

*South Dakota*

**I-90 Exit 387**  
HARTFORD

INTERCHANGE MODIFICATION STUDY  
AND ENVIRONMENTAL REVIEW



# I-90 Exit 387 Interchange Modification Justification Report for Interstate 90 Exit 387 (Western Avenue/463<sup>rd</sup> Avenue) Interchange

HP5596(20) P, IM 0909(92) 387N

Hartford, South Dakota

January, 2020

Prepared for:



South Dakota Department of Transportation  
Office of Project Development  
700 E. Broadway Avenue  
Pierre, SD

Prepared by:

HR Green, Inc.

431 N. Phillips Avenue, Suite 400  
Sioux Falls, SD 57104

KLJ Engineering

5110 East 57<sup>th</sup> Street  
Sioux Falls, SD 57108

*The preparation of this report has been financed in part through grant(s) from the Federal Highway Administration and Federal Transit Administration, U.S. Department of Transportation, under the State Planning and Research Program, Section 505 of Title 23, U.S. Code. The contents of this report do not necessarily reflect the official views or policy of the U.S. Department of Transportation.*

*The South Dakota Department of Transportation provides services without regard to race, color, gender, religion, national origin, age or disability, according to the provisions contained in SDCL 20-13, Title VI of the Civil Rights Act of 1964, the Rehabilitation Act of 1973, as amended, the Americans With Disabilities Act of 1990 and Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations, 1994. To request additional information on the SDDOT's Title VI/Nondiscrimination policy or to file a discrimination complaint, please contact the Department's Civil Rights Office at 605-773-3540.*

## Table of Contents

<b>Executive Summary</b>	1
<b>1. Introduction</b>	3
1.1 Background	3
1.2 Purpose	3
1.3 Project Location	4
<b>2. Methodology</b>	8
<b>3. Existing Conditions</b>	8
3.1 Demographics	8
3.2 Existing Land Use	9
3.3 Existing Roadway Network	10
3.4 Alternative Travel Modes	13
3.5 Interchanges	13
3.6 Existing Data	18
3.7 Operational Performance	19
3.8 Existing Safety Conditions	26
3.9 Existing Environmental Conditions	32
<b>4. Need</b>	37
4.1 Condition of the Structure	37
4.2 Transportation Demand	37
4.3 Planned Land Use	38
<b>5. Alternatives</b>	38
5.1 Relation to the Environmental Process	38
5.2 Preliminary Improvement Concepts	38
5.3 Improvements to Alternative Interchanges	59
5.4 Transportation System Management Alternatives	59
5.5 Alternative Transportation Modes	59
5.6 Alternatives Carried Forward in IMJR	59
<b>6. Future Year Traffic</b>	60
6.1 Development of Future Year Traffic Volumes	60
6.2 2025 No-Build Condition Traffic Operations	66
6.3 2050 No-Build Condition Traffic Operations	70
6.4 Future Year No-Build Traffic Operations Conclusions	73

<b>7. Alternatives Analysis</b>	74
7.1 Traffic Operations	74
7.2 Conformance with Transportation Plans	84
7.3 Compliance with Policies and Engineering Studies	84
7.4 Environmental Impacts	84
7.5 Safety	85
7.6 Evaluation Matrix	87
<b>8. Coordination</b>	90
<b>9. Funding Plan</b>	92
<b>10. Recommendation</b>	93

[Appendix \(Available Electronically\)](#)

- A. Methods and Assumptions Document
- B. Existing, 2025 No-Build, and 2050 No-Build Conditions Traffic Volumes and Operations Analysis
- C. HCS Analysis Reports
- D. I-90 Exit 387 Interchange Geometric Review
- E. Crash Analysis Memorandum
- F. Crash Prediction Memorandum
- G. Purpose and Need Memorandum
- H. Environmental Scan Report
- I. Traffic Projections Memorandum
- J. Concept Evaluation Memorandum
- K. Build Alternatives Traffic Operations Memorandum
- L. Constructability Review Memorandum
- M. Public Meeting Materials
- N. Public Input and Comments
- O. Follow-up Alternative Analysis Memorandum

## List of Figures

1.	IMJR Study Area and Analysis Intersections	6
2.	Existing I-90 Exit 387 Interchange	7
3.	Study Area Future Land Use Data	9
4.	Existing City of Hartford Zoning	10
5.	Existing Roadway Network	12
6.	Existing I-90 Exit 387 Interchange Configuration	15
7.	Existing I-90 Exit 390 Interchange Configuration	17
8.	Existing Conditions Traffic Volumes	24
9.	Study Area Crash Locations (2013-2017)	27
10.	I-90 Crash Types (2013-2017)	28
11.	Western Avenue Crash Types (2013-2017)	29
12.	Crash Types on SD Highway 38 (2013-2017)	30
13.	Study Area Crash Statistics (2013-2017)	31
14.	Environmental Study Area	33
15.	Threatened and Endangered Species, Wetlands and Waterways	34
16.	Floodplain	35
17.	Recreational Resources	36
18.	Options for Construction Staging - Diamond	43
19.	Options for Construction Staging – Roundabout	44
20.	Concept 1, Standard Diamond	45
21.	Concept 2, Standard Diamond with Roundabouts	46
22.	Concept 3, Standard Diamond, Western Avenue Shifted West	47
23.	Concept 4, Standard Diamond with Roundabouts, Western Avenue Shifted West	48
24.	Concept 5, Standard Diamond with Lowered I-90	49
25.	Concept 6, Standard Diamond with Roundabouts, Lowered I-90	50
26.	Concept 7, Standard Diamond with Lowered I-90, Western Avenue Shifted West	51
27.	Concept 8, Standard Diamond with Lowered I-90, Roundabouts, Western Avenue Shifted West	52
28.	Concept 9, Standard Diamond with I-90 over Western Avenue	53
29.	Western Avenue 2-Lane Rural Section, North of Interchange Only	54
30.	Western Avenue 3-Lane Urban Section, North of Interchange Only	55
31.	Western Avenue 2-Lane Rural Section, South of Interchange Only	56
32.	Western Avenue 2-Lane Rural Section without Shared-Use Path, South of Interchange Only	57
33.	Western Avenue Southwest Quadrant Frontage Road Realignment	58
34.	2025 Daily Traffic Projections	62
35.	2050 Daily Traffic Projections	63
36.	2025 Peak Hour Turning Movement Projections	64
37.	2050 Peak Hour Turning Movement Projections	65
38.	2025 No-Build Traffic Operations	69
39.	2050 No-Build Conditions Traffic Operations	72
40.	2025 Standard Diamond Build Conditions	75
41.	2025 Standard Diamond with Roundabouts Build Conditions	76

42.	2050 Standard Diamond Build Conditions	79
43.	2050 Standard Diamond with Roundabouts Build Conditions	80
44.	I-90 Exit 387 Study Website	91
45.	Proposed Right-of-Way and Control of Access	96
46.	Large Scale Signing Plan	97
47.	Interchange Area Signing Plan	98

## List of Tables

1.	Population History	8
2.	Traffic Data Collection Summary	18
3.	Freeway Level of Service Thresholds	20
4.	Intersection Level of Service Thresholds	20
5.	Western Avenue/463rd Avenue Intersection Traffic Operations - Existing Conditions	21
6.	Western Avenue/463rd Avenue Local Network Intersection Traffic Operations (Weighted Average) – Existing Conditions	21
7.	I-90 Exit 390 Ramp Terminal Intersections – Existing Conditions	22
8.	Western Avenue Corridor Two-Lane Highway Segments – Existing Conditions	22
9.	I-90 Freeway Segment Traffic Operations – Existing Conditions	23
10.	Pedestrian and Bicycle Modes Level of Service Criteria	25
11.	Western Avenue Intersection Traffic Operations – 2025 No-Build Conditions	66
12.	Western Avenue Corridor Local Network Intersections (Weighted Average) - 2025 No-Build Conditions	66
13.	I-90 Exit 390 Ramp Terminal Intersections – 2025 No-Build Conditions	66
14.	Western Avenue Corridor Two-Lane Highway Segments – 2025 No-Build Conditions	67
15.	I-90 Freeway Segment Traffic Operations – 2025 No-Build Conditions	68
16.	Western Avenue Corridor Intersections – 2050 No-Build Conditions	70
17.	Western Avenue Corridor Local Intersections (Weighted Average) – 2050 No-Build Conditions	70
18.	I-90 Exit 390 Ramp Terminal Traffic Operations – 2050 No-Build Conditions	71
19.	I-90 Freeway Segment Traffic Operations – 2050 No-Build Conditions	71
20.	2025 Build Conditions – I-90 Exit 387 Ramp Terminal Intersection 95 <sup>th</sup> Percentile Queues	77
21.	2025 Build Conditions – Interchange O-D Delay	77
22.	2050 Build Conditions – I-90 Exit 387 Ramp Terminal Intersection 95 <sup>th</sup> Percentile Queues	81
23.	2050 Build Conditions – Interchange O-D Delay	81
24.	Minimum Control of Access Along Crossroad	84
25.	Study Area Crash Prediction Summary	86
26.	Alternatives Evaluation Matrix	88
27.	Alternatives 3,4 Evaluation Matrix	89
28.	Anticipated Funding Allocation (2019 dollars)	92

## Executive Summary

The South Dakota Department of Transportation (SDDOT) initiated a study of the I-90 Exit 387 Interchange & Western Avenue/463<sup>rd</sup> Avenue corridor in order to develop and evaluate potential improvements within the study area. As part of the study, this Interchange Modification Justification Report (IMJR) was developed to provide a technical evaluation of the operational feasibility of the proposed improvements. This document also determines whether the proposed I-90 Exit 387 Interchange & Western Avenue/463<sup>rd</sup> Avenue corridor improvements satisfy requirements established by the Federal Highway Administration's (FHWA) policy concerning additional or revised access to the Interstate Highway System.

This IMJR document was developed using the methodology and approach outlined in Figure 3 of Section 3.5 of the *Interstate System Access Information Guide*. This IMJR was developed concurrently with the preparation of an Environmental Document.

Improvements are needed at Exit 387 to provide greater clearance over the I-90 mainline. Two significant crashes have been noted within history where the bridge superstructure was damaged by collisions by vehicles on the I-90 mainline. Additional collisions will result in the need to replace at least one of the main support beams and require full closure of the interchange during construction and subsequent long-distance traffic diversions.

The following alternatives were developed and analyzed to determine which best met the project needs:

### Interchange Alternatives

- No Build
- 1. Standard Diamond
- 2. Standard Diamond with Roundabouts
- 3. Standard Diamond – Western Avenue Shifted West
- 4. Standard Diamond with Roundabouts – Western Avenue Shifted West
- 5. Standard Diamond with Lowered I-90
- 6. Standard Diamond with Roundabouts and Lowered I-90
- 7. Standard Diamond with Lowered I-90 – Western Avenue Shifted West
- 8. Standard Diamond with Roundabouts and Lowered I-90 – Western Avenue Shifted West
- 9. Standard Diamond with I-90 over Western Avenue

### Corridor Concepts

- A. 2-Lane Rural Section (North of Interchange only)
- B. 3-Lane Urban Section (North of Interchange only)
- C. 2-Lane Rural Section with Shared-Use Path (South of Interchange only)
- D. 2-Lane Rural Section without Shared-Use Path (South of Interchange only)
- E. Southwest Quadrant Frontage Road Realignment

Operations analysis showed that all alternatives provided the required levels of service in 2025 for all intersections and segments in the study area. In 2050, the stop-controlled ramp terminal

intersections at the adjacent interchange (Exit 390) showed levels of service of E and F. While Exit 390 is not the subject of this IMJR and would experience these levels of service regardless of which alternative is chosen at Exit 387, it appears that the levels of service at Exit 390 could be improved with Transportation System Management measures, like addition of turn lanes and possible signalization.

The interchange alternatives were evaluated through a detailed screening analysis in a Concept Evaluation memo (**Appendix J**) and public input in 2018. The evaluation determined that concepts 5 – 9 posed additional costs related to lowering the I-90 mainline, requiring additional right-of-way and drainage facilities. Interchange alternatives 1 – 4 were carried forward for further evaluation and public comment. That evaluation determined that alternatives 1 and 2 required full closure of the interchange during construction, resulting in long detours and severe impacts to businesses and other property owners in the study area. Alternatives 3 and 4 were then compared against each other to determine their relative life-cycle costs.

Corridor concept A required considerable additional right-of-way compared to concept B, while concept D did not provide the shared-use path favored by the stakeholders and public. For those reasons, concepts B, C, and E were carried forward for implementation.

Based on the analysis contained herein, the IMJR-recommended alternative that best meets the established transportation needs within the study area is as follows:

- Interchange Build Alternative 3: Standard Diamond interchange, crossroad shifted west to allow maintaining traffic during construction.
- Corridor Build Alternative B: Western Avenue – 3-lane urban section north of Jeffrey Street.
- Corridor Build Alternative C: Western Avenue – 2-lane rural section with shared-use path south of Jeffrey Street.
- Southwest Quadrant Frontage Road Realignment.

This request is to modify the existing I-90 Exit 387 Interchange. No additional access to the Interstate system is being requested.

The proposed improvements at Exit 387 will result in a full interchange, providing all movements normally found at Interstate interchanges. The interchange improvement will not result in additional access to the Interstate system and will be designed to meet all current standards.

## 1. Introduction

The South Dakota Department of Transportation (SDDOT) initiated a study of the I-90 Exit 387 Interchange and Western Avenue/463<sup>rd</sup> Avenue corridor in order to develop and evaluate potential improvements within the study area. As part of the study, this Interchange Modification Justification Report (IMJR) was developed to help determine if the proposed interchange improvements satisfy requirements established by the Federal Highway Administration's (FHWA) policy concerning additional or revised access to the Interstate Highway System. This IMJR was developed concurrently with the environmental analysis process.

This document was developed on behalf of the SDDOT, for submittal to FHWA as a request to modify Interstate access at the I-90 Exit 387 Interchange.

### 1.1. Background

The bridge structure at the I-90 Exit 387 interchange has been hit multiple times, requiring repairs that are costly and imposing traffic delays from the time damage occurs until repairs can be completed. Each time the bridge has been hit, the SDDOT has been able to utilize heat strengthening to repair the bridge to the SDDOT standards for a safe structure. However, this application can only be utilized a limited number of times until the repair method is no longer effective. If the structure were to sustain another bridge strike, the likely repair methodology would require a partial girder replacement. This method would carry substantial cost and would require an emergency partial or full closure of the bridge.

Because of numerous bridge strikes, the South Dakota Department of Transportation (SDDOT) has determined that the I-90 Exit 387 (Hartford) interchange will need to have a new overpass structure in the near future. The SDDOT in conjunction with the City of Hartford, Minnehaha County, the Sioux Falls Metropolitan Planning Organization (MPO) and the Federal Highway Administration (FHWA) has concluded that a study is needed to determine the proper interchange configuration that will be needed to handle current and future traffic levels. A previous comprehensive Interstate system study, the 2010 Decennial Interstate Corridor Study, found no deficiencies at Exit 387, but forecast that the existing interchange may reach operational capacity after 2030. Since that study, the structure collisions have forced consideration of replacing the interchange.

### 1.2. Purpose

The purpose for this project is to accommodate the current and future transportation needs for the I-90 Exit 387 (Hartford) Interchange and the segment of the S. Western Avenue connected to the interchange. The numerous bridge strikes in recent years have elevated the need to pursue replacement of the bridge before any major rehabilitation work will be necessary. Through the reconstruction of the facility, the needs of accommodating future traffic demand and multi-modal transportation through the interchange can also be met. The outcome of this project will be a facility demonstrating an increase to current design standards, improved safety, and an increase to the efficiency of the transportation system along the I-90 and Western Avenue/463<sup>rd</sup> Avenue corridors.

### 1.3. Project Location

The existing I-90 Exit 387 Diamond Interchange is located along the southern edge of the City of Hartford in Minnehaha County, South Dakota. The interchange is approximately nine miles west of the I-90 & I-29 systems interchange and serves as an important regional transportation gateway for the Hartford area. While the Hartford corporate limits only include the Western Avenue/463<sup>rd</sup> Avenue corridor north of I-90, the entire study area is within their growth area. The entire IMJR study area, shown in Figure 1, is within the Sioux Falls MPO planning boundary and encompasses the following limits:

- Minnehaha County 151/463<sup>rd</sup> Avenue/Western Avenue from the intersection with 261<sup>st</sup> Street to the intersection with 260<sup>th</sup> Street/Mickelson Avenue, approximately 1.0 mile (referred to as Western Avenue)
- SD38 from the I-90 Westbound Ramp Terminal to the I-90 Eastbound Ramp Terminal, approximately 0.3 miles,
- Mainline I-90 from MRM 384 west of the I-90 Exit 387 interchange to MRM 391 east of the I-90 Exit 390 interchange, approximately 7.0 miles,
- The ramps for the I-90 Exit 387(Hartford) interchange, and
- The ramps for the I-90 Exit 390 (SD38/Buffalo Ridge) interchange.

Within the IMJR study area, the following intersections were analyzed as part of this study (existing traffic control):

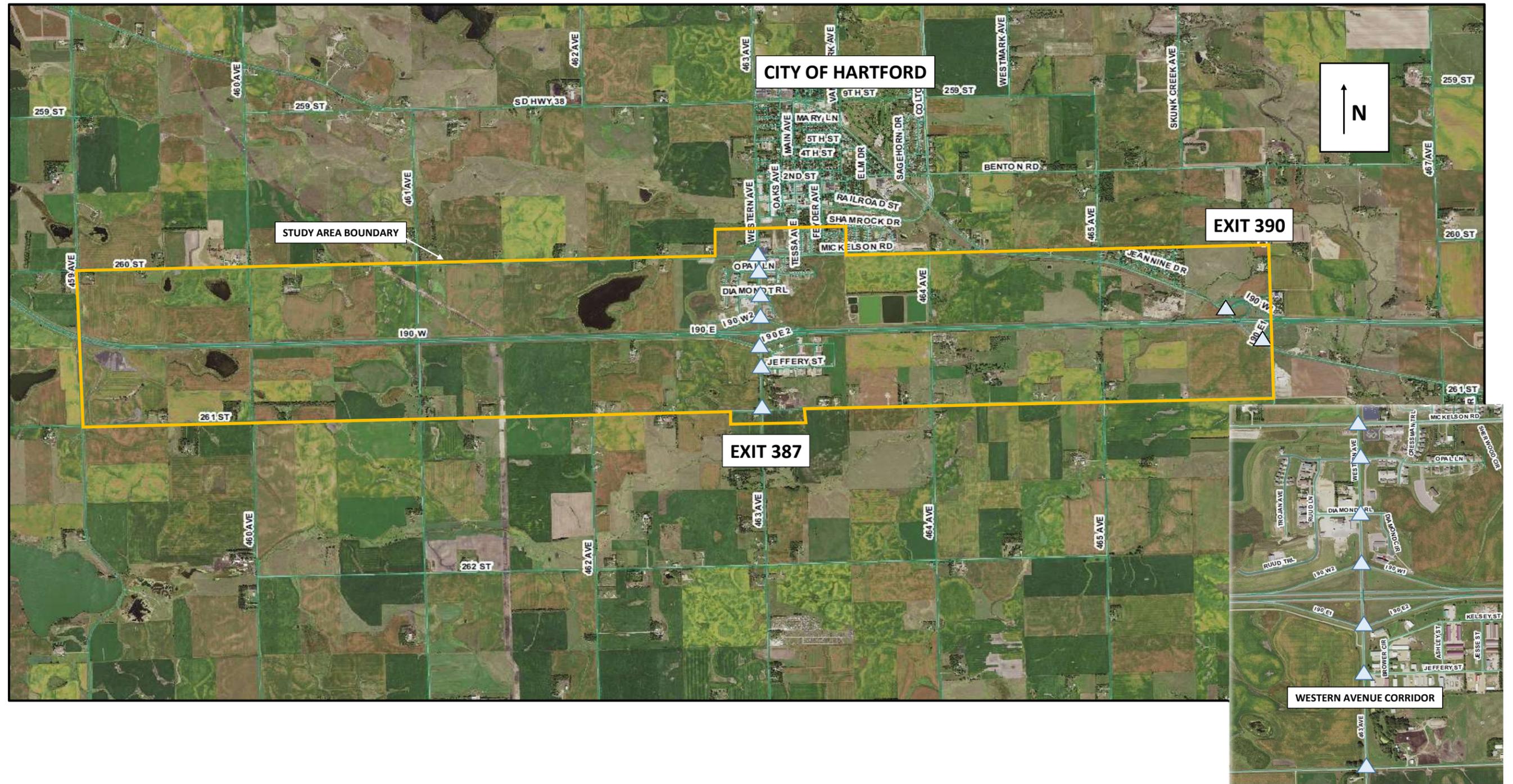
- Western Avenue corridor
  - 260<sup>th</sup> Street/Mickelson Road (stop-controlled from minor street approach)
  - Opal Lane (stop-controlled from minor street approach)
  - Diamond Trail (stop-controlled from minor street approach)
  - Westbound I-90 ramp terminal intersection (stop-controlled from off-ramp approach).
  - Eastbound I-90 ramp terminal intersection (stop-controlled from off-ramp approach).
  - Jeffrey Street (stop-controlled from minor street approach)
  - 261<sup>st</sup> Street (stop-controlled from minor street approach)
- Highway 38 corridor
  - Westbound I-90 ramp terminal intersection (stop-controlled from off-ramp approach).
  - Eastbound I-90 ramp terminal intersection (stop-controlled from off-ramp approach).

The following projects are currently under construction or are planned for construction within the study area:

- Construction of crossovers on I-90 mainline and ramps from west of Humboldt to near Hartford to accommodate later I-90 construction projects (IM 0909(89)379).
- Construction on the I-90 mainline from west of Humboldt to east of Hartford to replace surfacing, replace a structure, and correct a clearance deficiency (IM-FP 0909(90)377).

The existing I-90 Exit 387 Interchange is a diamond-type interchange configuration as shown in **Figure 2**. The proposed improvements would reconstruct this interchange to a diamond-type

interchange to fulfill current design standards, improve safety, and increase the efficiency of the transportation system along the I-90 Interstate and Western Avenue/463<sup>rd</sup> Avenue corridors.



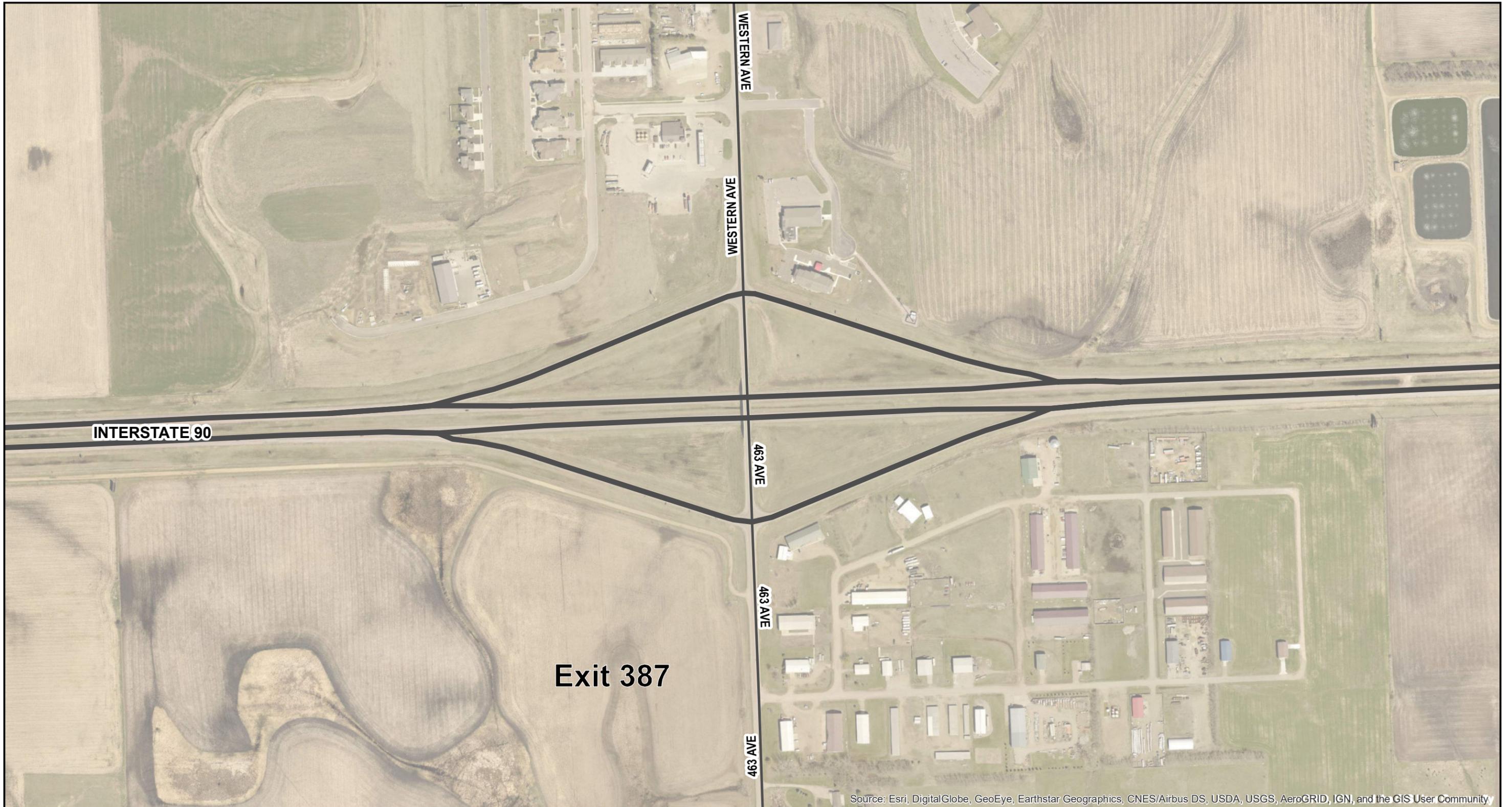
**IMJR Study Area and Analysis Intersections**  
 I-90 Exit 387 Interchange Modification Justification Study  
 Hartford, SD

**LEGEND**  
 ANALYSIS INTERSECTION



January, 2019

**FIGURE 1**



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

**I-90 Exit 387 Interchange  
Modification Study and  
Environmental Review**

*Hartford  
South Dakota*

**Legend**

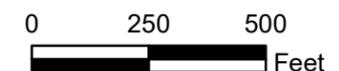
- Railroad
- Stream/River
- Interstate
- Arterials and Collector Streets
- Other Streets

**Existing Exit 387  
Interchange Area**



**I-90 Exit 387**  
HARTFORD

INTERCHANGE MODIFICATION STUDY  
AND ENVIRONMENTAL REVIEW



**February 2019**

**Figure 2**

## 2. Methodology

This IMJR document was developed using the methodology and approach outlined in the *Interstate System Access Information Guide*<sup>1</sup>, following the outline presented in **Figure 3** of Section 3.5. The general IMJR study process entailed:

1. Establishment of project Methods and Assumptions document.
2. Collection of current data.
3. Identification and evaluation of existing and future needs within the study area.
4. Development of interchange and arterial corridor concepts to address established needs.
5. High-level analysis and screening of initial concepts.
6. Refinement of concepts carried forward to establish study interchange and corridor Build Alternatives.
7. Analysis and screening of Build Alternatives.
8. Development of IMJR and Environmental documents.
9. Identification of a Preferred Alternative.

The IMJR document is prepared in conjunction with the development of the Environmental Document. The Environmental Document establishes the overall project purpose and need and provides the overarching discussion and evaluation of alternatives, environmental resources, and impacts of the proposed action with appropriate mitigation measures. The IMJR provides technical evaluation support of the alternatives to the Environmental Document and is the SDDOT’s formal request for modifying access to the Interstate system.

## 3. Existing Conditions

### 3.1. Demographics

The Sioux Falls Metropolitan Statistical Area, which includes the City of Hartford, has seen quick, yet steady growth over the last several decades illustrated in **Table 1**. The City of Hartford has seen growth at an even faster rate and if recent growth trends continue the population can be expected to increase to approximately 10,000 people by the 2050 planning year. Population growth in both the Sioux Falls Metropolitan Statistical Area (38 percent) and the City of Hartford (76 percent) has outpaced the statewide growth rate (15 percent) between 2000 and 2017.

**Table 1: Population History**

	2000	2010	2017 (estimate)	2000-2017 Percent Increase
Sioux Falls Statistical Area	187,093	228,261	259,094	38%
City of Hartford	1,844	2,534	3,237	76%
South Dakota	754,844	814,180	869,666	15%

*United States Census Bureau* (<https://www.census.gov/>).

Employment within the statistical area has grown along with the population. Unemployment rates within the Sioux Falls metropolitan area and the State of South Dakota were 2.2 percent and 3.0

<sup>1</sup> *Interstate System Access Informational Guide*. August 2010. U.S. Department of Transportation, Federal Highway Administration, and Office of Infrastructure.

percent, respectively, in October 2018<sup>2</sup>. The unemployment rate in the City of Hartford was 3.1 percent in 2016<sup>3</sup>.

The future land use plan for the City of Hartford, as presented in the 2017-2037 Hartford Comprehensive Plan, includes further development of the area south of the I-90 Exit 387 interchange, seen below in **Figure 3**. The anticipated zoning land uses include commercial zoning immediately south of the interchange skirted by industrial zoned land uses. Residential and commercial zoned land use is expected to increase north of the interchange. Currently, the service industry is the leading employment type within the City of Hartford, followed by retail and finance occupational employment. These three employment categories have been shown to increase over the last decade at a rate that outpaces others.

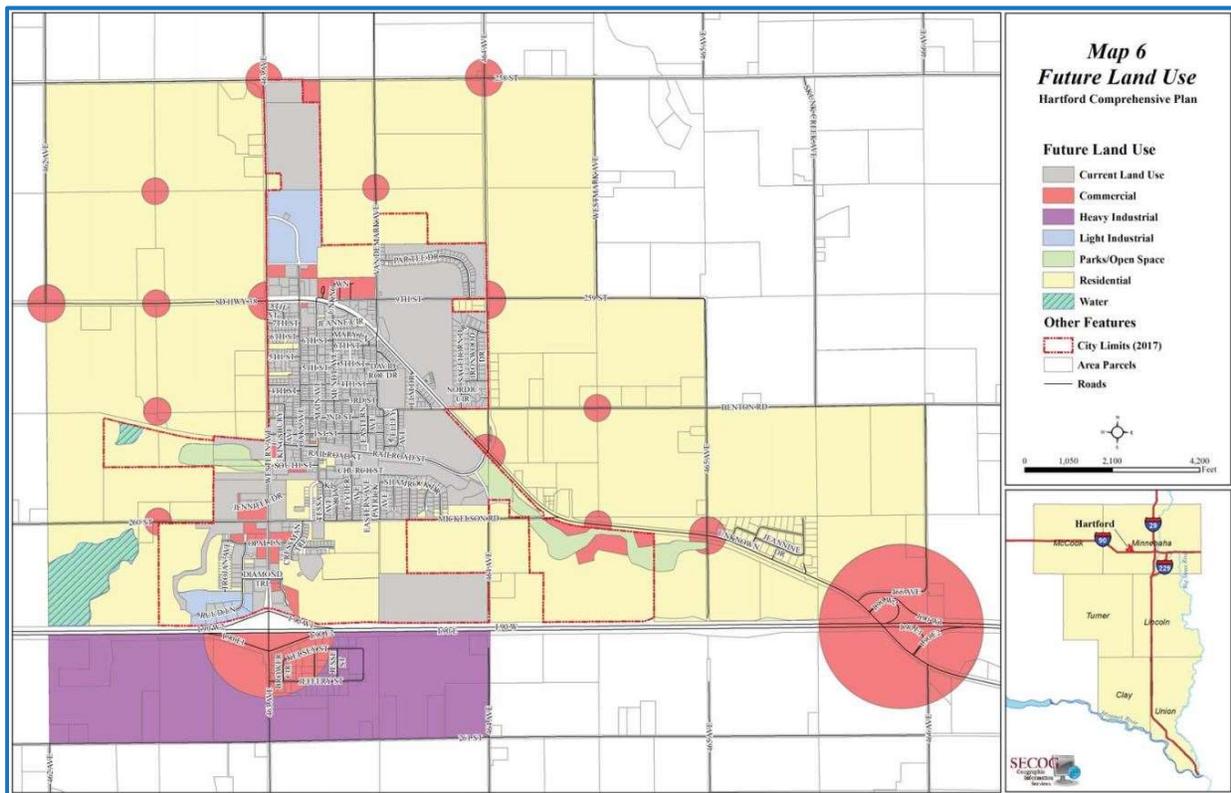


Figure 3: Study Area Future Land Use Data

### 3.2. Existing Land Use

The study area comprises a mix of residential, commercial, industrial, institutional and agricultural uses. **Figure 4** illustrates current City of Hartford zoning within the study area.

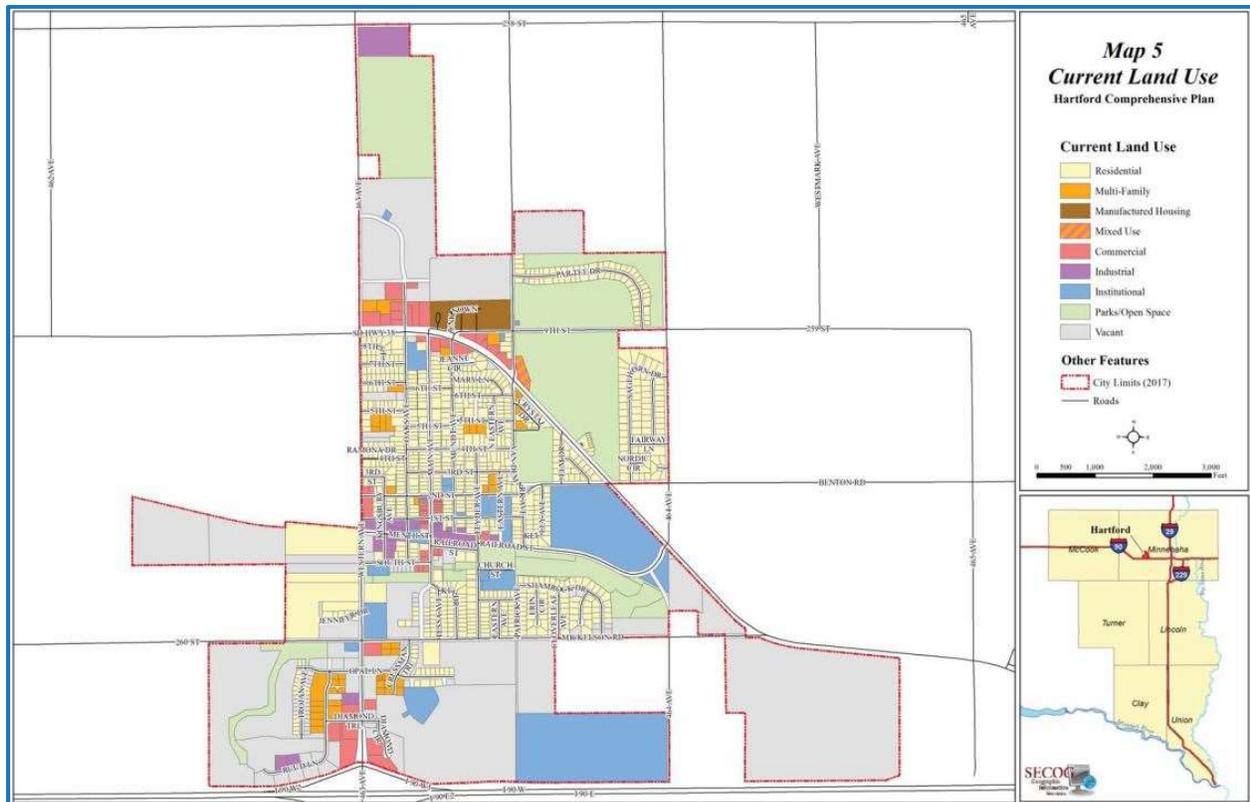
A number of light industrial businesses are clustered in the southeast quadrant of the Exit 387 interchange. Agricultural land use occupies the remainder of the study area south of I-90.

<sup>2</sup> Bureau of Labor Statistics, United States Department of Labor. <https://www.bls.gov/eag/eag.sd.htm> (retrieved November 2018).

<sup>3</sup> 2012-2016 American Community Survey 5-year Estimate, US Census Bureau. <https://factfinder.census.gov> (retrieved November 2018)

North of I-90, there is a mix of commercial, industrial, institutional, agricultural, and residential land use. Commercial uses now line Western Avenue north of I-90, providing services to I-90 travelers and Hartford residents.

The City of Hartford Comprehensive Plan identifies continued commercial development around the interchange, with heavy industrial uses replacing many of the existing agricultural uses south of I-90.



**Figure 4: Existing City of Hartford Zoning**

*(Reproduced from the 2017-2037 Hartford Comprehensive Plan Zoning Map)*

### 3.3. Existing Roadway Network

The major streets within the study area, as illustrated in **Figure 5**, are as follows:

#### Interstate 90

- West of Western Avenue/463<sup>rd</sup> Avenue: Rural Interstate:
  - SDDOT access classification: Interstate.
  - 2 lanes eastbound and westbound through study area, separated by a depressed turf median.
- East of Western Avenue/463<sup>rd</sup> Avenue: Rural Interstate:
  - SDDOT access classification: Interstate.
  - 2 lanes eastbound and westbound through study area, separated by a depressed turf median.

