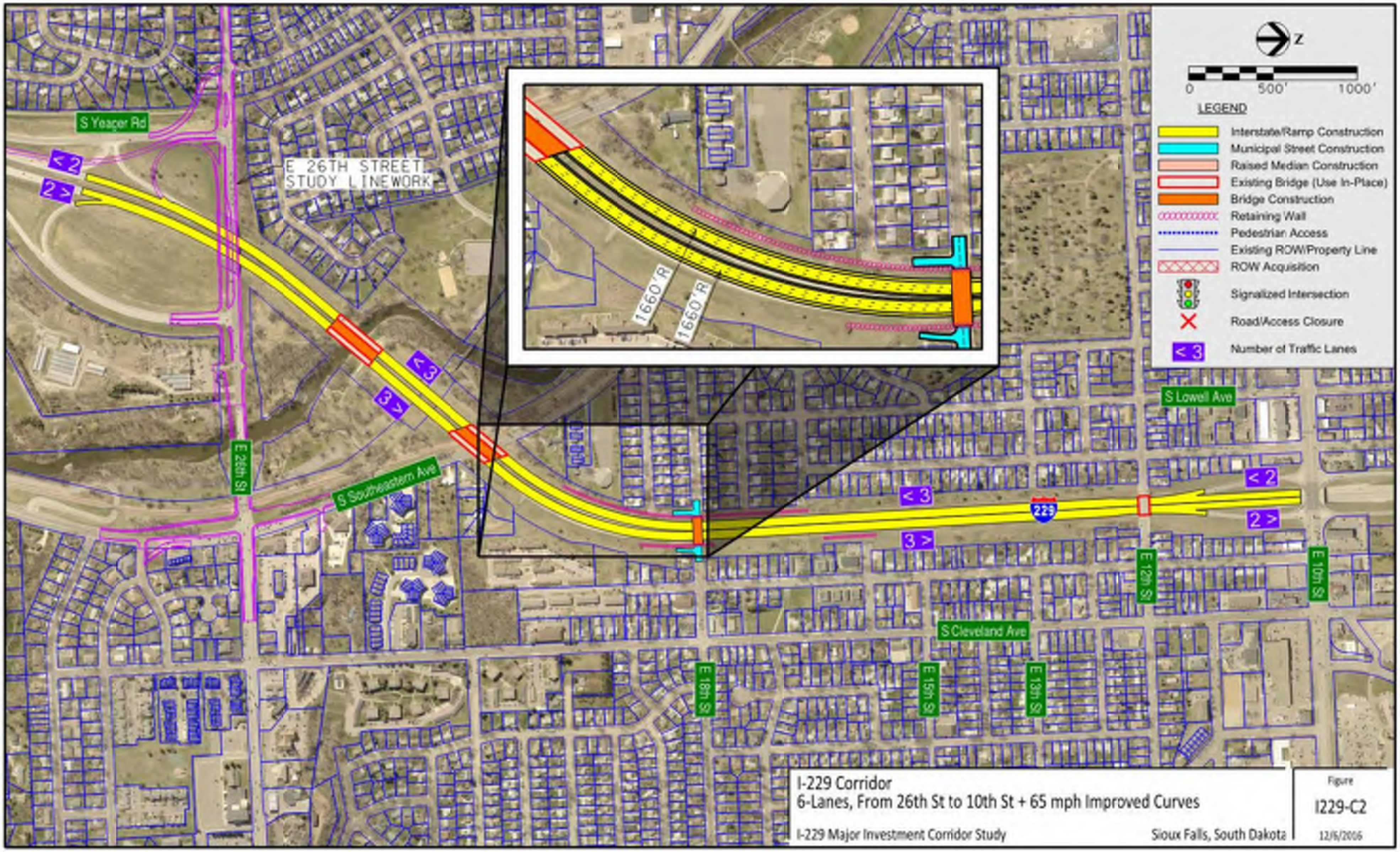
I-229 CORRIDOR IMPROVEMENTS

ADD 3RD LANE EACH DIRECTION
BETWEEN 26TH STREET AND 10TH STREET



I-229 CORRIDOR IMPROVEMENTS

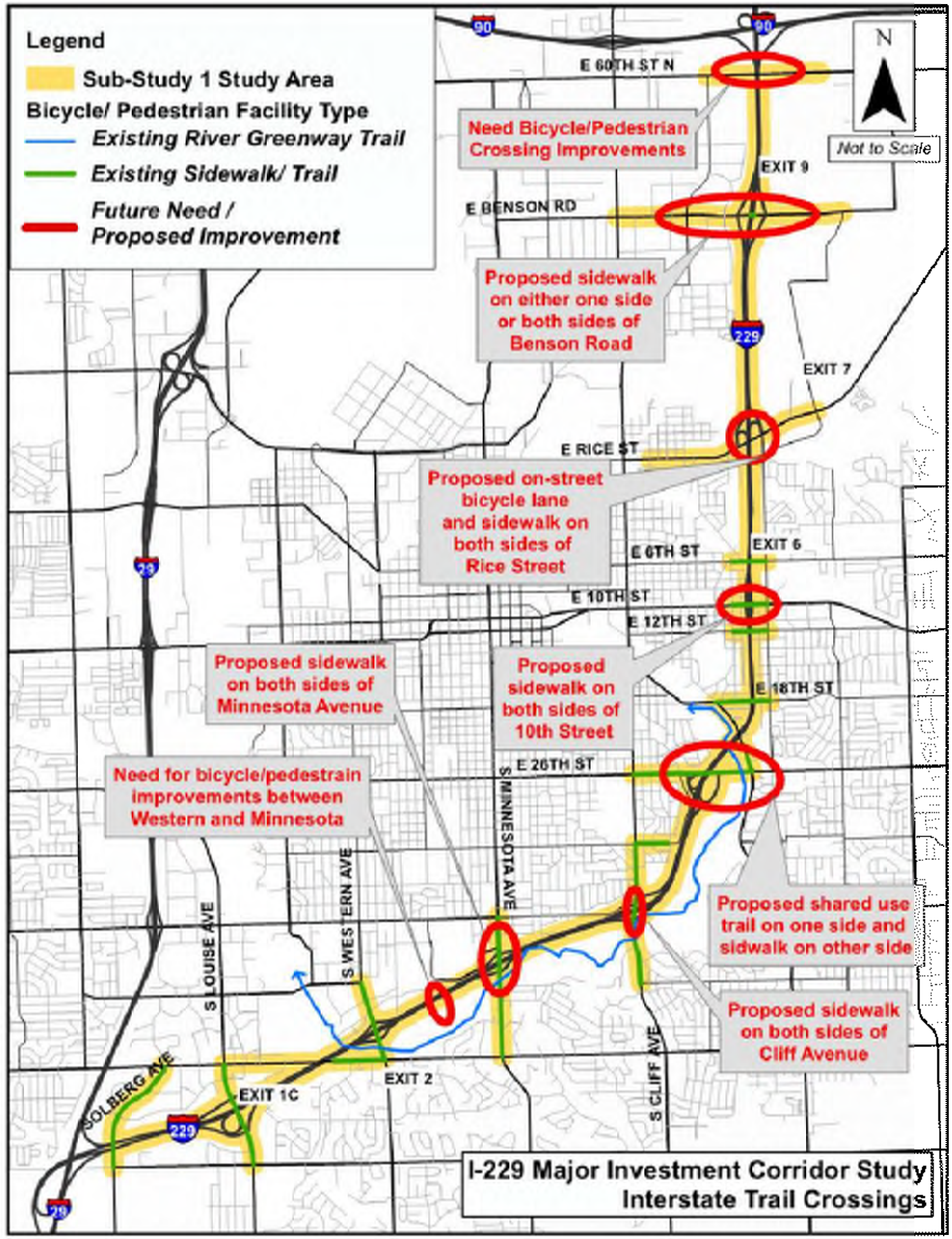
MODIFY CURVE RADIUS BETWEEN SOUTHEASTERN AVE & 18TH ST TO ALLOW 65 MPH DESIGN SPEED



I-229 CORRIDOR IMPROVEMENTS

PEDESTRIAN / BICYCLE CROSSING NEEDS & IMPROVEMENTS

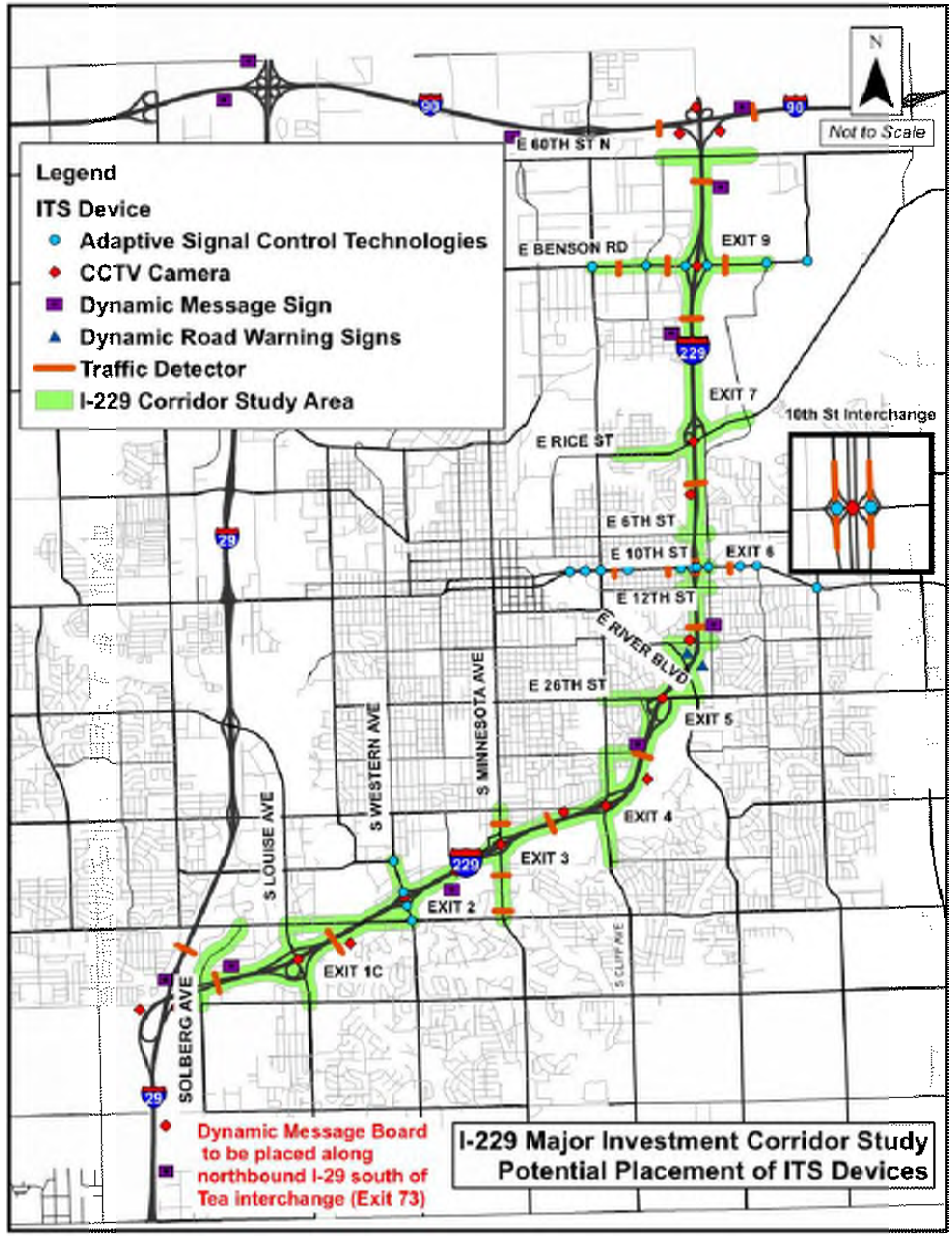
- Sub-study Proposed Improvements
  - Minnesota Avenue
  - Cliff Avenue
  - 10th Street
  - Rice Street
  - Benson Road
- Other Need Locations



I-229 CORRIDOR IMPROVEMENTS

INTELLIGENT TRANSPORTATION SYSTEMS (ITS) CONCEPTS

- Adaptive Signal Control Technologies
- CCTV Cameras
- Dynamic Message Signs
- Dynamic Road Warning Signs
- Traffic Detectors



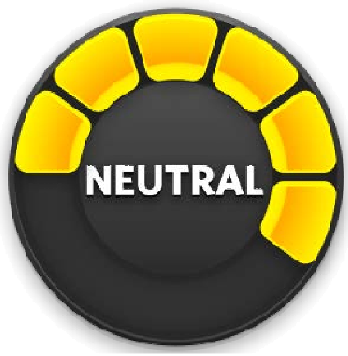
INTERCHANGE AND CROSS ROAD SUB-STUDIES

- Concept Evaluation Process
- Concept Evaluation Results
- Concepts for Further Consideration in Future Phases

CONCEPT EVALUATION PROCESS

- Evaluation Factors:

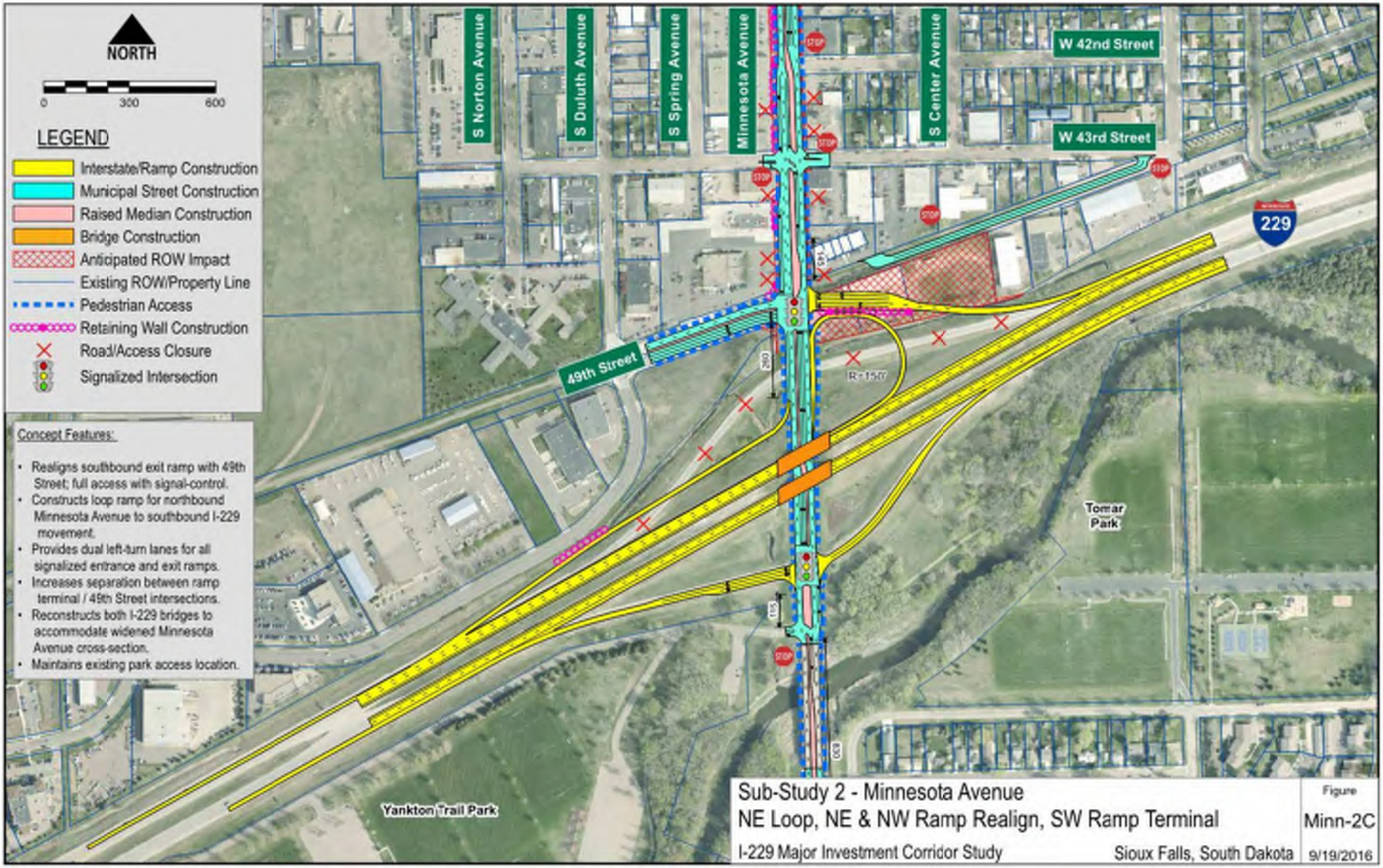
Option	Description	Traffic Operations	Safety	Environmental	Property Impacts	Construction & ROW Cost	DRAFT Recommendation
Concept ID	Interchange and Corridor Type	•Traffic Delay •Level of Service •Interchange Year of Failure	Predicted Crash Reduction during 2012-2035	Potential impact to wetlands, historical resources, threatened and endangered species, public lands, and floodplains	Total Right of Way (ROW) Required and Acquisitions	Total Constuction Cost (including ROW)	Advance or Eliminate



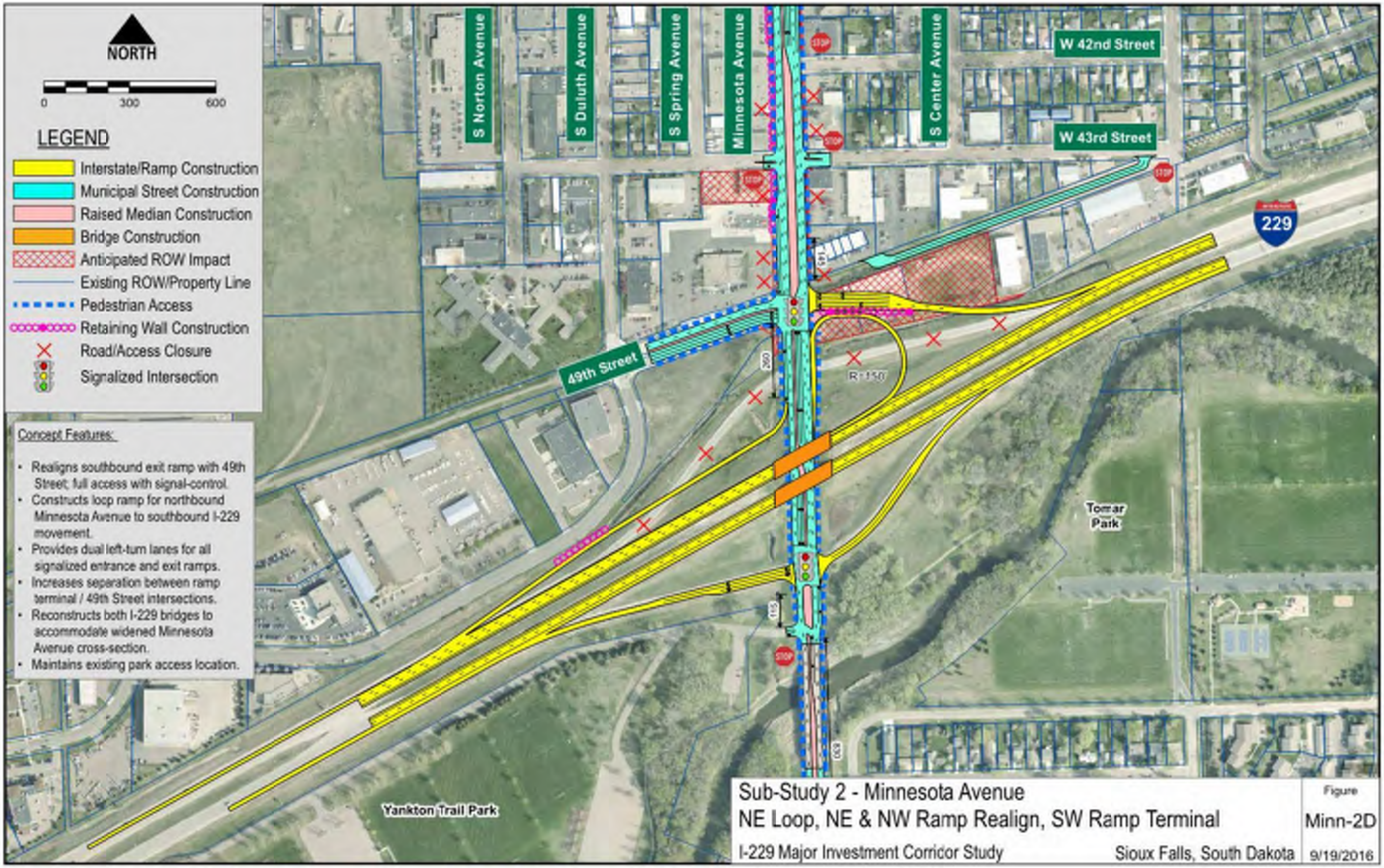
- Recommended Action

CONCEPTS FOR FURTHER CONSIDERATION

MINNESOTA AVENUE – 2C



CONCEPTS FOR FURTHER CONSIDERATION
MINNESOTA AVENUE – 2D



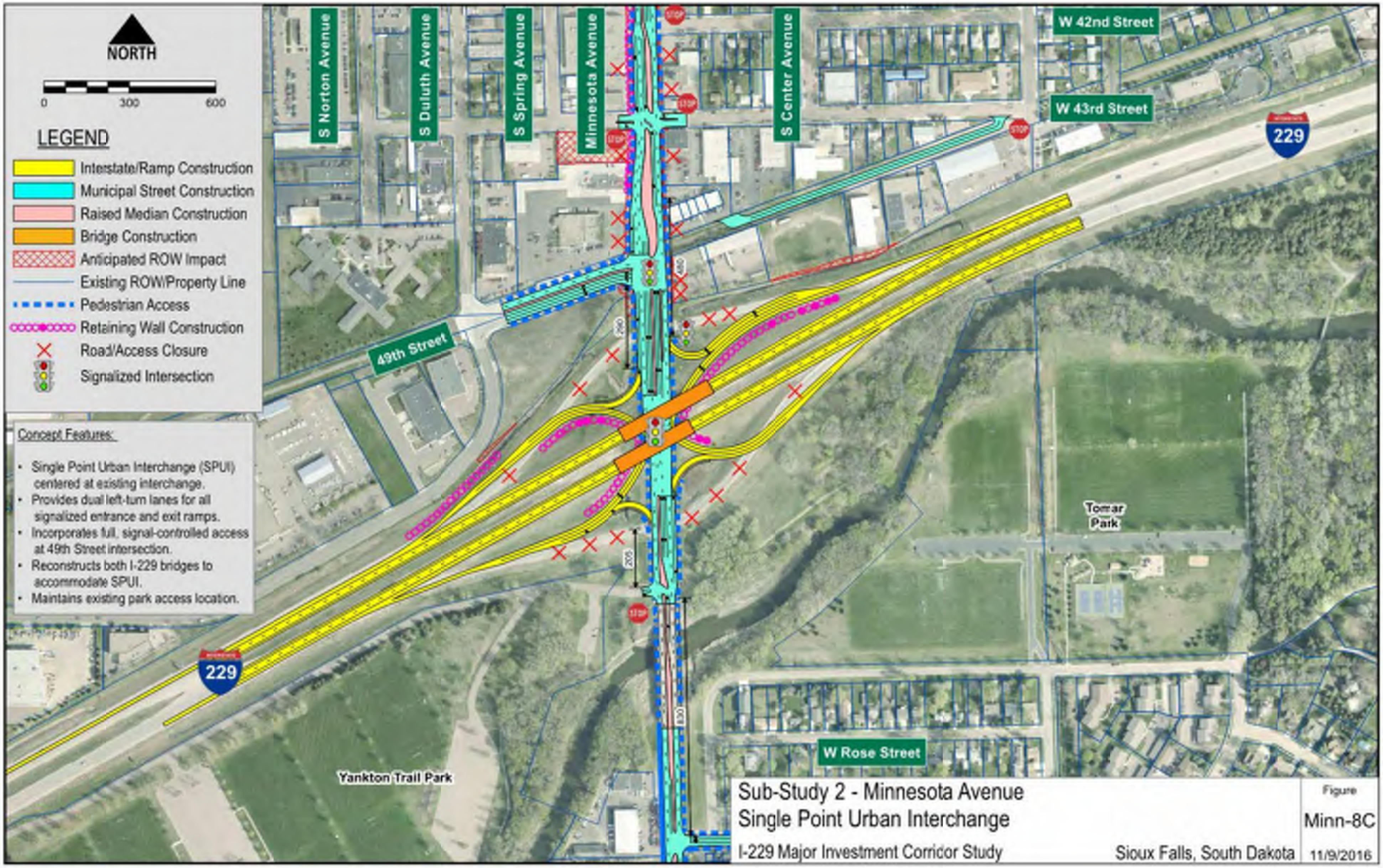
CONCEPT EVALUATION RESULTS

MINNESOTA AVENUE

Option	Description	Traffic Operations	Safety	Environmental	Property Impacts	Construction & ROW Cost	DRAFT Recommendation
No-Build	No-Build	POOR	NEUTRAL	N/A	N/A	N/A	Advance
Minn-2C	Diamond with Loop, Direct Connect to 49th St, 5-Lane Big Sioux River to 41st St	NEUTRAL	GOOD	NEUTRAL	NEUTRAL	GOOD	Advance
Minn-2D	Diamond with Loop, Direct Connect to 49th St, 6-Lane Big Sioux River to 41st St	NEUTRAL	GOOD	NEUTRAL	NEUTRAL	GOOD	Advance
Minn-5D	Diverging Diamond Interchange, 6-Lane Big Sioux River to 41st St, 49th St Right-In Right-Out	GOOD	VERY GOOD	NEUTRAL	GOOD	GOOD	**Eliminate** Closure of 49th Street Access

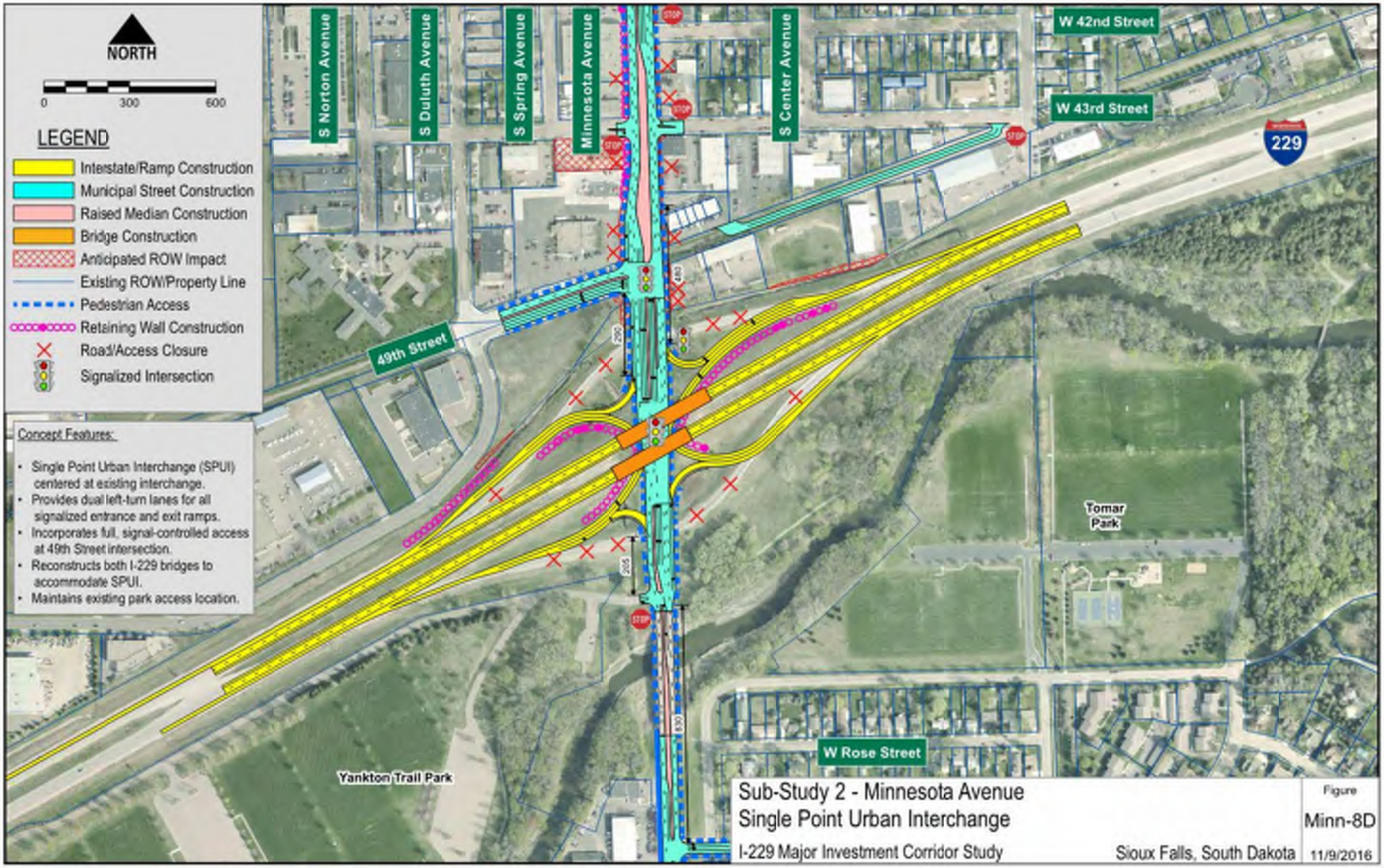
CONCEPTS FOR FURTHER CONSIDERATION

MINNESOTA AVENUE – 8C



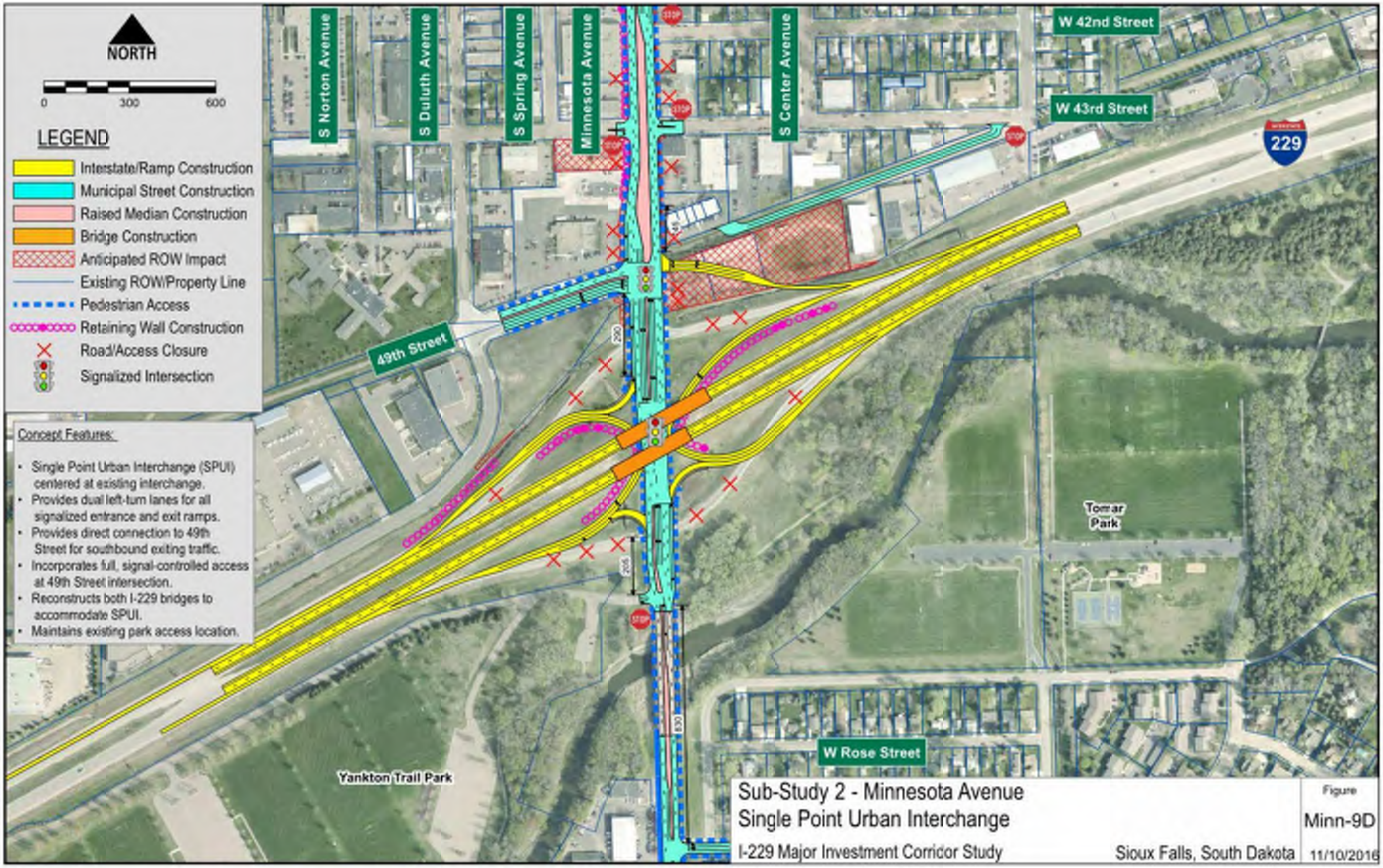
CONCEPTS FOR FURTHER CONSIDERATION

MINNESOTA AVENUE – 8D



CONCEPTS FOR FURTHER CONSIDERATION

MINNESOTA AVENUE – 9D



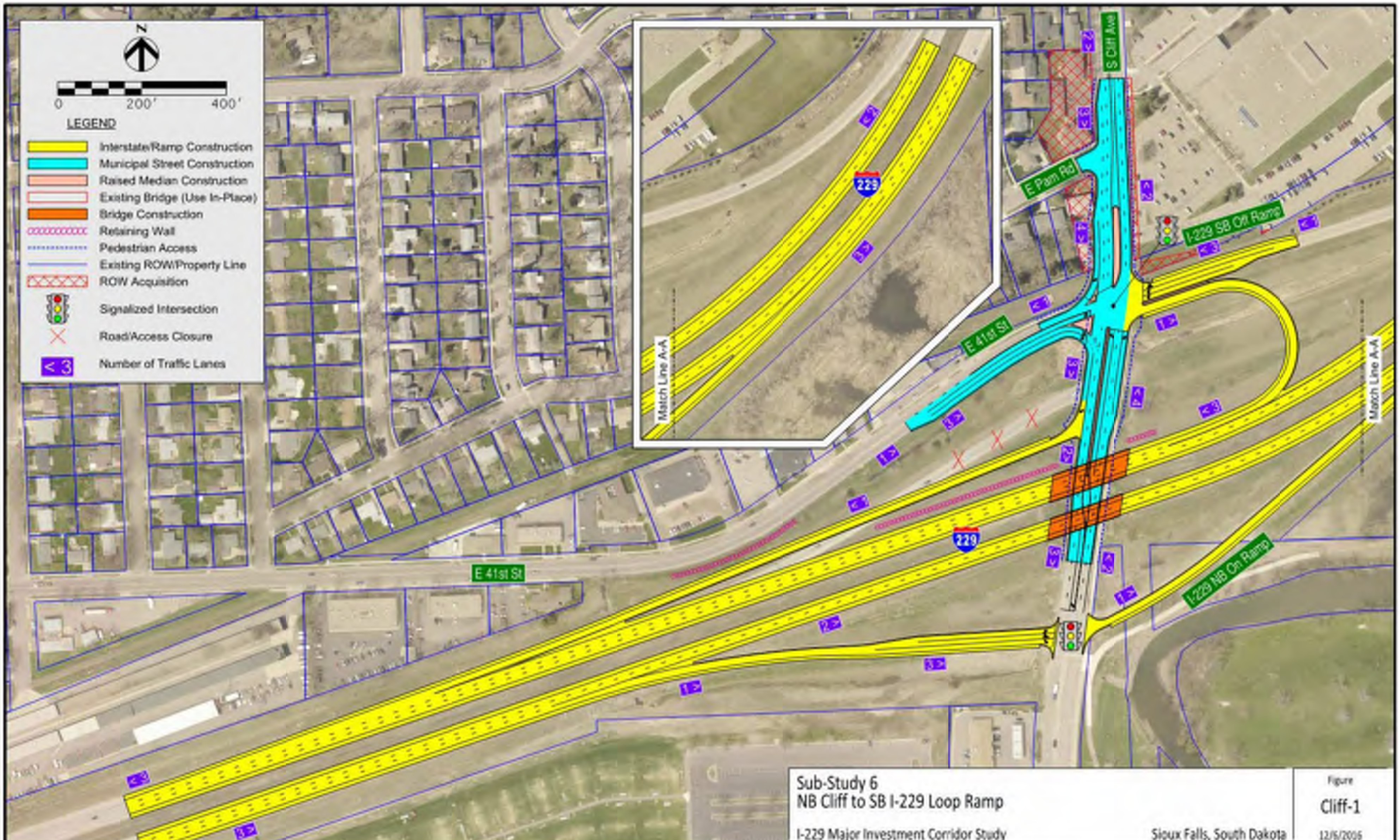
CONCEPT EVALUATION RESULTS

MINNESOTA AVENUE (cont.)

Option	Description	Traffic Operations	Safety	Environmental	Property Impacts	Construction & ROW Cost	DRAFT Recommendation
Minn-8C	Single Point Urban Interchange, 5-Lane Big Sioux River to 41st St, 49th St Full Access	GOOD	GOOD	NEUTRAL	GOOD	NEUTRAL	Advance
Minn-8D	Single Point Urban Interchange, 6-Lane Big Sioux River to 41st St, 49th St Full Access	GOOD	GOOD	NEUTRAL	GOOD	NEUTRAL	Advance
Minn-9	Single Point Urban Interchange, Exit Ramp Connection to 49th St, 5-Lane Big Sioux River to 41st St	NEUTRAL	GOOD	NEUTRAL	NEUTRAL	NEUTRAL	Advance

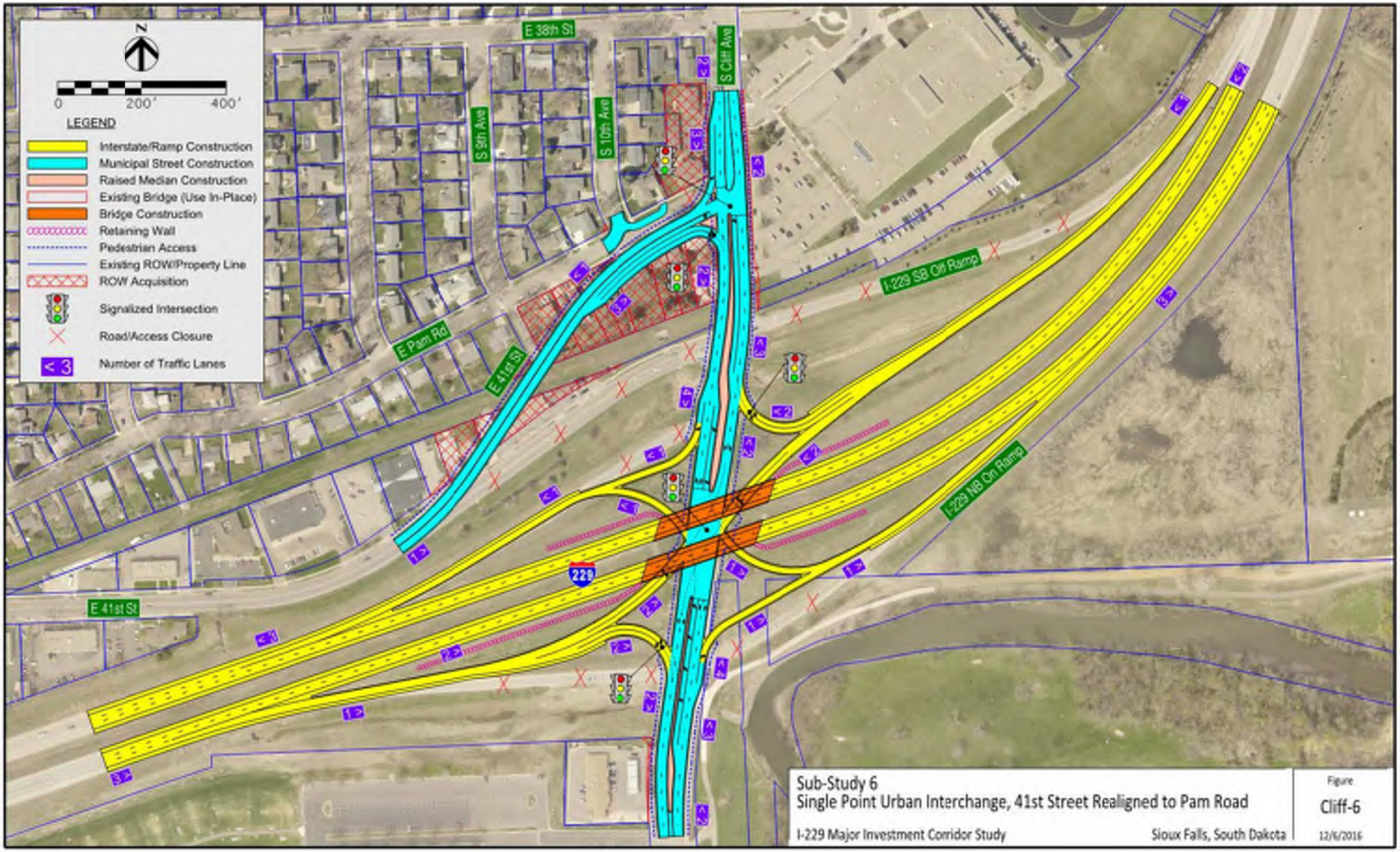
CONCEPTS FOR FURTHER CONSIDERATION

CLIFF AVENUE – 1



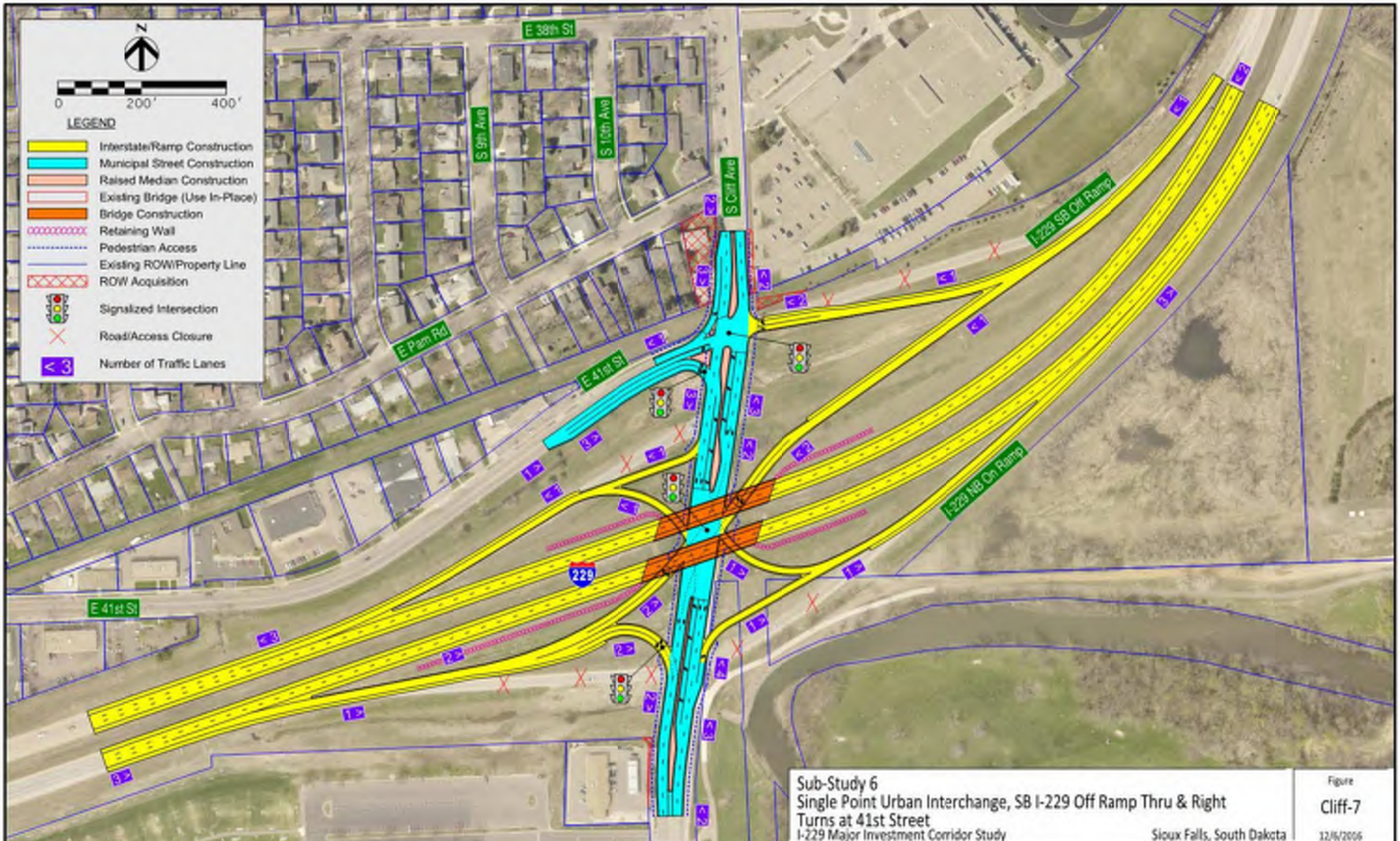
CONCEPTS FOR FURTHER CONSIDERATION

CLIFF AVENUE – 6



CONCEPTS FOR FURTHER CONSIDERATION

CLIFF AVENUE – 7



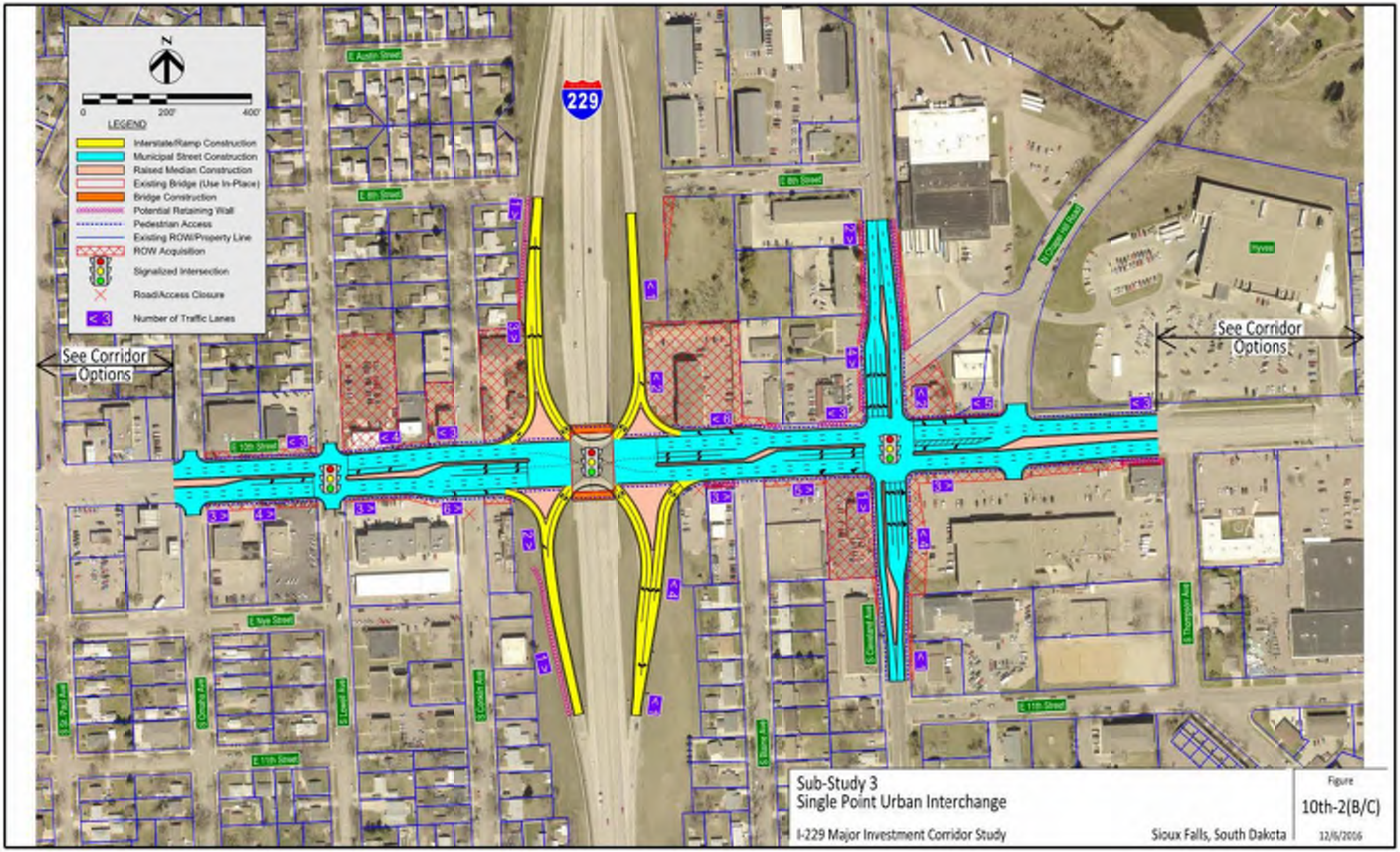
CONCEPT EVALUATION RESULTS

CLIFF AVENUE

Option	Description	Traffic Operations	Safety	Environmental	Property Impacts	Construction & ROW Cost	DRAFT Recommendation
No-Build	No-Build	POOR	NEUTRAL	N/A	N/A	N/A	Advance
Cliff-1	NB Cliff to SB I-229 Loop Ramp	GOOD	NEUTRAL	GOOD	GOOD	GOOD	Advance
Cliff-6	Single Point Urban Interchange, 41st St Realigned to Pam Rd	VERY GOOD	GOOD	GOOD	POOR	POOR	Advance
Cliff-7	Single Point Urban Interchange, SB I-229 Off-Ramp Thru & Right Turns at 41st St	GOOD	GOOD	GOOD	VERY GOOD	POOR	Advance

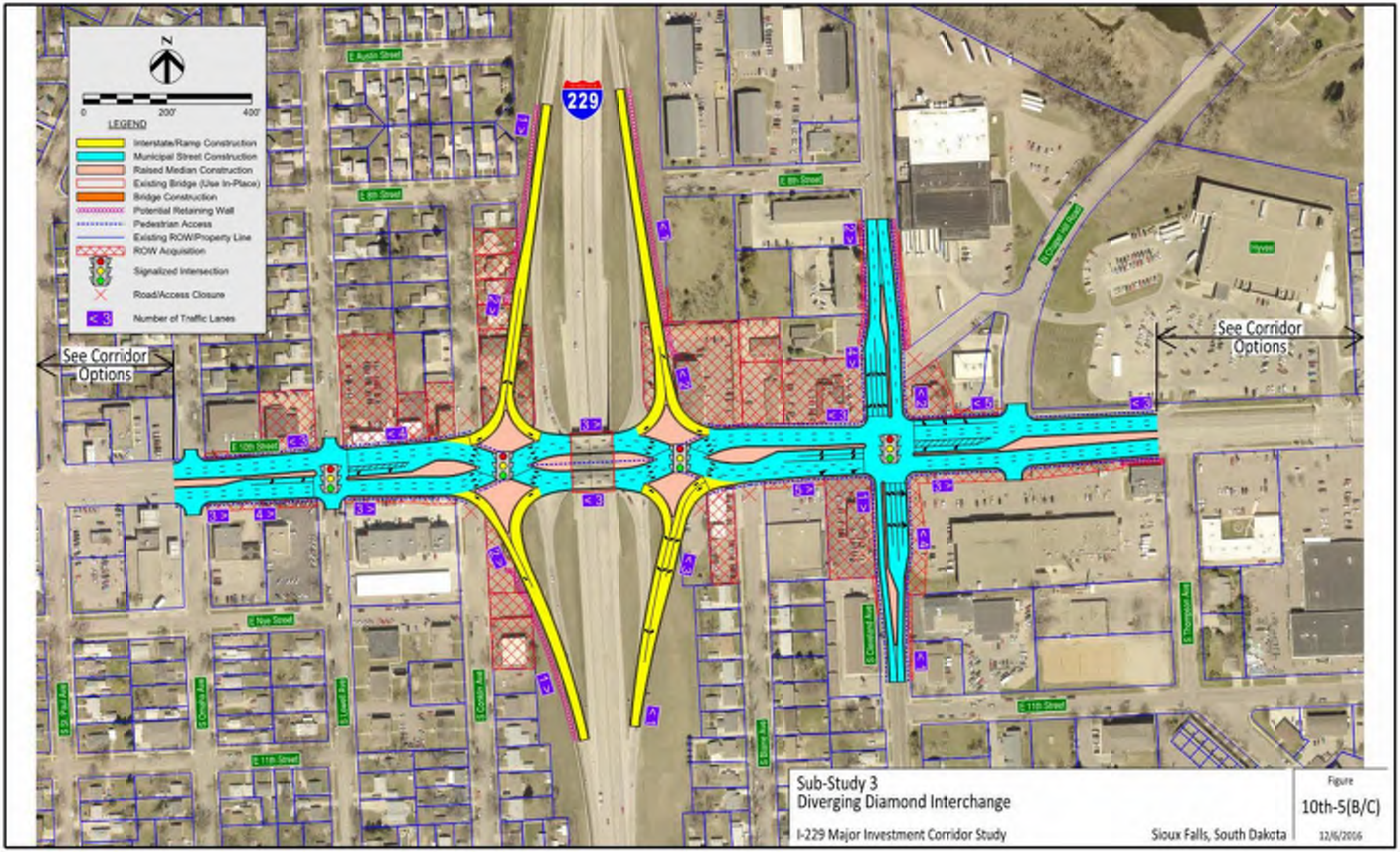
CONCEPTS FOR FURTHER CONSIDERATION

10TH STREET – 2 (B/C)



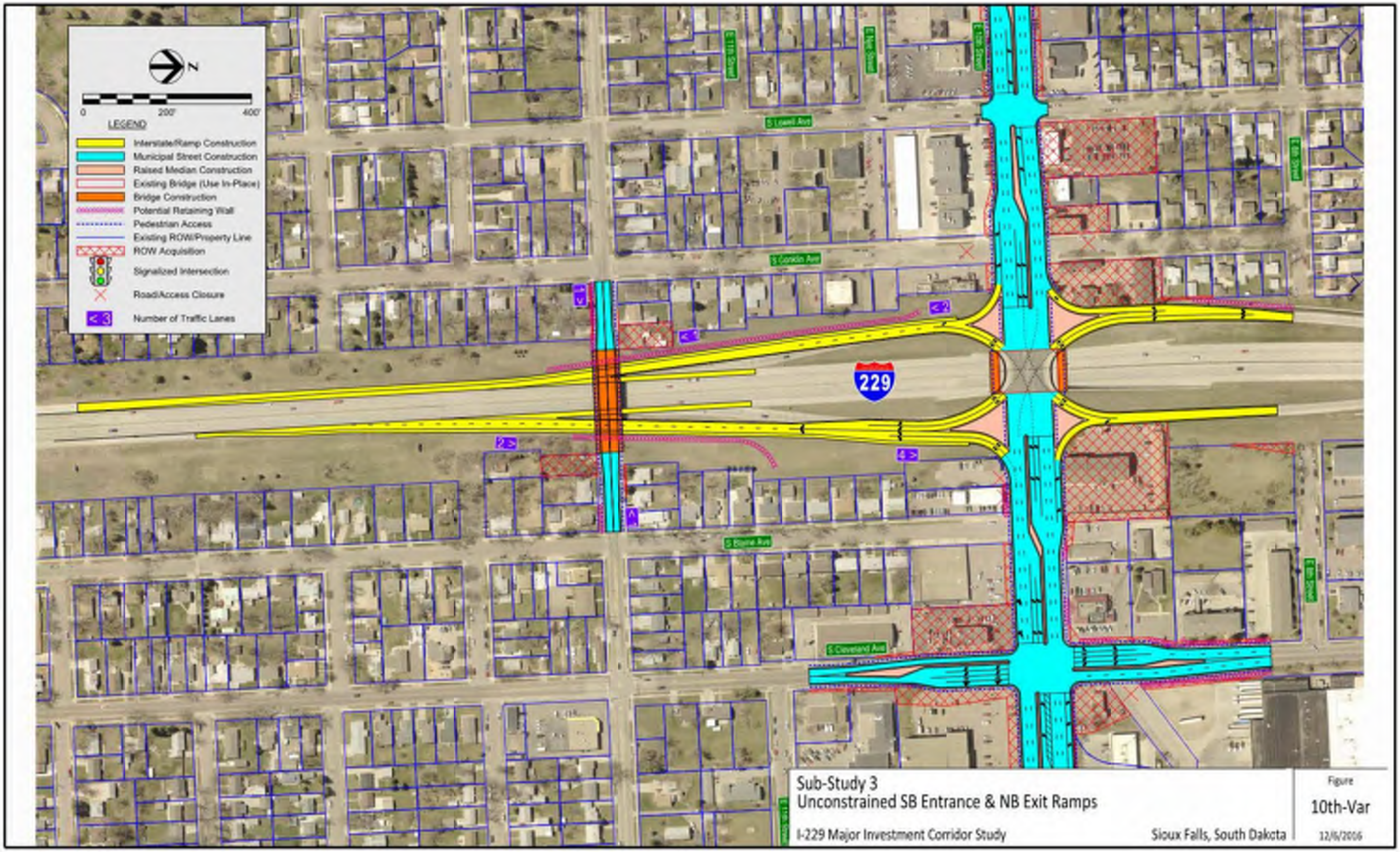
CONCEPTS FOR FURTHER CONSIDERATION

10TH STREET – 5 (B/C)

