2020 South Dakota Decennial Interstate Corridor Study

SD DOT

Phase Two Report

September 2021

prepared by:

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SOUTH DAKOTA DOT 2020 DECENNIAL INTERSTATE CORRIDOR STUDY

Phase 2 Report

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South Dakota DOT 2020 Decennial ICS

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EXECUTIVE SUMMARY

The South Dakota Department of Transportation (SDDOT) retained Felsburg Holt & Ullevig (FHU) to conduct an analysis of the Interstate System. The study focuses on continuing to provide an Interstate System in South Dakota that provides acceptable traffic operations, maximizes roadway safety and compliance with road design standards, and maintains acceptable bridge condition.

Phase 1 of the study provides an inventory of the statewide Interstate System, noting locations where road design, safety or operational problems are occurring or are expected to occur in the 30-year future scenario. The Phase 1 effort resulted in a comprehensive list of locations with needs throughout the system. A subset of 12 existing interchanges with identified needs has been advanced to Phase 2 for more detailed evaluation of potential solutions. In addition, four potential new interchange locations are evaluated for feasibility.

ES.1 Phase 2 Overview

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

- Traffic operations analyses (updated traffic counts, forecasts, and/or Levels of Service)
- Conceptual design drawings for options being considered
- Evaluations that describe the performance of each option across a range of categories and support the SDDOT in taking next steps with each interchange
- Probable costs for each option

The existing interchanges evaluated in this Phase 2 report are:

- I-29 Exit 1 – Dakota Dunes
- I-29 Exit 2 – North Sioux City
- I-29 Exit 4 – McCook Lake
- I-29 Exit 26 – Vermillion/Yankton
- I-29 Exit 59 – Davis
- I-29 Exit 86 – Renner/Crooks
- I-90 Exit 10 – North Avenue/Belle Fourche
- I-90 Exit 17 – Lead/Deadwood
- I-90 Exit 48 – Stage Stop Canyon Road
- I-90 Exit 55 – Deadwood Avenue
- I-90 Exit 110 – Wall/Badlands Loop
- I-90 Exit 112 – Philip/Pierre

Potential new interchange locations evaluated as a part of Phase 2 include:

- I-29 Exit 87 – Crooks, 257th Street
- I-29 Exit 88 – Crooks, 256th Street
- I-29 Exit 89 – Crooks, 255th Street
- I-90 Exit 16 – Rainbow Road, Spearfish
- I-90 Exit 264 – Chamberlain
- I-90 Exit 404 – Brandon
- I-90 Exit 408 – Brandon

ES.2 Summary of Options

Table ES-1 provides a summary of options for each location.

Results of this Phase 2 evaluation identify a range of approximately $82 million to $207 million to implement improvements at the existing interchanges. Construction of the potential future interchanges could require up to $178 million.

Phase 3 of the study will group and prioritize upcoming projects based on the results of Phases 1 and 2.

Table ES-1. Summary of Phase 2 Interchange Options

Interchange	Options	Probable Construction Cost
I-29 Exit 1 Dakota Dunes	Option 1: Signalization of SB Ramp Terminal	$700,000
	Option 2: Offset Single Point Urban Interchange (SPUI)	$34.2 Million
	Option 3: SPUI with SB On-Ramp Retained	$34.3 Million
I-29 Exit 2 River Drive North Sioux City	Option 1: Signalization of SB Ramp Terminal	$2.9 Million
	Option 2: Signalization of SB Ramp Terminal	$2.5 Million
	Option 3: Single Point Urban Interchange (SPUI)	$19.5 Million
I-29 Exit 4 McCook Lake	Option 1: Bridge Widening and Ramp Terminal Realignment	$7.9 Million
I-29 Exit 26 Vermillion/Yankton	Option 1: Signalization of NB Ramp and Modifications to Shoulders/Clear Zone	$8.1 Million
I-29 Exit 59 Davis	Option 1: Diamond Interchange Reconstruction	$20.6 Million
I-29 Exit 86 Renner/Crooks	Option 1: Bridge Widening and Turn Lane Additions	$8.4 Million
	Option 2: Single Point Urban Interchange (SPUI)	$32.2 Million
I-90 Exit 10 North Avenue/Belle Fourche	Option 1: Signalization of EB/WB Ramp Intersections, Median U-Turn, Ramp Modifications	$4.8 Million
	Option 2: Signalization of EB/WB Ramp Intersections, Brookview Road Bridge over I-90, Ramp Modifications	$10.9 Million
	Option 3: Offset Single Point Urban Interchange (SPUI)	$25.1 Million

Table ES-1. Summary of Phase 2 Interchange Options

Interchange	Options	Probable Construction Cost
I-90 Exit 17 Lead/Deadwood	Option 1: Signalization of EB/WB Ramp Intersections and Ramp Improvements	$1.1 Million
	Option 2: Diverging Diamond Interchange (DDI)	$11.2 Million
I-90 Exit 48 Stage Stop Canyon Road	Option 1: Interstate and Ramp Modifications	$9.7 Million
	Option 2: Crossroad Realignment	$19.2 Million
	Option 3: Single Point Urban Interchange (SPUI)	$27.3 Million
I-90 Exit 55 Deadwood Avenue	Option 1: Ramp Modifications	$2.1 Million
I-90 Exit 110 Wall/Badlands Loop	Option 1: Ramp Terminal and Shoulder Modifications	$200,000
I-90 Exit 112 Philip/Pierre	Option 1: Bridge Removal and US14 Realignment	$16.3 Million
	Option 2: Bridge Removal with US14 Realignment, New Ramp and Signalization	$20.4 Million
I-29 Exit 87 Crooks 257th Street	Option 1: Diamond Interchange	$26.6 Million
I-29 Exit 88 Crooks 256th Street	Option 1: Diamond Interchange	$39.5 Million
I-29 Exit 89 Crooks 255th Street	Option 1: Diamond Interchange	$24.5 Million
I-90 Exit 16 Rainbow Rd/Spearfish	Option 1: Folded Diamond Interchange	$46.6 Million
I-90 Exit 264 Chamberlain	Option 1: Folded Diamond Interchange	$32.6 Million
I-90 Exit 404 Brandon	Option 1: Diamond Interchange	$36.6 Million
I-90 Exit 408 Brandon	Option 1: Diamond Interchange	$22.6 Million

1. INTRODUCTION

The South Dakota Department of Transportation (SDDOT) and the Study Advisory Team (SAT) are conducting a study that focuses on ensuring a mainline Level of Service (LOS) of B or better throughout the rural Interstate System and LOS C or better throughout the urban Interstate System and identifying areas not in compliance with current Interstate design standards. The study is expected to:

- Complete a traffic LOS analysis for both existing and future conditions on the Interstate System mainline and interchanges.
- Identify locations on the Interstate System not in compliance with current design standards under both the current and predicted future traffic conditions.
- Identify bridges on the Interstate System that will need bridge replacement before 2035.
- Develop feasible solutions to address the portions of the Interstate System that fail to meet current design standards and/or traffic LOS expectations under both the current and predicted future traffic conditions.
- Create a final product for use by SDDOT that will guide the Department in the prioritization implementation of recommended improvements.

This study builds on both the Year 2000 and the Year 2010 study efforts, in addition to incorporating several new evaluations. Phase 1 of the study, completed in November 2020, provided an inventory of the statewide Interstate System, noting locations where road design, safety or operational problems are occurring or are expected to occur in the 30-year future scenario. The Phase 1 effort resulted in a comprehensive list of locations with needs throughout the system. A subset of 12 existing interchanges with identified needs has been advanced to Phase 2 for more detailed evaluation of potential solutions. In addition, four potential new interchange locations are evaluated for feasibility.

1.1 Improvements Constructed Since the 2010 Study

Since the time of the 2010 ICS, several existing interchanges have been reconstructed or are currently under construction:

- I-29 Exit 62 – Canton (2016)
- I-29 Exit 75 – I-229 (2017)
- I-29 Exit 98 – Dell Rapids (2018)
- I-90 Exit 14 – US14A / 27th Street, Spearfish (2018)
- I-90 Exit 44 – Piedmont (2019)
- I-90 Exit 399 – Cliff Avenue (2013)
- I-90 Exit 402 – Veterans Parkway (2019)
- I-190 Exit 1 – Silver Street (2017)
- I-229 Exit 5 – 26th Street (currently under construction)

1.2 Recent and Ongoing Interchange Studies

Since the completion of the 2010 Decennial ICS, several existing and proposed interchange locations have been studied in greater detail. Many of these studies 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.

1.2.1 Recent Interchange Studies

- I-29 Exit 62 (US 18 / Canton) – September 2014
- I-29 Exit 74 / I-229 Exit 0 (85th Street, Sioux Falls / Tea) – October 2018
- I-29 Exit 75 / I-229 Exit 1A / 1B (System Interchange, Sioux Falls) – February 2014
- I-29 Exit 77 (41st Street, Sioux Falls) – October 2017
- I-29 Exit 83 Feasibility Study (SD38 / 60th Street N, Sioux Falls) – April 2017
- I-29 Exit 98 (SD115 / Dell Rapids) – February 2015
- I-29 Exit 130 (20th Street South, Brookings) IJR – November 2020
- I-90 Exit 14 (US14A / 27th Street, Spearfish) – October 2013
- I-90 Exit 34 – Black Hills National Cemetery IMJR – March 2021
- I-90 Exit 37 (Pleasant Valley Road, Meade County) – December 2019
- I-90 Exit 44 (Bethlehem Road, Meade County) – February 2014
- I-90 Exit 46 (Elk Creek Road) Interchange Study – April 2016
- I-90 Exit 59 (La Crosse Street, Rapid City) – April 2014
- I-90 Exit 387 (Hartford) Interchange Study – January 2020
- I-90 Exit 399 (Cliff Street, Sioux Falls) – February 2011
- I-90 Exit 402 (Timberline Road / EROS, Minnehaha County) – June 2014
- I-90 Exit 406 (SD11 / Corson / Brandon, Brandon) – September 2018
- I-190 Exit 1 (Silver Street, Rapid City) – December 2011
- I-229 Exit 5 (26th Street, Sioux Falls) – October 2014
- I-229 Exit 9 (Benson Rd) Interchange Study – January 2019

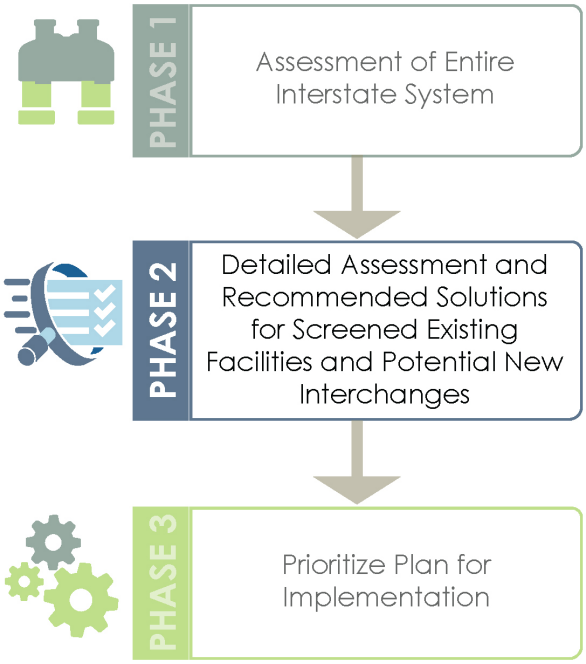
1.2.2 Recent Corridor Studies

- I-29 Exit 62 to Exit 73 Corridor Study – July 2018
- I-29 Exit 73 to Exit 77 Corridor Study – December 2010
- I-29 Exit 77 Crossroad Corridor Study – June 2012
- US14A Corridor Study (Spearfish, including I-90 Exit 14) – March 2012
- I-90 Exit 32 to Exit 40 Corridor Study – October 2019
- I-90 Exit 61 to Exit 67 Corridor Study – December 2017
- I-190 Corridor / Silver Street Interchange Study, Rapid City – June 2012
- I-229 Major Investment Corridor Study – June 2017

1.2.3 Ongoing Studies

- I-90 Exit 63 (Box Elder / Ellsworth AFB) Interchange Study
- I-229 Exit 3 (Minnesota Ave) and Exit 4 (Cliff Ave) Interchange Study (IMJR's approved)
- I-229 Exit 6 (10th Street) Interchange Study

1.3 Phase 2 Study Process



As in previous editions, the 2020 Decennial ICS is being conducted in three phases as depicted graphically on the left. Phase 2, summarized in this report, includes a more detailed examination of potential solutions for needs identified in Phase 1 for a select group of 12 existing interchanges, as well as a feasibility exploration of 7 potential new interchange locations.

Phase 2 includes the development of geometric layouts of interchange options and a review of the projected traffic operations associated with each option. Phase 3 will provide a prioritized order for implementing improvements, incorporating information from both Phases 1 and 2.

For each existing interchange, Phase 2 evaluations include the following items:

1. **Refined option design information** – Drawings for each option that depict the geometric requirements for intersections, traffic control, and lane requirements. Construction cost estimates for each option are also provided.
2. **Traffic operations analyses** – Interchange ramp terminal and merge/diverge section LOS findings for Year 2030 and Year 2050 traffic conditions for each option.
3. **Performance** – Summary of option performance characteristics across a range of categories as applicable, including property impacts, physical environment, traffic/access, geometric design, safety, constructability and costs. The evaluation categories are listed in **Table 1.1**, along with the factors considered in evaluating each.

Table 1.1 Option Performance Categories

Evaluation Factors		Measures and/or Items Addressed	Rating System		
			Better Performance / Lesser Impacts and Cost	Moderate Performance, Mid-Level Impacts and Cost	Poor Performance, Higher Impacts and Cost
Physical Environment Impacts		Hazardous sites, 4(f)/6(f) sites, wetlands impacts, flood and drainage impacts	Minimal environmental impacts	Moderate environmental impacts	Multiple environmental impacts
Development Compatibility		Level of accessibility provided to developed and developable land	Opens up developable land and local access	Maintains current development and access	Detracts from development and access opportunities
Multimodal Compatibility		Effectiveness for nonmotorized and transit modes, including sidewalks, crossings, bike and transit facilities, conflict points and routing	Enhanced accommodations	Few/no added accommodations	Reduced accommodations
Geometric Design		Conformity of preliminary concept design to SDDOT road design standards, including control of access, curvature, etc.	Addresses all current geometric deficiencies	Some geometric deficiencies anticipated/remain due to design constraints	Does not address current substandard geometrics and/or introduces geometric deficiencies
Safety		Improvement of existing hazardous conditions, Interstate incident/emergency response	High potential for crash reduction and/or reduces emergency response times	Low potential for crash reduction and/or maintains current emergency response times	Increased crash potential and/or emergency response times
Constructability		Degree of complexity of utility relocations, construction phasing, haul routes, or scheduling	Minor/typical degree of complexity	Moderate degree of complexity	High degree of complexity
Traffic Level of Service	**2030**	Critical intersection and/or ramp merge/diverge LOS vs. SDDOT Criteria (LOS C or better)	Better than criteria	At criteria	Worse than criteria
	2050				
Right-of-Way		Area (SF) of additional ROW required	No property impacts	Moderate ROW needs (1–150 KSF)	Significant ROW needs (150 KSF plus)
# of Properties Impacted (take or access)		# of parcels taken and/or impacted	No parcels impacted	Few parcels impacted (1–3)	Multiple parcels impacted (4 plus)
Construction Costs		Estimated construction cost relative to other Phase 2 options	Relatively low cost (<$3M)	Moderate cost ($3M to $11M)	Higher cost ($11M plus)

The relative performance of each option was evaluated within each category using quantities where available.

The evaluation is compiled to provide a tool for comparing the relative performance of interchange options. Improvements necessary at the other locations were captured with a single option.

For each potential new interchange, Phase 2 evaluations include the following items:

1. Brief background of interchange location and planning context
2. Conceptual drawings of a standard interchange configuration overlaid on existing terrain, infrastructure, and other environmental constraints
3. Approximation of lane geometry and traffic control requirements needed to provide acceptable traffic operations
4. Cost: Estimate of construction cost of building the new interchange
5. Environmental constraints/feasibility: A cursory review of the potential new 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 interchange implementation. Environmental resources that may require analysis include potential wetlands, hazardous materials, prime and unique farmland, air, noise, threatened/endangered species, cultural resources, and 4(f) and 6(f) resources.

These evaluations are used to provide a qualitative assessment of the cost and environmental feasibility of providing or not providing a new interchange at each subject location.

1.4 Report Organization

This report is organized into the following sections:

- **Section 2**: Existing Interchanges – The following elements are provided for each interchange, as applicable:
  - Review of Phase 1 findings and identified needs
  - Interchange options
  - Option evaluation (if applicable)
  - Interchange graphics and tables, in the following order:
    - Concept drawings
    - Traffic volumes and operations
    - Cost breakdowns

- **Section 3**: Potential New Interchanges – In Section 3, the following elements are provided for each interchange, as appropriate:
  - Background
  - Interchange concept
  - Environmental review
  - Opinion of probable cost
  - Do-Nothing scenario
  - Recommendation
- **Section 4**: Conclusion

1.5 List of Phase 2 Interchanges

Following completion of Phase 1, the project team and SAT identified the following existing interchanges for evaluation within this Phase 2 analysis.

1.5.1 Existing Interchanges

Existing interchanges for Phase 2 include:

- I-29 Exit 1 – Dakota Dunes
- I-29 Exit 2 – North Sioux City
- I-29 Exit 4 – McCook Lake
- I-29 Exit 26 – Vermillion/Yankton
- I-29 Exit 59 – Davis
- I-29 Exit 86 – Renner/Crooks
- I-90 Exit 10 – North Avenue/Belle Fourche
- I-90 Exit 17 – Lead/Deadwood
- I-90 Exit 48 – Stage Stop Canyon Road
- I-90 Exit 55 – Deadwood Avenue
- I-90 Exit 110 – Wall/Badlands Loop
- I-90 Exit 112 – Phillip/Pierre

1.5.2 Potential New Interchanges

Potential new interchanges for evaluation in Phase 2, as included in the initial and amended project scope, include:

- I-29 Exit 87 – Crooks, 257th Street
- I-29 Exit 88 – Crooks, 256th Street
- I-29 Exit 89 – Crooks, 255th Street
- I-90 Exit 16 – Rainbow Road, Spearfish
- I-90 Exit 264 – Chamberlain
- I-90 Exit 404 – Brandon
- I-90 Exit 408 – Brandon

2. EXISTING INTERCHANGES

2.1 I-29 Exit 1 – Dakota Dunes

2.1.1 Review of Interchange Needs

Phase 1 revealed operations and safety needs at this interchange as currently configured, described as follows.

Operations

Phase 1 of the study evaluated Year 2019 peak hour traffic operations, and year 2050 forecasts were developed based on linear extrapolation from the Siouxland Interstate Metropolitan Planning Council (SIMPCO) 2040 Travel Demand Model. The NCHRP 765 methodology was used to calculate Long Term Future (2050) traffic volumes.

Progressing into Phase 2 tasks, Year 2030 traffic volumes were forecasted by interpolating between the 2019 and 2050 traffic volumes to establish a LOS baseline for the potential opening year. LOS results for 2019, 2030, and 2050 based on a No-Action condition are reported in **Table 2.1a**.

Table 2.1a I-29 Exit 1 No-Action Interchange LOS Findings

Type	Location Description	AM/PM Peak Hour Level of Service by Year		
		2019	2030	2050
Ramp Terminal Intersections	Northbound (Signalized[1])	C/B	B/B	C/B
	Southbound (Unsignalized[2])	c/b	c/b	d/c
Ramp Merge/Diverge Sections	Northbound off-ramp (Ramp B)	B/B	B/B	B/B
	Northbound on-ramp (Ramp A)	B/B	B/B	B/B
	Northbound Loop on-ramp (Ramp F)	B/B	B/B	B/B
	Southbound off-ramp (Ramp D)	B/A	B/A	B/A
	Southbound on-ramp (Ramp C)	B/A	B/A	B/A
	Southbound Loop on-ramp (Ramp H)	B/B	B/B	B/B

[1]Signalized LOS is reported for the intersection as a whole
[2]Unsignalized LOS is reported for the critical intersection movement

As shown, operational analyses revealed that both ramp terminal intersections and all ramp merge/diverge sections currently operate at acceptable LOS and are projected to continue to do so through Year 2050. The lone exception is the southbound ramp terminal intersection, where the southbound left turn movement is projected to operate at a substandard LOS D by Year 2050.

Traffic Safety

The Phase 1 review of interchange crash history noted that a pattern of rear-end type collisions is occurring at the interchange ramp terminal intersections. In addition to these needs, the mixing of local development access and on-ramp traffic on Ramp C presents concern, as drivers seeking to attain higher speeds for interstate entry mix with lower speed traffic entering and exiting the commercial properties.

2.1.2 Discussion of Options

Due to operational and safety concerns, this interchange was moved forward to Phase 2 of the study to further develop solutions to the needs outlined in the Phase 1 report. The following improvement options were identified.

Interim Safety Recommendations:

The following actions are recommended to address traffic safety in advance of more significant interchange options:

- At the northbound (NB) ramp terminal intersection, provide overhead signal head indications for each travel lane. Provide arrow signal indications for northbound movements rather than ball indications. Install No Right Turn on Red LED Blankout side for NB off-ramp to improve visibility. Relocate NB on-ramp away from signalized intersection to clarify expected movements.
- Provide striping for southbound (SB) off-ramp, including dividing lane line, left and right turn arrow pavement markings, and advanced lane assignment signing. Evaluate SB off-ramp terminal for signalization.

The following three interchange reconfiguration options were identified:

- **Option 1: Signalization of SB Ramp Intersection –** Signalization would address operational concerns at the SB ramp and minimal reconstruction of the interchange would need to be done, resulting in a lower cost option. Signalization of the SB ramp terminal would introduce an additional signal approximately 500 feet from an existing signal to the west at Sioux Point Road with Dakota Dunes Boulevard. This could lead to queuing problems, providing only a short distance for weaving movements, and signal coordination would be a concern.
- **Option 2: Conversion to Offset Single Point Urban Interchange (SPUI)** – The offset SPUI would help to optimize signal spacing, resulting in improved traffic flow along the crossroad, as well as use of the existing right-of-way. It would also allow the majority of the ramp movements to be maintained during construction, resulting in preferable construction phasing and better traffic flow compared to that of Option 3. The Option 2 offset SPUI improvement would require flyover bridges over I-29 due to it being offset to the northeast of the main interchange, resulting in a much higher construction cost.

- **Option 3: Conversion to SPUI with Existing SB On-Ramp Retained** – Option 3 would help to optimize signal spacing resulting in improved traffic flow along the crossroad, as well as use of the existing right-of-way. The second suggested SPUI option would retain the SB on-ramp, allowing the SPUI to be aligned at the current interchange footprint and require less structural work. The downside of this second SPUI option is that it would not address the conflict of Sioux Point Road acting as an access road and as an interstate on-ramp.

2.1.3 Evaluation of Options

Operations of the freeway facilities and ramp terminals were analyzed for potential improvements under Opening (2030) and Future (2050) traffic conditions using Highway Capacity Software (HCS). Results of the HCS analysis and traffic conditions are depicted on **Figure 2.1d, Figure 2.1e**, and **Figure 2.1f**. For all options, the ramp movement traffic volumes are not expected to change compared to the No-Action scenario analyzed in Phase 1, discussed previously.

The traffic operations performance of each option is described as follows, with additional information provided as appropriate regarding performance in other categories.

Option 1: Signalization of SB Ramp Terminal

With traffic signalization of the SB ramp terminal, the intersection would be expected to operate at LOS A in the AM and PM peak periods under Opening (2030) and under Future (2050) traffic conditions. The concept drawing of this improvement option is shown on **Figure 2.1a**. Construction costs for this concept are estimated at $700,000.

Option 2: Offset Single Point Urban Interchange (SPUI)

With the conversion of the interchange to an offset SPUI, the single point intersection would be expected to operate at LOS C in the AM and PM peak periods under Opening (2030) traffic conditions and LOS C/D in the AM/PM peak period under Future (2050) traffic conditions. The concept drawing of this improvement option is shown on **Figure 2.1b**. Construction costs for this concept are estimated at $34.2 million. The relatively high cost of this concept is due primarily to the need to reconstruct all four of the ramps and to construct two new bridges over I-29.

Option 3: SPUI with SB On-Ramp Retained

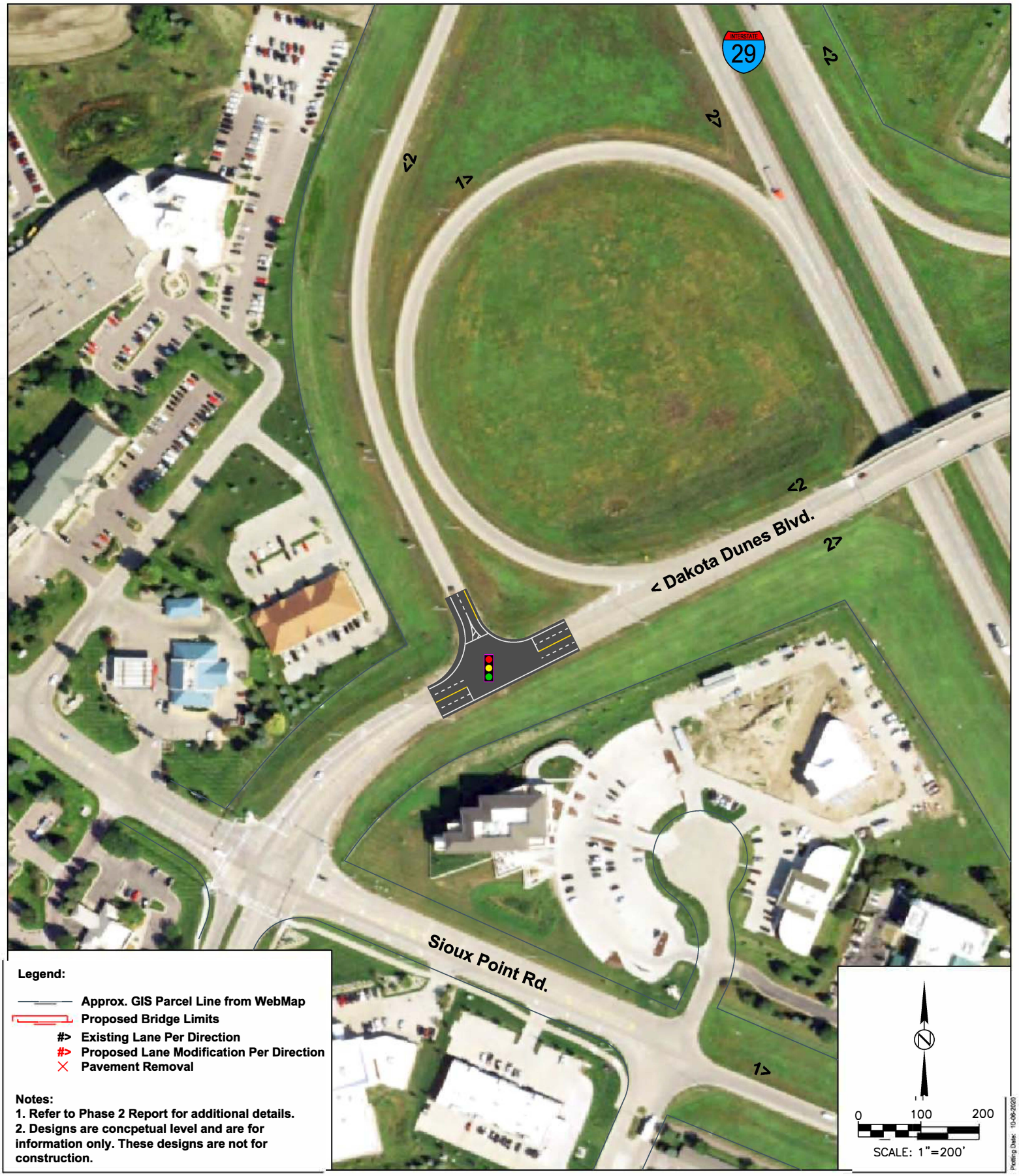
With the conversion of the interchange to a centered SPUI with the current SB On-Ramp Retained, the single point intersection would be expected to operate at LOS C/B in the AM/PM peak hours under Opening (2030) traffic conditions and LOS C in the AM and PM peak periods under Future (2050) traffic conditions. The concept drawing of this improvement option is shown on **Figure 2.1c**. Construction costs for this concept are estimated at $34.3 million. The relatively high cost of this concept is due to the need to reconstruct three of the ramps and to construct one new bridge over I-29.

Detailed cost estimates for each option are provided in **Table 2.1c**, **Table 2.1d**, and **Table 2.1e**.

Options were analyzed to comparatively evaluate the benefits and impacts associated with each option. The various evaluation factors discussed in the previous section were tabulated and are summarized using color coding in **Table 2.1b**.

Table 2.1b I-29 Exit 1 Options Evaluation Summary

Evaluation Factors		Option 1 Signalization of SB Ramp Terminal	Option 2 Offset Single Point Urban Interchange	Option 3 SPUI with SB On-Ramp Retained
Environmental Impacts		Minimal	Moderate	Minimal
Development Compatibility		Maintains current development and access	Maintains current development and access	Maintains current development and access
Multimodal Compatibility		Enhanced accommodations	Enhanced accommodations	Enhanced accommodations
Geometric Design		Addresses all current geometric deficiencies	Anticipates some geometric deficiencies due to design constraints	Addresses all current geometric deficiencies
Safety		High potential for crash reduction and/or reduces emergency response times	High potential for crash reduction and/or reduces emergency response times	Low potential for crash reduction and/or maintains current emergency response times
Constructability		Minor/typical degree of complexity	High degree of complexity	High degree of complexity
Traffic Level of Service	**2030**	LOS A	LOS C	LOS C
	2050	LOS A	LOS D	LOS C
Right-of-way (SF)		0	80,600	42,800
# of Properties Impacted (take or access)		0	6	3
Construction Costs		$700,000	$34.2 Million	$34.3 Million



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CONCEPTUAL

Figure 2.1a
I-29 Exit 1 Dakota Dunes
Option 1: Signalization of SB Ramp Terminal

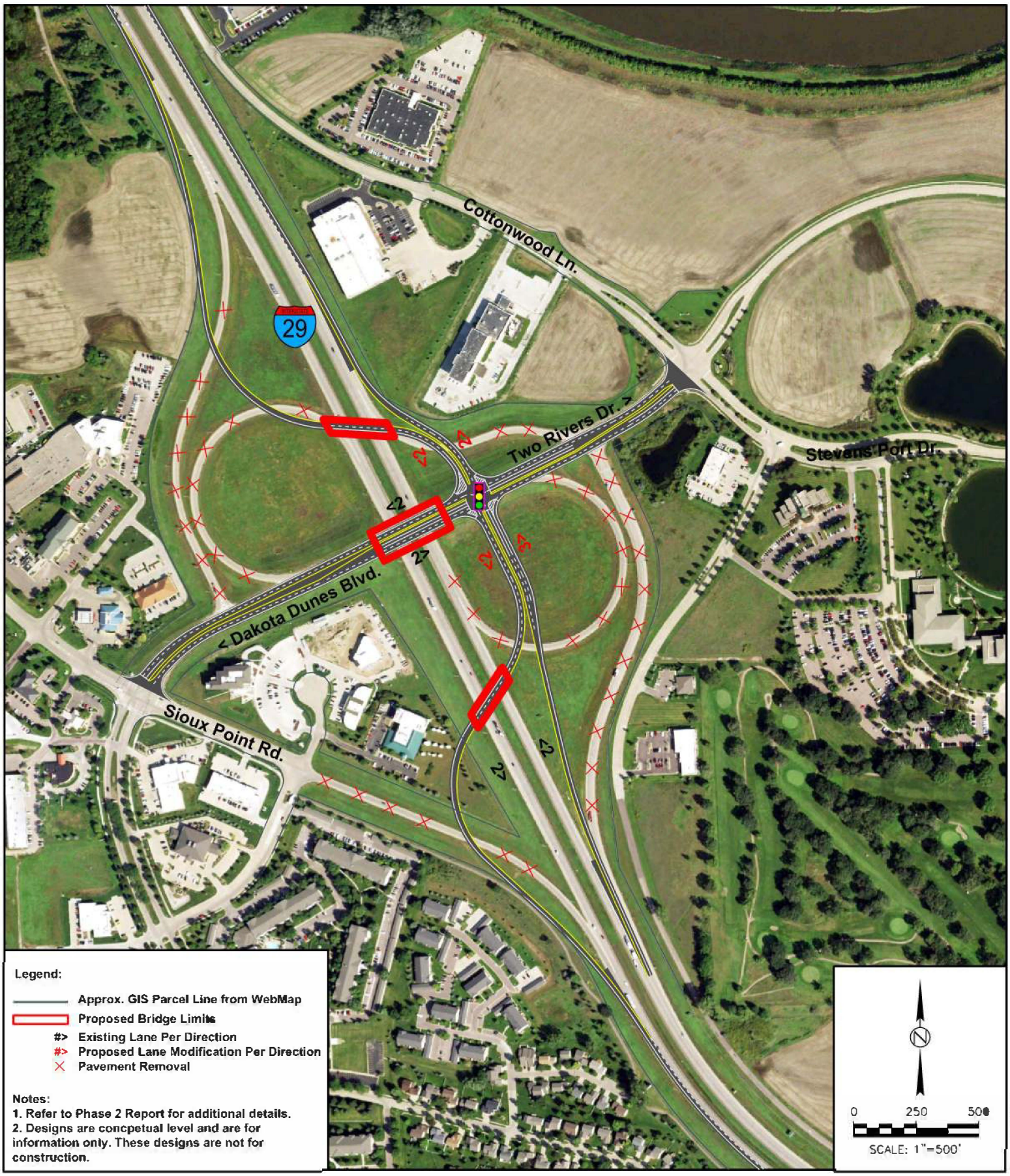

Figure 2.1b
I-29 Exit 1 Dakota Dunes
Option 2: Offset Single-Point Urban Interchange (SPUI)

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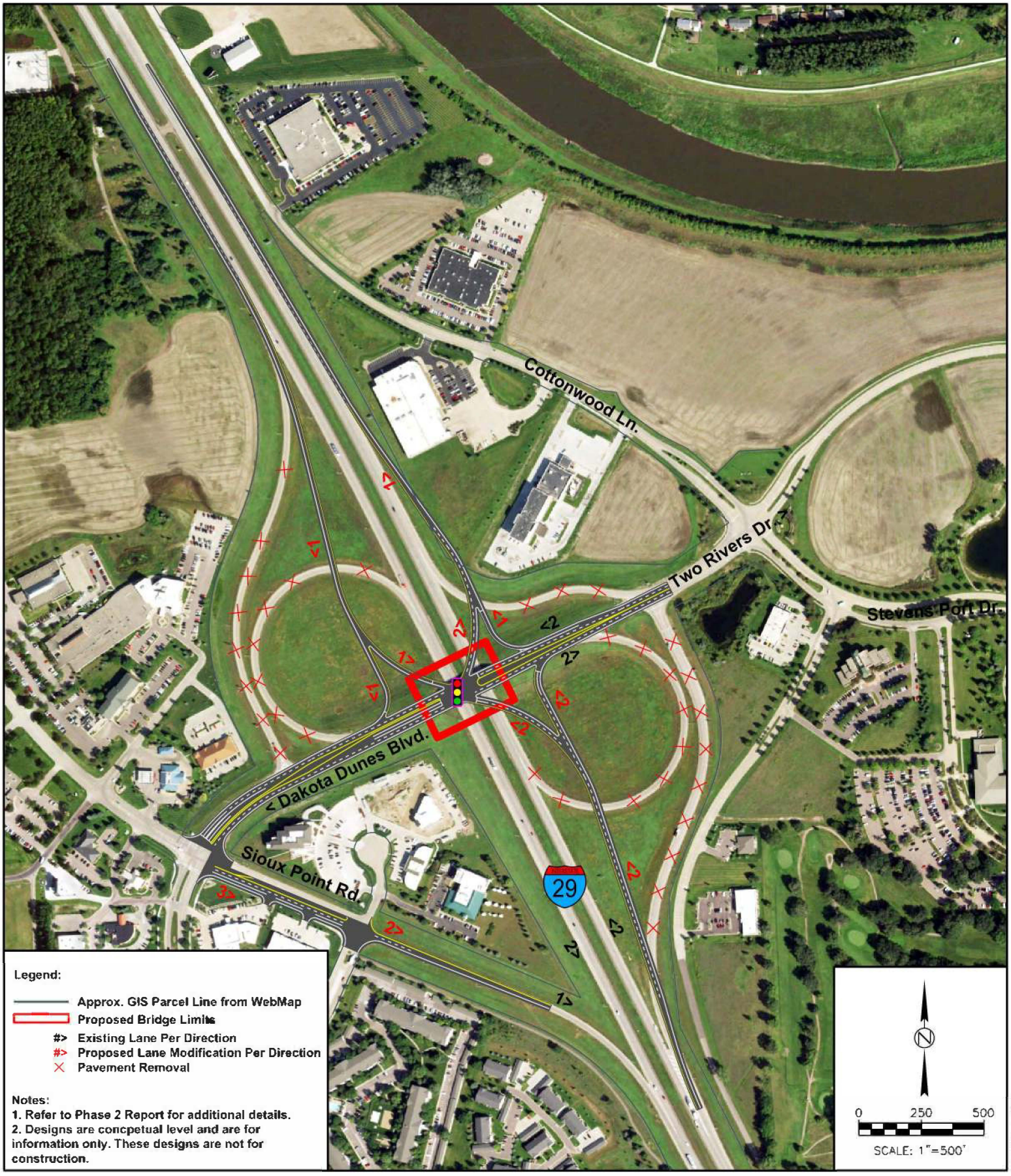

Figure 2.1c
I-29 Exit 1 Dakota Dunes
Option 3: SPUI with SB On-Ramp Retained

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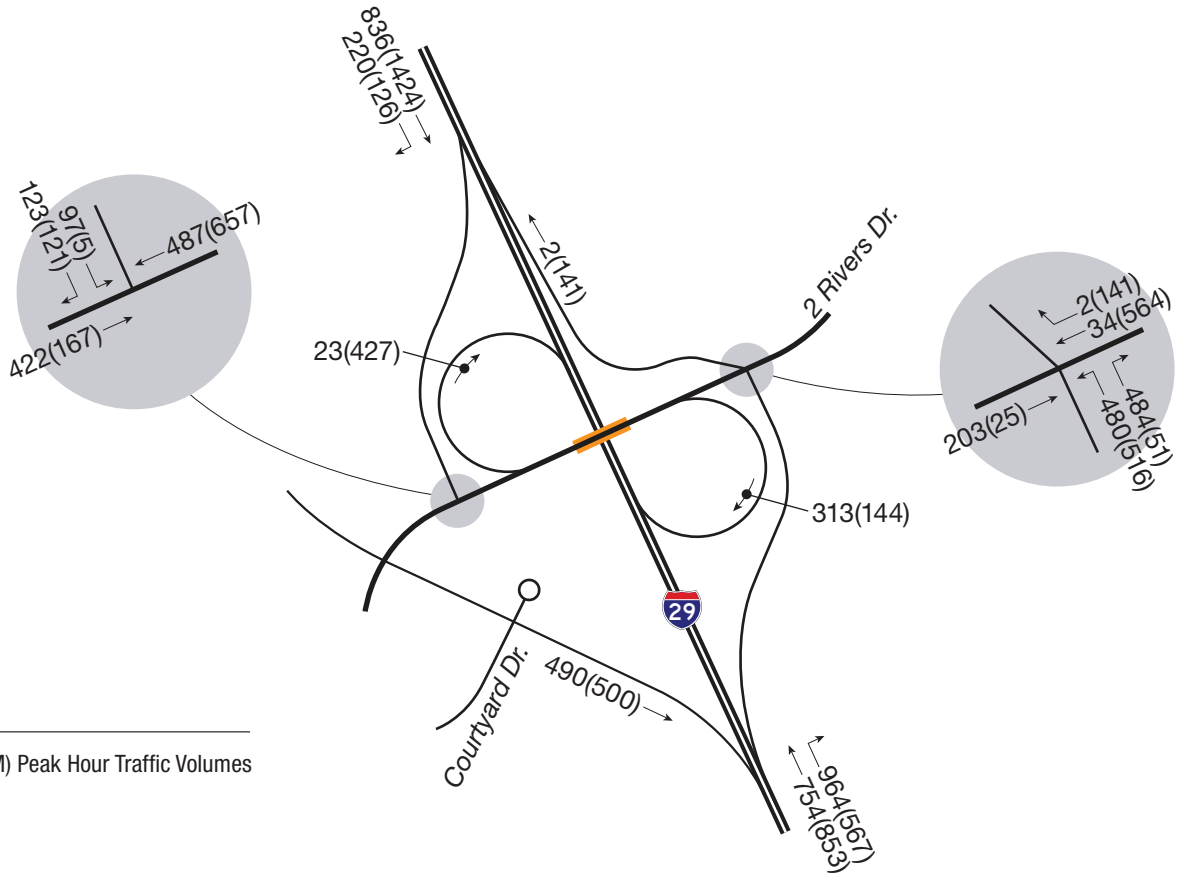
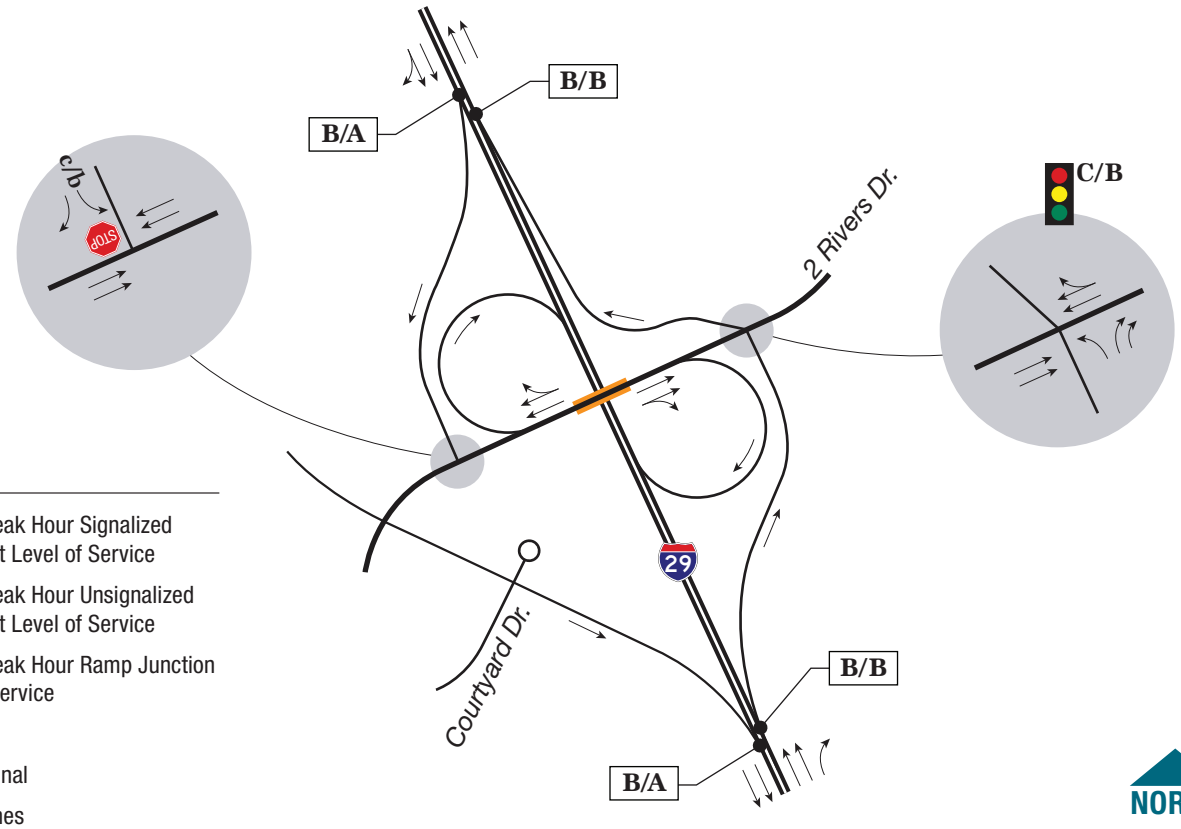
CONCEPTUAL



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	=	Stop Sign
	=	Traffic Signal
	=	Travel Lanes

NORTH

FELSBURG HOLT & ULLEVIG

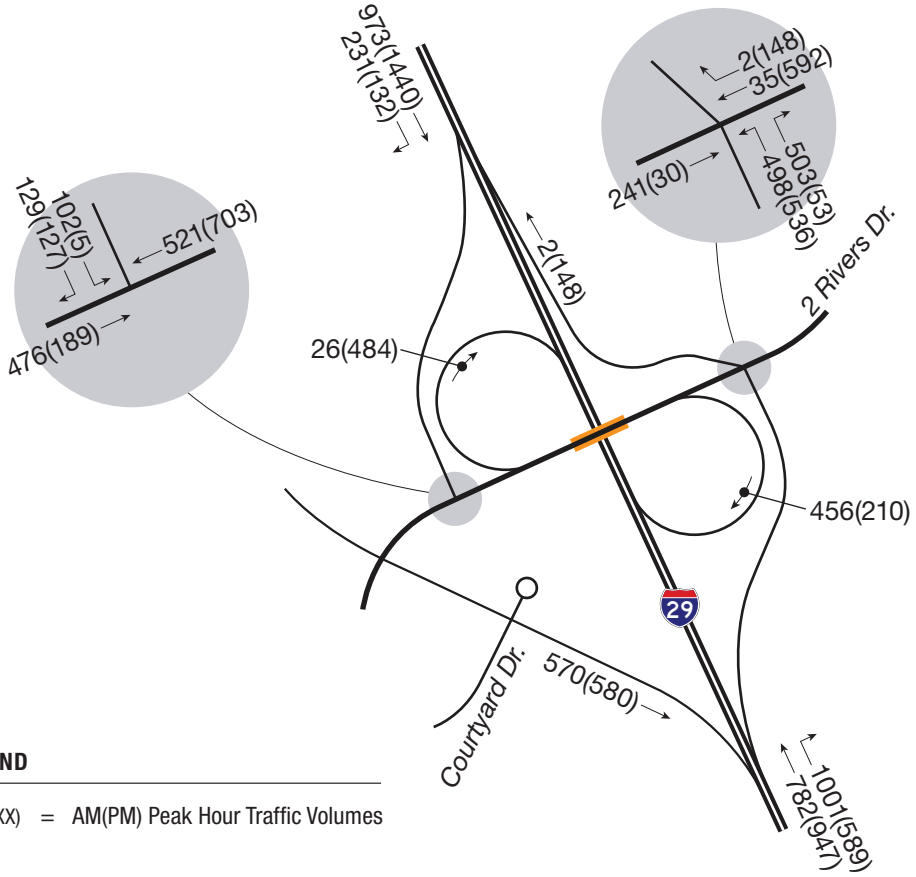
NOTE: Drawing Not to Scale

FIGURE 2.1d

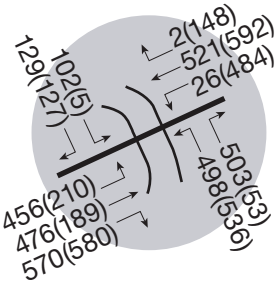
Interstate 29 Exit 1

Existing (2019) Traffic Conditions

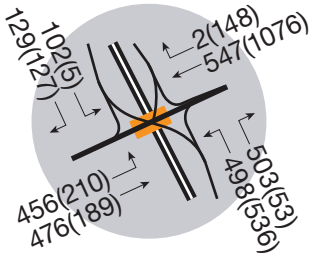
SDDOT Decennial 2020 ICS - Phase 2 18-571-01 12/3/20



Option 2
Offset SPUI



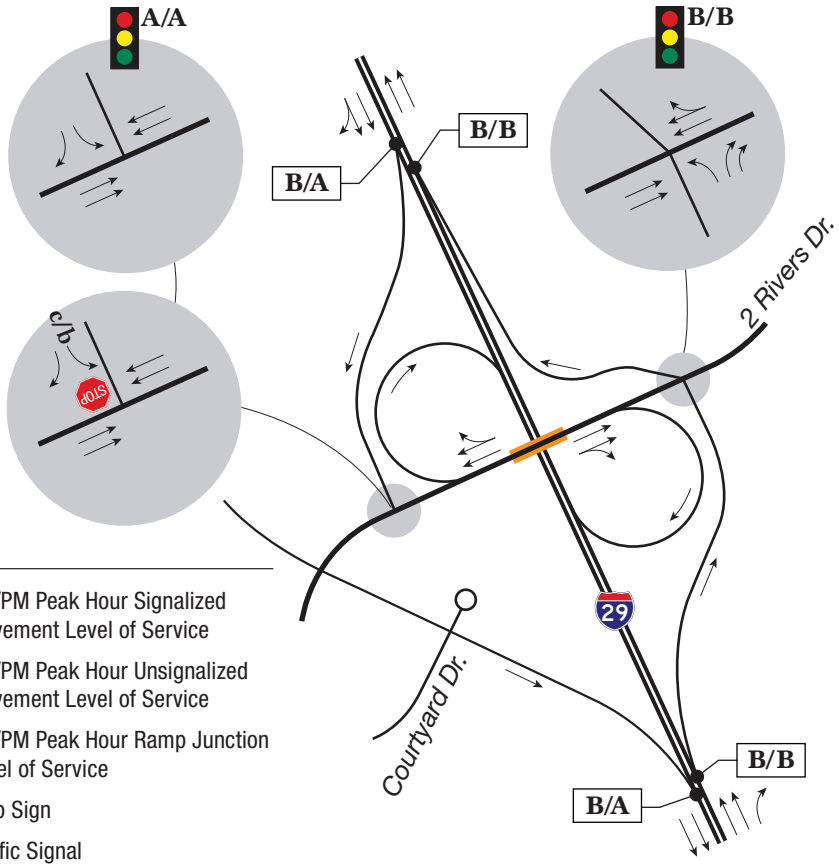
Option 3
SPUI with
SB On-Ramp Retained



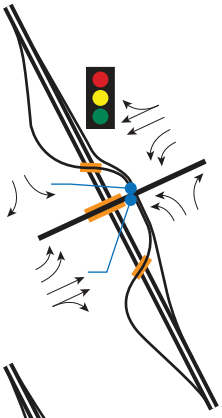
LEGEND

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

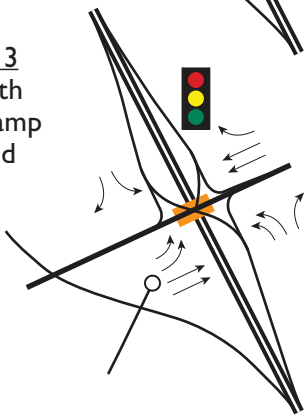
Option 1
Signalized
SB Ramp



Option 2
Offset SPUI
C/D



Option 3
SPUI with
SB On-Ramp
Retained
C/B



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	=	Stop Sign
	=	Traffic Signal
	=	Travel Lanes

NORTH

FELSBURG HOLT & ULLEVIG

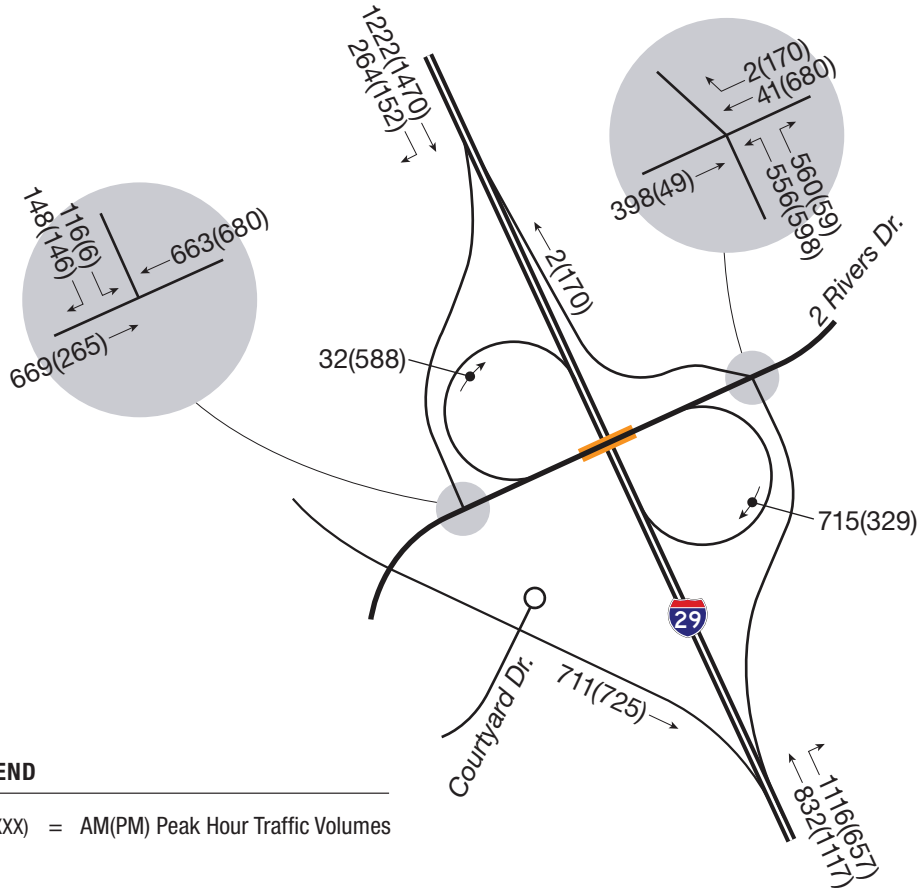
NOTE: Drawing Not to Scale

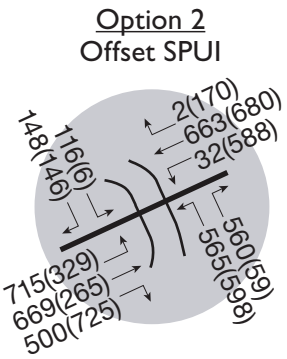
FIGURE 2.1e

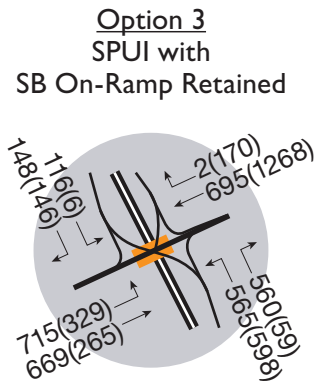
Interstate 29 Exit 1

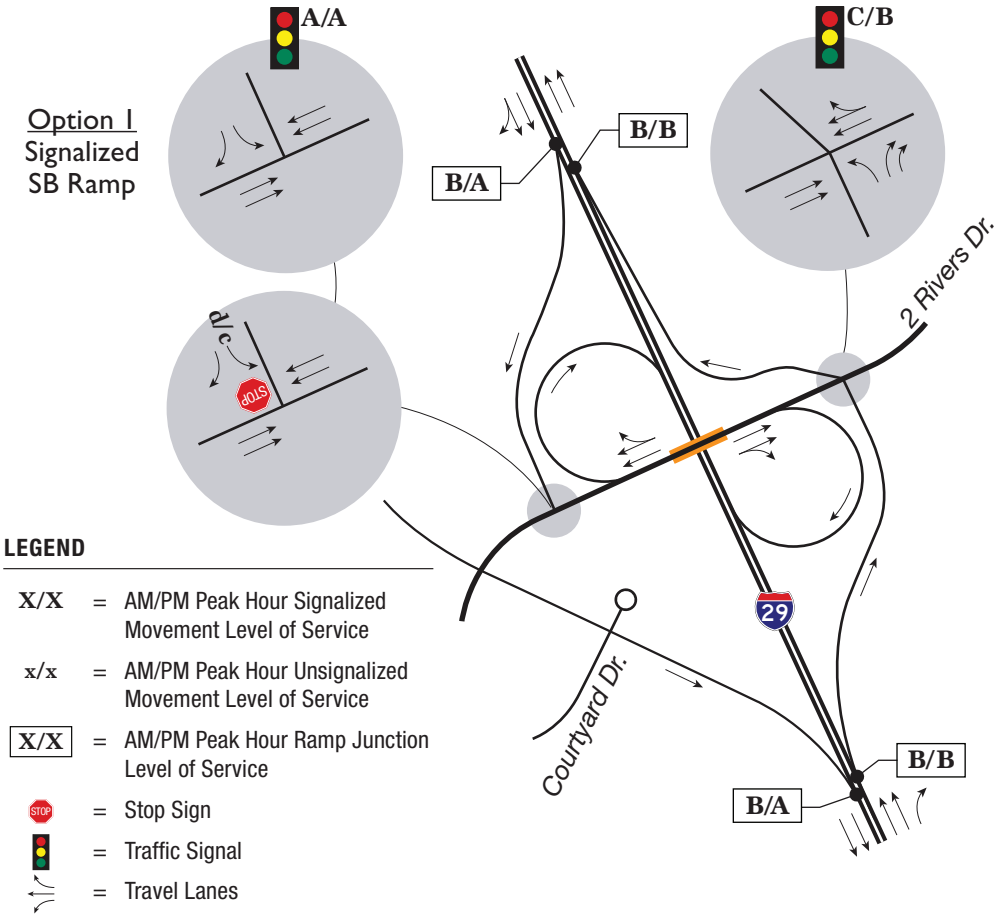
Opening (2030) Traffic Conditions

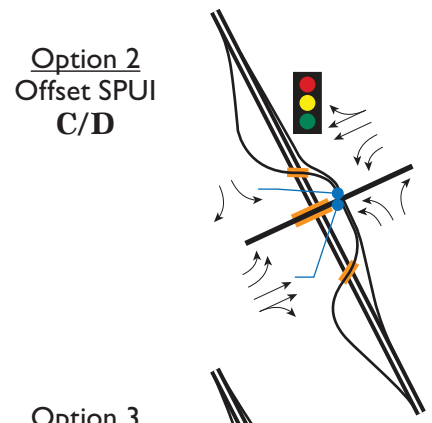
SDDOT Decennial 2020 ICS - Phase 2 18-571-01 12/3/20

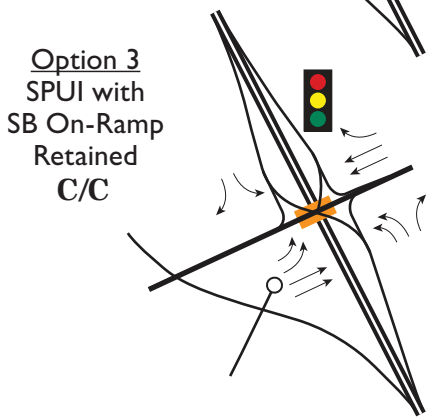












NORTH

FELSBURG HOLT & ULLEVIG

NOTE: Drawing Not to Scale

FIGURE 2.1f

Interstate 29 Exit 1

Future (2050) Traffic Conditions

SDDOT Decennial 2020 ICS - Phase 2 18-571-01 12/1/20

Table 2.1c I-29 Exit 1 Probable Construction Costs - Option 1

SOUTH DAKOTA DOT 2020 DECENNIAL INTERSTATE CORRIDOR STUDY

FHU PROJ NO. 118571-01

CONCEPTUAL LEVEL OPINION OF PROBABLE COST

FELSBURG HOLT & ULLEVIG

Alternative: I-29 Exit 1 Option 1

Prepared By: A. Orellana Date: 12/2/2020

	ITEM	DESCRIPTION	UNIT	CONTINGENCY	UNIT COST	QUANTITY	COST
1	**110**	Earthwork and Removals (2' Depth)	SY		$ **15**	1,500	$ 22,500
2	**110**	Earthwork (Significant Impacts)	CY		$ **10**	0	$ -
3	**110**	Remove Bridge	EA		$ **25,000**	0	$ -
4	**380**	Surfacing (Interstate & Ramps)	SY		$ **75**	3,000	$ 225,000
		SUBTOTAL (A)					$ **247,500**
5	**530**	Structures - Bridge	SF		$ **200**	0	$ -
6	**450**	Drainage - New	% of (A)	**3%**	$ -	-	$ 7,430
7	**451**	Utility Relocations	% of (A)	**3%**	$ -	-	$ 7,430
8	**632/633**	Traffic - Signing/Striping	% of (A)	**2%**	$ -	-	$ 3,720
9	**634**	Traffic Control	% of (A)	**2%**	$ -	-	$ 3,720
10	**734**	Erosion Control/Environmental	% of (A)	**2%**	$ -	-	$ 4,950
		SUBTOTAL (B)					$ **27,250**
11	**635**	Traffic - Signals (New)	EA		$ **270,000**	1	$ 270,000
12	**997**	Railroad Crossing	EA		$ **250,000**		$ -
13	**009**	Mobilization	% of (A)+(B)	**5%**	$ -	-	$ 13,740
14	**100**	Clearing	% of (A)+(B)	**2%**	$ -	-	$ 5,500
15		Contingency	% of (A)+(B)	**25%**	$ -	-	$ 68,690
		SUBTOTAL (C)					$ **357,930**
		CONSTRUCTION TOTAL (D)	**(A)+(B)+(C)**				$ **632,680**
16		Engineering Services	% of (D)	**15%**	$ -		$ 94,910
17		ROW Impacts	SF		$ **10**	0	$ -
							$ ***727,590***
		PROJECT TOTAL (E)					$ **728,000**
		CONSTRUCTION (D) + ROW TOTAL COST					$ **700,000**

Note: In providing opinions of probable construction cost, the Client understands that Felsburg Holt & Ullevig has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing. The unit prices and percentages shown above were applied under the direction of the South Dakota Department of Transportation and FHU makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bid or actual costs.

Table 2.1d I-29 Exit 1 Probable Construction Costs - Option 2

SOUTH DAKOTA DOT 2020 DECENNIAL INTERSTATE CORRIDOR STUDY

FHU PROJ NO. 118571-01

CONCEPTUAL LEVEL OPINION OF PROBABLE COST

FELSBURG HOLT & ULLEVIG

Alternative: I-29 Exit 1 Option 2

Prepared By: A. Orellana Date: 12/2/2020

	ITEM	DESCRIPTION	UNIT	CONTINGENCY	UNIT COST	QUANTITY	COST
1	**110**	Earthwork and Removals (2' Depth)	SY		$ **15**	130,000	$ 1,950,000
2	**110**	Earthwork (Significant Impacts)	CY		$ **10**	197,400	$ 1,974,000
3	**110**	Remove Bridge	EA		$ **25,000**	1	$ 25,000
4	**380**	Surfacing (Interstate & Ramps)	SY		$ **75**	65,000	$ 4,875,000
		SUBTOTAL (A)					$ **8,824,000**
5	**530**	Structures - Bridge	SF		$ **200**	63,500	$ 12,700,000
6	**450**	Drainage - New	% of (A)	**8%**	$ -	-	$ 705,920
7	**451**	Utility Relocations	% of (A)	**6%**	$ -	-	$ 529,440
8	**632/633**	Traffic - Signing/Striping	% of (A)	**4%**	$ -	-	$ 352,960
9	**634**	Traffic Control	% of (A)	**6%**	$ -	-	$ 529,440
10	**734**	Erosion Control/Environmental	% of (A)	**6%**	$ -	-	$ 529,440
		SUBTOTAL (B)					$ **15,347,200**
11	**635**	Traffic - Signals (New)	EA		$ **270,000**	1	$ 270,000
12	**997**	Railroad Crossing	EA		$ **250,000**		$ -
13	**009**	Mobilization	% of (A)+(B)	**5%**	$ -	-	$ 1,208,560
14	**100**	Clearing	% of (A)+(B)	**2%**	$ -	-	$ 483,430
15		Contingency	% of (A)+(B)	**30%**	$ -	-	$ 7,251,360
		SUBTOTAL (C)					$ **9,213,350**
		CONSTRUCTION TOTAL (D)	**(A)+(B)+(C)**				$ **33,384,550**
16		Engineering Services	% of (D)	**15%**	$ -		$ 5,007,690
17		ROW Impacts	SF		$ **10**	80,600	$ 806,000
							$ ***39,198,240***
		PROJECT TOTAL (E)					$ **39,199,000**
		CONSTRUCTION (D) + ROW TOTAL COST					$ **34,200,000**

Note: In providing opinions of probable construction cost, the Client understands that Felsburg Holt & Ullevig has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing. The unit prices and percentages shown above were applied under the direction of the South Dakota Department of Transportation and FHU makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bid or actual costs.