**SD 38**

- West of I-90: Major Collector
  - SDDOT access classification: Rural, with control of access within interchange area
  - 2-lane rural type cross-section with turn lanes at I-90 ramp termini
- East of I-90: Minor Arterial
  - SDDOT access classification: Rural, with control of access within interchange area
  - 2-lane rural type cross-section with turn lanes at I-90 ramp termini

**Western Avenue/463<sup>rd</sup> Avenue**

- FHWA functional class rural major collector
  - 2-lane rural type cross-section throughout study area

**Mickelson Road**

- FHWA functional class rural local road
  - Three-lane urban cross-section east of Western Avenue
  - Two-lane rural cross-section west of Western Avenue

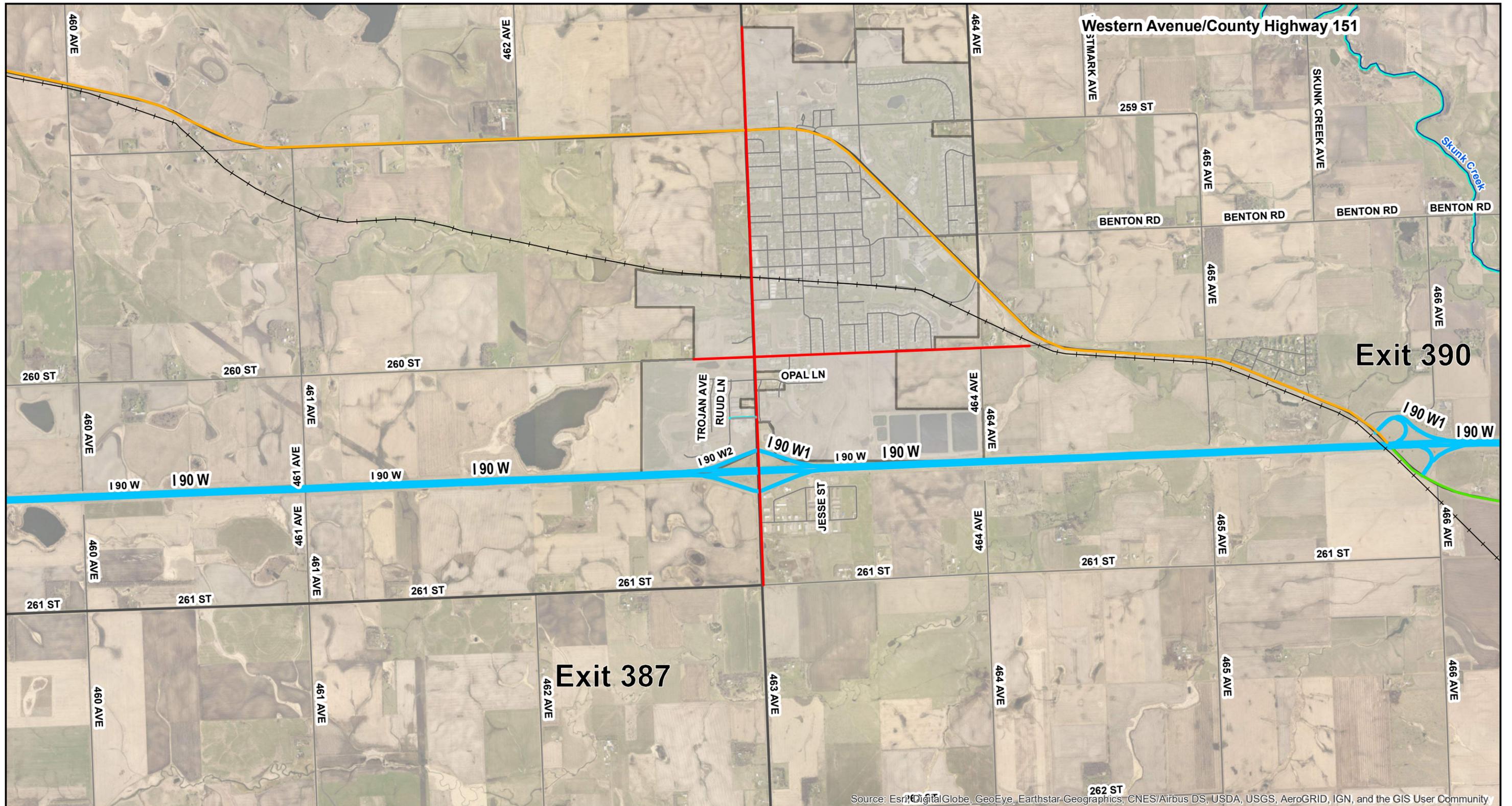
**261<sup>st</sup> Street**

- Unclassified rural roadway
  - Two-lane rural cross-section east of Western Avenue
  - Two-lane rural cross-section west of Western Avenue

Other public streets of note within the study area include analyzed Western Avenue intersections with local streets:

**Local Analyzed Streets**

- Opal Lane: FHWA functional class rural road
- Diamond Trail: FHWA functional class rural road
- Jeffrey Street: FHWA functional class rural road



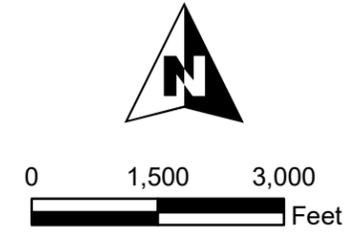
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

**Existing Roadway Network**  
Hartford  
South Dakota

**Legend**

- Railroad
- Interstate
- Other Streets
- Hartford City Limits
- State Major Collector
- State Minor Arterial
- Local Arterial

*South Dakota*  
**I-90 Exit 387**  
HARTFORD  
INTERCHANGE MODIFICATION STUDY  
AND ENVIRONMENTAL REVIEW



**February 2019**

**Figure 5**

### 3.4. Alternative Travel Modes

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

#### Bicycle and Pedestrian Facilities

Pedestrian and bicycle facilities are limited within the study area, particularly along Western Avenue. Sidewalks are provided on some of the recently-constructed intersecting streets and a multiple-use recreational trail exists along the south side of Mickelson Road. There are shoulders on both sides of Western Avenue, except across the interchange structure, where the narrow width of the bridge deck restricts bicycle and pedestrian mobility along the corridor.

#### Transit

Fixed-route transit within the Sioux Falls metropolitan area is served by the Sioux Area Metro. However, routes do not currently extend to the Hartford area. Hartford Area Transit, Inc. provides on-call door-to-door service that covers the study area depending on passenger destinations.

Jefferson Lines provides regional bus transportation along I-90 through the interchange, providing connectivity between prime transfer points of Sioux Falls and Rapid City. Jefferson Lines does not provide a bus stop in Hartford and, therefore, does not routinely use the interchange.

#### Airports

The nearest commercial airport is the Sioux Falls Regional Airport located approximately eleven miles east of the I-90 Exit 387 Interchange. The airport may be accessed via SD 38 or the I-90 Cliff Avenue Exit (Exit 399).

#### Railroad

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

### 3.5. Interchanges

Two interchanges are located within the study area, Exits 387, and 390, and are further described in the following subsections.

#### I-90 Exit 387

The existing interchange at Exit 387 is a Standard Diamond configuration with approximately 945-foot separation between ramp terminal intersections as shown in **Figure 6**. Each ramp terminal is stop-controlled from the off-ramp approach. Diagonal ramps in all four quadrants are single lane. A review of the geometric conditions at the interchange was reported in a project memorandum provided in **Appendix D**.

Through a review of construction plans and previous studies, the following elements of the existing interchange design support improvement at the interchange:

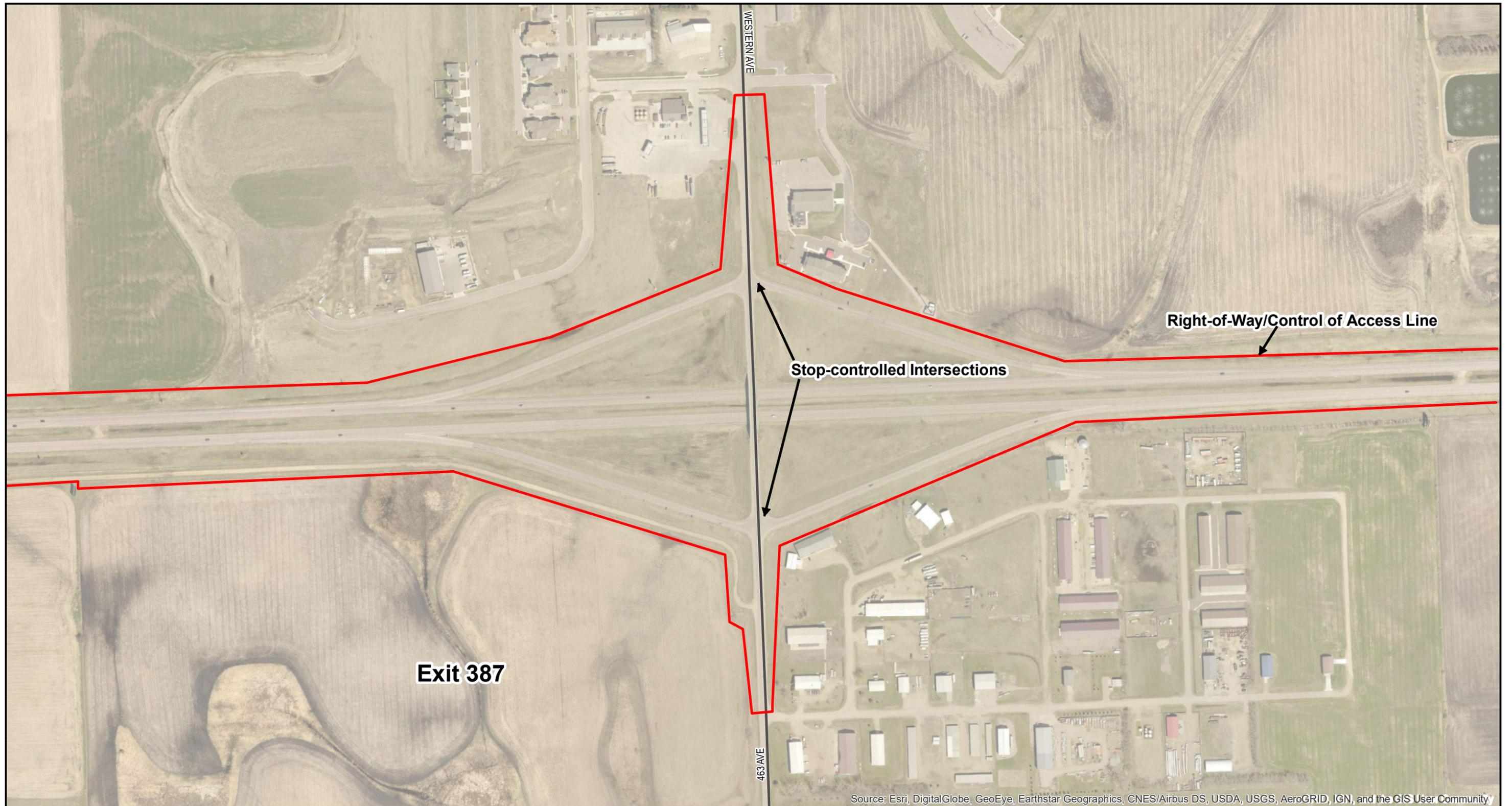
- The foreslopes adjacent to the ramp shoulders do not meet current standards within the clear zone unless protected by guardrail.

- The interchange ramps do not have deceleration or acceleration tapers.
- The distance from the ramp terminal intersections to the mainline centerline is shorter than the current design guidance.
- The distance from the ramp P.I. to the centerline of the crossroad do not meet the current design guidance.

The existing structure over I-90 has a total bridge roadway width of 30 feet, restricting the ability to accommodate increasing travel demand and multi-modal mobility. This limited bridge width also negates the opportunity to develop left-turn lanes across the bridge for I-90 on-ramps. In addition, the current bridge deck does not provide adequate clear zone space between travel lanes and the bridge railing, and separate pedestrian/bicycle facilities are not provided.

The first public roadway intersection south of the interchange is Jeffrey Street, with a west leg approximately 300' south and an east left approximately 730' south (measured center-of-intersection to center-of-intersection) of the eastbound I-90 ramp terminal intersection. A two-lane segment is present between the intersections.

To the north of the interchange, the first access breaks are driveways to a commercial property approximately 530' and 675' north of the westbound I-90 ramp terminal intersection. The first local street intersection is Diamond Trail, approximately 775' north of the westbound I-90 ramp terminal intersection.



**Existing I-90 Exit 387  
Interchange Configuration**  
*Hartford  
South Dakota*

**Legend**

- Railroad
- Stream/River



INTERCHANGE MODIFICATION STUDY  
AND ENVIRONMENTAL REVIEW

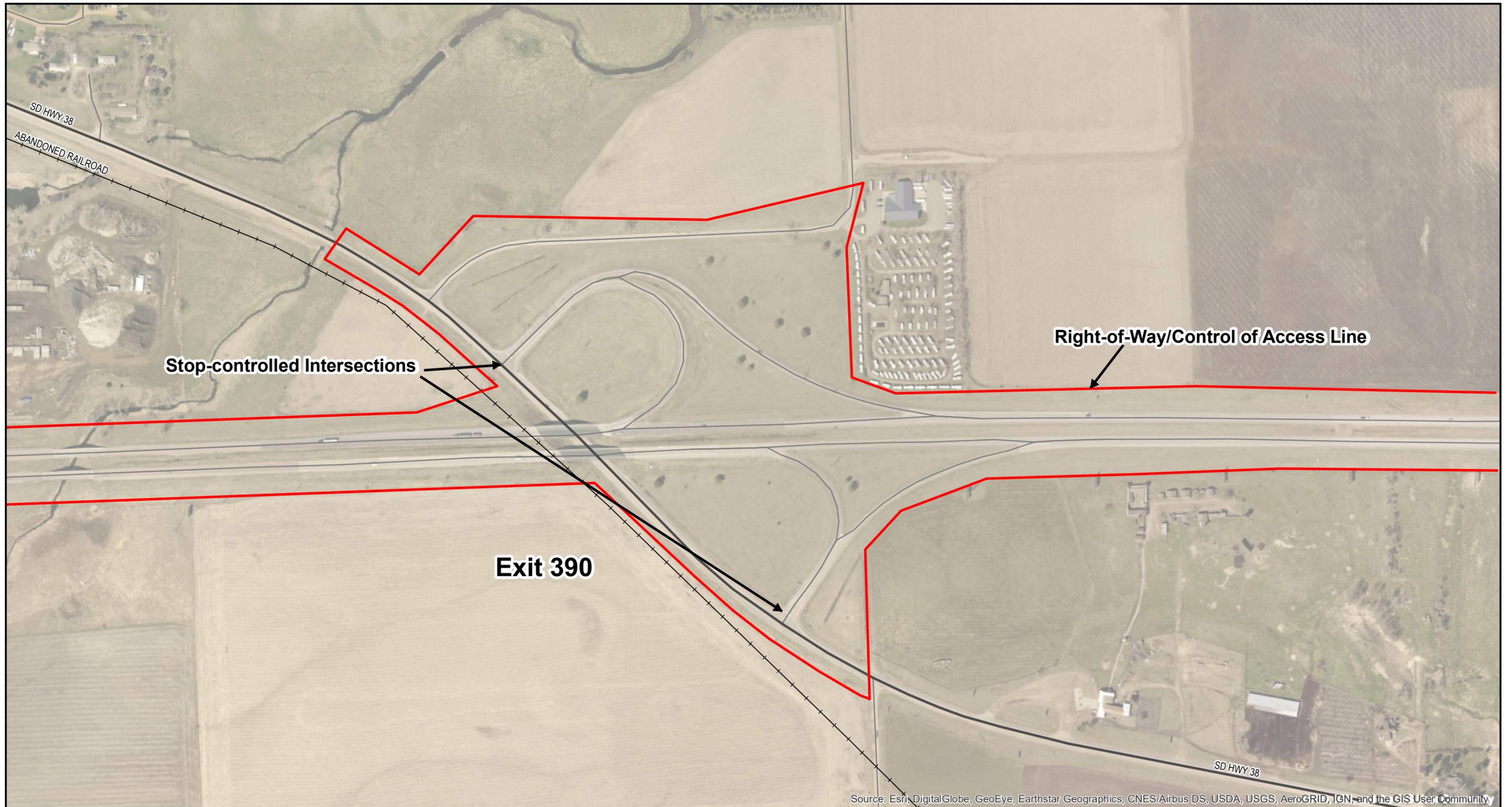


**February 2019**

**Figure 6**

I-90 Exit 390

The I-90 Exit 390 Interchange, shown in **Figure 7**, is a Folded Diamond configuration including a single through lane in each direction on the crossroad (SD 38) through the interchange. An auxiliary right turn lane exists for westbound traffic on SD 38 turning onto the westbound I-90 on-ramp. A left turn lane exists for eastbound traffic on SD 38 turning onto the eastbound I-90 on-ramp. Each interchange ramp has a single lane and ramp terminal intersections are stop-controlled from the off-ramp approach.



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

**Existing I-90 Exit 390  
Interchange Configuration**  
*Hartford  
South Dakota*

**Legend**

- +— Railroad
- Stream/River



INTERCHANGE MODIFICATION STUDY  
AND ENVIRONMENTAL REVIEW



**February 2019**

**Figure 7**

### 3.6. Existing Data

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

#### Traffic Data

Existing traffic data was collected during 2018, summarized in the following table. Peak hour volumes and heavy vehicle percentages were extracted from the data to develop a balanced Existing Conditions traffic data set of AM and PM peak hour traffic volumes.

**Table 2: Traffic Data Collection Summary**

<b><u>Western Avenue Corridor</u></b>	
2018 13-hour Intersection Turning Movement Counts <ul style="list-style-type: none"> <li>• Mickelson Road</li> <li>• Opal Lane</li> <li>• Diamond Trail</li> <li>• I-90 Exit 387 WB Ramp Terminal</li> <li>• I-90 Exit 387 EB Ramp Terminal</li> <li>• Jeffrey Street</li> <li>• 261<sup>st</sup> Street</li> </ul>	Truck Percentages <ul style="list-style-type: none"> <li>• 2018 intersection turning movement counts</li> </ul> Peak Hour Factor (Intersections) <ul style="list-style-type: none"> <li>• 2018 intersection turning movement counts</li> </ul> Speed <ul style="list-style-type: none"> <li>• Posted speed limit</li> </ul>
2018 Western Avenue Corridor Counts <ul style="list-style-type: none"> <li>• North and South of Mickelson Road</li> </ul>	
<b><u>I-90 Freeway and Exits 387 and 390 Interchange Ramps</u></b>	
2018 24-hour I-90 Freeway Counts <ul style="list-style-type: none"> <li>• I-90 EB/WB mainline locations west of Exit 387, between Exits 387 and 390, and east of Exit 390</li> </ul>	Truck Percentages <ul style="list-style-type: none"> <li>• Freeway: 2018 24-hour I-90 freeway counts</li> <li>• Ramps: 2018 13-hour intersection turning movement counts</li> </ul>
2018 24-hour Ramp Counts <ul style="list-style-type: none"> <li>• I-90 Exit 387 ramps</li> <li>• I-90 Exit 390 ramps</li> </ul>	Peak Hour Factor (Intersections) <ul style="list-style-type: none"> <li>• Freeway: 2018 24-hour I-90 freeway counts</li> <li>• Ramps: 2018 13-hour intersection turning movement counts</li> </ul>
2018 13-hour Intersection Turning Movement Counts <ul style="list-style-type: none"> <li>• Exit 390 EB Ramp Terminal</li> <li>• Exit 390 WB Ramp Terminal</li> </ul>	Speed <ul style="list-style-type: none"> <li>• Freeway: 2018 24-hour I-90 freeway counts</li> </ul>

### Future-Year Traffic Data

The development of future-year traffic volumes was based on the existing traffic counts and traffic forecasts from the Sioux Falls 2040 Travel Demand Model (TDM). The Sioux Falls MPO provided the most current version of the Sioux Falls 2040 TDM for this study.

### Crash Data

The SDDOT provided a GIS database of reported crashes within the study over a 5-year period between 2013 and 2017. Crash data, including crash information such as severity, manner of collision, location and contributing circumstances, was reviewable in tabular and spatial format.

### Geometric Data

Geometric data review of existing conditions was based on construction plans provided by the SDDOT.

For conceptual design and refinement of Build Alternatives, the SDDOT provided topographic survey files for the interchange area and along the Western Avenue/463<sup>rd</sup> Avenue corridor.

## 3.7. Operational Performance

### Existing Traffic Operations

Traffic operations for all roadway elements within the study area were evaluated using methodology described in the 6<sup>th</sup> edition of the Highway Capacity Manual (HCM 6). The Highway Capacity Software (HCS 7), release 7.5, was used in the analysis of traffic operations at freeway mainline, merge, and diverge segments, two-way stop-controlled intersections (minor crossroad and ramp-terminal intersection), and signalized intersections. HCS 7 measures average control delay in terms of seconds of delay per vehicle (sec/veh) at two-way stop-control and signalized intersections. It measures density in terms of passenger cars per mile per lane (pc/mi/ln) on freeway segments. Level of Service (LOS) values were applied to these measures in accordance with methodologies outlined in the HCM 6.

A weighted average approach was also used to present an alternative average delay measure at minor two-way stop-controlled intersections with Western Avenue/463<sup>rd</sup> Avenue and SD 38. This methodology uses average control delay values for the stop-controlled approach calculated in the HCM 6 two-way stop-control analysis and assumes zero delay for the major street through and right-turn vehicles to calculate an average delay for all vehicles entering the intersection. A LOS measure was applied to the weighted average delay using HCM 6 all-way stop-control thresholds for intersection delay and LOS.

**Table 3 and Table 4** present the LOS thresholds used to evaluate operations along freeway elements and at intersections within the study area.

**Table 3: Freeway Level of Service Thresholds**

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

Source: Transportation Research Board, Highway Capacity Manual, 2010.

**Table 4: Intersection Level of Service Thresholds**

Level of Service (LOS)	Intersection Delay (sec/veh)	
	Signalized Intersections	Two-Way Stop-Control*, All-Way Stop-Control, Roundabouts
A	0 – 10	0 – 10
B	> 10 – 20	> 10 – 15
C	> 20 – 35	> 15 – 25
D	> 35 – 55	> 25 – 35
E	> 55 – 80	> 35 – 50
F	Demand exceeds capacity; > 80	Demand exceeds capacity; > 50

Source: Transportation Research Board, Highway Capacity Manual, 2010.

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

- Ramp Terminal Intersections:
  - Intersection: LOS C.
  - Individual Movements: LOS D with overall intersection at LOS C or better.
- Signalized Non-Ramp Terminal Intersections (modified by project):
  - Intersection: LOS D.
  - Individual Movements: LOS E with overall intersection at LOS D or better.
  - Individual Movements: Cannot operate with a v/c ratio greater than 1.0.
- Other Non-Ramp Terminal Intersections (modified by project):
  - Intersection: LOS D.
  - Individual Movements: LOS E or F with overall intersection at LOS D or better.
- Intersections Not Modified by Project:
  - Intersection: LOS D.
  - Individual Movements: LOS E or F with overall intersection at LOS D or better.

The LOS results are summarized in **Figure 8** and shown in **Tables 5 - 9**. HCS 7 reports are provided in **Appendix C**.

**Table 5: Western Avenue/463rd Avenue Intersection Traffic Operations – Existing Conditions**

Western Avenue Intersection	Intersection Control Type	AM Peak Period		PM Peak Period	
		Avg. Delay (sec/veh)	LOS	Avg. Delay (sec/veh)	LOS
Mickelson Road (260 <sup>th</sup> Street)	TWSC*	12.9	B	13.2	B
Opal Lane	TWSC*	13.0	B	13.5	B
Diamond Trail	TWSC*	14.1	B	12.8	B
I-90 Exit 387 WB Ramp Terminal	TWSC*	10.6	B	12.4	B
I-90 Exit 387 EB Ramp Terminal	TWSC*	16.3	C	11.5	B
Jeffrey Street	TWSC*	9.8	A	9.8	A
261 <sup>st</sup> Street	TWSC*	10.1	B	10.9	B

\* Two-way stop-control LOS reflects worst-case stop-controlled approach.

**Table 6: Western Avenue/463rd Avenue Local Network Intersection Traffic Operations (Weighted Average) – Existing Conditions**

Western Avenue Intersection	Intersection Control Type	AM Peak Period		PM Peak Period	
		Weighted Avg. Delay (sec/veh)	LOS	Weighted Avg. Delay (sec/veh)	LOS
Mickelson Road (260 <sup>th</sup> Street)	TWSC	2.8	A	1.7	A
Opal Lane	TWSC	1.3	A	0.9	A
Diamond Trail	TWSC	1.8	A	1.8	A
Jeffrey Street	TWSC	1.1	A	1.3	A
261 <sup>st</sup> Street	TWSC	1.3	A	0.5	A

**Table 7: I-90 Exit 390 Ramp Terminal Intersections – Existing Conditions**

SD38 Intersection	Intersection Control Type	AM Peak Period		PM Peak Period	
		Avg. Delay (sec/veh)	LOS	Avg. Delay (sec/veh)	LOS
I-90 Exit 390 WB Ramp Terminal	TWSC*	9.3	A	11.7	B
I-90 Exit 390 EB Ramp Terminal	TWSC*	15.8	C	11.1	B

\* Two-way stop-control LOS reflects worst-case stop-controlled approach.

**Table 8: Western Avenue Corridor Two-Lane Highway Segments – Existing Conditions**

Western Avenue Segment	Direction of Travel	Segment Length (mi)	AM Peak Period		PM Peak Period		Bicycle Score LOS (AM/PM)
			PTSF (%)	LOS	PTSF* (%)	LOS	
Mickelson Road – Diamond Trail	NB	0.25	45.3	B	70.1	D	E/E
	SB		68.8	C	48.9	B	E/E
Diamond Trail – WB Ramp Terminal	NB	0.15	48.9	B	71.9	D	C/C
	SB		72.5	D	51.9	B	C/C
WB Ramp Terminal – EB Ramp Terminal	NB	0.2	40.8	B	44.2	B	E/E
	SB		71.3	D	62.5	C	F/E
EB Ramp Terminal – 261 <sup>st</sup> Street	NB	0.4	45.0	B	45.1	B	F/E
	SB		23.6	A	35.0	A	F/E
Facility	NB	1.0	45.2	B	62.8	C	-
	SB		65.5	C	50.2	B	-

\*PTSF = Percent Time Spent Following

Table 9: I-90 Freeway Segment Traffic Operations – Existing Conditions

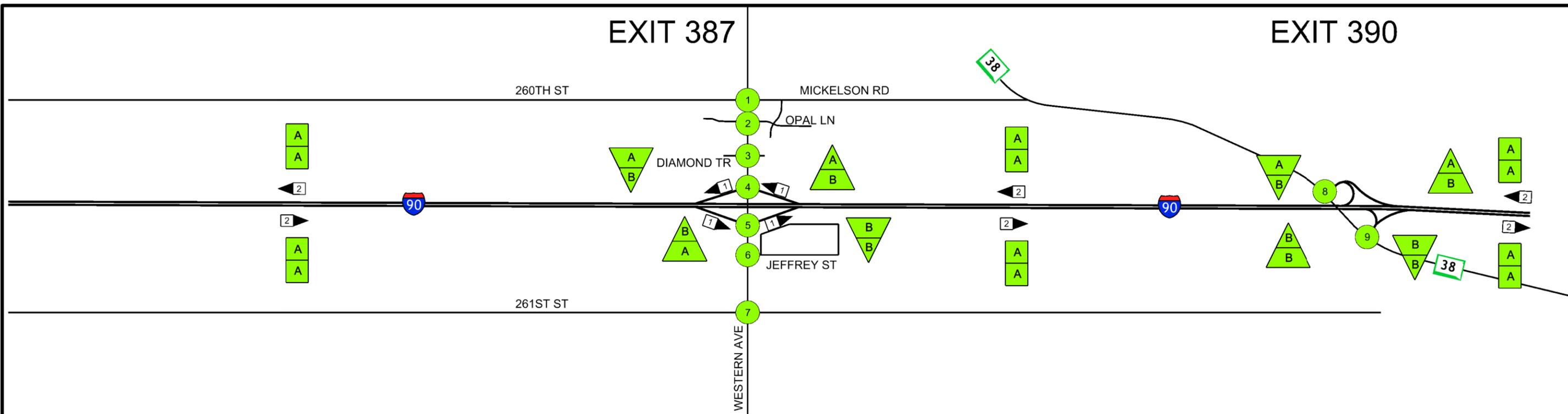
I-90 Freeway Segment	AM Peak Period		PM Peak Period	
	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS
<b>Eastbound I-90</b>				
Basic, 2-lane mainline to Exit 387	5.2	A	3.9	A
Diverge, to Western Avenue (Exit 387)	11.1	B	9.5	A
Basic, 2-lane mainline within Exit 387	5.1	A	3.8	A
Merge, from Western Avenue (Exit 387)	14.8	B	11.1	B
Basic, 2-lane mainline between Exits 387 and 390	8.3	A	4.8	A
Diverge, to SD38 (Exit 390)	14.9	B	10.4	B
Basic, 2-lane mainline within Exit 390	8.6	A	4.6	A
Merge, from SD38 (Exit 390)	17.2	B	11.5	B
Basic, 2-lane mainline from Exit 390	10.2	A	5.1	A
<b>Westbound I-90</b>				
Basic, 2-lane mainline to Exit 390	3.8	A	9.2	A
Diverge, to SD38 (Exit 390)	7.4	A	14.5	B
Basic, 2-lane mainline within Exit 390	3.3	A	7.8	A
Merge, from SD38 (Exit 390)	5.8	A	11.1	B
Basic, 2-lane mainline between Exits 390 and 387	3.4	A	7.8	A
Diverge, to Western Avenue (Exit 387)	8.7	A	14.5	B
Basic, 2-lane mainline within Exit 387	2.8	A	5.7	A
Merge, from Western Avenue (Exit 387)	9.3	A	12.8	B
Basic, 2-lane mainline from Exit 387	3.2	A	5.8	A
<b>Facility</b>				
Eastbound	7.0	B (R) A (U)	4.5	A (R) A (U)
Westbound	3.4	A (R) A (U)	7.1	B (R) A (U)

U = Urban Facility LOS; R = Rural Facility LOS as outlined in HCM6.

The Existing Conditions analysis shows generally good levels of service throughout the study area, although some congestion (LOS D) shows up in the peak hour two-way highway segment analysis on Western Avenue. All analyses of I-90 operations show LOS A or B.

EXIT 387

EXIT 390



### LEGEND

- NUMBER OF LANES AND FLOW DIRECTION
  - AM BASIC FREEWAY LEVEL OF SERVICE  
PM
  - AM RAMP MERGE LEVEL OF SERVICE  
PM
  - AM RAMP DIVERGE LEVEL OF SERVICE  
PM
  - AM INTERSECTION LEVEL OF SERVICE  
PM
- A
B
C
D
E
F

### INTERSECTION PEAK HOUR OPERATIONS

ID	CORRIDORS	CONTROL TYPE		HCM 6TH EDITION LEVEL OF SERVICE		LOCAL STREET WEIGHTED AVERAGE LEVEL OF SERVICE	
		SIGNAL	STOP	AM	PM	AM	PM
<b>Western Ave</b>							
1	Western Avenue & Mickelson Road		X	B	B	A	A
2	Western Avenue & Opal Lane		X	B	B	A	A
3	Western Avenue & Diamond Trail		X	B	B	A	A
4	Western Avenue & I-90 WB Ramp Terminal		X	B	B	-	-
5	Western Avenue & I-90 EB Ramp Terminal		X	C	B	-	-
6	Western Avenue & Jeffrey Street		X	A	A	A	A
7	Western Avenue & 261st Street		X	B	B	A	A
<b>SD 38</b>							
8	SD 38 & I-90 WB Ramp Terminal		X	A	B	-	-
9	SD 38 & I-90 EB Ramp Terminal		X	C	B	-	-

NOTES:  
 WEIGHTED AVERAGE LOS DERIVED FROM HCM 6TH EDITION AWSC LOS CRITERIA  
 \* DENOTES V/C RATIO > 1



NOT TO SCALE

2018 EXISTING CONDITIONS

IMJR TRAFFIC OPERATIONS ANALYSIS  
 I-90 EXIT 387 INTERCHANGE  
 MINNEHAHA COUNTY, SOUTH DAKOTA

JULY 2018

Figure 8

**Existing Bicycle and Pedestrian (Nonautomobile Mode) Facility Evaluation**

The Streets Module in HCS 7 was used to analyze pedestrian and bicycle facilities, when applicable. HCM 7 Chapters 16, 17, and 18 provides a nonautomobile mode LOS criteria for pedestrian and bicycle modes at and through signalized intersections. The quality of service-based LOS score measures a combination of factors that describe performance measures and intersection character. The LOS score criteria are provided in **Table 10**.

**Table 10: Pedestrian and Bicycle Modes Level of Service Criteria**

Level of Service (LOS)	Level of Service Score
A	≤ 2.00
B	> 2.00-2.75
C	> 2.75-3.50
D	> 3.50-4.25
E	> 4.25-5.00
F	> 5.00

*Source: Transportation Research Board, Highway Capacity Manual, 2010.*

Western Avenue corridor segments through the study area were analyzed as two-way highway segments as part of the Existing Conditions analysis, providing an evaluation of bicycle level of service. That analysis showed low levels of service (LOS E, F) due to lack of facilities (lack of shoulders and/or sidewalk and bridge width restrictions across I-90). Analysis of pedestrian level of service was not possible due to the existing roadway configuration, but the lack of specific pedestrian facilities would likely result in low levels of service. It should be noted; however, that the Build Alternatives were developed to provide improvements to both pedestrian and bicycle mobility throughout the corridor when compared to the Existing Conditions.

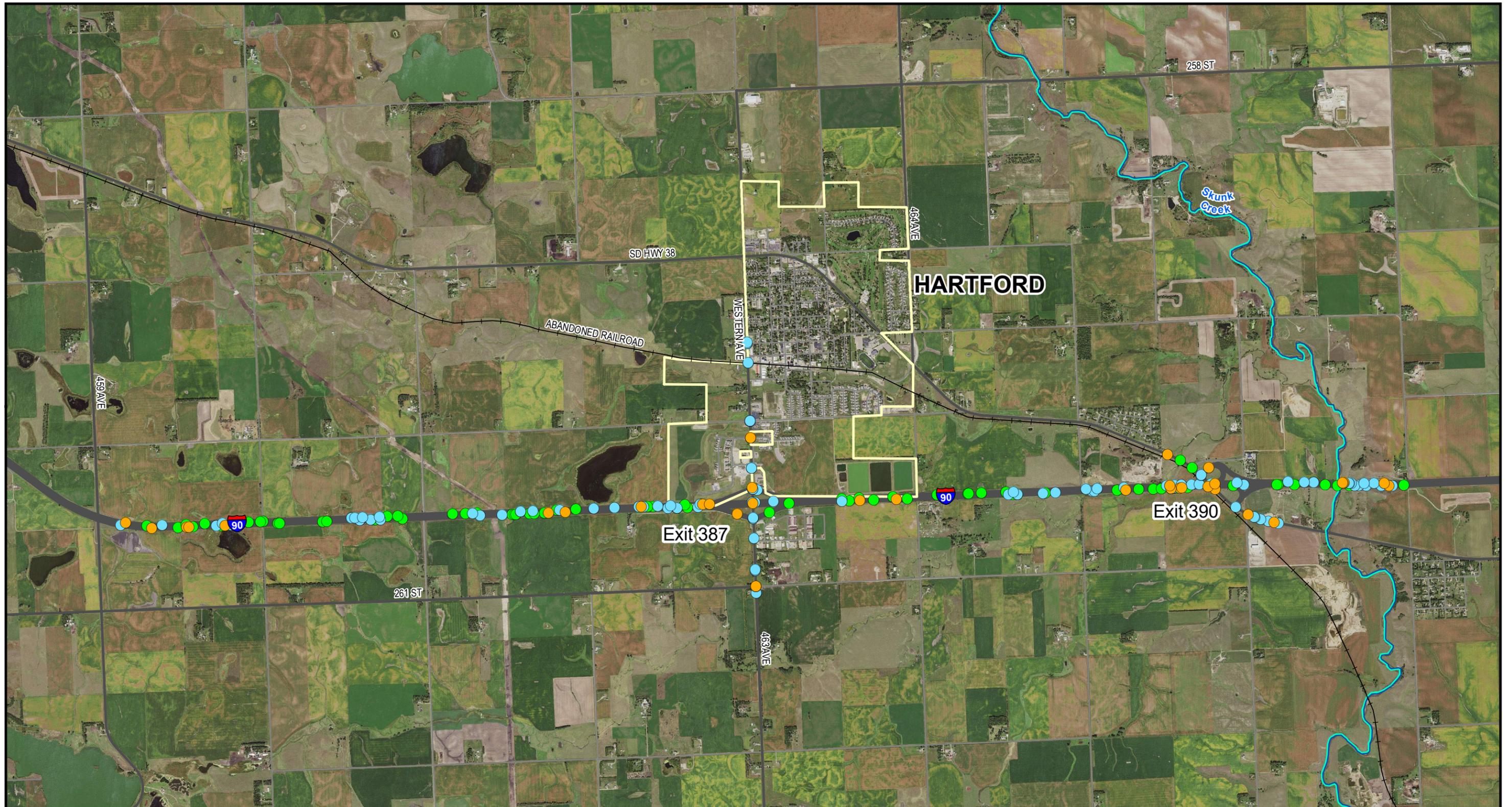
**3.8. Existing Safety Conditions**

A review of crash data was completed for the I-90 Exit 387 study area to identify potential trends or safety concerns within the study area. Crash data from the South Dakota Department of Transportation was collected and analyzed for nine study area intersections, as well as the I-90, Western Avenue and SD Highway 38 segments in the study area. The study period is the five-year period between January 1, 2013 and December 31, 2017. The study area crash distribution is shown in **Figure 10**.

In addition to the three study segments, the study intersections analyzed are:

1. Western Avenue and 261<sup>st</sup> Street
2. Western Avenue and Jeffrey Street
3. Western Avenue and I-90 EB ramps (south ramps)
4. Western Avenue and I-90 WB ramps (north ramps)
5. Western Avenue and Diamond Trail

6. Western Avenue and Opal Lane
7. Western Avenue and Mickelson Road
8. SD 38 and I-90 EB ramps (south ramps)
9. SD 38 and I-90 WB ramps (north ramps)



**Study Area Crash History (2013-2017)**

I-90 Exit 387 Interchange Modification Study  
Hartford, South Dakota

**Legend**

- Injury (37)
- Property Damage Only (100)
- Wild Animal Hit (71)
- City Limits
- Railroad
- Stream/River



**I-90 Exit 387**  
HARTFORD

INTERCHANGE MODIFICATION STUDY  
AND ENVIRONMENTAL REVIEW



0 1,500 3,000  
Feet

**June 2018**

**Figure 9**

Crash frequencies, rates and severities were evaluated for study intersections and roadway segments. To determine if potential safety issues are present, intersection and segment crash rates were compared to typical crash rates on similar facilities. The data used for this comparison was published by the Minnesota Department of Transportation for similar roadway types as similar data from SDDOT is not readily available.