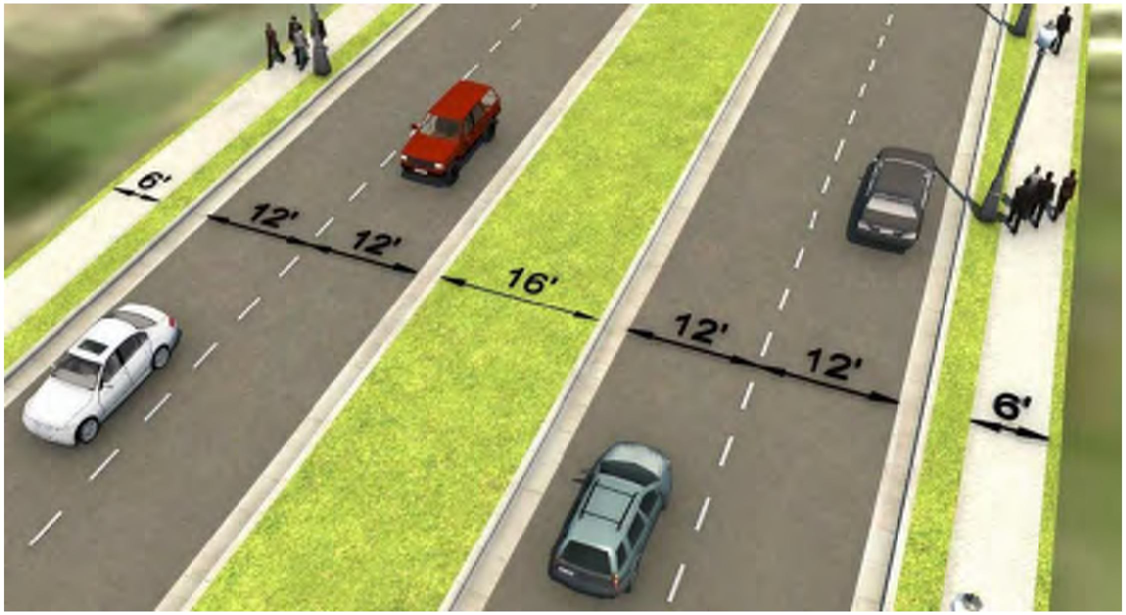


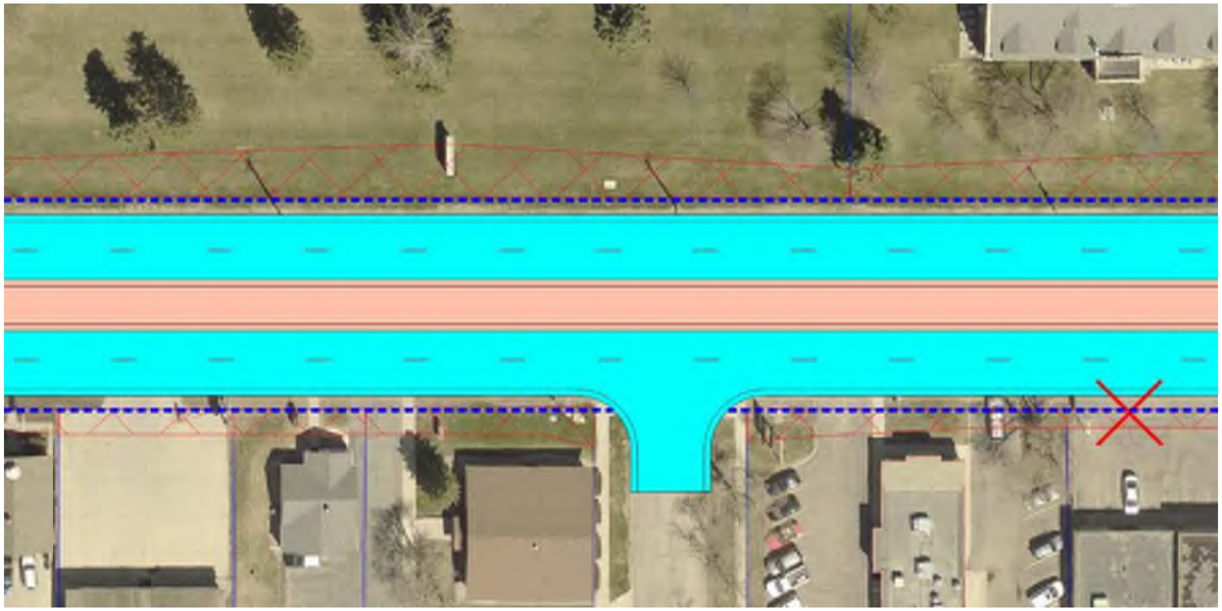
CONCEPTS FOR FURTHER CONSIDERATION

10TH STREET – VAR

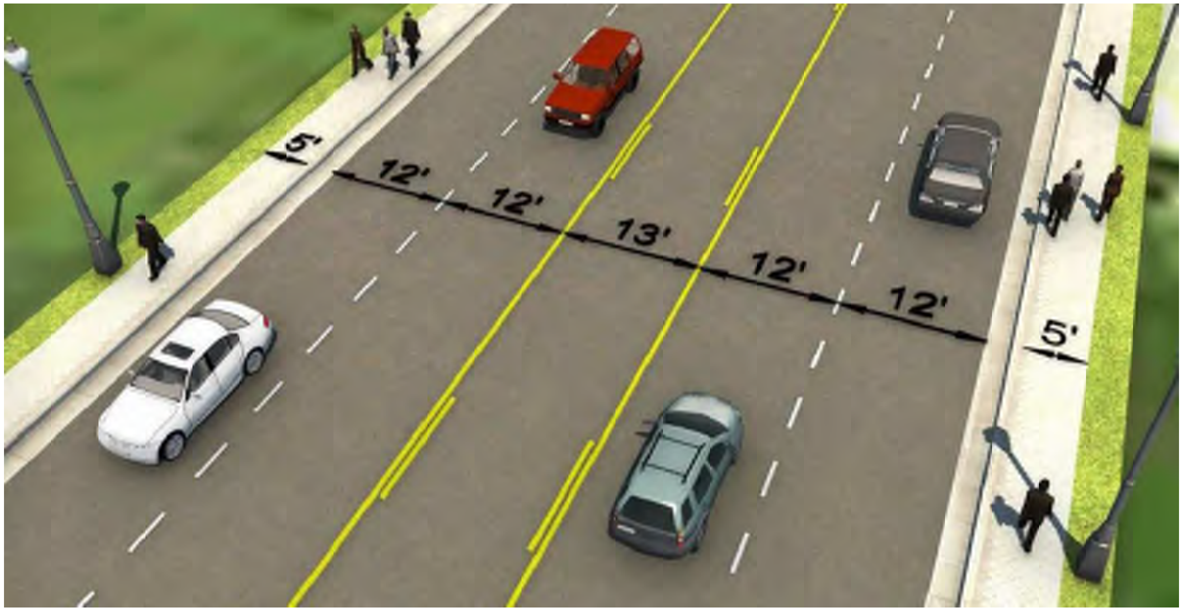


4-Lane Divided Corridor





5-Lane Undivided Corridor



CONCEPT EVALUATION RESULTS

10TH STREET

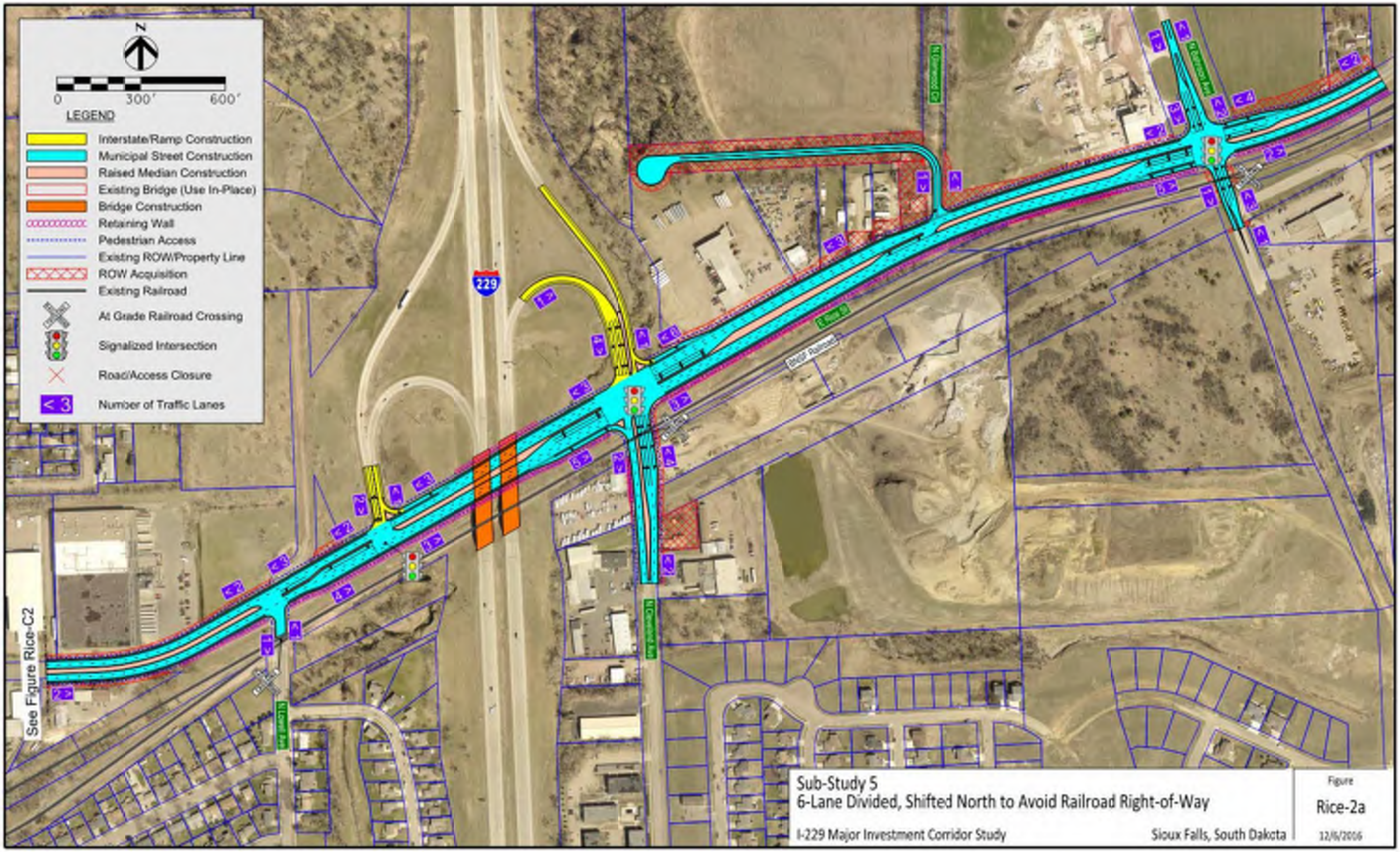
Option	Description	Traffic Operations	Safety	Environmental	Property Impacts	Construction & ROW Cost	DRAFT Recommendation
No-Build	No-Build	POOR	NEUTRAL	N/A	N/A	N/A	Advance
10th-2A	Single Point Urban Interchange, 6-Lane Divided Corridor	VERY GOOD	NEUTRAL	NEUTRAL	POOR	POOR	Eliminate Property impacts, environmental impacts, and cost
10th-2B	Single Point Urban Interchange, 4-Lane Divided Corridor	GOOD	NEUTRAL	NEUTRAL	NEUTRAL	NEUTRAL	Advance
10th-2C	Single Point Urban Interchange, 5-Lane Undivided Corridor	GOOD	NEUTRAL	NEUTRAL	GOOD	GOOD	Advance

CONCEPT EVALUATION RESULTS 10TH STREET (cont.)

Option	Description	Traffic Operations	Safety	Environmental	Property Impacts	Construction & ROW Cost	DRAFT Recommendation
10th-5A	Diverging Diamond Interchange, 6-Lane Divided Corridor	VERY GOOD	GOOD	NEUTRAL	POOR	POOR	**Eliminate** Property impacts, environmental impacts, and cost
10th-5B	Diverging Diamond Interchange, 4-Lane Divided Corridor	GOOD	GOOD	NEUTRAL	NEUTRAL	NEUTRAL	**Advance**
10th-5C	Diverging Diamond Interchange, 5-Lane Undivided Corridor	GOOD	GOOD	NEUTRAL	GOOD	GOOD	**Advance**
10th-9A	Tight Split Diamond, 6th St/10th St with 4-Lane Divided Corridor	NEUTRAL	POOR	POOR	NEUTRAL	POOR	**Eliminate** Environmental impacts, cost, and lower traffic & safety benefits
10th-9B	Tight Split Diamond, 6th St/10th St with 5-Lane Undivided Corridor	NEUTRAL	POOR	POOR	GOOD	NEUTRAL	**Eliminate** Environmental impacts and lower traffic & safety benefits
10th-Var							**Advance**

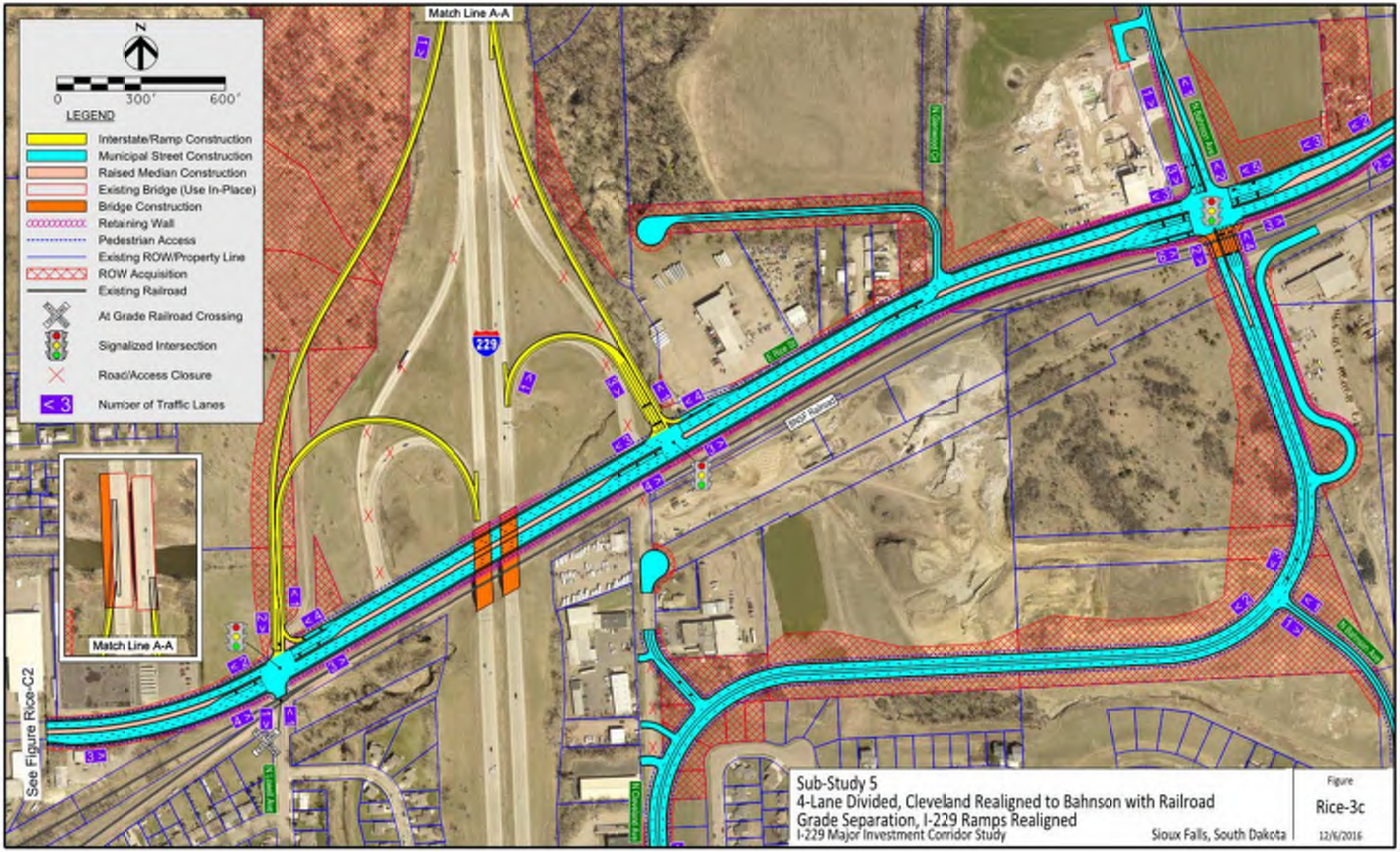
CONCEPTS FOR FURTHER CONSIDERATION

RICE STREET – 2A



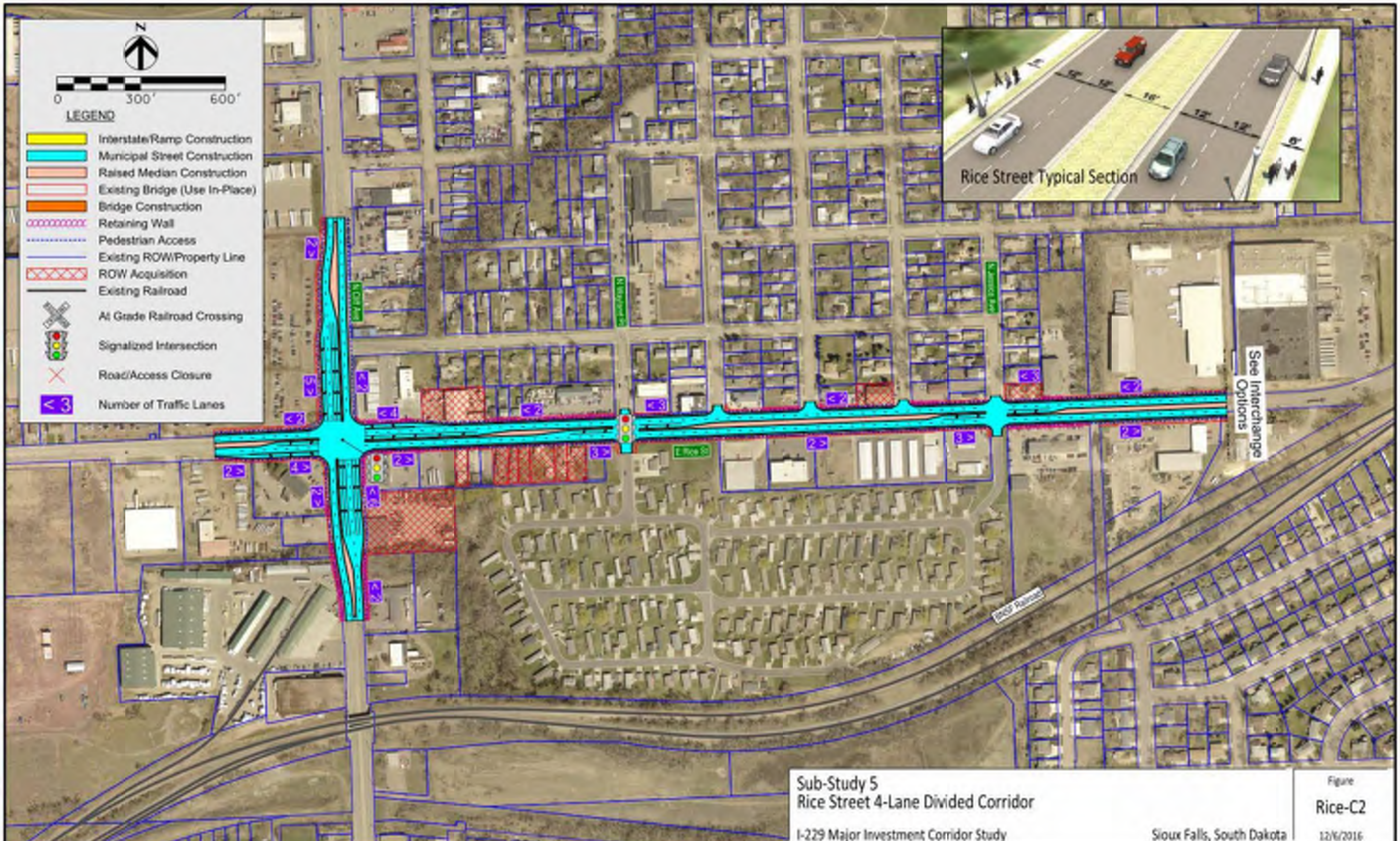
CONCEPTS FOR FURTHER CONSIDERATION

RICE STREET – 3C



CONCEPTS FOR FURTHER CONSIDERATION

RICE STREET – C2



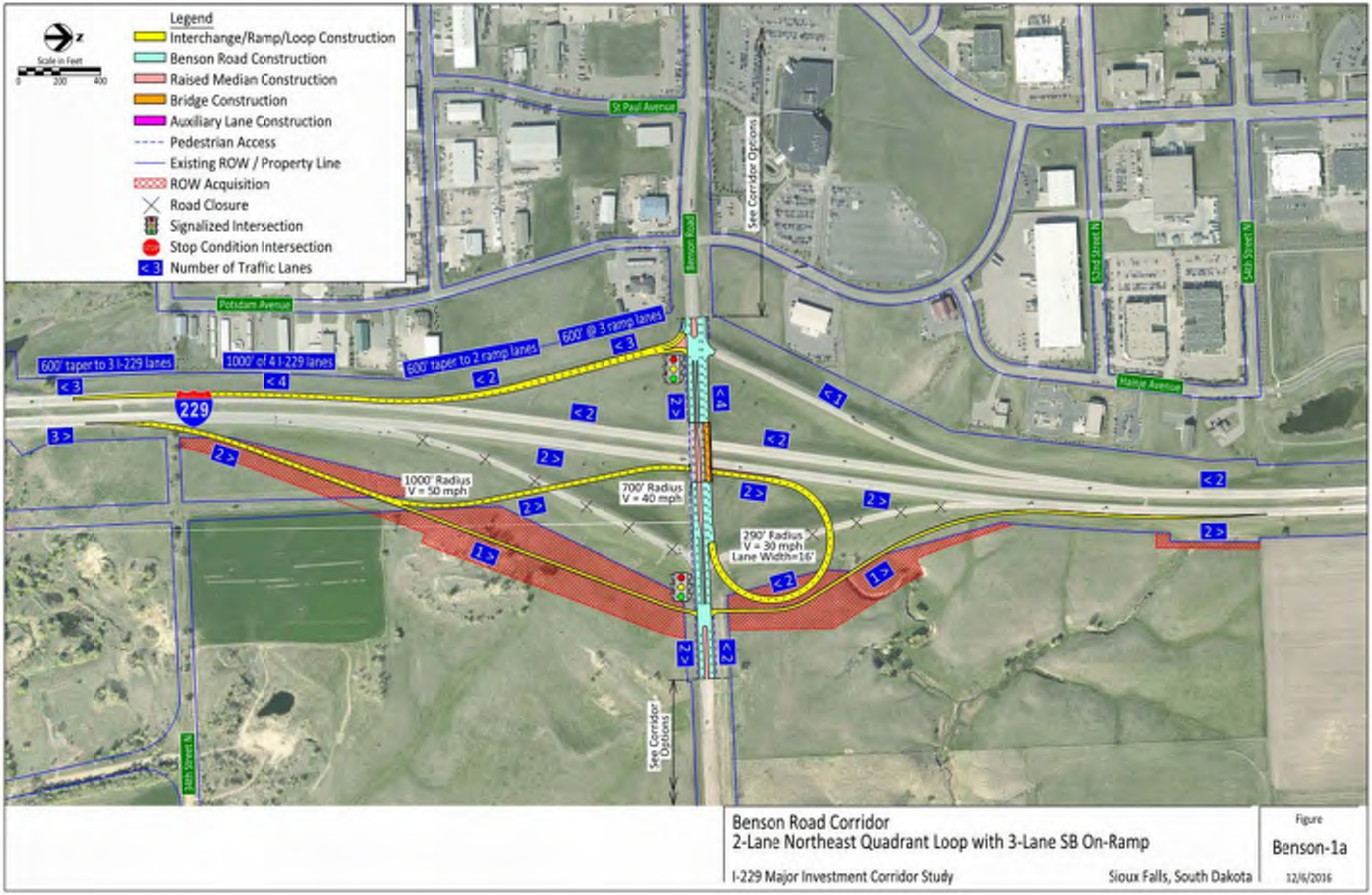
CONCEPT EVALUATION RESULTS

RICE STREET

Option	Description	Traffic Operations	Safety	Environmental	Property Impacts	Construction & ROW Cost	DRAFT Recommendation
No-Build	No-Build	POOR	NEUTRAL	N/A	N/A	N/A	Advance
Rice-2	6-Lane Divided	VERY GOOD	GOOD	NEUTRAL	GOOD	GOOD	Advance
Rice-2A	6-Lane Divided, Shifted North to Avoid Railroad Right-of-Way	VERY GOOD	GOOD	NEUTRAL	GOOD	GOOD	Advance
Rice-3C	4-Lane Divided, Cleveland Realigned to Bahnson with Railroad Grade Separation, I-229 Ramps Realigned	VERY GOOD	VERY GOOD	POOR	POOR	POOR	Advance

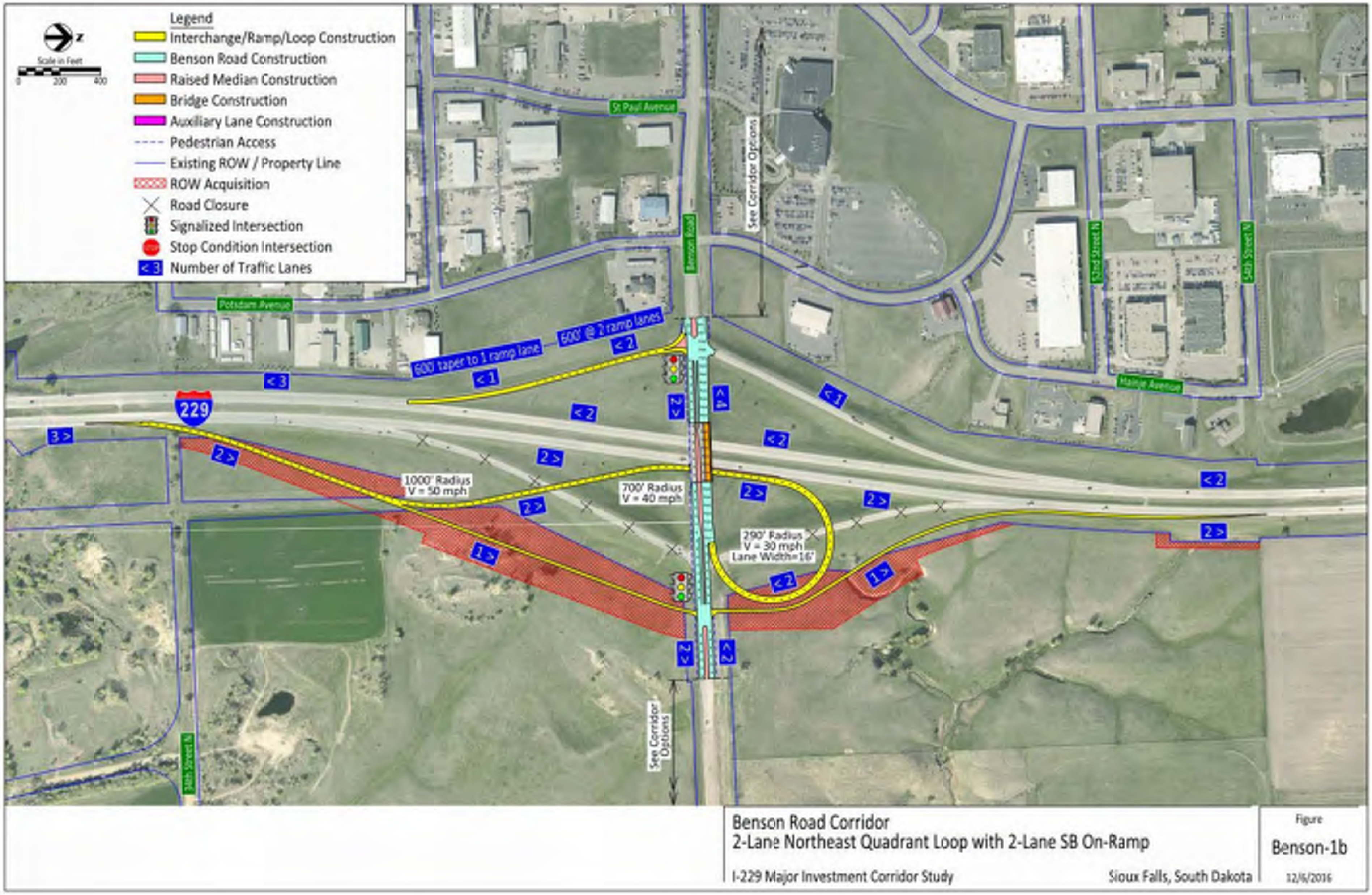
CONCEPTS FOR FURTHER CONSIDERATION

BENSON ROAD – 1A



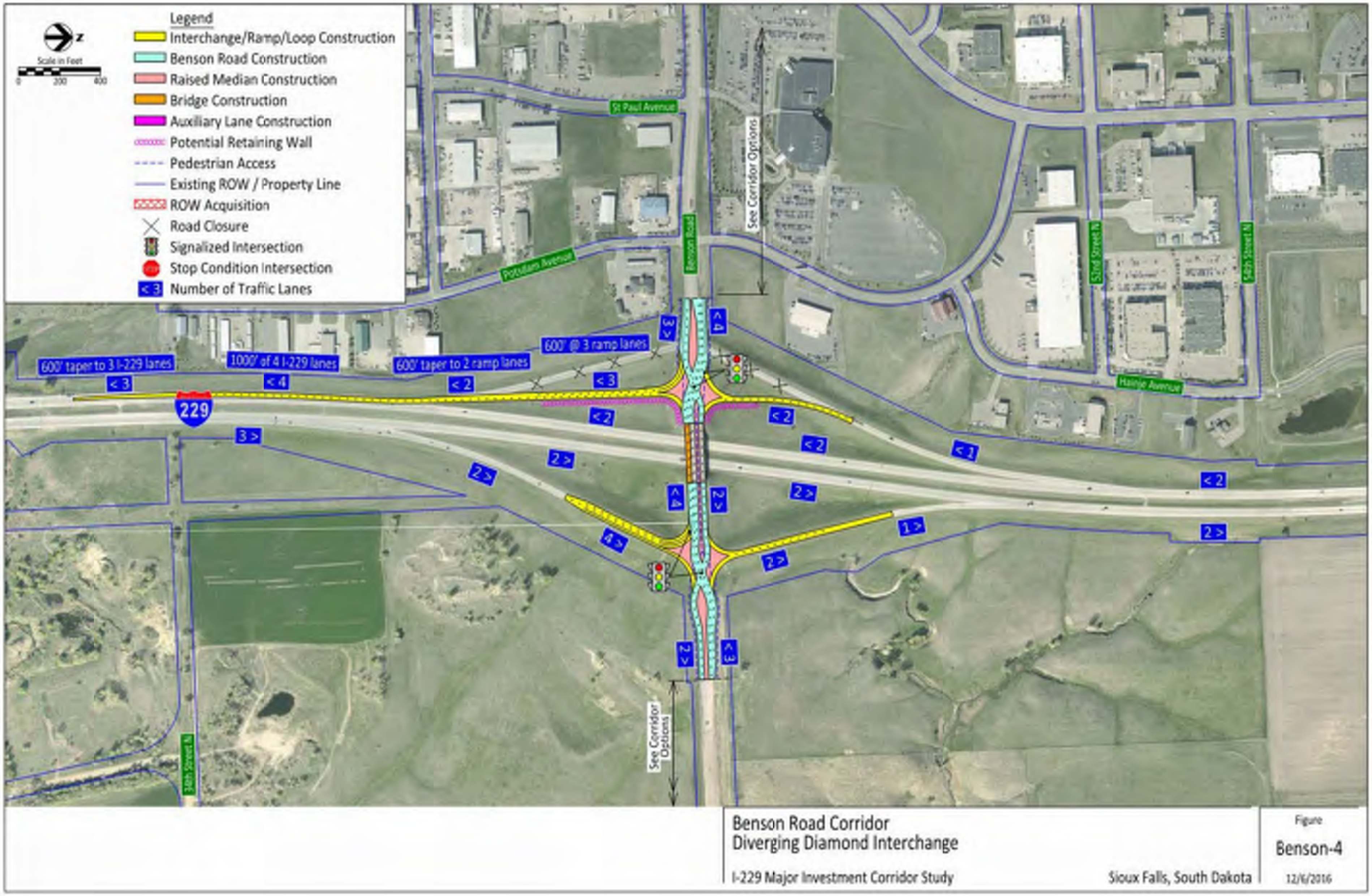
CONCEPTS FOR FURTHER CONSIDERATION

BENSON ROAD – 1B



CONCEPTS FOR FURTHER CONSIDERATION

BENSON ROAD – 4



CONCEPT EVALUATION RESULTS

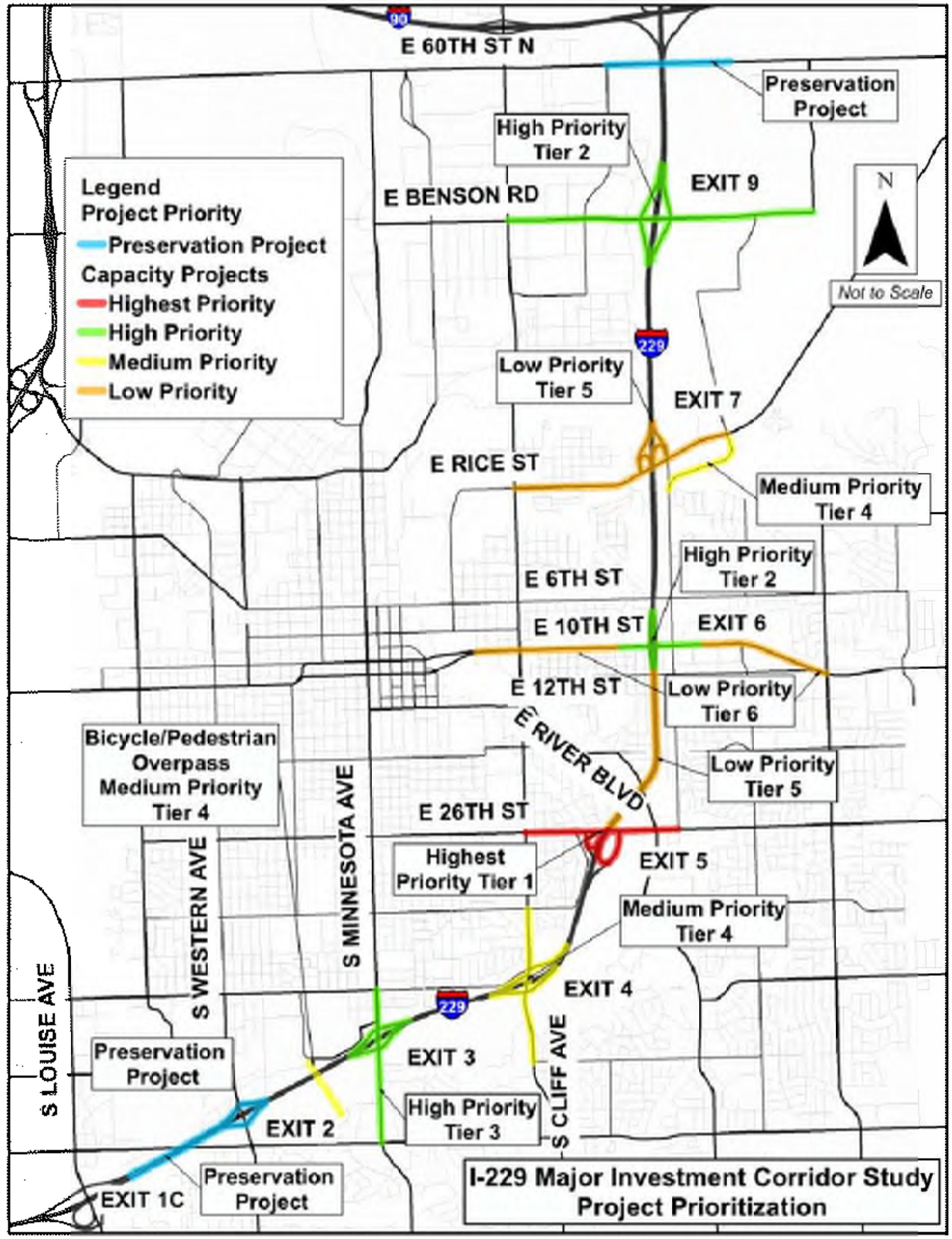
BENSON ROAD

Option	Description	Traffic Operations	Safety	Environmental	Property Impacts	Construction & ROW Cost	DRAFT Recommendation
No-Build	No-Build	POOR	NEUTRAL	N/A	N/A	N/A	Advance
Benson-1A	2-Lane Northeast Quadrant Loop with 3-Lane SB On-Ramp	VERY GOOD	GOOD	NEUTRAL	NEUTRAL	NEUTRAL	Advance
Benson-1B	2-Lane Northeast Quadrant Loop with 2-Lane SB On-Ramp	VERY GOOD	GOOD	NEUTRAL	NEUTRAL	NEUTRAL	Advance
Benson-4	Diverging Diamond Interchange	NEUTRAL	VERY GOOD	GOOD	VERY GOOD	NEUTRAL	Advance

FUTURE I-229 CORRIDOR PROJECTS

PRELIMINARY PRIORITIZATION

- Minnesota Avenue
- Cliff Avenue
- 10th Street
- Rice Street
- Benson Road
- Other projects list



NEXT STEPS

- Assemble Stakeholder and Public Comments
- SDDOT / City Finalize Project Priorities
- Complete Study Reports
- SDDOT / City Program Projects
- Project Development Process = 5-6 year timeline when initiated by SDDOT & City
  - Prepare Interchange Modification Justification Report and Environmental Document
  - Develop Project Design
  - Acquire Right of Way
  - Construction

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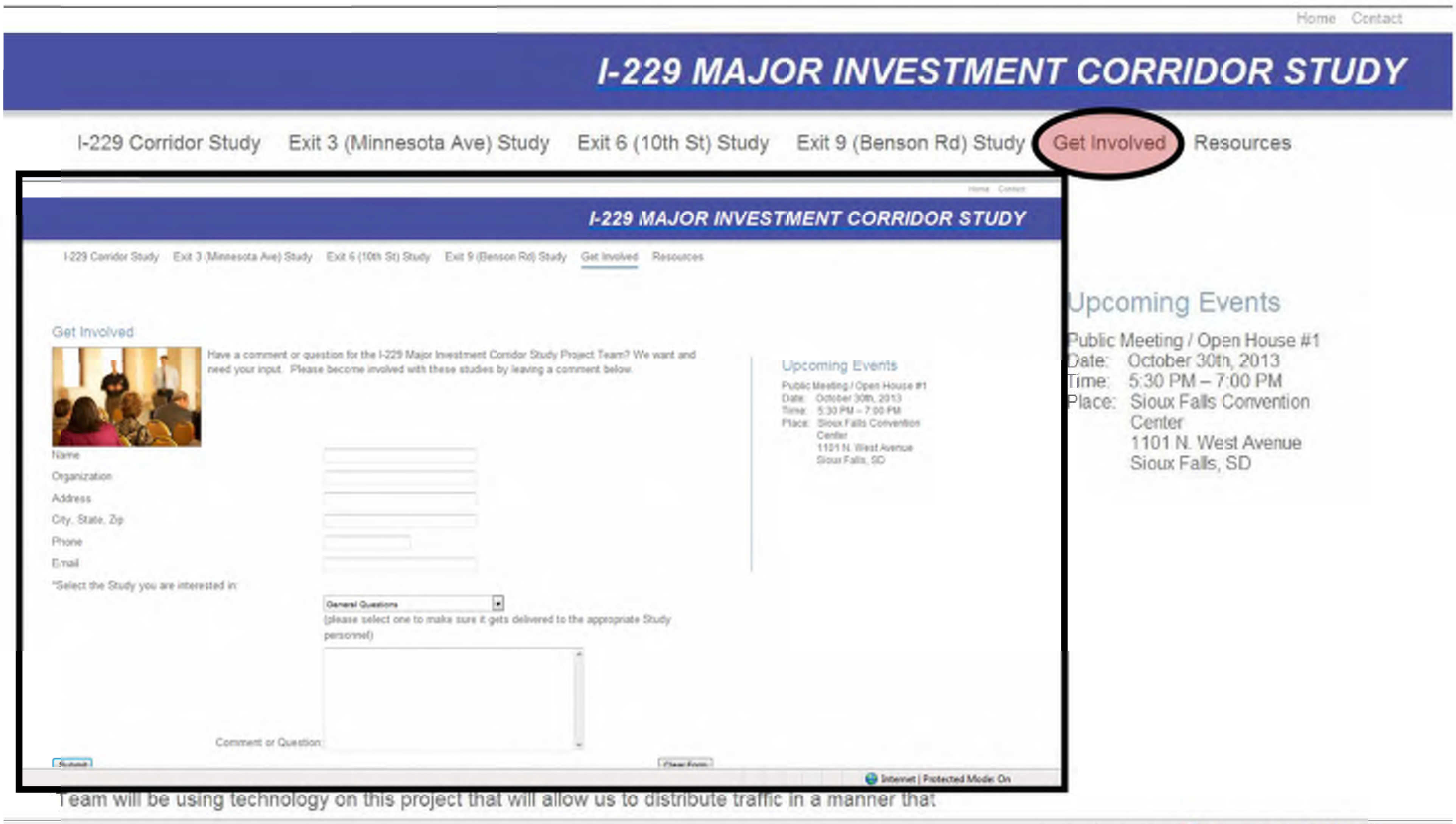

PROJECT CONTACTS:

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Dave Meier – HDR Engineering, Inc.
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Shannon Ausen – City of Sioux Falls
605-367-8607 or sausen@siouxfalls.org

Steve Gramm – SDDOT Project Development
605-773-6641 or steve.gramm@state.sd.us

INTERSTATE 229 MAJOR INVESTMENT STUDY

Thanks for attending!

HRGreen

APPENDIX -

STAKEHOLDER MEETINGS #1 –
DECEMBER 15TH & 16TH, 2014
JUNE 22ND, 2016 (CLIFF AVENUE & RICE STREET)

BENSON ROAD

DECEMBER 15TH, 2014

- **MEETING NOTES**
- **SIGN-IN SHEETS**
- **POWERPOINT SLIDES**

Meeting Minutes

Project:	I-229 Major Investment Corridor Study; PL 0100(87) 3616P, PCN 044K
Subject:	Stakeholder Meeting – Sub-study 4 (Benson Road from Cliff Avenue to Sycamore Avenue)
Date:	Monday, December 15, 2014
Location:	Sioux Falls Convention Center Conference Room 6
Attendees:	Paul Nikolas, Travis Dressen (SDDOT) Heath Hoftiezer, (City of Sioux Falls) Russ Robers (First National Bank) Jason Kjenstad, James Unruh (HDR)

Jason Kjenstad covered the PowerPoint slides (attached to meeting notes).

Follow-up discussion items included:

1. Existing Benson Road traffic observations:
   1.1 A.M. peak hour – Westbound traffic on Benson Road west of I-229 is heavy and limits access from the I-229 SB off-ramp and from driveways along Benson Road.
   1.2 P.M. peak hour – Eastbound traffic is heavy but flows reasonably well under normal traffic conditions (if there is no traffic diverted from other areas).
      - The EB to SB movement at the I-229 SB on-ramp is at capacity.
      - There is a high volume of left turning traffic from Potsdam Avenue to Benson Road. It is difficult for this traffic to find gaps in the Benson Road traffic.

   1.3 Off-peak periods – The Lewis Avenue/Benson Road intersection is busy but not congested.

2. Existing I-229 traffic observations
   2.1 Traffic coming from the on-ramps tends to merge into I-229 traffic before getting up to adequate speeds rather than staying in the auxiliary lane. The worst location for this is the 26th Street SB on-ramp where the ramp traffic speeds are slow due to the tight ramp curve. It was noted that the preferred 26th Street interchange configuration will improve this condition.
   2.2 At 10th Street, the trucks turning from the SB off-ramp to EB 10th Street make the turn through the single point intersection slowly and cause the SB off-ramp traffic to back up to I-229 during peak hour traffic. Hoftiezer noted that this is partly due to how the loop detectors sense the truck traffic.

3. Existing geometric constraints
   3.1 The south leg of the Lewis Avenue intersection is too narrow for the trucks that turn onto and off of Benson Road.

4. Benson Road improvement considerations
   4.1 If a 3rd WB lane is added from I-229 to Lewis Avenue, the Potsdam Avenue intersection may need to be right-in/right-out or a ¾ access condition with restriction of left-out movements. Potsdam traffic would re-route to Lewis Avenue. A signalized intersection along Lewis Avenue would be required to accommodate this traffic. Rob suggested that a signal may be most effective at 54th Street.
   4.2 A 3rd EB lane may be necessary from Lewis Avenue to I-229 with free-flow conditions for the SB on-ramp movement. Dual right turns at the SB on-ramp would require signalization and may reduce capacity in comparison to an unrestricted movement.

4.3 The forecast traffic volumes for the MIS project assume that Benson Road will be extended to the east from Sycamore Avenue across the Big Sioux River. The timeframe for this is not known.

5. I-229 improvement considerations
   5.1 60th Street access to/from I-229 would help divert traffic from Benson Road. It was noted the Federal Highway Administration limits the type of access at 60th Street due to the close proximity to I-90 to the north.
   5.2 Benson Road/I-229 ramp terminals will likely need to be signalized.
   5.3 Various interchange configurations are being considered for Benson Road. The configurations will be presented at the next public meeting.

Sign In Sheet

Subject I-229 Major Investment Corridor Study – Stakeholder Meetings for Benson Road Sub-Study

Client City of Sioux Falls/South Dakota Department of Transportation

Project PL 0100(87) 3610P, PCN 044K

Project No.: 207030

Meeting Date Monday, December 15, 2014 5:30 PM

Meeting Location: Sioux Falls Convention Center

Please print clearly. Thank you.

	Name	Address	Best Contact Phone	Email
1	James Unruh	HDR, Inc. 6300 S. Old Village Pl	605-977-7766	james.unruh@hdrinc.com
2	Jason Kjenstad			
3	Heath Hoftiezer	City of Sioux Falls		
4	Paul Nikolas	SDDOT		
5	Travis Dressen	SDDOT		
6	Russ Robers First Nat'l Bank	1901 E. Benson Rd SF SD 57104	605-782-5801	rerobers@fnbsf.com
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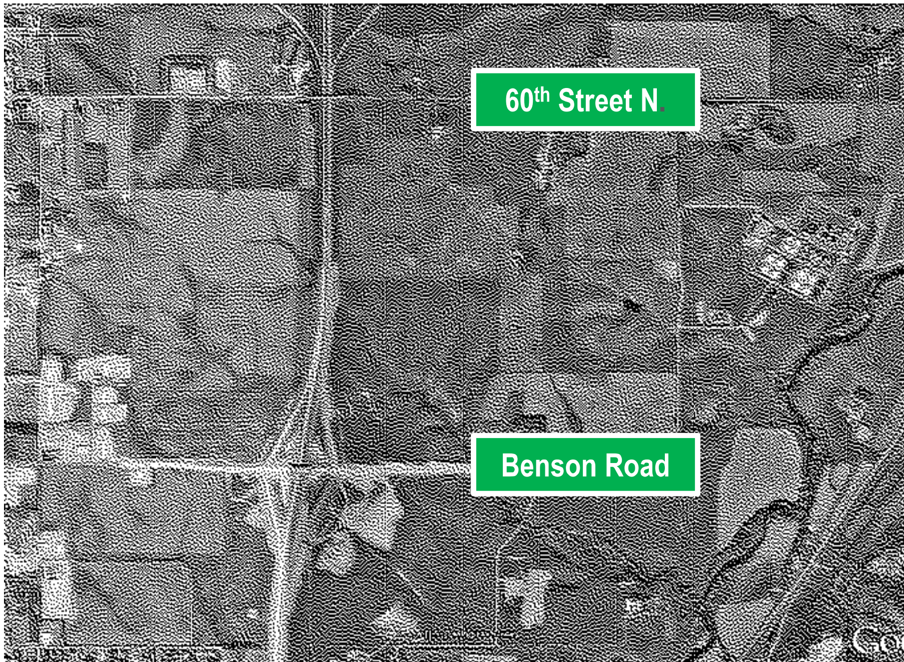


Interstate 229 Major Investment Study

Exit 9 – Benson Rd

Stakeholder Meeting
December 15th, 2014
5:30 pm to 6:30 pm

HDR
HRGreen

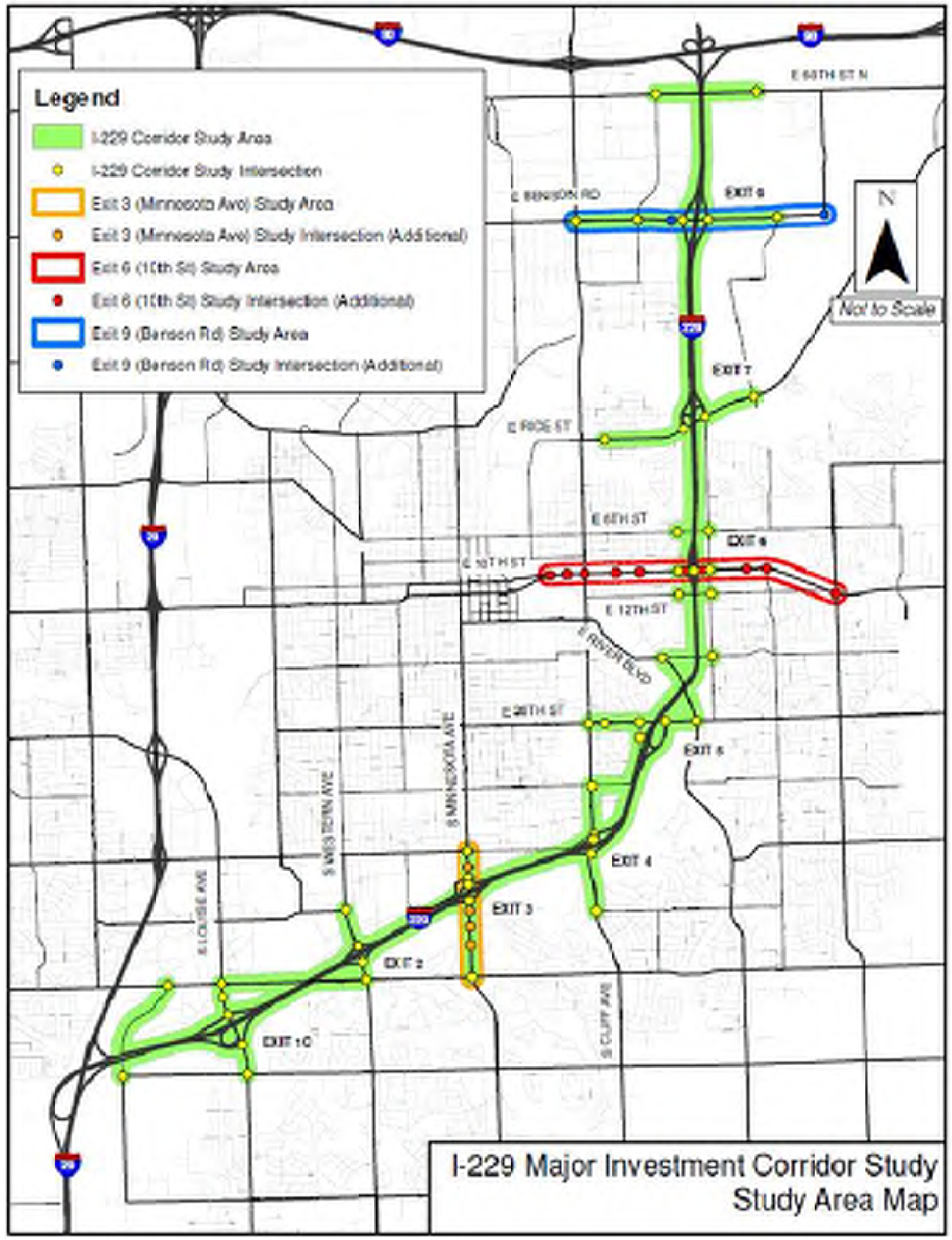
Study Area Map

I-229 Corridor Study

Solberg Avenue Overpass
to
60th Street N. Overpass

Additional Studies

Exit 3 – Minnesota Ave
Exit 6 – 10th Street
Exit 9 – Benson Road



Study Advisory Partners

South Dakota Department of Transportation (SDDOT)

South Dakota Highway Patrol

City of Sioux Falls

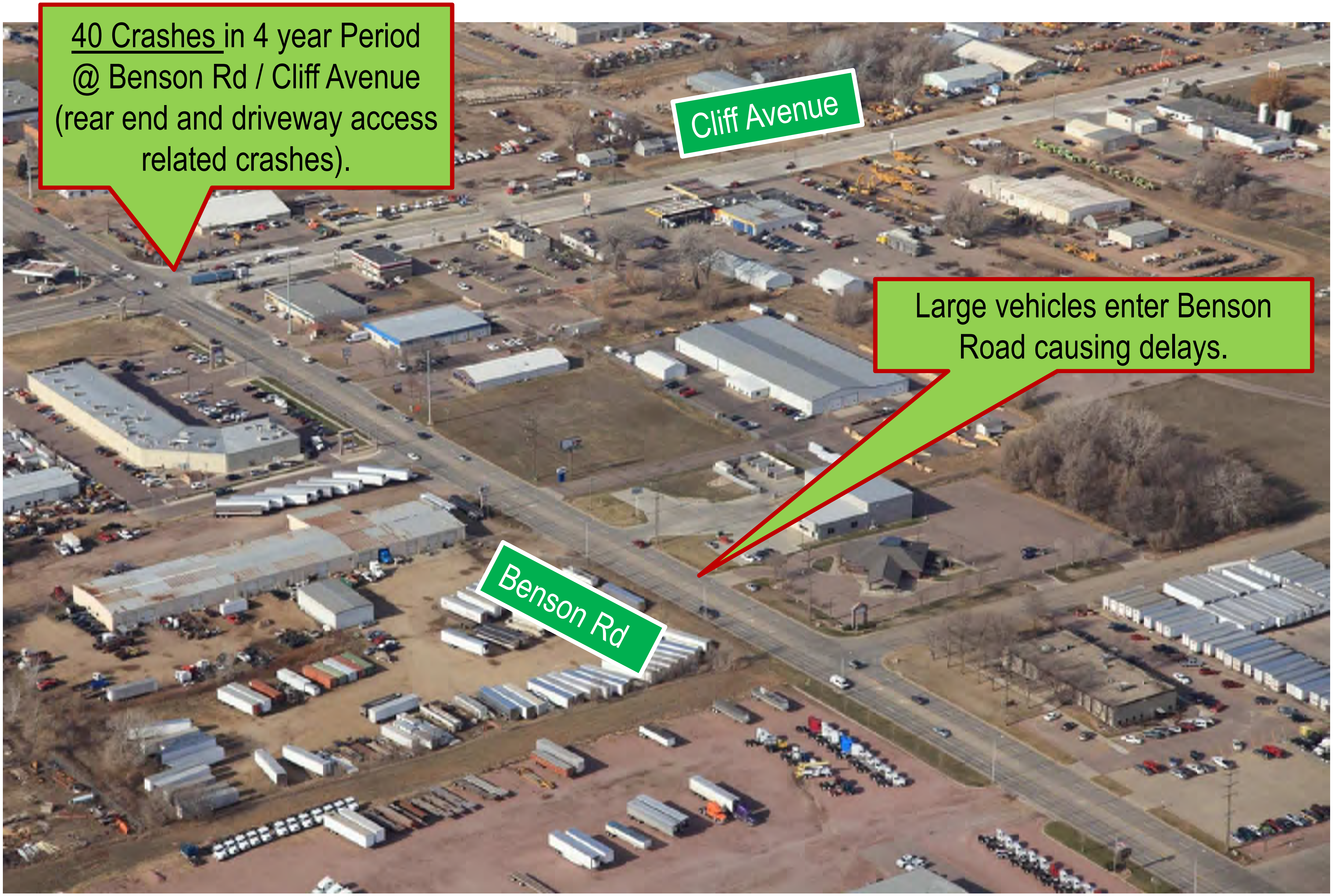
Sioux Falls Metropolitan Planning Organization (MPO)