Table 2.1e I-29 Exit 1 Probable Construction Costs - Option 3

SOUTH DAKOTA DOT 2020 DECENNIAL INTERSTATE CORRIDOR STUDY

FHU PROJ NO. 118571-01

CONCEPTUAL LEVEL OPINION OF PROBABLE COST

FELSBURG HOLT & ULLEVIG

Alternative: I-29 Exit 1 Option 3

Prepared By: A. Orellana Date: 12/2/2020

	ITEM	DESCRIPTION	UNIT	CONTINGENCY	UNIT COST	QUANTITY	COST
1	**110**	Earthwork and Removals (2' Depth)	SY		$ **15**	108,000	$ 1,620,000
2	**110**	Earthwork (Significant Impacts)	CY		$ **10**	161,100	$ 1,611,000
3	**110**	Remove Bridge	EA		$ **25,000**	1	$ 25,000
4	**380**	Surfacing (Interstate & Ramps)	SY		$ **75**	54,000	$ 4,050,000
		SUBTOTAL (A)					$ **7,306,000**
5	**530**	Structures - Bridge	SF		$ **200**	75,000	$ 15,000,000
6	**450**	Drainage - New	% of (A)	**8%**	$ -	-	$ 584,480
7	**451**	Utility Relocations	% of (A)	**6%**	$ -	-	$ 438,360
8	**632/633**	Traffic - Signing/Striping	% of (A)	**4%**	$ -	-	$ 292,240
9	**634**	Traffic Control	% of (A)	**6%**	$ -	-	$ 438,360
10	**734**	Erosion Control/Environmental	% of (A)	**6%**	$ -	-	$ 438,360
		SUBTOTAL (B)					$ **17,191,800**
11	**635**	Traffic - Signals (New)	EA		$ **270,000**	1	$ 270,000
12	**997**	Railroad Crossing	EA		$ **250,000**		$ -
13	**009**	Mobilization	% of (A)+(B)	**5%**	$ -	-	$ 1,224,890
14	**100**	Clearing	% of (A)+(B)	**2%**	$ -	-	$ 489,960
15		Contingency	% of (A)+(B)	**30%**	$ -	-	$ 7,349,340
		SUBTOTAL (C)					$ **9,334,190**
		CONSTRUCTION TOTAL (D)	**(A)+(B)+(C)**				$ **33,831,990**
16		Engineering Services	% of (D)	**15%**	$ -		$ 5,074,800
17		ROW Impacts	SF		$ **10**	42,800	$ 428,000
							$ ***39,334,790***
		PROJECT TOTAL (E)					$ **39,335,000**
		CONSTRUCTION (D) + ROW TOTAL COST					$ **34,300,000**

Note: In providing opinions of probable construction cost, the Client understands that Felsburg Holt & Ullevig has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing. The unit prices and percentages shown above were applied under the direction of the South Dakota Department of Transportation and FHU makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bid or actual costs.

2.2 I-29 Exit 2 – North Sioux City

2.2.1 Review of Interchange Needs

Phase 1 revealed operations needs at this interchange as currently configured, described as follows:

Operations

Phase 1 of the study evaluated Year 2019 peak hour traffic operations, and year 2050 forecasts were developed based on linear extrapolation from the SIMPCO 2040 Travel Demand Model. The NCHRP 765 methodology was used to calculate Long Term Future (2050) traffic volumes.

Progressing into Phase 2 tasks, Year 2030 traffic volumes were forecasted by interpolating between the 2019 and 2050 traffic volumes to establish a LOS baseline for the potential opening year. LOS results for 2019, 2030, and 2050 based on a No-Action condition are reported in **Table 2.2a**.

Table 2.2a I-29 Exit 2 No-Action Interchange LOS Findings

Type	Location Description	AM/PM Peak Hour Level of Service by Year		
		2019	2030	2050
Ramp Terminal Intersections	Northbound (Signalized[1])	A/A	A/A	A/A
	Southbound (Unsignalized[2])	c/f	d/f	d/f
Ramp Merge/Diverge Section	Northbound off-ramp (Ramp B)	B/B	B/B	B/B
	Northbound on-ramp (Ramp A)	B/B	B/B	B/B
	Southbound off-ramp (Ramp D)	A/A	A/A	A/A
	Southbound on-ramp (Ramp C)	A/A	A/A	A/A

[1]Signalized LOS is reported for the intersection as a whole
[2]Unsignalized LOS is reported for the critical intersection movement

As shown, operational analyses revealed that both ramp terminal intersections and all ramp merge/diverge sections currently operate at acceptable LOS and are projected to continue to do so through Year 2050. The lone exception is the SB ramp terminal intersection, where the SB left turn movement is projected to operate at a substandard LOS F in all time horizons.

Other Needs

Though not highlighted as a Phase 1 deficiency, modifications to this interchange should consider opportunities to address close access spacing distance between the interchange and adjacent accesses along River Drive, both east and west of the interchange.

2.2.2 Discussion of Options

Due to operational concerns, this interchange was moved forward to Phase 2 of the study to further develop solutions to the deficiencies outlined and discussed in-depth in the Phase 1 report. One local

access improvement option was suggested in Phase 1. A second access improvement option and an interchange reconstruction option have been added for Phase 2.

Option 1: Signalization of SB Ramp Terminal

The proposed improvement would signalize the SB ramp terminal and provide a local access modification that would consolidate the number of accesses along River Drive by using existing Sodrac Drive. South of River Drive, Sodrac Drive would furnish local access via offsetting intersections and extend through an existing parcel to reconnect as a service road. Additionally, most existing traffic patterns would be maintained during construction, with most construction occurring offline creating a simpler construction phasing plan. This improvement would require acquiring right-of-way for relocation of local access.

Option 2: Signalization of SB Ramp Terminal (Modified)

A slight modification to Option 1, this option includes signalization of the SB ramp terminal combined with a local access modification that would consolidate the number of accesses along River Drive by using existing Sodrac Drive and creating a single 90 degree traditional intersection south of River Drive rather than two offset angle intersections. Additionally, most existing traffic patterns would be maintained during construction, with most construction occurring offline creating a simpler construction phasing plan. This improvement would require acquiring right-of-way for relocation of local access.

Option 3: Conversion to Single Point Urban Interchange (SPUI)

Converting the existing interchange to a SPUI would slightly improve access spacing while addressing operational concerns. Option 3 would require a rebuild of all the ramps, as well as a new intersection at the underpass, resulting in higher costs compared to the previous option, as well as impacting traffic operations during construction.

2.2.3 Evaluation of Options

Operations of the freeway facilities and ramp terminals were analyzed for potential improvements under Opening (2030) and Future (2050) traffic conditions using HCS. Results of the HCS analysis and traffic conditions are depicted on **Figure 2.2d, Figure 2.2e**, and **Figure 2.2f**. For all option scenarios, the ramp movements are not expected to change compared to the No-Action scenario from Phase 1, discussed previously.

Option 1: Signalization of SB Ramp Terminal

With traffic signalization of the SB ramp terminal, the intersection would be expected to operate at LOS B in the AM and PM peak periods under Opening (2030) traffic conditions and LOS B in the AM and PM peak periods under Future (2050) traffic conditions. The concept drawing of this improvement option is shown on **Figure 2.2a**. Construction costs for this concept are estimated at $2.9 million.

Option 2: Signalization of SB Ramp Terminal (Modified)

With traffic signalization of the southbound ramp terminal, the intersection would be expected to operate at LOS B in the AM and PM peak periods under Opening (2030) traffic conditions and LOS B in the AM and PM peak periods under Future (2050) traffic conditions. The concept drawing of this improvement option is shown on **Figure 2.2b**. Construction costs for this concept are estimated at $2.5 million.

Option 3: Single Point Urban Interchange (SPUI)

With the conversion of the interchange to a SPUI, the single point intersection would be expected to operate at LOS C in the AM and PM peak periods under Opening (2030) traffic conditions and LOS C in the AM and PM peak periods under Future (2050) traffic conditions. The concept drawing of this improvement option is shown on **Figure 2.2c**. Construction costs for this concept are estimated at $19.5 million.

Detailed cost estimates for each concept are included in **Table 2.2c, Table 2.2.d**, and **Table 2.2e**.

Options were analyzed to comparatively evaluate the benefits and impacts associated with each option. The various evaluation factors discussed in the previous section were tabulated and are summarized in **Table 2.2b**.

Table 2.2b I-29 Exit 2 Options Evaluation Summary

Evaluation Factors		Option 1 Signalization of SB Ramp Terminal	Option 2 Signalization of SB Ramp Terminal (Modified)	Option 3 Single Point Urban Interchange (SPUI)
Environmental Impacts		Multiple environmental impacts	Multiple environmental impacts	Minimal environmental impacts
Development Compatibility		Opens up developable land and local access	Opens up developable land and local access	Maintains current development and access
Multimodal Compatibility		Few/no added accommodations	Few/no added accommodations	Reduced accommodations
Geometric Design		Addresses all current geometric deficiencies	Addresses all current geometric deficiencies	Addresses all current geometric deficiencies
Safety		High potential for crash reduction and/or reduces emergency response times	High potential for crash reduction and/or reduces emergency response times	Low potential for crash reduction and/or maintains current emergency response times
Constructability		Moderate degree of complexity	Moderate degree of complexity	High degree of complexity
Traffic Level of Service	**2030**	LOS B	LOS B	LOS C
	2050	LOS B	LOS B	LOS C
Right-of-way (SF)		131,400	105,800	11,300
# of Properties Impacted (take or access)		3	3	1
Construction Costs		$2.9 million	$2.5 million	$19.5 million

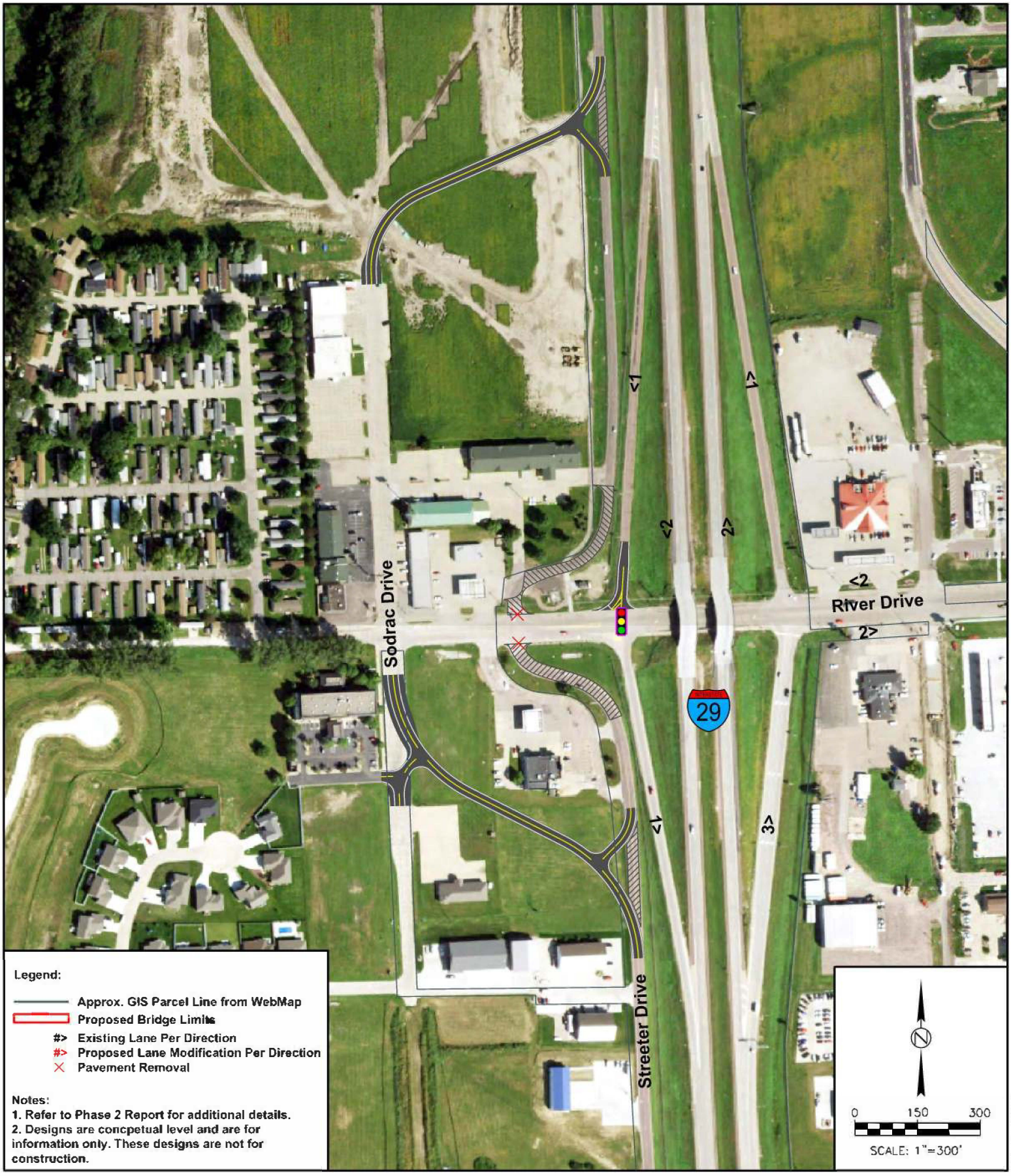


Figure 2.2a
I-29 Exit 2 North Sioux City
Option 1: Signalization of SB Ramp Terminal

FELSBURG HOLT & ULLEVIG

CONCEPTUAL

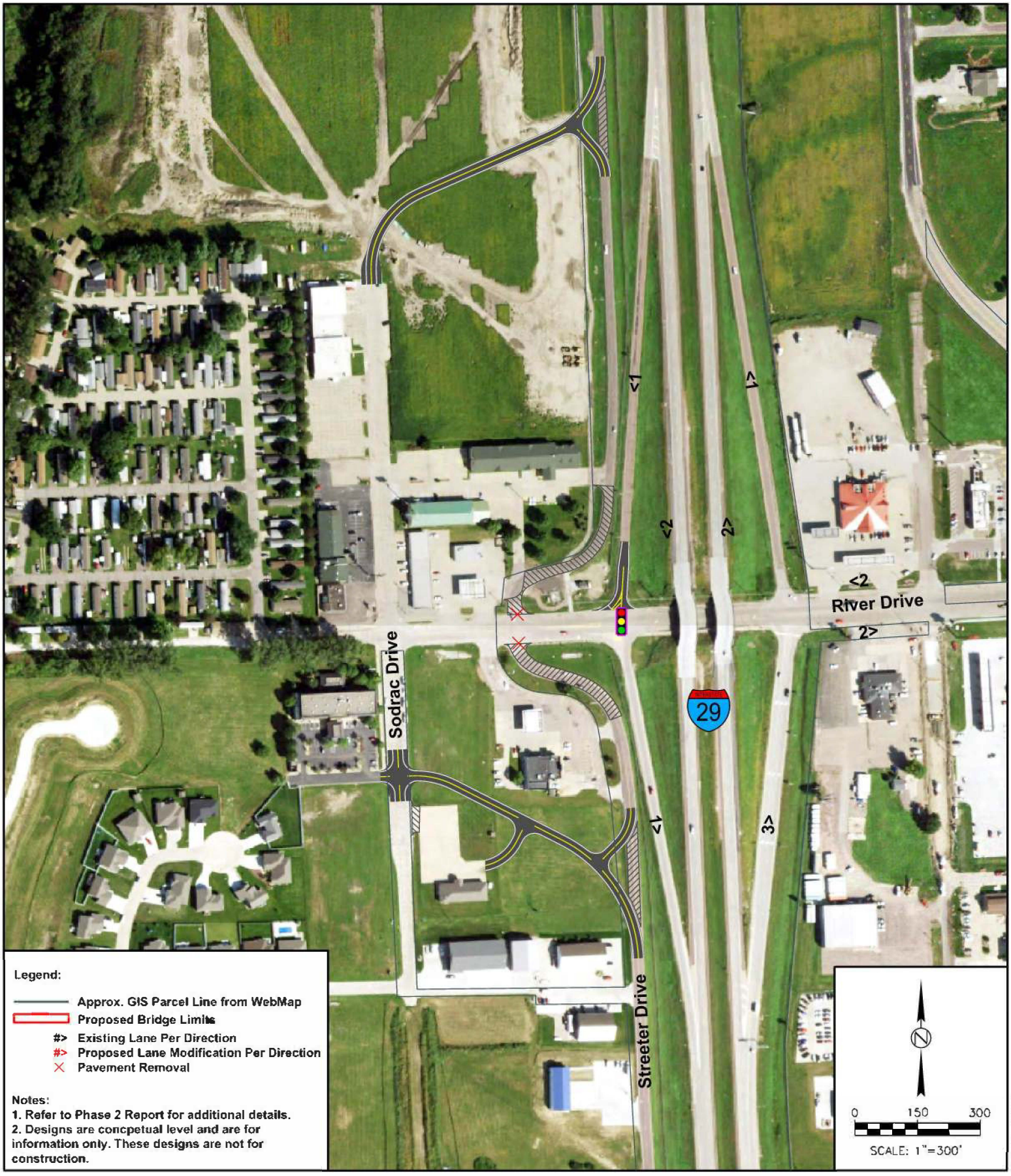


Figure 2.2b
I-29 Exit 2 North Sioux City
Option 2: Signalization of SB Ramp Terminal

FELSBURG HOLT & ULLEVIG

CONCEPTUAL

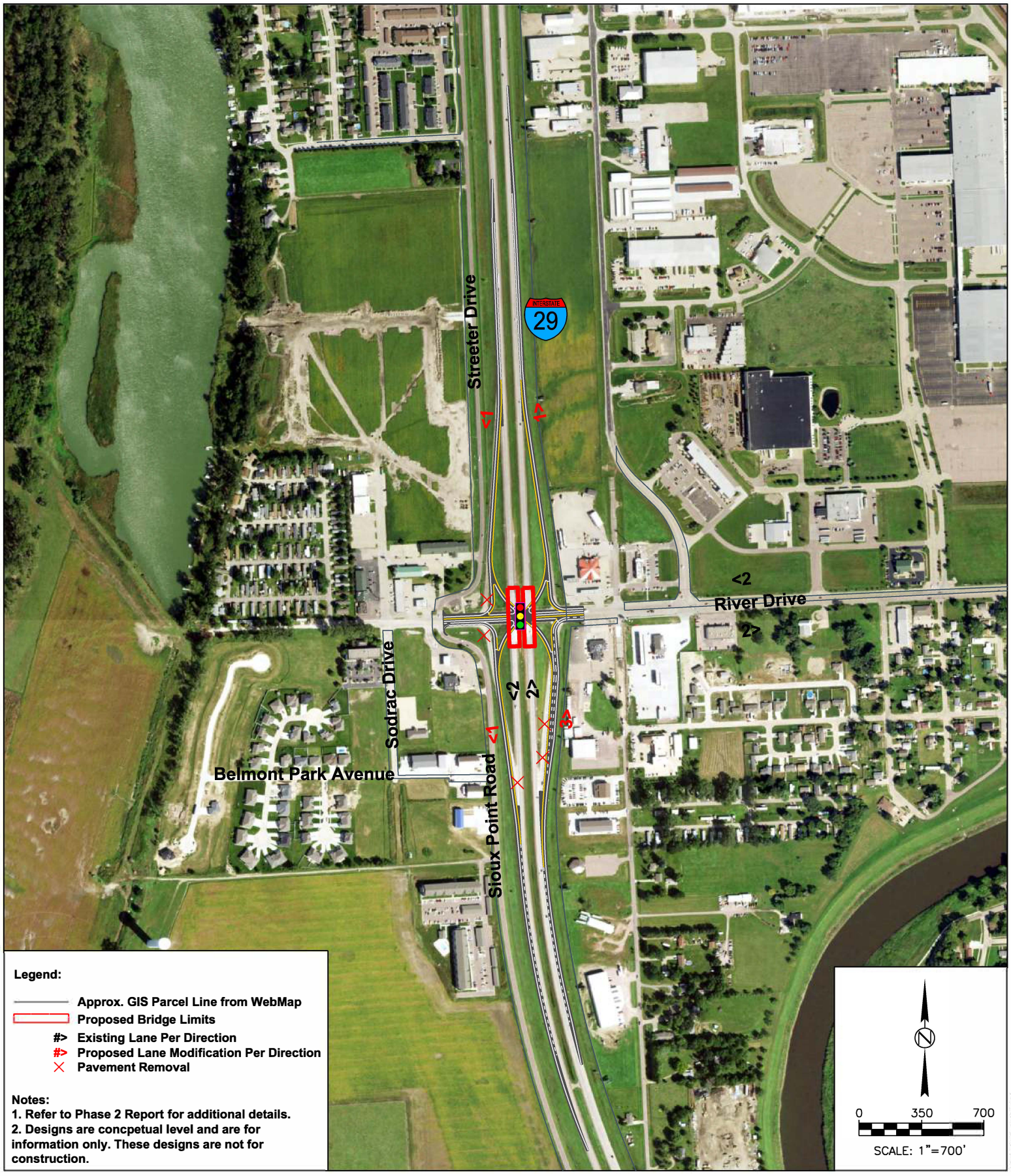
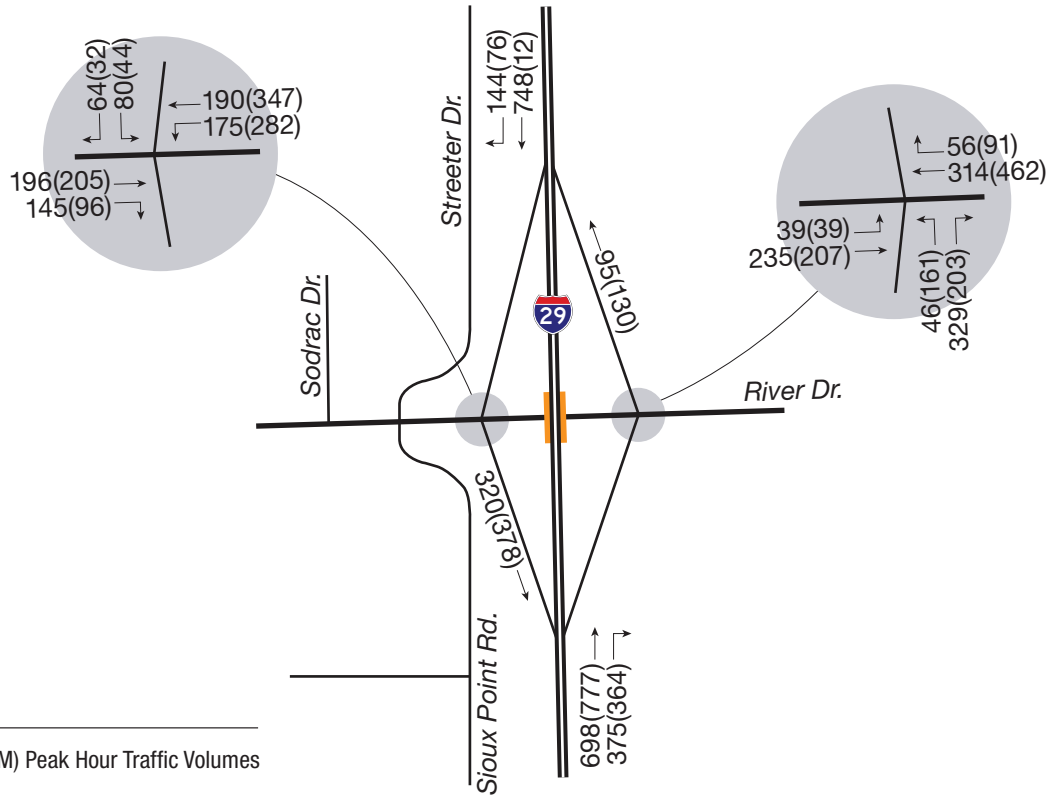


Figure 2.2c
I-29 Exit 2 North Sioux City
Option 3: Single-Point Urban Interchange (SPUI)

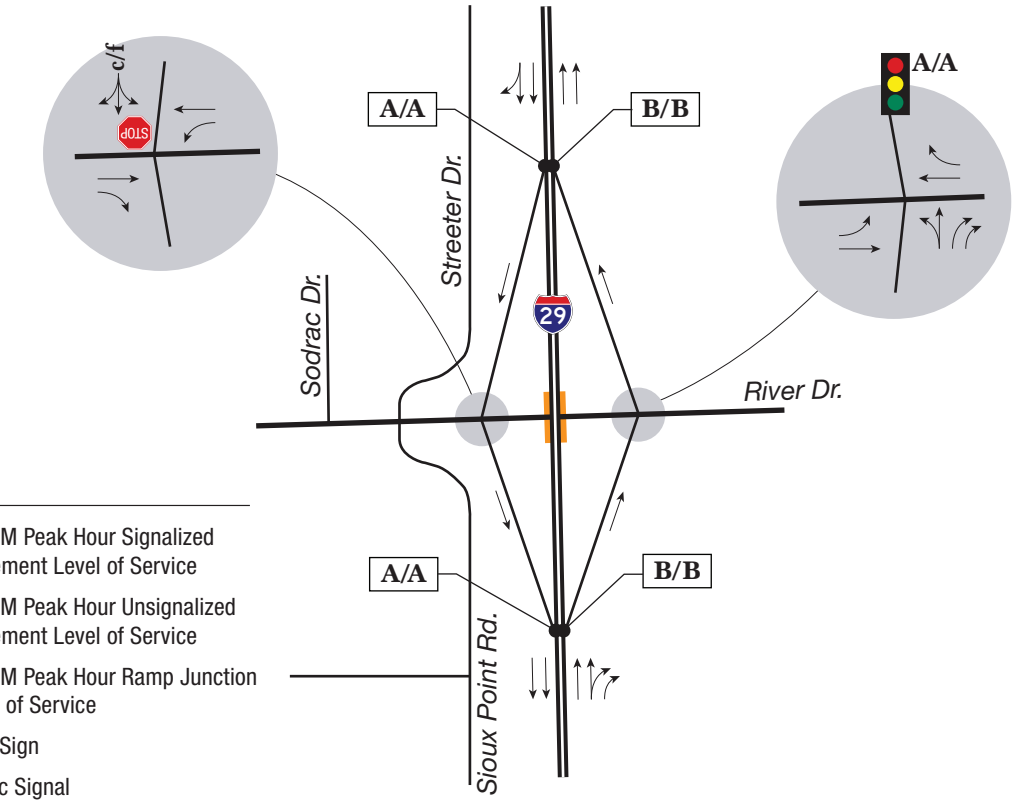
FELSBURG HOLT & ULLEVIG

CONCEPTUAL



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	=	Stop Sign
	=	Traffic Signal
	=	Travel Lanes

NORTH

FELSBURG HOLT & ULLEVIG

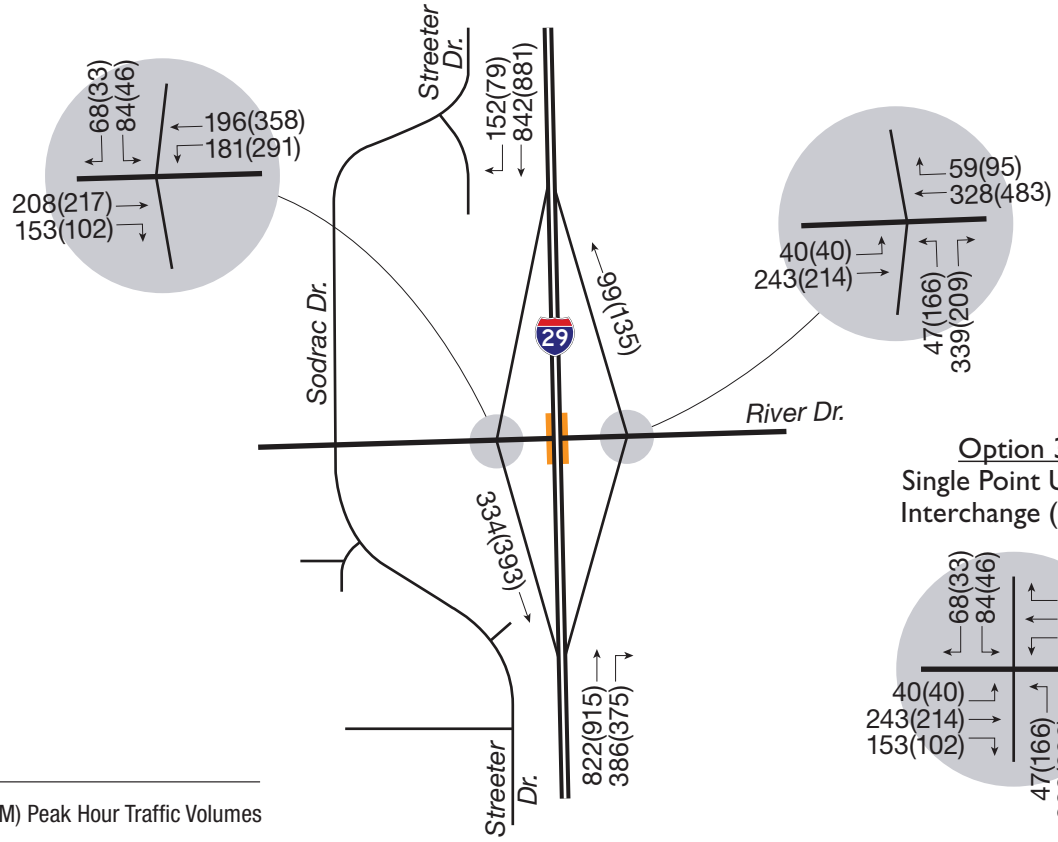
NOTE: Drawing Not to Scale

FIGURE 2.2d

Interstate 29 Exit 2

Existing (2019) Traffic Conditions

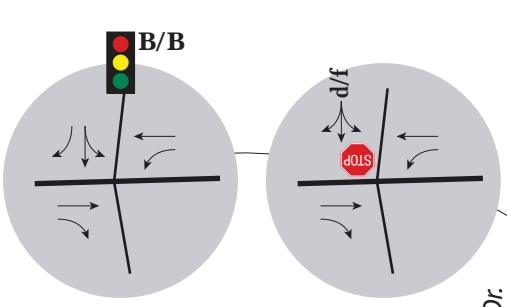
SDDOT Decennial 2020 ICS - Phase 2 18-571-01 12/4/20



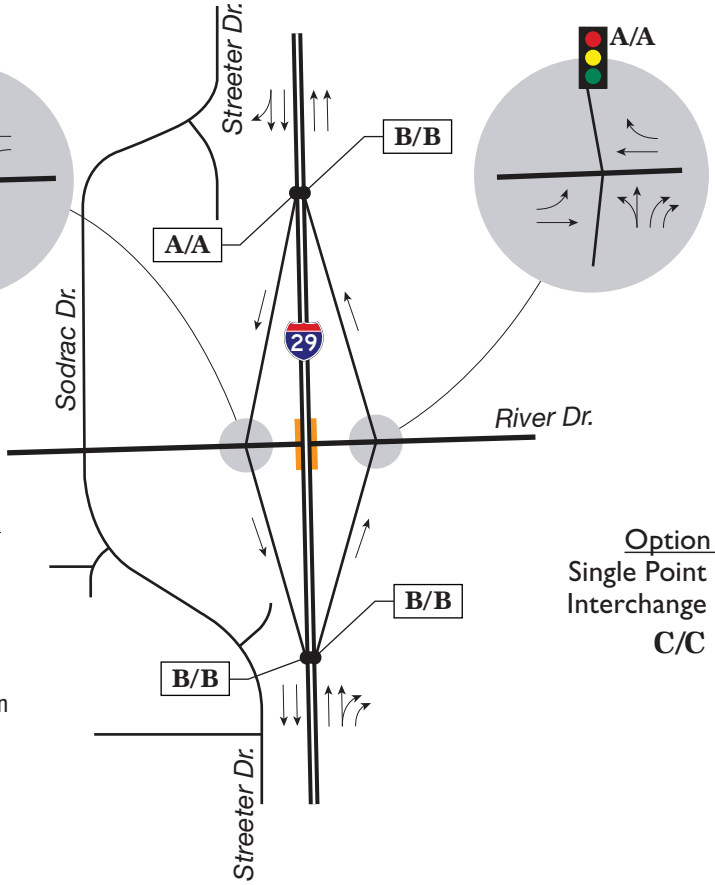
Option 3
Single Point Urban Interchange (SPUI)

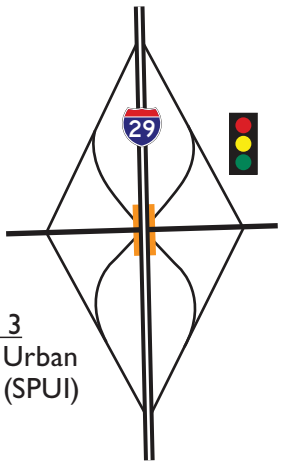
LEGEND

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



Option 1 & 2
Signalized SB Ramp and Local Access Modifications





Option 3
Single Point Urban Interchange (SPUI)
C/C

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	=	Stop Sign
	=	Traffic Signal
	=	Travel Lanes

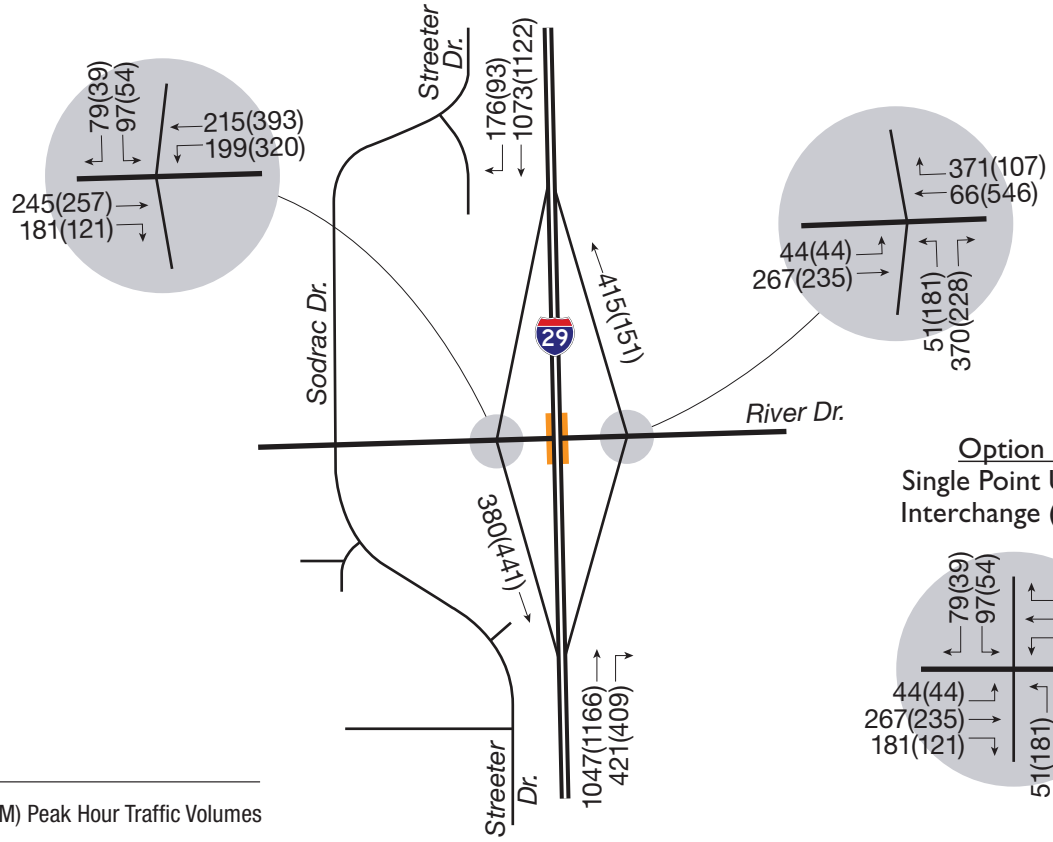
NORTH

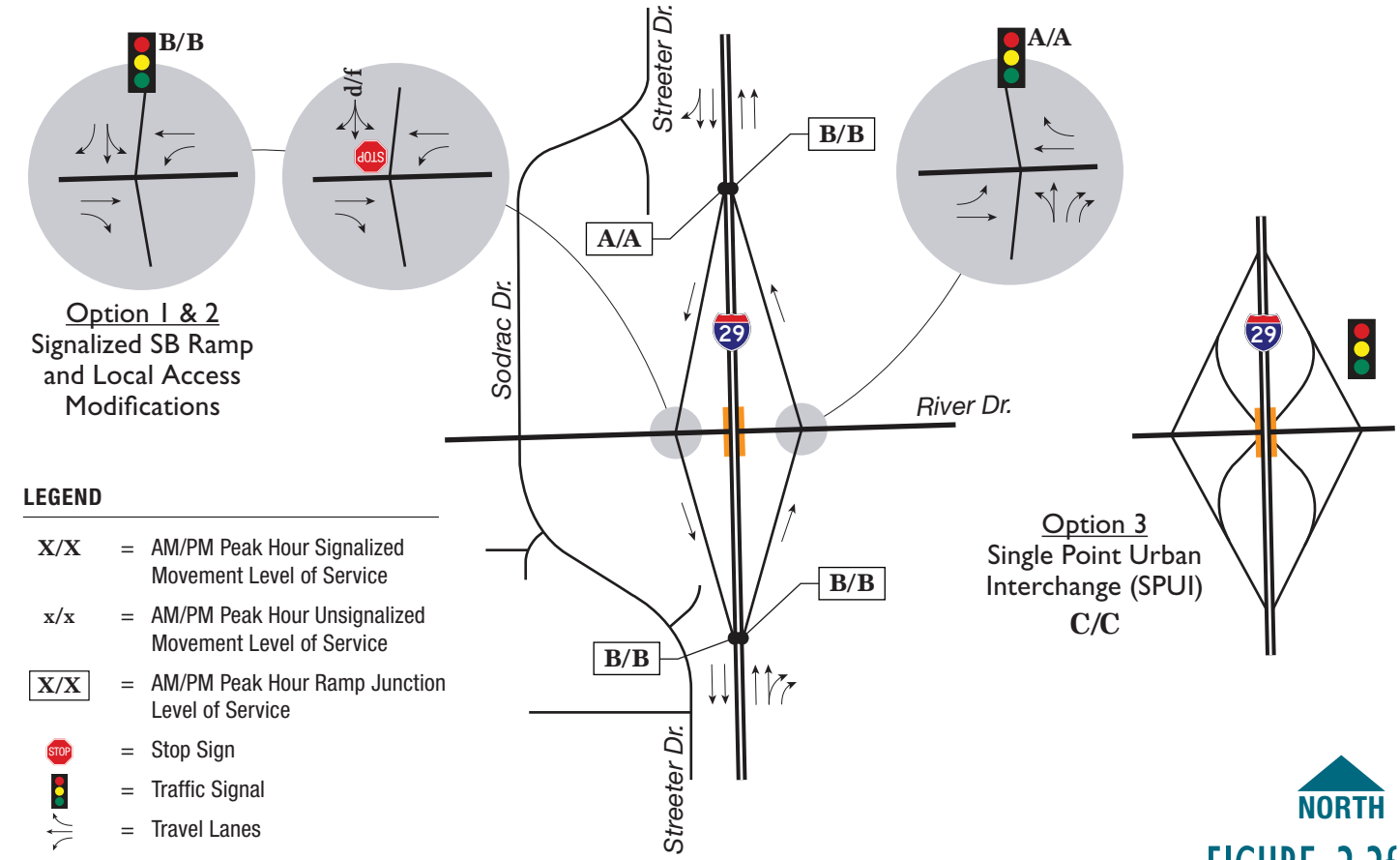
FELSBURG HOLT & ULLEVIG

NOTE: Drawing Not to Scale

FIGURE 2.2e
Interstate 29 Exit 2
Opening (2030) Traffic Conditions

SDDOT Decennial 2020 ICS - Phase 2 18-571-01 12/4/20





NORTH

FELSBURG HOLT & ULLEVIG

NOTE: Drawing Not to Scale

FIGURE 2.2f

Interstate 29 Exit 2

Future (2050) Traffic Conditions

SDDOT Decennial 2020 ICS - Phase 2 18-571-01 12/4/20

Table 2.2c I-29 Exit 2 Probable Construction Costs - Option 1

SOUTH DAKOTA DOT 2020 DECENNIAL INTERSTATE CORRIDOR STUDY

FHU PROJ NO. 118571-01

CONCEPTUAL LEVEL OPINION OF PROBABLE COST

FELSBURG HOLT & ULLEVIG

Alternative: I-29 Exit 2 Option 1

Prepared By: A. Orellana Date: 12/2/2020

	ITEM	DESCRIPTION	UNIT	CONTINGENCY	UNIT COST	QUANTITY	COST
1	**110**	Earthwork and Removals (2' Depth)	SY		$ **15**	12,100	$ 181,500
2	**110**	Earthwork (Significant Impacts)	CY		$ **10**	0	$ -
3	**110**	Remove Bridge	EA		$ **25,000**	0	$ -
4	**380**	Surfacing (Interstate & Ramps)	SY		$ **75**	9,000	$ 675,000
		SUBTOTAL (A)					$ **856,500**
5	**530**	Structures - Bridge	SF		$ **200**	0	$ -
6	**450**	Drainage - New	% of (A)	**3%**	$ -	-	$ 25,700
7	**451**	Utility Relocations	% of (A)	**3%**	$ -	-	$ 25,700
8	**632/633**	Traffic - Signing/Striping	% of (A)	**2%**	$ -	-	$ 12,850
9	**634**	Traffic Control	% of (A)	**2%**	$ -	-	$ 12,850
10	**734**	Erosion Control/Environmental	% of (A)	**2%**	$ -	-	$ 17,130
		SUBTOTAL (B)					$ **94,230**
11	**635**	Traffic - Signals (New)	EA		$ **270,000**	1	$ 270,000
12	**997**	Railroad Crossing	EA		$ **250,000**		$ -
13	**009**	Mobilization	% of (A)+(B)	**5%**	$ -	-	$ 47,540
14	**100**	Clearing	% of (A)+(B)	**2%**	$ -	-	$ 19,020
15		Contingency	% of (A)+(B)	**25%**	$ -	-	$ 237,690
		SUBTOTAL (C)					$ **574,250**
		CONSTRUCTION TOTAL (D)	**(A)+(B)+(C)**				$ **1,524,980**
16		Engineering Services	% of (D)	**15%**	$ -		$ 228,750
17		ROW Impacts	SF		$ **10**	131,400	$ 1,314,000
							$ ***3,067,730***
		PROJECT TOTAL (E)					$ **3,068,000**
		CONSTRUCTION (D) + ROW TOTAL COST					$ **2,900,000**

Note: In providing opinions of probable construction cost, the Client understands that Felsburg Holt & Ullevig has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing. The unit prices and percentages shown above were applied under the direction of the South Dakota Department of Transportation and FHU makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bid or actual costs.

Table 2.2d I-29 Exit 2 Probable Construction Costs - Option 2

SOUTH DAKOTA DOT 2020 DECENNIAL INTERSTATE CORRIDOR STUDY

FHU PROJ NO. 118571-01

CONCEPTUAL LEVEL OPINION OF PROBABLE COST

FELSBURG HOLT & ULLEVIG

Alternative: I-29 Exit 2 Option 2

Prepared By: A. Orellana Date: 12/2/2020

	ITEM	DESCRIPTION	UNIT	CONTINGENCY	UNIT COST	QUANTITY	COST
1	**110**	Earthwork and Removals (2' Depth)	SY		$ **15**	11,200	$ 168,000
2	**110**	Earthwork (Significant Impacts)	CY		$ **10**	0	$ -
3	**110**	Remove Bridge	EA		$ **25,000**	0	$ -
4	**380**	Surfacing (Interstate & Ramps)	SY		$ **75**	8,000	$ 600,000
		SUBTOTAL (A)					$ **768,000**
5	**530**	Structures - Bridge	SF		$ **200**	0	$ -
6	**450**	Drainage - New	% of (A)	**3%**	$ -	-	$ 23,040
7	**451**	Utility Relocations	% of (A)	**3%**	$ -	-	$ 23,040
8	**632/633**	Traffic - Signing/Striping	% of (A)	**2%**	$ -	-	$ 11,520
9	**634**	Traffic Control	% of (A)	**2%**	$ -	-	$ 11,520
10	**734**	Erosion Control/Environmental	% of (A)	**2%**	$ -	-	$ 15,360
		SUBTOTAL (B)					$ **84,480**
11	**635**	Traffic - Signals (New)	EA		$ **270,000**	1	$ 270,000
12	**997**	Railroad Crossing	EA		$ **250,000**		$ -
13	**009**	Mobilization	% of (A)+(B)	**5%**	$ -	-	$ 42,630
14	**100**	Clearing	% of (A)+(B)	**2%**	$ -	-	$ 17,050
15		Contingency	% of (A)+(B)	**25%**	$ -	-	$ 213,120
		SUBTOTAL (C)					$ **542,800**
		CONSTRUCTION TOTAL (D)	**(A)+(B)+(C)**				$ **1,395,280**
16		Engineering Services	% of (D)	**15%**	$ -		$ 209,300
17		ROW Impacts	SF		$ **10**	105,800	$ 1,058,000
							$ ***2,662,580***
		PROJECT TOTAL (E)					$ **2,663,000**
		CONSTRUCTION (D) + ROW TOTAL COST					$ **2,500,000**

Note: In providing opinions of probable construction cost, the Client understands that Felsburg Holt & Ullevig has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing. The unit prices and percentages shown above were applied under the direction of the South Dakota Department of Transportation and FHU makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bid or actual costs.

Table 2.2e I-29 Exit 2 Probable Construction Costs - Option 3

SOUTH DAKOTA DOT 2020 DECENNIAL INTERSTATE CORRIDOR STUDY

FHU PROJ NO. 118571-01

CONCEPTUAL LEVEL OPINION OF PROBABLE COST

FELSBURG HOLT & ULLEVIG

Alternative: I-29 Exit 2 Option 3

Prepared By: A. Orellana Date: 12/2/2020

	ITEM	DESCRIPTION	UNIT	CONTINGENCY	UNIT COST	QUANTITY	COST
1	**110**	Earthwork and Removals (2' Depth)	SY		$ **15**	32,388	$ 485,820
2	**110**	Earthwork (Significant Impacts)	CY		$ **10**	151,400	$ 1,514,000
3	**110**	Remove Bridge	EA		$ **25,000**	2	$ 50,000
4	**380**	Surfacing (Interstate & Ramps)	SY		$ **75**	39,000	$ 2,925,000
		SUBTOTAL (A)					$ **4,974,820**
5	**530**	Structures - Bridge	SF		$ **200**	37,400	$ 7,480,000
6	**450**	Drainage - New	% of (A)	**8%**	$ -	-	$ 397,990
7	**451**	Utility Relocations	% of (A)	**6%**	$ -	-	$ 298,490
8	**632/633**	Traffic - Signing/Striping	% of (A)	**4%**	$ -	-	$ 199,000
9	**634**	Traffic Control	% of (A)	**6%**	$ -	-	$ 298,490
10	**734**	Erosion Control/Environmental	% of (A)	**6%**	$ -	-	$ 298,490
		SUBTOTAL (B)					$ **8,972,460**
11	**635**	Traffic - Signals (New)	EA		$ **270,000**	1	$ 270,000
12	**997**	Railroad Crossing	EA		$ **250,000**		$ -
13	**009**	Mobilization	% of (A)+(B)	**5%**	$ -	-	$ 697,370
14	**100**	Clearing	% of (A)+(B)	**2%**	$ -	-	$ 278,950
15		Contingency	% of (A)+(B)	**30%**	$ -	-	$ 4,184,190
		SUBTOTAL (C)					$ **5,430,510**
		CONSTRUCTION TOTAL (D)	**(A)+(B)+(C)**				$ **19,377,790**
16		Engineering Services	% of (D)	**15%**	$ -		$ 2,906,670
17		ROW Impacts	SF		$ **10**	11,300	$ 113,000
							$ ***22,397,460***
		PROJECT TOTAL (E)					$ **22,398,000**
		CONSTRUCTION (D) + ROW TOTAL COST					$ **19,500,000**

Note: In providing opinions of probable construction cost, the Client understands that Felsburg Holt & Ullevig has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing. The unit prices and percentages shown above were applied under the direction of the South Dakota Department of Transportation and FHU makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bid or actual costs.

2.3 I-29 Exit 4 – McCook Lake

2.3.1 Review of Interchange Needs

Phase 1 revealed operations needs at this interchange as currently configured, described as follows:

Operations

Phase 1 of the study evaluated Year 2019 peak hour traffic operations, and year 2050 forecasts were developed based on linear extrapolation from the SIMPCO 2040 Travel Demand Model. The NCHRP 765 methodology was used to calculate Long Term Future (2050) traffic volumes.

Progressing into Phase 2 tasks, Year 2030 traffic volumes were forecasted by interpolating between the 2019 and 2050 traffic volumes to establish a LOS baseline for the potential opening year. LOS results for 2019, 2030, and 2050 based on a No-Action condition are reported in **Table 2.3a** and depicted graphically on **Figures 2.3b through Figure 2.3d**.

Table 2.3a I-29 Exit 4 No-Action Interchange LOS Findings

Type	Location Description	AM/PM Peak Hour Level of Service by Year		
		2019	2030	2050
Ramp Terminal Intersections	Northbound (Unsignalized[1])	d/b	d/b	d/b
	Southbound (Unsignalized)	c/a	c/a	c/a
Ramp Merge/Diverge Section	Northbound off-ramp (Ramp B)	A/A	B/A	B/B
	Northbound on-ramp (Ramp A)	B/B	B/B	B/B
	Southbound off-ramp (Ramp D)	B/B	B/B	B/B
	Southbound on-ramp (Ramp C)	A/B	A/B	B/B

[1]Unsignalized LOS is reported for the critical intersection movement

As shown, operational analyses revealed that both ramp terminal intersections and all ramp merge/diverge sections currently operate at acceptable LOS and are projected to continue to do so through Year 2050. The lone exception is the northbound ramp terminal intersection, where the northbound left turn movement is projected to operate at a substandard LOS D in all time horizons.

2.3.2 Discussion of Options

Due to operational concerns, this interchange was moved forward to Phase 2 of the study to further develop solutions to the deficiencies outlined in the Phase 1 report. One improvement option was identified.

Option 1: Bridge Widening and Ramp Terminal Realignment

The provision of a three-lane bridge over I-29 would furnish a center left turn lane approaching both ramp terminals, and the NB approach to the NB ramp terminal would be improved to provide two

approach lanes—a shared through/left and the other an exclusive right turn lane. Additionally, the ramp terminals would be realigned to improve driver efficiency when navigating through the ramp intersections. The concept drawing of this improvement option is shown on **Figure 2.3a**.

2.3.3 Evaluation of Options

Operations of the freeway facilities and ramp terminals were analyzed for the potential improvements under Opening (2030) and Future (2050) traffic conditions using HCS. Results of the HCS analysis and traffic conditions are depicted on **Figure 2.3b, Figure 2.3c,** and **Figure 2.3d**. Traffic volumes would remain consistent with No-Action conditions, discussed previously.

Option 1: Bridge Widening and Ramp Terminal Realignment

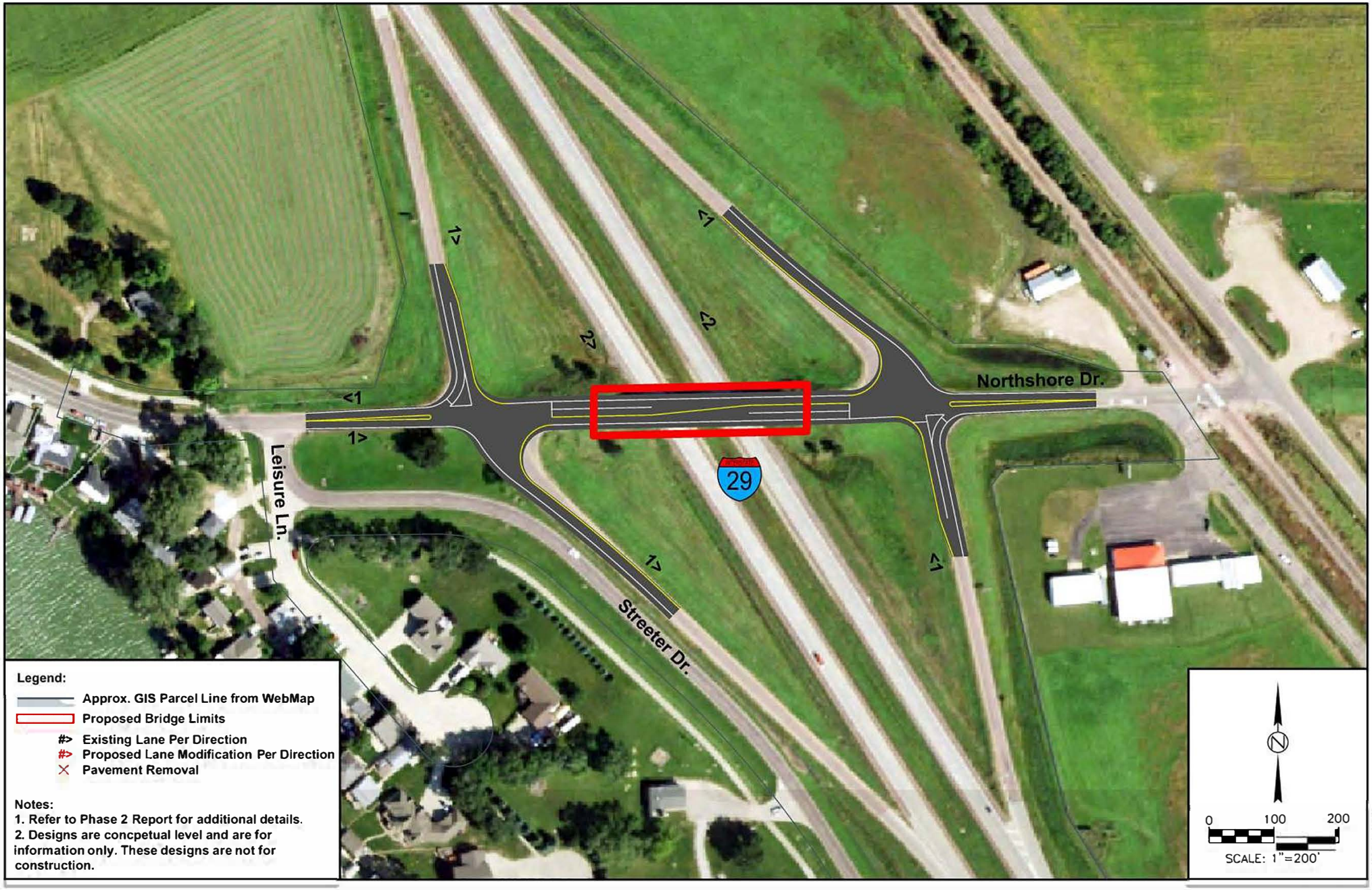
With two approach lanes at the NB ramp terminal, the NB approach critical movement would improve to LOS C in the AM peak period and LOS B in the PM peak period under Opening (2030) and Future (2050) traffic conditions. The concept drawing of this improvement option is shown on **Figure 2.3a**. Construction costs for this concept are estimated at $7.9 million.

A detailed cost estimate for this option is included in **Table 2.3e**.

An analysis of Option 1 was conducted to provide an evaluation of benefits and impacts. The various evaluation factors discussed are summarized in **Table 2.3b**.