To determine whether crash rates are above typical crash rates simply due to the random nature of crashes or if elevated crash rates are attributable to roadway design or traffic control, the *critical crash rate* analysis methodology was used. The critical crash rate method uses statistical analysis to determine if differences between observed crash rates and crash rates for a larger population of locations are statistically significant. Improvements to reduce crashes will be considered in the alternatives analysis at any locations that may exhibit crash rates outside the critical crash rate. Crash data and statistics are shown in **Table 13**.

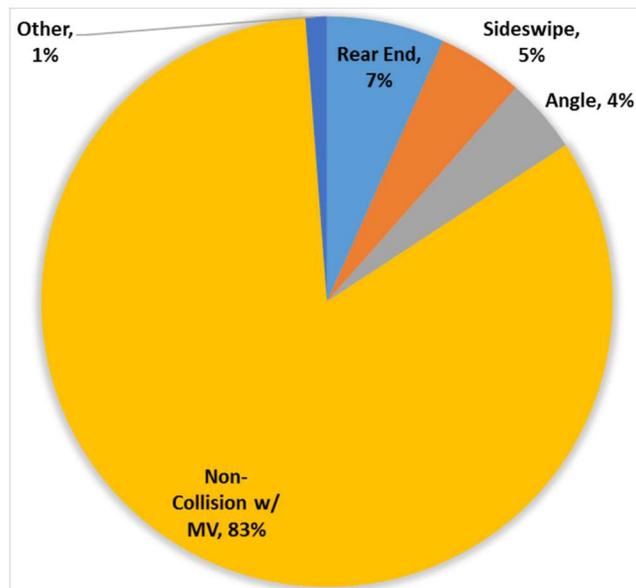
### I-90 Crash History

Crash history was evaluated for the eight mile I-90 segment between 459<sup>th</sup> Avenue and 467<sup>th</sup> Avenue. There were 165 segment crashes in the 5-year analysis period, of which 25 crashes resulted in injuries or possible injuries (six incapacitating injuries). No fatalities were reported in the study period.

Single vehicle crashes were the most reported crash type, with 131 such crashes reported (83 percent). There were 69 single vehicle/animal crashes on I-90.

In the past five years, two trucks collided with the overhead bridge structure at Exit 387. One collision occurred in 2014 and the other in 2016. Both involved flatbed trucks carrying equipment that had not been fully retracted for highway travel.

**Figure 10: I-90 Crash Types (2013-2017)**



**Western Avenue Corridor Crash History**

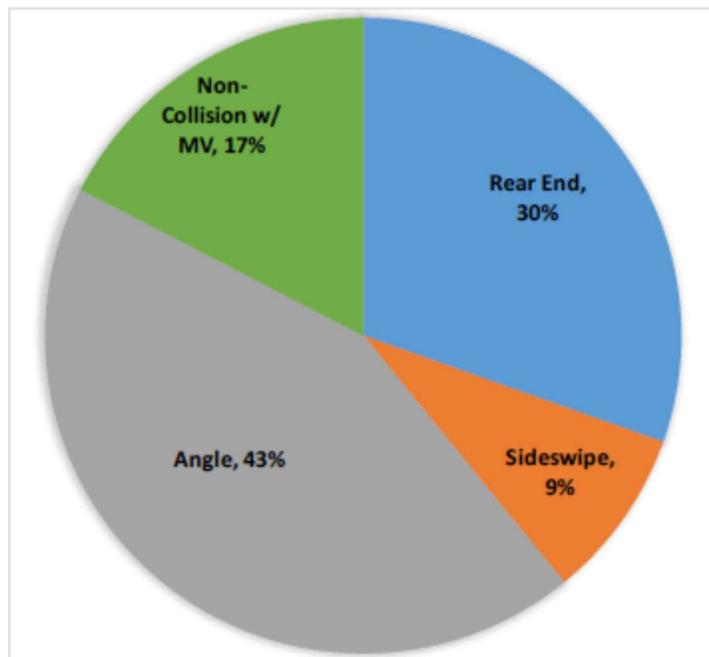
Crash history was evaluated on the one-mile long segment of Western Avenue between 261<sup>st</sup> Street and Mickelson Road. There are seven intersections on this segment, including the I-90 interchange ramps.

The Western Avenue corridor experienced 22 total crashes in the five-year analysis period, with 18 of these being intersection or intersection-related crashes. There were no fatal crashes. A summary of the types of crashes occurring on Western Avenue can be seen in **Figure 11**.

All intersections analyzed on Western Avenue have crash rates below the critical crash rate, however the intersections with 261<sup>st</sup> Street, the I-90 eastbound and westbound ramps, and Mickelson Road have crash rates above the typical rate at many similar intersections. While crash rates are above the typical rate at many Western Avenue intersections due to low traffic volumes, no more than four crashes were reported at any of these intersections, resulting in fewer than one crash per year on average. Angle crashes were the most common intersection crash type at Western Avenue intersections (9 crashes), followed by rear-end crashes (5 crashes).

Of the 18 intersection crashes, six resulted in injuries or possible injuries. There was one incapacitating injury crash at 261<sup>st</sup> Street (sideswipe collision) and one incapacitating injury crash at the I-90 eastbound ramps (run-off-road crash).

**Figure 11: Western Avenue Crash Types (2013-2017)**



**SD Highway 38 Crash History**

Crash history was also evaluated on the 2.9-mile long segment of SD Highway 38 between 465<sup>th</sup> Avenue and 467<sup>th</sup> Avenue.

There were 32 crashes in the SD Highway 38 study area in the five-year analysis period, with only four crashes occurring at the two ramp intersections. No fatal crashes occurred in the study period. A summary of the types of crashes occurring on SD Highway 38 can be seen in **Figure 12**.

Three intersection crashes were reported at the westbound I-90 ramp intersection and one crash was reported at the eastbound I-90 ramp intersection. One incapacitating run-off-road crash involving a motorcycle was reported at the I-90 westbound ramp intersection. The three intersection crashes at the westbound ramps result in a crash rate above the typical crash rate, however this is an average of fewer than one crash per year.

The other 28 crashes on SD Highway 38 were segment-type crashes which is just under the typical rate for similar rural minor arterials. Sixteen of these segment-type crashes were single-vehicle collisions, with 12 involving collisions with animals. The next most prevalent segment crash type was run-off-road crashes, with 10 such crashes being reported. Seven of the 28 segment crashes resulted in injuries or possible injuries, with one incapacitating injury crash being reported (opposite direction sideswipe crash).

**Figure 12: Crash Types on SD Highway 38 (2013-2017)**

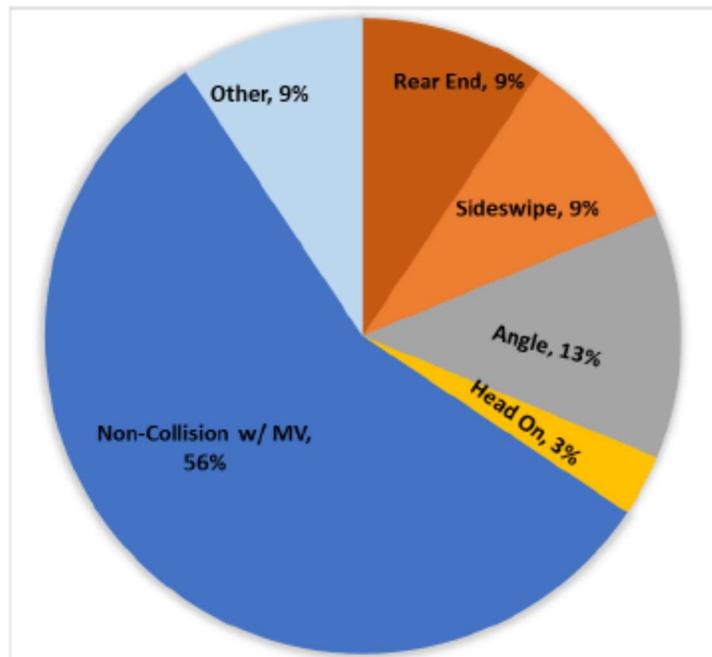


FIGURE 13 - I-90 EXIT 387 CRASH ANALYSIS

INTERSECTION CRASHES

Intersection	Traffic Control	Total Crashes	Crash Severity					Typical Crash Rate*	Observed Crash Rate	Critical Crash Rate	Crash Type					
			Fatal	Incap. Inj.	Non-Incap. Inj.	Poss. Inj.	PDO				Rear End	Sideswipe	Angle	Head On	Non-Collision w/MV	Other
261st St/Western Ave	Rural Thru/Stop	2	0	1	1	0	0	0.25	0.44	0.97	0	1	1	0	0	0
Jeffrey St/Western Ave	Rural Thru/Stop	1	0	0	0	0	1	0.25	0.19	0.90	0	0	0	0	1	0
I-90 EB/Western Ave	Rural Thru/Stop	4	0	1	0	0	3	0.25	0.56	0.80	1	0	2	0	1	0
I-90 WB/Western Ave	Rural Thru/Stop	4	0	0	0	1	3	0.25	0.36	0.68	3	1	0	0	0	0
Diamond Trl/Western Ave	Rural Thru/Stop	2	0	0	0	0	2	0.25	0.18	0.69	0	0	2	0	0	0
Opal Ln/Western Ave	Rural Thru/Stop	2	0	0	0	2	0	0.25	0.23	0.74	0	0	2	0	0	0
Mickelson Rd/Western Ave	Rural Thru/Stop	3	0	0	0	0	3	0.25	0.36	0.76	1	0	2	0	0	0
I-90 EB/SD 38	Rural Thru/Stop	1	0	0	0	0	1	0.25	0.13	0.77	0	0	0	0	1	0
I-90 WB/SD 38	Rural Thru/Stop	3	0	1	0	0	2	0.25	0.36	0.76	1	0	1	0	1	0

\*2015 MnDOT Typical Intersection Crash Rates

SEGMENT CRASHES

Segment	Roadway Section	Total Crashes	Crash Severity					Typical Crash Rate*	Observed Crash Rate	Critical Crash Rate	Crash Type					
			Fatal	Incap. Inj.	Non-Incap. Inj.	Poss. Inj.	PDO				Rear End	Sideswipe	Angle	Head On	Non-Collision w/MV	Other
Western Ave (South of I-90 WB ramps)	Rural Local Road	3	0	0	0	0	3	1.15	1.03	2.94	1	0	1	0	1	0
I-90	Rural Interstate	165	0	6	6	13	140	0.90	0.87	1.08	11	8	7	0	137	2
SD Highway 38	Rural Minor Arterial	28	0	1	5	1	21	1.76	1.51	2.58	2	3	2	1	17	3
Western Ave (North of I-90 WB Ramps)	Rural Local Road	1	0	0	0	0	1	1.15	0.36	2.99	0	0	0	0	1	0

\*2015 MnDOT Typical Intersection Crash Rates

### 3.9. Existing Environmental Conditions

The environmental conditions and subsequent impacts of proposed alternatives are being identified in the Environmental Scan. The Study Area is in southwestern Minnehaha County and is approximately 14 square miles in size and includes the City of Hartford. The Study Area encompasses the range of all reasonable concepts that meet the Project's purpose and need. The Study Area extends along I-90 from three miles west of Exit 387 and slightly east of Exit 390 to capture any effects to traffic on I-90. The Study Area also includes a segment of SD 38 from the 460<sup>th</sup> Avenue intersection to the 466<sup>th</sup> Avenue intersection. Within the Study Area, the following resources have been identified and described in more detail within the Environmental Scan.

- Social Environmental
- Wetlands/Waters of the U.S.
- Cultural Resources
- Bicyclists, pedestrians, recreational resources
- Economic resources
- Noise
- Floodplain
- Soils, vegetation, Fish and Wildlife
- Threatened and Endangered Species
- Water quality

Figure 14, 15 ,16 and 17 illustrate the location of some of these features.

Figure 14: Environmental Study Area

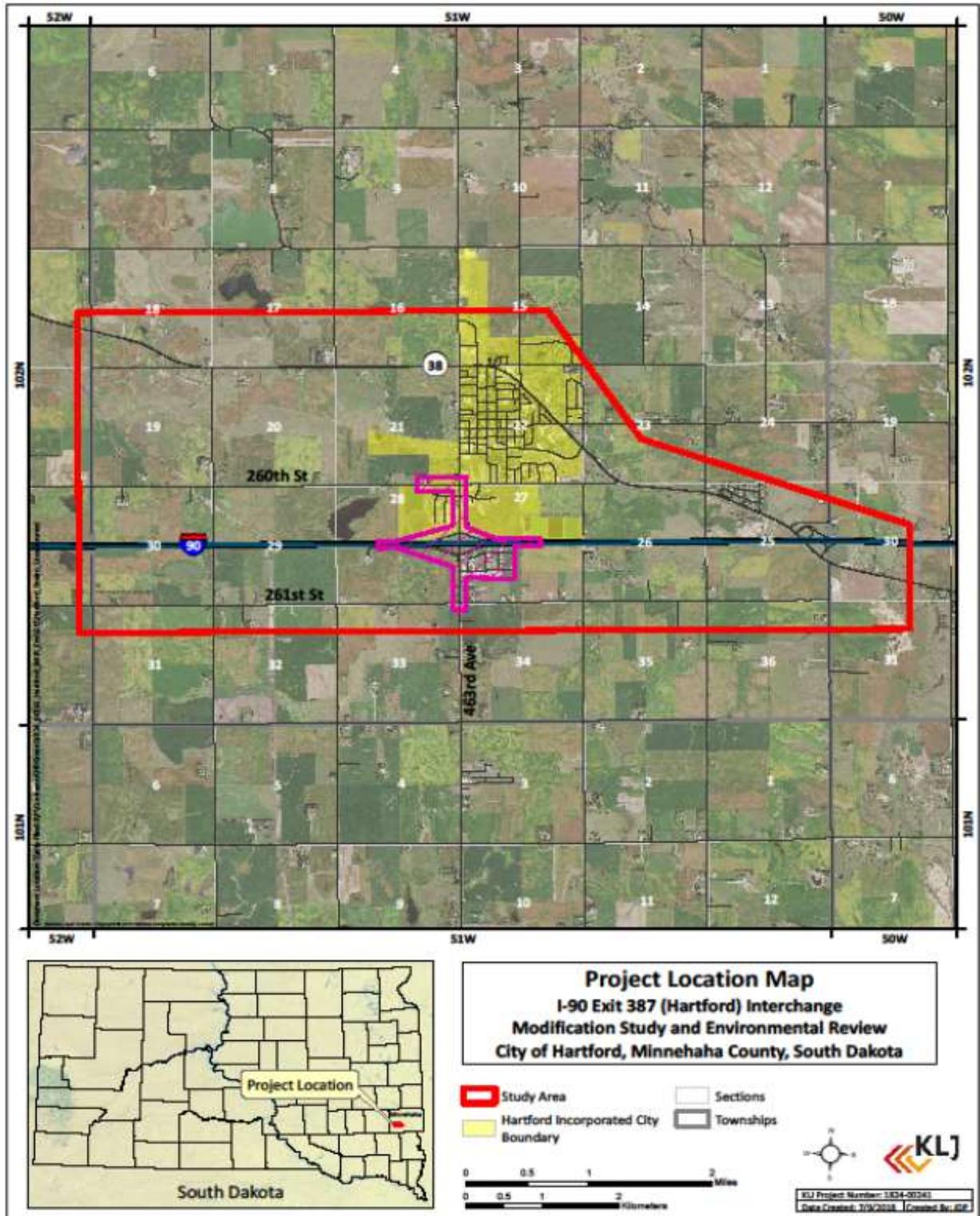




Figure 16: Floodplain

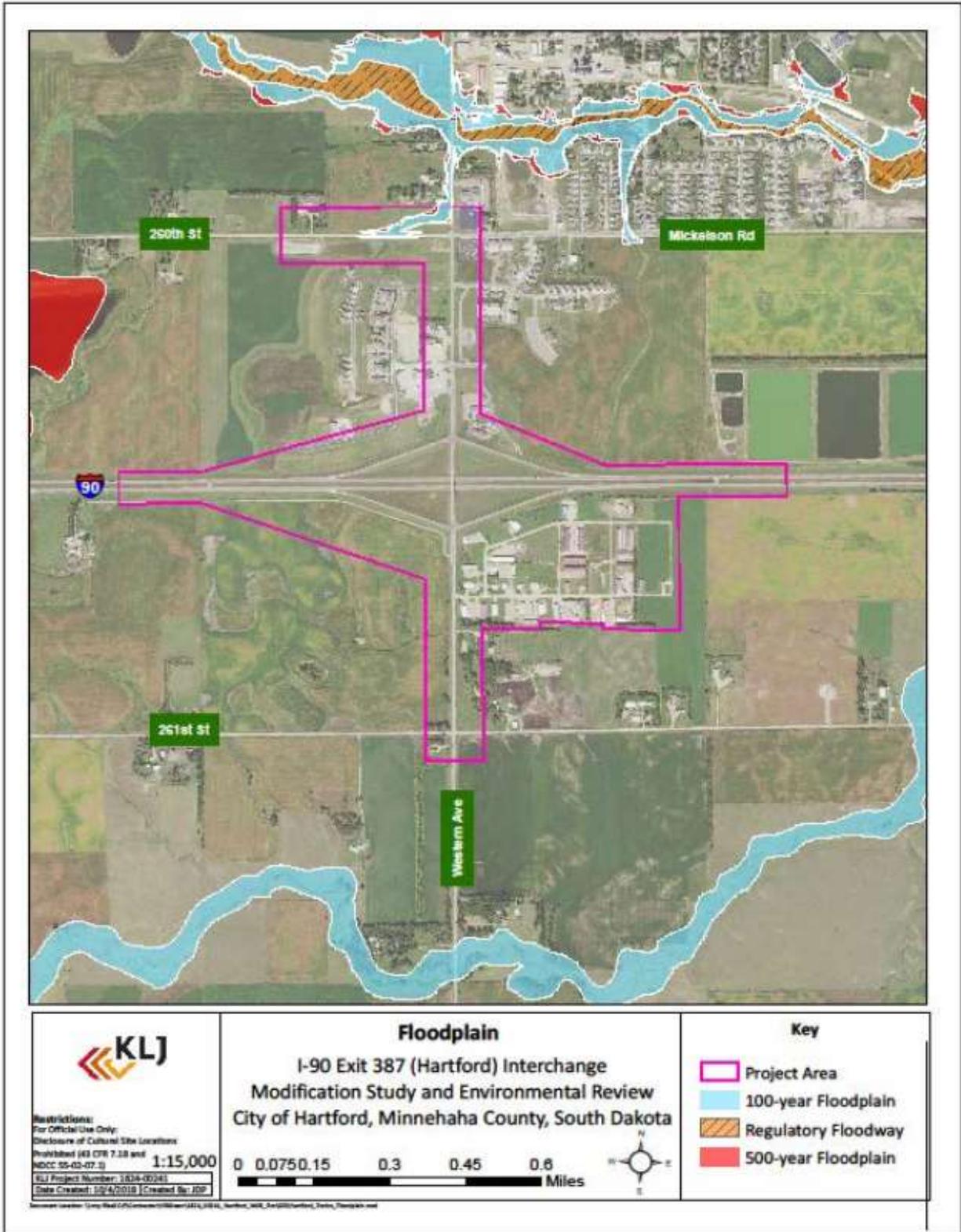
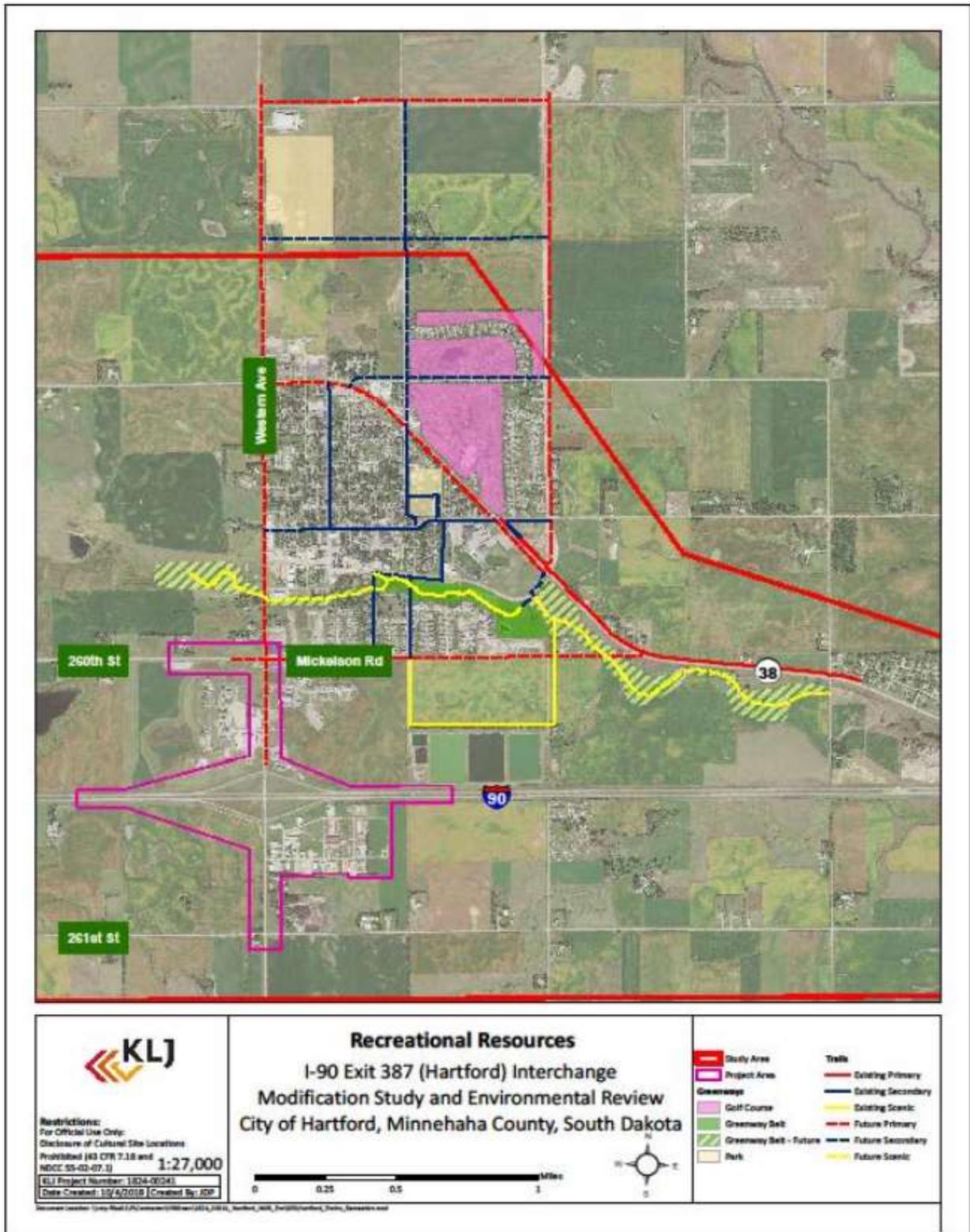


Figure 17: Recreational Resources



## 4. Need

### 4.1. Condition of the Structure

The structure at this I-90 Exit has been hit multiple times, requiring costly repairs and creating traffic delays from the time damage occurs until repairs are completed. Although the clearance of this bridge meets standards, this clearance is the lowest on the I-90 westbound side from the Minnesota state line to Exit 374 (Montrose). The following information provided by the SDDOT details the known bridge hits:

- First strike was on July 1, 2014. The repair cost approximately \$270,324 in contractor costs. This cost did not include state employee or mileage costs. The repairs required emergency closures for approximately 51 days.
- Second strike was on August 1, 2016. The repair cost was approximately \$584,997, including state employee and mileage costs. This repair required two separate closures for a total duration of approximately 117 days.

Each strike causes traffic delays since traffic is reduced to one lane across the bridge. In addition, safety is reduced due to the lane reduction and presence of a work zone. Adjacent businesses have reported economic impacts due to repair closures.

Each time the bridge is hit, the SDDOT has been able to use heat strengthening to repair the bridge to SDDOT safety standards. Heat strengthening can only be used a limited number of times until it is no longer effective. If the bridge is hit again, the repair method would likely be a partial girder replacement. Incurring greater cost and requiring an emergency partial or full bridge closure. Emergency closures affect the public by not allowing for planned detours. The unexpected closures can also affect businesses economically and operationally.

### 4.2. Transportation Demand

Analysis was conducted of Interstate and crossroad operations under 2018 conditions. That analysis indicated that all Interstate facilities operated at Level of Service (LOS) A or B. Intersections on the crossroad corridors, including Western Avenue and SD 38 operate at LOS A, B or C. Some crossroad segments on Western Avenue, however, operate at LOS D during the peak weekday hours.

Planned growth within the City of Hartford and the Sioux Falls Metropolitan Planning Organization (MPO) area indicate that travel demand will increase in the future and put increased pressure on transportation facilities within the study area. Future transportation demand will be analyzed in detail in Chapter 6 of this IMJR.

The current bridge at Exit 387 does not provide specific facilities for pedestrian and bicycle users, although a multi-use path exists along the south side of Mickelson Road and future multi-use path development is planned. The existing commercial and industrial area and planned residential expansion south of I-90 will create increased demand and need for sidewalks and multi-use paths.

### 4.3. Planned Land Use

The *Hartford Comprehensive Plan 2017-2037* indicates a steady growth trend within the Hartford Community and plans for expansion of residential, commercial and industrial uses within the study area, particularly south of I-90. I-90 presents a barrier between much of this planned development and interactions with the rest of the community. Careful planning of the Exit 387 interchange area is necessary to implement existing land use plans.

## 5. Alternatives

This chapter presents and evaluates concepts developed for the I-90 Exit 387 (Hartford) Interchange and Western Avenue corridor. At this stage of concept development, interchange and corridor concepts were prepared independently. As the project progresses, these concepts may be combined for specific Build Alternatives. The purpose of this chapter is to introduce each concept and narrow the number of concepts down to those that will be developed into Build Alternatives. The Build Alternatives will be analyzed to determine the preferred alternative that will be fully considered later in the Interchange Modification Justification Report (IMJR) and the Environmental Document.

### 5.1. Relation to the Environmental Process

The National Environmental Policy Act (NEPA) and other environmental requirements rely on a project decision-making process guided by the Purpose and Need for the project. The purpose is a brief statement of the primary intended transportation objective and related goals to be achieved by the proposed transportation improvement. The need is a condition(s) sought to be relieved or a statement of the problem in need of a solution. The alternatives are developed, evaluated, and compared based on how well they address the purpose and need statement. The purpose and need statement is developed with the consideration of stakeholders, public and agency input.

The purpose of this Project is to accommodate existing and future traffic needs for the I-90 Exit 387 (Hartford) Interchange with a facility that:

- Replaces the existing bridge structure accommodating higher clearances,
- Accommodates the future traffic capacity needs projected along S. Western Avenue, and
- Accommodates multi-modal transportation such as pedestrians and bicyclists as the City expands to south of I-90.

### 5.2. Preliminary Improvement Concepts

#### No-Build Alternative

A No-Build Alternative is carried through the entire environmental process. It assumes no substantial modifications to the study area except for routine maintenance and preservation type projects. Therefore, the No-Build Alternative would not include replacement of the existing bridge and other interchange-related capacity or multi-modal improvements.

#### Build Alternatives

The Project will consider the I-90 Exit 387 interchange and the extents of Western Avenue where traffic movements would be affected by the work at the interchange. Currently, the development

of Build Alternatives is in the concept design process, which provides the high-level, conceptual view of potential improvements. **Each concept presented in this chapter has been developed to meet the Purpose and Need of the project.** Concepts are evaluated and screened as part of this report. Those concepts that are not screened out will be pulled forward to a more detailed refinement and evaluation as Build Alternatives.

### *Western Avenue Bridge Staging Options*

In addition to a Full-Closure with Detour option, the following three Bridge Staging Options were developed based on a 3-lane roadway plus sidewalk and shared-use path (**Figures 18 and 19**):

#### **1. Maintain One Lane of Two-Way Traffic**

- a. One 12-foot wide lane of two-way traffic during each of two stages
- b. Maintains existing horizontal alignment of Western Avenue
- c. Temporary barrier placed at edge of deck during Stage 2, requiring bracing to prevent deflection

#### **2. Maintain Two Lanes of Traffic**

- a. Two 10-foot wide lanes of head-to-head traffic during each of two stages
- b. Requires horizontal alignment of Western Avenue to be shifted approximately 11 feet to west
- c. Temporary barrier placed at edge of deck during Stage 2, requiring bracing to prevent deflection

#### **3. Maintain Two Lanes of Traffic and Construct Bridge in 3 Stages**

- a. Two 10-foot wide lanes of head-to-head traffic during first two stages
- b. Maintains traffic during Stage 2 on portion of bridge that will be sidewalk when bridge is fully constructed
  - i. Eliminates possibility of cantilevering sidewalk from back of barrier
  - ii. Permanent separation barrier between traffic and sidewalk cannot be built in Stage 2
- c. Temporary barrier placed at edge of deck during Stages 1 and 2, requiring bracing to prevent deflection
- d. Requires a third stage to construct permanent separation barrier between traffic and sidewalk
- e. Requires horizontal alignment of Western Avenue to be shifted 5.5 feet to west

### *I-90 Exit 387 Interchange Concepts*

In addition to the No-Build alternative, the following interchange concepts were developed. Interchange concept layouts and profiles are shown in **Figures 20-28**.

#### **1. Standard Diamond**

- a. Reconstructs the existing standard diamond interchange
- b. Stop control from the off-ramp approaches
- c. Bridge staging options:

- i. Full Closure with Detour
  - ii. Maintain one lane of traffic (Bridge Staging Option 1)
- 2. Standard Diamond with Roundabouts**
  - a. Reconstructs the existing standard diamond interchange
  - b. Roundabout ramp terminal intersections
  - c. Bridge staging options:
    - i. Full Closure with Detour
    - ii. Maintain one lane of traffic (Bridge Staging Option 1)
- 3. Standard Diamond, Western Avenue Shifted West**
  - a. Reconstructs the existing standard diamond interchange
  - b. Stop control from the off-ramp approaches
  - c. Bridge staging options:
    - i. Maintain two lanes of traffic with approximately 11-foot shift in alignment (Bridge Staging Option 2)
    - ii. Maintain two lanes of traffic with 5.5-foot shift in alignment (Bridge Staging Option 3)
- 4. Standard Diamond with Roundabouts, Western Avenue Shifted West**
  - a. Reconstructs the existing standard diamond interchange
  - b. Roundabout ramp terminal intersections
  - c. Bridge staging options:
    - i. Maintain two lanes of traffic with approximately 11-foot shift in alignment (Bridge Staging Option 2)
    - ii. Maintain two lanes of traffic with 5.5-foot shift in alignment (Bridge Staging Option 3)
- 5. Standard Diamond with Lowered I-90**
  - a. Reconstructs the existing standard diamond interchange with similar features as Standard Diamond Concept 1
  - b. I-90 profile lowered approximately 1-foot below the Western Avenue corridor to allow for a lower Western Avenue profile
    - i. Required limits of I-90 reconstruction included in concept
- 6. Standard Diamond with Roundabouts and Lowered I-90**
  - a. Reconstructs the existing standard diamond interchange with similar features as Standard Diamond, Western Avenue Shifted West, Concept 3
  - b. I-90 profile lowered approximately 1-foot below the Western Avenue corridor to allow for a lower Western Avenue profile
    - i. Required limits of I-90 reconstruction included in concept
- 7. Standard Diamond with Lowered I-90 and Western Avenue Shifted West**

- a. Reconstructs the existing standard diamond interchange with similar features as Standard Diamond with Roundabouts Concept 2
  - b. I-90 profile lowered approximately 1-foot below the Western Avenue corridor to allow for a lower Western Avenue profile
    - i. Required limits of I-90 reconstruction included in concept
- 8. Standard Diamond with Roundabouts and Lowered I-90, Western Avenue Shifted West**
- a. Reconstructs the existing standard diamond interchange with similar features as Standard Diamond with Roundabouts, Western Avenue Shifted West, Concept 4
  - b. I-90 profile lowered approximately 1-foot below the Western Avenue corridor to allow for a lower Western Avenue profile
    - i. Required limits of I-90 reconstruction included in concept
- 9. Standard Diamond with I-90 over Western Avenue**
- a. Reconstruction of existing standard diamond interchange with I-90 over Western Avenue
    - i. Required limits of I-90 mainline reconstruction included in concept, including structures
  - b. Stop control from the off-ramp approaches
  - c. Structure options:
    - i. Phased construction requiring closures on Western Avenue

Interchange concept notes:

- At this stage, all interchange concepts are assumed constructible based on a high-level constructability and maintenance of traffic review. Concepts carried forward from this process will be evaluated in more detail during the refinement of build options.
- A typical 3-lane bridge, plus sidewalk and shared-use path, over I-90 was used for Concepts 1-8. Bridge widths will be further refined for build options being carried forward.
- Detour route impacts have not yet been identified and may increase costs of concepts requiring full closures.
- Property impacts based on standard offsets from proposed improvements. The build option refinement phase will model proposed modifications to better understand fill impacts.
- Ramp junction design incorporated tapered exit and parallel entrance.
- Control of Access (COA) distances are subject to change. Distances are currently noted to next access break.
- Interchange layout limits are shown to end of potential COA.

***Western Avenue Concepts***

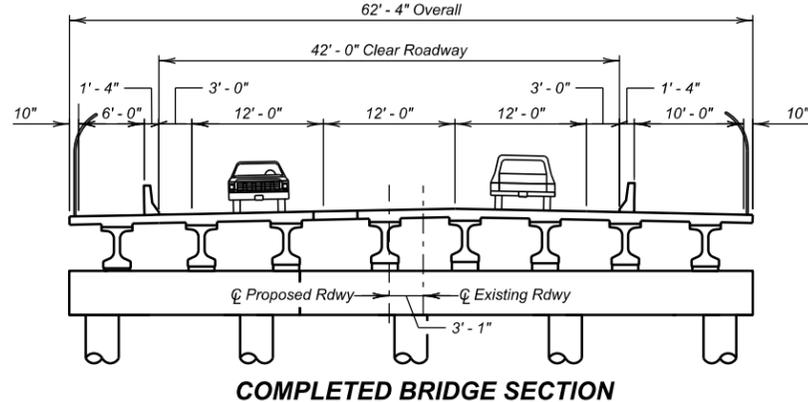
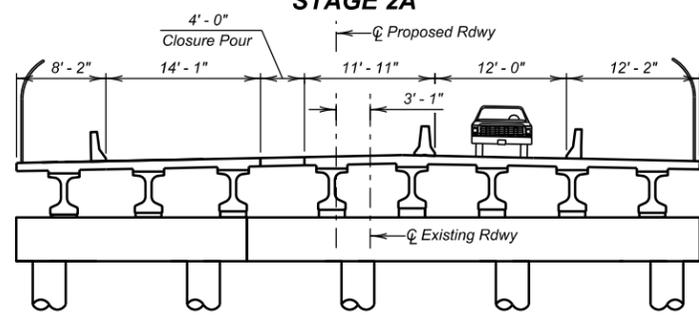
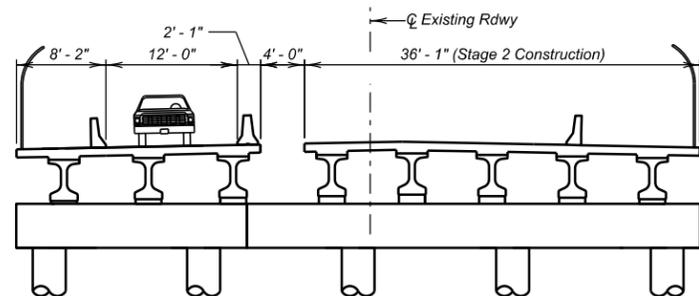
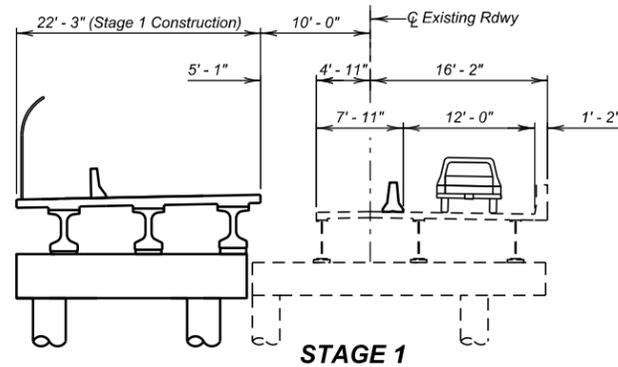
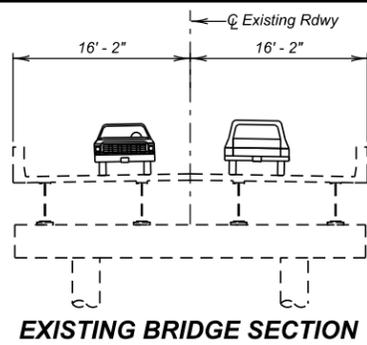
In addition to the No-Build alternative, the following corridor concepts were developed (**Figures 29-33**):

- A. 2-Lane Rural Section (North of Interchange only)**
  - a. Upgrades the current rural road facility to include 8-foot shoulders, turn lanes where warranted, sidewalk, and shared-use path
  - b. Shown with connections to Interchange Concept 1
  
- B. 3-Lane Urban Section (North of Interchange only)**
  - a. Provides an urban road section with a continuous left-turn lane, warranted right-turn lanes, sidewalk, and shared-use path
  - b. Shown with connections to Interchange Concept 1
- C. 2-Lane Rural Section With Shared-Use Path (South of Interchange only)**
  - a. Upgrades the current rural road facility to include 4-foot shoulders, left-turn lanes where warranted, and 100-foot right-of-way (ROW)
  - b. Shared-use path extension southward from the interchange to Jeffrey Street
  - c. Shown with connections to Interchange Concept 1
- D. 2-Lane Rural Section Without Shared-Use Path (South of Interchange only)**
  - a. Upgrades the current rural road facility to include 4-foot shoulders and left-turn lanes where warranted, and 100-foot ROW
  - b. Shown with connections to Interchange Concept 1
- E. Southwest Quadrant Frontage Road Realignment**
  - a. Realigns frontage road for connection with Western Avenue at Jeffrey Street
  - b. Shown with connections to Interchange Concept 1

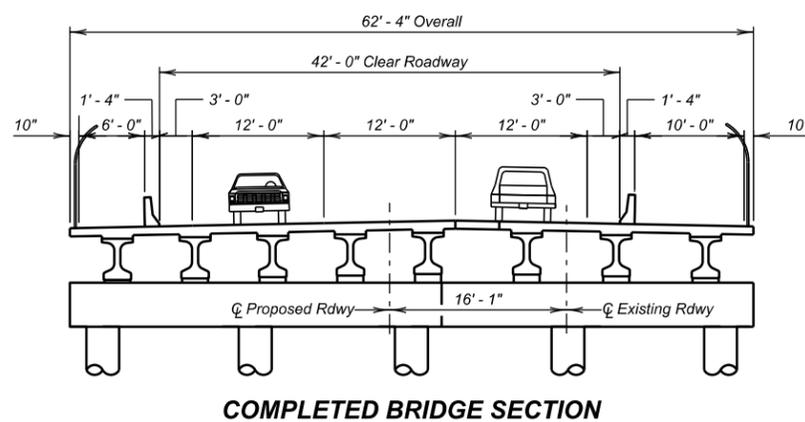
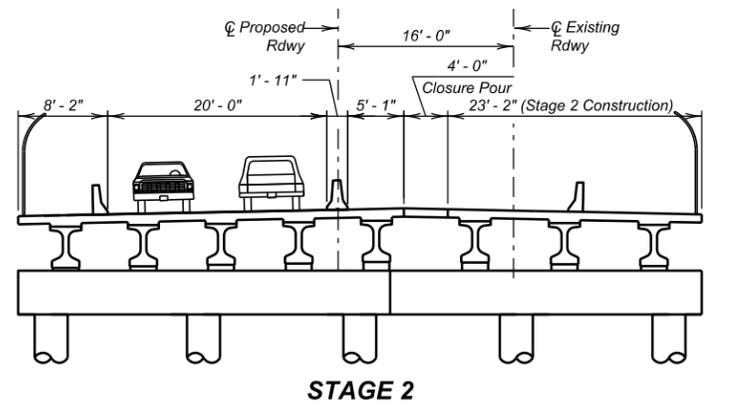
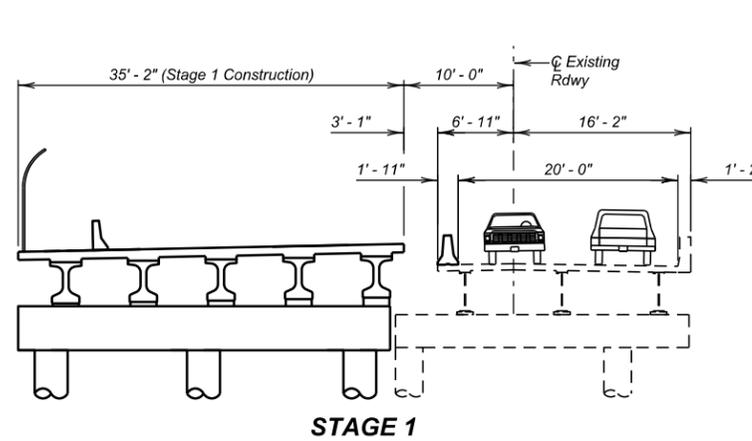
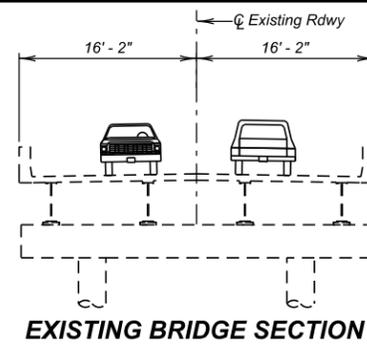
Corridor concept notes:

- At this stage, all corridor concepts are assumed constructible. Concepts carried forward from this process will be evaluated in more detail during the refinement of build options.
- Each corridor concept may be applied to any of the interchange concepts. A reverse curve transition between concepts will be needed for offset interchange alignments.

