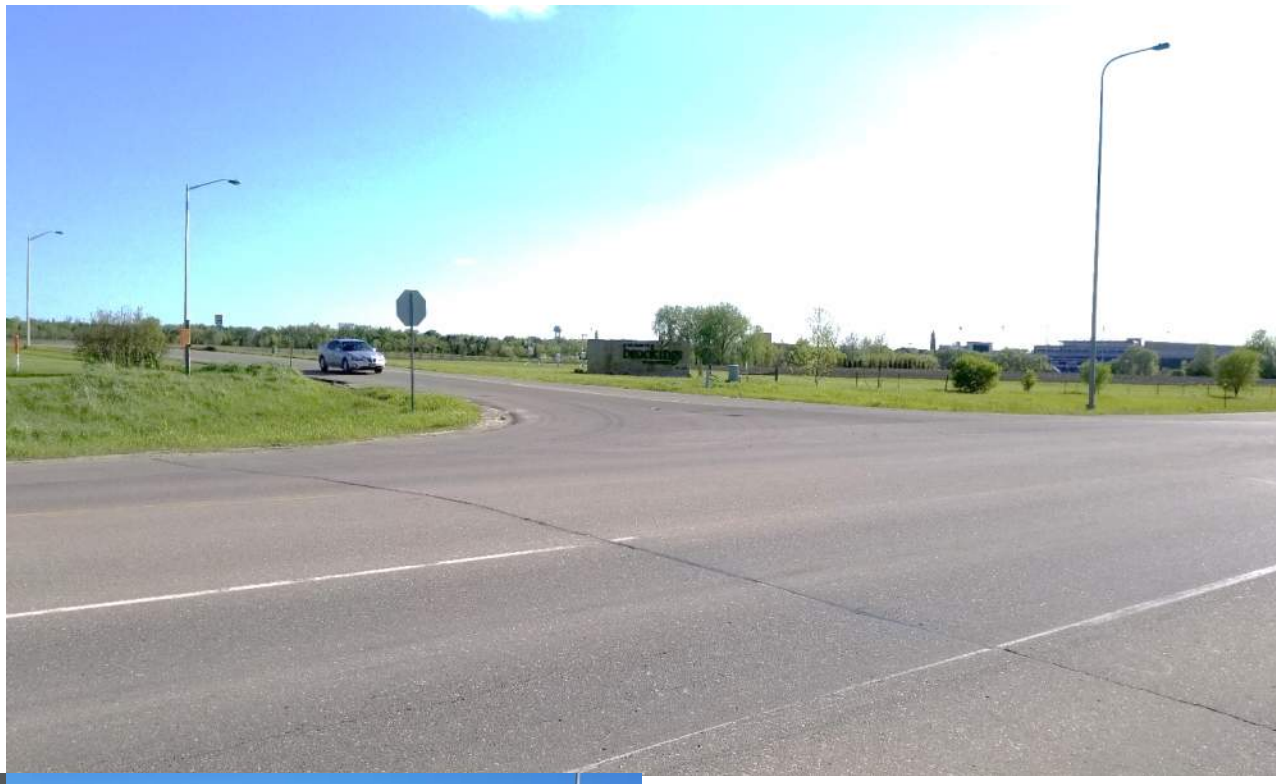

US14 – US14 Bypass Corridor Study Technical Report

Brookings County, South Dakota

November 20, 2020

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

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1. Executive Summary

In 2019, the South Dakota Department of Transportation (SDDOT) initiated a study with the City of Volga, City of Brookings, and Federal Highway Administration to develop a long-range plan for over 20 miles of the US Highway 14 – US Highway 14 Bypass (US14-US14 Bypass) corridor. The study limits entail the following:

- **US14** from the US81 intersection south of Arlington to the US14/US14 Bypass intersection west of Brookings.
- **US14 Bypass** from US14 west of Brookings to US14 east of Brookings.

The primary impetus for the study was to identify capacity improvements at the US14 Bypass/22nd Avenue intersection as part of a planned intersection project. To align the intersection project with the long-range vision of the corridor, future needs and potential improvements were identified throughout the US14 Bypass and US14 to the west.

The study process encompassed four primary steps, each with study advisory team (SAT), stakeholder, and public involvement to help guide the study and provide feedback at key milestones:

Step 1: Identify Transportation Issues and Needs

- Public/stakeholder meetings #1 – gather feedback on issues and needs

Step 2: Develop Concepts

- SAT workshop #1 – concept brainstorming
- Public/stakeholder meetings #2 – present concepts for feedback

Step 3: Develop Feasible Solutions for Potential Projects

- SAT workshop #2 – corridor scenario development
- Public meeting #3 – present corridor scenarios for feedback

Step 4: Develop Recommendations

- Recommendation development based on SAT, public and stakeholder feedback from the previous steps.

This report documents the four-step process to support long-range corridor recommendations contained herein. The following presents a summary of short-term, development driven, and long-range recommended capital improvements, generalized timeline, and planning-level costs as identified by this corridor study. Overarching US14 Bypass reconstruction projects are noted with **Bold Blue** in the tables and shown graphically in **Figure ES-1.**

Table ES-1: Recommendations and Planning Timelines (to Year 2040)

Planning Timeline	Improvement	Corridor Segment	Long-Range Segment Scenario	Construction & ROW Cost ($mil)
2024 and earlier	Construct warranted turn lanes at 458th Ave and 459th Ave intersections	US14 West of Volga	Scenario B	$0.5*
	Reconstruct US14/US81 intersection	US14 West of Volga	Scenario B	$8.3**
	Reconstruct 22nd Ave intersection	**US14 Bypass – US14 (west) to I-29**	**Scenario B**	**$3.5**
2025 – 2030	Construct US14 passing lanes	US14 West of Volga	Scenario B	$6.0
	Construct Caspian Ave NB RT lane	US14 in Volga	Scenario B	$0.5
	Construct Hansina Ave traffic signal (if warranted) and EB RT lane	US14 in Volga	Scenario B	< $0.5
	Construct 466th Ave WB RT lane	US14 Volga to Brookings	Scenario A	< $0.5
	Construct Western Ave traffic signal (if warranted) and NB RT lane	US14 Bypass – US14 (west) to I-29	Scenario B	< $0.5
2030 – 2035	**Reconstruct US14 Bypass from US14 (west) to 34th Ave** *Priorities:* *1. 22nd Ave intersection* *2a. Medary Ave to 22nd Ave* *2b. I-29 interchange* *3. US14 (west) to Medary Ave* *4. 32nd Ave to 24th Ave*	**US14 Bypass – US14 (west) to I-29** **I-29 interchange** **I-29 to US14 (east)**	**Scenario B** **Scenario C** **Scenario B**	**$24.5***** **$10.0** **$2.5**
2030 – 2040	Reconstruct Samara Ave intersection (consider with potential US14 passing lanes)	US14 in Volga	Scenario B	$2.0
	Reconstruct US14/US14 Bypass (west) at-grade intersection	**US14/US14 Bypass (west)**	**Scenario C-ii**	**$8.0**

* Programmed as part of 2021-2024 STIP project PCN 06K2.
** Programmed as part of 2021-2024 STIP project PCN 05HU, which includes US14/US81 intersection reconstruction.
*** Includes 22nd Avenue intersection reconstruction costs.

Table ES-2: Recommendations and Planning Timelines (Development Driven Projects)

Planning Timeline	Improvement	Corridor Segment	Long-Range Segment Scenario	Construction & ROW Cost ($mil)
Dependent on timeline of future projects and/or development.	Reconstruct north leg of Caspian Ave	US14 in Volga	Scenario B	$0.5
	Samara Ave rearage road	US14 in Volga	Scenario B, rearage road option	< $0.5
	Construct 469th Ave rearage road	US14/US14 Bypass (west)	Scenario C-ii, rearage option	$0.75
	Signalize 34th Ave intersection when warranted	US14 Bypass – I-29 to US14 (east)	Scenario B	< $0.5
	Realign 211th St/18th St northward	US14 Bypass – I-29 to US14 (east)	Scenario B, 211th St/18th St realignment option	$1.0

Projects identified in this table do not have a specific planning timeline. Future development/redevelopment and coordination with other area projects will dictate timeline.

Table ES-3: Recommendations and Planning Timelines (Long-range, Beyond Year 2040)

Planning Timeline	Improvement	Corridor Segment	Long-Range Segment Scenario	Planning Cost ($mil)
Long range: Beyond 2040	Construct multilane section	US14 West of Volga	Scenario D	$39.5
	Reconstruct US14/US14 Bypass (east) intersection	US14 Bypass – I-29 to US14 (east)	Scenario B, Intersection Option C	$1.0

Additional considerations and recommendations in conjunction with the identified capital improvements involve the following elements as presented in this study:

- ITS recommendations
- Blowing and drifting snow recommendations
- Bicycle and Pedestrian Plan
- Access Plan

US14-US14 Bypass CORRIDOR STUDY

SEGMENT A: US14 West of Volga

Corridor Scenario:
Passing lane Scenario B

CROSS-SECTION:
Maintain existing 2-lane highway with recommended improvements

TIMELINE:

2024 and earlier
- Construct warranted turn lanes at 458th Ave and 459th Ave intersections (2021 STIP project)
- Reconstruct US14/US81 intersection and US14 multilane section (2023 STIP project)

2025–2030
★ Construct Scenario B passing lanes

Beyond 2040 (long-range)
- Reconstruct as Scenario D multilane section

SEGMENT B: US14 in Volga

Corridor Scenario:
Scenario B

CROSS-SECTION:
Maintain existing 5-lane urban section

TIMELINE:

2025 - 2030
- Construct Caspian Ave northbound right turn lane to provide a LT, T, RT configuration
- Construct Hansina Ave traffic signal and eastbound right turn lane (or provide room for eastbound right turn lane)

2030–2040
★ Reconstruct and signalize Samara Ave intersection

SEGMENT C: US14 Volga to Brookings

Corridor Scenario:
Scenario A

CROSS-SECTION:
Maintain existing rural 4-lane divided

TIMELINE:

2025–2030
★ Construct westbound right turn lane at 466th Ave

DETAIL:
- The mainline corridor of US14 between Volga and Brookings is not changing

SEGMENT D: US14/US14 Bypass (West) Intersection

Corridor Scenario:
Intersection Option C-ii

CROSS-SECTION:
- 4-Lane Divided – Suburban
- 4-Lane Divided – Urban section where needed at intersections and constrained ROW

TIMELINE:

2030–2040
★ Reconstruct as at-grade intersection

SEGMENT E: US14 Bypass – US14 (West) to I-29

Corridor Scenario:
Scenario B

CROSS-SECTION:
- 4-Lane Divided – Suburban
- 4-Lane Divided – Urban section where needed at intersections and constrained ROW

TIMELINE:

2024
★ Reconstruct 22nd Ave intersection

2025 – 2030
- Signalize Western Ave when warranted and add northbound right turn lane

2030 – 2035
★ Reconstruct US14 Bypass from US14 (west) to I-29

SEGMENT F: US14 Bypass/ I-29 Interchange

Corridor Scenario:
Scenario C

CROSS-SECTION:
- 4-Lane Divided – Suburban
- 4-Lane Divided – Urban section where needed at intersections and constrained ROW

TIMELINE:

2030–2035
★ Reconstruct interchange in conjunction with US14 Bypass reconstruction project(s)

DETAIL:
- In the interim, signalize ramps and channelize approaches to extend acceptable operations to reconstruction year

SEGMENT G: US14 Bypass – I-29 to US14 (East)