Table 2.3b I-29 Exit 4 Options Evaluation Summary

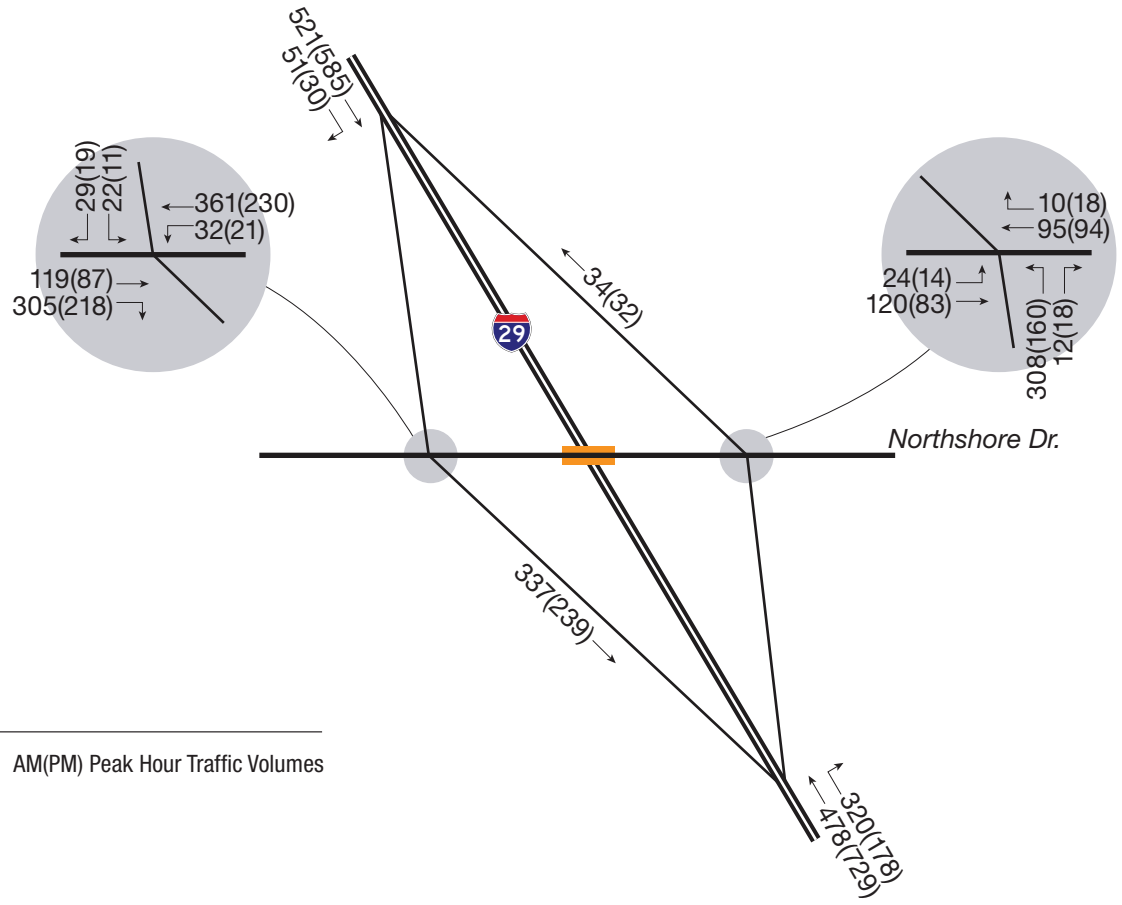
Evaluation Factors		Option 1 Bridge Widening and Ramp Terminal Realignment
Environmental Impacts		Minimal
Development Compatibility		Maintains current development and access
Multimodal Compatibility		Few/no added accommodations
Geometric Design		Addresses all current geometric deficiencies
Safety		High potential for crash reduction and/or reduces emergency response times
Constructability		Moderate degree of complexity
Traffic Level of Service	**2030**	LOS A
	2050	LOS A
Right-of-Way (SF)		0
# of Properties Impacted (take or access)		0
Construction Costs		$7.9 million



FELSBURG HOLT & ULLEVIG

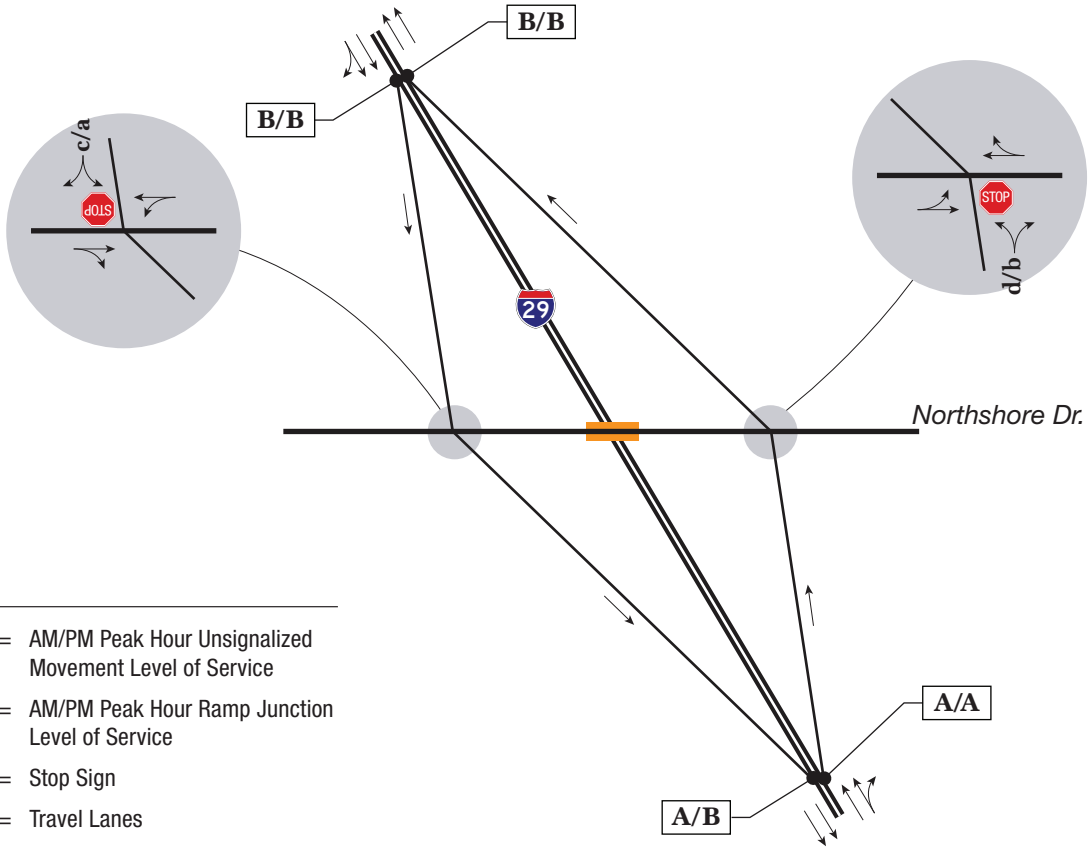
CONCEPTUAL

Figure 2.3a
I-29 Exit 4 McCook Lake
Option 1: Bridge Widening and Ramp Terminal Realignment



LEGEND

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



LEGEND

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

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

STOP = Stop Sign

= Travel Lanes

NORTH

FIGURE 2.3b

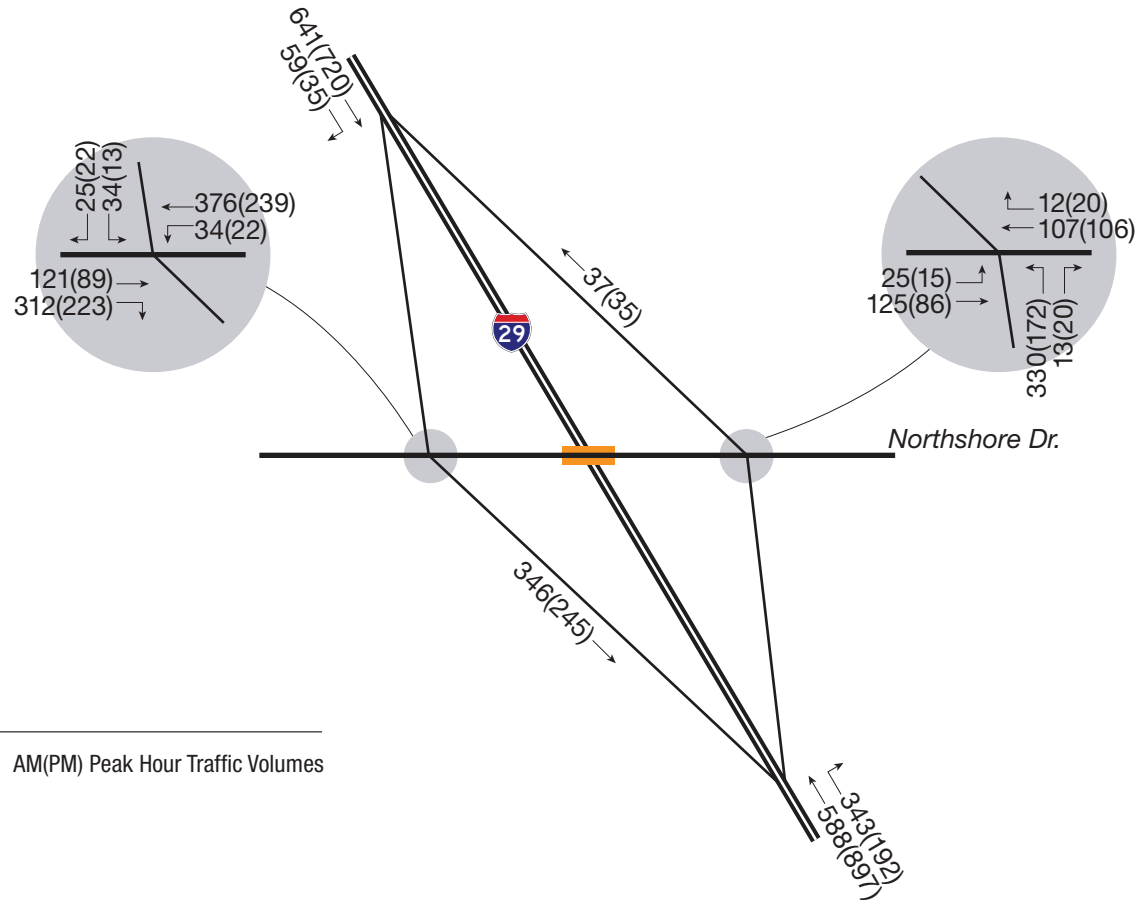
Interstate 29 Exit 4

Existing (2019) Traffic Conditions

SDDOT Decennial 2020 ICS - Phase 2 18-571-01 12/4/20

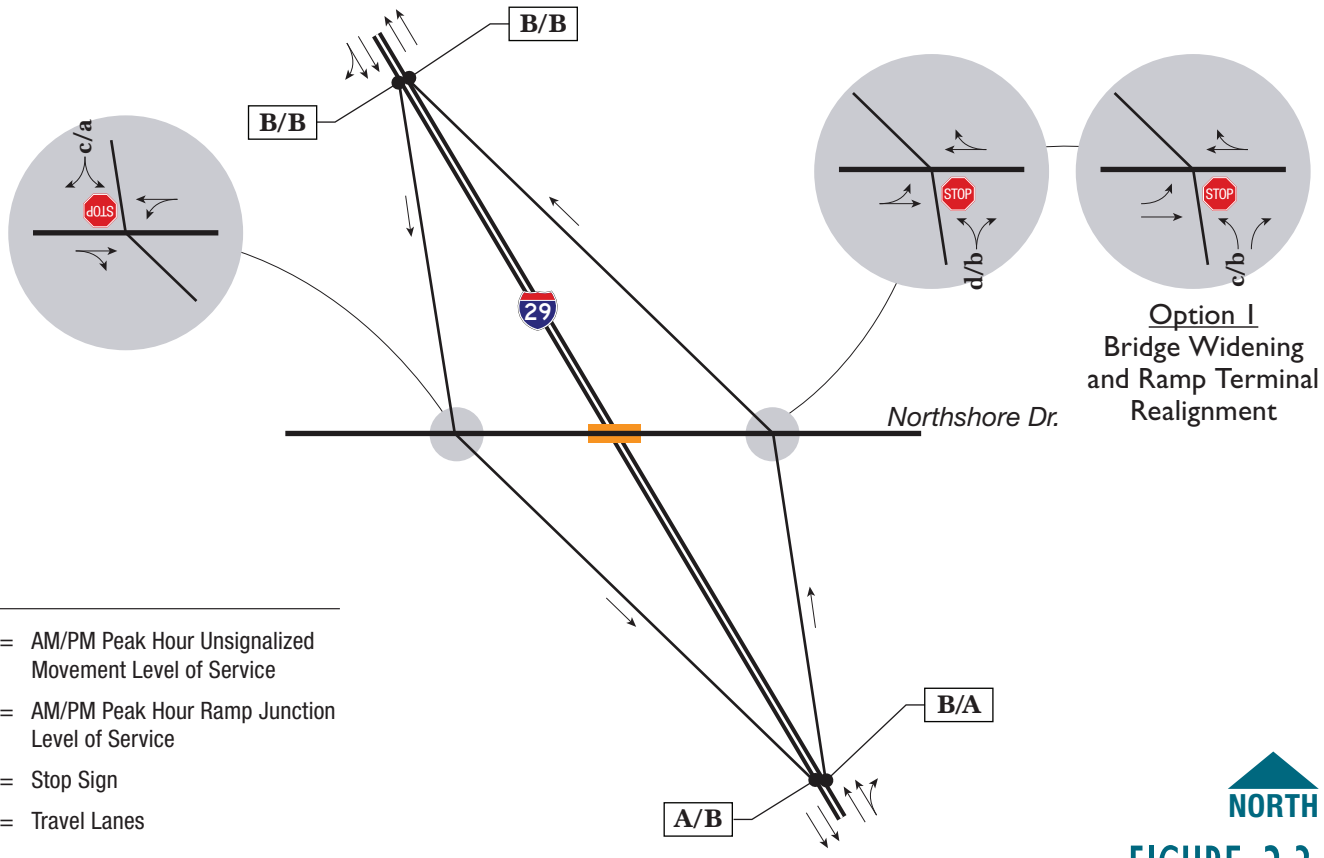
FELSBURG HOLT & ULLEVIG

NOTE: Drawing Not to Scale



LEGEND

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



Option 1
Bridge Widening and Ramp Terminal Realignment

LEGEND

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

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

STOP = Stop Sign

= Travel Lanes

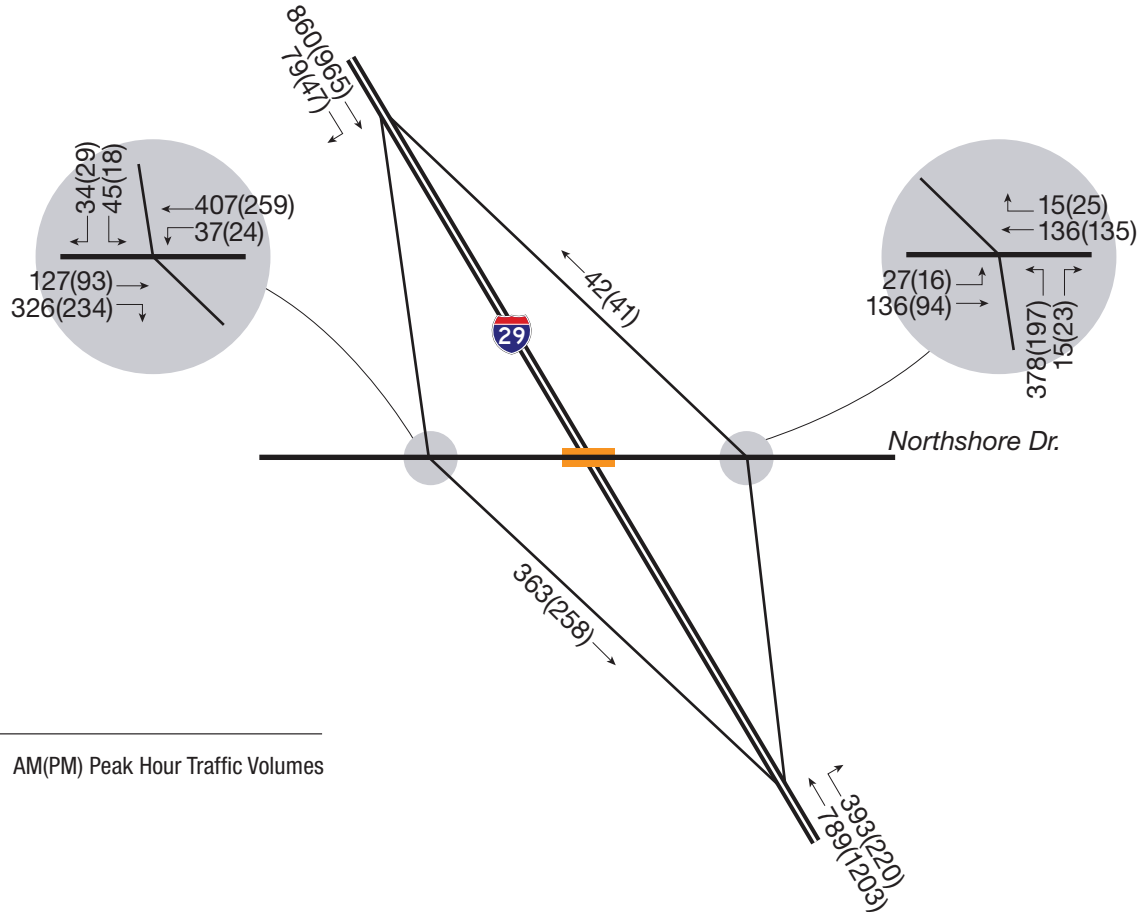
NORTH

FELSBURG HOLT & ULLEVIG

NOTE: Drawing Not to Scale

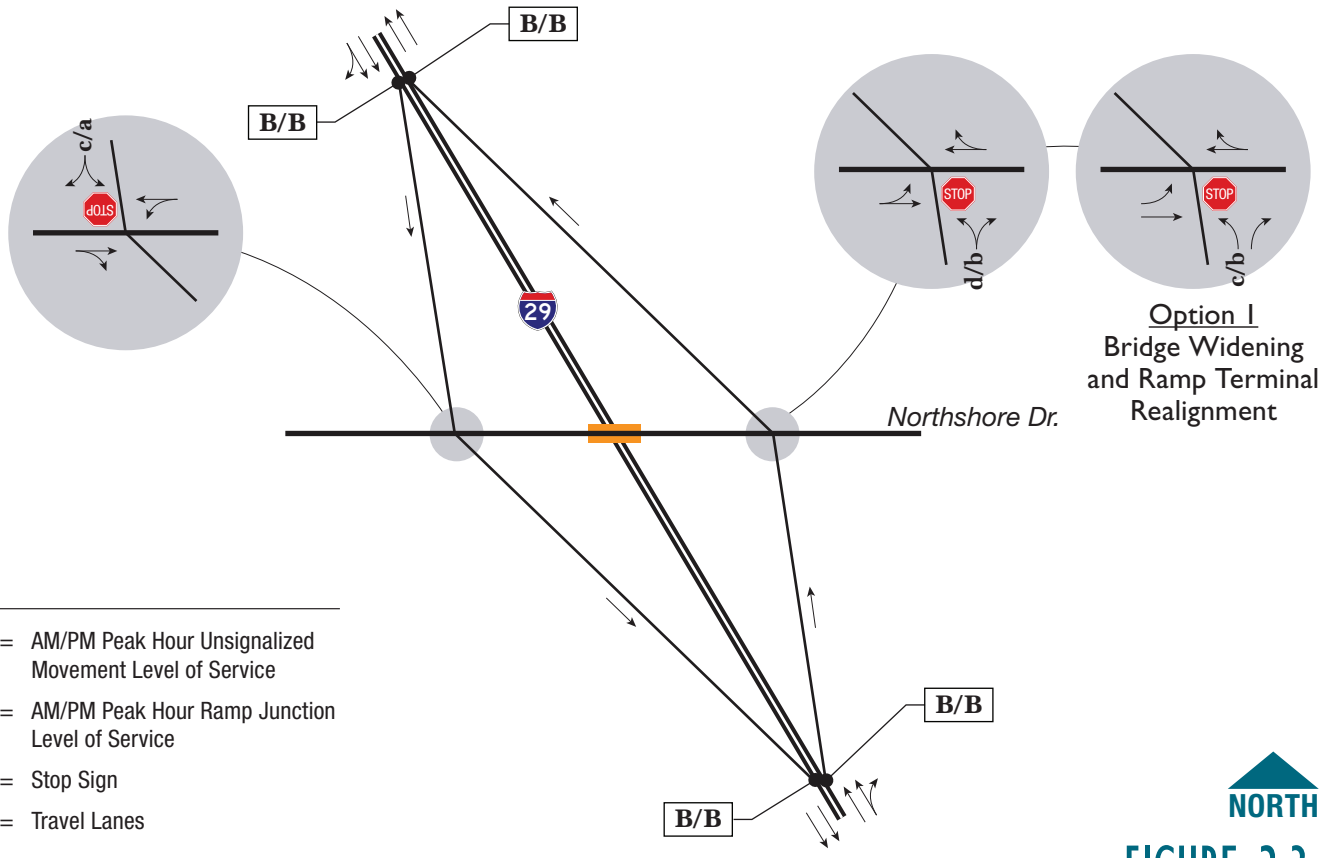
FIGURE 2.3c
Interstate 29 Exit 4
Opening (2030) Traffic Conditions

SDDOT Decennial 2020 ICS - Phase 2 18-571-01 12/4/20



LEGEND

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



Option 1
Bridge Widening and Ramp Terminal Realignment

LEGEND

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

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

STOP = Stop Sign

= Travel Lanes

NORTH

FELSBURG HOLT & ULLEVIG

NOTE: Drawing Not to Scale

FIGURE 2.3d

Interstate 29 Exit 4
Future (2050) Traffic Conditions

SDDOT Decennial 2020 ICS - Phase 2 18-571-01 12/4/20

Table 2.3c I-29 Exit 4 Probable Construction Costs - Option 1

SOUTH DAKOTA DOT 2020 DECENNIAL INTERSTATE CORRIDOR STUDY

FHU PROJ NO. 118571-01

CONCEPTUAL LEVEL OPINION OF PROBABLE COST

FELSBURG HOLT & ULLEVIG

Alternative: I-29 Exit 4 Option 1

Prepared By: A. Orellana Date: 12/2/2020

	ITEM	DESCRIPTION	UNIT	CONTINGENCY	UNIT COST	QUANTITY	COST
1	**110**	Earthwork and Removals (2' Depth)	SY		$ **15**	16,500	$ 247,500
2	**110**	Earthwork (Significant Impacts)	CY		$ **10**	0	$ -
3	**110**	Remove Bridge	EA		$ **25,000**	1	$ 25,000
4	**380**	Surfacing (Interstate & Ramps)	SY		$ **75**	11,000	$ 825,000
		SUBTOTAL (A)					$ **1,097,500**
5	**530**	Structures - Bridge	SF		$ **200**	23,700	$ 4,740,000
6	**450**	Drainage - New	% of (A)	**3%**	$ -	-	$ 32,930
7	**451**	Utility Relocations	% of (A)	**3%**	$ -	-	$ 32,930
8	**632/633**	Traffic - Signing/Striping	% of (A)	**2%**	$ -	-	$ 16,470
9	**634**	Traffic Control	% of (A)	**2%**	$ -	-	$ 16,470
10	**734**	Erosion Control/Environmental	% of (A)	**2%**	$ -	-	$ 21,950
		SUBTOTAL (B)					$ **4,860,750**
11	**635**	Traffic - Signals (New)	EA		$ **270,000**	0	$ -
12	**997**	Railroad Crossing	EA		$ **250,000**		$ -
13	**009**	Mobilization	% of (A)+(B)	**5%**	$ -	-	$ 297,920
14	**100**	Clearing	% of (A)+(B)	**2%**	$ -	-	$ 119,170
15		Contingency	% of (A)+(B)	**25%**	$ -	-	$ 1,489,570
		SUBTOTAL (C)					$ **1,906,660**
		CONSTRUCTION TOTAL (D)	**(A)+(B)+(C)**				$ **7,864,910**
16		Engineering Services	% of (D)	**15%**	$ -		$ 1,179,740
17		ROW Impacts	SF		$ **10**	0	$ -
							$ ***9,044,650***
		PROJECT TOTAL (E)					$ **9,045,000**
		CONSTRUCTION (D) + ROW TOTAL COST					$ **7,900,000**

Note: In providing opinions of probable construction cost, the Client understands that Felsburg Holt & Ullevig has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing. The unit prices and percentages shown above were applied under the direction of the South Dakota Department of Transportation and FHU makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bid or actual costs.

2.4 I-29 Exit 26 – Vermillion

2.4.1 Review of Interchange Needs

Phase 1 revealed operations and Long Combination Vehicle (LCV) movement needs at this interchange as currently configured, described as follows:

Operations

Phase 1 of the study evaluated Year 2019 peak hour traffic operations, and year 2050 forecasts were developed based on SDDOT county-specific growth rates for each leg of the ramp terminals. Straight-line growth projections and the NCHRP 765 methodology were used. Progressing into Phase 2 tasks, Year 2030 traffic volumes were forecasted by interpolating between the 2019 and 2050 traffic volumes to establish a LOS baseline for the potential opening year. LOS results for 2019, 2030, and 2050 based on a No-Action condition are reported in **Table 2.4a** and depicted graphically on **Figure 2.4b through Figure 2.4.d**.

Table 2.4a I-29 Exit 26 No-Action Interchange LOS Findings

Type	Location Description	AM/PM Peak Hour Level of Service by Year		
		2019	2030	2050
Ramp Terminal Intersections	Northbound (Unsignalized[1])	c/c	c/d	e/f
	Southbound (Unsignalized)	b/c	b/c	c/c
Ramp Merge/Diverge Section	Northbound off-ramp (Ramp B)	A/A	A/A	A/A
	Northbound on-ramp (Ramp A)	A/A	A/A	A/A
	Southbound off-ramp (Ramp D)	A/A	A/A	A/A
	Southbound on-ramp (Ramp C)	A/A	A/A	A/A

[1]Unsignalized LOS is reported for the critical intersection movement

As shown, the stop-controlled NB ramp terminal is expected to operate at LOS C in the AM peak period and LOS D in the PM peak period by Opening (2030) and LOS E in the AM peak period and LOS F in the PM peak period by Future (2050). The stop-controlled SB ramp terminal is expected to operate at LOS B in the AM peak period and LOS C in the PM peak period by Opening (2030) and LOS C in the AM and PM peak periods by the year 2050.

The merge and diverge movements at the ramps were also examined using the same volumes and analysis methodology. For all scenarios, merge and diverge movements are expected to operate at acceptable LOS.

Long Combination Vehicle (LCV) Movements

The Exit 26 interchange connects with a designated LCV route, SD Highway 50. In Phase 1, the project team assessed the ability of the Exit 26 ramp terminal intersections to accommodate LCVs. It was found

that the current intersections are unable to accommodate these larger vehicles. Improvements are needed to each ramp to provide standard acceleration and deceleration distances, and additional pavement is needed to limit truck overtracking on Ramps A, B, and C. In addition, the right shoulder should be improved on Ramps B and C, and the inslope should be improved to 6:1 on Ramps B, C and D.

2.4.2 Discussion of Options

Due to operational and LCV movement concerns, this interchange was advanced to Phase 2 of the study to further develop solutions to the deficiencies outlined in the Phase 1 report. One improvement option was identified to address the needs.

Option 1: Signalization of NB Ramp and Modifications to Shoulders and Clear Zone

The bridge over I-90 would be widened to provide three lanes and standard-width shoulders. The signalization of the NB ramp intersection and modifications around the interchange ramps to the shoulders, clear zone, and inslope would provide multiple benefits. Additionally, the option would provide improvements to curb returns to better accommodate LCV movements.

2.4.3 Evaluation of Options

Operations of the freeway facilities and ramp terminals were analyzed for the potential improvements under Opening (2030) and Future (2050) traffic conditions using HCS. Results of the HCS analysis and traffic conditions are depicted on **Figures 2.4b, Figure 2.4.c,** and **Figure 2.4.d**. Traffic volumes would remain consistent with No-Action conditions, discussed previously.

Option 1: Signalization of NB Ramp and Modifications to Shoulders and Clear Zone

With the signalization of the NB ramp intersection, the intersection would operate at LOS A in the AM and PM peak periods under Opening (2030) and Future (2050) traffic conditions. The concept drawing of this improvement option is shown on **Figure 2.4a**. Construction costs for this concept are estimated at $8.1 million.

A detailed cost estimate is included following the interchange concept drawings in **Table 2.4c**.

An analysis was conducted to provide a comparative evaluation of the benefits and impacts associated with Option 1. The various evaluation factors discussed in the previous section were tabulated and are summarized in **Table 2.4b**.

Table 2.4b I-29 Exit 26 Options Evaluation Summary

Evaluation Factors		Option 1 Signalization of NB Ramp and Modifications to Shoulders and Clear Zone
Environmental Impacts		Minimal
Development Compatibility		Unchanged
Multimodal Compatibility		Enhanced accommodations
Geometric Design		Addresses all current geometric deficiencies
Safety		High potential for crash reduction and/or reduces emergency response times
Constructability		Moderate degree of complexity
Traffic Level of Service	**2030**	LOS B
	2050	LOS B
Right-of-Way (SF)		700
# of Properties Impacted (take or access)		0
Construction Costs		$8.1 million

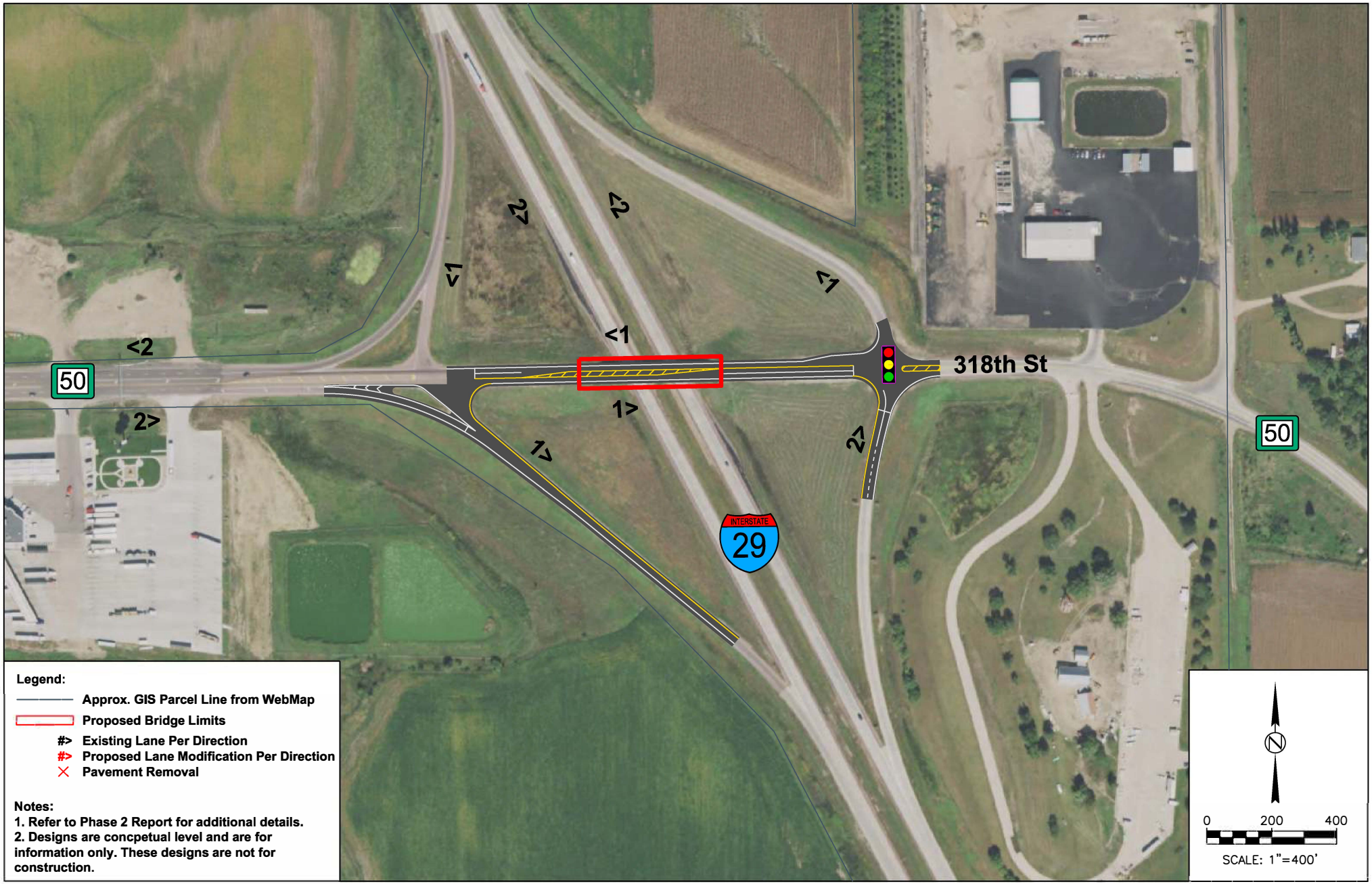
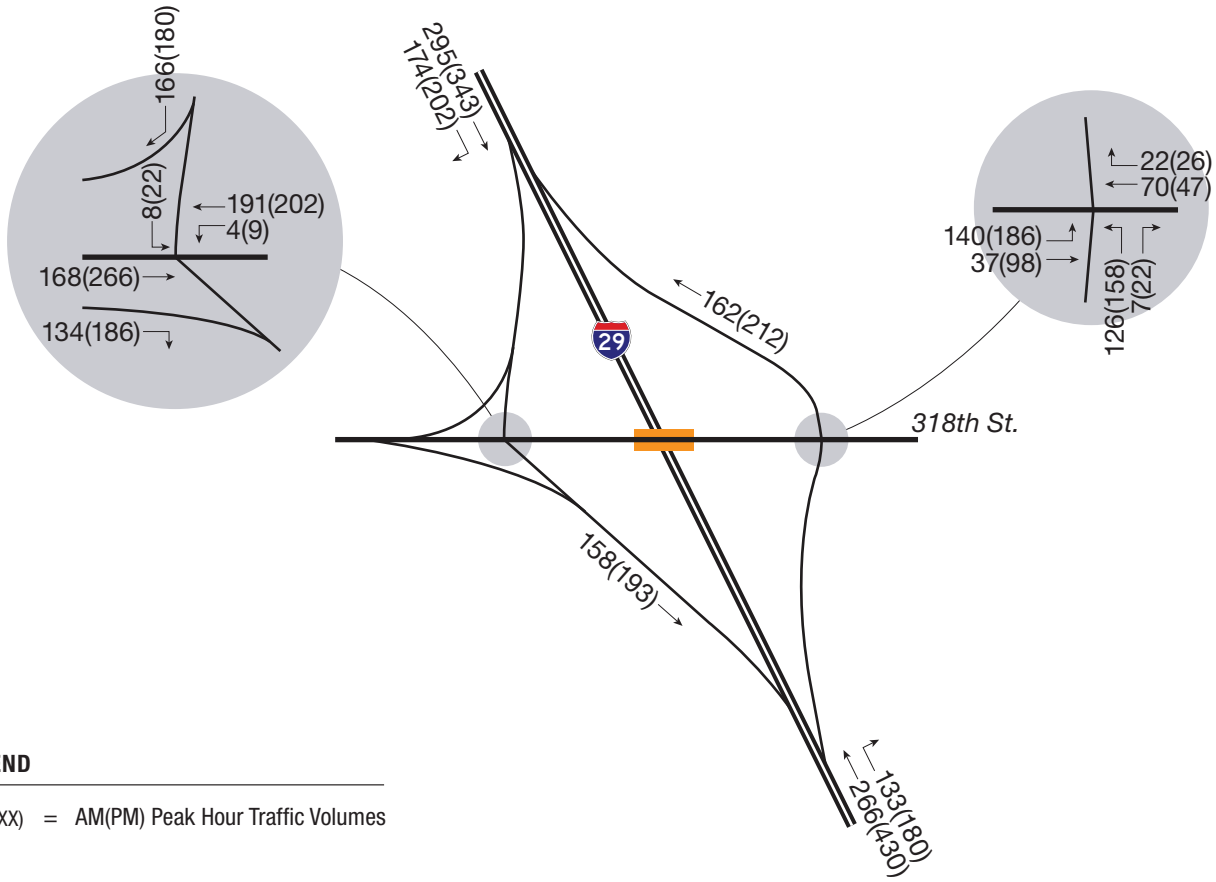


Figure 2.4a
I-29 Exit 26 Vermillion / Yankton
Option 1: Signalization of NB Ramp and Modifications to Shoulders/Clear Zone

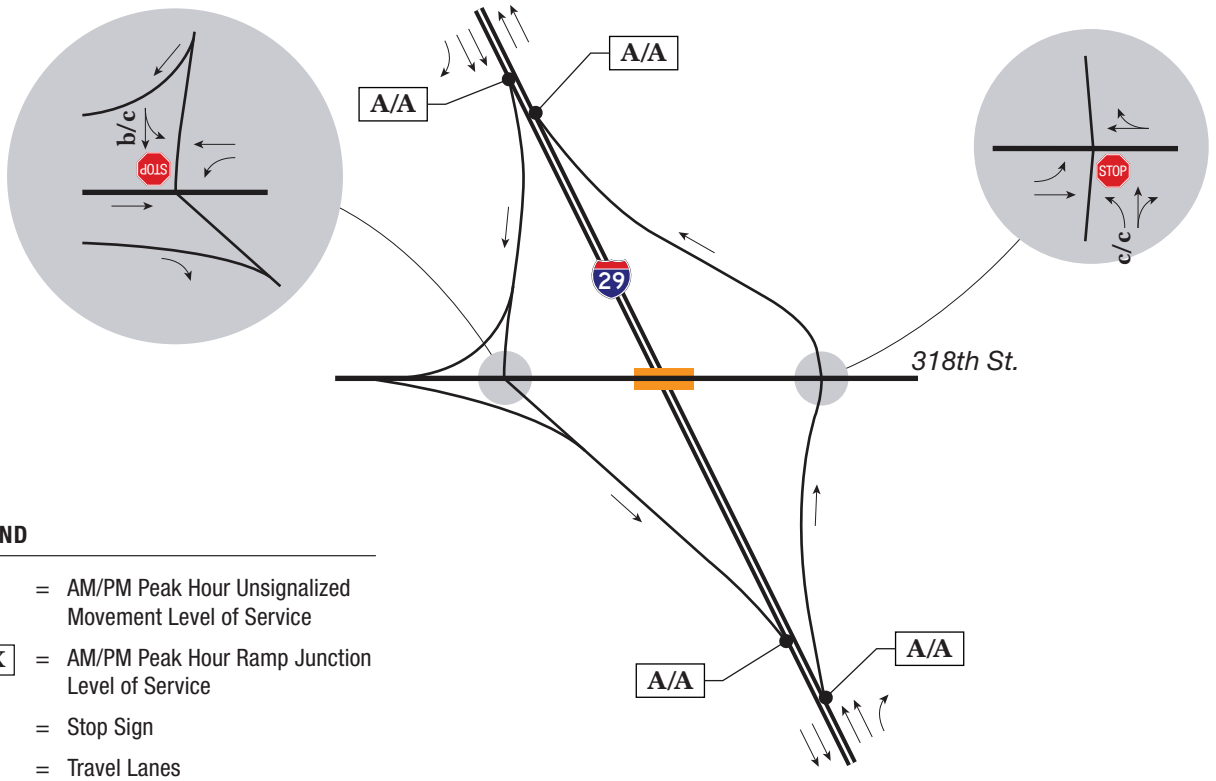
FELSBURG HOLT & ULLEVIG

CONCEPTUAL



LEGEND

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



LEGEND

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

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

STOP = Stop Sign

= Travel Lanes

NORTH

FELSBURG HOLT & ULLEVIG

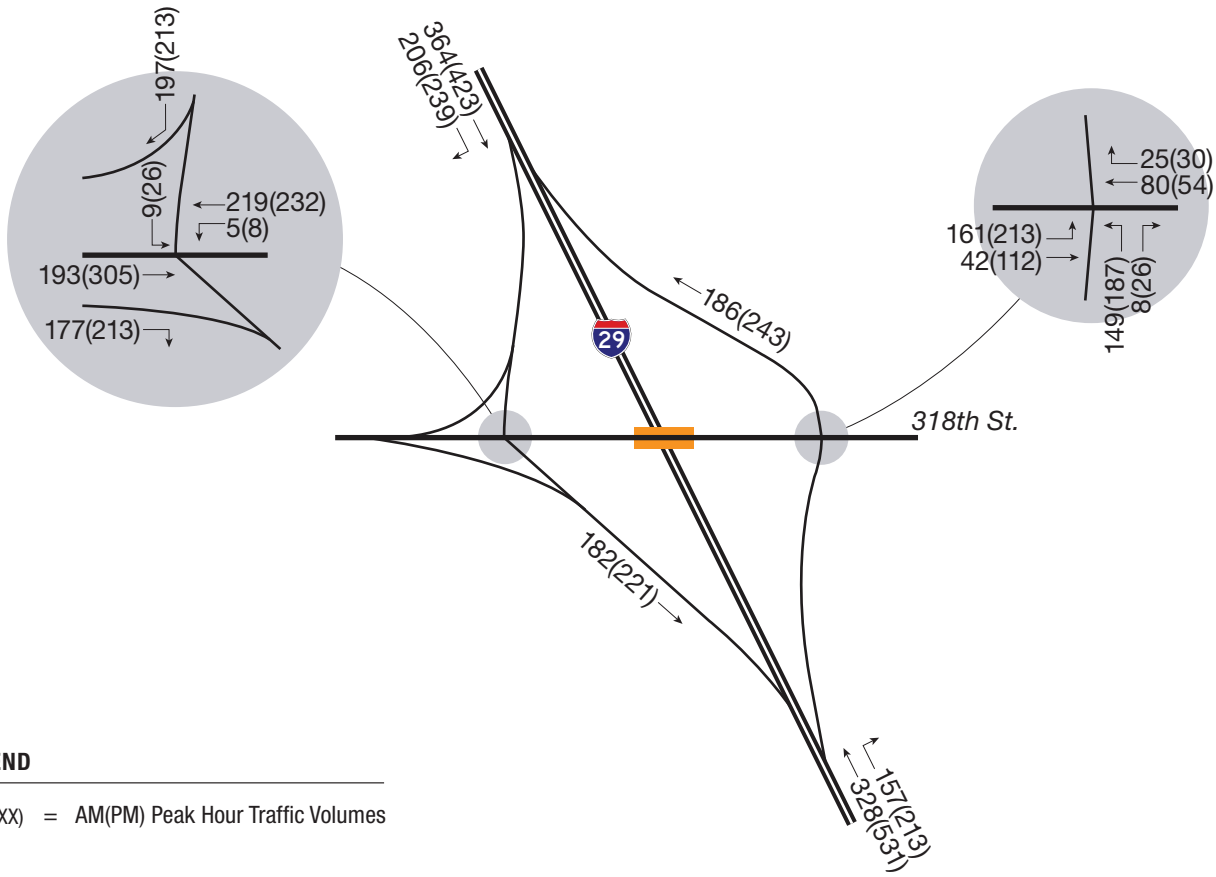
NOTE: Drawing Not to Scale

FIGURE 2.4b

Interstate 29 Exit 26

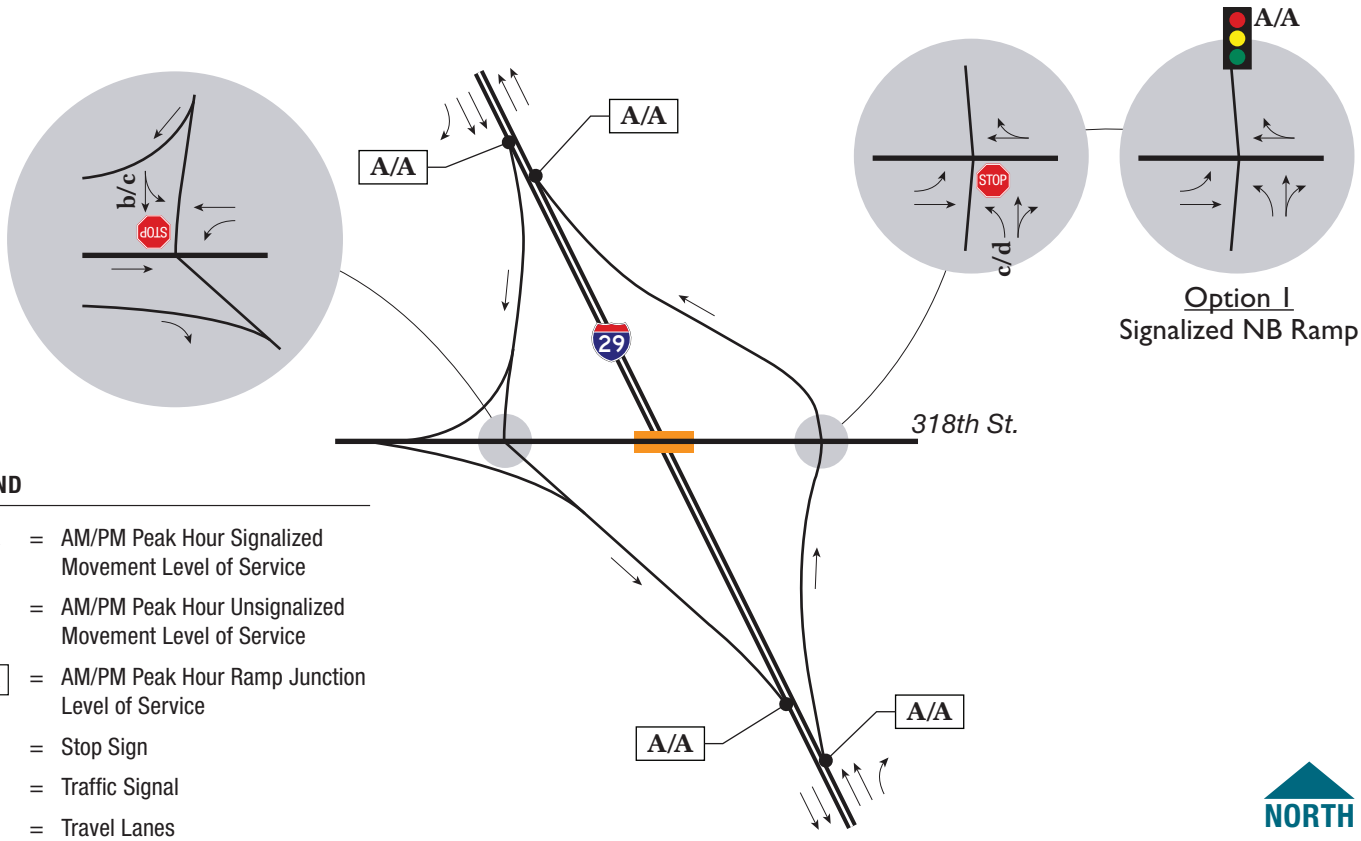
Existing (2019) Traffic Conditions

SDDOT Decennial 2020 ICS - Phase 2 18-571-01 12/4/20



LEGEND

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



Option 1
Signalized NB Ramp

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	=	Stop Sign
	=	Traffic Signal
	=	Travel Lanes

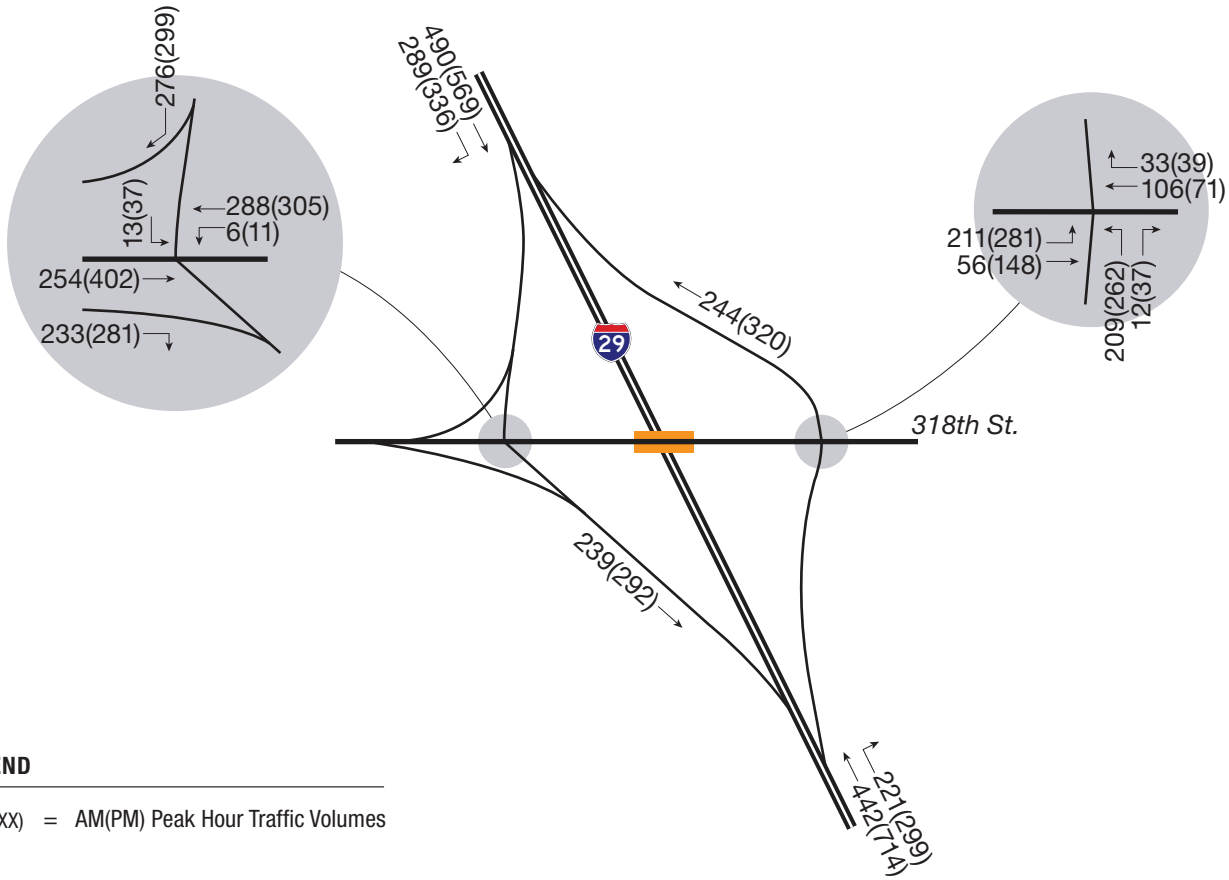
NORTH

FELSBURG HOLT & ULLEVIG

NOTE: Drawing Not to Scale

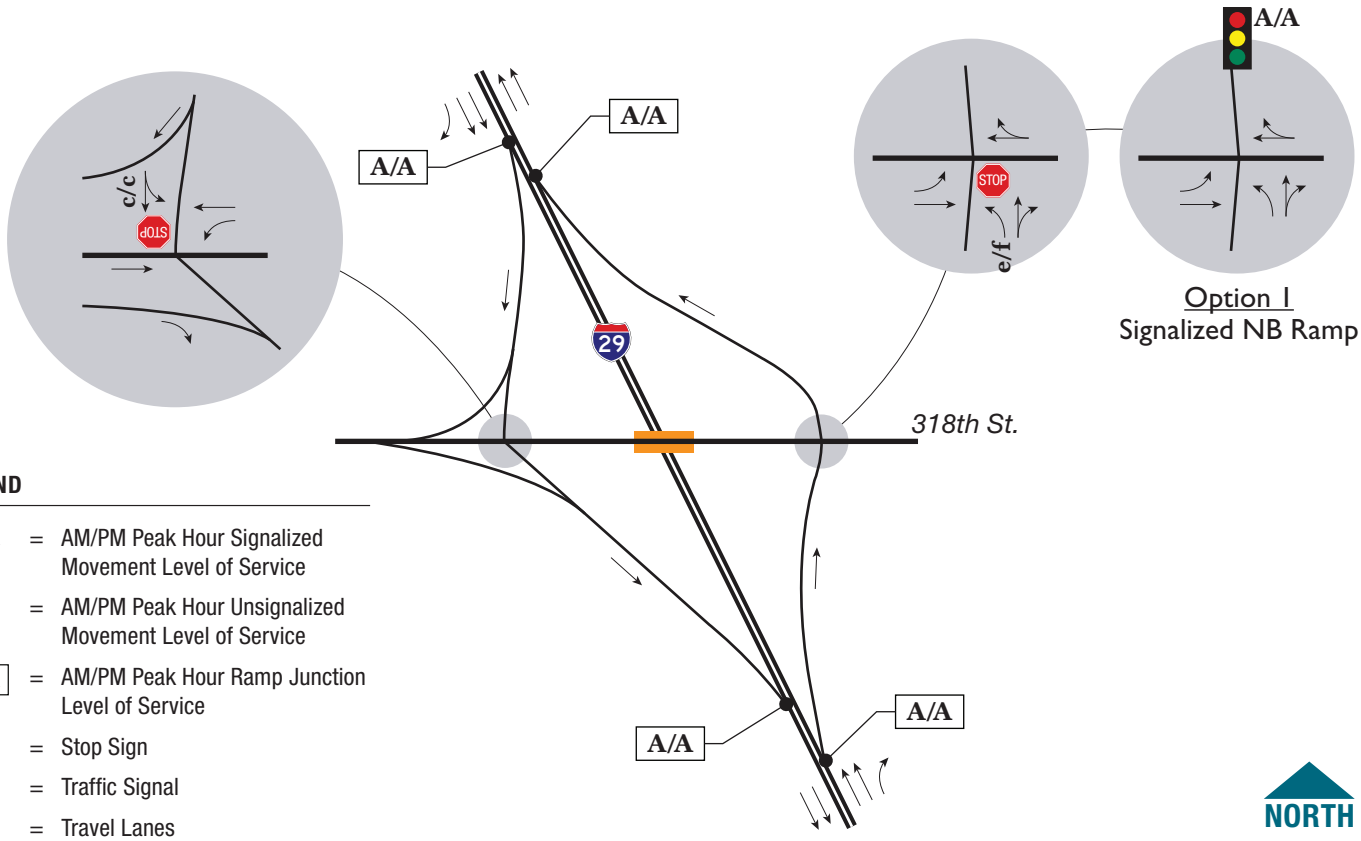
FIGURE 2.4c
Interstate 29 Exit 26
Opening (2030) Traffic Conditions

SDDOT Decennial 2020 ICS - Phase 2 18-571-01 12/4/20



LEGEND

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



Option 1
Signalized NB Ramp

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	=	Stop Sign
	=	Traffic Signal
	=	Travel Lanes

NORTH

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NOTE: Drawing Not to Scale

FIGURE 2.4d

Interstate 29 Exit 26
Future (2050) Traffic Conditions

SDDOT Decennial 2020 ICS - Phase 2 18-571-01 12/4/20

Table 2.4c I-29 Exit 26 Probable Construction Costs - Option 1

SOUTH DAKOTA DOT 2020 DECENNIAL INTERSTATE CORRIDOR STUDY

FHU PROJ NO. 118571-01

CONCEPTUAL LEVEL OPINION OF PROBABLE COST

FELSBURG HOLT & ULLEVIG

Alternative: I-29 Exit 26 Option 1

Prepared By: A. Orellana Date: 12/2/2020

	ITEM	DESCRIPTION	UNIT	CONTINGENCY	UNIT COST	QUANTITY	COST
1	**110**	Earthwork and Removals (2' Depth)	SY		$ **15**	19,500	$ 292,500
2	**110**	Earthwork (Significant Impacts)	CY		$ **10**	0	$ -
3	**110**	Remove Bridge	EA		$ **25,000**	1	$ 25,000
4	**380**	Surfacing (Interstate & Ramps)	SY		$ **75**	13,000	$ 975,000
		SUBTOTAL (A)					$ **1,292,500**
5	**530**	Structures - Bridge	SF		$ **200**	22,400	$ 4,480,000
6	**450**	Drainage - New	% of (A)	**3%**	$ -	-	$ 38,780
7	**451**	Utility Relocations	% of (A)	**3%**	$ -	-	$ 38,780
8	**632/633**	Traffic - Signing/Striping	% of (A)	**2%**	$ -	-	$ 19,390
9	**634**	Traffic Control	% of (A)	**2%**	$ -	-	$ 19,390
10	**734**	Erosion Control/Environmental	% of (A)	**2%**	$ -	-	$ 25,850
		SUBTOTAL (B)					$ **4,622,190**
11	**635**	Traffic - Signals (New)	EA		$ **270,000**	1	$ 270,000
12	**997**	Railroad Crossing	EA		$ **250,000**		$ -
13	**009**	Mobilization	% of (A)+(B)	**5%**	$ -	-	$ 295,740
14	**100**	Clearing	% of (A)+(B)	**2%**	$ -	-	$ 118,300
15		Contingency	% of (A)+(B)	**25%**	$ -	-	$ 1,478,680
		SUBTOTAL (C)					$ **2,162,720**
		CONSTRUCTION TOTAL (D)	**(A)+(B)+(C)**				$ **8,077,410**
16		Engineering Services	% of (D)	**15%**	$ -		$ 1,211,620
17		ROW Impacts	SF		$ **10**	700	$ 7,000
							$ ***9,296,030***
		PROJECT TOTAL (E)					$ **9,297,000**
		CONSTRUCTION (D) + ROW TOTAL COST					$ **8,100,000**

Note: In providing opinions of probable construction cost, the Client understands that Felsburg Holt & Ullevig has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing. The unit prices and percentages shown above were applied under the direction of the South Dakota Department of Transportation and FHU makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bid or actual costs.

2.5 I-29 Exit 59 – Davis

2.5.1 Review of Interchange Needs

Phase 1 revealed structural condition and bridge clearance needs at this interchange as currently configured, described as follows:

Structural Condition

The existing crossroad bridge over I-90 built in 1960 has a poor bridge condition rating (sufficiency rating of 52.3).

Bridge Clearance

The existing bridge provides vertical clearance of 15.92 feet over I-29, shy of the required 17 feet of minimum vertical clearance.

Geometric Conditions

Though not identified as needs based on Phase 1 criteria, there are geometric deficiencies present at the current Exit 59 interchange, including narrow shoulder widths and inslope. In addition, the interchange ramp termini require improvements to accommodate LCVs.

Operations

Traffic operations do not constitute a need at this interchange. Based on the Phase 1 analyses, traffic operations are currently acceptable at the Exit 59 interchange and are expected to remain acceptable through the Year 2050 with the No-Action condition in place.

Additional analyses were performed in Phase 2 to confirm this finding and provide an opening year (2030) analysis scenario. Growth rates for each leg of the ramp terminals were calculated using SDDOT county specific growth rates to develop Year 2050 forecasts. Straight-line projections and the NCHRP 765 methodology were used to estimate Opening (2030) traffic volumes. **Table 2.5a** provides a summary of LOS findings.

Table 2.5a I-29 Exit 59 No-Action Interchange LOS Findings

Type	Location Description	AM/PM Peak Hour Level of Service by Year		
		2019	2030	2050
Ramp Terminal Intersections	Northbound (Unsignalized[1])	a/a	a/a	a/b
	Southbound (Unsignalized)	a/a	a/a	a/a
Ramp Merge/Diverge Section	Northbound off-ramp (Ramp B)	A/A	A/B	B/B
	Northbound on-ramp (Ramp A)	A/A	B/B	B/B
	Southbound off-ramp (Ramp D)	A/A	B/B	B/B
	Southbound on-ramp (Ramp C)	A/A	B/B	B/B

[1]Unsignalized LOS is reported for the critical intersection movement

As shown, operational analyses revealed that both ramp terminal intersections and all ramp merge/diverge sections currently operate at acceptable LOS and are projected to continue to do so through Year 2050.

2.5.2 Discussion of Options

Due to structural condition and bridge clearance concerns, this interchange was advanced to Phase 2 of the study to further develop solutions to the deficiencies outlined in the Phase 1 report. One improvement option was identified.

Option 1: Diamond Interchange Reconstruction

Option 1 would provide a new bridge over I-29, addressing the existing structural deficiency and vertical clearance needs. Raising the vertical profile of the new bridge would require some reconstruction along the crossroad to meet grade requirements, and the new diamond interchange is proposed to be constructed to meet SDDOT standards for ramp terminal spacing in addition to addressing other geometric deficiencies and providing improvements to curb returns to better accommodate WB-92D and WB-109D truck movements.

2.5.3 Analysis of Options

Operations of the freeway facilities and ramp terminals were analyzed for the potential improvements under Opening (2030) and Future (2050) traffic conditions using HCS. Results of the HCS analysis and traffic conditions are depicted on **Figure 2.5b, Figure 2.5c,** and **Figure 2.5d**. For all options, the ramp movements are not expected to change compared to the No-Action scenario from Phase 1, discussed previously.

Option 1: Diamond Interchange Reconstruction

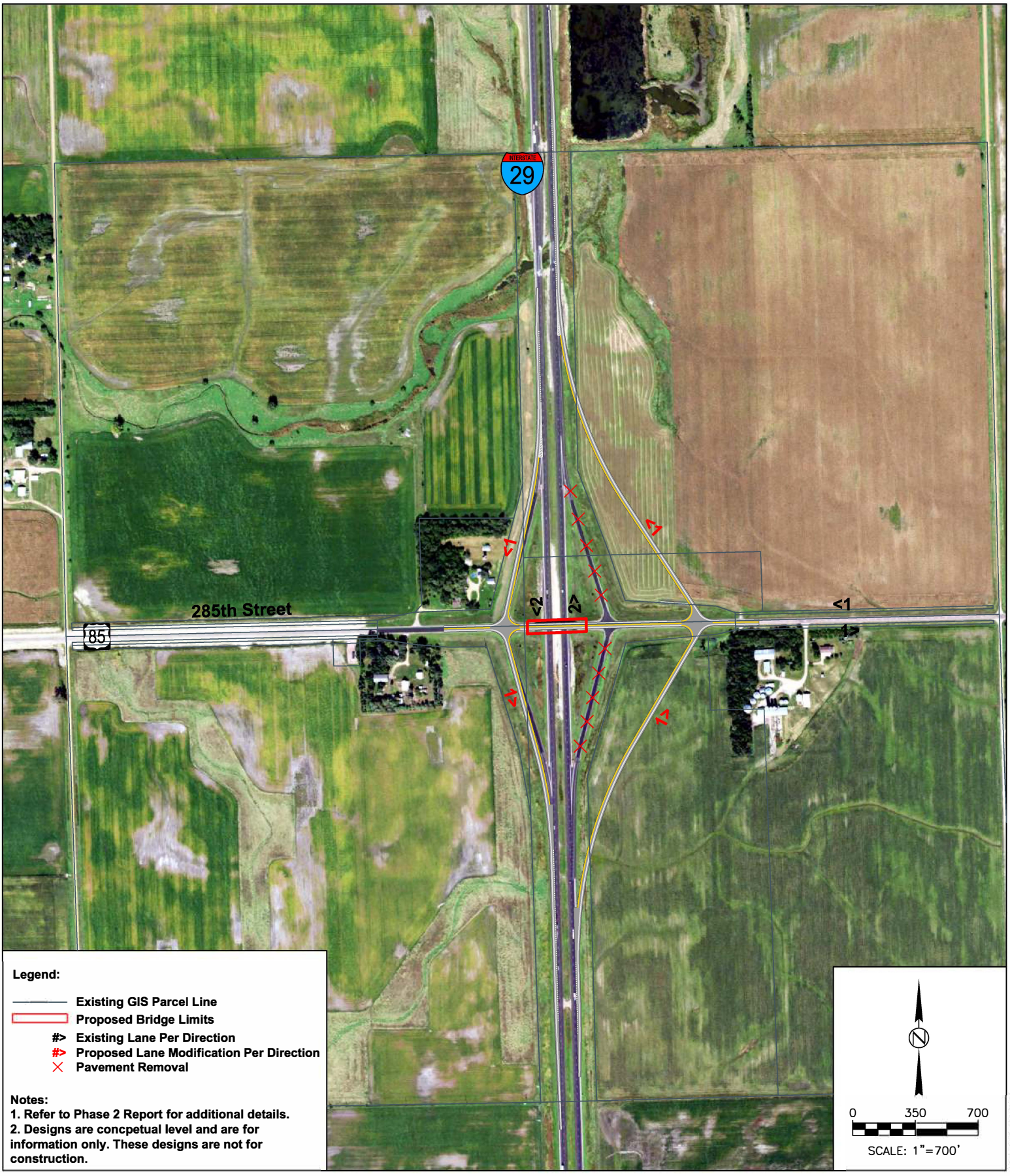
Both ramp terminals would remain stop-controlled, and no modifications to current lane geometry are needed to maintain acceptable operations into the future. Interchange operations would remain the same as the No-Action conditions shown in **Table 2.5a**. The concept drawing of this improvement option is shown on **Figure 2.5a**. Construction costs for this concept are estimated at $20.6 million. A detailed cost estimate is provided in **Table 2.5c**.

2.5.4 Evaluation of Options

An analysis of the Option was conducted to provide an evaluation of the associated benefits and impacts. The various evaluation factors were tabulated and are summarized in **Table 2.5b**.