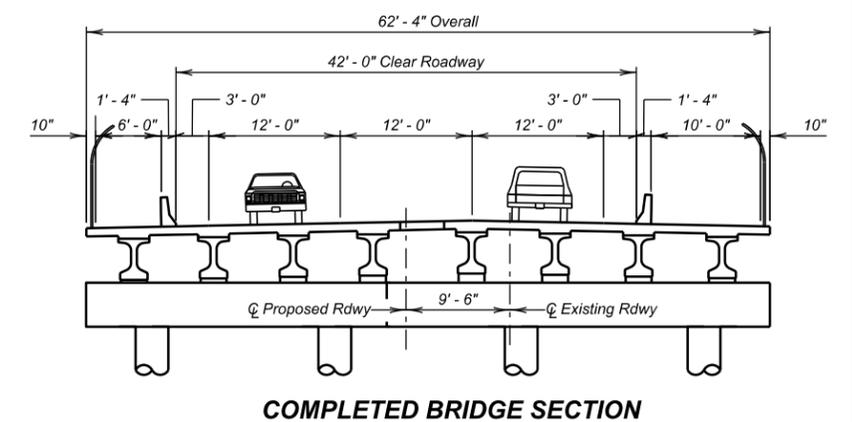
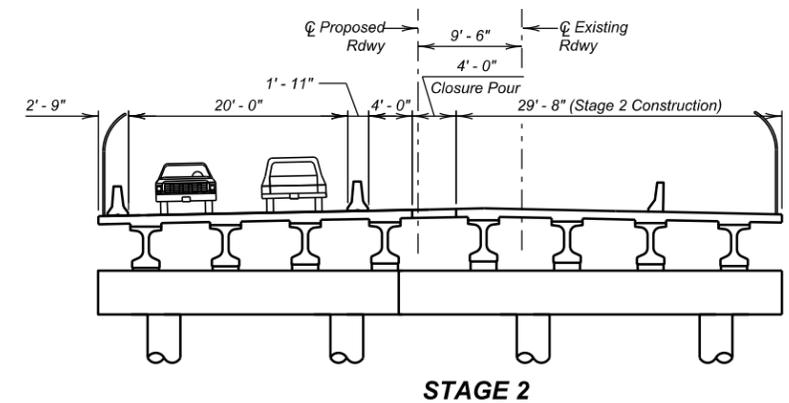
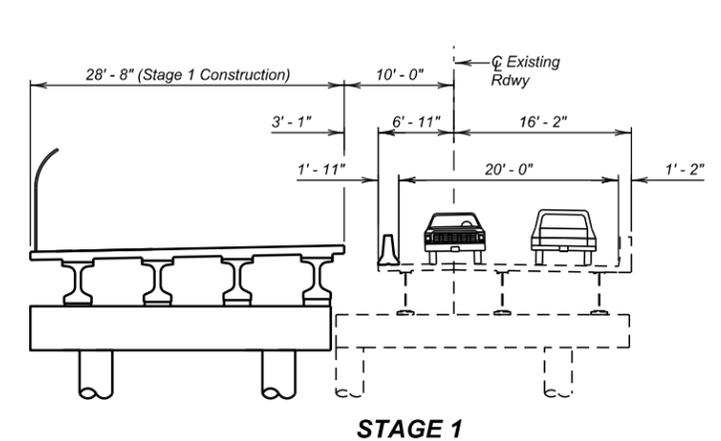
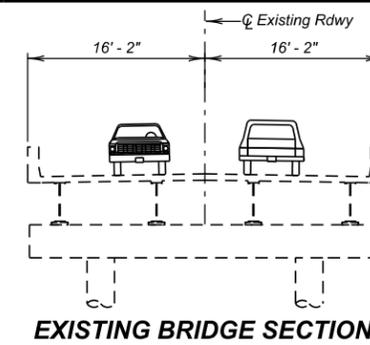
**DIAMOND  
Option 1 (1 Lane)**



**DIAMOND  
Option 2 (2 Lanes w/  
Sidewalk in Stage 2)**



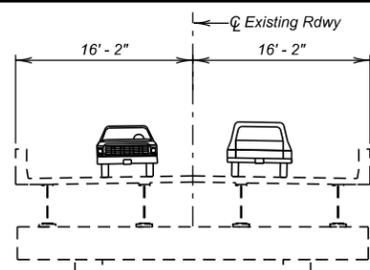
**DIAMOND  
Option 3 (2 Lanes w/o  
Sidewalk in Stage 2)**



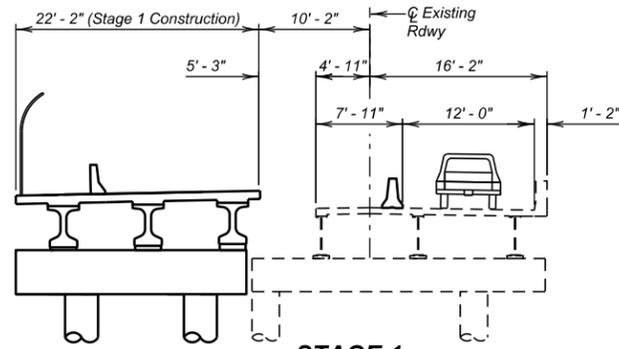
CONSTRUCTION STAGING  
I-90 EXIT 387

DESIGNED BY EM	CK. DES. BY KJB	DRAFTED BY EM	<b>Figure 18</b> BRIDGE ENGINEER

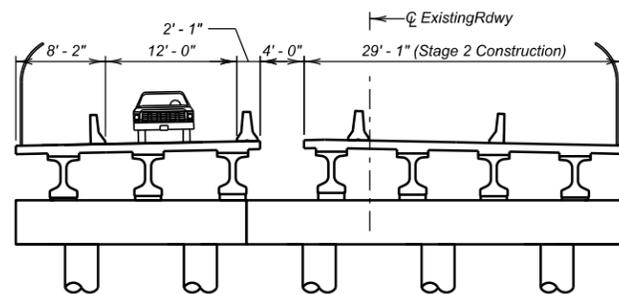
**ROUNDAABOUT  
Option 1 (1 Lane)**



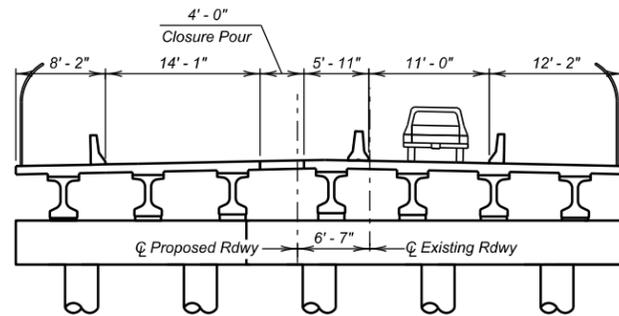
**EXISTING BRIDGE SECTION**



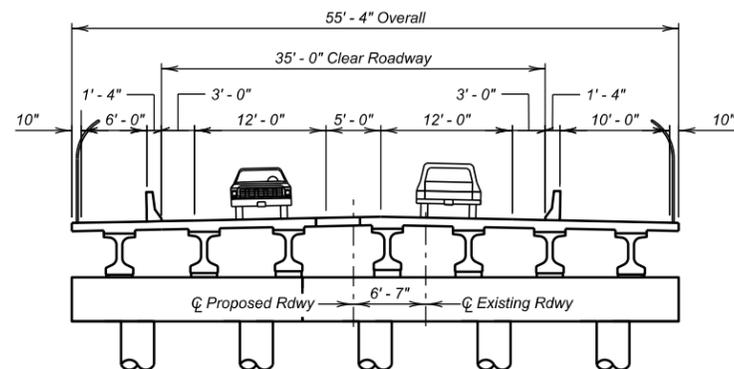
**STAGE 1**



**STAGE 2A**

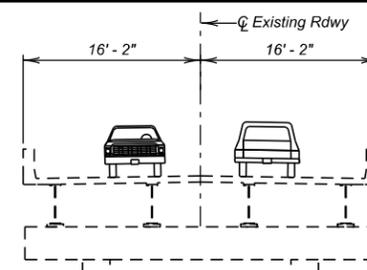


**STAGE 2B**

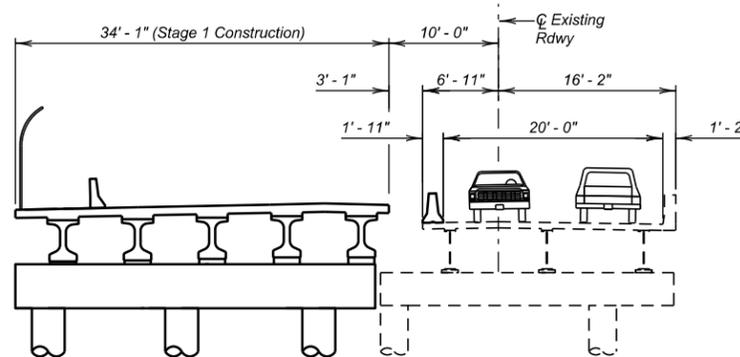


**COMPLETED BRIDGE SECTION**

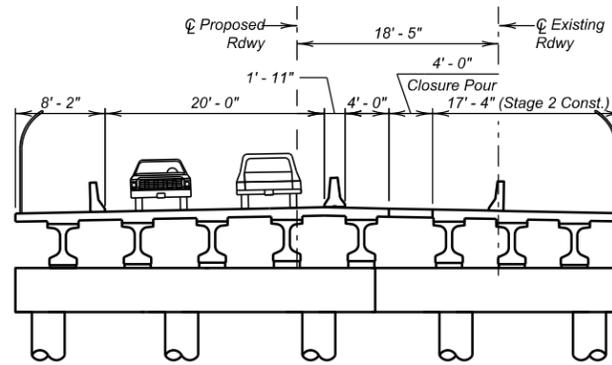
**ROUNDAABOUT  
Option 2 (2 Lanes w/  
Sidewalk in Stage 2)**



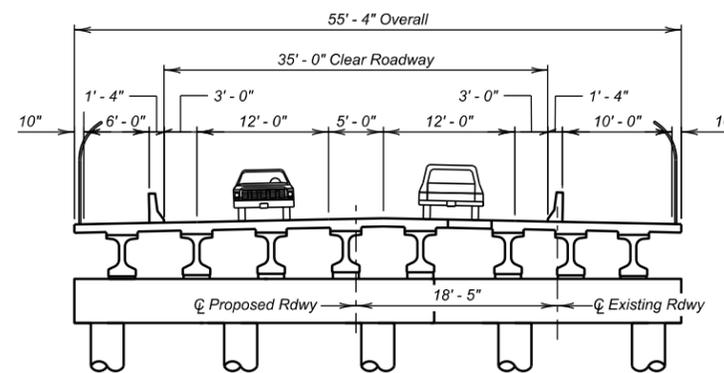
**EXISTING BRIDGE SECTION**



**STAGE 1**

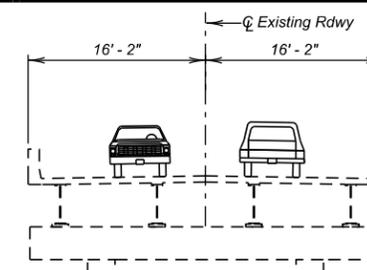


**STAGE 2**

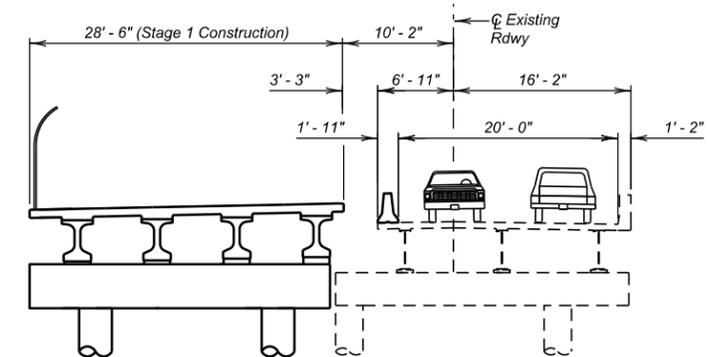


**COMPLETED BRIDGE SECTION**

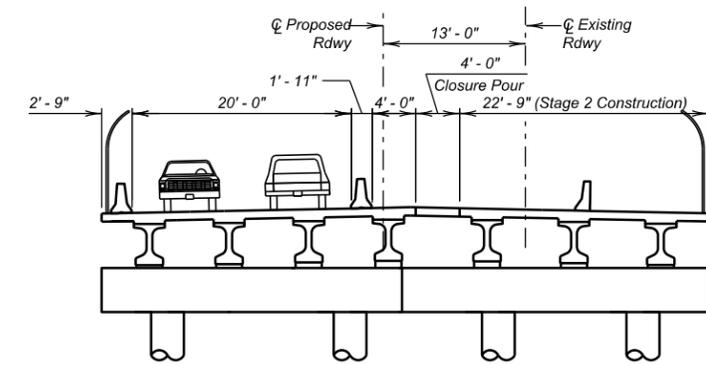
**ROUNDAABOUT  
Option 3 (2 Lanes w/o  
Sidewalk in Stage 2)**



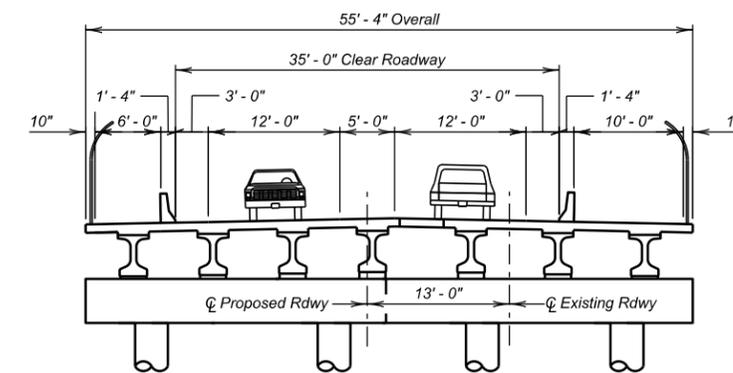
**EXISTING BRIDGE SECTION**



**STAGE 1**



**STAGE 2**



**COMPLETED BRIDGE SECTION**

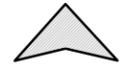
**CONSTRUCTION STAGING**

I-90 EXIT 387

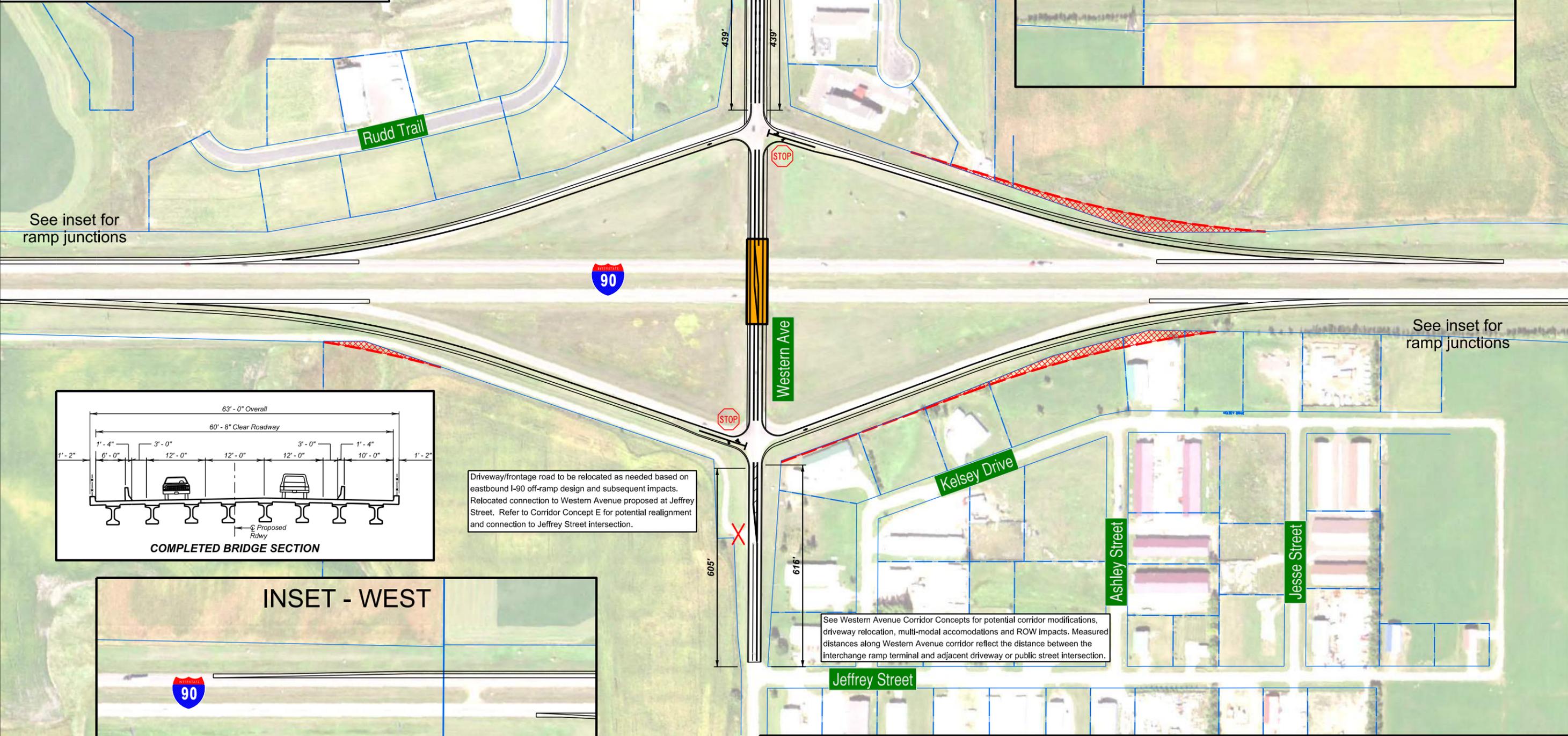
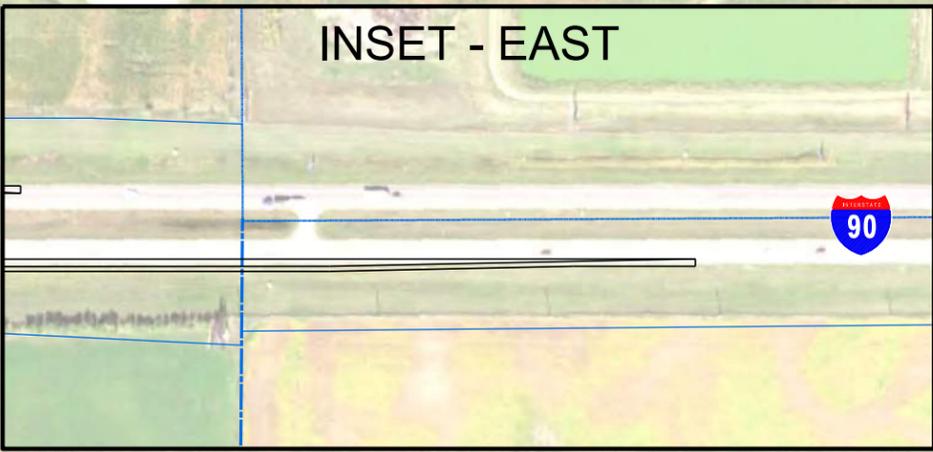
DESIGNED BY EM	CK. DES. BY KJB	DRAFTED BY EM	<b>Figure 19</b> BRIDGE ENGINEER

**LEGEND**

-  Bridge Construction
-  Existing ROW/Property Line
-  Potential Impact Area (75' from Ramp Control Line)
-  Potential ROW Impact
-  Proposed Driveway Closure

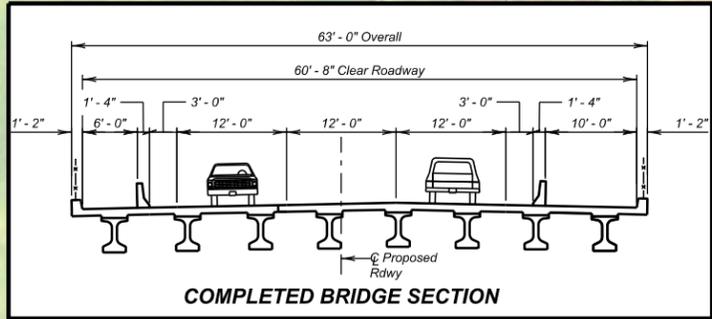
  
**NORTH**  
 SCALE  
 1:300

See Western Avenue Corridor Concepts for potential corridor modifications and ROW impacts. Measured distances along Western Avenue corridor reflect the distance between the interchange ramp terminal and adjacent driveway or public street intersection.



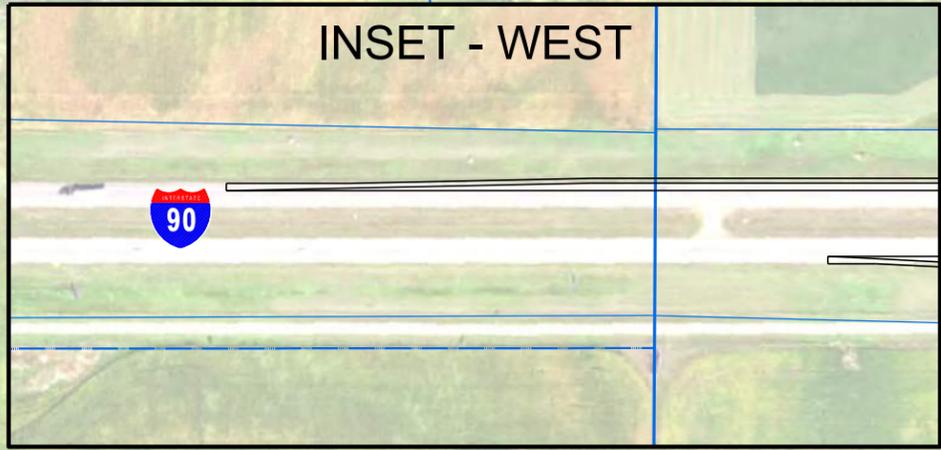
See inset for ramp junctions

See inset for ramp junctions



Driveway/frontage road to be relocated as needed based on eastbound I-90 off-ramp design and subsequent impacts. Relocated connection to Western Avenue proposed at Jeffrey Street. Refer to Corridor Concept E for potential realignment and connection to Jeffrey Street intersection.

See Western Avenue Corridor Concepts for potential corridor modifications, driveway relocation, multi-modal accommodations and ROW impacts. Measured distances along Western Avenue corridor reflect the distance between the interchange ramp terminal and adjacent driveway or public street intersection.



**CONCEPT 1: STANDARD DIAMOND**

**I-90 EXIT 387 INTERCHANGE MODIFICATION STUDY**

Hartford, South Dakota

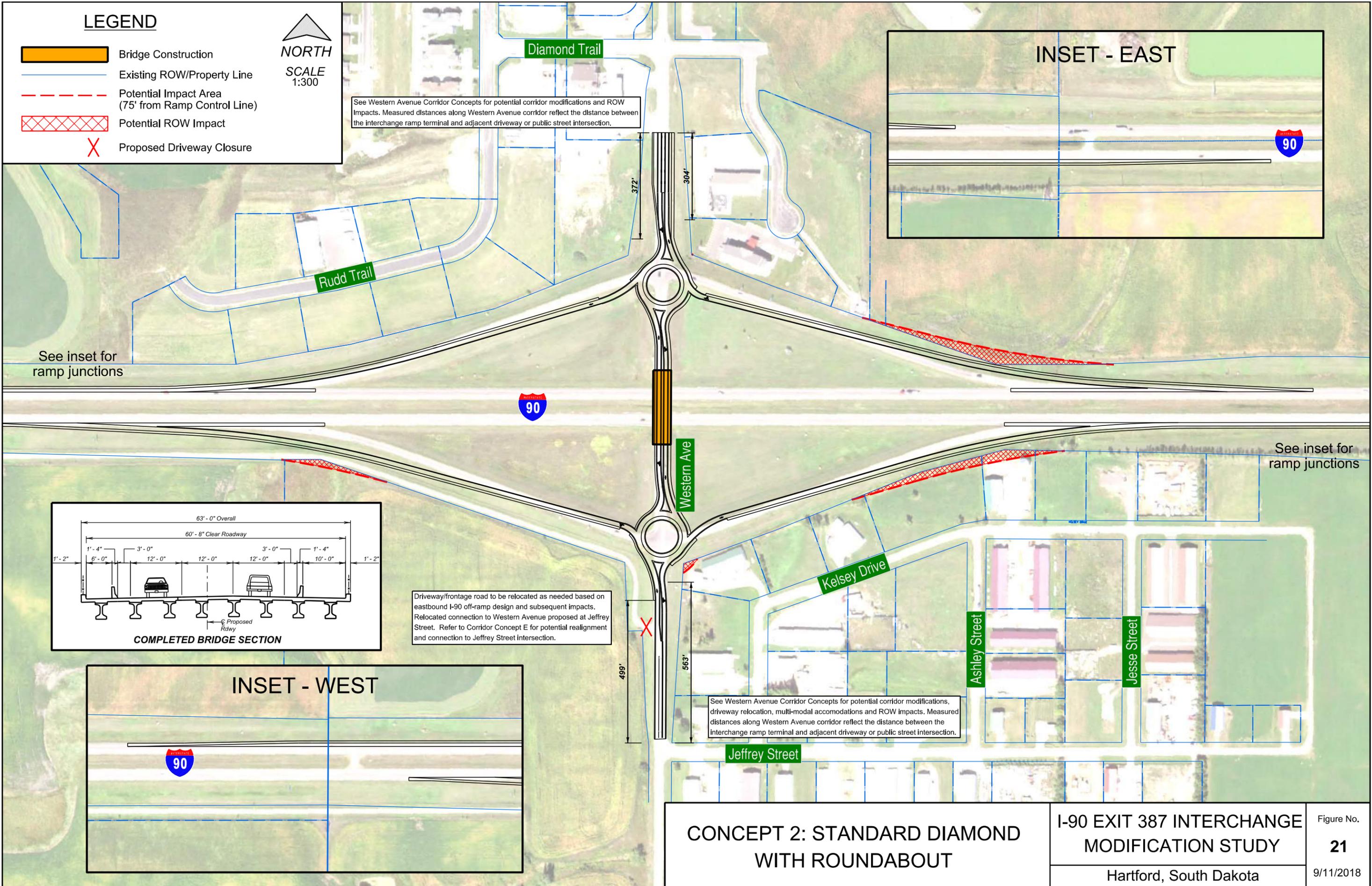
Figure No.  
 20  
 9/11/2018

**LEGEND**

-  Bridge Construction
-  Existing ROW/Property Line
-  Potential Impact Area (75' from Ramp Control Line)
-  Potential ROW Impact
-  Proposed Driveway Closure

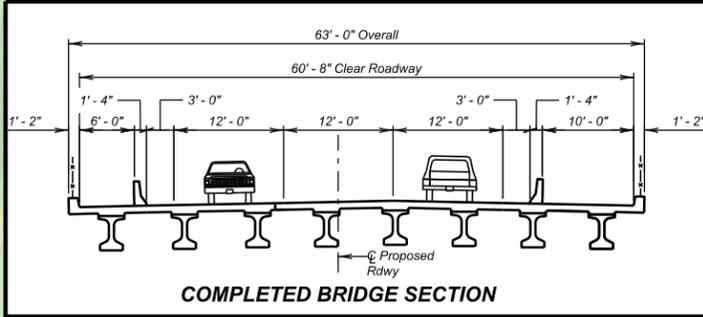
  
**NORTH**  
 SCALE  
 1:300

See Western Avenue Corridor Concepts for potential corridor modifications and ROW Impacts. Measured distances along Western Avenue corridor reflect the distance between the interchange ramp terminal and adjacent driveway or public street intersection.



See inset for ramp junctions

See inset for ramp junctions



Driveway/frontage road to be relocated as needed based on eastbound I-90 off-ramp design and subsequent impacts. Relocated connection to Western Avenue proposed at Jeffrey Street. Refer to Corridor Concept E for potential realignment and connection to Jeffrey Street intersection.

See Western Avenue Corridor Concepts for potential corridor modifications, driveway relocation, multi-modal accommodations and ROW impacts. Measured distances along Western Avenue corridor reflect the distance between the interchange ramp terminal and adjacent driveway or public street intersection.



**CONCEPT 2: STANDARD DIAMOND WITH ROUNDABOUT**

**I-90 EXIT 387 INTERCHANGE MODIFICATION STUDY**

Hartford, South Dakota

Figure No.

**21**

9/11/2018

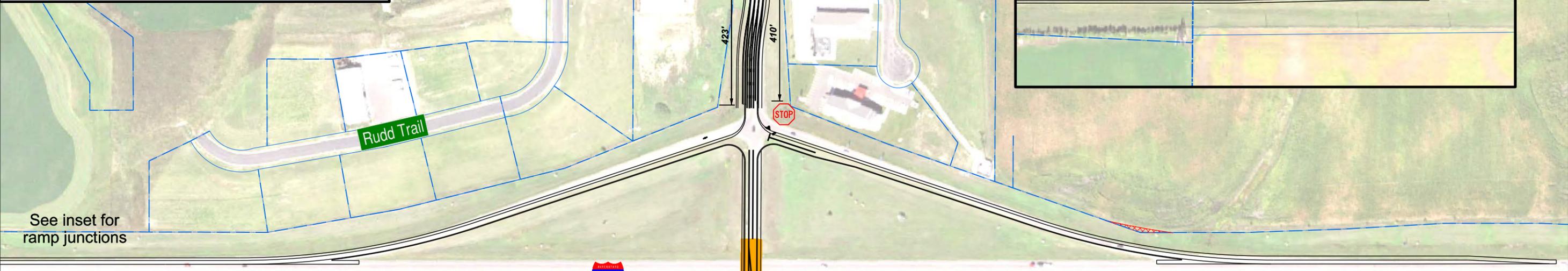
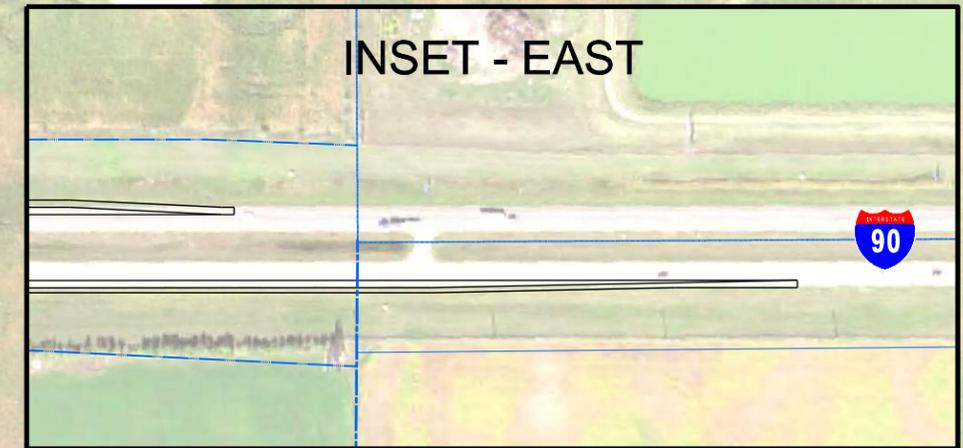
**LEGEND**

-  Bridge Construction
-  Existing ROW/Property Line
-  Potential Impact Area (75' from Ramp Control Line)
-  Potential ROW Impact
-  Proposed Driveway Closure



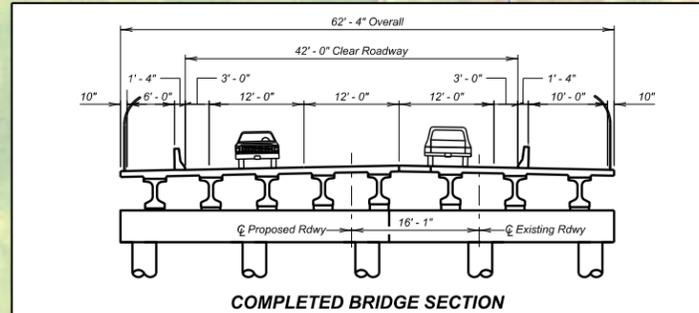
SCALE  
1:300

See Western Avenue Corridor Concepts for potential corridor modifications and ROW impacts. Measured distances along Western Avenue corridor reflect the distance between the interchange ramp terminal and adjacent driveway or public street intersection.



See inset for ramp junctions

See inset for ramp junctions



Driveway/frontage road to be relocated as needed based on eastbound I-90 off-ramp design and subsequent impacts. Relocated connection to Western Avenue proposed at Jeffrey Street. Refer to Corridor Concept E for potential realignment and connection to Jeffrey Street intersection.

See Western Avenue Corridor Concepts for potential corridor modifications, driveway relocation, multi-modal accommodations and ROW impacts. Measured distances along Western Avenue corridor reflect the distance between the interchange ramp terminal and adjacent driveway or public street intersection.