Corridor Scenario:
Scenario B

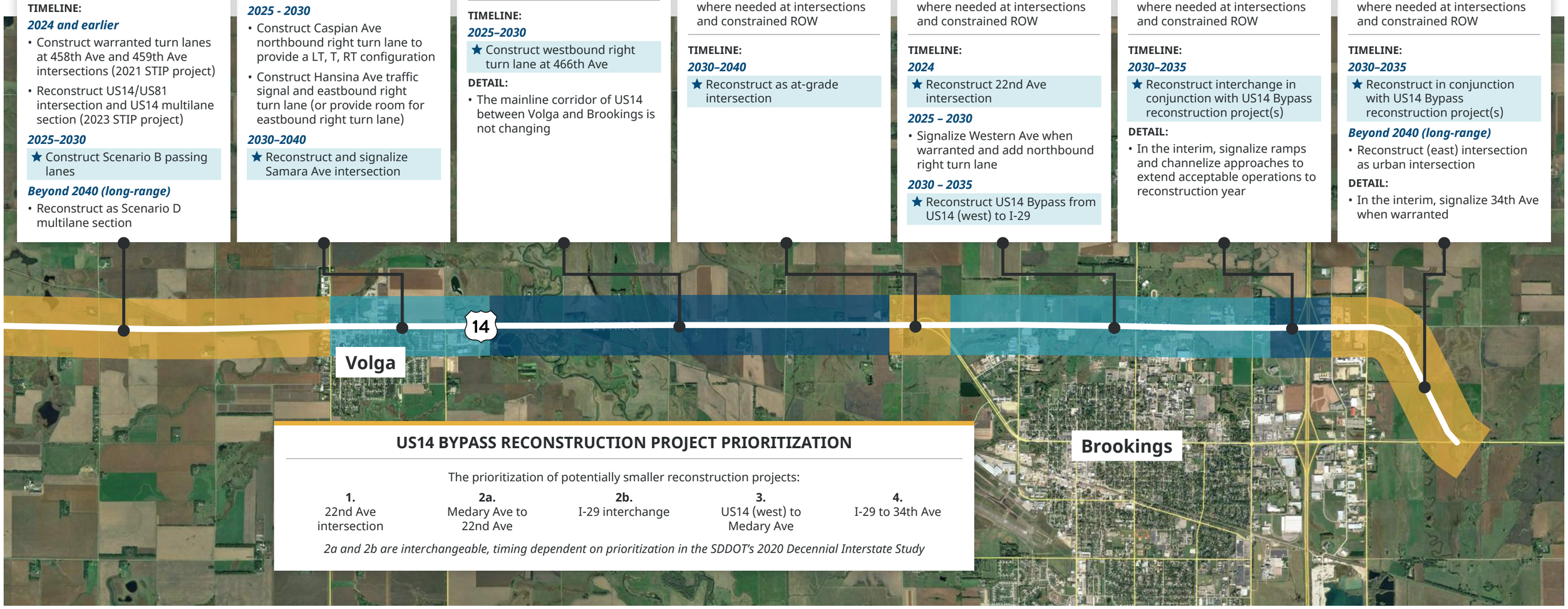
CROSS-SECTION:
- 4-Lane Divided – Suburban
- 4-Lane Divided – Urban section where needed at intersections and constrained ROW

TIMELINE:

2030–2035
★ Reconstruct in conjunction with US14 Bypass reconstruction project(s)

Beyond 2040 (long-range)
- Reconstruct (east) intersection as urban intersection

DETAIL:
- In the interim, signalize 34th Ave when warranted



US14 BYPASS RECONSTRUCTION PROJECT PRIORITIZATION

The prioritization of potentially smaller reconstruction projects:

1.	2a.	2b.	3.	4.
22nd Ave intersection	Medary Ave to 22nd Ave	I-29 interchange	US14 (west) to Medary Ave	I-29 to 34th Ave

2a and 2b are interchangeable, timing dependent on prioritization in the SDDOT's 2020 Decennial Interstate Study

★ Key project(s) within each segment

US14-US14 BYPASS LONG-RANGE PLAN SUMMARY

FIGURE ES-1, PAGE 1

2. Introduction

2.1. Background and Study Area

In 2019, the South Dakota Department of Transportation (SDDOT) initiated a study with the City of Volga, City of Brookings, and Federal Highway Administration to develop a long-range plan for over 20 miles of the US Highway 14 – US Highway 14 Bypass (US14-US14 Bypass) corridor. The study limits entail the following (**Figure 1**):

- **US14** from the US81 intersection south of Arlington to the US14/US14 Bypass intersection west of Brookings.
- **US14 Bypass** from US14 west of Brookings to US14 east of Brookings.

When first constructed in the late 1960's, the primary purpose of the US14 Bypass was to provide a truck bypass route around Brookings as part of a more regional I-29 to Huron corridor. The City of Brookings continues to grow northward and densify, with several large employers building and/or expanding in the corridor area. This has led to increased local traffic on the US14 Bypass and over time, traffic patterns and trip purpose have become more diverse. The corridor is expected to continue to evolve with the City of Brookings' planned growth north of the US14 Bypass corridor over the next several decades.

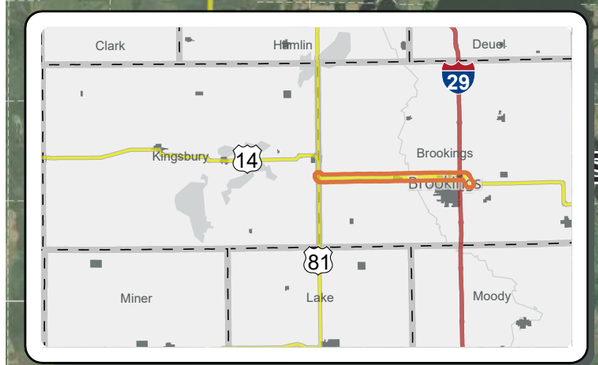
Increasing traffic volumes and evolving traffic patterns throughout US14-US14 Bypass corridor have created multimodal operational and safety challenges that the SDDOT would like to address through the development of a long-range corridor plan. These challenges are most apparent at the US14 Bypass/22nd Avenue intersection, which was the impetus for the overall corridor study. Similar transportation needs are anticipated to emerge throughout the corridor as volumes continue to grow and it will be important to understand the relationship of needs and potential future projects.

The overarching goal of this report is to present a corridor-wide long-range plan for future projects that address anticipated transportation needs through the 2050 Planning Horizon. The purpose of this report is to document the process, beginning with concept development through feasible scenario refinement, analysis, evaluation, and public involvement to support recommendations. Recommendations from this corridor study will aid the SDDOT in planning for future projects throughout the corridor.

2.2. Study Methods and Assumptions

A methods and assumptions (M&A) document was prepared at the onset of this study to serve as a historical record of study process, analysis methodology, dates, and decisions made by the study team representatives for the corridor study. The most recent version of the M&A document is provided in **Appendix A**.

205 ST
206 ST
207 ST
208 ST
209 ST
210 ST
211 ST
212 ST
213 ST
214 ST
215 ST
216 ST
453 AVE
460 AVE
456 AVE
458 AVE
462 AVE
464 AVE
466 AVE
468 AVE
470 AVE
472 AVE
474 AVE
455 AVE
459 AVE
461 AVE
461B AVE
463 AVE
465 AVE
467 AVE
469 AVE
471 AVE
473 AVE
475 AVE
MEDARY AVE
22ND AVE
34TH AVE
6TH ST
81
14
14B
29
324
Arlington
Volga
Brookings
South Dakota State University
Sinai



0 2 Miles

Study Area

STUDY AREA

Figure 1, Page 1

US14 - US14 BYPASS CORRIDOR STUDY

\\SXF-SRV01\ENG\GIS\PROJECTS\SDDOT\US14_CORRIDORSTDY\MAP_DOCS\DRAFT\US14.APRX DATE: 12/7/2020

2.3. Prior Studies and Planning

The following historical planning documents were referenced to support efforts completed to date and regional transportation goals throughout the corridor's various jurisdictions.

- *Brookings Area Master Transportation Plan* (2011)
- *Brookings County Master Transportation Plan* (2013)
- *Brookings, South Dakota Comprehensive Plan 2040* (2018)
- *Brookings Bicycle Master Plan* (2017)
- *2010 Decennial Interstate Corridor Study* (2010)
- *Brookings County Comprehensive Land Use Plan* (2016)
- *2017-2022 City of Volga Strategic Plan* (2017)

3. Study Process

This study used the following four-step process to develop long-range planning recommendations. Study Advisory Team (SAT), public, and stakeholder involvement were all instrumental in a process that included two SAT workshops and three sets of stakeholder and public meetings. A summary of the four steps and relationship to chapters in this report, is provided in **Table 1**.

Table 1: Study Process

Step	Components	Applicable Chapters
1	**Identify Transportation Issues and Needs** • Data collection • Analysis of existing and future No Build conditions • Begin environmental review of corridor • Public/stakeholder meetings #1 – gather feedback on issues and needs	Chapters 4 - 10
2	**Develop Concepts** • SAT workshop #1 – concept brainstorming • Develop, analyze, and refine concepts • Public/stakeholder meetings #2 – present concepts for feedback	Chapter 11
3	**Develop Feasible Solutions for Potential Projects** • SAT workshop #2 – corridor scenario development • Develop, analyze, and refine corridor scenarios • Develop supporting corridor plans • Public meeting #3 – present corridor scenarios for feedback	Chapters 12 - 24
4	**Develop Recommendations** • Identify future project recommendations and timelines for implementation • Develop corridor study report • Develop environmental overview report	Chapters 12 - 25

4. Existing Conditions

4.1. Existing Road Conditions and Structures

Existing roadway segment, intersection, and structure information is shown in **Figure 2**.

4.2. Existing Access

The SDDOT has established access classification criteria, shown in **Table 2**, to help guide access management along state highway corridors. Current SDDOT access classification varies throughout the study corridor and is summarized in **Figure 2**. These criteria were used throughout the study to identify access management needs and potential improvements.

Table 2: SDDOT Access Classification Criteria

Access Classification	Signal Spacing Distance (mile)	Median Opening Spacing (mile)	Minimum Unsignalized Access Spacing (feet)	Access Density	Denial of Direct Access When Other Available
Interstate	N/A	N/A	N/A	N/A	Yes
Expressway	1/2	1/2 F, 1/2 D	2640	at half-mile increments	Yes
Free Flow Urban	1/2	1/2 F, 1/4 D	1320	at quarter-mile increments	Yes
Intermediate Urban	1/2	1/2 F, 1/4 D	660	1 access/block face, right in/right out preferred	Yes
Urban Developed	1/4	1/4	100	2 accesses/block face	Yes
Urban Fringe	1/4	1/4	1000	5 accesses/side/mile	Yes
Rural	N/A	N/A	1000	5 accesses/side/mile	Yes

Notes:

1. Access to the Interstate system is governed by SDDOT interchange policy. No access shall be provided on non-interstate routes within the following distance of interstate ramp terminals: 1/8 mile directional access, 1/4 mile full access
2. N/A = Not Applicable, F = Full Movement – all turns and through movements provided, D = Directional Only – certain turning and through movements not provided.
3. SDDOT may defer to stricter local standards.
4. SDDOT will seek opportunities to reduce access density wherever possible.
5. Rural class minimum unsignalized access spacing may be reduced to 660' by the Area Engineer, based on results of an engineering study as described in 70:09:01:02
6. Unsignalized access spacing also is subject to corner clearance analysis.

