South Dakota DOT
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South Dakota Decennial Interstate Corridor Study

PHASE TWO REPORT

August 2010

FELSBURG HOLT & ULLEVIG

SOUTH DAKOTA DOT
DECENNIAL INTERSTATE CORRIDOR STUDY

Phase 2 Report

Prepared for:

South Dakota Department of Transportation
700 East Broadway Avenue
Pierre, South Dakota 57501

Prepared by:

FELSBURG HOLT & ULLEVIG

Felsburg Holt & Ullevig
6300 South Syracuse Way, Suite 600
Centennial, CO 80111

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ACKNOWLDEDGEMENTS:

SDDOT Executive Staff:

Secretary of Transportation: Darin Bergquist
Director of Planning and Engineering: Joel Jundt
Director of Finance and Management: Kelly Beck
Director of Operations: Greg Fuller

Study Advisory Team (SAT):

Steve Gramm, SDDOT Project Manager
Rocky Hook, SDDOT Transportation Inventory Management
Mark Leiferman, SDDOT Road Design
Kevin Goeden, SDDOT Bridge Design
Mike Behm, SDDOT State Highway Engineer
Jerry Ortbahn, SDDOT Project Development
Craig Smith, SDDOT Sioux Falls Area Engineer
Ron Sherman, SDDOT Watertown Area Engineer
Doug Sherman, SDDOT Winner Area Engineer
Daniel Staton, Access Management Engineer, Pierre and Rapid City Regions
Mark Hoines, Federal Highway Administration

Assisting Agencies:

South Eastern Council of Local Governments (SECOG)
Rapid City MPO
City of Brookings
City of Watertown
City of Aberdeen
First District
District III
Black Hills Council
City of Fort Pierre
City of Mitchell
Mitchell Area Development Corporation
South Dakota Enhancement District

Felsburg Holt & Ullevig:

Bob Felsburg, Principal-In-Charge
Kyle Anderson, Project Manager
Matt McFadden
Lyle DeVries
Mark Meisinger
Ryan Germeroth
Brian Wiltshire
Jeff Babcock

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EXECUTIVE SUMMARY

Introduction

The South Dakota Department of Transportation (SDDOT) retained Felsburg Holt & Ullevig to conduct an analysis of the Interstate system. The study is focused on:

- Ensuring a mainline Level of Service (LOS) of C or better throughout the Interstate System,
- Ensuring an interchange LOS of D or better for all interchanges throughout the Interstate System, and
- Identification of areas not in compliance with current Interstate design standards.

Phase 1 of the study was completed in March of 2010, providing an inventory of the statewide Interstate system, noting locations where geometric, safety or operational problems are occurring or are expected to occur in the 10 to 20 year future. The Phase 1 effort resulted in identification of ten existing interchanges in need of particular attention. These interchanges have been forwarded to Phase 2, along with five potential new interchanges.

Phase 2 Overview

Each interchange is examined in detail in this Phase 2 report in order to address questions raised by SDDOT staff and provide recommendations for future improvements. Technical information for each interchange includes all or portions of the following:

- Traffic analyses (updated traffic counts, forecasts, and/or Levels of Service)
- Conceptual design drawings for Alternatives being considered
- Alternative performance evaluations that compare the alternatives across a range of categories and support the recommendation of a Most Feasible Alternative
- Probable costs for each alternative
- Review of environmental resource impacts for each alternative

The existing interchanges evaluated in this Phase 2 report are:

- I-29 Exit 2 – River Drive, North Sioux City
- I-29 Exit 71 – Tea/Harrisburg
- I-29 Exit 77 – 41st Street, Sioux Falls
- I-90 Exit 17 – US 85, Spearfish/Lead/Deadwood
- I-90 Exit 55 – Deadwood Avenue, Rapid City
- I-90 Exit 59 – LaCrosse Street, Rapid City

- I-90 Exit 63 – Ellsworth Air Force Base Commercial, Box Elder
- I-90 Exit 332 – SD 37/SD 90L, Mitchell/Parkston
- I-90 Exit 406 – SD11, Brandon/Corson
- I-229 Exit 5 – Sioux Falls, 26th Street

Potential new interchanges evaluated as a part of Phase 2 include:

- I-29 Exit 130 – 20th Street, Brookings
- I-29 Exit 175 – South Connector, Watertown
- I-90 Exit 69 – Box Elder
- I-90 Exit 393 – Ellis Road, Sioux Falls
- I-90 Exit 398 – Minnesota Avenue, Sioux Falls

Alternative Recommendations

At each location, alternative interchange configurations were tested against each other based on a list of six evaluation factors. These factors include:

- Property Impacts
- Physical Environment
- Traffic
- Geometric Design
- Safety
- Construction

Each factor includes a number of evaluation categories. For example, the Physical Environment factor included hazardous sites, wetlands impacts and flood/drainage impacts. Alternatives were assigned ratings of 1, 2, or 3 within each category, 3 being the highest rating and 1 being lowest.

Table S-1 identifies for each location the best-performing, or Most Feasible, Alternative based on the performance evaluation.

Results of this Phase 2 evaluation identify a list of approximately $90.0 Million in interchange improvements at the selected existing interchanges and potential future interchanges.

Phase 3 of the study will prioritize these projects and develop an implementation plan.

Table S-1 Most Feasible Alternative Selections

Interchange	Most Feasible Alternative	Probable Construction Cost	Comments
Existing Interchanges			
I-29 Exit 2 River Drive North Sioux City	Alternative 1 – Signalization and Access Improvements	$0.86 Million	Low cost and simplicity of design is primary advantage over other options
I-29 Exit 71 Tea/Harrisburg	Alternative 1 – Widen Crossroad and Bridge to 3-lanes w/ Shoulders	$3.44 Million	Low cost and simplicity of design; no other concepts were considered
I-29 Exit 77 41st Street Sioux Falls	Alternative 2 – Diverging Diamond	$3.08 Million	Operational advantages for lower cost. Uses existing bridge with minor modifications
I-90 Exit 17 US 85 Spearfish/Lead/Deadwood	Alternative 1 – New Turn Lanes and Signals	$4.4 Million	Low cost is primary advantage over Single Point option
I-90 Exit 55 Deadwood Avenue Rapid City	Alternative 3 – Interchange Improvements and Closed Access	$2.83 Million	Provides best access control, cost is same as other options
I-90 Exit 59 LaCrosse Street Rapid City	Alternative 3 – Diverging Diamond Interchange	$6.11 Million	Div. Diamond provides operational advantages for lower cost. Would require bridge widening.
I-90 Exit 63 Ellsworth Base Comm. Box Elder	Alternative 1 – Diamond Interchange	$11.13 Million	Cost, Right-of-way and property impacts eliminate Alternatives 2 and 3
I-90 Exit 332 SD 37/SD 90L Mitchell/Parkston	Alternative 1 – Signal Timing Enhancements	n/a	No capital improvements recommended
I-90 Exit 406 SD11 Brandon/Corson	Alternative 1 – Crossroad and Bridge Improvements	$5.78 Million	Low cost and less ROW and construction impacts
I-229 Exit 5 Sioux Falls 26th Street	Alternative 1 – Crossroad and Ramp Improvements	$7.53 Million	City of Sioux Falls concept; eliminates hook ramps
Potential New Interchanges			
I-29 Exit 130 20th Street Brookings	Alternative 1 – Folded Diamond Interchange	$10.97 Million	City supports this location; folded diamond avoids some properties
I-29 Exit 175 South Connector Watertown	Alternative 1 – Diamond Interchange	$11.34 Million	Area Transportation Plan proposes this location and simple diamond is adequate
I-90 Exit 69 Box Elder	No Build	No Build	Adjacent interchange provides sufficient capacity for future growth
I-90 Exit 393 Ellis Road Sioux Falls	Alternative 1 – Folded Diamond Interchange	$12.13 Million	Folded diamond avoids properties in NW and SE quadrants
I-90 Exit 398 Minn. Ave., Sioux Falls	No Build	No Build	local improvements recommended instead of new interchange

1.0 INTRODUCTION

The South Dakota Department of Transportation (SDDOT) retained Felsburg Holt & Ullevig to conduct an analysis of the Interstate system. The study is focused on:

- Ensuring a mainline Level of Service (LOS) of C or better throughout the Interstate System,
- Ensuring an interchange LOS of D or better for all interchanges throughout the Interstate System, and
- Identification of areas not in compliance with current Interstate design standards.

1.1 Improvements Constructed since Previous Study

The SDDOT completed the First Edition of the Interstate Corridor Study in the Year 2000. Since the time of the 2000 Interstate Corridor Study, several existing interchanges have been reconstructed and four new/relocated interchanges have been added to the interstate system. These interchanges are listed below:

Reconstructed Interchanges

- I-90 Exit 32 – Junction Avenue, Sturgis (2006)
- I-90 Exit 51 – Black Hawk Road, Black Hawk (2009)
- I-90 Exit 57 – I-190 (2000)
- I-90 Exit 58 – Haines Ave. (2000)
- I-90 Exit 60 – East North Street, Rapid City (2006)
- I-90 Exit 61 – Elk Vale Road, Rapid City (2007)
- I-90 Exit 66 – Ellsworth Road, Ellsworth AFB (removed) (2003)
- I-29 Exit 73 – County Road 106, Tea (2005)
- I-29 Exit 79 – 12th Street, Sioux Falls (2007)
- I-29 Exit 81 – Russell Street/Maple Street, Sioux Falls (2003-4)
- I-29 Exit 83 – SD 38 (60th Street), Sioux Falls (2003-4)

New/Relocated Interchanges

- I-90 Exit 8 – McGuigan Road, Spearfish (2002)
- I-29 Exit 80 – Madison Street, Sioux Falls (2004)
- I-29 Exit 82 – Benson Road, Sioux Falls (2003-4)
- Relocated from I-90 Exit 66: I-90 Exit 67 – Main Gate Road/Liberty Blvd., Box Elder/Ellsworth AFB (2002)

1.2 Recent Interchange Studies

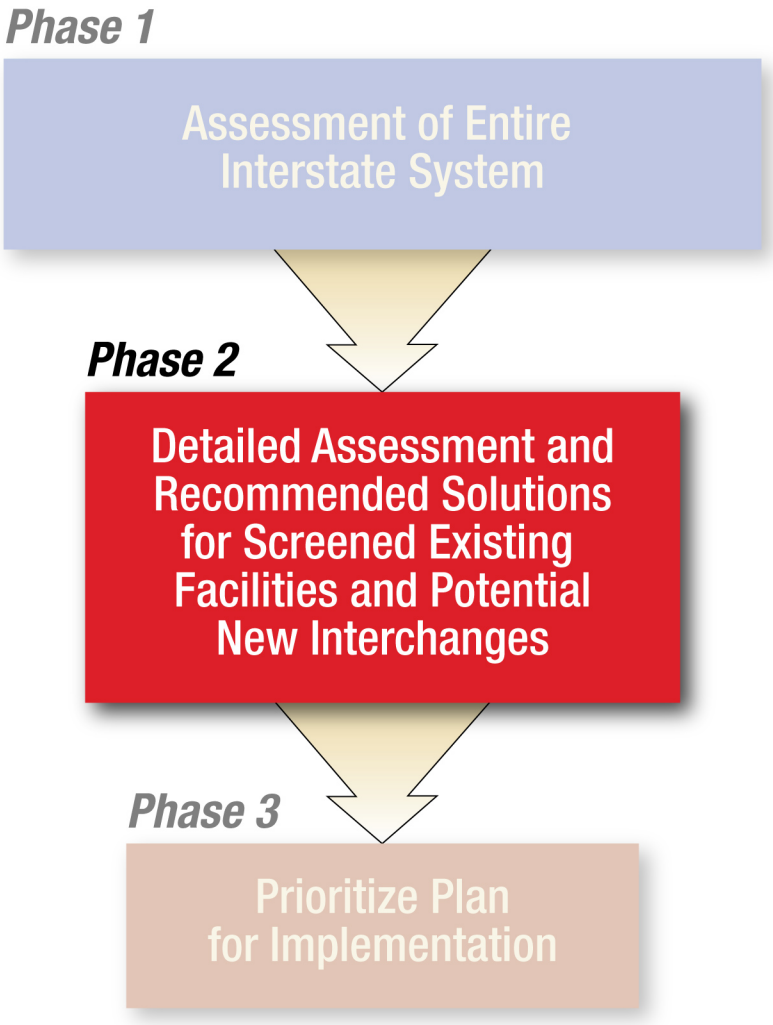
Since the completion of the 2000 Interstate Corridor Study, a number of existing and proposed interchange locations have been studied in greater detail. Many of these led to the ultimate construction of new or reconfigured interchanges identified in the previous section and are not included with this list. Other locations have much more recent or even current studies underway as a part of the planning and design process associated with future Interstate access modifications. Since these detailed studies have been conducted or are underway, these existing and potential new interchange locations were not included in this Phase 1 or Phase 2 analysis. Recent interchange studies include the following:

Recent Interchange Studies

- I-29/I-229 and I-90/I-229 Interchange Improvements – January 2008
- Environmental Assessment for I-90/I-229 Interchange – September 2008
- I-29 Corridor Study: Exit 73 (Tea Exit) to Exit 77 (41st Street Exit) – Ongoing
- Interstate 29/85th Street Interchange Justification Report - Ongoing
- I-90 at Marion Road, Interchange Justification Study – March 2006
- I-90/I-29 Interchange Justification Study – March 2006
- I-90 Exit 399 (Cliff Ave.) Interchange Modification Justification Study – Ongoing
- I-229 and Minnesota Avenue Interchange Justification Report (by City of Sioux Falls) – February 2007
- I-90 Blackhawk – Sturgis Corridor Preservation Study – December 2004
- I-90 Environmental Assessment (Exit 40 to Exit 51) – September 2008
- US14A Corridor Study - Ongoing
- I-190 Corridor Study: Silver Street - Ongoing

1.3 Study Process

Phase 1 of the study was documented in a previous report, completed in March of 2010. The report reviewed the roadway geometrics, crash history and daily traffic volumes for all 678 centerline miles of Interstate mainline in South Dakota and 126 of the 152 total existing interchanges. The result of Phase 1 is a combination of 15 existing and potential new interchanges to be analyzed further in next phase of the study. Phase 2, addressed in this report, provides a detailed assessment of these locations, addresses key questions that have been raised about each location and includes recommended solutions. Phase 3 will provide a prioritized plan for implementing the solutions.



1.4 Phase 2 Purpose

The purpose of Phase 2 is to recommend solutions at ten existing interchanges and evaluate the impacts of five potential future interchange locations.

1.5 Evaluation of Alternatives

To identify a Most Feasible Alternative, the alternatives described above were evaluated in ten categories. The evaluation categories are listed in **Table 1.1**, along with the criteria considered in evaluating each.

Table 1.1 Alternative Evaluation Factors

Evaluation Factors	Category	Good (3)	Fair (2)	Poor (1)
Property Impacts	# of business properties taken and/or impacted	Relatively few impacts to property	Moderate property impacts	Multiple properties impacted
	# of residential properties taken and/or impacted			
	Amount of Right-of-way acquisition required			
Physical Environment	Hazardous Sites, 4(f), 6(f)	Minimal environmental impacts	Moderate environmental impacts	Significant environmental impacts
	Wetlands Impacts			
	Flood and Drainage Impacts			
Traffic	Traffic Operations	LOS B or better	LOS C conditions	LOS D or worse
	Development Access	Direct	Limited movements	No access
	Multimodal Compatibility	Continuous sidewalks, safe crossings, good bike/transit infrastructure	Reduced sidewalks, ltd. crossings., little bike/transit infrastructure	Little or no sidewalks, poor crossings., no bicycle infrastructure
Geometric Design	Conformity to SDDOT design standards, including access management, roadway curvature, etc.	Addresses all current substandard geometrics	Addresses some current substandard geometrics	Addresses little or no current substandard geometrics
Safety	Improvement of existing hazardous conditions	High potential for crash reduction	Little potential for crash reduction	No potential for crash reduction
	Interstate Incident Response / Emergency Response	Reduces response time	No change	Increases response time
Construction	Utility Impacts	Requires No relocations	Minimal relocations	Req. significant relocations
	Scheduling/Adaptability	Can be built in phases, shorter schedule with minor traffic impacts	Moderate traffic impacts and schedule with some phasing possible	Little or no phasing, time-consuming and impacts traffic
	Relative Construction Cost	Least costly option	Middle-ranked cost	Most costly option
Construction Cost[1]	Preliminary opinion of probable construction cost	Relative construction costs are rated in the previous category. Const. cost est. is provided in 2010 dollars		

[1]**Construction Cost does not include Right-of-Way acquisition cost**. Project construction costs will be considerably higher once required Right-of-Way acquisition costs are incorporated into the final cost estimate.

The performance of each alternative was evaluated within each category according to these measures and assigned a rating of good, fair, or poor within each category. A good rating was

worth 3 points, fair was 2, and poor was 1. A total rating was developed for each alternative as the sum of all of the individual ratings.

The ratings were compiled to provide a tool for comparing the alternatives and selecting a Most Feasible Alternative for each location for which multiple alternatives were developed. Improvements necessary at the other locations were captured with a single alternative. The No Build Alternative was only evaluated if it was found to satisfy acceptable Level of Service results by the Year 2030.

1.6 Report Organization

This report is organized into the following sections:

- **Section 2.0**: Existing Interchanges

  In section 2.0, the following elements are provided for each interchange, as appropriate:

  - Review of Phase 1 findings
  - Phase 2 Issues
  - Interchange Concepts
  - Environmental Review
  - Alternative Evaluation (if applicable)
  - Interchange graphics and tables, in the following order:
    1. Concept drawings,
    2. Traffic volumes and operations, and
    3. Cost breakdowns
    4. Detailed Alternative Performance Matrix

- **Section 3.0**: Potential New Interchanges

  In section 3.0, the following elements are provided for each interchange, as appropriate:

  - Background, including location and previous planning efforts
  - Traffic Evaluation, including forecasts, operations, and interchange configuration options
  - Interchange Concept(s) with probable cost
  - Environmental Review

- **Section 4.0**: Conclusion

1.7 List of Phase 2 Interchanges

Following completion of Phase 1, the SAT identified the following existing interchanges and potential new interchanges for evaluation within this Phase 2 analysis:

1.7.1 Existing Interchanges

Existing interchanges for Phase 2 include:

- I-29 Exit 2 – River Drive, North Sioux City
- I-29 Exit 71 – Tea/Harrisburg
- I-29 Exit 77 – 41st Street, Sioux Falls
- I-90 Exit 17 – US 85, Spearfish/Lead/Deadwood
- I-90 Exit 55 – Deadwood Avenue, Rapid City
- I-90 Exit 59 – LaCrosse Street, Rapid City
- I-90 Exit 63 – Ellsworth Air Force Base Commercial, Box Elder
- I-90 Exit 332 – SD 37/SD 90L, Mitchell/Parkston
- I-90 Exit 406 – SD11, Brandon/Corson
- I-229 Exit 5 – Sioux Falls, 26th Street

1.7.2 Potential New Interchanges

Potential new interchanges for Phase 2 include:

- I-29 Exit 130 – 20th Street, Brookings
- I-29 Exit 175 – South Connector, Watertown
- I-90 Exit 69 – Box Elder
- I-90 Exit 393 – Ellis Road, Sioux Falls
- I-90 Exit 398 – Minnesota Avenue, Sioux Falls

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2.0 EXISTING INTERCHANGES

2.1 I-29 Exit 2 – North Sioux City

2.1.1 Review of Phase 1 Findings

In Phase 1 of the study, the southbound ramp terminal intersection peak hour traffic volumes were estimated from daily traffic volumes as actual turning movement counts were not available. An annual growth rate of 1.0% was applied to all traffic movements at the interchange to determine future year traffic forecasts.

It was determined that the southbound ramp terminal intersection is expected to operate at LOS F in both the AM and PM peak periods by 2030. Two improvement options were suggested at the southbound ramp terminal to improve traffic operations:

- Traffic signalization and the addition of a southbound right-turn lane
- Conversion to single-lane roundabout

2.1.2 Phase 2 Issues

Questions Raised

The SDDOT requested analysis of a SPUI concept, along with a more detailed analysis of each of the improvement concepts offered in Phase 1. SDDOT also requested a review of the potential impacts to pedestrian travel related to each of the alternative concepts. Pedestrians are currently accommodated with a sidewalk along the north side of River Drive through the interchange area.

In addition, the full access intersection of River Drive with Streeter Drive / Sioux Point Road is located approximately 250 feet west of the southbound ramp terminals. The close proximity of these two intersections raises traffic operational and safety concerns, particularly for southbound I-29 ramp traffic to westbound River Drive. For each of the concepts, this intersection is proposed to be closed, and connections to the development west of the interchange are provided off of Sadroc Drive.

Analysis Approach

In order to provide more accurate baseline data, peak hour turning movement counts were conducted at the southbound ramp terminal intersection. The Phase 1 traffic forecasts were refined using the NCHRP 255 procedure to estimate future traffic volumes for each individual movement, rather than applying a single growth rate to all movements at the interchange.

Findings

Year 2030 daily traffic forecasts for all interchange approach legs were obtained from the SIMPCO regional travel demand model. These forecasts were then compared to 2008 Average Daily Traffic counts as published by SIMPCO. The NCHRP 255 procedure was utilized to

estimate turning movements at the study intersections by comparing Year 2008 ADT counts with forecasted levels. The results of the methodology were then reviewed and manually adjusted using engineering judgment to determine Year 2030 AM and PM peak hour traffic volumes. Traffic conditions are depicted on the graphics following the Exit 2 text, **Figures 2.4** and **2.5**.

2.1.3 Interchange Concepts

Alternative 1 – Signalization and Access Improvements

With traffic signalization and the addition of a southbound right turn lane at the southbound ramp terminal, both signals would be expected to operate at LOS C or better in the AM and PM peak periods. Pedestrians at the southbound ramp terminal intersection would be required to cross an additional lane with the proposed improvements. The traffic signal should include pedestrian signals, similar to those provided at the northbound ramp terminal intersection. The concept drawing of this improvement option is shown in **Figure 2.1**. Construction costs for this concept are estimated at $860,000. It should be noted that this estimate includes the construction costs associated with the new connections between Streeter Drive and Sadroc Drive.

Alternative 2 – Roundabout and Access Improvements

If the southbound ramp terminal intersection is converted to a single-lane roundabout, the critical movements at both intersections would be expected to operate at LOS C or better in the AM and PM peak periods. The roundabout would need to be designed to accommodate heavy truck turning movements traveling through the intersection. Pedestrians at the southbound ramp terminal intersection would only be required to cross one lane of traffic; therefore, a dedicated pedestrian signal would not be needed. The concept drawing of this improvement option is shown in **Figure 2.2**. Construction costs for this concept are estimated at $990,000, which also includes the new street connections previously described.

Alternative 3 – Single Point Urban Interchange

With conversion of the interchange to a SPUI, the single point intersection would be expected to operate at LOS B or better in both the AM and PM peak periods. With the SPUI concept, pedestrians would need to cross multiple lanes of traffic at each ramp, requiring pedestrian signals. With the reconstruction of both ramp terminals, four separate ramps would need to be crossed, rather than the two ramps with the diamond configuration. The concept drawing of this improvement option is shown in **Figure 2.3**. Construction costs for this concept are estimated at $6,900,000. The relatively high cost of this concept is due to the need to reconstruct all four of the ramps to meet current design standards. The bridges on I-29 would also need to be reconstructed due to a conflict with the piers which are located immediately outside of the pavement edges on River Drive.

Detailed cost estimates for each concept are included following the interchange concept drawings. **Construction Cost does not include Right-of-Way acquisition cost**.

2.1.4 Environmental Review

A cursory review of the interchange and surrounding area was conducted to identify potential environmental resources that may be affected by the project and could require further assessment during later stages of the project. The cursory review was conducted by reviewing aerial photography and FHU's in-house GIS data for the area.

Land use in the general area of the interchange consists primarily of commercial and industrial properties surrounded by residential and agricultural land. A mobile home park is located approximately a quarter-mile north of the interchange; however improvements to the interchange will not impact the mobile home park. Also, there appears to be several filling stations, including one in each quadrant of the interchange, which may have the potential for hazardous materials issues.

Other environmental resources that may require analysis include potential wetlands, prime and unique farmland, air, noise, threatened/endangered species, cultural resources, and 4(f) and 6(f) resources in support of National Environmental Policy Act (NEPA) documentation prior to final design and construction activities. However, none of the proposed alternative concepts are anticipated to significantly impact these environmental resources.

2.1.5 Alternative Evaluation

An analysis of the No-Build, Traffic Signalization, Roundabout, and SPUI Alternatives was conducted to provide a comparative evaluation of the benefits and impacts associated with each alternative.

The various evaluation factors discussed in the previous section were tabulated and are summarized in **Table 2.1**. Many of the evaluation criteria were ranked similarly between the three concepts. The primary differences were associated with construction related issues, such as utility impacts, construction phasing and costs. The No-Build Alternative was ranked the lowest due to its inability to provide acceptable traffic operations for the design year. The SPUI was ranked second lowest due to construction related impacts, even though the traffic operations were ranked the highest. The traffic signalization and the roundabout concepts were ranked very closely, with a slight advantage to the roundabout. Both will provide acceptable traffic operations, however, consideration must be given to the truck traffic passing through this intersection. The roundabout must be designed properly to accommodate heavy truck turning movements. Either concept would provide acceptable traffic operations at this intersection.

Table 2.1 Exit 2 Alternative Evaluation Summary

Evaluation Factors (Max. Points)	Alternative Ratings		
	Alternative 1 Signalize. & Access Improvements	Alternative 2 Roundabout & Access Improvements	Alternative 3 Single Point Urban Interchange
Property Impacts (9)	7	7	7
Physical Environment (9)	7	6	5
Traffic/Access (9)	6	7	7
Geometric Design (3)	2	2	2
Safety (6)	6	4	6
Construction (9)	7	7	3
Overall Total (45)	35	33	30
Construction Costs[1]	$860,000	$990,000	$6,900,000

[1]Project construction costs will be considerably higher once required Right-of-Way acquisition costs are incorporated into the final cost estimate.

Supporting Exit 2 Figures and Tables follow:

Figure 2.1	I-29 Exit 2 Alternative 1 – Signalization and Access Improvements
Figure 2.2	I-29 Exit 2 Alternative 2 – Roundabout and Access Improvements
Figure 2.3	I-29 Exit 2 Alternative 3 – Single-Point Urban Interchange
Figure 2.4	I-29 Exit 2 Traffic Conditions Year 2009
Figure 2.5	I-29 Exit 2 Traffic Conditions Year 2030
Table 2.2	I-29 Exit 2 Probable Construction Costs Alternative 1 Signalization and Access Improvements
Table 2.3	I-29 Exit 2 Probable Construction Costs Alternative 2 Roundabout and Access Improvements
Table 2.4	I-29 Exit 2 Probable Construction Costs Alternative 2 SPUI and Access Improvements
Table 2.5	I-29 Exit 2 Alternative Performance Matrix

Figure 2.1
I-29 Exit 2 - North Sioux City
Alternative 1
Signalization and Access Improvements

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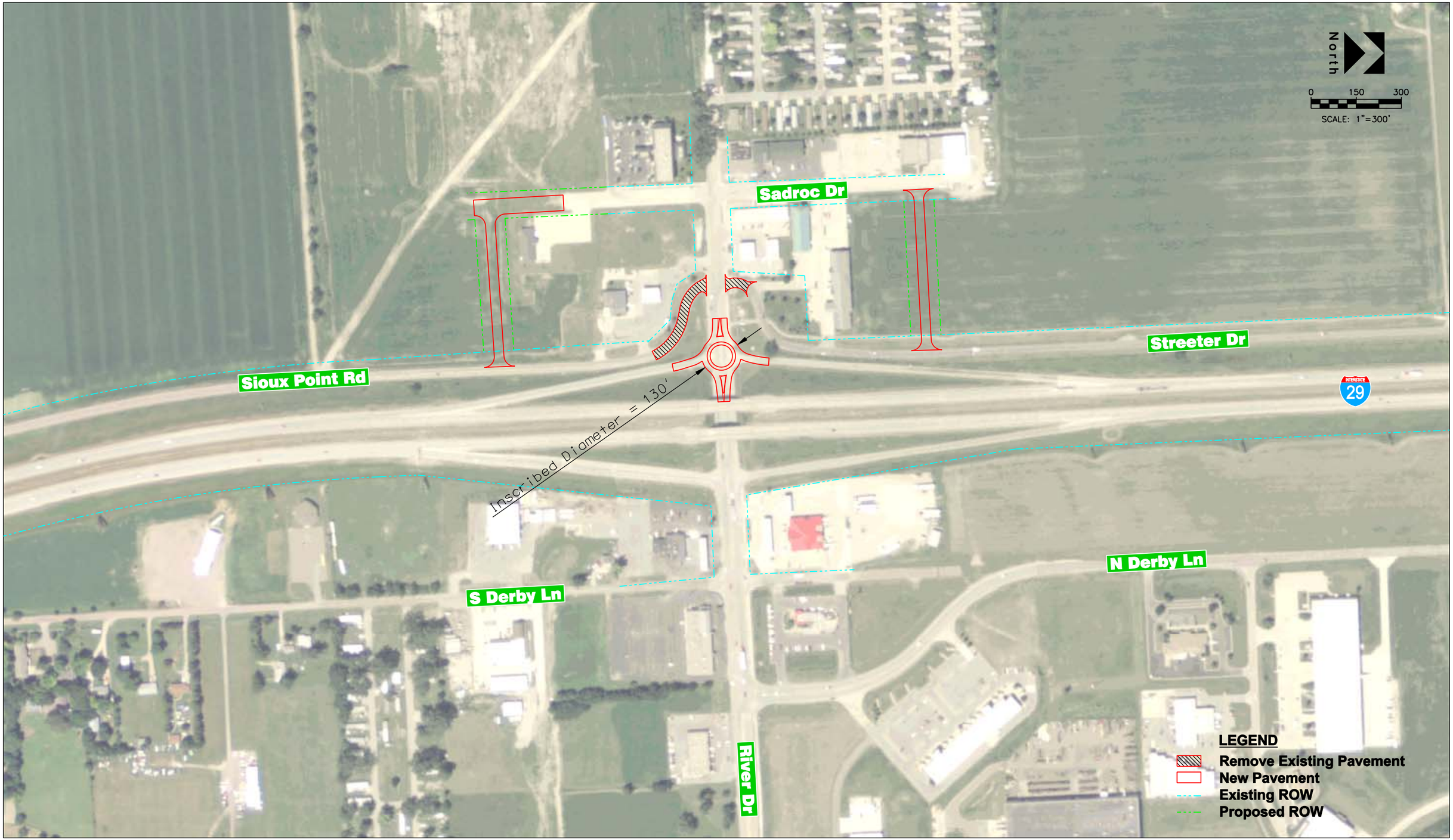
CONCEPTUAL DESIGN



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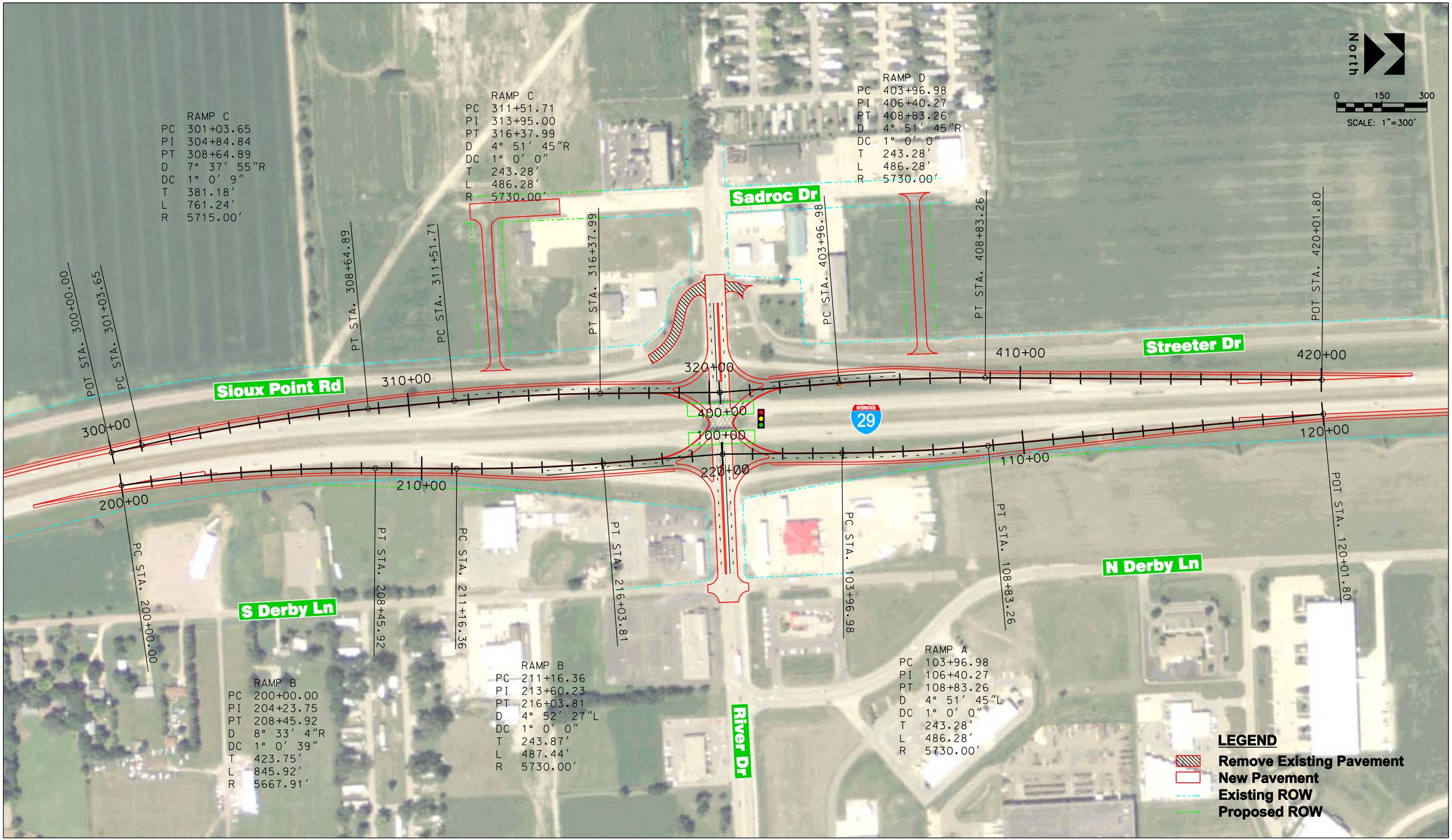
CONCEPTUAL DESIGN

Figure 2.2
I-29 Exit 2 - North Sioux City
Alternative 2
Roundabout and Access Improvements



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CONCEPTUAL DESIGN

Figure 2.3
I-29 Exit 2 - North Sioux City
Alternative 3
Single Point Urban Interchange

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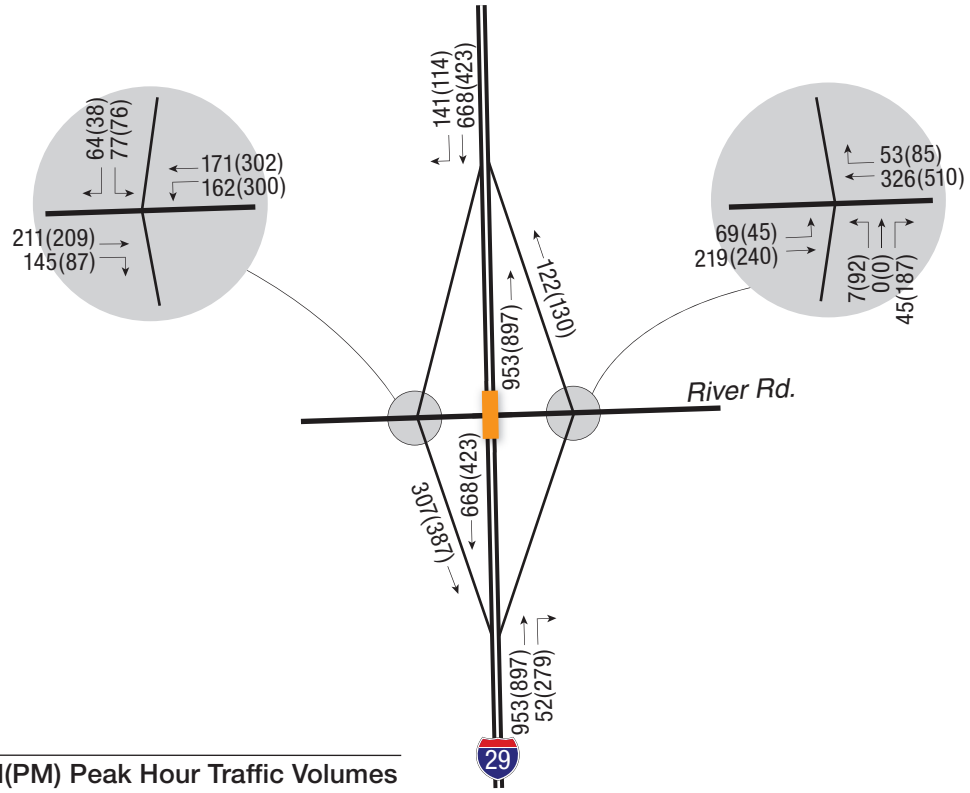
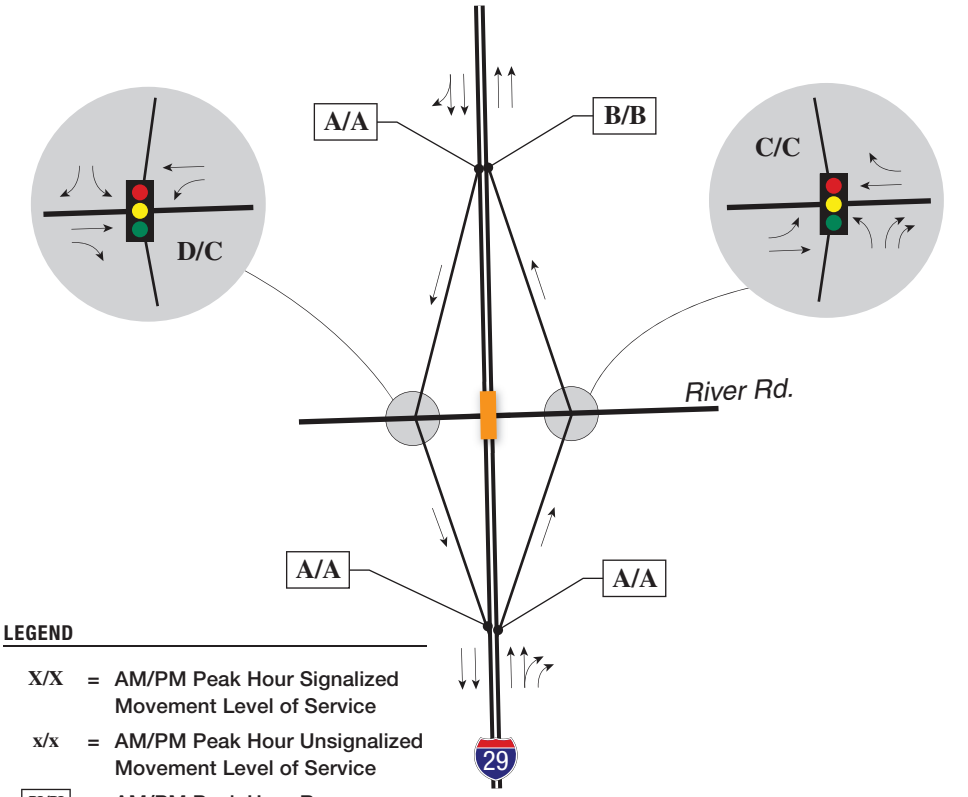


LEGEND

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes



LEGEND

X/X = AM/PM Peak Hour Signalized Movement Level of Service

x/x = AM/PM Peak Hour Unsignalized Movement Level of Service

X/X = AM/PM Peak Hour Ramp Junction Level of Service

= Traffic Signal

= Stop Sign

= Travel Lanes

Figure 2.4
Interstate 29 Exit 2
Traffic Conditions Year 2009

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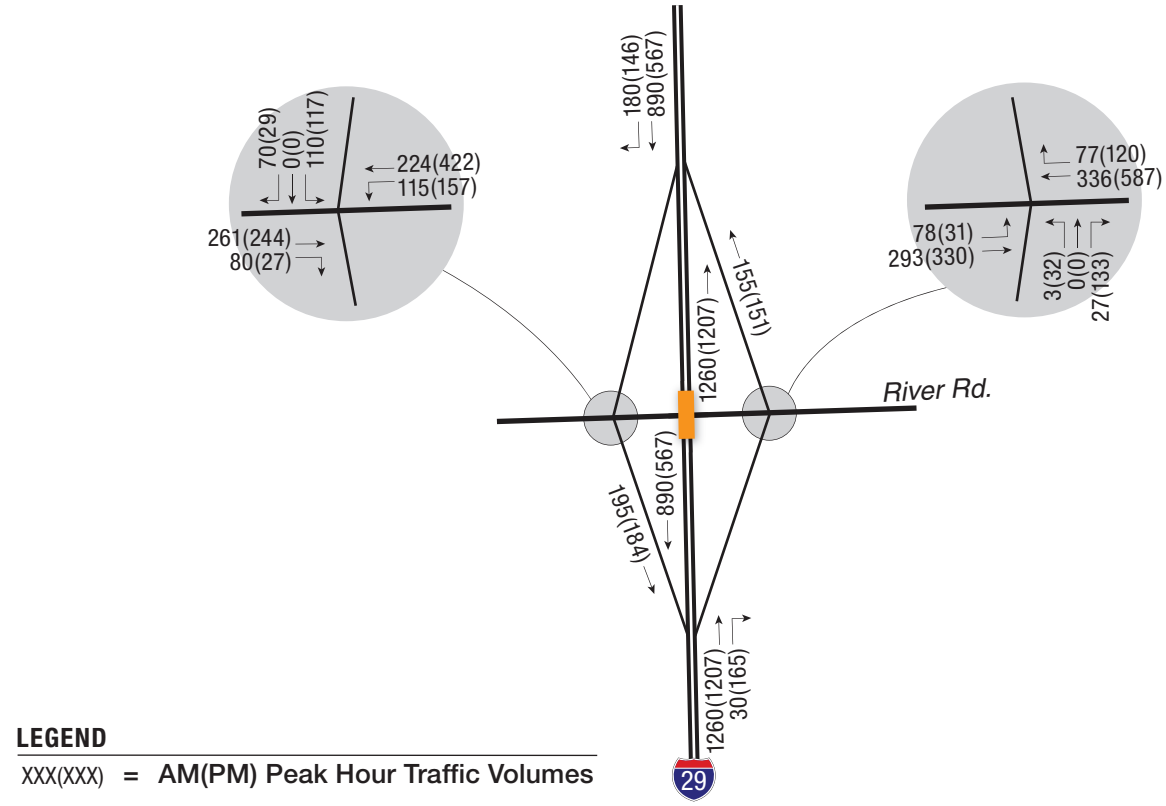
NORTH

SDDOT Decennial Corridor Phase 2, 09-104-01, 05/26/10



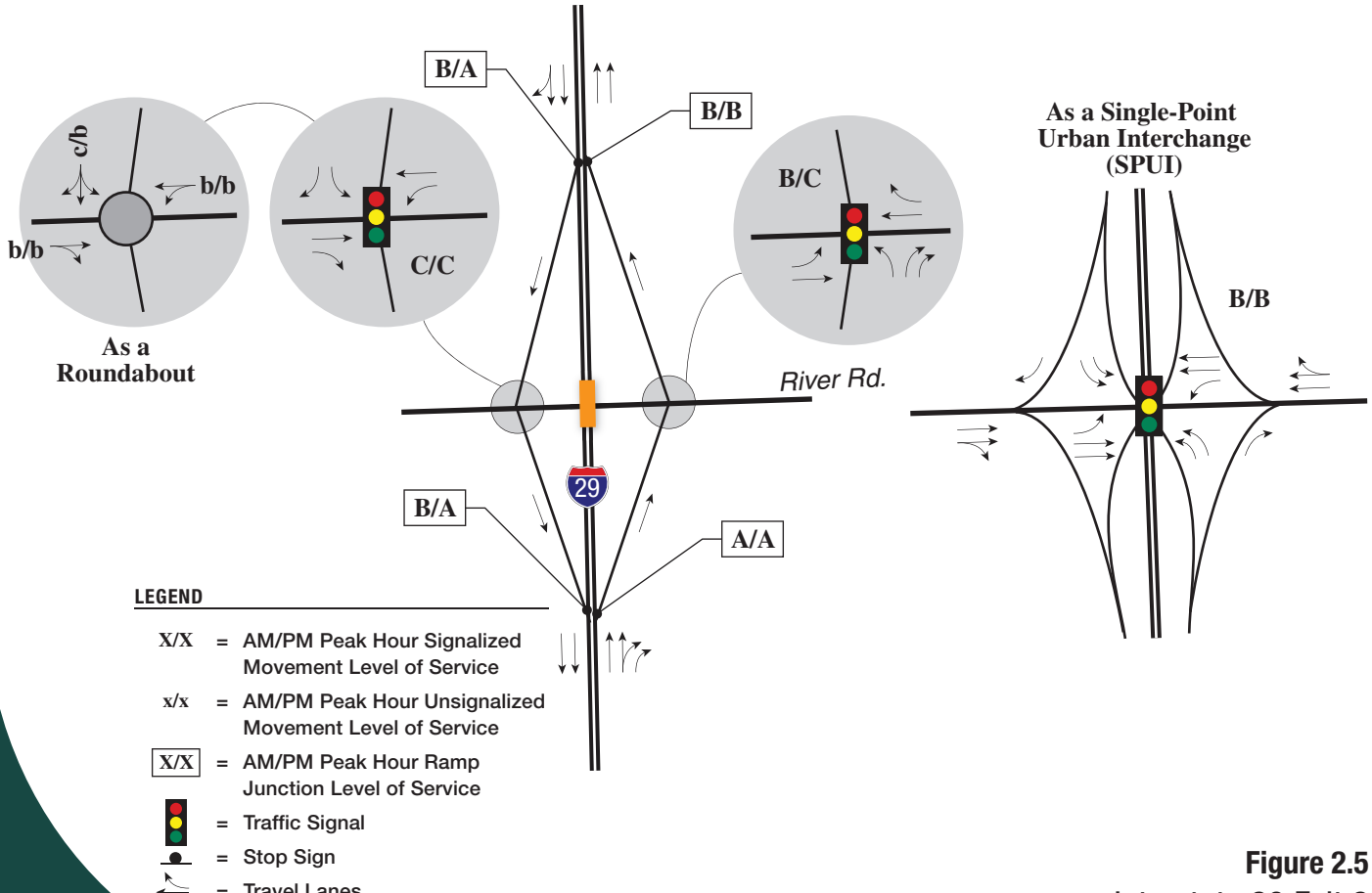


Figure 2.5
Interstate 29 Exit 2
Traffic Conditions Year 2030

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NORTH

Probable Construction Costs
I-29 Exit 2 - Alternative 1 Signalization and Access Improvements

Item Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*
Mobilization	1	LUMP SUM	$20,000.00	$20,000
Traffic Control	1	LUMP SUM	$39,000.00	$39,000
Clearing	1	LUMP SUM	$8,000.00	$8,000
Removal of Concrete Pavement	-	SQ. YD.	$3.88	$0
Removal of Asphalt Pavement	1,437	SQ. YD.	$7.39	$10,622
Remove Bridge	-	SQ. FT.	$9.00	$0
Borrow, Unclassified Excavation	15,143	CU. YD.	$5.30	$80,287
Base Course	681	TON	$10.64	$7,239
Asphalt Composite		TON	$80.91	$0
PCC Pavement 8" (frontage rd)	5,654	SQ. YD.	$43.40	$245,355
PCC Pavement 8" (ramps)	1,081	SQ. YD.	$43.40	$46,910
PCC Pavement 8" Shoulder (ramps)	456	SQ. YD.		
Concrete Approach Slab	-	SQ. YD.	$188.34	$0
Bridges	-	SQ. FT.	$100.00	$0
Guard Rail	0	LF	$100.00	$0
Permanent Signing/Markings	1	LUMP SUM	$10,000.00	$10,000
Traffic Signal	1	EACH	$125,000.00	$125,000
Roadway Lighting	1	LUMP SUM	$10,000.00	$10,000
Drainage (18" RCP)	30	LF	$24.53	$736
Subtotal				$600,000
Contingencies	25%			$150,000
Total Probable Construction Costs				$750,000
Engineering, Administration	15%			$112,500
Total Project Costs				$860,000

Table 2.2
Probable Construction Costs
I-29 Exit 2 - Alternative 1
Signalization and Access Improvements

FELSBURG HOLT & ULLEVIG

Probable Construction Costs
I-29 Exit 2 - Alternative 2 Roundabout and Access Improvements

Item Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*
Mobilization	1	LUMP SUM	$23,000.00	$23,000
Traffic Control	1	LUMP SUM	$47,000.00	$47,000
Clearing	1	LUMP SUM	$9,000.00	$9,000
Removal of Concrete Pavement	-	SQ. YD.	$3.88	$0
Removal of Asphalt Pavement	4,600	SQ. YD.	$7.39	$34,003
Remove Bridge	-	SQ. FT.	$9.00	$0
Borrow, Unclassified Excavation	15,143	CU. YD.	$5.30	$80,287
Base Course	681	TON	$10.64	$7,239
Asphalt Composite		TON	$80.91	$0
PCC Pavement 8" (frontage rd)	5,654	SQ. YD.	$43.40	$245,355
PCC Pavement 8" (ramps)	2,288	SQ. YD.	$43.40	$99,288
PCC Pavement 8" Shoulder (ramps)	-	SQ. YD.		
Concrete Approach Slab	-	SQ. YD.	$188.34	$0
Bridges	-	SQ. FT.	$100.00	$0
Guard Rail	0	LF	$100.00	$0
Permanent Signing/Markings	1	LUMP SUM	$10,000.00	$10,000
Traffic Signal	1	EACH	$125,000.00	$125,000
Roadway Lighting	1	LUMP SUM	$10,000.00	$10,000
Drainage (18" RCP)	30	LF	$24.53	$736
Subtotal				$690,000
Contingencies	25%			$172,500
Total Probable Construction Costs				$860,000
Engineering, Administration	15%			$129,000
Total Project Costs				$990,000

Table 2.3
Probable Construction Costs
I-29 Exit 2 - Alternative 2
Roundabout and Access Improvements

FELSBURG HOLT & ULLEVIG

Probable Construction Costs
I-29 Exit 2 - Alternative 3 SPUI and Access Improvements

Item Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*
Mobilization	1	LUMP SUM	$191,000.00	$191,000
Traffic Control	1	LUMP SUM	$383,000.00	$383,000
Clearing	1	LUMP SUM	$77,000.00	$77,000
Removal of Concrete Pavement	26,867	SQ. YD.	$3.88	$104,325
Removal of Asphalt Pavement		SQ. YD.	$7.39	$0
Remove Bridge	18,480	SQ. FT.	$9.00	$166,320
Borrow, Unclassified Excavation	15,143	CU. YD.	$5.30	$80,287
Base Course	681	TON	$10.64	$7,239
Asphalt Composite		TON	$80.91	$0
PCC Pavement 8" (frontage rd)	8,992	SQ. YD.	$43.40	$390,208
PCC Pavement 8" (ramps)	25,314	SQ. YD.	$43.40	$1,098,501
PCC Pavement 8" Shoulder (ramps)	11,981	SQ. YD.		
Concrete Approach Slab	711	SQ. YD.	$188.34	$133,932
Bridges	18,480	SQ. FT.	$100.00	$1,848,000
Guard Rail	0	LF	$100.00	$0
Permanent Signing/Markings	1	LUMP SUM	$110,000.00	$110,000
Traffic Signal	1	EACH	$125,000.00	$125,000
Roadway Lighting	1	LUMP SUM	$80,000.00	$80,000
Drainage (18" RCP)	30	LF	$24.53	$736
Subtotal				$4,800,000
Contingencies	25%			$1,200,000
Total Probable Construction Costs				$6,000,000
Engineering, Administration	15%			$900,000
Total Project Costs				$6,900,000

Table 2.4
Probable Construction Costs
I-29 Exit 2 - Alternative 3
SPUI and Access Improvements

FELSBURG HOLT & ULLEVIG

Evaluation Factors/Categories	Alternative 1 – Traffic Signalization & Access Improvements	Alternative 2 – Roundabout and Access Improvements	Alternative 3 – Single Point Urban Interchange
Evaluation Factors	**Rating**	**Rating**	**Rating**
Property Impacts			
Businesses	2	2	2
Residences	2	2	2
Right-of-Way Acquisition	3	3	3
Subtotal	**7**	**7**	**7**
Physical Environment			
Hazardous Sites, 4(f), 6(f)	2	2	2
Wetlands Impacts	2	2	2
Flood and Drainage Impacts	3	2	1
Subtotal	**7**	**6**	**5**
Traffic/Access			
Traffic Operations	2	2	3
Development Access	2	2	3
Multimodal Compatibility	2	3	1
Subtotal	**6**	**7**	**7**
Geometric Design			
Meeting Standards	2	2	2
Subtotal	**2**	**2**	**2**
Safety			
Improvement of Existing Hazard(s)	3	2	3
Incident Response	3	2	3
Subtotal	**6**	**4**	**6**
Construction			
Utility Impacts	3	3	1
Scheduling/Adapatability	2	2	1
Relative Construction Cost	2	2	1
Subtotal	**7**	**7**	**3**
Construction Costs	$860,000	$990,000	$6,900,000
Totals	**35**	**33**	**30**

Table 2.5
I-29 Exit 2 - Alternative Performance Matrix

2.2 I-29 Exit 71 – Tea/Harrisburg

2.2.1 Review of Phase 1 Findings

In Phase 1 of the study, both the northbound and southbound ramp terminal intersection peak hour traffic volumes were estimated from daily traffic volumes as turning movement counts were not available. An annual growth rate of 3.8% was applied to all traffic movements at the interchange to determine future year traffic forecasts.