Table 2.5b I-29 Exit 59 Options Evaluation Summary

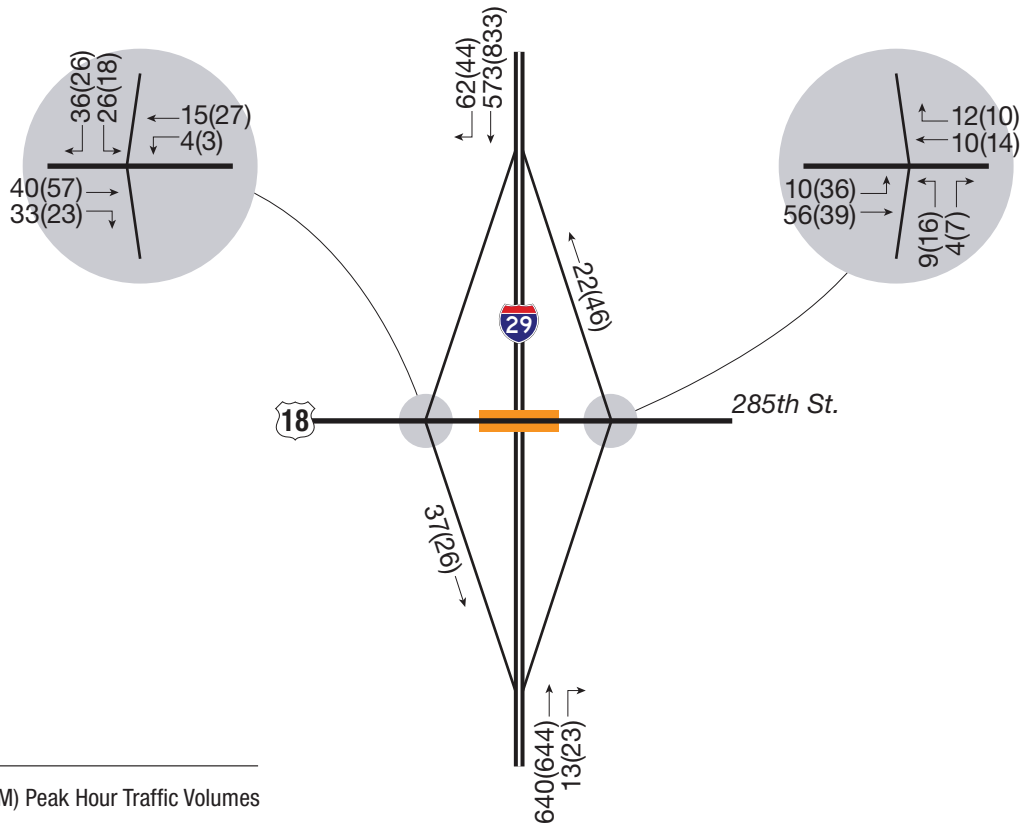
Evaluation Factors		Option 1
		Diamond Interchange Reconstruction
Environmental Impacts		Multiple
Development Compatibility		Maintains current development and access
Multimodal Compatibility		Few added accommodations
Geometric Design		Addresses all current geometric deficiencies
Safety		Low potential for crash reduction, maintains current emergency response times
Constructability		Moderate degree of complexity
Traffic Level of Service	**2030**	LOS A
	2050	LOS A
Right-of-way (SF)		546,800
# of Properties Impacted (take or access)		2
Construction Costs		$20.6 million



FELSBURG HOLT & ULLEVIG

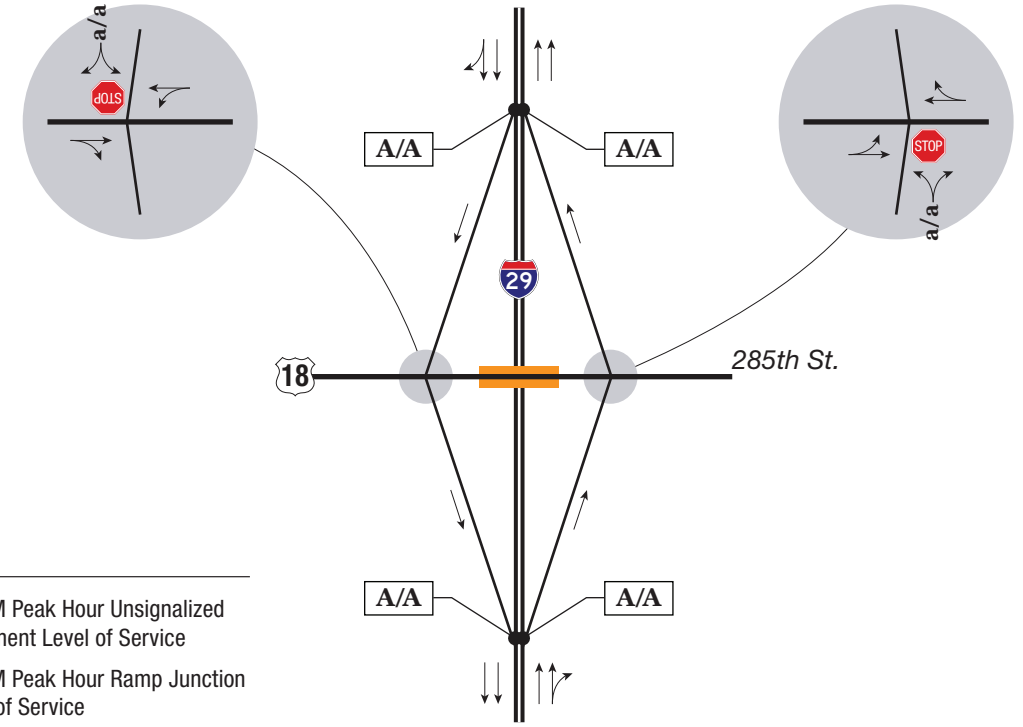
CONCEPTUAL

Figure 2.5a
I-29 Exit 59 Davis
Option 1: Diamond Interchange Reconstruction



LEGEND

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



LEGEND

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

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

STOP = Stop Sign

= Travel Lanes

NORTH

FIGURE 2.5b

Interstate 29 Exit 59

Existing (2019) Traffic Conditions

SDDOT Decennial 2020 ICS - Phase 2 18-571-01 12/4/20

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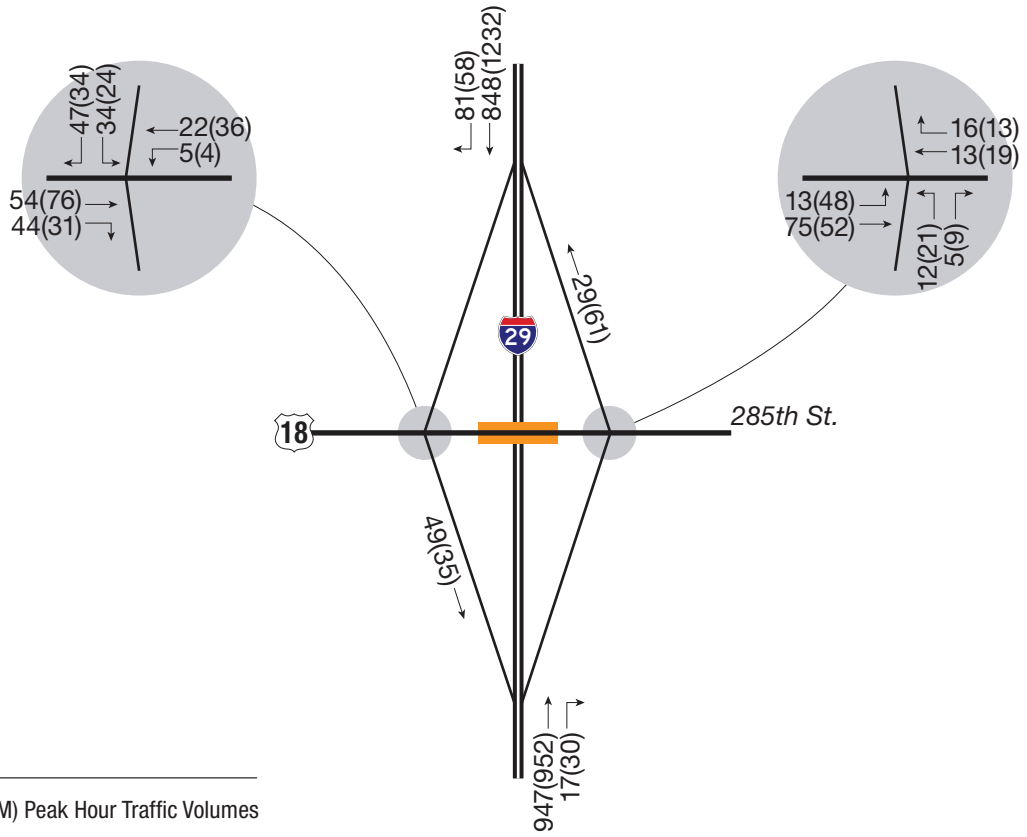
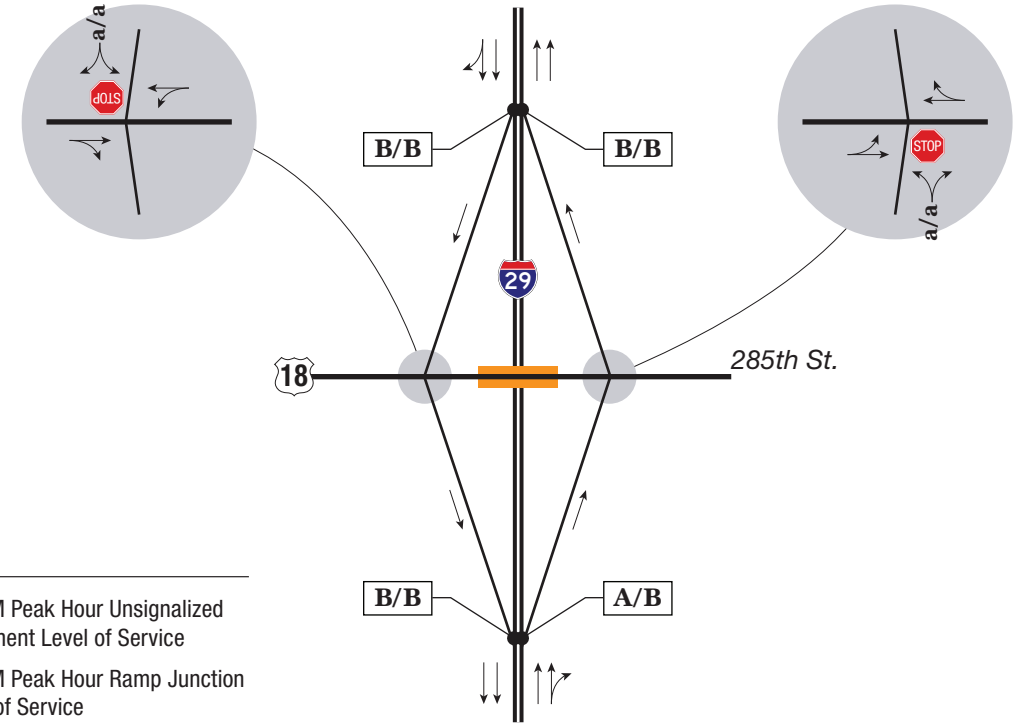
NOTE: Drawing Not to Scale



LEGEND

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



LEGEND

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

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

STOP = Stop Sign

= Travel Lanes

NORTH

FELSBURG HOLT & ULLEVIG

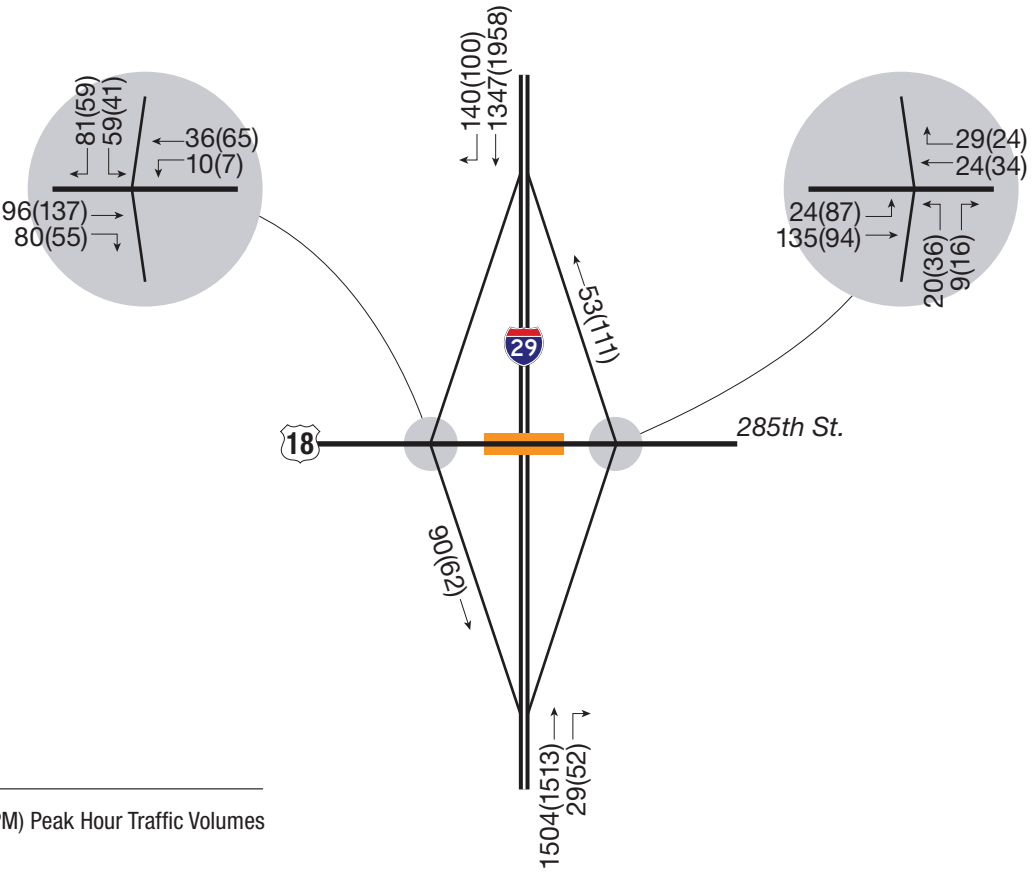
NOTE: Drawing Not to Scale

FIGURE 2.5c

Interstate 29 Exit 59

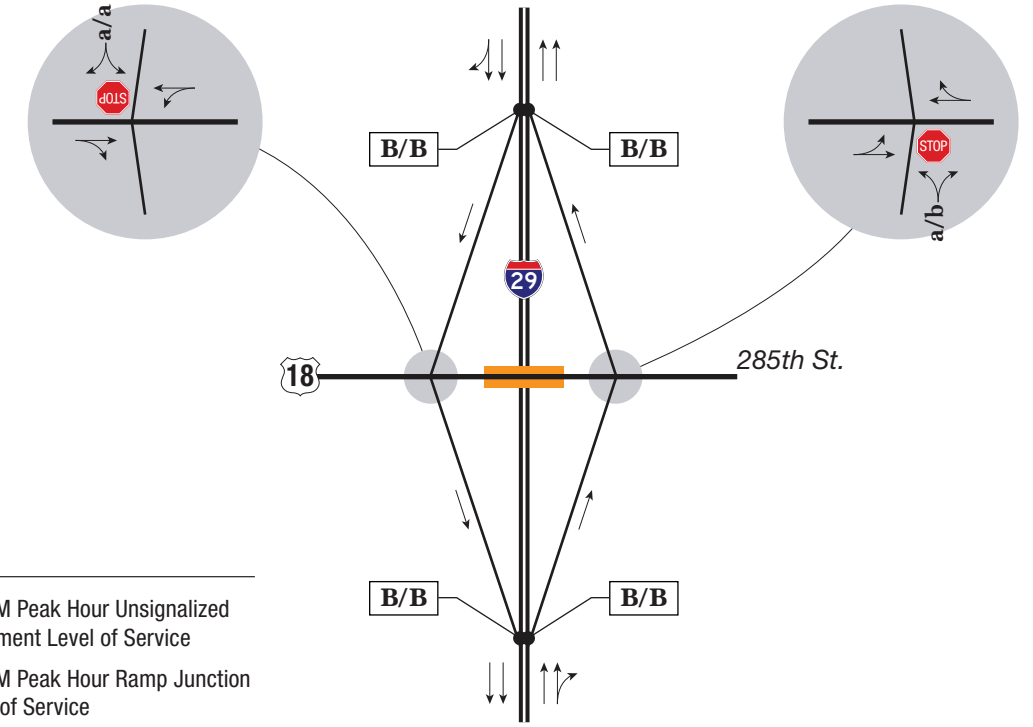
Opening (2030) Traffic Conditions

SDDOT Decennial 2020 ICS - Phase 2 18-571-01 12/4/20



LEGEND

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



LEGEND

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

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

STOP = Stop Sign

= Travel Lanes

NORTH

FIGURE 2.5d

Interstate 29 Exit 59
Future (2050) Traffic Conditions

SDDOT Decennial 2020 ICS - Phase 2 18-571-01 12/4/20

FELSBURG HOLT & ULLEVIG

NOTE: Drawing Not to Scale

Table 2.5c I-29 Exit 59 Probable Construction Costs – Option 1

SOUTH DAKOTA DOT 2020 DECENNIAL INTERSTATE CORRIDOR STUDY

FHU PROJ NO. 118571-01

CONCEPTUAL LEVEL OPINION OF PROBABLE COST

FELSBURG HOLT & ULLEVIG

Alternative: I-29 Exit 59 Option 1

Prepared By: A. Orellana Date: 12/7/2020

	ITEM	DESCRIPTION	UNIT	CONTINGENCY	UNIT COST	QUANTITY	COST
1	**110**	Earthwork and Removals (2' Depth)	SY		$ **15**	46,300	$ 694,500
2	**110**	Earthwork (Significant Impacts)	CY		$ **10**	132,800	$ 1,328,000
3	**110**	Remove Bridge	EA		$ **25,000**	1	$ 25,000
4	**380**	Surfacing (Interstate & Ramps)	SY		$ **75**	37,000	$ 2,775,000
		SUBTOTAL (A)					$ **4,822,500**
5	**530**	Structures - Bridge	SF		$ **200**	23,700	$ 4,740,000
6	**450**	Drainage - New	% of (A)	**8%**	$ -	-	$ 385,800
7	**451**	Utility Relocations	% of (A)	**6%**	$ -	-	$ 289,350
8	**632/633**	Traffic - Signing/Striping	% of (A)	**4%**	$ -	-	$ 192,900
9	**634**	Traffic Control	% of (A)	**6%**	$ -	-	$ 289,350
10	**734**	Erosion Control/Environmental	% of (A)	**6%**	$ -	-	$ 289,350
		SUBTOTAL (B)					$ **6,186,750**
11	**635**	Traffic - Signals (New)	EA		$ **270,000**	0	$ -
12	**997**	Railroad Crossing	EA		$ **250,000**		$ -
13	**009**	Mobilization	% of (A)+(B)	**5%**	$ -	-	$ 550,470
14	**100**	Clearing	% of (A)+(B)	**2%**	$ -	-	$ 220,190
15		Contingency	% of (A)+(B)	**30%**	$ -	-	$ 3,302,780
		SUBTOTAL (C)					$ **4,073,440**
		CONSTRUCTION TOTAL (D)	**(A)+(B)+(C)**				$ **15,082,690**
16		Engineering Services	% of (D)	**15%**	$ -		$ 2,262,410
17		ROW Impacts	SF		$ **10**	546,800	$ 5,468,000
							$ ***22,813,100***
		PROJECT TOTAL (E)					$ **22,814,000**
		CONSTRUCTION (D) + ROW TOTAL COST					$ **20,600,000**

Note: In providing opinions of probable construction cost, the Client understands that Felsburg Holt & Ullevig has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing. The unit prices and percentages shown above were applied under the direction of the South Dakota Department of Transportation and FHU makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bid or actual costs.

2.6 I-29 Exit 86 – Renner/Crooks

2.6.1 Review of Interchange Needs

The Phase 1 study revealed no concerns causing designation as needs. However, potential future growth impacts on operations emerged for consideration upon completion of Phase 1, described as follows:

Operations

In Phase 1 of the study, peak hour traffic counts for the SB and NB ramp terminal intersection peak hour traffic volumes were estimated from historical counts in the area, annual daily traffic of ramps and mainline, and engineering judgment. Growth rates for each leg of the ramp terminals were calculated using the Year 2045 Sioux Falls MPO Travel Demand Model growth rates. Straight-line projection and NCHRP 765 methodology were used to get to Opening (2030) and Future (2050) traffic volume scenarios. This analysis indicated that traffic operations are currently acceptable and would remain acceptable through the Year 2050.

Upon advancing into Phase 2 tasks, growth expectations for developable land within Foundation Park proximate to the interchange west gained further definition, and traffic volume forecasts with the development complete (*Project Stampede Traffic Impact Study*, Figures 11 and 14) were furnished to the project team for use in reanalyzing future traffic operations. Year 2030 traffic volumes were forecasted by interpolating between the provided Year 2022 and 2045 traffic volumes to establish a LOS baseline for the potential opening year and 2050 forecasts were developed by extrapolating. LOS results for 2019 (reflecting Phase 1 analysis), 2030, and 2050 based on a No-Action condition are reported in **Table 2.6a**.

Table 2.6a I-29 Exit 86 No-Action Interchange LOS Findings

Type	Location Description	AM/PM Peak Hour Level of Service by Year		
		2019	2030	2050
Ramp Terminal Intersections	Northbound (Unsignalized[1])	a/a	c/f	f/f
	Southbound (Unsignalized)	a/a	b/b	c/f
Ramp Merge/Diverge Section	Northbound off-ramp (Ramp B)	B/A	B/B	B/B
	Northbound on-ramp (Ramp A)	A/A	B/A	B/B
	Southbound off-ramp (Ramp D)	A/A	A/A	A/A
	Southbound on-ramp (Ramp C)	A/A	A/A	A/A

[1]Unsignalized LOS is reported for the critical intersection movement

As shown, it was anticipated that the critical movement (NB left turn) at a stop-controlled NB ramp terminal would operate at LOS C in the AM and LOS F in the PM peak hour by Opening (2030) and LOS F/F in the AM/PM peak hours by Year 2050. The stop-controlled SB ramp terminal is expected to

operate at LOS B in the AM and PM peak hours by Opening (2030) and LOS C/F in the AM/PM peak hours by Year 2050.

The merge and diverge movements at the ramp junctions with I-29 were also examined and are forecasted to operate acceptably through Year 2050.

2.6.2 Discussion of Options

Due to future operational needs revealed and clarified through Phase 2 operations analyses, this interchange was moved forward to Phase 2 of the study to further develop solutions. Two improvement options were identified.

Option 1: Bridge Widening and Turn Lane Additions

Turn lane additions would include adding an eastbound (EB)-left turn lane at the NB ramp terminal and an EB-right and WB-left turn lane at the SB ramp terminal and signalizing both intersections. The turn lane additions would accommodate future traffic growth in the area. These improvements necessitate the bridge widening and would reduce maintenance cost and extend the total lifespan of the structure, ensuring operation well into the future. A conceptual drawing of this option is provided on **Figure 2.6a**.

Option 2: Single Point Urban Interchange (SPUI)

A SPUI interchange concept was developed as a means to address operational needs. The SPUI would be constructed with the central structure above I-29 and would require dual left turn lanes approaching from Ramp B and dual EB right turn lanes entering Ramp D. This option is conceptualized on **Figure 2.6b**.

2.6.3 Evaluation of Options

Operations of the freeway facilities and ramp terminals were analyzed for potential improvements under Opening (2030) and Future (2050) traffic conditions using HCS. Results of the HCS analysis and traffic conditions are depicted on **Figure 2.6c, Figure 2.6d**, and **Figure 2.6e**. For all Option scenarios, the ramp movements are not expected to change compared to the No-Action scenario from Phase 1, discussed previously.

Option 1: Bridge Widening and Turn Lane Additions

Future traffic operations for the NB ramp terminal with turn lane additions and signalization are expected to reach LOS B/C in the AM/PM peak hour by Opening (2030) and LOS C/C in the AM/PM peak hour by Year 2050. The stop-controlled SB ramp terminal is expected to operate at LOS B in the AM/PM peak hours through Year 2050. Construction costs for this concept are estimated at $8.4 million. A detailed cost estimate is included in **Table 2.6c**.

Option 2: Single Point Urban Interchange (SPUI)

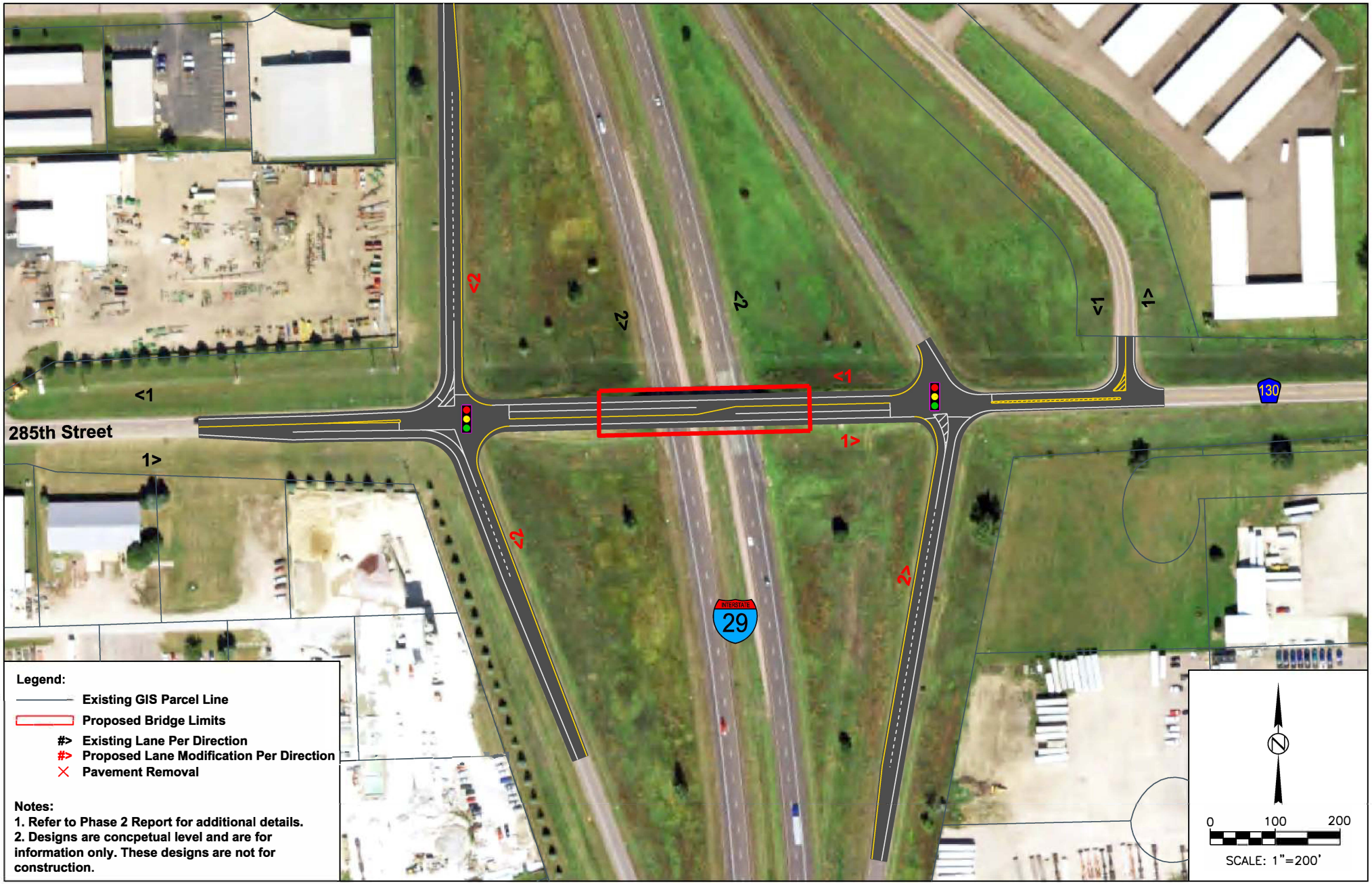
The SPUI intersection would operate at LOS B/B during AM/PM peak hours by 2030 and then reach LOS C/B conditions by Year 2050. Construction costs for the concept are estimated at $32.2 million. A detailed cost estimate is included in **Table 2.6d.**

2.6.4 Evaluation of Options

An analysis was conducted to provide a comparative evaluation of the benefits and impacts associated with each option. The various evaluation factors discussed in the previous section were tabulated and are summarized in **Table 2.6b**.

Table 2.6b I-29 Exit 86 Options Evaluation Summary

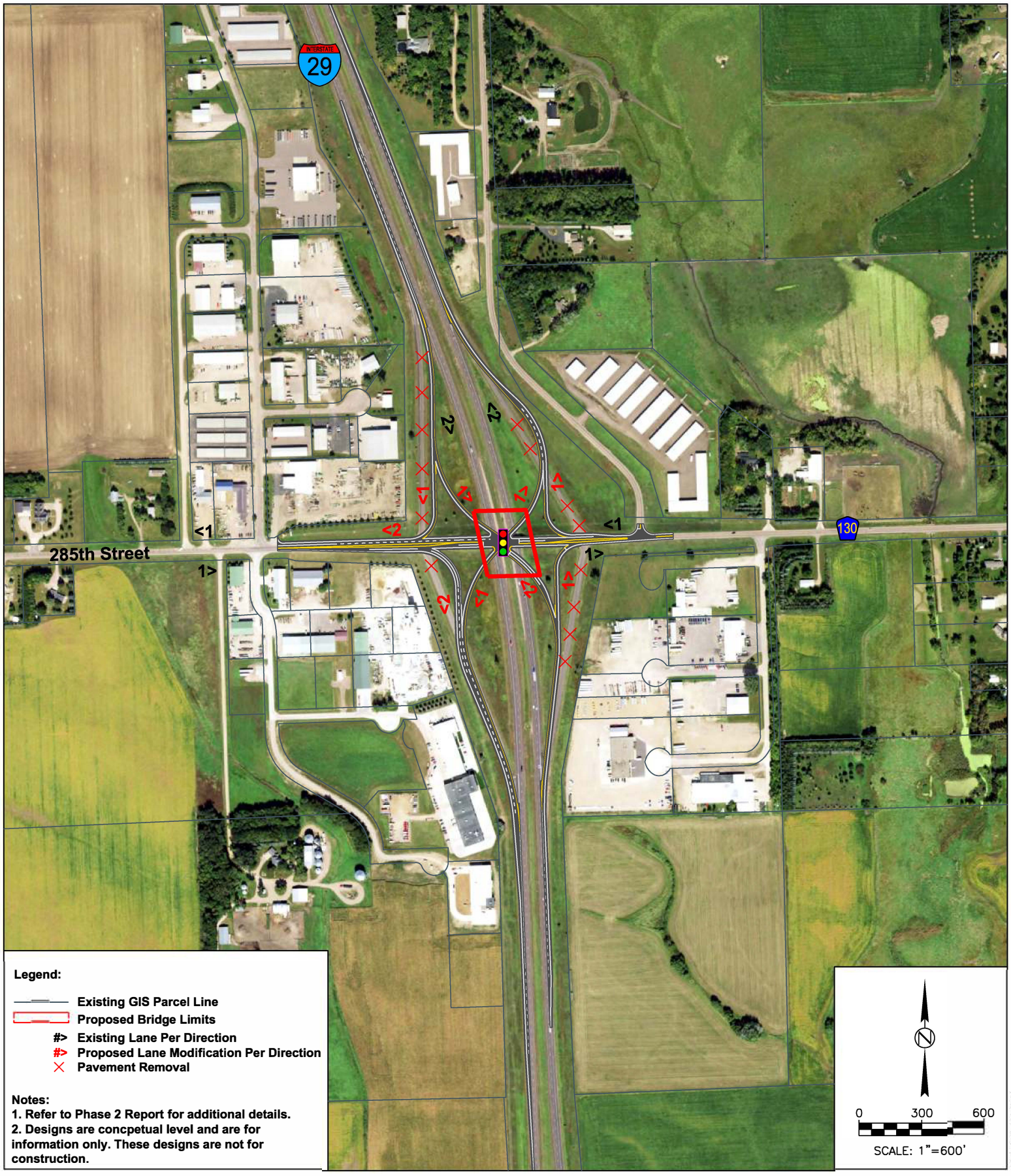
Evaluation Factors		Option 1 Bridge Widening and Turn Lane Additions	Option 2 Single Point Urban Interchange (SPUI)
Environmental Impacts		Minimal	Minimal
Development Compatibility		Detracts from development and access opportunities	Maintains current development and access
Multimodal Compatibility		Enhanced accommodations	Reduced Accommodations
Geometric Design		Addresses all current geometric deficiencies	Addresses all current geometric deficiencies
Safety		Low potential for crash reduction and/or maintains current emergency response times	Low potential for crash reduction and/or maintains current emergency response times
Constructability		Minor/typical degree of complexity	High degree of complexity
Traffic Level of Service	**2030**	LOS A	LOS B
	2050	LOS B	LOS B
Right-of-Way (SF)		—	—
# of Properties Impacted (take or access)		1	0
Construction Costs		$8.4 million	$32.2 million



FELSBURG HOLT & ULLEVIG

CONCEPTUAL

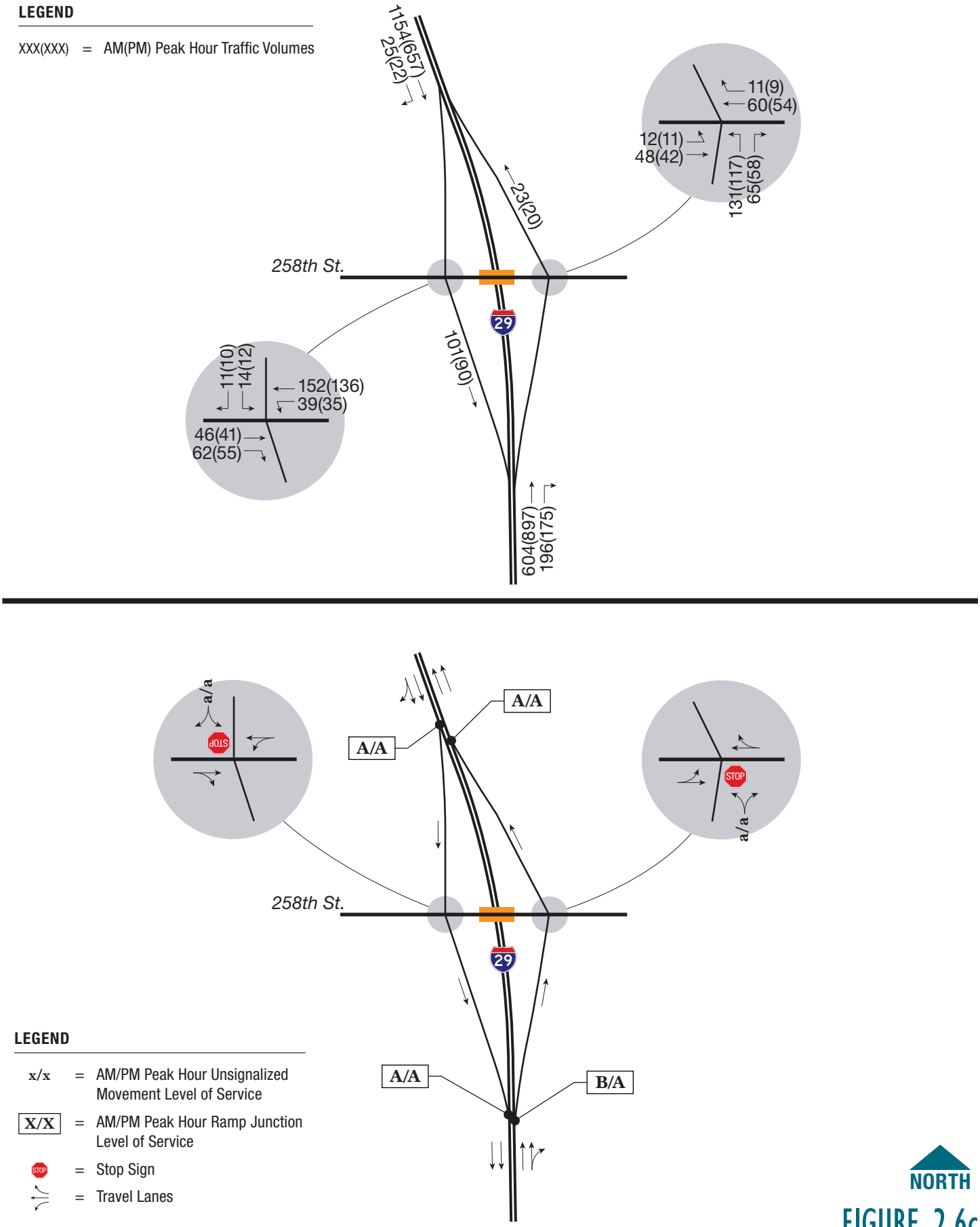
Figure 2.6a
I-29 Exit 86 Renner/Crooks
Option 1: Bridge Widening and Turn Lane Additions



FELSBURG HOLT & ULLEVIG

CONCEPTUAL

Figure 2.6b
I-29 Exit 86 Renner/Crooks
Option 2: Single-Point Urban Interchange (SPUI)



FELSBURG HOLT & ULLEVIG

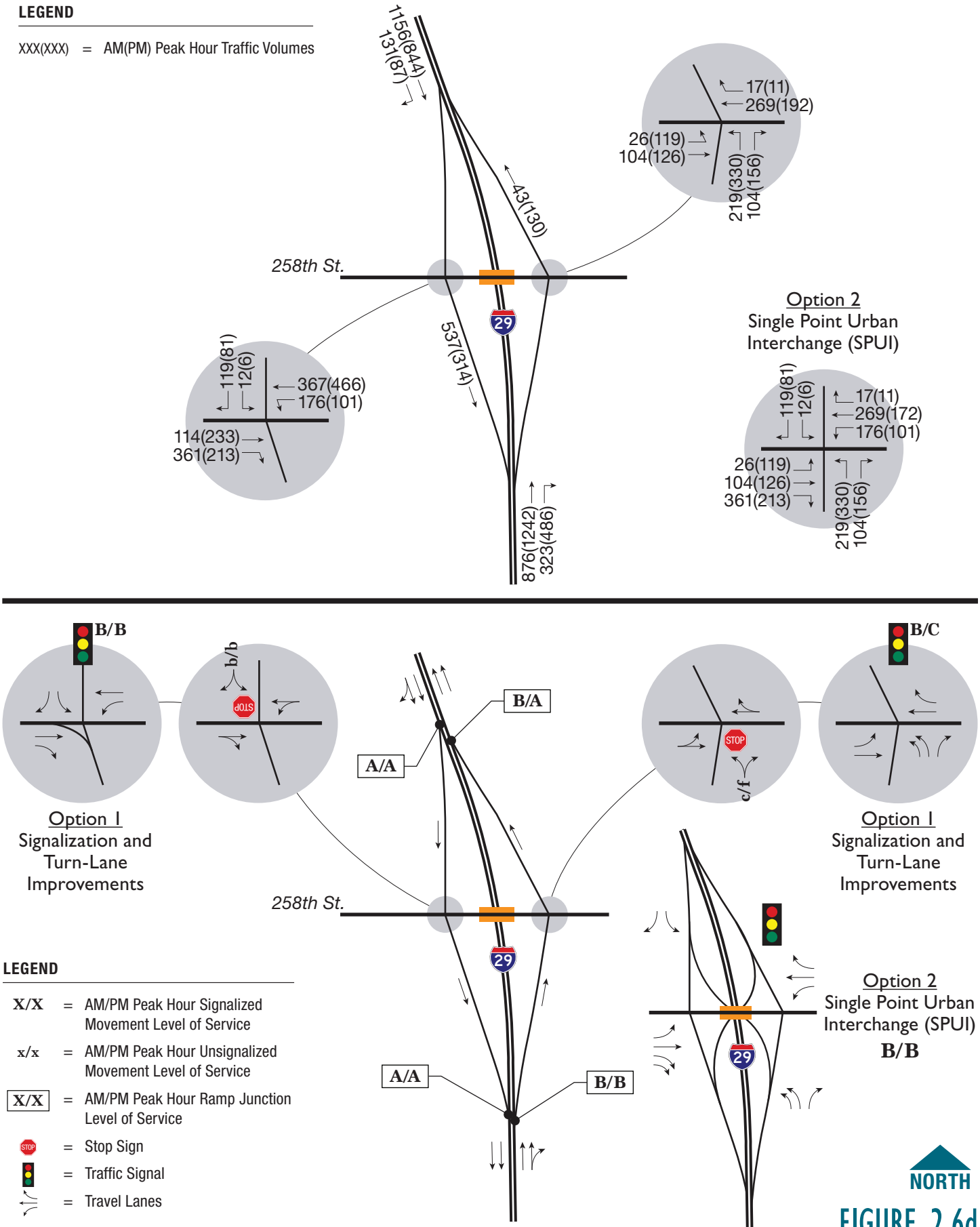
NOTE: Drawing Not to Scale

FIGURE 2.6c

Interstate 29 Exit 86

Existing (2019) Traffic Conditions

SDDOT Decennial 2020 ICS - Phase 2 18-571-01 12/4/20



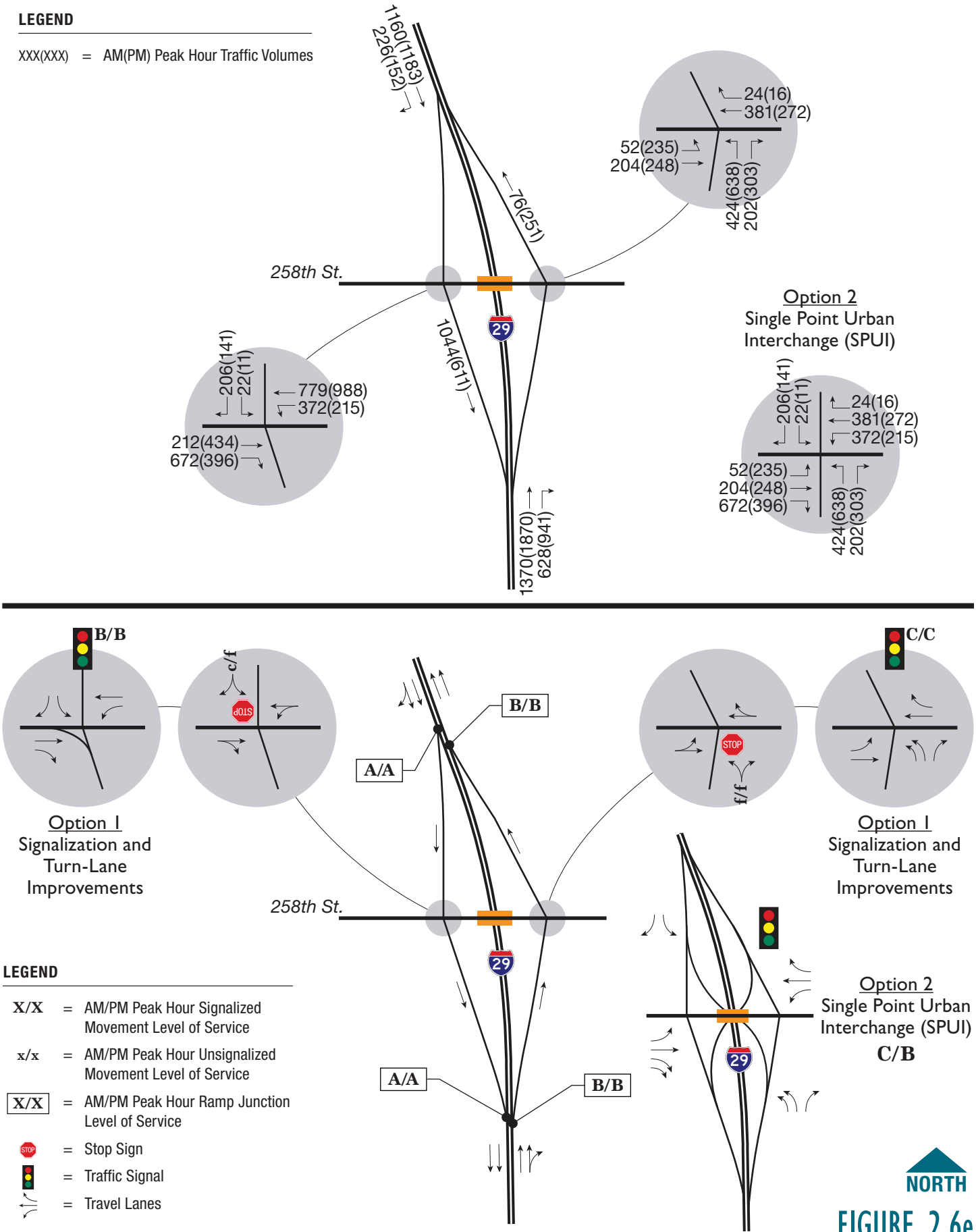
FELSBURG HOLT & ULLEVIG

NOTE: Drawing Not to Scale

FIGURE 2.6d

Interstate 29 Exit 86
Opening (2030) Traffic Conditions

SDDOT Decennial 2020 ICS - Phase 2 18-571-01 12/4/20



FELSBURG HOLT & ULLEVIG

NOTE: Drawing Not to Scale

FIGURE 2.6e

Interstate 29 Exit 86
Future (2050) Traffic Conditions

SDDOT Decennial 2020 ICS - Phase 2 18-571-01 12/4/20

Table 2.6c I-29 Exit 86 Probable Construction Costs – Option 1

SOUTH DAKOTA DOT 2020 DECENNIAL INTERSTATE CORRIDOR STUDY

FHU PROJ NO. 118571-01

CONCEPTUAL LEVEL OPINION OF PROBABLE COST

FELSBURG HOLT & ULLEVIG

Alternative: I-29 Exit 86 Option 1

Prepared By: A. Orellana Date: 12/2/2020

	ITEM	DESCRIPTION	UNIT	CONTINGENCY	UNIT COST	QUANTITY	COST
1	**110**	Earthwork and Removals (2' Depth)	SY		$ **15**	11,300	$ 169,500
2	**110**	Earthwork (Significant Impacts)	CY		$ **10**	0	$ -
3	**110**	Remove Bridge	EA		$ **25,000**	1	$ 25,000
4	**380**	Surfacing (Interstate & Ramps)	SY		$ **75**	15,000	$ 1,125,000
		SUBTOTAL (A)					$ **1,319,500**
5	**530**	Structures - Bridge	SF		$ **200**	22,400	$ 4,480,000
6	**450**	Drainage - New	% of (A)	**3%**	$ -	-	$ 39,590
7	**451**	Utility Relocations	% of (A)	**3%**	$ -	-	$ 39,590
8	**632/633**	Traffic - Signing/Striping	% of (A)	**2%**	$ -	-	$ 19,800
9	**634**	Traffic Control	% of (A)	**2%**	$ -	-	$ 19,800
10	**734**	Erosion Control/Environmental	% of (A)	**2%**	$ -	-	$ 26,390
		SUBTOTAL (B)					$ **4,625,170**
11	**635**	Traffic - Signals (New)	EA		$ **270,000**	2	$ 540,000
12	**997**	Railroad Crossing	EA		$ **250,000**		$ -
13	**009**	Mobilization	% of (A)+(B)	**5%**	$ -	-	$ 297,240
14	**100**	Clearing	% of (A)+(B)	**2%**	$ -	-	$ 118,900
15		Contingency	% of (A)+(B)	**25%**	$ -	-	$ 1,486,170
		SUBTOTAL (C)					$ **2,442,310**
		CONSTRUCTION TOTAL (D)	**(A)+(B)+(C)**				$ **8,386,980**
16		Engineering Services	% of (D)	**15%**	$ -		$ 1,258,050
17		ROW Impacts	SF		$ **10**	0	$ -
							$ ***9,645,030***
		PROJECT TOTAL (E)					$ **9,646,000**
		CONSTRUCTION (D) + ROW TOTAL COST					$ **8,400,000**

Note: In providing opinions of probable construction cost, the Client understands that Felsburg Holt & Ullevig has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing. The unit prices and percentages shown above were applied under the direction of the South Dakota Department of Transportation and FHU makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bid or actual costs.

Table 2.6d I-29 Exit 86 Probable Construction Costs - Option 2

SOUTH DAKOTA DOT 2020 DECENNIAL INTERSTATE CORRIDOR STUDY

FHU PROJ NO. 118571-01

CONCEPTUAL LEVEL OPINION OF PROBABLE COST

FELSBURG HOLT & ULLEVIG

Alternative: I-29 Exit 86 Option 2

Prepared By: A. Orellana Date: 12/2/2020

	ITEM	DESCRIPTION	UNIT	CONTINGENCY	UNIT COST	QUANTITY	COST
1	**110**	Earthwork and Removals (2' Depth)	SY		$ **15**	35,300	$ 529,500
2	**110**	Earthwork (Significant Impacts)	CY		$ **10**	168,800	$ 1,688,000
3	**110**	Remove Bridge	EA		$ **25,000**	1	$ 25,000
4	**380**	Surfacing (Interstate & Ramps)	SY		$ **75**	47,000	$ 3,525,000
		SUBTOTAL (A)					$ **5,767,500**
5	**530**	Structures - Bridge	SF		$ **200**	78,700	$ 15,740,000
6	**450**	Drainage - New	% of (A)	**8%**	$ -	-	$ 461,400
7	**451**	Utility Relocations	% of (A)	**6%**	$ -	-	$ 346,050
8	**632/633**	Traffic - Signing/Striping	% of (A)	**4%**	$ -	-	$ 230,700
9	**634**	Traffic Control	% of (A)	**6%**	$ -	-	$ 346,050
10	**734**	Erosion Control/Environmental	% of (A)	**6%**	$ -	-	$ 346,050
		SUBTOTAL (B)					$ **17,470,250**
11	**635**	Traffic - Signals (New)	EA		$ **270,000**	1	$ 270,000
12	**997**	Railroad Crossing	EA		$ **250,000**		$ -
13	**009**	Mobilization	% of (A)+(B)	**5%**	$ -	-	$ 1,161,890
14	**100**	Clearing	% of (A)+(B)	**2%**	$ -	-	$ 464,760
15		Contingency	% of (A)+(B)	**30%**	$ -	-	$ 6,971,330
		SUBTOTAL (C)					$ **8,867,980**
		CONSTRUCTION TOTAL (D)	**(A)+(B)+(C)**				$ **32,105,730**
16		Engineering Services	% of (D)	**15%**	$ -		$ 4,815,860
17		ROW Impacts	SF		$ **10**	0	$ -
							$ ***36,921,590***
		PROJECT TOTAL (E)					$ **36,922,000**
		CONSTRUCTION (D) + ROW TOTAL COST					$ **32,200,000**

Note: In providing opinions of probable construction cost, the Client understands that Felsburg Holt & Ullevig has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing. The unit prices and percentages shown above were applied under the direction of the South Dakota Department of Transportation and FHU makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bid or actual costs.

2.7 I-90 Exit 10 – North Avenue/Belle Fouche

2.7.1 Review of Interchange Needs

Phase 1 revealed operations, safety and LCV needs at this interchange as currently configured, described as follows:

Operations

Phase 1 of the study evaluated Year 2019 peak hour traffic operations, and year 2050 forecasts were developed based on SDDOT county-specific growth rates for each leg of the ramp terminals. Straight-line growth projections and the NCHRP 765 methodology were used to develop turning movement forecasts.

Progressing into Phase 2 tasks, Year 2030 traffic volumes were forecasted by interpolating between the 2019 and 2050 traffic volumes to establish a LOS baseline for the potential opening year. LOS results for 2019, 2030, and 2050 based on a No-Action condition are reported in **Table 2.7a** and depicted graphically on **Figure 2.7c through Figure 2.7e**.

Table 2.7a I-90 Exit 10 No-Action Interchange LOS Findings

Type	Location Description	AM/PM Peak Hour Level of Service by Year		
		2019	2030	2050
Ramp Terminal Intersections	Eastbound (Unsignalized[1])	a/b	a/b	c/f
	Westbound (Unsignalized)	a/b	b/b	f/f
Ramp Merge/Diverge Section	Eastbound off-ramp (Ramp C)	A/A	A/A	A/A
	Eastbound on-ramp (Ramp B)	A/A	A/A	A/A
	Westbound off-ramp (Ramp A)	A/A	A/B	A/B
	Westbound on-ramp (Ramp D)	A/A	A/A	A/A

[1]Unsignalized LOS is reported for the critical intersection movement

As shown, the ramp terminal interchanges are expected to operate acceptably through the year 2030. By the year 2050, it is projected that the intersection ramp terminals would operate at substandard LOS, reaching LOS F for the stop-controlled left turn movements during the peak hours.

The merge and diverge movements at the ramps were also examined. Under Opening (2030) traffic conditions, both merge and diverge movements are expected to operate at LOS B or better during AM and PM peak hours. Under Future (2050) traffic conditions, both merge and diverge movements are expected to operate at LOS B or better during AM and PM peak hours.

Traffic Safety

The Phase 1 review of interchange crash history revealed a pattern of angle and run-off-the-road type collisions occurring at the interchange. Possible contributing factors to this crash experience include higher travel speeds along the crossroad, US Highway 85, low visibility of traffic control signs, and close spacing of access adjacent to the EB ramp terminal intersection.

Long Combination Vehicle Movements

The Exit 10 interchange connects with a designated LCV route, US Highway 85. In Phase 1, the project team assessed the ability of the Exit 10 ramp terminal intersections to accommodate LCVs. It was found that the current intersections are unable to accommodate these larger vehicles. Improvements are needed to Ramps A, B, and C to add pavement to accommodate truck overtracking, and the inslope should be improved to 6:1. In addition, the right shoulder should be improved along Ramps B and C.

2.7.2 Discussion of Options

Due to operations, safety and LCV movement concerns, this interchange was moved forward to Phase 2 of the study to further develop solutions to the deficiencies outlined and discussed in-depth in the Phase 1 report. The following improvement options were identified.

Interim Safety Recommendations

The following actions are recommended to address traffic safety in advance of more significant interchange options:

- Ramp terminal intersections: Conduct a traffic control needs study to confirm acceptable options for intersection traffic control type and understand whether signalization would be appropriate. Upgrade intersection stop signs to 36"x36" size to improve visibility.
- Evaluate travel speeds along US Highway 85 through the interchange and identify potential speed management strategies for application if speeding is determined to be a concern.

The following three interchange reconstruction options were identified.

Option 1: Signalization of EB/WB Ramp Intersections, Median U-Turn, Ramp Modifications

Signalization of the EB and WB ramp intersections would improve future traffic operations and accommodate future growth. The construction of a median U-Turn configuration for the Old US Highway 14 (Old US 14) / US Highway 85 intersection would help to address safety concerns associated with close access spacing by displacing eastbound left turns to a location south of the intersection.

Option 2: Signalization of EB/WB Ramp Intersections and Brookview Road Bridge over I-90

Signalization of the EB and WB ramp intersections would improve future traffic operations and accommodate future growth. The installation of a bridge over I-90 on Brookview Road would alleviate some local traffic using the interchange to cross over I-90. The provision of this crossing would also allow turning movement restrictions to be implemented at the Old US 14 and Ramshead Road intersection, where there is limited spacing from the EB ramp terminal. This option would require acquisition of right-of-way for relocation of local access. Vehicle-trips would be added to Brookview Road.

Option 3: Offset Single Point Urban Interchange (SPUI)

Converting the existing interchange to an offset SPUI would help to address substandard LOS and relieve safety concerns associated with close full movement intersection spacing south of the interchange. This option would require a rebuild of all the ramps, as well as two fly-over bridges, resulting in higher construction costs. The reconfigured ramp alignment for Ramp C would require additional right-of-way.

2.7.3 Evaluation of Options

Operations of the freeway facilities and ramp terminals were analyzed for the potential improvements under Opening (2030) and Future (2050) traffic conditions using HCS. Results of the HCS analysis and traffic conditions are depicted on **Figure 2.7d, Figure 2.7e, and Figure 2.7f**. For all options, the forecasted ramp movement traffic volumes are consistent with No-Action forecasts.

Option 1: Signalization of EB/WB Ramp Intersections, Median U-Turn, Ramp Modifications

With signalization of both the EB and WB ramp intersections, the EB ramp intersection would operate at LOS B in the AM and PM peak hours under Opening (2030) and Year 2050 traffic conditions. The WB ramp intersection would be expected to operate at LOS A in the AM and PM peak periods under Opening (2030) traffic conditions and LOS A in the AM and PM peak periods under Future (2050) traffic conditions. The concept drawing of this improvement option is shown on **Figure 2.7a**. Construction costs for this concept are estimated at $4.8 million.

Option 2: Signalization of EB/WB Ramp Intersections and Brookview Road Bridge over I-90

With signalization of both the EB and WB ramp intersections and the Brookview Road bridge over I-90, the EB ramp intersection would operate at LOS B in the AM and PM peak hours under Opening (2030) and Year 2050 traffic conditions. The WB ramp intersection would be expected to operate at LOS A in the AM and PM peak periods under Opening (2030) traffic conditions and LOS A in the AM and PM peak periods under Future (2050) traffic conditions. The concept drawing of this improvement option is shown on **Figure 2.7b**. Construction costs for this concept are estimated at $10.9 million.

Option 3: Offset Single Point Urban Interchange (SPUI)

With the conversion of the interchange to an offset SPUI, the single point intersection would be expected to operate at LOS B in the AM and PM peak periods under Opening (2030) traffic conditions and LOS B in the AM and PM peak periods under Future (2050) traffic conditions. The concept drawing of this improvement option is shown on **Figure 2.7c**. Construction costs for this concept are estimated at $25.1 million.

Detailed cost estimates for each concept are included on **Table 2.7c, Table 2.7d,** and **Table 2.7e**.

An analysis was conducted to provide a comparative evaluation of the benefits and impacts associated with each option. The various evaluation factors discussed in the previous section were tabulated and are summarized in **Table 2.7b**.

Table 2.7b I-90 Exit 10 Options Evaluation Summary

Evaluation Factors		Option 1 Signalization of EB/WB Ramp Intersections, Median U-turn, Ramp Modifications	Option 2 Signalization of EB/WB Ramp Intersections, Brookview Road Bridge over I-90, Ramp Modifications	Option 3 Offset Single Point Urban Interchange (SPUI)
Environmental Impacts		Minimal environmental impacts	Moderate environmental impacts	Multiple environmental impacts
Development Compatibility		Maintains current development and access	Opens up developable land and local access	Maintains current development and access
Multimodal Compatibility		Enhanced accommodations	Enhanced accommodations	Enhanced accommodations
Geometric Design		Some geometric deficiencies anticipated due to design constraints	Addresses all current geometric deficiencies	Some geometric deficiencies anticipated due to design constraints
Safety		High potential for crash reduction and/or reduces emergency response times	High potential for crash reduction and/or reduces emergency response times	High potential for crash reduction and/or reduces emergency response times
Constructability		Addresses all current geometric deficiencies	Moderate degree of complexity	High degree of complexity
Traffic Level of Service	**2030**	LOS B	LOS B	LOS B
	2050	LOS B	LOS B	LOS B
Right-of-Way (SF)		65,500	89,500	238,900
# of Properties Impacted (take or access)		0	5	6
Construction Costs		$4.8 million	$10.9 million	$25.1 million

FELSBURG HOLT & ULLEVIG

CONCEPTUAL

Figure 2.7a

I-90 Exit 10 North Avenue / Belle Fourche

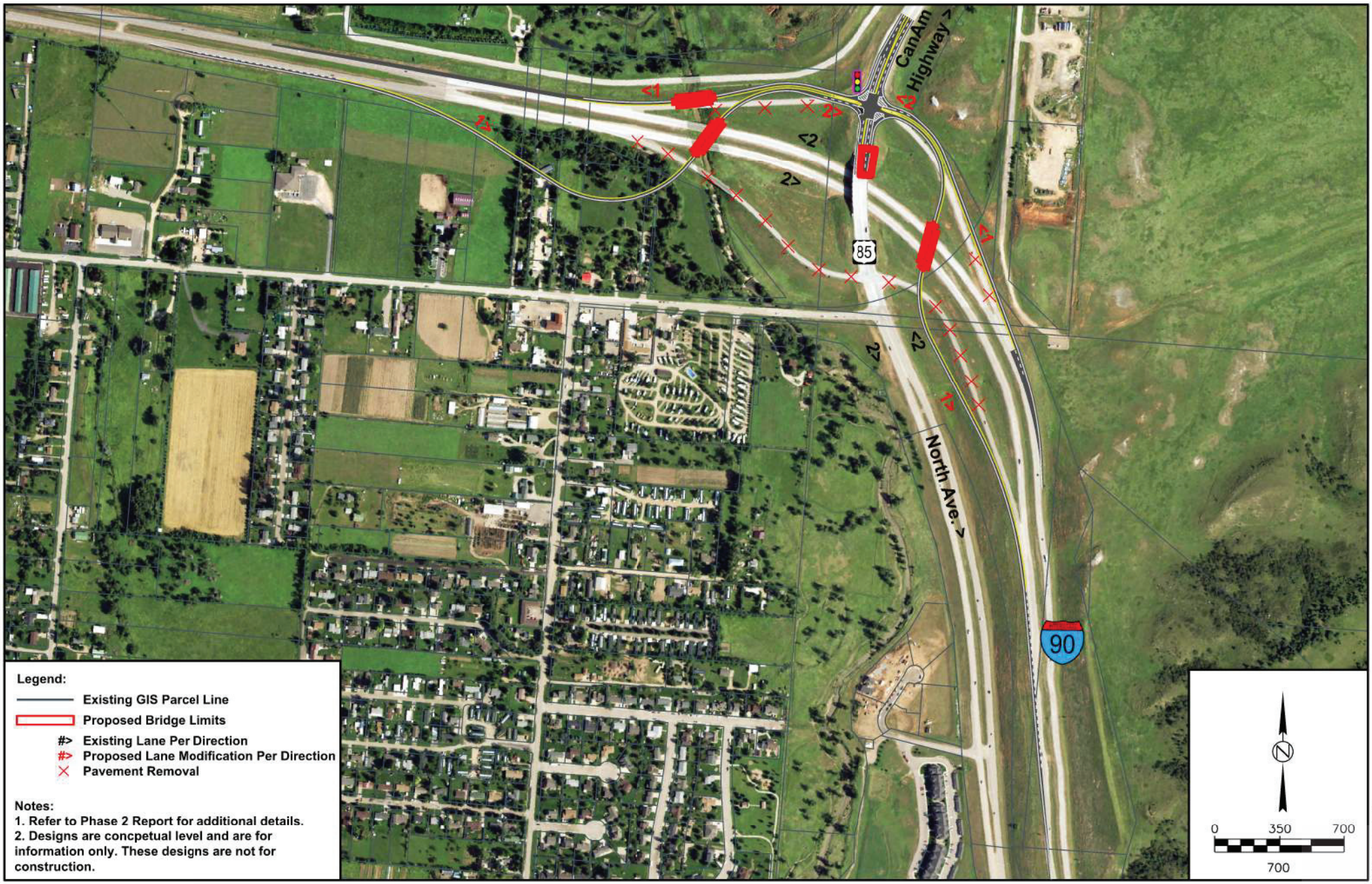
Option 1: Signalization of EB/WB Ramp Intersections, Median U-Turn, Ramp Modifications

FELSBURG HOLT & ULLEVIG

CONCEPTUAL

South Dakota Decennial Interstate Corridor Study

Figure 2.7b
I-90 Exit 10 North Avenue / Belle Fouche
Option 1: Signalization of EB/WB Ramp Intersections, Brookview Rd Bridge over I-90, Ramp Modifications



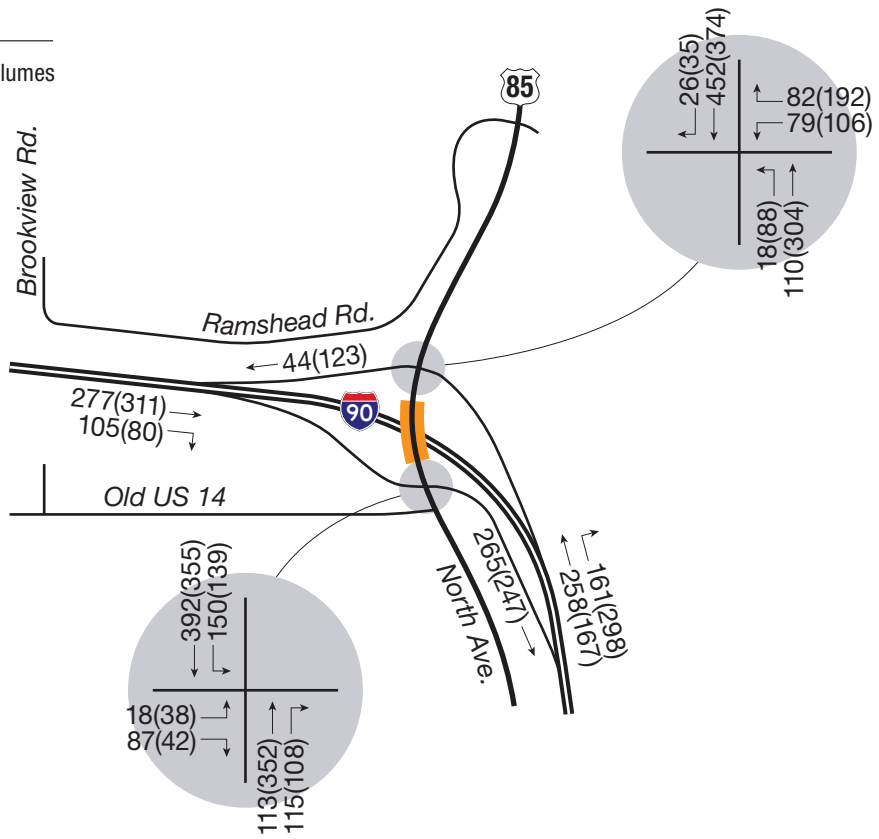
FELSBURG HOLT & ULLEVIG

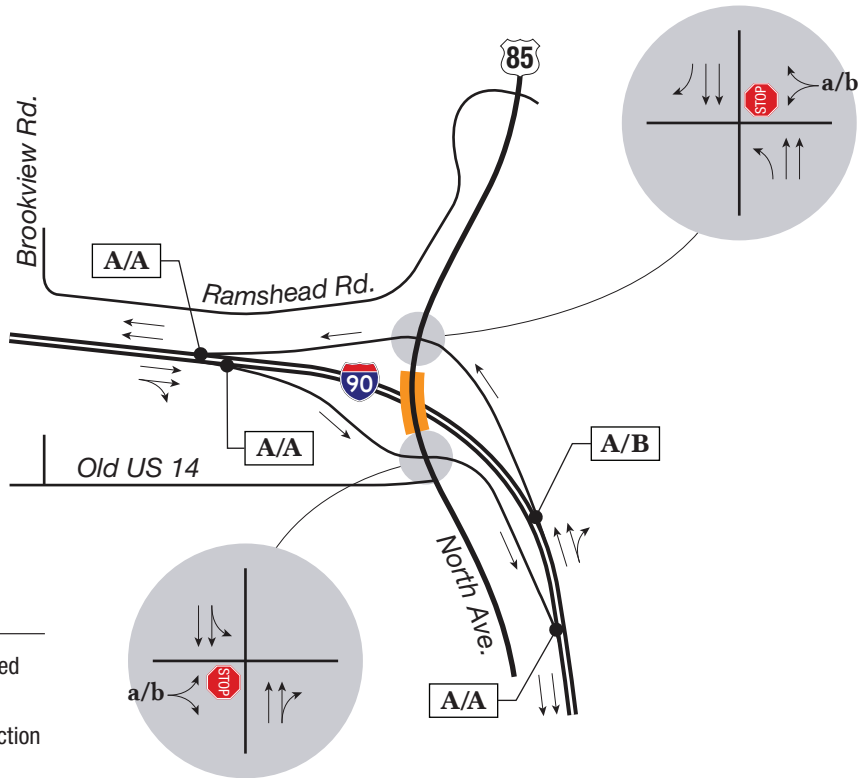
CONCEPTUAL

Figure 2.7c
I-90 Exit 10 North Avenue / Belle Fouche
Option 2: Offset Single-Point Urban Interchange (SPUI)

LEGEND

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





LEGEND

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

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

STOP = Stop Sign

= Travel Lanes

NORTH

FIGURE 2.7d

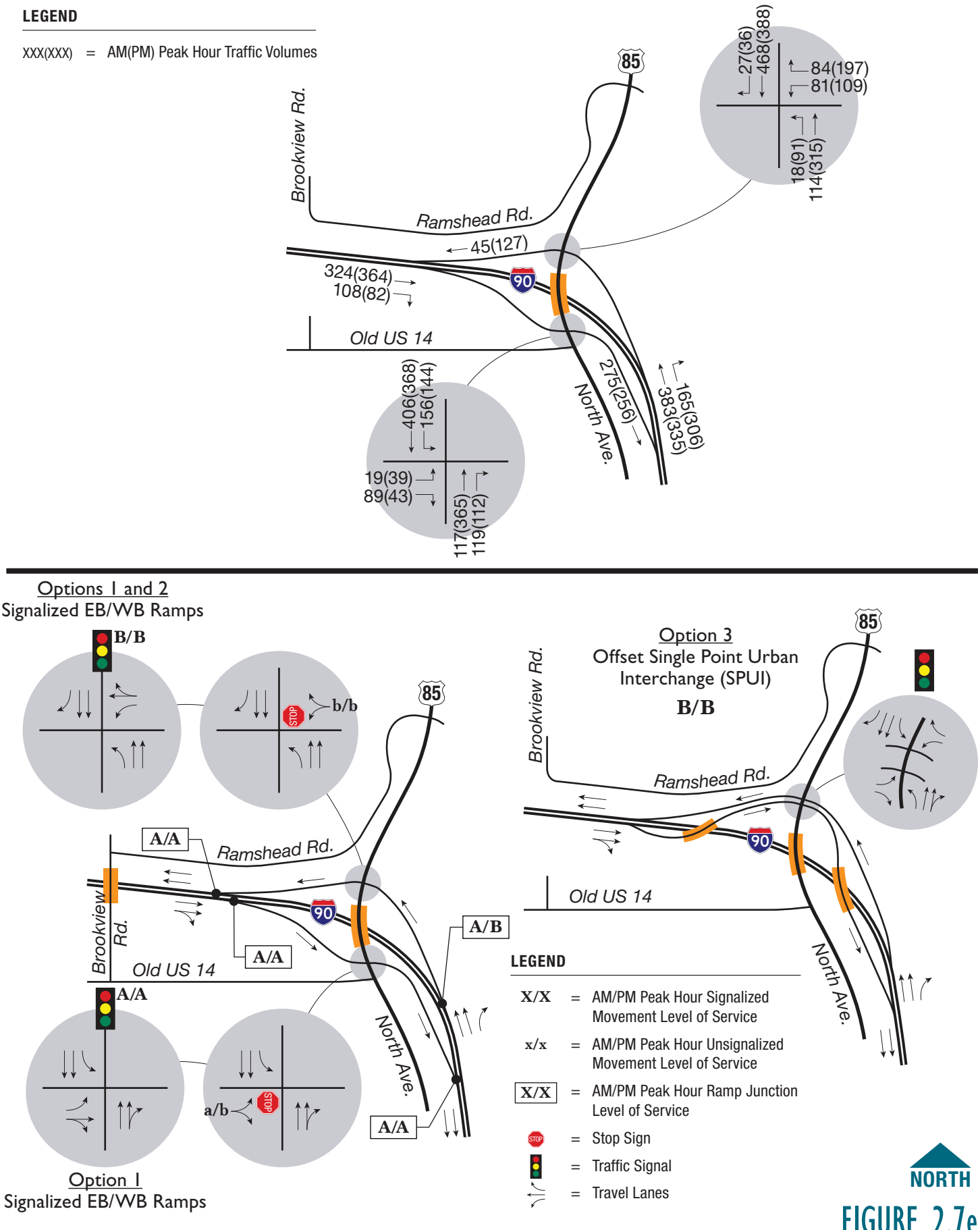
Interstate 90 Exit 10

Existing (2019) Traffic Conditions

SDDOT Decennial 2020 ICS - Phase 2 18-571-01 4/21/21

FELSBURG HOLT & ULLEVIG

NOTE: Drawing Not to Scale



FELSBURG HOLT & ULLEVIG

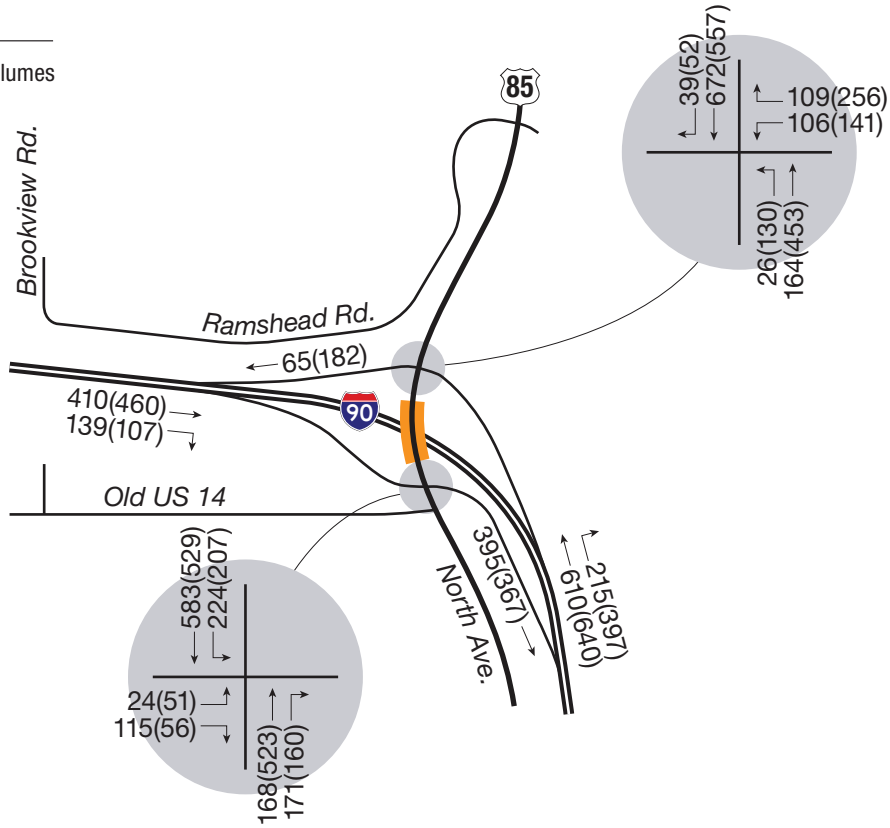
NOTE: Drawing Not to Scale

FIGURE 2.7e
Interstate 90 Exit 10
Opening (2030) Traffic Conditions

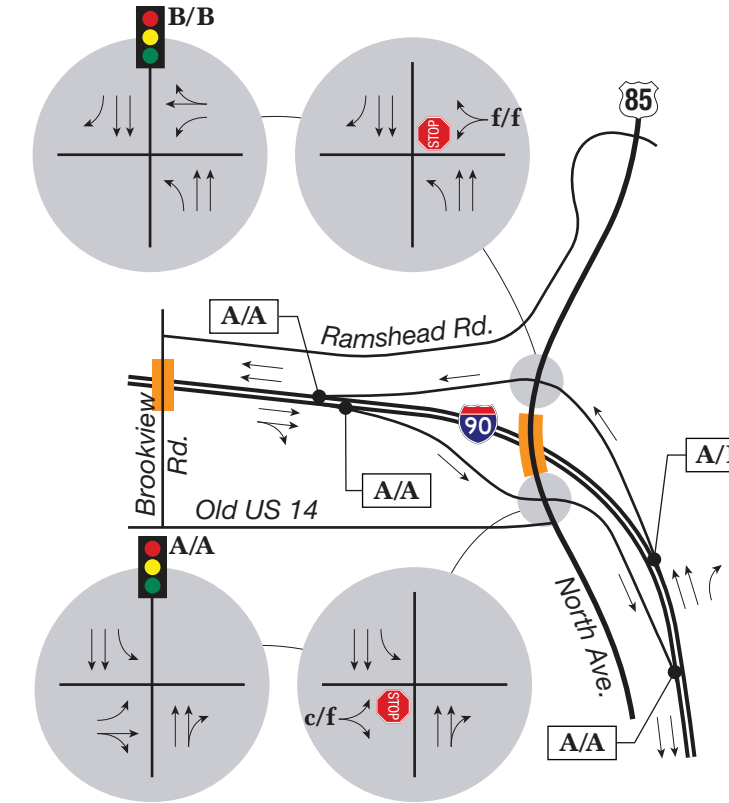
SDDOT Decennial 2020 ICS - Phase 2 18-571-01 4/21/21

LEGEND

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

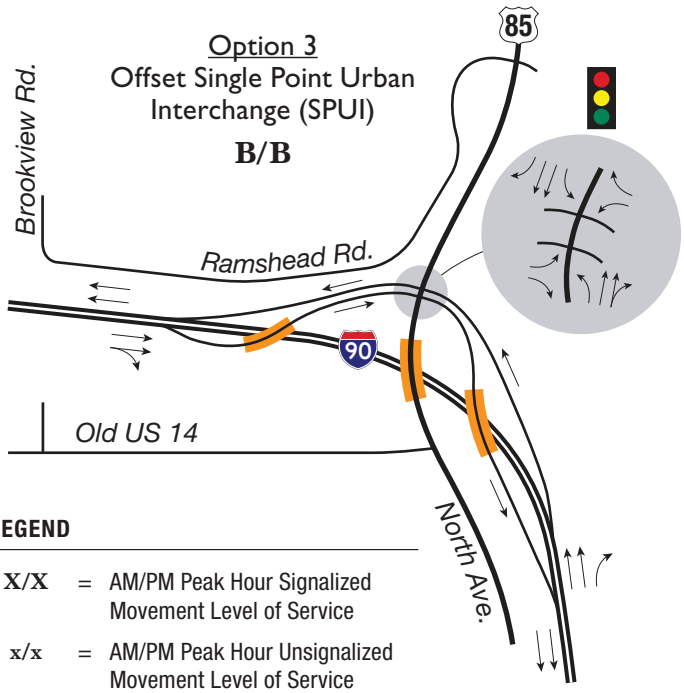


Options 1 and 2
Signalized EB/WB Ramps



Option 1
Signalized EB/WB Ramps

Option 3
Offset Single Point Urban Interchange (SPUI)
B/B



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	=	Stop Sign
	=	Traffic Signal
	=	Travel Lanes

NORTH

FELSBURG HOLT & ULLEVIG

NOTE: Drawing Not to Scale

FIGURE 2.7f
Interstate 90 Exit 10
Future (2050) Traffic Conditions

SDDOT Decennial 2020 ICS - Phase 2 18-571-01 4/21/21

Table 2.7c I-90 Exit 10 Probable Construction Costs - Option 1

SOUTH DAKOTA DOT 2020 DECENNIAL INTERSTATE CORRIDOR STUDY

FHU PROJ NO. 118571-01

CONCEPTUAL LEVEL OPINION OF PROBABLE COST

FELSBURG HOLT & ULLEVIG

Alternative: I-90 Exit 10 Option 1

Prepared By: J. Wilcox Date: 3/26/2021

	ITEM	DESCRIPTION	UNIT	CONTINGENCY	UNIT COST	QUANTITY	COST
1	110	Earthwork and Removals (2' Depth)	SY		$ 15	18,000	$ 270,000
2	110	Earthwork (Significant Impacts)	CY		$ 10	35,800	$ 358,000
3	110	Remove Bridge	EA		$ 25,000	0	$ -
4	380	Surfacing (Interstate & Ramps)	SY		$ 75	18,000	$ 1,350,000
		SUBTOTAL (A)					**$ 1,978,000**
5	530	Structures - Retaining Wall	SF		$ 200	0	$ -
6	450	Drainage - New	% of (A)	8%	$ -	-	$ 158,240
7	451	Utility Relocations	% of (A)	6%	$ -	-	$ 118,680
8	632/633	Traffic - Signing/Striping	% of (A)	4%	$ -	-	$ 79,120
9	634	Traffic Control	% of (A)	6%	$ -	-	$ 118,680
10	734	Erosion Control/Environmental	% of (A)	6%	$ -	-	$ 118,680
		SUBTOTAL (B)					**$ 593,400**
11	635	Traffic - Signals (New)	EA		$ 270,000	2	$ 540,000
12	997	Railroad Crossing	EA		$ 250,000	0	$ -
13	009	Mobilization	% of (A)+(B)	5%	$ -	-	$ 128,570
14	100	Clearing	% of (A)+(B)	2%	$ -	-	$ 51,430
15		Contingency	% of (A)+(B)	30%	$ -	-	$ 771,420
		SUBTOTAL (C)					**$ 1,491,420**
		CONSTRUCTION TOTAL (D)	**(A)+(B)+(C)**				**$ 4,062,820**
16		Engineering Services	% of (D)	15%	$ -		$ 609,430
17		ROW Impacts	SF		$ 10	65,500	$ 655,000
							$ 5,327,250
		PROJECT TOTAL (E)					**$ 5,328,000**
		CONSTRUCTION (D) + ROW TOTAL COST					**$ 4,800,000**

Note: In providing opinions of probable construction cost, the Client understands that Felsburg Holt & Ullevig has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing. The unit prices and percentages shown above were applied under the direction of the South Dakota Department of Transportation and FHU makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bid or actual costs.