Source: Figure 17-4, SDDOT Road Design Manual (access 9/15/2020)

US14: 4-lane Divided
SDDOT Access Classification: Rural
Posted Speed: 65 mph

Surface Width: varies 24'
Inside Shoulder: 3'
Outside Shoulder: Varies 6'-8'
Depressed Turf Median Width: 64'
ROW Width: 285'-305'

Long Combination Vehicle (LCV) Route

US14: 2-lane West of Volga
SDDOT Access Classification: Rural
Posted Speed: 65 mph

Surface Width: 24'
Inside Shoulder: -
Outside Shoulder: 8'
Depressed Turf Median Width: -
ROW Width: 249'

Long Combination Vehicle (LCV) Route

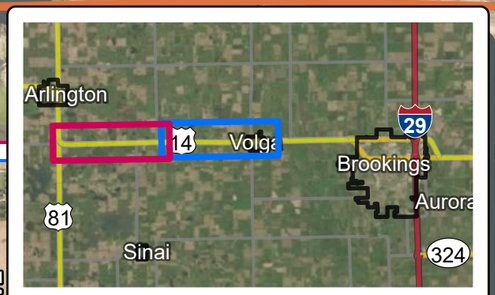
0 2,000 Ft

N

403
456 AVE
457 AVE
459 AVE
211 ST
81
404
405
406
407
408
DAHL WPA RD
458 AVE

Legend
- Study Area
- MRM
- Bridge Structure

Functional Classifications
- Rural Principal Arterial Segment
- Urban Principal Arterial Segment
- Rural Minor Arterial
- Urban Minor Arterial



210 ST

US14: 2-lane West of Volga
SDDOT Access Classification: Rural
Posted Speed: 65 mph

Surface Width: 24'
Inside Shoulder: -
Outside Shoulder: 8'
Depressed Turf Median Width: -
ROW Width: 249'

Long Combination Vehicle (LCV) Route

US14: 5-lane in Volga
SDDOT Access Classification: Urban Developed
Posted Speed: 35-50 mph

Surface Width: varies 60'
Inside Shoulder: -
Outside Shoulder: 2' (cg) / 8' (rural)
Depressed Turf Median Width: -
ROW Width: 100'-249'

Long Combination Vehicle (LCV) Route

460 AVE
462 AVE
463 AVE
464 AVE
465 AVE
Rapid City, Pierre & Eastern RR
409
410
411
412
413
414
461 AVE
211A ST
SAMARA AVE
KASAN AVE
HANSINA AVE
CASPIAN AVE
Volga

N

0 2,000 Ft

Note:
Roadway geometrics often vary within an individual segment.
Noted dimensions represent a typical value.

EXISTING ROAD AND STRUCTURE CONDITIONS

Figure 2, Page 1

US14: 5-lane in Volga
SDDOT Access Classification: Urban Developed
Posted Speed: 35-50 mph

Surface Width: varies 60'
Inside Shoulder: -
Outside Shoulder: 2' (cg) / 8' (rural)
Depressed Turf Median Width: -
ROW Width: 100'-249'

Long Combination Vehicle (LCV) Route

US14: 4-lane divided
SDDOT Access Classification: Expressway
Posted Speed: 65 mph

Surface Width: 30'
Inside Shoulder: 4' or 5'
Outside Shoulder: 7' or 8'
Depressed Turf Median Width: 70'
ROW Width: varies 300' typical

Long Combination Vehicle (LCV) Route

0 2,000 Ft

464 AVE
466 AVE
468 AVE
467 AVE
469 AVE
SAMARA AVE
KASAN AVE
HANSINA AVE
CASPIAN AVE
413
414
415
416
417
418
Volga
Brookings

ID: 06116150
Year Built: 2001
Continuous Concrete

ID: 06119150
Year Built: 2001
Continuous Concrete

ID: 06124150
Year Built: 2001
Continuous Concrete

ID: 06126150
Year Built: 2001
Continuous Concrete

ID: 06139150
Year Built: 2001
Continuous Concrete

ID: 06141151
Year Built: 1979
Continuous Concrete

ID: 06154150
Year Built: 1970
Steel Girder Continuous

ID: 06116151
Year Built: 1978
Continuous Concrete

ID: 06119151
Year Built: 1978
Continuous Concrete

ID: 06124151
Year Built: 1978
Continuous Concrete

ID: 06126151
Year Built: 1978
Continuous Concrete

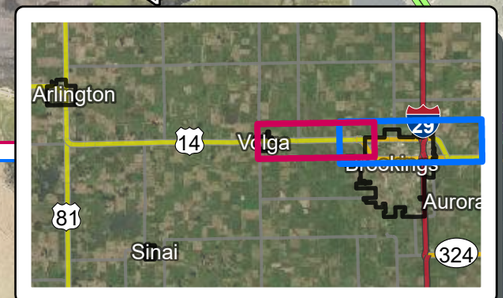
ID: 06139151
Year Built: 1978
Continuous Concrete

ID: 06141150
Year Built: 2001
Continuous Concrete

Rapid City, Pierre & Eastern RR
Big Sioux River
North Deer Creek

Legend
- Study Area
- MRM
- Bridge Structure

Functional Classifications
- Rural Principal Arterial Segment
- Urban Principal Arterial Segment
- Rural Minor Arterial
- Urban Minor Arterial



US14: Bypass 3-lane; US14 (West) to 34th Ave
SDDOT Access Classification: Free Flow Urban
Posted Speed: 55 mph

Surface Width: 36'
Inside Shoulder: -
Outside Shoulder: 10'-14'
Depressed Turf Median Width: -
ROW Width: 200'

Long Combination Vehicle (LCV) route from I-29 West

US14: Bypass 2-lane; 34th Ave to US14 (East)
SDDOT Access Classification: Urban Fringe
Posted Speed: 65 mph

Surface Width: 36'
Inside Shoulder: -
Outside Shoulder: 10'-2'
Depressed Turf Median Width: -
ROW Width: 200'

470 AVE
471 AVE
469 AVE
475 AVE
22ND AVE
MEDARY AVE
34TH AVE
418
419
420
421
422
423
424
134
133
29
212 ST
6TH ST
Brookings
South Dakota State University
Sixmile Creek
Deer Creek
Rapid City, Pierre & Eastern RR

ID: 06154150
Year Built: 1970
Steel Girder Continuous

ID: 06166150
Year Built: 1967
Continuous Concrete

ID: 06160150
Year Built: 1967
Box Culvert

ID: 06169150
Year Built: 1968
Continuous Concrete

ID: 06185150
Year Built: 1966
Steel Girder Continuous

ID: 06196156
Year Built: 1967
Continuous Concrete

0 4,320 Ft

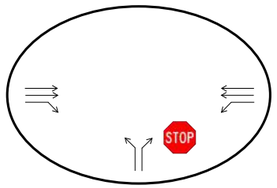
Note:
Roadway geometrics often vary within an individual segment.
Noted dimensions represent a typical value.

EXISTING ROAD AND STRUCTURE CONDITIONS

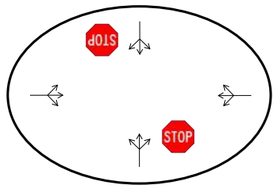
H:\GIS\PROJECTS\SDDOT\US14_CORRIDORSTDY\MAP_DOCS\DRAFT\US14.APRX DATE: 11/20/2020

US 14 West of Volga

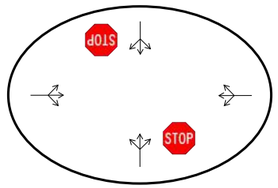
1 US14 & US81



2 US14 & Brookings Co. 11 / 458th Ave

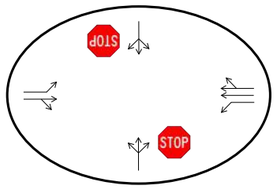


3 US14 & Brookings Co. 1 / 459th Ave

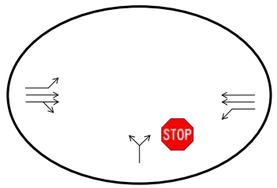


US 14 in Volga and East

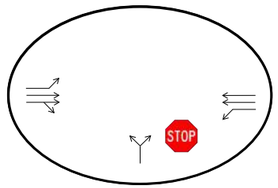
4 US14 & Brookings Co. 5 / 464th Ave / Samara Ave



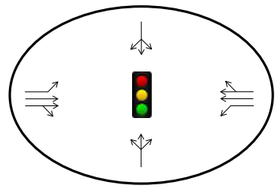
5 US14 & Kasan Ave



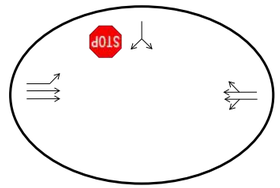
6 US14 & Hansina Ave



7 US14 & Caspian Ave



8 US14 & Brookings Co. 7 / 466th Ave



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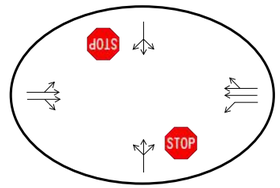
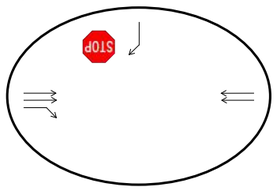
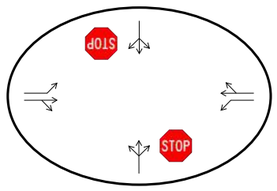


US 14 Bypass

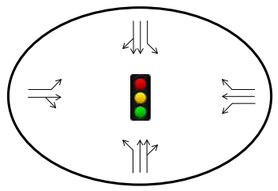
10 US14 & US14 Bypass (West)



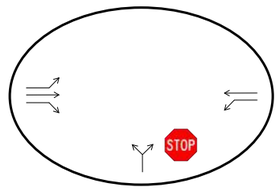
11 US14 Bypass & Western Ave



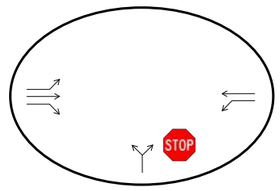
12 US14 Bypass & Medary Ave



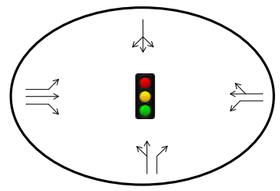
13 US14 Bypass & Stadium Rd



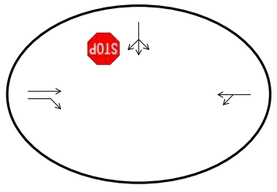
14 US14 Bypass & Jackrabbit Ave



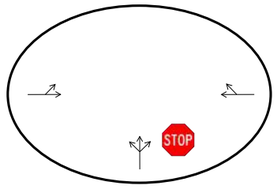
15 US14 Bypass & 22nd Ave



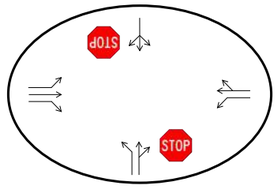
16 US14 Bypass & I-29 SB Ramp Terminal



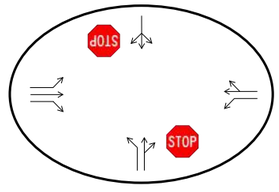
17 US14 Bypass & I-29 NB Ramp Terminal



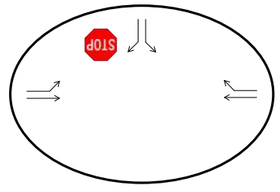
18 US14 Bypass & 32nd Ave



19 US14 Bypass & 34th Ave



20 US14 & US14 Bypass (East)



Legend

- Lane Configuration
- Stop Sign
- Traffic Signal

4.3. Existing Traffic Volumes

Existing Condition (2019) traffic volumes, shown in **Figure 3**, were based on the following daily and peak hour traffic counts collected as part of the corridor study.