Federal Highway Administration (FHWA)

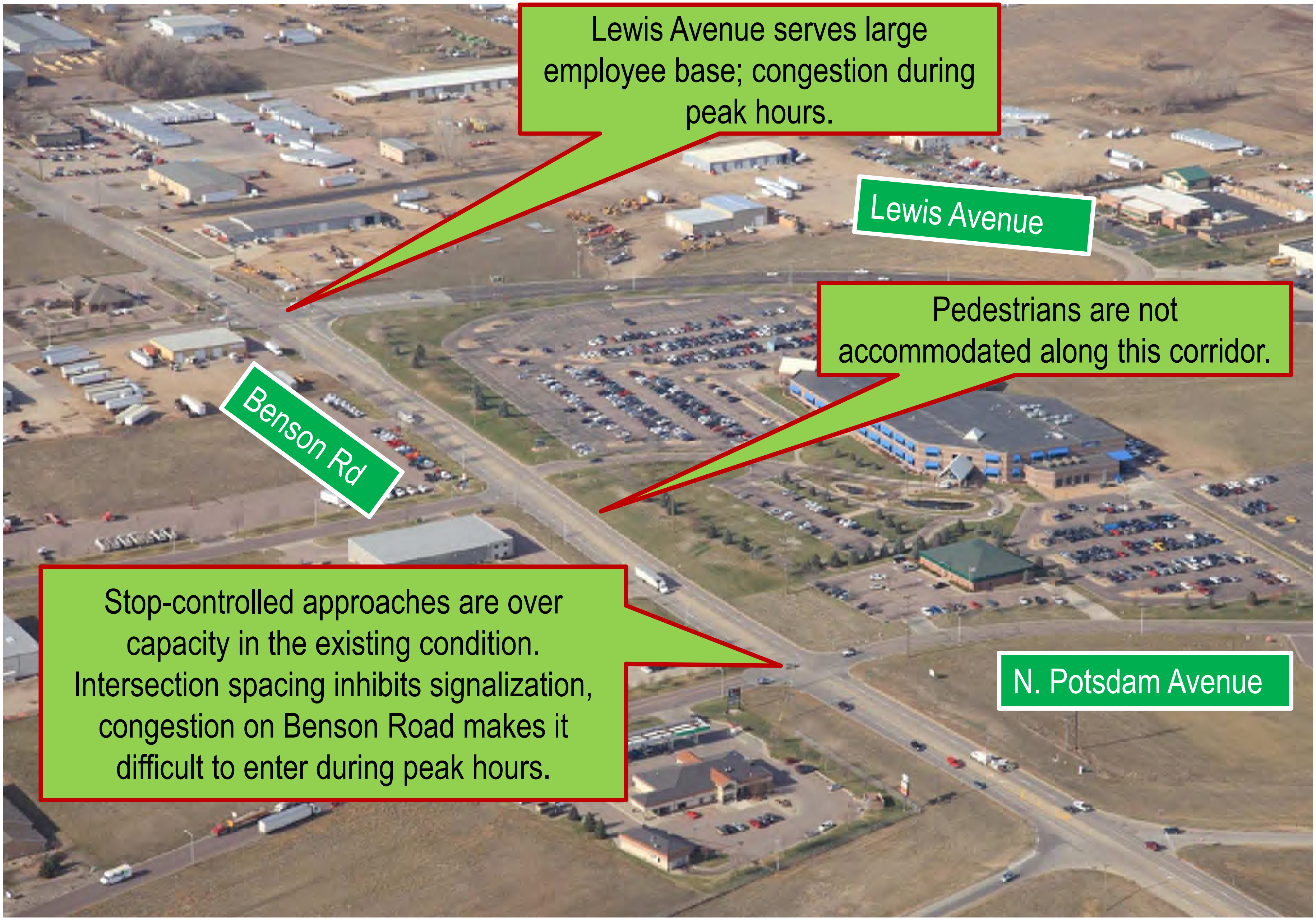
Exit 9 (Benson Road) Crossroad Study Goals

- Reduce traffic congestion at NB on/off interchange ramp terminal
- Develop Corridor Growth Plan to meet traffic demands from development taking place east of I-229
- Improve pedestrian mobility
- Make recommendations to improve corridor intersections
- Develop interchange alternatives to meet future traffic demands

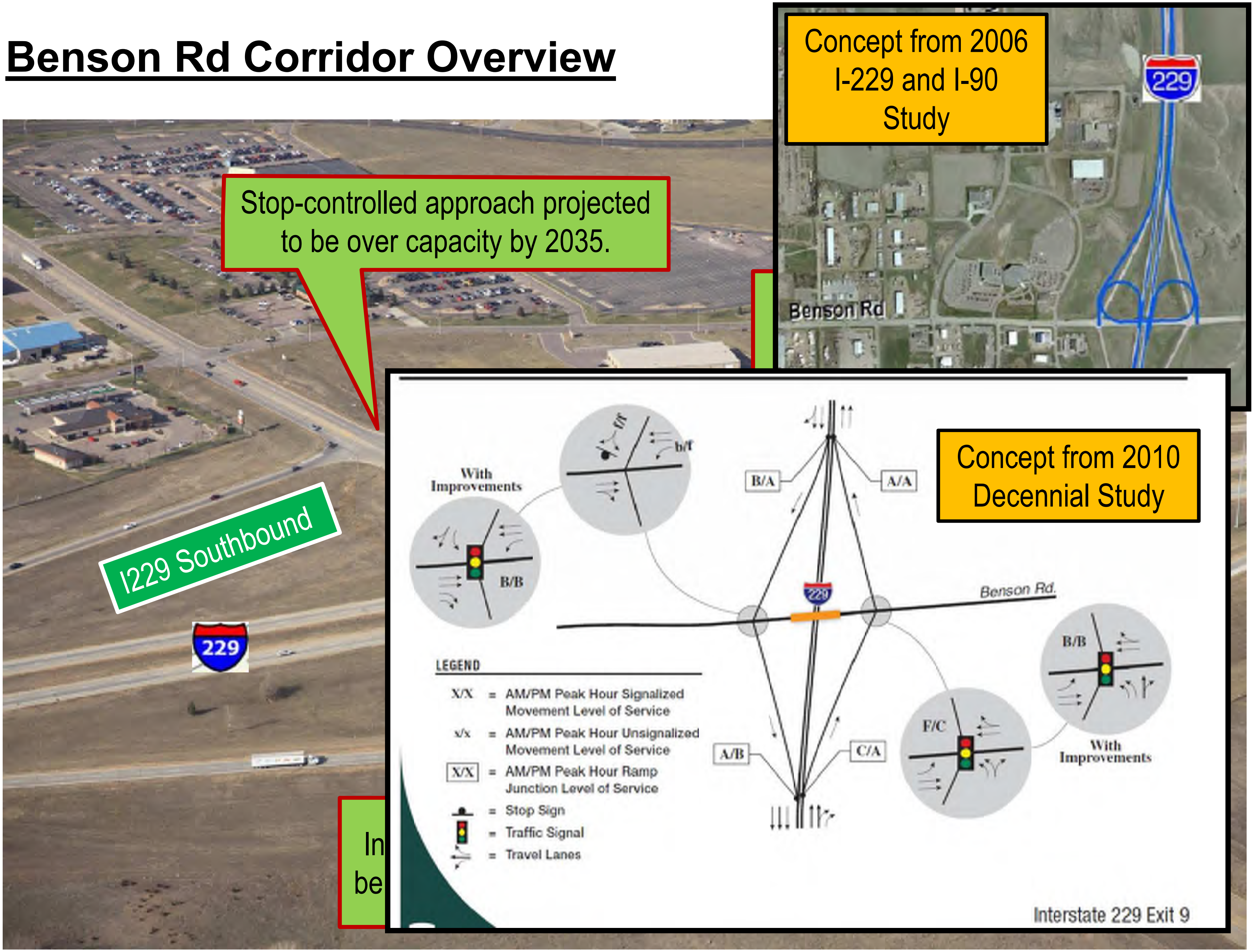
Benson Rd Corridor Overview



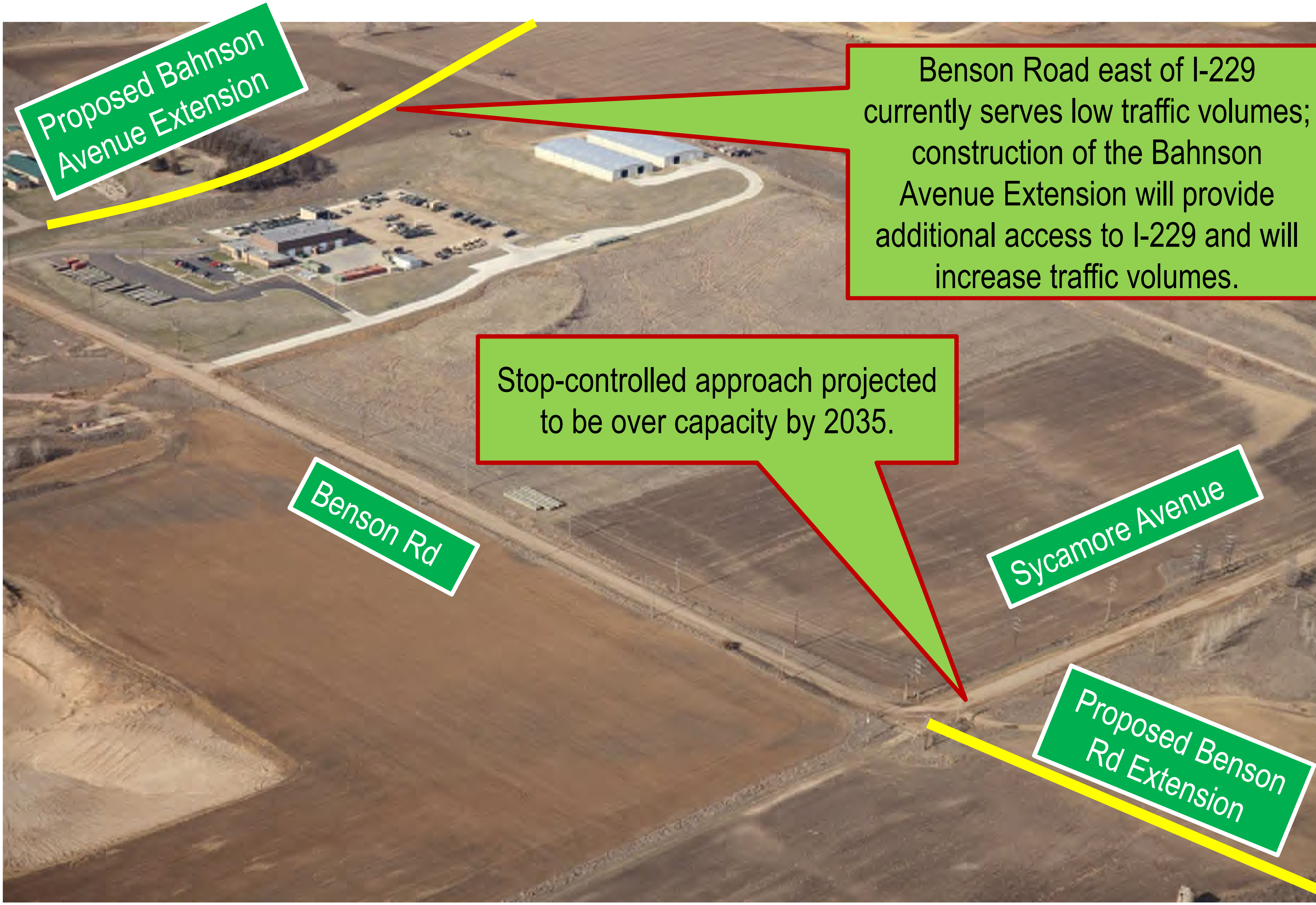
Benson Rd Corridor Overview



Benson Rd Corridor Overview



Benson Rd Corridor Overview



PROJECT CONTACTS:

Jason Kjenstad – HDR Engineering, Inc.
605-977-7740 or jason.kjenstad@hdrinc.com

James Unruh – HDR Engineering, Inc.
605-977-7740 or james.unruh@hdrinc.com

Shannon Ausen – City of Sioux Falls
605-367-8607 or sausen@siouxfalls.org

Steve Gramm – SDDOT Project Development
605-773-6641 or steve.gramm@state.sd.us

Interstate 229 Major Investment Study
Exit 9 – Benson Rd

Thanks for Attending!!!!!

HRGreen

10TH STREET

DECEMBER 16TH, 2014

- MEETING NOTES
- SIGN-IN SHEETS
- POWERPOINT SLIDES

Meeting Minutes

Project:	I-229 Major Investment Corridor Study; PL 0100(87) 3616P, PCN 044K
Subject:	Stakeholder Meeting – Sub-study 3 (10th Street from Downtown Viaducts to Sycamore Avenue)
Date:	Tuesday, December 16, 2014
Location:	Sioux Falls Convention Center Conference Room 6
Attendees:	See attached Sign In sheets

Jason Kjenstad covered the PowerPoint slides (attached to meeting notes).

Follow-up discussion items included:

1. Existing 10th Street traffic observations:
   - 1.1 A.M. peak hour – Congestion on 10th Street in vicinity of interchange, WB through traffic queues can be obsessive from Cleveland to Hy-Vee.
   - 1.2 P.M. peak hour – Congestion on 10th Street in vicinity of interchange, WB & EB through traffic queues can be obsessive near I-229. High demand for turning traffic at 10th and Cleveland causes signal coordination issues with the I-229 interchange. Traffic queues on the interchange ramps are a concern.
2. Existing I-229 traffic observations
   - 2.1 Interchange congestion is noticed during the AM and PM peak hours.
   - 2.2 Crashes on the NB off ramp at 10th Street a problem, has been better since SDDOT lengthened ramps onto the mainline.
3. Existing geometric constraints
   - 3.1 The 10th Street and I-229 Single Point Urban Interchange is restricted to single lefts in lieu of dual lefts which is a capacity limitation and leads to additional single lane queuing.
   - 3.2 Proper queue lengths are not provided at 10th Street and Cleveland causing overlaps with I-229 and 10th Street.
   - 3.3 10th and Sycamore was a high crash intersection due to the horizontal curvature, 2014 the intersection was reconstructed that changed all the lefts to dual movements that are protected movements. This will remove the crash trends.
4. 10th Street improvement considerations
   - 4.1 Place a raised median to improve traffic flow by removing conflict locations
   - 4.2 Possibility widen to 6 lanes to increase capacity
   - 4.3 Develop interchange alternatives that improve traffic flow a ¼ mile either side of I-229
   - 4.4 Restrict turning movements at specific intersections to improve traffic flow
5. I-229 improvement considerations
   - 5.1 Various interchange configurations are being considered for Minnesota Avenue. The configurations will be presented at the next public meeting.
   - 5.2 Add an additional lane from 26th Street to 10th Street on I-229 to provide increased capacity.

The following notes were gathered during the discussion with the adjacent landowners and business owners. The statements below are questions asked by the meeting attendees for us to consider as we develop options:

- Biggest problems with 10th St traffic operations are during morning and afternoon peak hours.
- Need to get commuters to use 6th St, 12th St and 18th St to access downtown to relieve 10th St.
- Would raising the posted speed limit on 10th St help traffic flow?
- Why was the traffic signal installed at Lowell?
- 10th St should be widened only at the I-229 interchange.
- Constructing medians slow businesses down.
- If there were ramps from I-229 to 6th and 12th those streets would be viable alternatives to 10th for downtown access. More exists on I-229 would be a cheaper investment than elevated lanes on 10th.
- At Cleveland, traffic from the north is the problem.
- Widening on Cleveland should be done on the east side.
- Relocate Old Home (from the east side of Cleveland).
- A median on Cleveland is not the answer.
- Improvements made at 10th and Sycamore was a good project.
- Relocate the Pizza Hut.
- I-229 should be connected to River Blvd with ramps.
- 6th St should be used instead of 12th St for a split diamond interchange with 10th St.
- Westbound to southbound left turns from 10th St to Cleveland are difficult to make.

Sign In Sheet

Subject I-229 Major Investment Corridor Study – Stakeholder Meetings for 10th Street Sub-Study

Client City of Sioux Falls/South Dakota Department of Transportation

Project PL 0100(87) 3616P, PCN 044K **Project No.:** 207030

Meeting Date Tuesday, December 16, 2014 3:30 PM **Meeting Location:** Sioux Falls Convention Center

Please print clearly. Thank you.

	Name	Address	Best Contact Phone	Email
1	HERSIL PATEL	2616 E 10TH STREET SIOUX FALLS SD 57103	605 338 8881	gm@super8siouxfalls.com
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Sign In Sheet

Subject I-229 Major Investment Corridor Study – Stakeholder Meetings for 10th Street Sub-Study

Client City of Sioux Falls/South Dakota Department of Transportation

Project PL 0100(87) 3616P, PCN 044K **Project No.:** 207030

Meeting Date Tuesday, December 16, 2014 3:30 PM **Meeting Location:** Sioux Falls Convention Center

Please print clearly. Thank you.

	Name	Address	Best Contact Phone	Email
1	Tami Johnson	Casey's General Store - 1901 East 10th St.	515 871-7184	jajrtp63@gmail.com
2	Mark Elisson	101 S. Cleveland Ave	605-338-8151	melisson@sio.midco.net
3	Mike Bruns	2310 E 10th	605-728-1570	mike@buildersmw.com
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Sign In Sheet

Subject I-229 Major Investment Corridor Study – Stakeholder Meetings for 10th Street Sub-Study

Client City of Sioux Falls/South Dakota Department of Transportation

Project PL 0100(37) 3018P, PCN 044K **Project No.:** 207030

Meeting Date Tuesday, December 16, 2014 3:30 PM **Meeting Location:** Sioux Falls Convention Center

Please print clearly. Thank you.

	Name	Address	Best Contact Phone	Email
1	Gary Busselman	SF SD 57110 7201 E Madison ST	605 334 5692	gary@garyboss.com
2	CHUCK GUSTAFSON	705 E. RIDGE RD SFSD 57105	332-1000	CGUSTAFSON@mac.com
3	Travis Dressen	SF Area DOT	367-5680	travis.dressen@state.sd.us
4	Lynne Beatty	2520 W. 8th St SF SD 57104	339-1053	lynne.bebprop@[illegible]
5	Shannon Ausen	224 [illegible] St	367-8607	sausen@siouxfalls.org
6	Gayle Nelson	2901 S Bahnson 57103	366-5782	DEKDAD@AOL.com
7	Layton Noonk	301 S. Blaine	338-2206	
8	Quality Efficiencies Linda Hart	3503 S Norton Ave Sioux Falls, SD 57105	339-3382	[illegible].com
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Interstate 229 Major Investment Study

Exit 6 – 10th Street

Stakeholder Meeting
December 16th, 2014
3:30 pm to 4:30 pm

HRGreen

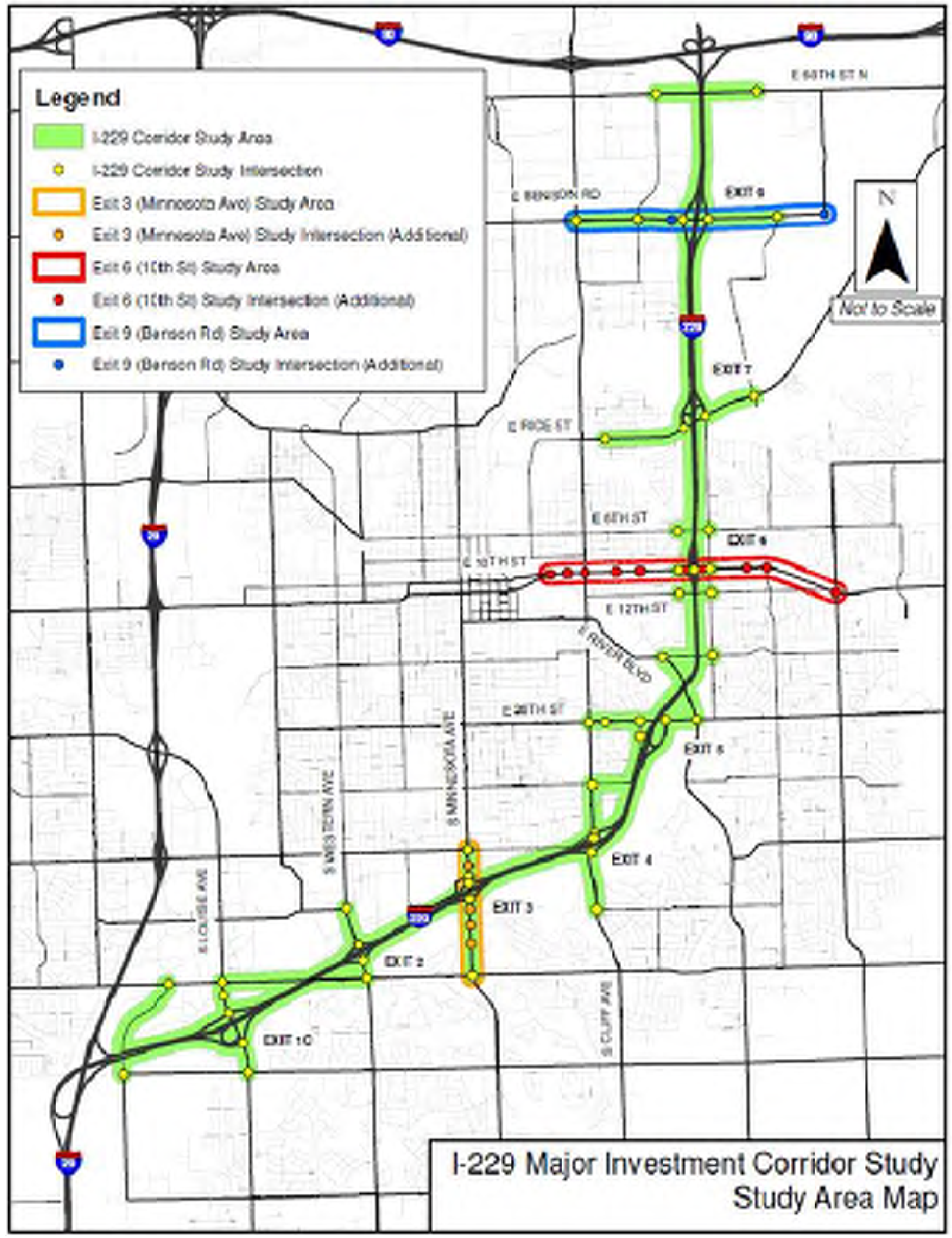
Study Area Map

I-229 Corridor Study

Solberg Avenue Overpass
to
60th Street N. Overpass

Additional Studies

Exit 3 – Minnesota Ave
Exit 6 – 10th Street
Exit 9 – Benson Road



Study Advisory Partners

South Dakota Department of Transportation (SDDOT)

South Dakota Highway Patrol

City of Sioux Falls

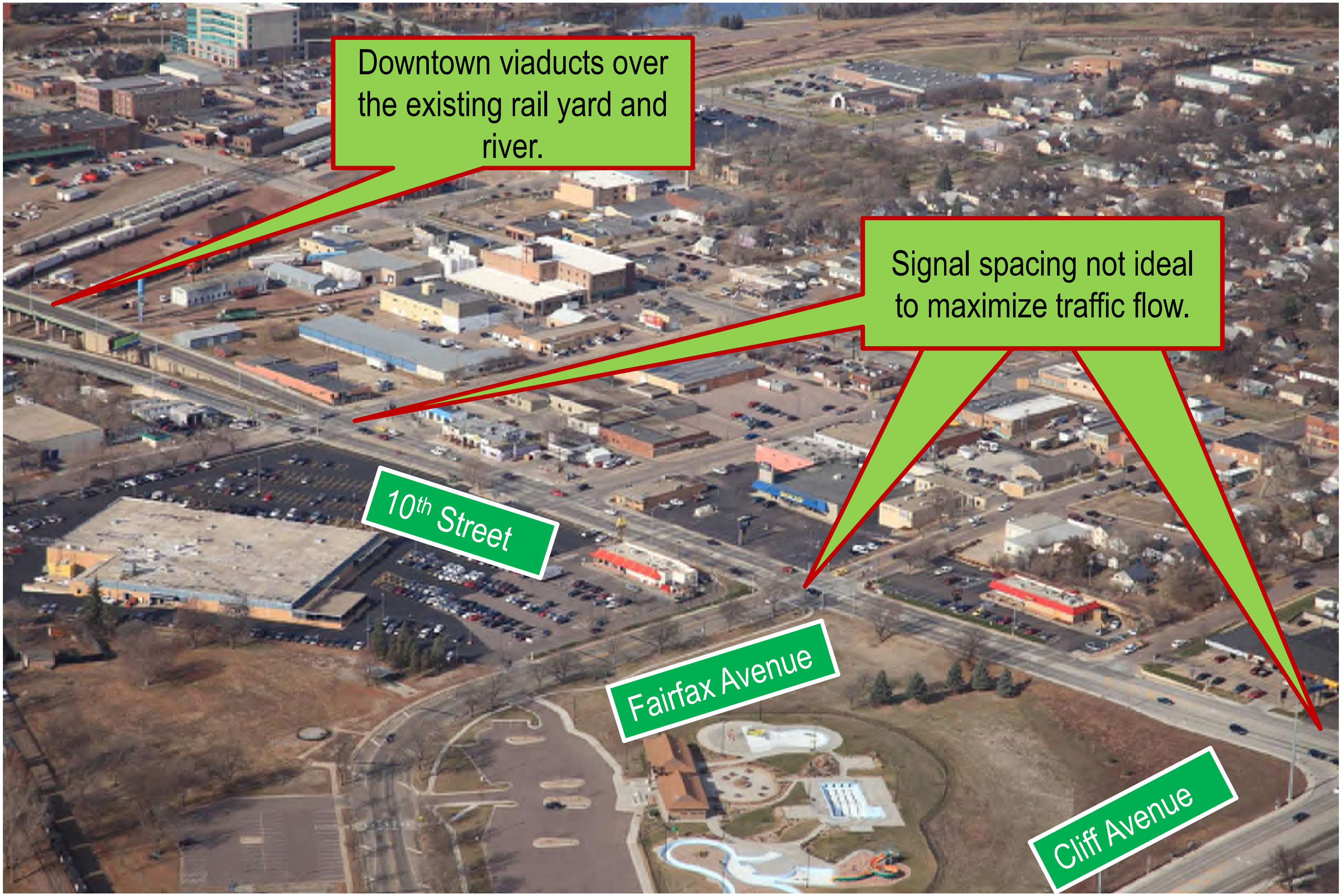
Sioux Falls Metropolitan Planning Organization (MPO)

Federal Highway Administration (FHWA)

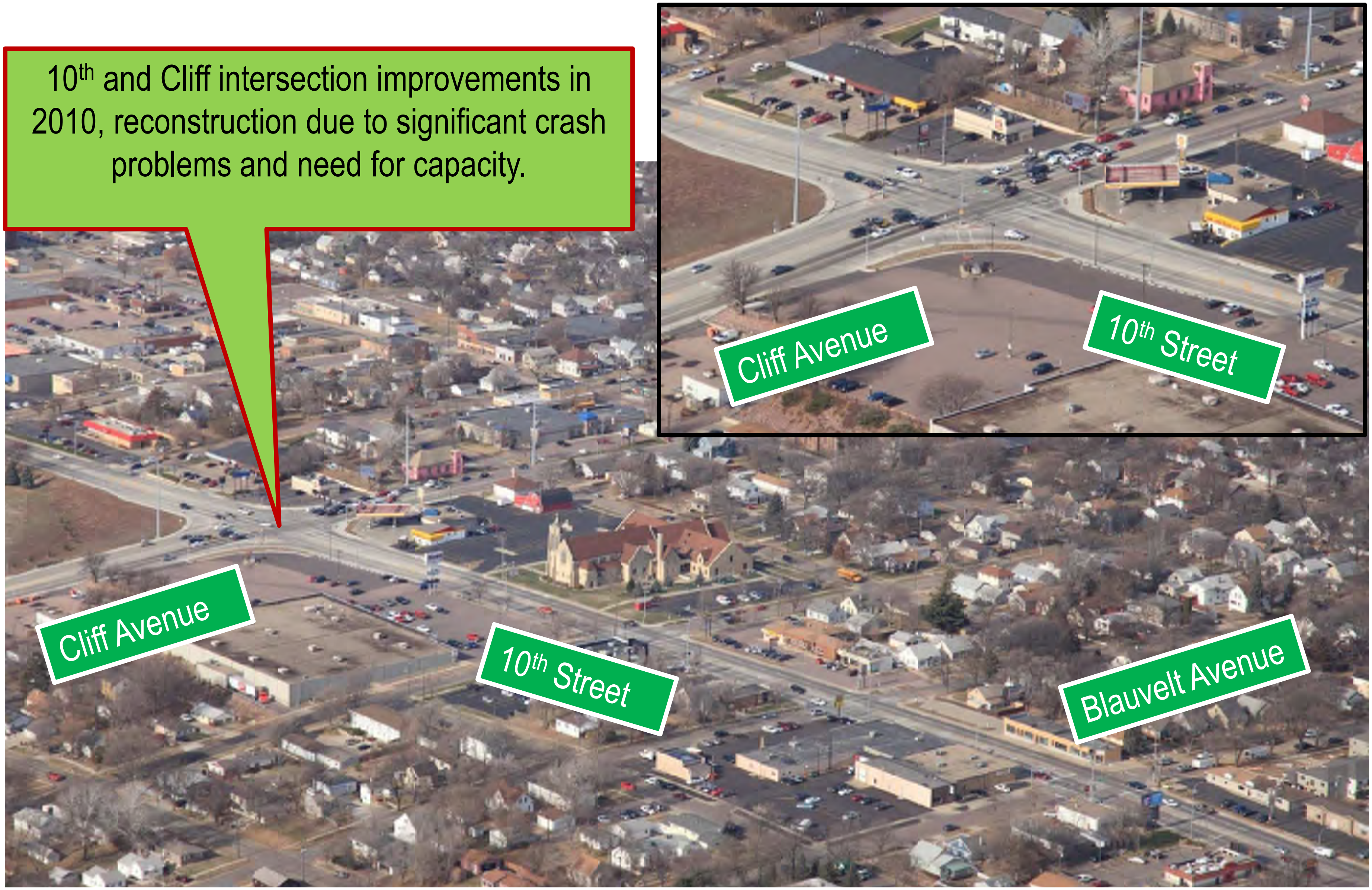
Exit 6 (10th Street) Crossroad Study Goals

- Reduce traffic congestion
- Develop Corridor Growth Plan to meet traffic demands but minimizing impacts to developed properties
- Improve pedestrian mobility
- Improve safety for corridor users
- Identify improvements to the interchange as well as the 10th Street and Cleveland Ave intersection

10th Street Corridor Overview

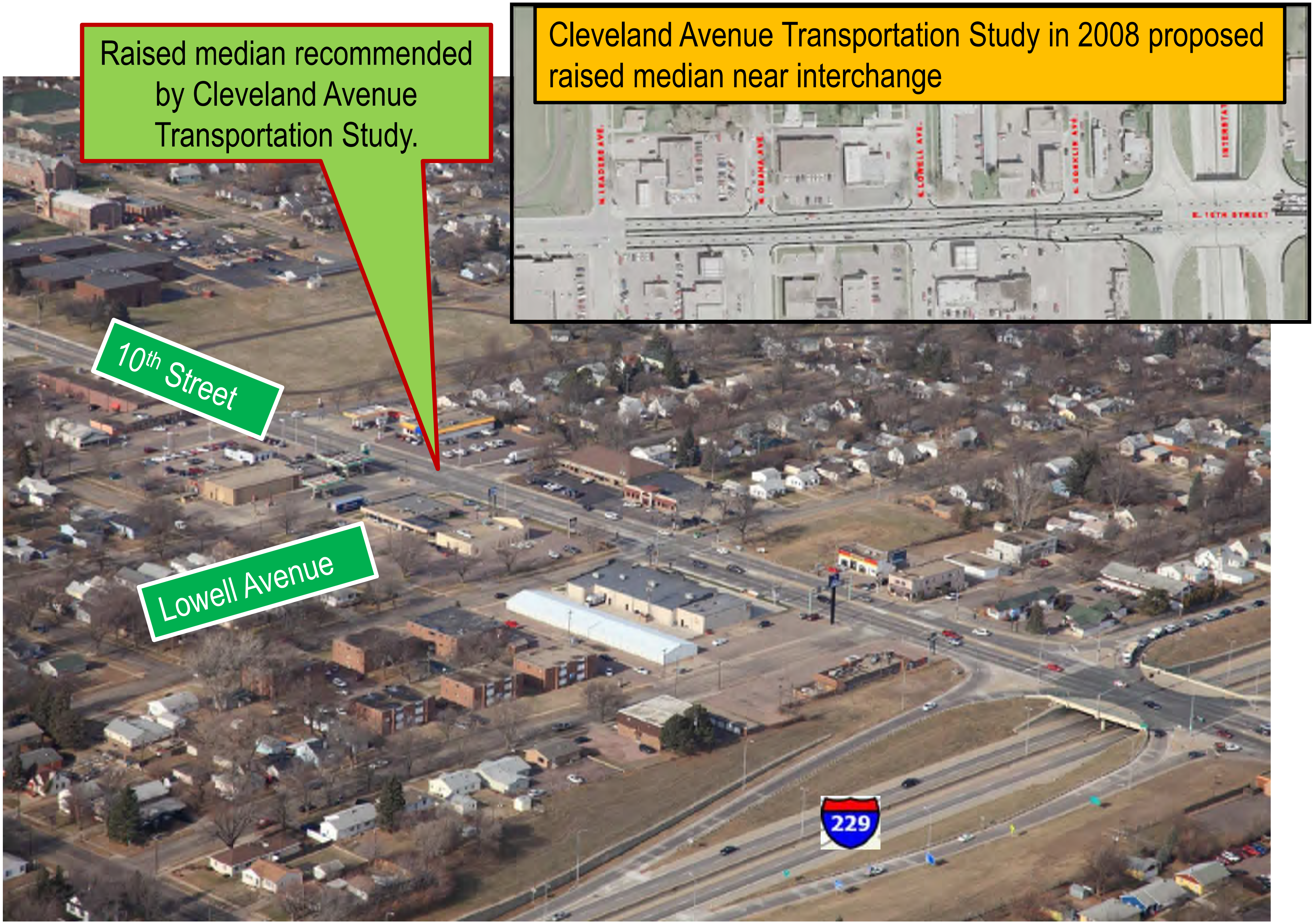


10th Street Corridor Overview

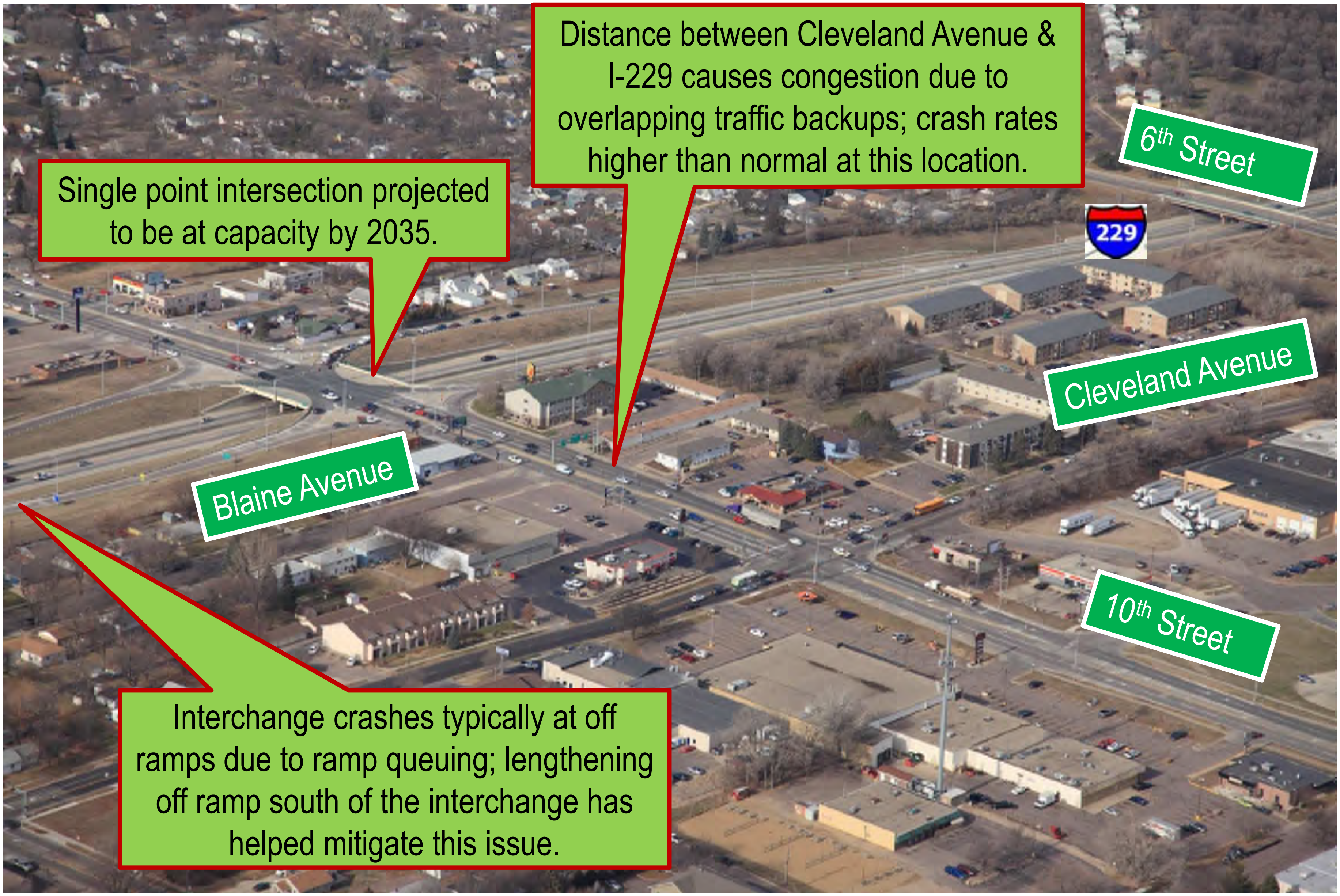


10th Street Corridor Overview

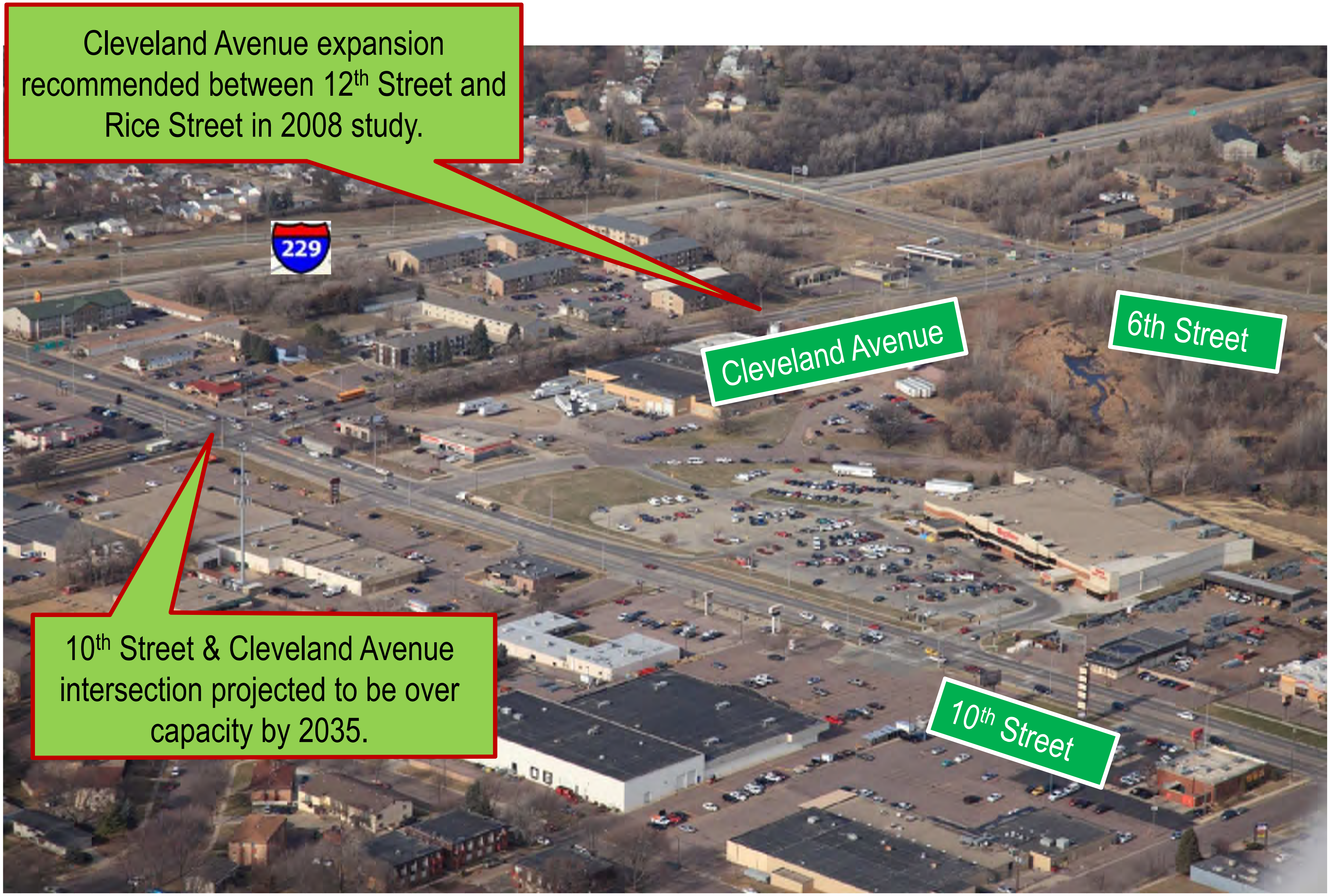
10th Street Corridor Overview



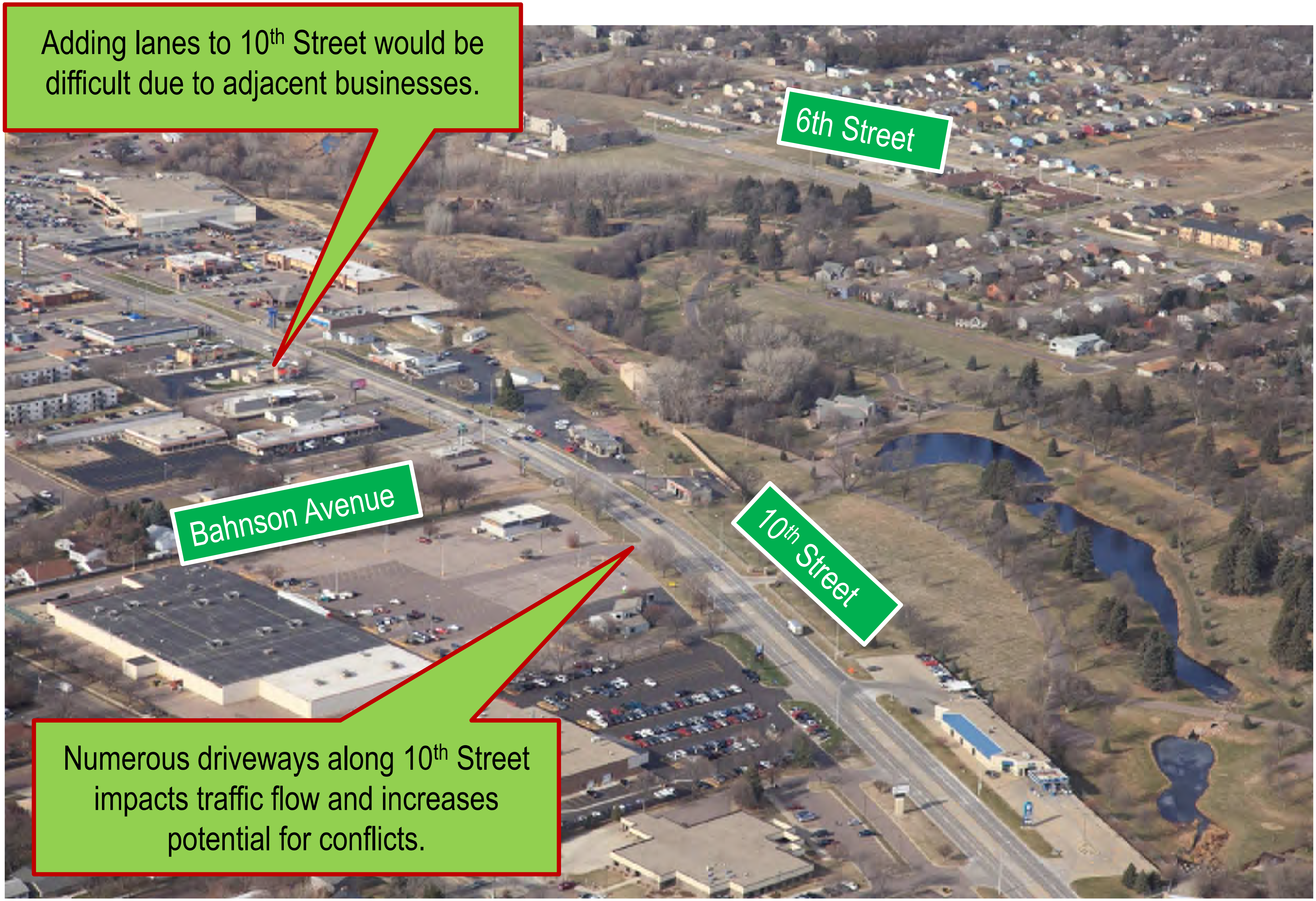
10th Street Corridor Overview



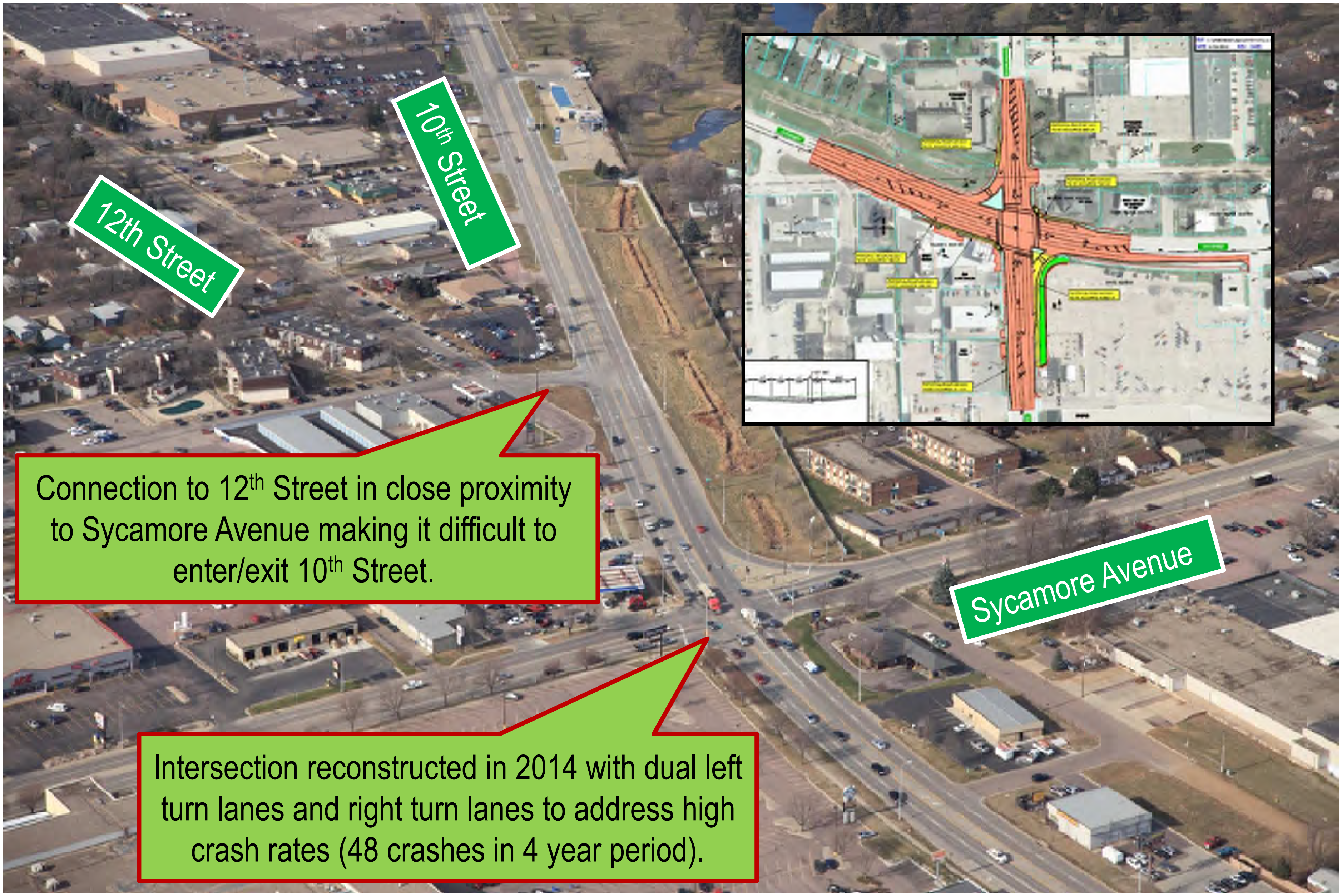
10th Street Corridor Overview



10^{th} Street Corridor Overview

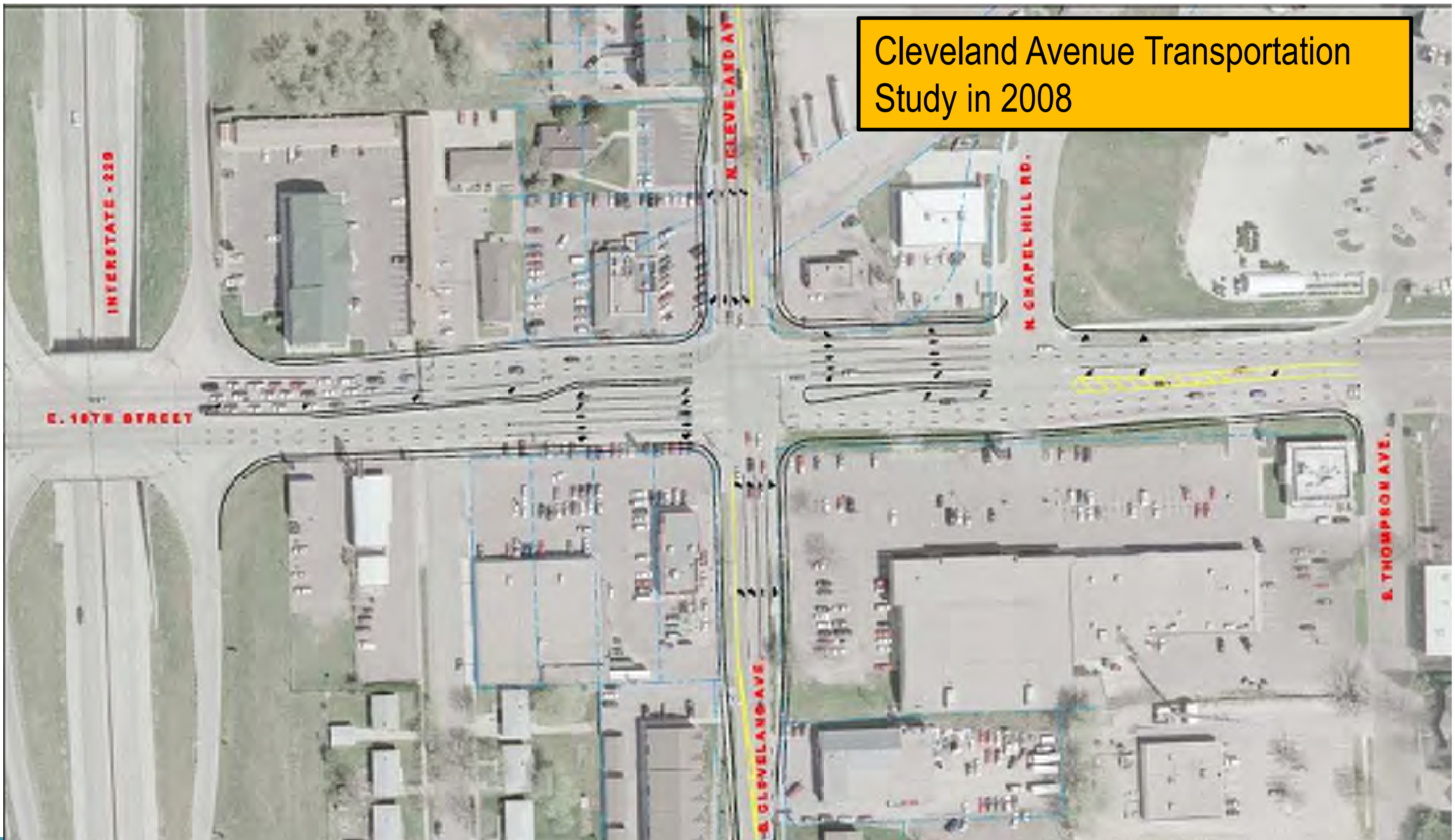


10th Street Corridor Overview



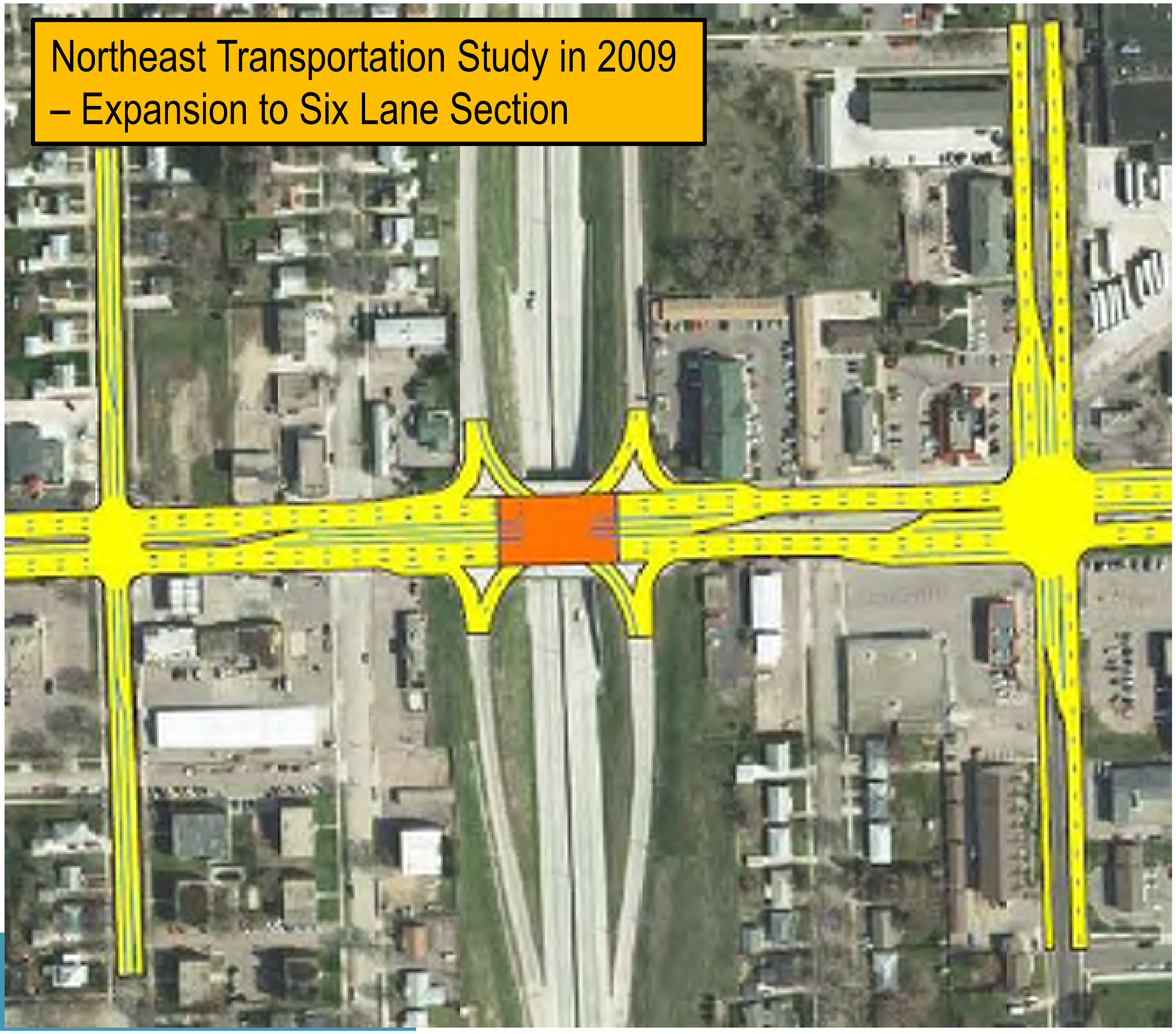
Previous Study Ideas for 10th Street Corridor

- Cleveland Ave. Transportation Study



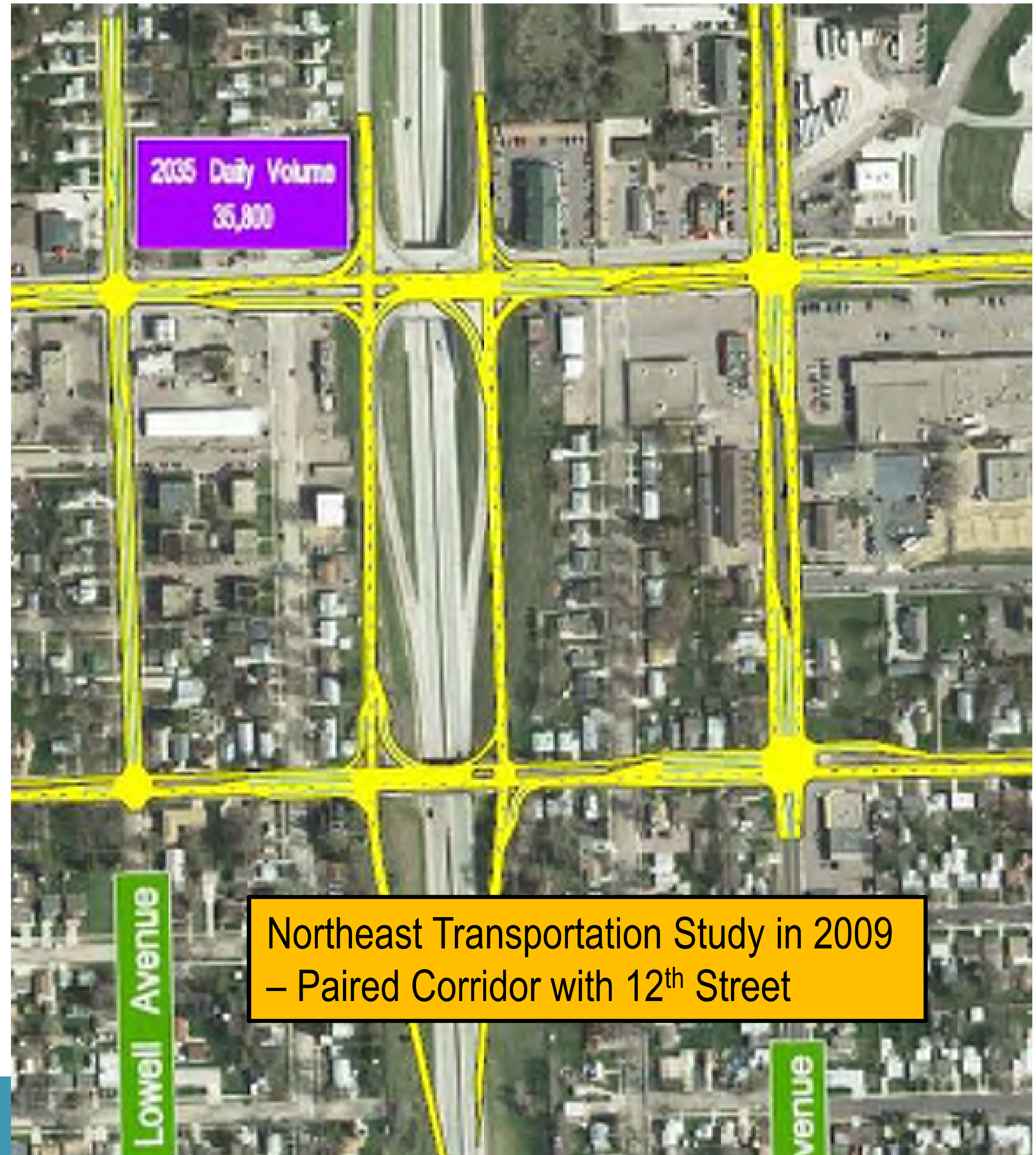
Previous Study Ideas for 10th Street Corridor

- **Northeast Transportation Study**



Previous Study Ideas for 10th Street Corridor

- Northeast Transportation Study



PROJECT CONTACTS:

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Chris Malmberg – HDR Engineering, Inc.
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Shannon Ausen – City of Sioux Falls
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Steve Gramm – SDDOT Project Development
605-773-6641 or steve.gramm@state.sd.us

Interstate 229 Major Investment Study
Exit 6 – 10th Street

Thanks for Attending!!!!!