Table 2.7d I-90 Exit 10 Probable Construction Costs - Option 2

SOUTH DAKOTA DOT 2020 DECENNIAL INTERSTATE CORRIDOR STUDY

FHU PROJ NO. 118571-01

CONCEPTUAL LEVEL OPINION OF PROBABLE COST

FELSBURG HOLT & ULLEVIG

Alternative: I-90 Exit 10 Option 2

Prepared By: A. Orellana Date: 3/23/2021

	ITEM	DESCRIPTION	UNIT	CONTINGENCY	UNIT COST	QUANTITY	COST
1	110	Earthwork and Removals (2' Depth)	SY		$ 15	70,000	$ 1,050,000
2	110	Earthwork (Significant Impacts)	CY		$ 10	73,300	$ 733,000
3	110	Remove Bridge	EA		$ 25,000	0	$ -
4	380	Surfacing (Interstate & Ramps)	SY		$ 75	35,000	$ 2,625,000
		SUBTOTAL (A)					**$ 4,408,000**
5	530	Structures - Bridge	SF		$ 200	11,000	$ 2,200,000
6	450	Drainage - New	% of (A)	8%	$ -	-	$ 352,640
7	451	Utility Relocations	% of (A)	6%	$ -	-	$ 264,480
8	632/633	Traffic - Signing/Striping	% of (A)	4%	$ -	-	$ 176,320
9	634	Traffic Control	% of (A)	6%	$ -	-	$ 264,480
10	734	Erosion Control/Environmental	% of (A)	6%	$ -	-	$ 264,480
		SUBTOTAL (B)					**$ 3,522,400**
11	635	Traffic - Signals (New)	EA		$ 270,000	2	$ 540,000
12	997	Railroad Crossing	EA		$ 250,000	0	$ -
13	009	Mobilization	% of (A)+(B)	5%	$ -	-	$ 396,520
14	100	Clearing	% of (A)+(B)	2%	$ -	-	$ 158,610
15		Contingency	% of (A)+(B)	30%	$ -	-	$ 2,379,120
		SUBTOTAL (C)					**$ 3,474,250**
		CONSTRUCTION TOTAL (D)	**(A)+(B)+(C)**				**$ 11,404,650**
16		Engineering Services	% of (D)	15%	$ -		$ 1,710,700
17		ROW Impacts	SF		$ 10	89,500	$ 895,000
							$ 14,010,350
		PROJECT TOTAL (E)					**$ 14,011,000**
		CONSTRUCTION (D) + ROW TOTAL COST					**$ 12,300,000**

Note: In providing opinions of probable construction cost, the Client understands that Felsburg Holt & Ullevig has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing. The unit prices and percentages shown above were applied under the direction of the South Dakota Department of Transportation and FHU makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bid or actual costs.

Table 2.7e I-90 Exit 10 Probable Construction Costs - Option 3

SOUTH DAKOTA DOT 2020 DECENNIAL INTERSTATE CORRIDOR STUDY

FHU PROJ NO. 118571-01

CONCEPTUAL LEVEL OPINION OF PROBABLE COST

FELSBURG HOLT & ULLEVIG

Alternative: I-90 Exit 10 Option 3

Prepared By: A. Orellana Date: 3/23/2021

	ITEM	DESCRIPTION	UNIT	CONTINGENCY	UNIT COST	QUANTITY	COST
1	110	Earthwork and Removals (2' Depth)	SY		$ 15	24,000	$ 360,000
2	110	Earthwork (Significant Impacts)	CY		$ 10	174,100	$ 1,741,000
3	110	Remove Bridge	EA		$ 25,000	2	$ 50,000
4	380	Surfacing (Interstate & Ramps)	SY		$ 75	48,000	$ 3,600,000
		SUBTOTAL (A)					**$ 5,751,000**
5	530	Structures - Bridge	SF		$ 200	37,200	$ 7,440,000
6	450	Drainage - New	% of (A)	8%	$ -	-	$ 460,080
7	451	Utility Relocations	% of (A)	6%	$ -	-	$ 345,060
8	632/633	Traffic - Signing/Striping	% of (A)	4%	$ -	-	$ 230,040
9	634	Traffic Control	% of (A)	6%	$ -	-	$ 345,060
10	734	Erosion Control/Environmental	% of (A)	6%	$ -	-	$ 345,060
		SUBTOTAL (B)					**$ 9,165,300**
11	635	Traffic - Signals (New)	EA		$ 270,000	1	$ 270,000
12	997	Railroad Crossing	EA		$ 250,000	0	$ -
13	009	Mobilization	% of (A)+(B)	5%	$ -	-	$ 745,820
14	100	Clearing	% of (A)+(B)	2%	$ -	-	$ 298,330
15		Contingency	% of (A)+(B)	30%	$ -	-	$ 4,474,890
		SUBTOTAL (C)					**$ 5,789,040**
		CONSTRUCTION TOTAL (D)	**(A)+(B)+(C)**				**$ 20,705,340**
16		Engineering Services	% of (D)	15%	$ -		$ 3,105,810
17		ROW Impacts	SF		$ 10	238,900	$ 2,389,000
							$ 26,200,150
		PROJECT TOTAL (E)					**$ 26,201,000**
		CONSTRUCTION (D) + ROW TOTAL COST					**$ 23,100,000**

Note: In providing opinions of probable construction cost, the Client understands that Felsburg Holt & Ullevig has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing. The unit prices and percentages shown above were applied under the direction of the South Dakota Department of Transportation and FHU makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bid or actual costs.

2.8 I-90 Exit 17 – Lead/Deadwood

2.8.1 Review of Interchange Needs

Phase 1 revealed operations needs at the Exit 17 (US Highway 85) interchange as currently configured, described as follows:

Operations

Phase 1 of the study evaluated Year 2019 peak hour traffic operations, and Year 2050 forecasts were developed based on SDDOT county-specific growth rates for each leg of the ramp terminals. Straight-line growth projections and the NCHRP 765 methodology were used to develop turning movement forecasts.

Progressing into Phase 2 tasks, Year 2030 traffic volumes were forecasted by interpolating between the 2019 and 2050 traffic volumes to establish a LOS baseline for the potential opening year. LOS results for 2019, 2030, and 2050 based on a No-Action condition are reported in **Table 2.8a** and are depicted graphically on **Figure 2.8c through Figure 2.8e**.

Table 2.8a I-90 Exit 17 No-Action Interchange LOS Findings

Type	Location Description	AM/PM Peak Hour Level of Service by Year		
		2019	2030	2050
Ramp Terminal Intersections	Eastbound (Unsignalized[1])	a/a	a/a	a/a
	Westbound (Unsignalized)	c/c	c/c	d/d
Ramp Merge/Diverge Section	Eastbound off-ramp (Ramp C)	B/B	B/B	B/B
	Eastbound on-ramp (Ramp B)	A/A	A/A	A/A
	Westbound off-ramp (Ramp A)	B/A	B/A	B/A
	Westbound on-ramp (Ramp D)	B/B	B/B	B/B

[1]Unsignalized LOS is reported for the critical intersection movement

As shown, all intersection movements are anticipated to operate acceptably during peak hours through Year 2030. By Year 2050, the stop-controlled left turn movement at the WB ramp terminal intersection is anticipated to operate at a substandard LOS D. The ramp merge and diverge movements at the ramp junctions with I-90 were also analyzed and shown to operate acceptably through Year 2050.

2.8.2 Discussion of Options

Due to operational concerns, this interchange was moved forward to Phase 2 of the study to further develop solutions to the deficiencies outlined in the Phase 1 report. Two improvement options were identified.

Option 1: Signalization of EB and WB Ramp Intersections and Ramp Improvements

Signalization of the EB and WB ramp terminal intersections, along with widening of the ramp approaches to provide separate left/through and right turn lanes, would improve traffic operations with future growth. Minimal improvements would be required to provide optimal operational benefits. This option would not address substandard control of access north of the interchange, and existing minor ramp geometric deficiencies would remain.

Option 2: Conversion to Diverging Diamond Interchange (DDI)

Conversion of the existing interchange to a DDI would improve congestion and safety while using some existing infrastructure. Maintaining the existing bridge would lead to lower costs. Traffic signal operations would be simplified. Ramps would be improved to SDDOT design standards and construction could likely occur within existing right-of-way. Current substandard control of access north of the interchange would remain due to physical constraints.

2.8.3 Evaluation of Options

Operations of the freeway facilities and ramp terminals were analyzed for the potential improvements under Opening (2030) and Future (2050) traffic conditions using HCS. Results of the HCS analysis and traffic conditions are depicted on **Figure 2.8c, Figure 2.8d,** and **Figure 2.8e**. Forecasted peak hour turning movements for the No-Action condition were kept consistent for the operational evaluation of options.

Option 1: Signalization of EB and WB Ramp Intersections and Ramp Improvements

With signalization of both the EB and WB ramp intersection and ramp approach widening, intersection traffic operations would be acceptable through Year 2050. The concept drawing of this improvement option is shown on **Figure 2.8a**. Construction costs for this concept are estimated at $1.1 million.

Option 2: Diverging Diamond Interchange (DDI)

With the conversion of the interchange to a DDI, the new interchange would be expected to operate at LOS B in the AM and PM peak hours through Year 2050. The concept drawing of this improvement option is shown on **Figure 2.8b**. Construction costs for this concept are estimated at $11.2 million.

Detailed cost estimates for each concept are included in **Table 2.8c** and **Table 2.8d**.

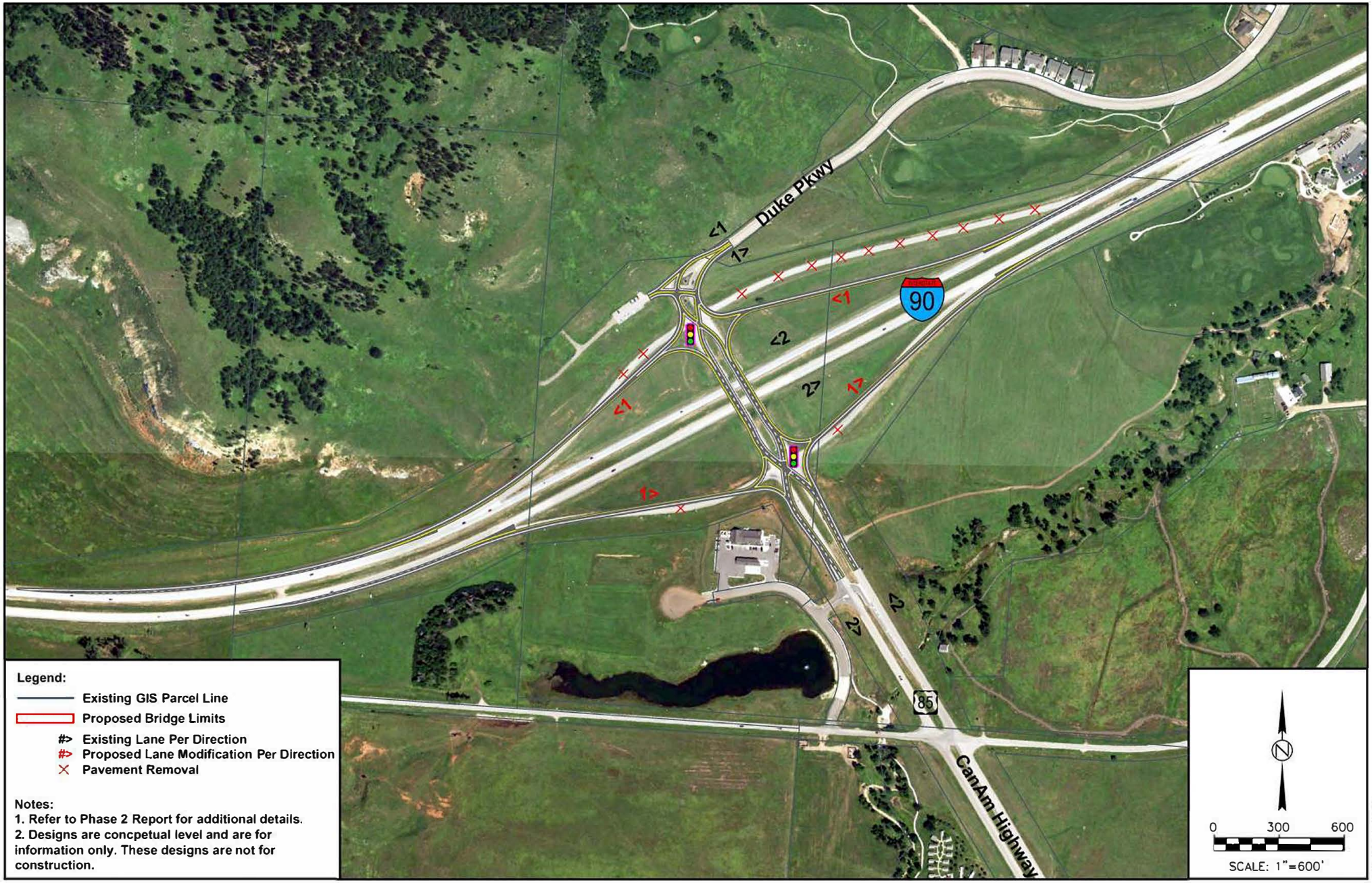
An analysis was conducted to provide a comparative evaluation of the benefits and impacts associated with each option. The various evaluation factors discussed in the previous section were tabulated and are summarized in **Table 2.8b**.

Table 2.8b I-90 Exit 17 Options Evaluation Summary

Evaluation Factors		Option 1 Signalization of EB/WB Ramp Intersections and Ramp Improvements	Option 2 Diverging Diamond Interchange (DDI)
Environmental Impacts		Minimal environmental impacts	Moderate environmental impacts
Development Compatibility		Maintains current development and access	Maintains current development and access
Multimodal Compatibility		Enhanced accommodations	Reduced accommodations
Geometric Design		Some geometric deficiencies would remain (control of access and ramp deficiencies)	Some geometric deficiencies would remain (north control of access)
Safety		Low potential for crash reduction, maintains current emergency response times	Moderate/High potential for crash reduction
Constructability		Minor/typical degree of complexity	High degree of complexity
Traffic Level of Service	**2030**	LOS B	LOS B
	2050	LOS B	LOS B
Right-of-Way (SF)		0	5,300
# of Properties Impacted (take or access)		0	4
Construction Costs		$1.1 million	$11.2 million

Figure 2.8a
I-90 Exit 17 Lead / Deadwood
Option 1: Signalization of EB/WB Ramp Intersections and Ramp Improvements

FELSBURG HOLT & ULLEVIG **CONCEPTUAL**



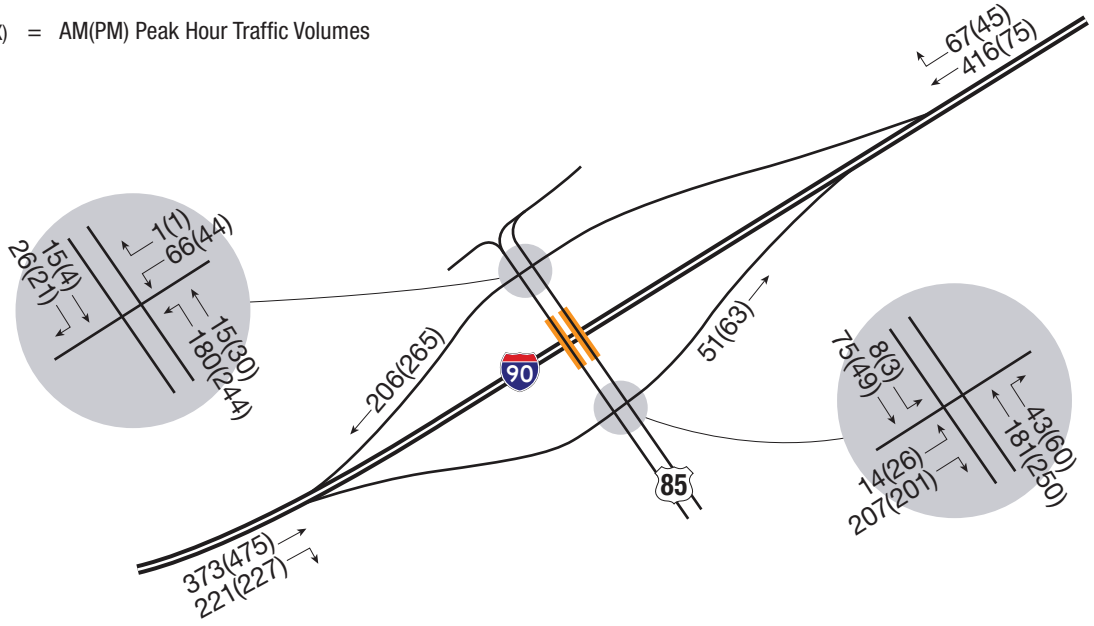
FELSBURG HOLT & ULLEVIG

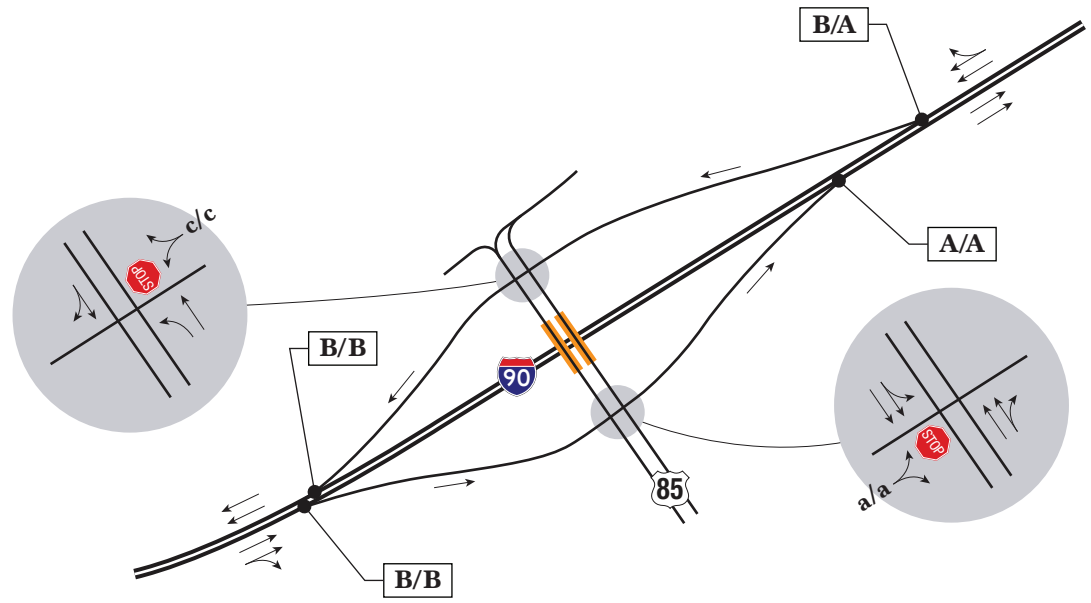
CONCEPTUAL

Figure 2.8b
I-90 Exit 17 Lead / Deadwood
Option 2: Diverging Diamond Interchange (DDI)

LEGEND

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





LEGEND

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

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

STOP = Stop Sign

= Travel Lanes

NORTH

FELSBURG HOLT & ULLEVIG

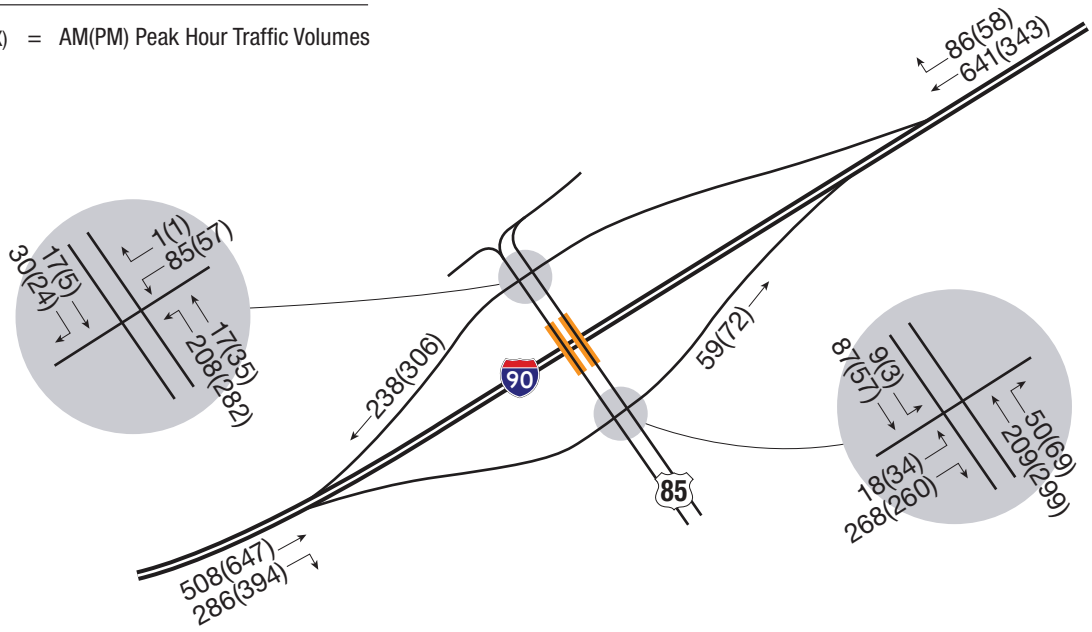
NOTE: Drawing Not to Scale

FIGURE 2.8c
Interstate 90 Exit 17
Existing (2019) Traffic Conditions

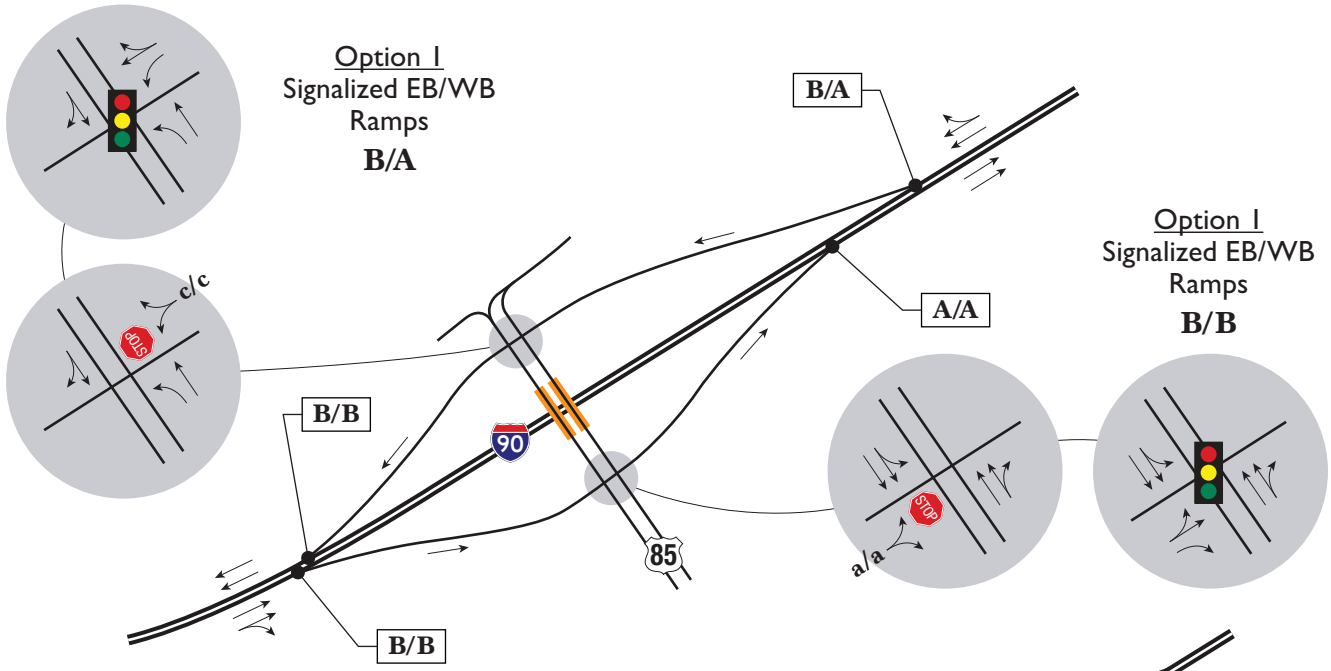
SDDOT Decennial 2020 ICS - Phase 2 18-571-01 12/4/20

LEGEND

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



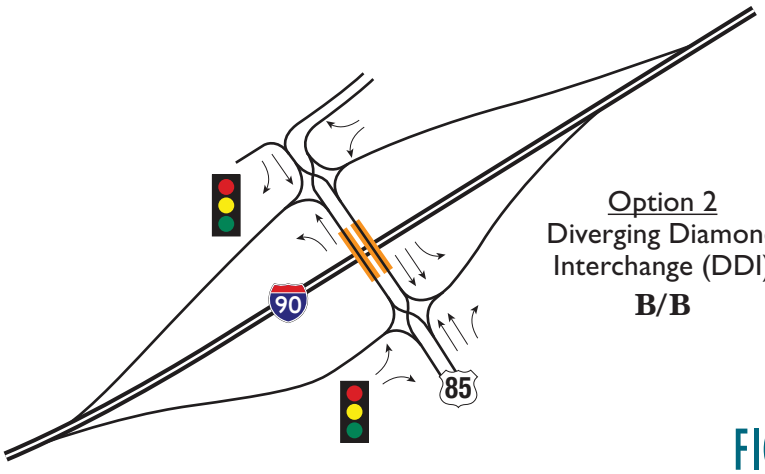
Option 1
Signalized EB/WB
Ramps
B/A



Option 1
Signalized EB/WB
Ramps
B/B

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	=	Stop Sign
	=	Travel Lanes



Option 2
Diverging Diamond
Interchange (DDI)
B/B

NORTH

FELSBURG HOLT & ULLEVIG

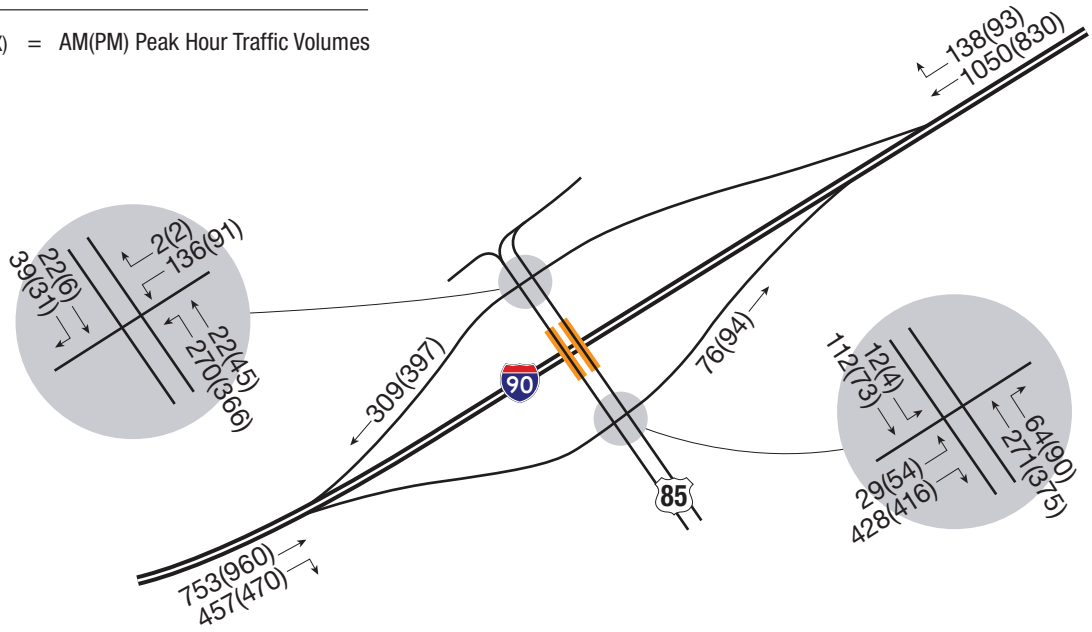
NOTE: Drawing Not to Scale

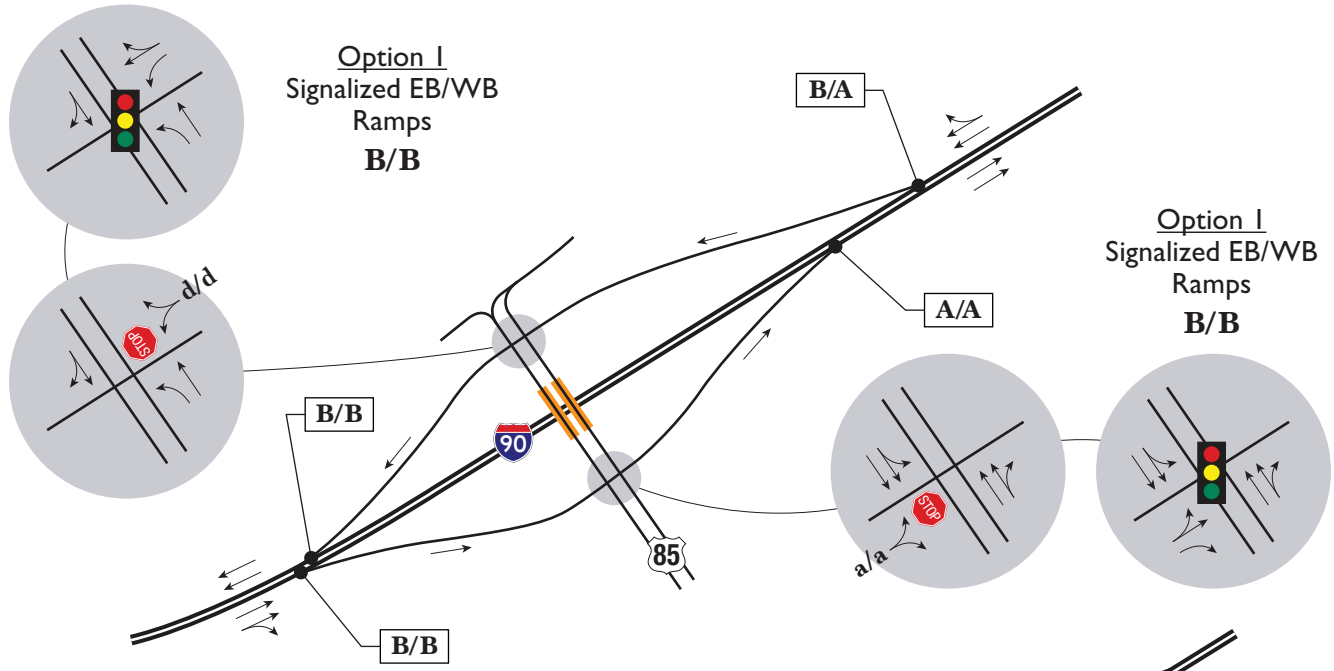
FIGURE 2.8d
Interstate 90 Exit 17
Opening (2030) Traffic Conditions

SDDOT Decennial 2020 ICS - Phase 2 18-571-01 12/4/20

LEGEND

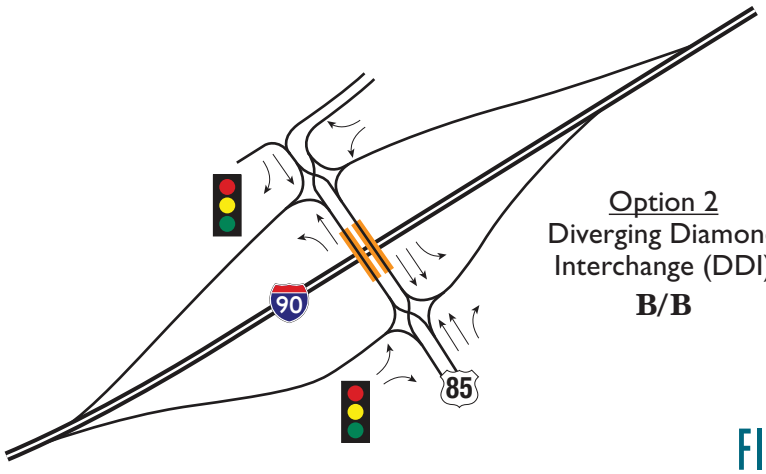
XXX(XXX) = AM(PM) Peak Hour Traffic Volumes





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	=	Stop Sign
	=	Travel Lanes



Option 2
Diverging Diamond
Interchange (DDI)
B/B

NORTH

FELSBURG HOLT & ULLEVIG

NOTE: Drawing Not to Scale

FIGURE 2.8e
Interstate 90 Exit 17
Future (2050) Traffic Conditions

SDDOT Decennial 2020 ICS - Phase 2 18-571-01 12/4/20

Table 2.8c I-90 Exit 17 Probable Construction Costs - Option 1

SOUTH DAKOTA DOT 2020 DECENNIAL INTERSTATE CORRIDOR STUDY

FHU PROJ NO. 118571-01

CONCEPTUAL LEVEL OPINION OF PROBABLE COST

FELSBURG HOLT & ULLEVIG

Alternative: I-90 Exit 17 Option 1

Prepared By: A. Orellana Date: 12/3/2020

	ITEM	DESCRIPTION	UNIT	CONTINGENCY	UNIT COST	QUANTITY	COST
1	**110**	Earthwork and Removals (2' Depth)	SY		$ **15**	3,000	$ 45,000
2	**110**	Earthwork (Significant Impacts)	CY		$ **10**	0	$ -
3	**110**	Remove Bridge	EA		$ **25,000**	0	$ -
4	**380**	Surfacing (Interstate & Ramps)	SY		$ **75**	4,000	$ 300,000
		SUBTOTAL (A)					$ **345,000**
5	**530**	Structures - Bridge	SF		$ **200**	0	$ -
6	**450**	Drainage - New	% of (A)	**3%**	$ -	-	$ 10,350
7	**451**	Utility Relocations	% of (A)	**3%**	$ -	-	$ 10,350
8	**632/633**	Traffic - Signing/Striping	% of (A)	**2%**	$ -	-	$ 5,180
9	**634**	Traffic Control	% of (A)	**2%**	$ -	-	$ 5,180
10	**734**	Erosion Control/Environmental	% of (A)	**2%**	$ -	-	$ 6,900
		SUBTOTAL (B)					$ **37,960**
11	**635**	Traffic - Signals (New)	EA		$ **270,000**	2	$ 540,000
12	**997**	Railroad Crossing	EA		$ **250,000**		$ -
13	**009**	Mobilization	% of (A)+(B)	**5%**	$ -	-	$ 19,150
14	**100**	Clearing	% of (A)+(B)	**2%**	$ -	-	$ 7,660
15		Contingency	% of (A)+(B)	**25%**	$ -	-	$ 95,740
		SUBTOTAL (C)					$ **662,550**
		CONSTRUCTION TOTAL (D)	**(A)+(B)+(C)**				$ **1,045,510**
16		Engineering Services	% of (D)	**15%**	$ -		$ 156,830
17		ROW Impacts	SF		$ **10**	0	$ -
							$ ***1,202,340***
		PROJECT TOTAL (E)					$ **1,203,000**
		CONSTRUCTION (D) + ROW TOTAL COST					$ **1,100,000**

Note: In providing opinions of probable construction cost, the Client understands that Felsburg Holt & Ullevig has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing. The unit prices and percentages shown above were applied under the direction of the South Dakota Department of Transportation and FHU makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bid or actual costs.

Table 2.8d I-90 Exit 17 Probable Construction Costs - Option 2

SOUTH DAKOTA DOT 2020 DECENNIAL INTERSTATE CORRIDOR STUDY

FHU PROJ NO. 118571-01

CONCEPTUAL LEVEL OPINION OF PROBABLE COST

FELSBURG HOLT & ULLEVIG

Alternative: I-90 Exit 17 Option 2

Prepared By: A. Orellana Date: 12/3/2020

	ITEM	DESCRIPTION	UNIT	CONTINGENCY	UNIT COST	QUANTITY	COST
1	**110**	Earthwork and Removals (2' Depth)	SY		$ **15**	36,000	$ 540,000
2	**110**	Earthwork (Significant Impacts)	CY		$ **10**	176,000	$ 1,760,000
3	**110**	Remove Bridge	EA		$ **25,000**	0	$ -
4	**380**	Surfacing (Interstate & Ramps)	SY		$ **75**	48,000	$ 3,600,000
		SUBTOTAL (A)					$ **5,900,000**
5	**530**	Structures - Bridge	SF		$ **200**	0	$ -
6	**450**	Drainage - New	% of (A)	**8%**	$ -	-	$ 472,000
7	**451**	Utility Relocations	% of (A)	**6%**	$ -	-	$ 354,000
8	**632/633**	Traffic - Signing/Striping	% of (A)	**4%**	$ -	-	$ 236,000
9	**634**	Traffic Control	% of (A)	**6%**	$ -	-	$ 354,000
10	**734**	Erosion Control/Environmental	% of (A)	**6%**	$ -	-	$ 354,000
		SUBTOTAL (B)					$ **1,770,000**
11	**635**	Traffic - Signals (New)	EA		$ **270,000**	2	$ 540,000
12	**997**	Railroad Crossing	EA		$ **250,000**	0	$ -
13	**009**	Mobilization	% of (A)+(B)	**5%**	$ -	-	$ 383,500
14	**100**	Clearing	% of (A)+(B)	**2%**	$ -	-	$ 153,400
15		Contingency	% of (A)+(B)	**30%**	$ -	-	$ 2,301,000
		SUBTOTAL (C)					$ **3,377,900**
		CONSTRUCTION TOTAL (D)	**(A)+(B)+(C)**				$ **11,047,900**
16		Engineering Services	% of (D)	**15%**	$ -		$ 1,657,190
17		ROW Impacts	SF		$ **10**	5,300	$ 53,000
							$ ***12,758,090***
		PROJECT TOTAL (E)					$ **12,759,000**
		CONSTRUCTION (D) + ROW TOTAL COST					$ **11,200,000**

Note: In providing opinions of probable construction cost, the Client understands that Felsburg Holt & Ullevig has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing. The unit prices and percentages shown above were applied under the direction of the South Dakota Department of Transportation and FHU makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bid or actual costs.

2.9 I-90 Exit 48 – Stage Stop Canyon Road

2.9.1 Review of Interchange Needs

The Phase 1 analysis effort revealed operations needs at this interchange as currently configured, described as follows:

Operations

Phase 1 of the study evaluated Year 2019 peak hour traffic operations, and Year 2050 forecasts were developed using traffic growth rates derived from the Rapid City Area MPO Travel Demand Model. Straight-line growth projections and the NCHRP 765 methodology were used to develop turning movement forecasts.

Progressing into Phase 2 tasks, Year 2030 traffic volumes were forecasted by interpolating between the 2019 and 2050 traffic volumes to establish a LOS baseline for the potential opening year. LOS results for 2019, 2030, and 2050 based on a No-Action condition are reported in **Table 2.9a** and are depicted graphically on **Figure 2.9d through Figure 2.9f**.

Table 2.9a I-90 Exit 48 No-Action Interchange LOS Findings

Type	Location Description	AM/PM Peak Hour Level of Service by Year		
		2019	2030	2050
Ramp Terminal Intersections	Eastbound (Unsignalized[1])	b/b	b/b	b/b
	Westbound (Unsignalized)	b/c	b/c	b/f
Ramp Merge/Diverge Section	Eastbound off-ramp (Ramp C)	B/A	B/A	B/B
	Eastbound on-ramp (Ramp B)	B/A	B/B	B/B
	Westbound off-ramp (Ramp A)	B/B	C/B	D/C
	Westbound on-ramp (Ramp D)	B/A	B/B	B/B

[1]Unsignalized LOS is reported for the critical intersection movement

It was determined that the stop-controlled EB ramp terminal is expected to operate at LOS B in the AM and PM peak hours for all scenarios. The stop-controlled approach to the westbound (WB) ramp terminal is expected to operate at LOS B/C in the AM/PM peak hour by Year 2030 and LOS B/F by Year 2050. Growth to Year 2050 introduces operations needs.

The merge and diverge movements at the ramps were also examined using the same forecasted traffic volumes. Under Opening (2030) traffic conditions, all merge and diverge sections would operate at acceptable LOS. By Year 2050, substandard operations are identified at LOS D for the WB off-ramp.

2.9.2 Discussion of Options

Due to operational concerns, this interchange was moved forward to Phase 2 of the study to further develop solutions to the deficiencies outlined in the Phase 1 report. Three improvement options were identified.

Option 1: Interstate and Ramp Modifications

Option 1 would maintain the same basic layout as current conditions but would provide Interstate and ramp modifications, including a slight realignment of the interstate to allow improved alignment of Ramps A and D.

Option 2: Crossroad Realignment

A crossroad realignment would provide more spacing between the ramp terminals and local accesses, resulting in improved traffic flow. Option 2 would require a new bridge over the interstate and a second bridge over a railroad crossing. These improvements would also require additional right-of-way.

Option 3: Single Point Urban Interchange (SPUI)

Conversion of the existing interchange to a SPUI would improve congestion and safety. Ramps would be improved to SDDOT design standards and construction could likely occur within existing right-of-way. Although, reconstruction of the crossroad at the SPUI and ramps would occur on the existing alignments, creating a challenging construction phasing plan. Lane closures would likely be required, as well as new bridge structure. This would be a high cost option.

2.9.3 Evaluation of Options

Operations of the freeway facilities and ramp terminals were analyzed for the potential improvements under Opening (2030) and Future (2050) traffic conditions using HCS. Results of the HCS analysis and traffic conditions are depicted on **Figure 2.9d, Figure 2.9e,** and **Figure 2.9f**. Forecasted peak hour traffic volumes were kept consistent for the evaluation of all options.

Option 1: Interstate and Ramp Modifications

Option 1 would not lead to any change in traffic operations compared to a No-Action situation, the results of which were discussed previously. The concept drawing of this improvement option is shown on **Figure 2.9a**. Construction costs for this concept are estimated at $9.7 million.

Option 2: Crossroad Realignment

Option 2 would not lead to any change in traffic operations compared to a No-Action situation, the results of which were discussed previously. The concept drawing of this improvement option is shown on **Figure 2.9b**. Construction costs for this concept are estimated at $19.2 million.

Option 3: Single Point Urban Interchange (SPUI)

With the conversion of the interchange to a SPUI, the new interchange would be expected to operate at LOS A in the AM peak period and LOS B in the PM peak period under Opening (2030) traffic conditions and LOS B in the AM and PM peak periods under Future (2050) traffic conditions. The concept drawing of this improvement option is shown on **Figure 2.9c**. Construction costs for this concept are estimated at $27.3 million.

Detailed cost estimates for each concept are included in **Table 2.9c, Table 2.9d**, and **Table 2.9e**.

An analysis was conducted to provide a comparative evaluation of the benefits and impacts associated with each option. The various evaluation factors discussed in the previous section were tabulated and are summarized in **Table 2.9b**.

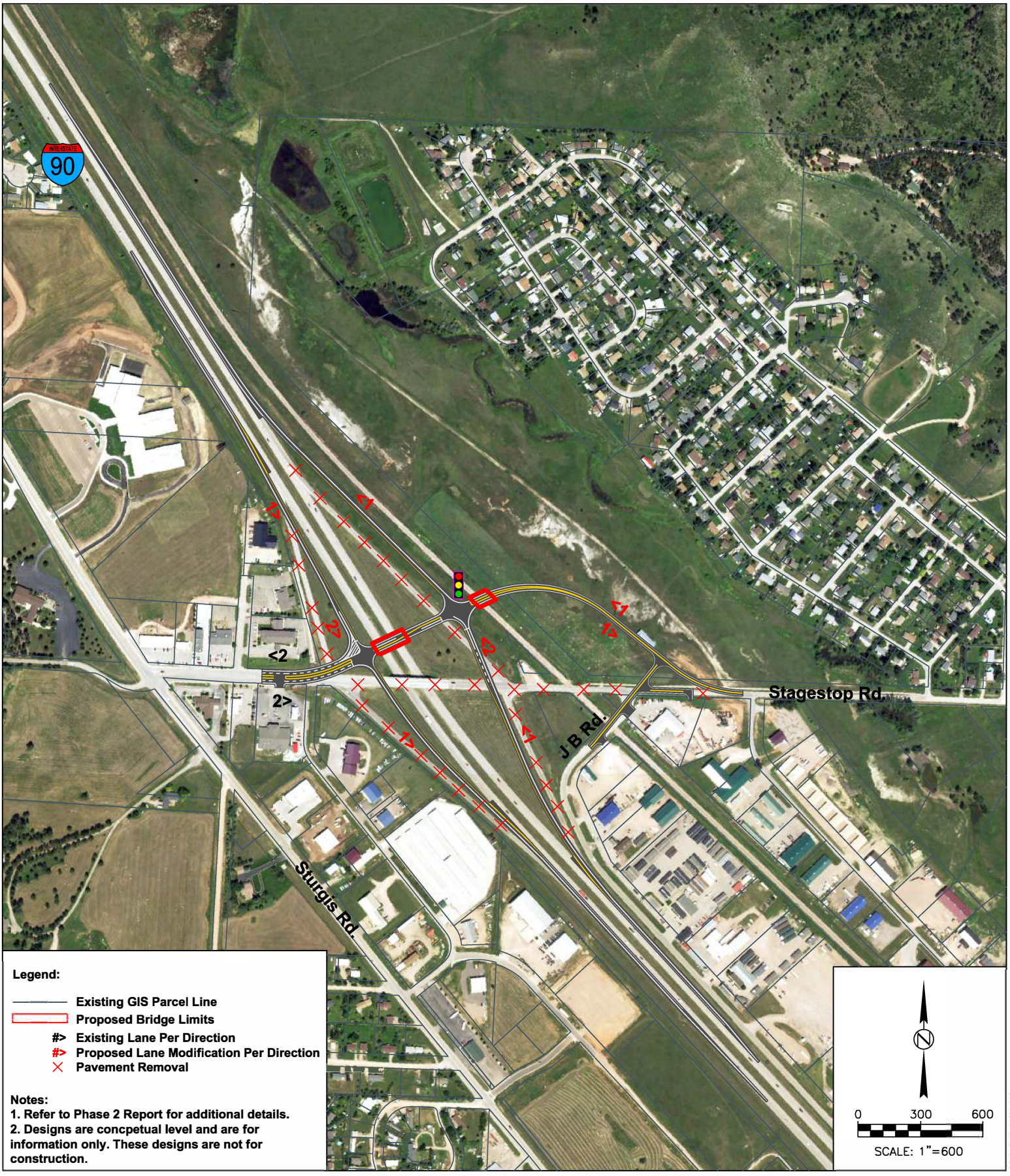
Table 2.9b I-90 Exit 48 Options Evaluation Summary

Evaluation Factors		Option 1 Interstate and Ramp Modifications	Option 2 Crossroad Realignment	Option 3 Single Point Urban Interchange (SPUI)
Environmental Impacts		Minimal environmental impacts	Multiple environmental impacts	Minimal environmental impacts
Development Compatibility		Maintains current development and access	Maintains current development and access	Maintains current development and access
Multimodal Compatibility		Few/no added accommodations	Few/no added accommodations	Reduced accommodations
Geometric Design		Some geometric deficiencies anticipated due to design constraints	Addresses all current geometric deficiencies	Addresses all current geometric deficiencies
Safety		Low potential for crash reduction and/or maintains current emergency response times	High potential for crash reduction and/or reduces emergency response times	Low potential for crash reduction and/or maintains current emergency response times
Constructability		Low Complexity	Moderate degree of complexity	High Complexity
Traffic Level of Service	**2030**	LOS C	LOS C	LOS B
	2050	LOS C	LOS C	LOS B
Right-of-Way (SF)		0	232,100	5,000
# of Properties Impacted (take or access)		0	7	2
Construction Costs		$9.7 million	$19.2 million	$27.3 million

Figure 2.9a
I-90 Exit 48 Stage Stop Canyon Road
Option 1: Interstate and Ramp Modifications

FELSBURG HOLT & ULLEVIG

CONCEPTUAL



FELSBURG HOLT & ULLEVIG

CONCEPTUAL

Figure 2.9b
I-90 Exit 48 Stage Stop Canyon Road
Option 2: Crossroad Realignment

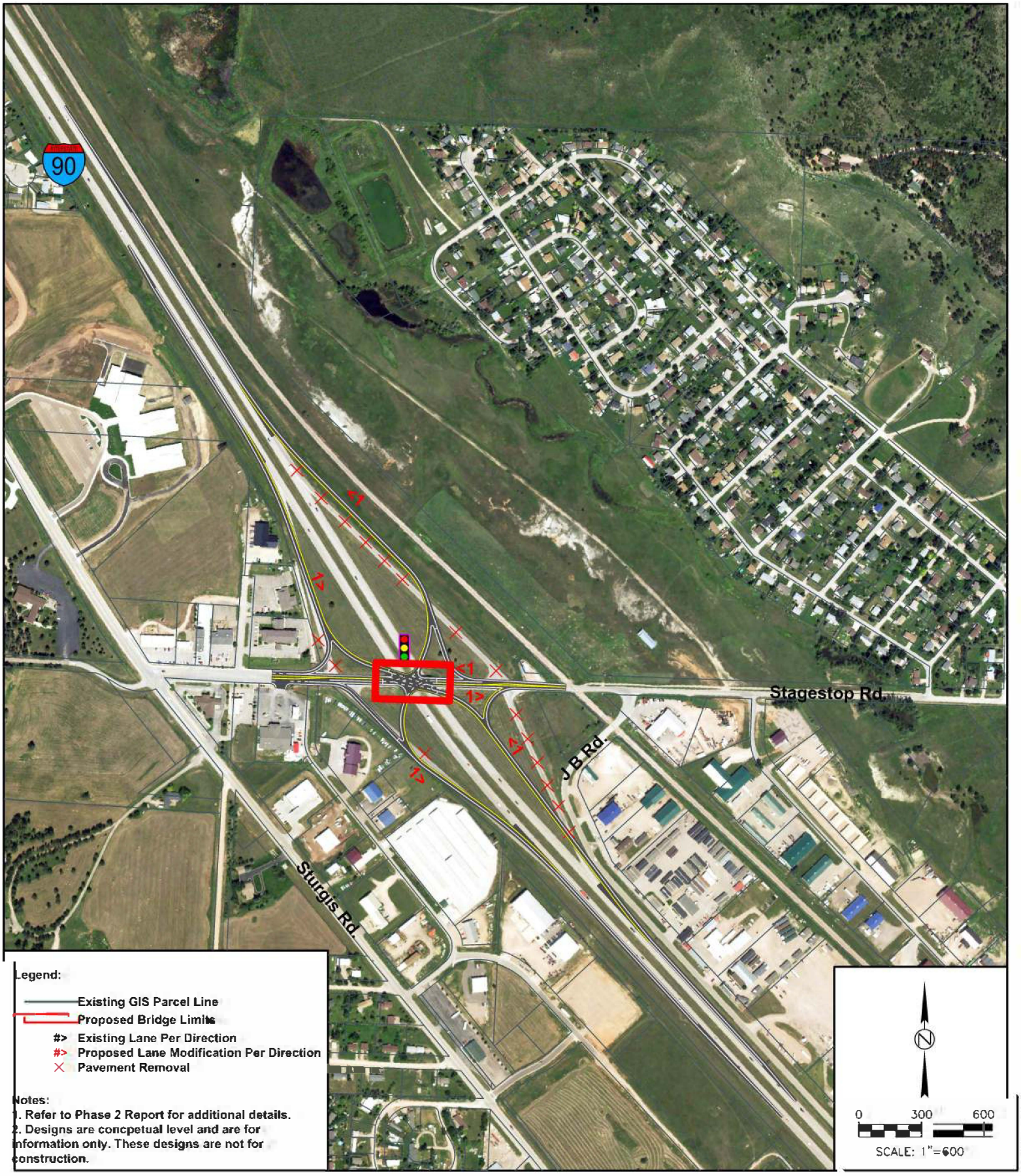


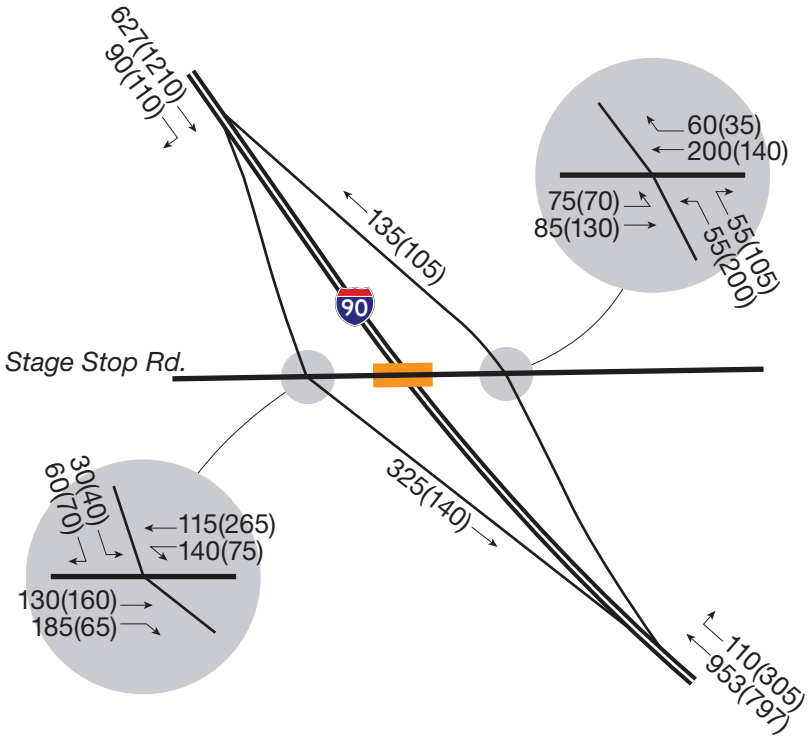
Figure 2.9c
I-90 Exit 48 Stage Stop Canyon Road
Option 3: Single-Point Urban Interchange (SPUI)