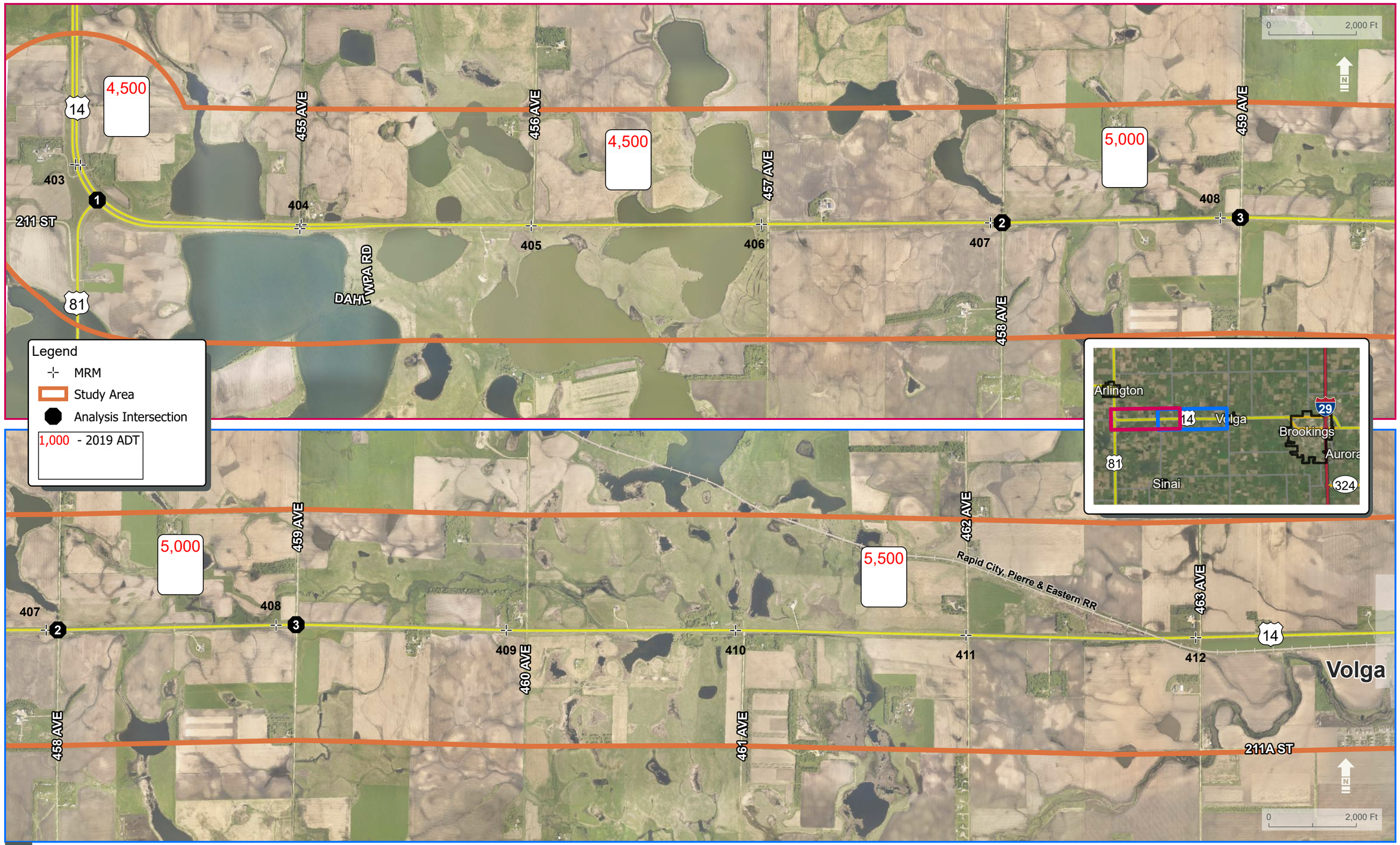
24-hour Peak hour intersection turning movement counts

- Collected on Wednesday, April 24, 2019.
- Provided daily segment volumes, peak hour intersection turning movement volumes, peak hour factors, and heavy vehicle percentages.
- Reflects morning and afternoon/evening commute periods.

24-hour roadway segment counts

- Collected from April 23 to 29, 2019.
- Provided daily segment volumes, heavy vehicle percentages, and speeds.

All volumes were adjusted to reflect an August ‘design season’ to account for higher corridor traffic volumes occurring in the summer months.



EXISTING TRAFFIC VOLUMES (2019)

Figure 3, Page 1

US14 - US14 BYPASS CORRIDOR STUDY

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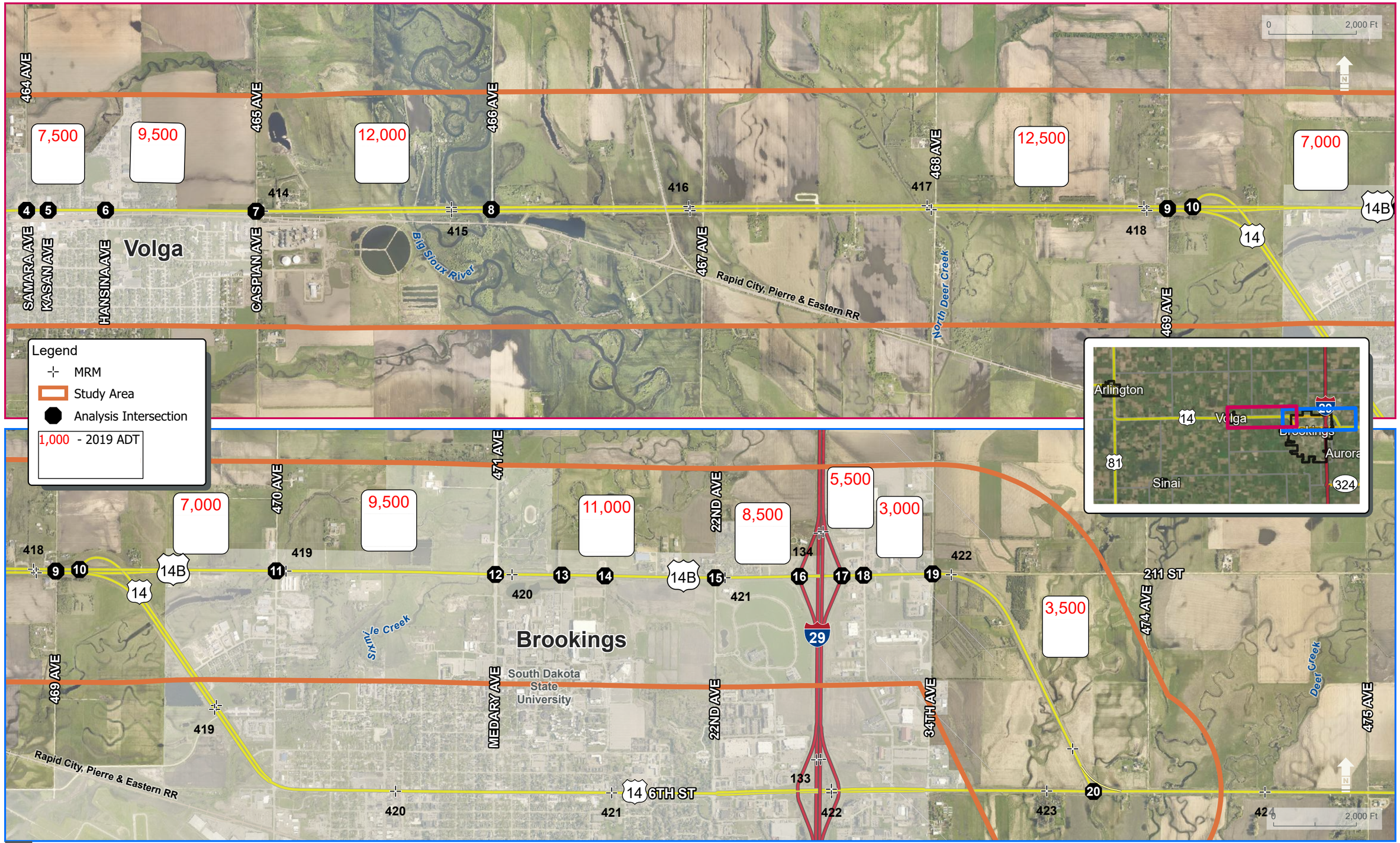


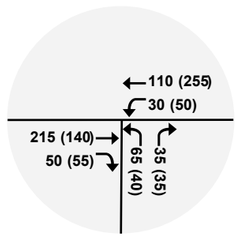
EXISTING TRAFFIC VOLUMES (2019)

Figure 3, Page 2

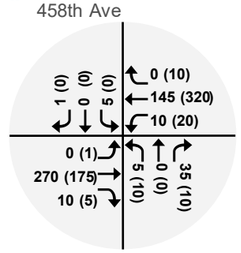
US14 - US14 BYPASS CORRIDOR STUDY

US14
West of Volga

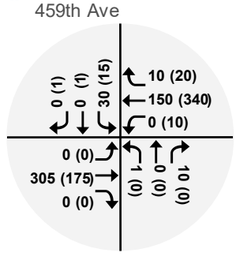
1 US14 & US81



2 US14 & Brookings Co. 11 / 458th Ave

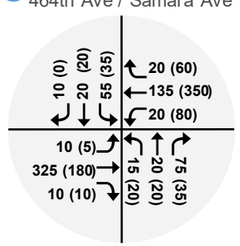


3 US14 & Brookings Co. 1 / 459th Ave

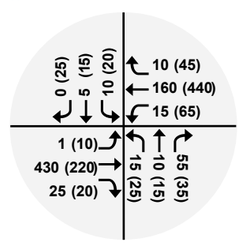


US14 in Volga and East

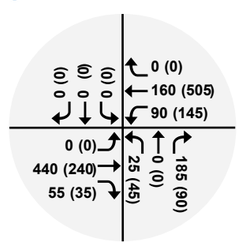
4 US14 & Brookings Co. 5 / 464th Ave / Samara Ave



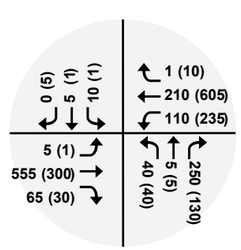
5 US14 & Kasan Ave



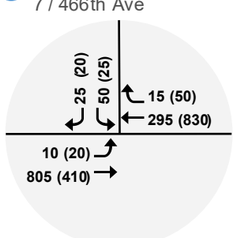
6 US14 & Hansina Ave



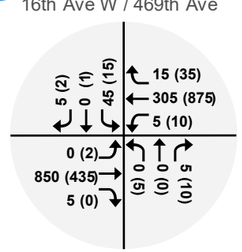
7 US14 & Caspian Ave



8 US14 & Brookings Co. 7 / 466th Ave

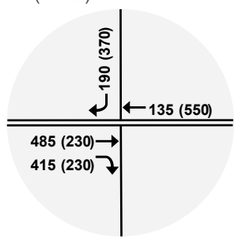


9 US14 & Brookings Co. 9 / 16th Ave W / 469th Ave

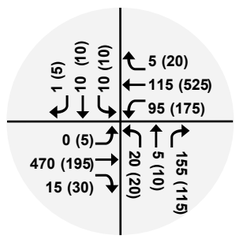


US14 Bypass

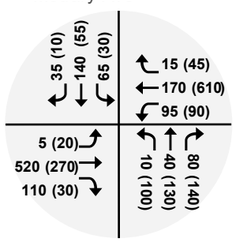
10 US14 & US14 Bypass (West)