It was determined that both of the ramp terminal intersections are expected to operate at LOS D in both the AM and PM peak periods by 2030. Minor improvements to the southbound ramp acceleration and deceleration lanes were recommended. It was also determined that the interchange would be a candidate for sight distance improvements based upon field observations, k-value calculations, and stopping sight distance calculations.

2.2.2 Phase 2 Issues

Questions Raised

The SDDOT requested further analysis of this interchange due to inquiries by developers and concerns that future development was not taken into account in the traffic forecasts. Phase 1 calculations and field observations indicated that sight distance is not adequate at the interchange. SDDOT has also received some complaints of inadequate sight distance at the ramp terminal intersections. To address this concern, Phase 2 should include an analysis to determine the configuration and footprint of the interchange if it is rebuilt to correct sight distance problems.

Analysis Approach

In order to provide more accurate baseline data, peak hour turning movement counts were conducted at the northbound and southbound ramp terminal intersections. It should be noted that these counts did not include through traffic on County Highway 110, so Phase 1 traffic estimates were used. The Phase 1 traffic forecasts were refined using the SECOG Year 2030 traffic forecasts and the NCHRP 255 procedure to estimate future traffic volumes for each individual movement, rather than applying a single growth rate to all movements at the interchange.

Findings

Figure 2.7 depicts updated Year 2009 traffic conditions based on the recent peak hour traffic counts. Year 2030 daily traffic forecasts for all interchange approach legs were obtained from the SECOG regional travel demand model, which includes future development assumptions for the area around the interchange. These forecasts were then compared to 2008 Average Daily Traffic counts as published by SECOG. The NCHRP 255 procedure was utilized to estimate turning movements at the study intersections by comparing Year 2008 ADT counts with forecasted levels. The results of the methodology were then reviewed and manually adjusted using engineering judgment to determine Year 2030 AM and PM peak hour traffic volumes as shown on **Figure 2.8**.

A review of the Phase 1 calculations indicated that the k-value and stopping sight distance on County Highway 110 were inadequate. Field observations indicated that the intersection sight distance at the ramp terminals is limited by the guardrails on the bridge. A new bridge design that accommodates a three lane roadway cross section was developed to address these deficiencies.

2.2.3 Interchange Concepts

Alternative 1 – Widen Crossroad and Bridge to 3-Lanes w/ Shoulders

In order to provide adequate sight distance at the interchange ramp terminal intersections, the interchange should be reconstructed to provide a three lane cross section on County Highway 110. The addition of a southbound right turn lane at the southbound ramp terminal is also recommended. With these improvements and maintaining stop sign control, all critical movements at both the ramp terminal intersections would be expected to operate at LOS C or better in the AM and PM peak periods for the Year 2030. The concept drawing of this improvement option is shown in **Figure 2.6**. Construction costs for this concept are estimated at $3,440,000. A breakdown of the construction cost estimate is shown on **Table 2.6.** Construction Cost does not include Right-of-Way acquisition cost.

2.2.4 Environmental Review

A cursory review of the interchange and surrounding area was conducted to identify potential environmental resources that may be affected by the project and could require further assessment during later stages of the project. The cursory review was conducted by reviewing aerial photography and FHU's in-house GIS data for the area.

Land use in the general area of the interchange consists primarily of agricultural land, however, the southeast quadrant appears to be mix-use commercial and industrial, including what appears to be a scrap yard which may present hazardous materials issues.

Other environmental resources that may require analysis include potential wetlands, prime and unique farmland, noise, threatened/endangered species, cultural resources, and 4(f) and 6(f) resources in support of National Environmental Policy Act (NEPA) documentation prior to final design and construction activities. However, none of the proposed alternative concepts are anticipated to significantly impact these environmental resources.

Supporting Exit 71 Figures and Tables follow:

Figure 2.6	I-29 Exit 71 Alternative 1 – Widen Cross Road and Bridge to 3-Lanes w/ Shoulders
Figure 2.7	I-29 Exit 71 Traffic Conditions Year 2009
Figure 2.8	I-29 Exit 71 Traffic Conditions Year 2030
Table 2.6	I-29 Exit 71 Probable Construction Costs Alt. 1 Widen Cross Road & Bridge to 3-Lanes w/ Shoulders

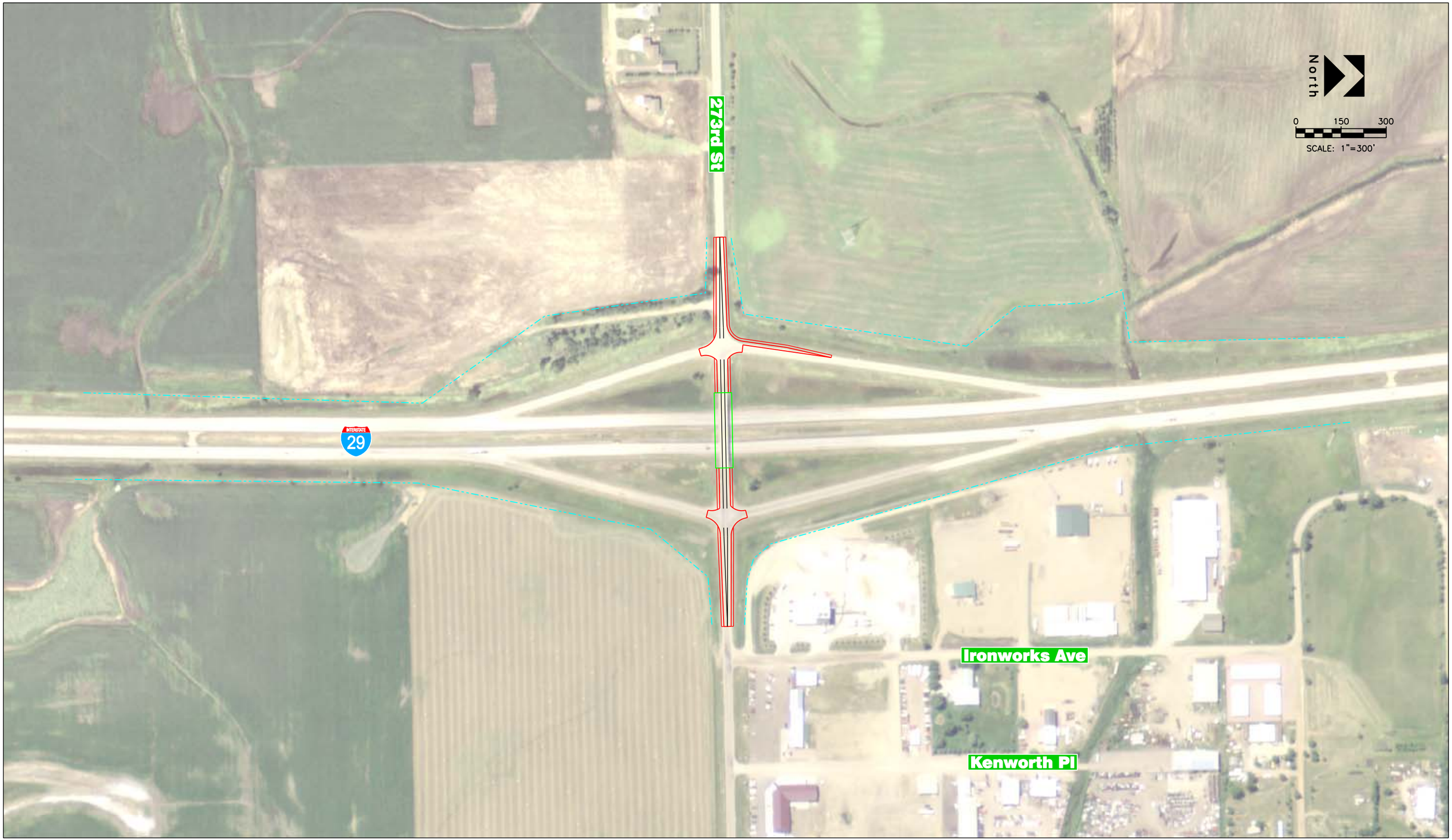

Figure 2.6
I-29 Exit 71 - Harrisburg/Tea
Alternative 1
Widen Cross Road and Bridge to 3-Lanes w/ Shoulders

FELSBURG HOLT & ULLEVIG

CONCEPTUAL DESIGN

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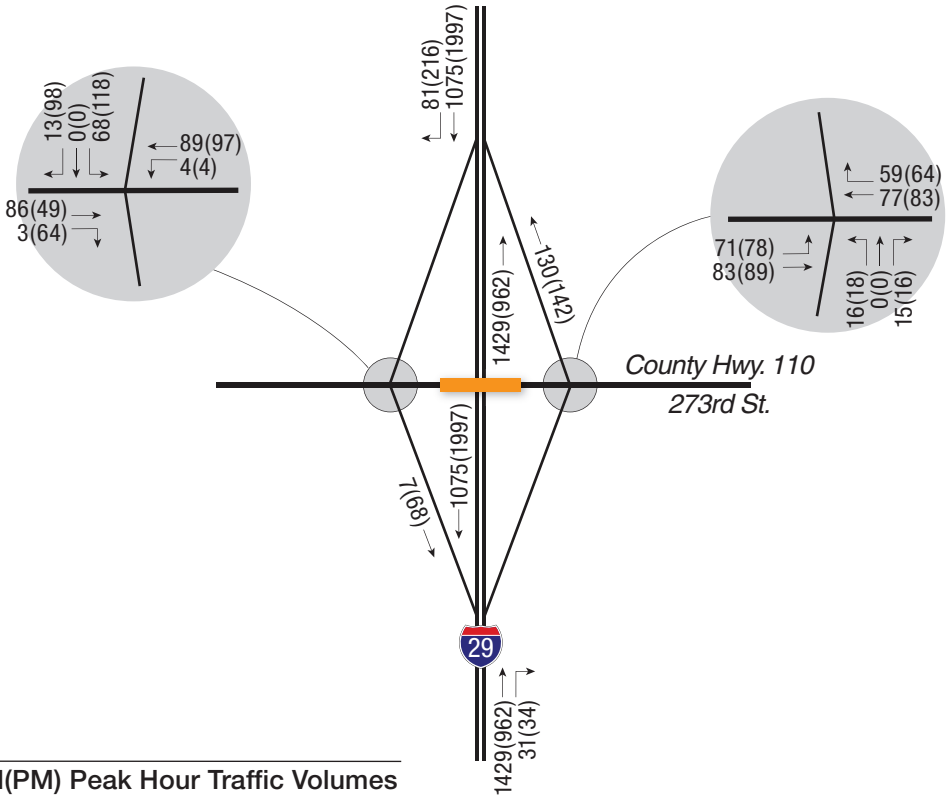
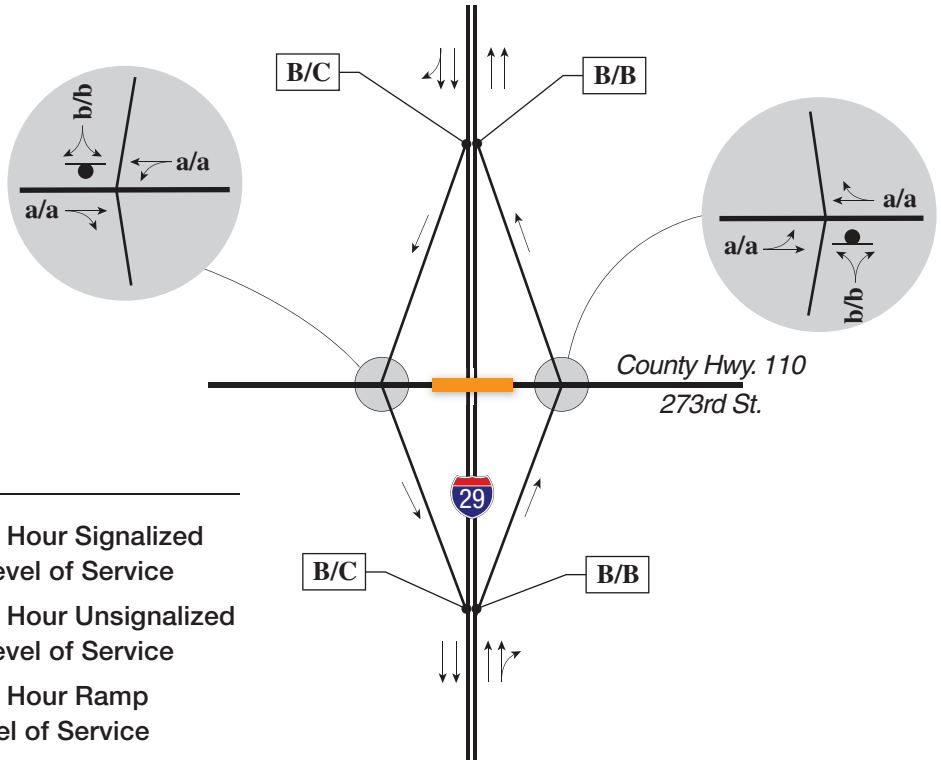


LEGEND

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes



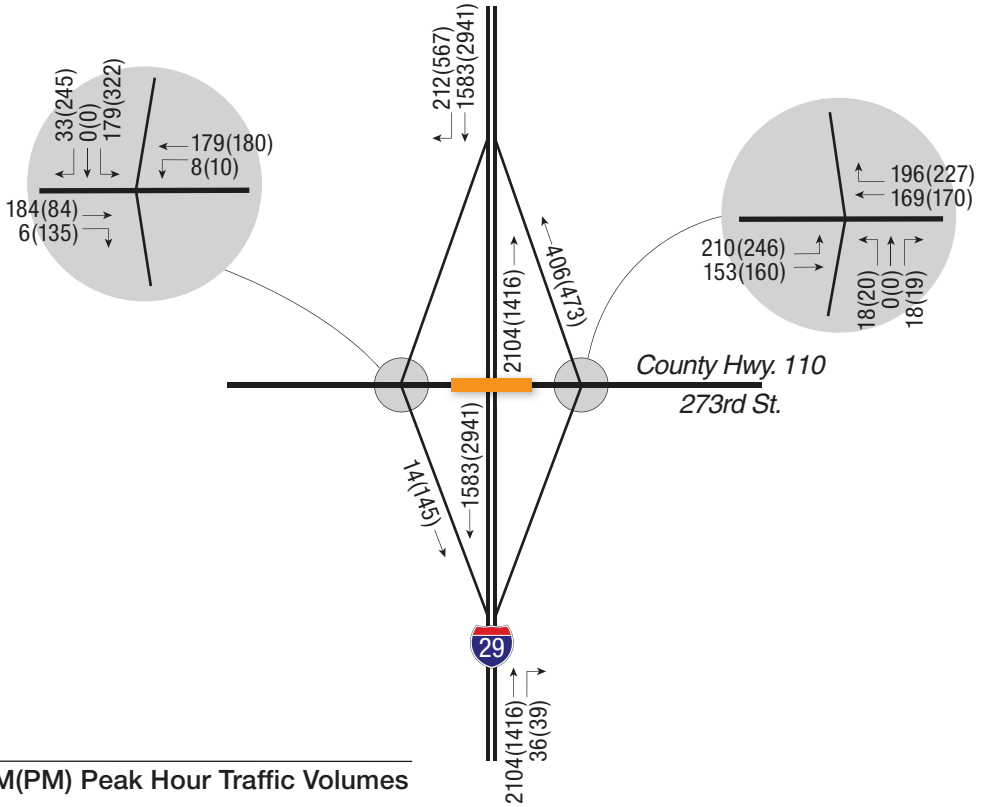
LEGEND

X/X	=	AM/PM Peak Hour Signalized Movement Level of Service
x/x	=	AM/PM Peak Hour Unsignalized Movement Level of Service
X/X	=	AM/PM Peak Hour Ramp Junction Level of Service
	=	Stop Sign
	=	Travel Lanes

Figure 2.7
Interstate 29 Exit 71
Traffic Conditions Year 2009

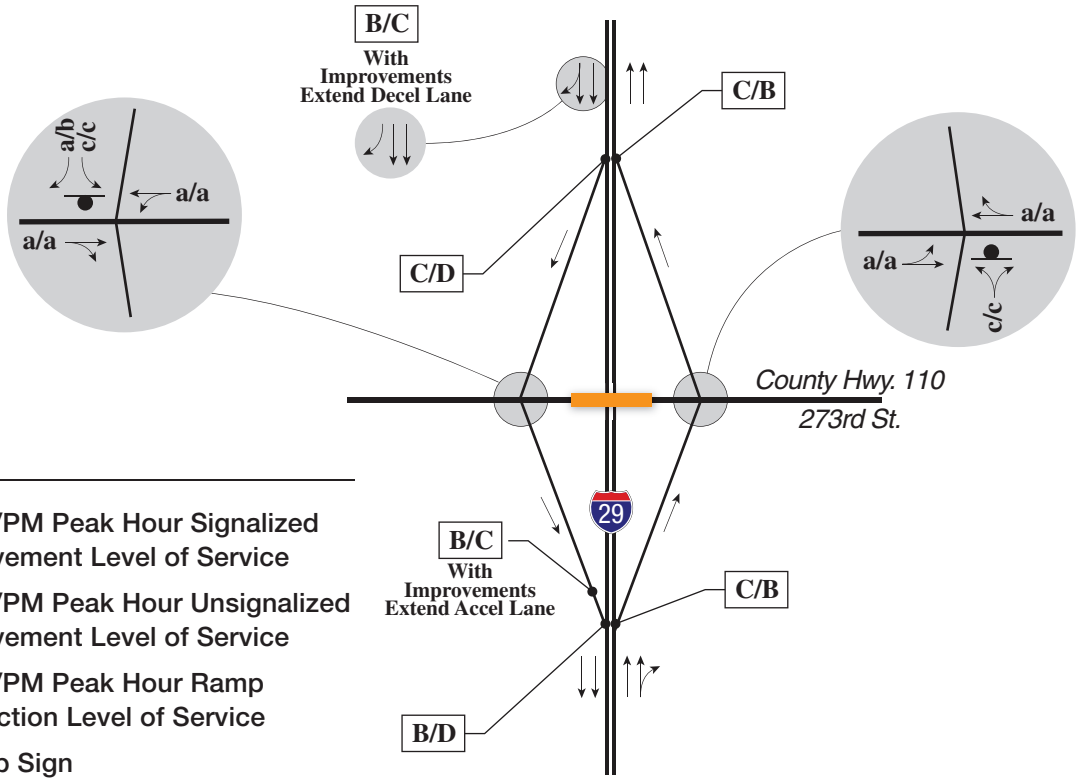
FELSBURG HOLT & ULLEVIG

NORTH



LEGEND

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes



LEGEND

- X/X = AM/PM Peak Hour Signalized Movement Level of Service
- x/x = AM/PM Peak Hour Unsignalized Movement Level of Service
- [X/X] = AM/PM Peak Hour Ramp Junction Level of Service
- = Stop Sign
- = Travel Lanes

Figure 2.8
Interstate 29 Exit 71
Traffic Conditions Year 2030

FELSBURG HOLT & ULLEVIG

NORTH

Probable Construction Costs
I-29 Exit 71 - Alternative 1 Widen Cross Road and Bridge to 3-Lanes w/ Shoulders

Item Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*
Mobilization	1	LUMP SUM	$98,000.00	$98,000
Traffic Control	1	LUMP SUM	$196,000.00	$196,000
Clearing	1	LUMP SUM	$39,000.00	$39,000
Removal of Concrete Pavement	4,793	SQ. YD.	$3.88	$18,610
Removal of Asphalt Pavement		SQ. YD.	$7.39	$0
Remove Bridge	7,500	SQ. FT.	$9.00	$67,500
Borrow, Unclassified Excavation	8,655	CU. YD.	$5.30	$45,891
Base Course	3,189	TON	$10.64	$33,925
Asphalt Composite		TON	$80.91	$0
PCC Pavement 8" (cross street)	6,983	SQ. YD.	$33.12	$231,274
PCC Pavement 8" (ramps)	-	SQ. YD.	$43.40	$0
Concrete Approach Slab	578	SQ. YD.	$188.34	$108,820
Bridges	14,500	SQ. FT.	$100.00	$1,450,000
Guard Rail	0	LF	$100.00	$0
Permanent Signing/Markings	1	LUMP SUM	$60,000.00	$60,000
Traffic Signal	0	EACH	$125,000.00	$0
Roadway Lighting	1	LUMP SUM	$40,000.00	$40,000
Drainage (18" RCP)	180	LF	$24.53	$4,415
Subtotal				$2,390,000
Contingencies	25%			$597,500
Total Probable Construction Costs				$2,990,000
Engineering, Administration	15%			$448,500
Total Project Costs				$3,440,000

Table 2.6
Probable Construction Costs
I-29 Exit 71 - Alternative 1
Widen Cross Road and Bridge to 3-Lanes w/Shoulders

FELSBURG HOLT & ULLEVIG

2.3 I-29 Exit 77 – Sioux Falls 41st Street

2.3.1 Review of Phase 1 Findings

The Phase 1 analysis of this interchange identified a combination of operational and safety issues. As a result, several safety improvements were identified to reduce the number of crashes at the interchange. Geometric deficiencies related to the ramp taper rate and intersection spacing were also identified, which should be addressed in the proposed interchange concept.

In Phase 1 of the study, an annual growth rate of 1.0% was applied to all traffic movements at the interchange to determine future year traffic forecasts. The interchange currently operates at LOS E in the AM peak period and LOS F in the PM peak at both ramp terminals. It was determined that both the northbound and southbound ramp terminal intersections are expected to operate at LOS F in both the AM and PM peak periods by 2030. Limited ROW at the interchange prevents the addition of loop ramps to eliminate left-turn movements. As such, two improvement options were developed at the interchange to improve traffic operations:

- Single Point Urban Interchange
- Diverging Diamond

2.3.2 Phase 2 Issues

Questions Raised

The SDDOT requested a more detailed analysis of each of the improvement concepts offered in Phase 1. In order to provide more accurate baseline data, peak hour turning movement counts were conducted at the intersections of 41st Street with Terry Avenue, Carolyn Avenue, and the Mall Entrance. These counts were incorporated with the Phase 1 traffic counts at the interchange, and were refined using the NCHRP 255 procedure to estimate future traffic volumes for each individual intersection. The traffic volumes were balanced throughout the corridor, rather than applying a single growth rate to all movements at each intersection.

Analysis Approach

Year 2030 daily traffic forecasts for all interchange approach legs were obtained from the SECOG regional travel demand model. These forecasts were then compared to 2008 Average Daily Traffic counts as published by SECOG. The NCHRP 255 procedure was utilized to estimate turning movements at the study intersections by comparing Year 2008 ADT counts with forecasted levels. The results of the methodology were then reviewed and manually adjusted using engineering judgment to determine Year 2030 AM and PM peak hour traffic volumes. Traffic conditions are depicted on **Figures 2.11** through **2.13**.

The full access intersection of 41st Street with Carolyn Avenue is located approximately 200 feet east of the northbound ramp terminals. The close proximity of these two intersections raises traffic operational and safety concerns, particularly for westbound 41st Street traffic to

northbound I-29. For each of the concepts, this intersection is proposed to be modified to provide right-in/right-out access only.

2.3.3 *Interchange Concepts*

Alternative 1 – Single Point Urban Interchange (SPUI)

In the Phase 2 concept, the southbound off-ramp would be two lanes rather than the three lanes depicted in the Phase 1 concept drawing. With conversion of the interchange to a SPUI, the single point intersection would be expected to operate at LOS D in both the AM and PM peak periods. The intersections with Terry Avenue and the Mall Entrance would both be expected to operate at LOS D or better in both the AM and PM peak periods. At Carolyn Avenue, the intersection would be converted to right in-right out access, and be controlled by a median. It would be expected to operate at LOS B or better in both the AM and PM peak periods.

With the SPUI concept, pedestrians would need to cross multiple lanes of traffic at each ramp, requiring pedestrian signals. With the reconstruction of both ramp terminals, four separate ramps would need to be crossed. The concept drawing of this improvement option is shown in **Figure 2.9**. Construction costs for this concept are estimated at $10,590,000. The relatively high cost of this concept is due to the need to reconstruct all four of the ramps to meet current design standards, and the construction of a very wide bridge to accommodate the left turning movements through the intersection.

Alternative 2 – Diverging Diamond Interchange

With conversion of the interchange to a diverging diamond, both ramp terminal intersections would be expected to operate at LOS D or better in both the AM peak period and LOS C or better in the PM peak period. The intersections with Terry Avenue and the Mall Entrance would both be expected to operate at LOS D or better in both the AM and PM peak periods. At Carolyn Avenue, the intersection would be converted to right in-right out access, and be controlled by a median. It would be expected to operate at LOS B or better in both the AM and PM peak periods.

With the diverging diamond concept, pedestrians would also need to cross multiple lanes of traffic at each ramp, requiring pedestrian signals. There are different options available to accommodate pedestrians through the interchange. Sidewalks can be provided in the center median between the crossovers, or along the side of the road. This decision can be made during preliminary design of the interchange, as there are advantages and disadvantages of each. The concept drawing of this improvement option is shown in **Figure 2.10**. Construction costs for this concept are estimated at $3,080,000. This concept would retain the existing bridge and modifications would be made to the crossroad and ramps.

Capacity analysis worksheets and detailed cost estimates for each concept are included in **Tables 2.8** and **2.9**.

2.3.4 Environmental Review

A cursory review of the interchange and surrounding area was conducted to identify potential environmental resources that may be affected by the project and could require further assessment during later stages of the project. The cursory review was conducted by reviewing aerial photography and FHU's in-house GIS data for the area.

Land use in the general area of the interchange consists primarily of commercial and residential properties. The Sunset Hills residential neighborhood is located in the northwest quadrant of the interchange. It was built pre-1962 and could potentially have historic value. Also, there appears to be two or three gas stations along 41st Street which may present hazardous materials issues.

Other environmental resources that may require analysis include potential wetlands, prime and unique farmland, air, noise, threatened/endangered species, cultural resources, and 4(f) and 6(f) resources in support of National Environmental Policy Act (NEPA) documentation prior to final design and construction activities. However, none of the proposed alternative concepts are anticipated to significantly impact these environmental resources. Due to the developments surrounding the interchange, it is possible that noise impacts may require mitigation.

2.3.5 Alternative Evaluation

An analysis of the SPUI and Diverging Diamond alternatives was conducted to provide a comparative evaluation of the benefits and impacts associated with each alternative. Each of the alternative concepts was rated on a point system based upon pre-determined evaluation criteria. The criteria include property impacts, physical environment, community support, traffic/access, safety, and construction cost. A "good" rating was worth 3 points, "fair" was 2, and "poor" was 1.

The various evaluation factors discussed in the previous section were tabulated and are summarized in **Table 2.7**. Some of the evaluation criteria were ranked similarly between the three concepts. The primary differences were associated with right-of-way impacts and construction related issues, such as utility impacts, construction phasing and costs. The No-Build Alternative was ranked the lowest due to its inability to provide acceptable traffic operations for the design year or address existing safety concerns. The diverging diamond concept was ranked as the preferred configuration. This concept provides acceptable traffic operations in the design year, and can be constructed with minimal right-of-way impacts and for considerably less cost than the SPUI configuration.

Table 2.7 Exit 77 Alternative Evaluation Summary

Evaluation Factors (Max. Points)	Alternative Ratings	
	Alternative 1	Alternative 2
	Single Point Urban Interchange	Diverging Diamond
Property Impacts (9)	7	9
Physical Environment (9)	5	5
Traffic/Access (9)	4	5
Geometric Design (3)	2	2
Safety (6)	5	6
Construction (9)	4	6
Overall Total (45)	27	33
Construction Costs[1]	$10,590,000	$3,080,000

[1]Project construction costs will be considerably higher once required Right-of-Way acquisition costs are incorporated into the final cost estimate.

Supporting Exit 77 Figures and Tables follow:

Figure 2.9	I-29 Exit 77 Alternative 1 – Single Point Urban Interchange
Figure 2.10	I-29 Exit 77 Alternative 2 – Diverging Diamond Interchange
Figure 2.11	I-29 Exit 77 Traffic Conditions Year 2009
Figure 2.12	I-29 Exit 77 Alternative 1 Single Point Urban Interchange Traffic Conditions Year 2030
Figure 2.13	I-29 Exit 77 Alternative 2 Diverging Diamond Interchange Traffic Conditions Year 2030
Table 2.8	I-29 Exit 77 Probable Construction Costs Alternative 1 Single Point Urban Interchange
Table 2.9	I-29 Exit 77 Probable Construction Costs Alternative 2 Diverging Diamond Interchange
Table 2.10	I-29 Exit 77 Alternative Performance Matrix

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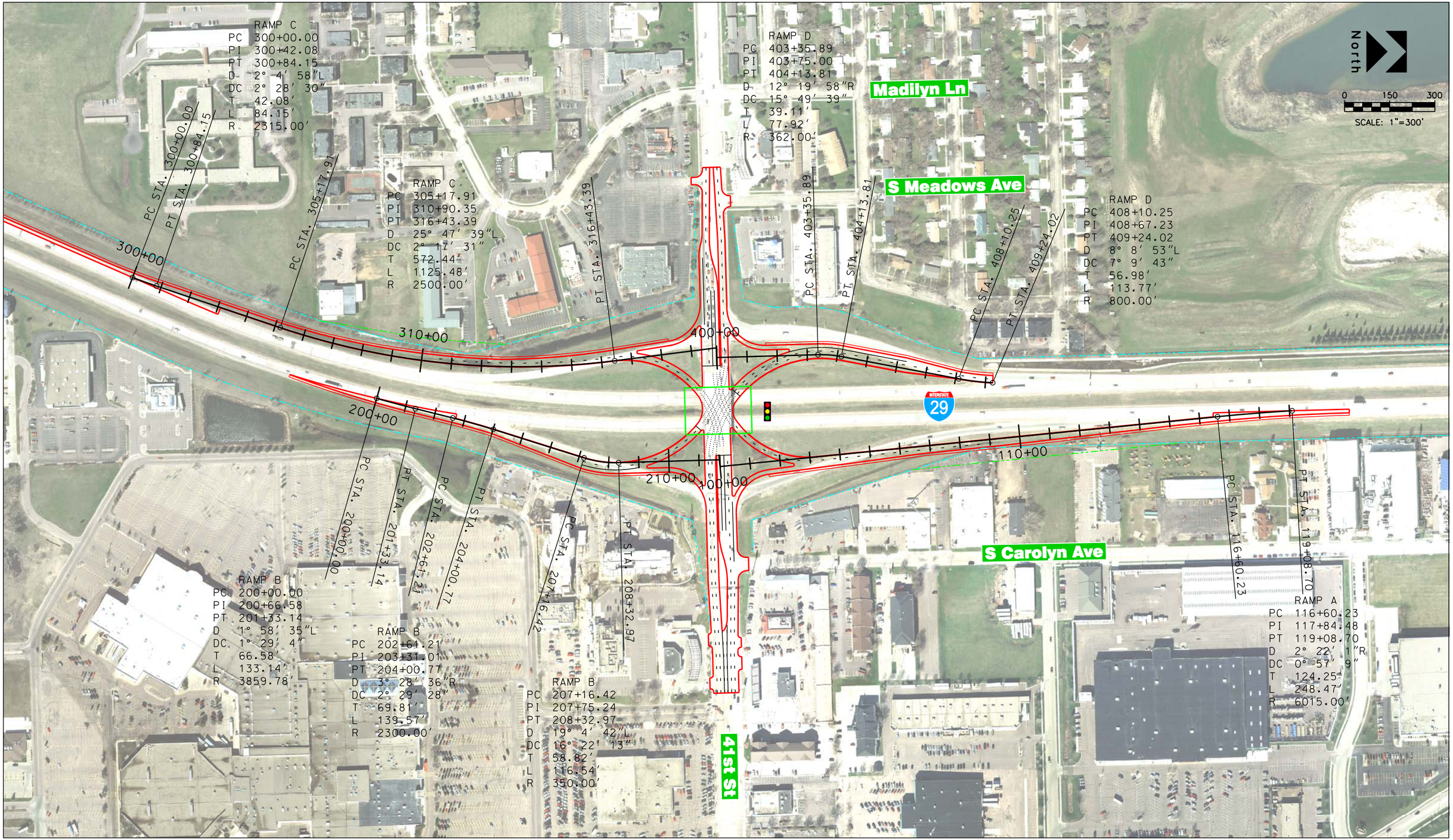

FELSBURG HOLT & ULLEVIG

CONCEPTUAL DESIGN

Figure 2.9
I-29 Exit 77 - 41st Street
Alternative 1
Single Point Urban Interchange

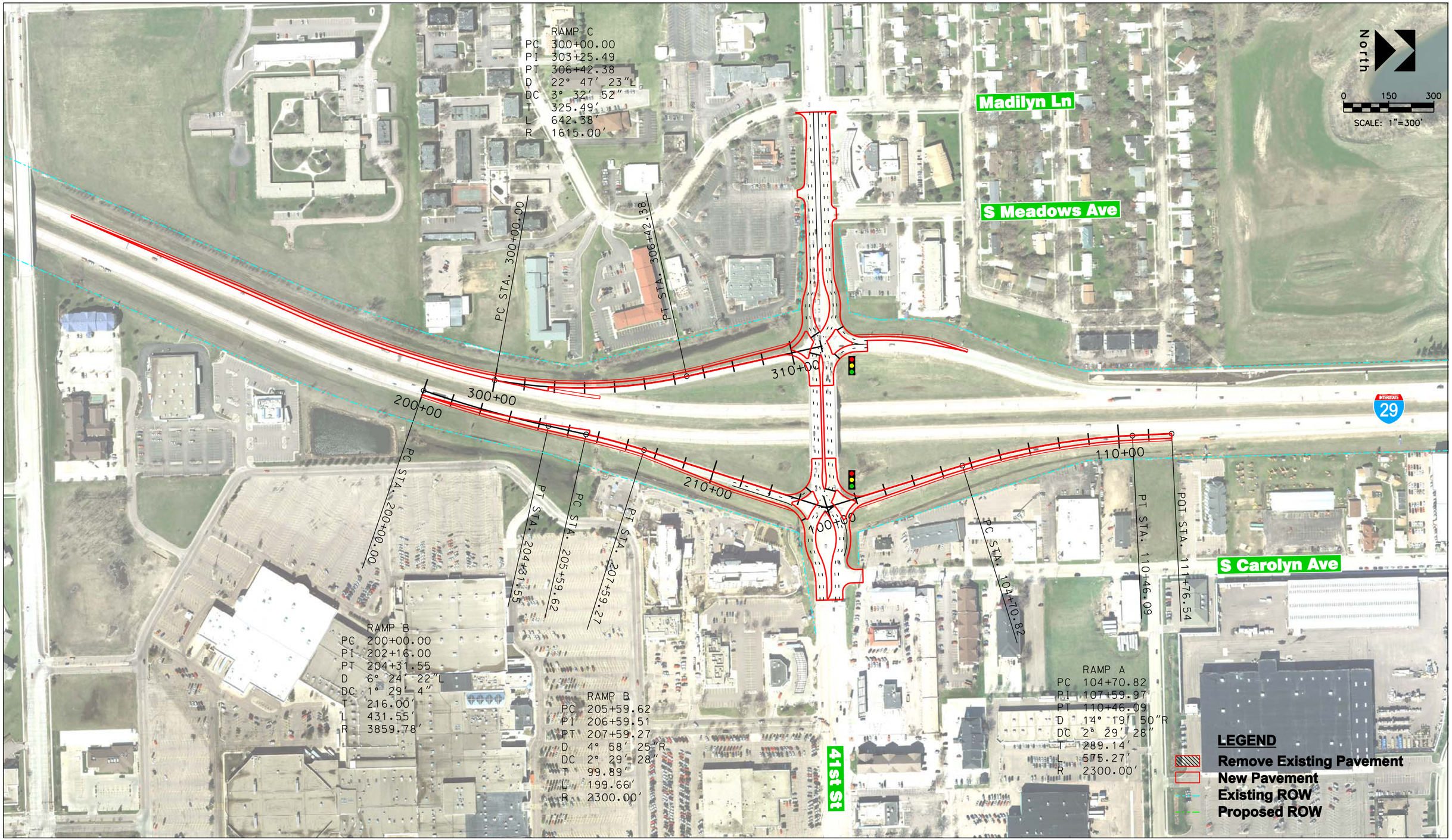

Figure 2.10
I-29 Exit 77 - 41st Street
Alternative 2
Diverging Diamond interchange

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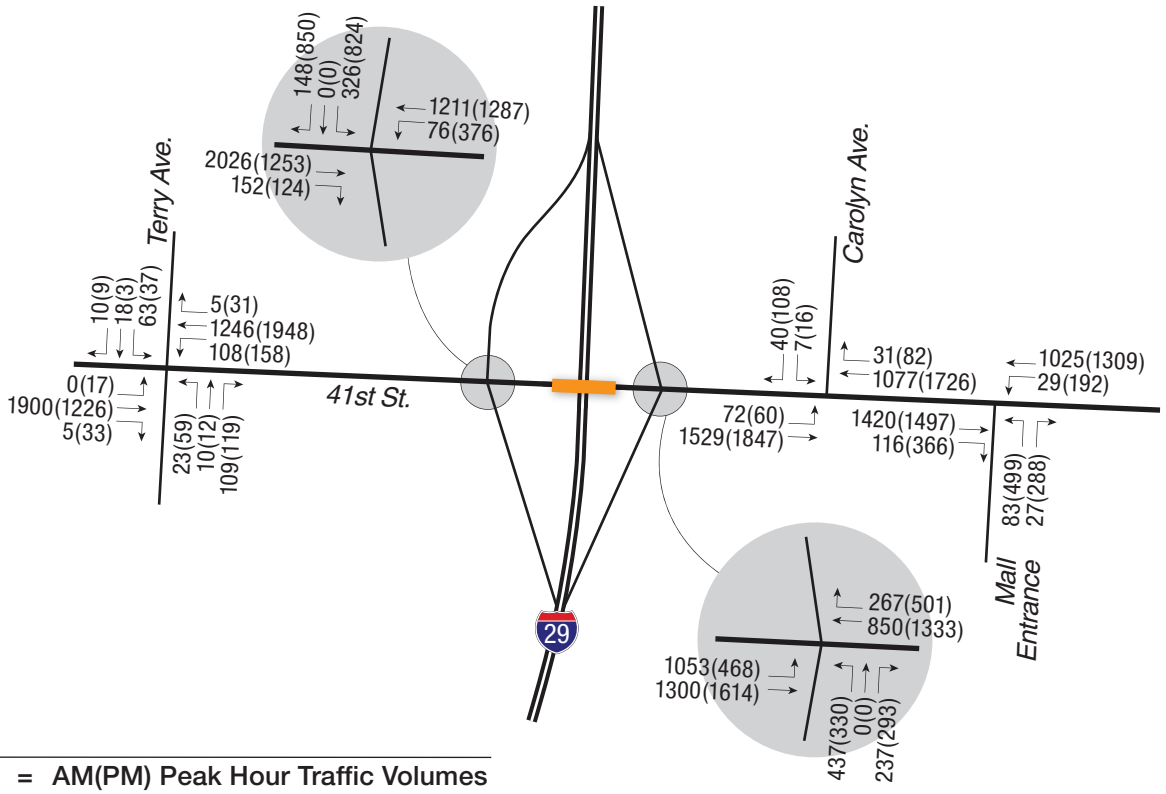
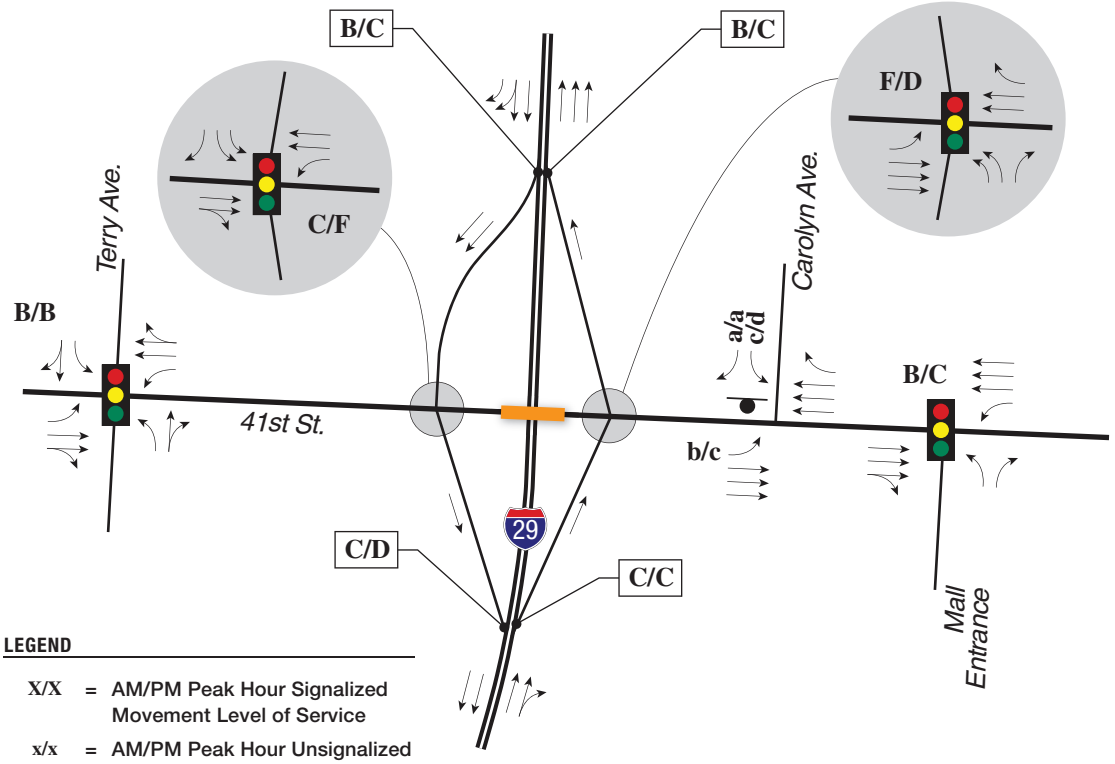
CONCEPTUAL DESIGN