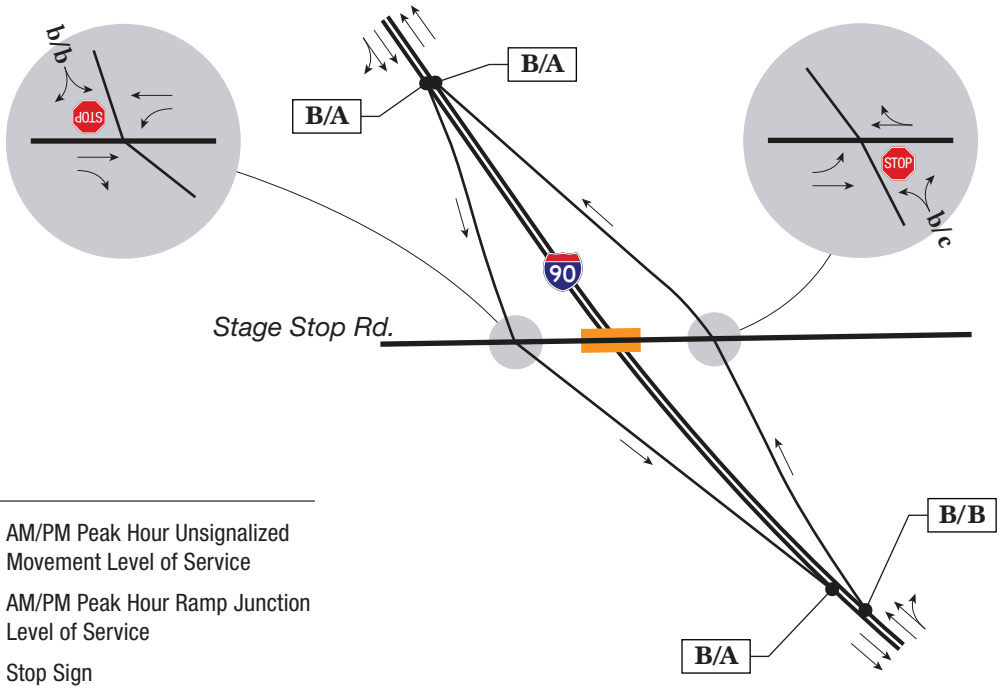
FELSBURG HOLT & ULLEVIG

CONCEPTUAL

LEGEND

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





LEGEND

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

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

STOP = Stop Sign

= Travel Lanes

NORTH

FELSBURG HOLT & ULLEVIG

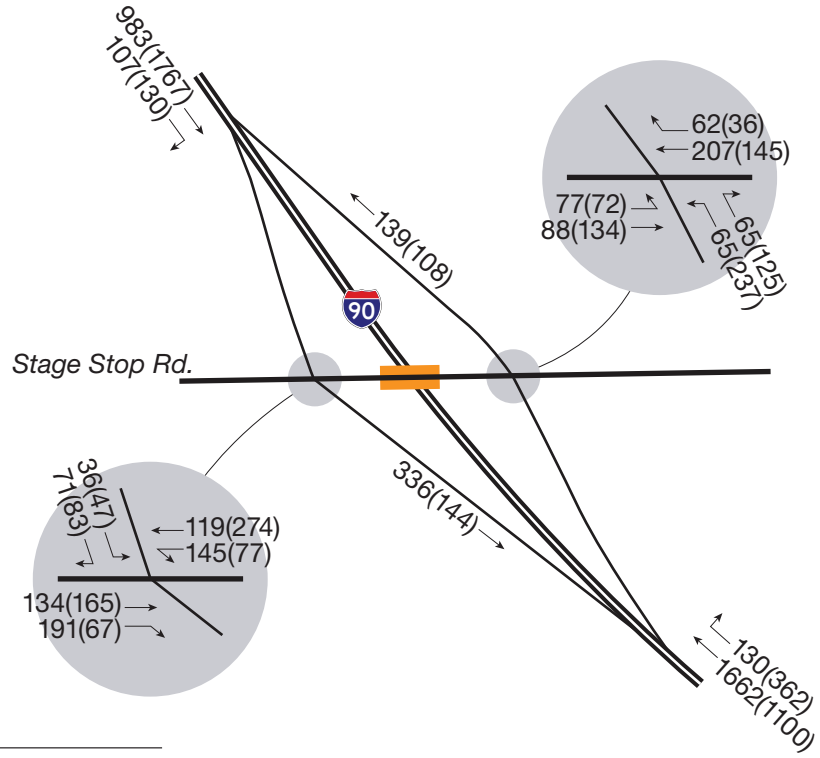
NOTE: Drawing Not to Scale

FIGURE 2.9d

Interstate 90 Exit 48

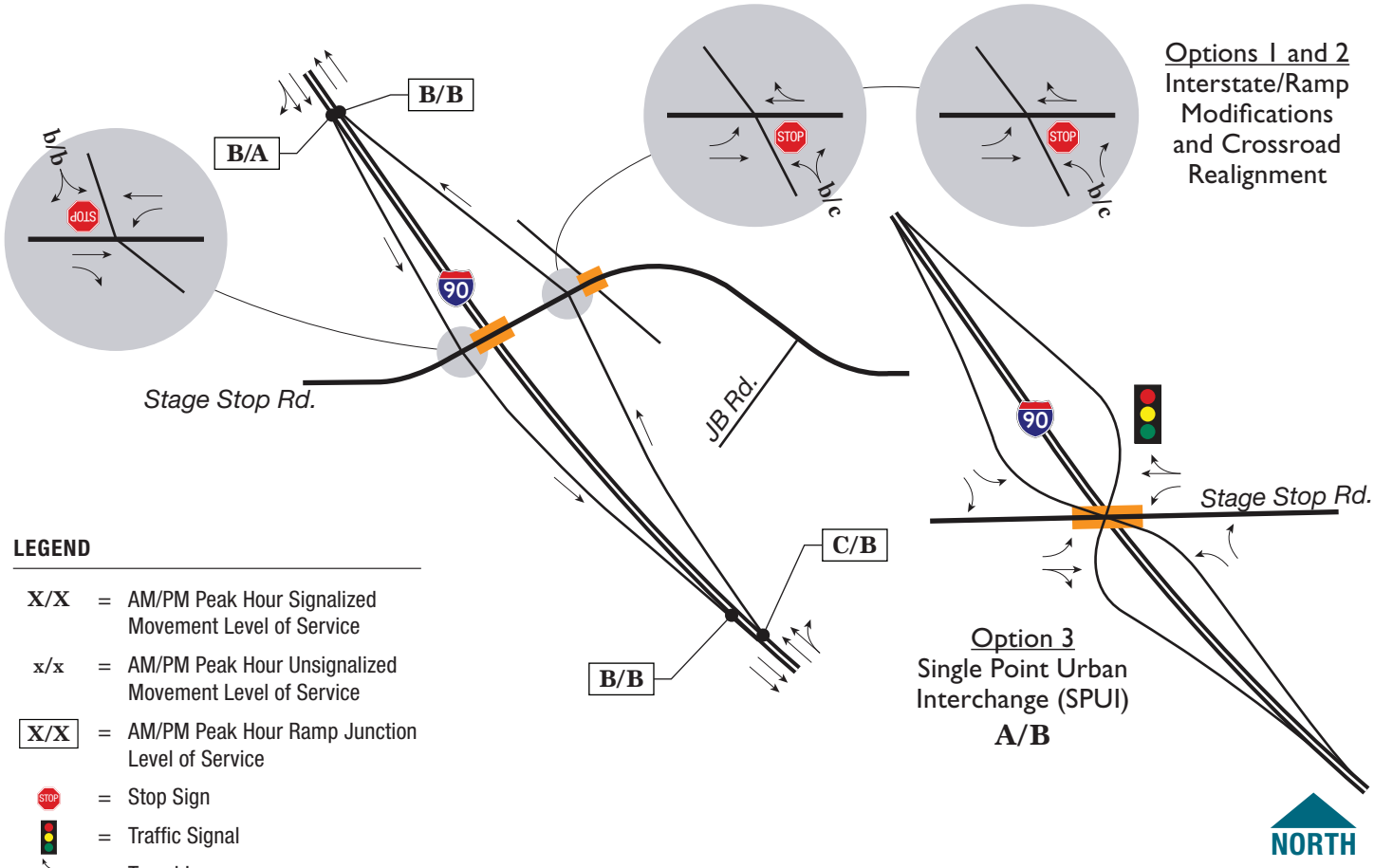
Existing (2019) Traffic Conditions

SDDOT Decennial 2020 ICS - Phase 2 18-571-01 12/4/20



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	=	Stop Sign
	=	Traffic Signal
	=	Travel Lanes

FELSBURG HOLT & ULLEVIG

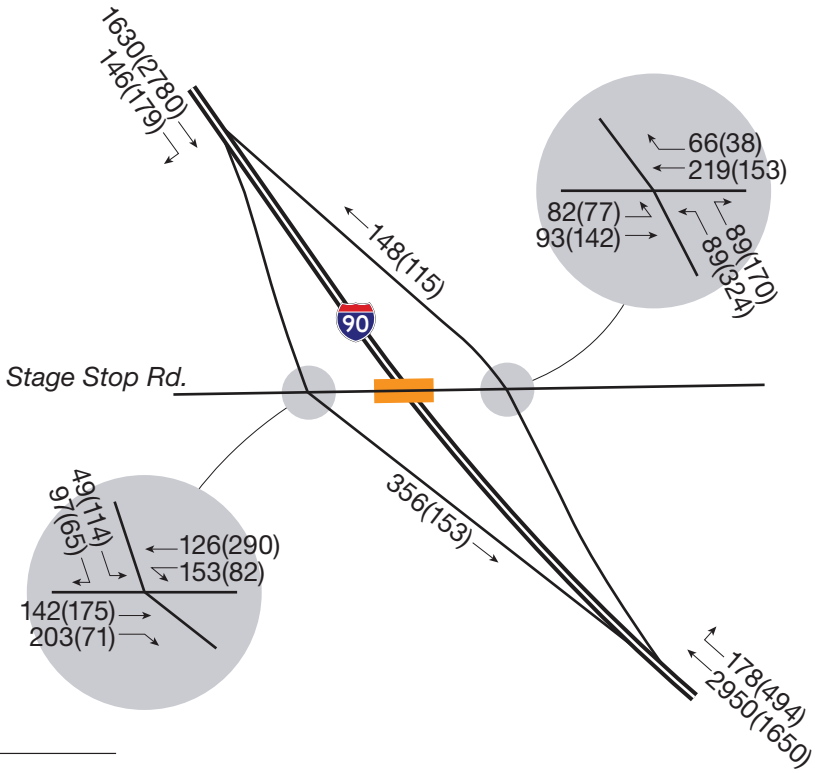
NOTE: Drawing Not to Scale

FIGURE 2.9e

Interstate 90 Exit 48

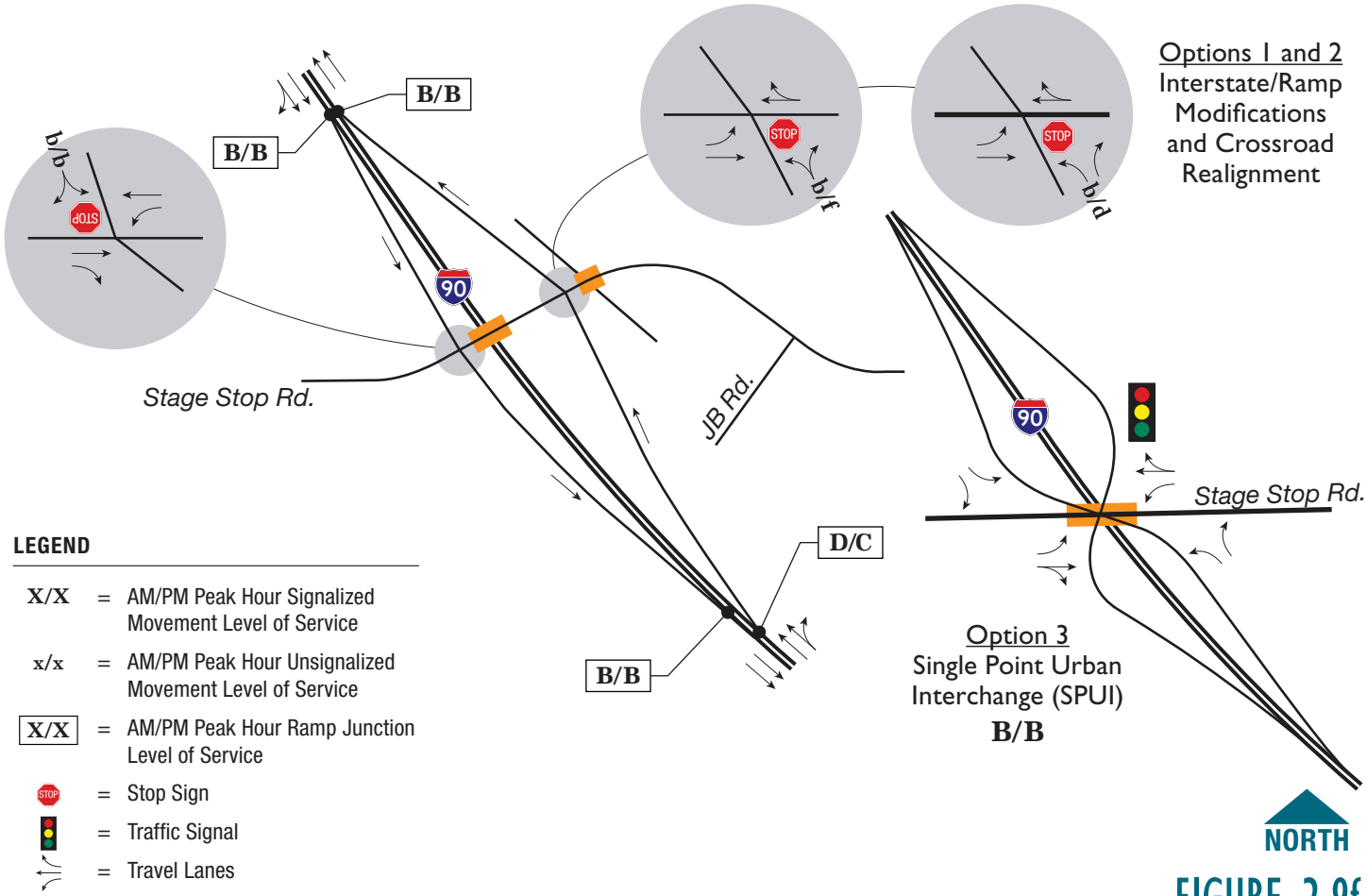
Opening (2030) Traffic Conditions

SDDOT Decennial 2020 ICS - Phase 2 18-571-01 12/4/20



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	=	Stop Sign
	=	Traffic Signal
	=	Travel Lanes

FELSBURG HOLT & ULLEVIG

NOTE: Drawing Not to Scale

FIGURE 2.9f

Interstate 90 Exit 48
Future (2050) Traffic Conditions

SDDOT Decennial 2020 ICS - Phase 2 18-571-01 12/4/20

Table 2.9c I-90 Exit 48 Probable Construction Costs – Option 1

SOUTH DAKOTA DOT 2020 DECENNIAL INTERSTATE CORRIDOR STUDY

FHU PROJ NO. 118571-01

CONCEPTUAL LEVEL OPINION OF PROBABLE COST

FELSBURG HOLT & ULLEVIG

Alternative: I-90 Exit 48 Option 1

Prepared By: A. Orellana Date: 12/3/2020

	ITEM	DESCRIPTION	UNIT	CONTINGENCY	UNIT COST	QUANTITY	COST
1	**110**	Earthwork and Removals (2' Depth)	SY		$ **15**	26,000	$ 390,000
2	**110**	Earthwork (Significant Impacts)	CY		$ **10**	0	$ -
3	**110**	Remove Bridge	EA		$ **25,000**	1	$ 25,000
4	**380**	Surfacing (Interstate & Ramps)	SY		$ **75**	26,000	$ 1,950,000
		SUBTOTAL (A)					$ **2,365,000**
5	**530**	Structures - Bridge	SF		$ **200**	23,600	$ 4,720,000
6	**450**	Drainage - New	% of (A)	**3%**	$ -	-	$ 70,950
7	**451**	Utility Relocations	% of (A)	**3%**	$ -	-	$ 70,950
8	**632/633**	Traffic - Signing/Striping	% of (A)	**2%**	$ -	-	$ 35,480
9	**634**	Traffic Control	% of (A)	**2%**	$ -	-	$ 35,480
10	**734**	Erosion Control/Environmental	% of (A)	**2%**	$ -	-	$ 47,300
		SUBTOTAL (B)					$ **4,980,160**
11	**635**	Traffic - Signals (New)	EA		$ **270,000**	0	$ -
12	**997**	Railroad Crossing	EA		$ **250,000**	0	$ -
13	**009**	Mobilization	% of (A)+(B)	**5%**	$ -	-	$ 367,260
14	**100**	Clearing	% of (A)+(B)	**2%**	$ -	-	$ 146,910
15		Contingency	% of (A)+(B)	**25%**	$ -	-	$ 1,836,290
		SUBTOTAL (C)					$ **2,350,460**
		CONSTRUCTION TOTAL (D)	**(A)+(B)+(C)**				$ **9,695,620**
16		Engineering Services	% of (D)	**15%**	$ -		$ 1,454,350
17		ROW Impacts	SF		$ **10**	0	$ -
							$ ***11,149,970***
		PROJECT TOTAL (E)					$ **11,150,000**
		CONSTRUCTION (D) + ROW TOTAL COST					$ **9,700,000**

Note: In providing opinions of probable construction cost, the Client understands that Felsburg Holt & Ullevig has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing. The unit prices and percentages shown above were applied under the direction of the South Dakota Department of Transportation and FHU makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bid or actual costs.

Table 2.9d I-90 Exit 48 Probable Construction Costs – Option 2

SOUTH DAKOTA DOT 2020 DECENNIAL INTERSTATE CORRIDOR STUDY

FHU PROJ NO. 118571-01

CONCEPTUAL LEVEL OPINION OF PROBABLE COST

FELSBURG HOLT & ULLEVIG

Alternative: I-90 Exit 48 Option 2

Prepared By: A. Orellana Date: 12/3/2020

	ITEM	DESCRIPTION	UNIT	CONTINGENCY	UNIT COST	QUANTITY	COST
1	**110**	Earthwork and Removals (2' Depth)	SY		$ **15**	92,000	$ 1,380,000
2	**110**	Earthwork (Significant Impacts)	CY		$ **10**	185,100	$ 1,851,000
3	**110**	Remove Bridge	EA		$ **25,000**	1	$ 25,000
4	**380**	Surfacing (Interstate & Ramps)	SY		$ **75**	46,000	$ 3,450,000
		SUBTOTAL (A)					$ **6,706,000**
5	**530**	Structures - Bridge	SF		$ **200**	15,800	$ 3,160,000
6	**450**	Drainage - New	% of (A)	**8%**	$ -	-	$ 536,480
7	**451**	Utility Relocations	% of (A)	**6%**	$ -	-	$ 402,360
8	**632/633**	Traffic - Signing/Striping	% of (A)	**4%**	$ -	-	$ 268,240
9	**634**	Traffic Control	% of (A)	**6%**	$ -	-	$ 402,360
10	**734**	Erosion Control/Environmental	% of (A)	**6%**	$ -	-	$ 402,360
		SUBTOTAL (B)					$ **5,171,800**
11	**635**	Traffic - Signals (New)	EA		$ **270,000**	1	$ 270,000
12	**997**	Railroad Crossing	EA		$ **250,000**	1	$ 250,000
13	**009**	Mobilization	% of (A)+(B)	**5%**	$ -	-	$ 593,890
14	**100**	Clearing	% of (A)+(B)	**2%**	$ -	-	$ 237,560
15		Contingency	% of (A)+(B)	**30%**	$ -	-	$ 3,563,340
		SUBTOTAL (C)					$ **4,914,790**
		CONSTRUCTION TOTAL (D)	**(A)+(B)+(C)**				$ **16,792,590**
16		Engineering Services	% of (D)	**15%**	$ -		$ 2,518,890
17		ROW Impacts	SF		$ **10**	232,100	$ 2,321,000
							$ ***21,632,480***
		PROJECT TOTAL (E)					$ **21,633,000**
		CONSTRUCTION (D) + ROW TOTAL COST					$ **19,200,000**

Note: In providing opinions of probable construction cost, the Client understands that Felsburg Holt & Ullevig has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing. The unit prices and percentages shown above were applied under the direction of the South Dakota Department of Transportation and FHU makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bid or actual costs.

Table 2.9e I-90 Exit 48 Probable Construction Costs – Option 3

SOUTH DAKOTA DOT 2020 DECENNIAL INTERSTATE CORRIDOR STUDY

FHU PROJ NO. 118571-01

CONCEPTUAL LEVEL OPINION OF PROBABLE COST

FELSBURG HOLT & ULLEVIG

Alternative: I-90 Exit 48 Option 3

Prepared By: A. Orellana Date: 12/3/2020

	ITEM	DESCRIPTION	UNIT	CONTINGENCY	UNIT COST	QUANTITY	COST
1	**110**	Earthwork and Removals (2' Depth)	SY		$ **15**	71,800	$ 1,077,000
2	**110**	Earthwork (Significant Impacts)	CY		$ **10**	147,100	$ 1,471,000
3	**110**	Remove Bridge	EA		$ **25,000**	1	$ 25,000
4	**380**	Surfacing (Interstate & Ramps)	SY		$ **75**	41,000	$ 3,075,000
		SUBTOTAL (A)					$ **5,648,000**
5	**530**	Structures - Bridge	SF		$ **200**	61,500	$ 12,300,000
6	**450**	Drainage - New	% of (A)	**8%**	$ -	-	$ 451,840
7	**451**	Utility Relocations	% of (A)	**6%**	$ -	-	$ 338,880
8	**632/633**	Traffic - Signing/Striping	% of (A)	**4%**	$ -	-	$ 225,920
9	**634**	Traffic Control	% of (A)	**6%**	$ -	-	$ 338,880
10	**734**	Erosion Control/Environmental	% of (A)	**6%**	$ -	-	$ 338,880
		SUBTOTAL (B)					$ **13,994,400**
11	**635**	Traffic - Signals (New)	EA		$ **270,000**	1	$ 270,000
12	**997**	Railroad Crossing	EA		$ **250,000**	0	$ -
13	**009**	Mobilization	% of (A)+(B)	**5%**	$ -	-	$ 982,120
14	**100**	Clearing	% of (A)+(B)	**2%**	$ -	-	$ 392,850
15		Contingency	% of (A)+(B)	**30%**	$ -	-	$ 5,892,720
		SUBTOTAL (C)					$ **7,537,690**
		CONSTRUCTION TOTAL (D)	**(A)+(B)+(C)**				$ **27,180,090**
16		Engineering Services	% of (D)	**15%**	$ -		$ 4,077,020
17		ROW Impacts	SF		$ **10**	5,000	$ 50,000
							$ ***31,307,110***
		PROJECT TOTAL (E)					$ **31,308,000**
		CONSTRUCTION (D) + ROW TOTAL COST					$ **27,300,000**

Note: In providing opinions of probable construction cost, the Client understands that Felsburg Holt & Ullevig has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing. The unit prices and percentages shown above were applied under the direction of the South Dakota Department of Transportation and FHU makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bid or actual costs.

2.10 I-90 Exit 55 – Deadwood Avenue

2.10.1 Review of Interchange Needs

The Phase 1 analysis effort revealed operations and geometrics needs at this interchange as currently configured, described as follows:

Operations

Phase 1 of the study evaluated Year 2019 peak hour traffic operations, and Year 2050 forecasts were developed using traffic growth rates derived from the Rapid City Area MPO Travel Demand Model. Straight-line growth projections and the NCHRP 765 methodology were used to develop turning movement forecasts.

Progressing into Phase 2 tasks, Year 2030 traffic volumes were forecasted by interpolating between the 2019 and 2050 traffic volumes to establish a LOS baseline for the potential opening year. LOS results for 2019, 2030, and 2050 based on a No-Action condition are reported in **Table 2.10a** and are depicted graphically on **Figures 2.10b through Figure 2.10d**.

Table 2.10a I-90 Exit 55 No-Action Interchange LOS Findings

Type	Location Description	AM/PM Peak Hour Level of Service by Year		
		2019	2030	2050
Ramp Terminal Intersections	Eastbound (Unsignalized[1])	c/f	c/f	c/f
	Westbound (Signalized[2])	C/C	C/C	C/C
Ramp Merge/Diverge Section	Eastbound off-ramp (Ramp C)	B/B	B/B	B/B
	Eastbound on-ramp (Ramp B)	B/B	B/B	B/B
	Westbound off-ramp (Ramp A)	B/B	C/B	F/C
	Westbound on-ramp (Ramp D)	B/B	B/B	B/B

[1]Unsignalized LOS is reported for the critical intersection movement
[2]Signalized LOS is reported for the intersection as a whole

As shown, the EB ramp intersection functions as a stop-controlled intersection, and a temporary signal is provided at higher volume times of the year. As a stop-controlled intersection, it is expected to operate at LOS C in the AM peak hour and LOS F in the PM peak hour currently and into the future. As a signalized intersection, it operates at LOS B/C in the AM/PM peak hours and is expected to remain acceptable into the future. The signalized WB ramp terminal is expected to operate at LOS C in the AM and PM peak hours into the future.

The merge and diverge movements at the ramps were also examined using forecasted traffic levels. All ramp merge/diverge sections are anticipated to operate at acceptable LOS through Year 2050, with the

exception of the WB diverge section. This section is expected to operate at LOS F in the AM peak hour by Year 2050.

Geometrics

The I-90 Exit 55 interchange demonstrated numerous geometric deficiencies based on the Phase 1 review. Deficiencies included substandard ramp lane and shoulder widths and stopping sight distance. The nearest access is located approximately 50 feet north of the WB ramp terminal intersection, below the 100 feet specified by the SDDOT Road Design Manual.

In addition to these geometric deficiencies, the interchange ramp termini are unable to accommodate LCVs as currently configured.

2.10.2 Discussion of Options

Due to operations and geometric concerns, this interchange was moved forward to Phase 2 of the study to further develop solutions to the deficiencies outlined in the Phase 1 report. One improvement option was identified.

Option 1: Ramp Modifications

The option to complete ramp modifications encompasses improvements to shoulders, inslopes, and clear zones along three of the four ramps, improving roadside conditions. Additionally, the design provides improvements to curb returns to better accommodate WB-92D and WB-109D truck movements. It is recommended that the EB ramp terminal intersection be converted to full time signalized control in the future.

2.10.3 Evaluation of Options

Operations of the freeway facilities and ramp terminals were analyzed for the potential improvements under Opening (2030) and Future (2050) traffic conditions using HCS. Results of the HCS analysis and traffic conditions are depicted on **Figure 2.10b, Figure 2.10c,** and **Figure 2.10d**. No-Action future traffic volume forecasts were retained for analyses of the build options.

Option 1: Ramp Modifications

This option would not lead to any change in traffic operations compared to a No-Action condition. The concept drawing of this improvement option is shown on **Figure 2.10a**. Construction costs for this concept are estimated at $2.1 million.

A detailed cost estimate for these improvements is included in **Table 2.10c**.

An analysis was conducted to provide an evaluation of its benefits and impacts. The various evaluation factors discussed in the previous section were tabulated and are summarized in **Table 2.10b**.

Table 2.10b I-90 Exit 55 Options Evaluation Summary

Evaluation Factors		Option 1
		Ramp Modifications
Environmental Impacts		Minimal environmental impacts
Development Compatibility		Maintains current development and access
Multimodal Compatibility		Few/no added accommodations
Geometric Design		Some geometric deficiencies anticipated to remain due to design limitations
Safety		Low potential for crash reduction and maintains current emergency response times
Constructability		Minor/typical degree of complexity
Traffic Level of Service	**2030**	LOS C
	2050	LOS C
Right-of-Way (SF)		3,000
# of Properties Impacted (take or access)		0
Construction Costs		$2.1 million

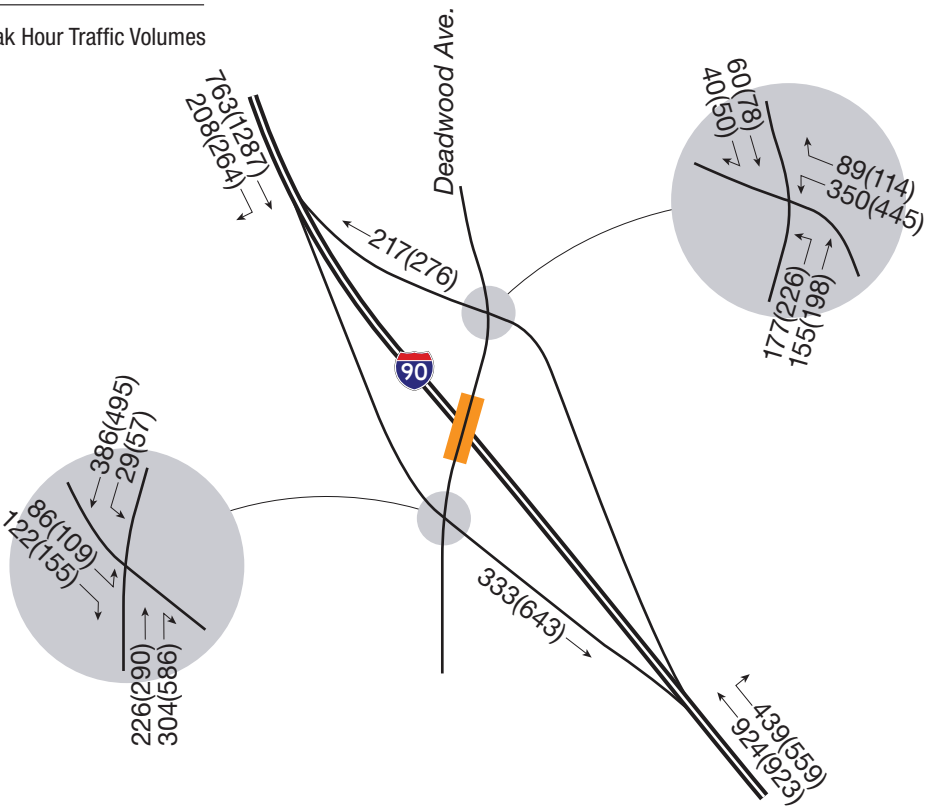
Figure 2.10a
I-90 Exit 55 Deadwood Avenue
Option 1: Ramp Modifications

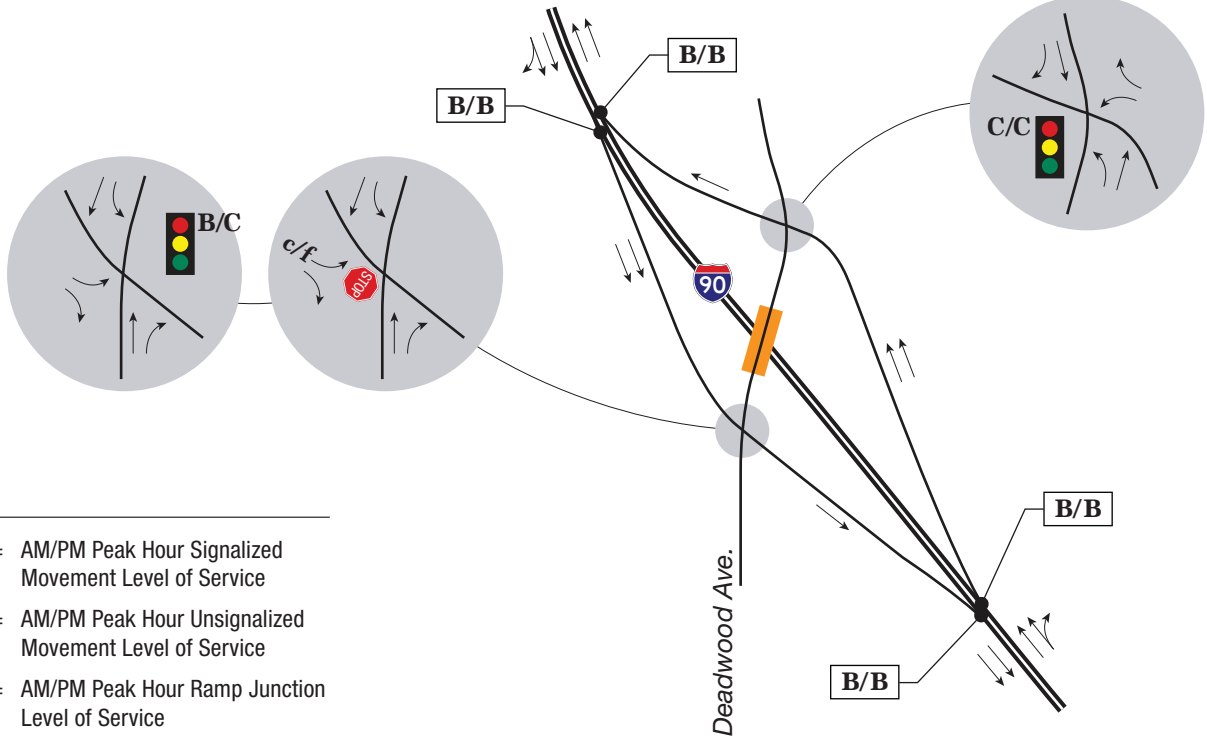
FELSBURG HOLT & ULLEVIG

CONCEPTUAL

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 = Stop Sign

= Traffic Signal

= Travel Lanes

NORTH

FELSBURG HOLT & ULLEVIG

NOTE: Drawing Not to Scale

FIGURE 2.10b

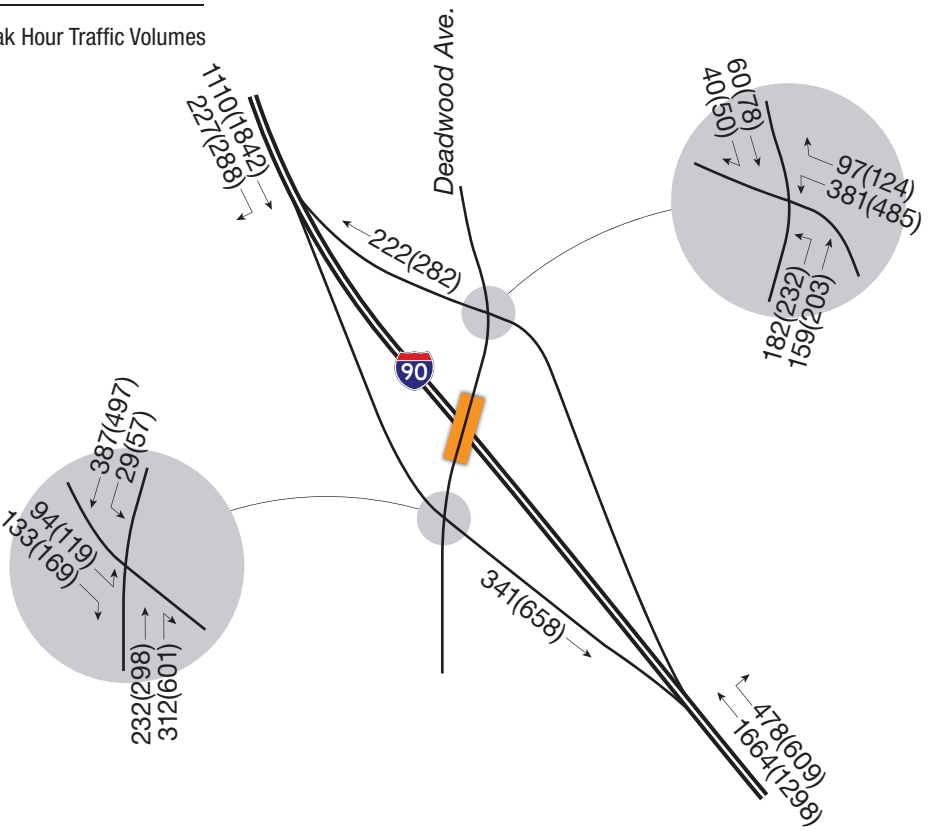
Interstate 90 Exit 55

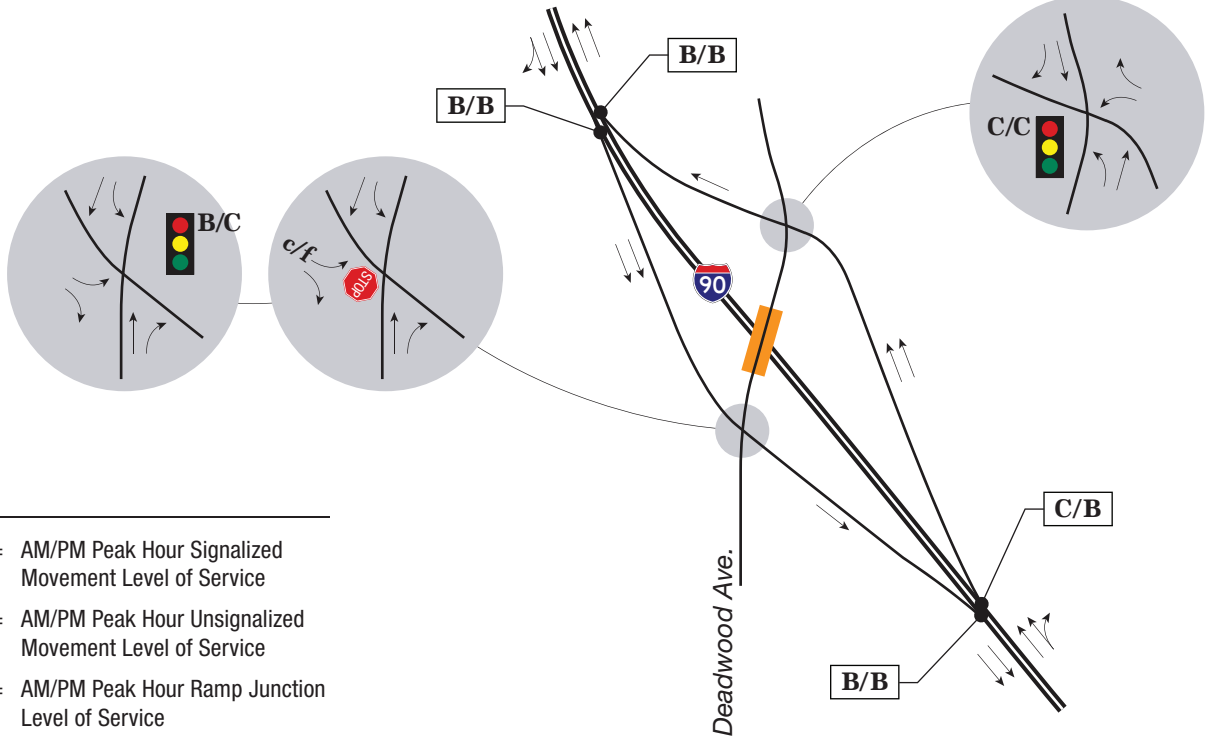
Existing (2019) Traffic Conditions

SDDOT Decennial 2020 ICS - Phase 2 18-571-01 12/4/20

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	=	Stop Sign
	=	Traffic Signal
	=	Travel Lanes

NORTH

FELSBURG HOLT & ULLEVIG

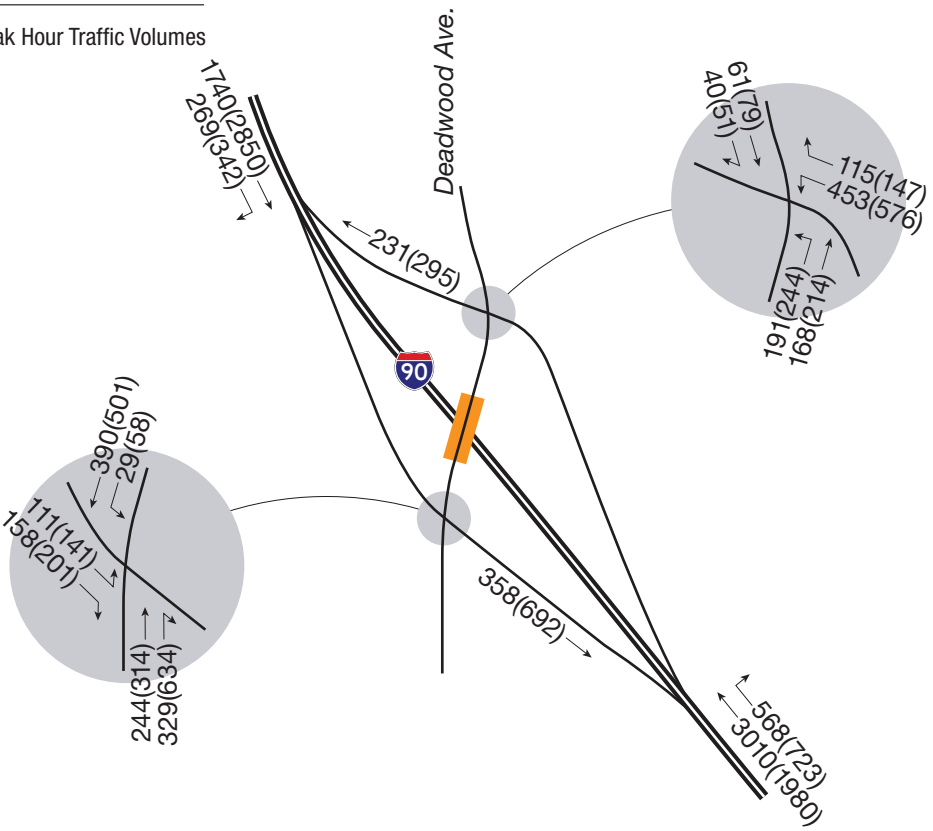
NOTE: Drawing Not to Scale

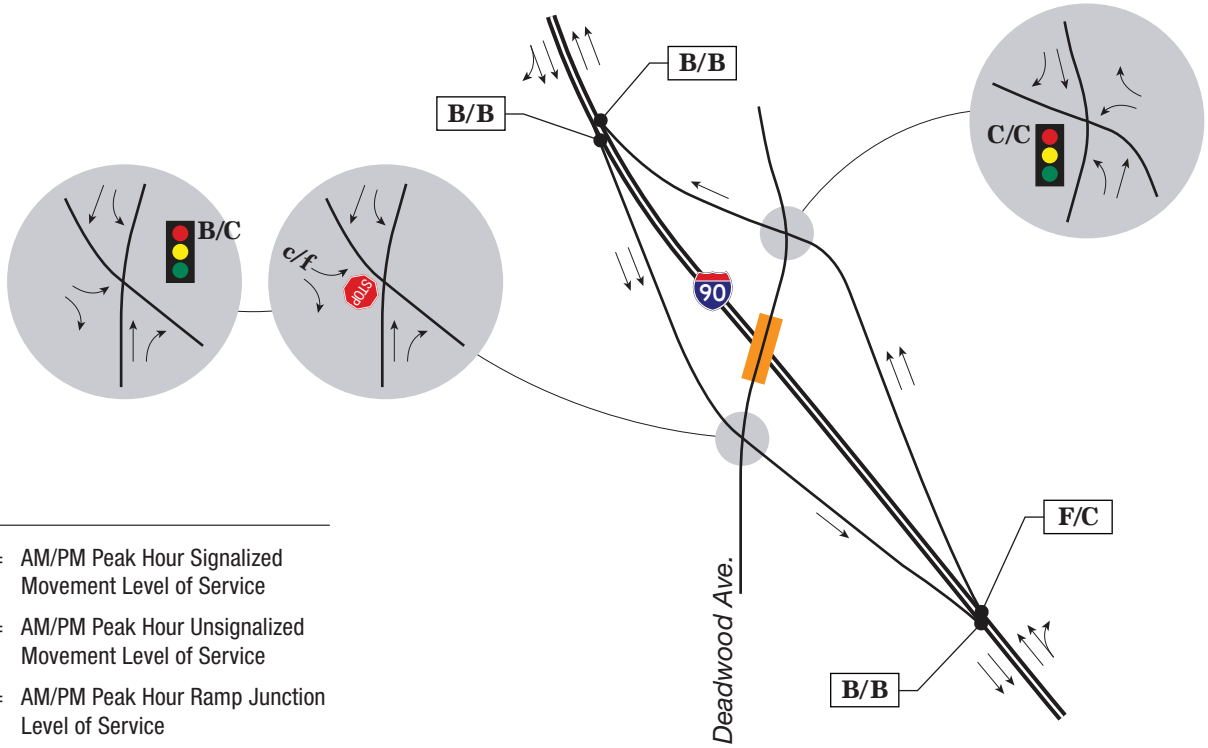
FIGURE 2.10c
Interstate 90 Exit 55
Opening (2030) Traffic Conditions

SDDOT Decennial 2020 ICS - Phase 2 18-571-01 12/4/20

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	=	Stop Sign
	=	Traffic Signal
	=	Travel Lanes

NORTH

FELSBURG HOLT & ULLEVIG

NOTE: Drawing Not to Scale

FIGURE 2.10d

Interstate 90 Exit 55

Future (2050) Traffic Conditions

SDDOT Decennial 2020 ICS - Phase 2 18-571-01 12/4/20

Table 2.10c I-90 Exit 55 Probable Construction Costs – Option 1

SOUTH DAKOTA DOT 2020 DECENNIAL INTERSTATE CORRIDOR STUDY

FHU PROJ NO. 118571-01

CONCEPTUAL LEVEL OPINION OF PROBABLE COST

FELSBURG HOLT & ULLEVIG

Alternative: I-90 Exit 55 Option 1

Prepared By: A. Orellana Date: 12/3/2020

	ITEM	DESCRIPTION	UNIT	CONTINGENCY	UNIT COST	QUANTITY	COST
1	**110**	Earthwork and Removals (2' Depth)	SY		$ **15**	12,000	$ 180,000
2	**110**	Earthwork (Significant Impacts)	CY		$ **10**	0	$ -
3	**110**	Remove Bridge	EA		$ **25,000**	0	$ -
4	**380**	Surfacing (Interstate & Ramps)	SY		$ **75**	16,000	$ 1,200,000
		SUBTOTAL (A)					$ **1,380,000**
5	**530**	Structures - Bridge	SF		$ **200**	0	$ -
6	**450**	Drainage - New	% of (A)	**3%**	$ -	-	$ 41,400
7	**451**	Utility Relocations	% of (A)	**3%**	$ -	-	$ 41,400
8	**632/633**	Traffic - Signing/Striping	% of (A)	**2%**	$ -	-	$ 20,700
9	**634**	Traffic Control	% of (A)	**2%**	$ -	-	$ 20,700
10	**734**	Erosion Control/Environmental	% of (A)	**2%**	$ -	-	$ 27,600
		SUBTOTAL (B)					$ **151,800**
11	**635**	Traffic - Signals (New)	EA		$ **270,000**	0	$ -
12	**997**	Railroad Crossing	EA		$ **250,000**	0	$ -
13	**009**	Mobilization	% of (A)+(B)	**5%**	$ -	-	$ 76,590
14	**100**	Clearing	% of (A)+(B)	**2%**	$ -	-	$ 30,640
15		Contingency	% of (A)+(B)	**25%**	$ -	-	$ 382,950
		SUBTOTAL (C)					$ **490,180**
		CONSTRUCTION TOTAL (D)	**(A)+(B)+(C)**				$ **2,021,980**
16		Engineering Services	% of (D)	**15%**	$ -		$ 303,300
17		ROW Impacts	SF		$ **10**	3,000	$ 30,000
							$ ***2,355,280***
		PROJECT TOTAL (E)					$ **2,356,000**
		CONSTRUCTION (D) + ROW TOTAL COST					$ **2,100,000**

Note: In providing opinions of probable construction cost, the Client understands that Felsburg Holt & Ullevig has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing. The unit prices and percentages shown above were applied under the direction of the South Dakota Department of Transportation and FHU makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bid or actual costs.

2.11 I-90 Exit 110 – Wall/Badlands Loop

2.11.1 Review of Interchange Needs

The Phase 1 study revealed no concerns causing designation as needs. However, the potential impact of future anticipated growth on interchange effectiveness caused the SAT to support advancement of Exit 110 to Phase 2 for consideration of solutions. Areas of evaluation/potential improvement are described as follows:

Geometrics and Long Combination Vehicles

The interchange ramp terminal intersections are limited in size and unable to accommodate LCV movements within their current paved surface. Control of access is limited, particularly north of the interchange into the City of Wall, where spacing distance from the ramp terminal intersection is limited to approximately 100 feet.

Operations

Phase 1 of the study evaluated Year 2019 peak hour traffic operations, and Year 2030 and 2050 forecasts were developed using SDDOT county-specific growth rates. LOS results for 2019, 2030, and 2050 based on a No-Action condition are reported in **Table 2.11a** and are depicted graphically on **Figure 2.11b through Figure 2.11d**.

Table 2.11a I-90 Exit 110 No-Action Interchange LOS Findings

Type	Location Description	AM/PM Peak Hour Level of Service by Year		
		2019	2030	2050
Ramp Terminal Intersections	Eastbound (Unsignalized[1])	a/a	a/a	a/a
	Westbound (Unsignalized)	a/a	a/a	a/a
Ramp Merge/Diverge Section	Eastbound off-ramp (Ramp C)	A/A	A/A	A/A
	Eastbound on-ramp (Ramp B)	A/A	A/A	A/A
	Westbound off-ramp (Ramp A)	A/A	A/A	A/A
	Westbound on-ramp (Ramp D)	A/A	A/A	A/A

[1]Unsignalized LOS is reported for the critical intersection movement

As shown, all ramp terminal intersection movements currently operate at acceptable LOS and are projected to continue to do so through Year 2050. Similarly, all ramp merge and diverge movements are expected to operate at LOS A during AM and PM peak hours through Year 2050.

As an additional reference point, traffic forecasts provided in the June 2019 *Traffic Impact Study, Love's Travel Stop in Wall, SD* were reviewed to determine whether the addition of estimated vehicle-trips associated with the proposed development would cause future intersection LOS to deteriorate below standards. The proposed travel stop is to be located in the southwest quadrant of the interchange.

Findings indicated that intersection movements would operate at LOS B or better by the year 2050 with additional site trips included.

2.11.2 Discussion of Options

This interchange was moved forward to Phase 2 of the study to further develop solutions to the deficiencies noted. One improvement option was identified.

Option 1: Ramp Terminal and Shoulder Modifications

Intersection shoulder modifications encompass improvements to the clear zone and inslopes, improving roadside conditions and better accommodating WB-92D and WB-109D truck turning movements at the ramp terminal intersections.

2.11.3 Evaluation of Options

Operations of the freeway facilities and ramp terminals were analyzed for potential improvements under Opening (2030) and Future (2050) traffic conditions using HCS. Results of the HCS analysis and traffic conditions are depicted on **Figure 2.11b through Figure 2.11d**.

Option 1: Ramp Terminal and Shoulder Modifications

This option would not lead to any change in traffic operations compared to a No-Action condition, the results of which were discussed previously. The concept drawing of this improvement option is shown on **Figure 2.11a**. Construction costs for this concept are estimated at $200,000.

A detailed cost estimate for the option is included in **Table 2.11c**.

An analysis was conducted to depict this option's benefits and impacts. The various evaluation factors discussed in the previous section were tabulated and are summarized in **Table 2.11b**.

Table 2.11b Exit 110 Options Evaluation Summary

Evaluation Factors		Option 1
		Ramp Terminal and Shoulder Modifications
Environmental Impacts		Minimal environmental impacts
Development Compatibility		Maintains current development and access
Multimodal Compatibility		Few/no added accommodations
Geometric Design		Some geometric deficiencies anticipated due to design constraints
Safety		Low potential for crash reduction and/or maintains current emergency response times
Constructability		Minor/typical degree of complexity
Traffic Level of Service	**2030**	LOS A
	2050	LOS A
Right-of-Way (SF)		0
# of Properties Impacted (take or access)		0
Construction Costs		$200,000

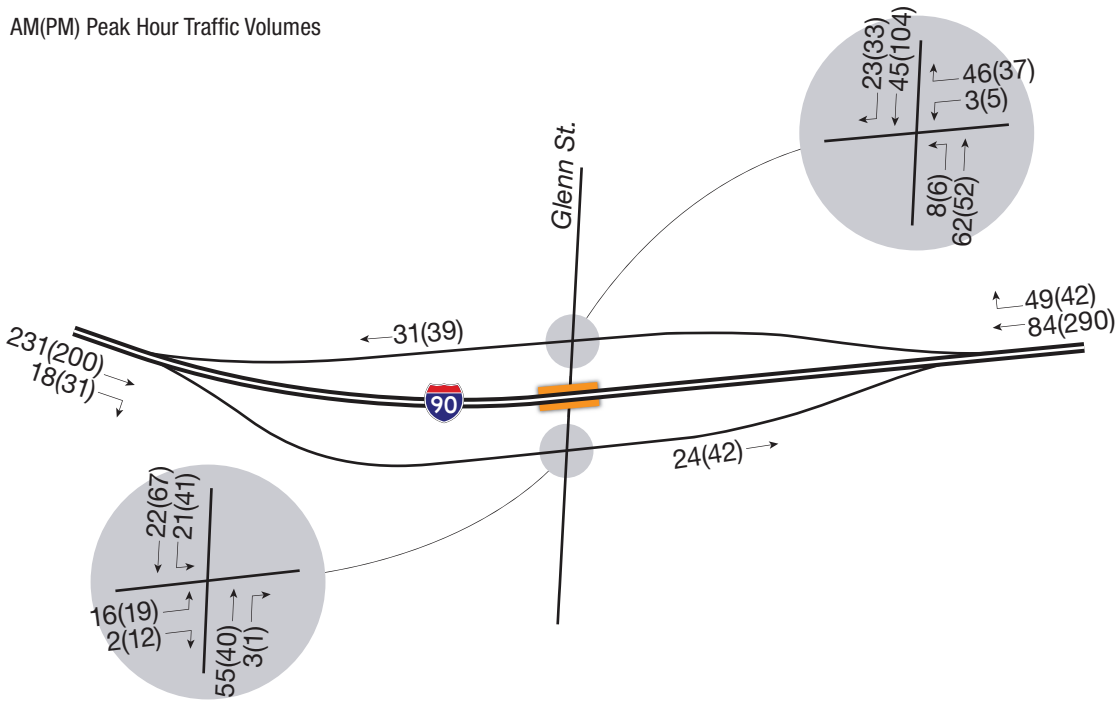
Figure 2.11a
I-90 Exit 110 Wall / Badlands Loop
Option 1: Ramp Terminal Shoulder Modifications

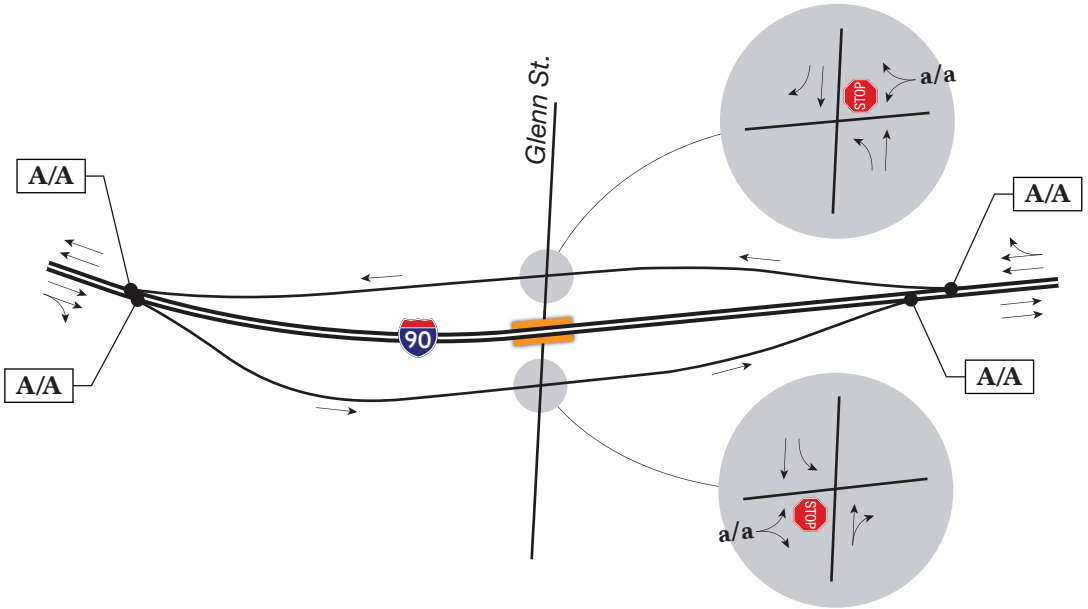
FELSBURG HOLT & ULLEVIG

CONCEPTUAL

LEGEND

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





LEGEND

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

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

STOP = Stop Sign

= Travel Lanes

NORTH

FELSBURG HOLT & ULLEVIG

NOTE: Drawing Not to Scale

FIGURE 2.11b

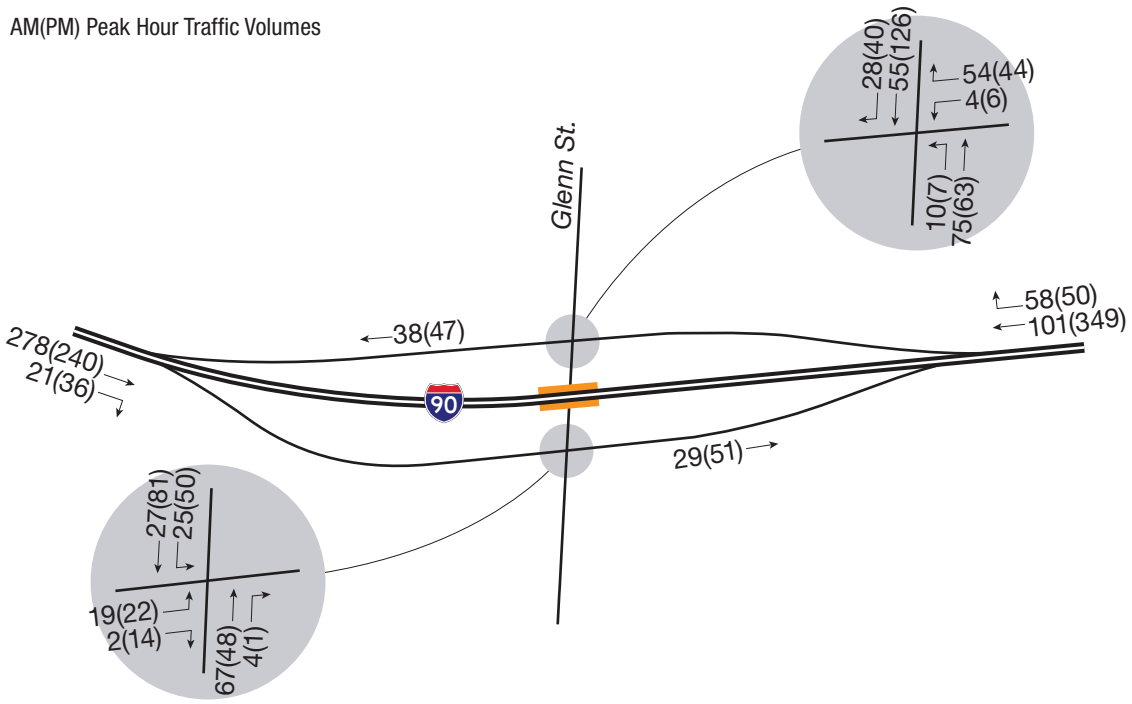
Interstate 90 Exit 110

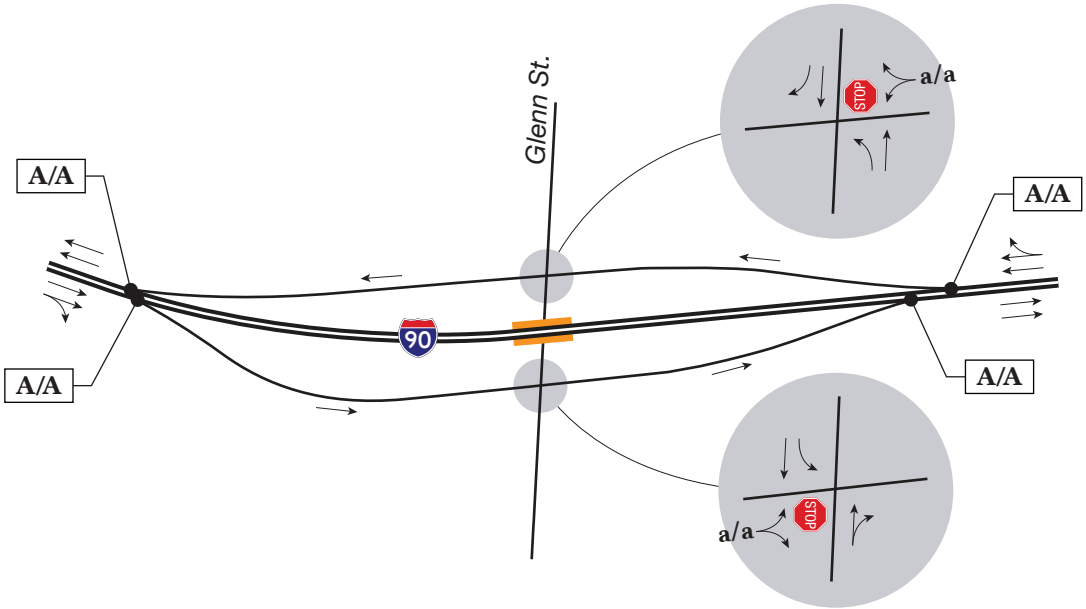
Existing (2019) Traffic Conditions

SDDOT Decennial 2020 ICS - Phase 2 18-571-01 12/4/20

LEGEND

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





LEGEND

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

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

STOP = Stop Sign

= Travel Lanes

NORTH

FELSBURG HOLT & ULLEVIG

NOTE: Drawing Not to Scale

FIGURE 2.11c

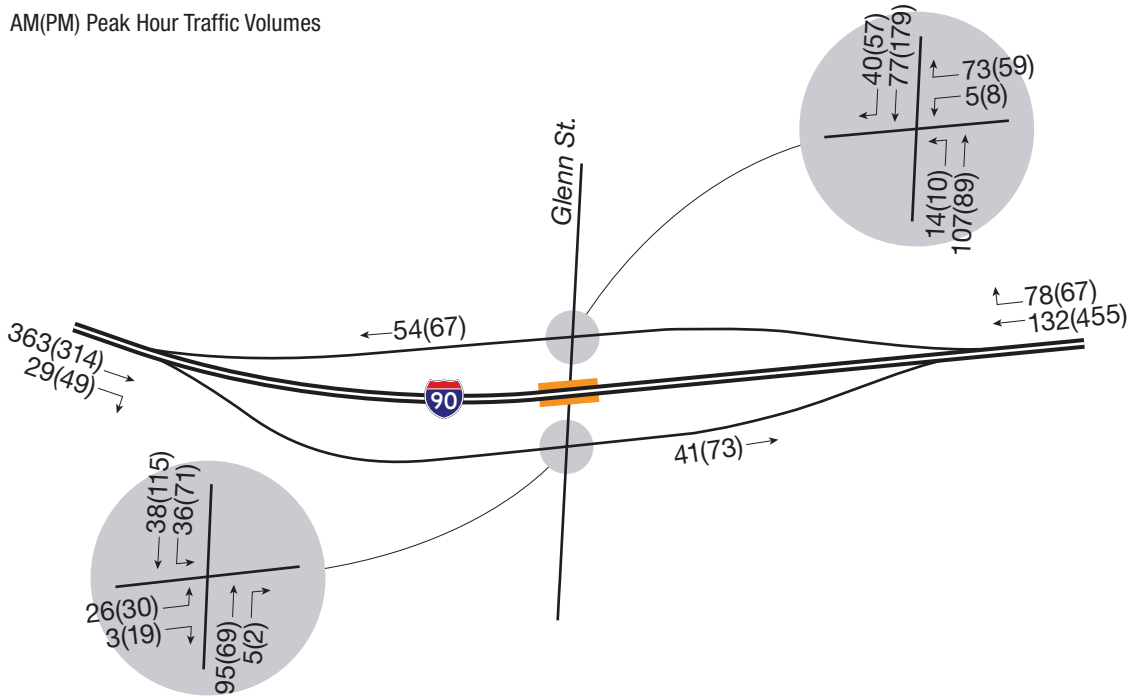
Interstate 90 Exit 110

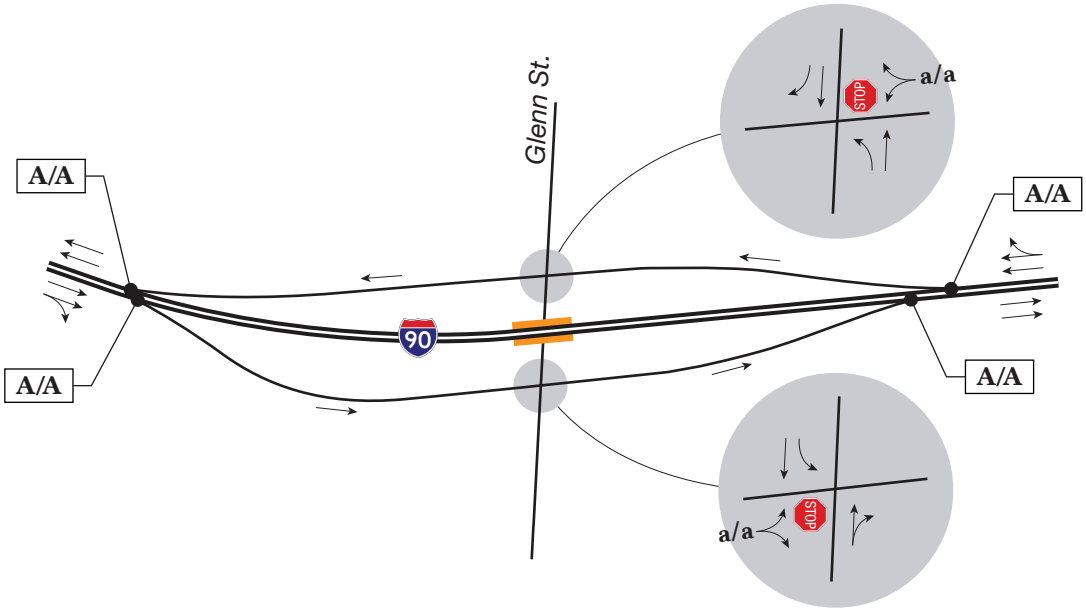
Opening (2030) Traffic Conditions

SDDOT Decennial 2020 ICS - Phase 2 18-571-01 12/4/20

LEGEND

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





LEGEND

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

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

STOP = Stop Sign

= Travel Lanes

NORTH

FELSBURG HOLT & ULLEVIG

NOTE: Drawing Not to Scale

FIGURE 2.11d

Interstate 90 Exit 110

Future (2050) Traffic Conditions

SDDOT Decennial 2020 ICS - Phase 2 18-571-01 12/4/20

Table 2.11c I-90 Exit 110 Probable Construction Costs – Option 1

SOUTH DAKOTA DOT 2020 DECENNIAL INTERSTATE CORRIDOR STUDY

FHU PROJ NO. 118571-01

CONCEPTUAL LEVEL OPINION OF PROBABLE COST

FELSBURG HOLT & ULLEVIG

Alternative: I-90 Exit 110 Option 1

Prepared By: A. Orellana Date: 12/3/2020

	ITEM	DESCRIPTION	UNIT	CONTINGENCY	UNIT COST	QUANTITY	COST
1	**110**	Earthwork and Removals (2' Depth)	SY		$ **15**	800	$ 12,000
2	**110**	Earthwork (Significant Impacts)	CY		$ **10**	0	$ -
3	**110**	Remove Bridge	EA		$ **25,000**	0	$ -
4	**380**	Surfacing (Interstate & Ramps)	SY		$ **75**	1,000	$ 75,000
		SUBTOTAL (A)				\	$ **87,000**
5	**530**	Structures - Bridge	SF		$ **200**	0	$ -
6	**450**	Drainage - New	% of (A)	**3%**	$ -	-	$ 2,610
7	**451**	Utility Relocations	% of (A)	**3%**	$ -	-	$ 2,610
8	**632/633**	Traffic - Signing/Striping	% of (A)	**2%**	$ -	-	$ 1,310
9	**634**	Traffic Control	% of (A)	**2%**	$ -	-	$ 1,310
10	**734**	Erosion Control/Environmental	% of (A)	**2%**	$ -	-	$ 1,740
		SUBTOTAL (B)					$ **9,580**
11	**635**	Traffic - Signals (New)	EA		$ **270,000**	0	$ -
12	**997**	Railroad Crossing	EA		$ **250,000**	0	$ -
13	**009**	Mobilization	% of (A)+(B)	**5%**	$ -	-	$ 4,830
14	**100**	Clearing	% of (A)+(B)	**2%**	$ -	-	$ 1,940
15		Contingency	% of (A)+(B)	**25%**	$ -	-	$ 24,150
		SUBTOTAL (C)					$ **30,920**
		CONSTRUCTION TOTAL (D)	**(A)+(B)+(C)**				$ **127,500**
16		Engineering Services	% of (D)	**15%**	$ -		$ 19,130
17		ROW Impacts	SF		$ **10**	0	$ -
							$ ***146,630***
		PROJECT TOTAL (E)					$ **147,000**
		CONSTRUCTION (D) + ROW TOTAL COST					$ **200,000**

Note: In providing opinions of probable construction cost, the Client understands that Felsburg Holt & Ullevig has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing. The unit prices and percentages shown above were applied under the direction of the South Dakota Department of Transportation and FHU makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bid or actual costs.