HRGreen

Minnesota Avenue

December 16th, 2014

- Meeting Notes
- Sign-In Sheets
- PowerPoint Slides

Meeting Minutes

Project:	I-229 Major Investment Corridor Study; PL 0100(87) 3616P, PCN 044K
Subject:	Stakeholder Meeting – Sub-study 2 (Minnesota Ave from 57th Street to 41st Street)
Date:	Tuesday, December 16, 2014
Location:	Sioux Falls Convention Center Conference Room 6
Attendees:	See attached Sign In sheets

Jason Kjenstad covered the PowerPoint slides (attached to meeting notes).

Follow-up discussion items included:

1. Existing Minnesota Avenue traffic observations:
   1.1 A.M. peak hour – NB traffic on Minnesota Queues at I-229 and 41st Street. 57th Street traffic queues on East approach (WB) at Minnesota Avenue.
   1.2 P.M. peak hour – SB traffic on Minnesota is extremely congested between 41st Street and I-229. The 49th Street extension is blocked due to this.
2. Existing I-229 traffic observations
   2.1 Traffic queues at the NB off ramp in both AM and PM peak hours and SB off ramp in the AM peak hour.
   2.2 Travel Time runs on I-229 indicate capacity is good on the mainline.
   2.3 Crashes are highly noticed along the NB off ramp.
3. Existing geometric constraints
   3.1 Driveway from Yankton trail park is a concern in relationship to the I-229 ramps
   3.2 Proximity of 49th Street extension in relation to interchange.
4. Minnesota Avenue improvement considerations
   4.1 Place a raised median to improve traffic flow by removing conflict locations
   4.2 Possibility widen to 6 lanes to increase capacity
   4.3 Develop interchange alternatives that work with the 49th Street extension location on Minnesota Avenue
   4.4 Possibility relocate Yankton Trail Park entrance further south
5. I-229 improvement considerations
   5.1 Various interchange configurations are being considered for Minnesota Avenue. The configurations will be presented at the next public meeting.

The following notes were gathered during the discussion with the adjacent landowners and business owners.

- <u>57th Street and Minnesota:</u> Commenters noted that the angle of the curve in the intersection and the topographic changes create safety concerns – can't see when vehicles are in turning lanes. It was explained that a break in the section line (platting) was the original issue that caused the current misalignment and that it is being slowly corrected each time improvements are made. Angle crashes at the intersection and speed limit changes at the intersection approach were also discussed.

- Lotta Street concerns: (multiple mentions, compiled below) – also see handout provided by Aspen Condominiums representative (attached).
    - Left turning movement safety from Lotta Street at Minnesota Avenue (driver delay and speed of approaching vehicles)
    - Speed on Minnesota Avenue at Lotta Street, particularly northbound (picking up speed heading down the hill)
    - Safety (turning gaps, speed, driveways and pedestrians/bicyclists)
    - Offset drives can lead to some confusion on turning movements
    - Residents at Aspen Condominiums are largely retired and many are elderly.
- Discussion on legal access: Southern building, east of the 49th Street intersection, has separate ownership than the others within the development. If they lose their access to Minnesota Avenue, they would lose their legal access to the property.
- Traffic volumes on 49th: Comment that there has been much more traffic on 49th over last couple years due to new construction and operation of Costco and a new apartment complex.
- Truck Parking West of Minnesota Avenue: A comment was made that Midco trucks park on- streets, creating safety concerns. It was noted that Midco is planning to build a separate facility with off-street parking in the near future, which could potentially alleviate this issue.
- Plans for 49th Street: It was noted the City plans to construct 49th Street beginning in 2017, starting on the west end. Multiple phases will over next several years. The final phase that ties into the existing 49th Street segment would be last, and will be dependent on the committed Minnesota Avenue interchange design.
- New Development Traffic (Walmart, Costco, and Apartments): It was noted that each of these new developments have been accounted for in the travel demand model.
- Safe Access to Minnesota Avenue: A property owner of building immediately adjacent to southbound exit ramp mentioned it was very difficult to turn left out of the property onto Minnesota Avenue.
- Interior cross parcel access: One commenter noted that motorists cut across parking lots west of Minnesota Avenue (North of 49th Street) via cross easements or interior driveways to avoid Minnesota Avenue.

- Center Median Proposed: City of Sioux Falls staff noted that they have begun to look at a median along Minnesota Avenue, starting near the airport and heading south along Minnesota Avenue.

- Bicyclist Safety: A commenter noted that there is a safety issue at the park access driveway with the number/frequency of bicyclists/pedestrians traveling north-south along Minnesota Avenue, across the park driveway. City staff noted they will continue with this study, at bike/ped bridges or overpasses for crossings of I-229.

- Adaptive Traffic Signal Control: City staff noted they plan to implement an adaptive traffic signal control system along Minnesota (from 18th to the southern ramp terminal intersection).

- 41st and Minnesota: City staff mentioned the intent to construct a new eastbound lane at 41st Street, for approximately one to three blocks. This will create an EBL, EBL, EBT, and EBR lane configuration at the Minnesota intersection. Looking at construction as early as 2016. The City plans to replace the existing 5-section heads at Minnesota to remove the Dallas phasing, thereby replacing it with the flashing yellow signal head.

Sign In Sheet

Subject I-229 Major Investment Corridor Study – Stakeholder Meetings for Minnesota Avenue Sub-Study

Client City of Sioux Falls/South Dakota Department of Transportation

Project PL 0100(87) 3516P, PCN 044K

Project No.: 207030

Meeting Date Tuesday, December 16, 2014 1:30 PM

Meeting Location: Sioux Falls Convention Center

Please print clearly. Thank you.

	Name	Address	Best Contact Phone	Email
1	Shannon Auser	224 W. 9th St SF SD	367-8607	sauser@siouxfalls.org
2	Bob Bothn	3600 S. Duluth Ave	334-4220	robert.bohn@clfabilities.org
3	Pam Taylor	5000 S. Sunnymede Cir Sioux Falls	332-6509	Pam.Jansa@gmail.com
4	Steve Sherman	3800 S. Grange	359-7857	ssherman@jackhenry.com
5	Cindy Shrewsbury	4300 S. Pine Cone Place	3678871	Cabernet@AOL.com
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Sign In Sheet

Subject I-229 Major Investment Corridor Study – Stakeholder Meetings for Minnesota Avenue Sub-Study

Client City of Sioux Falls/South Dakota Department of Transportation

Project PL 0100(37) 3615P, PCN 044K **Project No.:** 207030

Meeting Date Tuesday, December 16, 2014 1:30 PM **Meeting Location:** Sioux Falls Convention Center

Please print clearly. Thank you.

	Name	Address	Best Contact Phone	Email
1	Dianne Metli	4304 S. Minn Ave.	339-2864	metli@sio.midco.net
2	Thomas Hein	6100 E. Hein Place SF 57110	361-8400	Theinmail@gmail.COM
3	Paul Nikolas	5316 W. 60th St. N.	367-5680	Paul.Nikolas@state.sd.us
4	Ann Kelly	4601 S. Minn Ave.	334-2858	
5	Normandie Haai	4600 W. 12th.	605-366-3233	normdehaai@billionauto.com
6	BRIAN SATHER	3508 S. Wilson, #108 BSUS 6000 E AUTUMN LN	338-3205	[illegible]
7	John Hart	1309 W. 51st	444-6320	j.hart@voa-dakotas.org
8	MARK KOZEL	4040 S. GRANGE AVE	336.0860	mkozel@lampertyards.com
9	Richard Elmen	3501 S. minnesota	366 0252	relmen@rentall-inc.com
10	Kelly Vis	409 S. Grange Ave	336-6860	kvis@lampertlumber.com
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Interstate 229 Major Investment Study

Exit 3 – Minnesota Avenue

Stakeholder Meeting
December 16th, 2014
1:30 pm to 2:30 pm

HDR

HRGreen

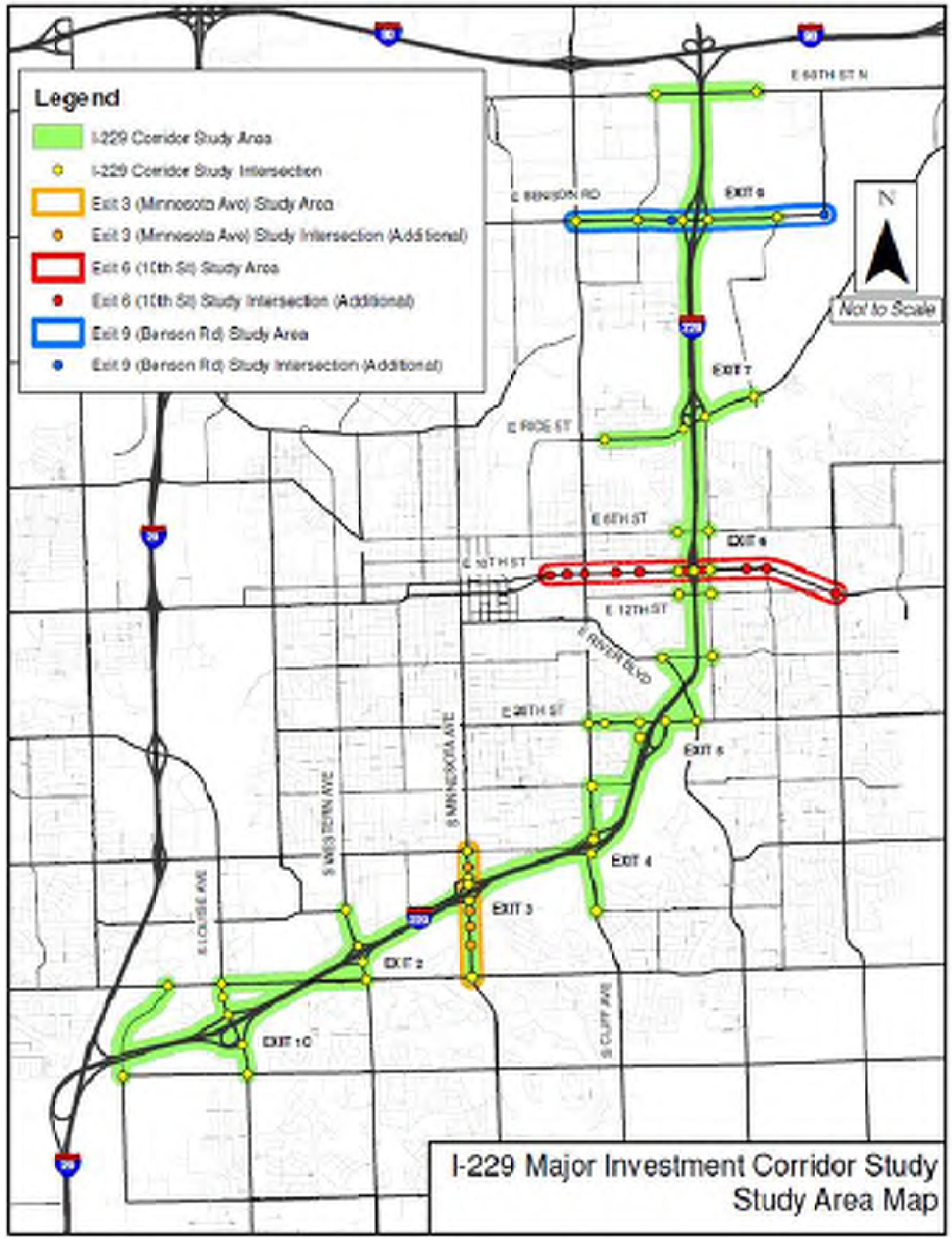
Study Area Map

I-229 Corridor Study

Solberg Avenue Overpass
to
60th Street N. Overpass

Additional Studies

Exit 3 – Minnesota Ave
Exit 6 – 10th Street
Exit 9 – Benson Road



Study Advisory Partners

South Dakota Department of Transportation (SDDOT)

South Dakota Highway Patrol

City of Sioux Falls

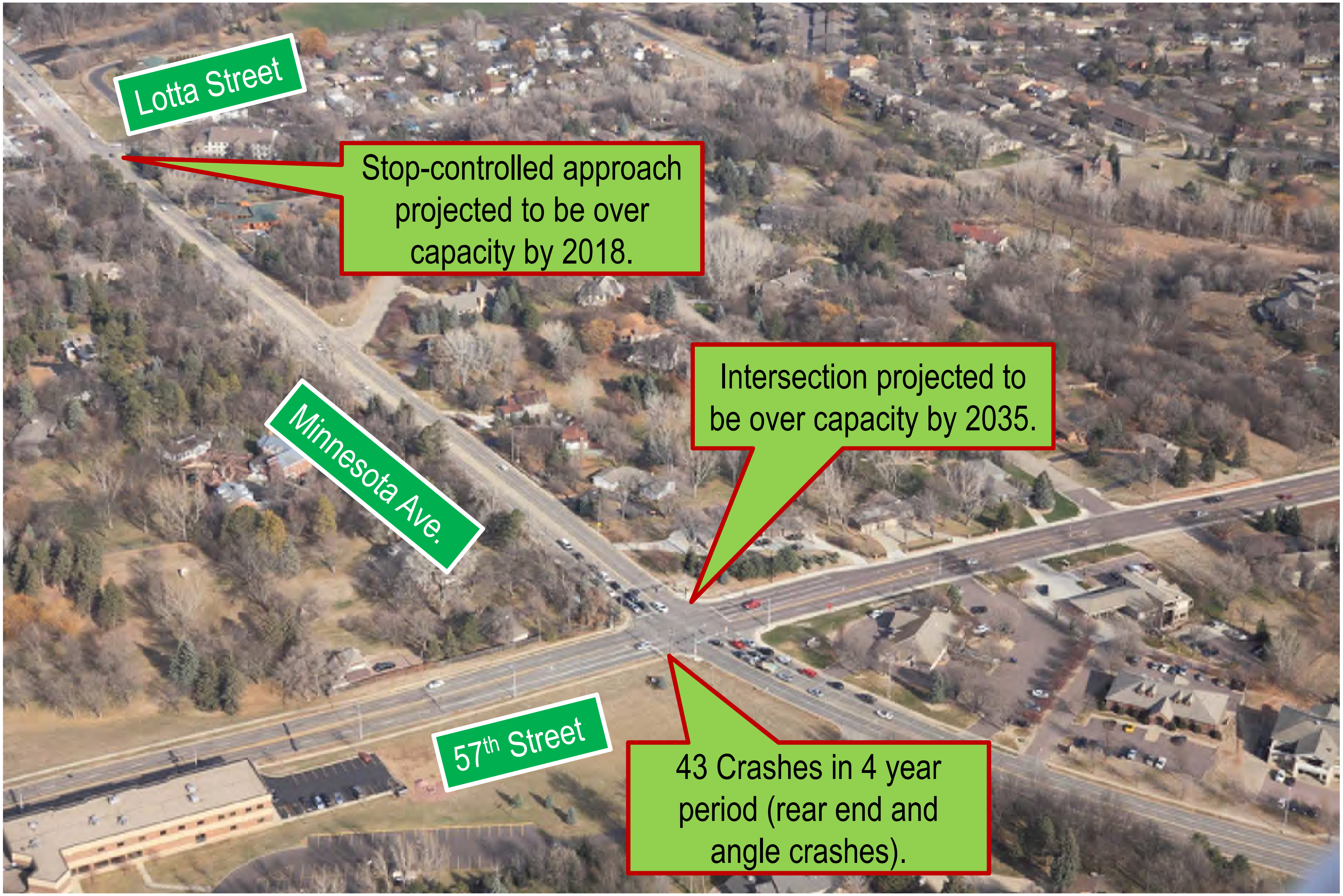
Sioux Falls Metropolitan Planning Organization (MPO)

Federal Highway Administration (FHWA)

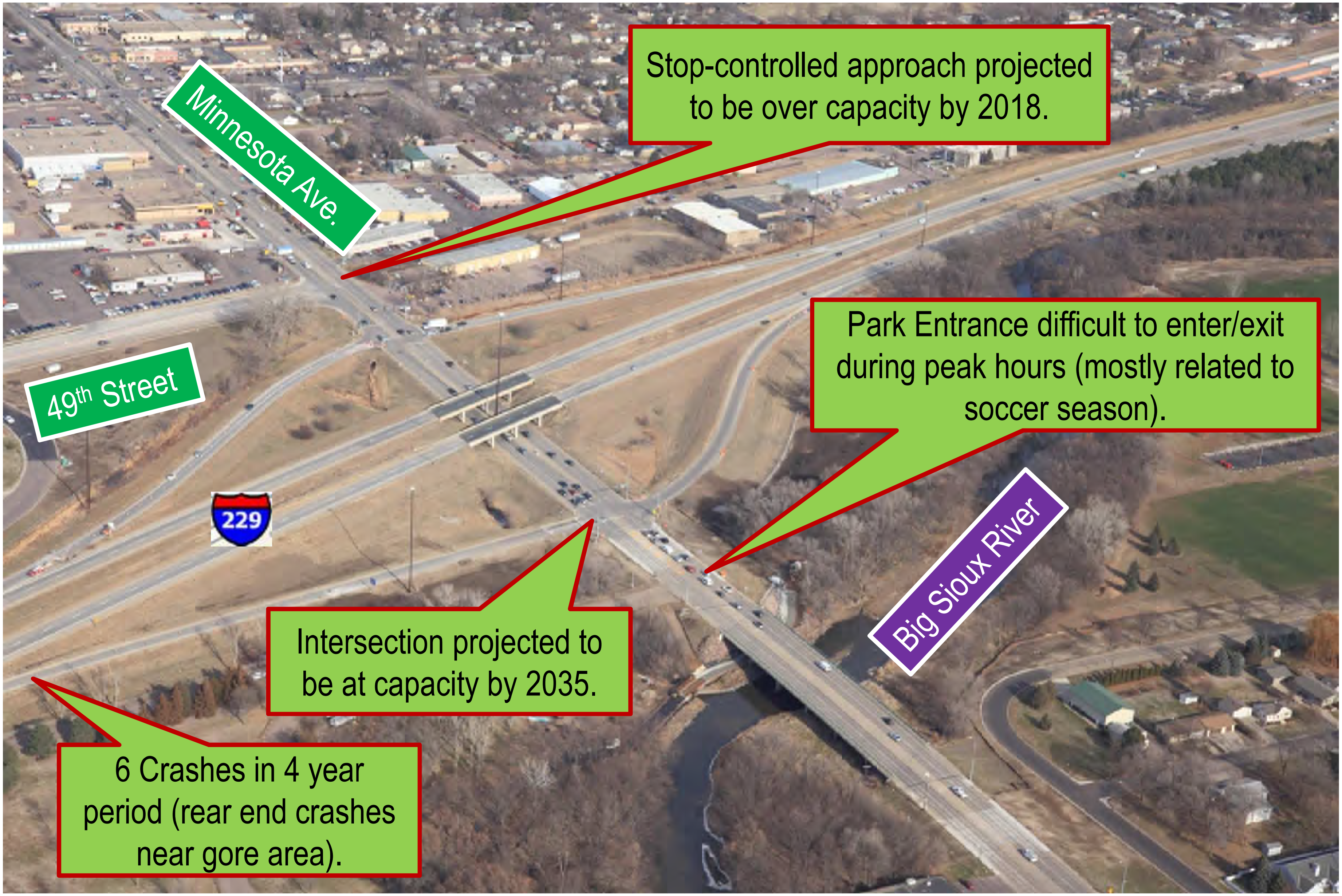
Exit 3 (Minnesota Avenue) Crossroad Study Goals

- Reduce traffic congestion
- Evaluate interchange options
- Integrate plans for the 49th Street Extension with the interchange options developed
- Improve pedestrian and bike access to the Big Sioux River Pathway
- Improve safety for corridor users
- Improve vehicle safety to Yankton Trail Park

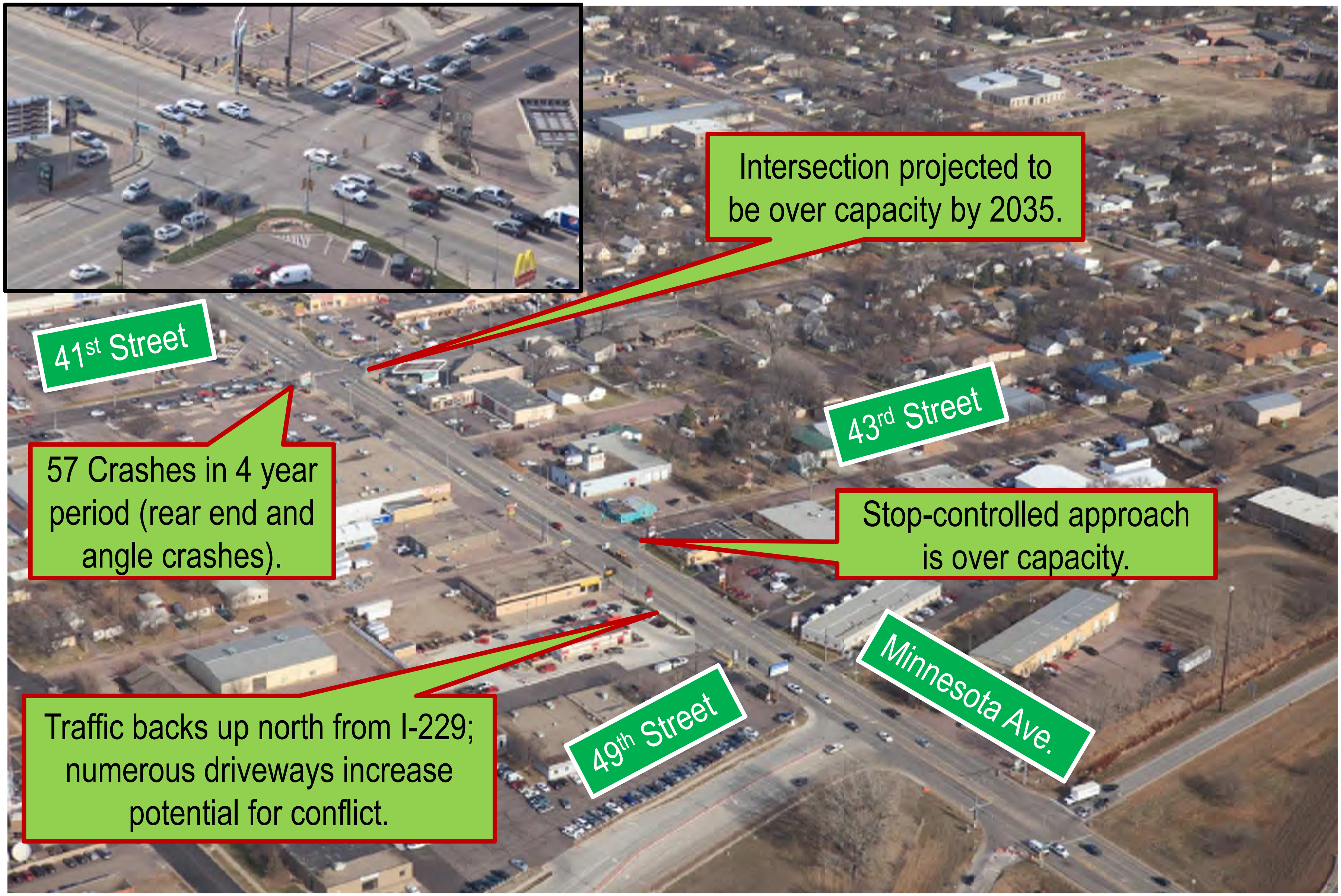
Minnesota Avenue Corridor Overview



Minnesota Avenue Corridor Overview



Minnesota Avenue Corridor Overview



Relevant Previous Studies

Preliminary local street extensions, interchange concepts, and traffic impact analyses in the vicinity of I-229 & Minnesota Avenue were identified in the following studies:

- **41st Street Corridor Study**
- **Sioux Falls Major Street and Access Management Plan**
- **2000 and 2010 Decennial Interstate Corridor Studies**
- **49th Street Extension Study**
- **Traffic Impact Studies – Costco, Scheels, and Walmart**

PROJECT CONTACTS:

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Steve Gramm – SDDOT Project Development
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Interstate 229 Major Investment Study
Exit 3 – Minnesota Avenue

Thanks for Attending!!!!!

HRGreen

RICE STREET

JUNE 22ND, 2016

- SIGN-IN SHEETS
- POWERPOINT SLIDES
- MEETING NOTES (SEE CLIFF AVENUE AND RICE STREET PUBLIC MEETINGS APPENDIX)
- COMMENTS (SEE CLIFF AVENUE AND RICE STREET PUBLIC MEETINGS APPENDIX)

Sign In Sheet

Subject I-229 Major Investment Corridor Study – Stakeholder Meetings for Rice Street Sub-Study
Client City of Sioux Falls/South Dakota Department of Transportation
Project PL 0100(87) 3616P, PCN 044K **Project No.:** 207030
Meeting Date Wednesday, June 22, 2016 1:00 PM **Meeting Location:** Sioux Falls Convention Center

Please print clearly. Thank you.

	Name	Address	Best Contact Phone	Email
1	Patty Nohr Myrl & Roy's Paving	1300 N. Bahnson Ave	334-3204	Patty.n@Mrpaving.com
2	Darrel Hoyer	1300 N Bahnson Ave SFSD	334-3204	darrel.hoyer@myrlandroysPaving.com
3	Milt Nussbaum	2900 East Rice St SFSD	605-338-0053	[illegible]
4	Dan Kearney	47046 259 St SFSD	351-5705	[illegible] @ Aol.com
5	[illegible]	1509 E 39 St N	366 3139	
6	James St Clair	1409/1413 E Rice	605 359-0005	jensenport@hotmail.com
7	Peggy Jensen	" "	605 310-0740	"
8	Jason Kjenstad	6300 S. Old Village Pl	605-977-7740	jason.kjenstad@hdrinc.com
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Interstate 229 Major Investment Study

Exit 7 – Rice Street

Stakeholder Meeting
June 22nd, 2016
1:00 pm to 2:00 pm

HDR

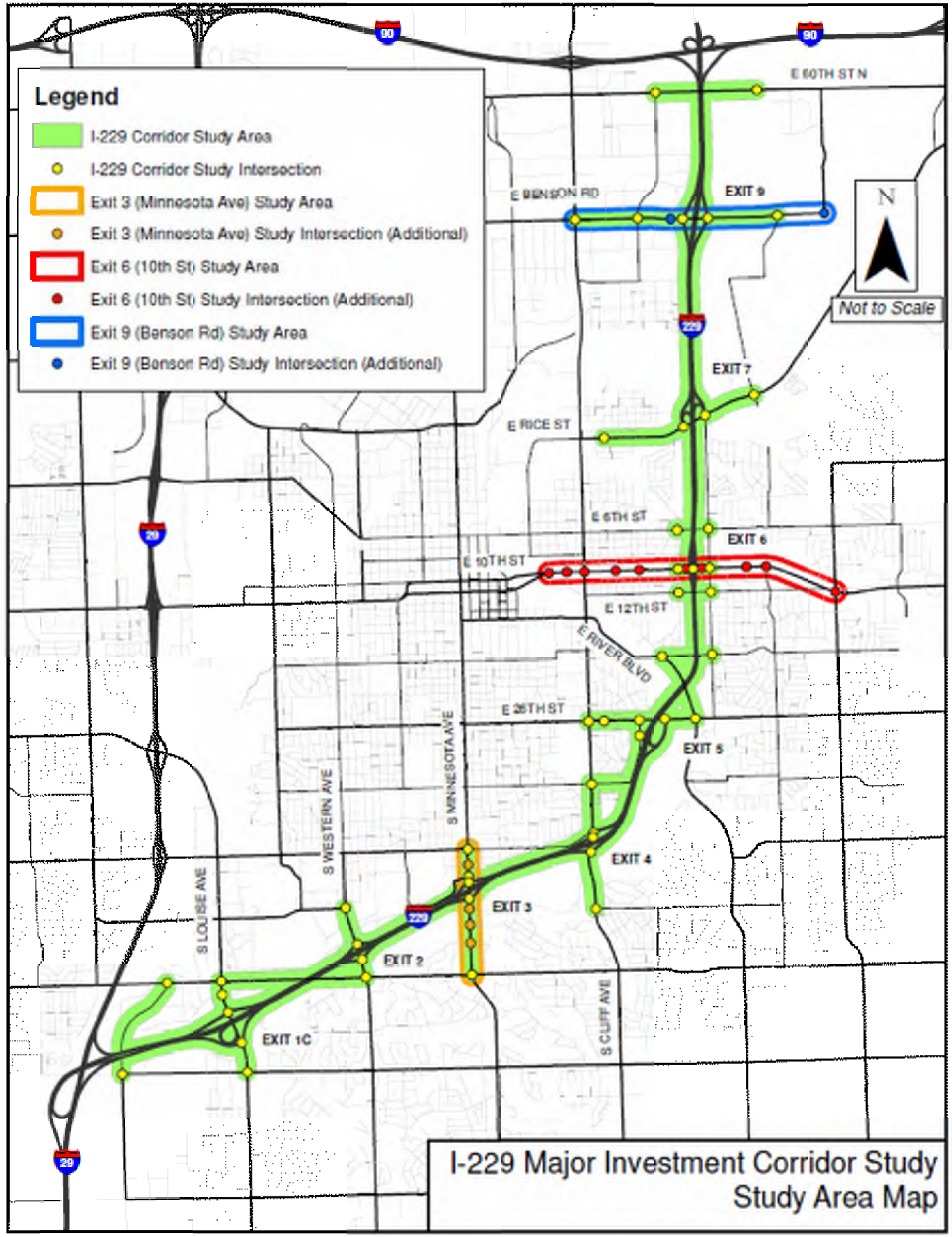
Study Area Map

I-229 Corridor Study

Solberg Avenue Overpass
to
60th Street N. Overpass

Additional Studies

Exit 3 – Minnesota Ave
Exit 6 – 10th Street
Exit 9 – Benson Road
Added Exit 4 – Cliff Avenue
Added Exit 7 – Rice Street



Study Advisory Partners

South Dakota Department of Transportation (SDDOT)

South Dakota Highway Patrol

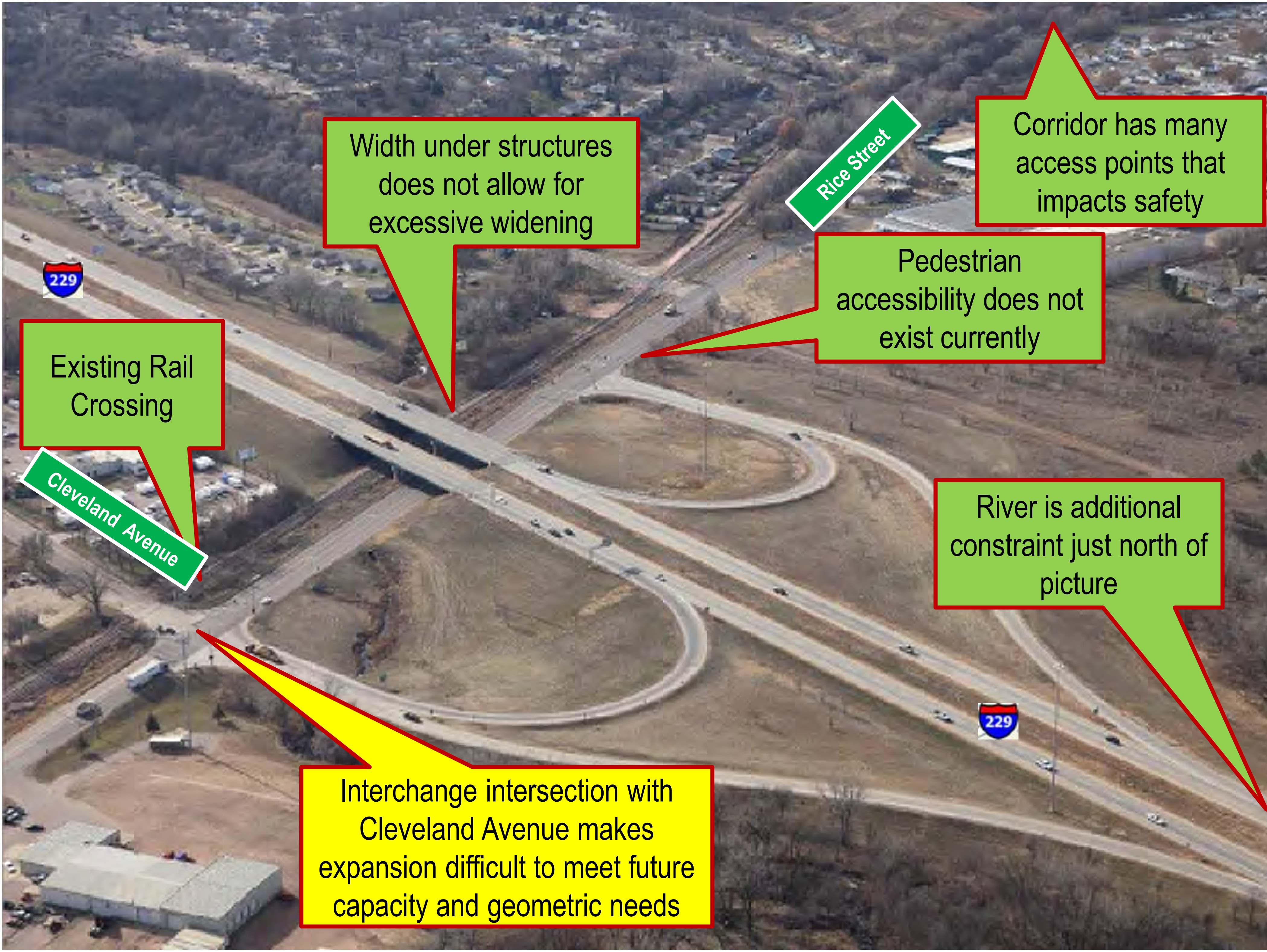
City of Sioux Falls

Sioux Falls Metropolitan Planning Organization (MPO)

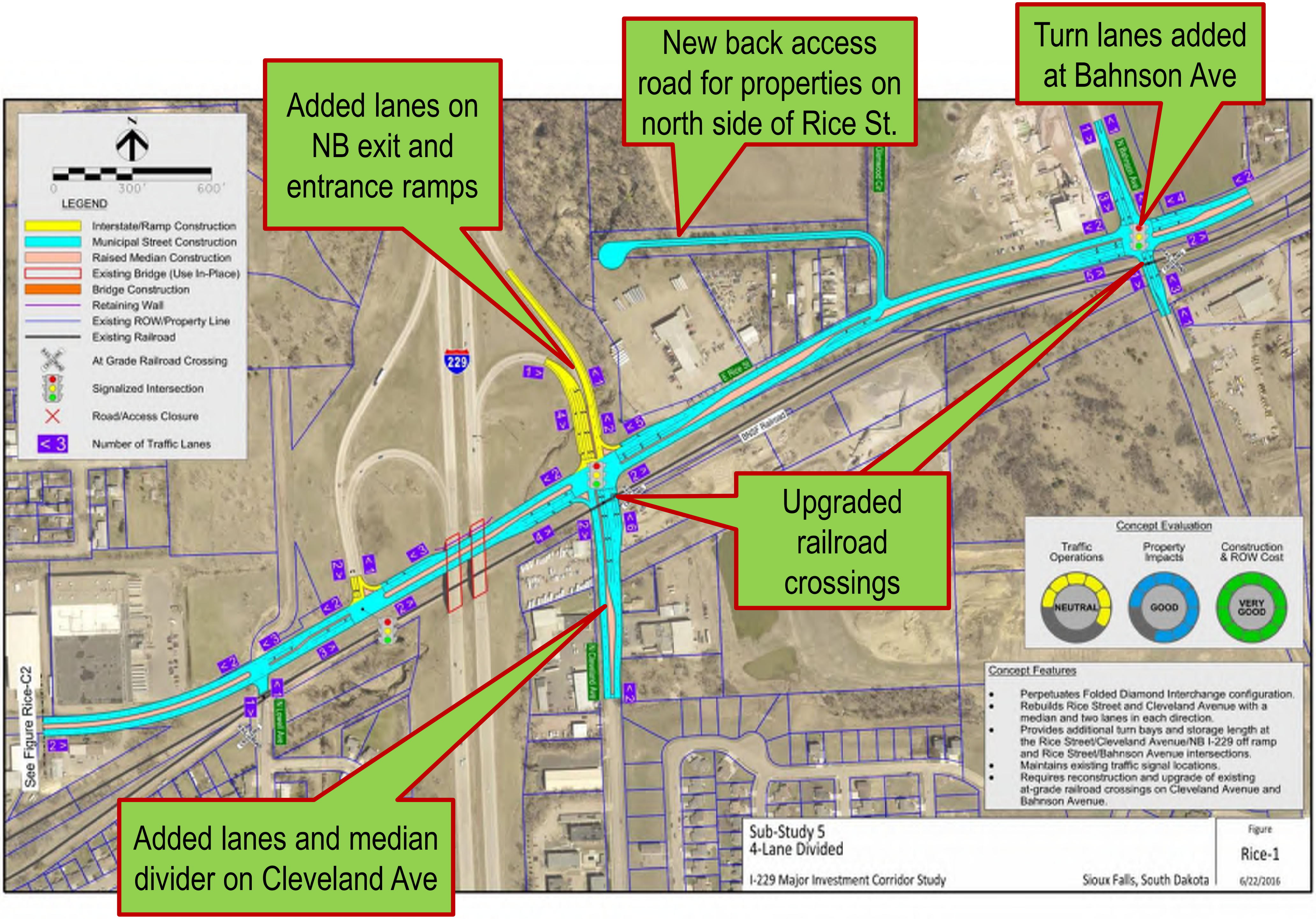
Federal Highway Administration (FHWA)

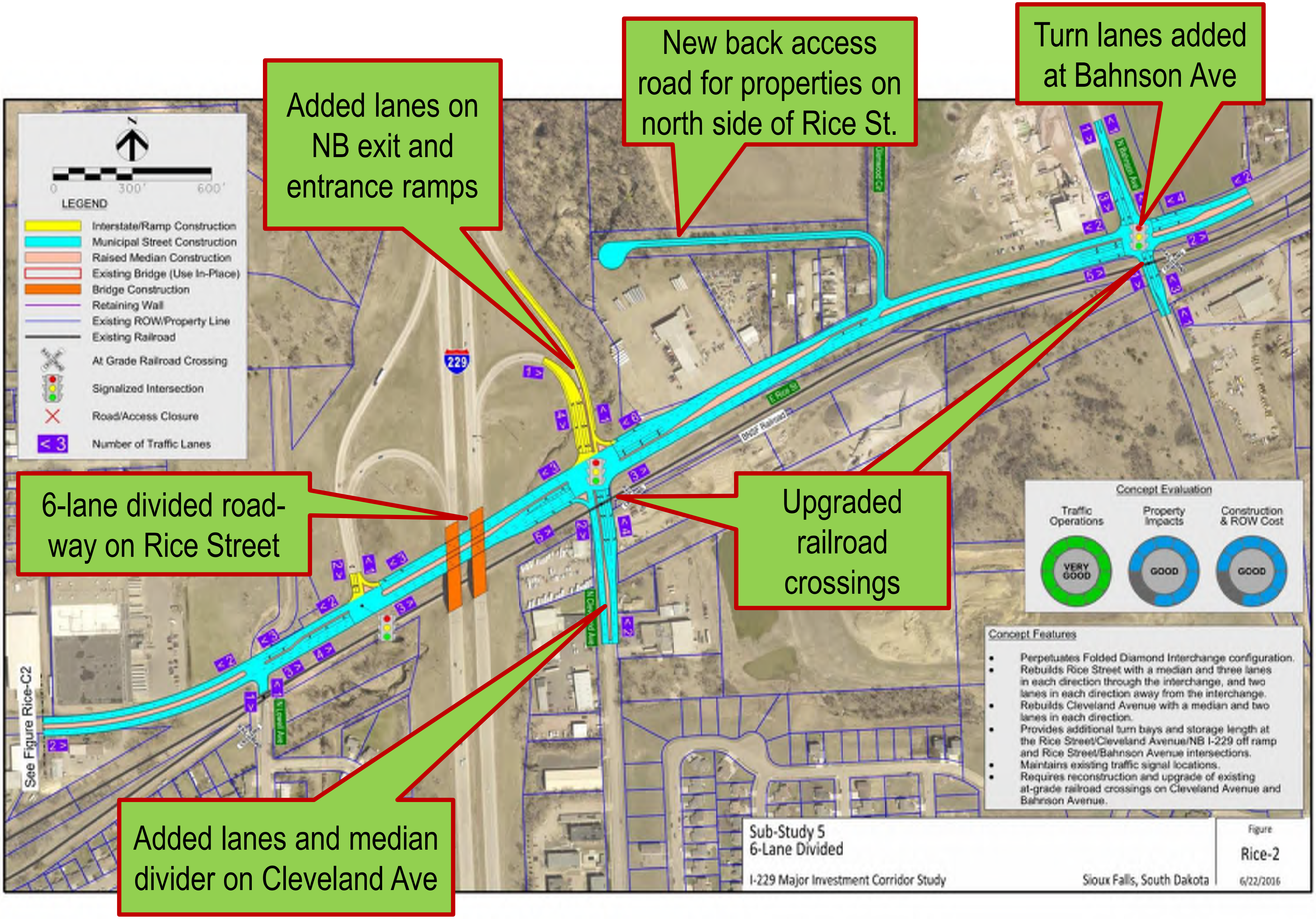
Exit 7 (Rice Street) Crossroad Study Goals

- Reduce traffic congestion
- Provide and Interchange that will meet the future capacity requirements
- Improve pedestrian mobility
- Improve safety for corridor users

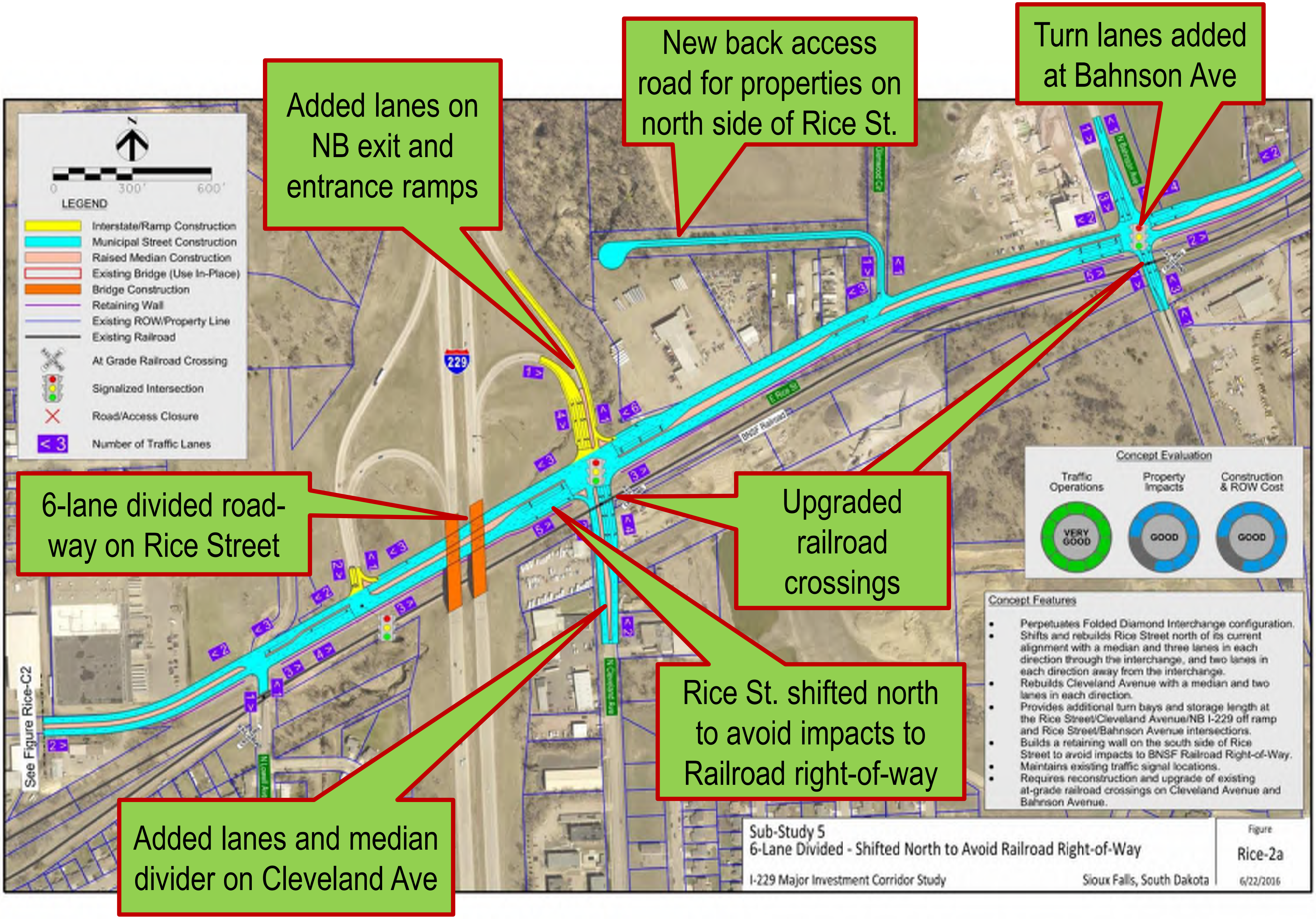


Rice Street
Corridor has many access points that impacts safety
Width under structures does not allow for excessive widening
229
Pedestrian accessibility does not exist currently
Existing Rail Crossing
Cleveland Avenue
River is additional constraint just north of picture
229
Interchange intersection with Cleveland Avenue makes expansion difficult to meet future capacity and geometric needs

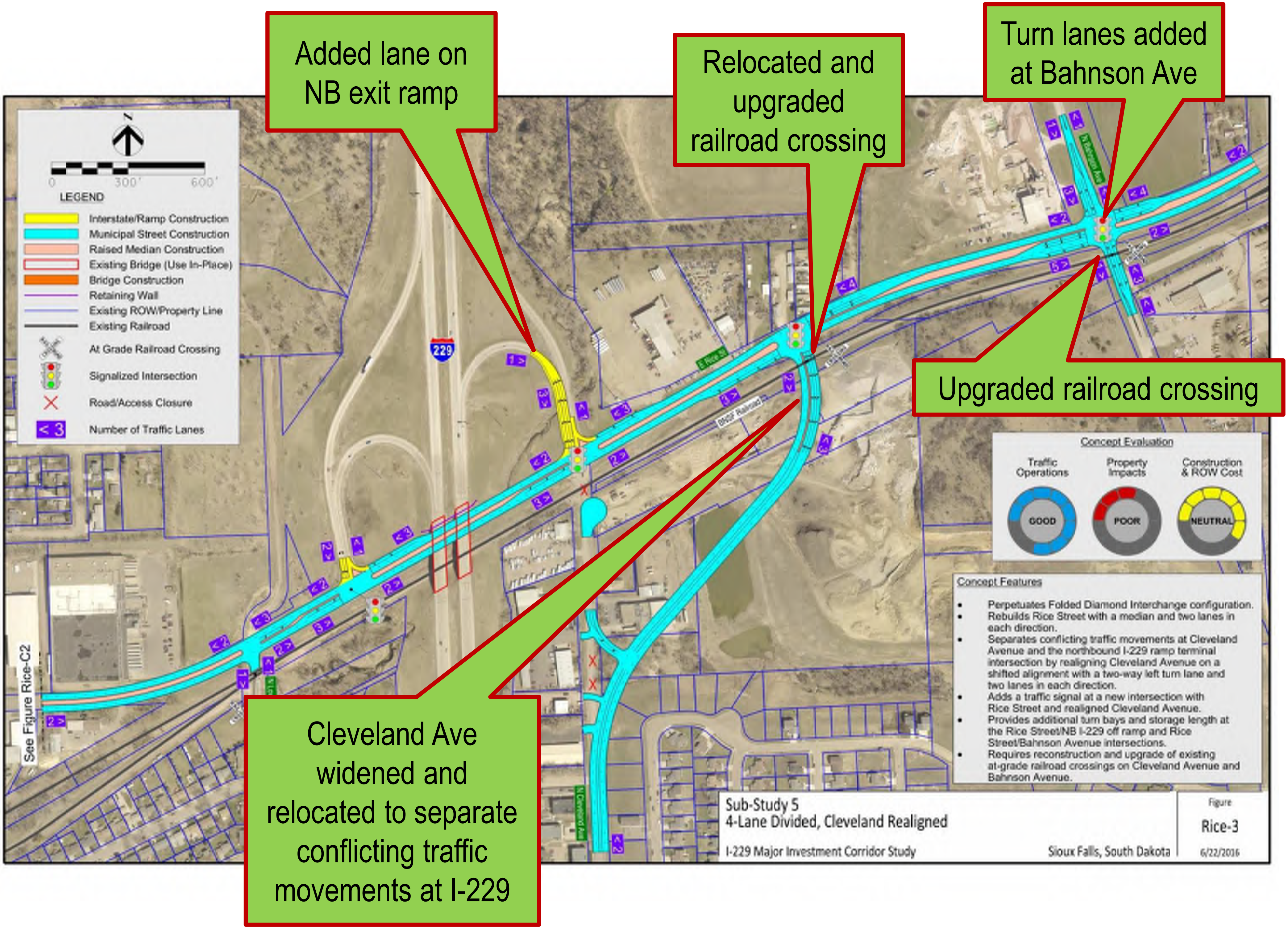

Added lanes on NB exit and entrance ramps
New back access road for properties on north side of Rice St.
Turn lanes added at Bahnson Ave
Upgraded railroad crossings
Added lanes and median divider on Cleveland Ave
0 300' 600'
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Existing Bridge (Use In-Place)
Bridge Construction
Retaining Wall
Existing ROW/Property Line
Existing Railroad
At Grade Railroad Crossing
Signalized Intersection
Road/Access Closure
Number of Traffic Lanes
229
E Rice St
BNSF Railroad
N Cleveland Ave
See Figure Rice-C2
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
NEUTRAL
GOOD
VERY GOOD
Concept Features
• Perpetuates Folded Diamond Interchange configuration.
• Rebuilds Rice Street and Cleveland Avenue with a median and two lanes in each direction.
• Provides additional turn bays and storage length at the Rice Street/Cleveland Avenue/NB I-229 off ramp and Rice Street/Bahnson Avenue intersections.
• Maintains existing traffic signal locations.
• Requires reconstruction and upgrade of existing at-grade railroad crossings on Cleveland Avenue and Bahnson Avenue.
Sub-Study 5
4-Lane Divided
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Rice-1
6/22/2016