LEGEND

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes



LEGEND

X/X = AM/PM Peak Hour Signalized Movement Level of Service

x/x = AM/PM Peak Hour Unsignalized Movement Level of Service

X/X = AM/PM Peak Hour Ramp Junction Level of Service

= Traffic Signal

= Stop Sign

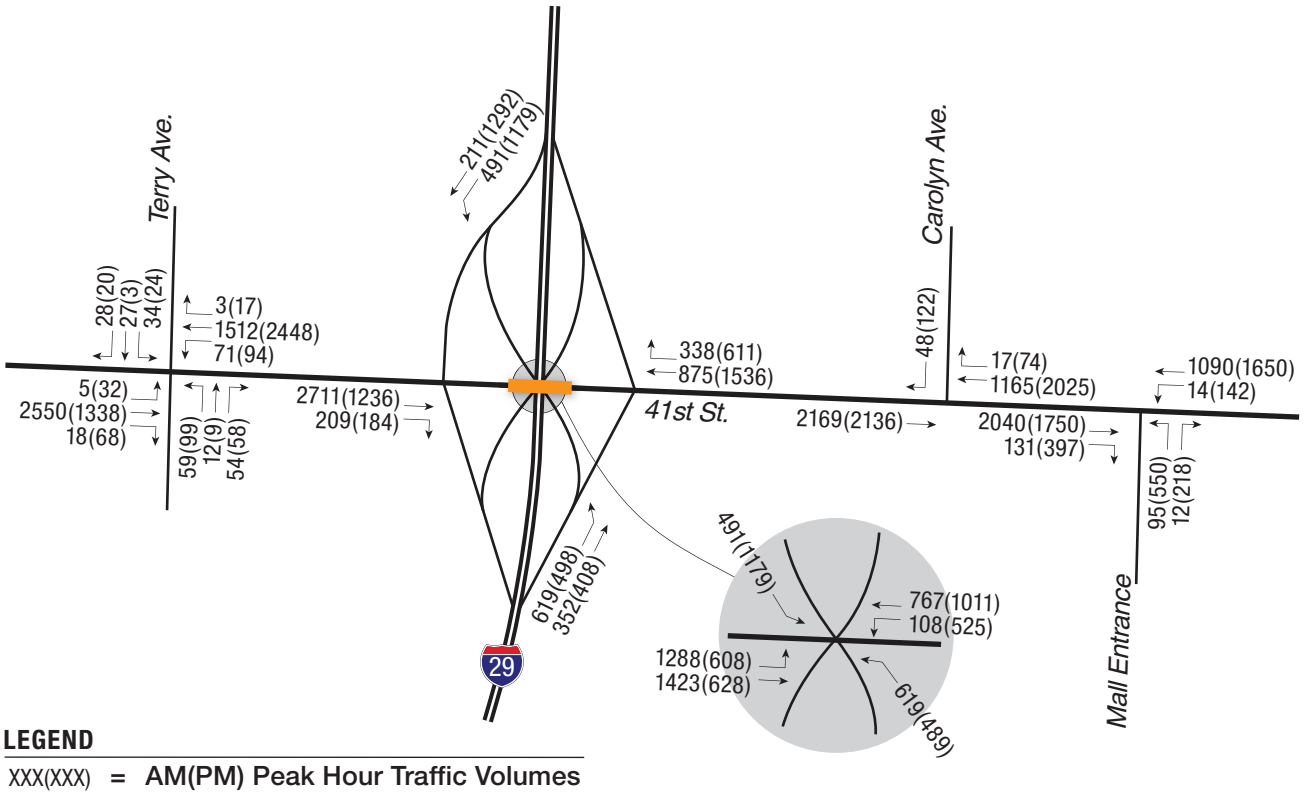
= Travel Lanes

Figure 2.11
Interstate 29 Exit 77
Traffic Conditions Year 2009

FELSBURG HOLT & ULLEVIG

NORTH

SDDOT Decennial Corridor, 09-104-01, 06/17/10



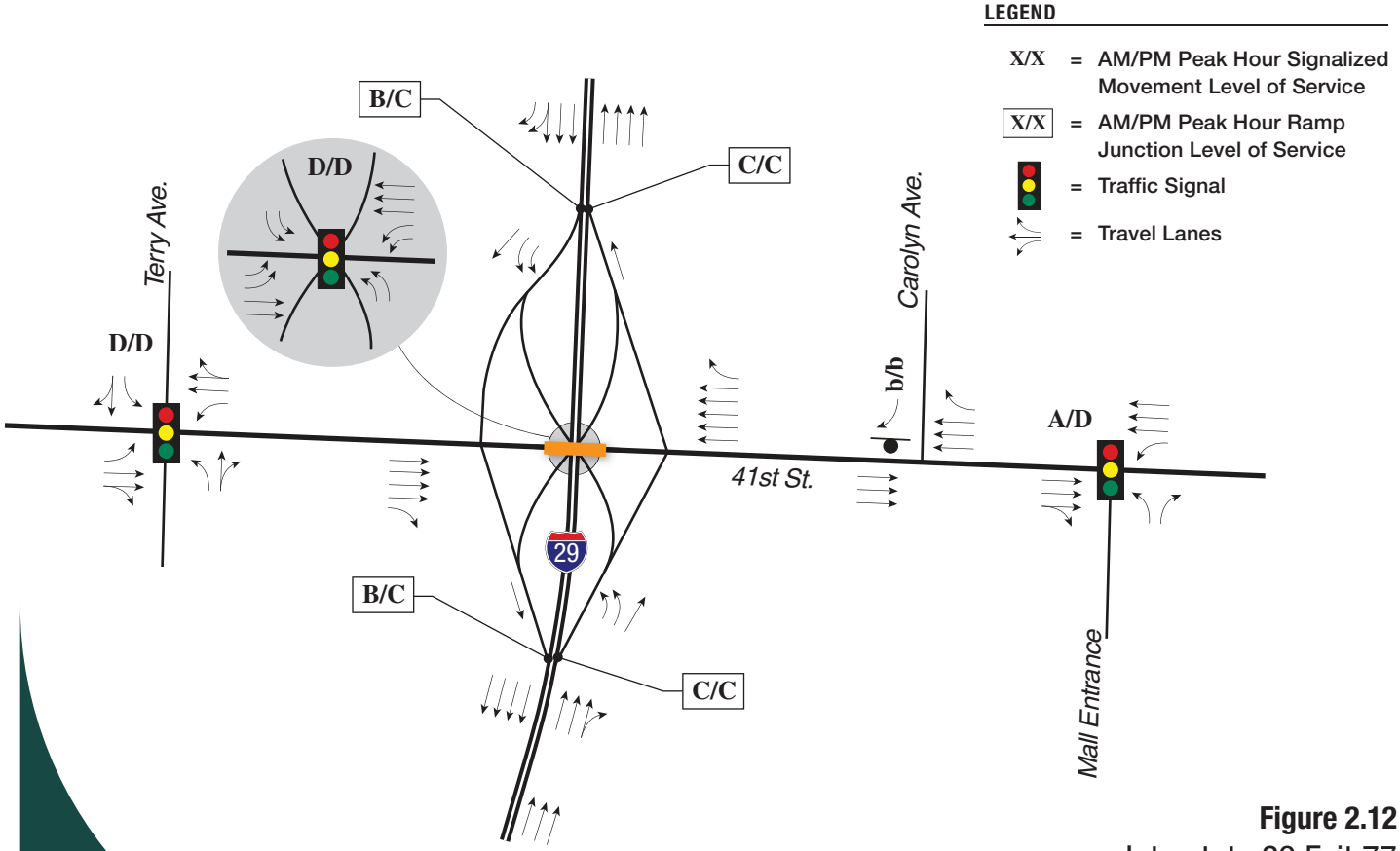
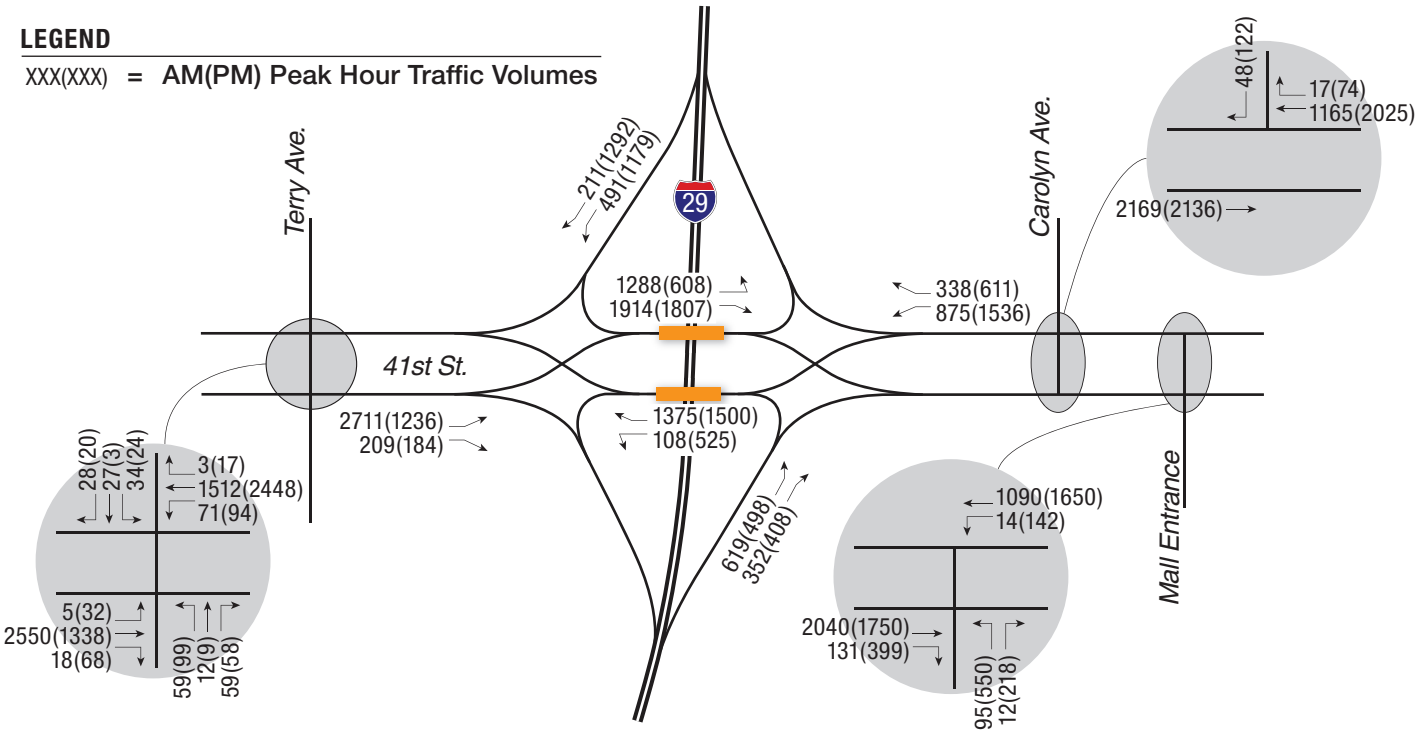


Figure 2.12
Interstate 29 Exit 77
Alternative 1 - Single Point Urban Interchange
Traffic Conditions Year 2030

FELSBURG HOLT & ULLEVIG

NORTH

SDDOT Decennial Corridor Phase 2, 09-104-01, 07/12/10



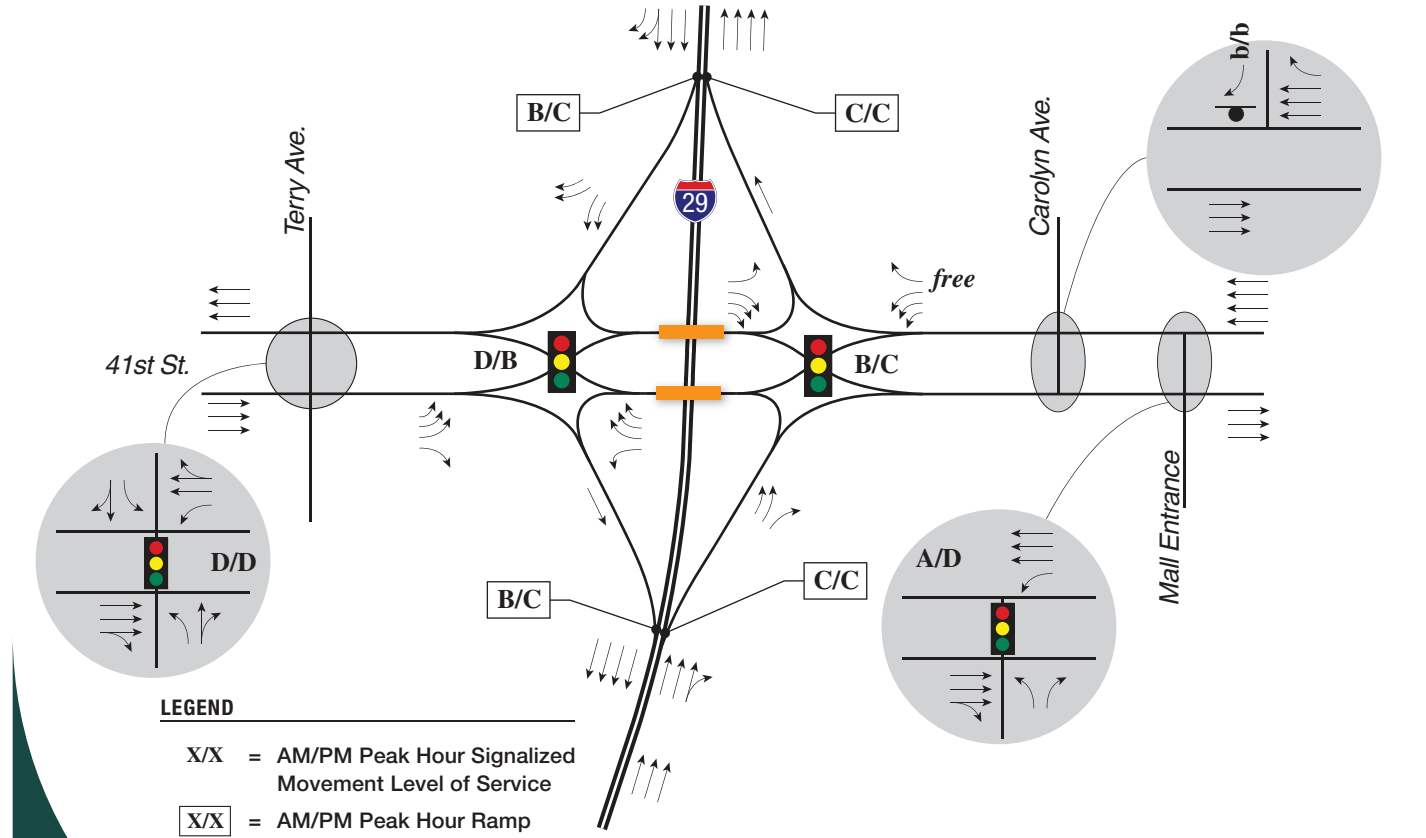


Figure 2.13
Interstate 29 Exit 77
Alternative 2 - Diverging Diamond Interchange
Traffic Conditions Year 2030

FELSBURG HOLT & ULLEVIG

NORTH

SDDOT Decennial Corridor Phase 2, 09-104-01, 07/12/10

Probable Construction Costs
I-29 Exit 77 - Alternative 1 Single Point Urban Interchange

Item Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*
Mobilization	1	LUMP SUM	$297,000.00	$297,000
Traffic Control	1	LUMP SUM	$593,000.00	$593,000
Clearing	1	LUMP SUM	$119,000.00	$119,000
Removal of Concrete Pavement	31,622	SQ. YD.	$3.88	$122,788
Removal of Asphalt Pavement		SQ. YD.	$7.39	$0
Remove Bridge	21,960	SQ. FT.	$9.00	$197,640
Borrow, Unclassified Excavation	29,990	CU. YD.	$5.30	$159,008
Base Course	18,065	TON	$10.64	$192,155
Asphalt Composite		TON	$80.91	$0
PCC Pavement 8" (cross street)	19,607	SQ. YD.	$33.12	$649,396
PCC Pavement 8" (ramps)	19,944	SQ. YD.	$43.40	$865,461
Concrete Approach Slab	1,622	SQ. YD.	$188.34	$305,533
Bridges	34,367	SQ. FT.	$100.00	$3,436,700
Guard Rail	0	LF	$100.00	$0
Permanent Signing/Markings	1	LUMP SUM	$180,000.00	$180,000
Traffic Signal	1	EACH	$125,000.00	$125,000
Roadway Lighting	1	LUMP SUM	$120,000.00	$120,000
Drainage (18" RCP)	180	LF	$24.53	$4,415
Subtotal				$7,370,000
Contingencies	25%			$1,842,500
Total Probable Construction Costs				$9,210,000
Engineering, Administration	15%			$1,381,500
Total Project Costs				$10,590,000

Table 2.8
Probable Construction Costs
I-29 Exit 77 - Alternative 1
Single Point Urban Interchange

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Probable Construction Costs
I-29 Exit 77 - Alternative 2 Diverging Diamond Interchange

Item Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*
Mobilization	1	LUMP SUM	$77,000.00	$77,000
Traffic Control	1	LUMP SUM	$154,000.00	$154,000
Clearing	1	LUMP SUM	$31,000.00	$31,000
Removal of Concrete Pavement	31,662	SQ. YD.	$3.88	$122,945
Removal of Asphalt Pavement		SQ. YD.	$7.39	$0
Remove Bridge		SQ. FT.	$9.00	$0
Borrow, Unclassified Excavation	15,970	CU. YD.	$5.30	$84,672
Base Course	13,016	TON	$10.64	$138,452
Asphalt Composite		TON	$80.91	$0
PCC Pavement 8" (cross street)	12,931	SQ. YD.	$33.12	$428,291
PCC Pavement 8" (ramps)	15,566	SQ. YD.	$43.40	$675,488
Concrete Approach Slab	-	SQ. YD.	$188.34	$0
Bridges	-	SQ. FT.	$100.00	$0
Guard Rail	900	LF	$100.00	$90,000
Permanent Signing/Markings	1	LUMP SUM	$50,000.00	$50,000
Traffic Signal	2	EACH	$125,000.00	$250,000
Roadway Lighting	1	LUMP SUM	$30,000.00	$30,000
Drainage (18" RCP)	180	LF	$24.53	$4,415
Subtotal				$2,140,000
Contingencies	25%			$535,000
Total Probable Construction Costs				$2,680,000
Engineering, Administration	15%			$402,000
Total Project Costs				$3,080,000

Table 2.9
Probable Construction Costs
I-29 Exit 77 - Alternative 2
Diverging Diamond Interchange

Evaluation Factors/Categories	Alternative 1 – Single Point Urban Interchange Rating	Alternative 2 – Diverging Diamond Interchange Rating
Property Impacts		
Businesses	2	3
Residences	3	3
Right-of-Way Acquisition	2	3
Subtotal	**7**	**9**
Physical Environment		
Hazardous Sites, 4(f), 6(f)	2	2
Wetlands Impacts	2	2
Flood and Drainage Impacts	1	1
Subtotal	**5**	**5**
Traffic/Access		
Traffic Operations	1	1
Development Access	2	2
Multimodal Compatibility	1	2
Subtotal	**4**	**5**
Geometric Design		
Meeting Standards	2	2
Subtotal	**2**	**2**
Safety		
Improvement of Existing Hazard(s)	3	3
Incident Response	2	3
Subtotal	**5**	**6**
Construction		
Utility Impacts	1	1
Scheduling/Adapatability	2	2
Relative Construction Cost	1	3
Subtotal	**4**	**6**
Construction Costs	$10,590,000	$3,080,000
Totals	**27**	**33**

Table 2.10
I-29 Exit 77 - Alternative Performance Matrix

2.4 I-90 Exit 17 – US Highway 85 to Lead-Deadwood

2.4.1 Review of Phase 1 Findings

In Phase 1 of the study, the traffic volumes in the Elkhorn Ridge Development Traffic Impact Study (Kirkham Michael, 2007) were used as the basis for the forecasted traffic volumes for the ramp terminals at this interchange. These volumes were used in order to take expected future development in the vicinity of the interchange into account. In this traffic study, the existing and future traffic conditions were 2007 and 2027 respectively. An annual growth rate of 3 percent per year was then applied to the volumes in these two scenarios in order to determine the traffic volumes for the existing, 2020 and 2030 analysis scenarios used in this Interstate Corridor Study.

Due to the expected increases in traffic related to the Elkhorn Ridge Development, the stop controlled approaches at both ramp terminals are expected to operate at LOS F by 2020. Two improvement options were proposed which include the following:

- Signalization and auxiliary lane improvements at both ramp terminals (may involve widening of existing bridges)
- Convert interchange to a Single Point Urban Interchange (SPUI)

2.4.2 Phase 2 Issues

Questions Raised

The SDDOT has requested that the traffic volumes developed for Phase 1 of this study be verified to confirm that all growth expected in the vicinity of this interchange has been taken into account.

Analysis Approach

The first step in this process was to compare more recent turning movement counts collected at both ramp termini and the intersection of US 85 and Colorado Boulevard to the existing counts in the Elkhorn Ridge Development Traffic Impact Study. Based on this comparison, the counts used as the basis for the traffic forecasts in Phase 1 from the Elkhorn Ridge study are the same or higher than the more recent counts. Also, in addition to the Elkhorn Ridge Development, which includes several different kinds of retail, office and residential uses, the Regional Hospital System has acquired land to the south of the interchange for a new hospital. All of these land uses, both related and unrelated to the Elkhorn Ridge Development, were taken into account in the Elkhorn Ridge Development Traffic Impact Study. This means that the traffic volumes used in the analysis of Phase 1 are both conservative and have taken into account the future land uses expected to be in place around the interchange.

Accordingly, no additional operational analyses of Exit 17 were performed for Phase 2.

2.4.3 Interchange Concepts

As mentioned previously, two interchange concepts were developed during Phase 1 for this interchange in order to provide improved traffic operations with expected future land uses in place. Both of these alternatives have been carried forward into Phase 2.

Alternative 1 – New Turn Lanes and Signals

Alternative 1 includes signalization as well as auxiliary lane improvements at both ramp terminals. The auxiliary lane improvements at the westbound I-90 ramp terminal include a new westbound left turn lane and northbound dual left turn lanes. These new lanes may result in the need for the existing bridge over I-90 to be widened. At the eastbound I-90 ramp terminal the auxiliary lane improvements include new eastbound and southbound left turn lanes as well as a new northbound right turn lane. The proposed interchange conceptual improvements can be seen on **Figure 2.14**. These new traffic signals and auxiliary lanes are estimated to cost approximately $4.4 million. With these improvements in place the ramp terminals are expected to operate at LOS B or better through 2030.

Alternative 2 – Single Point Urban Interchange

The second alternative would result in the reconstruction of the interchange into a SPUI. The proposed interchange conceptual improvements for this alternative can be seen on **Figure 2.15**. To reconstruct the interchange in this manner is estimated to cost approximately $12.83 million. With this configuration the SPUI is expected to operate at LOS B or better through 2030.

Construction cost estimates are detailed in **Tables 2.12** and **2.13**. Construction Cost does not include Right-of-Way acquisition cost, and will be considerably higher with Right-of-Way.

2.4.4 Environmental Review

A cursory review of the interchange and surrounding area was conducted to identify potential environmental resources that may be affected by the project and could require further assessment during later stages of the project. The cursory review was conducted by reviewing aerial photography and FHU's in-house GIS data for the area. Land use in the immediate area of the interchange is predominately undeveloped, although new development is occurring to the east. Based on the conceptual design for Alternatives 1 and 2, the potential environmental issues identified include:

- Miller Creek is present to the south of the interchange. Miller Creek may potentially provide habitat for migratory birds. Additionally, proposed improvements may be near the Miller Creek floodplain zone.
- A pond with potential wetlands is located south of the interchange and east of Highway 85.
- There are numerous drainages and potential wetlands north of the interchange.
- Several buildings are located to the southwest of the interchange, which could potentially be historical.

Other environmental resources that may require future analysis in support of National Environmental Policy Act (NEPA) documentation include air, noise, threatened/endangered species, cultural resources, and 4(f) and 6(f) resources.

2.4.5 Alternative Evaluation

An analysis of the enhancements provided by Alternative 1 and the reconstructed Single Point Urban Interchange of Alternative 2 was conducted to provide a comparative evaluation of the benefits and impacts associated with each alternative.

The results are shown in **Table 2.11**. Both alternatives demonstrate the ability to provide acceptable traffic operations through the Year 2030. Alternative 1 is able to provide acceptable traffic operations for a lesser construction cost, making Alternative 1 the Most Feasible Alternative for Exit 17.

Table 2.11 Exit 17 Alternative Evaluation Summary

Evaluation Factors (Max. Points)	Alternative Ratings	
	Alternative 1	Alternative 2
	New Turn Lanes and Signals	Single-Point Urban Interchange
Property Impacts (9)	9	9
Physical Environment (9)	9	9
Traffic/Access (9)	7	7
Geometric Design (3)	2	2
Safety (6)	4	4
Construction (9)	8	6
Overall Total (45)	39	37
Construction Cost[1]	$4,400,000	$12,830,000

[1]Project construction costs will be considerably higher once required Right-of-Way acquisition costs are incorporated into the final cost estimate.

Supporting Exit 17 Figures and Tables follow:

Figure 2.14	I-90 Exit 17 Alternative 1 – New Turn Lanes & Signals
Figure 2.15	I-90 Exit 17 Alternative 2 – Single Point Urban Interchange
Table 2.12	I-90 Exit 17 Probable Construction Costs Alternative 1 New Turn Lanes & Signals
Table 2.13	I-90 Exit 17 Probable Construction Costs Alternative 2 Single Point Urban Interchange
Table 2.14	I-90 Exit 17 Alternative Performance Matrix

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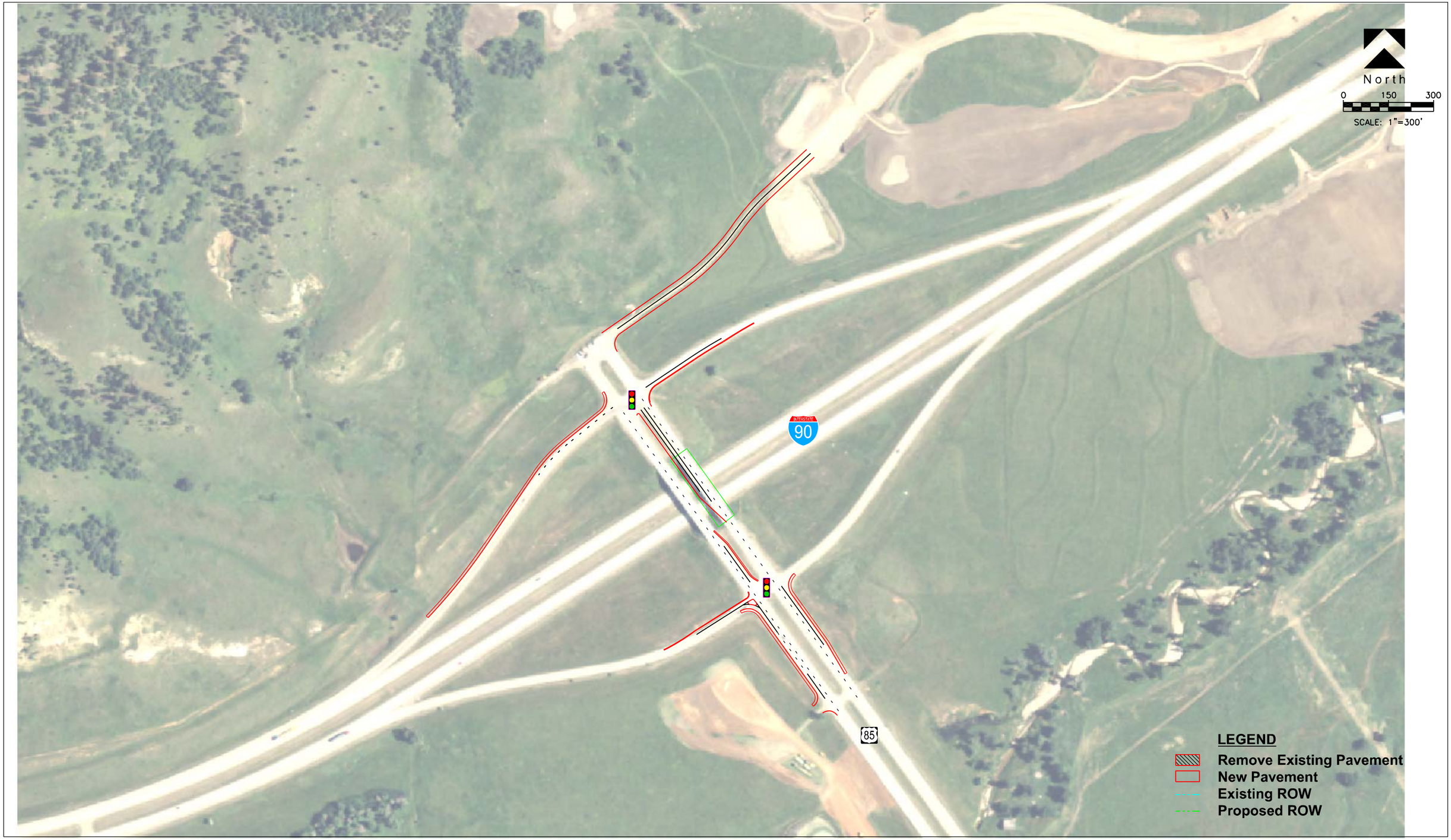

FELSBURG HOLT & ULLEVIG

CONCEPTUAL DESIGN

Figure 2.14
I-90 Exit 17 - Lead/Deadwood
Alternative 1
New Turn Lanes & Signals

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CONCEPTUAL DESIGN

Figure 2.15
I-90 Exit 17 - Lead/Deadwood
Alternative 2
Single Point Urban Interchange

Probable Construction Costs
I-90 Exit 17 - Alternative 1 New Turn Lanes and Signals

Item Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*
Mobilization	1	LUMP SUM	$115,000.00	$115,000
Traffic Control	1	LUMP SUM	$230,000.00	$230,000
Clearing	1	LUMP SUM	$46,000.00	$46,000
Removal of Concrete Pavement	-	SQ. YD.	$3.88	$0
Removal of Asphalt Pavement	-	SQ. YD.	$7.39	$0
Remove Bridge	9,864	SQ. FT.	$9.00	$88,776
Borrow, Unclassified Excavation	2,928	CU. YD.	$5.30	$15,522
Base Course	3,430	TON	$10.64	$36,483
Asphalt Composite	3,430	TON	$80.91	$277,487
PCC Pavement 11" (mainline)	-	SQ. YD.	$33.12	$0
PCC Pavement 8" (ramps)		SQ. YD.	$43.40	$0
Concrete Approach Slab	400	SQ. YD.	$188.34	$75,337
Bridges	18,084	SQ. FT.	$100.00	$1,808,400
Guard Rail	0	LF	$100.00	$0
Permanent Signing/Markings	1	LUMP SUM	$70,000.00	$70,000
Traffic Signal	2	EACH	$125,000.00	$250,000
Roadway Lighting	1	LUMP SUM	$50,000.00	$50,000
Drainage (18" RCP)	60	LF	$24.53	$1,472
Subtotal				$3,060,000
Contingencies	25%			$765,000
Total Probable Construction Costs				$3,830,000
Engineering, Administration	15%			$574,500
Total Project Costs				$4,400,000

Table 2.12
Probable Construction Costs
I-90 Exit 17 - Alternative 1
New Turn Lanes and Signals

Probable Construction Costs
I-90 Exit 17 - Alternative 2 Single Point Urban Interchange

Item Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*
Mobilization	1	LUMP SUM	$359,000.00	$359,000
Traffic Control	1	LUMP SUM	$717,000.00	$717,000
Clearing	1	LUMP SUM	$143,000.00	$143,000
Removal of Concrete Pavement	8,554	SQ. YD.	$3.88	$33,213
Removal of Asphalt Pavement	23,699	SQ. YD.	$7.39	$175,185
Remove Bridge	11,712	SQ. FT.	$9.00	$105,408
Borrow, Unclassified Excavation	26,916	CU. YD.	$5.30	$142,709
Base Course	17,758	TON	$10.64	$188,891
Asphalt Composite	17,758	TON	$80.91	$1,436,706
PCC Pavement 11" (mainline)	-	SQ. YD.	$33.12	$0
PCC Pavement 8" (ramps)		SQ. YD.	$43.40	$0
Concrete Approach Slab	656	SQ. YD.	$188.34	$123,469
Bridges	49,642	SQ. FT.	$100.00	$4,964,200
Guard Rail	0	LF	$100.00	$0
Roundabout (Single Lane)	1	EACH	$50,000.00	$50,000
Permanent Signing/Markings	1	LUMP SUM	$220,000.00	$220,000
Traffic Signal	1	EACH	$125,000.00	$125,000
Roadway Lighting	1	LUMP SUM	$140,000.00	$140,000
Drainage (18" RCP)	180	LF	$24.53	$4,415
Subtotal				$8,930,000
Contingencies	25%			$2,232,500
Total Probable Construction Costs				$11,160,000
Engineering, Administration	15%			$1,674,000
Total Project Costs				$12,830,000

Table 2.13
Probable Construction Costs
I-90 Exit 17 - Alternative 2
Single Point Urban Interchange

Evaluation Factors/Categories	Alternative 1 - New Turn Lanes and Signals Rating	Alternative 2 - Single-Point Urban Interchange Rating
Property Impacts		
Businesses	3	3
Residences	3	3
Right-of-Way Acquisition	3	3
Subtotal	**9**	**9**
Physical Environment		
Hazardous Sites, 4(f), 6(f)	3	3
Wetlands Impacts	3	3
Flood and Drainage Impacts	3	3
Subtotal	**9**	**9**
Traffic/Access		
Traffic Operations	3	3
Development Access	3	3
Multimodal Compatibility	1	1
Subtotal	**7**	**7**
Geometric Design		
Meeting Standards	2	2
Subtotal	**2**	**2**
Safety		
Improvement of existing hazard(s)	2	2
Incident Response	2	2
Subtotal	**4**	**4**
Construction		
Utility Impacts	2	2
Scheduling/Adapatability	3	3
Relative Construction Cost	3	1
Subtotal	**8**	**6**
Construction Cost	$4,400,000	$12,830,000
Totals	**39**	**37**

Table 2.14
I-90 Exit 17 - Alternative Performance Matrix

2.5 I-90 Exit 55 – Deadwood Avenue, Rapid City

2.5.1 Review of Phase 1 Findings

The Deadwood Avenue interchange serves the west edge of Rapid City, and traffic operations at the ramp terminal intersections are shown to deteriorate to LOS E/F by the year 2030. The south ramp terminal, currently unsignalized with a temporary signal during peak motorcycle rally season, would need to be signalized and widened to provide acceptable operations. Deadwood Avenue across I-90 would need to be widened to 4 lanes, necessitating a significant bridge widening project to provide acceptable future traffic operations. Phase 1 included a drawing of this improvement.

In addition to anticipated future traffic congestion at the Exit 55 ramp terminal intersections, there is a full movement truck stop access located approximately 330 feet south of the interchange. This distance meets minimum spacing criteria but does not meet the desired spacing distance of 660 feet. SDDOT staff has noted operational problems created by this close spacing. Movements at the adjacent south truck stop access should be limited to improve traffic safety and operations. Interchange traffic conditions are analyzed on **Figures 2.20** and **2.21**.

2.5.2 Phase 2 Issues

Questions Raised

The presence of a full movement truck stop and restaurant access approximately 330 feet south of the interchange has increased conflicting movements along Deadwood Avenue. This issue is of concern to the SDDOT, as increasing future traffic is likely to heighten the hazard and increase congestion. Trucks currently use the access to exit the fuel pump area and reach the interchange quickly, as shown on **Figure 2.19**. Passenger cars also make use of the access to reach the car fuel pump area and the restaurant, which is located within the north portion of the site.

Analysis Approach

To address these concerns, Phase 2 includes an operational evaluation of access movements along Deadwood Avenue south of the interchange and offers alternatives for improving the access spacing.

2.5.3 Interchange Concepts

Alternative 1 – Interchange Improvements, full movement access

Figure 2.16 depicts the refined conceptual design from Phase 1, labeled as Alternative 1. These improvements included the necessary bridge and ramp widening to accommodate additional travel lanes. This suite of improvements was refined for Phase 2 to extend the design south through the Deadwood Avenue / Universal Drive intersection. As shown, southbound Deadwood Avenue would be widened to provide three travel lanes, the outside of which would serve as a continuous right turn lane between the south ramp terminal and Universal Drive. The truck stop/restaurant access would remain a full-movement intersection with Deadwood Avenue.

Traffic operations were analyzed for the access intersection and the Deadwood Avenue / Universal Drive intersection. As shown on **Figure 2.20**, the signalized intersection with Universal Drive currently operates at LOS C or better during peak hours and left turns entering Deadwood Avenue from the truck stop access operate at LOS D or better. By the Year 2030, as shown on **Figure 2.22**, LOS is expected to reach D at the Universal Drive intersection and LOS F for left turns onto Deadwood Avenue at the access intersection.

The Year 2030 analysis indicated that lengthy queues could occur along southbound Deadwood Avenue approaching Universal Drive during the AM peak hour. Queues could extend as far north as the south interchange ramp terminal. To address this condition and improve intersection operations at the Deadwood Avenue / Universal Drive intersection, a continuous southbound right turn lane and a second eastbound left turn lane are recommended. Providing these improvements would improve the LOS to C or better, helping to ease congestion along Deadwood Avenue south of the interchange. The probable construction cost of this alternative is approximately $2.82 Million.

Alternative 2 – Interchange Improvements, Right-Turn Only Access

Figure 2.17 depicts Alternative 2, which includes the same interchange improvements as Alternative 1 with an additional change to the access configuration south of the interchange. Alternative 2 would limit movements at the truck stop/restaurant access to right-turns only, channeling all site-related left turns through the Deadwood Avenue / Universal Drive intersection. The additional traffic through this intersection could be accommodated with the same lane enhancements identified with Alternative 1. Level of Service results are shown on **Figure 2.23**.

This alternative would reduce conflict and improve traffic safety surrounding the truck stop/restaurant access by limiting movements. The truck stop/restaurant site would need to be reconfigured to accommodate the limitations, as trucks currently use the access to enter Deadwood Avenue after filling up (see **Figure 2.19**). An internal site circulation roadway would have to be developed to channel trucks and other vehicles around the truck stop in a counterclockwise direction back to Universal Drive. This may require some alterations to parking for the Windmill Restaurant and additional internal signing and striping. The probable construction cost of this alternative is approximately $2.82 Million.

Alternative 3 – Interchange Improvements, Closed Access

Figure 2.18 depicts Alternative 3, which varies from Alternative 2 in that it would fully close the truck stop/restaurant access instead of limiting the access to right turns only. This action would further reduce congestion and potential crashes along Deadwood Avenue by eliminating vehicular conflicts at the access intersection and channeling all traffic to the Universal Drive connection to Deadwood Avenue. As shown on **Figure 2.24**, operational conditions for Alternative 3 would be similar to the results with Alternative 2.The probable construction cost of this alternative is approximately $2.83 Million.

Probable Construction cost estimates, excluding Right-of-Way, are included in **Tables 2.16** through **2.18**. Inclusion of Right-of-Way acquisitions would considerably increase cost.

Environmental Review

A cursory review of the interchange and surrounding area was conducted to identify potential environmental resources that may be affected by the project and could require further assessment during later stages of the project. The cursory review was conducted by reviewing aerial photography and FHU's in-house GIS data for the area. Land use in the general area of the interchange consists primarily of commercial and light industrial properties. A tributary to Rapid Creek is located east of the project area and an un-named drainage is located to the west of the project area. Based on the conceptual design for Alternatives 1, 2, and 3, the potential environmental issues identified include:

- Potential wetlands could be present in the northwest, southwest, and southeast quadrants of the interchange.
- A truck stop and gasoline filling station is located adjacent to the proposed improvements in the southwest quadrant of the interchange, which has the potential to present hazardous materials issues. Hazardous materials issues could also be present due to the number of light industrial facilities surrounding the interchange.

Other environmental resources that may require future analysis in support of National Environmental Policy Act (NEPA) documentation include prime and unique farmlands, air, noise, threatened/endangered species, cultural resources, and 4(f) and 6(f) resources.

2.5.4 Alternative Evaluation

An analysis of the three Deadwood Avenue access Alternatives was performed to provide a comparative evaluation of the benefits and impacts associated with each.

The performance of the three alternatives is summarized in **Table 2.15**. The alternatives are closely related, the lone difference being the access configuration south of the interchange. Because of its ability to provide standard access spacing along Deadwood Avenue by closing the existing Truck Stop / Restaurant access, Alternative 3 is the Most Feasible Alternative. Alternative 1 rates slightly less safe than the other options due to the safety hazard posed by vehicles attempting to turn left onto Deadwood Avenue from the Truck Stop / Restaurant access.

Table 2.15 Exit 55 Alternative Evaluation Summary

Evaluation Factors (Max. Points)	Alternative Ratings		
	Alternative 1 Interchange Improvements & Full Movement Access	Alternative 2 Interchange Improvements and Right-Turn Only Access	Alternative 3 Interchange Improvements and Closed Access
Property Impacts (9)	7	7	7
Physical Environment (9)	6	6	6
Traffic/Access (9)	6	6	6
Geometric Design (3)	2	2	3
Safety (6)	3	4	4
Construction (9)	6	6	6
Overall Total (45)	30	31	32
Construction Cost[1]	$2,820,000	$2,820,000	$2,830,000

[1]Project construction costs will be considerably higher once required Right-of-Way acquisition costs are incorporated into the final cost estimate.