2.12 I-90 Exit 112 – Phillip/Pierre

2.12.1 Review of Interchange Needs

Phase 1 revealed structural condition and bridge clearance needs at this interchange as currently configured, described as follows:

Structural Condition

The existing WB crossroad bridge over I-90 built in 1974 has a poor bridge condition rating. The EB bridge has a fair bridge condition rating.

Bridge Clearance

The existing WB bridge provides vertical clearance of 15.83 feet over I-90, shy of the required 17 feet of minimum vertical clearance.

Geometric Conditions

Though not identified as needs based on Phase 1 criteria, there are geometric deficiencies present at the current Exit 112 interchange, including curve radii and shoulder width along ramps.

Operations

Traffic operations do not constitute a need at this interchange. Based on the Phase 1 analyses, traffic operations are currently acceptable at the Exit 112 interchange and are expected to remain acceptable through Year 2050 with the No-Action condition in place.

Additional analyses were performed in Phase 2 to confirm this finding and provide an opening year (2030) analysis scenario. Growth rates for the interchange ramps were calculated using SDDOT county specific growth rates to develop Year 2050 forecasts. Straight-line projections and the NCHRP 765 methodology were used to estimate Opening (2030) traffic volumes. **Table 2.12a** provides a summary of LOS findings, and results are depicted graphically on **Figure 2.12b through Figure 2.12d**.

Table 2.12a I-90 Exit 112: No-Action Interchange LOS Findings

Type	Location Description	AM/PM Peak Hour Level of Service by Year		
		2019	2030	2050
Ramp Merge/Diverge Section	Eastbound off-ramp (Ramp C)	A/A	A/A	A/A
	Eastbound on-ramp (Loop G)	A/A	A/A	A/A
	Westbound off-ramp (Ramp B)	A/A	A/A	A/A
	Westbound on-ramp (Ramp A)	A/A	A/A	A/A

[1]Unsignalized LOS is reported for the critical intersection movement

As shown, due to I-90 Exit 112 being a directional interchange and traffic does not stop at intersections, existing traffic LOS results were analyzed for only merge and diverge patterns. All merge and diverge

movements are expected to operate at LOS A for AM and PM peak hours by Opening (2030) and by Future (2050).

2.12.2 Discussion of Options

Due to structural concerns, this interchange was advanced to Phase 2 of the study to further develop solutions to the deficiencies outlined in the Phase 1 report. Two improvement options were suggested.

Option 1: Bridge Removal and US14 Realignment

Option 1 of removing the northern (WB) bridge structure would use most of the existing infrastructure, leading to a lower cost option. Option 1 would maintain free-flow interchange movements and use existing right-of-way. Option 1 would retain the existing Ramp G loop, and use of the existing bridge would lead to substandard shoulder widths.

Option 2: Bridge Removal with US14 Realignment, New Ramp and Signalization

Option 2 proposes removing the WB bridge also and improving the EB bridge. Option 2 would improve the EB bridge but replace the Ramp G loop with a new ramp controlled by a signalized intersection with US Highway 14. Option 2 may require acquiring right-of-way for construction of the new ramp. Additional analyses should be completed to understand impacts to vacant property where the ramp is located. Option 2 would also convert a free-flow interchange into a signal-controlled interchange by introducing a traffic signal at the new ramp terminal intersection.

2.12.3 Evaluation of Options

Operations of the freeway facilities and ramp terminals were analyzed for the potential improvements under Opening (2030) and Future (2050) traffic conditions using HCS. Results of the HCS analysis and traffic conditions are depicted on **Figure 2.12c, Figure 2.12d**, and **Figure 2.12e**.

Option 1: Bridge Removal and US14 Realignment

Option 1 would not lead to a significant change in traffic operations compared to the No-Action condition, the results of which were discussed previously. The concept drawing of this improvement option is shown on **Figure 2.12a**. Construction costs for this concept are estimated at $16.3 million.

Option 2: Bridge Removal with US14 Realignment, New Ramp and Signalization

The proposed signalized intersection is expected to operate at LOS A in the AM and PM peak periods by Opening (2030) and LOS A in the AM and PM peak periods by Future (2050). Additionally, Option 2 would not lead to a change in traffic operations of the merge and diverge movements compared to the No-Action condition, the results of which were discussed previously. The concept drawing of this

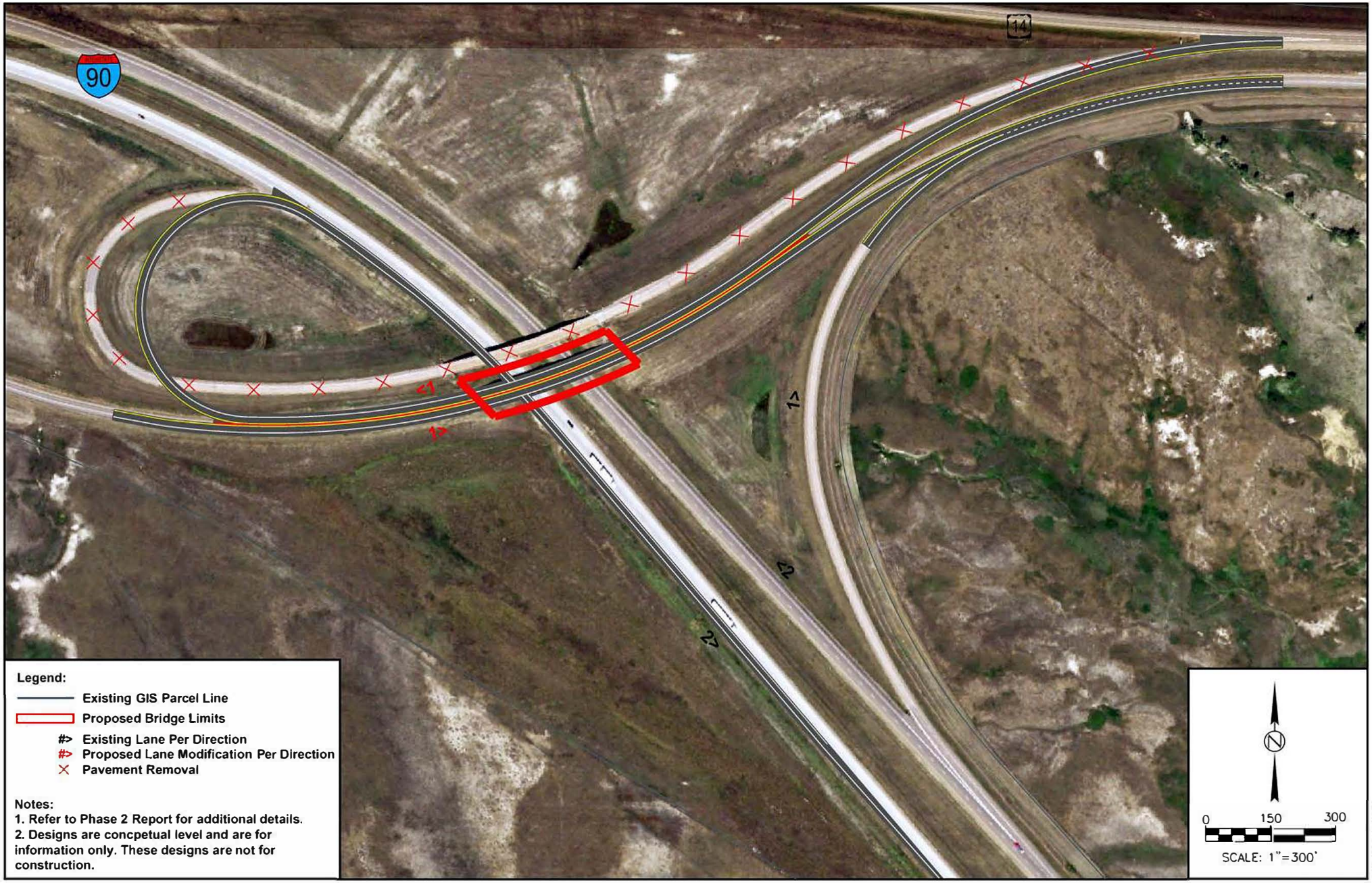
improvement option is shown on **Figure 2.12b**. Construction costs for Option 2 are estimated at $20.4 million.

Detailed cost estimates for each concept are included in **Table 2.12c** and **Table 2.12d**.

An analysis was conducted to provide a comparative evaluation of the benefits and impacts associated with each option. The various evaluation factors discussed in the previous section were tabulated and are summarized in **Table 2.12b**.

Table 2.12b Exit 112 Options Evaluation Summary

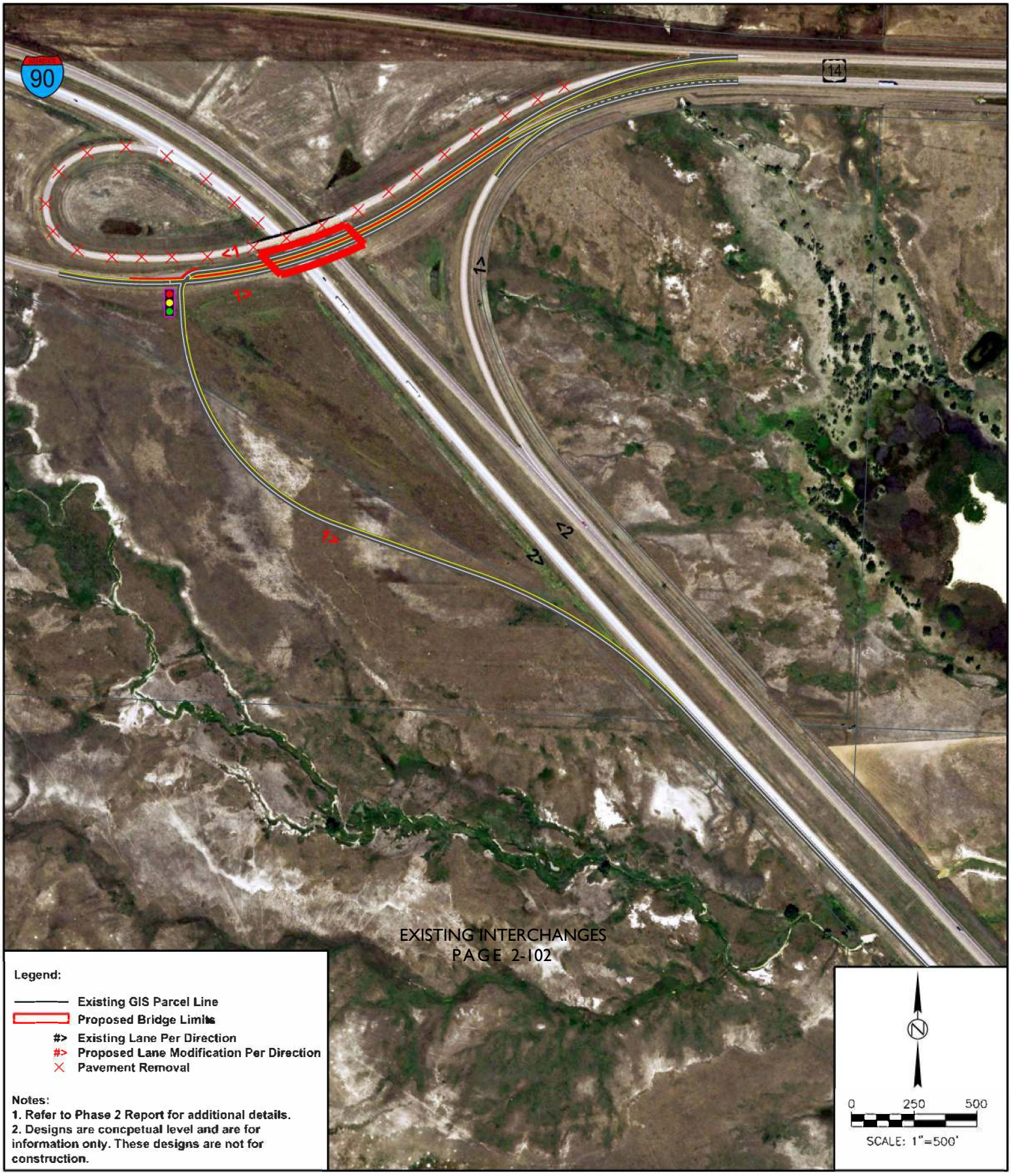
Evaluation Factors		Option 1 Bridge Removal and US14 Realignment	Option 2 Bridge Removal with US14 Realignment, New Ramp and Signalization
Environmental Impacts		Moderate environmental impacts	Multiple environmental impacts
Development Compatibility		Maintains current development and access	Maintains current development and access
Multimodal Compatibility		Few/no added accommodations	Few/no added accommodations
Geometric Design		Some geometric deficiencies would remain due to design limitations	Addresses all current geometric deficiencies
Safety		Low potential for crash reduction	Increased crash potential
Constructability		Minor/typical degree of complexity	Moderate degree of complexity
Traffic Level of Service	**2030**	LOS A	LOS A
	2050	LOS A	LOS A
Right-of-Way (SF)		0	265,800
# of Properties Impacted (take or access)		0	1
Construction Costs		$16.3 million	$20.4 million



FELSBURG HOLT & ULLEVIG

CONCEPTUAL

Figure 2.12a
I-90 Exit 112 Philip / Pierre
Option 1: Bridge Removal and US14 Realignment



EXISTING INTERCHANGES
PAGE 2-102

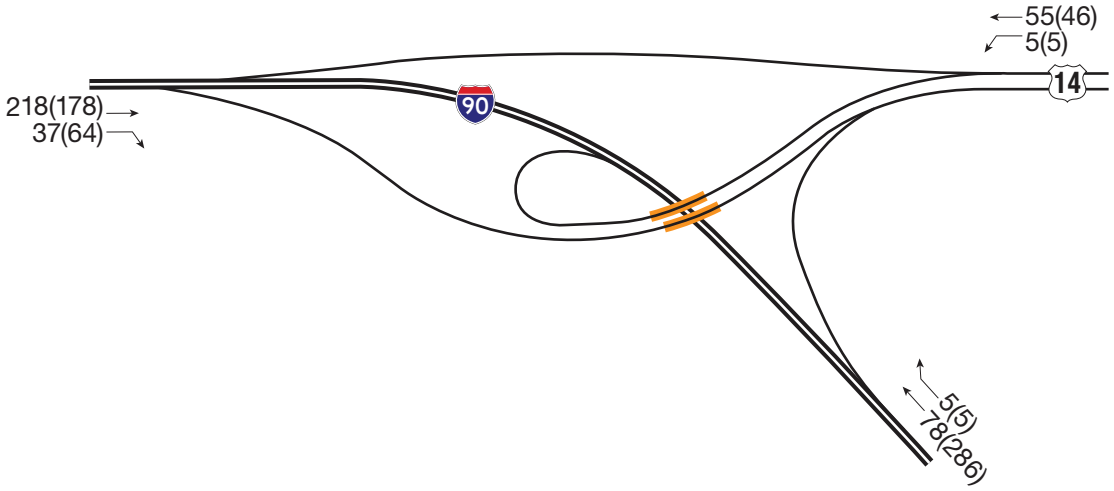
Figure 2.12b
I-90 Exit 112 Philip / Pierre
Option 2: Bridge Removal with US14 Realignment, New Ramp and Signalization

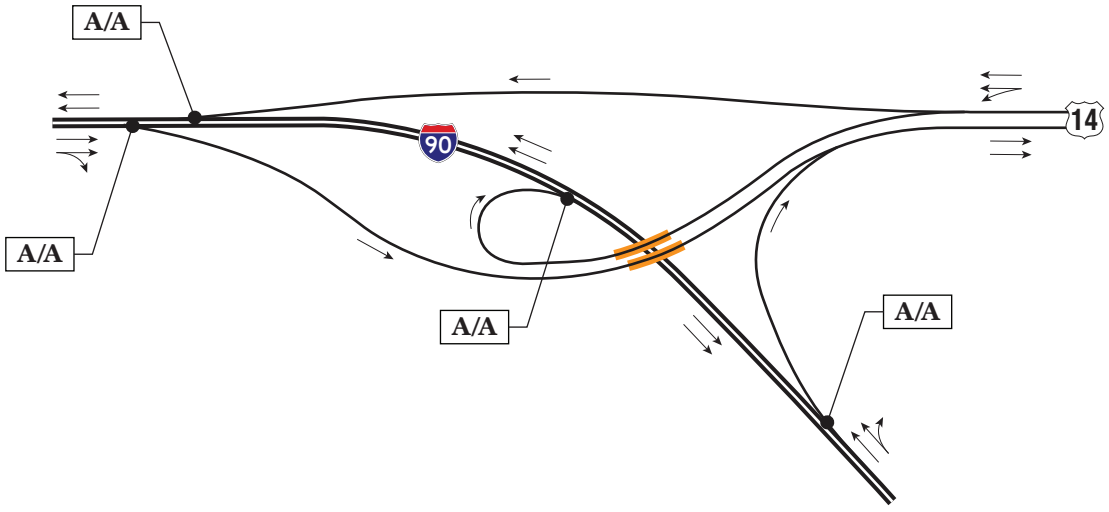
FELSBURG HOLT & ULLEVIG

CONCEPTUAL

LEGEND

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





LEGEND

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

= Travel Lanes

NORTH

FELSBURG HOLT & ULLEVIG

NOTE: Drawing Not to Scale

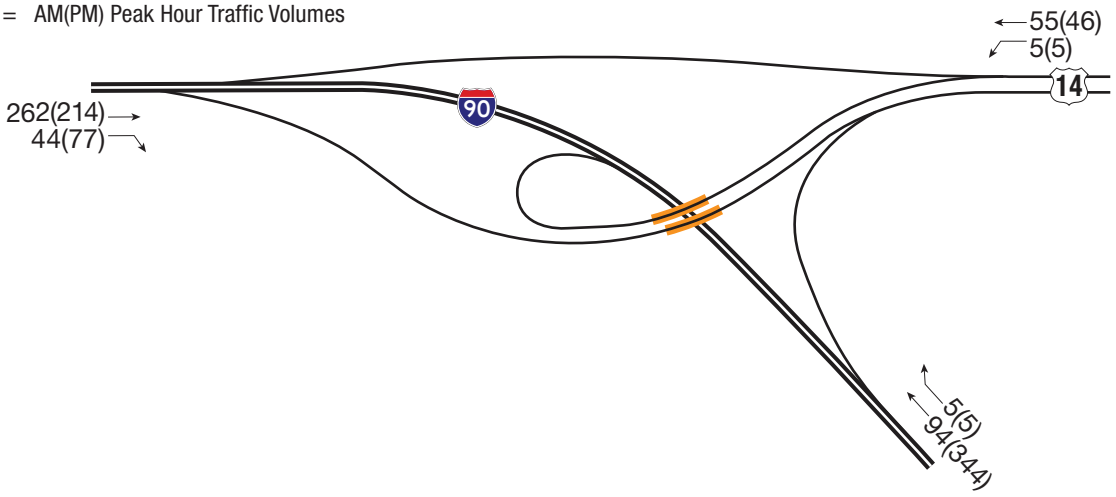
FIGURE 2.12c

Interstate 90 Exit 112
Existing (2019) Traffic Conditions

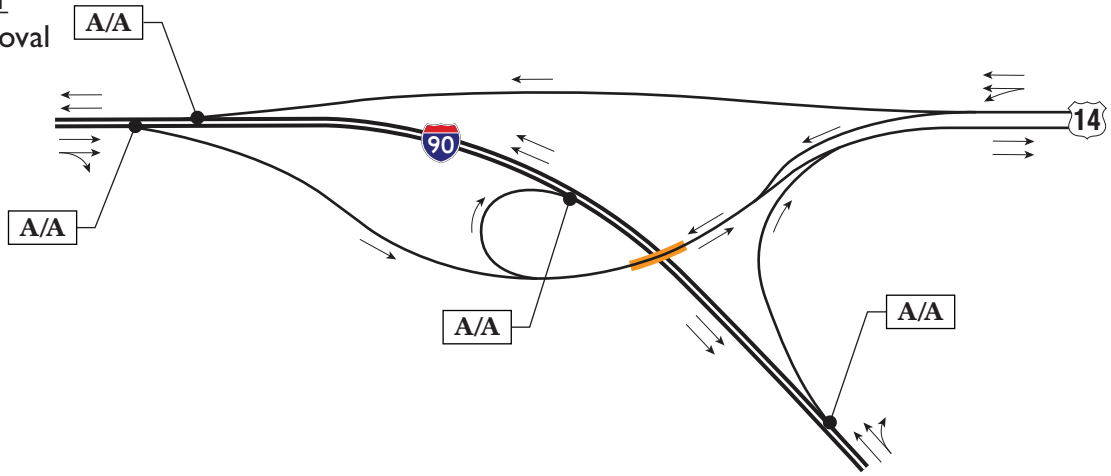
SDDOT Decennial 2020 ICS - Phase 2 18-571-01 12/4/20

LEGEND

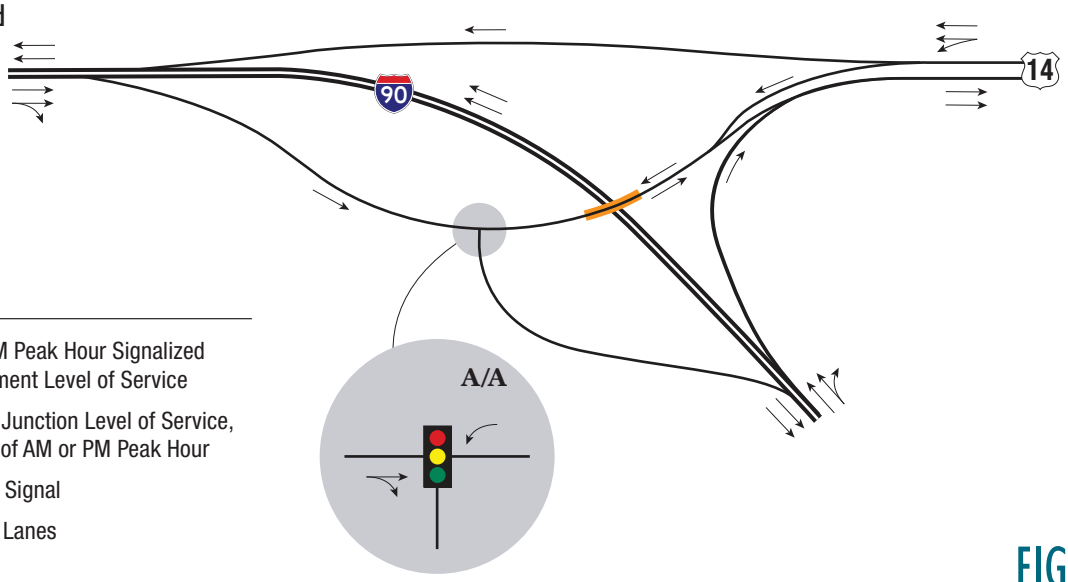
XXX(XXX) = AM(PM) Peak Hour Traffic Volumes



Option 1
Bridge Removal



Option 2
Bridge Removal,
New Ramp, and
Signalization



LEGEND

X/X	=	AM/PM Peak Hour Signalized Movement Level of Service
X/X	=	Ramp Junction Level of Service, Worst of AM or PM Peak Hour
	=	Traffic Signal
	=	Travel Lanes

NORTH

FELSBURG HOLT & ULLEVIG

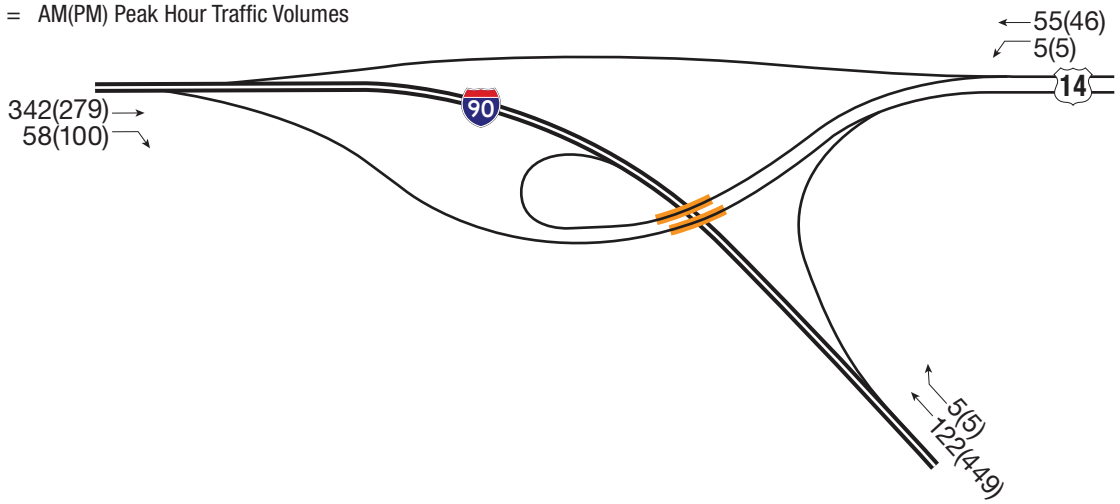
NOTE: Drawing Not to Scale

FIGURE 2.12d
Interstate 90 Exit 112
Opening (2030) Traffic Conditions

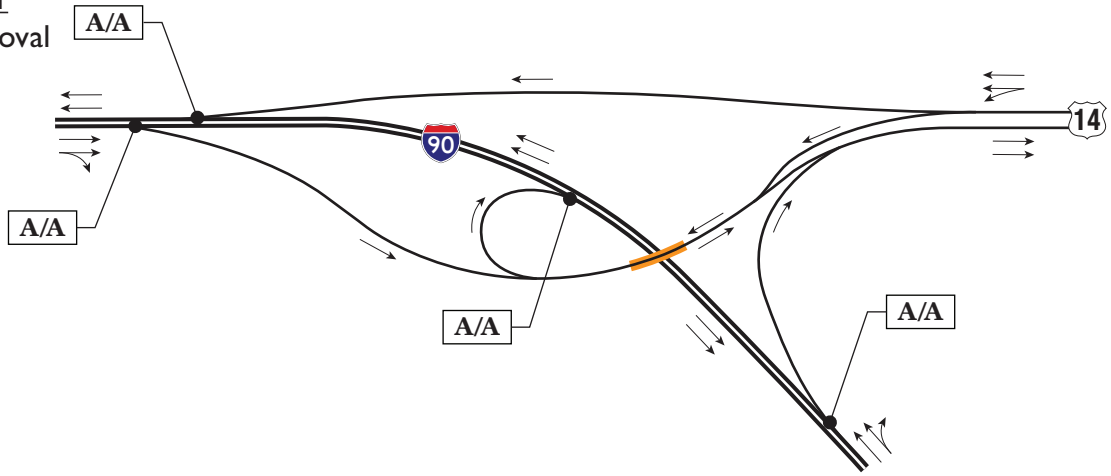
SDDOT Decennial 2020 ICS - Phase 2 18-571-01 12/4/20

LEGEND

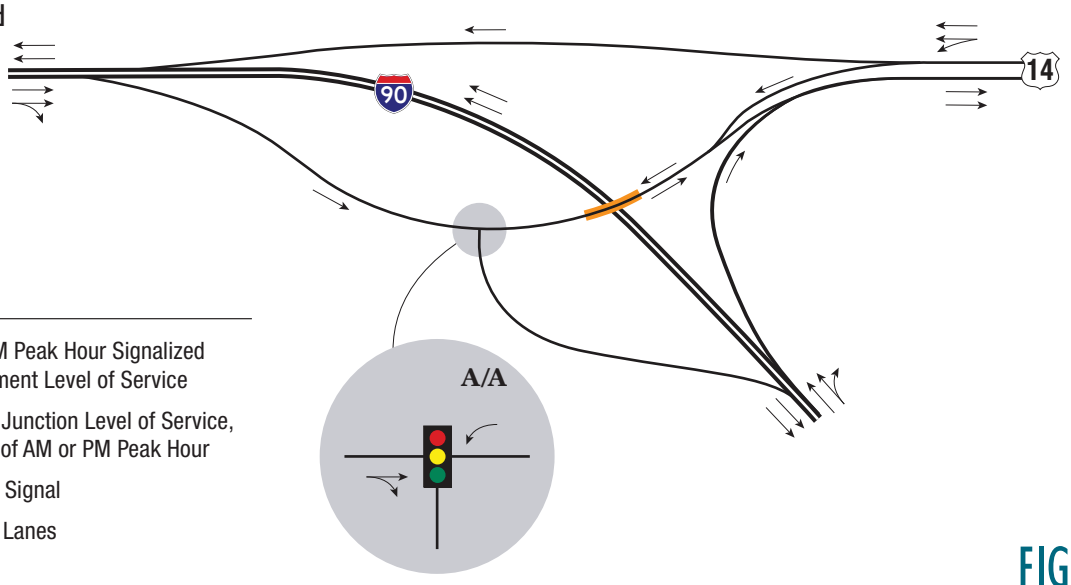
XXX(XXX) = AM(PM) Peak Hour Traffic Volumes



Option 1
Bridge Removal



Option 2
Bridge Removal,
New Ramp, and
Signalization



LEGEND

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

[X/X] = Ramp Junction Level of Service, Worst of AM or PM Peak Hour

= Traffic Signal

= Travel Lanes

NORTH

FELSBURG HOLT & ULLEVIG

NOTE: Drawing Not to Scale

FIGURE 2.12e
Interstate 90 Exit 112
Future (2050) Traffic Conditions

SDDOT Decennial 2020 ICS - Phase 2 18-571-01 12/4/20

Table 2.12c I-90 Exit 112 Probable Construction Costs – Option 1

SOUTH DAKOTA DOT 2020 DECENNIAL INTERSTATE CORRIDOR STUDY

FHU PROJ NO. 118571-01

CONCEPTUAL LEVEL OPINION OF PROBABLE COST

FELSBURG HOLT & ULLEVIG

Alternative: I-90 Exit 112 Option 1

Prepared By: A. Orellana Date: 12/3/2020

	ITEM	DESCRIPTION	UNIT	CONTINGENCY	UNIT COST	QUANTITY	COST
1	**110**	Earthwork and Removals (2' Depth)	SY		$ **15**	39,000	$ 585,000
2	**110**	Earthwork (Significant Impacts)	CY		$ **10**	94,900	$ 949,000
3	**110**	Remove Bridge	EA		$ **25,000**	1	$ 25,000
4	**380**	Surfacing (Interstate & Ramps)	SY		$ **75**	26,000	$ 1,950,000
		SUBTOTAL (A)					$ **3,509,000**
5	**530**	Structures - Bridge	SF		$ **200**	36,500	$ 7,300,000
6	**450**	Drainage - New	% of (A)	**8%**	$ -	-	$ 280,720
7	**451**	Utility Relocations	% of (A)	**6%**	$ -	-	$ 210,540
8	**632/633**	Traffic - Signing/Striping	% of (A)	**4%**	$ -	-	$ 140,360
9	**634**	Traffic Control	% of (A)	**6%**	$ -	-	$ 210,540
10	**734**	Erosion Control/Environmental	% of (A)	**6%**	$ -	-	$ 210,540
		SUBTOTAL (B)					$ **8,352,700**
11	**635**	Traffic - Signals (New)	EA		$ **270,000**	0	$ -
12	**997**	Railroad Crossing	EA		$ **250,000**	0	$ -
13	**009**	Mobilization	% of (A)+(B)	**5%**	$ -	-	$ 593,090
14	**100**	Clearing	% of (A)+(B)	**2%**	$ -	-	$ 237,240
15		Contingency	% of (A)+(B)	**30%**	$ -	-	$ 3,558,510
		SUBTOTAL (C)					$ **4,388,840**
		CONSTRUCTION TOTAL (D)	**(A)+(B)+(C)**				$ **16,250,540**
16		Engineering Services	% of (D)	**15%**	$ -		$ 2,437,590
17		ROW Impacts	SF		$ **10**	0	$ -
							$ ***18,688,130***
		PROJECT TOTAL (E)					$ **18,689,000**
		CONSTRUCTION (D) + ROW TOTAL COST					$ **16,300,000**

Note: In providing opinions of probable construction cost, the Client understands that Felsburg Holt & Ullevig has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing. The unit prices and percentages shown above were applied under the direction of the South Dakota Department of Transportation and FHU makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bid or actual costs.

Table 2.12d I-90 Exit 112 Probable Construction Costs – Option 2

SOUTH DAKOTA DOT 2020 DECENNIAL INTERSTATE CORRIDOR STUDY

FHU PROJ NO. 118571-01

CONCEPTUAL LEVEL OPINION OF PROBABLE COST

FELSBURG HOLT & ULLEVIG

Alternative: I-90 Exit 112 Option 2

Prepared By: A. Orellana Date: 12/3/2020

	ITEM	DESCRIPTION	UNIT	CONTINGENCY	UNIT COST	QUANTITY	COST
1	**110**	Earthwork and Removals (2' Depth)	SY		$ **15**	45,000	$ 675,000
2	**110**	Earthwork (Significant Impacts)	CY		$ **10**	119,100	$ 1,191,000
3	**110**	Remove Bridge	EA		$ **25,000**	1	$ 25,000
4	**380**	Surfacing (Interstate & Ramps)	SY		$ **75**	30,000	$ 2,250,000
		SUBTOTAL (A)					$ **4,141,000**
5	**530**	Structures - Bridge	SF		$ **200**	36,500	$ 7,300,000
6	**450**	Drainage - New	% of (A)	**8%**	$ -	-	$ 331,280
7	**451**	Utility Relocations	% of (A)	**6%**	$ -	-	$ 248,460
8	**632/633**	Traffic - Signing/Striping	% of (A)	**4%**	$ -	-	$ 165,640
9	**634**	Traffic Control	% of (A)	**6%**	$ -	-	$ 248,460
10	**734**	Erosion Control/Environmental	% of (A)	**6%**	$ -	-	$ 248,460
		SUBTOTAL (B)					$ **8,542,300**
11	**635**	Traffic - Signals (New)	EA		$ **270,000**	1	$ 270,000
12	**997**	Railroad Crossing	EA		$ **250,000**	0	$ -
13	**009**	Mobilization	% of (A)+(B)	**5%**	$ -	-	$ 634,170
14	**100**	Clearing	% of (A)+(B)	**2%**	$ -	-	$ 253,670
15		Contingency	% of (A)+(B)	**30%**	$ -	-	$ 3,804,990
		SUBTOTAL (C)					$ **4,962,830**
		CONSTRUCTION TOTAL (D)	**(A)+(B)+(C)**				$ **17,646,130**
16		Engineering Services	% of (D)	**15%**	$ -		$ 2,646,920
17		ROW Impacts	SF		$ **10**	265,800	$ 2,658,000
							$ ***22,951,050***
		PROJECT TOTAL (E)					$ **22,952,000**
		CONSTRUCTION (D) + ROW TOTAL COST					$ **20,400,000**

Note: In providing opinions of probable construction cost, the Client understands that Felsburg Holt & Ullevig has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing. The unit prices and percentages shown above were applied under the direction of the South Dakota Department of Transportation and FHU makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bid or actual costs.

3. POTENTIAL NEW INTERCHANGES

This section of the Phase 2 report describes the seven potential new interchanges that have been evaluated in the 2020 Decennial ICS. They are along I-29, located north of Exit 86 at roughly MRM's 87, 88 and 89, and along I-90, located at MRM 16 (Rainbow Road, Spearfish), MRM 264 (the existing Chamberlain Welcome Center interchange), MRM 404 (Brandon), and MRM 408 (Brandon). The evaluation for each interchange is described below.

3.1 I-29 Exit 87 – Crooks, 257th Street

This potential interchange is located at the 257th Street overpass east of Crooks, between Exit 86 (Renner / Crooks) and Exit 94 (Baltic). It is one of a group of three potential interchange location options envisioned to provide additional access to developing areas on the north side of the Sioux Falls urban area.

A rural 2-lane roadway, 257th Street, crosses over I-29 at approximately MRM 87.4. The existing structure over I-29 is rated fair and has a sufficiency rating over 95. 257th Street serves rural land uses both east and west of I-29 and is gravel except for a paved section between 472nd Avenue and the existing overpass. It intersects 471st Avenue about 0.7 mile west of the interstate and 472nd Avenue about 0.3 mile east of the interstate, both of which are similar rural 2-lane roads. Both 471st Avenue and 472nd Avenue provide connections into Sioux Falls, about 4 miles to the south. 257th Street provides a connection into downtown Crooks (as South 4th Street) about 1.75 miles west of I-29 and crosses the Big Sioux River (as Mapleton Road) about 1.75 miles east of I-29.

3.1.1 Interchange Concept

The potential Exit 87 concept would create a standard diamond interchange at the 257th Street overpass (approximately MRM 87.4). Several local driveways and farm accesses on the west side of I-29 would have to be relocated to maintain appropriate access spacing along 257th Street, but no public roadway intersection would require changes. An existing structure over a creek east of I-29 would need to be replaced to accommodate the revised 257th Street profile through the interchange. The 257th Street crossroad is assumed to remain a 2-lane road, without turn lanes at the stop-controlled ramp terminal intersections. The concept drawing of this improvement option is shown on **Figure 3.1a**.

3.1.2 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.

- National Hydrography Dataset (NHD) flowlines are mapped east of I-29 and crossing I-29 at the location of the proposed interchange. These flowlines may indicate the presence of channels. Based on aerial imagery, an unnamed channel is present on the east side of the proposed interchange flowing south through the project area to the Big Sioux River. Impacts to any intermittent or perennial channels would be subject to Section 404 permitting.
- National Wetland Inventory (NWI) wetlands are mapped in the southeast quadrant of the proposed interchange. Wetlands may be present along the drainages within the project area. Impacts to any jurisdictional wetlands would be subject to Section 404 permitting.
- No Special Flood Hazard Areas are located within the project area. The nearest flood zone is located along a drainage approximately 1 mile southwest of the project.
- Prime or unique farmland is located in the vicinity of the proposed interchange, although it is not present adjacent to the drainages in the area. Due to the Farmland Protection Policy Act (FPPA), impacts to prime or unique farmland could require coordination with Natural Resources Conservation Service (NRCS).
- Based on data from the Environmental Protection Agency (EPA) facility registry system, there are no known potential contaminated materials sites in the immediate vicinity of the proposed interchange. However, known sites are located at businesses near the I-29 Exit 86 interchange to the south. Newer businesses not included in the EPA facility registry system are located approximately 0.25 miles southwest including an auto paint and body shop. These businesses would also need to be investigated for potential contaminated materials concerns.
- There do not appear to be any recreational facilities in close proximity to the proposed interchange.
- Based on publicly available records in the National Register of Historic Places (NRHP), the nearest historic sites are bridges on the Big Sioux River and these would not be impacted by the proposed interchange.
- Threatened and endangered species that have been documented in Minnehaha County include Topeka Shiner, Lined Snake, Northern River Otter, and Western Prairie Fringed Orchid. However, other species may be present, including Northern Long-Eared Bat and Rufa Red Knot. Coordination with the South Dakota Game, Fish & Parks and U.S. Fish & Wildlife Service (USFWS) is recommended to ensure the project does not adversely impact any of these species.

These resources are presented on **Figure 3.1b.** The review above highlights the need for potential Section 404 reviews, hazardous materials concerns, and potential mitigations based on several factors. Potential mitigations could result in cost implications for the new interchange.

3.1.3 Opinion of Probable Cost

The conceptual improvements identified above are anticipated to cost approximately $26.6 million. Significant cost items include right-of-way, new structures, grading for the ramps, and paving of the new ramps and roadways. A detailed cost estimate for this concept is included in **Table 3.1a**.

3.1.4 Do-Nothing Scenario

If the new interchange is not constructed, Renner and Crooks residents and businesses would continue to access I-29 via Exit 86 (Renner / Crooks). Interstate access for these residents via Exit 94 is not reasonable given that it is about 7 miles to the north, although 471st Street and 472nd Street allow for this connection at slower-than-interstate speeds. Given the limited development surrounding the potential interchange, there would be limited changes in travel times or vehicle miles traveled (VMT). Additional interstate access is provided via 471st Avenue from Crooks south to I-90 Exit 395 and 475th Avenue from Renner south to I-90 Exit 399. Both connections are approximately 3 to 4 miles long and are 2-lane rural roadways serving agricultural land uses. As development occurs in northern Sioux Falls, the existing 471st Avenue and 475th Avenue interchanges at I-90 will experience volume increases, limiting their effectiveness as interstate connections for the Renner / Crooks area. Similarly, growth in the development surrounding I-29 Exit 86 will increase traffic at this interchange.

The new interchange is not expected to relieve congestion at I-29 Exit 86, as most trips in the existing interchange are either to or from the south, and the potential interchange is to the north of Exit 86. In addition, connectivity on the west side of I-29 is limited, requiring significant costs to extend dead end roadways or pave existing gravel roadways. Connectivity on the east side of I-29 is better, where 472nd Avenue (a paved facility) parallels I-29.

3.1.5 Recommendation

The evaluation of a potential new I-29 Exit 87 interchange has identified several key issues:

- 257th Street is only 1 mile north of Exit 86, which does not meet current FHWA guidance regarding rural interchange spacing. Of note, this location is likely to become more urbanized in the future, leading to potential adjustments in spacing expectations.
- There is the potential for increased costs related to wetlands, Section 404 permitting, and further hazardous materials investigations may be required.

Based on these issues, a new interchange is not recommended at this time. However, this interchange could become a reasonable candidate for future construction as urbanization expands. Of the three candidate locations, this location maximizes accessibility to developed areas.

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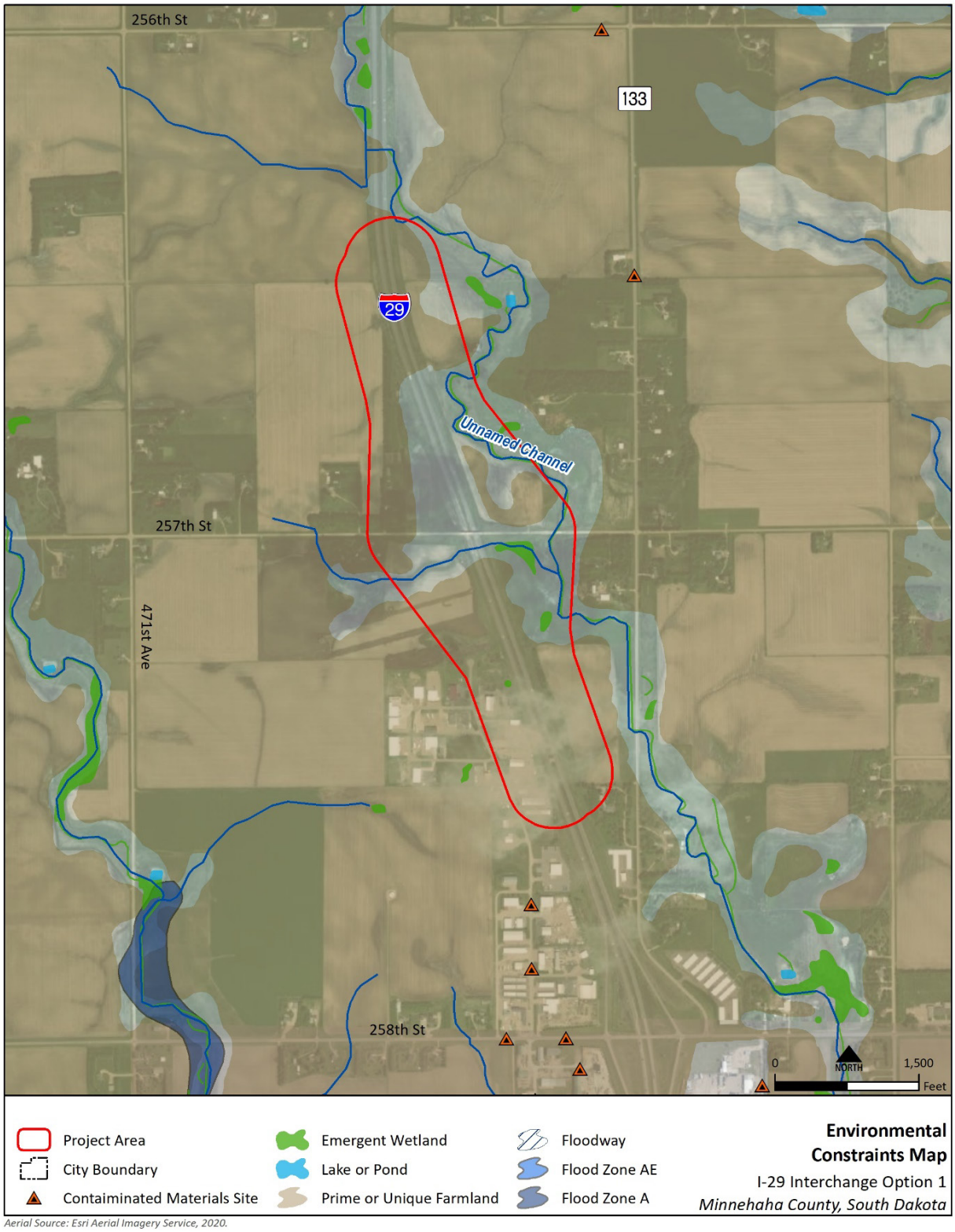
Figure 3.1a
I-29 Exit 87
Interchange Concept

Figure 3.1b. I-29 Exit 87 Environmental Constraints Map



Aerial Source: Esri Aerial Imagery Service, 2020.

Table 3.1a I-29 Exit 87 Probable Construction Costs

SOUTH DAKOTA DOT 2020 DECENNIAL INTERSTATE CORRIDOR STUDY

FHU PROJ NO. 118571-01

CONCEPTUAL LEVEL OPINION OF PROBABLE COST

FELSBURG HOLT & ULLEVIG

Alternative: I-29 Exit 87 Option 1

Prepared By: M. Martinez Date: 2/4/2021

	ITEM	DESCRIPTION	UNIT	CONTINGENCY	UNIT COST	QUANTITY	COST
1	110	Earthwork and Removals (2' Depth)	SY		$ 15	33,000	$ 495,000
2	110	Earthwork (Significant Impacts)	CY		$ 10	148,400	$ 1,484,000
3	110	Remove Bridge	EA		$ 25,000	2	$ 50,000
4	380	Surfacing (Interstate & Ramps)	SY		$ 75	44,000	$ 3,300,000
		SUBTOTAL (A)					**$ 5,329,000**
5	530	Structures - Bridge	SF		$ 200	26,600	$ 5,320,000
6	450	Drainage - New	% of (A)	8%	$ -	-	$ 426,320
7	451	Utility Relocations	% of (A)	6%	$ -	-	$ 319,740
8	632/633	Traffic - Signing/Striping	% of (A)	4%	$ -	-	$ 213,160
9	634	Traffic Control	% of (A)	6%	$ -	-	$ 319,740
10	734	Erosion Control/Environmental	% of (A)	6%	$ -	-	$ 319,740
		SUBTOTAL (B)					**$ 6,918,700**
11	635	Traffic - Signals (New)	EA		$ 270,000	0	$ -
12	997	Railroad Crossing	EA		$ 250,000		$ -
13	009	Mobilization	% of (A)+(B)	5%	$ -	-	$ 612,390
14	100	Clearing	% of (A)+(B)	2%	$ -	-	$ 244,960
15		Contingency	% of (A)+(B)	30%	$ -	-	$ 3,674,310
		SUBTOTAL (C)					**$ 4,531,660**
		CONSTRUCTION TOTAL (D)	**(A)+(B)+(C)**				**$ 16,779,360**
16		Engineering Services	% of (D)	15%	$ -		$ 2,516,910
17		ROW Impacts	SF		$ 10	981,600	$ 9,816,000
							$ 29,112,270
		PROJECT TOTAL (E)					**$ 29,113,000**
		CONSTRUCTION (D) + ROW TOTAL COST					**$ 26,600,000**

Note: In providing opinions of probable construction cost, the Client understands that Felsburg Holt & Ullevig has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing. The unit prices and percentages shown above were applied under the direction of the South Dakota Department of Transportation and FHU makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bid or actual costs.

3.2 I-29 Exit 88 – Crooks, 256th Street

This potential interchange is located along the 256th Street alignment northeast of Crooks, between Exit 86 (Renner / Crooks) and Exit 94 (Baltic). It is one of a group of three potential interchange location options envisioned to provide additional access to developing areas on the north side of the Sioux Falls urban area.

A rural 2-lane roadway, 256th Street dead ends both east and west of I-29 at approximately MRM 88.5 and does not cross the highway. A gravel road, 256th Street serves rural land uses on both sides of I-29. It intersects 471st Avenue about 0.5 mile west of the interstate and 472nd Avenue about 0.5 mile east of the interstate, both of which are similar rural 2-lane roads. Both 471st Avenue and 472nd Avenue provide connections into Sioux Falls, about 5 miles to the south. 256th Street provides a connection to Crooks via 470th Avenue about 1.5 miles west of I-29 and crosses the Big Sioux River about 2.25 miles east of I-29.

3.2.1 Interchange Concept

The potential Exit 88 concept creates a standard diamond interchange along the 256th Street alignment (approximately MRM 88.5). An existing creek flows south along the west side of I-29 that will require a longer structure over I-29, and there are structures along the SB exit and entrance ramps to maintain existing flows. The creek also crosses under I-29 at the south ramp gores and a tributary crosses under I-29 at the north ramp gores. Both I-29 crossings will have to be lengthened to accommodate these ramp gores. Several local driveways and farm accesses on both sides of I-29 would have to be relocated to maintain appropriate access spacing along 256th Street, but no public roadway intersection would require changes. The 256th Street crossroad is assumed to remain a 2-lane road, without turn lanes at the stop-controlled ramp terminal intersections. The concept drawing of this improvement option is shown on **Figure 3.2a**.

3.2.2 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.

- NHD flowlines are mapped west of I-29 and crossing I-29 north and south of the proposed interchange. These flowlines may indicate the presence of channels. Based on aerial imagery, an unnamed channel appears to be present on the west side of the proposed interchange flowing south through the project area. Impacts to any intermittent or perennial channels would be subject to Section 404 permitting.

- NWI wetlands are mapped near the proposed interchange. Based on aerial imagery, it appears that a forested wetland may be present on the west side of I-29 at the proposed interchange location. Impacts to any jurisdictional wetlands would be subject to Section 404 permitting.
- No Special Flood Hazard Areas are located within the project area.
- Prime or unique farmland is located in the vicinity of the proposed interchange, although it is not present adjacent to the drainages in the area. Due to the FPPA, impacts to prime or unique farmland could require coordination with NRCS.
- Based on data from the EPA facility registry system, there are no known potential contaminated materials sites in the immediate vicinity of the proposed interchange. However, one site is present on 256th Street approximately 0.4 miles west of the proposed interchange.
- There do not appear to be any recreational facilities in close proximity to the proposed interchange.
- Based on publicly available records in the National Register of Historic Places, the nearest historic sites are bridges on the Big Sioux River, and these would not be impacted by the proposed interchange.
- Threatened and endangered species that have been documented in Minnehaha County include Topeka Shiner, Lined Snake, Northern River Otter, and Western Prairie Fringed Orchid. However, other species may be present, including Northern Long-Eared Bat and Rufa Red Knot. Habitat for some of these listed species may be present within the wooded corridor on the west side of I-29. Coordination with the South Dakota Game, Fish & Parks and USFWS is recommended to ensure the project does not adversely impact any of these species.

These resources are presented on **Figure 3.2b.** The review above highlights the need for potential Section 404 reviews, possible threatened and endangered species, and potential mitigations based on several factors. Potential mitigations could result in cost implications for the new interchange.

3.2.3 Opinion of Probable Cost

The conceptual improvements identified above are anticipated to cost approximately $39.5 million. Significant cost items include multiple new structures, right-of-way, grading for the ramps and roadway connection across I-29, and paving of the new ramps and roadways. A detailed cost estimate for this concept is included in **Table 3.2a**.

3.2.4 Do-Nothing Scenario

If the new interchange is not constructed, Renner and Crooks residents and businesses would continue to access I-29 via Exit 86 (Renner / Crooks). Interstate access for these residents via Exit 94 is not reasonable given that it is about 6 miles to the north, although 471st Avenue and 472nd Avenue allow for

this connection at slower-than-interstate speeds. Given the limited development surrounding the potential interchange, there would be limited changes in travel times or VMT. Additional interstate access is provided via 471st Avenue from Crooks south to I-90 Exit 395 and 475th Avenue from Renner south to I-90 Exit 399. Both connections are approximately 4 to 5 miles long and are 2-lane rural roadways serving agricultural land uses. As development occurs in northern Sioux Falls, the existing 471st Avenue and 475th Avenue interchanges at I-90 will experience volume increases, limiting their effectiveness as interstate connections for the Renner / Crooks area. Similarly, growth in the development surrounding I-29 Exit 86 will increase traffic at this interchange.

The new interchange is not expected to relieve congestion at I-29 Exit 86, as most trips in the existing interchange are either to or from the south, and the potential interchange location is 2 miles north of Exit 86. In addition, connectivity on the west side of I-29 is limited, requiring existing gravel roadways to be paved. Connectivity on the east side of I-29 is better, where 472nd Avenue (a paved facility) parallels I-29.

3.2.5 Recommendation

The evaluation of a potential new I-29 Exit 88 interchange has identified several key issues:

- 256th Street is only 2 miles north of Exit 86, which does not meet current FHWA guidance regarding rural interchange spacing.
- The presence of the creek along the west side of I-29 would significantly increase costs for this interchange, requiring several longer bridges and supplemental structures.
- There is the potential for increased costs related to wetlands, Section 404 permitting and threatened and endangered species.

Based on these issues, a new interchange is not recommended at this time.

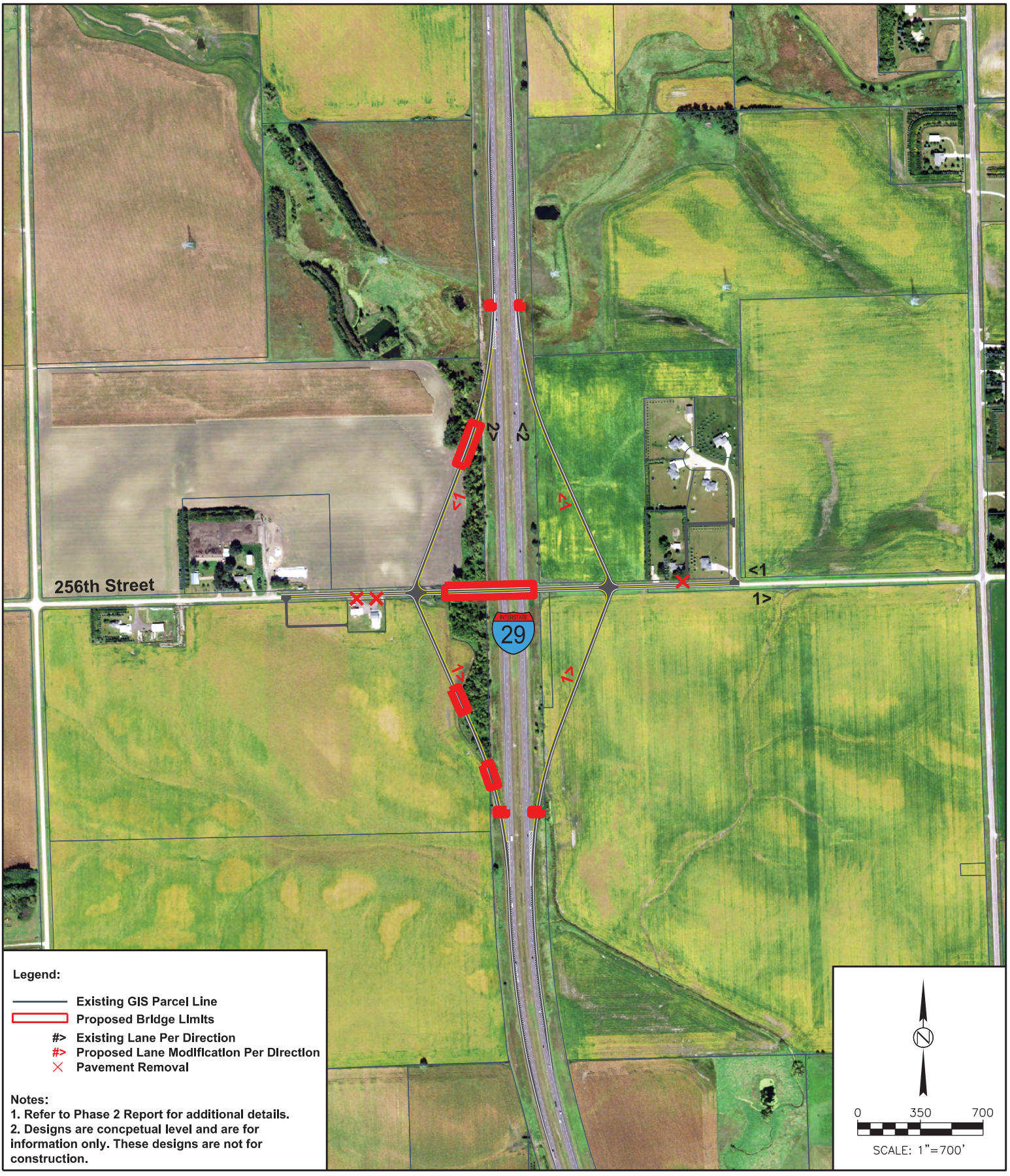


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Figure 3.2a
I-29 Exit 88
Interchange Concept

Figure 3.2b I-29 Exit 88 Environmental Constraints Map

Aerial Source: Esri Aerial Imagery Service, 2020.

Table 3.2a I-29 Exit 88 Probable Construction Costs

SOUTH DAKOTA DOT 2020 DECENNIAL INTERSTATE CORRIDOR STUDY

FHU PROJ NO. 118571-01

CONCEPTUAL LEVEL OPINION OF PROBABLE COST

FELSBURG HOLT & ULLEVIG

Alternative: I-29 Exit 88 Option 1

Prepared By: M. Martinez Date: 2/4/2021

	ITEM	DESCRIPTION	UNIT	CONTINGENCY	UNIT COST	QUANTITY	COST
1	110	Earthwork and Removals (2' Depth)	SY		$ 15	32,300	$ 484,500
2	110	Earthwork (Significant Impacts)	CY		$ 10	148,300	$ 1,483,000
3	110	Remove Bridge	EA		$ 25,000	0	$ -
4	380	Surfacing (Interstate & Ramps)	SY		$ 75	43,000	$ 3,225,000
		SUBTOTAL (A)					**$ 5,192,500**
5	530	Structures - Bridge	SF		$ 200	69,200	$ 13,840,000
6	450	Drainage - New	% of (A)	8%	$ -	-	$ 415,400
7	451	Utility Relocations	% of (A)	6%	$ -	-	$ 311,550
8	632/633	Traffic - Signing/Striping	% of (A)	4%	$ -	-	$ 207,700
9	634	Traffic Control	% of (A)	6%	$ -	-	$ 311,550
10	734	Erosion Control/Environmental	% of (A)	6%	$ -	-	$ 311,550
		SUBTOTAL (B)					**$ 15,397,750**
11	635	Traffic - Signals (New)	EA		$ 270,000	0	$ -
12	997	Railroad Crossing	EA		$ 250,000		$ -
13	009	Mobilization	% of (A)+(B)	5%	$ -	-	$ 1,029,520
14	100	Clearing	% of (A)+(B)	2%	$ -	-	$ 411,810
15		Contingency	% of (A)+(B)	30%	$ -	-	$ 6,177,080
		SUBTOTAL (C)					**$ 7,618,410**
		CONSTRUCTION TOTAL (D)	**(A)+(B)+(C)**				**$ 28,208,660**
16		Engineering Services	% of (D)	15%	$ -		$ 4,231,300
17		ROW Impacts	SF		$ 10	1,123,700	$ 11,237,000
							$ 43,676,960
		PROJECT TOTAL (E)					**$ 43,677,000**
		CONSTRUCTION (D) + ROW TOTAL COST					**$ 39,500,000**

Note: In providing opinions of probable construction cost, the Client understands that Felsburg Holt & Ullevig has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing. The unit prices and percentages shown above were applied under the direction of the South Dakota Department of Transportation and FHU makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bid or actual costs.

3.3 I-29 Exit 89 – Crooks, 255th Street

This potential interchange is located along the 255th Street alignment northeast of Crooks, between Exit 86 (Renner / Crooks) and Exit 94 (Baltic). It is one of a group of three potential interchange location options envisioned to provide additional access to developing areas on the north side of the Sioux Falls urban area.

A rural 2-lane roadway, 255th Street dead ends both east and west of I-29 at approximately MRM 89.5 and does not cross the highway. A gravel road, 255th Street serves rural land uses on both sides of I-29. It intersects 471st Avenue about 0.5 mile west of the interstate and 472nd Avenue about 0.5 mile east of the interstate, both of which are similar rural 2-lane roads. Both 471st Avenue and 472nd Avenue provide connections into Sioux Falls, about 6 miles to the south. 255th Street provides a connection to Crooks via 470th Avenue about 1.5 miles west of I-29 and crosses the Big Sioux River about 2 miles east of I-29.

3.3.1 Interchange Concept

The potential Exit 89 concept creates a standard diamond interchange along the 255th Street alignment (approximately MRM 89.5). One local driveway on the west side of I-29 and one farm access on the east side of I-29 would have to be relocated to maintain appropriate access spacing along 255th Street, but no public roadway intersection would require changes. The 255th Street crossroad is assumed to remain a 2-lane road, without turn lanes at the stop-controlled ramp terminal intersections. The concept drawing of this improvement option is shown on **Figure 3.3a**.

3.3.2 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.

- NHD flowlines are mapped northeast of the proposed interchange. These flowlines may indicate the presence of channels. Based on aerial imagery, an unnamed channel is present on the east side of the proposed interchange flowing south through the project area to the Big Sioux River. Impacts to any intermittent or perennial channels would be subject to Section 404 permitting.
- NWI wetlands are mapped along a drainage crossing I-29 north of the project area. Based on Google Streetview Imagery, large cattail wetlands are present in these areas. Impacts to any jurisdictional wetlands would be subject to Section 404 permitting.
- No Special Flood Hazard Areas are located within the project area.
- Prime or unique farmland is located in the vicinity of the proposed interchange. Due to the FPPA, impacts to prime or unique farmland could require coordination with NRCS.

- Based on data from the EPA facility registry system, there are no known potential contaminated materials sites in the immediate vicinity of the proposed interchange.
- There do not appear to be any recreational facilities in close proximity to the proposed interchange.
- Based on publicly available records in the National Register of Historic Places, the nearest historic sites are bridges on the Big Sioux River and these would not be impacted by the proposed interchange.
- Threatened and endangered species that have been documented in Minnehaha County include Topeka Shiner, Lined Snake, Northern River Otter, and Western Prairie Fringed Orchid. However, other species may be present, including Northern Long-Eared Bat and Rufa Red Knot. Coordination with the South Dakota Game, Fish & Parks and USFWS is recommended to ensure the project does not adversely impact any of these species.

These resources are presented on **Figure 3.3b.** The review above highlights the need for potential Section 404 reviews and potential mitigations based on several factors. Potential mitigations could result in cost implications for the new interchange.