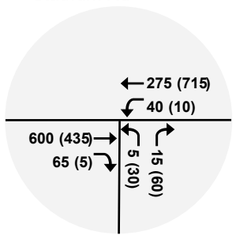
11 US14 Bypass & Western Ave



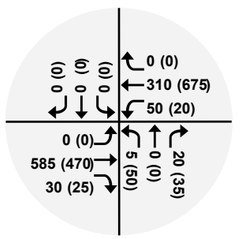
12 US14 Bypass & Medary Ave



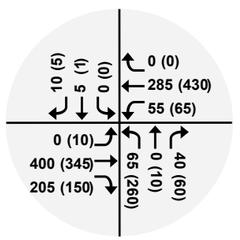
13 US14 Bypass & Stadium Rd



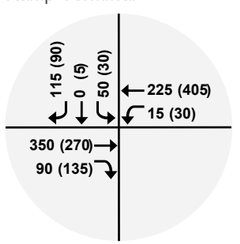
14 US14 Bypass & Jackrabbit Ave



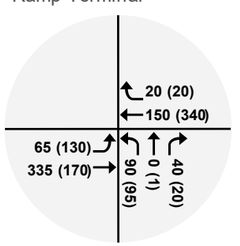
15 US14 Bypass & 22nd Ave



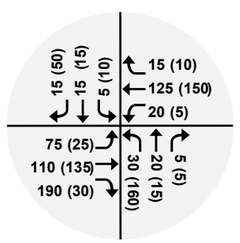
16 US14 Bypass & I-29 SB Ramp Terminal



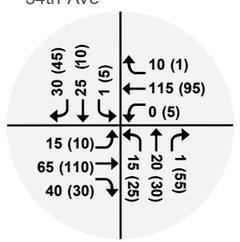
17 US14 Bypass & I-29 NB Ramp Terminal



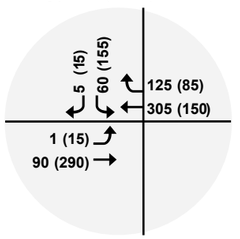
18 US14 Bypass & 32nd Ave



19 US14 Bypass & 34th Ave



20 US14 & US14 Bypass (East)



Legend

AM (PM) Existing (2019) Peak Hour Volumes

4.4. US14 Bypass Traffic Patterns (Origin-Destination Review)

An origin-destination (O-D) analysis of traffic entering and exiting the US14 Bypass corridor was conducted using StreetLight Data. The goal of this analysis was to better understand the type of trips served by the US14 Bypass corridor, such as local trips with a trip end along the US14 Bypass or more regional-based trips that use the corridor to 'bypass' Brookings.

StreetLight Data uses activity obtained from location-based services (i.e. recurring pings between cell phones and cell towers) to determine indexed origin-destination paths of all vehicles being observed. Since location-based services are not present in all vehicles, StreetLight Data represents an indexed output reflective of the activity sample and does not represent a total volume.

The analysis incorporated 32 different 'gates', or pass-through locations, to identify primary entry and exit points to the US14 Bypass corridor. Gates were also placed on US14/6th Street in Brookings to determine what percentage of pass-through traffic was using US14 or US14 Bypass. Seven different scenarios were developed to review seasonal, daily, and event traffic fluctuations.

Findings demonstrate the importance of the US14 Bypass for both distributing daily trips to north/south Brookings area roadways and serving the intended purpose of the US14 Bypass regarding regional trips and truck traffic. Each scenario identified the origin/destination of traffic entering/exiting the Brookings area via US14 west or east of Brookings.

Overarching Brookings area findings throughout scenarios

- Most significant origin/destination area is the commercial and industrial areas along the I-29 corridor (generally bound by 22nd Avenue and 34th Avenue).
- US14 Bypass was the predominant route for those traveling east-west through Brookings when compared to the US14/6th Street corridor.

US14 inbound scenarios (traffic entering the Brookings area via US14)

- Inbound US14 traffic that uses US14 Bypass for some portion of their trip represents:
  - 33 to 35 percent on a typical day.
  - 34 to 38 percent on SDSU Homecoming/Hobo Day, SDSU football game days, or Swiftel Event Center large event days.

US14 outbound scenarios (traffic leaving the Brookings area via US14)

- Outbound US14 traffic that uses US14 Bypass for some portion of their trip represents:
  - 37 percent on a typical day.
  - 33 to 39 percent on SDSU Homecoming/Hobo Day, SDSU football game days, or Swiftel Event Center large event days.

22nd Avenue corridor

- 13 to 16 percent of all US14 Bypass traffic that enters/exits the Brookings area via US14 is destined to or originates from 22nd Avenue on a typical day.

Commercial trucks

- 64 percent of all inbound US14 trucks use the US14 Bypass for some part of their trip.
- Nearly all trucks that travel east/west through Brookings use the US14 Bypass.

Additional information regarding the methodology, process, and findings from each of the seven scenarios is provided in the *StreetLight Origin-Destination Analysis* technical memo in **Appendix B**.

4.5. SDSU Football Game Day Traffic

SDSU football game days bring a considerable amount of traffic to the US14 Bypass corridor and surrounding roadways. Two primary access points to the 19,300-seat capacity Dana J. Dykhouse Stadium's parking lots are US14 Bypass intersections with Stadium Road and Jackrabbit Avenue.

At the onset of the study, meetings with the SAT, stakeholders, and public helped identify areas of concern during game days:

Pre-game (arriving traffic)

- Queued traffic on US14 Bypass waiting turn into Jackrabbit Avenue or Stadium Road stadium lots.
- Safety concerns related to:
    - Queues blocking sight lines of turning traffic,
    - Rear-end collisions due to queued traffic and speed differential, and
    - Impatient maneuvers due to delay.

Post-game (departing traffic)

- Eastbound US14 Bypass queue spillback from 22nd Avenue intersection (and beyond) impacts flow out of area.
- Stadium Road right turn traffic limits available gaps for Jackrabbit Avenue traffic.

Both pre- and post-game periods

- US14 Bypass route reliability
    - Route reliability for non-game day traffic, particularly during harvest season.
    - There are times where game traffic is blocking through lanes or traveling slowly. This degrades the reliability of US14 Bypass for other traffic not associated with the game.

The SDDOT provided video of select US14 Bypass intersections collected on two game days in 2018 for review and analysis. It was found that in both instances, overall intersection traffic volumes during the peak arrival and departure periods were very similar to those experienced during a typical morning and evening commute peak hour. The primary difference was in the traffic patterns, with notably higher volumes on the side streets entering/exiting the stadium parking lots.

Based on this analysis, two overarching themes were identified for further consideration throughout the remainder of the study:

1. Improve traffic flow into the parking lots via Jackrabbit Avenue and Stadium Road.
    a. Multiple southbound lanes of traffic would allow two lanes for processing vehicles and provide additional queue storage on side street instead of US14 Bypass.
    b. Other traffic management techniques may include:
        A. Expedite the process to scan parking passes,
        B. Locate scan location further away from US14 Bypass to increase available queue storage, and
        C. Restrict movements on select approaches to focus on one direction of travel.
2. Maintain functionality of US14 Bypass corridor during game days.
    a. Additional lanes would better simultaneously accommodate game and non-game traffic.
    b. Minimize queuing on US14 Bypass.
    c. Limit friction to traffic flow along US14 Bypass (turn restrictions, signal timing modifications, temporary changes to traffic control, etc.).

Additional information regarding the SDSU football game day traffic review is provided in **Appendix C**.

4.6. Crash History

Study area crash data for years 2014 through 2018 were provided by the SDDOT through a GIS geodatabase. Crashes were reviewed to identify any historical crash trends or high frequency crash areas to help develop potential mitigation measures for consideration in design. **Figure 5** graphically depicts the location and injury severity of each reported crash.

Crash rates and critical crash rates were determined for both intersections and roadway segments. Intersection crash rates were calculated in terms of crashes per million entering vehicles (crashes/MEV). Roadway segment crash rates were calculated in terms of million vehicle miles traveled (crashes/MVMT).

Critical crash rates were calculated based on the statistical populations of each crash location (intersection or segment), using methods presented in the *Highway Safety Manual* (HSM, American Association of State Highway and Transportation Officials (AASHTO), 2010). A critical crash rate accounts for a desired level of confidence, vehicle exposure, and similar

facility types. Intersections and segments where the crash rate exceeds the critical rate should be investigated further.

Weighted crash rates were also calculated for corridor segments by weighting each crash in accordance with its severity: fatal crash (12), injury crash (3), and property damage crash (1). Weights were assigned to each crash in accordance with methodology used by the SDDOT in determining statewide average crash rates. This method differs from the calculation of an average crash rate in that the weighted crash rate accounts for injury and fatal crashes through the weighting process. An average crash rate calculation reflects total crash frequency, regardless of injury severity.

Additional details regarding the crash history review, including a figure with all crashes mapped, can be found in the *Crash History Review* technical memo in **Appendix D**.

4.6.1. Corridor Summary

A total of 288 crashes were reported along the study corridor between 2014 and 2018. Eighty were identified as intersection crashes and the remaining 208 segment crashes. Corridor-wide annual crash frequency reflects a downward trend through this period, shown in **Figure 4**.

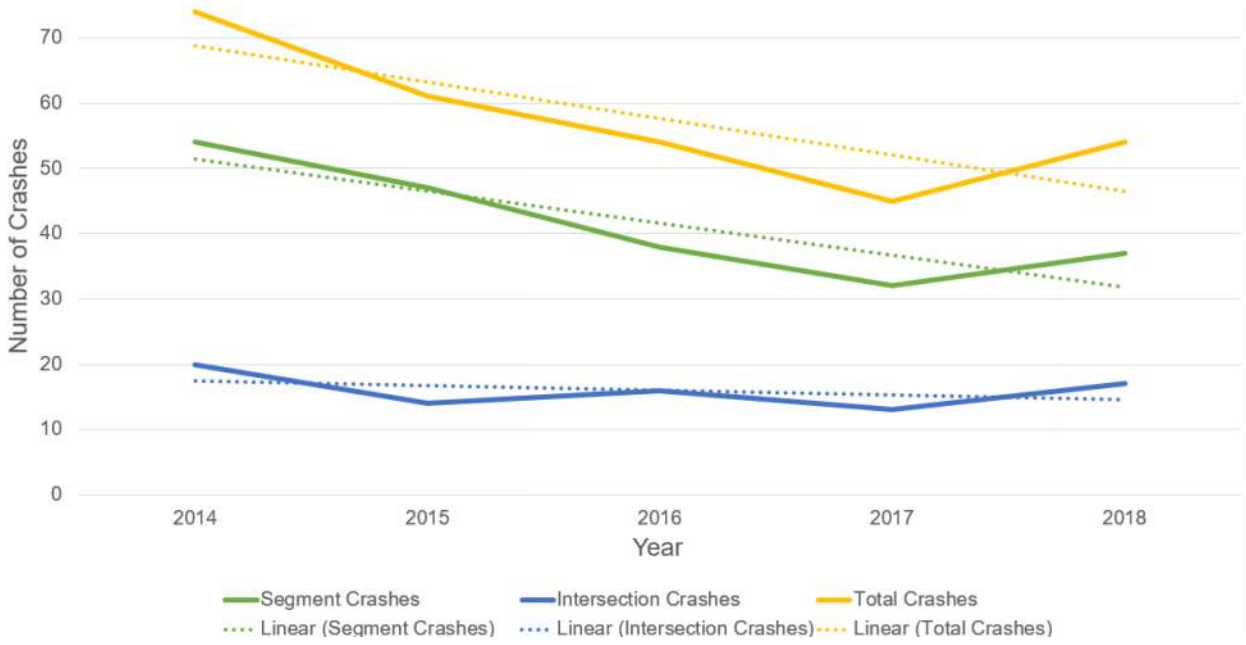


Figure 4: Segment and Intersection Crashes by Year (2014-2018)