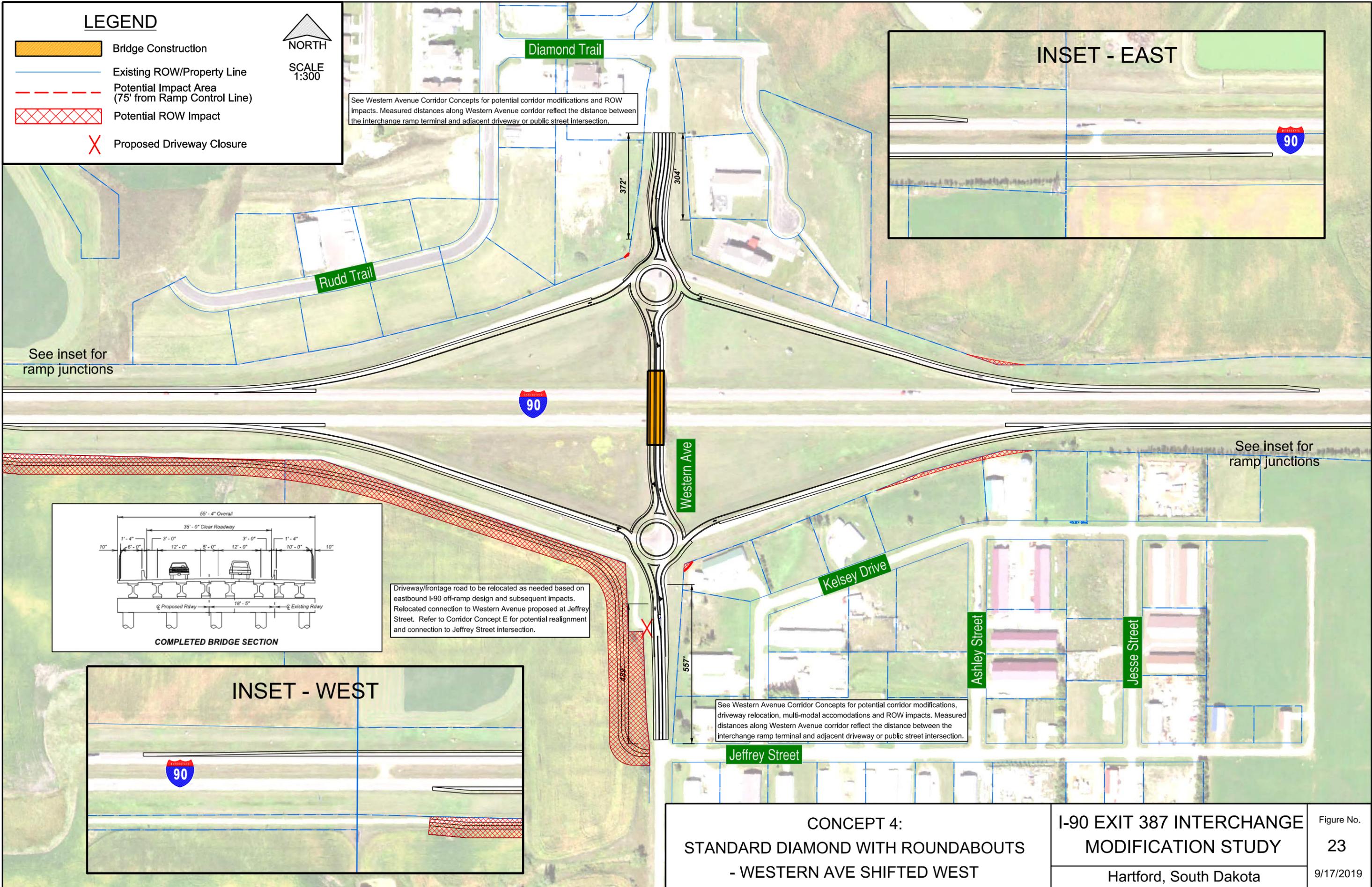
<p><b>CONCEPT 3: STANDARD DIAMOND - WESTERN AVE SHIFTED WEST</b></p>	<p><b>I-90 EXIT 387 INTERCHANGE MODIFICATION STUDY</b></p>	<p>Figure No. <b>22</b> 7/30/2019</p>
<p>Hartford, South Dakota</p>		

**LEGEND**

-  Bridge Construction
-  Existing ROW/Property Line
-  Potential Impact Area (75' from Ramp Control Line)
-  Potential ROW Impact
-  Proposed Driveway Closure

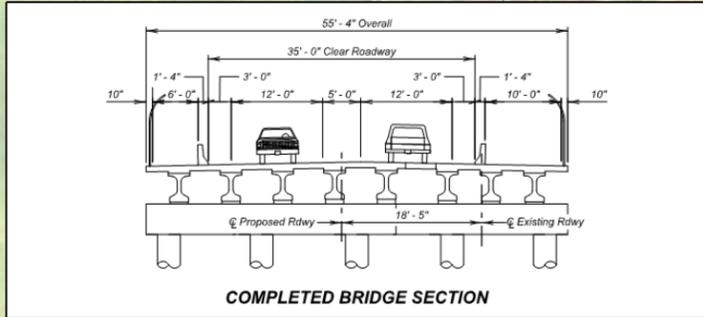


See Western Avenue Corridor Concepts for potential corridor modifications and ROW impacts. Measured distances along Western Avenue corridor reflect the distance between the interchange ramp terminal and adjacent driveway or public street intersection.



See inset for ramp junctions

See inset for ramp junctions



Driveway/frontage road to be relocated as needed based on eastbound I-90 off-ramp design and subsequent impacts. Relocated connection to Western Avenue proposed at Jeffrey Street. Refer to Corridor Concept E for potential realignment and connection to Jeffrey Street intersection.

See Western Avenue Corridor Concepts for potential corridor modifications, driveway relocation, multi-modal accommodations and ROW impacts. Measured distances along Western Avenue corridor reflect the distance between the interchange ramp terminal and adjacent driveway or public street intersection.



**CONCEPT 4:  
STANDARD DIAMOND WITH ROUNDABOUTS  
- WESTERN AVE SHIFTED WEST**

**I-90 EXIT 387 INTERCHANGE  
MODIFICATION STUDY**  
Hartford, South Dakota

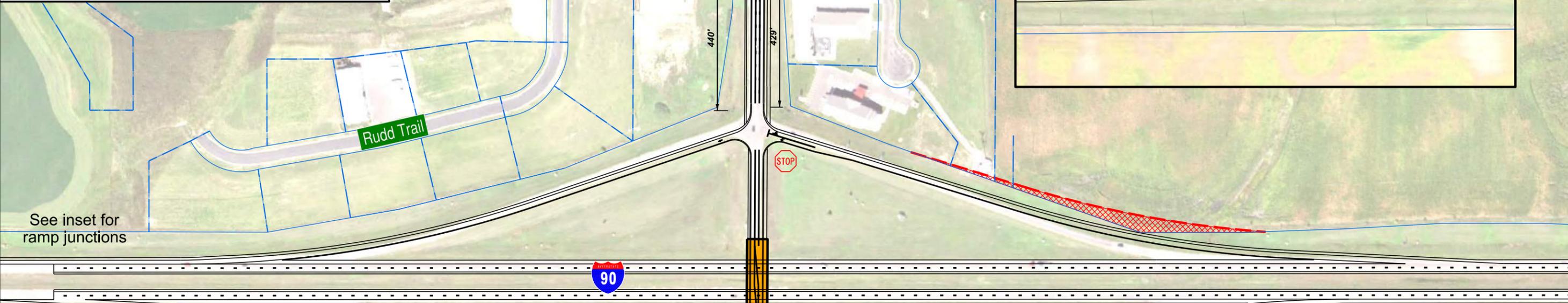
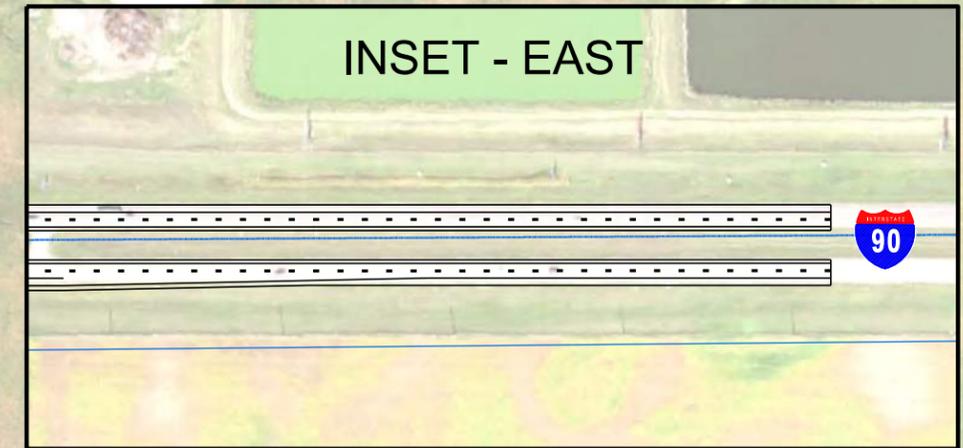
Figure No.  
**23**  
9/17/2019

**LEGEND**

-  Bridge Construction
-  Existing ROW/Property Line
-  Potential Impact Area (75' from Ramp Control Line)
-  Potential ROW Impact
-  Proposed Driveway Closure

**NORTH**  
SCALE  
1:300

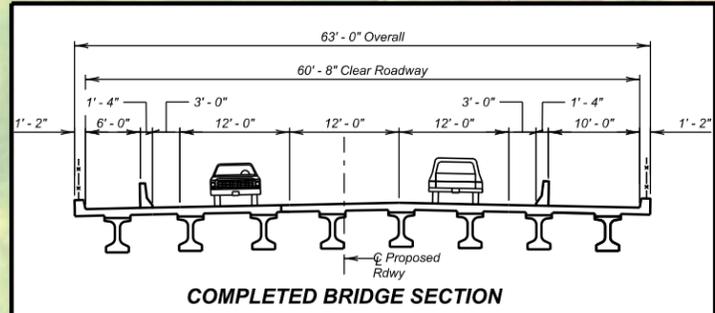
See Western Avenue Corridor Concepts for potential corridor modifications and ROW impacts. Measured distances along Western Avenue corridor reflect the distance between the interchange ramp terminal and adjacent driveway or public street intersection.



See inset for ramp junctions

See inset for ramp junctions

I-90 mainline reconstruction reflects approximate limits of grading to lower I-90 profile.



Driveway/frontage road to be relocated as needed based on eastbound I-90 off-ramp design and subsequent impacts. Relocated connection to Western Avenue proposed at Jeffrey Street. Refer to Corridor Concept E for potential realignment and connection to Jeffrey Street intersection.

See Western Avenue Corridor Concepts for potential corridor modifications, driveway relocation, multi-modal accommodations and ROW impacts. Measured distances along Western Avenue corridor reflect the distance between the interchange ramp terminal and adjacent driveway or public street intersection.



<p><b>CONCEPT 5: STANDARD DIAMOND WITH LOWERED I-90</b></p>	<p><b>I-90 EXIT 387 INTERCHANGE MODIFICATION STUDY</b></p>	<p>Figure No. <b>24</b> 9/11/2018</p>
<p>Hartford, South Dakota</p>		

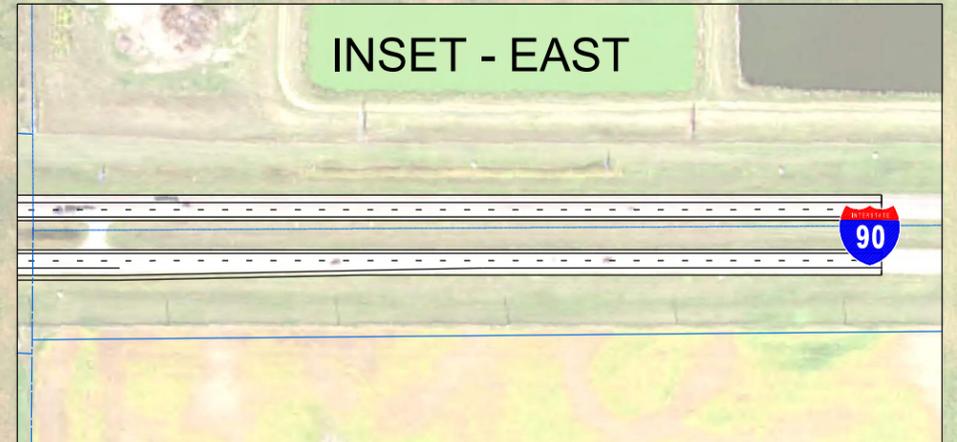
**LEGEND**

-  Bridge Construction
-  Existing ROW/Property Line
-  Potential Impact Area (75' from Ramp Control Line)
-  Potential ROW Impact
-  Proposed Driveway Closure

**NORTH**  
SCALE  
1:300

See Western Avenue Corridor Concepts for potential corridor modifications and ROW impacts. Measured distances along Western Avenue corridor reflect the distance between the interchange ramp terminal and adjacent driveway or public street intersection.

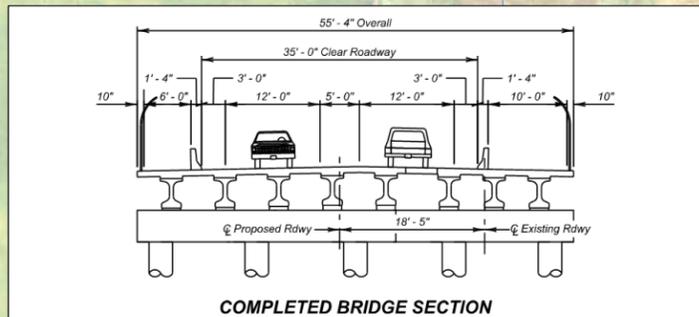
**INSET - EAST**



See inset for ramp junctions

I-90 mainline reconstruction reflects approximate limits of grading to lower I-90 profile.

See inset for ramp junctions



Driveway/frontage road to be relocated as needed based on eastbound I-90 off-ramp design and subsequent impacts. Relocated connection to Western Avenue proposed at Jeffrey Street. Refer to Corridor Concept E for potential realignment and connection to Jeffrey Street intersection.

**INSET - WEST**



**CONCEPT 6:  
STANDARD DIAMOND WITH  
ROUNDBABOUTS AND LOWERED I-90**

**I-90 EXIT 387 INTERCHANGE  
MODIFICATION STUDY**

Hartford, South Dakota

Figure No.

**25**

9/17/2019

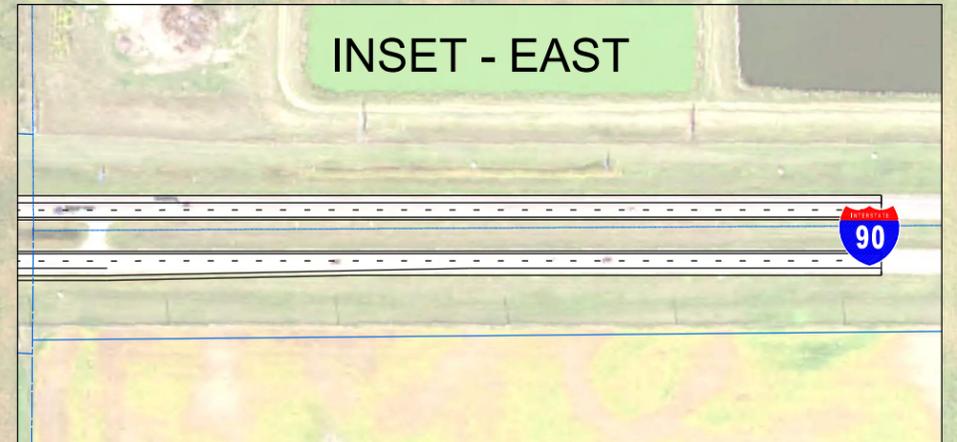
**LEGEND**

-  Bridge Construction
-  Existing ROW/Property Line
-  Potential Impact Area (75' from Ramp Control Line)
-  Potential ROW Impact
-  Proposed Driveway Closure

**NORTH**  
SCALE  
1:300

See Western Avenue Corridor Concepts for potential corridor modifications and ROW impacts. Measured distances along Western Avenue corridor reflect the distance between the interchange ramp terminal and adjacent driveway or public street intersection.

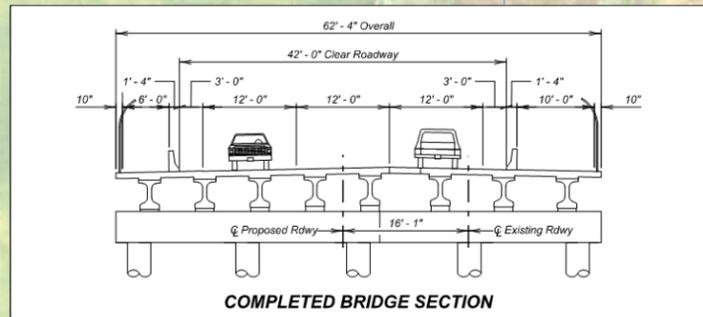
**INSET - EAST**



See inset for ramp junctions

I-90 mainline reconstruction reflects approximate limits of grading to lower I-90 profile.

See inset for ramp junctions



Driveway/frontage road to be relocated as needed based on eastbound I-90 off-ramp design and subsequent impacts. Relocated connection to Western Avenue proposed at Jeffrey Street. Refer to Corridor Concept E for potential realignment and connection to Jeffrey Street intersection.

**INSET - WEST**



See Western Avenue Corridor Concepts for potential corridor modifications, driveway relocation, multi-modal accommodations and ROW Impacts. Measured distances along Western Avenue corridor reflect the distance between the interchange ramp terminal and adjacent driveway or public street intersection.

**CONCEPT 7:  
STANDARD DIAMOND WITH LOWERED  
I-90 - WESTERN AVE SHIFTED WEST**

**I-90 EXIT 387 INTERCHANGE  
MODIFICATION STUDY**

Hartford, South Dakota

Figure No.

**26**

9/17/2019

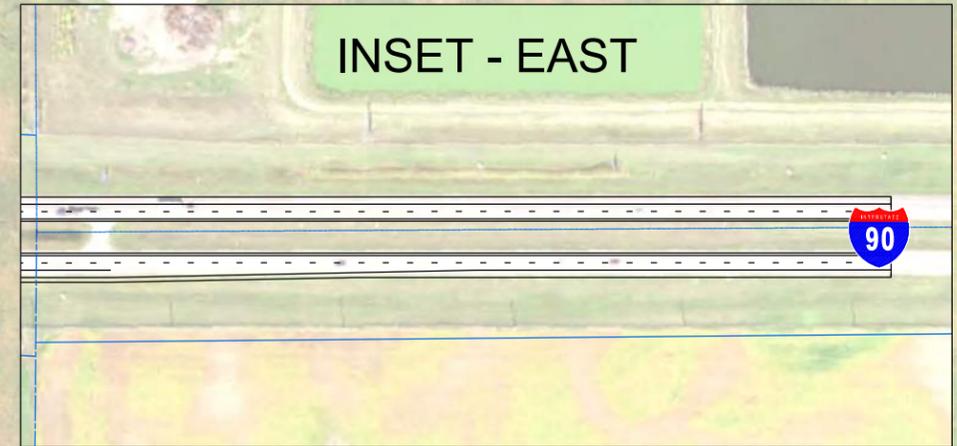
**LEGEND**

-  Bridge Construction
-  Existing ROW/Property Line
-  Potential Impact Area (75' from Ramp Control Line)
-  Potential ROW Impact
-  Proposed Driveway Closure

**NORTH**  
SCALE  
1:300

See Western Avenue Corridor Concepts for potential corridor modifications and ROW impacts. Measured distances along Western Avenue corridor reflect the distance between the interchange ramp terminal and adjacent driveway or public street intersection.

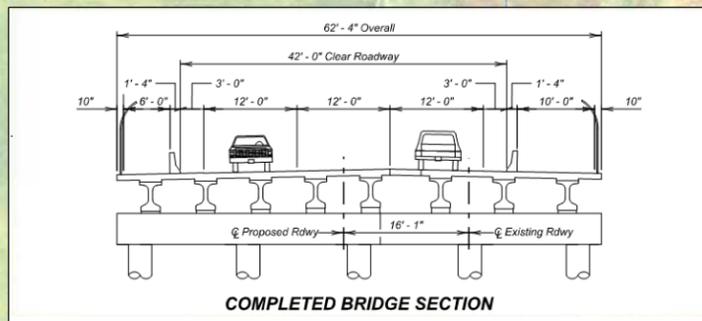
**INSET - EAST**



See inset for ramp junctions

I-90 mainline reconstruction reflects approximate limits of grading to lower I-90 profile.

See inset for ramp junctions



Driveway/frontage road to be relocated as needed based on eastbound I-90 off-ramp design and subsequent impacts. Relocated connection to Western Avenue proposed at Jeffrey Street. Refer to Corridor Concept E for potential realignment and connection to Jeffrey Street intersection.

**INSET - WEST**



See Western Avenue Corridor Concepts for potential corridor modifications, driveway relocation, multi-modal accommodations and ROW impacts. Measured distances along Western Avenue corridor reflect the distance between the interchange ramp terminal and adjacent driveway or public street intersection.

**CONCEPT 8:  
STANDARD DIAMOND WITH ROUNDABOUTS AND  
LOWERED I-90 - WESTERN AVE SHIFTED WEST**

**I-90 EXIT 387 INTERCHANGE  
MODIFICATION STUDY**

Hartford, South Dakota

Figure No.

**27**

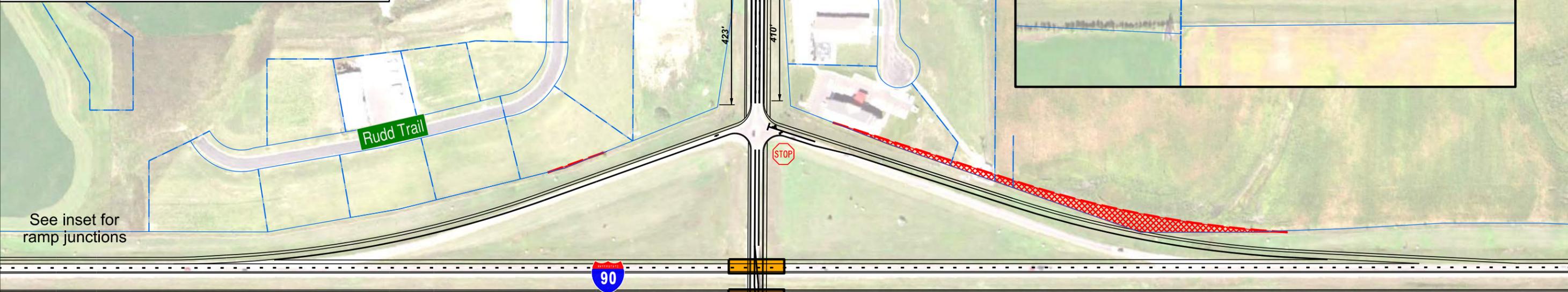
9/11/2018

**LEGEND**

-  Bridge Construction
-  Existing ROW/Property Line
-  Potential Impact Area (75' from Ramp Control Line)
-  Potential ROW Impact
-  Proposed Driveway Closure

**NORTH**  
SCALE  
1:300

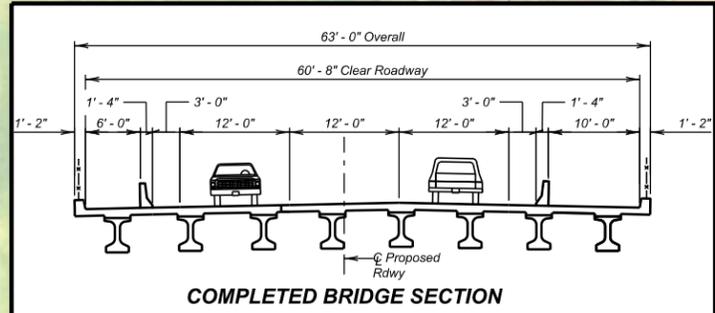
See Western Avenue Corridor Concepts for potential corridor modifications and ROW impacts. Measured distances along Western Avenue corridor reflect the distance between the interchange ramp terminal and adjacent driveway or public street intersection.



See inset for ramp junctions

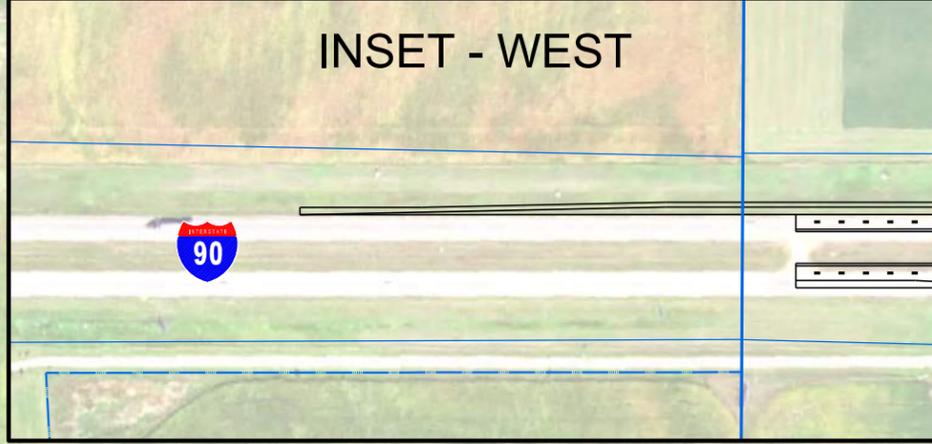
See inset for ramp junctions

I-90 mainline reconstruction reflects approximate limits of grading to raise I-90 profile.



Driveway/frontage road to be relocated as needed based on eastbound I-90 off-ramp design and subsequent impacts. Relocated connection to Western Avenue proposed at Jeffrey Street. Refer to Corridor Concept E for potential realignment and connection to Jeffrey Street intersection.

See Western Avenue Corridor Concepts for potential corridor modifications, driveway relocation, multi-modal accommodations and ROW impacts. Measured distances along Western Avenue corridor reflect the distance between the interchange ramp terminal and adjacent driveway or public street intersection.

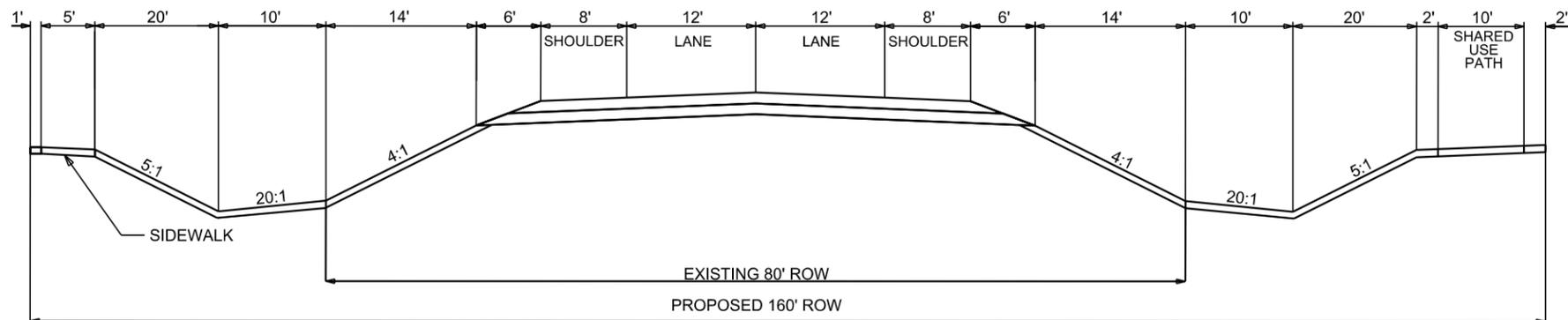
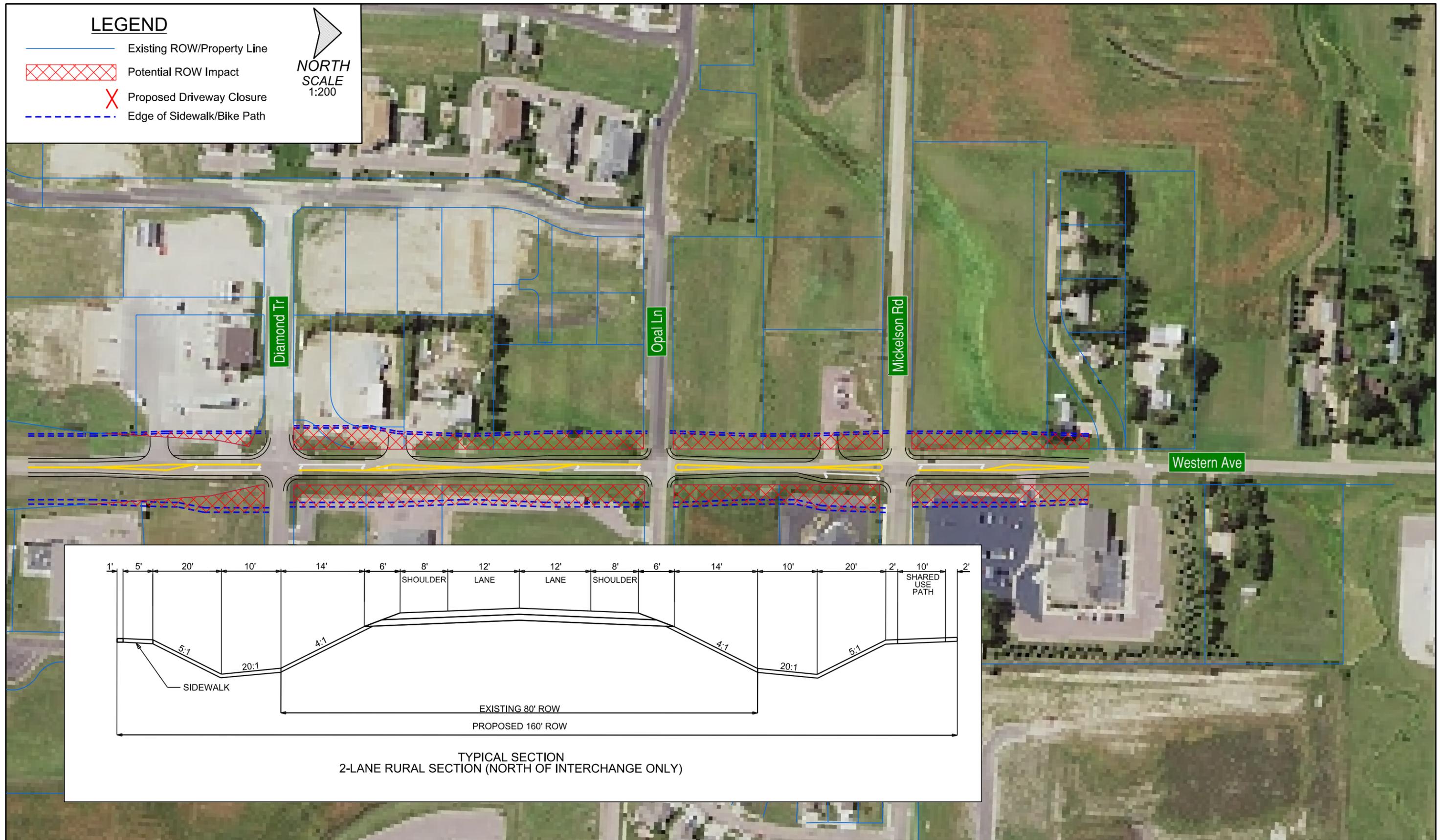


<p><b>CONCEPT 9: STANDARD DIAMOND WITH I-90 OVER WESTERN AVE</b></p>	<p><b>I-90 EXIT 387 INTERCHANGE MODIFICATION STUDY</b></p>	<p>Figure No. <b>28</b> 9/11/2018</p>
<p>Hartford, South Dakota</p>		

**LEGEND**

-  Existing ROW/Property Line
-  Potential ROW Impact
-  Proposed Driveway Closure
-  Edge of Sidewalk/Bike Path

**NORTH**  
SCALE  
1:200



TYPICAL SECTION  
2-LANE RURAL SECTION (NORTH OF INTERCHANGE ONLY)

See I-90 Exit 387 Interchange Concepts for potential tie in options for Western Avenue Corridor Concepts

2-LANE RURAL SECTION  
(NORTH OF INTERCHANGE ONLY)

I-90 EXIT 387 INTERCHANGE  
MODIFICATION STUDY

Hartford, South Dakota

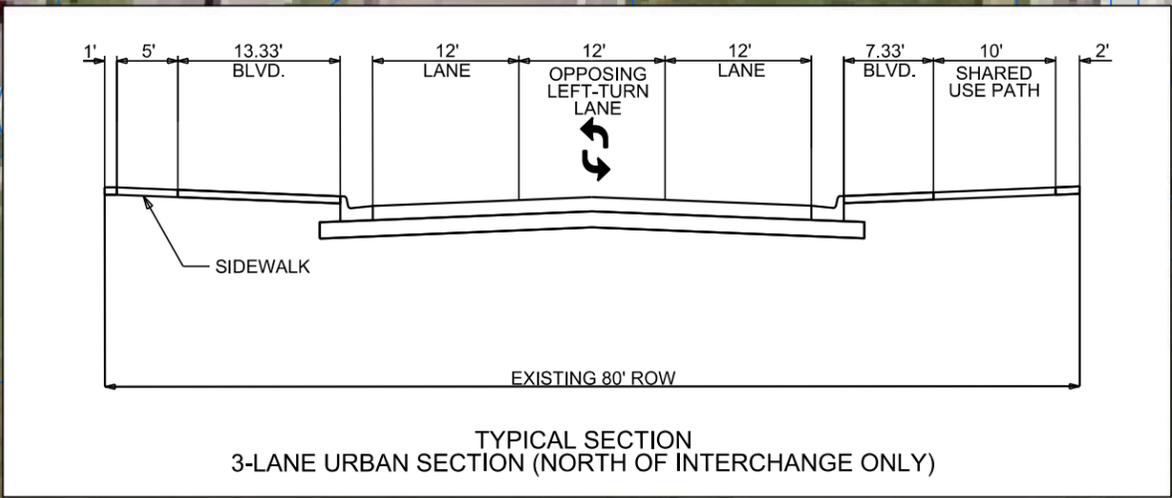
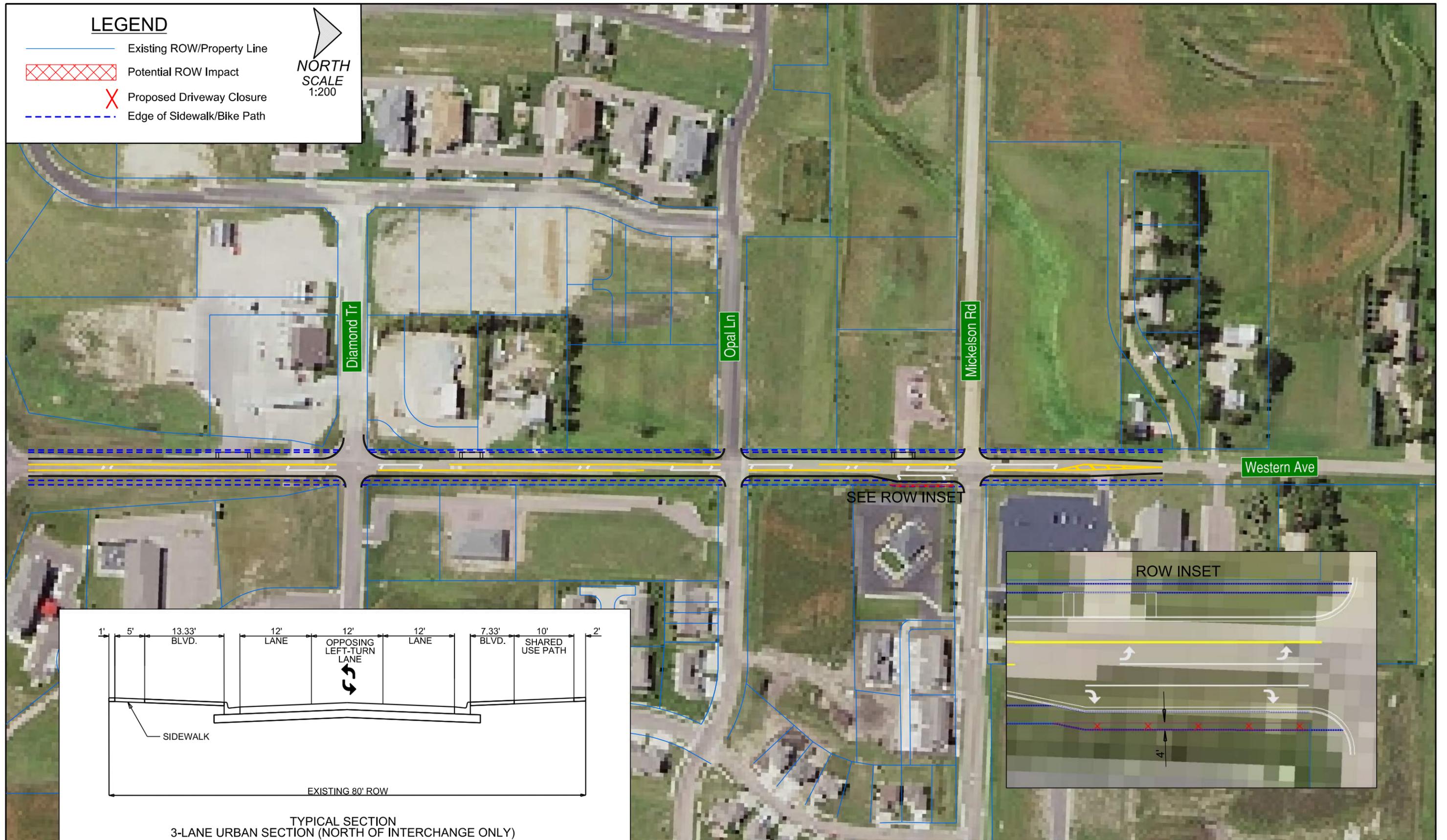
Figure No.

**29**

8/20/2018

**LEGEND**

-  Existing ROW/Property Line
-  Potential ROW Impact
-  Proposed Driveway Closure
-  Edge of Sidewalk/Bike Path



See I-90 Exit 387 Interchange Concepts for potential tie in options for Western Avenue Corridor Concepts

3-LANE URBAN SECTION  
(NORTH OF INTERCHANGE ONLY)

I-90 EXIT 387 INTERCHANGE  
MODIFICATION STUDY

Hartford, South Dakota

Figure No.