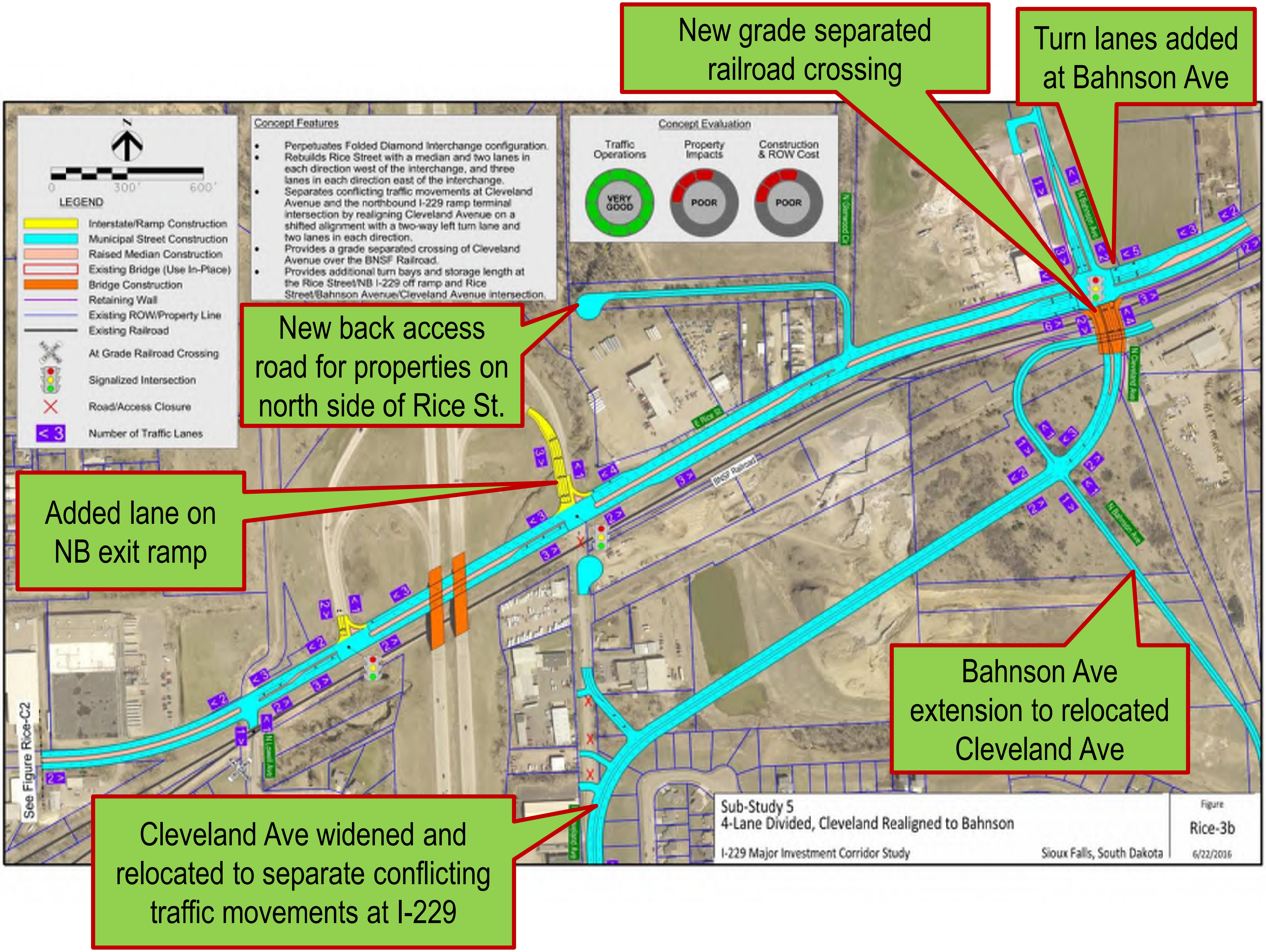
Added lanes on NB exit and entrance ramps
New back access road for properties on north side of Rice St.
Turn lanes added at Bahnson Ave
6-lane divided road-way on Rice Street
Upgraded railroad crossings
Added lanes and median divider on Cleveland Ave
0 300' 600'
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Existing Bridge (Use In-Place)
Bridge Construction
Retaining Wall
Existing ROW/Property Line
Existing Railroad
At Grade Railroad Crossing
Signalized Intersection
Road/Access Closure
Number of Traffic Lanes
229
E Rice St
BNSF Railroad
See Figure Rice-C2
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
VERY GOOD
GOOD
GOOD
Concept Features
• Perpetuates Folded Diamond Interchange configuration.
• Rebuilds Rice Street with a median and three lanes in each direction through the interchange, and two lanes in each direction away from the interchange.
• Rebuilds Cleveland Avenue with a median and two lanes in each direction.
• Provides additional turn bays and storage length at the Rice Street/Cleveland Avenue/NB I-229 off ramp and Rice Street/Bahnson Avenue intersections.
• Maintains existing traffic signal locations.
• Requires reconstruction and upgrade of existing at-grade railroad crossings on Cleveland Avenue and Bahnson Avenue.
Sub-Study 5
6-Lane Divided
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Rice-2
6/22/2016



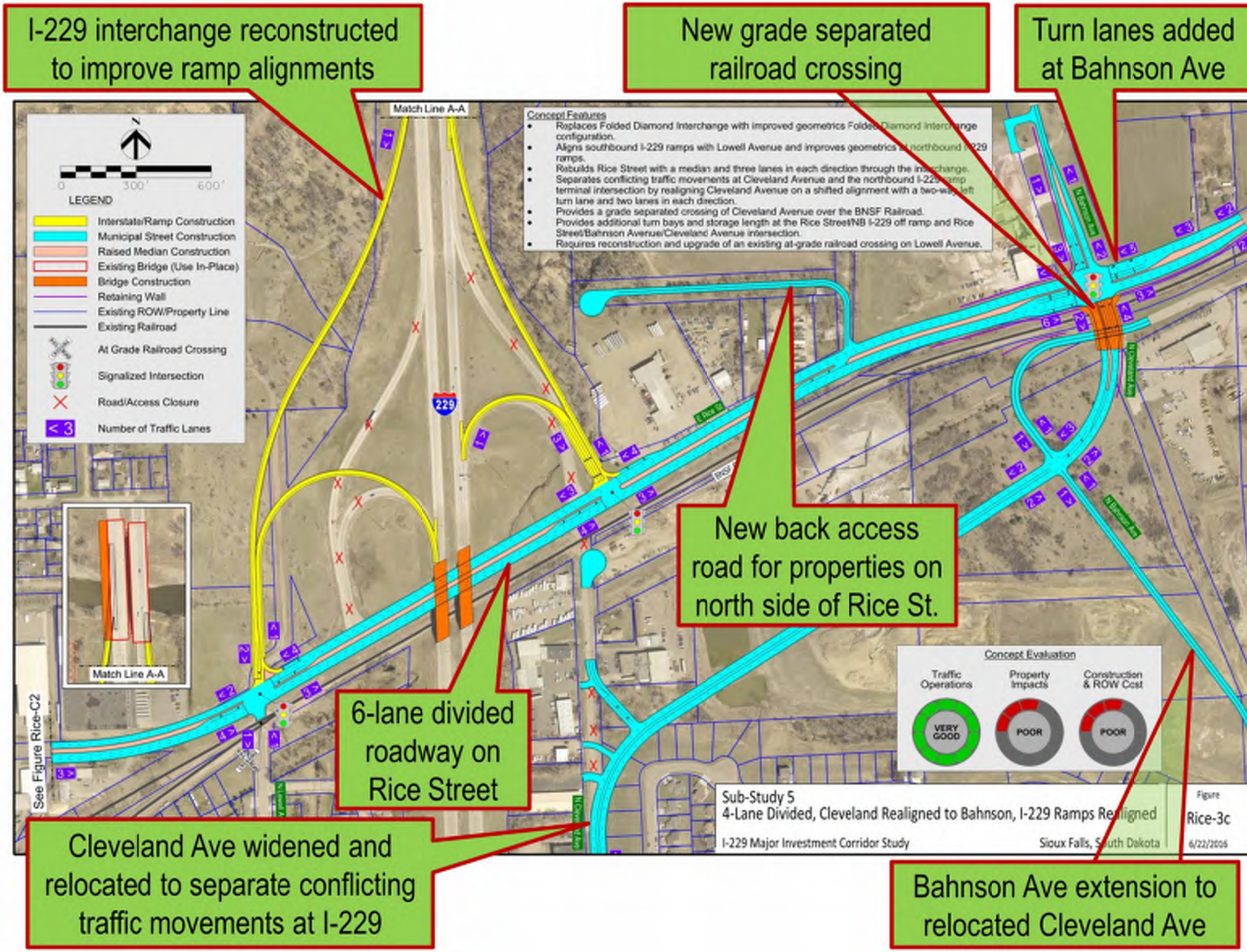
Added lanes on NB exit and entrance ramps
New back access road for properties on north side of Rice St.
Turn lanes added at Bahnson Ave
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Existing Bridge (Use In-Place)
Bridge Construction
Retaining Wall
Existing ROW/Property Line
Existing Railroad
At Grade Railroad Crossing
Signalized Intersection
Road/Access Closure
Number of Traffic Lanes
0 300' 600'
229
E Rice St
BNSF Railroad
6-lane divided road-way on Rice Street
Upgraded railroad crossings
Rice St. shifted north to avoid impacts to Railroad right-of-way
Added lanes and median divider on Cleveland Ave
See Figure Rice-C2
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
VERY GOOD
GOOD
GOOD
Concept Features
• Perpetuates Folded Diamond Interchange configuration.
• Shifts and rebuilds Rice Street north of its current alignment with a median and three lanes in each direction through the interchange, and two lanes in each direction away from the interchange.
• Rebuilds Cleveland Avenue with a median and two lanes in each direction.
• Provides additional turn bays and storage length at the Rice Street/Cleveland Avenue/NB I-229 off ramp and Rice Street/Bahnson Avenue intersections.
• Builds a retaining wall on the south side of Rice Street to avoid impacts to BNSF Railroad Right-of-Way.
• Maintains existing traffic signal locations.
• Requires reconstruction and upgrade of existing at-grade railroad crossings on Cleveland Avenue and Bahnson Avenue.
Sub-Study 5
6-Lane Divided - Shifted North to Avoid Railroad Right-of-Way
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Rice-2a
6/22/2016



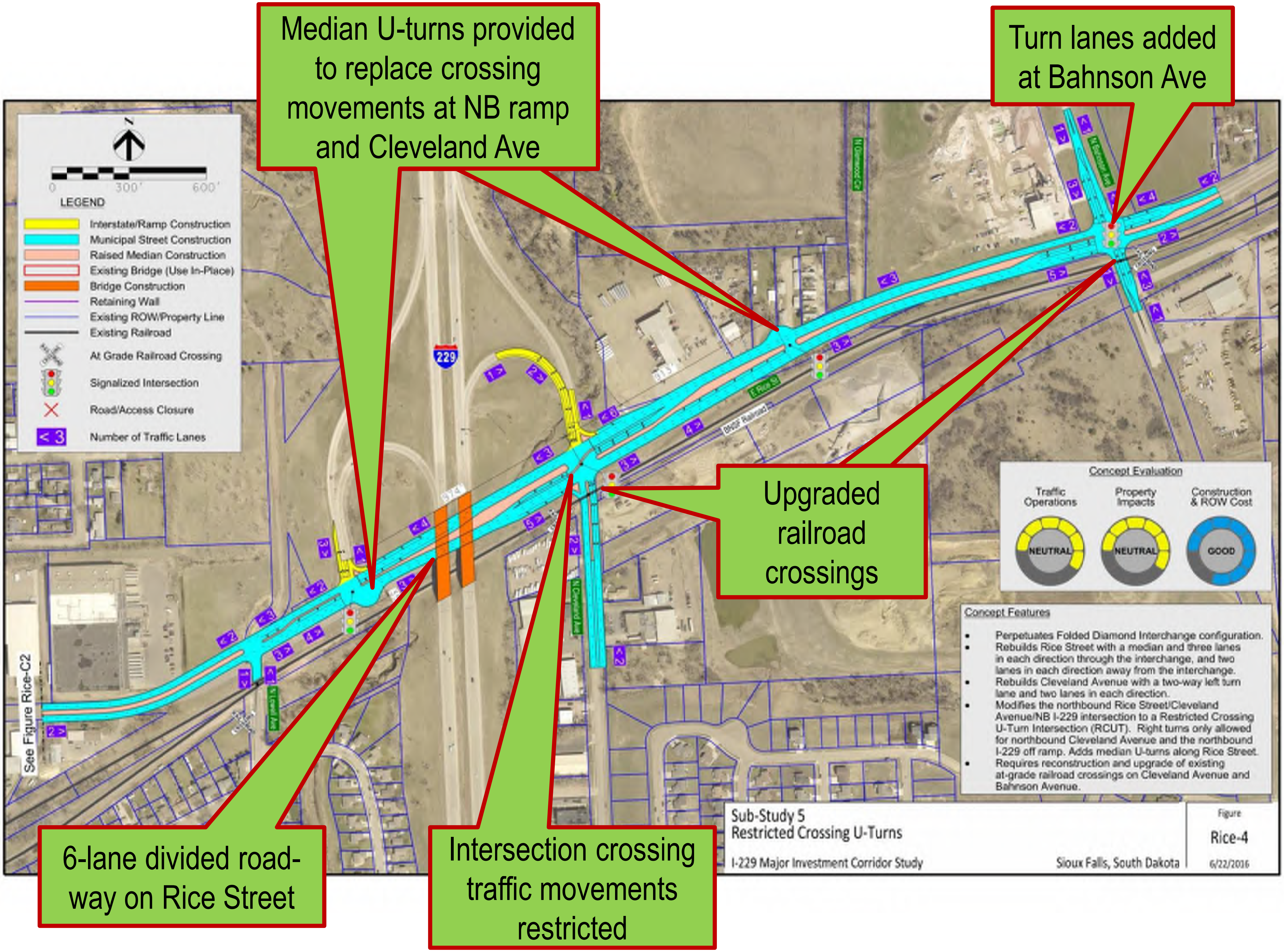
Added lane on NB exit ramp
Relocated and upgraded railroad crossing
Turn lanes added at Bahnson Ave
Upgraded railroad crossing
Cleveland Ave widened and relocated to separate conflicting traffic movements at I-229
0 300' 600'
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Existing Bridge (Use In-Place)
Bridge Construction
Retaining Wall
Existing ROW/Property Line
Existing Railroad
At Grade Railroad Crossing
Signalized Intersection
Road/Access Closure
Number of Traffic Lanes
229
E Rice St
BNSF Railroad
N Bahnson Ave
N Cleveland Ave
See Figure Rice-C2
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
GOOD
POOR
NEUTRAL
Concept Features
• Perpetuates Folded Diamond Interchange configuration.
• Rebuilds Rice Street with a median and two lanes in each direction.
• Separates conflicting traffic movements at Cleveland Avenue and the northbound I-229 ramp terminal intersection by realigning Cleveland Avenue on a shifted alignment with a two-way left turn lane and two lanes in each direction.
• Adds a traffic signal at a new intersection with Rice Street and realigned Cleveland Avenue.
• Provides additional turn bays and storage length at the Rice Street/NB I-229 off ramp and Rice Street/Bahnson Avenue intersections.
• Requires reconstruction and upgrade of existing at-grade railroad crossings on Cleveland Avenue and Bahnson Avenue.
Sub-Study 5
4-Lane Divided, Cleveland Realigned
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Rice-3
6/22/2016

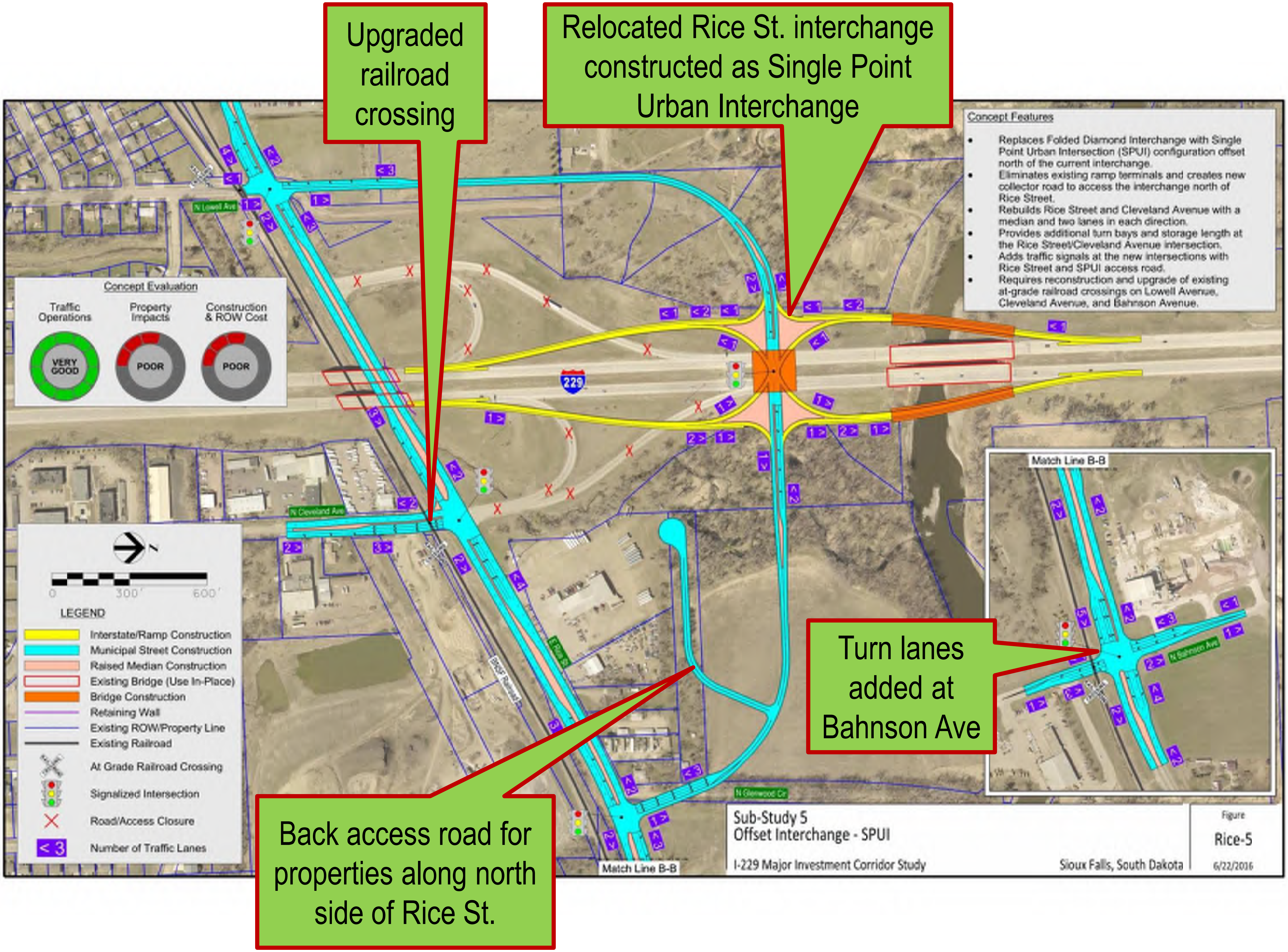


New grade separated railroad crossing
Turn lanes added at Bahnson Ave
New back access road for properties on north side of Rice St.
Added lane on NB exit ramp
Bahnson Ave extension to relocated Cleveland Ave
Cleveland Ave widened and relocated to separate conflicting traffic movements at I-229
0 300' 600'
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Existing Bridge (Use In-Place)
Bridge Construction
Retaining Wall
Existing ROW/Property Line
Existing Railroad
At Grade Railroad Crossing
Signalized Intersection
Road/Access Closure
Number of Traffic Lanes
Concept Features
• Perpetuates Folded Diamond Interchange configuration.
• Rebuilds Rice Street with a median and two lanes in each direction west of the interchange, and three lanes in each direction east of the interchange.
• Separates conflicting traffic movements at Cleveland Avenue and the northbound I-229 ramp terminal intersection by realigning Cleveland Avenue on a shifted alignment with a two-way left turn lane and two lanes in each direction.
• Provides a grade separated crossing of Cleveland Avenue over the BNSF Railroad.
• Provides additional turn bays and storage length at the Rice Street/NB I-229 off ramp and Rice Street/Bahnson Avenue/Cleveland Avenue intersection.
Concept Evaluation
Traffic Operations
VERY GOOD
Property Impacts
POOR
Construction & ROW Cost
POOR
E Rice St
BNSF Railroad
N Bahnson Ave
N Cleveland Ave
See Figure Rice-C2
Sub-Study 5
4-Lane Divided, Cleveland Realigned to Bahnson
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Rice-3b
6/22/2016

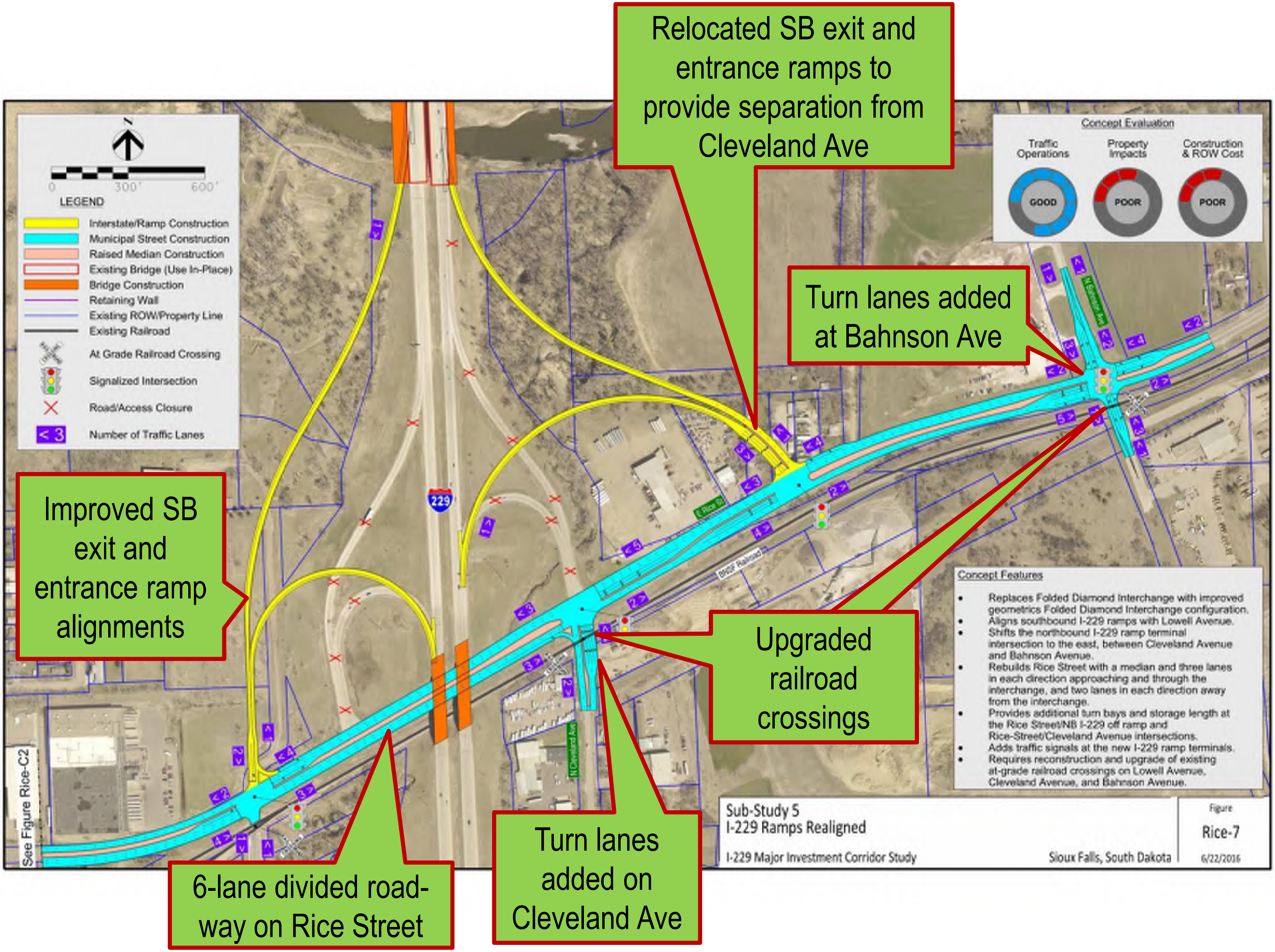


I-229 interchange reconstructed to improve ramp alignments
New grade separated railroad crossing
Turn lanes added at Bahnson Ave
Match Line A-A
Concept Features
• Replaces Folded Diamond Interchange with improved geometrics Folded Diamond Interchange configuration.
• Aligns southbound I-229 ramps with Lowell Avenue and improves geometrics at northbound I-229 ramps.
• Rebuilds Rice Street with a median and three lanes in each direction through the interchange.
• Separates conflicting traffic movements at Cleveland Avenue and the northbound I-229 ramp terminal intersection by realigning Cleveland Avenue on a shifted alignment with a two-way left turn lane and two lanes in each direction.
• Provides a grade separated crossing of Cleveland Avenue over the BNSF Railroad.
• Provides additional turn bays and storage length at the Rice Street/NB I-229 off ramp and Rice Street/Bahnson Avenue/Cleveland Avenue intersection.
• Requires reconstruction and upgrade of an existing at-grade railroad crossing on Lowell Avenue.
0 300' 600'
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Existing Bridge (Use In-Place)
Bridge Construction
Retaining Wall
Existing ROW/Property Line
Existing Railroad
At Grade Railroad Crossing
Signalized Intersection
Road/Access Closure
Number of Traffic Lanes
229
New back access road for properties on north side of Rice St.
6-lane divided roadway on Rice Street
Match Line A-A
See Figure Rice-C2
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
VERY GOOD
POOR
POOR
Sub-Study 5
4-Lane Divided, Cleveland Realigned to Bahnson, I-229 Ramps Realigned
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Rice-3c
6/22/2016
Cleveland Ave widened and relocated to separate conflicting traffic movements at I-229
Bahnson Ave extension to relocated Cleveland Ave

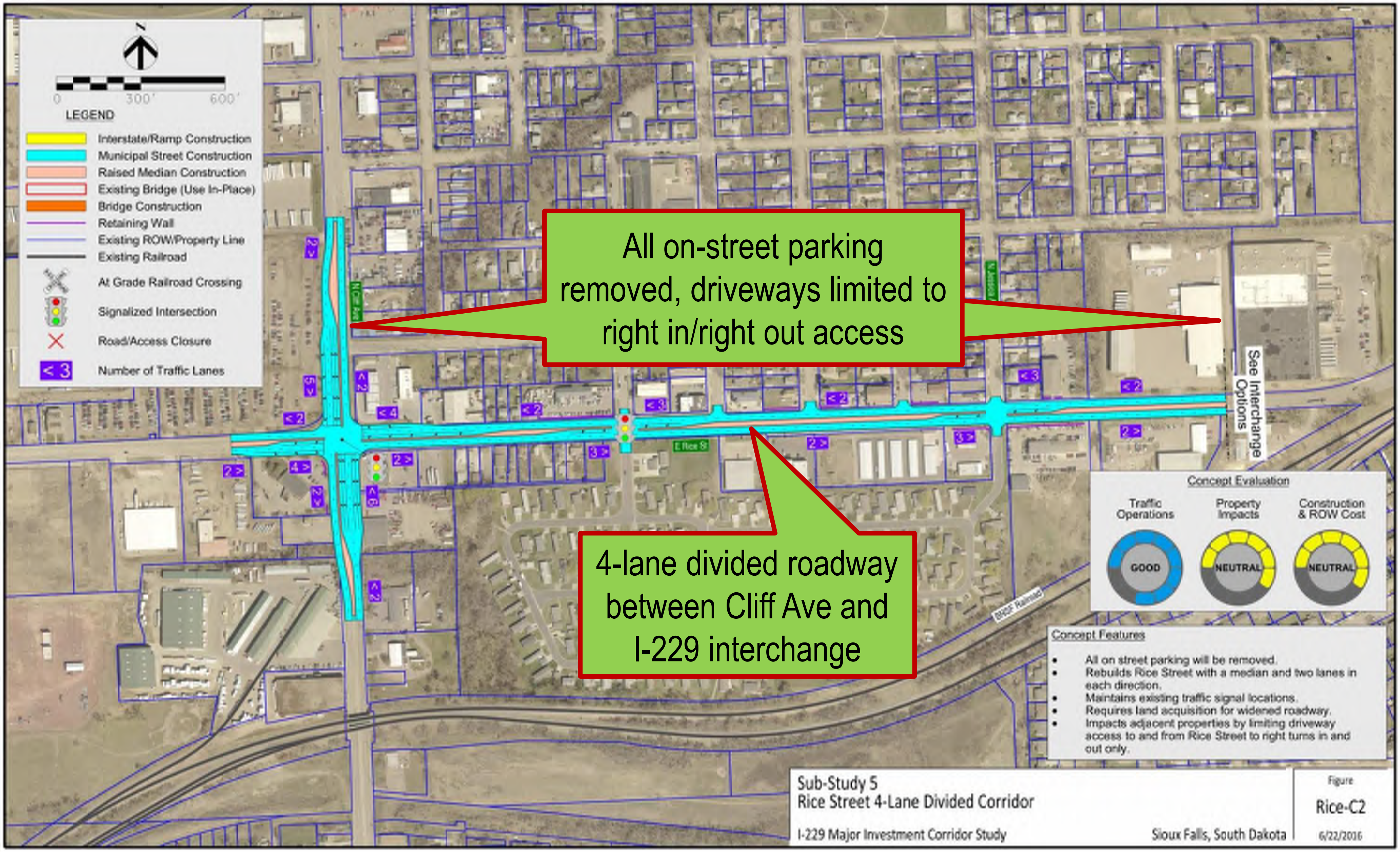

Median U-turns provided to replace crossing movements at NB ramp and Cleveland Ave
Turn lanes added at Bahnson Ave
Upgraded railroad crossings
6-lane divided road-way on Rice Street
Intersection crossing traffic movements restricted
0 300' 600'
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Existing Bridge (Use In-Place)
Bridge Construction
Retaining Wall
Existing ROW/Property Line
Existing Railroad
At Grade Railroad Crossing
Signalized Intersection
Road/Access Closure
Number of Traffic Lanes
229
E Rice St
BNSF Railroad
N Cleveland Ave
See Figure Rice-C2
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
NEUTRAL
NEUTRAL
GOOD
Concept Features
• Perpetuates Folded Diamond Interchange configuration.
• Rebuilds Rice Street with a median and three lanes in each direction through the interchange, and two lanes in each direction away from the interchange.
• Rebuilds Cleveland Avenue with a two-way left turn lane and two lanes in each direction.
• Modifies the northbound Rice Street/Cleveland Avenue/NB I-229 intersection to a Restricted Crossing U-Turn Intersection (RCUT). Right turns only allowed for northbound Cleveland Avenue and the northbound I-229 off ramp. Adds median U-turns along Rice Street.
• Requires reconstruction and upgrade of existing at-grade railroad crossings on Cleveland Avenue and Bahnson Avenue.
Sub-Study 5
Restricted Crossing U-Turns
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Rice-4
6/22/2016



Upgraded railroad crossing
Relocated Rice St. interchange constructed as Single Point Urban Interchange
Concept Features
• Replaces Folded Diamond Interchange with Single Point Urban Intersection (SPUI) configuration offset north of the current interchange.
• Eliminates existing ramp terminals and creates new collector road to access the interchange north of Rice Street.
• Rebuilds Rice Street and Cleveland Avenue with a median and two lanes in each direction.
• Provides additional turn bays and storage length at the Rice Street/Cleveland Avenue intersection.
• Adds traffic signals at the new intersections with Rice Street and SPUI access road.
• Requires reconstruction and upgrade of existing at-grade railroad crossings on Lowell Avenue, Cleveland Avenue, and Bahnson Avenue.
Concept Evaluation
Traffic Operations
VERY GOOD
Property Impacts
POOR
Construction & ROW Cost
POOR
N Lowell Ave
N Cleveland Ave
N Glenwood Cir
N Bahnson Ave
229
Match Line B-B
0
300'
600'
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Existing Bridge (Use In-Place)
Bridge Construction
Retaining Wall
Existing ROW/Property Line
Existing Railroad
At Grade Railroad Crossing
Signalized Intersection
Road/Access Closure
< 3
Number of Traffic Lanes
Turn lanes added at Bahnson Ave
Back access road for properties along north side of Rice St.
Sub-Study 5
Offset Interchange - SPUI
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Rice-5
6/22/2016



Relocated SB exit and entrance ramps to provide separation from Cleveland Ave
Turn lanes added at Bahnson Ave
Improved SB exit and entrance ramp alignments
Upgraded railroad crossings
6-lane divided road-way on Rice Street
Turn lanes added on Cleveland Ave
N
0 300' 600'
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Existing Bridge (Use In-Place)
Bridge Construction
Retaining Wall
Existing ROW/Property Line
Existing Railroad
At Grade Railroad Crossing
Signalized Intersection
Road/Access Closure
Number of Traffic Lanes
Concept Evaluation
Traffic Operations
GOOD
Property Impacts
POOR
Construction & ROW Cost
POOR
229
E Rice St
BNSF Railroad
N Cleveland Ave
N Bahnson Ave
See Figure Rice-C2
Concept Features
• Replaces Folded Diamond Interchange with improved geometrics Folded Diamond Interchange configuration.
• Aligns southbound I-229 ramps with Lowell Avenue.
• Shifts the northbound I-229 ramp terminal intersection to the east, between Cleveland Avenue and Bahnson Avenue.
• Rebuilds Rice Street with a median and three lanes in each direction approaching and through the interchange, and two lanes in each direction away from the interchange.
• Provides additional turn bays and storage length at the Rice Street/NB I-229 off ramp and Rice-Street/Cleveland Avenue intersections.
• Adds traffic signals at the new I-229 ramp terminals.
• Requires reconstruction and upgrade of existing at-grade railroad crossings on Lowell Avenue, Cleveland Avenue, and Bahnson Avenue.
Sub-Study 5
I-229 Ramps Realigned
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Rice-7
6/22/2016


LEGEND
0 300' 600'
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Existing Bridge (Use In-Place)
Bridge Construction
Retaining Wall
Existing ROW/Property Line
Existing Railroad
At Grade Railroad Crossing
Signalized Intersection
Road/Access Closure
Number of Traffic Lanes
All on-street parking removed, driveways limited to right in/right out access
4-lane divided roadway between Cliff Ave and I-229 interchange
See Interchange Options
E Rice St
BNSF Railroad
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
GOOD
NEUTRAL
NEUTRAL
Concept Features
• All on street parking will be removed.
• Rebuilds Rice Street with a median and two lanes in each direction.
• Maintains existing traffic signal locations.
• Requires land acquisition for widened roadway.
• Impacts adjacent properties by limiting driveway access to and from Rice Street to right turns in and out only.
Sub-Study 5
Rice Street 4-Lane Divided Corridor
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Rice-C2
6/22/2016

PROJECT CONTACTS:

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Dave Meier – HDR Engineering, Inc.
402-399-1068 or Dave.Meier@hdrinc.com

Shannon Ausen – City of Sioux Falls
605-367-8607 or sausen@siouxfalls.org

Steve Gramm – SDDOT Project Development
605-773-6641 or steve.gramm@state.sd.us

Interstate 229 Major Investment Study
Exit 7 – Rice Street

Thanks for Attending!!!!!

HDR

CLIFF AVENUE

JUNE 22ND, 2016

- SIGN-IN SHEETS
- POWERPOINT SLIDES
- MEETING NOTES (SEE CLIFF AVENUE AND RICE STREET PUBLIC MEETINGS APPENDIX)
- COMMENTS (SEE CLIFF AVENUE AND RICE STREET PUBLIC MEETINGS APPENDIX)

Sign In Sheet

Subject I-229 Major Investment Corridor Study – Stakeholder Meetings for Cliff Avenue Sub-Study

Client City of Sioux Falls/South Dakota Department of Transportation

Project PL 0100(87) 3616P, PCN 044K **Project No.:** 207030

Meeting Date Wednesday, June 22, 2016 2:30 PM **Meeting Location:** Sioux Falls Convention Center

Please print clearly. Thank you.

	Name	Address	Best Contact Phone	Email
1	Linda Mickelson Graham	4001 S Cliff Ave	605 940-4186	linda@aol.com
2	Jason Igrusted	6300 S. Old Village Pl	977-7740	jason.tjeasted@hdrinc.com
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Sign In Sheet

Subject I-229 Major Investment Corridor Study – Stakeholder Meetings for Cliff Avenue Sub Study

Client City of Sioux Falls/South Dakota Department of Transportation

Project PL 0100(87) 3616P, PCN 044K **Project No.:** 207030

Meeting Date Wednesday, June 22, 2016 2:30 PM **Meeting Location:** Sioux Falls Convention Center

Please print clearly. Thank you.

	Name	Address	Best Contact Phone	Email
1	Gene Napier	1109 + 1111 E. Pam Rd	373-0377	napier10@sio.midco.net
2	Jim Becker for E.J. King	2507 S. Big Timber Pl 2611 S. Big Timber Pl	334-7091	jrbecker25@hotmail.com
3	Dwight Smidt	3216 S. Phillips	201-1299	PutHRAH1340@sio.midco.net
4	JEFF KREITER	1101 N. WESTERN AVE	367-7965	JEFFREY.KREITER@KR.SD.US
5	Marsha Biggar	3000 S. 10th Ave	929-7637	MDB3000@sio.midco.net
6	Phil Johnson Minnehaha Properties	100 S Phillips Ave	782-4011	pfjohnson@fnbsf.com
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Interstate 229 Major Investment Study

Exit 4 – Cliff Avenue

Stakeholder Meeting
June 22nd, 2016
2:30 pm to 3:30 pm

HDR

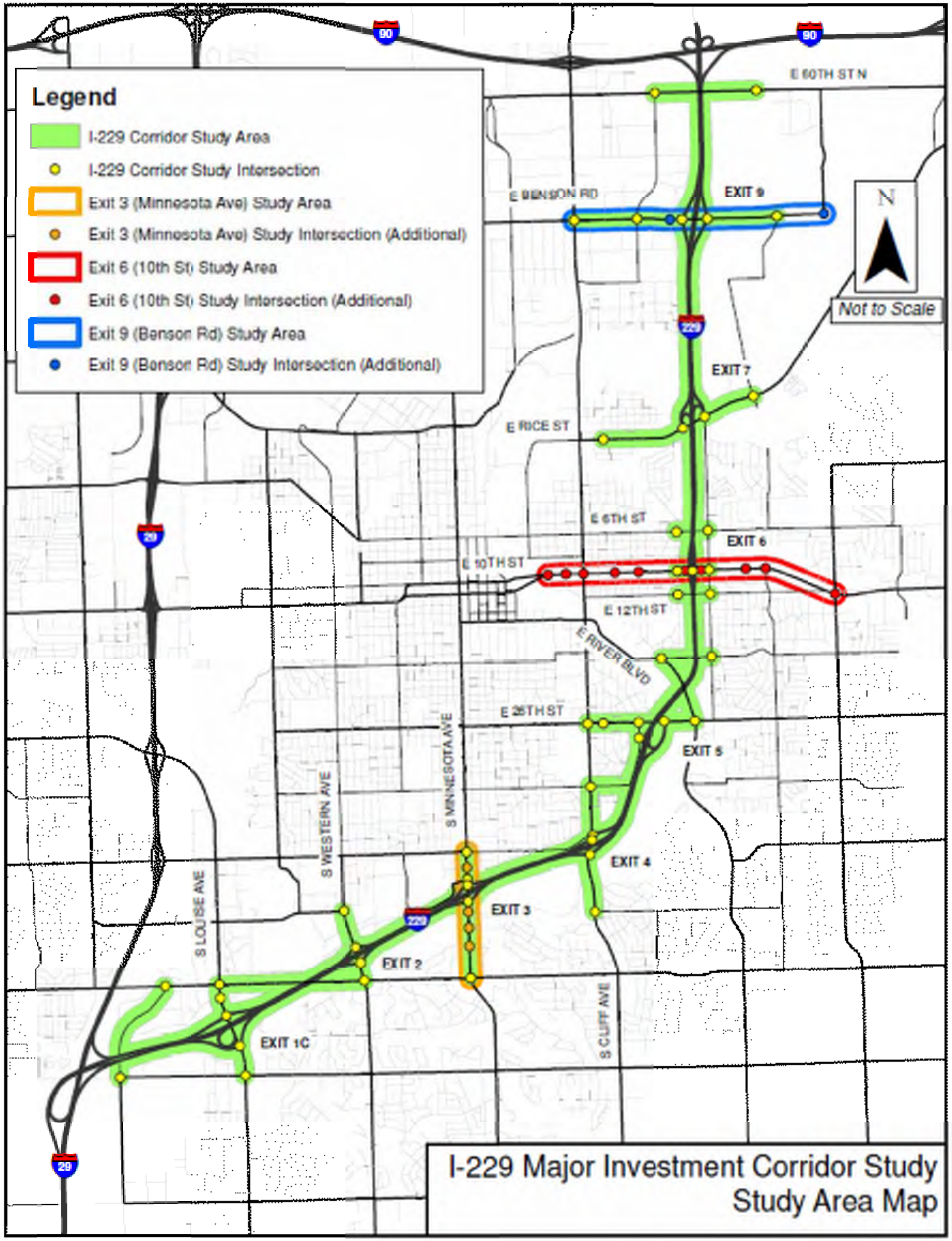
Study Area Map

I-229 Corridor Study

Solberg Avenue Overpass
to
60th Street N. Overpass

Additional Studies

Exit 3 – Minnesota Ave
Exit 6 – 10th Street
Exit 9 – Benson Road
Added Exit 4 – Cliff Avenue
Added Exit 7 – Rice Street



Study Advisory Partners

South Dakota Department of Transportation (SDDOT)

South Dakota Highway Patrol

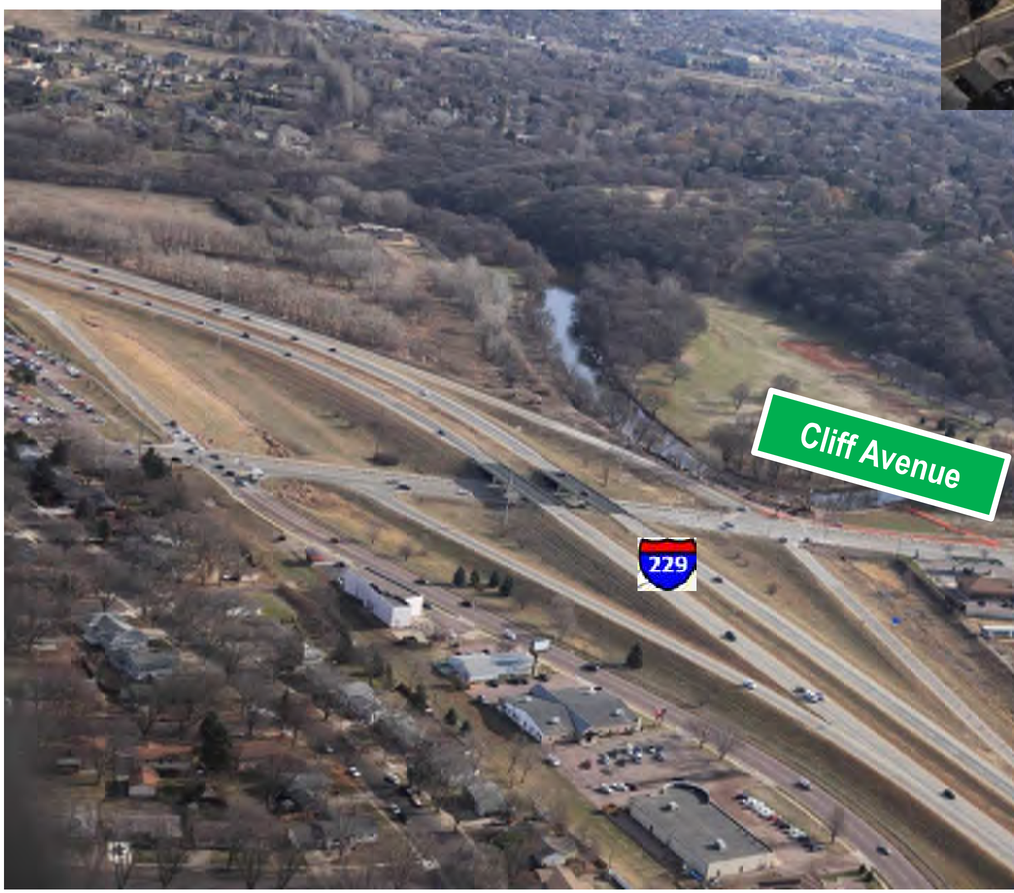
City of Sioux Falls

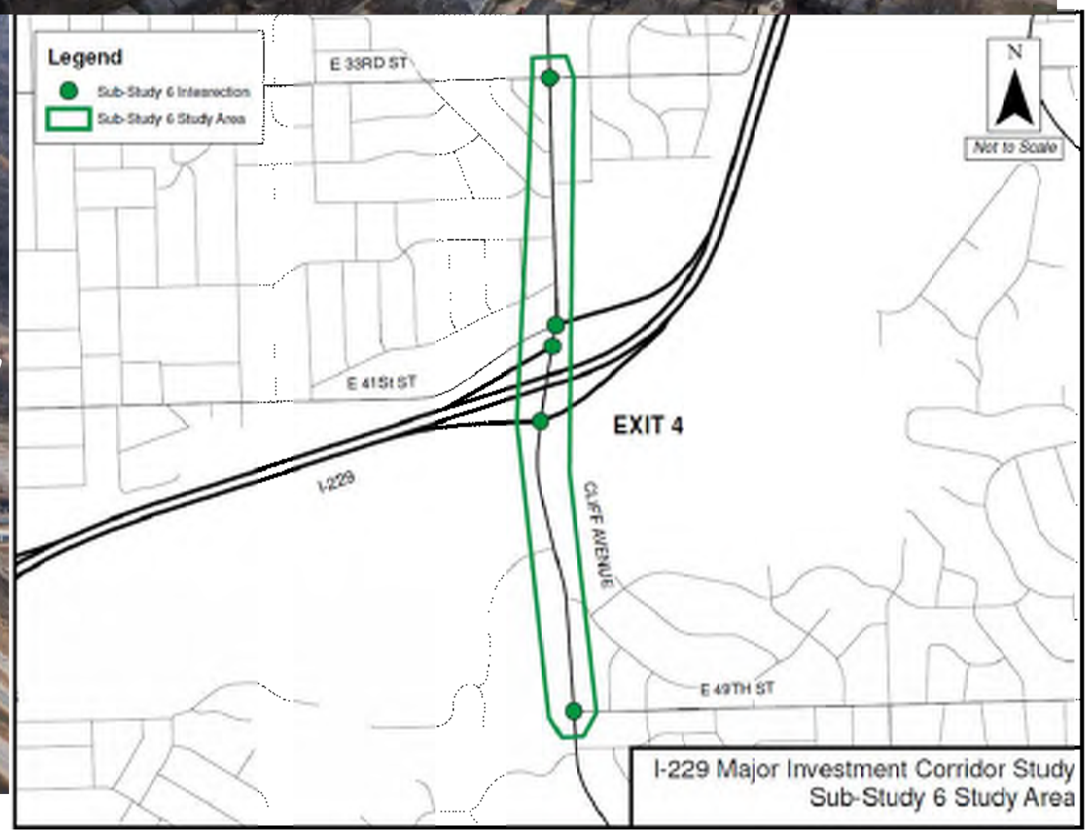
Sioux Falls Metropolitan Planning Organization (MPO)

Federal Highway Administration (FHWA)

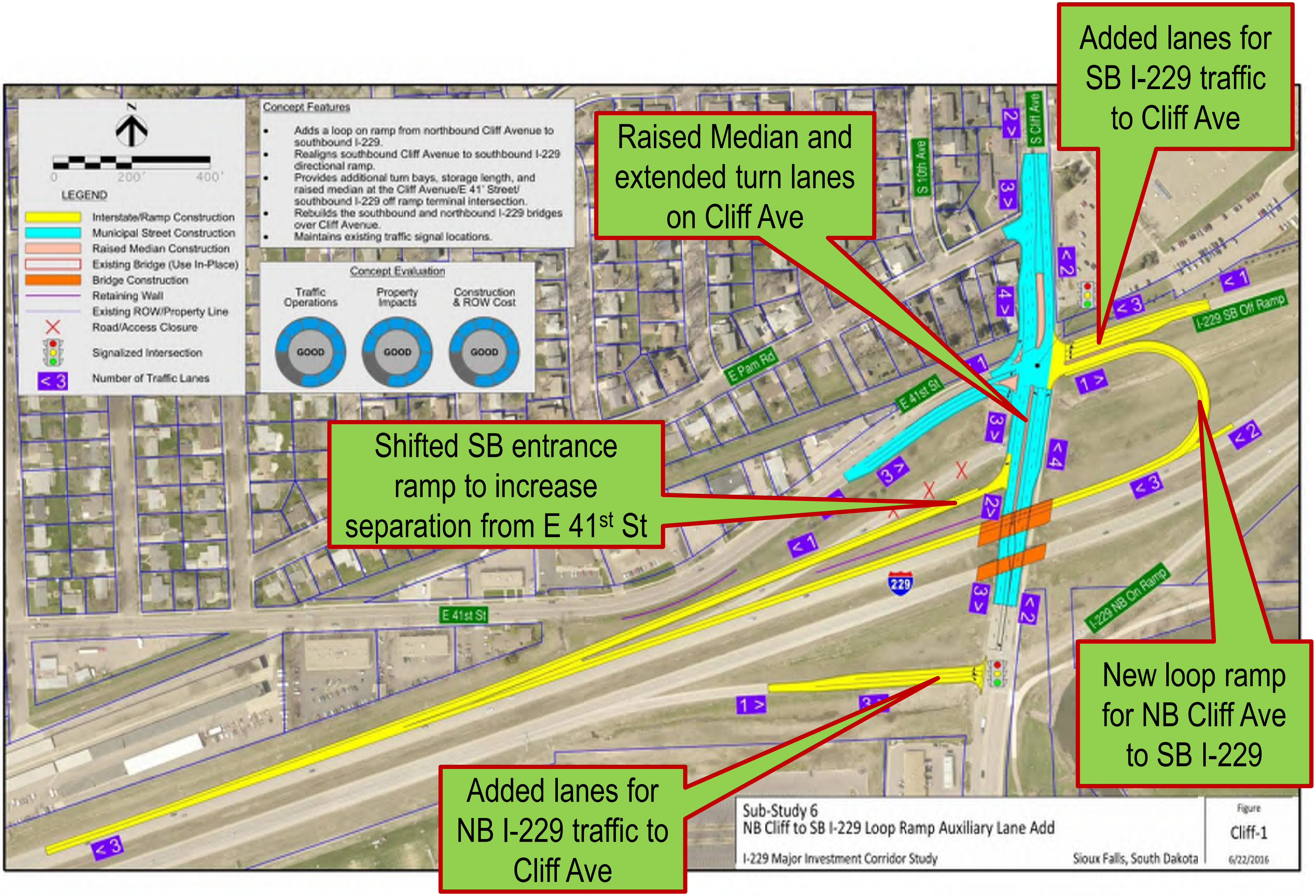
Exit 4 (Cliff Avenue) Sub - Study Goals

- Reduce traffic congestion
- Develop new geometrics to improve capacity at 41st Street and Interchange
- Improve pedestrian mobility
- Improve safety for corridor users

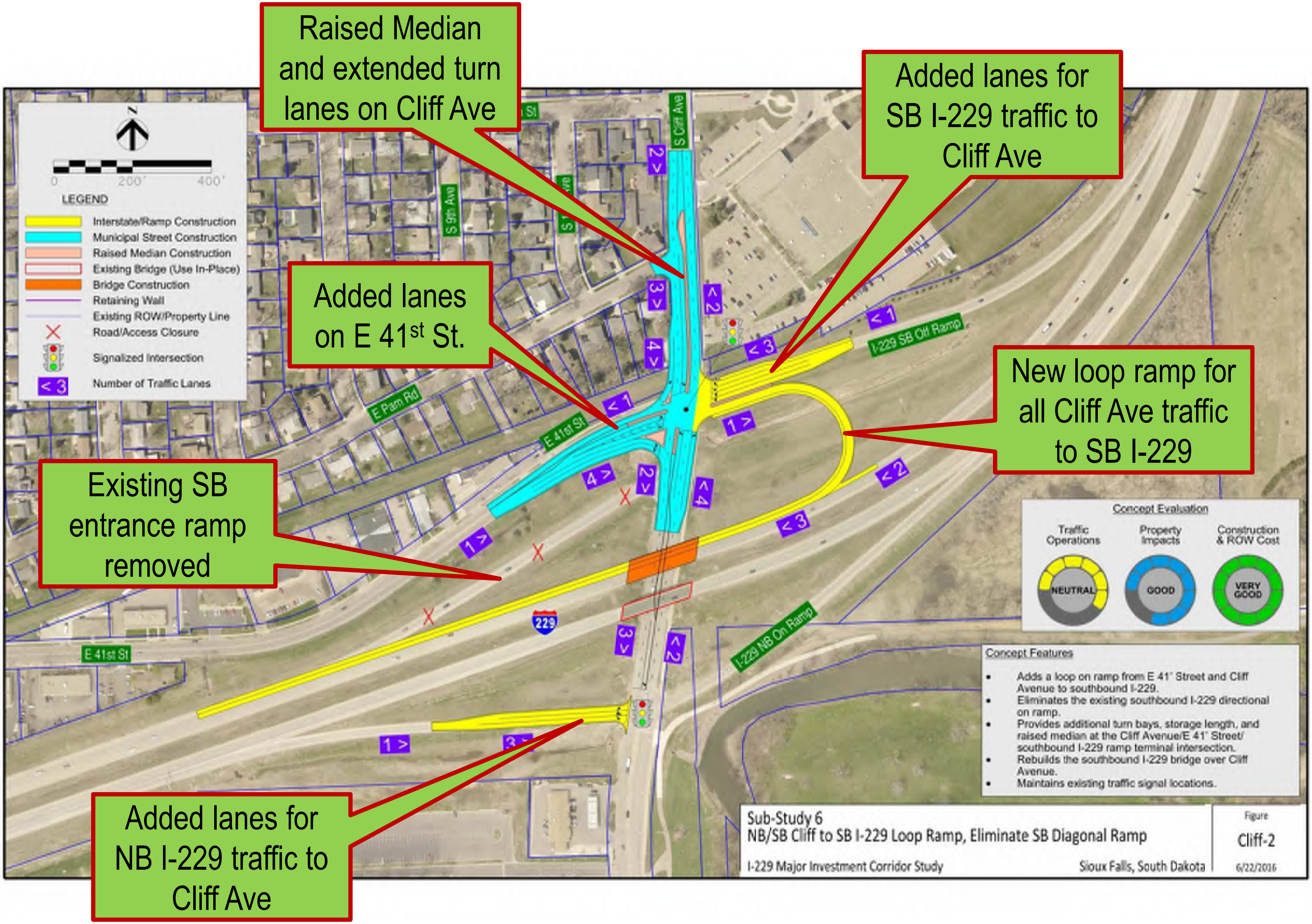


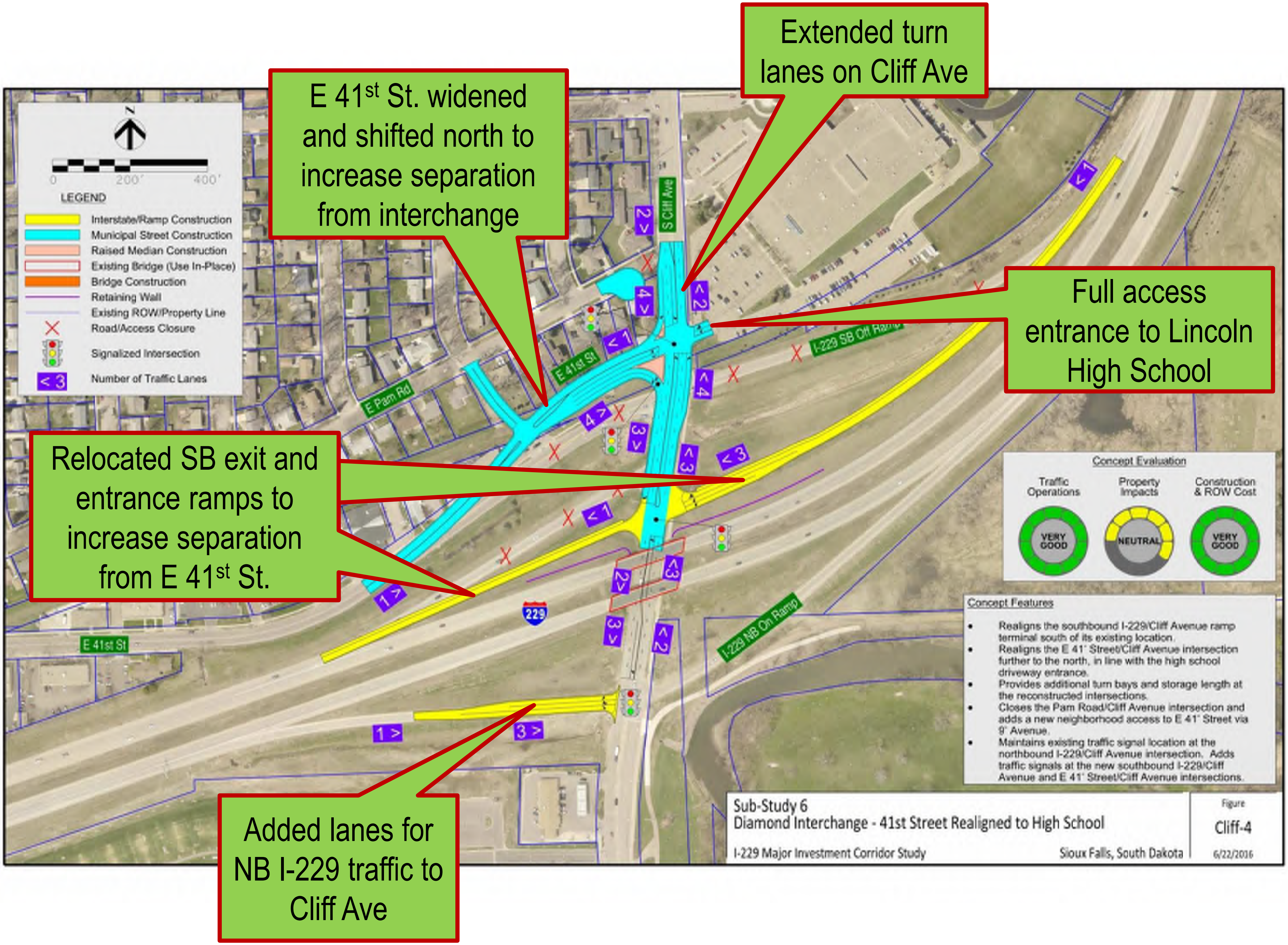



Access to Park close to interchange makes it difficult to exit during peak hour periods
Cliff Avenue
Turn Lane short and few gaps exist to complete left turn movement
229
Cliff Avenue
High Right Turn Volume in the PM Peak Hour
Congestion due to close proximity of 41st Street to I229 SB ON Ramp