A breakdown of corridor-wide crashes by injury severity and manner of collision are shown in **Table 3** and **Table 4.**

Table 3: Corridor Crash Summary – Injury Severity (2014-2018)

Crash Severity	Number of Crashes	Percent
Fatal Injury	5	2%
Incapacitating Injury	7	2%
Non-incapacitating Injury	6	2%
Possible Injury	25	9%
No Injury	111	39%
Wild Animal Hit	134	46%
Total	*288*	*100%*

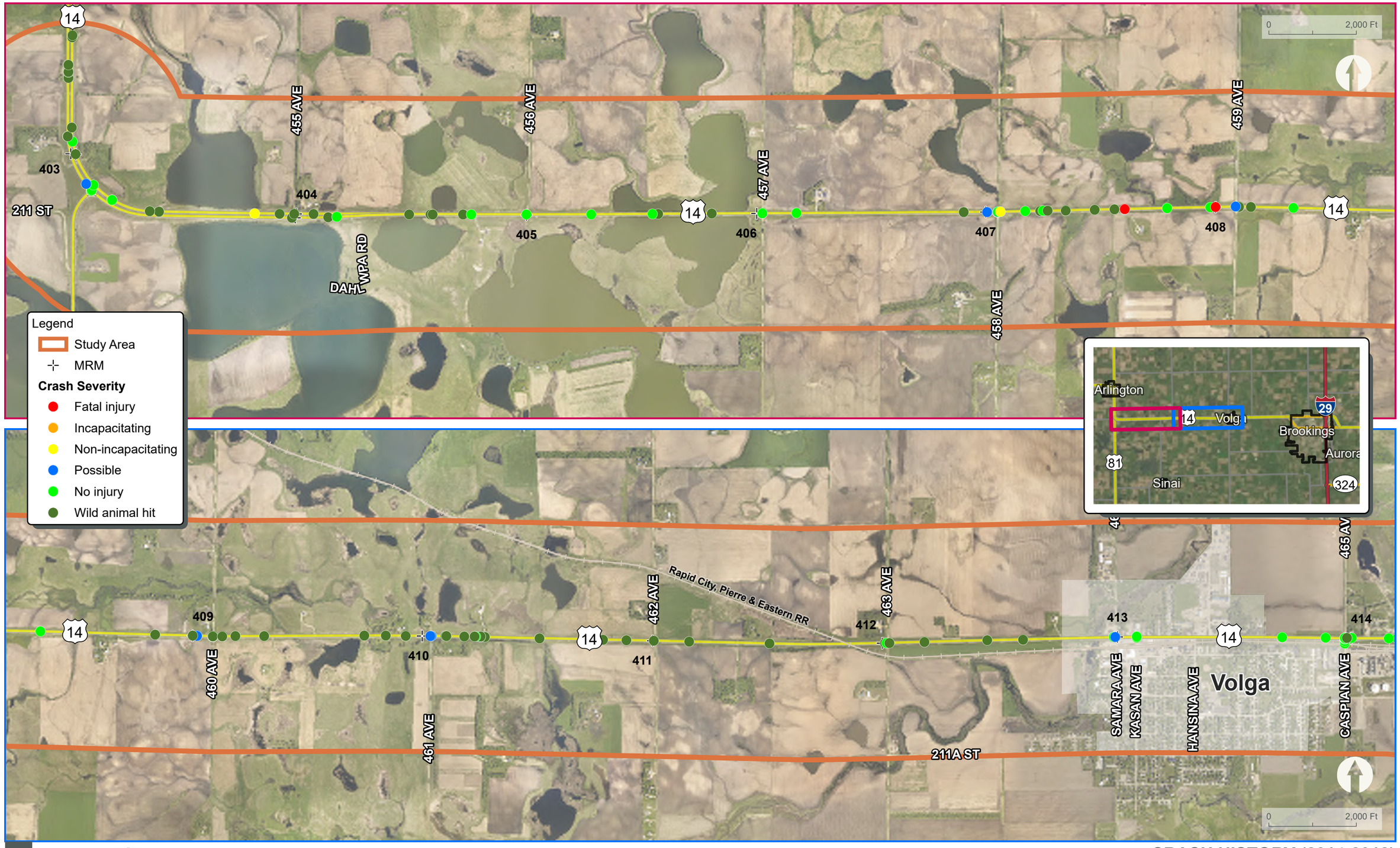
Table 4: Corridor Crash Summary – Manner of Collision (2014-2018)

Manner of Collision	Number of Crashes	Percent
Vehicle-animal	134	47%
Single Vehicle	49	17%
Angle	48	17%
Rear-end	41	14%
Sideswipe	13	4%
Head-on	3	1%
Total	*288*	*100%*

Overall, there were 12 serious injury (fatal and incapacitating injury) crashes throughout the study area as shown in **Figure 6**. A corridor-wide summary of those crashes by manner of collision is shown in **Table 5.** In general, intersections (8 of the 12) and US14 west of the US14 Bypass (8 of the 12) tend to exhibit greater propensity for serious injury crashes.

Table 5: Corridor Fatal and Incapacitating Injury Crash Summary (2014-2018)

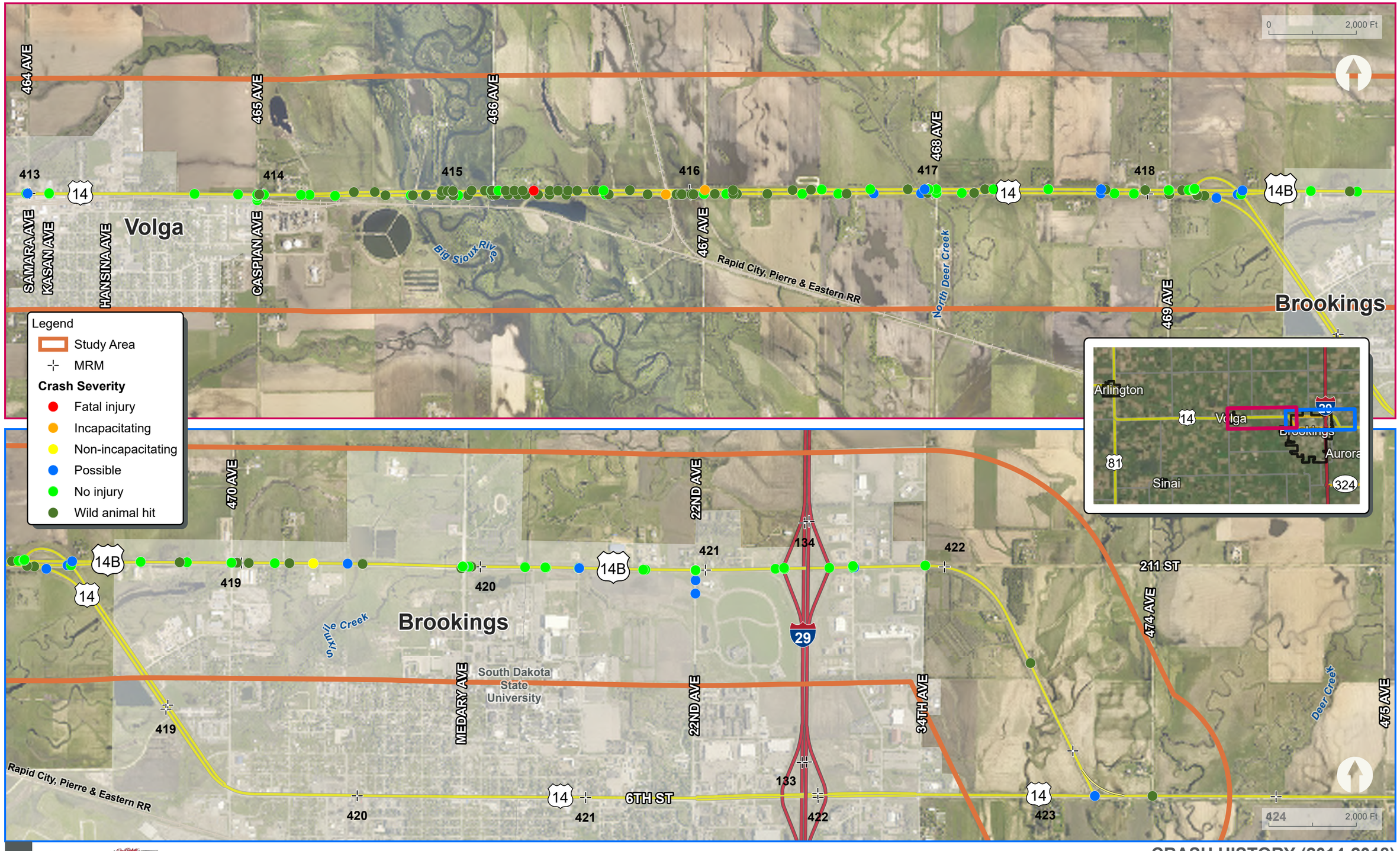
Manner of Collision	F&I Sorted by Corridor Feature		F&I Sorted by Primary Highway	
	Intersection	Segment	US14 Bypass	US14 Rural
Single Vehicle	1		1	
Rear-end	1	2		3
Angle	6	1	3	4
Head-on		1		1
Total	*12*		*12*	



CRASH HISTORY (2014-2018)

Figure 5, Page 1

US14 - US14 BYPASS CORRIDOR STUDY



CRASH HISTORY (2014-2018)

Figure 5, Page 2

4.6.2. Intersection Summary

A summary of US14-US14 Bypass corridor intersection-related crashes occurring within the study area is presented in **Table 6**. **Orange Bold** text signifies intersections with a crash rate exceeding the critical crash rate or where the weighted crash rate is the greatest.

Table 6: Intersection Crash Rate Summary (2014-2018)

Mainline	Crossroad	Total # of Crashes	Critical Crash Rates (crashes/MVMT)		Weighted Crash Rates (crashes/MVMT)	
			Crash Rate	Critical Crash Rate	Weighted Crash Rate	Rank
US14	US 81	7	**0.77**	0.58	2.19	**1**
US14	Brookings CR11 / 458th Ave	3	0.37	0.60	0.62	
US14	Brookings CR1 / 459th Ave	2	0.25	0.60	0.50	
US14	460th Ave	1	-	-	0.13	
US14	461st Ave	2	-	-	0.76	
US14	463rd Ave	1	-	-	0.13	
US14	Samara Ave	2	0.14	0.50	0.27	
US14	Kasan Ave	2	0.14	0.50	0.14	
US14	Hansina Ave	-	-	0.51	0	
US14	Caspian Ave	8	0.48	*(signal)*	0.61	
US14	Brookings CR7 / 466th Ave	-	-	0.49	0	
US14	467th Ave	2	-	-	0.26	
US14	468th Ave	2	-	-	0.13	
US14	Brookings CR9 / 16th Ave W / 469th Ave	1	0.06	0.49	0.06	
US14	US14 Bypass (west)	6	**0.55**	0.54	0.55	
US14 Bypass	Western Ave	3	0.20	0.49	0.33	
US14 Bypass	Medary Ave	7	0.31	*(signal)*	0.58	
US14 Bypass	Stadium Rd	3	0.17	0.47	0.17	
US14 Bypass	Jackrabbit Ave	2	0.11	0.47	0.23	
US14 Bypass	22nd Ave	11	**0.50**	0.45	0.95	**3**
US14 Bypass	I-29 SB Ramp Terminal	6	0.32	0.47	0.43	
US14 Bypass	I-29 NB Ramp Terminal	2	0.20	0.55	0.20	
US14 Bypass	32nd Ave	3	0.36	0.59	0.60	
US14 Bypass	34th Ave	1	0.10	0.56	0.10	
US14 Bypass	US14 Bypass (east)	3	0.25	0.53	1.34	**2**

Crash rates that exceed the critical crash rate noted in **Orange Bold** text.
Critical crash rate not calculated for signalized intersection due to low sample size (two intersections).
Intersections with highest weighted crash rate noted in **Orange Bold** ranking text.