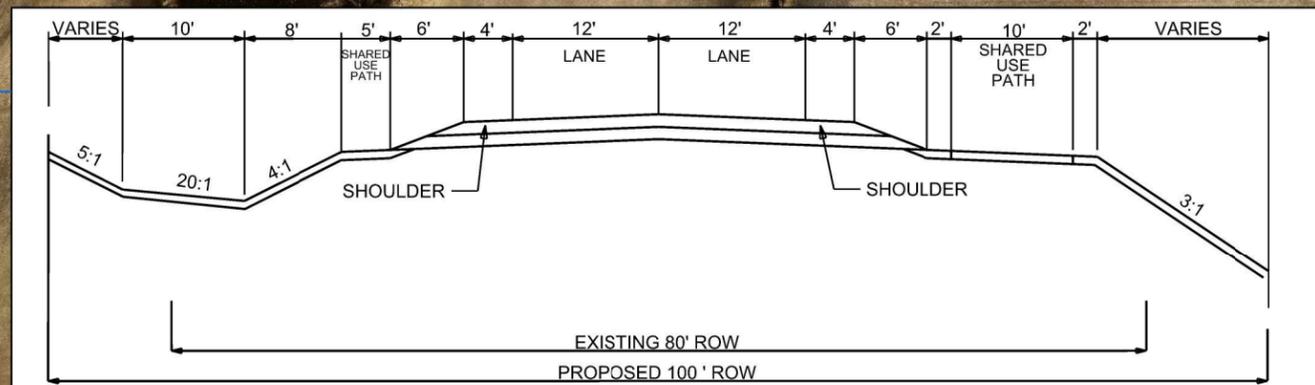
**30**

9/5/2018

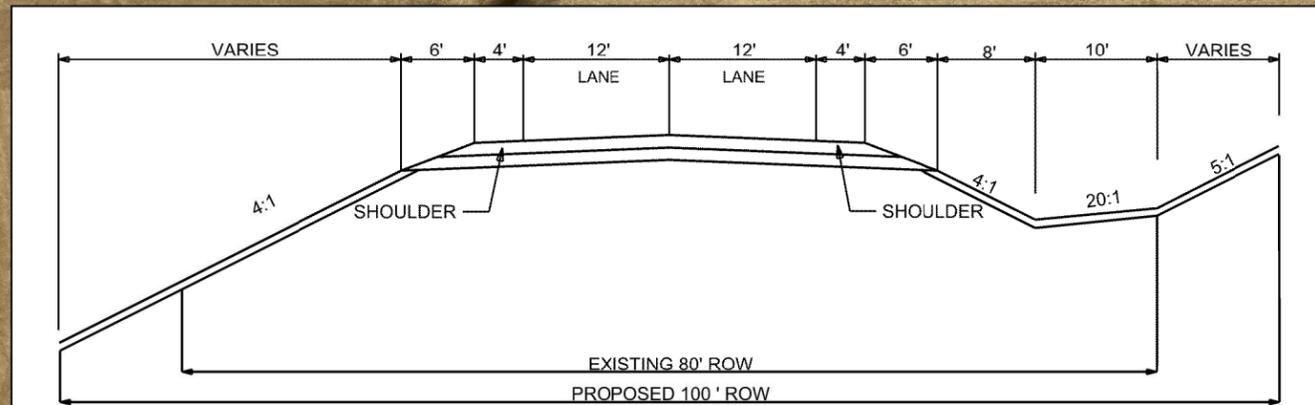
**LEGEND**

-  Existing ROW/Property Line
-  Potential ROW Impact
-  Proposed Driveway Closure
-  Edge of Sidewalk/Bike Path

**NORTH**  
SCALE  
1:200

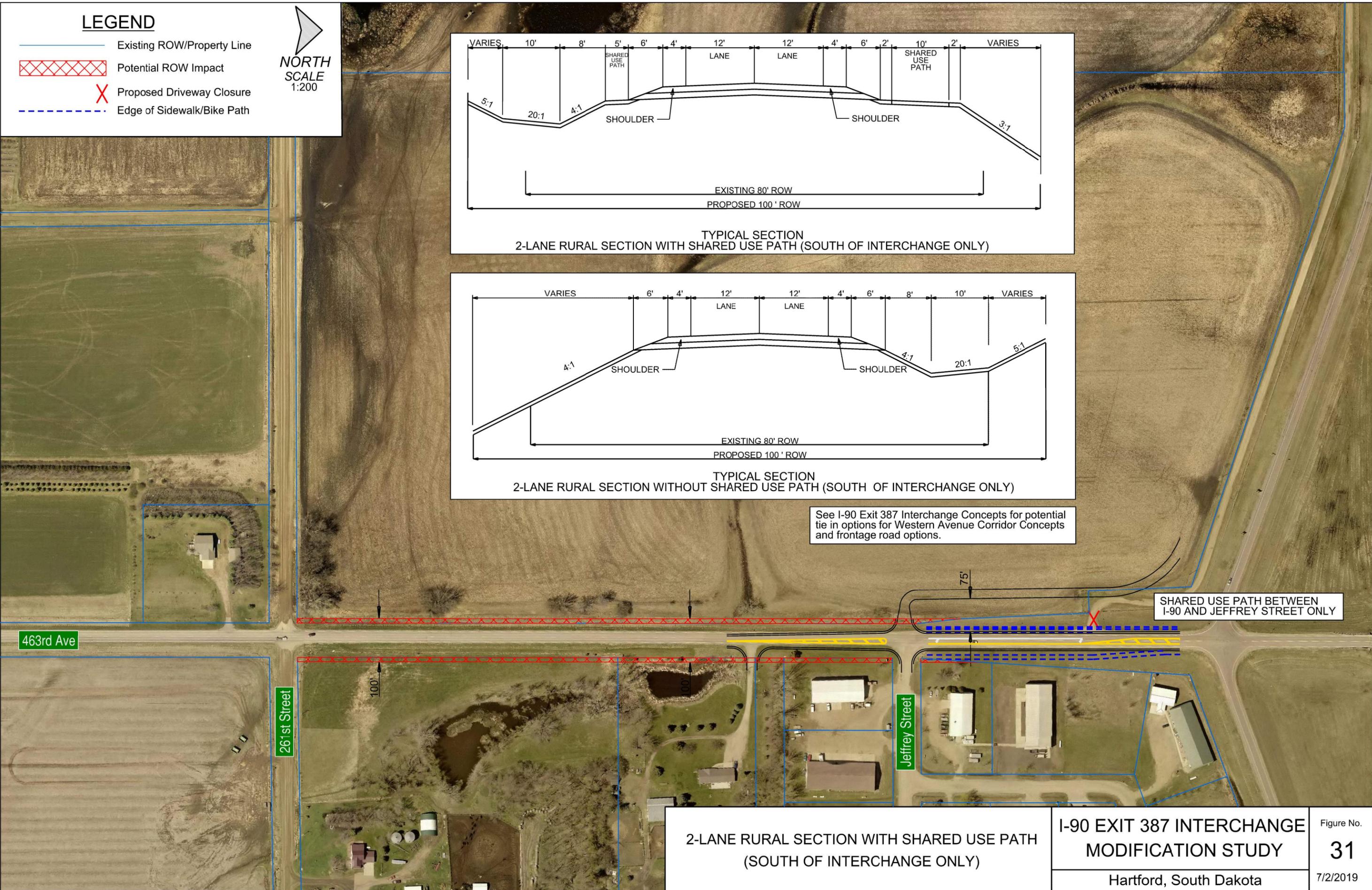


TYPICAL SECTION  
2-LANE RURAL SECTION WITH SHARED USE PATH (SOUTH OF INTERCHANGE ONLY)



TYPICAL SECTION  
2-LANE RURAL SECTION WITHOUT SHARED USE PATH (SOUTH OF INTERCHANGE ONLY)

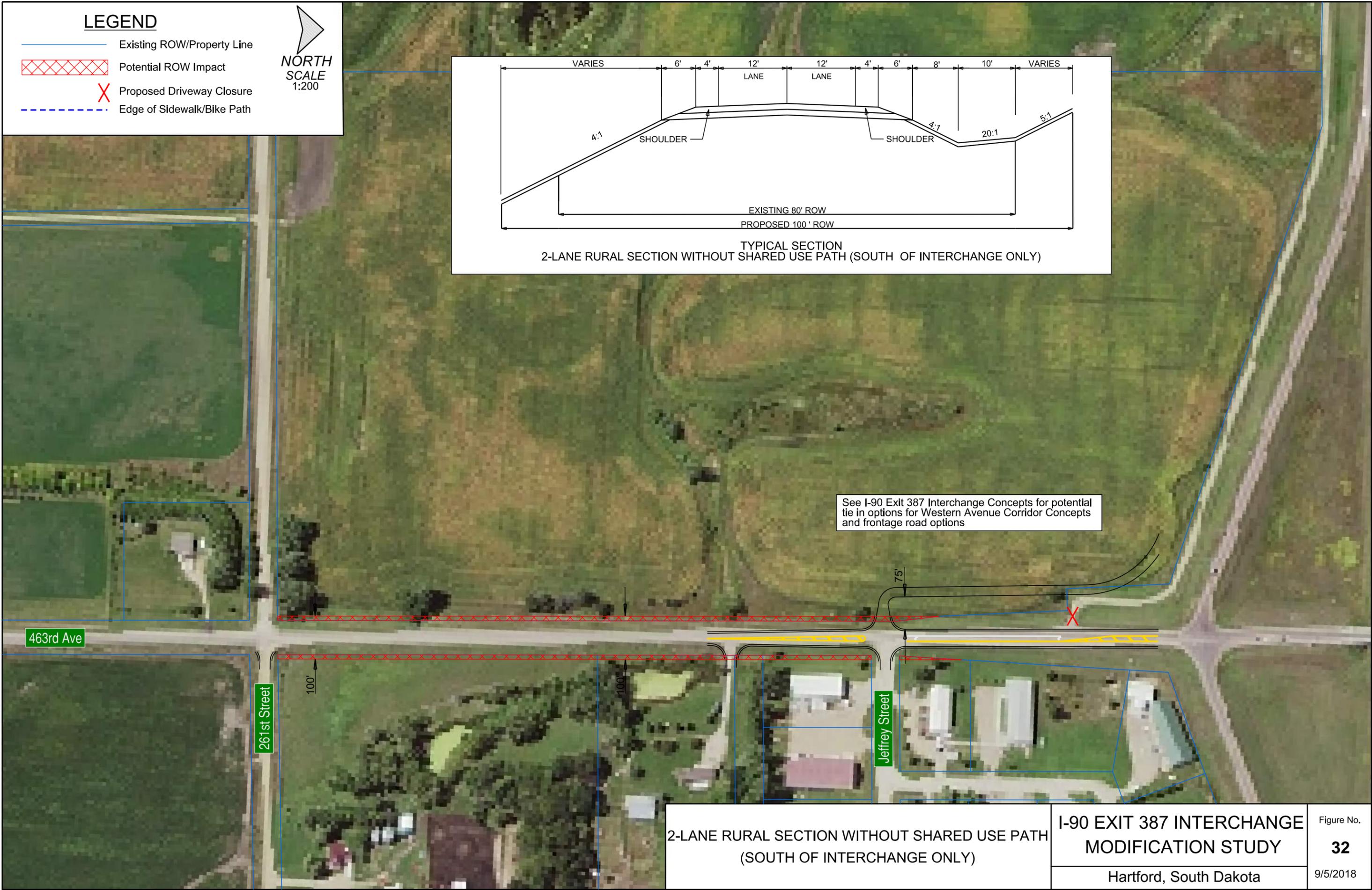
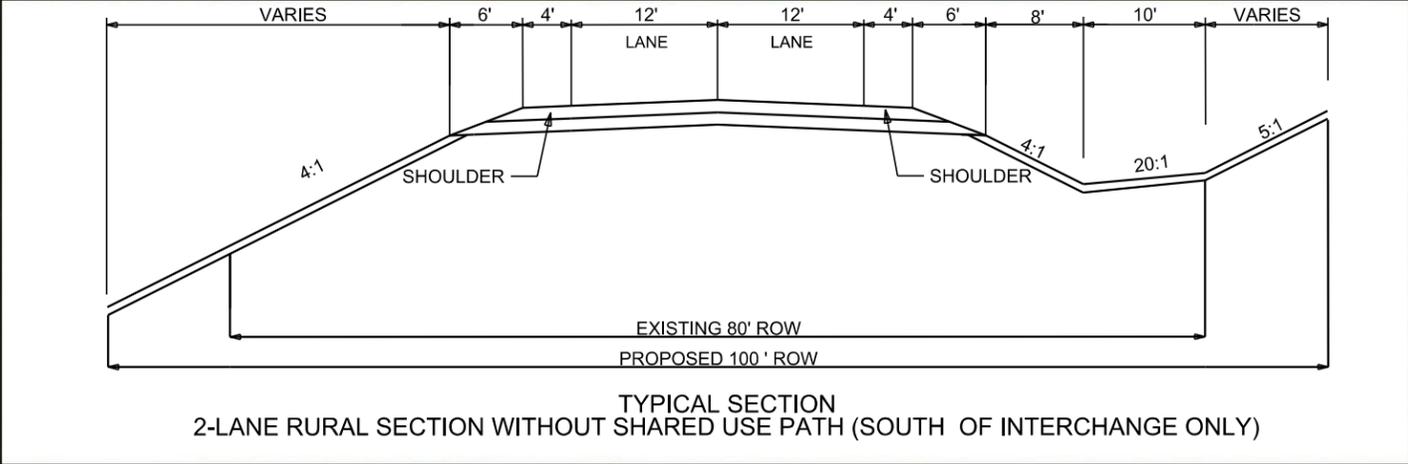
See I-90 Exit 387 Interchange Concepts for potential tie in options for Western Avenue Corridor Concepts and frontage road options.



2-LANE RURAL SECTION WITH SHARED USE PATH (SOUTH OF INTERCHANGE ONLY)	<b>I-90 EXIT 387 INTERCHANGE MODIFICATION STUDY</b>	Figure No. <b>31</b>
	Hartford, South Dakota	7/2/2019

**LEGEND**

-  Existing ROW/Property Line
-  Potential ROW Impact
-  Proposed Driveway Closure
-  Edge of Sidewalk/Bike Path



2-LANE RURAL SECTION WITHOUT SHARED USE PATH  
(SOUTH OF INTERCHANGE ONLY)

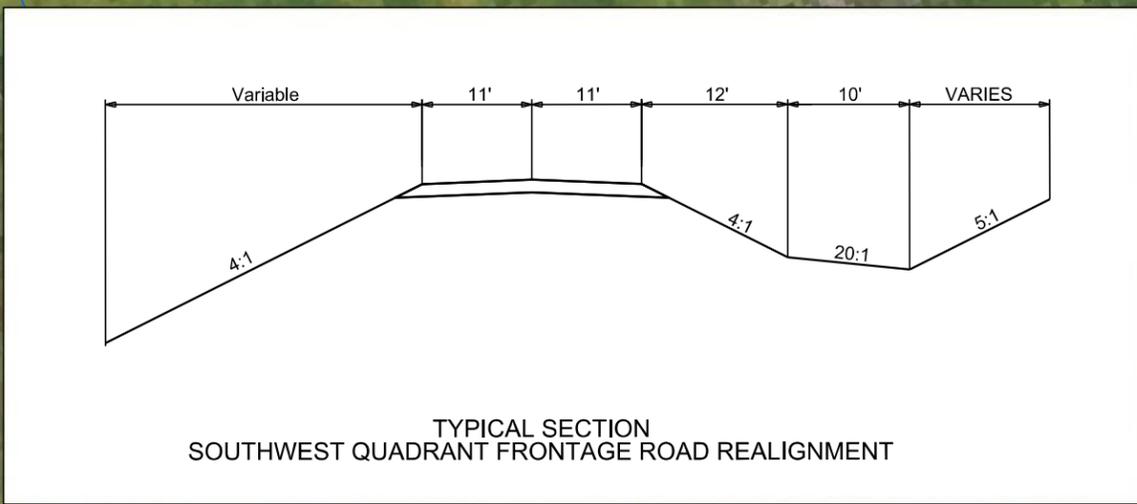
I-90 EXIT 387 INTERCHANGE  
MODIFICATION STUDY

Hartford, South Dakota

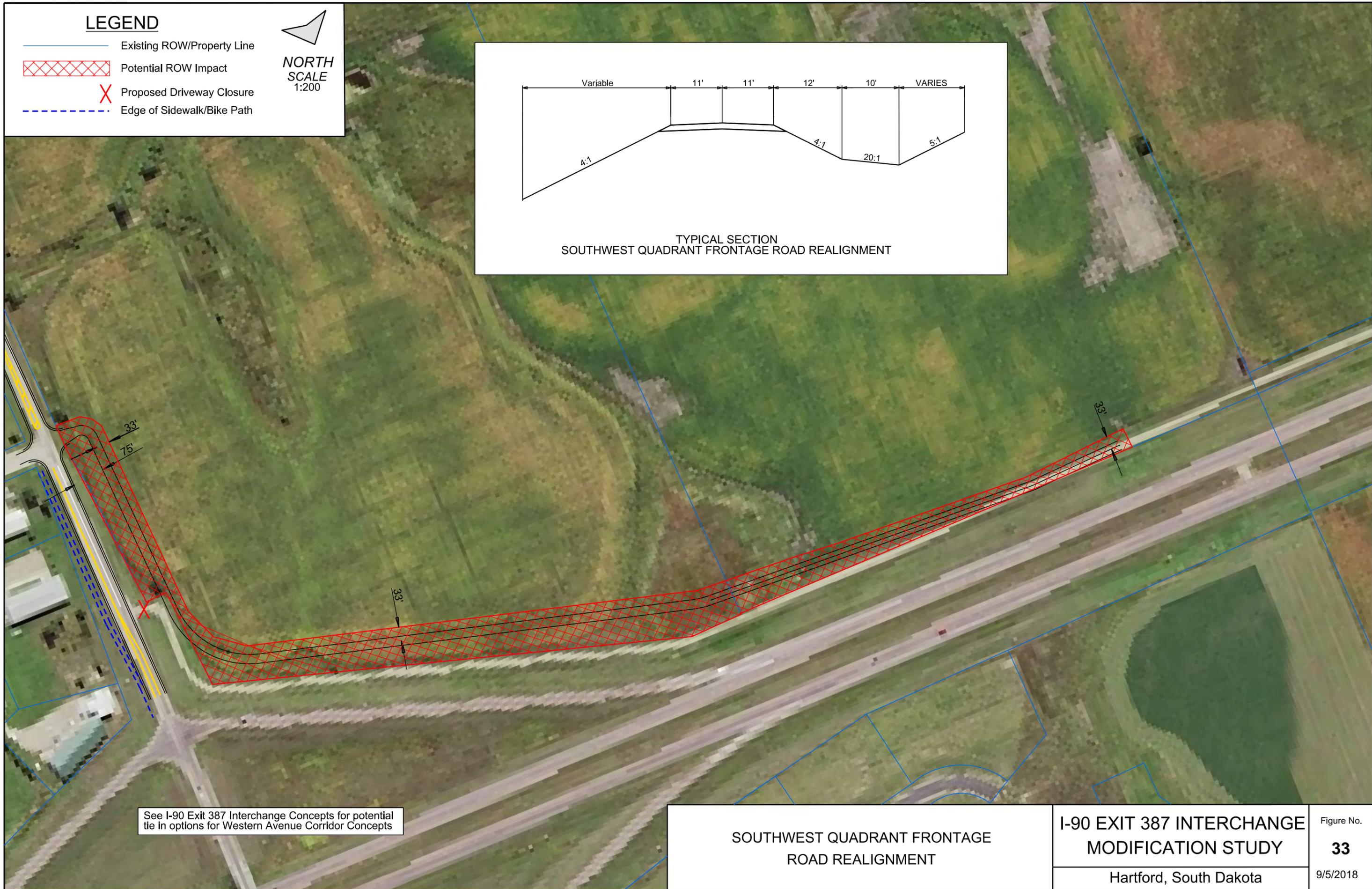
Figure No.  
**32**  
9/5/2018

**LEGEND**

-  Existing ROW/Property Line
-  Potential ROW Impact
-  Proposed Driveway Closure
-  Edge of Sidewalk/Bike Path



TYPICAL SECTION  
SOUTHWEST QUADRANT FRONTAGE ROAD REALIGNMENT



See I-90 Exit 387 Interchange Concepts for potential tie in options for Western Avenue Corridor Concepts

SOUTHWEST QUADRANT FRONTAGE  
ROAD REALIGNMENT

I-90 EXIT 387 INTERCHANGE  
MODIFICATION STUDY

Hartford, South Dakota

Figure No.

**33**

9/5/2018

### 5.3. Improvements to Alternate Interchanges

No improvements are planned or programmed for the I-90 interchanges adjacent to Exit 387 (Exit 379 – Humboldt and Exit 390 – SD 38). A slightly-elevated crash rate was noted at Exit 390 in the 2010 Decennial Interstate Corridor Study. No crash trend was identified and no improvement was recommended in that study. Improvements to the adjacent interchanges will not fulfill the primary need at Exit 387; the need to improve the interchange to avoid vehicles striking the structure.

### 5.4. Transportation System Management Alternatives

Transportation System Management (TSM) actions are not designed to solve the primary need at Exit 387; the need to improve the interchange to avoid vehicles striking the structure.

### 5.5. Alternative Transportation Modes

Alternative transportation modes available within the study area include on-call transit service and pedestrian and bicycle travel. While improvements within the interchange area should be designed to complement these alternative travel modes, the alternative modes will not solve the primary need at Exit 387; the need to improve the interchange to avoid vehicles striking the structure.

### 5.6. Alternatives Carried Forward in IMJR

A screening of the alternatives was conducted based on technical analysis and input from the Study Advisory Team. That screening, documented in the September 12, 2018, Concept Evaluation memo (**Appendix J**), made the following recommendations:

#### Interchange Concepts Carried Forward

10. Standard Diamond
11. Standard Diamond with Roundabouts
12. Standard Diamond – Western Avenue Shifted West
13. Standard Diamond with Roundabouts – Western Avenue Shifted West

#### Interchange Concepts Held for Further Consideration, only if needed due to property impacts or other findings in respective companion Concept 1-4

14. Standard Diamond with Lowered I-90
15. Standard Diamond with Roundabouts and Lowered I-90
16. Standard Diamond with Lowered I-90 – Western Avenue Shifted West
17. Standard Diamond with Roundabouts and Lowered I-90 – Western Avenue Shifter West

#### Interchange Concepts Eliminated from Further Consideration

18. Standard Diamond with I-90 over Western Avenue

#### Corridor Concepts Carried Forward

- B. 3-Lane Urban Section (North of Interchange only)
- C. 2-Lane Rural Section with Shared-Use Path (South of Interchange only)
- E. Southwest Quadrant Frontage Road Realignment
  - a. Merge this concept with interchange concepts in build option refinement phase

Corridor Concepts Eliminated from Further Consideration

- A. 2-Lane Rural Section (North of Interchange only)
- D. 2-Lane Rural Section without Shared-Use Path (South of Interchange only)

## 6. Future Year Traffic

### 6.1. Development of Future-Year Traffic Volumes

Traffic projections were developed for 2025 and 2050 using results from the 2040 Sioux Falls travel demand model. A travel demand model estimates area-wide traffic volume as a function of area-wide demographics (population and employment) and the roadway network.

The following travel modeling results were evaluated:

- **2013 Base Year Model:** Estimates 2013 regional traffic volumes based on 2013 population and employment locations. The base year model is used to best replicate actual conditions to improve the predicting capability of future year models.
- **2040 Model:** Estimates 2040 regional traffic volumes after inputting expected demographic changes and the expected roadway network based on funding availability.

To estimate 2025 and 2050 daily traffic volumes, the estimated annual traffic growth between 2013 and 2040 was evaluated for all model links in the project area (in terms of number of daily vehicles). This was done by dividing the total difference in modelled volume by 27 (2040-2013 = 27). To estimate 2025 volumes, this annual growth in traffic was multiplied by 7 (2025-2018 = 7) and this total was added to 2018 link volumes. To estimate 2050 volumes, the annual growth in traffic was multiplied by 32 (2050-2018 = 32), then added to 2018 link volumes. The 2025 and 2050 daily traffic projections can be seen in **Figures 34 and 35**.

AM and PM peak hour turning movement projections were estimated using the NCHRP 765 method, which estimates future intersection turning movements based on existing turning movement data and estimated growth factors on each intersection approach. The assumed growth factors were established based on projected daily volume growth. This method is commonly used since it is responsive to volume changes on each approach, meaning that if high growth is expected on only two approaches, turning movement projections will reflect this.

Turning movement projections assume that existing peaking characteristics (K-factors) from field-collected data will also occur in the future since field-collected data indicates much higher peaks in the morning and evening compared to modelled peaks. Based on Hartford's proximity to Sioux Falls, the team believes this to be a reasonable assumption due to commuter traffic in the mornings and evenings.

The 2018 peak hour turning movements and 2025/2050 peak hour turning movement projections can be seen in **Figures 36 and 37**. Turning movement projections were rounded to the nearest five. To be conservative, future peak hour turning movements are expected to have a minimum of five vehicles, except for eastbound/westbound through movements at interchange ramp terminals, since such movements are uncommon.

All turning movements (2018 and future conditions) were balanced between intersections other than the segment of Western Avenue between the I-90 westbound ramps and Diamond Trail, given the presence of the truck stop access on this segment.

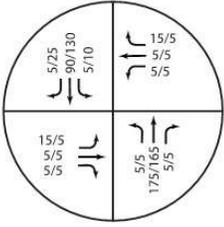


**Figure 34: I-90 Exit 387 Daily Traffic Projections**

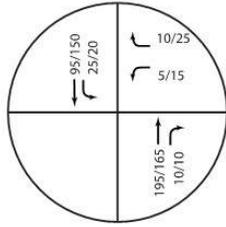


**Figure 35: I-90 Exit 390 Daily Traffic Projections**

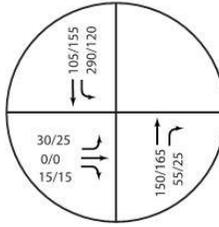
1. Western Ave and 261st St



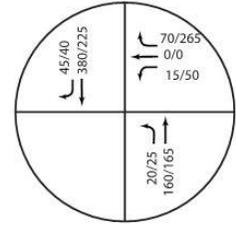
2. Western Ave and Jeffrey St



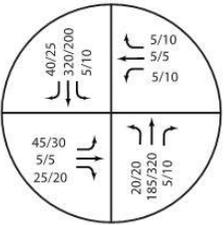
3. Western Ave and I-90 EB Ramps



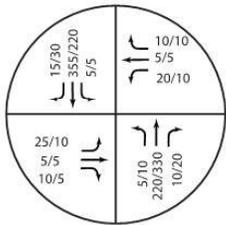
4. Western Ave and I-90 WB Ramps



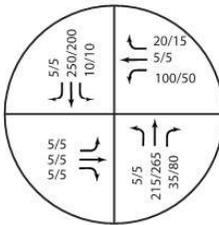
5. Western Ave and Diamond Tr



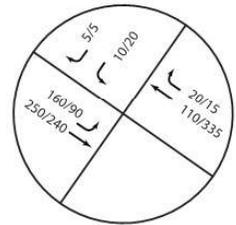
6. Western Ave and Opal Ln



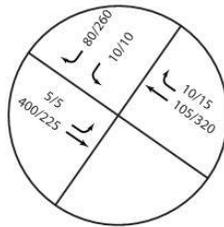
7. Western Ave and Mickelson Rd



8. SD 38 and I-90 EB Ramps



9. SD 38 and I-90 WB Ramps



2025 Mainline Peak Hour Mainline Volumes

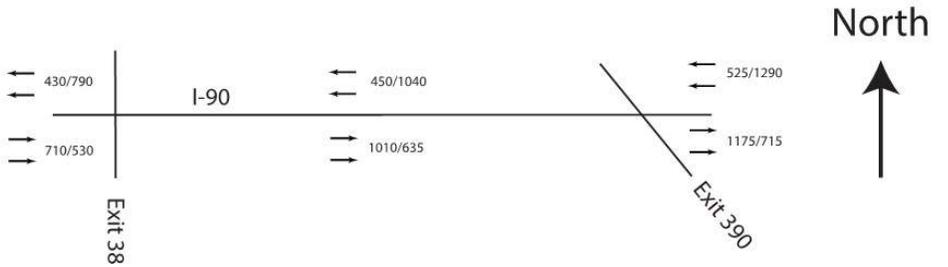
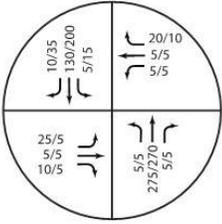
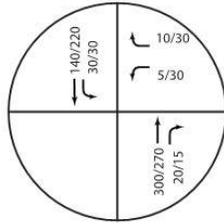


Figure 36: 2025 AM/PM Peak Hour Turning Movements

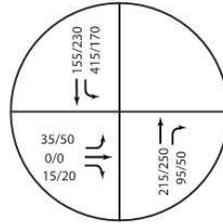
1. Western Ave and 261st St



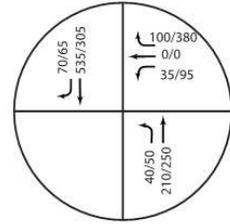
2. Western Ave and Jeffrey St



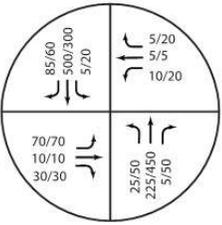
3. Western Ave and I-90 EB Ramps



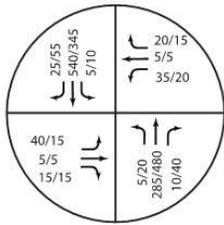
4. Western Ave and I-90 WB Ramps



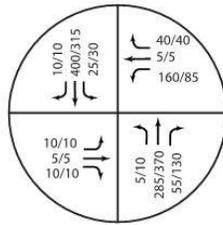
5. Western Ave and Diamond Tr



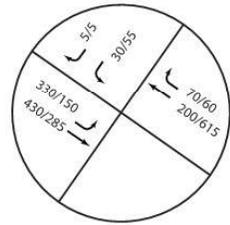
6. Western Ave and Opal Ln



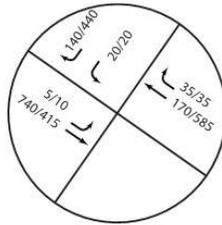
7. Western Ave and Mickelson Rd



8. SD 38 and I-90 EB Ramps



9. SD 38 and I-90 WB Ramps



2050 Mainline Peak Hour Mainline Volumes (By Lane)

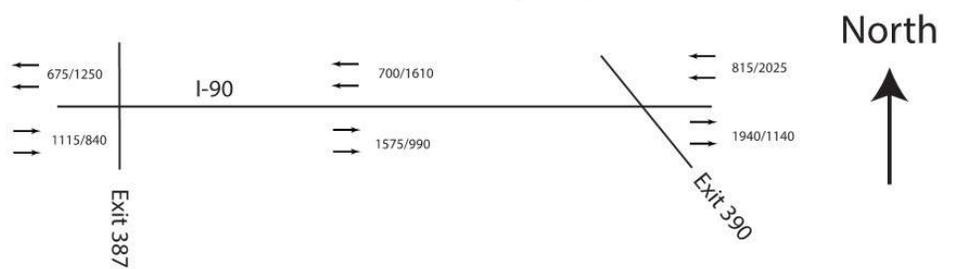


Figure 37: 2050 AM/PM Peak Hour Turning Movements

## 6.2. 2025 No-Build Condition Traffic Operations

The 2025 No-Build Conditions LOS results are summarized in **Figure 38** and **Tables 11-15**. All intersections operate at LOS C or better through 2025 with the existing traffic controls, while all Interstate segments operate at LOS B or better. Two-lane highway segment analysis showed that many segments of Western Avenue operate at LOS D during the peak hours and bicycle levels of service are between C and F during the peak hours due to the lack of specific bicycle facilities.

**Table 11: Western Avenue Intersection Traffic Operations – 2025 No-Build Conditions**

Western Avenue Intersection	Intersection Control Type	AM Peak Period		PM Peak Period	
		Avg. Delay (sec/veh)	LOS	Avg. Delay (sec/veh)	LOS
Mickelson Road (260 <sup>th</sup> St)	TWSC*	15.2	C	14.2	B
Opal Lane	TWSC*	15.4	C	14.0	B
Diamond Trail	TWSC*	14.1	B	13.6	B
I-90 Exit 387 WB	TWSC*	10.8	B	13.3	B
I-90 Exit 387 EB	TWSC*	16.7	C	12.4	B
Jeffrey Street	TWSC*	10.1	B	10.2	B
261 <sup>st</sup> Street	TWSC*	10.8	B	10.7	B

\* Two-way stop control LOS reflects worst-case stop-controlled approach

**Table 12: Western Avenue Corridor Local Network Intersections (Weighted Average) – 2025 No-Build Conditions**

Western Avenue Intersection	Intersection Control Type	AM Peak Period		PM Peak Period	
		Weighted Avg. Delay (sec/veh)	LOS	Weighted Avg. Delay (sec/veh)	LOS
Mickelson Road (260 <sup>th</sup> St)	TWSC	3.4	A	2.0	A
Opal Lane	TWSC	1.8	A	1.2	A
Diamond Trail	TWSC	2.3	A	2.1	A
Jeffrey Street	TWSC	1.1	A	1.5	A
261 <sup>st</sup> Street	TWSC	1.8	A	1.2	A

**Table 13: I-90 Exit 390 Ramp Terminal Intersections – 2025 No-Build Conditions**

SD38 Intersection	Intersection Control Type	AM Peak Period		PM Peak Period	
		Avg. Delay (sec/veh)	LOS	Avg. Delay (sec/veh)	LOS
I-90 Exit 390 WB	TWSC*	10.0	B	14.1	B
I-90 Exit 390 EB	TWSC*	13.8	B	16.4	C

\*Two-way stop-control LOS reflects worst-case stop-controlled approach

**Table 14: Western Avenue Corridor Two-Lane Highway Segments – 2025 No-Build Conditions**

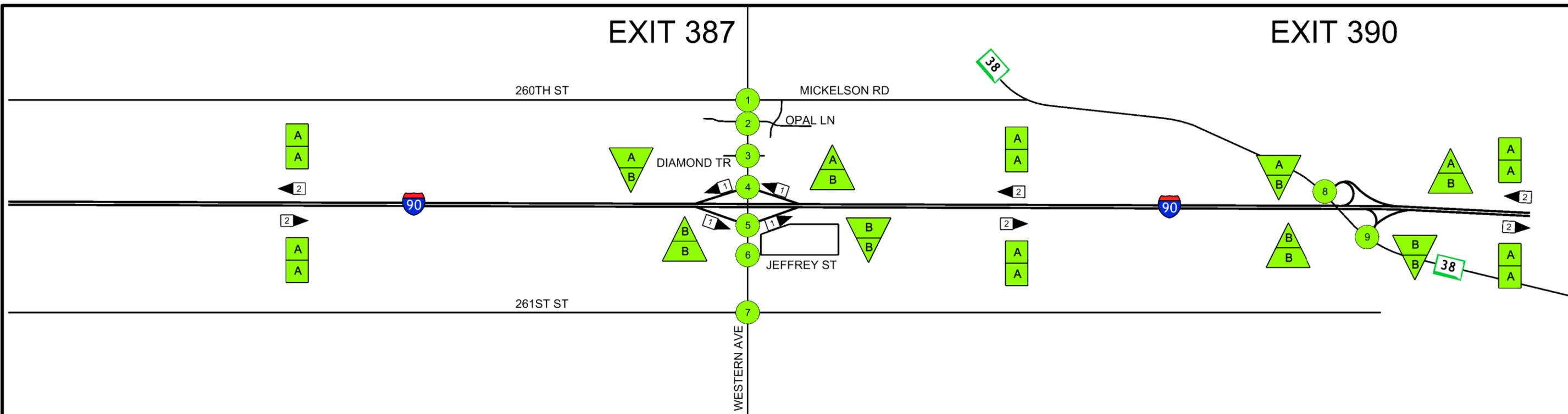
Western Avenue Segment	Direction of Travel	Segment Length (mi)	AM Peak Period		PM Peak Period		Bicycle Score LOS (AM/PM)
			PTSF (%)	LOS	PTSF (%)	LOS	
Mickelson Road - Diamond Trail	NB	0.25	51.4	B	71.2	D	E/E
	SB		71.3	D	51.0	B	E/E
Diamond Trail - WB Ramp Terminal	NB	0.15	48.3	B	72.2	D	C/C
	SB		71.9	D	52.3	B	C/C
WB Ramp Terminal - EB Ramp Terminal	NB	0.20	41.2	B	56.3	C	E/E
	SB		71.6	D	65.5	C	F/F
EB Ramp Terminal - 261st Street	NB	0.40	49.7	B	48.3	B	F/E
	SB		24.9	A	35.5	A	F/E
Facility	NB	1.00	48.3	B	65.5	C	-
	SB		67.0	C	52.4	B	-

Table 15: I-90 Freeway Segment Traffic Operations – 2025 No-Build Conditions

I-90 Freeway Segment	AM Peak Period		PM Peak Period	
	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS
<b>Eastbound I-90</b>				
Basic, 2-lane mainline to Exit 387	6.0	A	4.5	A
Diverge, to Western Avenue (Exit 387)	12.2	B	10.2	B
Basic, 2-lane mainline within Exit 387	5.8	A	4.3	A
Merge, from Western Avenue (Exit 387)	15.2	B	11.8	B
Basic, 2-lane mainline between Exits 387 and 390	8.8	A	5.5	A
Diverge, to SD 38 (Exit 390)	15.6	B	11.4	B
Basic, 2-lane within Exit 390	8.6	A	5.3	A
Merge, from SD 38 (Exit 390)	17.1	B	12.6	B
Basic, 2-lane mainline from Exit 390	10.1	A	6.1	A
<b>Westbound I-90</b>				
Basic, 2-lane mainline to Exit 390	4.5	A	10.7	A
Diverge, to SD 38 (Exit 390)	8.3	A	16.5	B
Basic, 2-lane mainline within Exit 390	3.8	A	8.8	A
Merge, from SD 38 (Exit 390)	6.4	A	12.4	B
Basic, 2-lane mainline between Exits 390 and 387	3.9	A	8.8	A
Diverge, to Western Avenue (Exit 387)	9.4	A	15.8	B
Basic, 2-lane mainline within Exit 387	3.3	A	6.5	A
Merge, from Western Avenue (Exit 387)	10.0	A	13.8	B
Basic, 2-lane mainline from Exit 387	3.8	A	6.7	A
<b>Facility</b>				
Eastbound	7.6	B (rural)	5.1	A (rural)
		A (urban)		A (urban)
Westbound	4.0	A (rural)	8.1	B (rural)
		A (urban)		A (urban)

EXIT 387

EXIT 390



### LEGEND

- NUMBER OF LANES AND FLOW DIRECTION
  - AM BASIC FREEWAY LEVEL OF SERVICE  
PM
  - AM RAMP MERGE LEVEL OF SERVICE  
PM
  - AM RAMP DIVERGE LEVEL OF SERVICE  
PM
  - AM INTERSECTION LEVEL OF SERVICE  
PM
- A
B
C
D
E
F

### INTERSECTION PEAK HOUR OPERATIONS

ID	CORRIDORS	CONTROL TYPE		HCM 6TH EDITION LEVEL OF SERVICE		LOCAL STREET WEIGHTED AVERAGE LEVEL OF SERVICE	
		SIGNAL	STOP	AM	PM	AM	PM
<b>Western Ave</b>							
1	Western Avenue & Mickelson Road		X	C	B	A	A
2	Western Avenue & Opal Lane		X	C	B	A	A
3	Western Avenue & Diamond Trail		X	B	B	A	A
4	Western Avenue & I-90 WB Ramp Terminal		X	B	B	-	-
5	Western Avenue & I-90 EB Ramp Terminal		X	C	B	-	-
6	Western Avenue & Jeffrey Street		X	B	B	A	A
7	Western Avenue & 261st Street		X	B	B	A	A
<b>SD 38</b>							
8	SD 38 & I-90 WB Ramp Terminal		X	B	B	-	-
9	SD 38 & I-90 EB Ramp Terminal		X	B	C	-	-

NOTES:  
 WEIGHTED AVERAGE LOS DERIVED FROM HCM 6TH EDITION AWSC LOS CRITERIA  
 \* DENOTES V/C RATIO > 1



2025 NO-BUILD CONDITIONS

IMJR TRAFFIC OPERATIONS ANALYSIS  
 I-90 EXIT 387 INTERCHANGE  
 MINNEHAHA COUNTY, SOUTH DAKOTA

JULY 2018  
 Figure 38

### 6.3. 2050 No-Build Condition Traffic Operations

The 2050 Planning Year No-Build Conditions LOS results are summarized in **Figure 39** and shown with respective density and average control delay values in **Tables 16-19**. Measured LOS values reflective of the worst-case stop-controlled approach delay and weighted average intersection delay are reported for each stop-controlled local road intersection.