Supporting Exit 55 Figures and Tables follow:

Figure 2.16	I-90 Exit 55 Alternative 1 – Full Movement Access
Figure 2.17	I-90 Exit 55 Alternative 2 – Right Turn Only Access
Figure 2.18	I-90 Exit 55 Alternative 3 – Closed Access
Figure 2.19	I-90 Exit 55 – Current Site Circulation
Figure 2.20	I-90 Exit 55 Traffic Conditions Year 2009
Figure 2.21	I-90 Exit 55 Traffic Conditions Year 2030
Figure 2.22	I-90 Exit 55 Alternative 1 Interchange Improvements & Full Movement Access Traffic Conditions Year 2030
Figure 2.23	I-90 Exit 55 Alternative 2 Interchange Improvements & Right-Turn Only Access Traffic Conditions Year 2030
Figure 2.24	I-90 Exit 55 Alternative 3 Interchange Improvements & Closed Access Traffic Conditions Year 2030
Table 2.16	I-90 Exit 55 Probable Construction Costs Alternative 1 Interchange Improvements & Full Movement Access
Table 2.17	I-90 Exit 55 Probable Construction Costs Alternative 2 Interchange Improvements & Right-Turn Only Access
Table 2.18	I-90 Exit 55 Probable Construction Costs Alternative 3 Interchange Improvements & Closed Access
Table 2.19	I-90 Exit 55 Alternative Performance Matrix

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CONCEPTUAL DESIGN

Figure 2.16
I-90 Exit 55 - Deadwood Avenue, Rapid City
Alternative 1
Interchange Improvements - Full Movement Access

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CONCEPTUAL DESIGN

Figure 2.17
I-90 Exit 55 - Deadwood Avenue, Rapid City
Alternative 2
Interchange Improvements - Right-Turn Only Access

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CONCEPTUAL DESIGN

Figure 2.18
I-90 Exit 55 - Deadwood Avenue, Rapid City
Alternative 3
Interchange Improvements - Closed Access

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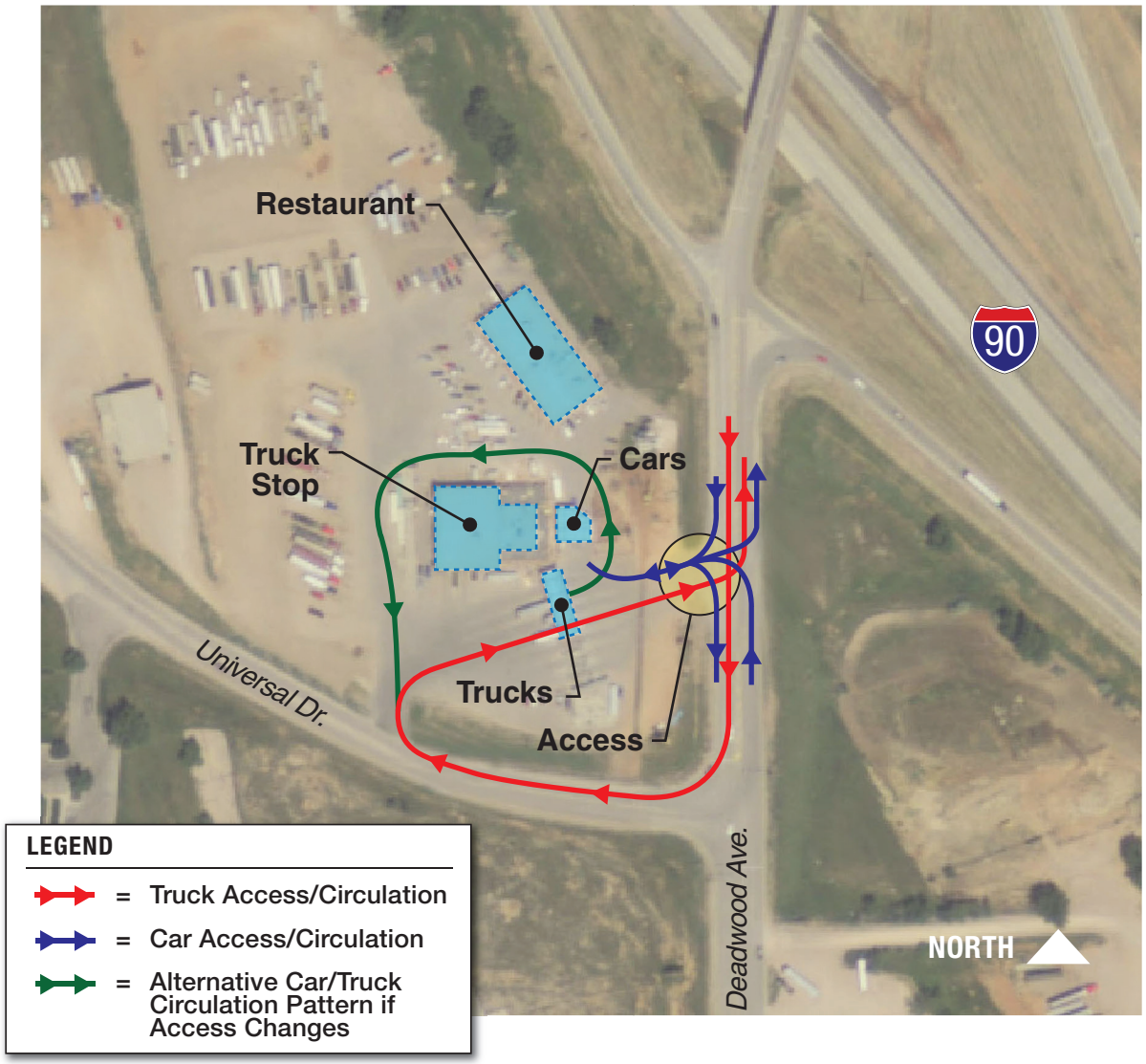

Figure 2.19
Interstate 90 Exit 55
Current Site Circulation

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NORTH

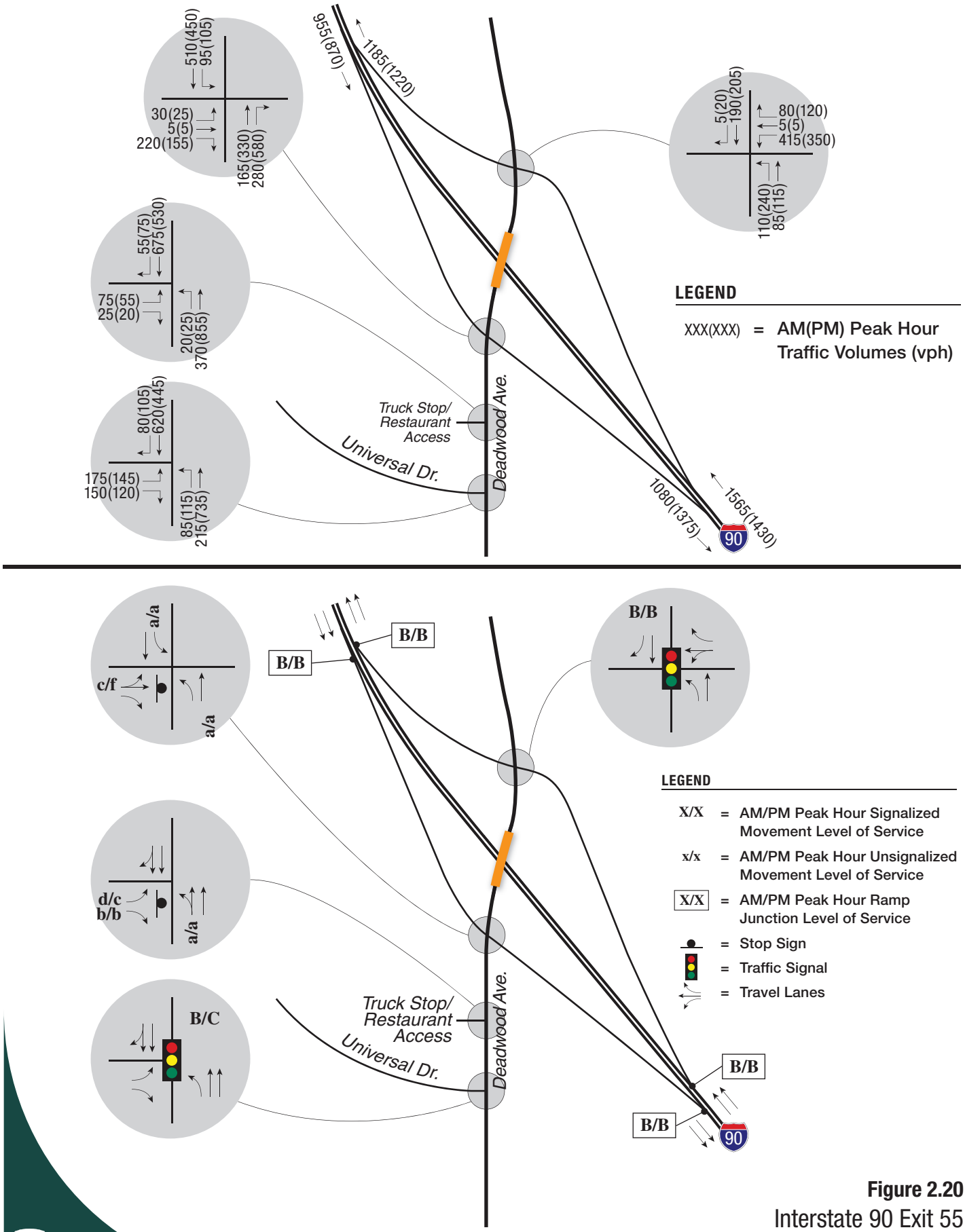

Figure 2.20
Interstate 90 Exit 55
Traffic Conditions Year 2009

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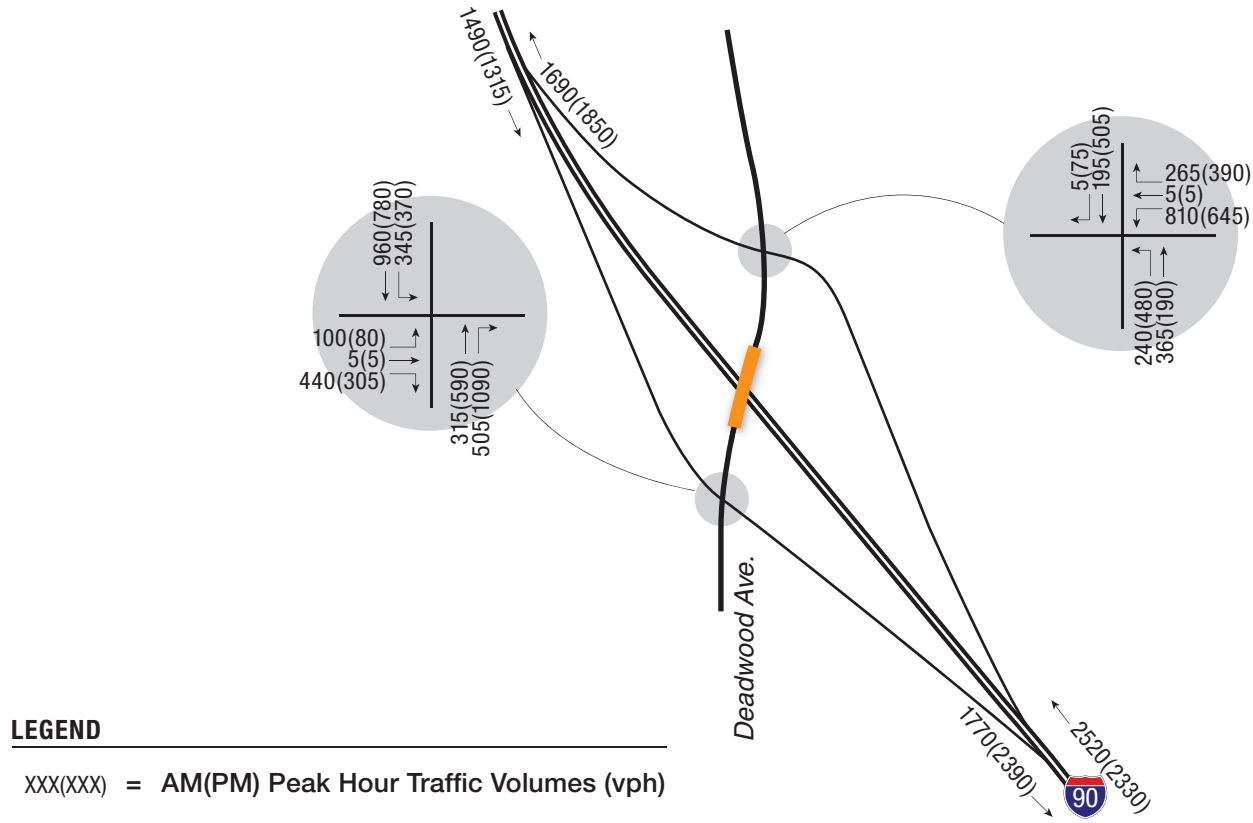
NORTH

SDDOT Decennial Corridor Phase 2, 09-104-01, 05/26/10



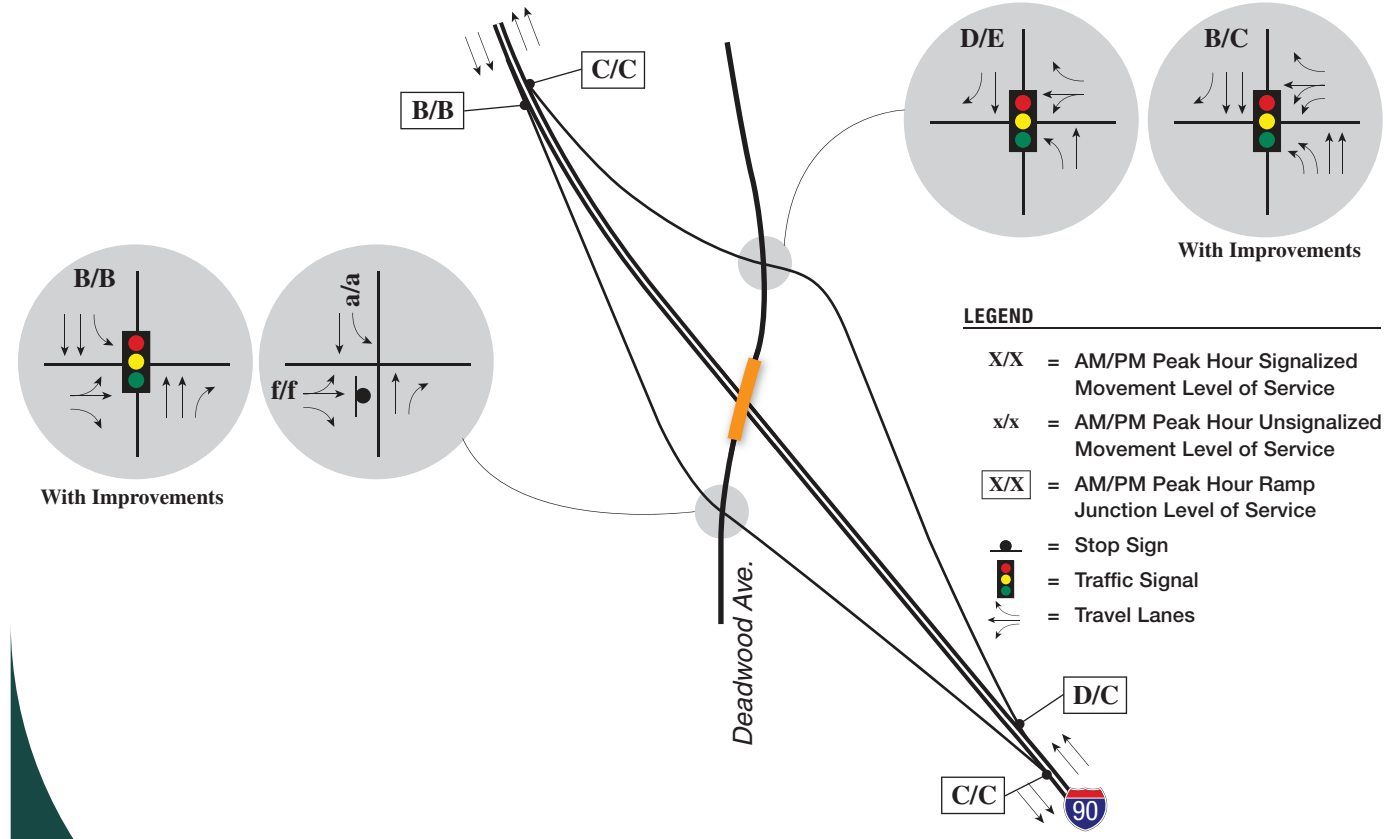


Figure 2.21
Interstate 90 Exit 55
Traffic Conditions Year 2030

FELSBURG HOLT & ULLEVIG

NORTH

SDDOT Decennial Corridor, 09-104-01, 06/10/10

Probable Construction Costs
I-90 Exit 55 - Alternative 1 Interchange Improvements & Full Movement Access

Item Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*
Mobilization	1	LUMP SUM	$80,000.00	$80,000
Traffic Control	1	LUMP SUM	$161,000.00	$161,000
Clearing	1	LUMP SUM	$32,000.00	$32,000
Removal of Concrete Pavement	-	SQ. YD.	$3.88	$0
Removal of Asphalt Pavement	583	SQ. YD.	$7.39	$4,313
Remove Bridge	-	SQ. FT.	$9.00	$0
Borrow, Unclassified Excavation	755	CU. YD.	$5.30	$4,006
Base Course	2,100	TON	$10.64	$22,340
Asphalt Composite	324	TON	$80.91	$26,237
PCC Pavement 11" (mainline)	-	SQ. YD.	$33.12	$0
PCC Pavement 8" (ramps)	4,598	SQ. YD.	$43.40	$199,535
Concrete Approach Slab	467	SQ. YD.	$188.34	$87,893
Bridges	12,600	SQ. FT.	$100.00	$1,260,000
Guard Rail	0	LF	$100.00	$0
Permanent Signing/Markings	1	LUMP SUM	$50,000.00	$50,000
Traffic Signal	0	EACH	$125,000.00	$0
Roadway Lighting	1	LUMP SUM	$30,000.00	$30,000
Drainage (18" RCP)	90	LF	$24.53	$2,208
Subtotal				$1,960,000
Contingencies	25%			$490,000
Total Probable Construction Costs				$2,450,000
Engineering, Administration	15%			$367,500
Total Project Costs				$2,820,000

Table 2.16
Probable Construction Costs
I-90 Exit 55 - Alternative 1
Interchange Improvements & Full Movement Access

FELSBURG HOLT & ULLEVIG

Probable Construction Costs
I-90 Exit 55 - Alternative 2 Interchange Improvements & Right-turn Only Access

Item Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*
Mobilization	1	LUMP SUM	$80,000.00	$80,000
Traffic Control	1	LUMP SUM	$161,000.00	$161,000
Clearing	1	LUMP SUM	$32,000.00	$32,000
Removal of Concrete Pavement	-	SQ. YD.	$3.88	$0
Removal of Asphalt Pavement	583	SQ. YD.	$7.39	$4,313
Remove Bridge	-	SQ. FT.	$9.00	$0
Borrow, Unclassified Excavation	755	CU. YD.	$5.30	$4,006
Base Course	2,100	TON	$10.64	$22,340
Asphalt Composite	324	TON	$80.91	$26,237
PCC Pavement 11" (mainline)	-	SQ. YD.	$33.12	$0
PCC Pavement 8" (ramps)	4,598	SQ. YD.	$43.40	$199,535
Concrete Approach Slab	467	SQ. YD.	$188.34	$87,893
Bridges	12,600	SQ. FT.	$100.00	$1,260,000
Guard Rail	0	LF	$100.00	$0
Permanent Signing/Markings	1	LUMP SUM	$50,000.00	$50,000
Traffic Signal	0	EACH	$125,000.00	$0
Roadway Lighting	1	LUMP SUM	$30,000.00	$30,000
Drainage (18" RCP)	90	LF	$24.53	$2,208
Subtotal				$1,960,000
Contingencies	25%			$490,000
Total Probable Construction Costs				$2,450,000
Engineering, Administration	15%			$367,500
Total Project Costs				$2,820,000

Table 2.17
Probable Construction Costs
I-90 Exit 55 - Alternative 2
Interchange Improvements & Right-turn Only Access

FELSBURG HOLT & ULLEVIG

Probable Construction Costs
I-90 Exit 55 - Alternative 3 Interchange Improvements & Closed Access

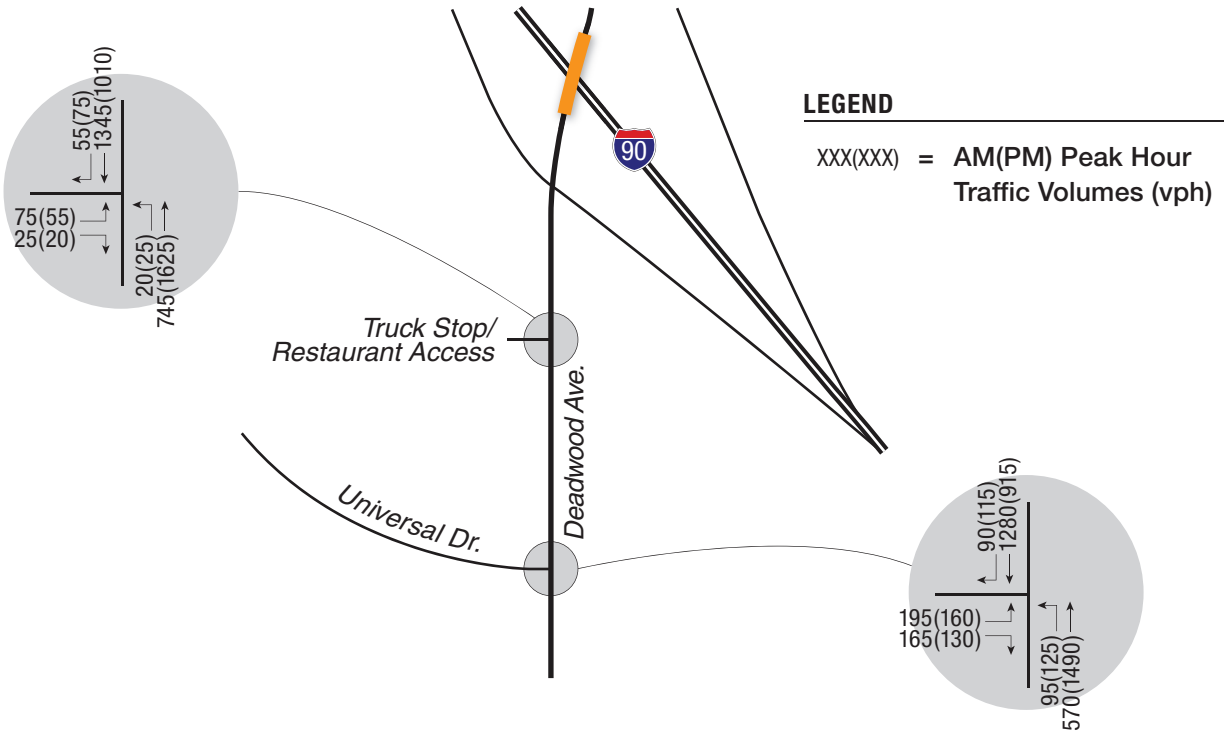
Item Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*
Mobilization	1	LUMP SUM	$81,000.00	$81,000
Traffic Control	1	LUMP SUM	$162,000.00	$162,000
Clearing	1	LUMP SUM	$32,000.00	$32,000
Removal of Concrete Pavement	-	SQ. YD.	$3.88	$0
Removal of Asphalt Pavement	583	SQ. YD.	$7.39	$4,313
Remove Bridge	-	SQ. FT.	$9.00	$0
Borrow, Unclassified Excavation	755	CU. YD.	$5.30	$4,006
Base Course	2,188	TON	$10.64	$23,274
Asphalt Composite	324	TON	$80.91	$26,237
PCC Pavement 11" (mainline)	-	SQ. YD.	$33.12	$0
PCC Pavement 8" (ramps)	4,790	SQ. YD.	$43.40	$207,877
Concrete Approach Slab	467	SQ. YD.	$188.34	$87,893
Bridges	12,600	SQ. FT.	$100.00	$1,260,000
Guard Rail	0	LF	$100.00	$0
Permanent Signing/Markings	1	LUMP SUM	$50,000.00	$50,000
Traffic Signal	0	EACH	$125,000.00	$0
Roadway Lighting	1	LUMP SUM	$30,000.00	$30,000
Drainage (18" RCP)	90	LF	$24.53	$2,208
Subtotal				$1,970,000
Contingencies	25%			$492,500
Total Probable Construction Costs				$2,460,000
Engineering, Administration	15%			$369,000
Total Project Costs				$2,830,000

Table 2.18
Probable Construction Costs
I-90 Exit 55 - Alternative 3
Interchange Improvements & Closed Access

FELSBURG HOLT & ULLEVIG

Evaluation Factors/Categories	Alternative 1 - Interchange Improvements & Full movement access Rating	Alternative 2 - Interchange Improvements & Right-turn only access Rating	Alternative 3 - Interchange Improvements & Closed Access Rating
Property Impacts			
Businesses	2	2	2
Residences	3	3	3
Right-of-Way Acquisition	2	2	2
Subtotal	**7**	**7**	**7**
Physical Environment			
Hazardous Sites, 4(f), 6(f)	2	2	2
Wetlands Impacts	2	2	2
Flood and Drainage Impacts	2	2	2
Subtotal	**6**	**6**	**6**
Traffic/Access			
Traffic Operations	1	2	3
Development Access	3	2	1
Multimodal Compatibility	2	2	2
Subtotal	**6**	**6**	**6**
Geometric Design			
Meeting Standards	2	2	3
Subtotal	**2**	**2**	**3**
Safety			
Improvement of existing hazard(s)	1	2	2
Incident Response	2	2	2
Subtotal	**3**	**4**	**4**
Construction			
Utility Impacts	2	2	2
Scheduling/Adapatability	2	2	2
Relative Construction Cost	2	2	2
Subtotal	**6**	**6**	**6**
Construction Cost	$2,820,000	$2,820,000	$2,830,000
Totals	**30**	**31**	**32**

Table 2.19
I-90 Exit 55 - Alternative Performance Matrix



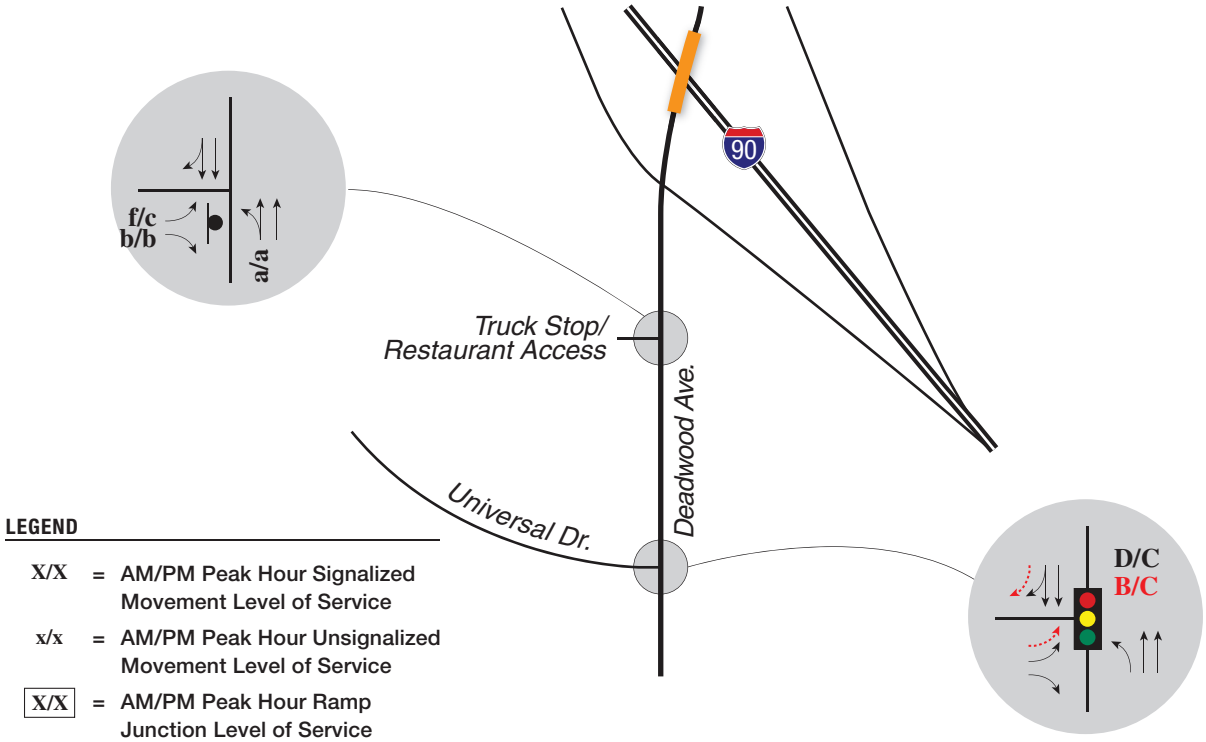
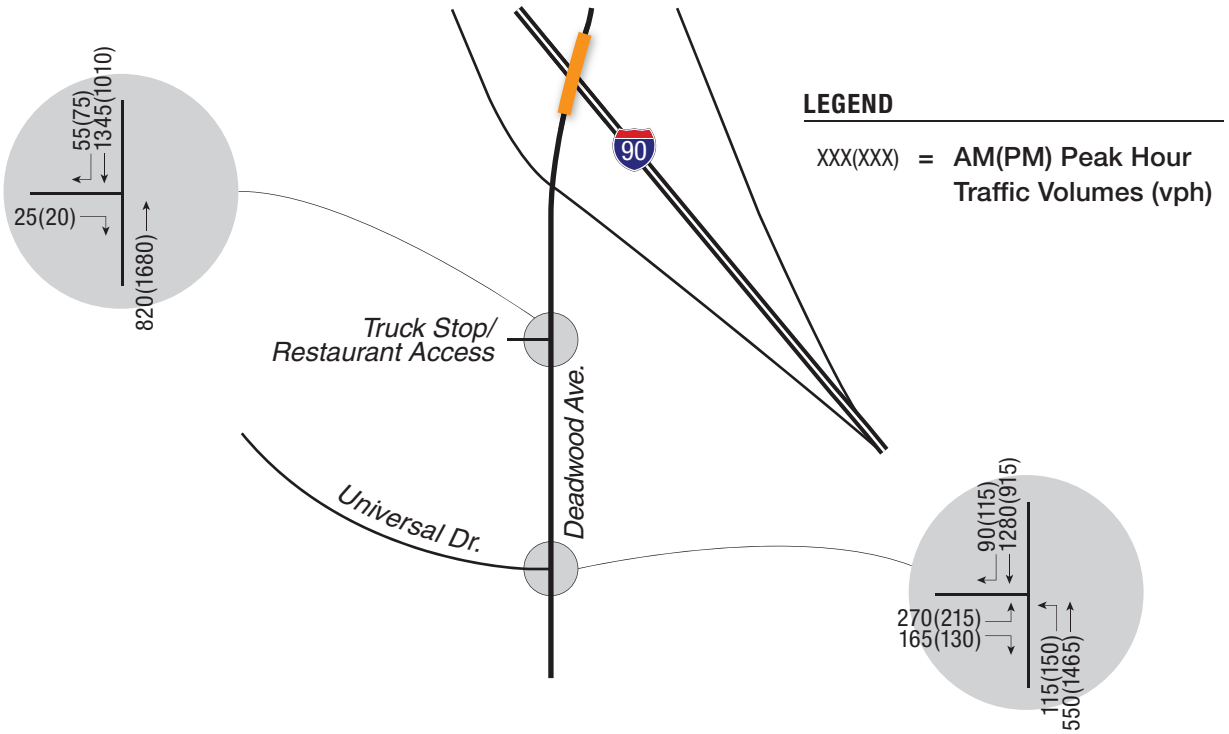


Figure 2.22
Interstate 90 Exit 55
Interchange Improvements & Full Movement Access
Traffic Conditions Year 2030

FELSBURG HOLT & ULLEVIG

NORTH

SDDOT Decennial Corridor Phase 2, 09-104-01, 06/10/10



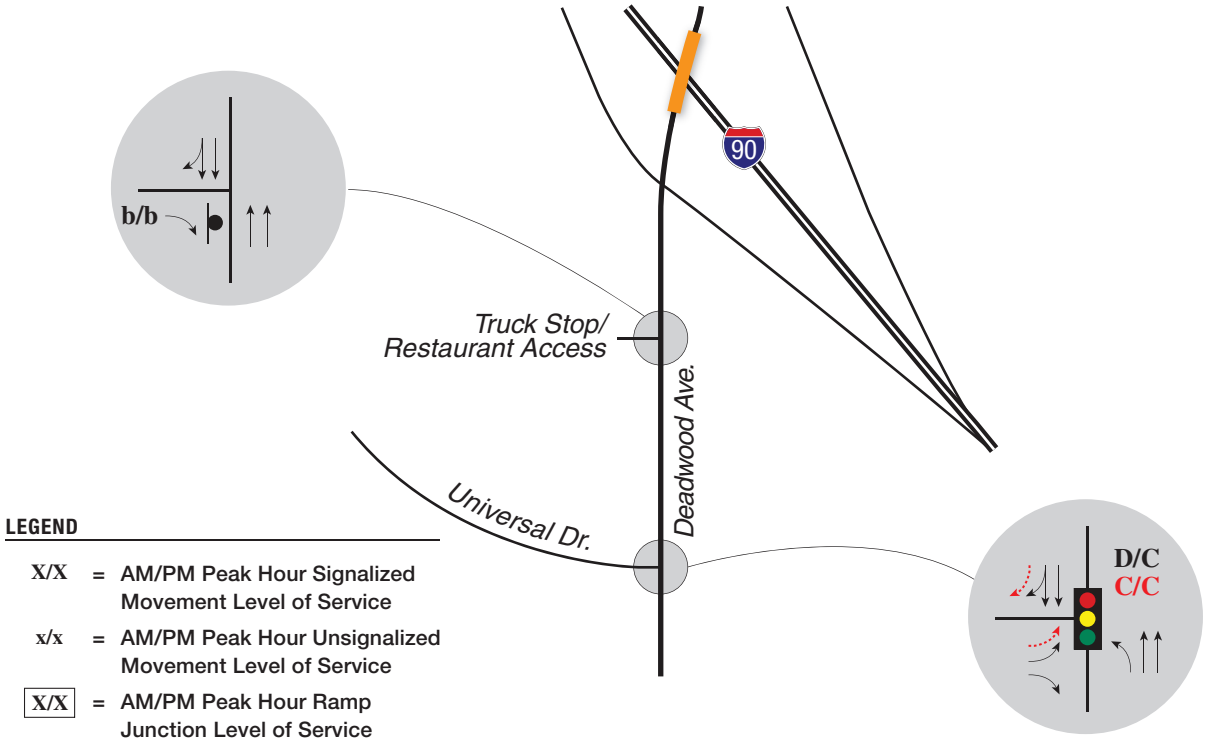
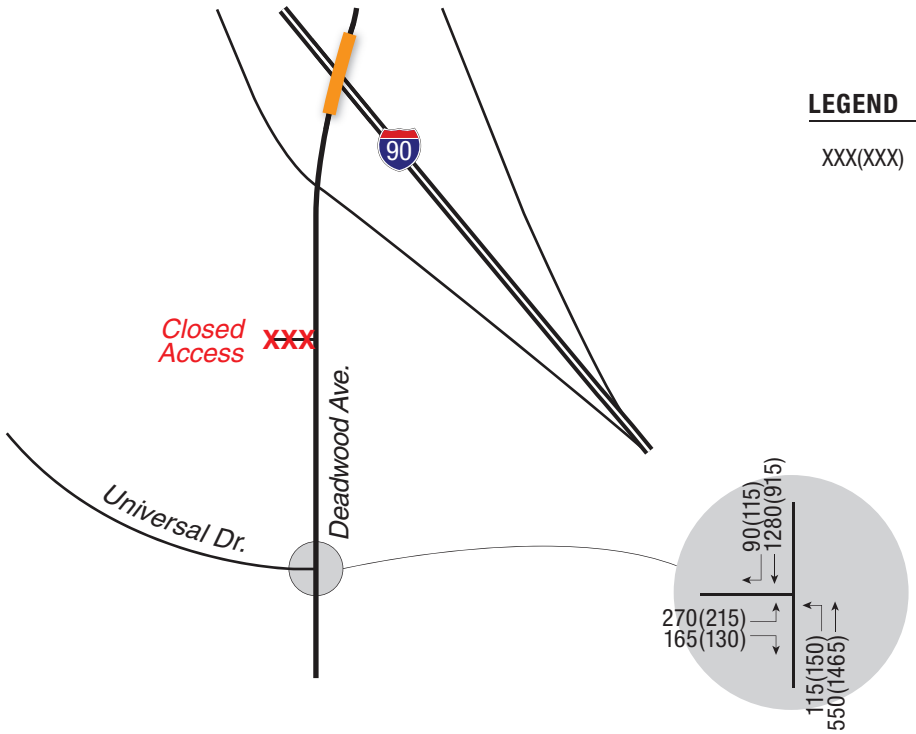


Figure 2.23
Interstate 90 Exit 55
Interchange Improvements & Right-Turn Only Access
Traffic Conditions Year 2030

FELSBURG HOLT & ULLEVIG

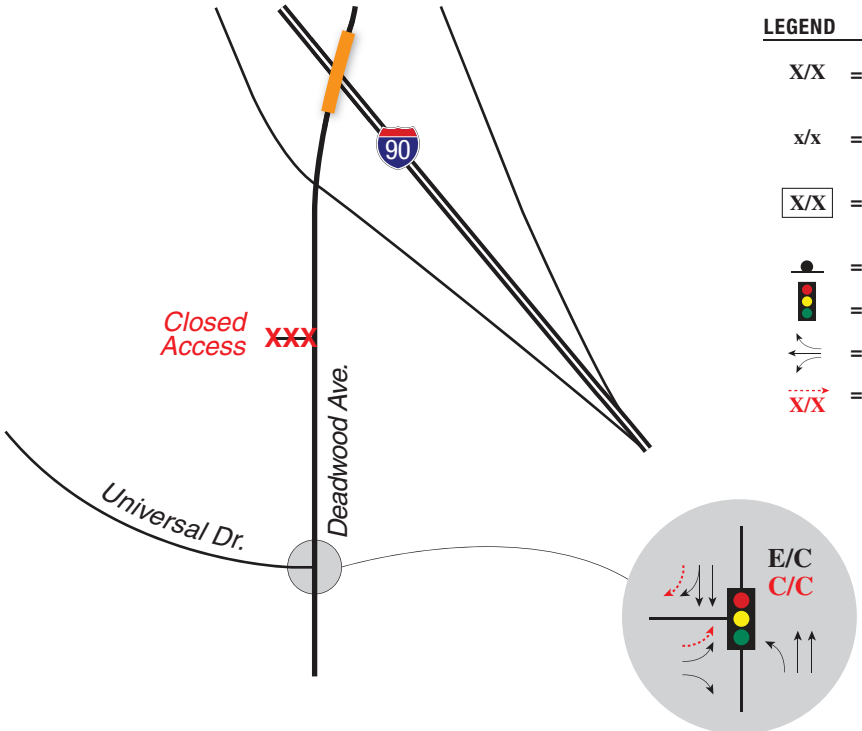
NORTH

SDDOT Decennial Corridor Phase 2, 09-104-01, 06/10/10



LEGEND

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes (vph)



LEGEND

X/X = AM/PM Peak Hour Signalized Movement Level of Service

x/x = AM/PM Peak Hour Unsignalized Movement Level of Service

X/X = AM/PM Peak Hour Ramp Junction Level of Service

= Stop Sign

= Traffic Signal

= Travel Lanes

X/X = Lane Enhancements

Figure 2.24
Interstate 90 Exit 55
Interchange Improvements & Closed Access
Traffic Conditions Year 2030

FELSBURG HOLT & ULLEVIG

NORTH

2.6 I-90 Exit 59 – LaCrosse Street, Rapid City

2.6.1 Review of Phase 1 Findings

The LaCrosse Street interchange serves the growing northeast edge of Rapid City. Recent years have seen this interchange become increasingly congested, confirmed by operational analyses completed during Phase 1. The signalized ramp terminal intersections currently operate at LOS D and E during the PM peak period, as shown on **Figure 2.28**. Additional turn lanes at the ramp terminal intersections and widening of the LaCrosse Street bridge would improve substandard traffic operations. Providing a free eastbound to southbound right turn movement would substantially improve traffic operations. A Single-Point Urban Interchange would operate at LOS A/C by the Year 2030 (**Figure 2.29**) and would serve to increase distance to adjacent accesses along LaCrosse Street.

The interchange also demonstrates elevated crash rates, ranking 5th of the 126 interchanges evaluated based on weighted crash rates. It is likely that the high number of rear-end crashes is related to congestion in the vicinity of the interchange so there may be little that can be done to reduce the occurrence of this crash type. Some crash types can be reduced with changes to the signal phasing (i.e. protected lefts) or changes to the clearance interval length.

The westbound interchange ramps demonstrate mildly substandard vertical curvature. Adjacent accesses to LaCrosse Street lie as close as 150 feet away from the ramp termini, well below the minimum of 300 feet away from ramp termini.

2.6.2 Phase 2 Issues

Growth is hastening the need for improvements to this interchange. Exit 59 was studied in Phase 2 of the Year 2000 Interstate Corridor Study and is included in the current Phase 2 because of continued traffic pressure. In seeking a future solution for this interchange, SDDOT staff requested that the two alternatives evaluated in Phase 1 be expanded with Phase 2 to include a third option, a diverging diamond configuration. Accordingly, this Phase 2 analysis includes a diverging diamond Alternative analyzed alongside the previous two options.

2.6.3 Interchange Concepts

Alternative 1 – Bridge widening

Shown on **Figure 2.25**, Alternative 1 includes widening of the LaCrosse Street bridge over I-90, widening of LaCrosse Street south of I-90 and widening along the ramp approaches to accommodate additional turn lanes. These improvements would provide acceptable ramp terminal intersection operations. Widening of LaCrosse Street south of the interchange would likely close the north access to the existing filling station and/or require alteration of the site. The probable construction cost of this alternative is estimated to be approximately $5.06 Million.

Alternative 2 – Single-Point Urban Interchange

A Single-Point Urban Interchange (SPUI) is a common interchange design for the Rapid City area. The adjacent interchanges on both sides of Exit 59 (Exit 58 and Exit 60) are SPUI's. Exit

61 was also recently reconstructed as a SPUI. Alternative 2, shown on **Figure 2.26**, depicts a SPUI for Exit 59 that would replace the current diamond interchange. This interchange would operate at LOS C or better during peak hours by the Year 2030, as shown on **Figure 2.30**. As with Alternative 1, widening of LaCrosse Street south of I-90 would be necessary to accommodate an eastbound free right turn. Raised medians would be installed along LaCrosse Street north and south of the interchange, limiting several local accesses to right-turn only. Widening of LaCrosse Street south of the interchange would likely close the north access to the existing filling station and/or require alteration of the site. The probable construction cost of this alternative is estimated to be approximately $10.84 Million.

Alternative 3 – Diverging Diamond Interchange

Figure 2.27 depicts Alternative 3, a diverging diamond configuration. Analyses of forecast Year 2030 traffic conditions indicates that the crossover ramp termini would operate at Level of Service C or better, as shown on **Figure 2.31**. The interchange would require widening of the existing bridge to accommodate the southbound left turn lane approaching the south ramp terminal, and spot widening of LaCrosse Street would be required north and south of the interchange to accommodate the transition to the diverging diamond. However, no significant widening of southbound LaCrosse Street is needed, as no continuous right-turn lane is necessary to achieve acceptable traffic operations. The estimated probable construction cost of this alternative is approximately $6.11 Million.

Cost estimates, excluding Right-of-Way costs, are provided in **Tables 2.21** through **2.23**. Including Right-of-Way acquisitions will considerably increase project costs.

2.6.4 Environmental Review

A cursory review of the interchange and surrounding area was conducted to identify potential environmental resources that may be affected by the project and could require further assessment during later stages of the project. The cursory review was conducted by reviewing aerial photography and FHU's in-house GIS data for the area. Land use in the general area of the interchange consists predominantly of commercial and light industrial properties. Additionally, some high-density and single-family residences are located to the southwest of the interchange. Based on the conceptual designs for Alternatives 1, 2, and 3, the potential environmental issues identified include:

- A gasoline filling station is located adjacent to the proposed improvements in the southwest quadrant of the interchange, which could present some hazardous materials issues.
- Potential wetlands are present in the northwest and southwest quadrants of the interchange.
- What appears to be a light industrial property is located in the northeast quadrant of the interchange. This property has the potential to present some hazardous materials issues.

Other environmental resources that may require future analysis for all three alternatives in support of National Environmental Policy Act (NEPA) documentation include prime and unique farmlands, air, noise, threatened/endangered species, cultural resources, and 4(f) and 6(f) resources.

2.6.5 Alternative Evaluation

An analysis of the three LaCrosse Street interchange alternatives was performed to provide a comparative evaluation of the benefits and impacts associated with each.

The performance of the three alternatives is summarized in **Table 2.20**. The alternatives are all able to provide acceptable traffic operations. However, the bridge widening and SPUI alternatives (1 and 2) require widening of southbound LaCrosse Street south of the interchange to provide for free right turn movements from the eastbound off ramp. The Diverging Diamond Alternative, because of its simplified 2-phase signal operation at the south ramp terminal, provides acceptable operations without a free right turn movement. The Diverging Diamond Alternative, Alternative 3, is the highest scoring Alternative, performing particularly well in Property impacts and slightly better than others in the Construction Evaluation Factor. Alternative 3 is the Most Feasible Alternative for Exit 59.

Table 2.20 Exit 59 Alternative Evaluation Summary

Evaluation Factors (Max. Points)	Alternative Ratings		
	Alternative 1	Alternative 2	Alternative 3
	Bridge Widening	Single-Point Urban Interchange	Diverging Diamond Interchange
Property Impacts (9)	5	5	7
Physical Environment (9)	6	6	6
Traffic/Access (9)	7	5	6
Geometric Design (3)	1	3	2
Safety (6)	4	5	5
Construction (9)	8	5	6
Overall Total (45)	31	29	32
Construction Cost[1]	$5,060,000	$10,840,000	$6,110,000

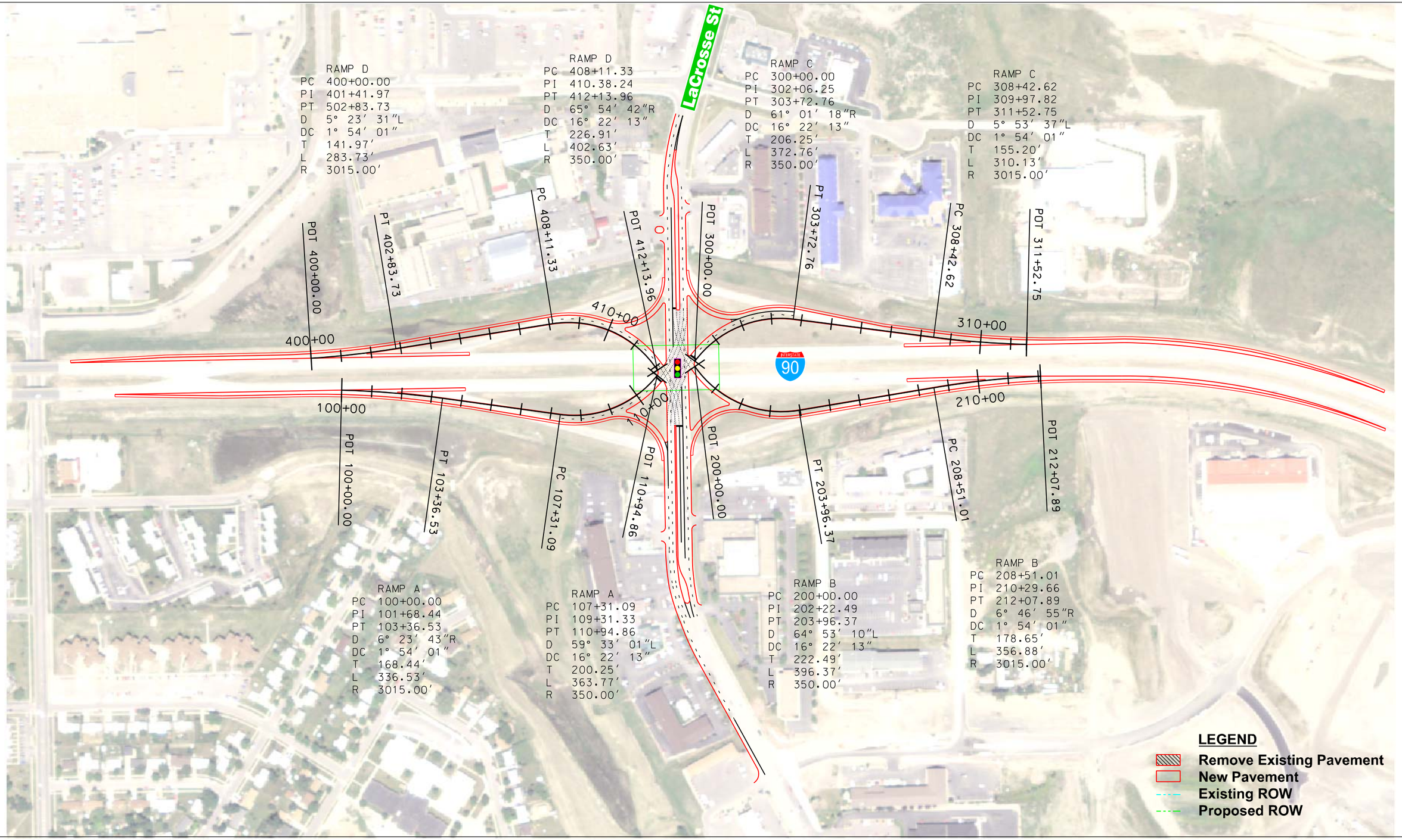
[1]Project construction costs will be considerably higher once required Right-of-Way acquisition costs are incorporated into the final cost estimate.