Fatal and incapacitating injury crashes were reported at the following intersections:

- US81 – 1 fatal and 1 incapacitating injury crash
- 467th Avenue – 1 incapacitating injury crash
- Caspian Avenue – 1 incapacitating injury crash
- Medary Avenue – 1 incapacitating injury crash
- 22nd Avenue – 2 incapacitating injury crashes
- US14/US14 Bypass (east) – 1 fatal crash

4.6.1. Corridor Segment Summary

Table 7 summarizes US14-US14 Bypass corridor segment crash rates in terms of critical rates and weighted crash rates. **Orange Bold** text signifies intersections with a crash rate exceeding the critical crash rate or where the weighted crash rate exceeds the statewide average weighted rate.

Fatal and incapacitating injury crashes were reported on the following US14 segments:

- 458th Avenue to 459th Avenue: 2 fatal crashes
- 466th Avenue to 469th Avenue: 1 fatal and 1 incapacitating injury crash

4.6.2. Winter Weather Summary

Fifty crashes occurred on winter weather-related road conditions (snow, ice, or slush) throughout the study corridor, as shown in **Figure 6**. Clusters occurred at two primary locations:

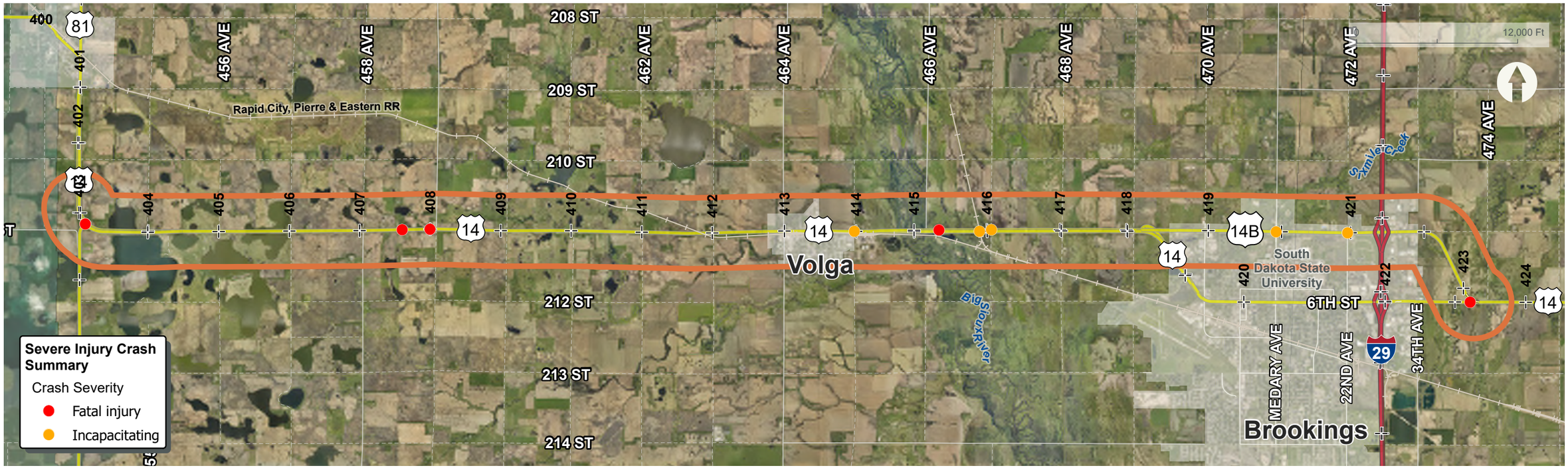
- US14 between 458th Avenue and 459th Avenue
- US14 between Brookings and Volga

Six winter road condition crashes occurred between 458th Avenue and 459th Avenue. Four of these six crashes resulted in injury, including one fatality. Through discussions with the SAT and SDDOT Watertown Area maintenance staff, there has been concern of blowing snow across this segment of highway that leads to (often unexpected) slippery road conditions.

Approximately 17 winter road condition-related crashes occurred along US14 between Volga and Brookings, all PDO crashes. This segment has had issues with icy bridge decks and approach slabs due to blowing snow, windy conditions, and the amount of water through this area that leads to morning frost.

4.6.1. Crash Review Conclusions

Intersections and segments identified by **Orange Bold** text within the preceding tables were locations designated for additional review and identify an area of potential transportation needs to be addressed as part of this study. Additional discussion regarding crash trends at each of these locations, as well as additional corridor-wide crash information and figures, is presented in the *Crash History Review* technical memo.



CRASH HISTORY, SEVERE INJURY AND WINTER WEATHER (2014-2018)

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Table 7: Segment Crash Rate Summary (2014-2018)

Mainline	From	To	Length (miles)	Total # of Crashes	Critical Crash Rates (crashes/MVMT)		Weighted Crash Rates (crashes/MVMT)	
					Crash Rate	Critical Crash Rate	Weighted Crash Rate	State Rate
US14	MRM 402.94	US 81	0.15	6	**5.36**	2.24	**7.15**	1.45
US14	US81	Brookings CR11 / 458th Ave	3.96	26	0.83	1.82	0.24	1.45
US14	Brookings CR11 / 458th Ave	Brookings CR1 / 459th Ave	1.04	13	1.58	2.20	**4.31**	1.45
US14	Brookings CR1 / 459th Ave	Brookings CR5 / 464th Ave	4.90	34	0.84	1.77	0.19	1.45
US14	Brookings CR5 / 464th Ave	Kasan Ave	0.09	-	-	2.03	0	1.45
US14	Kasan Ave	Hansina Ave	0.27	-	-	2.03	0	1.45
US14	Hansina Ave	Caspian Ave	0.63	3	0.36	2.03	0.36	1.45
US14	Caspian Ave	Brookings CR7 / 466th Ave	1.19	32	1.80	1.95	**1.51**	1.45
US14	Brookings CR7 / 466th Ave	Brookings CR9 / 16th Ave W / 469th Ave	2.93	70	1.55	1.76	0.72	1.45
US14	Brookings CR9 / 16th Ave W / 469th Ave	US14 Bypass (west)	0.09	5	**3.75**	2.00	**3.75**	1.45
US14 Bypass	US14 (west)	Western Ave	0.77	7	0.73	2.70	1.15	2.00
US14 Bypass	Western Ave	Medary Ave	0.97	7	0.55	2.68	0.86	2.00
US14 Bypass	Medary Ave	Jackrabbit Ave	0.49	2	0.24	2.60	0.24	2.00
US14 Bypass	Jackrabbit Ave	22nd Ave	0.41	1	0.14	2.60	0.14	2.00
US14 Bypass	22nd Ave	I-29 SB Ramp Terminal	0.39	1	0.16	2.61	0.16	2.00
US14 Bypass	I-29 SB Ramp Terminal	I-29 NB Ramp Terminal	0.19	-	-	2.77	0	2.00
US14 Bypass	I-29 NB Ramp Terminal	32nd Ave	0.20	-	-	3.00	0	2.00
US14 Bypass	32nd Ave	34th Ave	0.22	-	-	3.00	0	2.00
US14 Bypass	34th Ave	US14 (east)	1.41	1	0.11	2.17	0.08	1.45

Crash rates that exceed the critical crash or statewide average crash rate noted in **Orange Bold** text.
Statewide average crash rate based on Functional Classification.

4.7. US14 Bypass Reliability

US14 Bypass reliability was evaluated in terms of travel time variability, speed, and potential sources of congestion. A full year of historical INRIX traffic data (2018) was obtained for the analysis. Conclusions from this review are as follows.

US14 Bypass corridor

- Seasonally, the winter months exhibited the greatest variability in travel time.
- Daily, the PM peak hour exhibited the greatest variability in speeds.
    - Generally, through traffic may experience a few minutes of unexpected delay about one weekday a month.
- Spikes in corridor travel time are generally 15 minutes or less and it was often difficult to attach a specific causal event.
    - Side-street delay due to a non-recurring point-load departure event in the PM peak hour was identified as a potential cause.
- Potential sources of congestion and impact to travel time reliability include:
    - Snow events shown to have the greatest impact.
    - Crash events and moderate rain events shown to have little impact to reliability.

Segment: US14 (west) intersection to 34th Avenue

- Wide speed variation likely impacts travelers' perception of reliability.
- While increasing the number of signals will likely increase travel times, it may improve a travelers' perception of corridor reliability as lower speeds would be less variable due to the signals.

Segment: 34th Avenue to US14 (east) intersection

- Some speed variability noted through this segment, possibly caused by large, slow moving vehicles.

Additional information is provided in the *Traffic and Reliability Analysis* technical memo attached in **Appendix E**.

5. Future Land Use

Available future land use plans were reviewed to aid in the development and assignment of traffic forecasts through the US14-US14 Bypass study corridor.

The Brookings County Comprehensive Plan Future Land Use Map (**Figure 7**) identifies development transition areas, development limitations (due to floodplain and other natural features), and urban and rural development areas. Transition areas for future development along the study are focused around Brookings and Volga urban areas.