The analysis shows that the Western Avenue worst-case stop-controlled approaches operate between LOS B and LOS D in the 2050 peak hours, while the weighted average delay operations at stop-controlled intersections on Western Avenue are LOS A and the ramp terminal intersections operate between LOS B and LOS F. The Western Avenue 2-lane highway segment operations range between LOS B and LOS D, while the segment bicycle operations range from LOS B to LOS F. All Interstate segments operate at LOS A or B.

**Table 16: Western Avenue Corridor Intersections – 2050 No-Build Conditions**

Western Avenue Intersection	Intersection Control Type	AM Peak Period		PM Peak Period	
		Avg. Delay (sec/veh)	LOS	Avg. Delay (sec/veh)	LOS
Mickelson Road (260 <sup>th</sup> St)	TWSC*	34.9	D	24.3	C
Opal Lane	TWSC*	23.6	C	21.2	C
Diamond Trail	TWSC*	22.3	C	29.3	D
I-90 Exit 387 WB	TWSC*	11.4	B	32.8	D
I-90 Exit 387 EB	TWSC*	30.1	D	18.4	C
Jeffrey Street	TWSC*	11.2	B	12.3	B
261 <sup>st</sup> Street	TWSC*	12.4	B	12.5	B

\* Two-way stop-control LOS reflects worst-case stop-controlled approach.

**Table 17: Western Avenue Corridor Local Network Intersections (Weighted Average) – 2050 No-Build Conditions**

Western Avenue Intersection	Intersection Control Type	AM Peak Period		PM Peak Period	
		Weighted Avg. Delay (sec/veh)	LOS	Weighted Avg. Delay (sec/veh)	LOS
Mickelson Road (260 <sup>th</sup> St)	TWSC	7.9	A	4.0	A
Opal Lane	TWSC	2.8	A	1.9	A
Diamond Trail	TWSC	3.3	A	4.8	A
Jeffrey Street	TWSC	0.9	A	1.8	A
261 <sup>st</sup> Street	TWSC	1.9	A	1.1	A

**Table 18: I-90 Exit 390 Ramp Terminal Traffic Operations – 2050 No-Build Conditions**

SD 38 Intersection	Intersection Control Type	AM Peak Period		PM Peak Period	
		Avg. Delay (sec/veh)	LOS	Avg. Delay (sec/veh)	LOS
I-90 WB Ramp Terminal	TWSC*	13.0	B	98.7	F#
I-90 EB Ramp Terminal	TWSC*	47.8	E	50.5	F

\*Two-way stop-control LOS reflects worst-case stop-controlled approach.

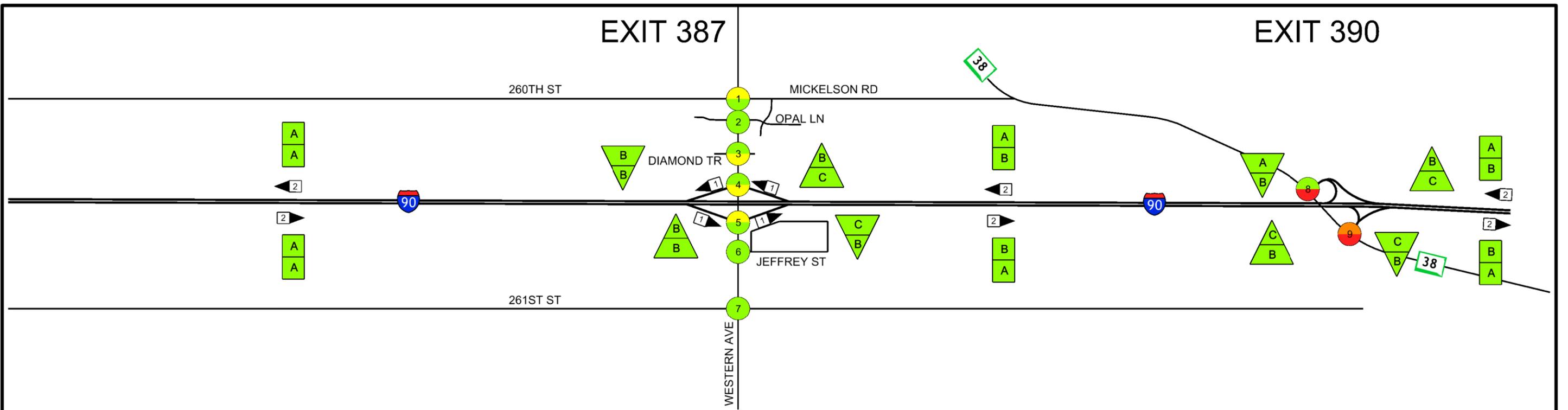
#Denotes volume/capacity ratio greater than 1.

**Table 19: I-90 Freeway Segment Traffic Operations – 2050 No-Build Conditions**

I-90 Freeway Segment	AM Peak Period		PM Peak Period	
	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS
<b>Eastbound I-90</b>				
Basic, 2-lane mainline to Exit 387	9.5	A	7.1	A
Diverge, to Western Avenue (Exit 387)	16.8	B	13.7	B
Basic, 2-lane mainline within Exit 387	9.3	A	6.7	A
Merge, from Western Avenue (Exit 387)	20.7	C	15.3	B
Basic, 2-lane mainline between Exits 387 and 390	13.7	B	8.6	A
Diverge, to SD 38 (Exit 390)	21.9	C	15.3	B
Basic, 2-lane within Exit 390	13.4	B	8.1	A
Merge, from SD 38 (Exit 390)	24.4	C	16.7	B
Basic, 2-lane mainline from Exit 390	16.9	B	9.8	A
<b>Westbound I-90</b>				
Basic, 2-lane mainline to Exit 390	6.8	A	17.2	B
Diverge, to SD 38 (Exit 390)	11.3	B	24.4	C
Basic, 2-lane mainline within Exit 390	5.5	A	13.5	B
Merge, from SD 38 (Exit 390)	8.7	A	18.1	B
Basic, 2-lane mainline between Exits 390 and 387	5.9	A	13.7	B
Diverge, to Western Avenue (Exit 387)	12.0	B	22.1	C
Basic, 2-lane mainline within Exit 387	4.8	A	10.2	A
Merge, from Western Avenue (Exit 387)	12.3	B	18.5	B
Basic, 2-lane mainline from Exit 387	5.7	A	10.7	A
<b>Facility</b>				
Eastbound	12.0	B (rural)	8.1	B (rural)
		B (urban)		A (urban)
Westbound	6.0	A (rural)	12.8	B (rural)
		A (urban)		B (urban)

EXIT 387

EXIT 390



### LEGEND

- NUMBER OF LANES AND FLOW DIRECTION
  - AM BASIC FREEWAY LEVEL OF SERVICE  
PM
  - AM RAMP MERGE LEVEL OF SERVICE  
PM
  - AM RAMP DIVERGE LEVEL OF SERVICE  
PM
  - AM INTERSECTION LEVEL OF SERVICE  
PM
- A
B
C
D
E
F

### INTERSECTION PEAK HOUR OPERATIONS

ID	CORRIDORS	CONTROL TYPE		HCM 6TH EDITION LEVEL OF SERVICE		LOCAL STREET WEIGHTED AVERAGE LEVEL OF SERVICE	
		SIGNAL	STOP	AM	PM	AM	PM
<b>Western Ave</b>							
1	Western Avenue & Mickelson Road		X	D	C	A	A
2	Western Avenue & Opal Lane		X	C	C	A	A
3	Western Avenue & Diamond Trail		X	C	D	A	A
4	Western Avenue & I-90 WB Ramp Terminal		X	B	D	-	-
5	Western Avenue & I-90 EB Ramp Terminal		X	D	C	-	-
6	Western Avenue & Jeffrey Street		X	B	B	A	A
7	Western Avenue & 261st Street		X	B	B	A	A
<b>SD 38</b>							
8	SD 38 & I-90 WB Ramp Terminal		X	B	F*	-	-
9	SD 38 & I-90 EB Ramp Terminal		X	E	F	-	-

NOTES:  
 WEIGHTED AVERAGE LOS DERIVED FROM HCM 6TH EDITION AWSC LOS CRITERIA  
 \* DENOTES V/C RATIO > 1



NOT TO SCALE

2050 NO-BUILD CONDITIONS

IMJR TRAFFIC OPERATIONS ANALYSIS  
 I-90 EXIT 387 INTERCHANGE  
 MINNEHAHA COUNTY, SOUTH DAKOTA

JULY 2018  
 Figure 39

#### **6.4. Future Year No-Build Traffic Operations Conclusions**

Analysis of the existing roadway network under 2050 traffic conditions shows that all segments will operate within the limits set in the Methods and Assumptions document without roadway improvements, except for the ramp terminal intersections at Exit 390. While the intersections along Western Avenue, including the ramp terminal intersections at Exit 387, don't require improvements for capacity reasons, the interchange needs to be revised to prevent future collisions with the interchange structure. Interchange improvements will provide the opportunity to provide potential enhancements to roadway safety and multi-modal service, as described in **Chapter 5**.

While capacity improvements at Exit 390 are not the subject of this study, it appears likely that low peak hour levels of service in 2050 at that location may be remedied by Transportation System Management (TSM) actions.

## 7. Alternatives Analysis

**Chapter 5**, Alternatives, summarized the development and screening process for potential interchange and corridor concepts and Build Alternatives. The following interchange and corridor Build Alternatives were carried forward (from **Chapter 5**) for further analysis in this chapter:

- No-Build

### Interchange Concepts Carried Forward

1. Standard Diamond
2. Standard Diamond with Roundabouts
3. Standard Diamond – Western Avenue Shifted West
4. Standard Diamond with Roundabouts – Western Avenue Shifted West

### Corridor Concepts Carried Forward

- B. 3-Lane Urban Section (North of Interchange only)
- C. 2-Lane Rural Section with Shared-Use Path (South of Interchange only)
- E. Southwest Quadrant Frontage Road Realignment
  - a. Merge this concept with interchange concepts in build option refinement phase

This chapter investigates the relative feasibility of each alternative and seeks to further determine which alternatives best meet the study purpose and need.

All interchange construction alternatives currently under consideration involve some form of standard diamond interchange, with associated construction on the adjacent segments of Western Avenue. Interchange Alternatives 1 and 2 keep Western Avenue on its current alignment through the interchange area while Alternatives 3 and 4 shift the Western Avenue alignment to the west to allow staged bridge construction and maintain traffic through the interchange area instead of requiring long construction detours. The corridor concepts under consideration complement the interchange alternatives by providing a 3-lane urban street north of the interchange, a 2-lane rural roadway south of the interchange and a realignment of the southwest quadrant frontage road to provide greater intersections spacing from the interchange.

### 7.1. Traffic Operations

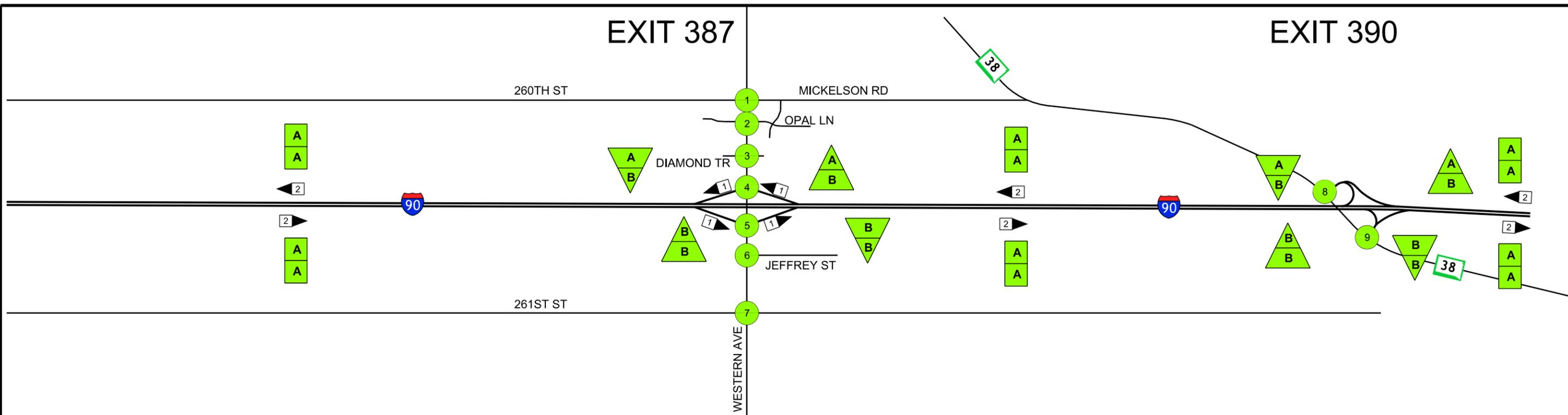
Analysis of the traffic operations of the construction alternatives was documented in the Build Alternatives Traffic Operations project memorandum (**Appendix K**). The results of the analysis are summarized in the following discussion.

#### Analysis for 2025 Conditions

Level of Service results shown in **Figures 40 and 41** show that all segments and intersections and all construction alternatives satisfy the relevant operational criteria under 2025 traffic conditions. **Tables 20 and 21** provide additional information on corridor operations.

EXIT 387

EXIT 390



### LEGEND

- NUMBER OF LANES AND FLOW DIRECTION
  - AM BASIC FREEWAY LEVEL OF SERVICE  
PM
  - AM RAMP MERGE LEVEL OF SERVICE  
PM
  - AM RAMP DIVERGE LEVEL OF SERVICE  
PM
  - AM INTERSECTION LEVEL OF SERVICE  
PM
- A
B
C
D
E
F

### INTERSECTION PEAK HOUR OPERATIONS

ID	CORRIDORS	CONTROL TYPE			HCM 6TH EDITION LEVEL OF SERVICE		LOCAL STREET WEIGHTED AVERAGE LEVEL OF SERVICE	
		SIGNAL	STOP	RAB	AM	PM	AM	PM
<b>Western Ave</b>								
1	Western Avenue & Mickelson Road		X		B	B	A	A
2	Western Avenue & Opal Lane		X		C	B	A	A
3	Western Avenue & Diamond Trail		X		B	B	A	A
4	Western Avenue & I-90 WB Ramp Terminal		X		B	B	-	-
5	Western Avenue & I-90 EB Ramp Terminal		X		C	B	-	-
6	Western Avenue & Jeffrey Street		X		B	B	A	A
7	Western Avenue & 261st Street		X		B	B	A	A
<b>SD 38</b>								
8	SD 38 & I-90 WB Ramp Terminal		X		B	B	-	-
9	SD 38 & I-90 EB Ramp Terminal		X		B	C	-	-

NOTES:  
 WEIGHTED AVERAGE LOS DERIVED FROM HCM 6TH EDITION AWSC LOS CRITERIA  
 \* DENOTES V/C RATIO > 1

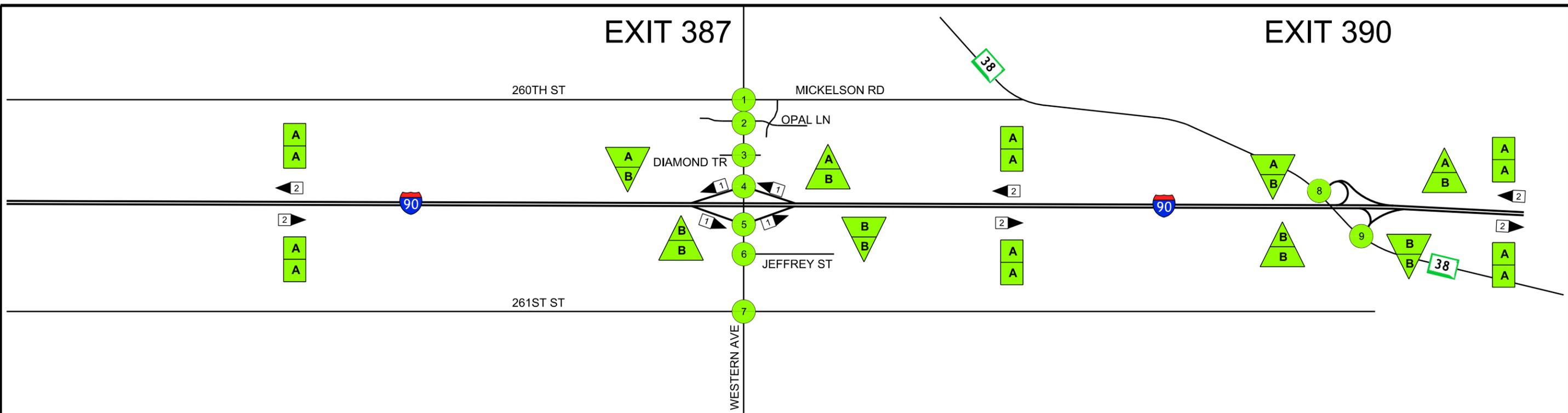


NOT TO SCALE

2025 STANDARD DIAMOND BUILD CONDITIONS	IMJR TRAFFIC OPERATIONS ANALYSIS	OCT 2018
	I-90 EXIT 387 INTERCHANGE MINNEHAHA COUNTY, SOUTH DAKOTA	Figure 40
		PAGE 27

EXIT 387

EXIT 390



### LEGEND

- NUMBER OF LANES AND FLOW DIRECTION
  - AM BASIC FREEWAY LEVEL OF SERVICE  
PM
  - AM RAMP MERGE LEVEL OF SERVICE  
PM
  - AM RAMP DIVERGE LEVEL OF SERVICE  
PM
  - AM INTERSECTION LEVEL OF SERVICE  
PM
- A
B
C
D
E
F

### INTERSECTION PEAK HOUR OPERATIONS

ID	CORRIDORS	CONTROL TYPE			HCM 6TH EDITION LEVEL OF SERVICE		LOCAL STREET WEIGHTED AVERAGE LEVEL OF SERVICE	
		SIGNAL	STOP	RAB	AM	PM	AM	PM
<b>Western Ave</b>								
1	Western Avenue & Mickelson Road		X		B	B	A	A
2	Western Avenue & Opal Lane		X		C	B	A	A
3	Western Avenue & Diamond Trail		X		B	B	A	A
4	Western Avenue & I-90 WB Ramp Terminal			X	A	A	-	-
5	Western Avenue & I-90 EB Ramp Terminal			X	A	A	-	-
6	Western Avenue & Jeffrey Street		X		B	B	A	A
7	Western Avenue & 261st Street		X		B	B	A	A
<b>SD 38</b>								
8	SD 38 & I-90 WB Ramp Terminal		X		B	B	-	-
9	SD 38 & I-90 EB Ramp Terminal		X		B	C	-	-

NOTES:  
WEIGHTED AVERAGE LOS DERIVED FROM HCM 6TH EDITION AWSC LOS CRITERIA  
\* DENOTES V/C RATIO > 1



NOT TO SCALE

**Table 20: 2025 Build Conditions – I-90 Exit 387 Ramp Terminal Intersection 95<sup>th</sup> Percentile Queues**

I-90 EXIT 387 RAMP TERMINAL INTERSECTION	MOVEMENT	NO-BUILD CONDITIONS		STANDARD DIAMOND (ALT. 1 & 3)		STANDARD DIAMOND WITH ROUNDBOUTS (ALT. 2 & 4)	
		95TH % QUEUE (FT.)		95TH % QUEUE (FT.)		95TH % QUEUE (FT.)	
		AM	PM	AM	PM	AM	PM
I-90 EXIT 387 WB RAMP TERMINAL	WB OFF-RAMP	10.0	57.5	7.5	37.5	7.5	35.0
	NB LEFT TURN	2.5	2.5	2.5	2.5	12.5	12.5
	INTERSECTION CONTROL	TWSC	TWSC	TWSC	TWSC	TWSC	TWSC
I-90 EXIT 387 EB RAMP TERMINAL	EB OFF-RAMP	12.5	7.5	10.0	5.0	5.0	2.5
	SB LEFT TURN	22.5	7.5	22.5	7.5	35.0	22.5
	INTERSECTION CONTROL	TWSC	TWSC	TWSC	TWSC	TWSC	TWSC

**Table 21: 2025 Build Conditions – Interchange O-D Delay**

ORIGIN-DESTINATION PATH CONTROL DELAY		NO-BUILD CONDITIONS		STANDARD DIAMOND (ALTS 1 & 3)		STANDARD DIAMOND WITH ROUNDBOUTS (ALTS 2 & 4)	
		DELAY (SEC/VEH)		DELAY (SEC/VEH)		DELAY (SEC/VEH)	
		AM	PM	AM	PM	AM	PM
WESTERN AVENUE THROUGH MOVEMENTS	O <sub>3</sub> - D <sub>4</sub>	0	0	0	0	10.5	8.7
	O <sub>4</sub> - D <sub>3</sub>	0	0	0	0	12.0	9.8
WESTERN AVENUE TO I- 90 ON-RAMP MOVEMENTS	O <sub>3</sub> - D <sub>1</sub>	0	0	0	0	6.5	4.8
	O <sub>3</sub> - D <sub>2</sub>	8.5	7.9	8.5	7.9	10.5	8.7
	O <sub>4</sub> - D <sub>2</sub>	0	0	0	0	6.3	5.1
I-90 OFF-RAMP TO WESTERN AVENUE MOVEMENTS	O <sub>4</sub> - D <sub>1</sub>	8.5	8.0	8.5	8.0	12.0	9.8
	O <sub>1</sub> - D <sub>3</sub>	10.8	13.3	14.2	12.9	10.0	11.2
	O <sub>1</sub> - D <sub>4</sub>	10.8	13.3	9.7	11.3	4.3	6.5
	O <sub>2</sub> - D <sub>3</sub>	16.7	12.4	9.0	9.3	5.1	4.2
	O <sub>2</sub> - D <sub>4</sub>	16.7	12.4	20.0	13.9	9.1	8.1

### Analysis for 2050 Conditions

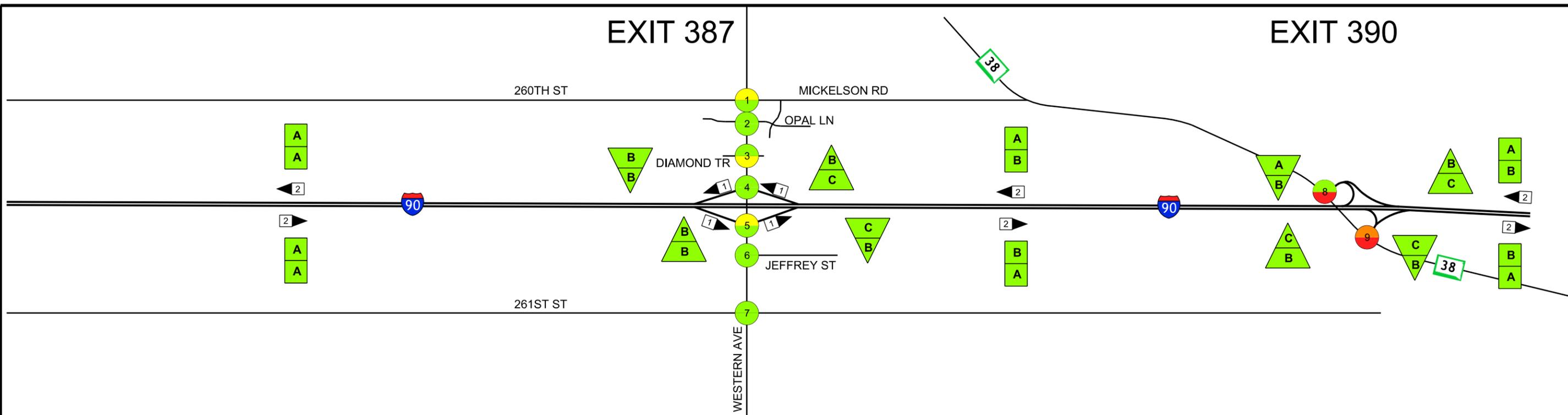
Level of Service results shown in **Figures 42 and 43** show that all segments and intersections and all construction alternatives satisfy the relevant operational criteria under 2050 traffic conditions, except the ramp terminal intersections at Exit 390 (SD 38). It appears that operations at Exit 390 may be improved through TSM measures such as the addition of turn lanes and/or intersection signalization. **Tables 22 and 23** provide additional information on corridor operations.

The analysis indicates that traffic signal control may be required by 2050 at the WB ramp terminal intersection and that roundabout control at the WB ramp terminal intersection provides better level of service than signal control (LOS A/A for roundabout, LOS A/B for signal control). Roundabout control also provides shorter 95% queues at the off-ramps. Delays for crossroad movements are expected to be slightly higher with roundabout control than with signals, although overall ramp terminal intersection delays are lower with roundabouts than with signals. At the time that signalization becomes needed, the SDDOT will reevaluate the ramp terminal intersections to determine whether or not to signalize or install a roundabout.

Interstate mainline and merge/diverge operations are unaffected by the choice of control at the ramp terminals. All Interstate operations are expected to be within the required level of service parameters through 2050.

EXIT 387

EXIT 390



### LEGEND

- NUMBER OF LANES AND FLOW DIRECTION
  - AM BASIC FREEWAY LEVEL OF SERVICE  
PM
  - AM RAMP MERGE LEVEL OF SERVICE  
PM
  - AM RAMP DIVERGE LEVEL OF SERVICE  
PM
  - AM INTERSECTION LEVEL OF SERVICE  
PM
- A
B
C
D
E
F

### INTERSECTION PEAK HOUR OPERATIONS

ID	CORRIDORS	CONTROL TYPE			HCM 6TH EDITION LEVEL OF SERVICE		LOCAL STREET WEIGHTED AVERAGE LEVEL OF SERVICE	
		SIGNAL	STOP	RAB	AM	PM	AM	PM
<b>Western Ave</b>								
1	Western Avenue & Mickelson Road		X		D	C	A	A
2	Western Avenue & Opal Lane		X		C	C	A	A
3	Western Avenue & Diamond Trail		X		C	D	A	A
4	Western Avenue & I-90 WB Ramp Terminal	X			A	B	-	-
5	Western Avenue & I-90 EB Ramp Terminal		X		C	C	-	-
6	Western Avenue & Jeffrey Street		X		B	B	A	A
7	Western Avenue & 261st Street		X		B	B	A	A
<b>SD 38</b>								
8	SD 38 & I-90 WB Ramp Terminal		X		B	F*	-	-
9	SD 38 & I-90 EB Ramp Terminal		X		E	F	-	-

NOTES:  
 WEIGHTED AVERAGE LOS DERIVED FROM HCM 6TH EDITION AWSC LOS CRITERIA  
 \* DENOTES V/C RATIO > 1

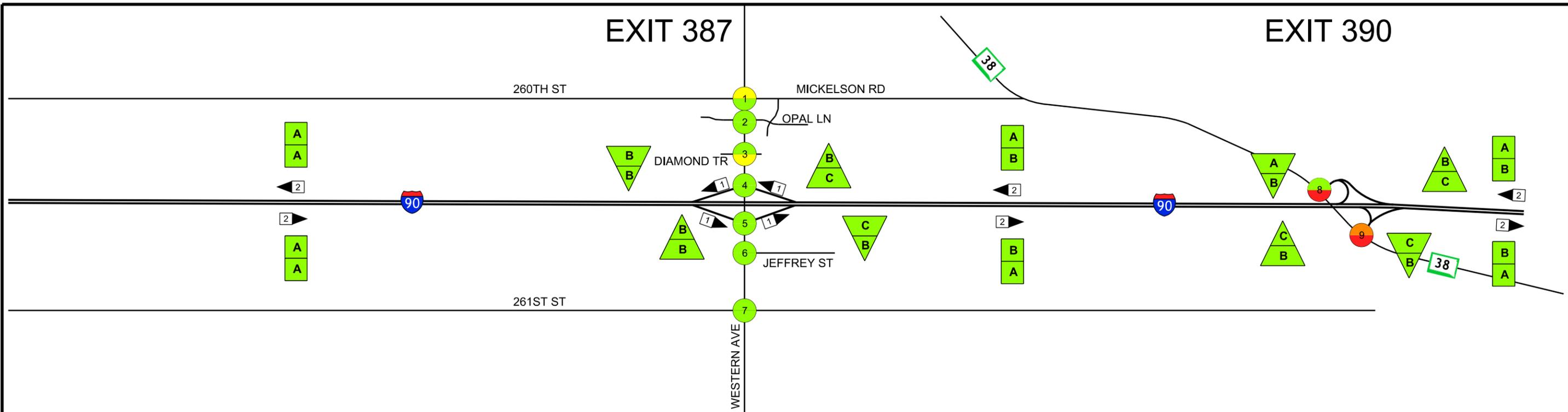


NOT TO SCALE

2050 STANDARD DIAMOND BUILD CONDITIONS

IMJR TRAFFIC OPERATIONS ANALYSIS  
 I-90 EXIT 387 INTERCHANGE  
 MINNEHAHA COUNTY, SOUTH DAKOTA

OCT 2018  
 FIGURE 42  
 PAGE 79



### LEGEND

- NUMBER OF LANES AND FLOW DIRECTION
  - AM BASIC FREEWAY LEVEL OF SERVICE  
PM
  - AM RAMP MERGE LEVEL OF SERVICE  
PM
  - AM RAMP DIVERGE LEVEL OF SERVICE  
PM
  - AM INTERSECTION LEVEL OF SERVICE  
PM
- A
B
C
D
E
F

### INTERSECTION PEAK HOUR OPERATIONS

ID	CORRIDORS	CONTROL TYPE			HCM 6TH EDITION LEVEL OF SERVICE		LOCAL STREET WEIGHTED AVERAGE LEVEL OF SERVICE	
		SIGNAL	STOP	RAB	AM	PM	AM	PM
<b>Western Ave</b>								
1	Western Avenue & Mickelson Road		X		D	C	A	A
2	Western Avenue & Opal Lane		X		C	C	A	A
3	Western Avenue & Diamond Trail		X		C	D	A	A
4	Western Avenue & I-90 WB Ramp Terminal			X	A	A	-	-
5	Western Avenue & I-90 EB Ramp Terminal			X	A	A	-	-
6	Western Avenue & Jeffrey Street		X		B	B	A	A
7	Western Avenue & 261st Street		X		B	B	A	A
<b>SD 38</b>								
8	SD 38 & I-90 WB Ramp Terminal		X		B	F*	-	-
9	SD 38 & I-90 EB Ramp Terminal		X		E	F	-	-

NOTES:  
 WEIGHTED AVERAGE LOS DERIVED FROM HCM 6TH EDITION AWSC LOS CRITERIA  
 \* DENOTES V/C RATIO > 1



NOT TO SCALE

**Table 22: 2050 Build Conditions – I-90 Exit 387 Ramp Terminal Intersection 95<sup>th</sup> Percentile Queues**

I-90 EXIT 387 RAMP TERMINAL INTERSECTION	MOVEMENT	NO-BUILD CONDITIONS		STANDARD DIAMOND (ALT. 1 & 3)		STANDARD DIAMOND WITH ROUNDBOUTS (ALT. 2 & 4)	
		95TH % QUEUE (FT.)		95TH % QUEUE (FT.)		95TH % QUEUE (FT.)	
		AM	PM	AM	PM	AM	PM
I-90 EXIT 387 WB RAMP TERMINAL	WB OFF-RAMP	27.5	220.0	65.5	230.0	12.5	85.0
	NB LEFT TURN	5.0	2.5	15.0	20.0	20.0	25.0
	INTERSECTION CONTROL	TWSC	TWSC	TRAFFIC SIGNAL	TRAFFIC SIGNAL	RDBT	RDBT
I-90 EXIT 387 EB RAMP TERMINAL	EB OFF-RAMP	27.5	20.0	25.0	17.5	7.5	7.5
	SB LEFT TURN	42.5	12.5	42.5	12.5	65.0	37.5
	INTERSECTION CONTROL	TWSC	TWSC	TWSC	TWSC	RDBT	RDBT

**Table 23: 2050 Build Conditions – Interchange O-D Delay**

ORIGIN-DESTINATION PATH CONTROL DELAY		NO-BUILD CONDITIONS		STANDARD DIAMOND (ALTS 1 & 3)		STANDARD DIAMOND WITH ROUNDBOUTS (ALTS 2 & 4)	
		DELAY (SEC/VEH)		DELAY (SEC/VEH)		DELAY (SEC/VEH)	
		AM	PM	AM	PM	AM	PM
WESTERN AVENUE THROUGH MOVEMENTS	O <sub>3</sub> - D <sub>4</sub>	0	0	4.3	9.8	14.8	11.4
	O <sub>4</sub> - D <sub>3</sub>	0	0	8.1	12.2	16.5	13.4
WESTERN AVENUE TO I- 90 ON-RAMP MOVEMENTS	O <sub>3</sub> - D <sub>1</sub>	0	0	0	0	10.3	6.7
	O <sub>3</sub> - D <sub>2</sub>	9.3	8.2	10.4	14.1	14.8	11.4
	O <sub>4</sub> - D <sub>2</sub>	0	0	0	0	9.2	6.8
	O <sub>4</sub> - D <sub>1</sub>	9.7	8.5	17.8	20.7	16.5	13.4
I-90 OFF-RAMP TO WESTERN AVENUE MOVEMENTS	O <sub>1</sub> - D <sub>3</sub>	14.4	32.8	22.5	12.5	12.6	17.5
	O <sub>1</sub> - D <sub>4</sub>	14.4	32.8	25.2	29.8	5.3	10.9
	O <sub>2</sub> - D <sub>3</sub>	30.1	18.4	9.3	9.8	6.4	5.9
	O <sub>2</sub> - D <sub>4</sub>	30.1	18.4	41.8	30.5	10.9	10.6

### Multi-modal Operations

Limitations to HCS7 Streets Module do not allow for the analysis of corridors not bounded by signalized intersections. Therefore, a formal, HCS7-based multi-modal (pedestrian and bicycle) analysis was not conducted for this study. However, proposed multi-modal accommodations as part of the Build Alternatives are an improvement to multi-modal mobility and accessibility throughout the study area.

The Western Avenue corridor currently lacks any multi-modal facilities along the corridor. Western Avenue is currently a rural section through the entire study area, with limited shoulders, no sidewalk or curb and gutter, and ditches to convey storm water. The existing bridge over I-90 does not have any additional room for pedestrians or bicycles outside of the vehicular travel lanes. This limits multi-modal mobility and accessibility throughout the corridor.

Recent development and side-street improvements has begun to extend sidewalks and pedestrian crossing opportunities up to Western Avenue, (Diamond Trail, Opal Lane, and Mickelson Road). However, these routes are currently fragmented and the lack of facilities along Western Avenue and over I-90 limits north/south connectivity.

Each proposed Build Alternative provides improved pedestrian and bicycle route accessibility and connectivity along Western Avenue and across I-90 through the following improvements:

- Interchange Build Alternatives
  - 10-foot shared use path on east side
  - 6-foot sidewalk on the west side (5-foot sidewalk where boulevard section is present)
  - Key features compared to No-Build Conditions:
    - Extends Western Avenue bicycle and pedestrian accommodations across I-90
- Western Avenue Build Alternative (North of I-90 Exit 387 interchange)
  - 10-foot shared use path on east side
  - 5-foot sidewalk where boulevard section is present (6-foot if located back of curb)
  - Key features compared to No-Build Conditions:
    - Extends bicycle and pedestrian accommodations along Western Avenue, connecting to proposed improvements at I-90 Exit 387 interchange
    - Connects to existing side-street sidewalks
    - Provides multi-modal connectivity to the Western Avenue corridor and the rest of Hartford for development extending outward from Western Avenue (eliminates the multi-modal island situation for some development)
- Western Avenue Build Alternative (South of I-90 Exit 387 interchange)
  - 10-foot shared use path on east side
  - Key features compared to No-Build Conditions:
    - Extends bicycle and pedestrian accommodations along Western Avenue south of the I-90 Exit 387 interchange to Jeffrey Street

Neither a sidewalk nor shared-use path are extended south of Jeffrey Street. At this time, Minnehaha County does not plan to extend these facilities southward beyond the interchange area. Jeffrey Street is considered the logical termini for multi-modal facilities for this study. It is anticipated that 463<sup>rd</sup> Avenue (Western Avenue) will see some bicycle use, but demand is expected to be low and riders are typically experienced road bicyclists. If or when future development does occur south of I-90, multi-modal improvements associated with that development will be able to tie into the proposed shared-use path and sidewalk extending southward through the I-90 Exit 387 interchange as part of this study's Build Alternatives.

It can be concluded that while an HCS7-based analysis was not conducted on multi-modal operations, the proposed Build Alternatives provide a significant improvement to multi-modal accessibility and connectivity.

### Corridor Analysis

Limitations to the HCS7 Streets Module does not allow for the analysis of corridors not bounded by signalized intersections. Therefore, a formal HCS7 Streets Module-based corridor analysis was not conducted for this study.

In the No-Build Conditions operations memorandum, the corridor was analyzed with HCM6 Two-Lane Highways methodology. This methodology assigns a LOS based on percent-time spent following (PTSF) of a vehicle following another vehicle.