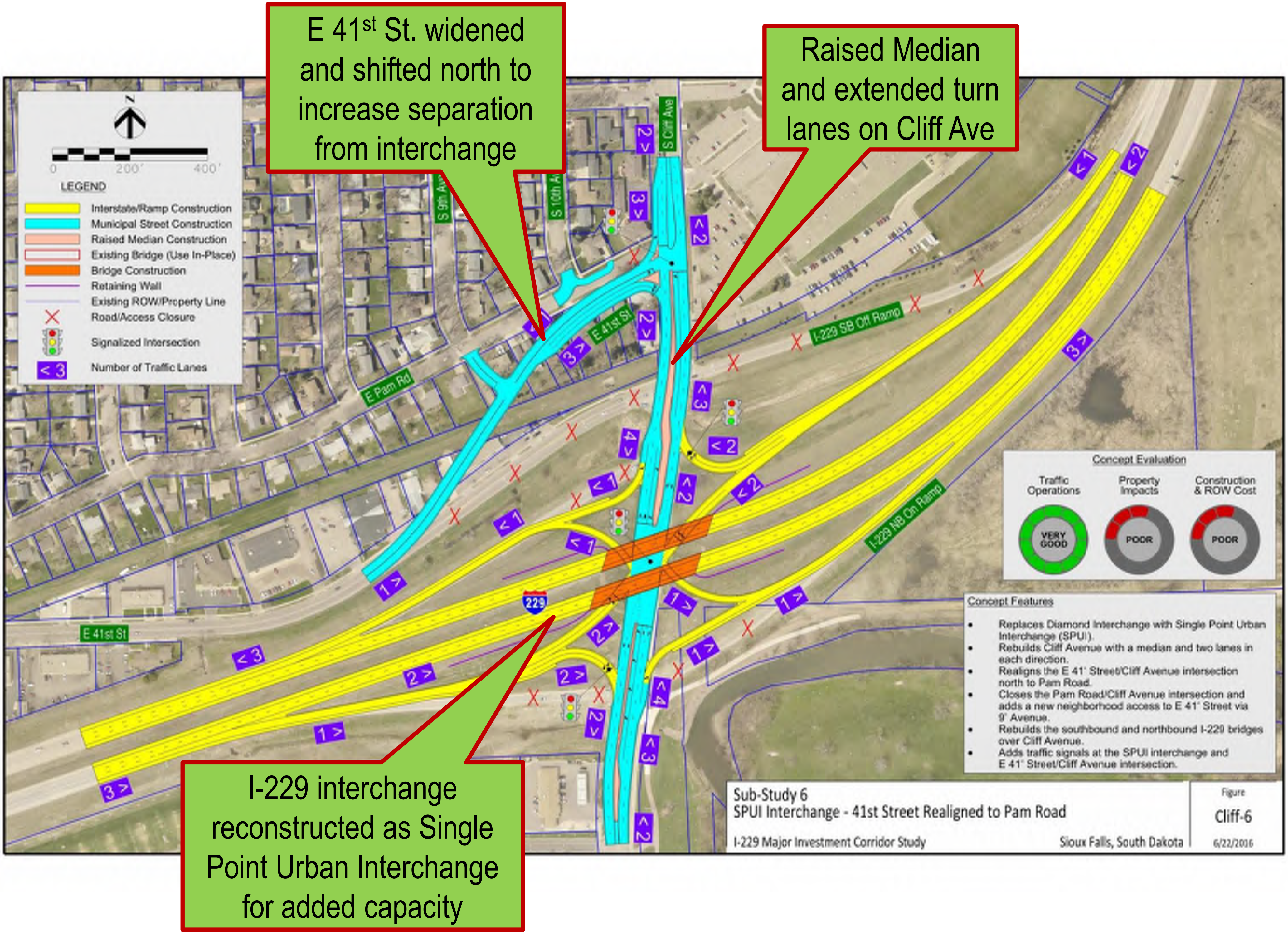


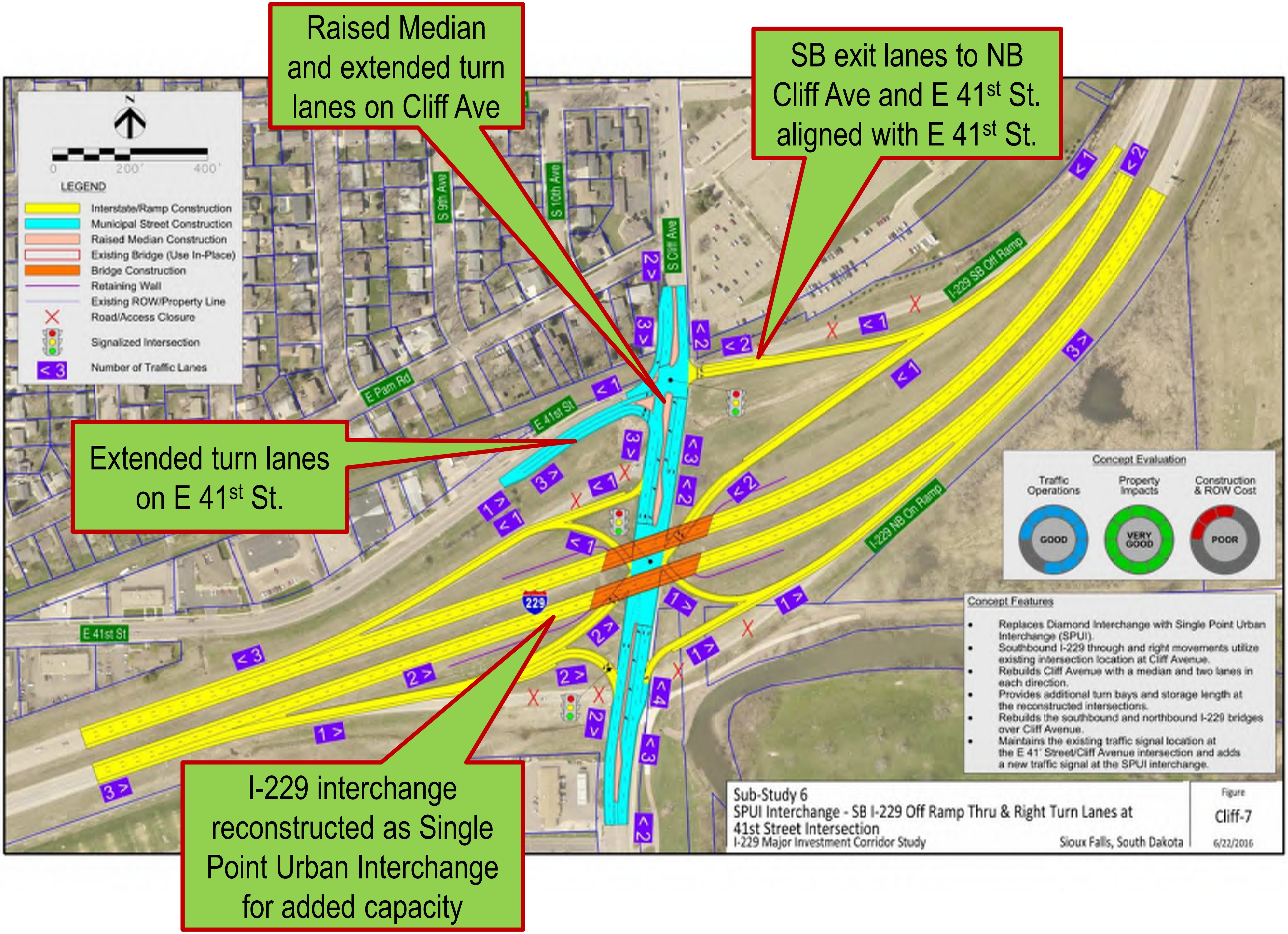
Added lanes for SB I-229 traffic to Cliff Ave
Raised Median and extended turn lanes on Cliff Ave
Shifted SB entrance ramp to increase separation from E 41st St
New loop ramp for NB Cliff Ave to SB I-229
Added lanes for NB I-229 traffic to Cliff Ave
Concept Features
Adds a loop on ramp from northbound Cliff Avenue to southbound I-229.
Realigns southbound Cliff Avenue to southbound I-229 directional ramp.
Provides additional turn bays, storage length, and raised median at the Cliff Avenue/E 41st Street/southbound I-229 off ramp terminal intersection.
Rebuilds the southbound and northbound I-229 bridges over Cliff Avenue.
Maintains existing traffic signal locations.
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
GOOD
GOOD
GOOD
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Existing Bridge (Use In-Place)
Bridge Construction
Retaining Wall
Existing ROW/Property Line
Road/Access Closure
Signalized Intersection
Number of Traffic Lanes
0
200'
400'
N
S Cliff Ave
S 10th Ave
E Pam Rd
E 41st St
I-229 SB Off Ramp
I-229 NB On Ramp
229
Sub-Study 6
NB Cliff to SB I-229 Loop Ramp Auxiliary Lane Add
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Cliff-1
6/22/2016

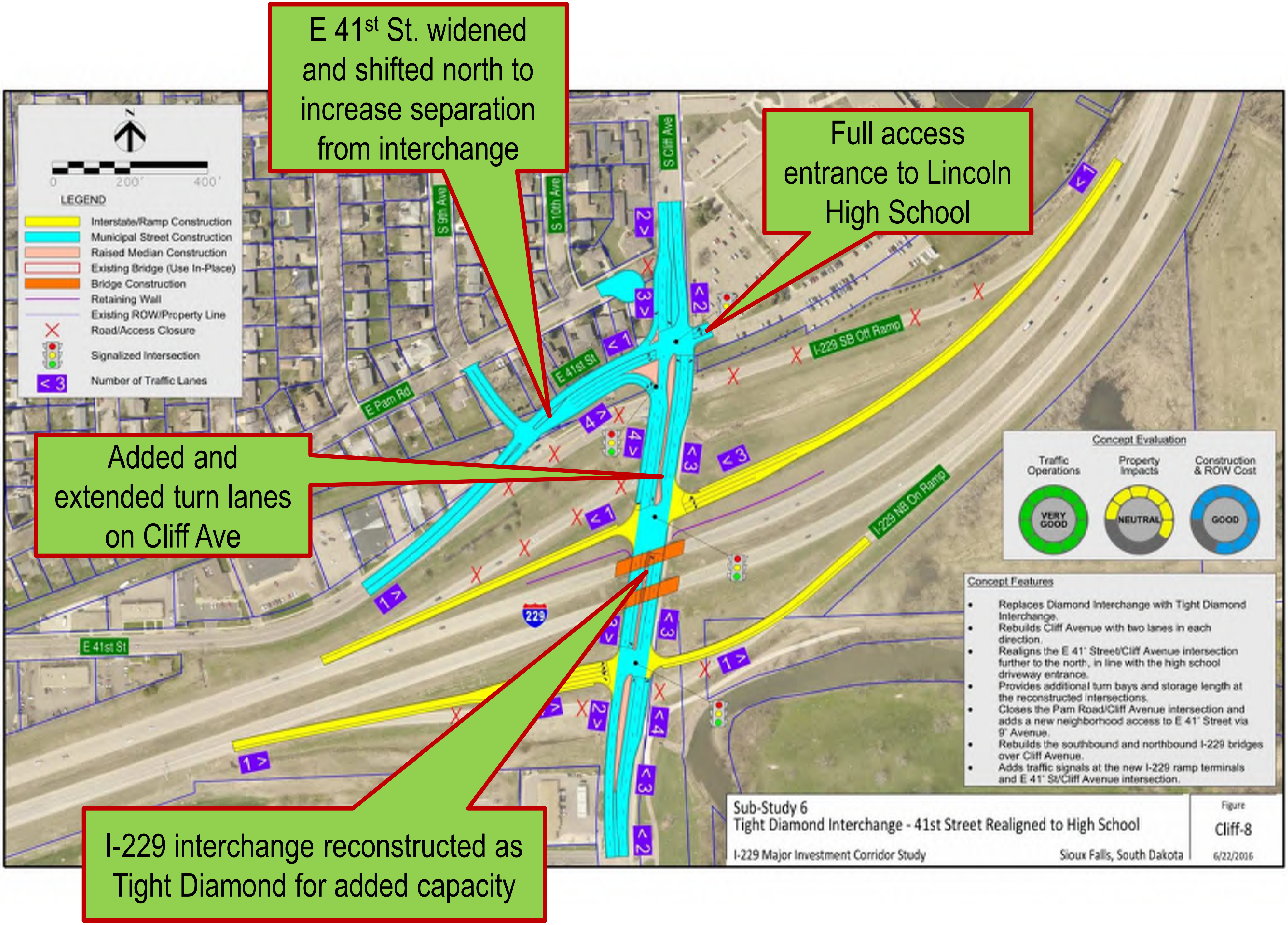

Raised Median and extended turn lanes on Cliff Ave
Added lanes for SB I-229 traffic to Cliff Ave
Added lanes on E 41st St.
New loop ramp for all Cliff Ave traffic to SB I-229
Existing SB entrance ramp removed
Added lanes for NB I-229 traffic to Cliff Ave
N
0 200' 400'
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Existing Bridge (Use In-Place)
Bridge Construction
Retaining Wall
Existing ROW/Property Line
Road/Access Closure
Signalized Intersection
Number of Traffic Lanes
S Cliff Ave
S 9th Ave
E Pam Rd
E 41st St
I-229 SB Off Ramp
I-229 NB On Ramp
229
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
NEUTRAL
GOOD
VERY GOOD
Concept Features
• Adds a loop on ramp from E 41st Street and Cliff Avenue to southbound I-229.
• Eliminates the existing southbound I-229 directional on ramp.
• Provides additional turn bays, storage length, and raised median at the Cliff Avenue/E 41st Street/ southbound I-229 ramp terminal intersection.
• Rebuilds the southbound I-229 bridge over Cliff Avenue.
• Maintains existing traffic signal locations.
Sub-Study 6
NB/SB Cliff to SB I-229 Loop Ramp, Eliminate SB Diagonal Ramp
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Cliff-2
6/22/2016



E 41st St. widened and shifted north to increase separation from interchange
Extended turn lanes on Cliff Ave
Full access entrance to Lincoln High School
Relocated SB exit and entrance ramps to increase separation from E 41st St.
Added lanes for NB I-229 traffic to Cliff Ave
N
0 200' 400'
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Existing Bridge (Use In-Place)
Bridge Construction
Retaining Wall
Existing ROW/Property Line
Road/Access Closure
Signalized Intersection
Number of Traffic Lanes
S Cliff Ave
E 41st St
E Pam Rd
I-229 SB Off Ramp
I-229 NB On Ramp
229
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
VERY GOOD
NEUTRAL
VERY GOOD
Concept Features
• Realigns the southbound I-229/Cliff Avenue ramp terminal south of its existing location.
• Realigns the E 41st Street/Cliff Avenue intersection further to the north, in line with the high school driveway entrance.
• Provides additional turn bays and storage length at the reconstructed intersections.
• Closes the Pam Road/Cliff Avenue intersection and adds a new neighborhood access to E 41st Street via 9th Avenue.
• Maintains existing traffic signal location at the northbound I-229/Cliff Avenue intersection. Adds traffic signals at the new southbound I-229/Cliff Avenue and E 41st Street/Cliff Avenue intersections.
Sub-Study 6
Diamond Interchange - 41st Street Realigned to High School
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Cliff-4
6/22/2016


E 41st St. widened and shifted north to increase separation from interchange
Raised Median and extended turn lanes on Cliff Ave
I-229 interchange reconstructed as Single Point Urban Interchange for added capacity
N
0 200' 400'
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Existing Bridge (Use In-Place)
Bridge Construction
Retaining Wall
Existing ROW/Property Line
Road/Access Closure
Signalized Intersection
Number of Traffic Lanes
S Cliff Ave
S 9th Ave
S 10th Ave
E 41st St
E Pam Rd
I-229 SB Off Ramp
I-229 NB On Ramp
229
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
VERY GOOD
POOR
POOR
Concept Features
Replaces Diamond Interchange with Single Point Urban Interchange (SPUI).
Rebuilds Cliff Avenue with a median and two lanes in each direction.
Realigns the E 41st Street/Cliff Avenue intersection north to Pam Road.
Closes the Pam Road/Cliff Avenue intersection and adds a new neighborhood access to E 41st Street via 9th Avenue.
Rebuilds the southbound and northbound I-229 bridges over Cliff Avenue.
Adds traffic signals at the SPUI interchange and E 41st Street/Cliff Avenue intersection.
Sub-Study 6
SPUI Interchange - 41st Street Realigned to Pam Road
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Cliff-6
6/22/2016


Raised Median and extended turn lanes on Cliff Ave
SB exit lanes to NB Cliff Ave and E 41st St. aligned with E 41st St.
Extended turn lanes on E 41st St.
I-229 interchange reconstructed as Single Point Urban Interchange for added capacity
N
0
200'
400'
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Existing Bridge (Use In-Place)
Bridge Construction
Retaining Wall
Existing ROW/Property Line
Road/Access Closure
Signalized Intersection
Number of Traffic Lanes
S 9th Ave
S 10th Ave
S Cliff Ave
E Pam Rd
E 41st St
I-229 SB Off Ramp
I-229 NB On Ramp
229
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
GOOD
VERY GOOD
POOR
Concept Features
Replaces Diamond Interchange with Single Point Urban Interchange (SPUI).
Southbound I-229 through and right movements utilize existing intersection location at Cliff Avenue.
Rebuilds Cliff Avenue with a median and two lanes in each direction.
Provides additional turn bays and storage length at the reconstructed intersections.
Rebuilds the southbound and northbound I-229 bridges over Cliff Avenue.
Maintains the existing traffic signal location at the E 41st Street/Cliff Avenue intersection and adds a new traffic signal at the SPUI interchange.
Sub-Study 6
SPUI Interchange - SB I-229 Off Ramp Thru & Right Turn Lanes at 41st Street Intersection
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Cliff-7
6/22/2016



E 41st St. widened and shifted north to increase separation from interchange
Full access entrance to Lincoln High School
Added and extended turn lanes on Cliff Ave
I-229 interchange reconstructed as Tight Diamond for added capacity
N
0 200' 400'
LEGEND
Interstate/Ramp Construction
Municipal Street Construction
Raised Median Construction
Existing Bridge (Use In-Place)
Bridge Construction
Retaining Wall
Existing ROW/Property Line
Road/Access Closure
Signalized Intersection
Number of Traffic Lanes
S Cliff Ave
S 9th Ave
S 10th Ave
E 41st St
E Pam Rd
I-229 SB Off Ramp
I-229 NB On Ramp
229
Concept Evaluation
Traffic Operations
Property Impacts
Construction & ROW Cost
VERY GOOD
NEUTRAL
GOOD
Concept Features
Replaces Diamond Interchange with Tight Diamond Interchange.
Rebuilds Cliff Avenue with two lanes in each direction.
Realigns the E 41st Street/Cliff Avenue intersection further to the north, in line with the high school driveway entrance.
Provides additional turn bays and storage length at the reconstructed intersections.
Closes the Pam Road/Cliff Avenue intersection and adds a new neighborhood access to E 41st Street via 9th Avenue.
Rebuilds the southbound and northbound I-229 bridges over Cliff Avenue.
Adds traffic signals at the new I-229 ramp terminals and E 41st St/Cliff Avenue intersection.
Sub-Study 6
Tight Diamond Interchange - 41st Street Realigned to High School
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Cliff-8
6/22/2016

PROJECT CONTACTS:

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Steve Gramm – SDDOT Project Development
605-773-6641 or steve.gramm@state.sd.us

Interstate 229 Major Investment Study

Exit 4 – Cliff Avenue

Thanks for Attending!!!!!

HDR

APPENDIX -

STAKEHOLDER MEETINGS #2 – DECEMBER 5TH & 6TH, 2016

BENSON ROAD

DECEMBER 5TH, 2016

- MEETING NOTES
- SIGN-IN SHEETS
- POWERPOINT SLIDES
- COMMENTS (SEE PUBLIC MEETING #3 APPENDIX)

Meeting Minutes

Project:	I-229 Major Investment Corridor Study, PL 0100(87) 3616P, PCN 044K
Subject:	Stakeholder Meeting – Sub-study 4 – Benson Road Exit 9
Date:	Monday, December 05, 2016
Location:	Sioux Falls Convention Center Conference Room 6
Attendees:	See Attached Sign In Sheet – 5 Participants

Stakeholder comments and questions noted:

1. Stakeholders representing Boyer Trucks (West side of St Paul Ave, south of Benson Rd) – The proposed concept will prevent westbound traffic on Benson Rd from turning left at St Paul Ave to go south. Concern noted in particular for westbound semi-trailer truck traffic headed for businesses along St Paul Ave. That traffic would have to turn onto Potsdam Ave or Lewis Ave and find their way to St Paul Ave via 39th St N. Truck drivers headed for businesses along St Paul Ave may get lost along the way. The routing is too inconvenient. Boyer Truck has no access to Lewis Ave.

2. At least half of the businesses located south of Benson Rd and west of I-229 are trucking-related.

3. Opposed to proposed median treatment on Benson Rd at Potsdam Avenue.

4. Stakeholder opinion - Crashes on Benson Road at intersections are due to speed on Benson Road (the existing posted speed limit is 40 mph).

5. Will Concept Benson-4 impact the property to the northeast of the northbound I-229 entrance ramp at Benson Rd? Response: At this stage of concept development, it appears that property impacts along the northbound entrance ramp would be very limited.

6. Will right of way acquisition be needed for proposed widening at Benson Rd and Lewis Ave? Response: Probably.

7. How many years in the future will the proposed improvements be constructed? Response: At least six years.

Meeting Minutes

Project:	I-229 MIS; PL 0100 (87) 3616P, PCN 044K
Subject:	Sub-study 4 (Benson Road) Stakeholder Meeting Notes
Date:	Monday, December 05, 2016
Location:	SF Convention Center
Attendees:	See sign in sheets

1. Presentation by Jason Kjenstad. I229 MIS Set 2 Stakeholder Mtg_Benson Rd
2. Stakeholder questions/comments and *responses* during and after presentation:
   - Trucking company on south side of St. Paul Avenue is concerned about loss of access from the proposed raised center median on Benson Road. *Kjenstad response was that center median is needed for safety benefits; City design standards call for raised center median for roadways with 3 through lanes in each direction.*
   - With the proposed raised median at Benson Road/St. Paul Avenue intersection, trucks will be forced to use Lewis Avenue/Potsdam Avenue/39th Street combination to get to the trucking businesses along St. Paul Avenue. These streets do not now accommodate the widths and intersection radii required for truck movements. *Kjenstad response was that alternative access routes would have to be reviewed for truck traffic and potential improvements would need to be considered.*
   - Recommend speed control/reduction methods on Benson Road to address traffic speeds in excess of posted speed limits. *Kjenstad response was that besides speed limit enforcement, for arterial streets like Benson Road, the City typically does not incorporate speed control/reduction methods.*
   - South-side landowners were assessed for 2016 installation of sidewalk along the south side of Benson Road. Would landowners get assessed again for future sidewalk improvements associated with Benson Road reconstruction/widening? *City response was that there would not be additional assessments to landowners for sidewalk work.*
   - Recommended adding a traffic signal at Benson Road/St. Paul Avenue intersection. *Kjenstad response was that signals are spaced to facilitate traffic movements and a signal at the Benson Road/St. Paul Avenue intersection would not meet City or SDDOT signal spacing criteria.*
   - What is the timeframe for proposed Benson Road improvements? *Kjenstad response was 7 to 10 years from now before any construction begins.*
   - SF Development owns the property in the northeast quadrant of the I-29/Benson Road interchange. They are concerned about the additional roadway right-of-way needed for the interchange loop options. *Kjenstad response was that the City will work with the landowner throughout the development plan process.*
   - Benson Road traffic is not bad during off-peak hours; why is widening required? *Kjenstad response was that peak period traffic is the basis for design and 3 through traffic lanes in each direction are needed to accommodate predicted peak period traffic to meet City and SDDOT level of service criteria.*
   - What is the cost difference between the interchange options? *Response by Unruh was that DDI option is about $4M less that the loop options ($40M estimated cost for options with loops; $36M estimated cost for DDI option).*

Sign In Sheet

Subject I-229 Major Investment Corridor Study – Stakeholder Meeting for Benson Road Sub-Study
Client City of Sioux Falls/South Dakota Department of Transportation
Project PL 0100(87) 3616P, PCN 044K **Project No.:** 207030
Meeting Date Monday, December 5th, 2016 3:00 PM **Meeting Location:** Sioux Falls Convention Center

Please print clearly. Thank you.

	Name	Address	Best Contact Phone	Email
1	Shannon Ausen	224 W 9th St SFSD	367-8607	sausen@siouxfalls.org
2	James Unruh	HDR 6300 S. Old Village Pl. SFSD	605-977-7740	james.unruh@hdrinc.com
3	Jason Kjenstad	HDR 6300 S. old Village Pl SF	605-977-7740	jason.kjenstad@hdrinc.com
4	Steve Gramm	700 E. Broadway Ave Pierre	605-773-6641	steve.gramm@state.sd.us
5	Bruce Mutschler	2101 E. Benson Rd	605-336-6100	bmutschler@beyertrucks.com
6	Lori Chromm...	SFDF 200 N. Phillips Ave	605-339-0700	lorc@siouxfalls.com
7	CHRIS RANS	3412 N POTSDAM AVE.	(605) 338-9110	CHRIS@SUNKOTACONSTRUCTION.COM
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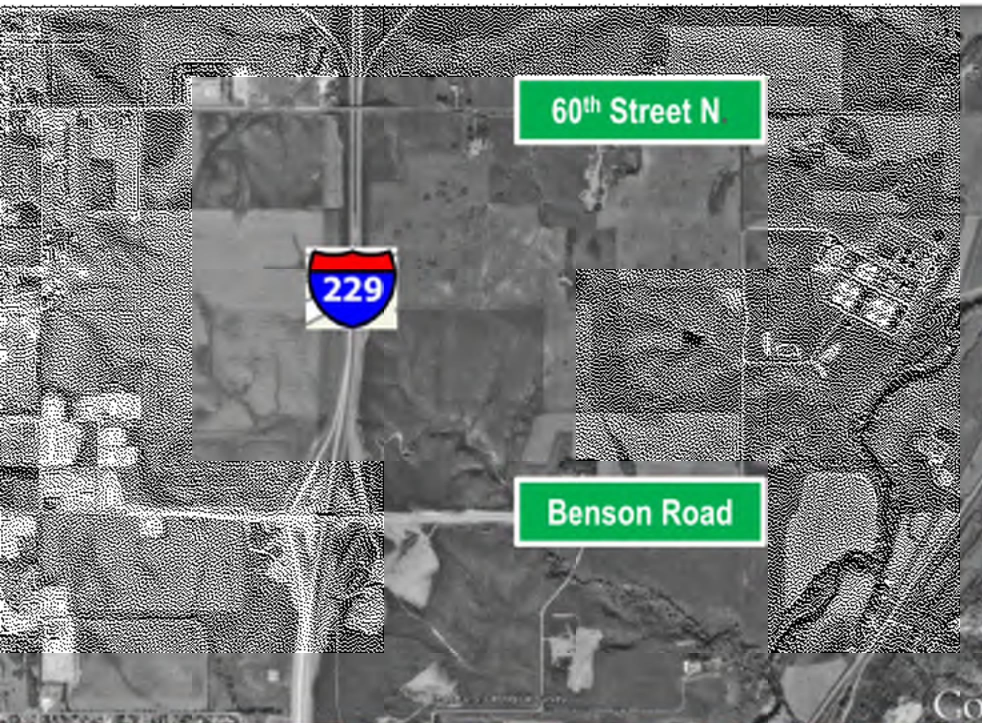


INTERSTATE 229 MAJOR INVESTMENT STUDY

Exit 9 – Benson Rd Sub-Study

Stakeholder Meeting

December 5th, 2016
3:00 pm to 4:00 pm

HDR

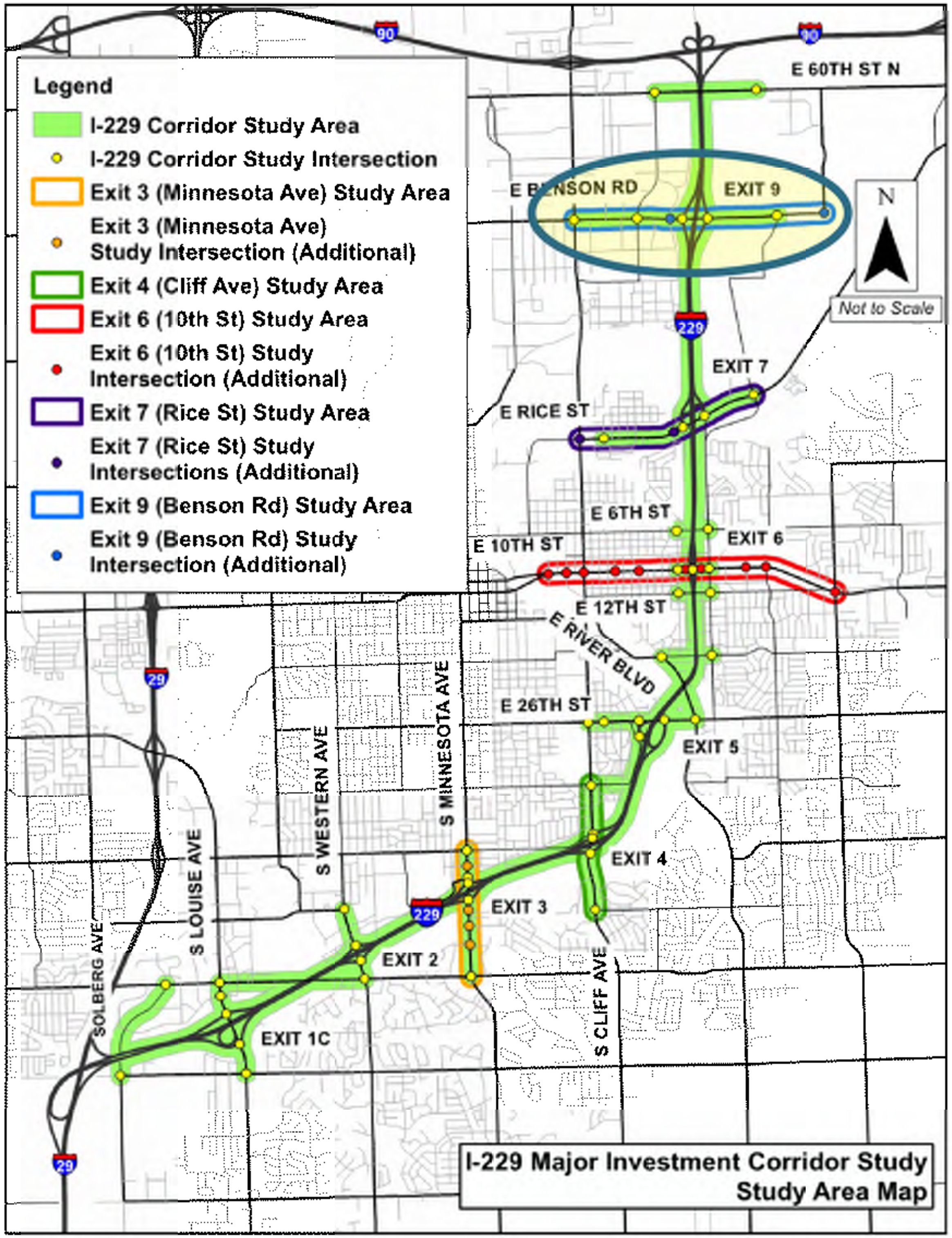
STUDY AREA MAP

I-229 Corridor Study

Solberg Avenue Overpass to 60th Street N Overpass

Meeting will focus on:

Exit 9 – Benson Road



STUDY ADVISORY PARTNERS

South Dakota Department of Transportation (SDDOT)

South Dakota Highway Patrol

City of Sioux Falls

Sioux Falls Metropolitan Planning Organization (MPO)

Federal Highway Administration (FHWA)

PRESENTATION AGENDA

- Concept Evaluation Process
- Concept Evaluation Results
- Concepts Recommended for Further Consideration in Future Phases (Interchange & Corridor Improvements)
- Next Steps

CONCEPT EVALUATION PROCESS

- Evaluation Factors:

Option	Description	Traffic Operations	Safety	Environmental	Property Impacts	Construction & ROW Cost	DRAFT Recommendation
Concept ID	Interchange and Corridor Type	•Traffic Delay •Level of Service •Interchange Year of Failure	Predicted Crash Reduction during 2012-2035	Potential impact to wetlands, historical resources, threatened and endangered species, public lands, and floodplains	Total Right of Way (ROW) Required and Acquisitions	Total Constuction Cost (including ROW)	Advance or Eliminate

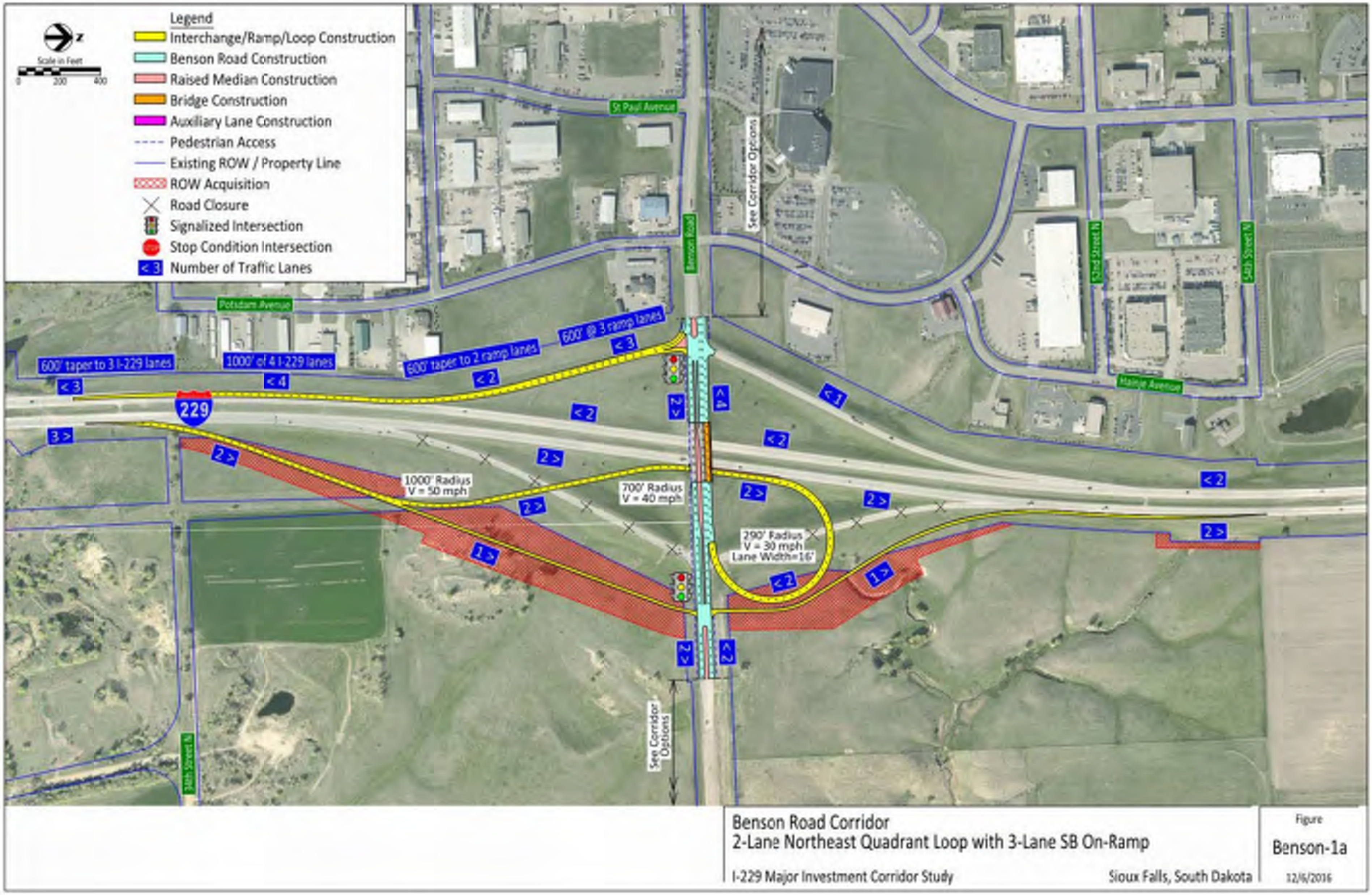
- Evaluation Matrix to Compare Concepts
- Recommended Action

CONCEPT EVALUATION RESULTS

Option	Description	Traffic Operations	Safety	Environmental	Property Impacts	Construction & ROW Cost	DRAFT Recommendation
No-Build	No-Build	POOR	NEUTRAL	N/A	N/A	N/A	Advance
Benson-1A	2-Lane Northeast Quadrant Loop with 3-Lane SB On-Ramp	VERY GOOD	GOOD	NEUTRAL	NEUTRAL	NEUTRAL	Advance
Benson-1B	2-Lane Northeast Quadrant Loop with 2-Lane SB On-Ramp	VERY GOOD	GOOD	NEUTRAL	NEUTRAL	NEUTRAL	Advance
Benson-4	Diverging Diamond Interchange	NEUTRAL	VERY GOOD	GOOD	VERY GOOD	NEUTRAL	Advance

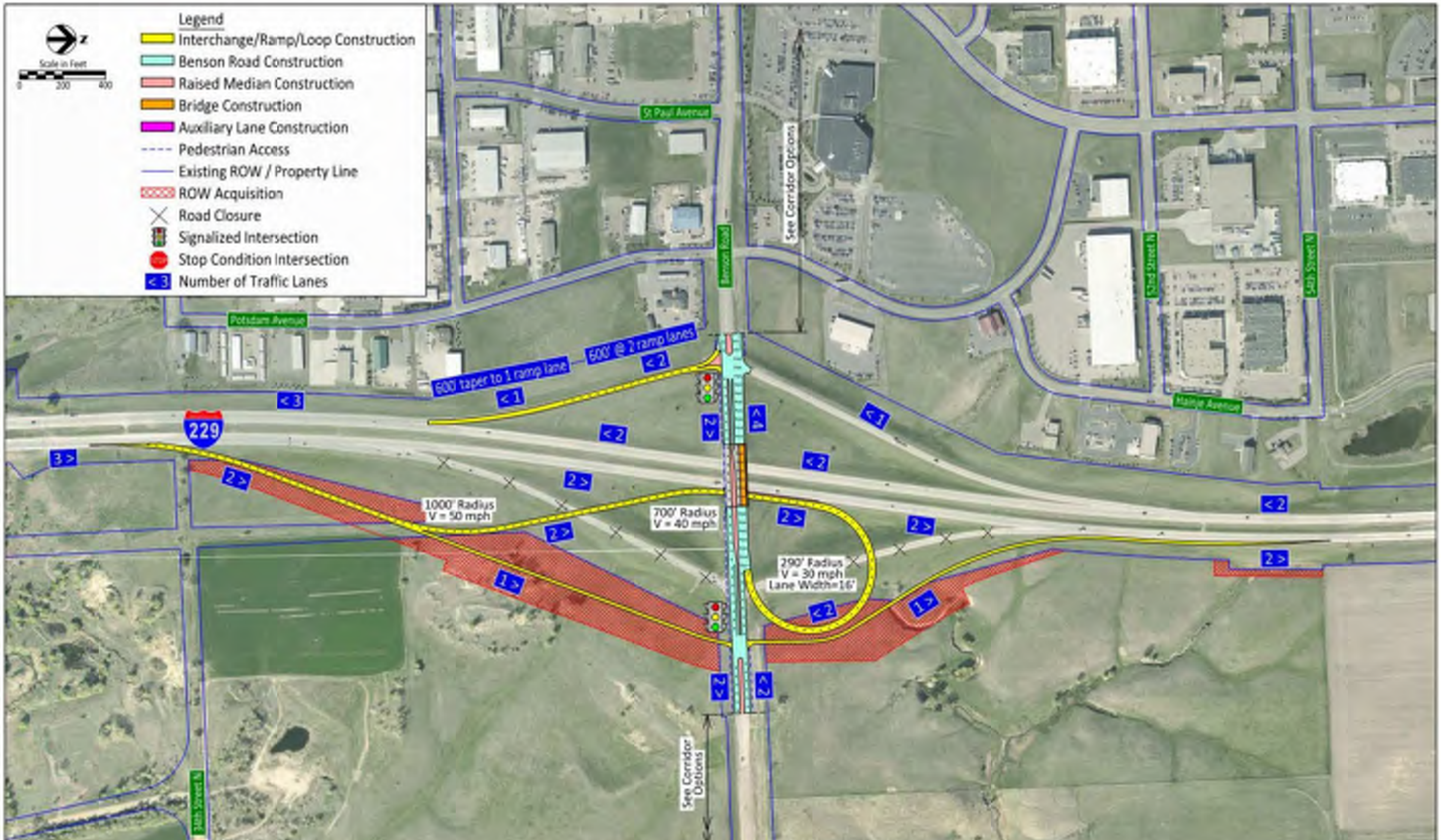
CONCEPTS FOR FURTHER CONSIDERATION

BENSON-1A



CONCEPTS FOR FURTHER CONSIDERATION

BENSON-1B



Benson Road Corridor
2-Lane Northeast Quadrant Loop with 2-Lane SB On-Ramp

I-229 Major Investment Corridor Study

Sioux Falls, South Dakota

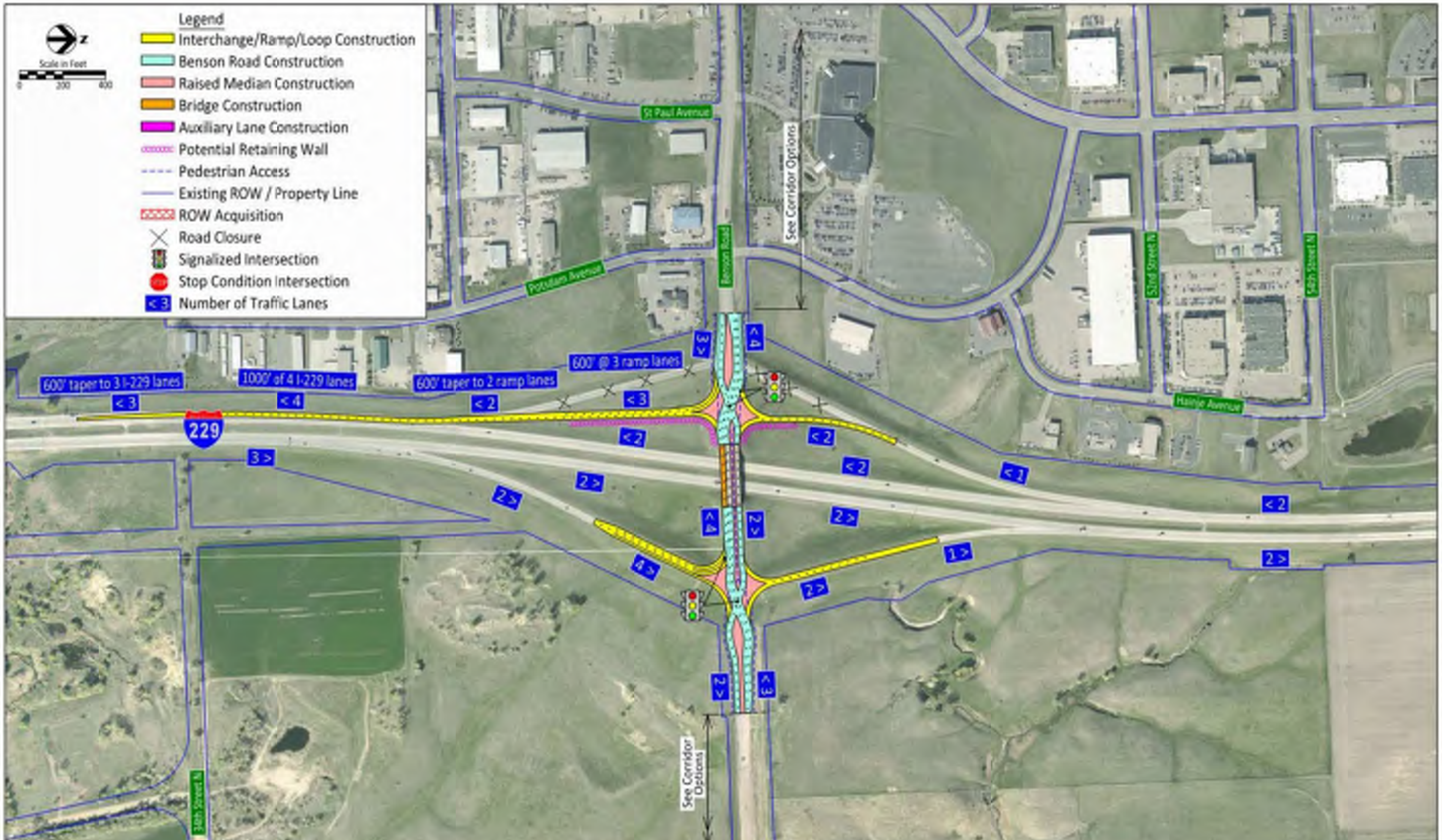
Figure

Benson-1b

12/6/2016

CONCEPTS FOR FURTHER CONSIDERATION

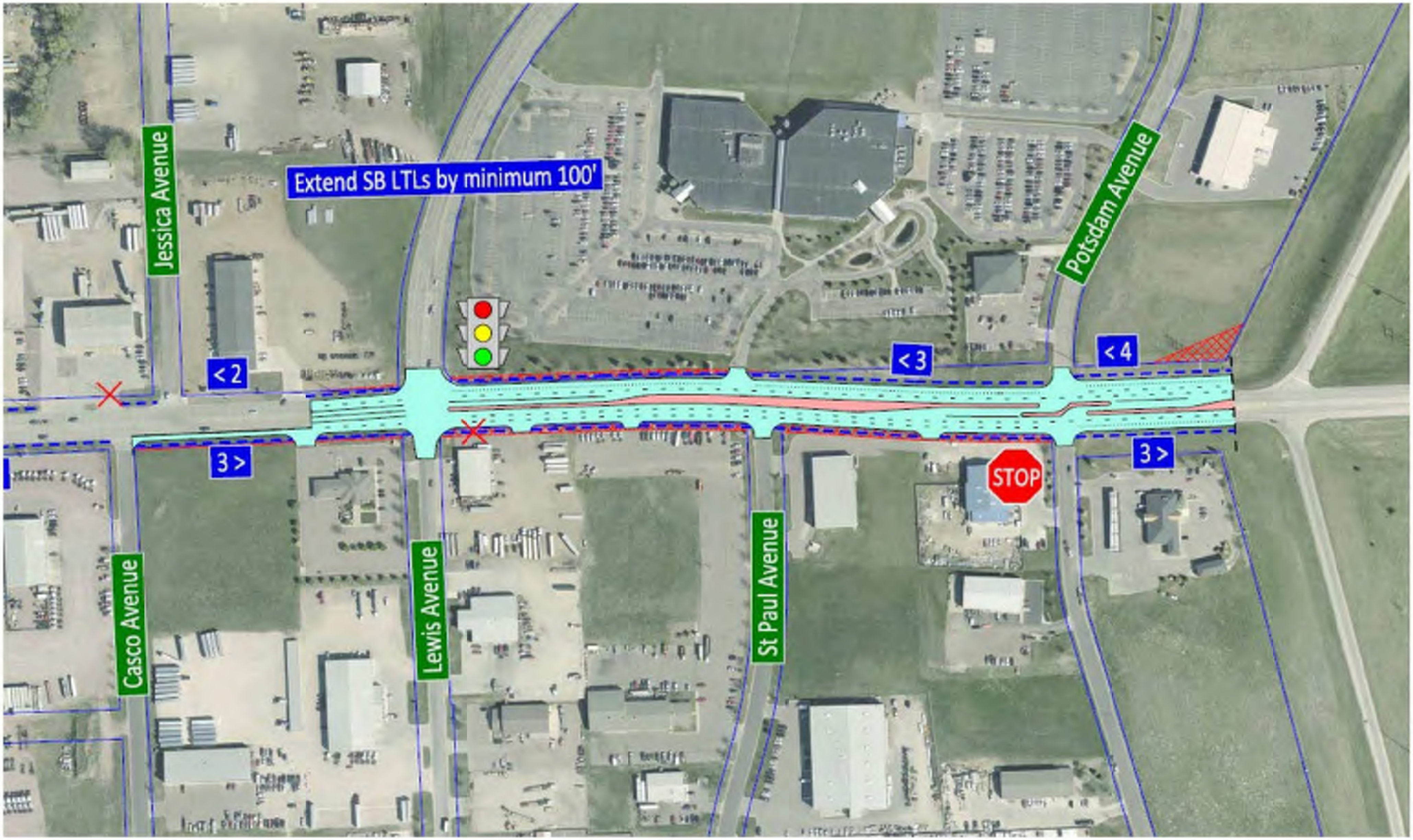
BENSON-4



Benson Road Corridor
Diverging Diamond Interchange
I-229 Major Investment Corridor Study
Sioux Falls, South Dakota
Figure
Benson-4
12/6/2016

CONCEPTS FOR FURTHER CONSIDERATION

BENSON IMPROVEMENTS



BENSON ROAD
PRELIMINARY PROJECT PRIORITY

- Priority recommendation based on existing and anticipated need and level of improvement and impacts associated with remaining concept options
- Benson Road Interchange and Corridor improvements = High Priority
- See exhibit board for additional information

NEXT STEPS

- Assemble Stakeholder and Public Comments
- Complete Study Report
- Project Development Process = 5-6 year timeline when initiated by SDDOT & City
  - Prepare Interchange Modification Justification Report and Environmental Document
  - Develop Project Design
  - Acquire Right of Way
  - Construction

PROJECT CONTACTS:

Jason Kjenstad – HDR Engineering, Inc.
605-977-7740 or jason.kjenstad@hdrinc.com

James Unruh – HDR Engineering, Inc.
605-977-7740 or james.unruh@hdrinc.com

Shannon Ausen – City of Sioux Falls
605-367-8607 or sausen@siouxfalls.org

Steve Gramm – SDDOT Project Development
605-773-6641 or steve.gramm@state.sd.us

INTERSTATE 229 MAJOR INVESTMENT STUDY

Exit 9 – Benson Rd Sub-Study

Thanks for attending!

HDR

10TH STREET

DECEMBER 5TH, 2016

- MEETING NOTES
- SIGN-IN SHEETS
- POWERPOINT SLIDES
- COMMENTS (SEE PUBLIC MEETING #3 APPENDIX)

Meeting Minutes

Project:	I-229 Major Investment Corridor Study, PL 0100(87) 3616P, PCN 044K
Subject:	Stakeholder Meeting – Sub-study 3 - Exit 6 (10th Street) Sub-Study
Date:	Monday, December 05, 2016
Location:	Sioux Falls Convention Center Conference Room 6
Attendees:	See Attached Sign In Sheet – 5 Participants

Stakeholder comments and questions noted:

1. Question from stakeholder associated with Fry'in Pan Restaurant (Northwest corner 10th & Cleveland) - Is a median proposed on Cleveland Avenue both north and south of 10th Street? Response: The alternatives include a median on Cleveland Avenue both north and south of 10th Street and dual left turn lanes are proposed on each Cleveland Ave approach to serve anticipated traffic.

The stakeholder noted that Cleveland Ave is only busy after school is dismissed, for about 45 minutes per day, so dual left turn lanes are not needed.

He stated that he does not support the proposed medians on Cleveland because he perceives that similar medians on 12th St "ruined" businesses there.

2. How will parking impacts will be addressed? Response: Replacement parking would be sought, but if replacement parking could not be identified, acquisition of the property would be considered.

3. What happens to the Super 8 Hotel on the northeast corner of I-229/10th Street? Response: It was noted that all of the alternatives impact the hotel similarly.

Sign In Sheet

Subject I-229 Major Investment Corridor Study – Stakeholder Meeting for 10th Street Sub-Study

Client City of Sioux Falls/South Dakota Department of Transportation

Project PL 0100(87) 3616P, PCN 044K **Project No.:** 207030

Meeting Date Monday, December 5th, 2016 4:30 PM **Meeting Location:** Sioux Falls Convention Center

Please print clearly. Thank you.