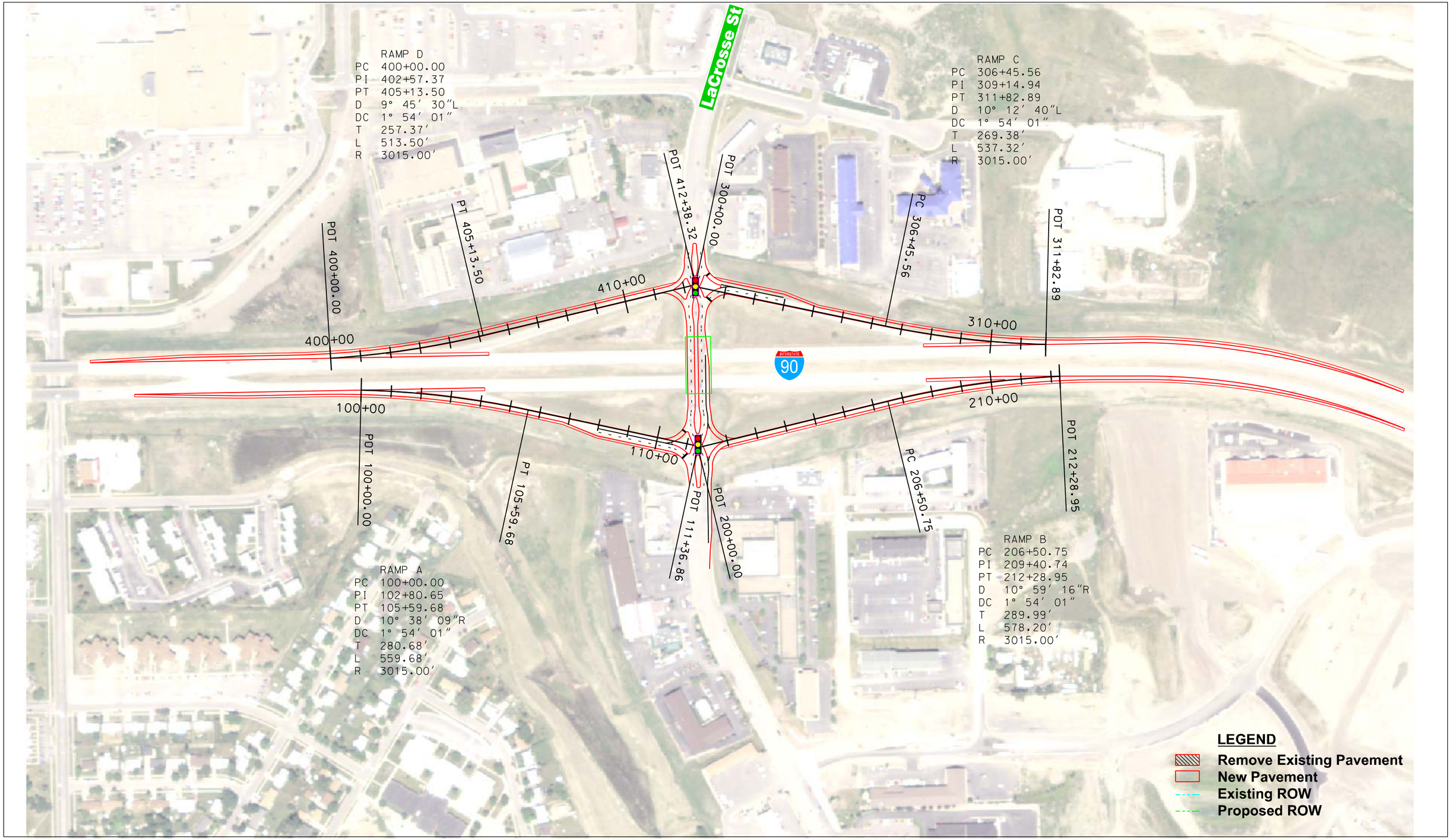
Supporting Exit 59 Figures and Tables follow:

FELSBURG HOLT & ULLEVIG

CONCEPTUAL DESIGN

Figure 2.25
I-90 Exit 59 - LaCrosse Street, Rapid City
Alternative 1
Bridge Widening


RAMP D
PC 400+00.00
PI 401+41.97
PT 502+83.73
D 5° 23′ 31″L
DC 1° 54′ 01″
T 141.97′
L 283.73′
R 3015.00′
RAMP D
PC 408+11.33
PI 410.38.24
PT 412+13.96
D 65° 54′ 42″R
DC 16° 22′ 13″
T 226.91′
L 402.63′
R 350.00′
LaCrosse St
RAMP C
PC 300+00.00
PI 302+06.25
PT 303+72.76
D 61° 01′ 18″R
DC 16° 22′ 13″
T 206.25′
L 372.76′
R 350.00′
RAMP C
PC 308+42.62
PI 309+97.82
PT 311+52.75
D 5° 53′ 37″L
DC 1° 54′ 01″
T 155.20′
L 310.13′
R 3015.00′
POT 400+00.00
PT 402+83.73
PC 408+11.33
POT 412+13.96
POT 300+00.00
PT 303+72.76
PC 308+42.62
POT 311+52.75
400+00
410+00
310+00
INTERSTATE 90
100+00
210+00
POT 100+00.00
PT 103+36.53
PC 107+31.09
POT 110+94.86
POT 200+00.00
PT 203+96.37
PC 208+51.01
POT 212+07.89
RAMP A
PC 100+00.00
PI 101+68.44
PT 103+36.53
D 6° 23′ 43″R
DC 1° 54′ 01″
T 168.44′
L 336.53′
R 3015.00′
RAMP A
PC 107+31.09
PI 109+31.33
PT 110+94.86
D 59° 33′ 01″L
DC 16° 22′ 13″
T 200.25′
L 363.77′
R 350.00′
RAMP B
PC 200+00.00
PI 202+22.49
PT 203+96.37
D 64° 53′ 10″L
DC 16° 22′ 13″
T 222.49′
L 396.37′
R 350.00′
RAMP B
PC 208+51.01
PI 210+29.66
PT 212+07.89
D 6° 46′ 55″R
DC 1° 54′ 01″
T 178.65′
L 356.88′
R 3015.00′
LEGEND
Remove Existing Pavement
New Pavement
Existing ROW
Proposed ROW



FELSBURG HOLT & ULLEVIG

CONCEPTUAL DESIGN

Figure 2.27
I-90 Exit 59 - LaCrosse Street, Rapid City
Alternative 3
Diverging Diamond Interchange

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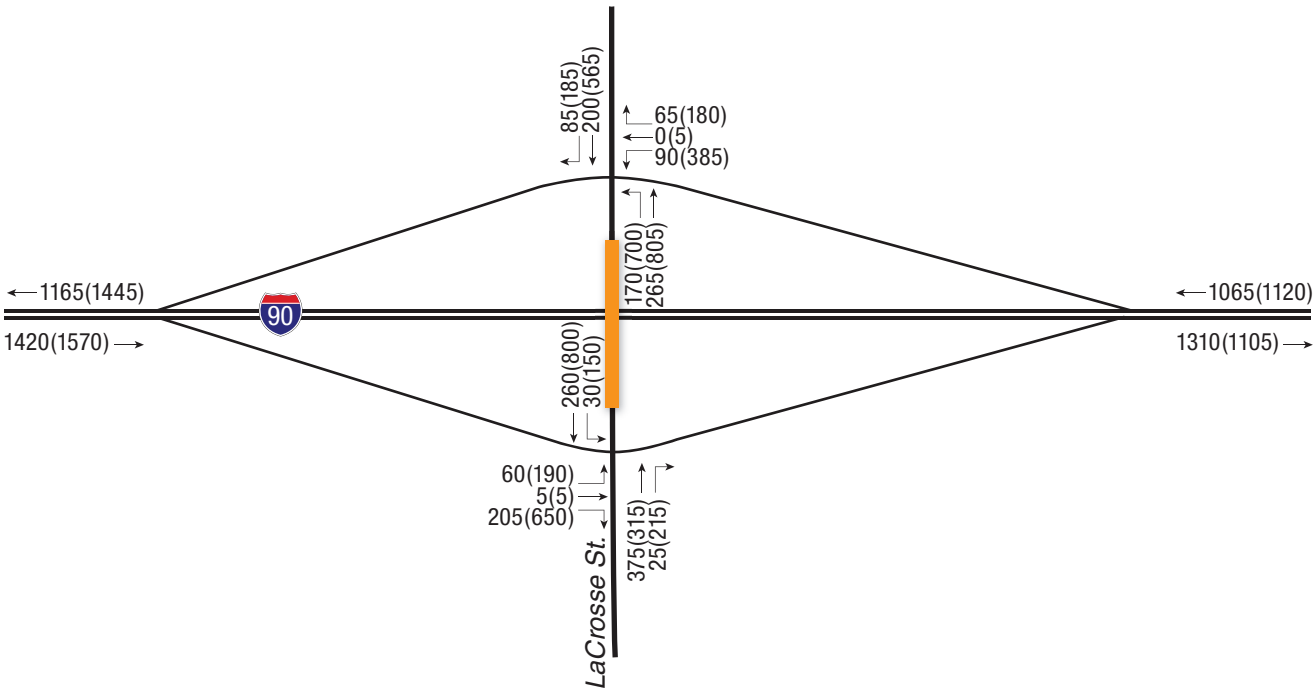
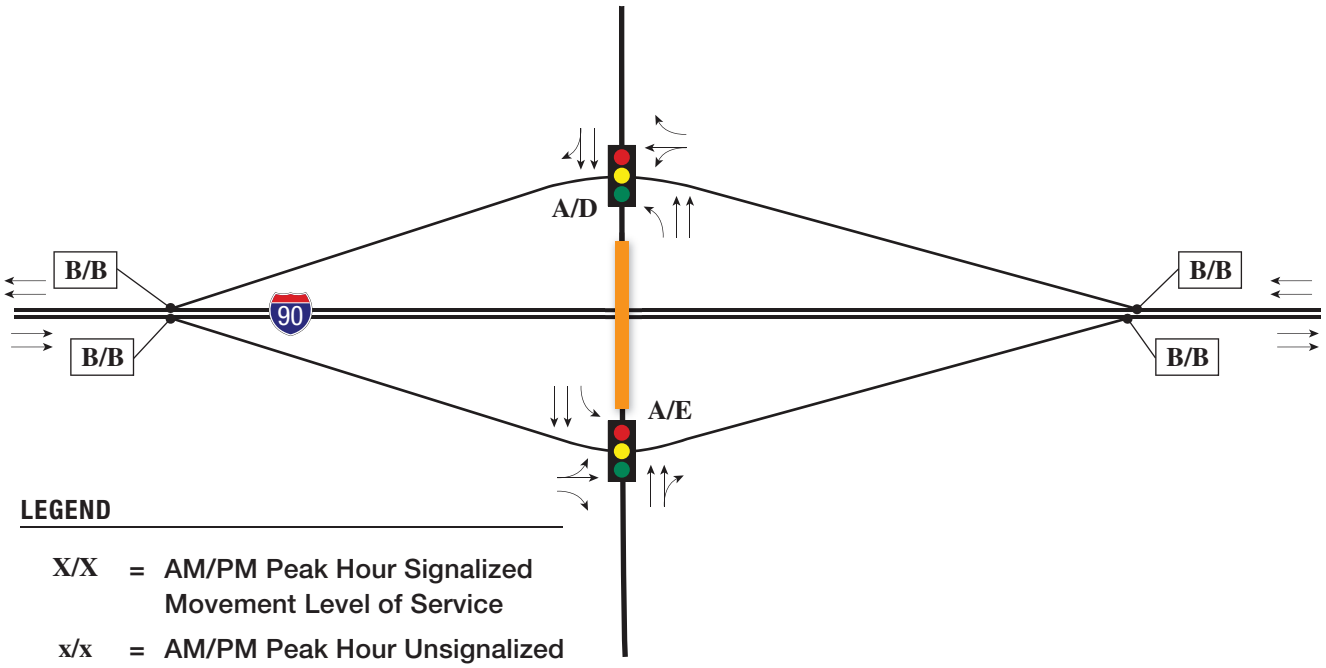


LEGEND

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes (vph)



LEGEND

X/X = AM/PM Peak Hour Signalized Movement Level of Service

x/x = AM/PM Peak Hour Unsignalized Movement Level of Service

X/X = AM/PM Peak Hour Ramp Junction Level of Service

= Traffic Signal

= Travel Lanes

Figure 2.28
Interstate 90 Exit 59
Traffic Conditions Year 2009

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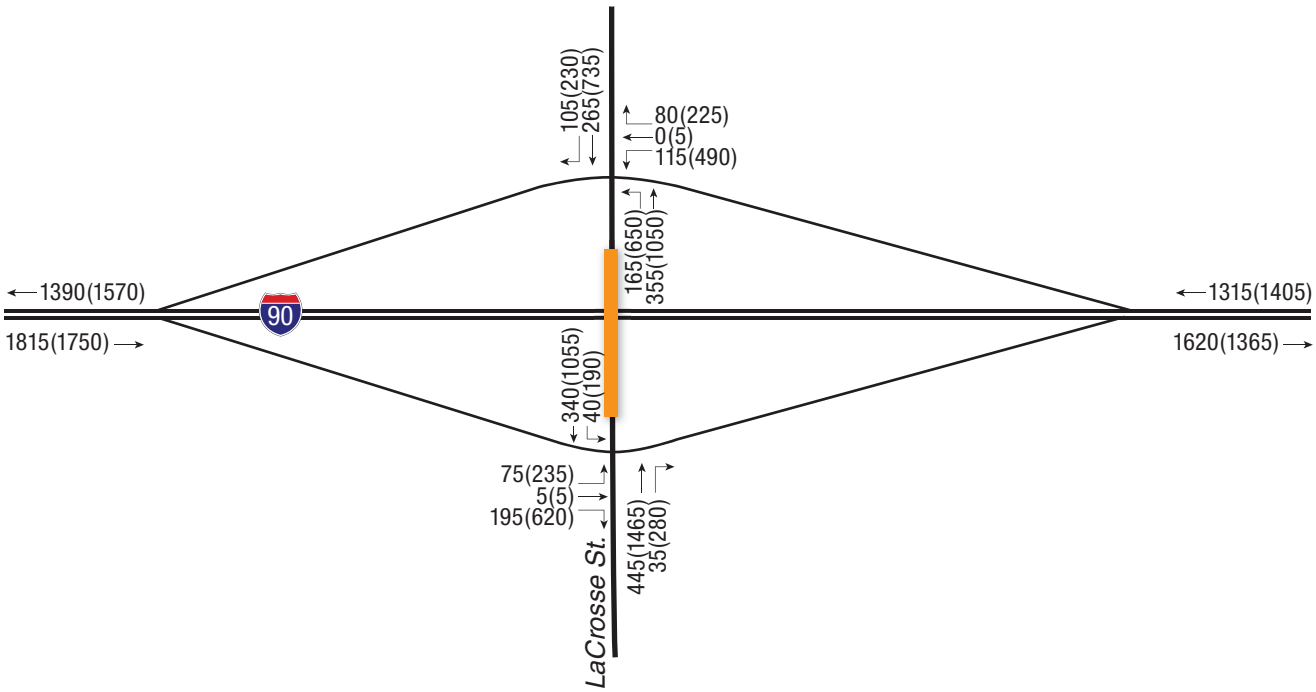
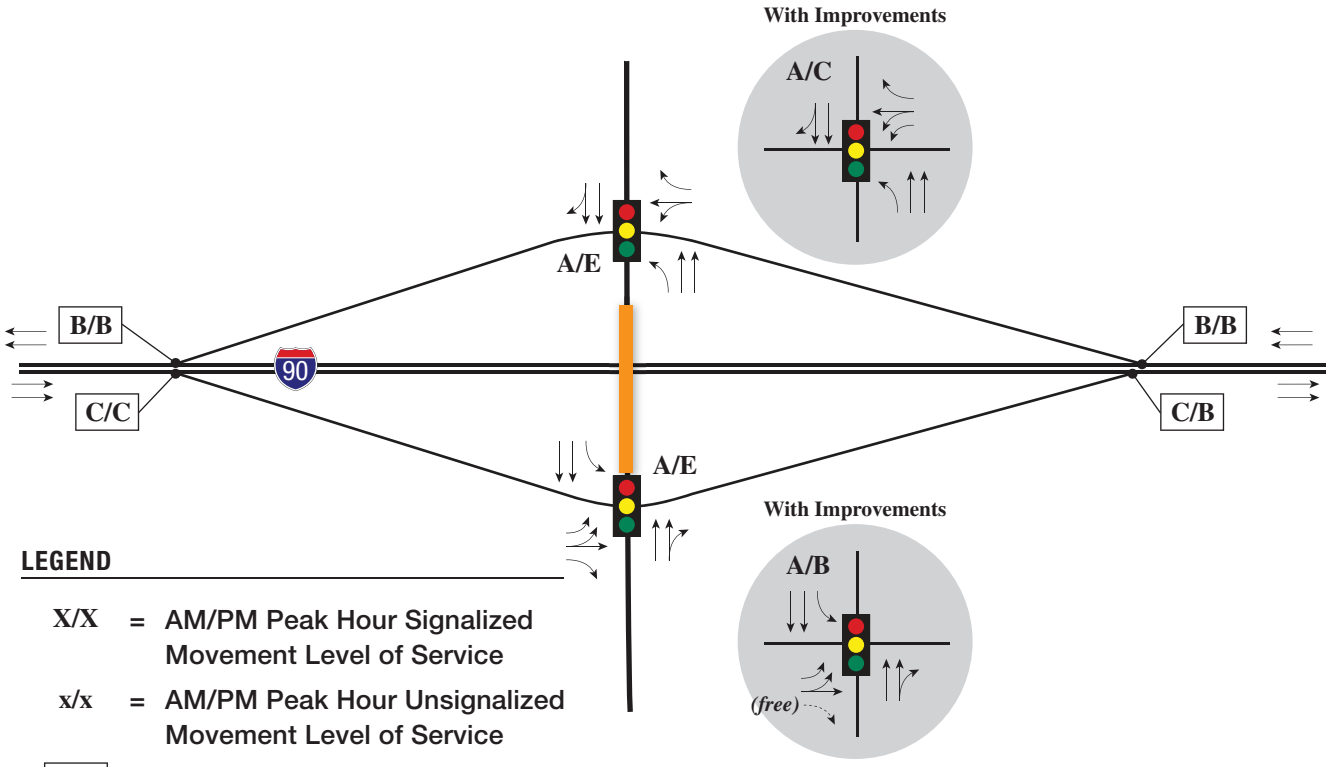
NORTH



LEGEND

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes (vph)



LEGEND

X/X = AM/PM Peak Hour Signalized Movement Level of Service

x/x = AM/PM Peak Hour Unsignalized Movement Level of Service

X/X = AM/PM Peak Hour Ramp Junction Level of Service

= Traffic Signal

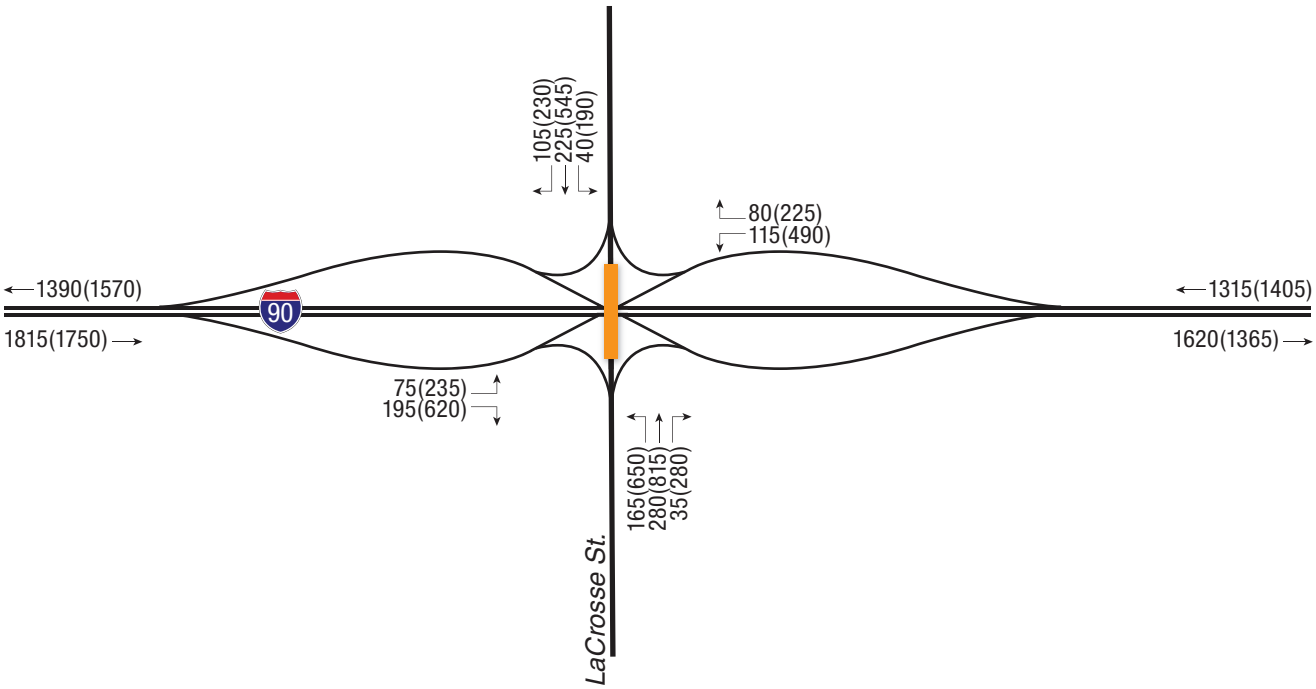
= Travel Lanes

Figure 2.29
Interstate 90 Exit 59
Alternative 1 - Bridge Widening
Traffic Conditions Year 2030

FELSBURG HOLT & ULLEVIG

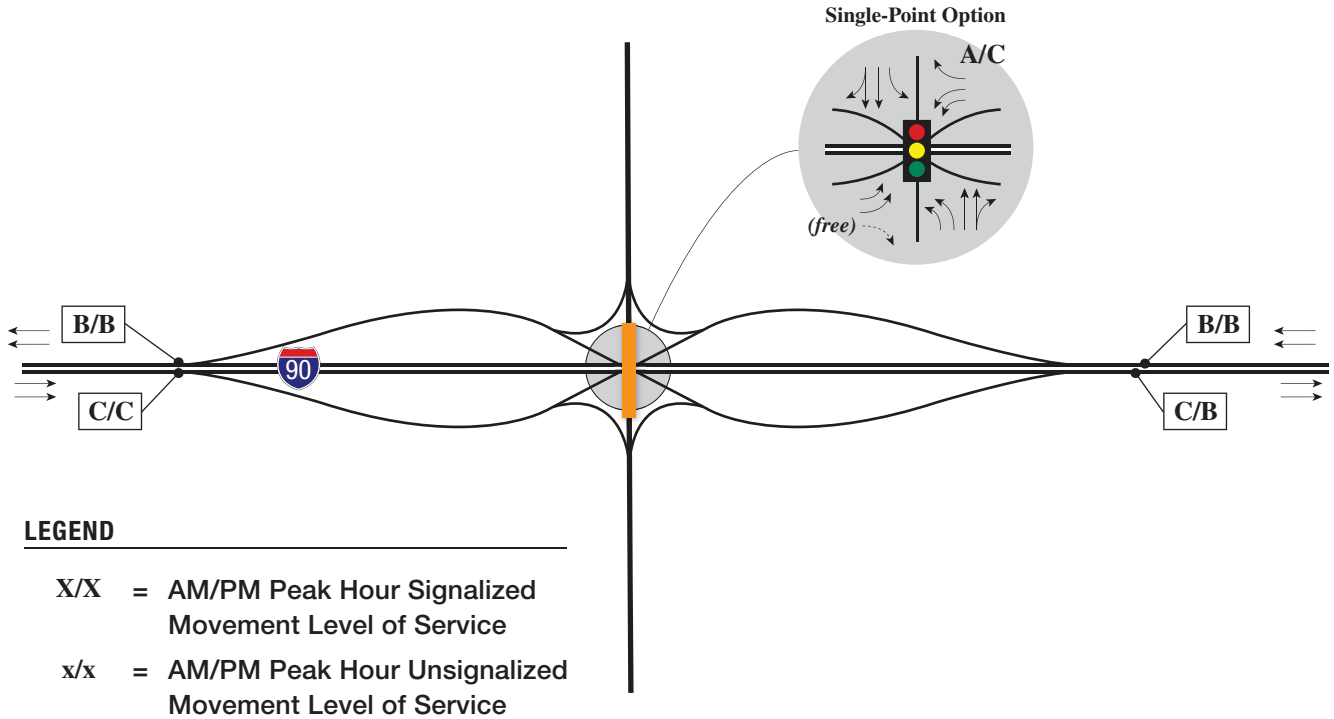
NORTH

SDDOT Decennial Corridor, 09-104-01, 06/10/10



LEGEND

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes (vph)



LEGEND

X/X = AM/PM Peak Hour Signalized Movement Level of Service

x/x = AM/PM Peak Hour Unsignalized Movement Level of Service

X/X = AM/PM Peak Hour Ramp Junction Level of Service

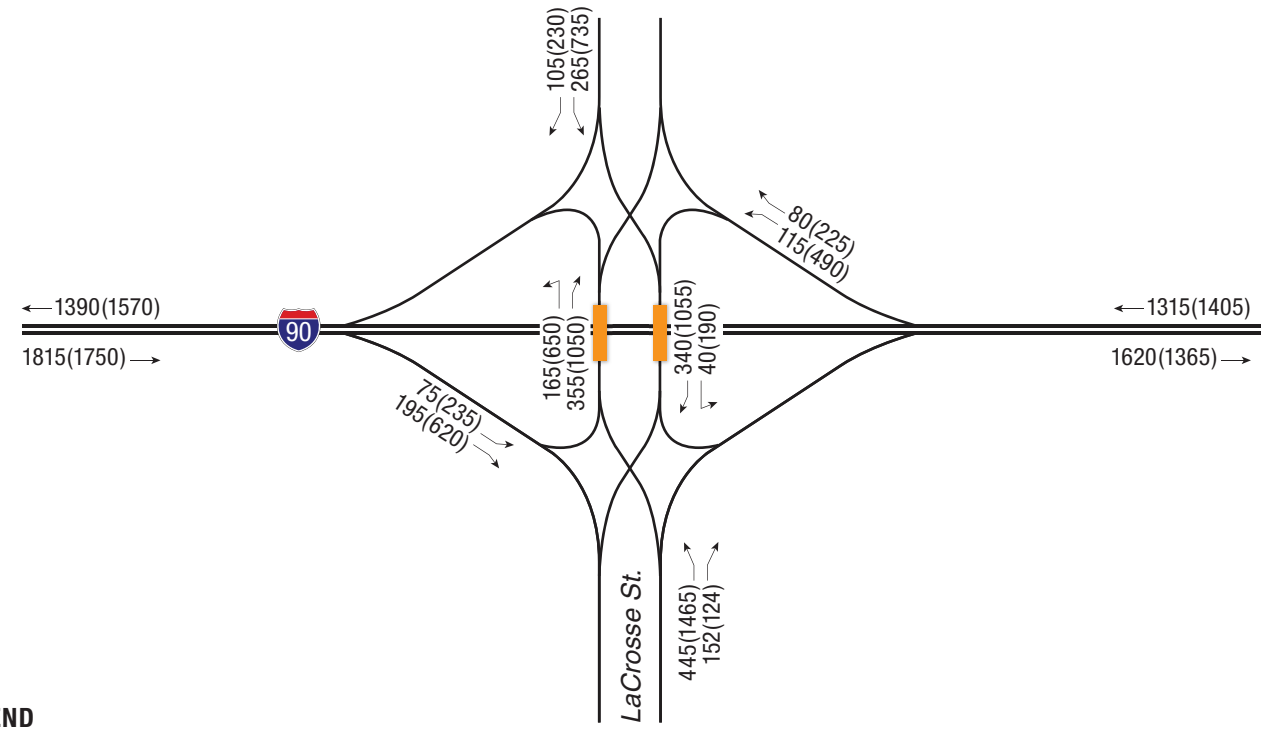
= Traffic Signal

= Travel Lanes

Figure 2.30
Interstate 90 Exit 59
Alternative 2 - Single Point Urban Interchange
Traffic Conditions Year 2030

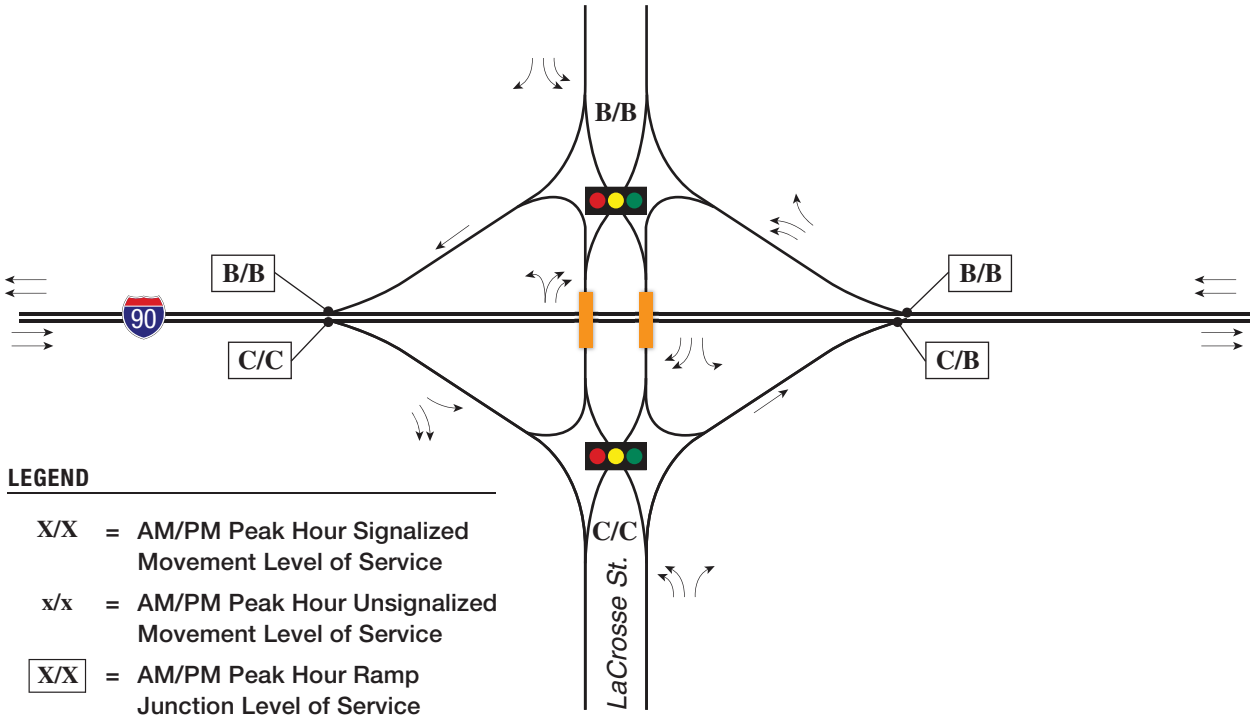
FELSBURG HOLT & ULLEVIG

NORTH



LEGEND

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes (vph)



LEGEND

X/X = AM/PM Peak Hour Signalized Movement Level of Service

x/x = AM/PM Peak Hour Unsignalized Movement Level of Service

X/X = AM/PM Peak Hour Ramp Junction Level of Service

= Traffic Signal

= Travel Lanes

Figure 2.31
Interstate 90 Exit 59
Alternative 3 - Diverging Diamond Interchange
Traffic Conditions Year 2030

FELSBURG HOLT & ULLEVIG

NORTH

Probable Construction Costs
I-90 Exit 59 - Alternative 1 Bridge Widening

Item Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*
Mobilization	1	LUMP SUM	$144,000.00	$144,000
Traffic Control	1	LUMP SUM	$288,000.00	$288,000
Clearing	1	LUMP SUM	$58,000.00	$58,000
Removal of Concrete Pavement	-	SQ. YD.	$3.88	$0
Removal of Asphalt Pavement	-	SQ. YD.	$7.39	$0
Remove Bridge	9,540	SQ. FT.	$9.00	$85,860
Borrow, Unclassified Excavation	664	CU. YD.	$5.30	$3,520
Base Course	986	TON	$10.64	$10,489
Asphalt Composite	-	TON	$80.91	$0
PCC Pavement 11" (mainline)	-	SQ. YD.	$33.12	$0
PCC Pavement 8" (ramps)	2,159	SQ. YD.	$43.40	$93,685
Concrete Approach Slab	800	SQ. YD.	$188.34	$150,674
Bridges	25,368	SQ. FT.	$100.00	$2,536,800
Guard Rail	0	LF	$100.00	$0
Permanent Signing/Markings	1	LUMP SUM	$90,000.00	$90,000
Traffic Signal	0	EACH	$125,000.00	$0
Roadway Lighting	1	LUMP SUM	$60,000.00	$60,000
Drainage (18" RCP)	30	LF	$24.53	$736
Subtotal				$3,520,000
Contingencies	25%			$880,000
Total Probable Construction Costs				$4,400,000
Engineering, Administration	15%			$660,000
Total Project Costs				$5,060,000

Table 2.21
Probable Construction Costs
I-90 Exit 59 - Alternative 1
Bridge Widening

FELSBURG HOLT & ULLEVIG

Probable Construction Costs
I-90 Exit 59 - Alternative 2 Single Point Urban Interchange

Item Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*
Mobilization	1	LUMP SUM	$304,000.00	$304,000
Traffic Control	1	LUMP SUM	$608,000.00	$608,000
Clearing	1	LUMP SUM	$122,000.00	$122,000
Removal of Concrete Pavement	22,497	SQ. YD.	$3.88	$87,357
Removal of Asphalt Pavement	-	SQ. YD.	$7.39	$0
Remove Bridge	9,540	SQ. FT.	$9.00	$85,860
Borrow, Unclassified Excavation	14,321	CU. YD.	$5.30	$75,929
Base Course	15,069	TON	$10.64	$160,288
Asphalt Composite	-	TON	$80.91	$0
PCC Pavement 11" (mainline)	19,213	SQ. YD.	$33.12	$636,339
PCC Pavement 8" (ramps)	13,779	SQ. YD.	$43.40	$597,945
Concrete Approach Slab	800	SQ. YD.	$188.34	$150,674
Bridges	42,857	SQ. FT.	$100.00	$4,285,700
Guard Rail	0	LF	$100.00	$0
Permanent Signing/Markings	1	LUMP SUM	$180,000.00	$180,000
Traffic Signal	1	EACH	$125,000.00	$125,000
Roadway Lighting	1	LUMP SUM	$120,000.00	$120,000
Drainage (18" RCP)	150	LF	$24.53	$3,680
Subtotal				$7,540,000
Contingencies	25%			$1,885,000
Total Probable Construction Costs				$9,430,000
Engineering, Administration	15%			$1,414,500
Total Project Costs				$10,840,000

Table 2.22
Probable Construction Costs
I-90 Exit 59 - Alternative 2
Single Point Urban Interchange

FELSBURG HOLT & ULLEVIG

Probable Construction Costs
I-90 Exit 59 - Alternative 3 Diverging Diamond Interchange

Item Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*
Mobilization	1	LUMP SUM	$169,000.00	$169,000
Traffic Control	1	LUMP SUM	$338,000.00	$338,000
Clearing	1	LUMP SUM	$68,000.00	$68,000
Removal of Concrete Pavement	22,306	SQ. YD.	$3.88	$86,616
Removal of Asphalt Pavement	-	SQ. YD.	$7.39	$0
Remove Bridge	9,540	SQ. FT.	$9.00	$85,860
Borrow, Unclassified Excavation	57,665	CU. YD.	$5.30	$305,739
Base Course	12,716	TON	$10.64	$135,262
Asphalt Composite	-	TON	$80.91	$0
PCC Pavement 11" (mainline)	15,283	SQ. YD.	$33.12	$506,185
PCC Pavement 8" (ramps)	12,558	SQ. YD.	$43.40	$544,940
Concrete Approach Slab	611	SQ. YD.	$188.34	$115,098
Bridges	15,960	SQ. FT.	$100.00	$1,596,000
Guard Rail	0	LF	$100.00	$0
Permanent Signing/Markings	1	LUMP SUM	$100,000.00	$100,000
Traffic Signal	1	EACH	$125,000.00	$125,000
Roadway Lighting	1	LUMP SUM	$70,000.00	$70,000
Drainage (18" RCP)	150	LF	$24.53	$3,680
Subtotal				$4,250,000
Contingencies	25%			$1,062,500
Total Probable Construction Costs				$5,310,000
Engineering, Administration	15%			$796,500
Total Project Costs				$6,110,000

Table 2.23
Probable Construction Costs
I-90 Exit 59 - Alternative 3
Diverging Diamond Interchange

FELSBURG HOLT & ULLEVIG

Evaluation Factors/Categories	Alternative 1 - Bridge Widening Rating	Alternative 2 - Single-Point Urban Interchange Rating	Alternative 3 - Diverging Diamond Interchange Rating
Property Impacts			
Businesses	1	1	2
Residences	2	2	2
Right-of-Way Acquisition	2	2	3
Subtotal	**5**	**5**	**7**
Physical Environment			
Hazardous Sites, 4(f), 6(f)	2	2	2
Wetlands Impacts	2	2	2
Flood and Drainage Impacts	2	2	2
Subtotal	**6**	**6**	**6**
Traffic/Access			
Traffic Operations	2	2	2
Development Access	2	1	2
Multimodal Compatibility	3	2	2
Subtotal	**7**	**5**	**6**
Geometric Design			
Meeting Standards	1	3	2
Subtotal	**1**	**3**	**2**
Safety			
Improvement of existing hazard(s)	2	3	3
Incident Response	2	2	2
Subtotal	**4**	**5**	**5**
Construction			
Utility Impacts	2	2	2
Scheduling/Adapatability	3	2	2
Relative Construction Cost	3	1	2
Subtotal	**8**	**5**	**6**
Construction Cost	$5,060,000	$10,840,000	$6,110,000
Totals	**31**	**29**	**32**

Table 2.24
I-90 Exit 59 - Alternative Performance Matrix

2.7 I-90 Exit 63 – Old Highway 14/16, Box Elder

2.7.1 Review of Phase 1 Findings

In Phase 1 of this study, existing ADT's as well as turning movements forecast at this partial interchange as part of the 2000 Corridor Study were used to develop new turning movements. This was done since existing counts were not available. An annual growth rate of 1 percent per year was used in order to determine the traffic volumes for the existing, 2020 and 2030 analysis scenarios used in this Interstate Corridor Study.

Even with the expected increases in traffic at this interchange, the stop controlled approaches at both ramp termini are expected to operate at LOS C or better through 2030. However, since this interchange is currently only a partial diamond, there is a desire to construct a full diamond interchange at this location. Two full diamond alternative concepts were developed for this location under which both ramp termini are expected to continue to operate at LOS C or better.

2.7.2 Phase 2 Issues

Questions Raised

The SDDOT has requested that follow up analyses be completed for this interchange to better understand the impact a reconfigured interchange will have to traffic volumes along Highway 14/16. In addition, Rapid City MPO Staff requested that an option be formulated for a replacement Diamond interchange located approximately 1 mile east of West Gate Road, at the Coble Road/Gumbo Drive alignment. This location would more directly serve the Rapid City Regional Airport.

Analysis Approach

Recent turning movement counts were used to refine the forecasted traffic volumes for the interchange ramp termini. The counts and LOS results are depicted on **Figure 2.35**. The same growth rate of 1 percent per year was used to forecast the revised traffic volumes both without and with the reconfigured interchange.

Findings

The projected traffic volumes for 2030 can be seen on **Figure 2.36**. As **Figure 2.36** shows, a large portion of the volumes that currently use this interchange are destined eastbound or westbound on Highway 14/16 with a very small portion of the traffic coming from the north on West Gate Road. Based on this, even with the relocation of the ramp termini to the north onto West Gate Road, the traffic volumes on Highway 14/16 are expected to remain about the same. This is primarily because Exit 63 is the best and most convenient option for any vehicles desiring to enter westbound I-90 or exit eastbound I-90 since the next closest interchange is four miles to the east at Exit 67. Exit 67 would be out of the way for a vehicle either coming from or heading to the west on I-90 that is currently traveling on Old Highway 14/16.

2.7.3 Interchange Concepts

As mentioned previously, two full diamond interchange concepts were developed during Phase 1 for this interchange in order to provide more complete access to I-90. Both of these alternatives have been carried forward into Phase 2. In addition to these, a third alternative for this interchange has been developed that would place the interchange to the east of the current location and in alignment with Gumbo Drive.

Alternative 1 – Diamond Interchange

The first of the three alternatives would place both ramp termini on West Gate Road just north of Old Highway 14/16 as well as provide ramps to and from the east on I-90. If constructed in this manner, the stop controlled approaches at the ramp termini are expected to operate at LOS B or better through 2030 (**Figure 2.37**). This alternative is estimated to cost about $11.1 million to construct and is expected to impact about 20 residential or commercial buildings. A conceptual layout can be seen on **Figure 2.32**.

Alternative 2 – Modified Diamond Interchange

The second alternative, also a full diamond interchange, was initially developed as part of the 2000 study. With this alternative, the new diamond interchange would tie into Old Highway 14/16 as well as Gisi Road to the north and west of I-90. This alignment would require that the existing frontage road on the north side of I-90 be shifted to the north. The traffic volumes and operations with this alternative would be very similar if not identical to those of the first alternative. This alternative is estimated to cost about $14.6 million and is not expected to impact any residential or commercial buildings. A conceptual layout is shown on **Figure 2.33**.

Alternative 3 – Relocated Diamond Interchange

As mentioned, the third alternative would place the interchange east of its current location and in alignment with Gumbo Drive. This location could provide better access to the Rapid City Regional Airport which is located to the south. As with the first two alternatives, the third alternative is a full diamond interchange. The traffic volumes and operations with this alternative would be very similar if not identical to those of the first two alternatives since all three alternatives are relatively close to each other in location. This alternative is estimated to cost about $8.0 million and impact about 75 residential or commercial buildings. A conceptual layout of this interchange can be seen on **Figure 2.34**.

Cost estimates, shown in **Tables 2.26** through **2.28**, do not include Right-of-Way acquisitions. Inclusion of Right-of-Way will considerably increase project costs.

2.7.4 Environmental Review

A cursory review of the interchange and surrounding area was conducted to identify potential environmental resources that may be affected by the project and could require further assessment during later stages of the project. The cursory review was conducted by reviewing aerial photography and FHU's in-house GIS data for the area. Land use in the general area of the interchange consists predominantly of residences and agricultural land.

Alternative 1 – Diamond Interchange

Based on the conceptual design for the Box Elder/Ellsworth AFB Alternative 1, the potential environmental issues identified include:

- A drainage ditch crosses I-90 to the east of the interchange. This feature could potentially be historic. Also, potential wetlands could be associated with the ditch.
- There are potential wetlands associated with an un-named tributary to Boxelder Creek. The tributary is located west of the ditch and north of the proposed westbound on-ramp to I-90.
- There are a number of potential residential acquisitions associated with this alternative. The potential residential acquisitions are located along Stealth Lane north of I-90. There are also a number of potential residential acquisitions south of I-90.
- A mobile home park is located off of Boxelder Road West. Although Alternative 1 does not appear to acquire any of the homes within the community, the proximity of the community to the interchange could be an environmental justice issue.
- The age of the structures that would potentially be acquired is unknown; however, some of these structures could potentially be historic.

Alternative 2 – Modified Diamond Interchange

Based on the conceptual design for the Box Elder/Ellsworth AFB Alternative 2, the potential environmental issues identified include:

- There are potential wetlands associated with two un-named tributaries to Boxelder Creek.
- A drainage ditch crosses I-90 to the east of the interchange. This feature could potentially be historic. Also, potential wetlands could be associated with the ditch.
- It also appears that there is a drainage ditch with potential wetlands to the south of the existing I-90 eastbound off-ramp.

Alternative 3 – Relocated Diamond Interchange

Based on the conceptual design for the Box Elder/Ellsworth AFB Alternative 3, the potential environmental issues identified include:

- There are a number of potential residential acquisitions associated with this alternative. The majority of the potential acquisitions are located south of I-90. It appears that many of these residences are located within a mobile home park community, which will likely be an environmental justice issue.
- Several other structures could potentially be acquired. The age of the structures is unknown; however, some of these structures could potentially be historic.

Other environmental resources that may require future analysis for all three alternatives in support of National Environmental Policy Act (NEPA) documentation include prime and unique farmlands, air, noise, threatened/endangered species, cultural resources, and 4(f) and 6(f) resources.

2.7.5 Alternative Evaluation

An analysis of the three Exit 63 alternatives was performed to provide a comparative evaluation of the benefits and impacts associated with each. Performance is summarized in **Table 2.25**. As shown, evaluation of the alternatives across the range of factors and categories resulted in a 3-way tie. The alternatives show differences in the Property Impact and Construction Cost categories. The project team recommends that Property Impacts and Construction Cost be used to break the tie. Alternative 2 is the most costly Alternative and Alternative 3 would impact the most properties. On this basis, Alternative 1 is recommended as the Most Feasible Alternative.

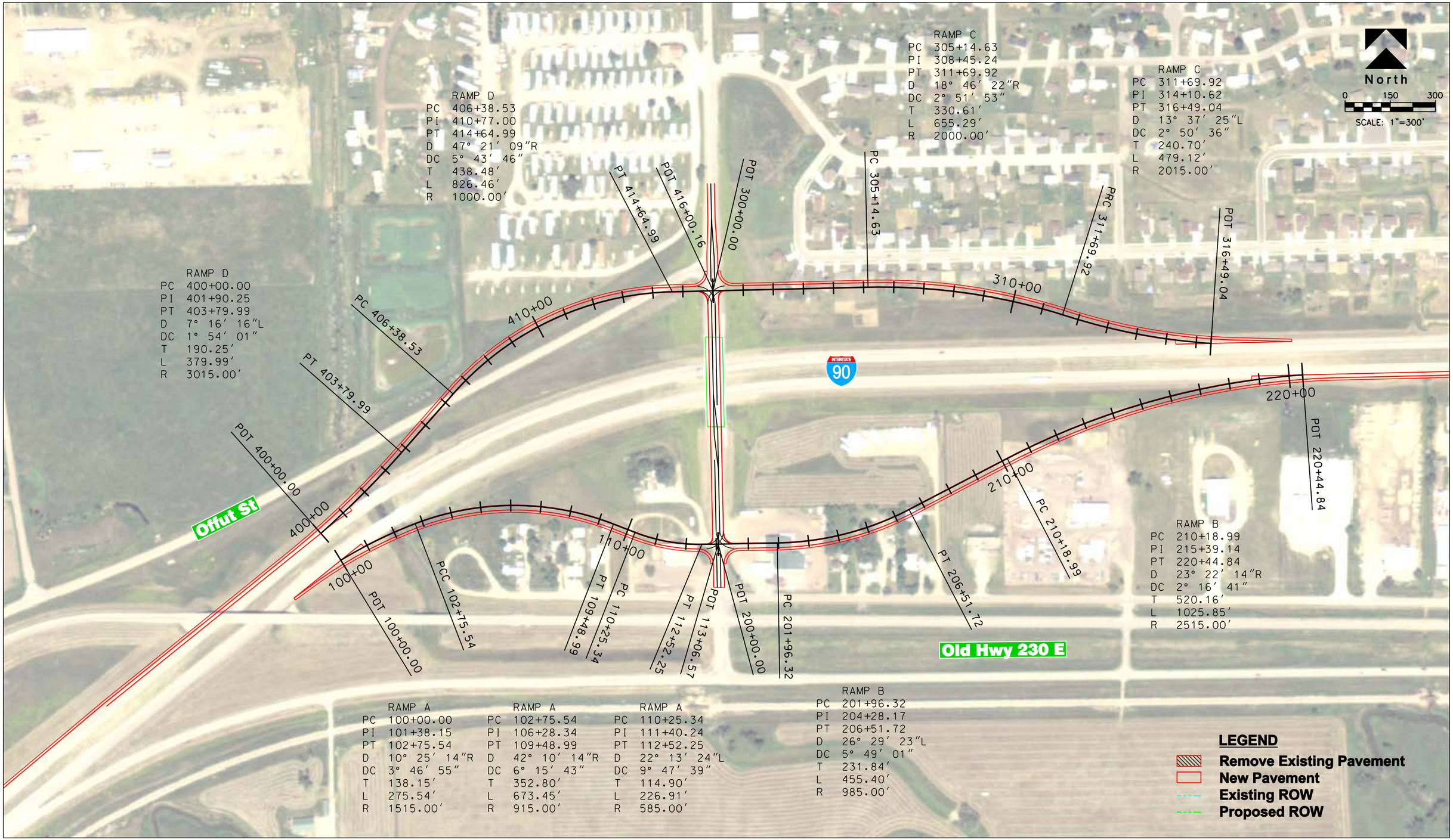
Table 2.25 Exit 63 Alternative Evaluation Summary

Evaluation Factors (Max. Points)	Alternative Ratings		
	Alternative 1	Alternative 2	Alternative 3
	Diamond Interchange	Modified Diamond Interchange	Relocated Diamond Interchange
Property Impacts (9)	6	7	4
Physical Environment (9)	6	6	6
Traffic/Access (9)	6	6	6
Geometric Design (3)	3	3	3
Safety (6)	4	4	4
Construction (9)	6	5	8
Overall Total (45)	31	31	31
Construction Cost[1]	$11,130,000	$14,620,000	$8,000,000

[1]Project construction costs will be considerably higher once required Right-of-Way acquisition costs are incorporated into the final cost estimate.