3.3.3 Opinion of Probable Cost

The conceptual improvements identified above are anticipated to cost approximately $24.5 million. Significant cost items include right-of-way, new structures, grading for the ramps and roadway connection across I-29, and paving of the new ramps and roadways. A detailed cost estimate for this concept is included in **Table 3.3a**.

3.3.4 Do-Nothing Scenario

If the new interchange is not constructed, Renner and Crooks residents and businesses would continue to access I-29 via Exit 86 (Renner / Crooks). Interstate access for these residents via Exit 94 is not reasonable given that it is about 4 miles to the north, although 471st Avenue and 472nd Avenue allow for this connection at slower-than-interstate speeds. Given the limited development surrounding the potential interchange, there would be limited changes in travel times or VMT. Additional interstate access is provided via 471st Avenue from Crooks south to I-90 Exit 395 and 475th Avenue from Renner south to I-90 Exit 399. Both connections are approximately 6 to 7 miles long and are 2-lane rural roadways serving agricultural land uses. As development occurs in northern Sioux Falls, the existing 471st Avenue and 475th Avenue interchanges at I-90 will experience volume increases, limiting their effectiveness as interstate connections for the Renner / Crooks area. Similarly, growth in the development surrounding I-29 Exit 86 will increase traffic at this interchange.

The new interchange is not expected to relieve congestion at I-29 Exit 86, as most trips in the existing interchange are either to or from the south, and the potential interchange is 3 miles north of Exit 86. In addition, connectivity on the west side of I-29 is limited, requiring existing gravel roadways to be paved. Connectivity on the east side of I-29 is better, where 472nd Avenue (a paved facility) parallels I-29.

3.3.5 Recommendation

The evaluation of a potential new I-29 Exit 89 interchange has identified several key issues:

- 255th Street is 3 miles north of Exit 86, which meets current FHWA guidance regarding rural interchange spacing.
- There is the potential for increased costs related to Section 404 permitting.

Based on these issues, a new interchange is not recommended at this time.

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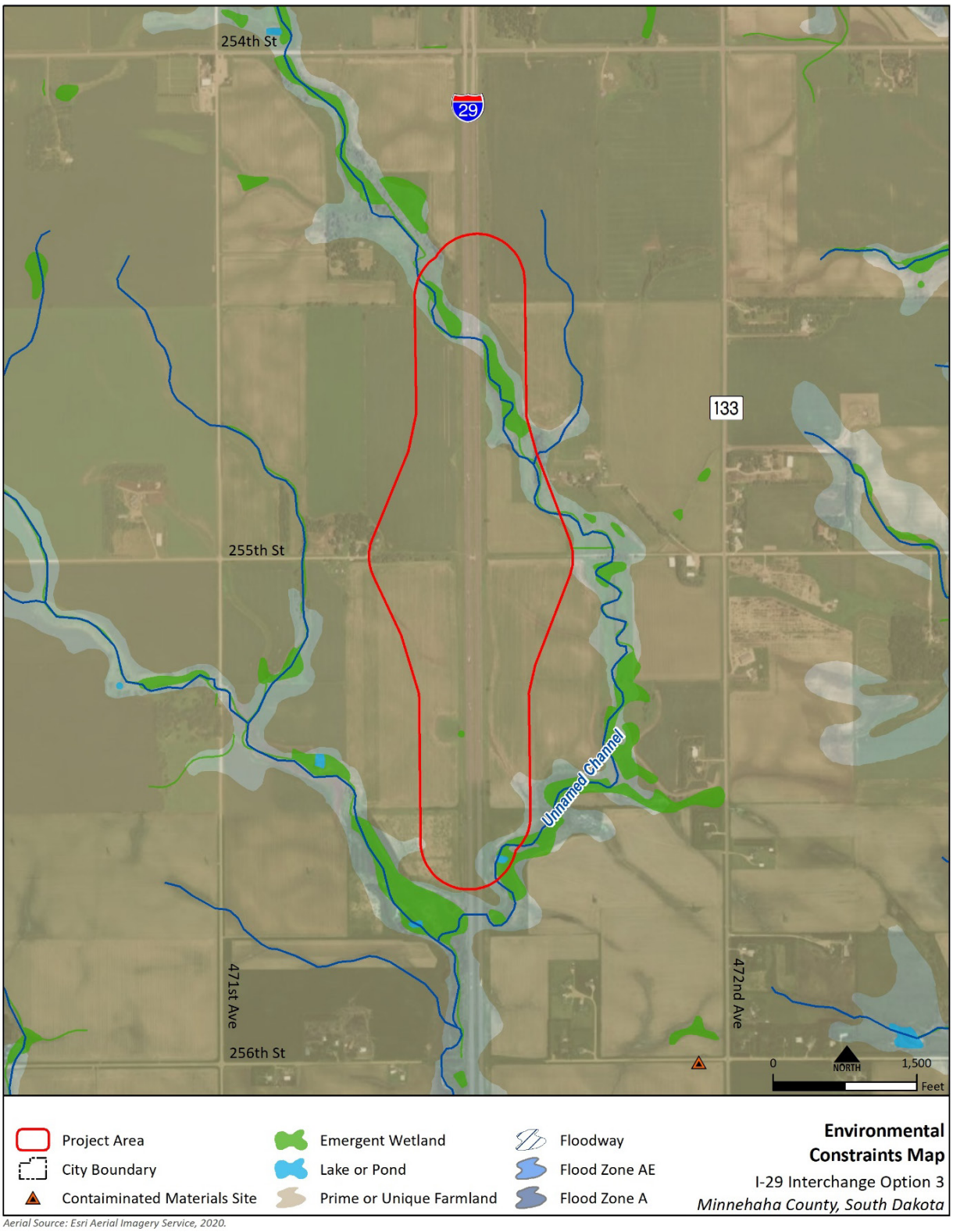
Figure 3.3a
I-29 Exit 89
Interchange Concept

Figure 3.3b I-29 Exit 89 Environmental Constraints Map



Aerial Source: Esri Aerial Imagery Service, 2020.

Table 3.3a I-29 Exit 89 Probable Construction Costs

SOUTH DAKOTA DOT 2020 DECENNIAL INTERSTATE CORRIDOR STUDY

FHU PROJ NO. 118571-01

CONCEPTUAL LEVEL OPINION OF PROBABLE COST

FELSBURG HOLT & ULLEVIG

Alternative: I-29 Exit 89 Option 1

Prepared By: M. Martinez Date: 2/4/2021

	ITEM	DESCRIPTION	UNIT	CONTINGENCY	UNIT COST	QUANTITY	COST
1	110	Earthwork and Removals (2' Depth)	SY		$ 15	32,300	$ 484,500
2	110	Earthwork (Significant Impacts)	CY		$ 10	147,900	$ 1,479,000
3	110	Remove Bridge	EA		$ 25,000	0	$ -
4	380	Surfacing (Interstate & Ramps)	SY		$ 75	43,000	$ 3,225,000
		SUBTOTAL (A)					**$ 5,188,500**
5	530	Structures - Bridge	SF		$ 200	17,100	$ 3,420,000
6	450	Drainage - New	% of (A)	8%	$ -	-	$ 415,080
7	451	Utility Relocations	% of (A)	6%	$ -	-	$ 311,310
8	632/633	Traffic - Signing/Striping	% of (A)	4%	$ -	-	$ 207,540
9	634	Traffic Control	% of (A)	6%	$ -	-	$ 311,310
10	734	Erosion Control/Environmental	% of (A)	6%	$ -	-	$ 311,310
		SUBTOTAL (B)					**$ 4,976,550**
11	635	Traffic - Signals (New)	EA		$ 270,000	0	$ -
12	997	Railroad Crossing	EA		$ 250,000		$ -
13	009	Mobilization	% of (A)+(B)	5%	$ -	-	$ 508,260
14	100	Clearing	% of (A)+(B)	2%	$ -	-	$ 203,310
15		Contingency	% of (A)+(B)	30%	$ -	-	$ 3,049,520
		SUBTOTAL (C)					**$ 3,761,090**
		CONSTRUCTION TOTAL (D)	**(A)+(B)+(C)**				**$ 13,926,140**
16		Engineering Services	% of (D)	15%	$ -		$ 2,088,930
17		ROW Impacts	SF		$ 10	1,055,700	$ 10,557,000
							$ 26,572,070
		PROJECT TOTAL (E)					**$ 26,573,000**
		CONSTRUCTION (D) + ROW TOTAL COST					**$ 24,500,000**

Note: In providing opinions of probable construction cost, the Client understands that Felsburg Holt & Ullevig has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing. The unit prices and percentages shown above were applied under the direction of the South Dakota Department of Transportation and FHU makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bid or actual costs.

3.4 I-90 Exit 16 – Rainbow Road, Spearfish

This potential interchange is located at the Rainbow Road underpass in Spearfish, between Exit 14 (27th Street / Spearfish Canyon) and Exit 17 (Lead / Deadwood).Background

Rainbow Road is a 2-lane roadway that crosses under I-90 at approximately MRM 16.7. The existing I-90 structures over Rainbow Road are rated good (south) and fair (north), and both have sufficiency ratings over 95. Rainbow Road serves rural land uses both north and south of I-90. It intersects Airport Road about 0.9 miles north of the interstate, providing access to the Black Hills Airport. It intersects E Colorado Boulevard (also a 2-lane roadway) less than 0.1 miles south of I-90, which connects N 27th Street (Exit 14) to US85 (Exit 17).

3.4.1 Interchange Concept

The potential Exit 16 interchange concept provides a folded diamond for WB movements, with an entrance ramp loop on the east side of Rainbow Road. This configuration was chosen as an appropriate layout as a standard WB diamond ramp would require the acquisition of several buildings located west of Rainbow Road and north of I-90. The existing driveway for these buildings would have to be relocated to the north to remain outside the interchange area. The proposed WB loop ramp along I-90 would require the reconstruction of the WB I-90 bridge over Rainbow Road to accommodate the merge area. The EB movements would be accommodated by a typical diamond ramp configuration, which would require the realignment of E Colorado Boulevard approximately 1,000 feet to the south of its current alignment. Rainbow Road is anticipated to remain a 2-lane facility, without turn lanes at the stop-controlled ramp terminal intersections. The concept drawing of this improvement option is shown on **Figure 3.4a.**

3.4.2 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 that 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.

- The Black Hills Airport is a public airport located directly northwest of the proposed interchange. Coordination would be required to ensure the project and all equipment used in its construction comply with height restrictions.
- NHD flowlines are mapped east and west of the proposed interchange and may indicate the presence of channels. Based on aerial imagery, a channel seems to be present at least on the west side of the proposed interchange flowing north through the project area to False Bottom Creek. Impacts to any intermittent or perennial channels would be subject to Section 404 permitting.

- No NWI wetlands are mapped in close vicinity of the project. However, based on aerial imagery, wetlands may be present along the drainages within the project area. Impacts to any jurisdictional wetlands would be subject to Section 404 permitting.
- No Special Flood Hazard Areas are located within the project area. The nearest flood zones are located along False Bottom Creek, approximately 1 mile west of the project, and Miller Creek, approximately 1.5 miles east of the proposed interchange.
- Prime or unique farmland is located adjacent to the proposed interchange. Based on the FPPA, impacts to prime or unique farmland could require coordination with the NRCS. However, based on the scope of the proposed interchange, the project would be unlikely to exceed the recommended allowable level.
- Based on data from the EPA facility registry system, there are no known potential contaminated materials sites within the area of the proposed interchange. The nearest sites are located at the adjacent Black Hills Airport.
- There do not appear to be any recreational facilities in close proximity to the proposed interchange.
- Based on publicly available records in the NRHP, one historic site is located in the vicinity of the proposed interchange. The McLaughlin Ranch Barn (Property ID 02000025) is located on the east side of N Rainbow Rd, north of I-90. This site is protected under Section 106 of the National Historic Preservation Act and Section 4(f) of the USDOT Act.
- Threatened and endangered species that may be present in Lawrence County include Finescale Dace, Longnose Sucker, American Dipper, Osprey, and Northern Long-Eared Bat. Coordination with the South Dakota Game, Fish & Parks and USFWS is recommended to ensure that the project does not adversely impact any of these species.

These resources are presented on **Figure 3.4b.** The review above highlights the need for potential Section 404 reviews and mitigations based on several factors. Potential mitigations could result in cost implications for the new interchange.

3.4.3 Opinion of Probable Cost

The conceptual improvements identified above are anticipated to cost approximately $46.6 million. Significant cost items include right-of-way, the new I-90 structure, grading for the ramps and the E Colorado Boulevard relocation, and paving of the new ramps and relocated roadways. A detailed cost estimate for this concept is included in **Table 3.4a**.

3.4.4 Do-Nothing Scenario

If the new interchange is not constructed, Spearfish residents, businesses, and airport users would continue to access I-90 via Exit 14 (Rainbow Road) and Exit 17 (US 85). Colorado Boulevard connects these facilities south of I-90, but users cannot travel at interstate speeds along this roadway. Hence, travelers going to destinations along North and South Rainbow Road would experience longer travel times without the interchange. The most significant travel time differential would be for Black Hills Airport users, as the main airport access is off North Rainbow Road and there is no reasonable alternate route to the airport.

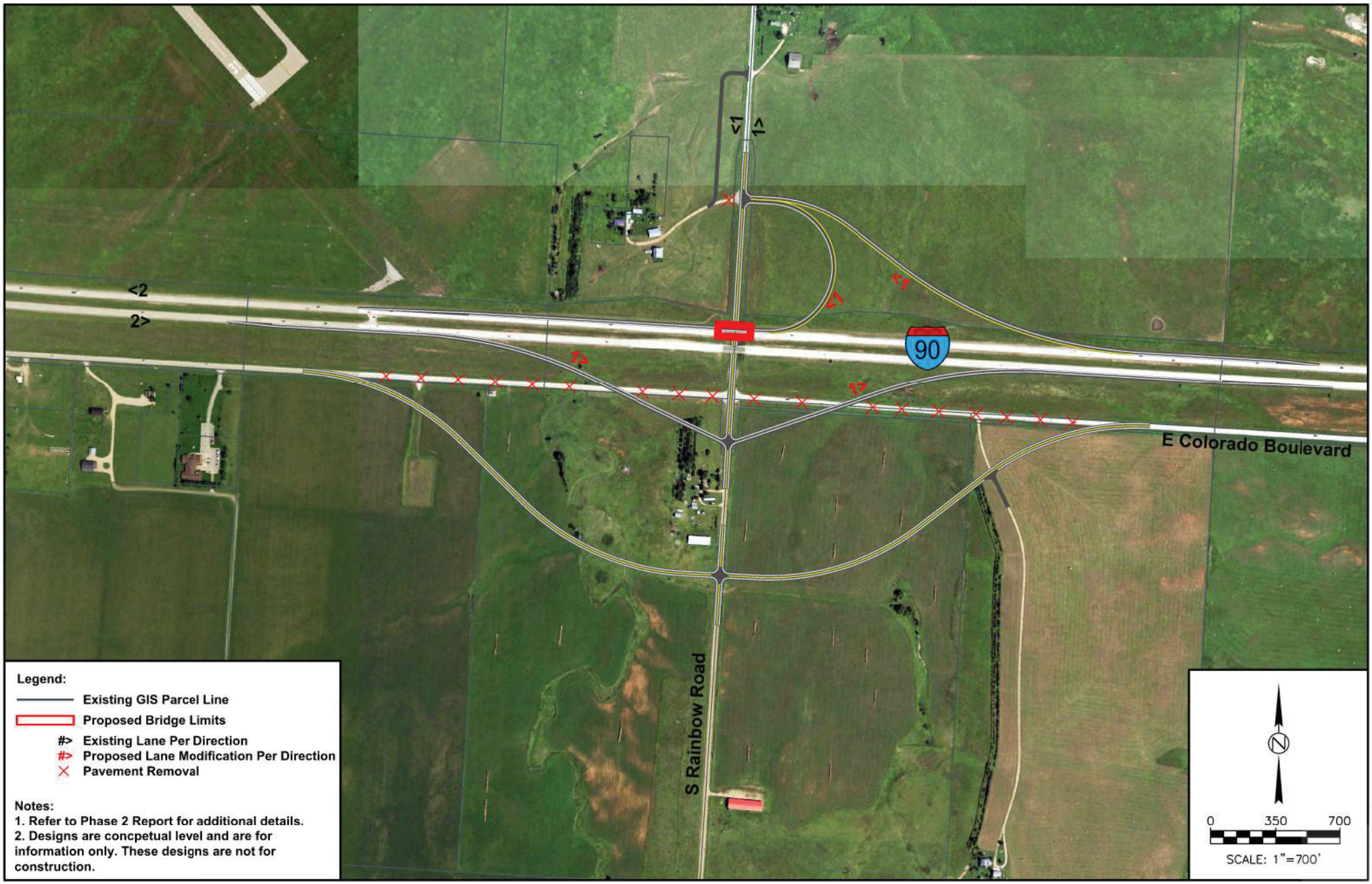
The potential new interchange would not be expected to relieve congestion at either Exit 14 or Exit 17, as Exit 14 was recently rebuilt and Exit 17 carries regional traffic to/from US85 that would not be served by Rainbow Road. In conclusion, the new Exit 16 interchange would enhance access to the Black Hills Airport for most users but would not affect congestion when compared to No-Action conditions.

3.4.5 Recommendation

The evaluation of a potential new I-90 Exit 16 interchange has identified several key issues:

- A standard diamond configuration is not feasible due to adjacent development.
- The interchange would be within 3,000 feet of the Black Hills Airport and may fall within the airport's crash protection zone.
- The acquisition of farmland would be expensive and may trigger FPPA concerns.
- There is the potential for increased costs related to Section 404 permitting.
- The relocation of the local driveway access on the north side of the interchange would result in the driveway being placed near an existing historic property.

Based on these issues, a new interchange is not recommended at this time. However, access, travel times, and VMT for areas north of I-90 should continue to be monitored.

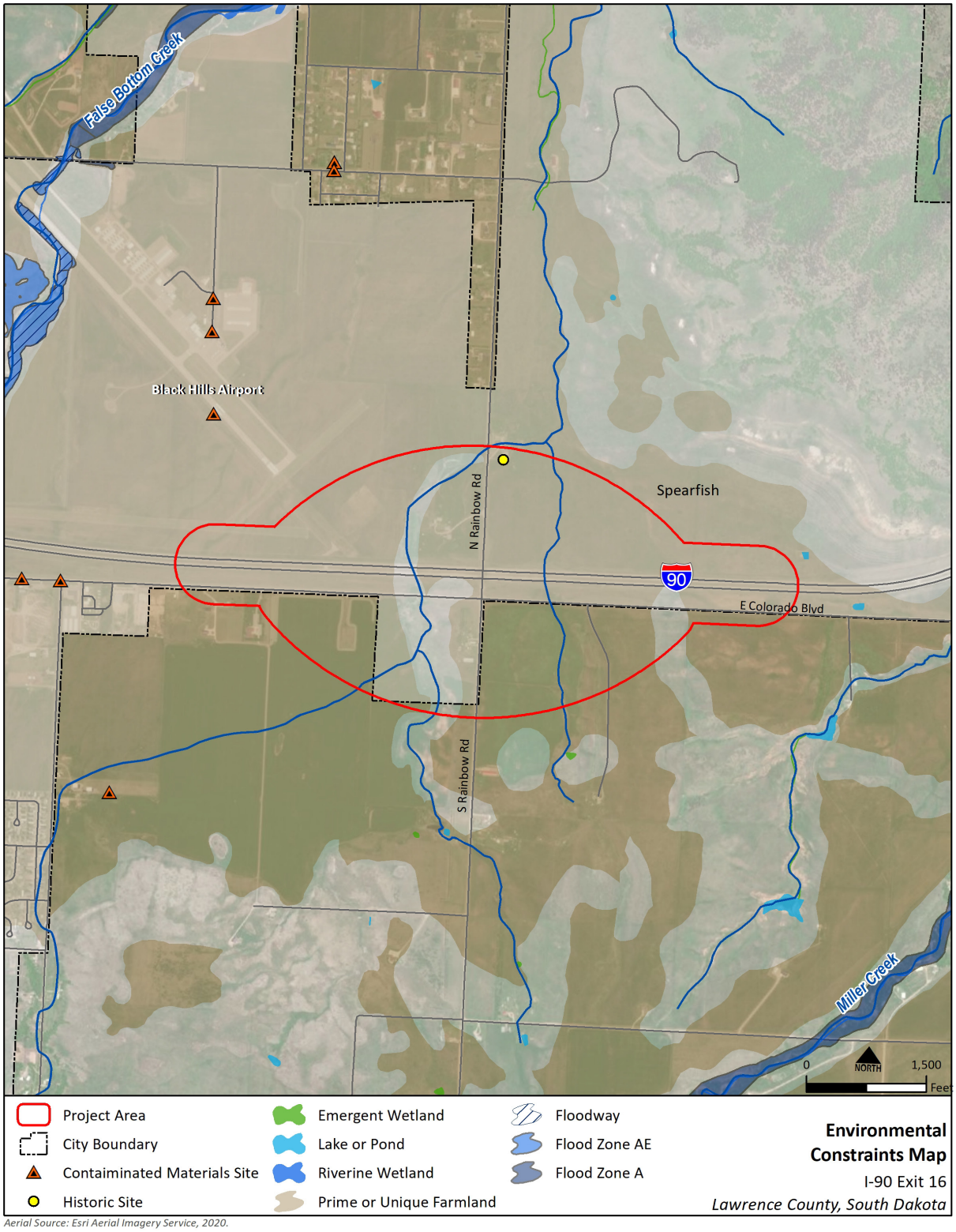


FELSBURG HOLT & ULLEVIG

CONCEPTUAL

Figure 3.4a
I-90 Exit 16
Interchange Concept

Figure 3.4b I-90 Exit 16 Environmental Constraints Map



Aerial Source: Esri Aerial Imagery Service, 2020.

Table 3.4a I-90 Exit 16 Probable Construction Costs

SOUTH DAKOTA DOT 2020 DECENNIAL INTERSTATE CORRIDOR STUDY

FHU PROJ NO. 118571-01

CONCEPTUAL LEVEL OPINION OF PROBABLE COST

FELSBURG HOLT & ULLEVIG

Alternative: I-90 Exit 16 Option 1

Prepared By: A. Orellana Date: 12/3/2020

	ITEM	DESCRIPTION	UNIT	CONTINGENCY	UNIT COST	QUANTITY	COST
1	**110**	Earthwork and Removals (2' Depth)	SY		$ **15**	45,800	$ 687,000
2	**110**	Earthwork (Significant Impacts)	CY		$ **10**	183,200	$ 1,832,000
3	**110**	Remove Bridge	EA		$ **25,000**	1	$ 25,000
4	**380**	Surfacing (Interstate & Ramps)	SY		$ **75**	61,000	$ 4,575,000
		SUBTOTAL (A)					$ **7,119,000**
5	**530**	Structures - Bridge	SF		$ **200**	11,000	$ 2,200,000
6	**450**	Drainage - New	% of (A)	**8%**	$ -	-	$ 569,520
7	**451**	Utility Relocations	% of (A)	**6%**	$ -	-	$ 427,140
8	**632/633**	Traffic - Signing/Striping	% of (A)	**4%**	$ -	-	$ 284,760
9	**634**	Traffic Control	% of (A)	**6%**	$ -	-	$ 427,140
10	**734**	Erosion Control/Environmental	% of (A)	**6%**	$ -	-	$ 427,140
		SUBTOTAL (B)					$ **4,335,700**
11	**635**	Traffic - Signals (New)	EA		$ **270,000**	0	$ -
12	**997**	Railroad Crossing	EA		$ **250,000**		$ -
13	**009**	Mobilization	% of (A)+(B)	**5%**	$ -	-	$ 572,740
14	**100**	Clearing	% of (A)+(B)	**2%**	$ -	-	$ 229,100
15		Contingency	% of (A)+(B)	**30%**	$ -	-	$ 3,436,410
		SUBTOTAL (C)					$ **4,238,250**
		CONSTRUCTION TOTAL (D)	**(A)+(B)+(C)**				$ **15,692,950**
16		Engineering Services	% of (D)	**15%**	$ -		$ 2,353,950
17		ROW Impacts	SF		$ **10**	3,087,600	$ 30,876,000
							$ ***48,922,900***
		PROJECT TOTAL (E)					$ **48,923,000**
		CONSTRUCTION (D) + ROW TOTAL COST					$ **46,600,000**

Note: In providing opinions of probable construction cost, the Client understands that Felsburg Holt & Ullevig has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing. The unit prices and percentages shown above were applied under the direction of the South Dakota Department of Transportation and FHU makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bid or actual costs.

3.5 I-90 Exit 264 – Chamberlain

This potential interchange is located at the existing Chamberlain Rest Area between Exit 263 (Chamberlain) and Exit 265 (Chamberlain).

3.5.1 Background

The existing Chamberlain Rest Area is served by a fully directional trumpet interchange with no connection to the nearby local street network. The rest area is located on the southwest side of I-90 and provides traveler services, a scenic Missouri River overlook, and other amenities. The rest area access road crosses over I-90 on a 2-lane structure that is rated fair.

3.5.2 Interchange Concept

The potential Exit 264 concept would convert the existing trumpet configuration to a folded diamond configuration. The existing I-90 overpass alignment precludes roadway connectivity on the north side of I-90 due to the Riverview Cemetery, so the crossroad has been realigned to the southeast to facilitate the connection. The WB entrance ramp would be a loop to avoid the cemetery. To accommodate the loop ramp footprint, the WB exit ramp would require realignment and reconstruction. Both EB ramps would need to be reconstructed to meet the crossroad as diamond ramps, allowing movements to either side of I-90. The new crossroad is proposed to be a 2-lane facility without turn lanes at the stop-controlled ramp terminal intersections. It would extend east to meet S Byron Boulevard near the existing Sanford Chamberlain Medical Center. The concept drawing of this improvement option is shown on **Figure 3.5a.**

3.5.3 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.

- The Chamberlain Municipal Airport is a public airport located directly southeast of the proposed interchange. Coordination would be required to ensure that the project and all equipment used in its construction comply with height restrictions.
- NHD flowlines are mapped in close vicinity of the project. Some flowlines are mapped within the bluffs northwest of the proposed interchange and drain northwest to the Missouri River. It does not appear that any channels are present or would be impacted by the activities to construct the proposed interchange.
- One NWI wetland is located on the north side of I-90, southeast of the proposed interchange. The wetland appears to be a farmed wetland located within a row-crop agricultural field. Impacts to any jurisdictional wetlands would be subject to Section 404 permitting.

- Special Flood Hazard Areas are located within the project area. Flood Zone A is located south of I-90 along the Big Sioux River and is likely to be impacted by construction of the proposed interchange. Floodway is also located along the Big Sioux River and could potentially be impacted depending on the design of the project.
- Prime or unique farmland is located adjacent to the proposed interchange. Based on the FPPA, impacts to prime or unique farmland could require coordination with NRCS. However, based on the scope of the proposed interchange, the project would be unlikely to exceed the recommended allowable level.
- Based on data from the EPA facility registry system, known potential contaminated materials sites within the area of the proposed project include the Sanford-Chamberlain Medical Center.
- The proposed interchange project is located in an area unmapped by FEMA for Special Flood Hazard Areas.
- The Riverview Cemetery is located directly north of the interchange on the east side of I-90.
- A rest area is present at the location of the interchange on the west side of I-90. The "Dignity Statue" is present at the rest area and is also visible from I-90. A path to a Missouri River Overlook is also present at the rest area and may be subject to Section 4(f) protection. Based on the conceptual plans for the intersection, it does not appear that the rest area or these features would be impacted.
- Based on publicly available records in the NRHP, one historic site is located in the vicinity of the proposed interchange. The Chamberlain Rest Stop Tipis are located at the rest area on the west side of I-90. This site is protected under Section 106 of the National Historic Preservation Act and Section 4(f) the USDOT Act.
- Threatened and endangered species that may be present in Brule County include Northern Redbelly Dace, Pallid Sturgeon, Shovelnose Sturgeon, Sturgeon Chub, Whooping Crane, Northern Long-Eared Bat, and Northern River Otter. Habitat for most of these species is associated with the Missouri River, which is located approximately 1 mile northwest of the project interchange and would not be impacted by project activities. However, coordination with the South Dakota Game, Fish & Parks and USFWS is recommended to ensure that the project does not adversely impact any of these species.

These resources are presented on **Figure 3.5b.** The review above highlights the need for potential Section 404 reviews, hazardous materials concerns, and potential mitigations based on several factors. Potential mitigations could result in cost implications for the new interchange.

3.5.4 Opinion of Probable Cost

The conceptual improvements identified above are anticipated to cost approximately $32.6 million. Significant cost items include right-of-way, the new structure over I-90, grading for the ramps and the S Byron Boulevard connection, and paving of the new ramps and relocated roadways. A detailed cost estimate for this concept is included in **Table 3.5a**.

3.5.5 Do-Nothing Scenario

If the new interchange is not constructed, Chamberlain residents, businesses, and airport users would continue to access I-90 via Exit 263 (Main Street) and Exit 265 (E King Street / I-90 Business Loop). Due to the bluffs along the Missouri River, there is no connection between these roadways parallel to I-90, although E King Street connects with Main Street about 1¼ miles north of I-90. The most direct existing access to Sanford Chamberlain Medical Center and Chamberlain High School is along E King Street, but Exit 264 would only enhance travel times for residents near Exit 263 since Chamberlain residents further north would have a more direct route via King Street. The main airport access is via E King Street, so the new interchange would not affect travel times to and from the airport.

The potential new interchange is not expected to relieve congestion at Exit 263, as this exit is separated from the Exit 264 area by the Missouri River bluffs. The potential interchange may divert limited Exit 265 traffic to and from the west, as regional motorists with destinations between Exit 264 and Exit 265 would use the new interchange. However, it is not anticipated to affect traffic volumes to and from the east since these motorists would reach Exit 265 first and would not travel past it. In conclusion, the new Exit 264 interchange would enhance access to the hospital and high school for a portion of their patrons but would not affect congestion when compared to No-Action conditions.

3.5.6 Recommendation

The evaluation of a potential new I-90 Exit 264 interchange has identified several key issues:

- A standard diamond configuration is not feasible due to the adjacent cemetery.
- The interchange would be within 1 mile of the Chamberlain Municipal Airport and may fall within the airport's crash protection zone.
- The acquisition of farmland may trigger FPPA concerns.
- There is the potential for increased costs related to Section 404 permitting.
- The connection of an interstate rest area to the local street network may create regulatory concerns with Federal Highway Administration and maintenance concerns for SDDOT.

Based on these issues, a new interchange is not recommended at this time.

Figure 3.5a
I-90 Exit 264
Interchange Concept

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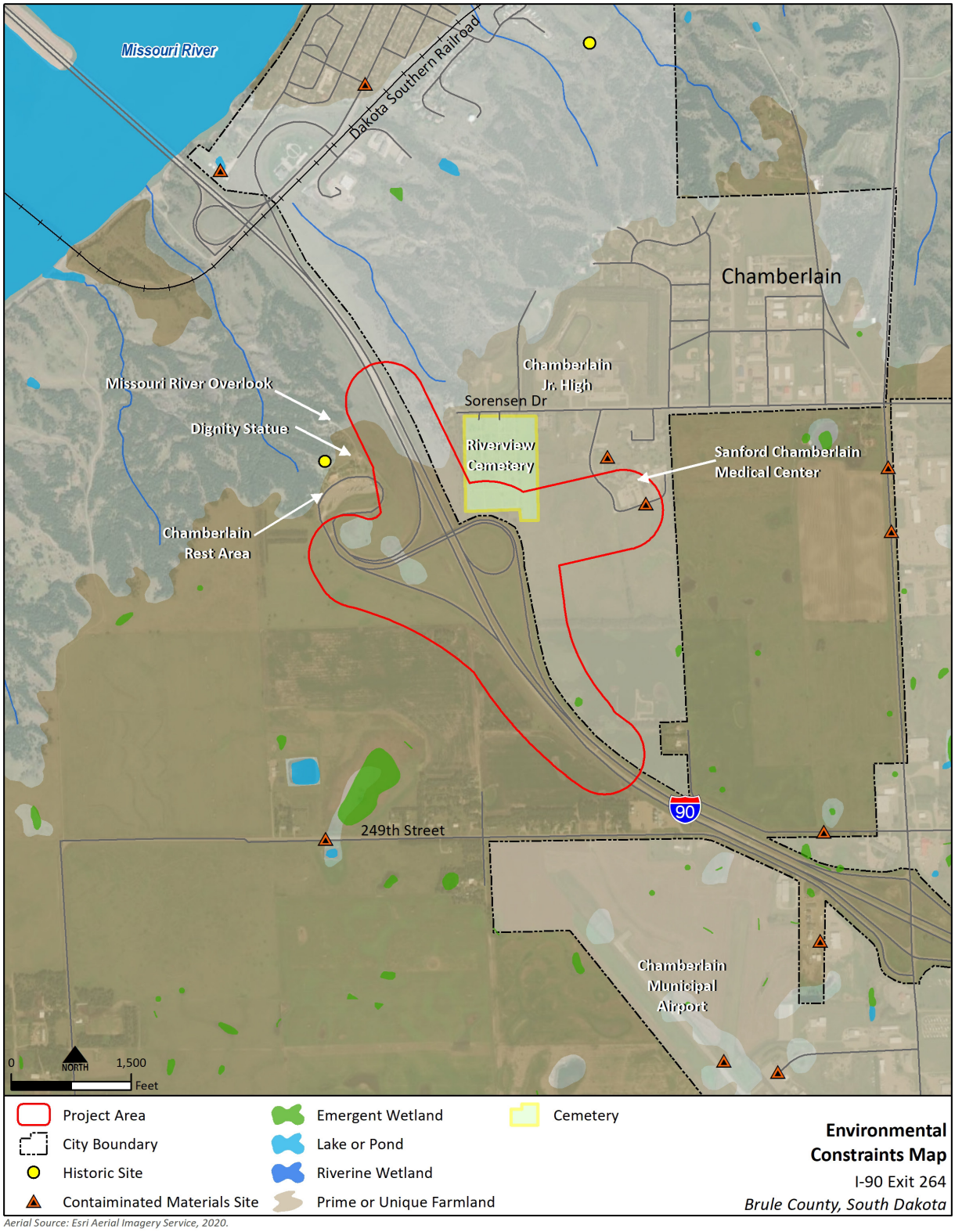
CONCEPTUAL

Figure 3.5b I-90 Exit 264 Environmental Constraints Map



Aerial Source: Esri Aerial Imagery Service, 2020.

Table 3.5a I-90 Exit 264 Probable Construction Costs

SOUTH DAKOTA DOT 2020 DECENNIAL INTERSTATE CORRIDOR STUDY

FHU PROJ NO. 118571-01

CONCEPTUAL LEVEL OPINION OF PROBABLE COST

FELSBURG HOLT & ULLEVIG

Alternative: I-90 Exit 264 Option 1

Prepared By: A. Orellana Date: 12/3/2020

	ITEM	DESCRIPTION	UNIT	CONTINGENCY	UNIT COST	QUANTITY	COST
1	**110**	Earthwork and Removals (2' Depth)	SY		$ **15**	104,000	$ 1,560,000
2	**110**	Earthwork (Significant Impacts)	CY		$ **10**	220,300	$ 2,203,000
3	**110**	Remove Bridge	EA		$ **25,000**	1	$ 25,000
4	**380**	Surfacing (Interstate & Ramps)	SY		$ **75**	52,000	$ 3,900,000
		SUBTOTAL (A)					$ **7,688,000**
5	**530**	Structures - Bridge	SF		$ **200**	21,100	$ 4,220,000
6	**450**	Drainage - New	% of (A)	**8%**	$ -	-	$ 615,040
7	**451**	Utility Relocations	% of (A)	**6%**	$ -	-	$ 461,280
8	**632/633**	Traffic - Signing/Striping	% of (A)	**4%**	$ -	-	$ 307,520
9	**634**	Traffic Control	% of (A)	**6%**	$ -	-	$ 461,280
10	**734**	Erosion Control/Environmental	% of (A)	**6%**	$ -	-	$ 461,280
		SUBTOTAL (B)					$ **6,526,400**
11	**635**	Traffic - Signals (New)	EA		$ **270,000**	0	$ -
12	**997**	Railroad Crossing	EA		$ **250,000**	0	$ -
13	**009**	Mobilization	% of (A)+(B)	**5%**	$ -	-	$ 710,720
14	**100**	Clearing	% of (A)+(B)	**2%**	$ -	-	$ 284,290
15		Contingency	% of (A)+(B)	**30%**	$ -	-	$ 4,264,320
		SUBTOTAL (C)					$ **5,259,330**
		CONSTRUCTION TOTAL (D)	**(A)+(B)+(C)**				$ **19,473,730**
16		Engineering Services	% of (D)	**15%**	$ -		$ 2,921,060
17		ROW Impacts	SF		$ **10**	1,306,800	$ 13,068,000
							$ ***35,462,790***
		PROJECT TOTAL (E)					$ **35,463,000**
		CONSTRUCTION (D) + ROW TOTAL COST					$ **32,600,000**

Note: In providing opinions of probable construction cost, the Client understands that Felsburg Holt & Ullevig has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing. The unit prices and percentages shown above were applied under the direction of the South Dakota Department of Transportation and FHU makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bid or actual costs.

3.6 I-90 Exit 404 – Brandon

This potential interchange is located along the 480th Avenue alignment just west of Brandon, between Exit 402 (Veteran's Parkway) and Exit 406 (Brandon / Corson).

3.6.1 Background

There is no existing I-90 crossing at this location today. The 480th Avenue alignment runs along a section line from just north of I-90 northward through rural areas for several miles, eventually ending at Jasper Road, which provides a connection to Dell Rapids. South of I-90, W Redwood Boulevard parallels the interstate between Veteran's Parkway (Exit 402) and N Splitrock Boulevard (Exit 406). The BNSF railroad and the Big Sioux River also parallel the interstate further south. Due to the east-west rail corridor and the Big Sioux River, there are no north-south streets south of I-90 in the potential interchange area, although the section line is visible in some development patterns.

3.6.2 Interchange Concept

The potential Exit 404 concept would create a standard diamond interchange at the 480th Avenue alignment (approximately MRM 404.5). The diamond would have to be shifted slightly north to avoid placing the southerly ramp terminal in the railroad alignment. The W Redwood Road alignment would be retained, and structures would be built to carry the eastbound exit ramp and the eastbound entrance ramp over the existing roadway. The I-90 overpass would also extend south to carry 480th Avenue across W Redwood Road, and a structure would be required to carry 480th Avenue over the BNSF railroad. The extension of 480th Avenue further south past the Big Sioux River would require a structure over the Big Sioux River, a new crossing of the Ellis & Eastern Railroad, and an eventual connection to W Holly Boulevard approximately 1 mile south of I-90. The new 480th Avenue facility is assumed to be a 2-lane road, without turn lanes at the stop-controlled ramp terminal intersections. It is anticipated to meet W Holly Boulevard at a side-street stop-controlled intersection with no turn lanes. The concept drawing of this improvement option is shown on **Figure 3.6a.**

3.6.3 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.

- A BNSF rail line is in close proximity to the proposed interchange and could be impacted.
- NHD flowlines are mapped in the vicinity of the proposed project and may indicate the presence of channels. Based on aerial imagery, channels appear to be present east and west of

the proposed interchange flowing south to the Big Sioux River. Impacts to any intermittent or perennial channels would be subject to Section 404 permitting.

- NWI wetlands are mapped south of I-90 and along a drainage east of the proposed interchange. Impacts to any jurisdictional wetlands would be subject to Section 404 permitting.
- Special Flood Hazard Areas are located within the project area including Zone A floodplain along the Big Sioux River south of I-90.
- Prime or unique farmland is located adjacent to the proposed interchange. Based on the FPPA, impacts to prime or unique farmland could require coordination with NRCS. However, based on the scope of proposed interchange, the project would be unlikely to exceed the recommended allowable level.
- The Big Sioux River located just south of the proposed interchange is on the 303(d) list of impaired waterbodies.
- Based on data from the EPA facility registry system, there are no known potential contaminated materials sites within the area of the proposed interchange. However, the proposed interchange is in close proximity to a rail line that has the potential for contamination and would require further investigation.
- Based on publicly available records in the NRHP, there are no historic sites in the vicinity of the proposed interchange.
- Threatened and endangered species that may be present in Minnehaha County include Topeka Shiner, Lined Snake, Northern River Otter, and Western Prairie Fringed Orchid. However, other species may be present, including Northern Long-Eared Bat and Rufa Red Knot. Coordination with the South Dakota Game, Fish & Parks and USFWS is recommended to ensure that the project does not adversely impact any of these species.

These resources are presented on **Figure 3.6b.** The review above highlights the need for potential Section 404 reviews, Section 303(d) concerns, hazardous materials concerns at railroad crossings, and potential mitigations based on several factors. Potential mitigations could result in cost implications for the new interchange.

3.6.4 Opinion of Probable Cost

The conceptual improvements identified above are anticipated to cost approximately $29.4 million. Significant cost items include right-of-way, multiple new structures, grading for the ramps and the W Holly Blvd connection, and paving of the new ramps and roadways. A detailed cost estimate for this concept is included in **Table 3.6a**.

3.6.5 Do-Nothing Scenario

If the new interchange is not constructed, eastern Sioux Falls and western Brandon residents and businesses would continue to access I-90 via Exit 402 (Veteran's Parkway) and Exit 406 (N Splitrock Boulevard). W Redwood Boulevard connects these facilities along the south side of I-90, but users cannot travel at interstate speeds along this roadway as there are several unimproved segments. Redwood Boulevard does not connect to development north of I-90 near MRM 404 as there is no interstate crossing. It connects to a few agricultural land uses along the south side of I-90, and it serves as their only access as there are no crossings of the Big Sioux River or the BNSF railroad. North of I-90, 259th Street connects Timberline Avenue (478th Avenue) to N Splitrock Boulevard (482nd Avenue). As noted above, 480th Avenue extends south to the northerly edge of the I-90 alignment. Both 259th Street and 480th Avenue are 2-lane rural roadways that service limited agricultural uses. Given the limited development surrounding the potential interchange, there would be limited changes in travel times or VMT. Further, development south of I-90 in this area would be limited by the railroad and the river floodplain.

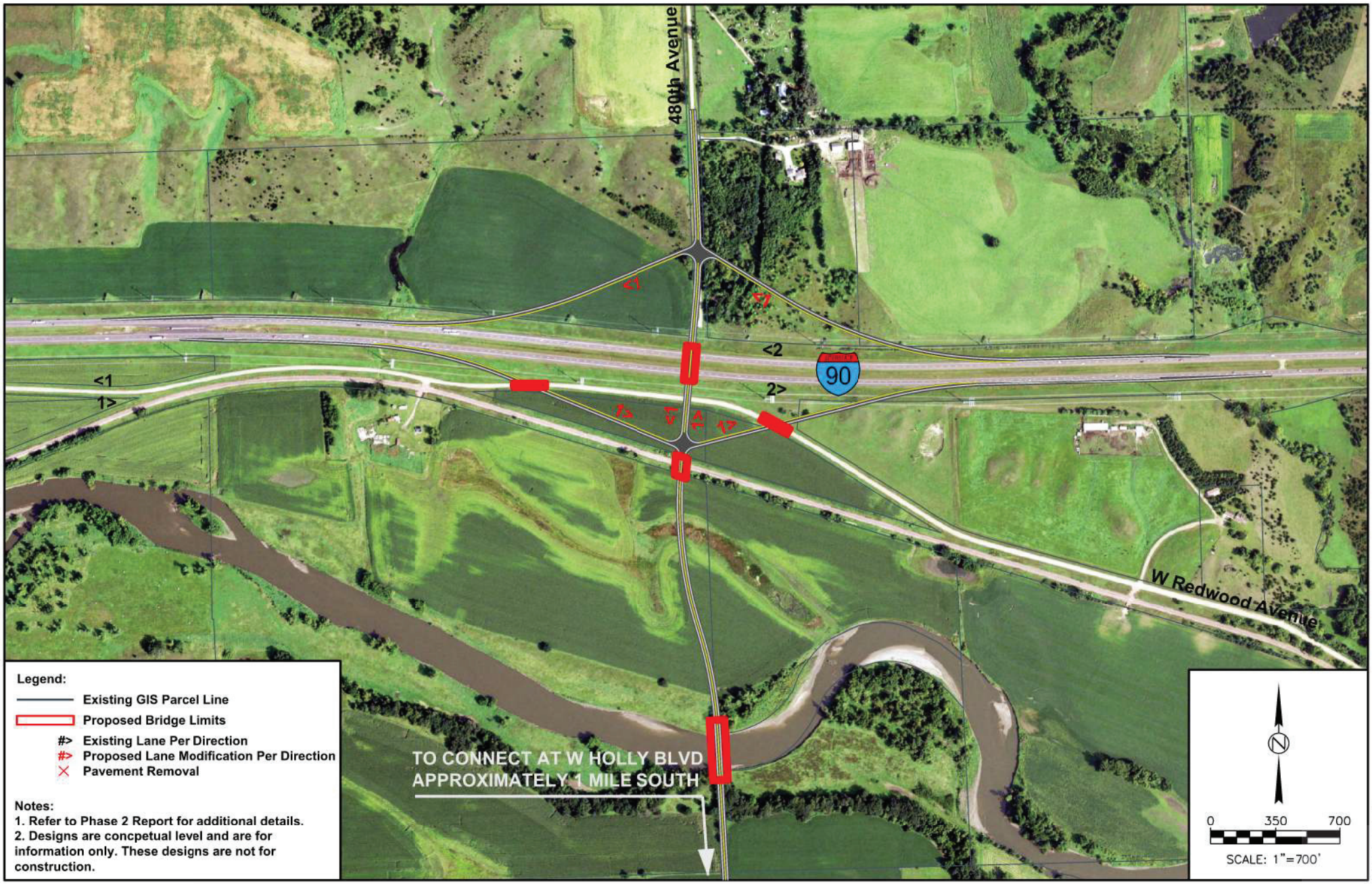
The new interchange is not expected to relieve congestion at Exit 402 or Exit 406, as connectivity to the south (where most of the current population lives and works) would be limited without significant additional investment to provide river and railroad crossings. In conclusion, the new Exit 404 interchange would serve only limited future development and would not affect congestion when compared to No-Action conditions.

3.6.6 Recommendation

The evaluation of a potential new I-90 Exit 404 interchange has identified several key issues:

- The Big Sioux River floodplain forces new roadways to be on fill or on structures; roadways cannot be lowered to go under other features.
- Two railroad crossings would be required along 480th Avenue. It is likely that new at grade crossings will not be allowed, increasing the need for structures.
- There are no feasible realignment options for W Redwood Avenue without at grade railroad crossings.
- Since 480th Avenue has to go over I-90 due to floodplain concerns, it may not be possible to maintain vertical clearance under the existing high tension powerlines north of I-90. Potential power pole relocations could result in cost implications for the new interchange.
- There is the potential for increased costs related to Section 404 permitting and Section 303(d) concerns.

Based on these issues, a new interchange is not recommended at this time.

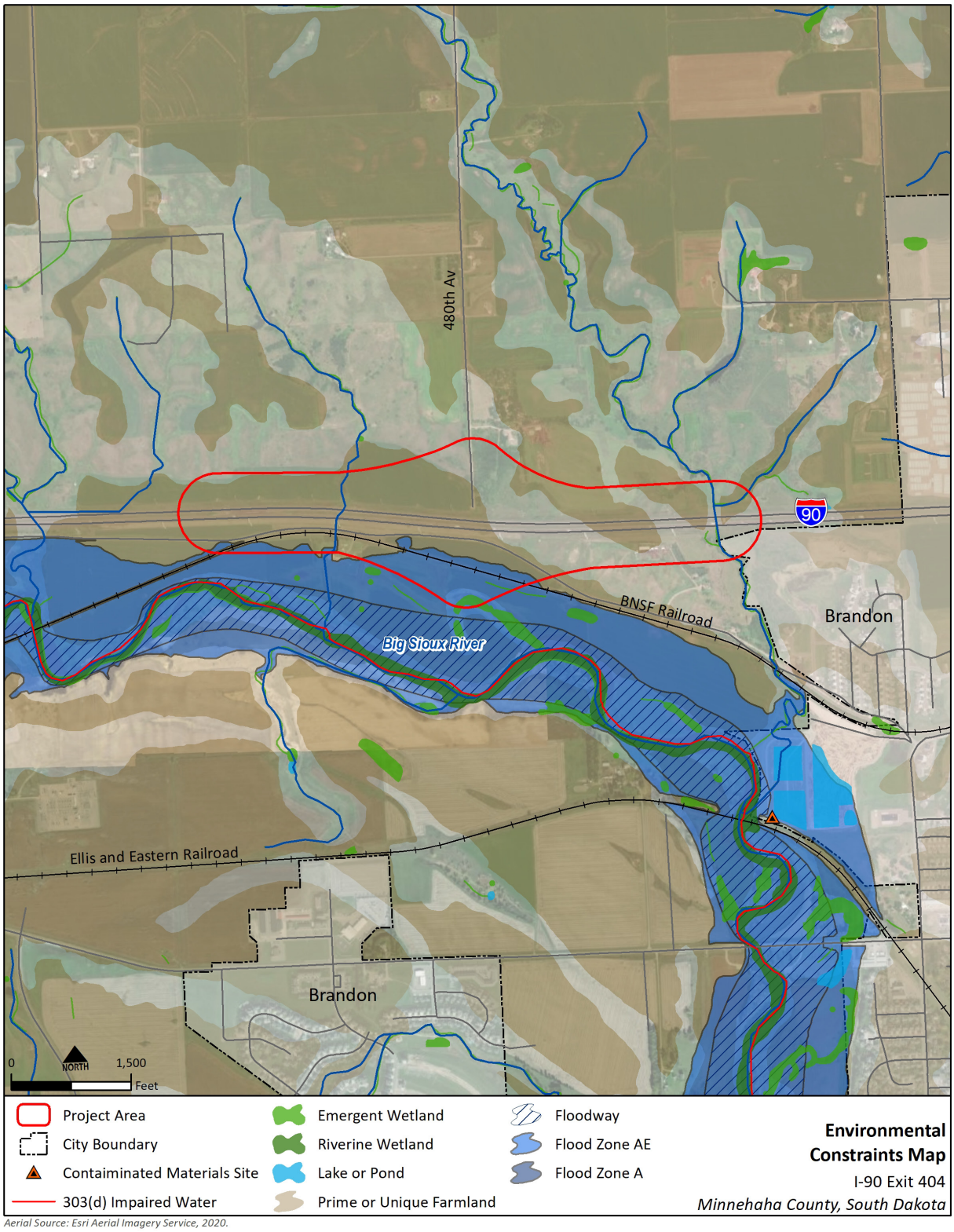


FELSBURG HOLT & ULLEVIG

CONCEPTUAL

Figure 3.6a
I-90 Exit 404
Interchange Concept

Figure 3.6b I-90 Exit 404 Environmental Constraints Map



Aerial Source: Esri Aerial Imagery Service, 2020.

Table 3.6a I-90 Exit 404 Probable Construction Costs

SOUTH DAKOTA DOT 2020 DECENNIAL INTERSTATE CORRIDOR STUDY

FHU PROJ NO. 118571-01

CONCEPTUAL LEVEL OPINION OF PROBABLE COST

FELSBURG HOLT & ULLEVIG

Alternative: I-90 Exit 404 Option 1

Prepared By: A. Orellana Date: 12/3/2020

	ITEM	DESCRIPTION	UNIT	CONTINGENCY	UNIT COST	QUANTITY	COST
1	**110**	Earthwork and Removals (2' Depth)	SY		$ **15**	73,800	$ 1,107,000
2	**110**	Earthwork (Significant Impacts)	CY		$ **10**	172,600	$ 1,726,000
3	**110**	Remove Bridge	EA		$ **25,000**	0	$ -
4	**380**	Surfacing (Interstate & Ramps)	SY		$ **75**	59,000	$ 4,425,000
		SUBTOTAL (A)					$ **7,258,000**
5	**530**	Structures - Bridge	SF		$ **200**	26,000	$ 5,200,000
6	**450**	Drainage - New	% of (A)	**8%**	$ -	-	$ 580,640
7	**451**	Utility Relocations	% of (A)	**20%**	$ -	-	$ 1,451,600
8	**632/633**	Traffic - Signing/Striping	% of (A)	**4%**	$ -	-	$ 290,320
9	**634**	Traffic Control	% of (A)	**6%**	$ -	-	$ 435,480
10	**734**	Erosion Control/Environmental	% of (A)	**6%**	$ -	-	$ 435,480
		SUBTOTAL (B)					$ **8,393,520**
11	**635**	Traffic - Signals (New)	EA		$ **270,000**	0	$ -
12	**997**	Railroad Crossing	EA		$ **250,000**	0	$ -
13	**009**	Mobilization	% of (A)+(B)	**5%**	$ -	-	$ 782,580
14	**100**	Clearing	% of (A)+(B)	**2%**	$ -	-	$ 313,040
15		Contingency	% of (A)+(B)	**30%**	$ -	-	$ 4,695,460
		SUBTOTAL (C)					$ **5,791,080**
		CONSTRUCTION TOTAL (D)	**(A)+(B)+(C)**				$ **21,442,600**
16		Engineering Services	% of (D)	**15%**	$ -		$ 3,216,390
17		ROW Impacts	SF		$ **10**	788,000	$ 7,880,000
							$ ***32,538,990***
		PROJECT TOTAL (E)					$ **32,539,000**
		CONSTRUCTION (D) + ROW TOTAL COST					$ **29,400,000**

Note: In providing opinions of probable construction cost, the Client understands that Felsburg Holt & Ullevig has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing. The unit prices and percentages shown above were applied under the direction of the South Dakota Department of Transportation and FHU makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bid or actual costs.

3.7 I-90 Exit 408 – Brandon

This potential interchange is located at the 484th Avenue overpass just east of Brandon, between Exit 406 (Brandon / Corson) and Exit 410 (Valley Springs / Garretson).

3.7.1 Background

A rural 2-lane roadway, 484th Avenue crosses over I-90 at approximately MRM 408.5. The existing structure over I-90 is rated fair and has a sufficiency rating over 95. 484th Avenue serves rural land uses both north and south of I-90. It intersects 260th Street about 0.5 mile north of the interstate and 261st Street about 0.5 mile south of I-90, both of which are similar rural 2-lane roads. 260th Street provides a connection to Corson to the west, and 261st Street provides a connection to Brandon to the west.

3.7.2 Interchange Concept

The potential Exit 408 concept creates a standard diamond interchange at the 484th Avenue overpass (approximately MRM 408.5). Several local driveways would have to be relocated to maintain appropriate access spacing along 484th Avenue, but no public roadway intersection would require changes. The 484th Avenue crossroad is assumed to remain a 2-lane road, without turn lanes at the stop-controlled ramp terminal intersections. The concept drawing of this improvement option is shown on **Figure 3.7a**.

3.7.3 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.

- NHD flowlines are mapped in the vicinity of the proposed project and may indicate the presence of channels. Based on aerial imagery, a channel appears to be present east of the proposed interchange flowing southwest to Split Rock Creek. Impacts to any intermittent or perennial channels would be subject to Section 404 permitting.
- NWI wetlands are mapped in the vicinity of the proposed interchange, including near a farmstead northwest of the proposed interchange, in the I-90 ditch southeast of the proposed interchange, and along the unnamed tributary to Split Rock Creek. Based on aerial imagery, wetland vegetation appears to be present in all these areas and the proposed interchange could have considerable impacts to them. Impacts to any jurisdictional wetlands would be subject to Section 404 permitting.
- Prime or unique farmland is located adjacent to the proposed interchange. Based on the FPPA, impacts to prime or unique farmland could require coordination with NRCS. However, based

on the scope of proposed interchange, the project would be unlikely to exceed the recommended allowable level.

- Based on data from the EPA facility registry system, there are no known potential contaminated materials sites within the area of the proposed interchange.
- There do not appear to be any recreational facilities in close proximity to the proposed interchange.
- Based on publicly available records in the NRHP, there are no historic sites in the vicinity of the proposed interchange.
- Threatened and endangered species that may be present in Minnehaha County include Topeka Shiner, Lined Snake, Northern River Otter, and Western Prairie Fringed Orchid. However, other species may be present, including Northern Long-Eared Bat and Rufa Red Knot. Coordination with the South Dakota Game, Fish & Parks and USFWS is recommended to ensure the project does not adversely impact any of these species.

These resources are presented on **Figure 3.7b.** The review above highlights the need for potential Section 404 reviews and potential mitigations based on several factors. Potential mitigations could result in cost implications for the new interchange.

3.7.4 Opinion of Probable Cost

The conceptual improvements identified above are anticipated to cost approximately $22.6 million. Significant cost items include right-of-way, the new structure over I-90, grading for the ramps, and paving of the new ramps and relocated roadways. A detailed cost estimate for this concept is included in **Table 3.7a**.

3.7.5 Do-Nothing Scenario

If the new interchange is not constructed, eastern Brandon residents and businesses would continue to access I-90 via Exit 406 (N Splitrock Boulevard) and Exit 410 (486th Avenue). 260th Street connects these facilities along the north side of I-90, but users cannot travel at interstate speeds along this roadway as there are several unimproved segments. Similarly, 261st Street connects these facilities along the south side of I-90, but users cannot travel at interstate speeds as there are several unimproved segments. 486th Avenue, 260th Street, and 261st Street are 2-lane rural roadways that provide access to agricultural parcels in this area. Given the limited development surrounding the potential interchange, there would be limited changes in travel times or VMT.

The new interchange is not expected to relieve congestion at Exit 406 or Exit 410, as connectivity would be limited without significant additional investment to provide paved east-west roadways for local access. In conclusion, the new Exit 408 interchange would serve only limited future development and would not affect congestion when compared to no action conditions.

3.7.6 Recommendation

The evaluation of a potential new I-90 Exit 408 interchange has identified several key issues:

- This interchange is not anticipated to provide access for significant new trips.
- There is the potential for increased costs related to Section 404 permitting concerns.

Based on these issues, a new interchange is not recommended at this time.

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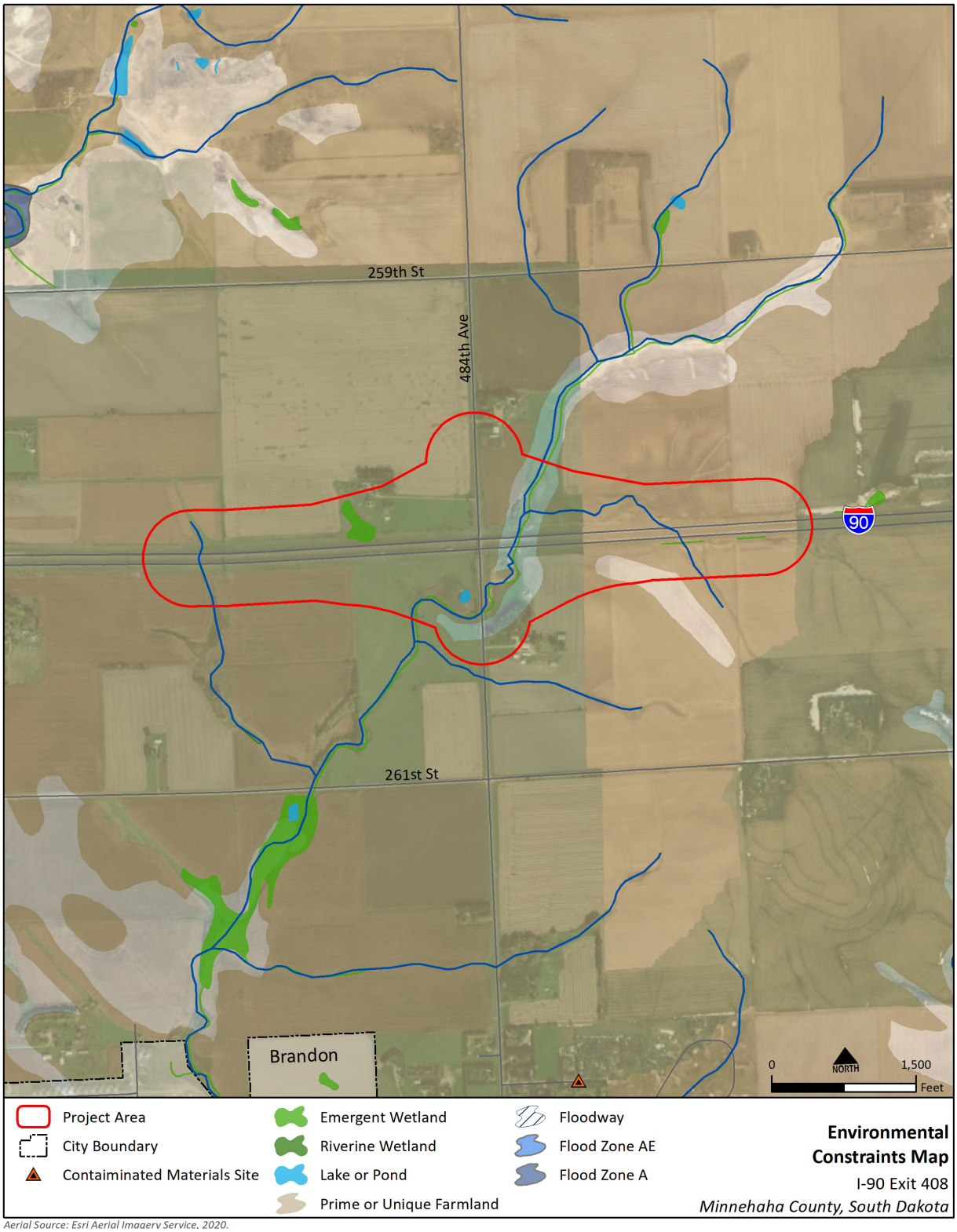
CONCEPTUAL

Figure 3.7a
I-90 Exit 408
Interchange Concept

Figure 3.7b I-90 Exit 408 Environmental Constraints Map



Aerial Source: Esri Aerial Imagery Service, 2020.

Table 3.7a I-90 Exit 408 Probable Construction Costs

SOUTH DAKOTA DOT 2020 DECENNIAL INTERSTATE CORRIDOR STUDY

FHU PROJ NO. 118571-01

CONCEPTUAL LEVEL OPINION OF PROBABLE COST

FELSBURG HOLT & ULLEVIG

Alternative: I-90 Exit 408 Option 1

Prepared By: A. Orellana Date: 12/3/2020

	ITEM	DESCRIPTION	UNIT	CONTINGENCY	UNIT COST	QUANTITY	COST
1	**110**	Earthwork and Removals (2' Depth)	SY		$ **15**	50,000	$ 750,000
2	**110**	Earthwork (Significant Impacts)	CY		$ **10**	149,500	$ 1,495,000
3	**110**	Remove Bridge	EA		$ **25,000**	0	$ -
4	**380**	Surfacing (Interstate & Ramps)	SY		$ **75**	40,000	$ 3,000,000
		SUBTOTAL (A)					$ **5,245,000**
5	**530**	Structures - Bridge	SF		$ **200**	9,500	$ 1,900,000
6	**450**	Drainage - New	% of (A)	**8%**	$ -	-	$ 419,600
7	**451**	Utility Relocations	% of (A)	**20%**	$ -	-	$ 1,049,000
8	**632/633**	Traffic - Signing/Striping	% of (A)	**4%**	$ -	-	$ 209,800
9	**634**	Traffic Control	% of (A)	**6%**	$ -	-	$ 314,700
10	**734**	Erosion Control/Environmental	% of (A)	**6%**	$ -	-	$ 314,700
		SUBTOTAL (B)					$ **4,207,800**
11	**635**	Traffic - Signals (New)	EA		$ **270,000**	0	$ -
12	**997**	Railroad Crossing	EA		$ **250,000**	0	$ -
13	**009**	Mobilization	% of (A)+(B)	**5%**	$ -	-	$ 472,640
14	**100**	Clearing	% of (A)+(B)	**2%**	$ -	-	$ 189,060
15		Contingency	% of (A)+(B)	**30%**	$ -	-	$ 2,835,840
		SUBTOTAL (C)					$ **3,497,540**
		CONSTRUCTION TOTAL (D)	**(A)+(B)+(C)**				$ **12,950,340**
16		Engineering Services	% of (D)	**15%**	$ -		$ 1,942,560
17		ROW Impacts	SF		$ **10**	957,600	$ 9,576,000
							$ ***24,468,900***
		PROJECT TOTAL (E)					$ **24,469,000**
		CONSTRUCTION (D) + ROW TOTAL COST					$ **22,600,000**

Note: In providing opinions of probable construction cost, the Client understands that Felsburg Holt & Ullevig has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing. The unit prices and percentages shown above were applied under the direction of the South Dakota Department of Transportation and FHU makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bid or actual costs.

South Dakota DOT

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