	Name	Address	Best Contact Phone	Email
1	gary busselman	7201 E Madison ST Sioux Falls SD 57110	605 334 5692	gary@garybuss.com
2	HERSIL PATEL	2616 E 10TH ST Sioux Falls SD 57103	727 776 1476 605 358 8881	hersil@yogimgt.com.
3	CHUCK GUSTAFSON	705 E RIDGE RD SFSD 57105	332-1000	CGUSTAFSON@MAC.COM
4	STAN MITZEL	2708 East 10th SF SD 57103	605-361-7804	Smitzel@FrynPan.net
5	~~JAMES NORD~~			
6	RYAN TYSON	LLOYD COMPANIES	376-0127	Ryan@LloydCompanies.com
7	Jason Kjenstad	HDR 1300 S. old Village Pl	977-7740	jason.kjenstad@hdrinc.com
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INTERSTATE 229 MAJOR INVESTMENT STUDY

Exit 6 – 10th Street Sub-Study

Stakeholder Meeting

December 5th, 2016
4:30 pm to 5:30 pm

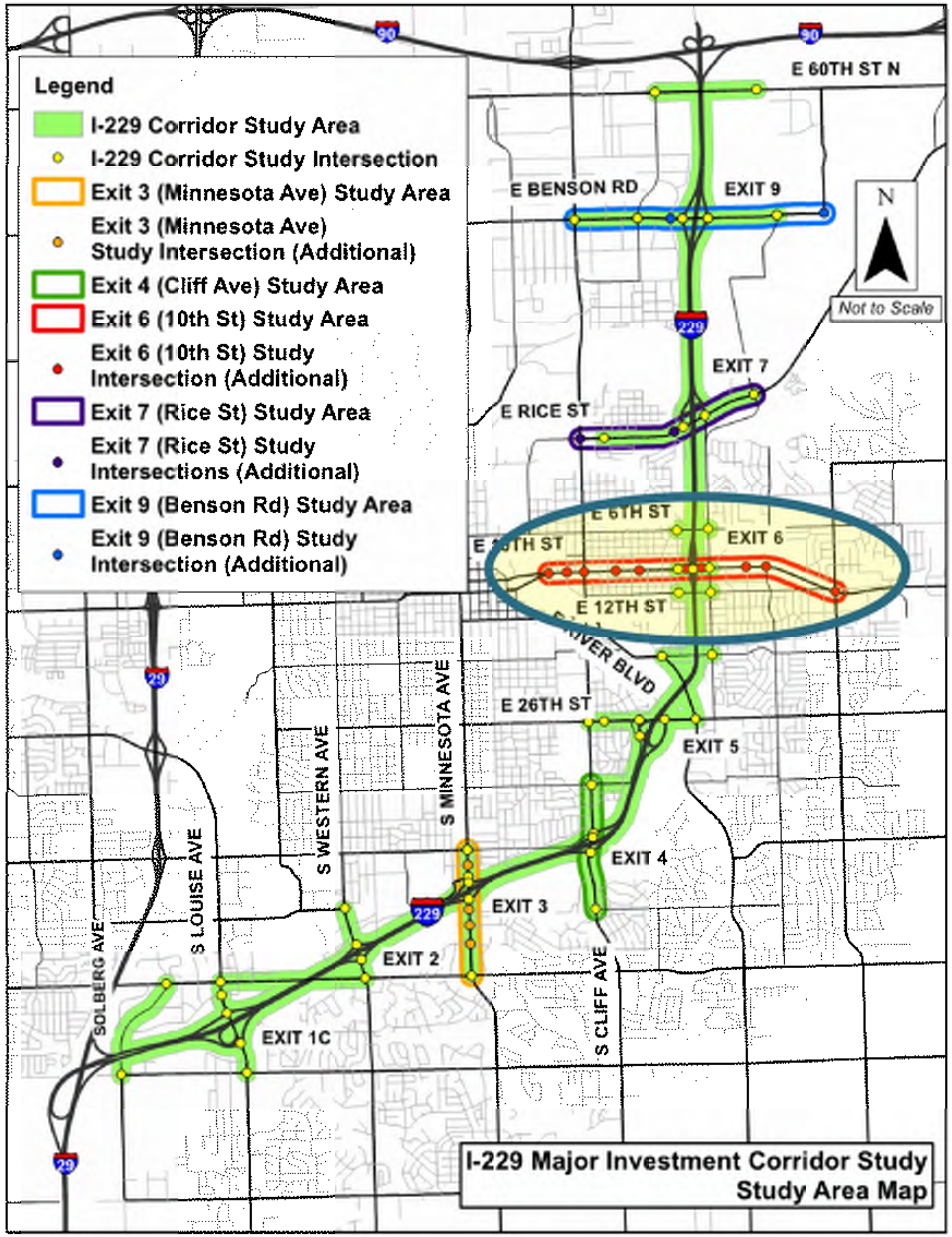
STUDY AREA MAP

I-229 Corridor Study

Solberg Avenue Overpass to 60th Street N Overpass

Meeting will focus on:

Exit 6 – 10th Street



STUDY ADVISORY PARTNERS

South Dakota Department of Transportation (SDDOT)

South Dakota Highway Patrol

City of Sioux Falls

Sioux Falls Metropolitan Planning Organization (MPO)

Federal Highway Administration (FHWA)

PRESENTATION AGENDA

- Concept Evaluation Process
- Concept Evaluation Results
- Concepts Recommended for Further Consideration in Future Phases (Interchange & Corridor Improvements)
- Next Steps

CONCEPT EVALUATION PROCESS

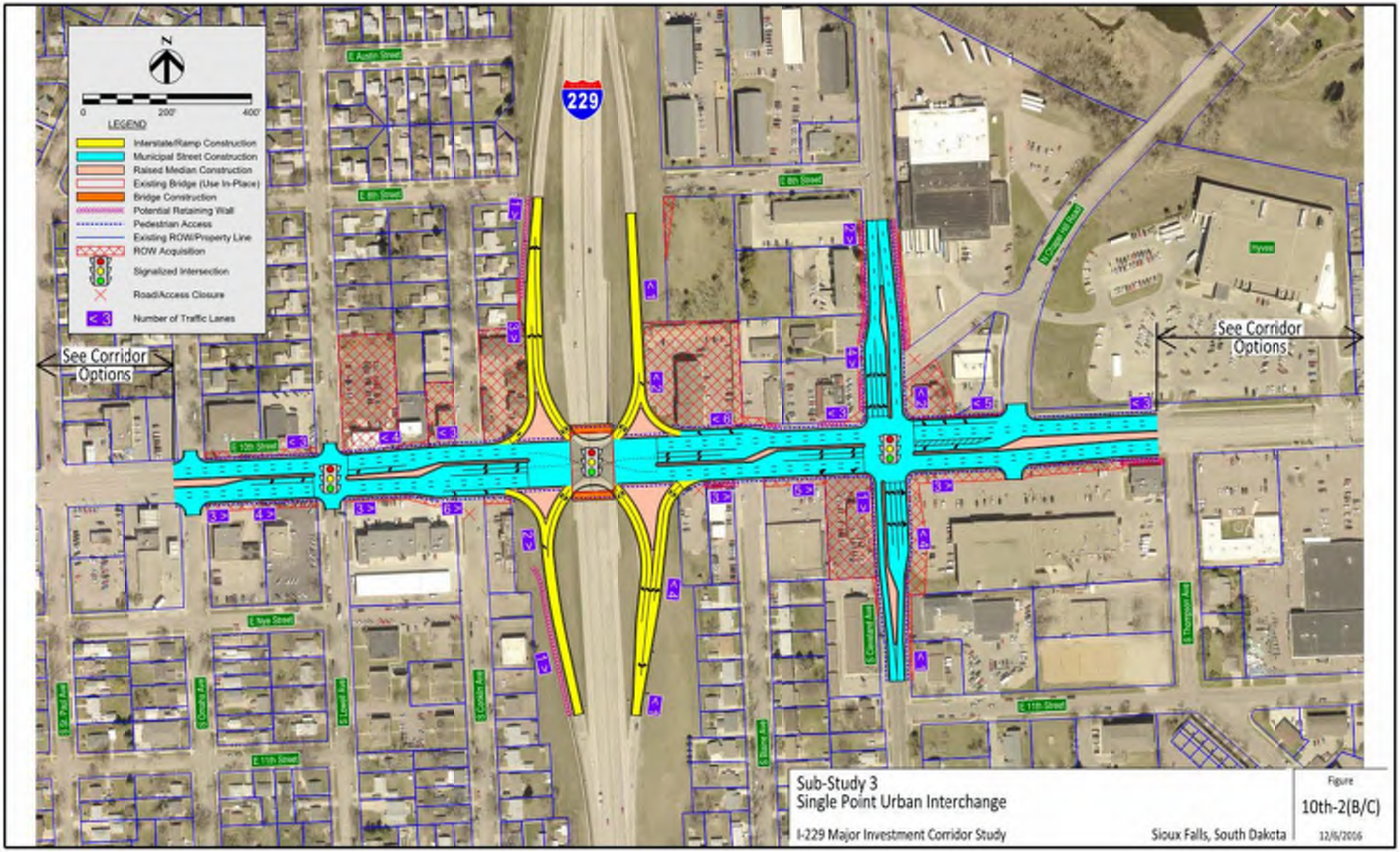
- Evaluation Factors:

Option	Description	Traffic Operations	Safety	Environmental	Property Impacts	Construction & ROW Cost	DRAFT Recommendation
Concept ID	Interchange and Corridor Type	•Traffic Delay •Level of Service •Interchange Year of Failure	Predicted Crash Reduction during 2012-2035	Potential impact to wetlands, historical resources, threatened and endangered species, public lands, and floodplains	Total Right of Way (ROW) Required and Acquisitions	Total Constuction Cost (including ROW)	**Advance** or **Eliminate**

- Evaluation Matrix to Compare Concepts
- Recommended Action

CONCEPTS FOR FURTHER CONSIDERATION

10^{TH}-2 (B/C)

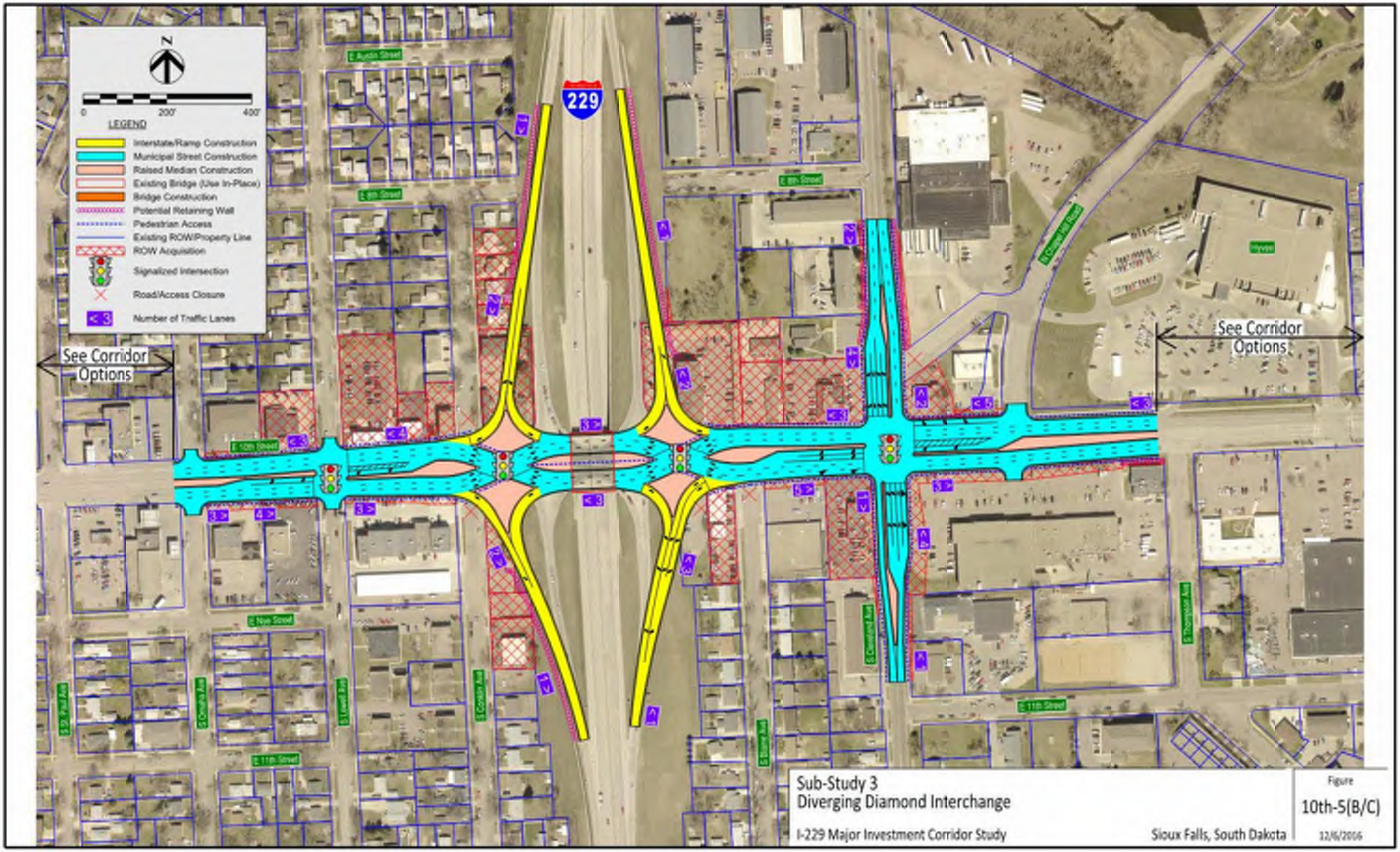


CONCEPT EVALUATION RESULTS

Option	Description	Traffic Operations	Safety	Environmental	Property Impacts	Construction & ROW Cost	DRAFT Recommendation
No-Build	No-Build	POOR	NEUTRAL	N/A	N/A	N/A	Advance
10th-2A	Single Point Urban Interchange, 6-Lane Divided Corridor	VERY GOOD	NEUTRAL	NEUTRAL	POOR	POOR	Eliminate Property impacts, environmental impacts, and cost
10th-2B	Single Point Urban Interchange, 4-Lane Divided Corridor	GOOD	NEUTRAL	NEUTRAL	NEUTRAL	NEUTRAL	Advance
10th-2C	Single Point Urban Interchange, 5-Lane Undivided Corridor	GOOD	NEUTRAL	NEUTRAL	GOOD	GOOD	Advance

CONCEPTS FOR FURTHER CONSIDERATION

10TH-5 (B/C)

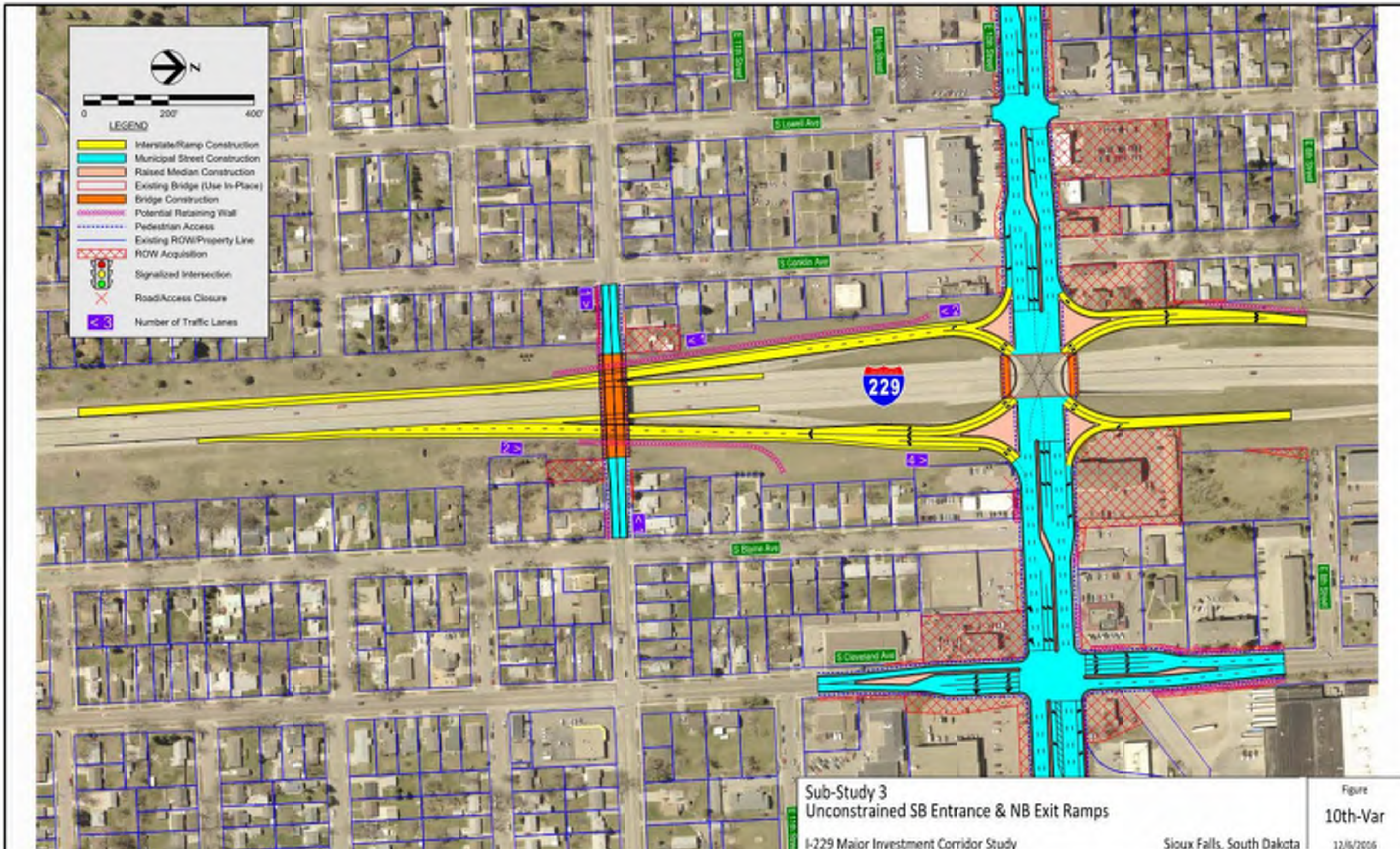


CONCEPT EVALUATION RESULTS (cont.)

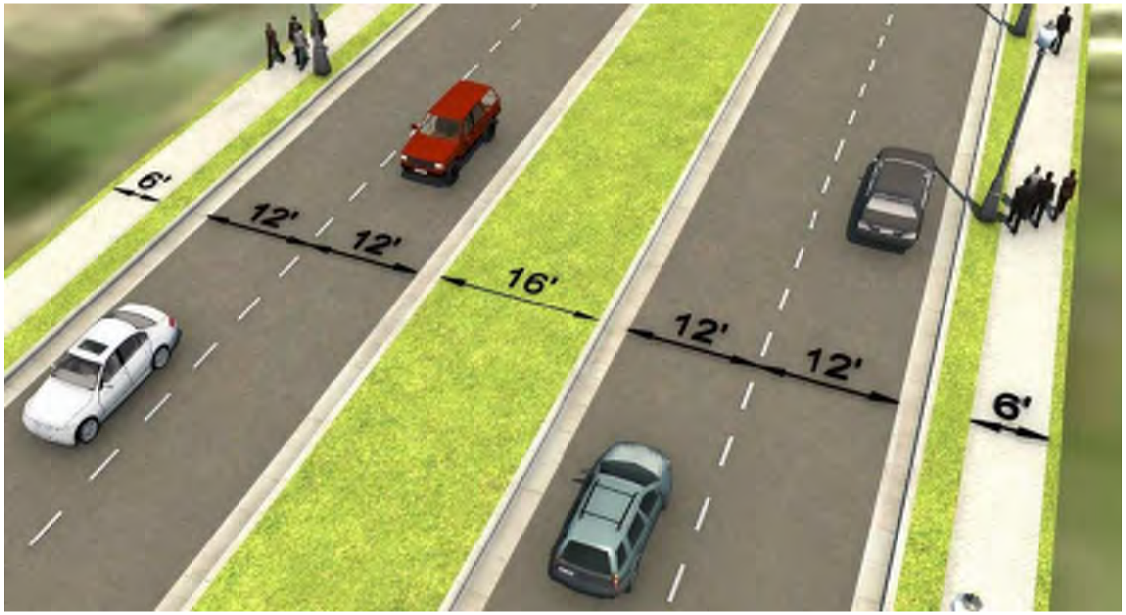
Option	Description	Traffic Operations	Safety	Environmental	Property Impacts	Construction & ROW Cost	DRAFT Recommendation
10th-5A	Diverging Diamond Interchange, 6-Lane Divided Corridor	VERY GOOD	GOOD	NEUTRAL	POOR	POOR	**Eliminate** Property impacts, environmental impacts, and cost
10th-5B	Diverging Diamond Interchange, 4-Lane Divided Corridor	GOOD	GOOD	NEUTRAL	NEUTRAL	NEUTRAL	**Advance**
10th-5C	Diverging Diamond Interchange, 5-Lane Undivided Corridor	GOOD	GOOD	NEUTRAL	GOOD	GOOD	**Advance**
10th-9A	Tight Split Diamond, 6th St/10th St with 4-Lane Divided Corridor	NEUTRAL	POOR	POOR	NEUTRAL	POOR	**Eliminate** Environmental impacts, cost, and lower traffic & safety benefits
10th-9B	Tight Split Diamond, 6th St/10th St with 5-Lane Undivided Corridor	NEUTRAL	POOR	POOR	GOOD	NEUTRAL	**Eliminate** Environmental impacts and lower traffic & safety benefits
10th-Var							**Advance**

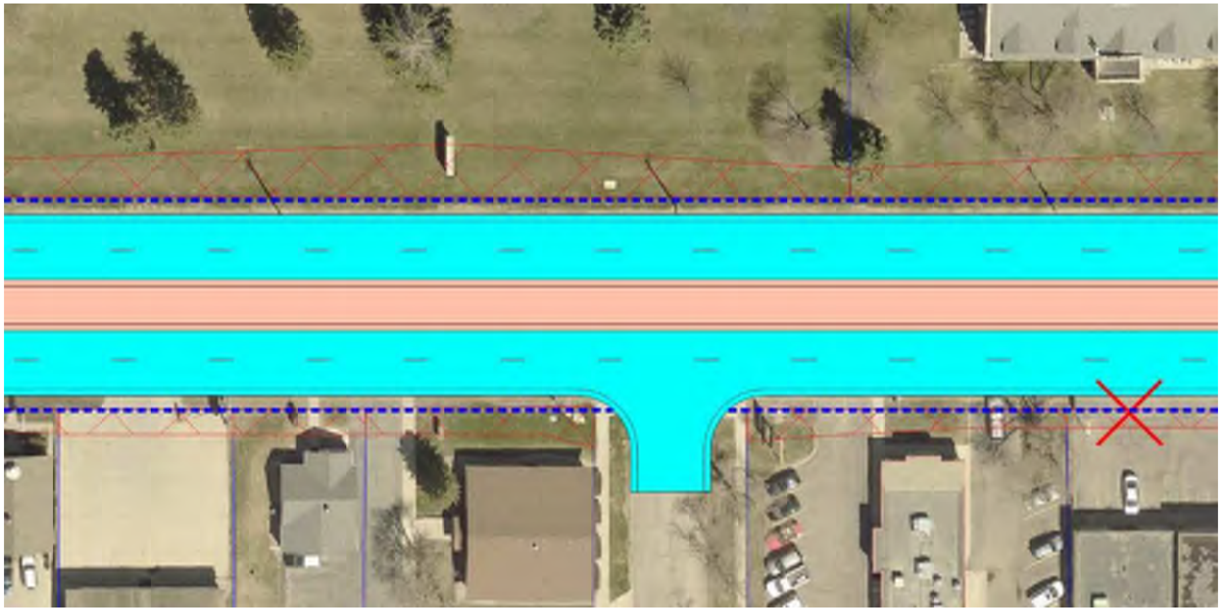
CONCEPTS FOR FURTHER CONSIDERATION

10TH-Var

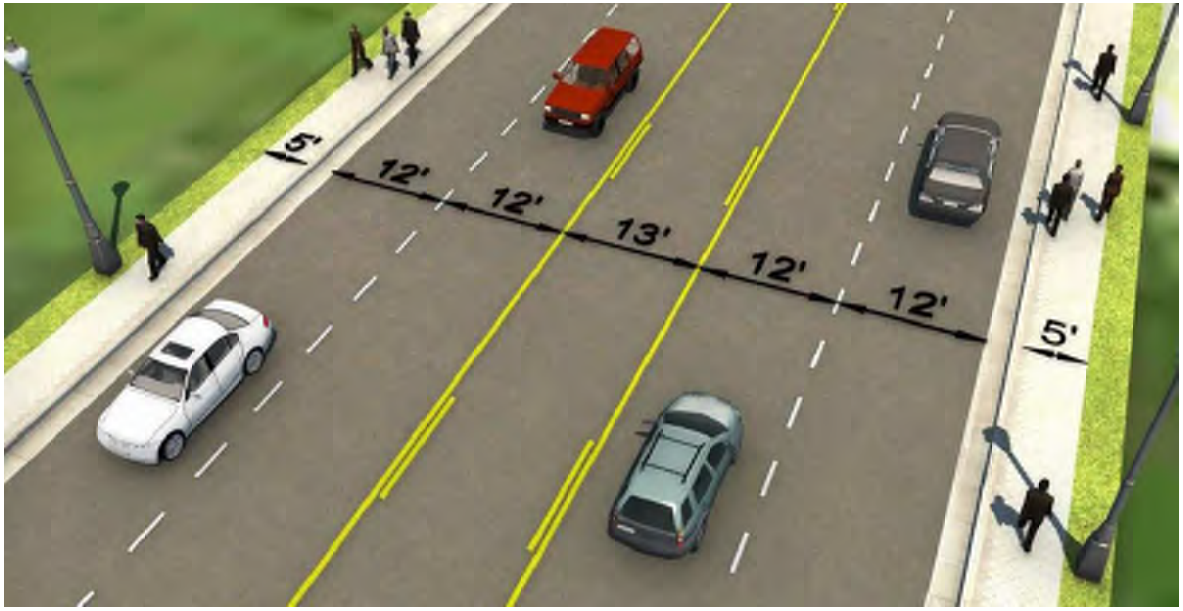


4-Lane Divided Corridor





5-Lane Undivided Corridor



10^{TH} STREET
PRELIMINARY PROJECT PRIORITY

- Priority recommendation based on existing and anticipated need and level of improvement and impacts associated with remaining concept options
- 10^{th} Street Interchange = High Priority
- 10^{th} Street Corridor improvements = Low Priority
- See exhibit board for additional information

NEXT STEPS

- Assemble Stakeholder and Public Comments
- Complete Study Report
- Project Development Process = 5-6 year timeline when initiated by SDDOT & City
  - Prepare Interchange Modification Justification Report and Environmental Document
  - Develop Project Design
  - Acquire Right of Way
  - Construction

PROJECT CONTACTS:

Jason Kjenstad – HDR Engineering, Inc.
605-977-7740 or jason.kjenstad@hdrinc.com

Chris Malmberg – HDR Engineering, Inc.
402-399-4959 or chris.malmberg@hdrinc.com

Shannon Ausen – City of Sioux Falls
605-367-8607 or sausen@siouxfalls.org

Steve Gramm – SDDOT Project Development
605-773-6641 or steve.gramm@state.sd.us

INTERSTATE 229 MAJOR INVESTMENT STUDY

Exit 6 – 10th Street Sub-Study

Thanks for attending!

HDR

CLIFF AVENUE

DECEMBER 5TH, 2016

- MEETING NOTES
- SIGN-IN SHEETS
- POWERPOINT SLIDES
- COMMENTS (SEE PUBLIC MEETING #3 APPENDIX)

Meeting Minutes

Project:	I-229 Major Investment Corridor Study, PL 0100(87) 3616P, PCN 044K
Subject:	Stakeholder Meeting – Sub-study 6 – Cliff Avenue Exit 4
Date:	Monday, December 05, 2016
Location:	Sioux Falls Convention Center Conference Room 6
Attendees:	See Attached Sign In Sheet – 10 Participants

Stakeholder comments and questions noted:

1. Are the crashes recorded within the Minnesota Ave study limits car crashes only? Response: A range of types of crashes involving a variety of vehicle types has been recorded in the Minnesota corridor.

2. Does the environmental impact assessment process consider loss of affordable housing? Development is taking affordable houses in the central city and the lost housing is replaced with higher cost housing on the metropolitan area periphery.

Sign In Sheet

Subject I-229 Major Investment Corridor Study – Stakeholder Meeting for Cliff Avenue Sub-Study

Client City of Sioux Falls/South Dakota Department of Transportation

Project PL 0100(87) 3616P, PCN 044K **Project No.:** 207030

Meeting Date Monday, December 5th, 2016 6:00 PM **Meeting Location:** Sioux Falls Convention Center

Please print clearly. Thank you.

	Name	Address	Best Contact Phone	Email
1	JAMES NORD	904 E 38th	605 254 2480	jnorde sio.midco.net
2	Shannon Ausen	224 W. 9th St SFSD 57104	605-367-8607	Sausen@ ~~sio.mid~~ siouxfallsgov
3	Marlys Roskens	3105 S. 9th Ave	605-336-6226	marlys@sio.midco.net
4	PAUL HARTMAN	1201 OTONKA	605-929-9768	HART Z HART @ SIO.MIDCO.NET
5	JEFF KRSHTE			
6	Gene Napier	1109 E. Pam Rd	605-373-0377	napier10@sio.midco.net
7	Jeff Roskens	3105 S. 9th Ave	605 553 2762	Jroskens@sio.midco.net
8	Barbara Richards	1112 East 38th St.	605-3382387	brichards@siomidco.net
9	Lois Merritt	3004 S. 10th Ave.	(605)334-9498	
10	Wendy Beeler Bauer	1104 E. Pam Rd.	605-906-1223	wbeeler.bauer@gmail.com
11	Jason Kjenstad	6300 S. Old Village Pl Suite 100 SF SD 57108	605.977.7740	jason.kjenstad@hdrinc.com
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INTERSTATE 229 MAJOR INVESTMENT STUDY

Exit 4 – Cliff Avenue Sub-Study

Stakeholder Meeting

December 5th, 2016
6:00 pm to 7:00 pm

HDR

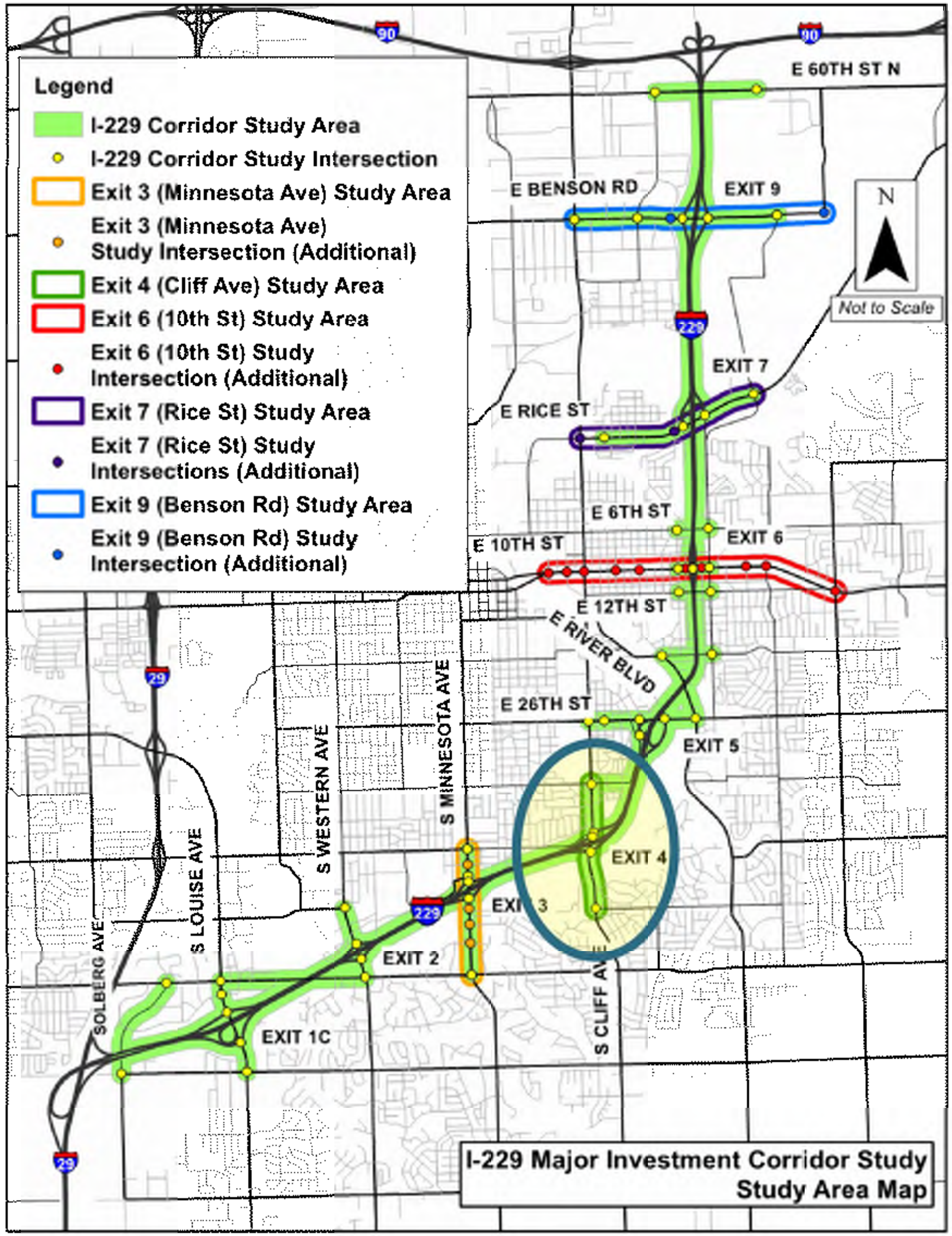
STUDY AREA MAP

I-229 Corridor Study

Solberg Avenue Overpass to 60th Street N Overpass

Meeting will focus on:

Exit 4 – Cliff Avenue



STUDY ADVISORY PARTNERS

South Dakota Department of Transportation (SDDOT)

South Dakota Highway Patrol

City of Sioux Falls

Sioux Falls Metropolitan Planning Organization (MPO)

Federal Highway Administration (FHWA)

PRESENTATION AGENDA

- Concept Evaluation Process
- Concept Evaluation Results
- Concepts Recommended for Further Consideration in Future Phases (Interchange & Corridor Improvements)
- Next Steps

CONCEPT EVALUATION PROCESS

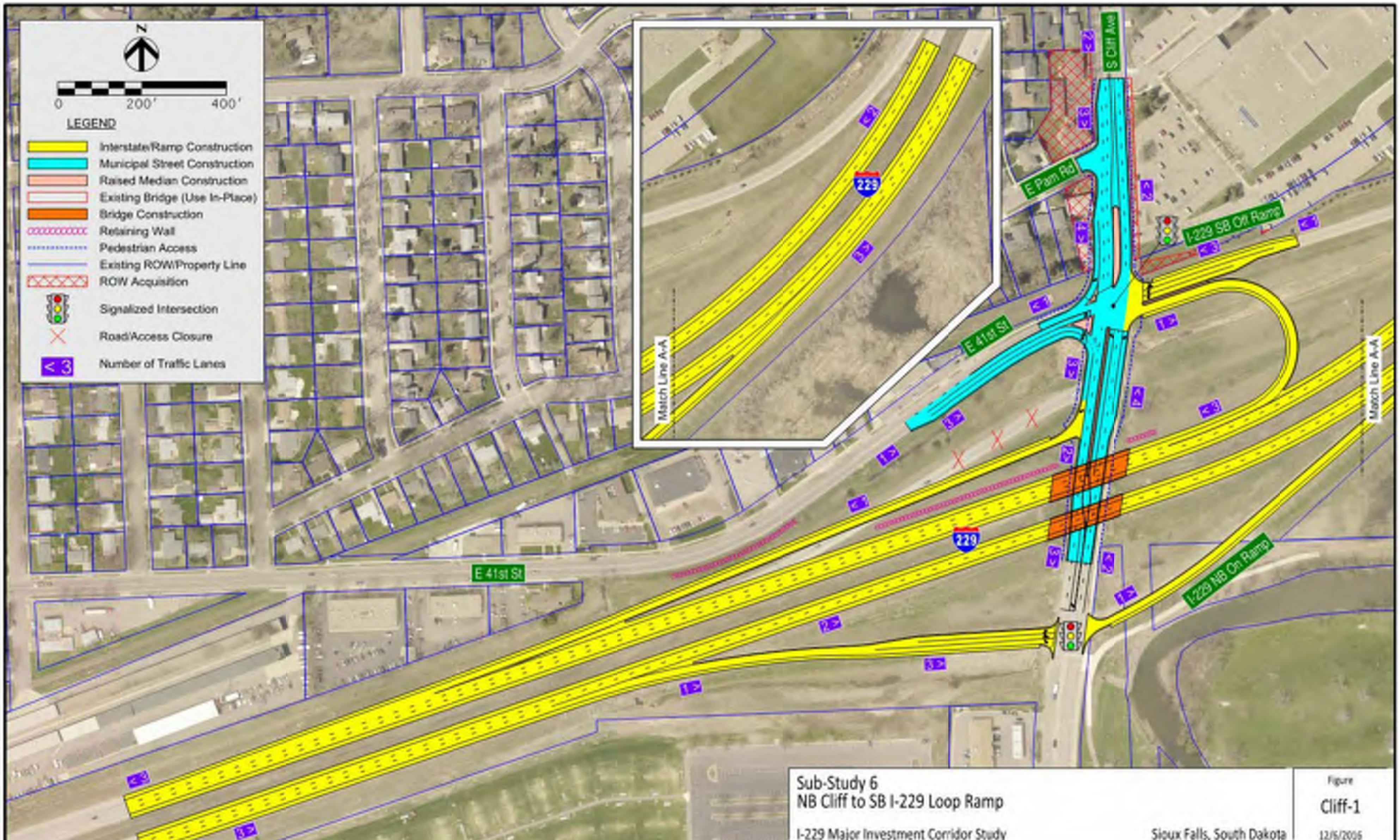
- Evaluation Factors:

Option	Description	Traffic Operations	Safety	Environmental	Property Impacts	Construction & ROW Cost	DRAFT Recommendation
Concept ID	Interchange and Corridor Type	•Traffic Delay •Level of Service •Interchange Year of Failure	Predicted Crash Reduction during 2012-2035	Potential impact to wetlands, historical resources, threatened and endangered species, public lands, and floodplains	Total Right of Way (ROW) Required and Acquisitions	Total Constuction Cost (including ROW)	**Advance** **or** **Eliminate**

- Evaluation Matrix to Compare Concepts
- Recommended Action

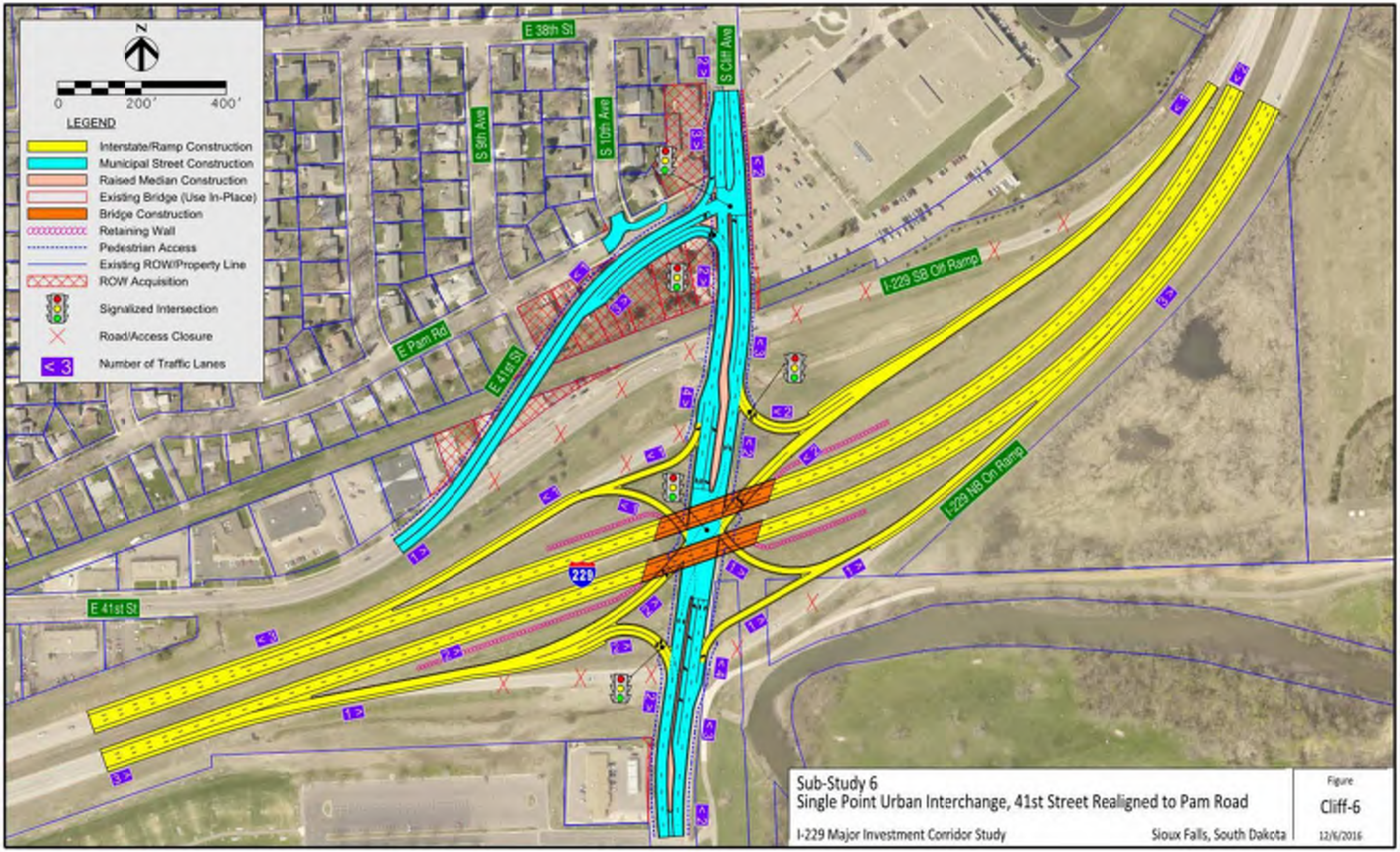
CONCEPTS FOR FURTHER CONSIDERATION

CLIFF-1



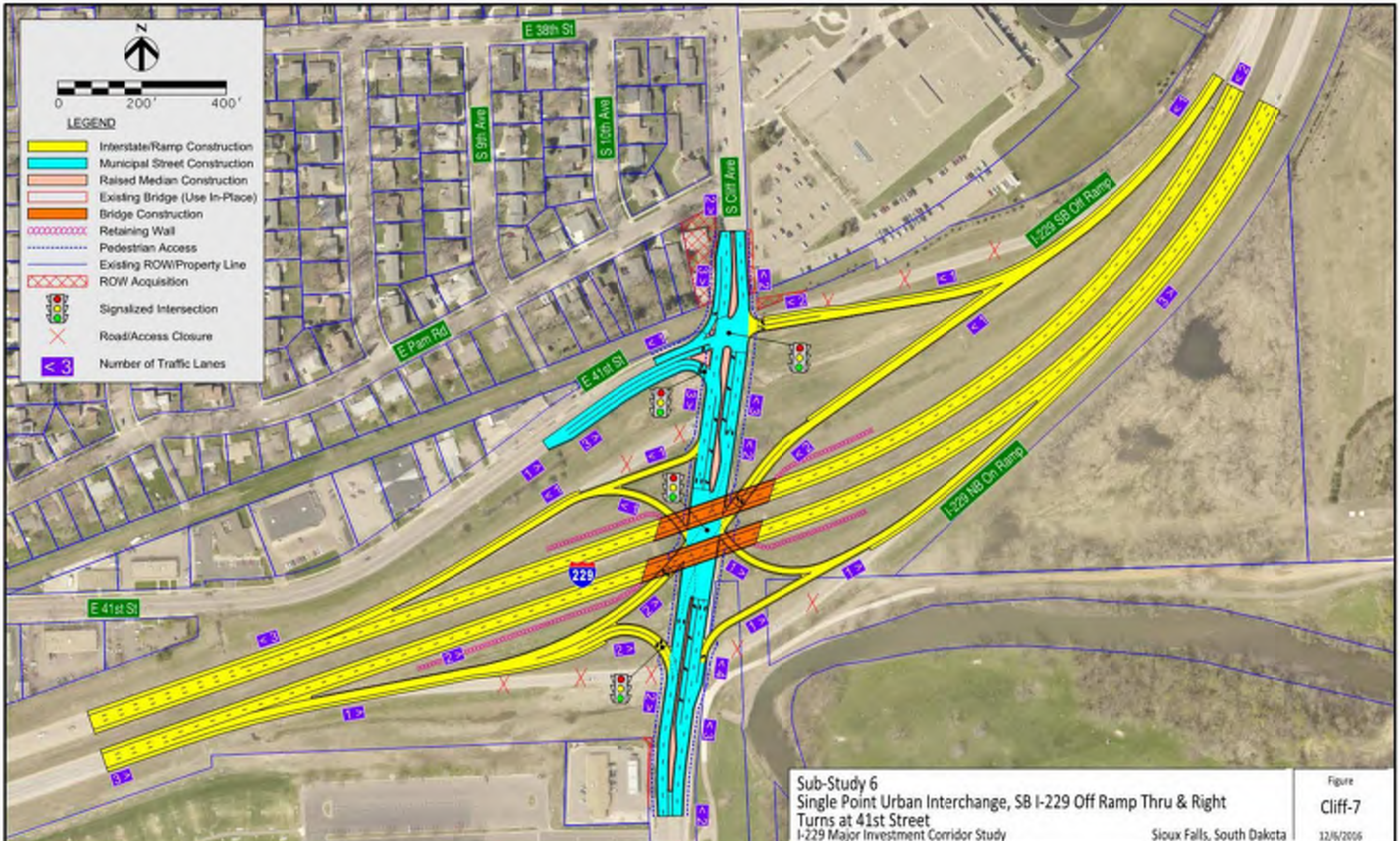
CONCEPTS FOR FURTHER CONSIDERATION

CLIFF- 6



CONCEPTS FOR FURTHER CONSIDERATION

CLIFF - 7



CONCEPT EVALUATION RESULTS

Option	Description	Traffic Operations	Safety	Environmental	Property Impacts	Construction & ROW Cost	DRAFT Recommendation
No-Build	No-Build	POOR	NEUTRAL	N/A	N/A	N/A	Advance
Cliff-1	NB Cliff to SB I-229 Loop Ramp	GOOD	NEUTRAL	GOOD	GOOD	GOOD	Advance
Cliff-6	Single Point Urban Interchange, 41st St Realigned to Pam Rd	VERY GOOD	GOOD	GOOD	POOR	POOR	Advance
Cliff-7	Single Point Urban Interchange, SB I-229 Off-Ramp Thru & Right Turns at 41st St	GOOD	GOOD	GOOD	VERY GOOD	POOR	Advance

CLIFF AVENUE
PRELIMINARY PROJECT PRIORITY

- Priority recommendation based on existing and anticipated need and level of improvement and impacts associated with remaining concept options
- Cliff Avenue Interchange = Medium Priority
- See exhibit board for additional information

NEXT STEPS

- Assemble Stakeholder and Public Comments
- Complete Study Report
- Project Development Process = 5-6 year timeline when initiated by SDDOT & City
  - Prepare Interchange Modification Justification Report and Environmental Document
  - Develop Project Design
  - Acquire Right of Way
  - Construction

PROJECT CONTACTS:

Jason Kjenstad – HDR Engineering, Inc.
605-977-7740 or jason.kjenstad@hdrinc.com

Brian Ray– HDR Engineering, Inc.
402-548-5066 or Brian.Ray@hdrinc.com

Shannon Ausen – City of Sioux Falls
605-367-8607 or sausen@siouxfalls.org

Steve Gramm – SDDOT Project Development
605-773-6641 or steve.gramm@state.sd.us

INTERSTATE 229 MAJOR INVESTMENT STUDY

Exit 4 – Cliff Avenue

Thanks for attending!

HDR

RICE STREET

DECEMBER 6TH, 2016

- MEETING NOTES
- SIGN-IN SHEETS
- POWERPOINT SLIDES
- COMMENTS (SEE PUBLIC MEETING #3 APPENDIX)

Meeting Minutes

Project:	I-229 Major Investment Corridor Study, PL 0100(87) 3616P, PCN 044K
Subject:	Stakeholder Meeting – Sub-study 5 – Rice Street Exit 7
Date:	Tuesday, December 06, 2016
Location:	Sioux Falls Convention Center Conference Room 6
Attendees:	See Attached Sign In Sheet – 21 Participants

Stakeholder comments and questions noted:

1. Railroad spur crossing ties up traffic on Rice Street to the east. Response (City): There are 3 to 5 unit trains per day using the spur line, with no projected increase indicated by BNSF Railroad. Growth is anticipated in the number of daily local trains, however.

2. The amount of additional right of way acquired from businesses along the north side of Rice St to avoid the need for an easement from BNSF along the south side of Rice St could create problems for those businesses in complying with City code requirements for customer and employee parking.

3. How would the residential property east of Eastgate Towing get access from Rice St? Response: Access to each of the properties on the north side of Rice St and between the I-229 interchange and N Glenwood Cir would be via the proposed back access road on the north side of the properties.

4. Public access along the proposed back access road poses a security concern for properties on the north side of Rice St. Response: The back access road would be lighted as a City street, but would not be designated an emergency snow route.

5. The contract that Eastgate Towing has with the City Police Dept requires towing operation in all weather. Eastgate Towing would need to use the back access road during and immediately after snow events.

6. Do the Rice St concepts assume that the proposed SD-100 project will be constructed? Response: Yes.

7. City – Would like to begin environmental impact assessment process sooner, if it is believed that Concept Rice-3C is the locally preferred option.

8. Will Concept Rice-3C slow down traffic on Cleveland Ave compared to existing conditions?

9. On Concept Rice-3C, how would access to the recycling pit be provided from realigned Cleveland Ave? There is no other access street shown.

10. Would storm sewers along Rice St be constructed as part of the proposed improvements? Response: Yes, storm sewers would be part of the Rice St improvements.

11. Will sidewalks along Rice St be constructed as part of the proposed improvements? Response: Yes, sidewalks on both sides of Rice St are proposed as part of the Rice St improvements. However, first time sidewalk construction costs will be assessed to adjacent property owners.

12. Will the proposed Rice St improvements with pedestrian or trail access along Rice St result in elimination of the existing trail along the Big Sioux River? Response: No. The river trail would not be impacted by proposed improvements along Rice St.

13. Is the Bahnson Ave extension to Benson Rd included in the proposed Rice St improvements? Response: No, construction of the Bahnson Ave extension would be tied to development need.

DOT | CITY OF SIOUX FALLS PUBLIC WORKS — Providing a Better Quality of Life for You!

Sign In Sheet

Subject I-229 Major Investment Corridor Study – Stakeholder Meeting for Rice Street Sub-Study

Client City of Sioux Falls/South Dakota Department of Transportation

Project PL 0100(87) 3616P, PCN 044K **Project No.:** 207030

Meeting Date Monday, December 5th, 2016 2:00 PM **Meeting Location:** Sioux Falls Convention Center

Please print clearly. Thank you.

	Name	Address	Best Contact Phone	Email
1	Pete Longman	SDDOT - PIERRE	773-6488	pete.longman@state.sd.us
2	Steve Gramm	700 E. Broadway Ave.	773-6641	steve.gramm@state.sd.us
3	[illegible]	2904 E Rice St. SF, SD	334-3160	[illegible]@midconetwork.com
4	Kim Meester	1811 N Lowell Ave	367-9871	ArcheryOutfitter@Live.com
5	Myrl + Roys Paving Chad Hartman	1300 N Bahnson	334-3204	Chad.h@mrpaving.com
6	Myrl + Roys Paving Luke Klein	" "	334-3204	luke.k@mrpaving.com
7	DAN KEARNEY	47046 255 St SF	351-5705	DKSL5489@Aol.com
8	Jason Kjenstad	6300 S. Old Village Place Suite 100 SF SD	977-7740	jason.kjenstad@[illegible].com
9	[illegible]	1500 N Sweetman Pl. SF, SD	605-728-2966	bschmidt@cmesd.com
10	Clark Meyer	1500 " "	605-336-5763	cmeyer@cmesd.com
11	Shawn Ausen	224 W. 9th ST SF SD	605-367-8607	[illegible]@siouxfalls.org
12	Judy Hartman	2908 E. Rice SFSD	605-728-2459	
13	Patty Nohr	1300 N. Bahnson Ave	334-3204	Patty.n@mrpaving.com
14	Stu Horsted	4009 E. Rice St	231-1763	shorsted@cmesd.com
15	Eva Sadat	1410 E Rice St	605-271-1099	[illegible]sales@midconetwork.com
16	Oscar Sadat	"	"	"
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City of Sioux Falls PUBLIC WORKS Providing a Better Quality of Life for You!

Sign In Sheet

Subject I-229 Major Investment Corridor Study – Stakeholder Meeting for Rice Street Sub-Study

Client City of Sioux Falls/South Dakota Department of Transportation

Project PL 0100(87) 3616P, PCN 044K **Project No.:** 207030

Meeting Date Monday, December 5th, 2016 2:00 PM **Meeting Location:** Sioux Falls Convention Center

Please print clearly. Thank you.

	Name	Address	Best Contact Phone	Email
1	Rodney Hartman	2908 E. Rice St	605-728-1667	RMS011@Net2000.net
2	Greg Rubin	2200 N. Bahnson	605-940-8501	GAJRUBIN@YAHOO.COM
3	Tammy Meland	1205 N. Caleb Ave	605-408-6763	
4	[illegible] Docken	3501 River Bluff Rd	605 366 3179	
5	Gary Harr	3408 Sycamore A	376 7328	
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INTERSTATE 229 MAJOR INVESTMENT STUDY

Exit 7 – Rice Street Sub-Study

Stakeholder Meeting

December 6th, 2016
2:00 pm to 3:00 pm

HDR

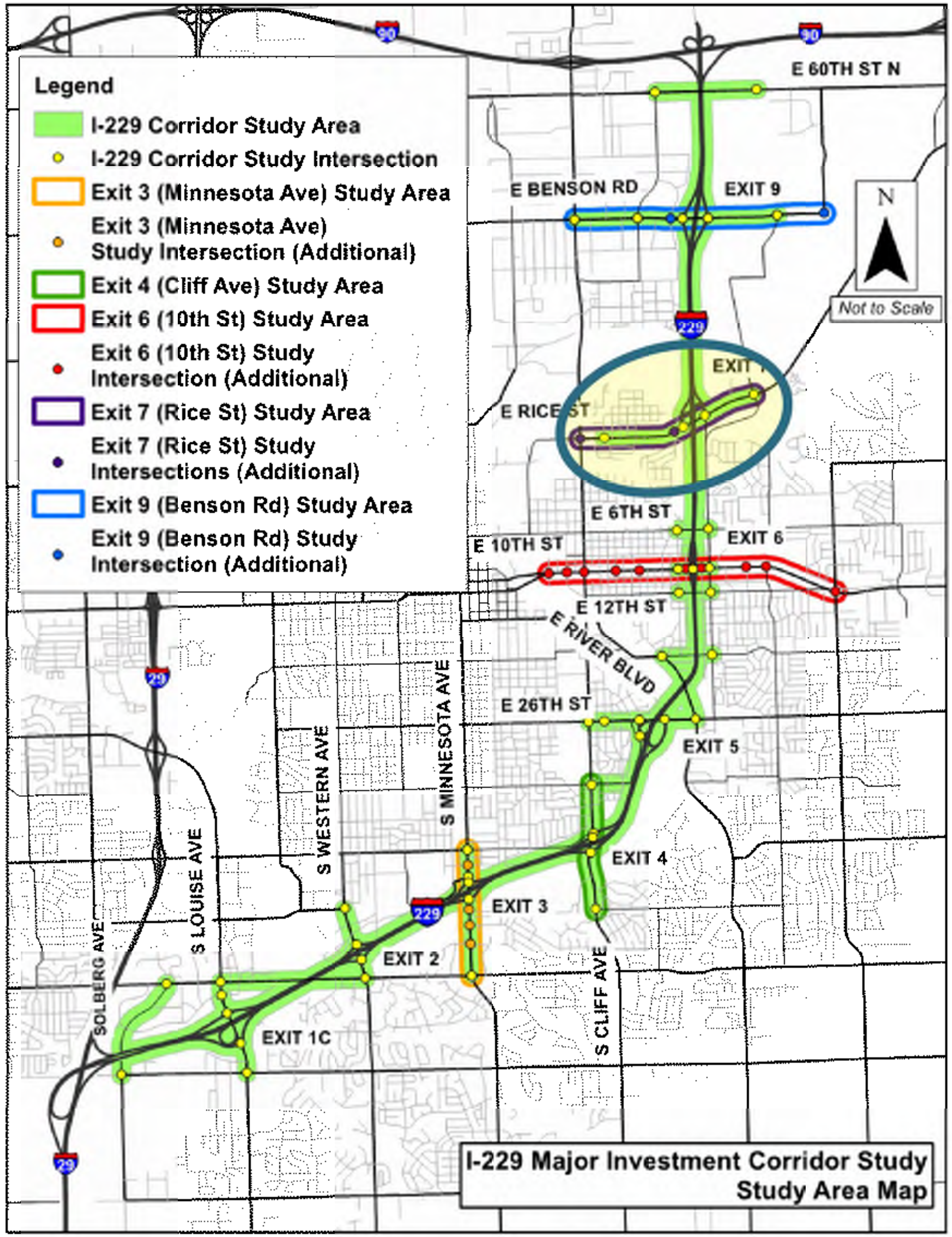
STUDY AREA MAP

I-229 Corridor Study

Solberg Avenue Overpass to 60th Street N Overpass

Meeting will focus on:

Exit 7 – Rice Street



STUDY ADVISORY PARTNERS

South Dakota Department of Transportation (SDDOT)

South Dakota Highway Patrol

City of Sioux Falls

Sioux Falls Metropolitan Planning Organization (MPO)

Federal Highway Administration (FHWA)

PRESENTATION AGENDA

- Concept Evaluation Process
- Concept Evaluation Results
- Concepts Recommended for Further Consideration in Future Phases (Interchange & Corridor Improvements)
- Next Steps

CONCEPT EVALUATION PROCESS

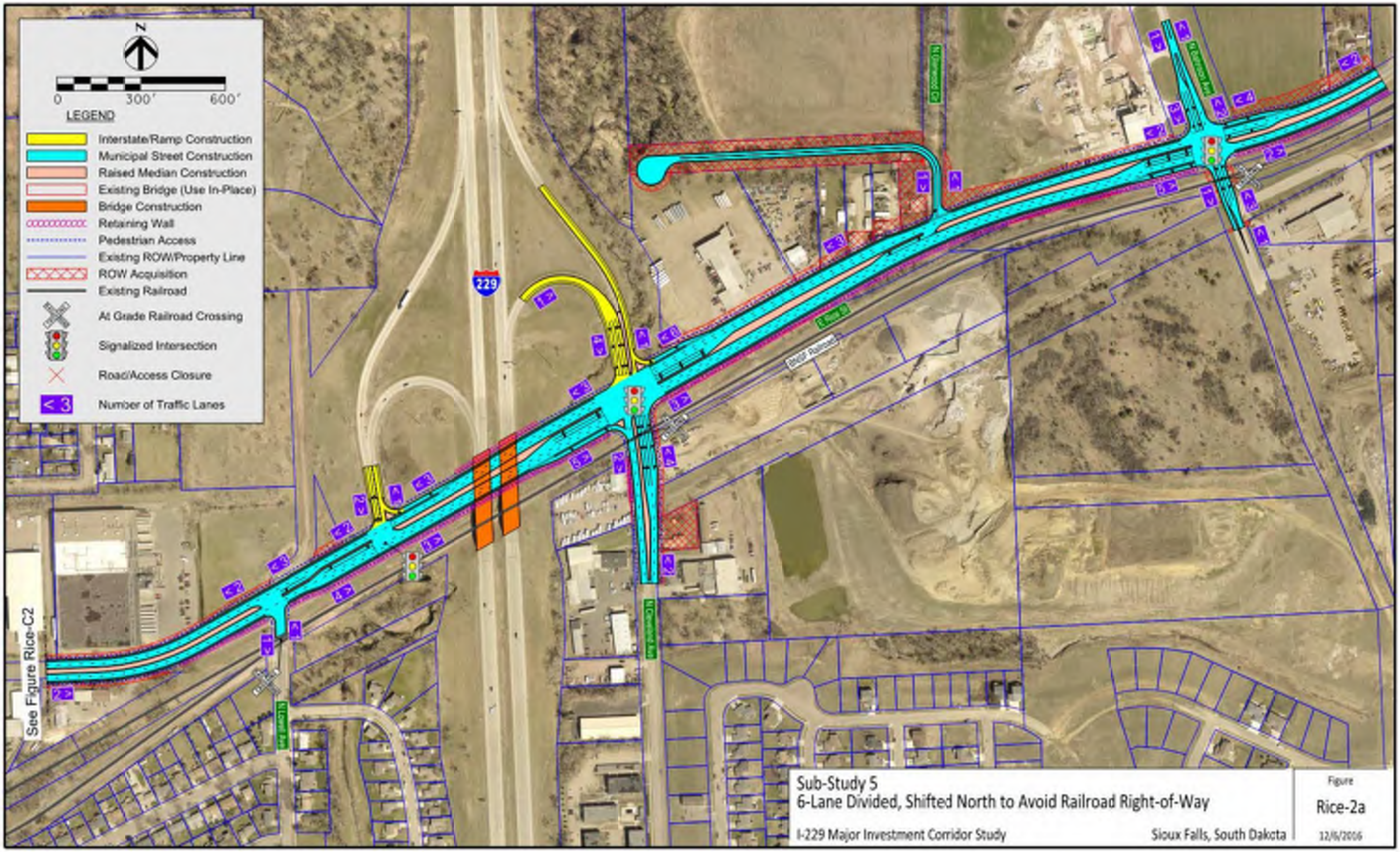
- Evaluation Factors:

Option	Description	Traffic Operations	Safety	Environmental	Property Impacts	Construction & ROW Cost	DRAFT Recommendation
Concept ID	Interchange and Corridor Type	•Traffic Delay •Level of Service •Interchange Year of Failure	Predicted Crash Reduction during 2012-2035	Potential impact to wetlands, historical resources, threatened and endangered species, public lands, and floodplains	Total Right of Way (ROW) Required and Acquisitions	Total Constuction Cost (including ROW)	**Advance** **or** **Eliminate**

- Evaluation Matrix to Compare Concepts
- Recommended Action

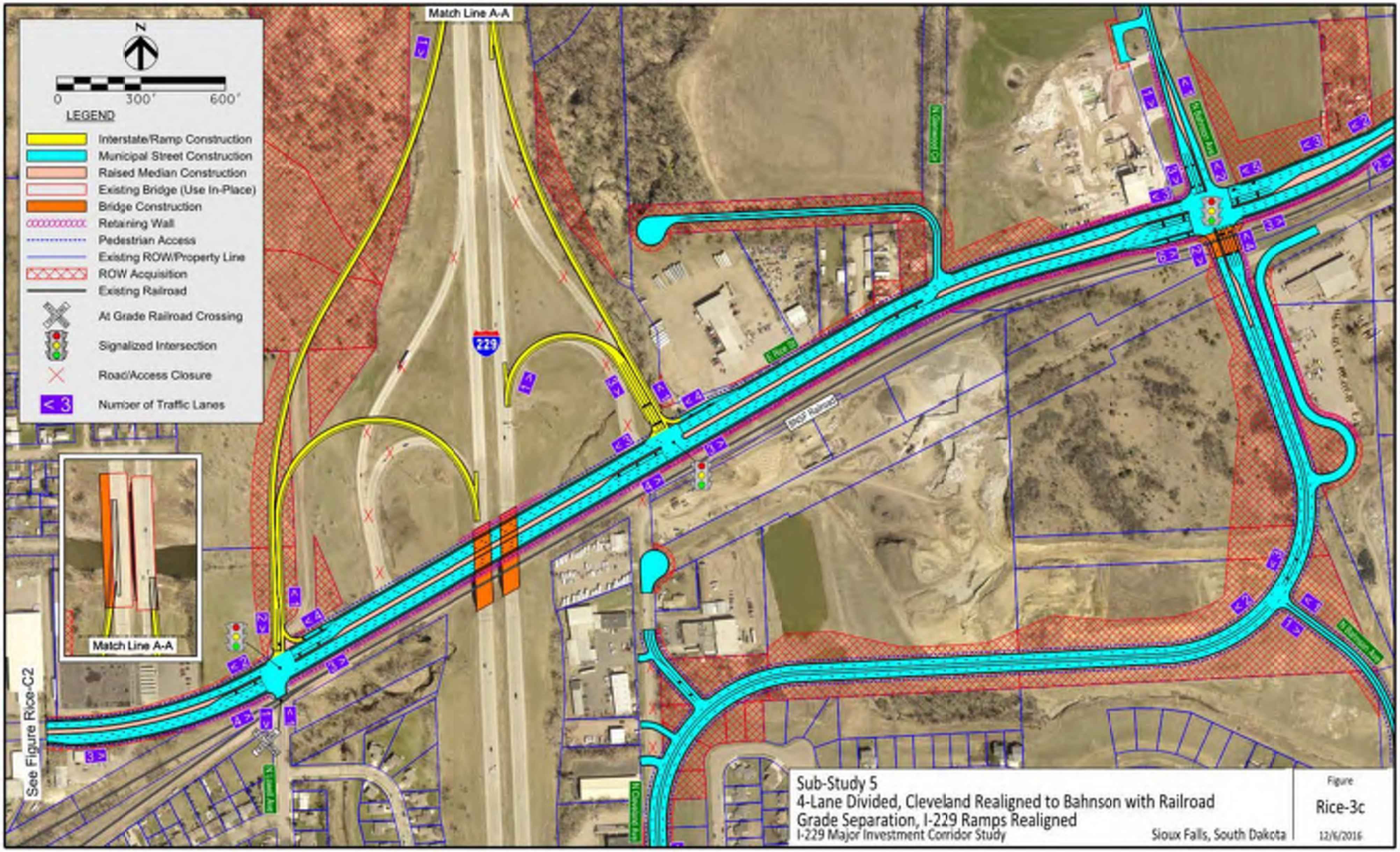
CONCEPTS FOR FURTHER CONSIDERATION

RICE-2A



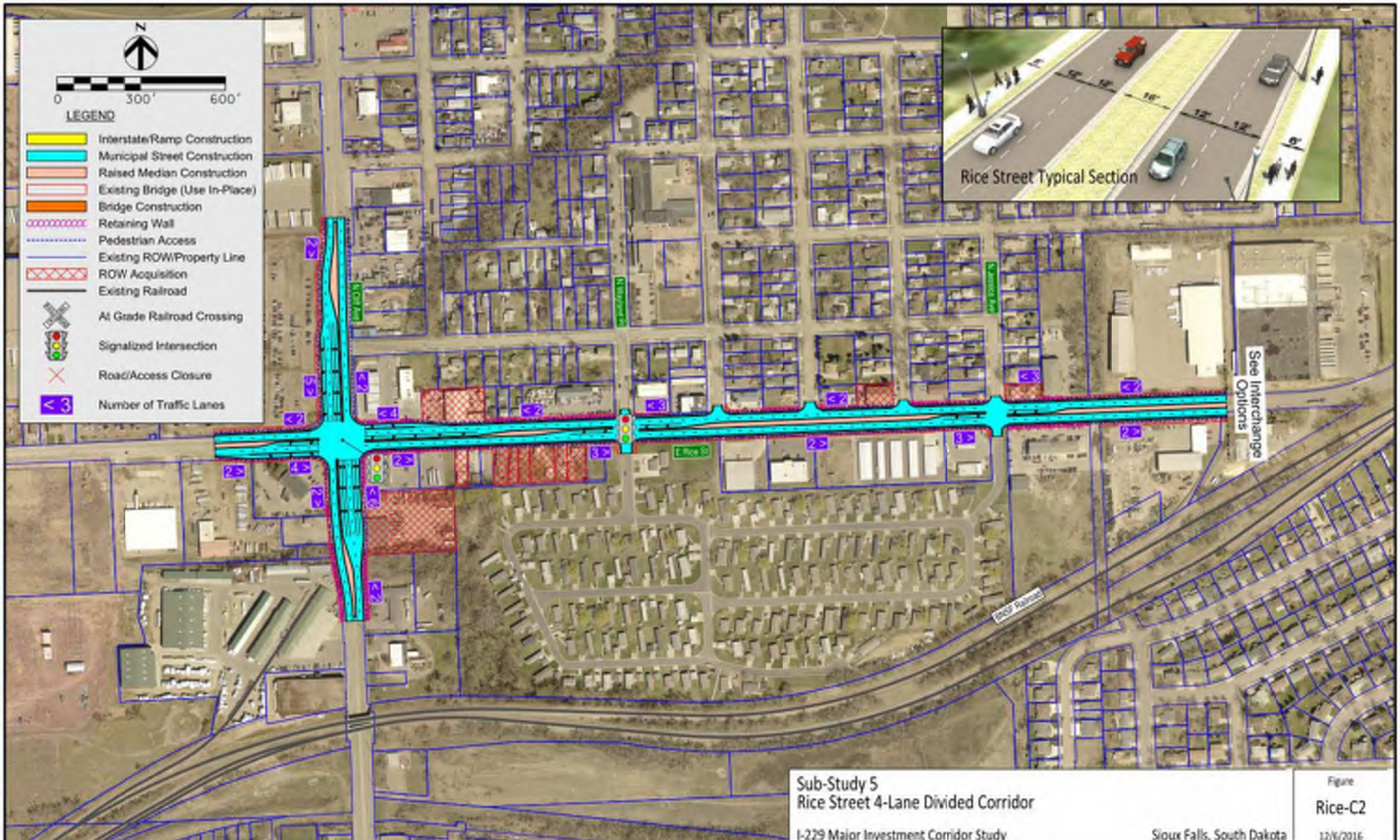
CONCEPTS FOR FURTHER CONSIDERATION

RICE-3C



CONCEPTS FOR FURTHER CONSIDERATION

RICE-C2



CONCEPT EVALUATION RESULTS

Option	Description	Traffic Operations	Safety	Environmental	Property Impacts	Construction & ROW Cost	DRAFT Recommendation
No-Build	No-Build	POOR	NEUTRAL	N/A	N/A	N/A	Advance
Rice-2	6-Lane Divided	VERY GOOD	GOOD	NEUTRAL	GOOD	GOOD	Advance
Rice-2A	6-Lane Divided, Shifted North to Avoid Railroad Right-of-Way	VERY GOOD	GOOD	NEUTRAL	GOOD	GOOD	Advance
Rice-3C	4-Lane Divided, Cleveland Realigned to Bahnson with Railroad Grade Separation, I-229 Ramps Realigned	VERY GOOD	VERY GOOD	POOR	POOR	POOR	Advance

RICE STREET
PRELIMINARY PROJECT PRIORITY

- Priority recommendation based on existing and anticipated need and level of improvement and impacts associated with remaining concept options
- Rice Street (Cleveland Avenue Realignment) = Medium Priority
- Rice Street Interchange = Low Priority
- See exhibit board for additional information

NEXT STEPS

- Assemble Stakeholder and Public Comments
- Complete Study Report
- Project Development Process = 5-6 year timeline when initiated by SDDOT & City
  - Prepare Interchange Modification Justification Report and Environmental Document
  - Develop Project Design
  - Acquire Right of Way
  - Construction

PROJECT CONTACTS:

Jason Kjenstad – HDR Engineering, Inc.
605-977-7740 or jason.kjenstad@hdrinc.com

Theo Weseman – HDR Engineering, Inc.
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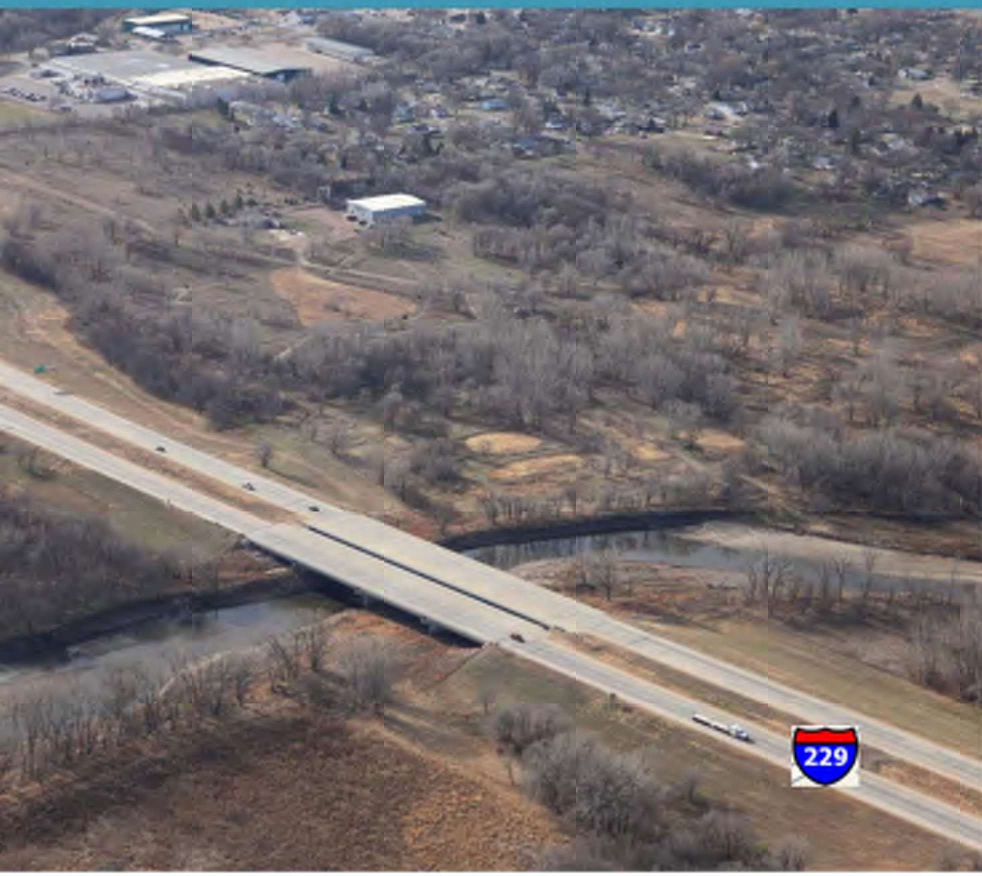
Shannon Ausen – City of Sioux Falls
605-367-8607 or sausen@siouxfalls.org

Steve Gramm – SDDOT Project Development
605-773-6641 or steve.gramm@state.sd.us



INTERSTATE 229 MAJOR INVESTMENT STUDY

Exit 7 – Rice Street Sub-Study

Thanks for attending!

Minnesota Avenue

December 6th, 2016

- **Meeting Notes**
- **Sign-In Sheets**
- **PowerPoint Slides**
- **Comments (See Public Meeting #3 Appendix)**

Meeting Minutes

Project:	I-229 Major Investment Corridor Study, PL 0100(87) 3616P, PCN 044K
Subject:	Stakeholder Meeting – Sub-study 2 – Minnesota Avenue Exit 3
Date:	Tuesday, December 06, 2016
Location:	Sioux Falls Convention Center Conference Room 6
Attendees:	See Attached Sign In Sheet – 19 Participants

Stakeholder comments and questions noted:

1. When might proposed improvements on Minnesota Ave and at the I-229 interchange be constructed? Response: At least 12 to 15 years in the future.

2. What is the status of proposed improvements along 49th St to the west? Response: Not all of the right of way for widening 49th St to the west has been acquired. The widening is not currently programmed. When construction begins, it will start at the west end.

3. Access to businesses along Minnesota Ave from the back would kill the businesses.

4. Is a right turn in/out a possibility where driveway closures are shown on the concepts? Response: Yes.

5. Eliminate the proposed medians and build service roads.

6. If the southbound I-229 exist ramp terminal is shifted north to 49th St as shown on Concept Minn-9D, traffic queues on Minnesota Ave would be pushed northward to 41st St. Response: Proposed added lanes on Minnesota Ave would manage traffic queues.

7. There are no concept options that do not include a proposed median.

8. Do the I-229 bridges over Minnesota Ave need replacement? Response: The replacement of the bridges is driven by a need to widen Minnesota Ave.

9. Minnesota Ave should be widened to a six-lane section with a two-way left turn lane.

10. Existing speed on Minnesota Ave is a problem between 41st and 57th St.

11. Owner of vacant property at I-229 and Minnesota Ave (east side) – Delay in implementing proposed project discourages property improvements.

12. Property owner commented that his property has already been held hostage for ten years or more due to uncertainty about improvements and impacts along Minnesota Ave.

13. Estimated costs of implementing the proposed concepts should be made available to the public.

14. Concern about ruining businesses due to poor access or very limited access.

15. Can the proposed median be eliminated? Also discussion regarding impacts due to corridor width.

16. Can the green light be extended at 41st and Minnesota? Comments regarding timing at the interchange ramp signals and how frequently are those updated.

17. Issues turning left from Lotta St onto Minnesota Ave. Support expressed for proposed traffic signal.

18. A lot of focus on the properties east of 49th Street intersection (on either side of abandoned railroad line). Impacts from access closures/restrictions, alternate routes, changes to traffic patterns, U-turns, and control of access were all topics of discussion.

19. In favor of improved pedestrian and bike crossings of I-229. Glad this was looked at in the study.

20. Was a diverging diamond type interchange considered for Minnesota Ave? Response: Yes.

Sign In Sheet

Subject I-229 Major Investment Corridor Study – Stakeholder Meeting for Minnesota Avenue Sub-Study

Client City of Sioux Falls/South Dakota Department of Transportation

Project PL 0100(87) 3616P, PCN 044K **Project No.:** 207030

Meeting Date Tuesday, December 6th, 2016 3:30 PM **Meeting Location:** Sioux Falls Convention Center

Please print clearly. Thank you.

	Name	Address	Best Contact Phone	Email
1	Pete Longman	SDDOT – Pierre SD	773-6488	pete.longman@state.sd.us
2	Brad Remmick	SDDOT – PIERRE	773-3093	bradley.remmick@state.sd.us
3	Andy Vandel	SDDOT – Pierre	773-4421	andy.vandel@state.sd.us
4	Pat Waly	4230 S Minn	6053343845	bPwale@sio.midco.net
5	Mary Stone		605-376-6954	mstone@[illegible].com
6	Shelly Rogers	48274 258 St Brandon SD 57005	321-3806	drogers3061@aol.com
7	Brian Frisbee	4101 S. Minnesota	338-6321	info@frisbeeinc.com
8	Lee Lewis	309 W 43rd St Ste 105	335-8805	LAL1966@basec.net
9	Mike Von Bockern	5800 S Remington Pl. #100	361 8211	Mike@VBClink.com
10	Kevin R Nyberg	330 W. 41st, SF	336-6474	knyberg@nybergsace.com
11	Heather Taylor	3306 S Minn. Ave.	201-2841	heather@gsfw.com
12	[illegible]	405 Chapel Dr.	321-5606	grant@alvine weidenaar.com
13	Mary Montoya		332-0147	mary.montoya@sio.midco.net
14	Jason Kjenstad	6300 S. Old Village suite 100 SF SD	977-7740	jason.kjenstad@hdrinc.com
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Sign In Sheet

Subject I-229 Major Investment Corridor Study – Stakeholder Meeting for Minnesota Avenue Sub-Study

Client City of Sioux Falls/South Dakota Department of Transportation

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Please print clearly. Thank you.

	Name	Address	Best Contact Phone	Email
1	Frank Howe	Brandon	5538484	franke prairie sons.com
2	Carol Twedt	4802 S Minnesota Ave SF SD 57105	940-0756	carolltwedt@sio.midco.net
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4	Dave McElroy	3310 S Minn Ave SF SD 57105	338-9519	mcelroy.dave@gmail.com
5	Erik Nyberg	330 W 41st Street	728-5553	erikn@cutlerlawfirm.com
6	Pam Layton	3600 S. Minn	332-6509	
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Sign In Sheet

Subject I-229 Major Investment Corridor Study – Stakeholder Meeting for Minnesota Avenue Sub-Study

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	Name	Address	Best Contact Phone	Email
1	Frishans, Inc Berry Howe	4101 S. Minnesota Ave.	605-338-6321	berryh@frishmain.com
2	Dianne Voth	4204 S. Minn Ave ST, SDG 7105	605-339-2864	nvoth@sio.midco.net
3	Kevin Kroeze	Boen & Associates 307 W. 41st 57105	605-336-0485	KevinK@BoenAssociates.com
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INTERSTATE 229 MAJOR INVESTMENT STUDY

Exit 3 – Minnesota Avenue Sub-Study

Stakeholder Meeting

December 6th, 2016
3:30 pm to 4:30 pm

HDR

HRGreen

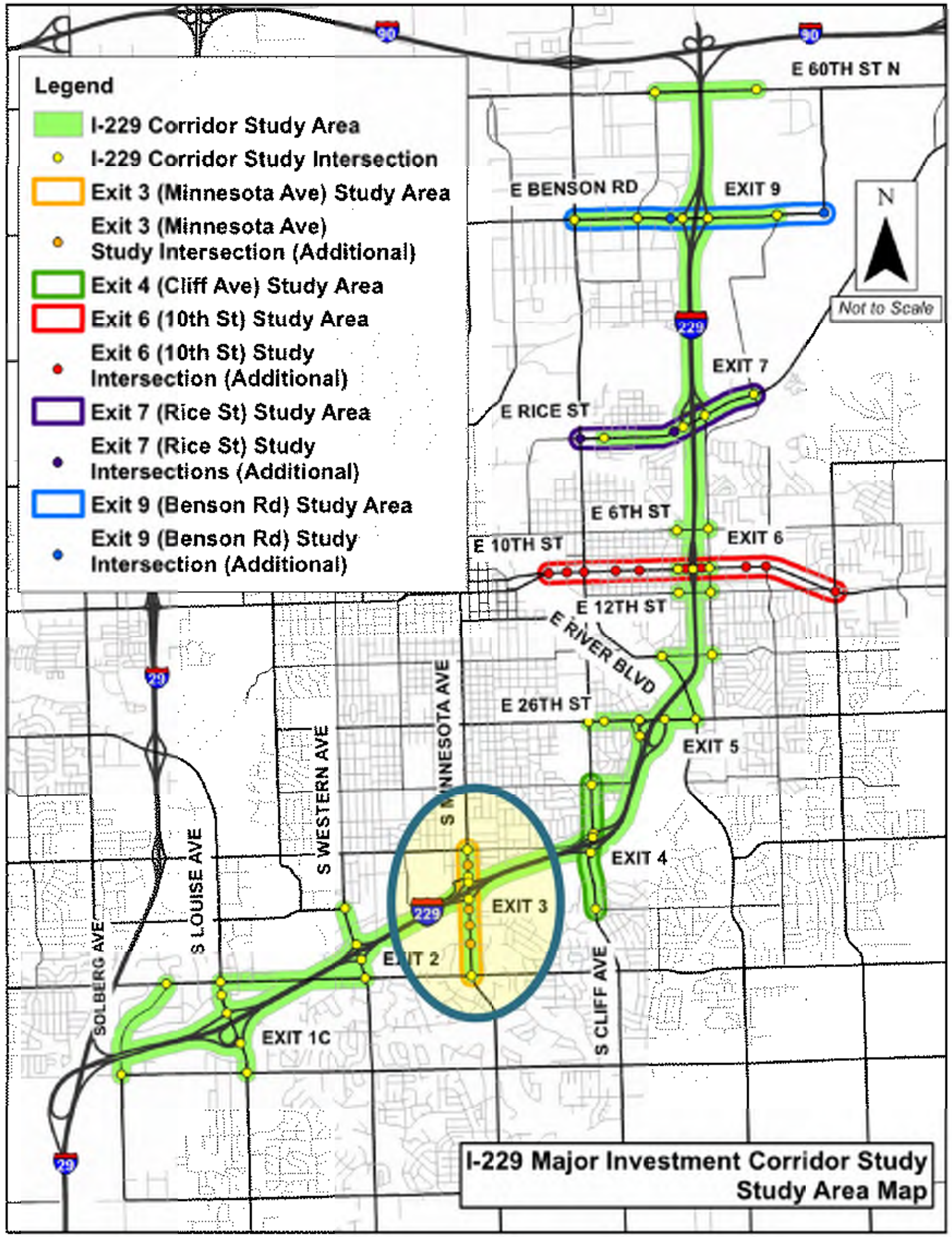
STUDY AREA MAP

I-229 Corridor Study

Solberg Avenue Overpass to 60th Street N Overpass

Meeting will focus on:

Exit 3 – Minnesota Avenue



STUDY ADVISORY PARTNERS

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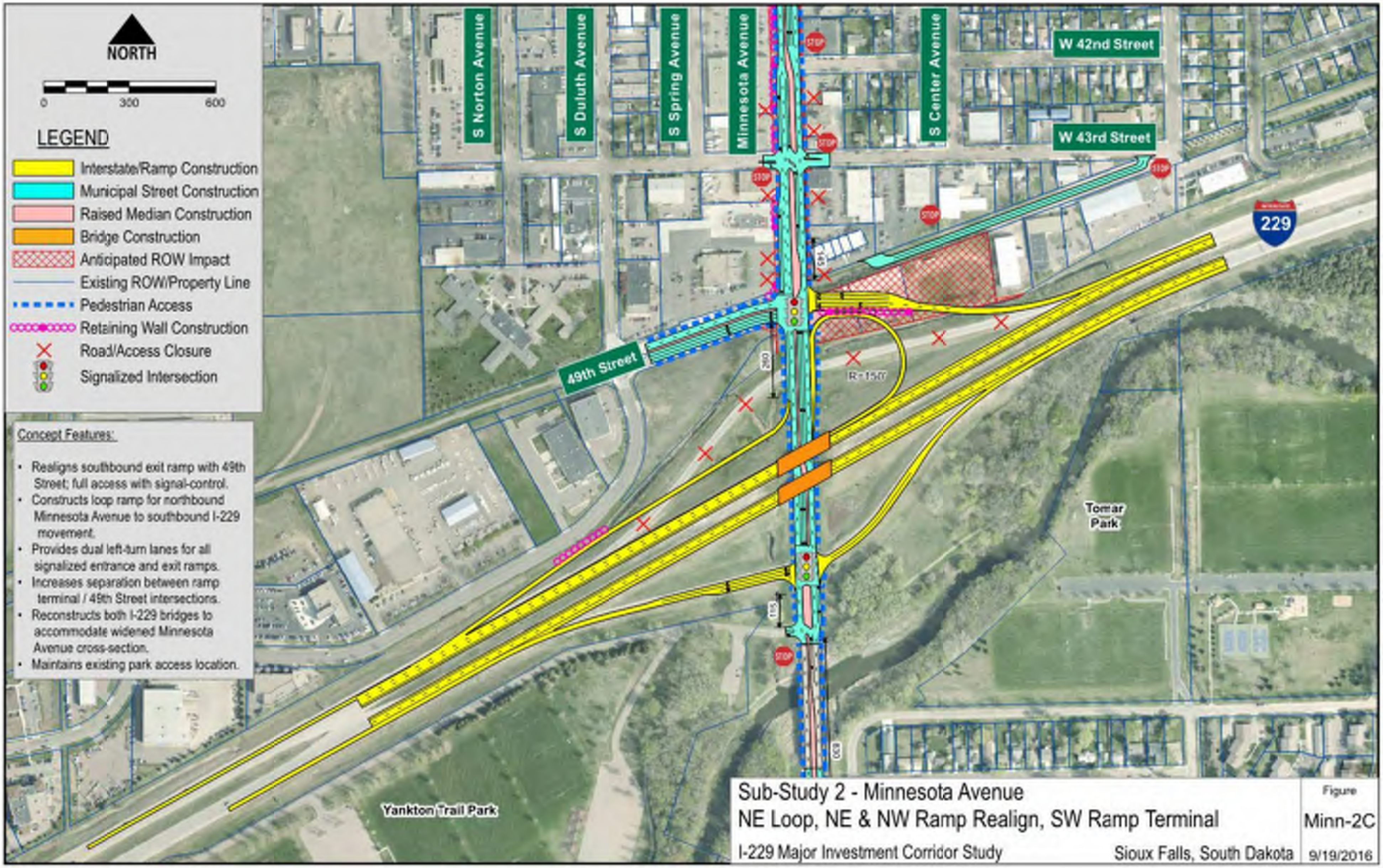
Concept ID	Interchange and Corridor Type	•Traffic Delay •Level of Service •Interchange Year of Failure	Predicted Crash Reduction during 2012-2035	Potential impact to wetlands, historical resources, threatened and endangered species, public lands, and floodplains	Total Right of Way (ROW) Required and Acquisitions	Total Constuction Cost (including ROW)	**Advance** **or** **Eliminate**

- Evaluation Matrix to Compare Concepts
- Recommended Action

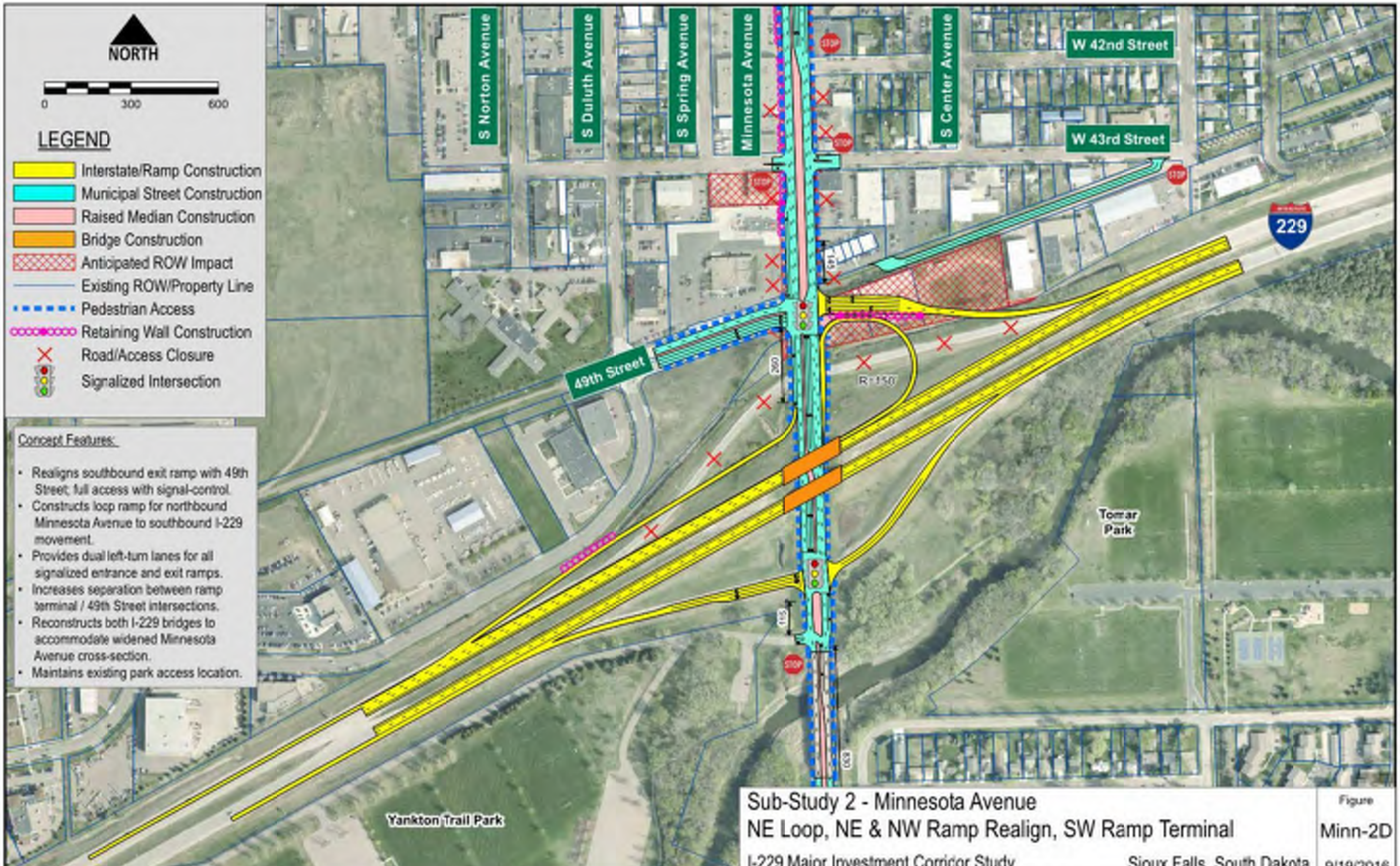
CONCEPTS FOR FURTHER CONSIDERATION

MINN-2C



CONCEPTS FOR FURTHER CONSIDERATION

MINN-2D

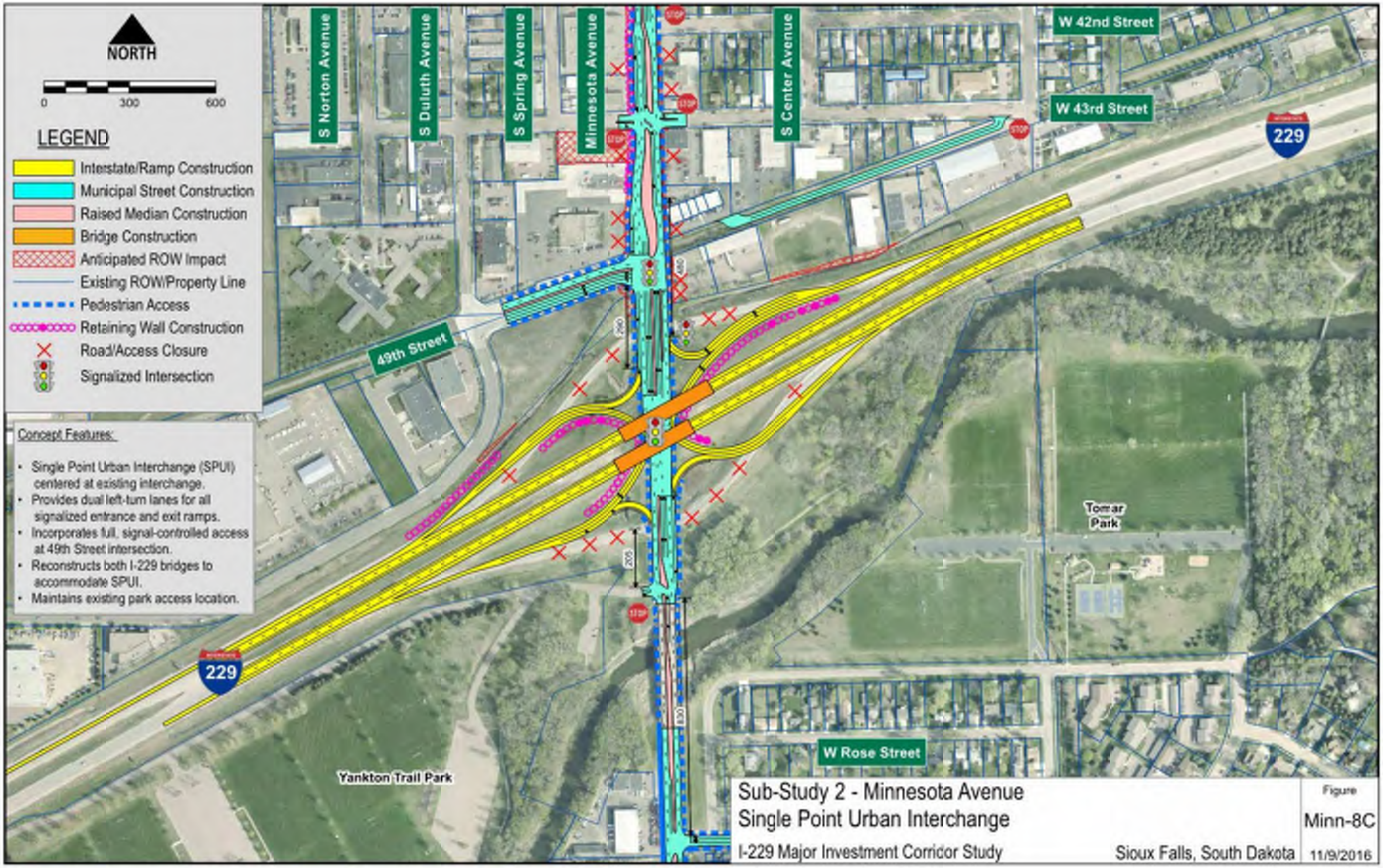


CONCEPT EVALUATION RESULTS

Option	Description	Traffic Operations	Safety	Environmental	Property Impacts	Construction & ROW Cost	DRAFT Recommendation
No-Build	No-Build	POOR	NEUTRAL	N/A	N/A	N/A	Advance
Minn-2C	Diamond with Loop, Direct Connect to 49th St, 5-Lane Big Sioux River to 41st St	NEUTRAL	GOOD	NEUTRAL	NEUTRAL	GOOD	Advance
Minn-2D	Diamond with Loop, Direct Connect to 49th St, 6-Lane Big Sioux River to 41st St	NEUTRAL	GOOD	NEUTRAL	NEUTRAL	GOOD	Advance
Minn-5D	Diverging Diamond Interchange, 6-Lane Big Sioux River to 41st St, 49th St Right-In Right-Out	GOOD	VERY GOOD	NEUTRAL	GOOD	GOOD	**Eliminate** Closure of 49th Street Access

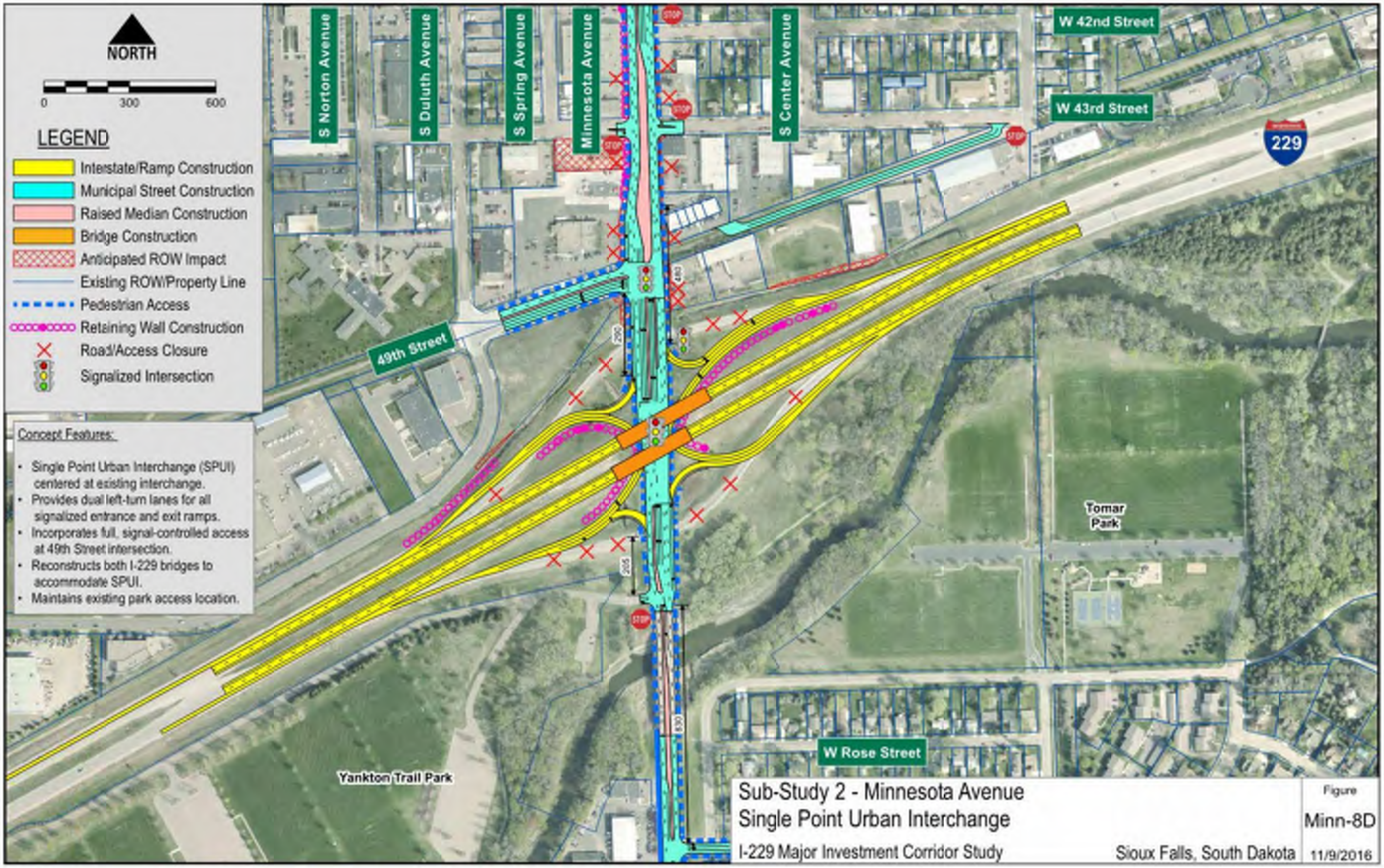
CONCEPTS FOR FURTHER CONSIDERATION

MINN-8C



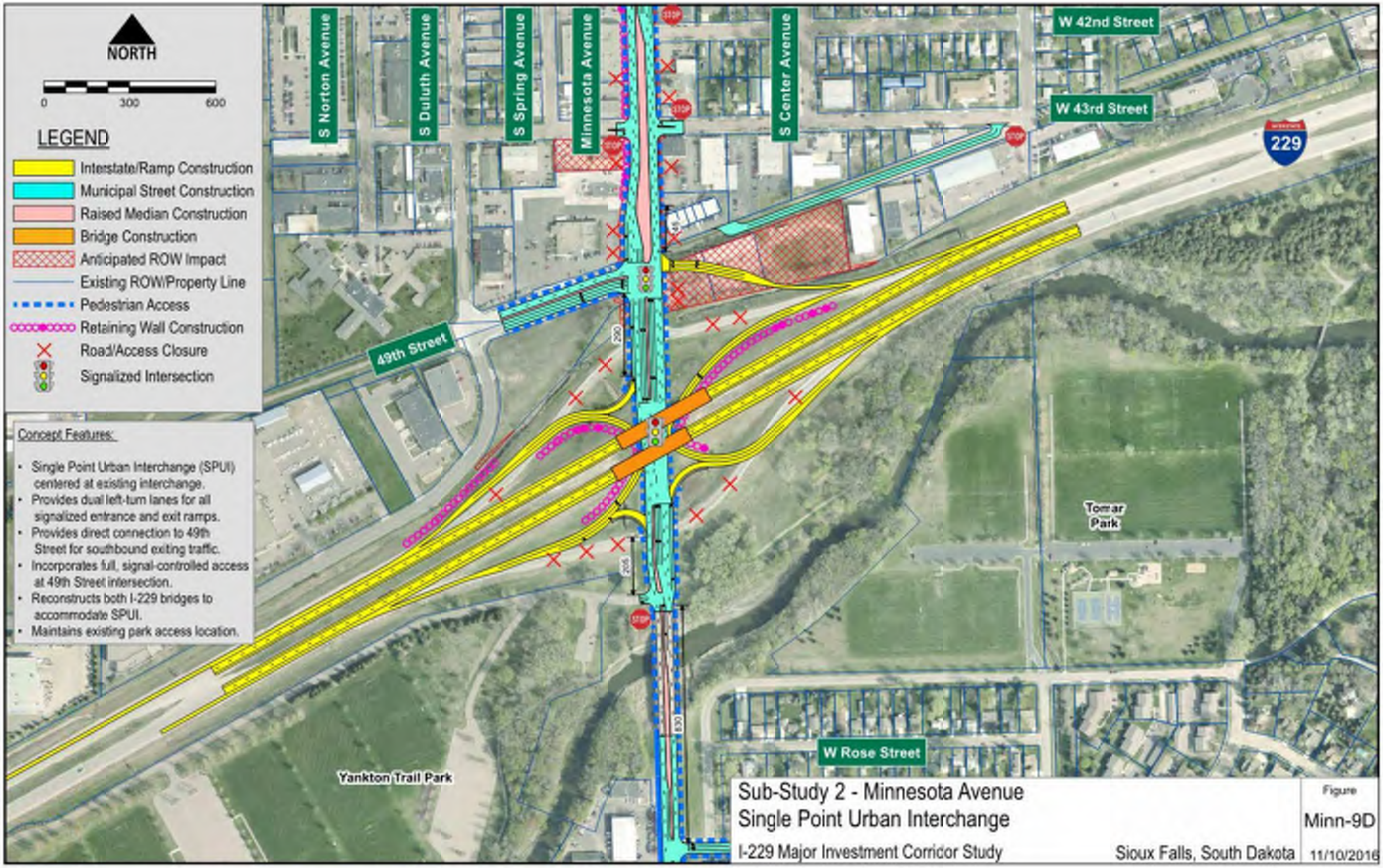
CONCEPTS FOR FURTHER CONSIDERATION

MINN-8D



CONCEPTS FOR FURTHER CONSIDERATION

MINN-9D



CONCEPT EVALUATION RESULTS (cont.)

Option	Description	Traffic Operations	Safety	Environmental	Property Impacts	Construction & ROW Cost	DRAFT Recommendation
Minn-8C	Single Point Urban Interchange, 5-Lane Big Sioux River to 41st St, 49th St Full Access	GOOD	GOOD	NEUTRAL	GOOD	NEUTRAL	Advance
Minn-8D	Single Point Urban Interchange, 6-Lane Big Sioux River to 41st St, 49th St Full Access	GOOD	GOOD	NEUTRAL	GOOD	NEUTRAL	Advance
Minn-9D	Single Point Urban Interchange, Exit Ramp Connection to 49th St, 5-Lane Big Sioux River to 41st St	NEUTRAL	GOOD	NEUTRAL	NEUTRAL	NEUTRAL	Advance

MINNESOTA AVENUE PRELIMINARY PROJECT PRIORITY

- Priority recommendation based on existing and anticipated need and level of improvement and impacts associated with remaining concept options
- Minnesota Avenue Interchange and Corridor improvements = High Priority
- See exhibit board for additional information

NEXT STEPS

- Assemble Stakeholder and Public Comments
- Complete Study Report
- Project Development Process = 5-6 year timeline when initiated by SDDOT & City
  - Prepare Interchange Modification Justification Report and Environmental Document
  - Develop Project Design
  - Acquire Right of Way
  - Construction

PROJECT CONTACTS:

Jason Kjenstad – HDR Engineering, Inc.
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Shannon Ausen – City of Sioux Falls
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Steve Gramm – SDDOT Project Development
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INTERSTATE 229 MAJOR INVESTMENT STUDY

Exit 3 – Minnesota Avenue Sub-Study

Thanks for attending!

HDR HRGreen

APPENDIX I -

EXISTING ACCESS CONTROL FIGURES

Existing Control of Access
S. Minnesota Avenue Interchange

I-229 Major Investment Corridor Study

Sioux Falls, South Dakota

Figure 1

June 2017

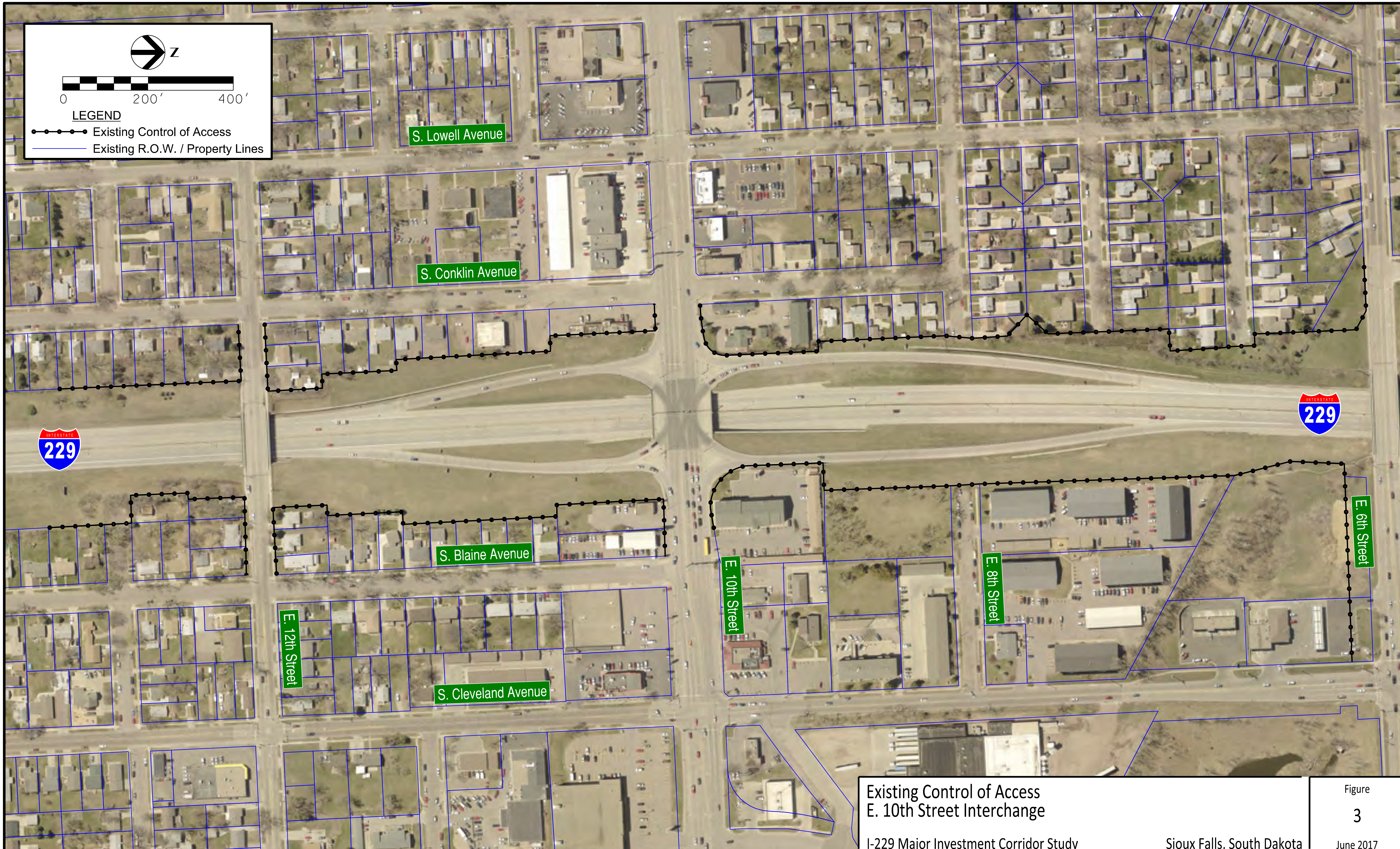
Existing Control of Access
S. Cliff Avenue Interchange

I-229 Major Investment Corridor Study

Sioux Falls, South Dakota

Figure 2

June 2017



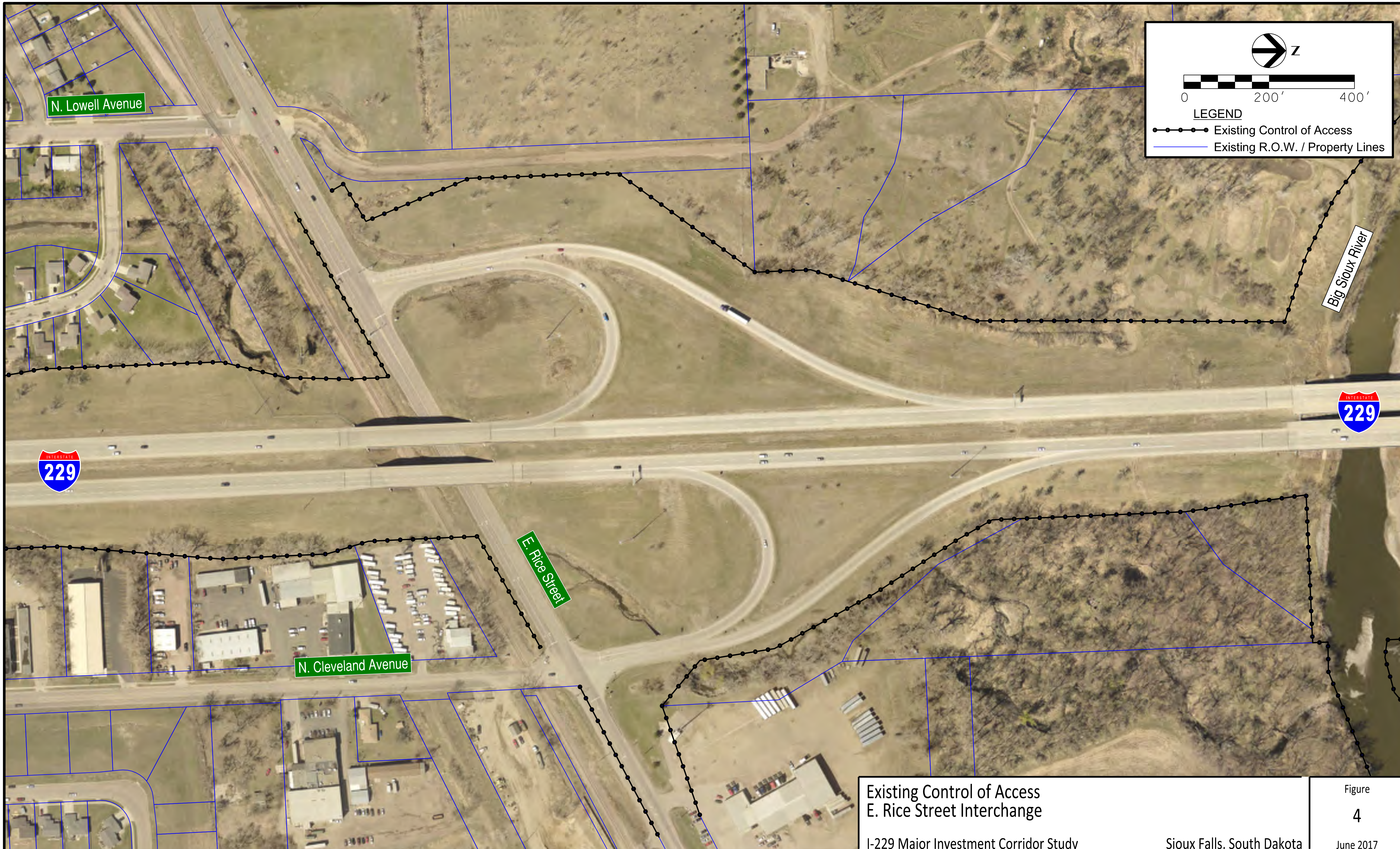
Existing Control of Access
E. 10th Street Interchange

I-229 Major Investment Corridor Study

Sioux Falls, South Dakota

Figure 3

June 2017



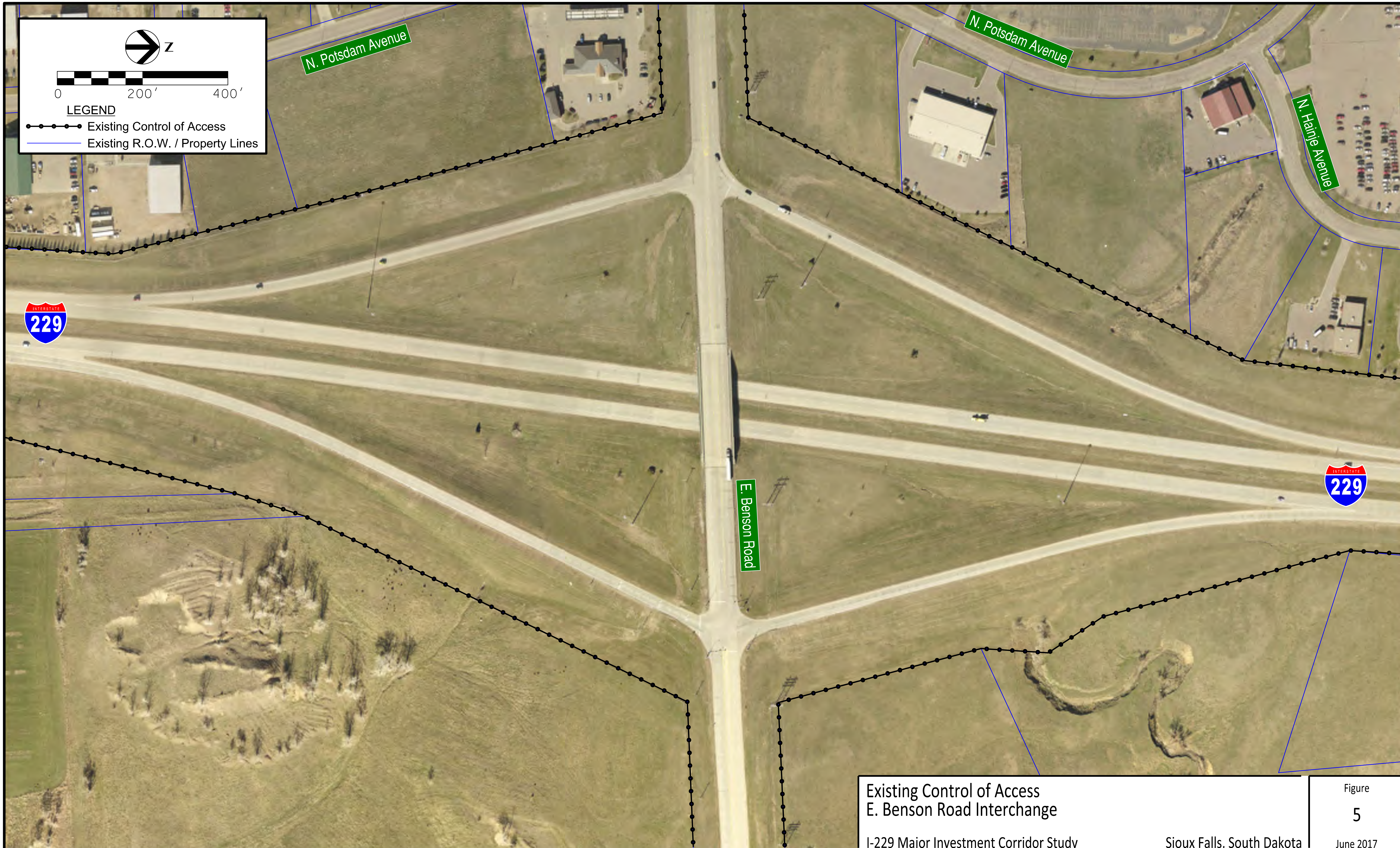
Existing Control of Access
E. Rice Street Interchange

I-229 Major Investment Corridor Study

Sioux Falls, South Dakota

Figure 4

June 2017



Existing Control of Access
E. Benson Road Interchange

I-229 Major Investment Corridor Study

Sioux Falls, South Dakota

Figure 5

June 2017