Supporting Exit 63 Figures and Tables follow:

Figure 2.32	I-90 Exit 63 Alternative 1 – Diamond Interchange
Figure 2.33	I-90 Exit 63 Alternative 2 – Modified Diamond Interchange
Figure 2.34	I-90 Exit 63 Alternative 3 – Relocated Diamond Interchange
Figure 2.35	I-90 Exit 63 Traffic Conditions Year 2009
Figure 2.36	I-90 Exit 63 Traffic Conditions Year 2030
Figure 2.37	I-90 Exit 63 All Alternatives Traffic Conditions Year 2030
Table 2.26	I-90 Exit 63 Probable Construction Cost Alternative 1 Diamond Interchange
Table 2.27	I-90 Exit 63 Probable Construction Cost Alternative 2 Modified Diamond Interchange
Table 2.28	I-90 Exit 63 Probable Construction Cost Alternative 3 Relocated Diamond Interchange
Table 2.29	I-90 Exit 63 Alternative Performance Matrix



FELSBURG HOLT & ULLEVIG

CONCEPTUAL DESIGN

Figure 2.32
I-90 Exit 63 - Box Elder/Ellsworth AFB
Alternative 1
Diamond Interchange

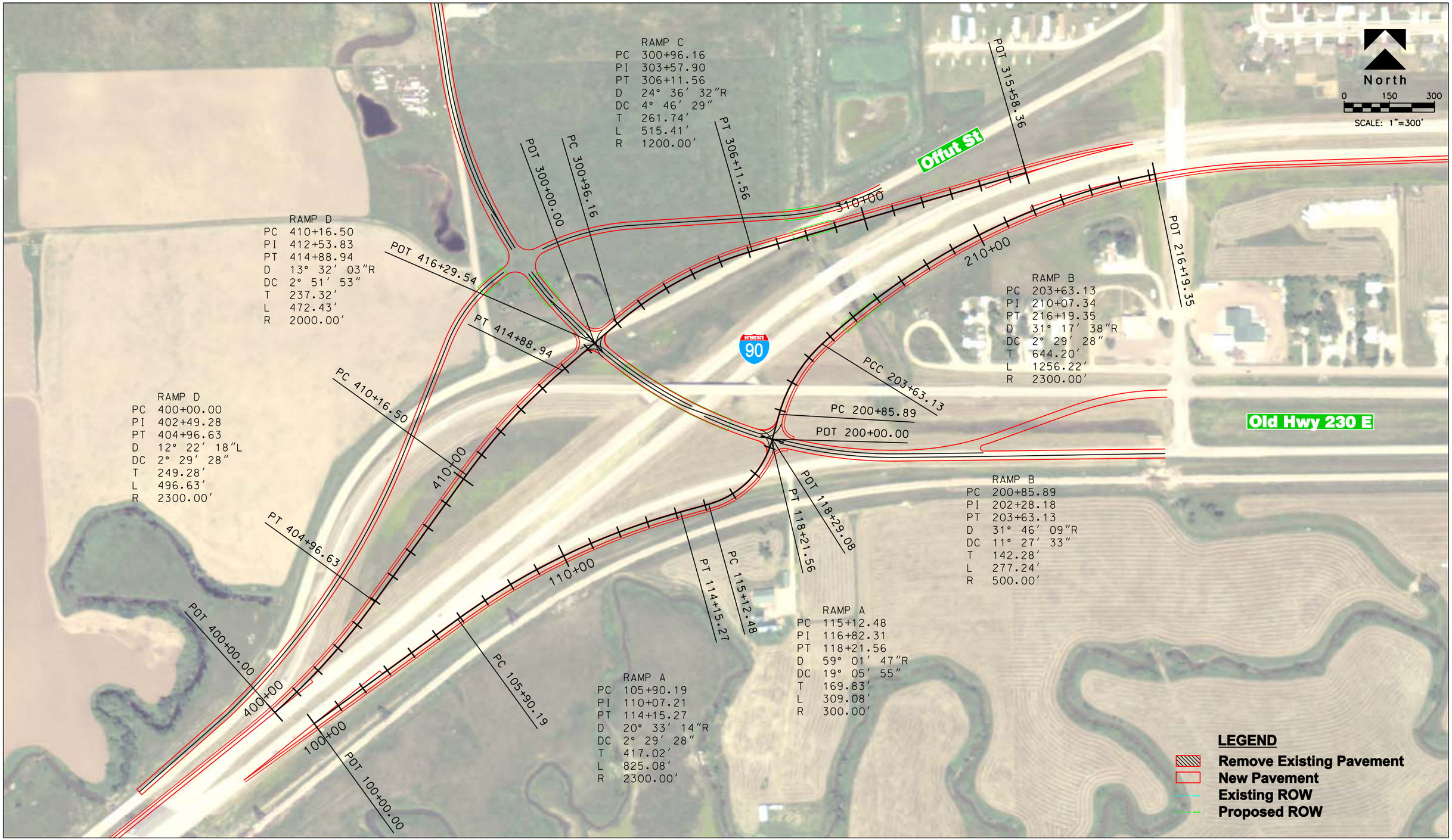


Figure 2.33
I-90 Exit 63 - Box Elder/Ellsworth AFB
Alternative 2
Modified Diamond Interchange

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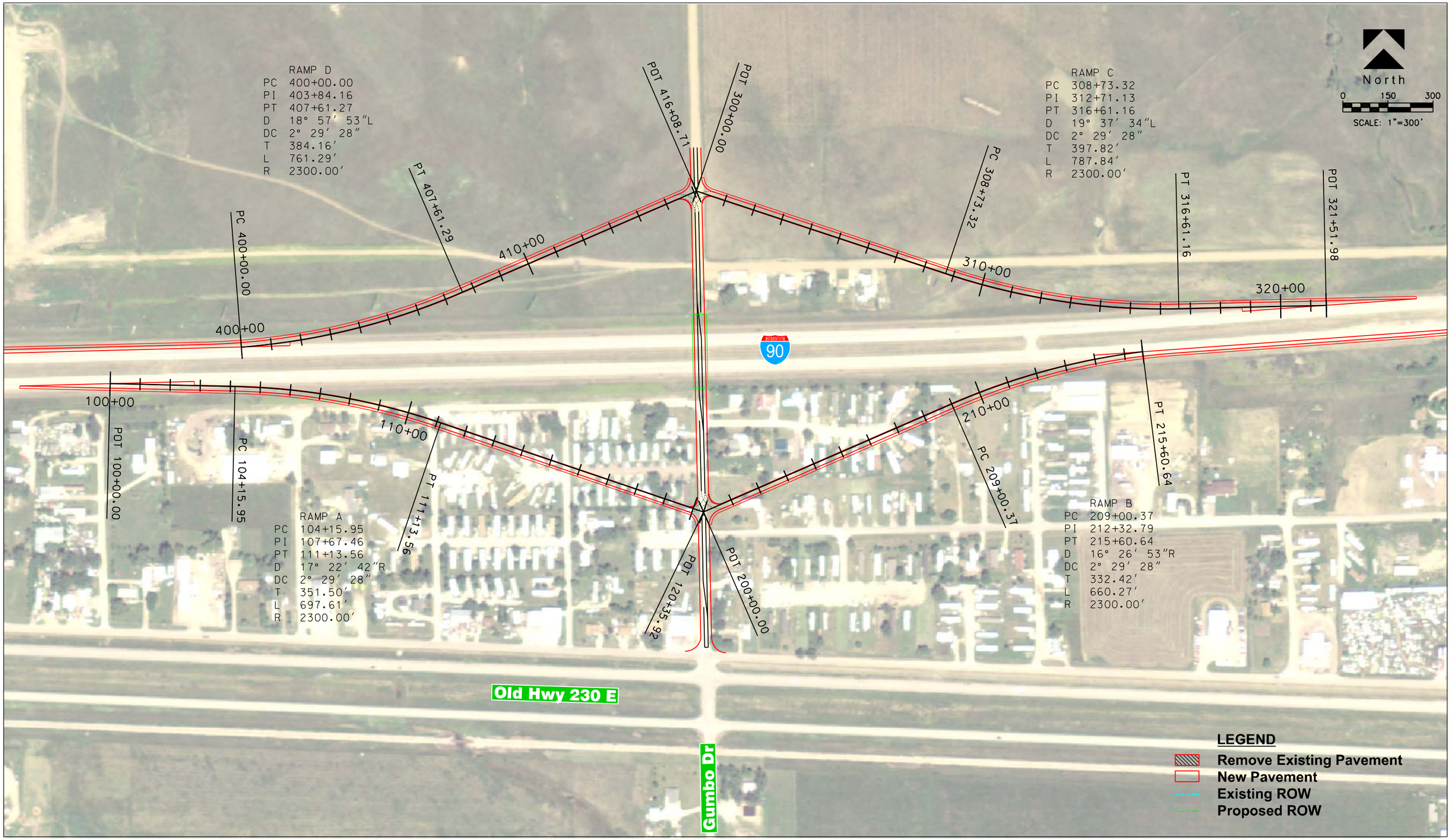
CONCEPTUAL DESIGN



FELSBURG HOLT & ULLEVIG

CONCEPTUAL DESIGN

Figure 2.34
I-90 Exit 63 - Box Elder/Ellsworth AFB
Alternative 3
Relocated Diamond Interchange

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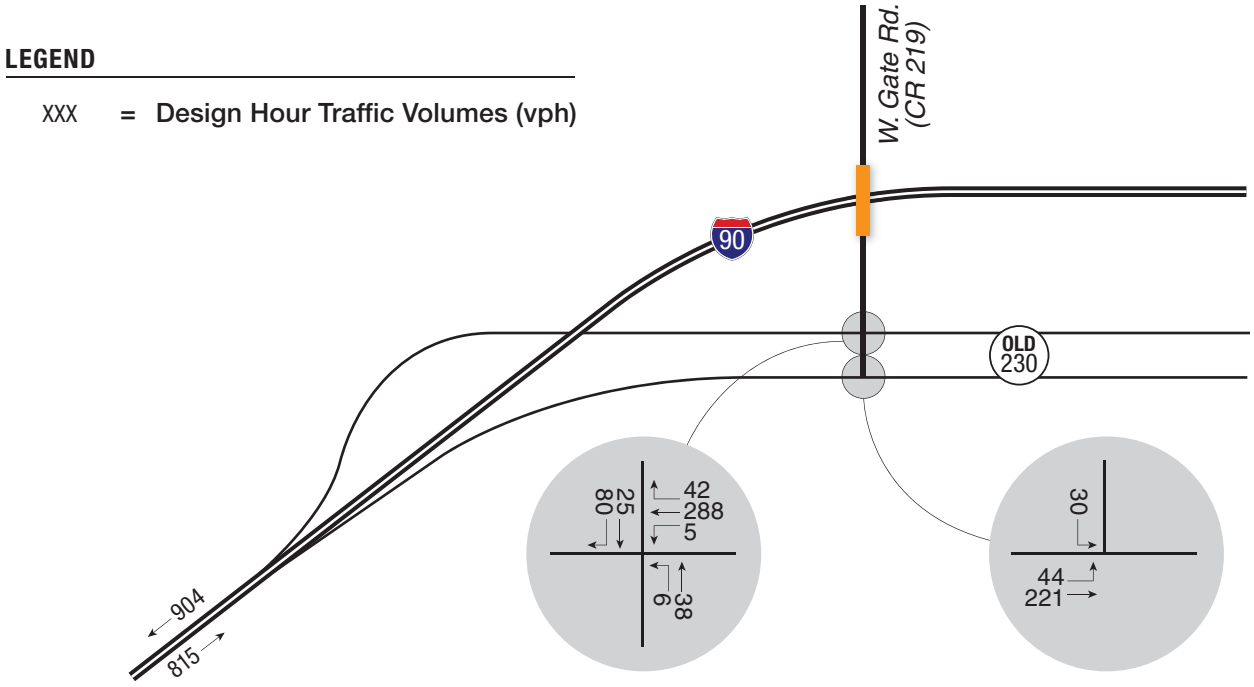


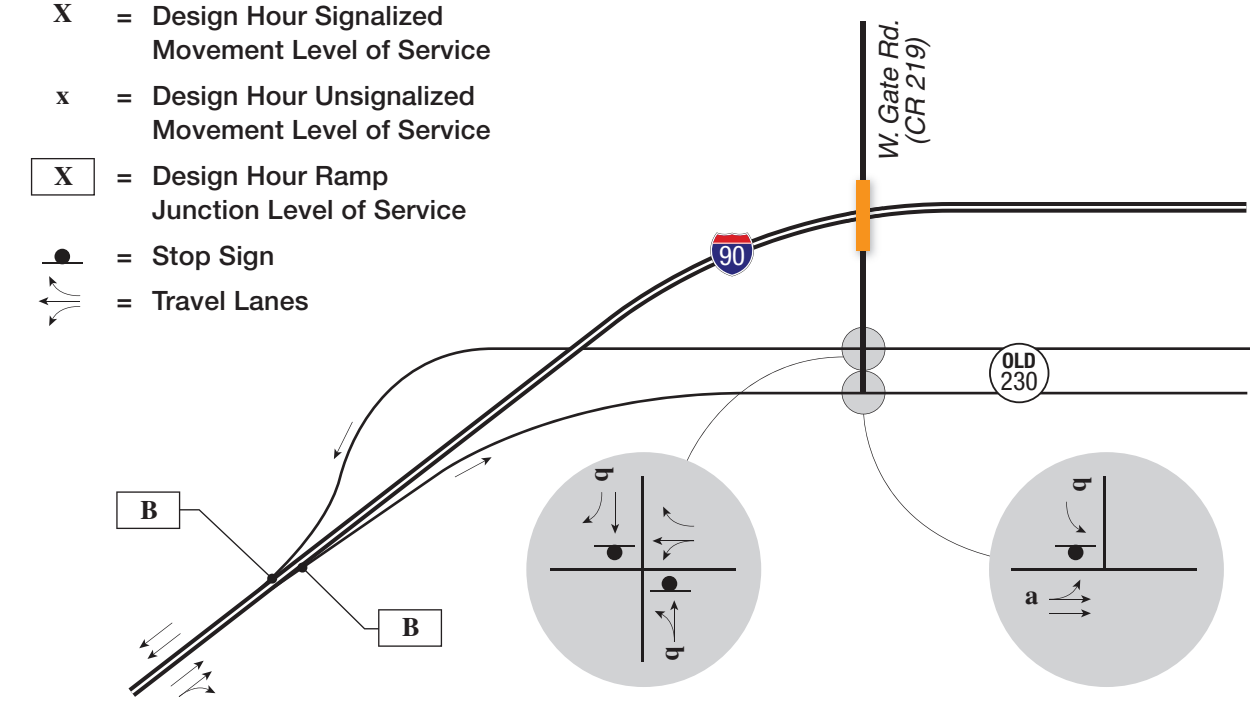
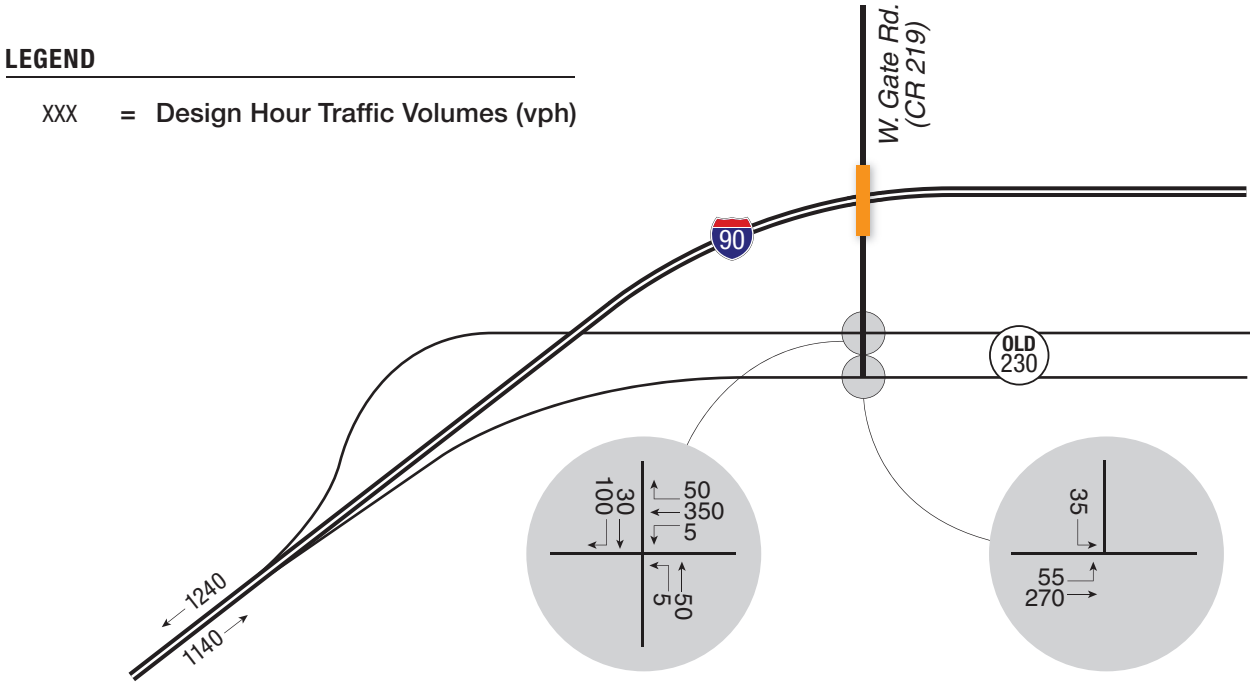


Figure 2.35
Interstate 90 Exit 63
Traffic Conditions Year 2009

FELSBURG HOLT & ULLEVIG

NORTH



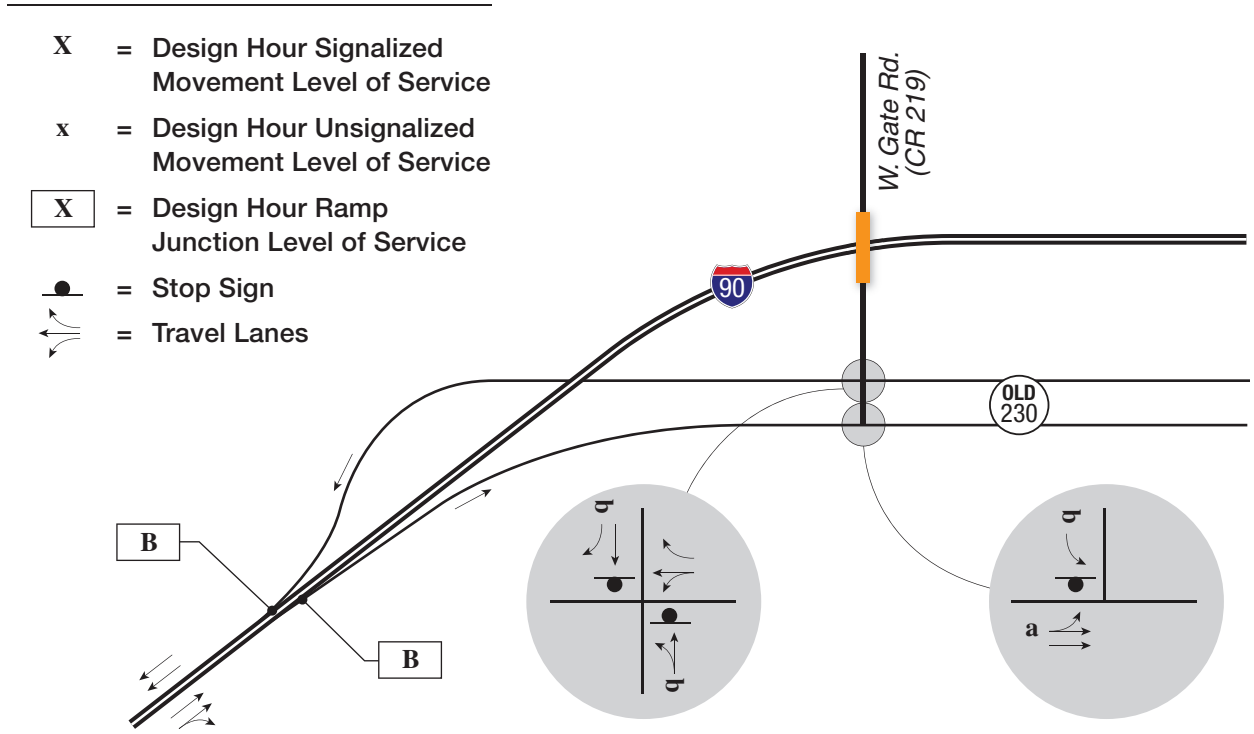


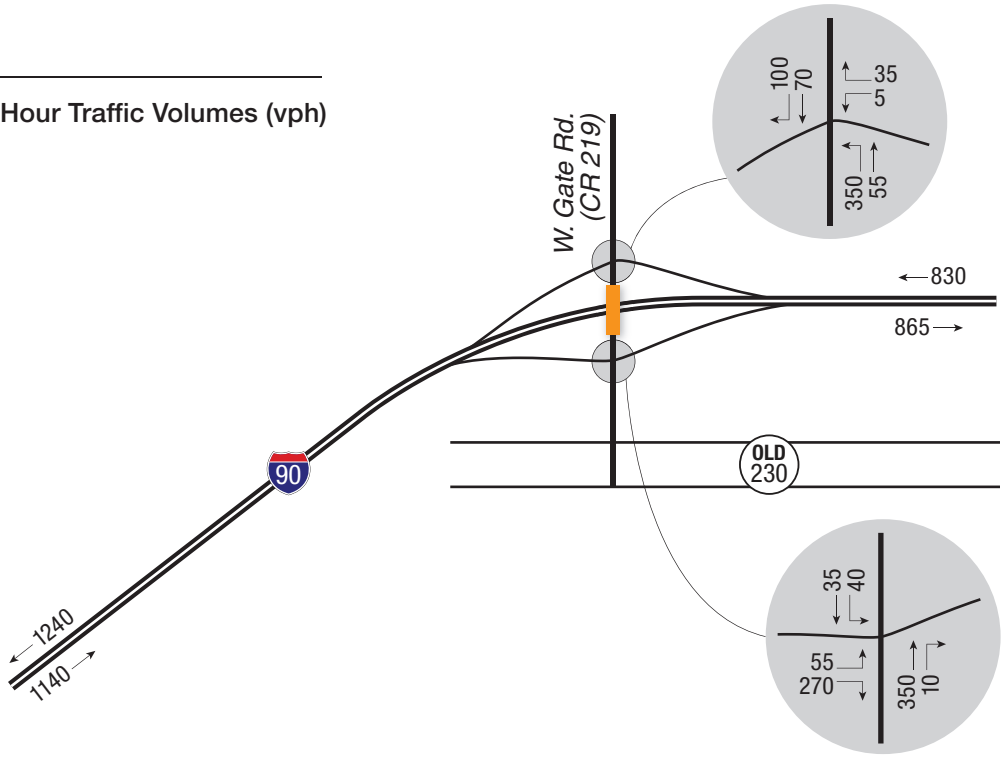
Figure 2.36
Interstate 90 Exit 63
Traffic Conditions Year 2030

FELSBURG HOLT & ULLEVIG

NORTH

LEGEND

XXX = Design Hour Traffic Volumes (vph)



LEGEND

x = Design Hour Unsignalized Movement Level of Service

X = Design Hour Ramp Junction Level of Service

= Travel Lanes

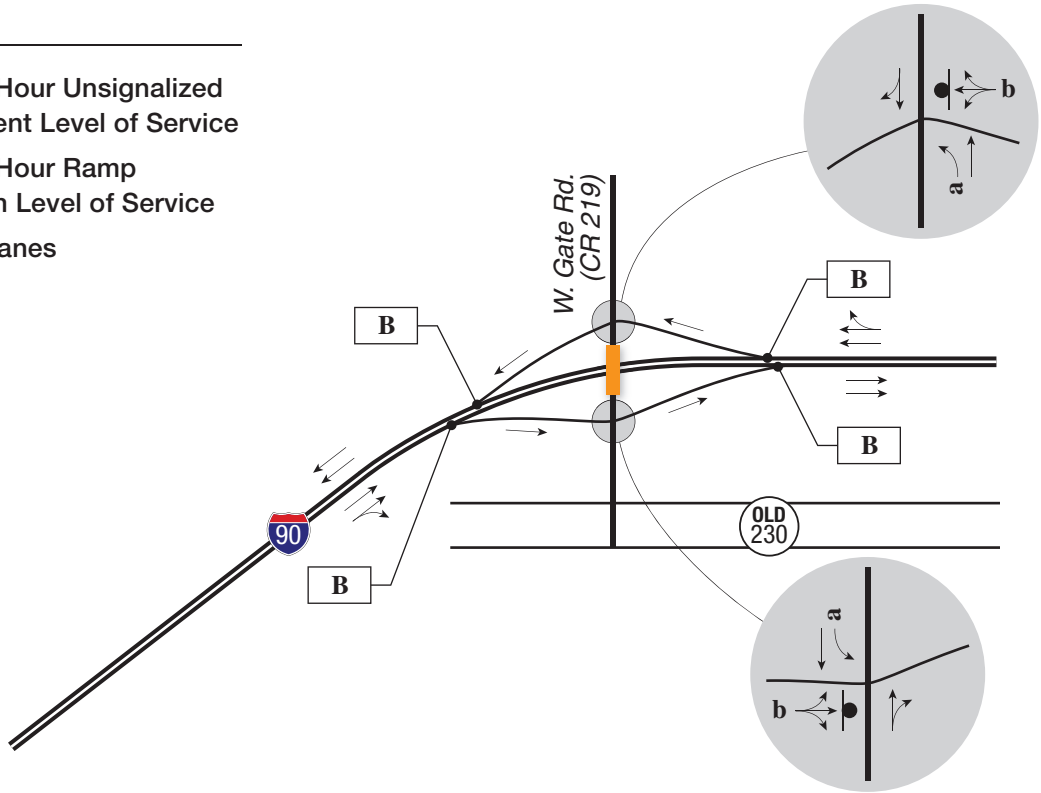


Figure 2.37
Interstate 90 Exit 63
All Alternatives
Traffic Conditions Year 2030

FELSBURG HOLT & ULLEVIG

NORTH

Probable Construction Costs
I-90 Exit 63 - Alternative 1 Diamond Interchange

Item Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*
Mobilization	1	LUMP SUM	$317,000.00	$317,000
Traffic Control	1	LUMP SUM	$634,000.00	$634,000
Clearing	1	LUMP SUM	$127,000.00	$127,000
Removal of Concrete Pavement	-	SQ. YD.	$3.88	$0
Removal of Asphalt Pavement	8,792	SQ. YD.	$7.39	$64,988
Remove Bridge	16,688	SQ. FT.	$9.00	$150,192
Borrow, Unclassified Excavation	399,617	CU. YD.	$5.30	$2,118,770
Base Course	13,082	TON	$10.64	$139,155
Asphalt Composite	13,082	TON	$80.91	$1,058,410
PCC Pavement 11" (mainline)	-	SQ. YD.	$33.12	$0
PCC Pavement 8" (ramps)		SQ. YD.	$43.40	$0
Concrete Approach Slab	1,178	SQ. YD.	$188.34	$221,825
Bridges	25,808	SQ. FT.	$100.00	$2,580,800
Guard Rail	0	LF	$100.00	$0
Permanent Signing/Markings	1	LUMP SUM	$190,000.00	$190,000
Traffic Signal	0	EACH	$125,000.00	$0
Roadway Lighting	1	LUMP SUM	$130,000.00	$130,000
Drainage (18" RCP)	240	LF	$24.53	$5,887
Subtotal				$7,740,000
Contingencies	25%			$1,935,000
Total Probable Construction Costs				$9,680,000
Engineering, Administration	15%			$1,452,000
Total Project Costs				$11,130,000

Table 2.26
Probable Construction Costs
I-90 Exit 63 - Alternative 1
Diamond Interchange

FELSBURG HOLT & ULLEVIG

Probable Construction Costs
I-90 Exit 63 - Alternative 2 Modified Diamond Interchange

Item Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*
Mobilization	1	LUMP SUM	$417,000.00	$417,000
Traffic Control	1	LUMP SUM	$834,000.00	$834,000
Clearing	1	LUMP SUM	$167,000.00	$167,000
Removal of Concrete Pavement	-	SQ. YD.	$3.88	$0
Removal of Asphalt Pavement	32,719	SQ. YD.	$7.39	$241,860
Remove Bridge	10,524	SQ. FT.	$9.00	$94,716
Borrow, Unclassified Excavation	312,051	CU. YD.	$5.30	$1,654,493
Base Course	21,598	TON	$10.64	$229,740
Asphalt Composite	21,598	TON	$80.91	$1,747,405
PCC Pavement 11" (mainline)	-	SQ. YD.	$33.12	$0
PCC Pavement 8" (ramps)	-	SQ. YD.	$43.40	$0
Concrete Approach Slab	2,667	SQ. YD.	$188.34	$502,245
Bridges	38,606	SQ. FT.	$100.00	$3,860,600
Guard Rail	0	LF	$100.00	$0
Permanent Signing/Markings	1	LUMP SUM	$250,000.00	$250,000
Traffic Signal	0	EACH	$125,000.00	$0
Roadway Lighting	1	LUMP SUM	$170,000.00	$170,000
Drainage (18" RCP)	240	LF	$24.53	$5,887
Subtotal				$10,170,000
Contingencies	25%			$2,542,500
Total Probable Construction Costs				$12,710,000
Engineering, Administration	15%			$1,906,500
Total Project Costs				$14,620,000

Table 2.27
Probable Construction Costs
I-90 Exit 63 - Alternative 2
Modified Diamond Interchange

FELSBURG HOLT & ULLEVIG

Probable Construction Costs
I-90 Exit 63 - Alternative 3 Relocated Diamond Interchange

Item Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*
Mobilization	1	LUMP SUM	$228,000.00	$228,000
Traffic Control	1	LUMP SUM	$456,000.00	$456,000
Clearing	1	LUMP SUM	$91,000.00	$91,000
Removal of Concrete Pavement	-	SQ. YD.	$3.88	$0
Removal of Asphalt Pavement	6,398	SQ. YD.	$7.39	$47,293
Remove Bridge	10,524	SQ. FT.	$9.00	$94,716
Borrow, Unclassified Excavation	206,554	CU. YD.	$5.30	$1,095,150
Base Course	15,231	TON	$10.64	$162,015
Asphalt Composite	15,231	TON	$80.91	$1,232,284
PCC Pavement 11" (mainline)	-	SQ. YD.	$33.12	$0
PCC Pavement 8" (ramps)	-	SQ. YD.	$43.40	$0
Concrete Approach Slab	622	SQ. YD.	$188.34	$117,191
Bridges	18,097	SQ. FT.	$100.00	$1,809,700
Guard Rail	0	LF	$100.00	$0
Permanent Signing/Markings	1	LUMP SUM	$140,000.00	$140,000
Traffic Signal	0	EACH	$125,000.00	$0
Roadway Lighting	1	LUMP SUM	$90,000.00	$90,000
Drainage (18" RCP)	240	LF	$24.53	$5,887
Subtotal				$5,570,000
Contingencies	25%			$1,392,500
Total Probable Construction Costs				$6,960,000
Engineering, Administration	15%			$1,044,000
Total Project Costs				$8,000,000

Table 2.28
Probable Construction Costs
I-90 Exit 63 - Alternative 3
Relocated Diamond Interchange

FELSBURG HOLT & ULLEVIG

Evaluation Factors/Categories	Alternative 1 - Diamond Interchange Rating	Alternative 2 - Modified Diamond Interchange Rating	Alternative 3 - Relocated Diamond Interchange Rating
Property Impacts			
Businesses	2	3	2
Residences	2	3	1
Right-of-Way Acquisition	2	1	1
Subtotal	**6**	**7**	**4**
Physical Environment			
Hazardous Sites, 4(f), 6(f)	2	2	1
Wetlands Impacts	2	2	2
Flood and Drainage Impacts	2	2	3
Subtotal	**6**	**6**	**6**
Traffic/Access			
Traffic Operations	3	3	3
Development Access	2	2	2
Multimodal Compatibility	1	1	1
Subtotal	**6**	**6**	**6**
Geometric Design			
Meeting Standards	3	3	3
Subtotal	**3**	**3**	**3**
Safety			
Improvement of existing hazard(s)	2	2	2
Incident Response	2	2	2
Subtotal	**4**	**4**	**4**
Construction			
Utility Impacts	2	2	2
Scheduling/Adapatability	2	2	3
Relative Construction Cost	2	1	3
Subtotal	**6**	**5**	**8**
Construction Cost	$11,130,000	$14,620,000	$8,000,000
Totals	**31**	**31**	**31**

Table 2.29
I-90 Exit 63 - Alternative Performance Matrix

2.8 I-90 Exit 332 – SD 37/SD 90L, Mitchell Parkston

2.8.1 Review of Phase 1 Findings

In Phase 1 of the study, an annual growth rate of 1.9% was applied to all traffic movements at the interchange to determine future year traffic forecasts. This rate included projected traffic related to future land uses south of the interchange area as provided by the Mitchell Area Development Corporation.

It was determined that the southbound ramp terminal intersection is expected to operate at LOS A in both the AM and PM peak periods by 2030. No geometric improvements were recommended in Phase 1, although signal timing changes were mentioned to correct observed crash patterns.

2.8.2 Phase 2 Issues

Questions Raised

The SDDOT requested a more detailed analysis of traffic operations as there are some perceived congestion problems at the interchange. A travel demand model is not available for the Mitchell area, so a sensitivity analyses was performed to determine how much additional traffic could be accommodated by the interchange.

Analysis Approach

Year 2009 traffic volumes as reported in Phase 1 were used as the baseline for the sensitivity analyses. These volumes were based upon 2006 turning movement counts at the interchange; the historic 1.9% annual straight-line growth rate was applied to obtain the 2009 values. In Phase 1, this growth rate was applied to the counts to obtain 2030 traffic volumes. Compared to 2009 values, this growth rate equates to a multiplier of 1.48.

Findings

With 2030 traffic volumes the interchange ramp terminals were expected to operate at LOS A in both the AM and PM peak periods. An iterative process of traffic projections and analyses was conducted to determine when each ramp terminal intersection reached the LOS E threshold. A multiplier was applied to 2009 traffic volumes at each intersection, and operational analyses were performed to determine the LOS results. It was determined that a multiplier of 5.1 in the AM peak period would be required before the interchange would be expected to operate at LOS E. In the PM peak period, the multiplier was 3.6. In other words, 3.6 times as many vehicles would need to travel through the interchange in the PM peak period before traffic operations would reach unacceptable levels. This growth is the equivalent to an annual growth rate in traffic volumes of 6.3% for the next 21 years. This exercise indicates that there is considerable excess capacity available through the interchange for the foreseeable future.

2.8.3 Interchange Concepts

Alternative 1 – Traffic Signal Timing

Traffic operational analyses were performed with the assumption that the traffic signals at the interchange were timed and coordinated properly for optimum performance. Traffic congestion and safety problems observed at the interchange may be the result of improper timing and/or traffic signal equipment malfunctions. It is recommended that the traffic signal timing and coordination at the interchange be reviewed and field adjusted. Each traffic signal should also be inspected to ensure that all detectors and controllers are operating properly.

2.8.4 Environmental Review

A cursory review of the interchange and surrounding area was conducted to identify potential environmental resources that may be affected by the project and could require further assessment during later stages of the project. The cursory review was conducted by reviewing aerial photography and FHU's in-house GIS data for the area.

Land use in the general area of the interchange consists primarily of commercial buildings, with some agricultural land in the southeast quadrant. A truck stop and filling station, which may present hazardous materials issues, is located in the northwest quadrant and the Mitchell Visitor's Center and campgrounds are located in the northeast quadrant of the interchange. A hotel is located in the southeast quadrant and a Cabela's Outfitter retail store is located in the southwest quadrant. Railroad tracks transect the Interstate at the eastern end of the interchange which may present hazardous materials issues. A drainage way parallels the northeastern quadrant of the interchange and drains easterly into a nearby creek which eventually flows into the James River.

Other environmental resources that may require analysis in addition to those mentioned above include air, noise, threatened/endangered species, cultural resources, and 4(f) and 6(f) resources in support of National Environmental Policy Act (NEPA) documentation prior to final design and construction activities. However, none of the proposed alternative concepts are anticipated to significantly impact these environmental resources.

2.9 I-90 Exit 406 – SD 11, Brandon/Corson

2.9.1 Review of Phase 1 Findings

In Phase 1 of the study, both the northbound and southbound ramp terminal intersection peak hour traffic volumes were estimated from daily traffic volumes as turning movement counts were not available. An annual growth rate of 3.4% was applied to all traffic movements at the interchange to determine future year traffic forecasts.

It was determined that both of the ramp terminal intersections are expected to operate at LOS F in both the AM and PM peak periods by 2030. Two improvement options were suggested at the ramp terminal intersections to improve traffic operations:

- Traffic signalization and reconstruct interchange with the addition of left-turn lanes on SD Highway 11
- Single Point Urban Interchange

2.9.2 Phase 2 Issues

Questions Raised

The SDDOT requested further analysis of this interchange due to inquiries/complaints regarding the two lane bridge with a connection to the four lane roadway to the south. In order to provide more accurate baseline data, peak hour turning movement counts were conducted at the northbound and southbound ramp terminal intersections (**Figure 2.40**). It should be noted that these counts did not include through traffic on SD Highway 11, so Phase 1 traffic estimates were used. The Phase 1 traffic forecasts were refined using the NCHRP 255 procedure to estimate future traffic volumes for each individual movement, rather than applying a single growth rate to all movements at the interchange.

Analysis Approach

Year 2030 daily traffic forecasts for all interchange approach legs were obtained from the SECOG regional travel demand model. These forecasts were then compared to 2008 Average Daily Traffic counts as published by SECOG. The NCHRP 255 procedure was utilized to estimate turning movements at the study intersections by comparing Year 2008 ADT counts with forecasted levels. The results of the methodology were then reviewed and manually adjusted using engineering judgment to determine Year 2030 AM and PM peak hour traffic volumes as shown in **Figure 2.41**.

The existing two lane bridge has a number of design deficiencies that support improvements, including inadequate shoulder width, clear zone, ramp grades, and ramp taper rate. A new bridge design that accommodates a three lane roadway cross section was developed to address these deficiencies.

2.9.3 Interchange Concepts

Alternative 1 – Traffic Signalization and Reconstruct Interchange with 3-Lane Bridge

In order to provide adequate traffic operations, the interchange should be reconstructed to provide a three lane cross section on SD Highway 11 with left-turn lanes at the ramp terminal intersections. The addition of a southbound right-turn lane at the westbound ramp terminal is also recommended. Traffic signals should be provided at both ramp terminals. With these improvements, all critical movements at both the ramp terminal intersections would be expected to operate at LOS B or better in the AM and PM peak periods in 2030. The concept drawing of this improvement option is shown in **Figure 2.38**. Construction costs for this concept are estimated at $4,150,000.

Alternative 2 – Single Point Urban Interchange

With conversion of the interchange to a SPUI, the single point intersection would be expected to operate at LOS B or better in both the AM and PM peak periods in 2030 (**Figure 2.42**). With the SPUI concept, pedestrians would need to cross multiple ramps, requiring pedestrian signals. With the reconstruction of both ramp terminals, four separate ramps would need to be crossed, rather than the two ramps with the diamond configuration. The concept drawing of this improvement option is shown in **Figure 2.39**. Construction costs for this concept are estimated at $10,350,000. The relatively high cost of this concept is due to the need to reconstruct all four of the ramps to meet current design standards and the construction of a wide bridge on SD Highway 11 to accommodate the left turn movement through the intersection.

Cost estimates, shown in **Tables 2.31** through **2.32**, do not include Right-of-Way acquisitions. Inclusion of Right-of-Way will considerably increase project costs.

2.9.4 Environmental Review

A cursory review of the interchange and surrounding area was conducted to identify potential environmental resources that may be affected by the project and could require further assessment during later stages of the project. The cursory review was conducted by reviewing aerial photography and FHU's in-house GIS data for the area.

Land use in the general area of the interchange consists primarily of commercial and agricultural land. What appears to be an ethanol plant is located northwest of the interchange and a filling station is located south of the interchange, both of which may present hazardous materials issues. With the SPUI interchange concept, right-of-way might need acquired and there is the potential that the agricultural land could be classified as Prime and Unique Farmland. Split Rock Creek is located to the east of the interchange and transects the Interstate at Bridge Number 406.99. Wetlands may be of concern in this area, as well as floodplain issues.

Other environmental resources that may require analysis include air, noise, threatened/endangered species, cultural resources, and 4(f) and 6(f) resources in support of National Environmental Policy Act (NEPA) documentation prior to final design and construction activities.

2.9.5 Alternative Evaluation

An analysis of the No-Build, Traffic Signalization and 3-Lane Bridge, and SPUI Alternatives was conducted to provide a comparative evaluation of the benefits and impacts associated with each alternative. Each of the alternative concepts was rated on a point system based upon pre-determined evaluation criteria. The criteria include property impacts, physical environment, community support, traffic/access, safety, and construction cost. A "good" rating was worth 3 points, "fair" was 2, and "poor" was 1.

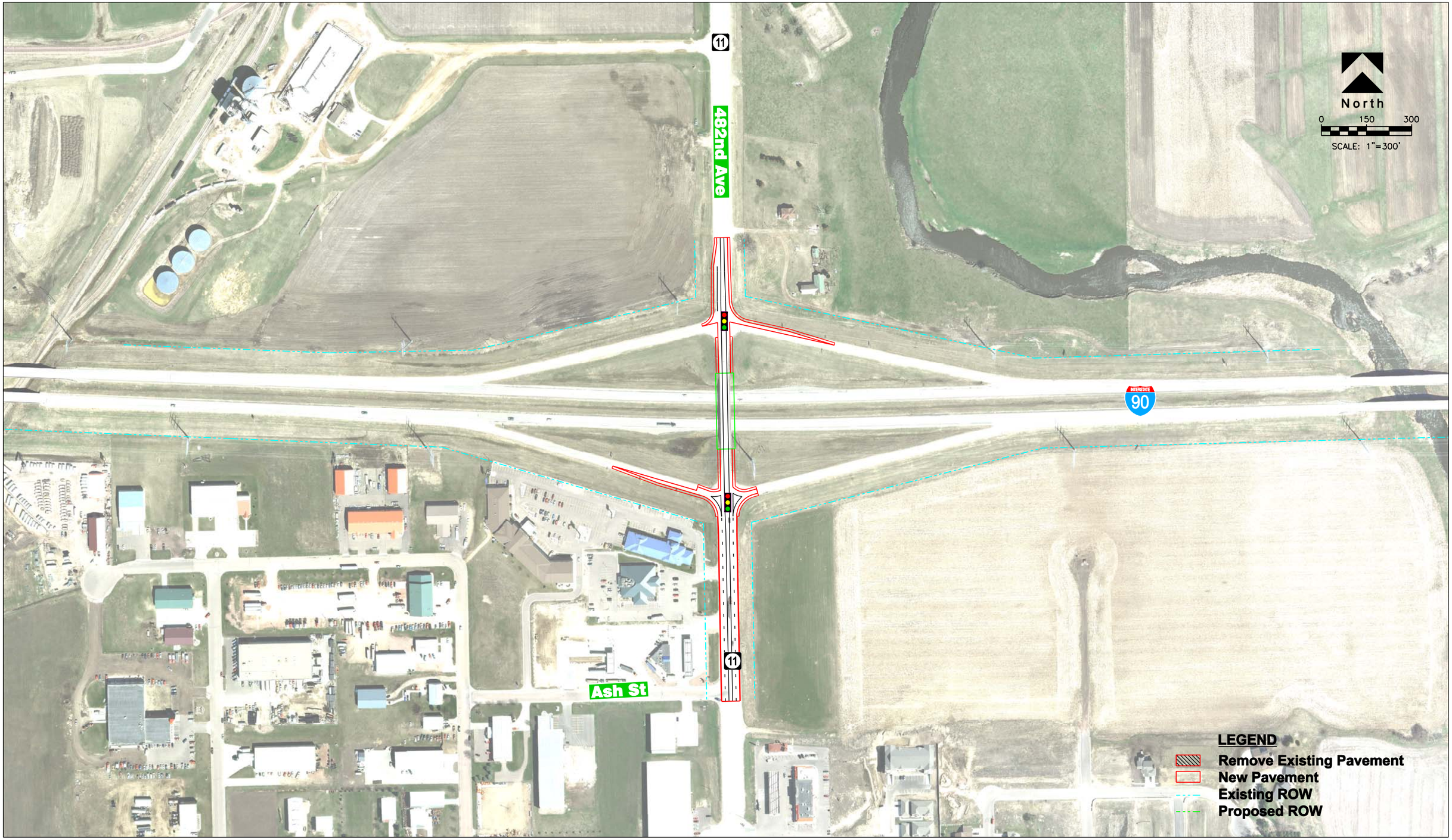
The various evaluation factors discussed in the previous section were tabulated and are summarized in **Table 2.30**. The No-Build Alternative was ranked the lowest due to its inability to provide acceptable traffic operations for the design year or address existing safety concerns. Replacing the existing bridge with a three-lane structure to improve the geometric deficiencies ranked as the preferred concept. This concept provides acceptable traffic operations in the design year, and can be constructed with minimal right-of-way impacts and for considerably less cost than the SPUI configuration.

Table 2.30 Exit 406 Alternative Evaluation Summary

Evaluation Factors (Max. Points)	Alternative Ratings	
	Alternative 1 – Crossroad and Bridge Improvements	Alternative 2 – Single Point Urban Interchange
Property Impacts (9)	9	4
Physical Environment (9)	5	5
Traffic/Access (9)	7	7
Geometric Design (3)	3	3
Safety (6)	5	6
Construction (9)	7	4
Overall Total (45)	36	29
Construction Costs[1]	$4,150,000	$10,350,000

[1]Project construction costs will be considerably higher once required Right-of-Way acquisition costs are incorporated into the final cost estimate.