Improvements proposed as part of this study will convert much of the Western Avenue corridor from a rural cross-section to an urban cross-section. Growth surrounding the interchange and throughout Hartford is expected to transform this area into more of an urbanized area as well. It is anticipated that this corridor would transition out of a HCM6-defined Class II two-lane highway to a Class III two-lane highway with 100 percent not passing. Therefore, the operational goals of this corridor begin to change and focus more on intersection operations as compared to the time one vehicle spends following another vehicle.

The HCM6 methodology does not formally evaluate two-way left-turn lanes in the Two-Lane Highways methodology. However, discussion in Chapter 15 highlights the delay reduction benefits of a two-way left-turn lane (TWLTL). The primary operational benefit is that left-turning traffic is removed from the through lane and allowed to start the left-turn movement from the two-way left-turn lane. Safety benefits are also realized with the reduced risk of rear-end collisions from stopped, left-turning vehicles in the through lane.

### Control of Access

Control of access (COA) along the Western Avenue corridor is an important consideration in the long-term operational and safety performance of the interchange. FHWA established COA requirements along the crossroad corridor upstream and downstream of the interchange. Distances are measured in accordance with Figure 13-12 in the *SDDOT Road Design Manual*<sup>4</sup>. The minimum COA, as noted in the *SDDOT Road Design Manual*, is shown in the following table.

---

<sup>4</sup> *South Dakota Department of Transportation Road Design Manual*. Accessed September 2017. <http://sddot.com/business/design/forms/roaddesign/Default.aspx>

**Table 24: Minimum Control of Access along Crossroad**

Location	Urban (ft.)	Rural (ft.)
Reconstruction of Existing Interchange	100	300
Construction of New Interchange	660	660

*SDDOT Road Design Manual (obtained September 2017).*

The SDDOT Road Design Manual notes that these are minimum distances as established by AASHTO’s *A Policy on Design Standards Interstate System*<sup>5</sup>. The manual also recommends additional control for existing interchanges with established safety and operational concerns or if it is feasible to meet South Dakota Access Location Criteria.

The following summarizes existing and proposed access locations and their relation to COA requirements.

Existing COA on the north side of the interchange extends approximately 720’ to Diamond Trail. A break in the COA has been granted for the Coffee Cup truck stop on the west side of Western Avenue. COA on the south side of the interchange currently extends approximately 730’ with a frontage road connection on the west side of Western Avenue within the COA area.

The proposed corridor improvement alternatives would maintain the existing COA north of the interchange and would relocate the frontage road intersection south to align with the existing Jeffrey Street intersection, creating an effective COA distance of 730’ on the south side of the interchange.

## 7.2. Conformance with Transportation Plans

The proposed interchange improvements conform to both state and local plans. While a project at Exit 387 was not identified in the 2010 Decennial Interstate Corridor Study, the need for interchange improvements has been driven by subsequent damage to the interchange structure. Preliminary engineering tasks have been programmed for Exit 387 in the 2022 fiscal year in the current STIP, with tentative construction in 2025.

## 7.3. Compliance with Policies and Engineering Studies

The interchange No-Build alternative does not meet the project need of providing greater clearance over the Interstate mainline and preventing further damage to the structure. Alternatives 1-4 all will provide proper clearance, as specified in the SDDOT Road Design Manual and other guidance. All other design and administrative aspects of Alternatives 1-4 will comply with the latest version of the SDDOT Road Design Manual.

## 7.4. Environmental Impacts

The Environmental Document provides details of the environmental evaluation of the No-Build alternative and build Alternatives 3 and 4. See the Environmental Document for additional

<sup>5</sup> *A Policy on Design Standards Interstate System*. American Association of State Highway and Transportation Officials. January 2016.

information on this evaluation. Potential impacts of the construction alternatives include wetlands, floodplain, right-of-way, and economic impact to adjacent businesses during construction. These impacts were determined to be minor and may either be avoided or mitigated.

### 7.5. Safety

A safety analysis of the alternatives was documented in a Crash Prediction Memorandum, contained in the **Appendix F**. That analysis, summarized in **Table 25**, shows that addition of turn lanes is expected to provide significant safety benefits when compared to the No-Build corridor. The Crash Prediction Memorandum also showed that use of roundabout intersection control at the Exit 387 ramp termini would provide significant safety and speed control benefits.

**Table 25: Study Area Crash Prediction Summary**

LOCATION	FACILITY TYPE	CONDITION	PREDICTED NO. OF CRASHES (2018-2050)	PERCENT REDUCTION
I-90 INTERCHANGE SOUTH RAMPS	INTERCHANGE	EXISTING	31.7	-
		ADD NB LEFT TURN LANE (TWSC)	22.8	28%
		ROUNDBABOUT	17.8	44%
I-90 INTERCHANGE NORTH RAMPS	INTERCHANGE	EXISTING	41.0	-
		ADD NB LEFT TURN LANE (TWSC)	29.5	28%
		ROUNDBABOUT	22.9	44%
WESTERN AVENUE - SOUTH OF I-90	ROADWAY SEGMENT	EXISTING	33.0	-
		ADD 4-FOOT SHOULDER	32.6	1%
WESTERN AVENUE - NORTH OF I-90	ROADWAY SEGMENT	EXISTING	60.5	-
		ADD 8-FOOT SHOULDER	48.9	19%
		ADD TWO-WAY LEFT TURN LANE	48.4	20%
JEFFREY STREET	INTERSECTION	EXISTING	15.3	-
		ADD SB LEFT TURN LANE	11.0	28%
DIAMOND TRAIL	INTERSECTION	EXISTING	49.9	-
		ADD NB AND SB LEFT TURN LANES	25.9	48%
OPAL LANE	INTERSECTION	EXISTING	36.1	-
		ADD NB LEFT TURN LANE	26.0	28%
MICKELSON ROAD	INTERSECTION	EXISTING	40.0	-
		ADD NB AND SB LEFT TURN LANES AND NB RIGHT TURN LANE	12.9	68%

## 7.6. Evaluation Matrix

**Table 26** provides a comparison of the No-Build and Build Alternatives. Evaluation criteria were established from the project Purpose and Need and feeds into the Environmental Document screening process. Ratings for each of the criterion are based on Poor/Good/Best or Yes/No. The evaluation shows that Alternatives 1 and 2, which require full closure of the cross-road during construction, pose major impacts related to traffic delay and economic effects on businesses.

Input at the second public and stakeholder meetings on November 26, 2018, indicated that there was strong public support for alternatives that would maintain traffic through the interchange during construction. Consideration was given to removing Alternatives 1 and 2 from the list of feasible alternatives and SDDOT requested a thorough life cycle analysis of Alternatives 3 and 4, **Table 27 and Appendix O**. That analysis showed a present value of crash cost savings and travel time savings benefits of \$2,514,593 and a present value of additional costs of \$898,257 for construction of Alternative 4 when compared with Alternative 3, resulting in a Benefit/Cost ratio of 2.80.

In July 2019, SDDOT provided a determination that due to public concern statewide with installation and functionality of roundabouts, SDDOT will consider alternative options for intersection configuration in the near future. The preferred alternative at this location will not preclude alternative intersection types in the future. Therefore, Alternative 3 stands as the concept that best meets the technical needs and community desires for replacement of the Exit 387 interchange. At the time that signalization becomes needed, the SDDOT will reevaluate the ramp terminal intersections to determine whether or not to signalize or install a roundabout.

TABLE 26 - I-90 EXIT 387 INTERCHANGE CONCEPT PRELIMINARY EVALUATION MATRIX

	CRITERION	STANDARD DIAMOND INTERCHANGES				STANDARD DIAMOND INTERCHANGES WITH LOWERED I-90				9. STANDARD DIAMOND WITH I-90 OVER WESTERN AVE
		1. STANDARD DIAMOND	2. STANDARD DIAMOND WITH ROUNDABOUTS	3. STANDARD DIAMOND - WESTERN AVE. SHIFTED WEST	4. STANDARD DIAMOND WITH ROUNDABOUTS - WESTERN AVE SHIFTED WEST	5. STANDARD DIAMOND WITH LOWERED I-90	6. STANDARD DIAMOND WITH ROUNDABOUTS AND LOWERED I-90	7. STANDARD DIAMOND WITH LOWERED I-90 - WESTERN AVE SHIFTED WEST	8. STANDARD DIAMOND WITH ROUNDABOUTS AND LOWERED I-90 - WESTERN AVE SHIFTED WEST	
PURPOSE & NEED	17' VERTICAL CLEARANCE ON I-90 - BOTTOM OF GIRDERS TO I-90 SURFACE	MEETS	MEETS	MEETS	MEETS	MEETS	MEETS	MEETS	MEETS	MEETS
	MEETS MULTI-MODAL NEEDS	MEETS	MEETS	MEETS	MEETS	MEETS	MEETS	MEETS	MEETS	MEETS
ENVIRONMENTAL FACTORS	ENVIRONMENTAL IMPACTS	MINOR IMPACTS	MINOR IMPACTS	MINOR IMPACTS	MINOR IMPACTS	MODERATE IMPACTS	MODERATE IMPACTS	MODERATE IMPACTS	MODERATE IMPACTS	MAJOR IMPACTS
	ECONOMIC IMPACT TO BUSINESSES DURING CONSTRUCTION	MODERATE IMPACTS	MODERATE IMPACTS	MINOR IMPACTS	MINOR IMPACTS	MODERATE IMPACTS	MODERATE IMPACTS	MINOR IMPACTS	MINOR IMPACTS	MAJOR IMPACTS
	RELOCATIONS	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE
TRAFFIC & ENGINEERING FACTORS	MEETS CURRENT DESIGN GUIDELINES	MEETS	MEETS	MEETS	MEETS	MEETS	MEETS	MEETS	MEETS	MEETS
	RAMP TERMINAL LOS (YEAR 2018)									
	WORST CASE APPROACH (WB/EB)	APPROACH: A/A	APPROACH: A/A	APPROACH: A/A	APPROACH: A/A	APPROACH: A/A	APPROACH: A/A	APPROACH: A/A	APPROACH: A/A	APPROACH: A/A
	WORST CASE INTERSECTION (WB/EB)	INTERSECTION: A/A	INTERSECTION: A/A	INTERSECTION: A/A	INTERSECTION: A/A	INTERSECTION: A/A	INTERSECTION: A/A	INTERSECTION: A/A	INTERSECTION: A/A	INTERSECTION: A/A
	WESTERN AVE ALIGNMENT SAFETY	NO ALIGNMENT SHIFT	NO ALIGNMENT SHIFT	ALIGNMENT SHIFT	ALIGNMENT SHIFT	NO ALIGNMENT SHIFT	NO ALIGNMENT SHIFT	ALIGNMENT SHIFT	ALIGNMENT SHIFT	NO ALIGNMENT SHIFT
	INTERSECTION SAFETY (RAMP TERMINI)	GOOD	BEST	GOOD	BEST	GOOD	BEST	GOOD	BEST	FAIR
CONSTRUCTABILITY & COST	BRIDGE CONSTRUCTABILITY	FULL CLOSURE: STANDARD 1-LANE: MINIMAL CHALLENGES	FULL CLOSURE: STANDARD 1-LANE: MINIMAL CHALLENGES	MINIMAL CHALLENGES	MINIMAL CHALLENGES	FULL CLOSURE: STANDARD 1-LANE: MINIMAL CHALLENGES	FULL CLOSURE: STANDARD 1-LANE: MINIMAL CHALLENGES	MINIMAL CHALLENGES	MINIMAL CHALLENGES	MODERATE CHALLENGES
	BRIDGE AREA (SF)	16,380	16,380	16,380	16,380	16,380	16,380	16,380	16,380	14,508
	EARTHWORK IMPACTS	STANDARD	MINOR IMPACTS	STANDARD	MINOR IMPACTS	MODERATE IMPACTS	MODERATE IMPACTS	MODERATE IMPACTS	MODERATE IMPACTS	MAJOR IMPACTS
	INTERCHANGE CONSTRUCTABILITY	FULL CLOSURE: BEST 1-LANE: GOOD	FULL CLOSURE: BEST 1-LANE: GOOD	GOOD	GOOD	FULL CLOSURE: BEST 1-LANE: GOOD	FULL CLOSURE: BEST 1-LANE: GOOD	GOOD	GOOD	POOR
	TRAFFIC DELAY OR TRAVEL TIME IMPACTS: MAINTENANCE OF TRAFFIC ACROSS I-90 DURING CONSTRUCTION	FULL CLOSURE: MAJOR IMPACTS 1-LANE: MODERATE IMPACTS	FULL CLOSURE: MAJOR IMPACTS 1-LANE: MODERATE IMPACTS	MAINTAIN 2 LANES: MINOR IMPACTS	MAINTAIN 2 LANES: MINOR IMPACTS	FULL CLOSURE: MAJOR IMPACTS 1-LANE: MODERATE IMPACTS	FULL CLOSURE: MAJOR IMPACTS 1-LANE: MODERATE IMPACTS	MAINTAIN 2 LANES: MINOR IMPACTS	MAINTAIN 2 LANES: MINOR IMPACTS	FULL CLOSURE: MAJOR IMPACTS
	RIGHT-OF-WAY (ACRES)	1.0	0.9	1.1	0.9	1.0	0.9	1.1	0.9	1.2
	CONSTRUCTION COST (\$ MILLION)	\$11.3	\$12.4	\$11.4	\$12.4	\$12.2	\$13.6	\$12.3	\$13.6	\$20.8
CONCLUSION		CARRY FORWARD	CARRY FORWARD	CARRY FORWARD	CARRY FORWARD	HOLD, PENDING CONCEPT 1 REFINEMENT	HOLD, PENDING CONCEPT 2 REFINEMENT	HOLD, PENDING CONCEPT 3 REFINEMENT	HOLD, PENDING CONCEPT 4 REFINEMENT	ELIMINATE

**Table 27: Alternative 3, 4 Evaluation Matrix**

MEASURE	STANDARD DIAMOND INTERCHANGES	
	3. STANDARD DIAMOND - WESTERN AVENUE SHIFTED WEST	4. STANDARD DIAMOND WITH ROUNDABOUTS - WESTERN AVENUE SHIFTED WEST
ENVIRONMENTAL IMPACTS <sup>1</sup>	MINOR IMPACTS	MINOR IMPACTS
ECONOMIC IMPACT TO BUSINESSES DURING CONSTRUCTION	MINOR IMPACTS	MINOR IMPACTS
REQUIRED RIGHT-OF-WAY (SF)	<b>222,468</b>	232,913
RAMP TERMINAL LOS (2050)		
WORST CASE APPROACH (WB/EB)	APPROACH: C/D	<b>APPROACH: B/B</b>
WORST CAST INTERSECTION (WB/EB)	INTERSECTION: A/A	INTERSECTION: A/A
WESTERN AVENUE ALIGNMENT SAFETY	ALIGNMENT SHIFT	ALIGNMENT SHIFT
INTERSECTION SAFETY (RAMP TERMINALS)	GOOD	<b>BEST</b>
INTERSECTION CONFLICT POINTS	32	<b>8</b>
CORRIDOR SPEED CONTROL <sup>2</sup>	REGULATORY ONLY	<b>REGULATORY AND GEOMETRIC</b>
TRAFFIC CALMING/SPEED REDUCTION	POOR	<b>GOOD</b>
BRIDGE CONSTRUCTABILITY	MINIMAL CHALLENGES	MINIMAL CHALLENGES
EARTHWORK IMPACTS	<b>STANDARD</b>	MINOR IMPACTS
INTERCHANGE CONSTRUCTABILITY	GOOD	GOOD
TRAFFIC DELAY OR TRAVEL TIME IMPACTS: MAINTENANCE OF TRAFFIC ACROSS I-90 DURING CONSTRUCTION	MAINTAIN 2 LANES: MINOR IMPACTS	MAINTAIN 2 LANES: MINOR IMPACTS
ANTICIPATED MAINTENANCE COST	\$5,516/YR	<b>\$5,297/YR</b>
LIFE CYCLE COST - FUTURE SIGNALIZATION (\$ MILLION)	\$12.8	
LIFE CYCLE COST - ROUNDABOUT GRADING IN 2025 (\$ MILLION)		\$13.4
LIFE CYCLE COST - ROUNDABOUT GRADING IN 2050 (\$ MILLION)		\$17.4
CONSTRUCTION COST (\$ MILLION), 2019 DOLLARS	<b>\$14.1</b>	\$15.0

<sup>1</sup>Both options have the same potential environmental impacts with one difference. Option 3 would permanently impact 1.11 acres of wetland and Option 4 would impact 1.02 acres

<sup>2</sup>City of Hartford has set up traffic counts and noted traffic with speeds up to 90 mph in corridor.

## 8. Coordination

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

- Stakeholder and Public Meeting #1: Gather feedback on study area issues and needs.
- Stakeholder and Public Meeting #2: Gather feedback on proposed Build Alternatives for further refinement and analysis.
- Public Meeting #3: As part of the publication of Environmental Document, requesting public comment on the preferred alternative and environmental impacts.

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

At the initial set of public and stakeholder meetings held June 28, 2018, the study team gathered feedback from the public regarding the issues and needs they see within and around the I-90 Exit 387 Interchange. Many of the comments focused on the need to maintain traffic through the interchange during construction and the need to add turn lanes on Western Avenue.

The second set of stakeholder and public meetings held November 26, 2018, presented the proposed interchange and corridor Build Alternatives developed for the study area for comment and feedback. Overall, there was notable support for both the Standard Diamond (shifted west) and Standard Diamond with Roundabouts (shifted west) alternatives, with slightly more favoring roundabouts. Comments also favored adding turn lanes on Western Avenue and providing pedestrian and bicycling features along the Western Avenue corridor.

The third public meeting will be held in conjunction with the publication of the Environmental Document, requesting feedback from the public on the proposed preferred alternative and the identified impacts.

Project information has been disseminated to the public through the project website at <http://www.i90exit387study.com>. The website provides links to study materials such as concept and Build Alternative figures, evaluation summaries, and public information meeting material. The website also provides study contact information for SDDOT and consultant project managers. Viewers of the website have the opportunity to submit comments and questions directly from the website.

1/16/2019 I-90 Exit 387

I-90 Exit 387 Overview Study Documents Get Involved Contact

## I-90 Exit 387 (Hartford) Interchange Modification Study and Environmental Review

The South Dakota Department of Transportation (SDDOT), City of Hartford, Sioux Falls Metropolitan Planning Organization (MPO), Minnehaha County, and Federal Highway Administration (FHWA), have identified a need to study the 1-90 Exit 387 interchange. The study includes an Interchange Modification Justification Report (IMJR) and associated environmental investigation.



### Overview

Learn about the study area, process, and study expectations that will guide the development of the project alternatives.

**Overview**



### Study Documents

Documents developed during preliminary research, analysis, visioning, and community input will be provided for review and input.



### Get Involved

You can get involved by reviewing the project overview and study documents, attending the public meeting, then submitting comments to the study contacts.

<http://www.i90exit387study.com/> 1/4

**Figure 44: I-90 Exit 387 Study Website**

*([www.i90exit387study.com](http://www.i90exit387study.com))*

## 9. Funding Plan

The following table provides the planned project that will include the proposed improvements identified as part of this IMJR.

**Table 28: Anticipated Funding Allocation (2019 dollars)**

Project Number	State Funding Category	Federal Funding Category	Federal Funds (\$ million)	State Funds (\$ million)	Other Funds (\$ million)	Total Funds (\$ million)
IM 0909(92)387. PCN 06G8	Interstate	National Highway Performance	\$16.614	\$1.830	\$4.081*	\$22.525
TOTAL:			\$16.614	\$1.830	\$4.081*	\$22.525

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

*\*City of Hartford currently shows this project as a future project in their Capital Improvements Program (CIP) with no estimated cost – these figures have been estimated based on the proposed improvements in this study, but have not been committed.*

Inflated costs to year of implementation are calculated at \$25.367 million

## 10. Recommendations

Based on the analysis contained herein, the IMJR-recommended alternative that best meets the established transportation needs within the study area is as follows:

- Interchange Build Alternative 3: Standard Diamond, Western Avenue moved west to allow phased construction and maintain traffic through the interchange area during construction.
- Corridor Build Alternative B: Western Avenue – 3-lane urban section (North of interchange only).
- Corridor Build Alternative C: Western Avenue – 2-lane rural section with shared-use path (South of interchange only).
- Southwest quadrant front road realignment.

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

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

The study area was defined as specified by the regulations and included approximately 7 miles of Interstate mainline, including interchange ramps and terminal intersections. Slightly more than 1 mile of the local crossroad was included in the study area.

The existing conditions operational analysis found that all intersections operate at LOS C or higher during the peak hours. All Interstate highway segments operate at LOS B or higher while the crossroad 2-way highway segments operate as low as LOS D during the peak hours. Bicycle and pedestrian levels of service are consistently from LOS C to LOS F because of the lack of specific pedestrian and bicycle facilities.

The existing conditions safety analysis found that five intersections exhibited crash rates higher than typical crash rates for similar intersections (Minnesota DOT rates, 2015). The crash rates for these intersections, however, were lower than the critical rate. The intersections include:

- 261<sup>st</sup> Street/Western Avenue
- I-90 EB/Western Avenue
- I-90 WB/Western Avenue
- Mickelson Road/Western Avenue
- I-90 WB/SD 38

All segment crash rates were below typical and critical crash rates.

The existing interchange, however, has experienced several crashes with over-height vehicles, damaging the bridge superstructure. Any more events of this type will likely force the closure of the interchange until the bridge can be rebuilt.

The future conditions analysis considered nine interchange alternatives and five crossroad alternatives. These alternatives were screened based on preliminary technical analysis and input from the Study Advisory team and four interchange alternatives and three crossroad alternatives were carried forward for further consideration.

Future year conditions were analyzed for 2025 and 2050 threshold years. That analysis determined that the Interstate mainline will continue to operate at LOS C or higher through 2050 without changes to the mainline configuration. The level of service at several of the crossroad intersections, including the I-90 Exit 387 ramp termini, however, will fall to LOS D by 2050 under no-build conditions.

Future year safety conditions were considered through a crash prediction analysis. That analysis concluded that addition of crossroad turn lanes, and pedestrian and bicycle facilities at the Exit 387 ramp termini will provide safety benefits compared with the other alternatives.

The interchange and crossroad alternatives were further screened based on the future year operational and safety analysis and it was determined that the interchange alternative with a standard diamond configuration moved west to allow phased construction and a combination of the three crossroad improvement alternatives provided for the best solution to transportation system needs, while providing the opportunity to rebuild the interchange bridge to avoid future collisions from over-height vehicles. At the time that signalization becomes needed, the SDDOT will reevaluate the ramp terminal intersections to determine whether to signalize or install a roundabout. Signalized ramp terminal intersections will provide LOS A/B (WB) and LOS A/A (EB) in 2050.

The operations and safety of the proposed alternative were summarized in **Chapter 7** and detailed in the **Appendix** materials. Conceptual plans for signing the proposed alternative are provided in **Figures 46 and 47**.

2. **The proposed access connects to a public road only and will provide for all traffic movements. Less than “full interchanges” may be considered on a case-by-case basis for applications requiring special access, such as managed lanes (e.g., transit or high occupancy vehicle and high occupancy toll lanes) or park and ride lots. The proposed access will be designed to meet or exceed current standards (23 CFR 625.2(a), 625.4(a)(2), and 655.603(d)). In rare instances where all basic movements are not provided by the proposed design, the report should include a full-interchange option with a comparison of the operational and safety analyses to the partial-interchange option. The report should also include the mitigation proposed to compensate for the missing movements, including wayfinding signage, impacts on local intersections, mitigation of driver expectation leading to wrong-way movement on ramps, etc. The report should describe whether future provision of a full interchange is precluded by the proposed design.**

The proposed access action involves improvement of an existing full-movement interchange to avoid impacts with the interchange structure by over-height vehicles and to bring the interchange up to current standards. The improved interchange will continue to serve all movements. The crossroad, Western Avenue/463<sup>rd</sup> Avenue, is a public road and will be improved to continue to provide good service as part of the local roadway network.

Based on this recommendation, the proposed control of access is provided in **Figure 45**. A tentative signing plan for the revised interchange is shown in **Figures 46 and 47**.

**LEGEND**

-  Bridge Construction
-  Existing ROW/Property Line
-  Potential Impact Area (75' from Ramp Control Line)
-  Potential ROW Impact
-  Proposed Driveway Closure
-  Proposed ROW/Control of Access

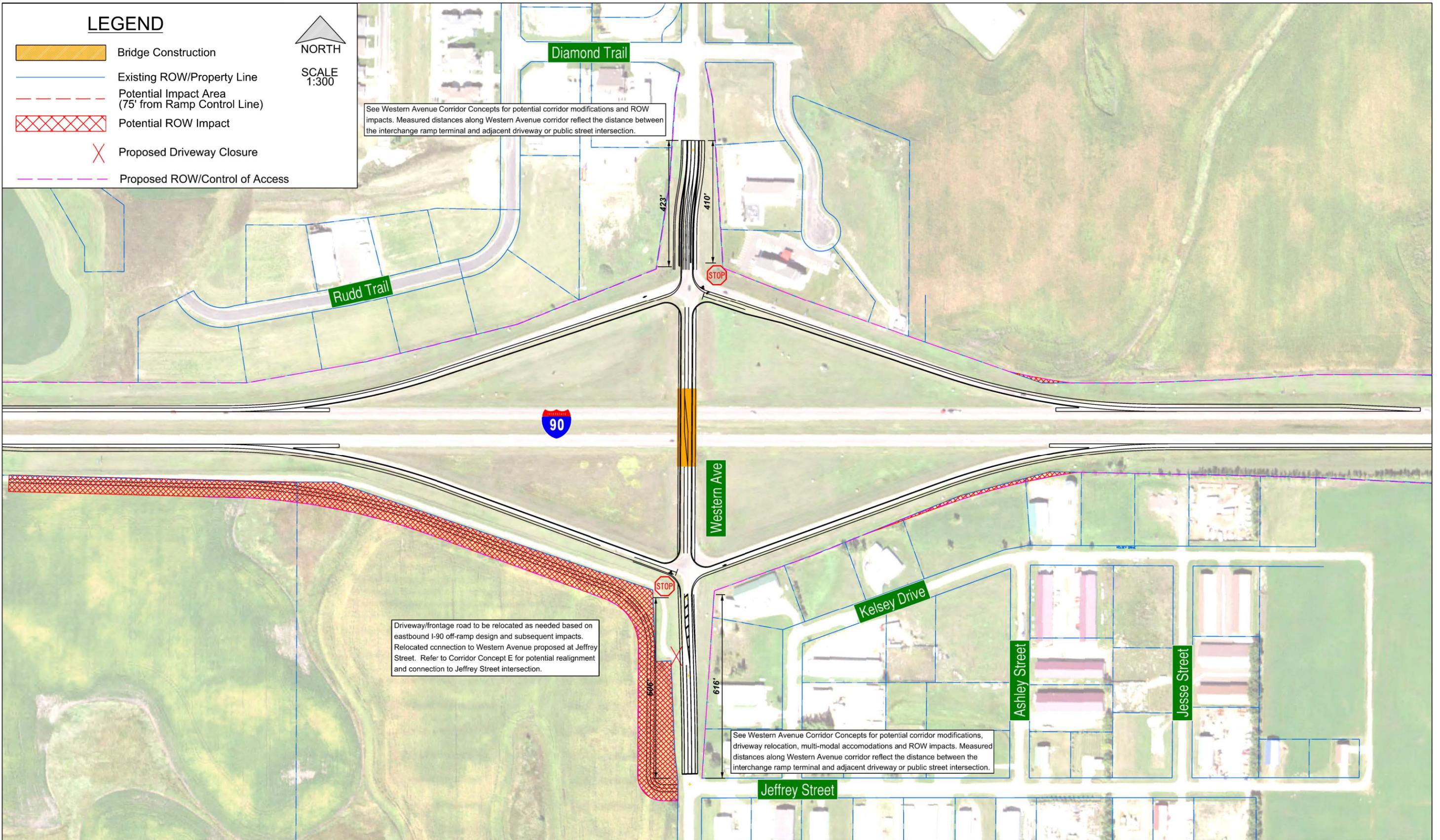
NORTH  
SCALE  
1:300

See Western Avenue Corridor Concepts for potential corridor modifications and ROW impacts. Measured distances along Western Avenue corridor reflect the distance between the interchange ramp terminal and adjacent driveway or public street intersection.

Driveway/frontage road to be relocated as needed based on eastbound I-90 off-ramp design and subsequent impacts. Relocated connection to Western Avenue proposed at Jeffrey Street. Refer to Corridor Concept E for potential realignment and connection to Jeffrey Street intersection.

See Western Avenue Corridor Concepts for potential corridor modifications, driveway relocation, multi-modal accommodations and ROW impacts. Measured distances along Western Avenue corridor reflect the distance between the interchange ramp terminal and adjacent driveway or public street intersection.

File - ...\_Displays\_03\_Diamond\_XR-Shifted-ROW.dgn



**PROPOSED RIGHT-OF-WAY  
AND CONTROL OF ACCESS**

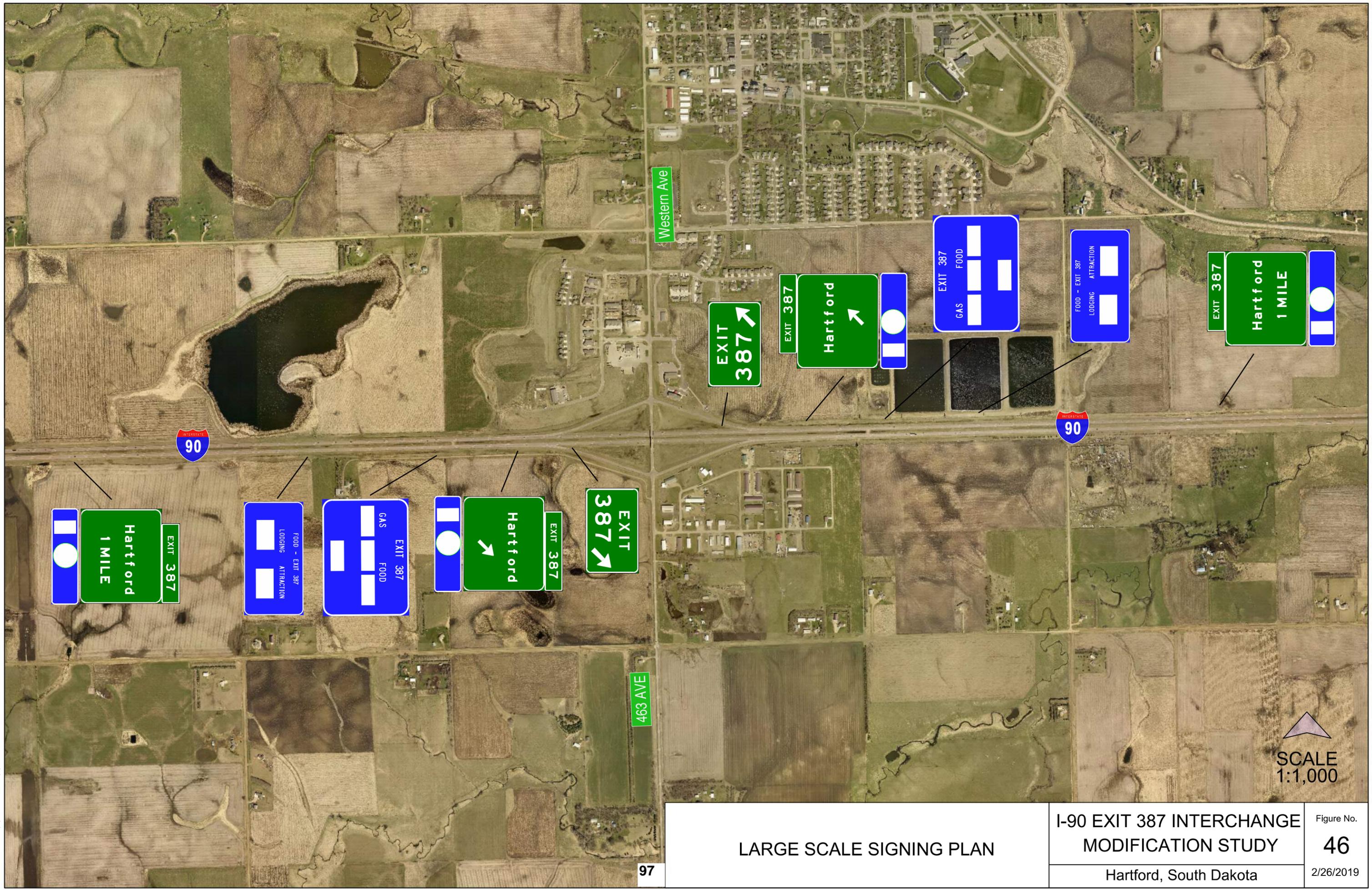
**I-90 EXIT 387 INTERCHANGE  
MODIFICATION STUDY**

Hartford, South Dakota

Figure No.

45

12/11/2019



LARGE SCALE SIGNING PLAN

I-90 EXIT 387 INTERCHANGE MODIFICATION STUDY

Hartford, South Dakota

Figure No.

46

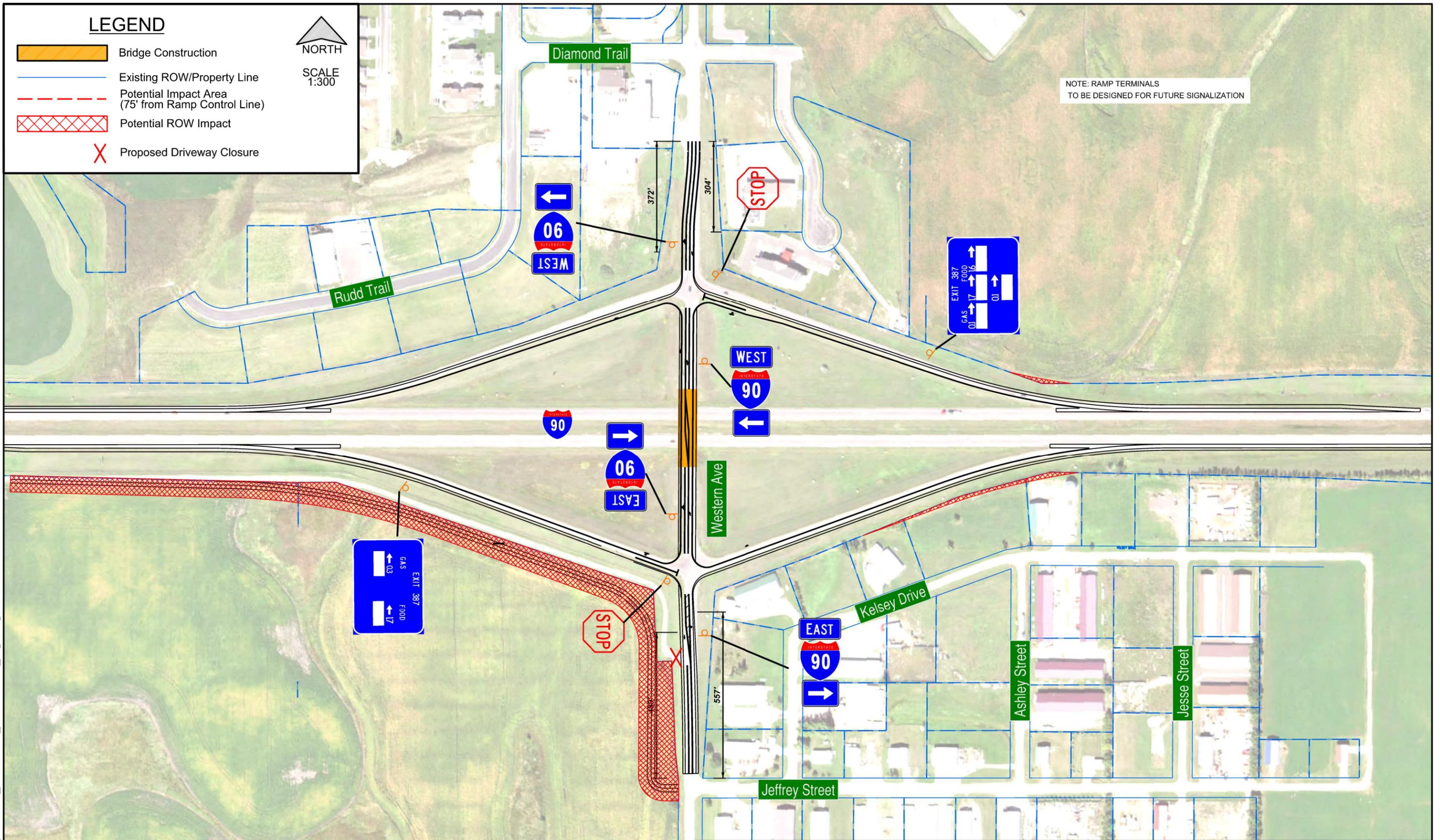
2/26/2019

**LEGEND**

-  Bridge Construction
-  Existing ROW/Property Line
-  Potential Impact Area (75' from Ramp Control Line)
-  Potential ROW Impact
-  Proposed Driveway Closure

NORTH  
SCALE  
1:300

NOTE: RAMP TERMINALS  
TO BE DESIGNED FOR FUTURE SIGNALIZATION



File - ...104\_Diamond\_XR-Shifted\_stadiaTraffic\_Signs.dgn

**INTERCHANGE AREA SIGNING PLAN**

**I-90 EXIT 387 INTERCHANGE  
MODIFICATION STUDY**

Hartford, South Dakota

Figure No.

**47**

12/11/2019

## Appendices (Available Electronically)

- A. Methods and Assumptions Document
- B. Existing, 2025 No-Build, and 2050 No-Build Conditions Traffic Volumes and Operations Analysis
- C. HCS Analysis Reports
- D. I-90 Exit 387 Interchange Geometric Review
- E. Crash Analysis Memorandum
- F. Crash Prediction Memorandum
- G. Purpose and Need Memorandum
- H. Environmental Scan Report
- I. Traffic Projections Memorandum
- J. Concept Evaluation Memorandum
- K. Build Alternatives Traffic Operations Memorandum
- L. Constructability Review Memorandum
- M. Public Meeting Materials
- N. Public Input and Comments
- O. Follow-up Alternative Analysis Memorandum