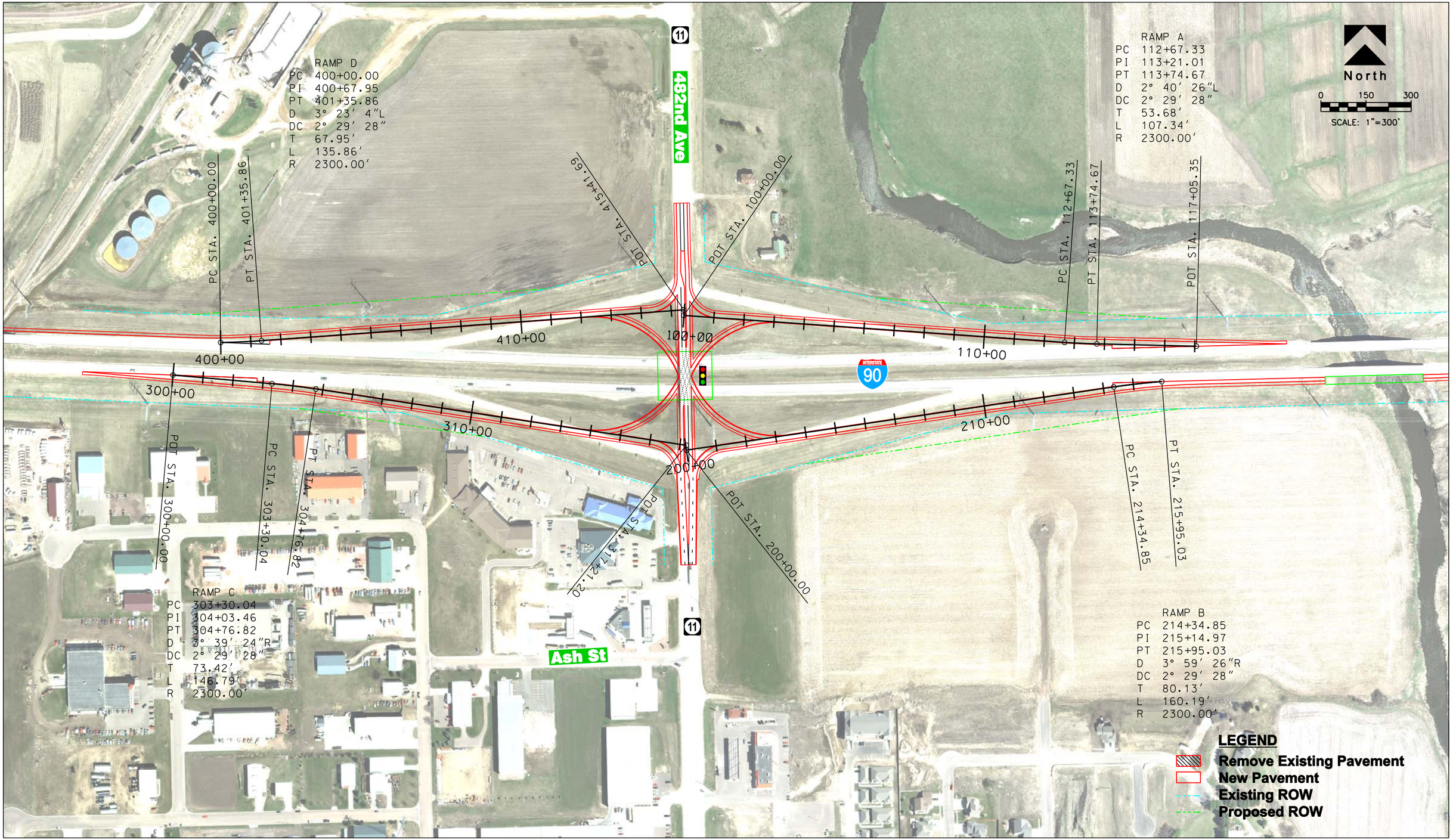
Supporting Exit 406 Figures and Tables follow:



FELSBURG HOLT & ULLEVIG

CONCEPTUAL DESIGN

Figure 2.38
I-90 Exit 406 - Brandon
Alternative 1
Crossroad and Bridge Improvements



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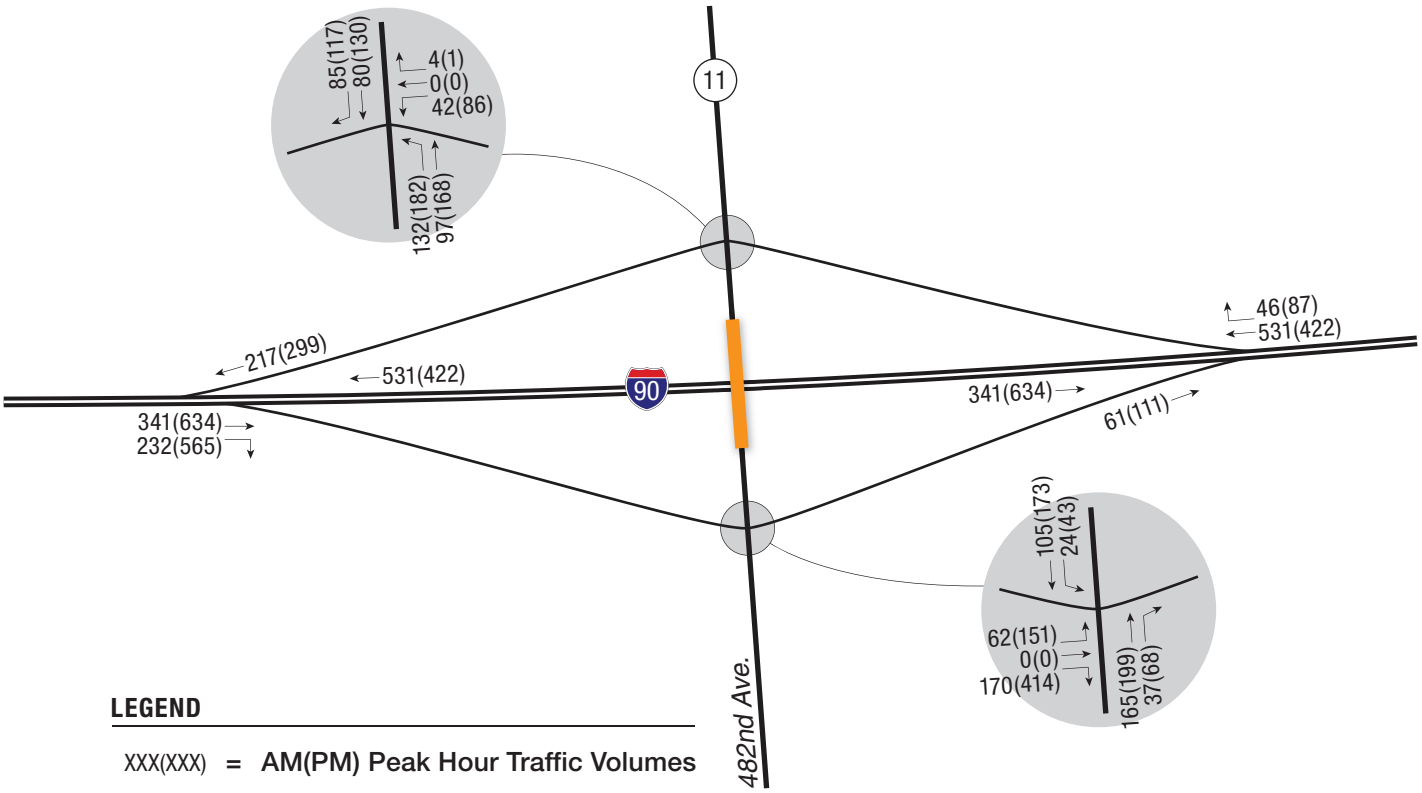
CONCEPTUAL DESIGN

Figure 2.39
I-90 Exit 406 - Brandon
Alternative 2
Single Point Urban Interchange



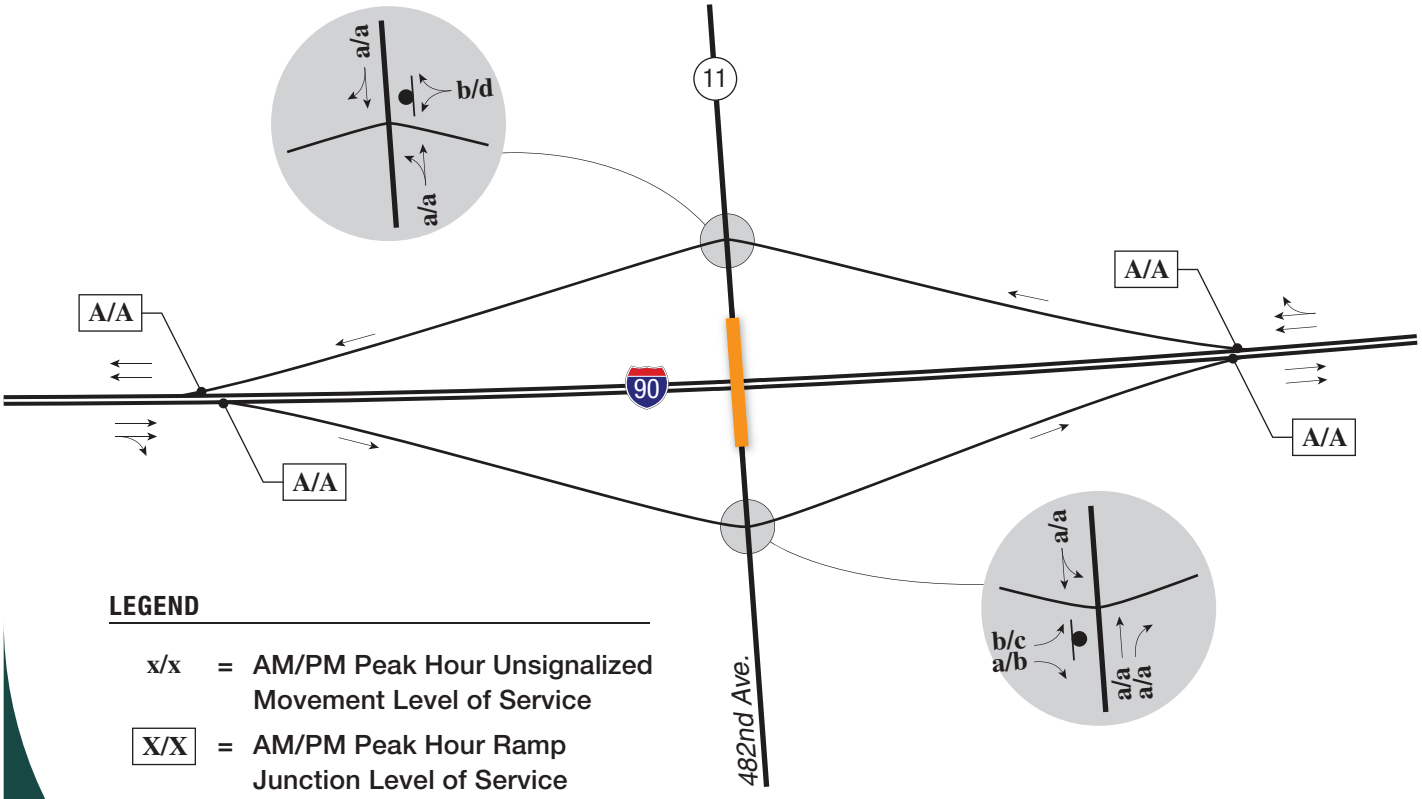
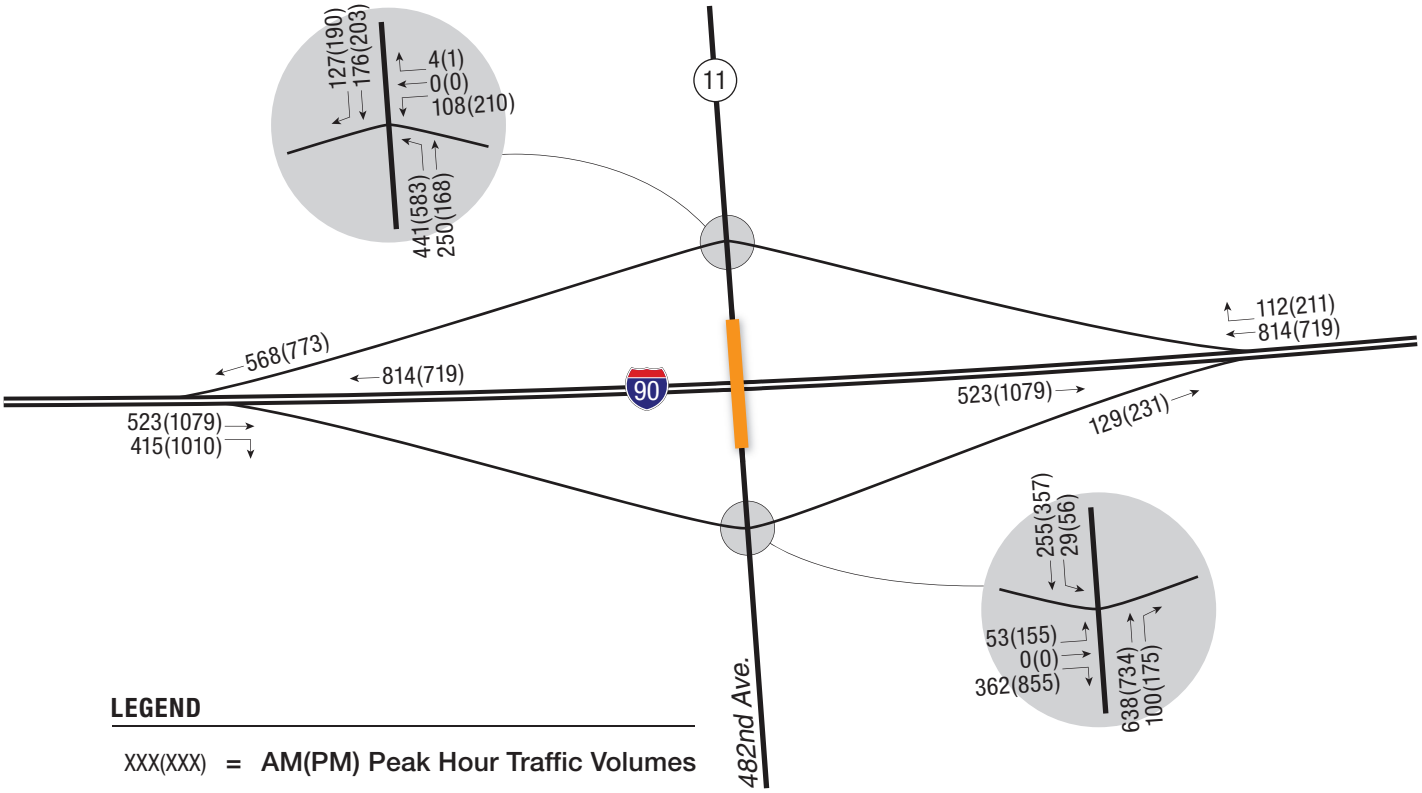


Figure 2.40
Interstate 90 Exit 406
Traffic Conditions Year 2009

FELSBURG HOLT & ULLEVIG

NORTH

SDDOT Decennial Corridor Phase 2, 09-104-01, 05/26/10



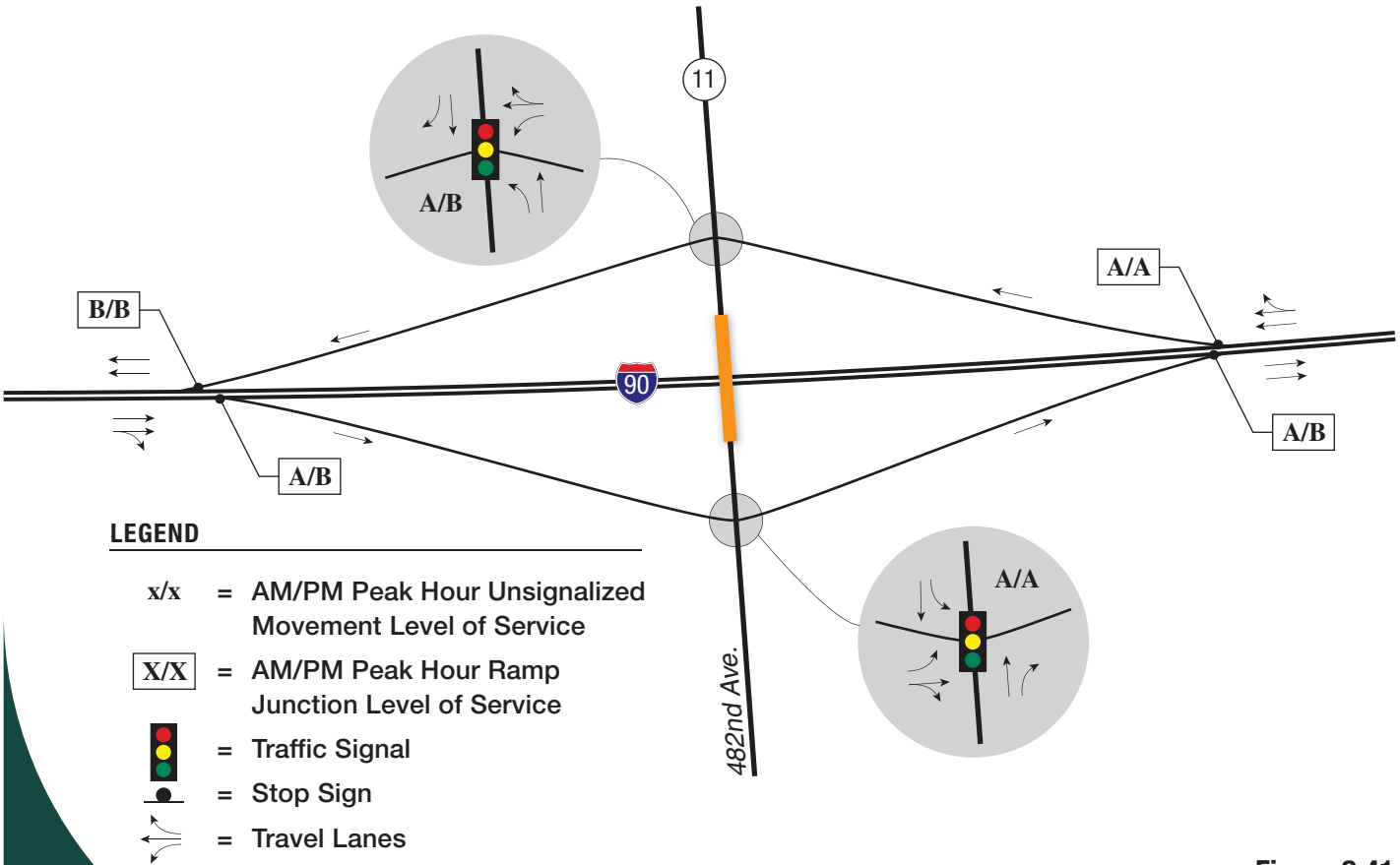
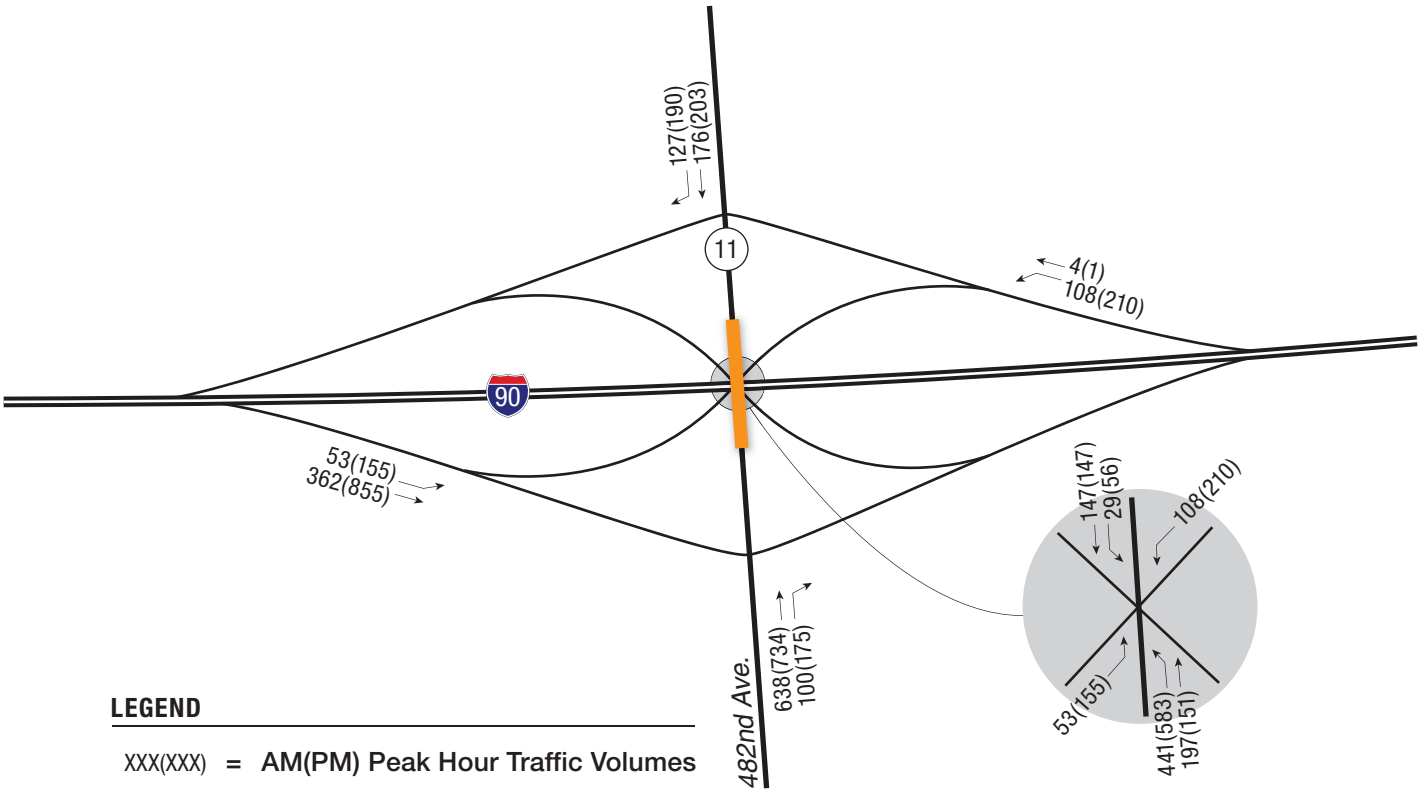


Figure 2.41
Interstate 90 Exit 406
Traffic Conditions Year 2030

FELSBURG HOLT & ULLEVIG

NORTH

SDDOT Decennial Corridor Phase 2, 09-104-01, 05/26/10



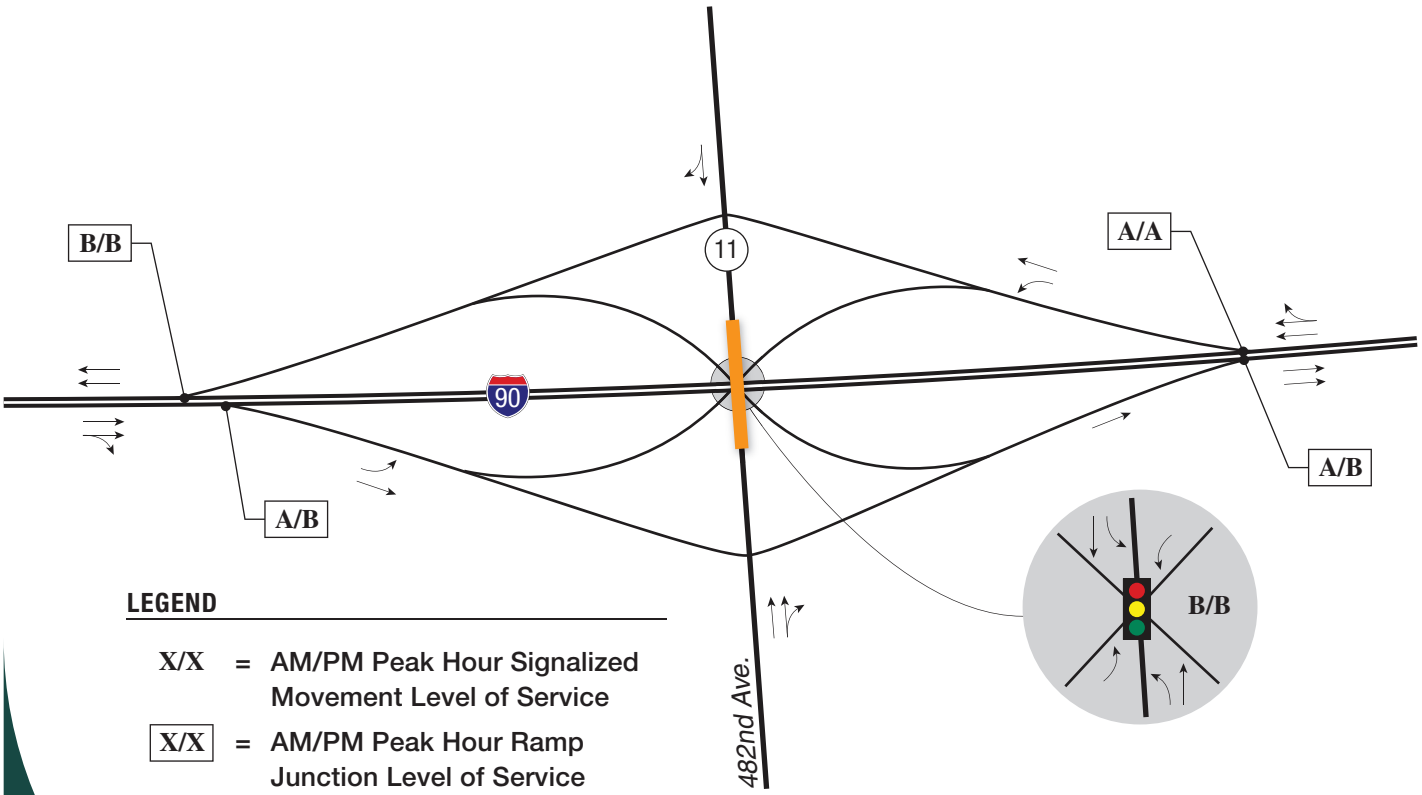


Figure 2.42
Interstate 90 Exit 406
SPUI Alternative
Traffic Conditions Year 2030

FELSBURG HOLT & ULLEVIG

NORTH

SDDOT Decennial Corridor Phase 2, 09-104-01, 05/26/10

Probable Construction Costs
I-90 Exit 406 - Alternative 1 Crossroad and Bridge Improvements

Item Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*
Mobilization	1	LUMP SUM	$113,000.00	$113,000
Traffic Control	1	LUMP SUM	$226,000.00	$226,000
Clearing	1	LUMP SUM	$45,000.00	$45,000
Removal of Concrete Pavement	7,853	SQ. YD.	$3.88	$30,493
Removal of Asphalt Pavement		SQ. YD.	$7.39	$0
Remove Bridge	10,584	SQ. FT.	$9.00	$95,256
Borrow, Unclassified Excavation	14,247	CU. YD.	$5.30	$75,539
Base Course	4,853	TON	$10.64	$51,626
Asphalt Composite		TON	$80.91	$0
PCC Pavement 8" (cross street)	8,821	SQ. YD.	$33.12	$292,176
PCC Pavement 8" (ramps)	1,804	SQ. YD.	$43.40	$78,306
Concrete Approach Slab	622	SQ. YD.	$188.34	$117,191
Bridges	15,120	SQ. FT.	$100.00	$1,512,000
Guard Rail	0	LF	$100.00	$0
Permanent Signing/Markings	1	LUMP SUM	$70,000.00	$70,000
Traffic Signal	1	EACH	$125,000.00	$125,000
Roadway Lighting	1	LUMP SUM	$50,000.00	$50,000
Drainage (18" RCP)	180	LF	$24.53	$4,415
Subtotal				$2,890,000
Contingencies	25%			$722,500
Total Probable Construction Costs				$3,610,000
Engineering, Administration	15%			$541,500
Total Project Costs				$4,150,000

Table 2.31
Probable Construction Costs
I-90 Exit 406 - Alternative 1
Crossroad and Bridge Improvements

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Probable Construction Costs
I-90 Exit 406 - Alternative 2 Single Point Urban Interchange

Item Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*
Mobilization	1	LUMP SUM	$290,000.00	$290,000
Traffic Control	1	LUMP SUM	$580,000.00	$580,000
Clearing	1	LUMP SUM	$116,000.00	$116,000
Removal of Concrete Pavement	23,587	SQ. YD.	$3.88	$91,587
Removal of Asphalt Pavement		SQ. YD.	$7.39	$0
Remove Bridge	8,160	SQ. FT.	$9.00	$73,440
Borrow, Unclassified Excavation	54,406	CU. YD.	$5.30	$288,461
Base Course	13,411	TON	$10.64	$142,650
Asphalt Composite		TON	$80.91	$0
PCC Pavement 8" (cross street)	6,416	SQ. YD.	$33.12	$212,501
PCC Pavement 8" (ramps)	22,945	SQ. YD.	$43.40	$995,715
Concrete Approach Slab	1,400	SQ. YD.	$188.34	$263,679
Bridges	37,250	SQ. FT.	$100.00	$3,725,000
Guard Rail	0	LF	$100.00	$0
Permanent Signing/Markings	1	LUMP SUM	$170,000.00	$170,000
Traffic Signal	1	EACH	$125,000.00	$125,000
Roadway Lighting	1	LUMP SUM	$120,000.00	$120,000
Drainage (18" RCP)	180	LF	$24.53	$4,415
Subtotal				$7,200,000
Contingencies	25%			$1,800,000
Total Probable Construction Costs				$9,000,000
Engineering, Administration	15%			$1,350,000
Total Project Costs				$10,350,000

Table 2.32
Probable Construction Costs
I-90 Exit 406 - Alternative 2
Single Point Urban Interchange

Evaluation Factors/Categories	Alternative 1 – Crossroad and Bridge Improvements Rating	Alternative 2 – Single Point Urban Interchange Rating
Property Impacts		
Businesses	3	1
Residences	3	2
Right-of-Way Acquisition	3	1
Subtotal	**9**	**4**
Physical Environment		
Hazardous Sites, 4(f), 6(f)	2	2
Wetlands Impacts	2	2
Flood and Drainage Impacts	1	1
Subtotal	**5**	**5**
Traffic/Access		
Traffic Operations	3	3
Development Access	2	3
Multimodal Compatibility	2	1
Subtotal	**7**	**7**
Geometric Design		
Meeting Standards	1	3
Subtotal	**1**	**3**
Safety		
Improvement of Existing Hazard(s)	3	3
Incident Response	2	3
Subtotal	**5**	**6**
Construction		
Utility Impacts	2	1
Scheduling/Adapatability	2	2
Relative Construction Cost	3	1
Subtotal	**7**	**4**
Construction Costs	$4,150,000	$10,350,000
Totals	**34**	**29**

Table 2.33
I-90 Exit 406 - Alternative Performance Matrix

2.10 I-229 Exit 5 – 26th Street, Sioux Falls

2.10.1 Review of Phase 1 Findings

A number of safety improvements were identified to reduce the number of crashes at the interchange. Geometric deficiencies related to the ramp taper rate, loop ramp curve radii, k-value calculations and stopping sight distance were also identified, which should be addressed in the proposed interchange concept.

The northbound ramp terminal intersection currently operates at LOS E in the AM peak period and the southbound ramp terminal intersection operates at LOS E in the PM peak period. In Phase 1 of the study, an annual growth rate of 1.0% was applied to all traffic movements at the interchange to determine future year traffic forecasts. It was determined that both the northbound and southbound ramp terminal intersections are expected to operate at LOS F in both the AM and PM peak periods by 2030. Two improvement options were developed at the interchange to improve traffic operations:

- Modification of 26th Street and southbound ramps and removal of Yeager Road to provide folded diamond interchange (proposed by City of Sioux Falls)
- Offset Single Point Urban Interchange

2.10.2 Phase 2 Issues

Questions Raised

The SDDOT requested an analysis to determine the configuration and footprint of the interchange if it is rebuilt as a folded diamond to correct operational problems. A suggestion was also made that a more detailed I-229 corridor study should be conducted in conjunction with the City and MPO to determine the scope of improvements to the arterial street network.

Analysis Approach

A concept drawing and cost estimate were prepared to determine the footprint of the proposed folded diamond interchange.

2.10.3 Interchange Concepts

Alternative 1 – Crossroad and Ramp Improvements

The City of Sioux Falls has previously investigated reconstruction of the southbound ramps in a folded diamond configuration. In this concept, the existing hook ramps and connection to Yeager Road would be removed to accommodate the new ramps. With conversion of the interchange to a folded diamond, both ramp terminal intersections would be expected to operate at LOS C or better in both the AM and PM peak periods in 2030.

The elimination of the segment of Yeager Road, between 26th Street and 33rd Street will result in modifications to travel patterns in the area. Motorists using this connection to access the

southern portion of the neighborhood will likely travel on other north/south local streets, such as Blauvelt Avenue or Wayland Avenue. Additional traffic is also anticipated to travel through the intersection of 26th Street and Cliff Avenue as a result of the elimination of Yeager Road. A more detailed traffic analysis of the entire roadway system in this area is recommended to fully identify and evaluate the potential impacts associated with redirected travel.

The concept drawing of this improvement option is shown in **Figure 2.43**. Construction costs for this concept are estimated at $7,530,000. The relatively high cost of this concept is due to the need to remove and replace the bridge over the Interstate, reconstruct 26th Street through both ramp terminal intersections, and reconstruct the southbound ramps to meet current design standards.

The estimated project cost, shown in **Table 2.34**, does not include Right-of-Way acquisitions. Inclusion of Right-of-Way will considerably increase project costs.

2.10.4 Environmental Review

A cursory review of the interchange and surrounding area was conducted to identify potential environmental resources that may be affected by the project and could require further assessment during later stages of the project. The cursory review was conducted by reviewing aerial photography and FHU's in-house GIS data for the area.

Land use in the general area of the interchange consists primarily of residential properties. However, there is one commercial property, Cliff Avenue Greenhouse and Garden Center, which is located on adjoining property south of the interchange which may present hazardous material issues. Also, the proposed closure of Yeager Road will impact access to the neighborhood.

Other environmental resources that may require analysis include potential wetlands, prime and unique farmland, air, noise, threatened/endangered species, cultural resources, and 4(f) and 6(f) resources in support of National Environmental Policy Act (NEPA) documentation prior to final design and construction activities. This concept should be able to be constructed without impacts to the 26th Street bridge over the Big Sioux River.

Supporting Exit 5 materials follow:

Figure 2.42	I-229 Exit 5 Alternative 1
Table 2.34	I-229 Exit 5 Probable Construction Costs Alternative 1 Crossroad and Ramp Improvements

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CONCEPTUAL DESIGN

Figure 2.43
I-229 Exit 5 - 26th Street
Alternative 1
Crossroad and Ramp Improvements

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Probable Construction Costs
I-229 Exit 5 - Alternative 1 Crossroad and Ramp Improvement

Item Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*
Mobilization	1	LUMP SUM	$209,000.00	$209,000
Traffic Control	1	LUMP SUM	$419,000.00	$419,000
Clearing	1	LUMP SUM	$84,000.00	$84,000
Removal of Concrete Pavement	29,562	SQ. YD.	$3.88	$114,788
Removal of Asphalt Pavement		SQ. YD.	$7.39	$0
Remove Bridge	23,071	SQ. FT.	$9.00	$207,639
Borrow, Unclassified Excavation	34,608	CU. YD.	$5.30	$183,493
Base Course	10,459	TON	$10.64	$111,256
Asphalt Composite		TON	$80.91	$0
PCC Pavement 8" (cross street)	11,349	SQ. YD.	$33.12	$375,876
PCC Pavement 8" (ramps)	11,551	SQ. YD.	$43.40	$501,249
Concrete Approach Slab	689	SQ. YD.	$188.34	$129,747
Bridges	25,600	SQ. FT.	$100.00	$2,560,000
Guard Rail	0	LF	$100.00	$0
Permanent Signing/Markings	1	LUMP SUM	$130,000.00	$130,000
Traffic Signal	1	EACH	$125,000.00	$125,000
Roadway Lighting	1	LUMP SUM	$80,000.00	$80,000
Drainage (18" RCP)	180	LF	$24.53	$4,415
Subtotal				$5,240,000
Contingencies	25%			$1,310,000
Total Probable Construction Costs				$6,550,000
Engineering, Administration	15%			$982,500
Total Project Costs				$7,530,000

Table 2.34
Probable Construction Costs
I-229 Exit 5 - Alternative 1
Cross Road and Ramp Improvement

FELSBURG HOLT & ULLEVIG

3.0 POTENTIAL NEW INTERCHANGES

3.1 I-29 Exit 130 – 20th Street, Brookings

3.1.1 Background

Location Description

An additional interchange at 20th Street has been considered to provide additional Interstate access to the south portion of Brookings. This new interchange would be located 3.0 miles north of SD 324 (Exit 127) and two miles south of US 14 (Exit 132). The purpose of the new interchange would be to relieve traffic on US 14 by providing a more direct connection between the residential development in the southwest portion of Brookings to the commercial and industrial development located on the east side of I-29, and to provide an alternate access from I-29 to the industrial park.

Previous Planning Efforts

In Phase 2 of the 2000 Interstate Corridor Study, a new interchange concept at 32nd Street was studied, which is located one mile south of the 20th Street alignment. The purpose of that interchange was similar, to provide a more direct route from the southern portion of the community to the east side of I-29. That concept consisted of a partial folded diamond interchange, with a loop ramp located in the northwest quadrant to avoid impacts to an existing lake. Construction costs were estimated to be $5.6 million in Year 2000 dollars.

The City and County of Brookings cosponsored a study in 2009 to address the paving of 34th Avenue, from US 14 south to 32nd Street (a distance of approximately 5 miles) and to construct an extension of 20th Street, from 22nd Avenue to 34th Avenue (a distance of 2 miles), including a new interchange with I-29. The purpose of these two projects is to complete the transportation "loop" around the southeastern portion of the community. A projected timeline was established to phase the construction of the improvements. The I-29 overpass on 20th Street was anticipated for construction in 2013. The final phase, anticipated in 2018 would include the construction of the ramps to complete the interchange.

3.1.2 Traffic Evaluation

The Phase 1 Report of the 2010 Decennial Interstate Corridor Study evaluated the current and future traffic operations at the US 14 (Exit 132) interchange. That evaluation indicated that the off-ramp movements at the existing interchange are currently operating at poor levels of service. The recommended improvements of traffic signalization and the construction of separate right and left turn lanes on both the northbound and southbound off-ramps, would provide acceptable levels of service through the Year 2030. It is anticipated that the construction of a new interchange at the 20th Street alignment would provide further congestion relief to the US 14 interchange.

A review of traffic operations forecast at the 32nd Street interchange conducted for the 2000 Interstate Corridor Study indicated that interchange would operate at LOS C or better for all

movements, based upon stop sign control. Slightly higher traffic movements and operations would be anticipated for an interchange at 20th Street, which could initially be constructed with stop sign control and converted to signalization when traffic volumes warrant the installation.

The City of Brookings, in conjunction with the South Dakota Department of Transportation will be conducting the ***Brookings Area Master Transportation Plan***, which will include the development of traffic forecasts for the entire community. It is anticipated that this transportation plan will provide daily traffic volumes for a future roadway network, which could include the construction of a new interchange at 20th Street as one of the concepts to provide additional Interstate access.

3.1.3 Conceptual Design

Alternative 1 – Folded Diamond Interchange
For the concept developed at this location, the ramp terminal intersections would be reconfigured to provide a folded diamond configuration due to conflicts on the north side of 20th Street. The Edgebrook Golf Course is located in the northwest quadrant of the interchange, and a lake is located in the northeast quadrant. A three-lane section across I-29 is recommended to provide separate left turn lanes from 20th Street onto the interchange ramps. The concept drawing of this improvement option is shown in **Figure 3.1.**

3.1.4 Opinion of Probable Cost

Construction costs for this concept are estimated at $10,190,000. The cost of this concept includes a new bridge over the Interstate as well as construction of ramps and ramp terminal intersections. Project costs will be considerably higher once required Right-of-Way acquisition costs are incorporated into the final cost estimate. **Table 3.1** provides a detailed cost breakdown.

3.1.5 Environmental Review

A cursory review of the interchange and surrounding area was conducted to identify potential environmental resources that may be affected by the project and could require further assessment during later stages of the project. The cursory review was conducted by reviewing aerial photography and FHU's in-house GIS data for the area.

Land use in the general area of the proposed interchange consists primarily of agricultural and residential properties. The Edgebrook Golf Course is located in the northwest quadrant of the interchange and an operational sand and gravel dredging pit is located in the northeast quadrant of the interchange. A mobile home park is located in the southwest quadrant of the interchange; however it will not be impacted by the proposed interchange alignment. A pond is also located in the southwest quadrant of the interchange. In order to construct the southbound ramps, this pond would have to be reconfigured.

In October 2008, HDR prepared a Technical Memorandum for the Brookings Industrial Park TIA that summarized the environmental resources in the project vicinity and the potential impacts to

those resources. It should be noted that the potential impacts discussed in the Technical Memorandum include the improvements to 34th Avenue as well. A brief summary of the findings identified in that Technical Memorandum are as follows:

- **Section 4(f) and 6(f) Resources** – The extension of 20th Street between 22nd Avenue and I-29 runs along the southern border of the Edgebrook Golf Course. The golf course received Land and Water Conservation Funds to develop the original nine holes. The roadway extension should be designed to avoid land acquisition from the golf course, although there may be temporary impacts during construction.
- **Wetlands and Waters of the U.S.** – A desktop analysis was conducted to identify areas that have been previously mapped as National Wetland Inventory (NWI) wetlands. A total of 0.93 acres of potential jurisdictional wetlands were identified along the 20th Street alignment that may be impacted by the proposed improvements.
- **Archeological and Historic Resources** – The wood building located in the northeast quadrant of I-29 and 20th Street has been documented by previous cultural surveys, but further analysis is needed to determine if it is eligible for the NRHP.

Other environmental resources that may require analysis include prime and unique farmland, noise, and threatened/endangered species.

Supporting Exit 130 materials follow:

Figure 3.1	I-29 Exit 130 Alternative 1 Folded Diamond Interchange
Table 3.1	I-29 Exit 130 Probable Construction Costs Alternative 1 Folded Diamond Interchange

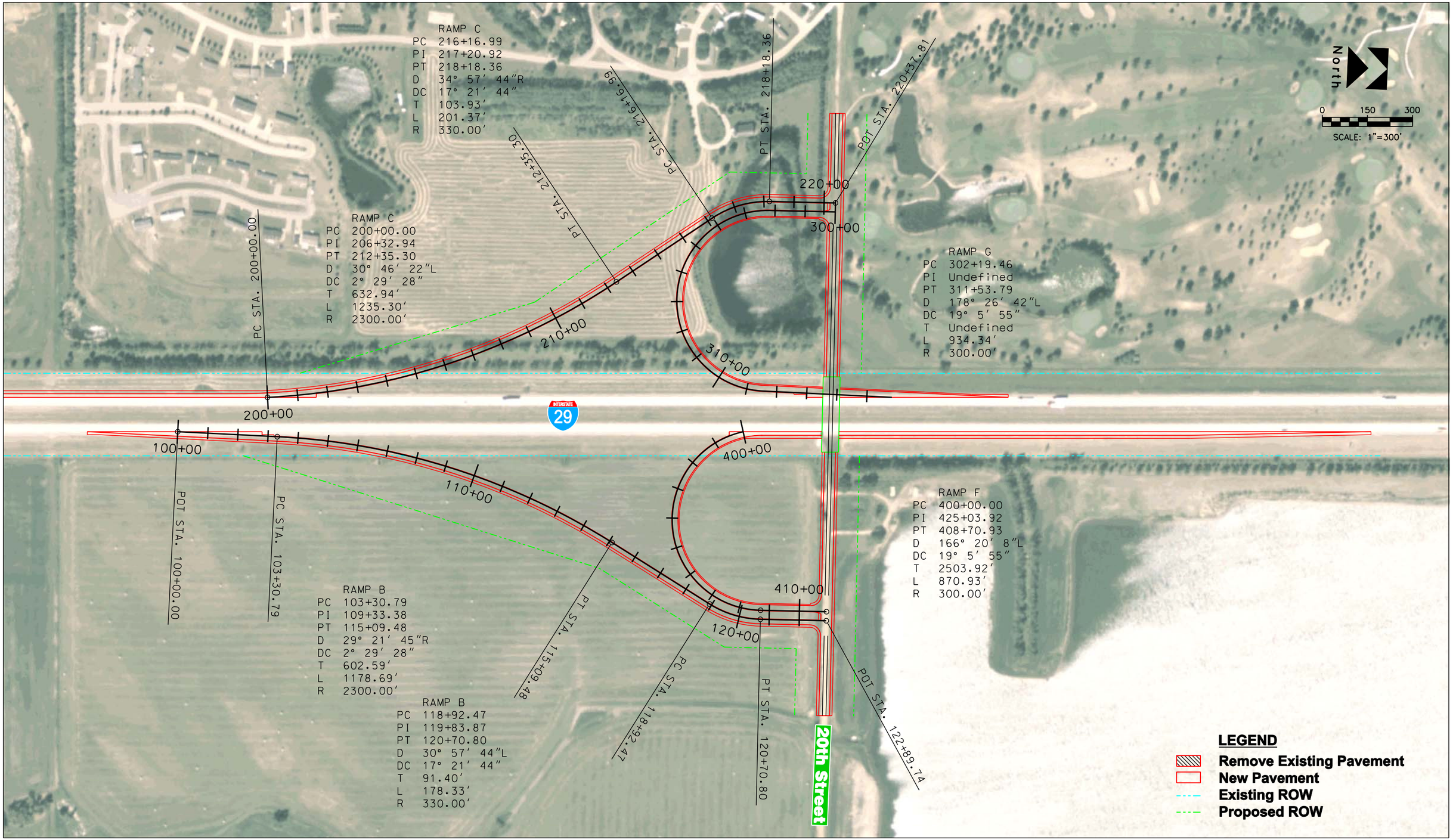

Figure 3.1
I-29 Exit 130 - Brookings - 20th Street
Alternative 1
Folded Diamond Interchange

FELSBURG HOLT & ULLEVIG

CONCEPTUAL DESIGN

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Probable Construction Costs
I-29 Exit 130 - Alternative 1 Folded Diamond Interchange

Item Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*
Mobilization	1	LUMP SUM	$290,000.00	$290,000
Traffic Control	1	LUMP SUM	$581,000.00	$581,000
Clearing	1	LUMP SUM	$116,000.00	$116,000
Removal of Concrete Pavement	-	SQ. YD.	$3.88	$0
Removal of Asphalt Pavement		SQ. YD.	$7.39	$0
Remove Bridge	-	SQ. FT.	$9.00	$0
Borrow, Unclassified Excavation	477,202	CU. YD.	$5.30	$2,530,126
Base Course	17,669	TON	$10.64	$187,941
Asphalt Composite		TON	$80.91	$0
PCC Pavement 8" (cross street)	9,913	SQ. YD.	$33.12	$328,314
PCC Pavement 8" (ramps)	28,771	SQ. YD.	$43.40	$1,248,509
Concrete Approach Slab	578	SQ. YD.	$188.34	$108,820
Bridges	14,000	SQ. FT.	$100.00	$1,400,000
Guard Rail	0	LF	$100.00	$0
Permanent Signing/Markings	1	LUMP SUM	$170,000.00	$170,000
Traffic Signal	0	EACH	$125,000.00	$0
Roadway Lighting	1	LUMP SUM	$120,000.00	$120,000
Drainage (18" RCP)	180	LF	$24.53	$4,415
Subtotal				$7,090,000
Contingencies	25%			$1,772,500
Total Probable Construction Costs				$8,860,000
Engineering, Administration	15%			$1,329,000
Total Project Costs				$10,190,000

Table 3.1
Probable Construction Costs
I-29 Exit 130 - Alternative 1
Folded Diamond Interchange

3.2 I-29 Exit 175 – South Connector, Watertown

3.2.1 Background

Location Description

An additional interchange at 20th Avenue SE has been considered to provide additional Interstate access to the south portion of Watertown. This new interchange would be located approximately one mile south of US 212 (Exit 177). The additional access point would primarily service a proposed industrial development area in the vicinity of I-29, but also provide a southern connection to US 81 and the rest of the community. It is anticipated that this proposed interchange would also relieve traffic at the I-29 interchange with US 212.

Previous Planning Efforts

The City of Watertown, in conjunction with the South Dakota Department of Transportation, commissioned the ***Watertown Area Transportation Plan*** which was completed by URS in November 2005. That study evaluated three potential locations for a new interchange with I-29. These locations included 41st Street SE and 20th Avenue SE, both located south of the existing US 212 interchange with I-29. In addition, a new South Bypass Route, located on the 175th Street alignment (approximately 1.4 miles further southeast on I-29) was also identified as a long range roadway network improvement.

The recommendation of that transportation plan was to construct the new interchange at the 41st Street SE alignment, which is located approximately two miles south of the existing US 212 interchange. Construction costs for the new interchange, utilizing the existing undercrossing of I-29, were estimated at $5.9 million in 2005 dollars. The transportation plan did not provide specifics with regard to the interchange configuration, but it is assume that a standard diamond interchange concept was considered.

3.2.2 Traffic Evaluation

The Phase 1 Report of the 2010 Decennial Interstate Corridor Study evaluated the current and future traffic operations at the US 212 (Exit 177) interchange. That evaluation indicated that the northbound off-ramp movements at the existing interchange is projected to operate at a poor level of service in the Year 2020 and 2030, without improvements. The recommended improvements of traffic signalization and the construction of a separate right turn lane on the northbound off-ramps would provide acceptable levels of service through the Year 2030. It is anticipated that the construction of a new interchange at the 20th Avenue SE alignment would provide further congestion relief to the US 212 interchange.

The future traffic analysis conducted in the ***Watertown Area Transportation Plan*** indicated that approximately 4,000 to 5,000 vpd would divert from the US 212 interchange to the proposed interchange with 41st Street SE. The transportation plan also forecast that up to 9,000 vpd are anticipated between I-29 and US 81. With daily traffic volumes in this range, and with a three-lane section through the interchange, it is anticipated that acceptable traffic operations can be provided at the interchange ramp terminals. The initial construction could include stop sign control, with signalization provided once warrants are met.

3.2.3 Conceptual Design

Alternative 1 – Diamond Interchange

Based upon the terrain in the vicinity of the 20th Avenue SE alignment, it appears that a standard diamond interchange configuration would be the most economical concept and would be expected to accommodate the traffic volumes anticipated for the new interchange. The extension of 20th Avenue SE would include a new structure over I-29, and a three lane concept, at least through the ramp terminal intersections. The concept drawing of this improvement option is shown in **Figure 3.2**.

As shown in the figure, the southern ramps extend into the mainline horizontal curve on I-29. The layout and design of ramps on a horizontal curve should be fully evaluated during preliminary and final design to determine if this condition would create any operational or safety concerns. If this ramp alignment is determined to be undesirable, another option for this interchange would be to construct a folded diamond interchange, with loop ramps provided on the north side of 20th Avenue SE. This would permit the merge and diverge movements to occur almost entirely on the tangent section of I-29.

3.2.4 Opinion of Probable Cost

Construction costs for this concept are estimated at $10,560,000. The cost of this concept includes a new bridge over the Interstate as well as construction of ramps and ramp terminal intersections. The extension of 20th Avenue SE, between 29th Street SE and 41st Street SE are not included in this estimate. Project costs will be considerably higher once required Right-of-Way acquisition costs are incorporated into the final cost estimate. A detailed cost estimate for the diamond concept is shown in **Table 3.2**.

3.2.5 Environmental Review

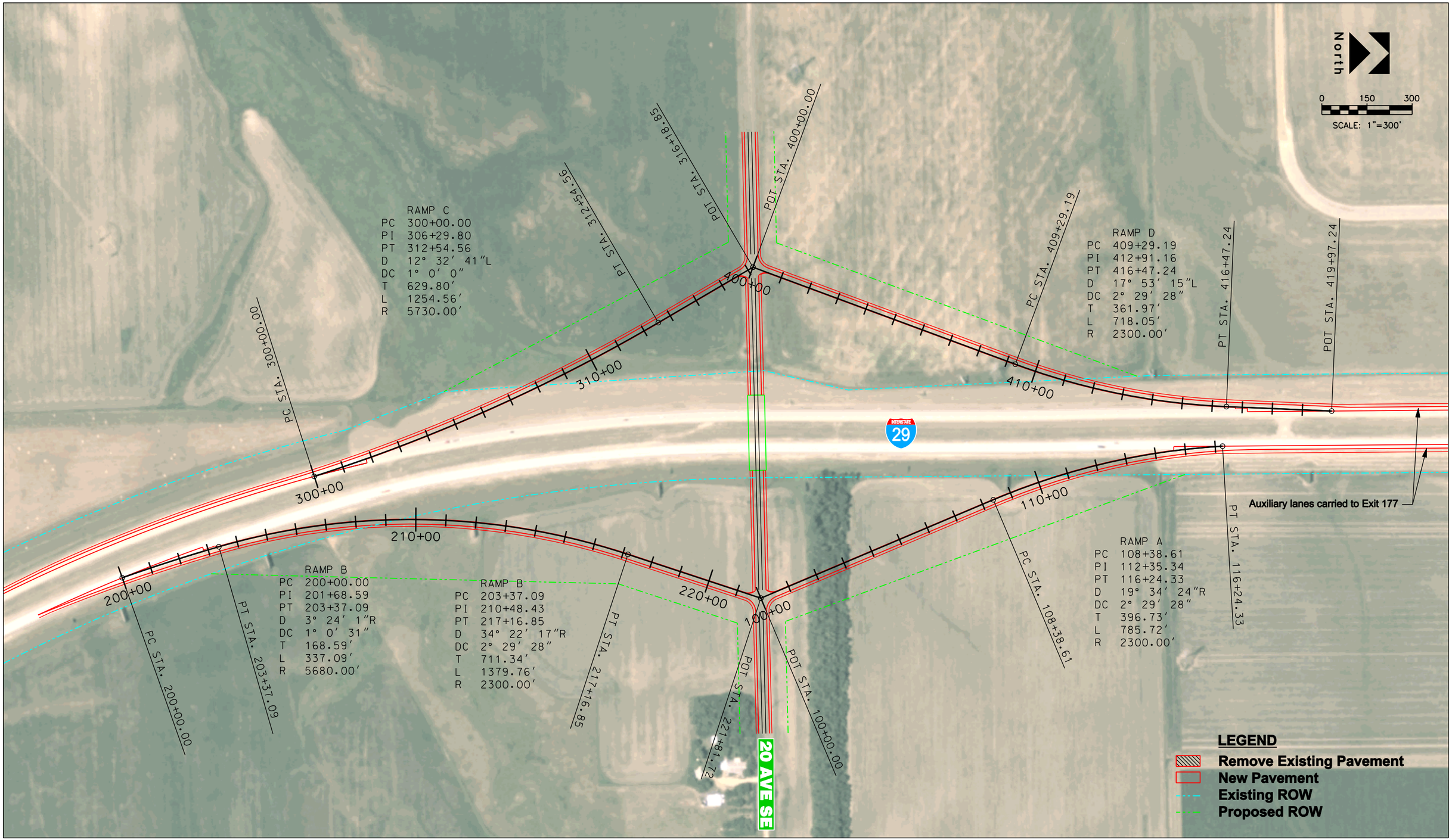
A cursory review of the interchange and surrounding area was conducted to identify potential environmental resources that may be affected by the project and could require further assessment during later stages of the project. The cursory review was conducted by reviewing aerial photography and FHU's in-house GIS data for the area.

Land use in the general area of the interchange consists primarily of agricultural cropland and one farmstead with associated buildings. Due to the proposed interchange alignment, right-of-way will need acquired and there is the potential that the agricultural land would be classified as Prime and Unique Farmland.

Other environmental resources that may require analysis include potential wetlands, noise, threatened/endangered species, cultural resources, and 4(f) and 6(f) resources in support of National Environmental Policy Act (NEPA) documentation prior to final design and construction activities. However, none of the proposed alternative concepts are anticipated to significantly impact these environmental resources.

Supporting Exit 175 materials follow:

Figure 3.2	I-29 Exit 175 Alternative 1 Diamond Interchange
Table 3.2	I-29 Exit 175 Probable Construction Costs Alternative 1 Diamond Interchange



FELSBURG HOLT & ULLEVIG

CONCEPTUAL DESIGN

Figure 3.2
I-29 Exit 175 - Watertown
Alternative 1
Diamond Interchange

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Probable Construction Costs
I-29 Exit 175 - Alternative 1 Diamond Interchange

Item Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*
Mobilization	1	LUMP SUM	$301,000.00	$301,000
Traffic Control	1	LUMP SUM	$601,000.00	$601,000
Clearing	1	LUMP SUM	$120,000.00	$120,000
Removal of Concrete Pavement	-	SQ. YD.	$3.88	$0
Removal of Asphalt Pavement		SQ. YD.	$7.39	$0
Remove Bridge	-	SQ. FT.	$9.00	$0
Borrow, Unclassified Excavation	482,253	CU. YD.	$5.30	$2,556,905
Base Course	19,361	TON	$10.64	$205,946
Asphalt Composite		TON	$80.91	$0
PCC Pavement 8" (cross street)	9,861	SQ. YD.	$33.12	$326,617
PCC Pavement 8" (ramps)	32,528	SQ. YD.	$43.40	$1,411,548
Concrete Approach Slab	578	SQ. YD.	$188.34	$108,820
Bridges	14,000	SQ. FT.	$100.00	$1,400,000
Guard Rail	0	LF	$100.00	$0
Permanent Signing/Markings	1	LUMP SUM	$180,000.00	$180,000
Traffic Signal	0	EACH	$125,000.00	$0
Roadway Lighting	1	LUMP SUM	$120,000.00	$120,000
Drainage (18" RCP)	180	LF	$24.53	$4,415
Subtotal				$7,340,000
Contingencies	25%			$1,835,000
Total Probable Construction Costs				$9,180,000
Engineering, Administration	15%			$1,377,000
Total Project Costs				$10,560,000

Table 3.2
Probable Construction Costs
I-29 Exit 175 - Alternative 1
Diamond Interchange

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3.3 I-90 Exit 69 – Box Elder

3.3.1 Background Information

This potential new interchange would be located approximately 2¼ miles east of I-90 Exit 67. The location would provide enhanced access opportunities for future development, including the Black Hills Transload facility, a transportation terminal under construction south of Old Pennington County Highway 14/16. A new roadway would have to be constructed extending north from Old Highway 14/16 north to I-90 to serve the new interchange.

3.3.2 Traffic Evaluation

The Transload facility is the primary generator of vehicular traffic in the vicinity of the potential new Exit 69. Additional development may arise surrounding the new interchange. The project team held a telephone conversation with John Coolbaugh, the Chief Financial Officer of Black Hills Transload, to gauge the potential for new vehicle-trips to be generated by the proposed development.

Mr. Coolbaugh indicated that the facility is expected to accommodate the arrival of 2-5 railcars per day. The cargo in these railcars will be unloaded into tractor-trailers to be trucked to various destinations. It is estimated that cargo in each railcar would fill approximately 4 trucks. Assuming that 5 railcars per day are unloaded onto trucks, approximately 20 trucks per day would arrive at and depart from the Transload facility. It is likely that most or all of these truck trips would utilize I-90 to reach various destinations. Therefore, it is estimated that the Transload facility would produce a total of 40 truck trips per day, plus approximately 20 vehicle-trips for local staff to enter and exit the facility for a total of 60 vehicle-trips per day.

When spread throughout a day, 60 vehicle-trips per day is a relatively minor level of traffic, and would not alone justify construction of a new freeway interchange. Additional commercial and/or residential development in the interchange area could trigger a need for a new interchange. However, the project team is not aware of specific plans for such development levels at this time.

3.3.3 Conceptual Design

To evaluate the impacts of constructing a new Exit 69 interchange at this location, the project team developed the conceptual drawing shown on **Figure 3.3**. The interchange is shown as a conventional diamond interchange built to meet SDDOT Road Design Standards.

3.3.4 Opinion of Probable Cost

Construction costs for this concept are estimated at $9,820,000. The cost of this concept includes a new bridge over the Interstate as well as construction of ramps and ramp terminal intersections. The extension of a new Crossroad south from the interchange is included in this estimate. Project costs will be considerably higher once required Right-of-Way acquisition costs

are incorporated into the final cost estimate. A detailed cost estimate for the diamond concept is shown in **Table 3.3**.

3.3.5 Environmental Review

A cursory review of the interchange and surrounding area was conducted to identify potential environmental resources that may be affected by the project and could require further assessment during later stages of the project. The cursory review was conducted by reviewing aerial photography and FHU's in-house GIS data for the area. Land use in the general area of the interchange is undeveloped. What appears to be a farm property is located to the northwest of the interchange. Based on the conceptual design for Alternative 1, the primary possible environmental issue identified includes the presence of several drainages with potential wetlands located in the vicinity of the interchange.

Other environmental resources that may require future analysis in support of National Environmental Policy Act (NEPA) documentation include prime and unique farmlands, air, noise, threatened/endangered species, cultural resources, and 4(f) and 6(f) resources.

Supporting Exit 69 materials follow:

Figure 3.3	I-90 Exit 69 Alternative 1 Diamond Interchange
Table 3.3	I-90 Exit 69 Probable Construction Costs Alternative 1 Diamond Interchange

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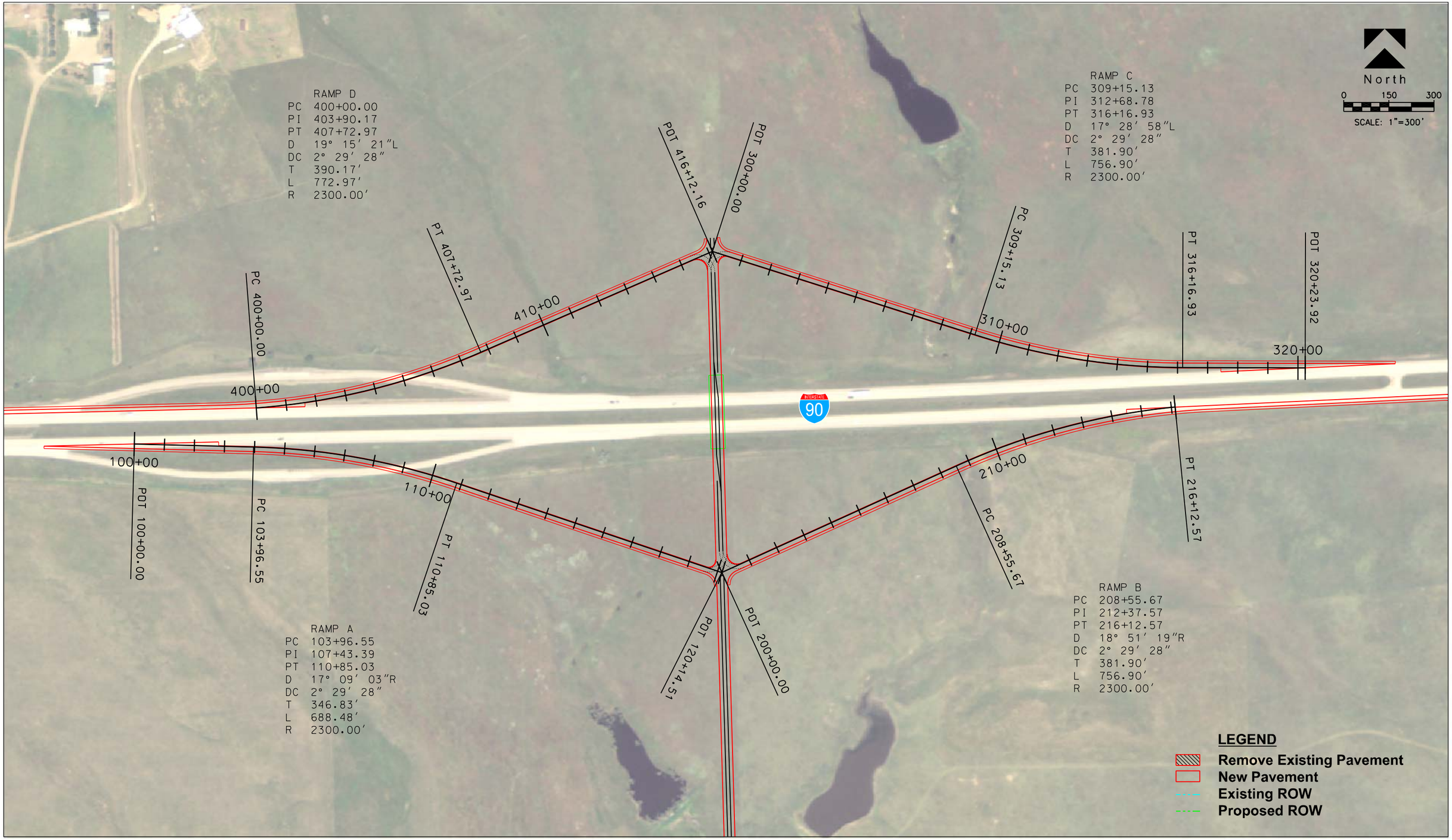

FELSBURG HOLT & ULLEVIG

CONCEPTUAL DESIGN

Figure 3.3
I-90 Exit 69 - Box Elder
Alternative 1
Diamond Interchange

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Probable Construction Costs
Potential New I-90 Exit 69 - Diamond

Item Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*
Mobilization	1	LUMP SUM	$280,000.00	$280,000
Traffic Control	1	LUMP SUM	$560,000.00	$560,000
Clearing	1	LUMP SUM	$112,000.00	$112,000
Removal of Concrete Pavement	-	SQ. YD.	$3.88	$0
Removal of Asphalt Pavement	4,978	SQ. YD.	$7.39	$36,799
Remove Bridge	-	SQ. FT.	$9.00	$0
Borrow, Unclassified Excavation	502,050	CU. YD.	$5.30	$2,661,871
Base Course	17,911	TON	$10.64	$190,524
Asphalt Composite	17,911	TON	$80.91	$1,449,126
PCC Pavement 11" (mainline)	-	SQ. YD.	$33.12	$0
PCC Pavement 8" (ramps)	-	SQ. YD.	$43.40	$0
Concrete Approach Slab	400	SQ. YD.	$188.34	$75,337
Bridges	11,760	SQ. FT.	$100.00	$1,176,000
Guard Rail	0	LF	$100.00	$0
Permanent Signing/Markings	1	LUMP SUM	$170,000.00	$170,000
Traffic Signal	0	EACH	$125,000.00	$0
Roadway Lighting	1	LUMP SUM	$110,000.00	$110,000
Drainage (18" RCP)	240	LF	$24.53	$5,887
Subtotal				$6,830,000
Contingencies	25%			$1,707,500
Total Probable Construction Costs				$8,540,000
Engineering, Administration	15%			$1,281,000
Total Project Costs				$9,820,000

Table 3.3
Probable Construction Costs
Potential New I-90 Exit 69
Diamond Interchange

FELSBURG HOLT & ULLEVIG

3.4 I-90 Exit 393 – Ellis Road, Sioux Falls

3.4.1 Background

Location Description

An additional interchange on I-90 at Ellis Road has been considered to provide additional access to the west side of Sioux Falls. Ellis Road does not currently extend up to I-90, however, the Ellis Road alignment is located approximately three miles west of the I-29/I-90 systems interchange.

Previous Planning Efforts

The Sioux Falls Metropolitan Planning Organization commissioned HDR to conduct a study to plan for a potential roadway on the western edge of the City. The ***West Side Corridor Study***, completed in 2004, evaluated the benefits and impacts of several alternative roadway locations and connections to I-90. The study indicated a preferred alignment halfway between La Mesa Road and Ellis Road. An alternative location was identified at the La Mesa Road location, which is approximately two miles from the I-29/I-90 systems interchange. The City of Sioux Falls and the Metropolitan Planning Organization (MPO) are now exploring the more traditional arterial street network expansion versus a regional network (West Side Corridor). This is due to new floodway boundary determinations that change the bridge span length requirements over Skunk Creek, and a property owner along the corridor who has been continuing denial of access, which prohibits the agencies from completing the archeological study portion of the EA. Therefore, as part of the Sioux Falls MPO Long Range Transportation Plan, the agencies have been exploring alternatives to meet their long term transportation goals. The emerging idea is that the existing Ellis Road corridor best provides the I-90 access for this alternative.

A new interchange is currently under construction at Marion Road, located approximately one mile west of the systems interchange. Concern was expressed about the interchange spacing with the potential La Mesa Drive location. If the proposed interchange is constructed at the Ellis Road alignment, two mile spacing would be provided from both the future Marion Road and three miles from the existing SD 38 interchange.

3.4.2 Traffic Evaluation

The purpose of this Phase 2 investigation is to determine a potential configuration for an interchange on the Ellis Road alignment, to identify the right-of-way required and to develop an estimated construction cost. If the construction of a West Side Corridor continues, traffic forecasts and a detailed traffic operations analysis must be conducted to determine the final configuration and traffic control required to provide acceptable traffic operations.

3.4.3 Conceptual Design

Alternative 1 – Folded Diamond (Parclo A) Interchange

Due to the presence of a farmstead located in the northwest quadrant of the proposed interchange, and an electrical substation in the southeast quadrant, a concept was developed to minimize impacts to both of these properties. A folded diamond configuration, with the loops provided in the northeast and southwest quadrants was developed and is shown in **Figure 3.4**. The concept includes the construction of a new bridge over I-90 and the construction of a three lane road through the interchange ramp terminals. It is assumed that the extension of Ellis Road, north of 60th Street, would be constructed.

3.4.4 Opinion of Probable Cost

Construction costs for this concept are estimated at $11,300,000. The cost of this concept includes a new bridge over the Interstate as well as construction of ramps and ramp terminal intersections. The estimated Right-of-Way required to construct this interchange is approximately 36 acres. Project costs will be considerably higher once required Right-of-Way acquisition costs are incorporated into the final cost estimate. A detailed cost estimate for the folded diamond concept is included in **Table 3.3**.

3.4.5 Environmental Review

A cursory review of the interchange and surrounding area was conducted to identify potential environmental resources that may be affected by the project and could require further assessment during later stages of the project. The cursory review was conducted by reviewing aerial photography and FHU's in-house GIS data for the area.

Land use in the general area of the interchange consists primarily of agricultural land, including a farmstead with outbuildings in the northwest quadrant of the interchange. There appears to be a potential wetland in the southwest quadrant of the interchange, immediately adjacent to the eastbound off-ramp. The northeastern portion of South Dakota is within the Prairie Pothole Region and the occurrence of wetlands is likely. Other water resources in the area include Willow Creek and its associated floodplain. Due to the proposed interchange alignment, right-of-way will need acquired and there is the potential that the agricultural land would be classified as Prime and Unique Farmland.

Other environmental resources that may require analysis in addition to those mentioned above include noise, threatened/endangered species, cultural resources, and 4(f) and 6(f) resources in support of National Environmental Policy Act (NEPA) documentation prior to final design and construction activities.

Supporting Exit 393 materials follow:

Figure 3.4	I-90 Exit 393 Alternative 1 Folded Diamond Interchange
Table 3.4	I-90 Exit 393 Probable Construction Costs Alternative 1 Folded Diamond Interchange

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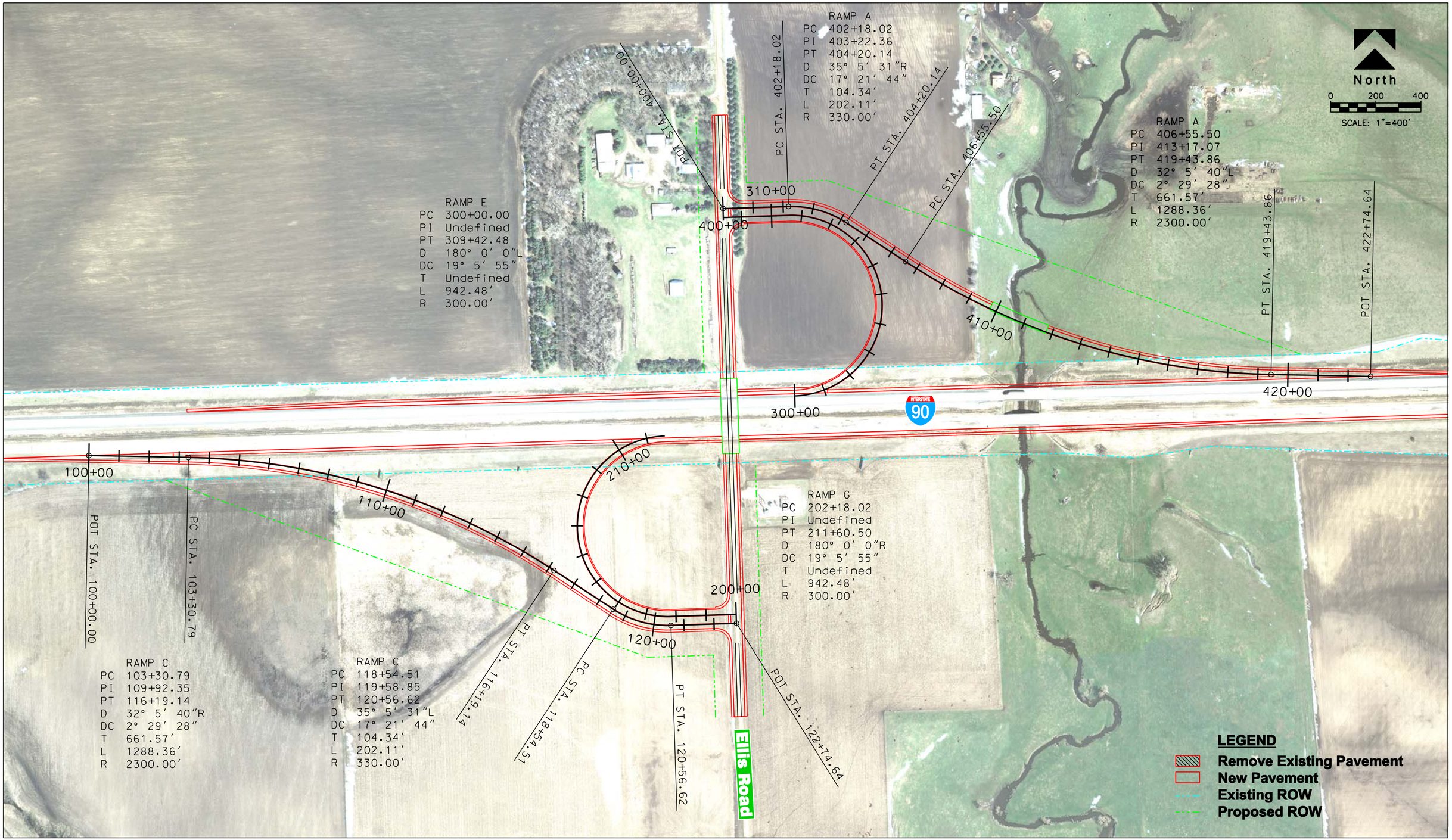
RAMP A
PC 402+18.02
PI 403+22.36
PT 404+20.14
D 35° 5′ 31″R
DC 17° 21′ 44″
T 104.34′
L 202.11′
R 330.00′
RAMP A
PC 406+55.50
PI 413+17.07
PT 419+43.86
D 32° 5′ 40″L
DC 2° 29′ 28″
T 661.57′
L 1288.36′
R 2300.00′
RAMP E
PC 300+00.00
PI Undefined
PT 309+42.48
D 180° 0′ 0″L
DC 19° 5′ 55″
T Undefined
L 942.48′
R 300.00′
RAMP C
PC 103+30.79
PI 109+92.35
PT 116+19.14
D 32° 5′ 40″R
DC 2° 29′ 28″
T 661.57′
L 1288.36′
R 2300.00′
RAMP C
PC 118+54.51
PI 119+58.85
PT 120+56.62
D 35° 5′ 31″L
DC 17° 21′ 44″
T 104.34′
L 202.11′
R 330.00′
RAMP G
PC 202+18.02
PI Undefined
PT 211+60.50
D 180° 0′ 0″R
DC 19° 5′ 55″
T Undefined
L 942.48′
R 300.00′
POM STA. 400+00.00
PC STA. 402+18.02
PT STA. 404+20.14
PC STA. 406+55.50
PT STA. 419+43.86
POT STA. 422+74.64
POT STA. 100+00.00
PC STA. 103+30.79
PT STA. 116+19.14
PC STA. 118+54.51
PT STA. 120+56.62
POT STA. 122+74.64
100+00
110+00
120+00
200+00
210+00
300+00
310+00
400+00
410+00
420+00
INTERSTATE
90
Ellis Road
North
0 200 400
SCALE: 1"=400'
LEGEND
Remove Existing Pavement
New Pavement
Existing ROW
Proposed ROW

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Probable Construction Costs
I-90 Exit 393 - Alternative 1 Folded Diamond Interchange

Item Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*
Mobilization	1	LUMP SUM	$322,000.00	$322,000
Traffic Control	1	LUMP SUM	$644,000.00	$644,000
Clearing	1	LUMP SUM	$129,000.00	$129,000
Removal of Concrete Pavement	-	SQ. YD.	$3.88	$0
Removal of Asphalt Pavement		SQ. YD.	$7.39	$0
Remove Bridge	-	SQ. FT.	$9.00	$0
Borrow, Unclassified Excavation	483,691	CU. YD.	$5.30	$2,564,528
Base Course	17,324	TON	$10.64	$184,280
Asphalt Composite		TON	$80.91	$0
PCC Pavement 8" (cross street)	9,867	SQ. YD.	$33.12	$326,808
PCC Pavement 8" (ramps)	28,063	SQ. YD.	$43.40	$1,217,785
Concrete Approach Slab	856	SQ. YD.	$188.34	$161,137
Bridges	19,837	SQ. FT.	$100.00	$1,983,700
Guard Rail	0	LF	$100.00	$0
Permanent Signing/Markings	1	LUMP SUM	$190,000.00	$190,000
Traffic Signal	0	EACH	$125,000.00	$0
Roadway Lighting	1	LUMP SUM	$130,000.00	$130,000
Drainage (18" RCP)	180	LF	$24.53	$4,415
Subtotal				$7,860,000
Contingencies	25%			$1,965,000
Total Probable Construction Costs				$9,830,000
Engineering, Administration	15%			$1,474,500
Total Project Costs				$11,300,000

Table 3.4
Probable Construction Costs
I-90 Exit 393- Alternative 1
Folded Diamond Interchange

FELSBURG HOLT & ULLEVIG

3.5 I-90 Exit 398 – Minnesota Avenue, Sioux Falls

3.5.1 Background

Location Description

An additional interchange on I-90, between the I-29 systems interchange and the Cliff Avenue service interchange has been proposed by a developer provide additional access to the commercial and industrial areas along the Interstate corridor. The Cliff Avenue interchange is located approximately three miles east of the I-29 systems interchange.

Previous Planning Efforts

In June 2007, HDR completed the ***I-90 Interchange Analysis, from I-29 to Cliff Avenue*** for Red Stone Development, Inc. The study identified a variety of alternative concepts to provide direct access to I-90 and improve traffic circulation for the existing and future developments along the Interstate corridor, between 60th Street and 72nd Street. A total of eleven interchange options were developed for this study, with eight options at Kiwanis Avenue (actually at a location approximately ½ mile east of Kiwanis) and three options at Minnesota Avenue. This evaluation will focus on the proposed concepts identified for the Minnesota Avenue alignment.

3.5.2 Traffic Evaluation

The focus of this evaluation is to determine if there are acceptable interchange configurations to provide an additional access to I-90 between the I-29 systems interchange and Cliff Avenue. Traffic forecasts and operational analyses were not provided in the previous study. If a concept is determined to be feasible, a more detailed Interchange Justification Study would be required to provide that information.

3.5.3 Conceptual Design

A brief evaluation of each of the three alternative concepts developed for the Minnesota Avenue interchange is provided in the following sections:

Alternative M1 – Split Cloverleaf Interchange

This concept provides a loop ramp in each quadrant of the interchange, with a conventional signalized intersection at the ramp terminal on an extended alignment of Minnesota Avenue. The concept drawing of this potential new interchange option is shown in Figure 3.5. This configuration, while providing full movement access from Minnesota Avenue to I-90, has several negative aspects, including:

- The construction of long, twin bridges on I-90 to span both the extended Minnesota Avenue and Silver Creek.
- Bridges would be required over Silver Creek for both the eastbound on-ramp and the westbound off-ramp.

- Short weaving distance provided on the I-90 mainline between the on-ramp and off-ramp movements in both directions.
- The amount of fill required for the loop ramp in the northeast quadrant would likely impact both the small lake inside the loop and the D&I Railroad line located immediately to the east.
- The entire interchange and the extended portion of Minnesota Avenue are located within the floodway of Big Sioux River.

With this type of interchange, the recommended configuration would include the construction of a collector-distributor (CD) road paralleling the Interstate mainline. This would allow the weaving movements between the on and off-ramps to occur at lower speeds with lower volumes, thereby eliminating the impact to through movements. Unfortunately, the construction of a CD road through this interchange location would be very expensive, requiring two new bridges over the D&I Railroad, two new bridges over Minnesota Avenue and two new bridges over Silver Creek.

Alternative M2 – North Side Split Cloverleaf and South Side Folded Diamond

This concept is similar to the previous configuration on the north side of I-90. On the south side, a folded diamond configuration is proposed. The loop ramp in the southeast quadrant would remain the same as in the previous concept, and a direct on-ramp is provided for eastbound traffic. The concept drawing of this potential new interchange option is shown on Figure 3.6. As a result, many of the concerns raised with Alternative M1 are present with this concept as well. These concerns include:

- The construction of long, twin bridges on I-90 to span both the extended Minnesota Avenue and Silver Creek.
- Bridges over Silver Creek for the westbound off-ramp.
- Short weaving distance provided on the I-90 mainline between the on-ramp and off-ramp movements in the westbound direction.
- The amount of fill required for the loop ramp in the northeast quadrant would likely impact both the small lake inside the loop and the D&I Railroad line located immediately to the east.
- The entire interchange and the extended portion of Minnesota Avenue are located within the floodway of Big Sioux River.
- A new bridge over the D&I Railroad for the eastbound on-ramp, which will require raising the grade on the extension of Minnesota Avenue to provide enough clearance over the railroad.
- The distance between the gore areas of the eastbound on-ramp at Minnesota Avenue and the eastbound off-ramp at Cliff Avenue is reduced to approximately 1,500 feet, providing a relatively short weaving section.

Alternative M3 – North Side Standard Diamond and South Side Folded Diamond

This concept includes shifting the alignment of Minnesota Avenue approximately 0.3 miles to the west, to the North Dike Road alignment. This provides additional spacing from the Cliff Avenue interchange, resulting in a more conventional interchange configuration. On the north side of I-90, a standard diamond interchange configuration is proposed, with direct ramps to and from the westbound mainline. On the south side, a folded diamond configuration is proposed. The concept drawing of this potential new interchange option is shown on Figure 3.7. While this is a more standard interchange layout, the following concerns are raised:

- The construction of new twin bridges on I-90 would be required to span the realigned Minnesota Avenue.
- Bridges would be required over Silver Creek for both the eastbound on-ramp and the westbound off-ramp.
- Bridges would be required over the D&I Railroad for both the eastbound on-ramp and the westbound off-ramp.
- The entire interchange and the extended portion of Minnesota Avenue are located within the floodway of Big Sioux River.
- A new bridge over the D&I Railroad for the eastbound on-ramp, which will require raising the grade on the extension of Minnesota Avenue to provide enough clearance over the railroad.
- The realignment of Minnesota Avenue north of 60th Street would result in a jog of nearly 1,600 feet, which disturb the north/south continuity of the Minnesota Avenue corridor.

Recommendations

Based upon this review of the concepts developed in the ***I-90 Interchange Analysis, from I-29 to Cliff Avenue***, it appears that each of the three configurations described in the previous sections result in some significant geometric, operational and environmental impacts. The constraints imposed by such features as the floodway of the Big Sioux River, the D&I Railroad, existing development and the proximity of the I-90/I-29 systems interchange to the Cliff Avenue interchange limit the feasible options for additional access along this section of I-90.

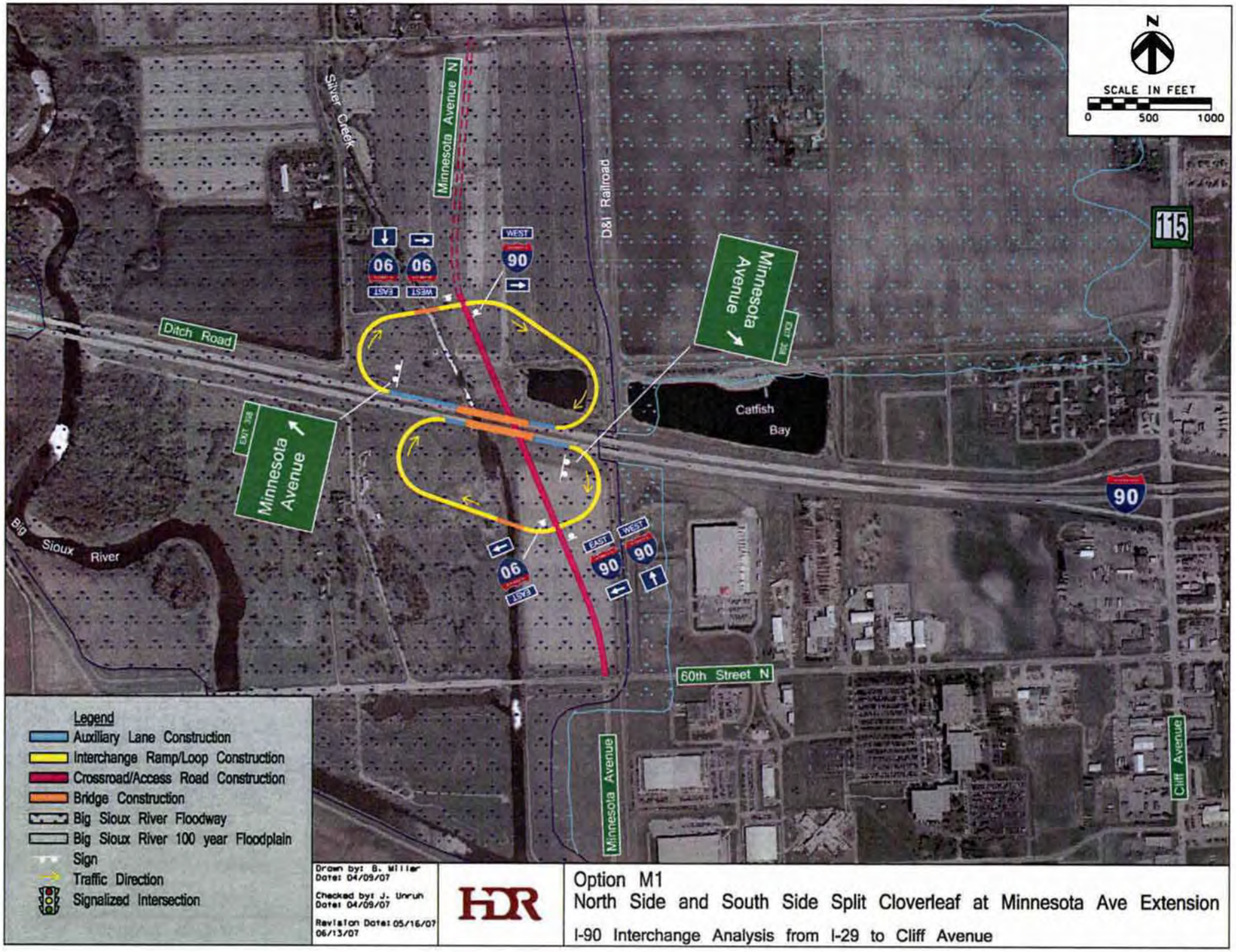
A more viable approach may be to develop the local roadway network to improve access to the Interstate system. The I-29 interchange with 60th Street was recently reconstructed to improve capacity and meet current design criteria, and the I-90 interchange with Cliff Avenue is programmed for reconstruction as well. Additional roadway network improvements to improve access and circulation in this area may include:

- Improvements to 60th Street, from I-29 to Cliff Avenue to better accommodate increased vehicular and truck traffic.
- Improvement to Kiwanis Avenue over I-90 to better accommodate increased vehicular and truck traffic.
- Extension of Minnesota Avenue across I-90 to 72nd Street.

- Improvements to 72nd Street, from Kiwanis Avenue to Cliff Avenue
- Improvements to Cliff Avenue, from 60th Street to 72nd Street.

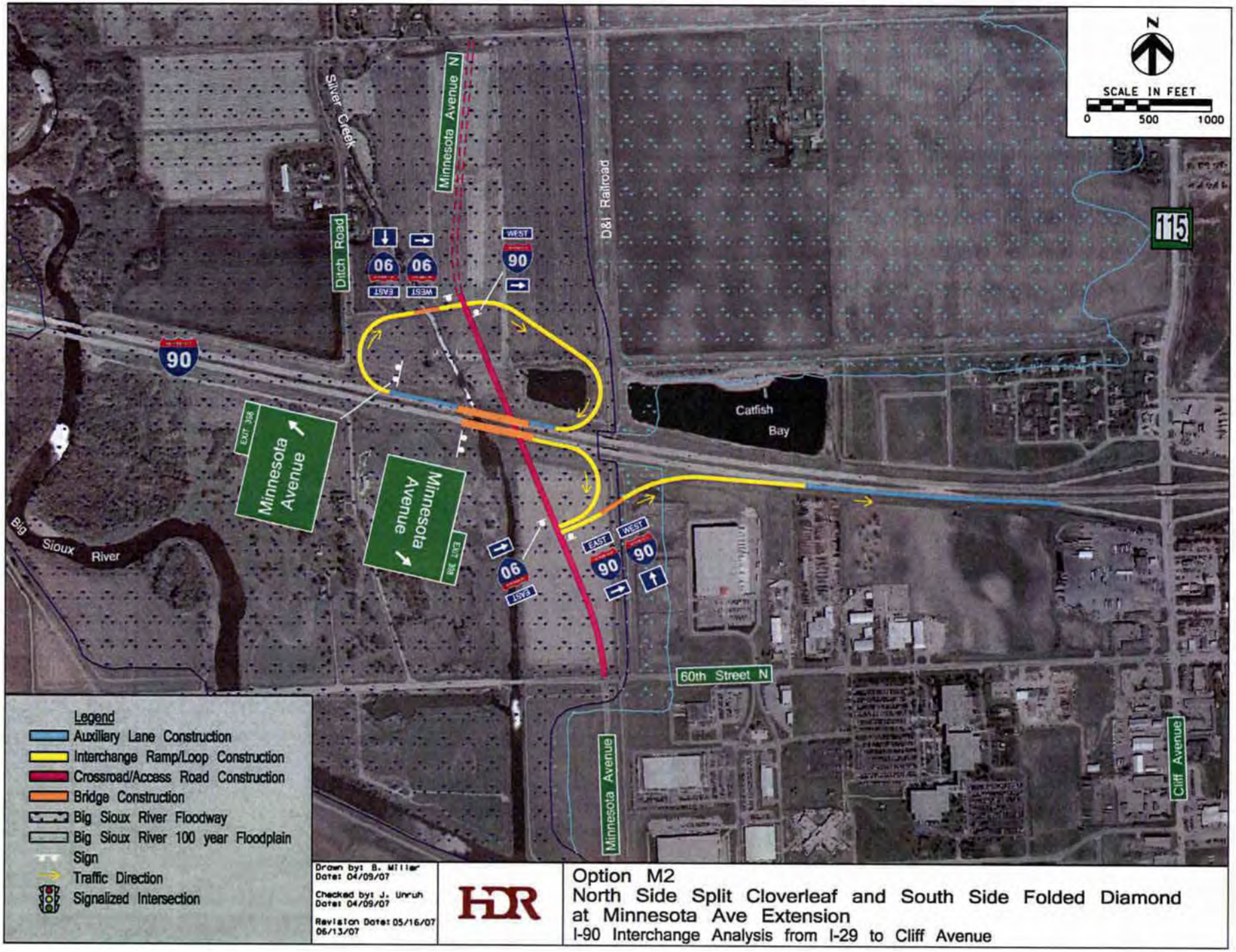
Supporting Exit 398 Figures follow, adapted from I-90 Interchange Analysis from I-29 to Cliff Avenue in Sioux Falls, SD (HDR, 2007):

Figure 3.5	I-90 Exit 398 Option M1 North Side and South Side Split Cloverleaf Interchange
Figure 3.6	I-90 Exit 398 Option M2 North Side Split Cloverleaf and South Side Folded Diamond Interchange
Figure 3.7	I-90 Exit 398 Option M3 North Side Standard Diamond and SE Quadrant Loops Interchange



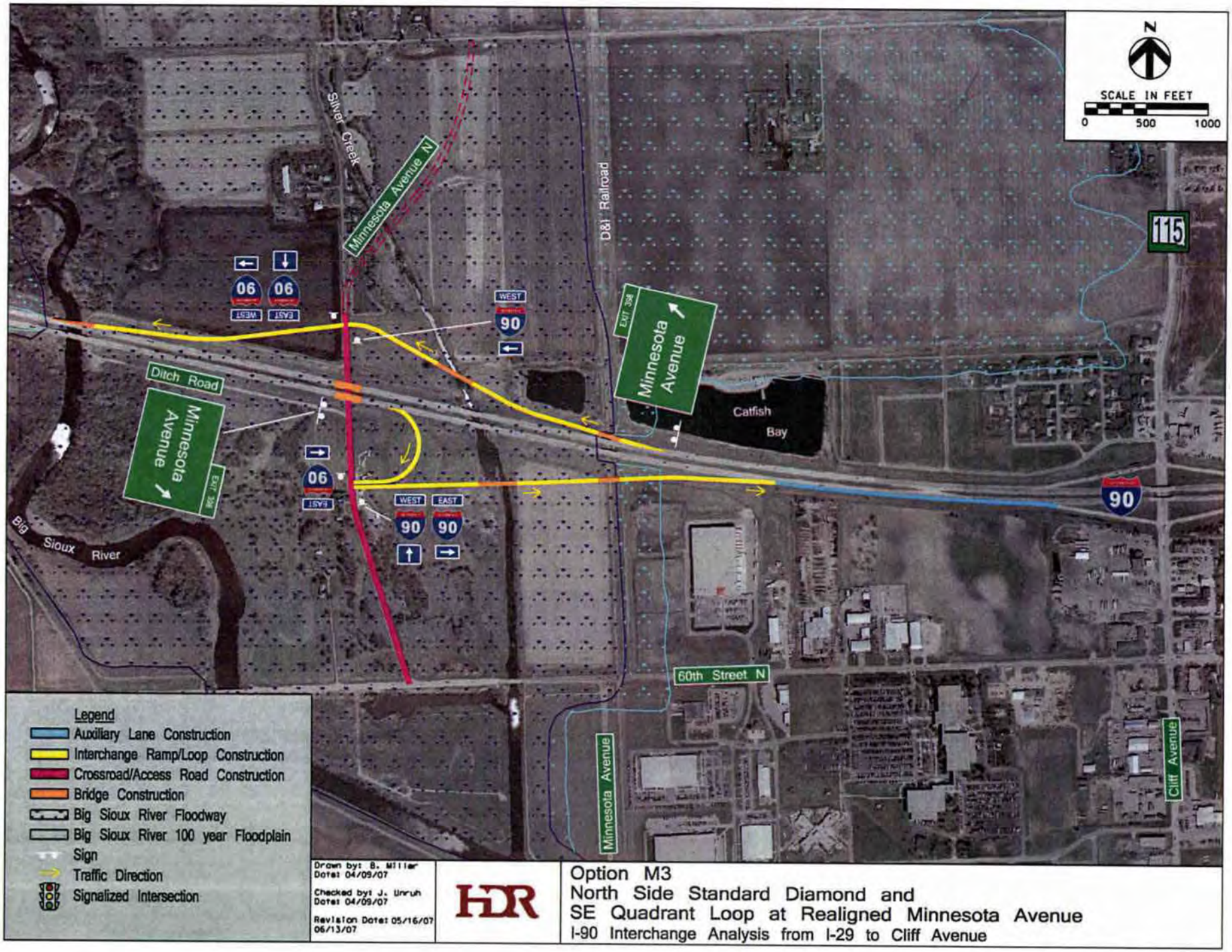
Note: Graphics Provided by HDR from I-90 Interchange Analysis from I-29 to Cliff Avenue in Sioux Falls, SD

Figure 3.5



Note: Graphics Provided by HDR from I-90 Interchange Analysis from I-29 to Cliff Avenue in Sioux Falls, SD

Figure 3.6



Note: Graphics Provided by HDR from I-90 Interchange Analysis from I-29 to Cliff Avenue in Sioux Falls, SD

Figure 3.7

engineering paths to transportation solutions

6300 S. Syracuse Way, Suite 600 Centennial, CO 80111
303.721.1440 303.721.0832 fax
www.fhueng.com