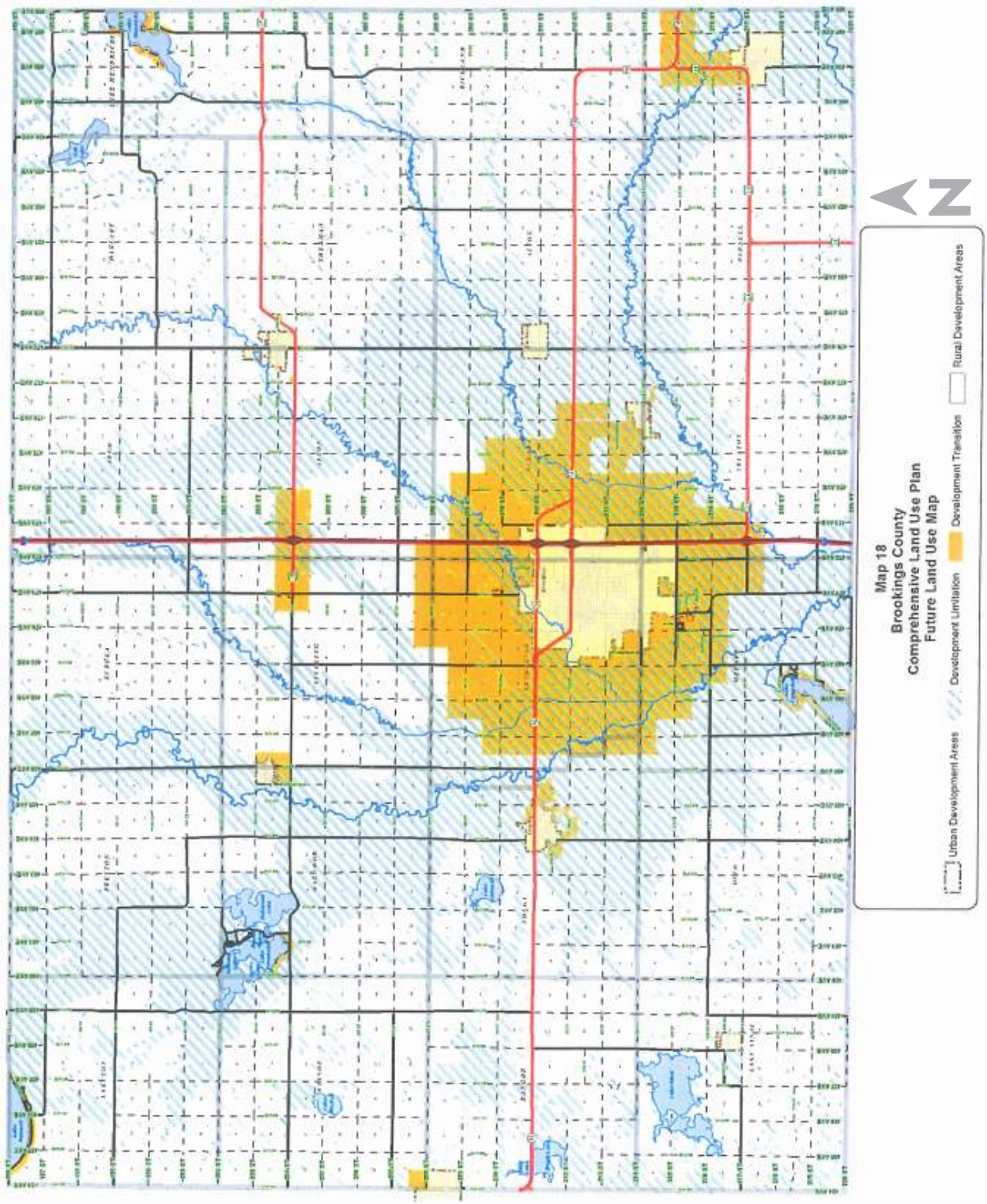


Figure 7: Brookings County Comprehensive Land Use Plan Future Land Use Map

Source: Brookings County Comprehensive Land Use Plan, February 2016, Page 60. Modified to add north arrow.

The Brookings Comprehensive Plan 2040 includes a Future Land Use Plan to guide zoning changes, development, infrastructure improvements, investment, and reinvestment. This plan, shown in **Figure 8**, looks beyond the current Brookings city limits and identifies developable areas for future growth within the City of Brookings/Brookings County joint jurisdiction area.

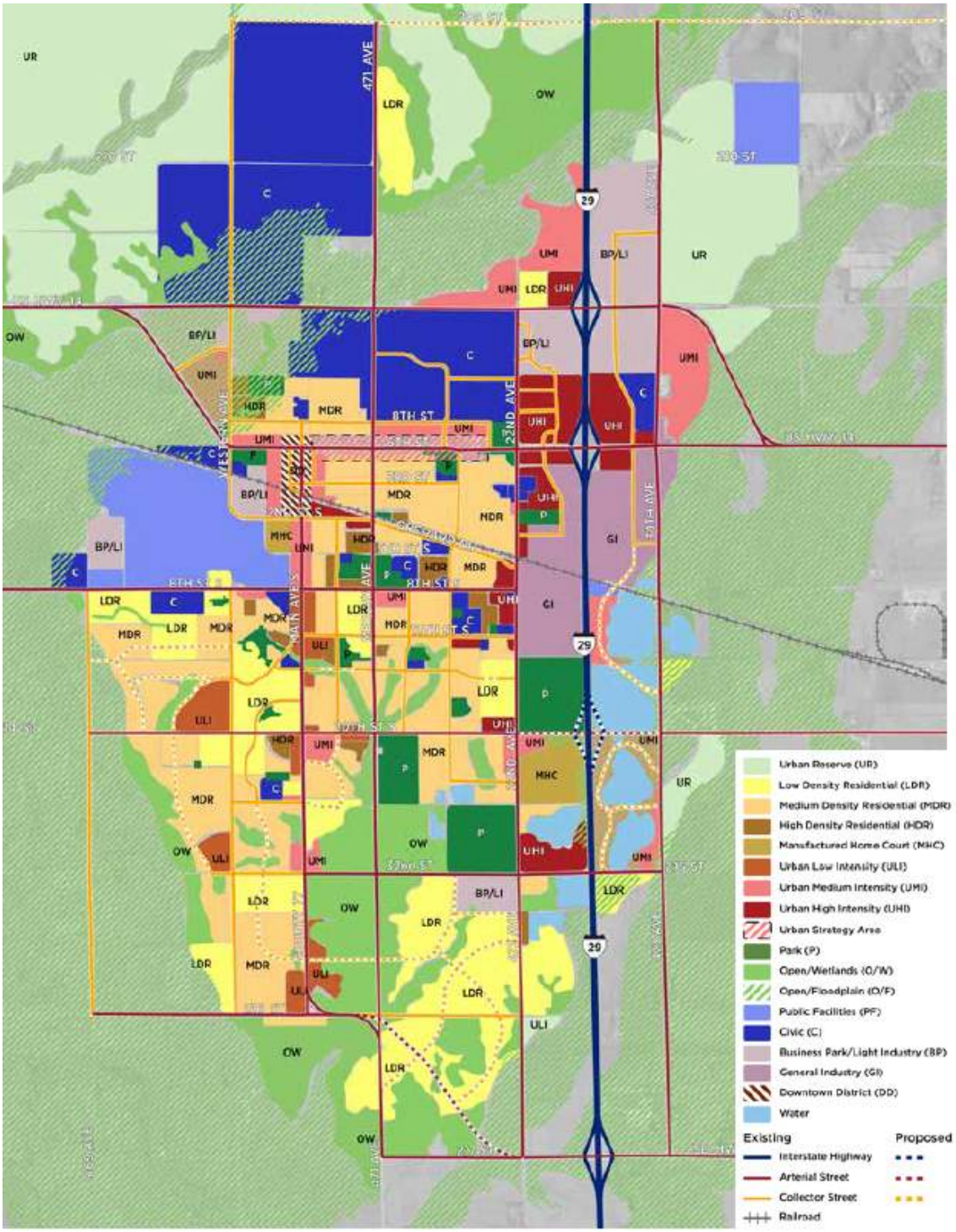


Figure 8: Brookings Comprehensive Plan Future Land Use

Source: Brookings, South Dakota, Comprehensive Plan 2040, April 2018. Page 80.

The comprehensive plan subdivides the Brookings area into four development policy areas, identifying specific issues, challenges, and recommended development policies for the area. This information highlights the type of development that is both feasible and anticipated in the area, which aids in the forecasting of traffic volumes generated by this development.

Some of the 'driest' land for future growth beyond the core area is north of the US14 Bypass, known as the 'North Development Area' in the Brookings Comprehensive Plan 2040 (**Figure 9**). Much of this area is shown as Urban Reserve (UR) on the Future Land Use Map and identifies future urban development areas when the Brookings core area has been fully developed. 469th Avenue, Western Avenue, and Medary Avenue are anticipated to be key north/south roadways accessing this development area.

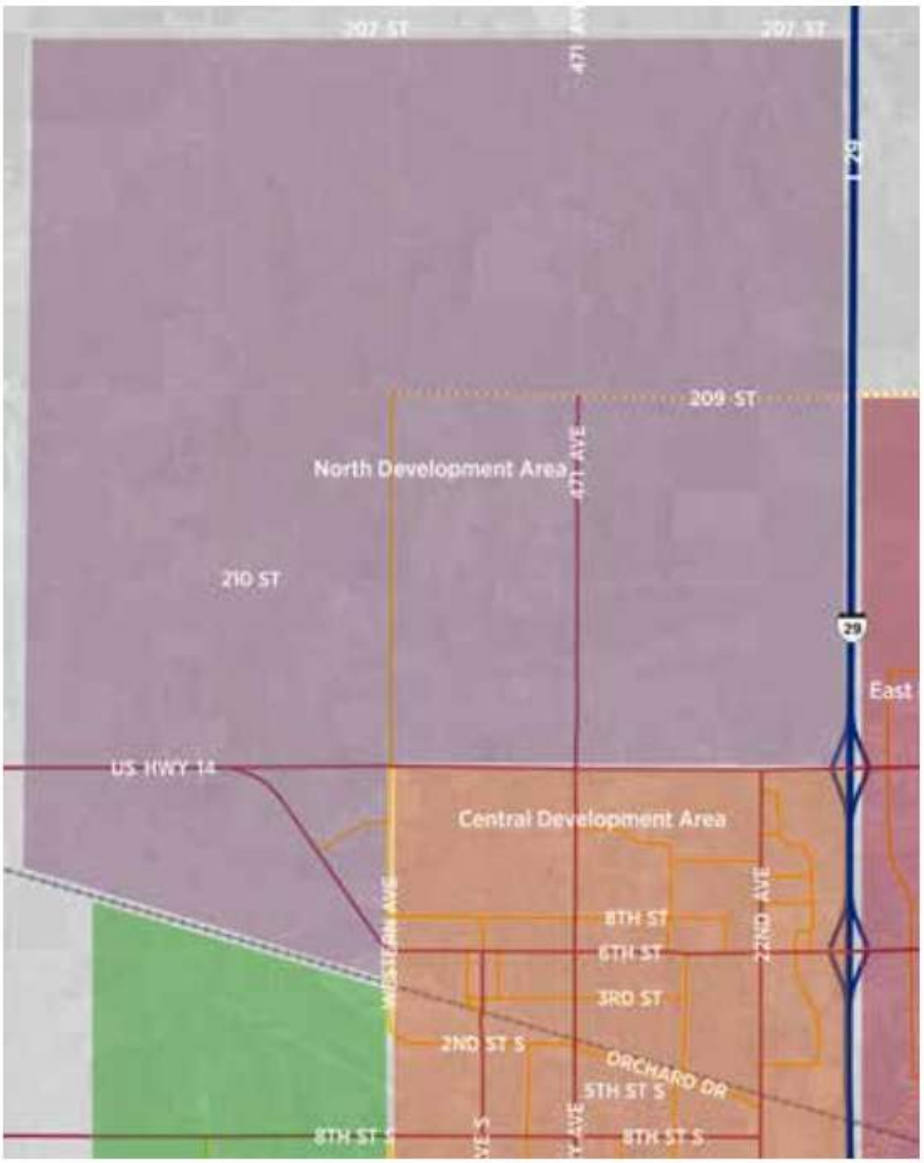


Figure 9: North Development Area

Source: Brookings, South Dakota, Comprehensive Plan 2040, April 2018. Page 73.

The primary constraint facing development in these areas is the need for extensive infrastructure extensions due to large gaps in developable land from floodplain, wetlands and high priority use South Dakota State University land/research farms. Thus, one of the policies identified in the Brookings Comprehensive Plan 2040 for the north development area:

> *Significant infrastructure extensions into this area should only occur after more cost effective extensions have been fully developed.*

The 'East Development Area' depicts a north/south rectangle along the east side of I-29 (**Figure 10**). Development in this area is primarily commercial and industrial, though there is also entertainment land uses along 6th Street. Much of the area between I-29 and 34th Avenue is already built-out between 213th Street and US14 Bypass.

Like the North Development Area, this area also has floodplain limitations to the east of the current Brookings city limit. This is a limiting factor in the amount of future development possible in this area.

The Brookings Comprehensive Plan 2040 presents an annexation priority map, shown in **Figure 11**. There is a mix of Priority 1, 2, and 3 annexation areas along the US14 Bypass, which are based on the likeliness of annexation into the Brookings city limits within the planning horizon. The bulk of the Priority 1 and 2 annexation areas (short and medium term) are along the southern city limits. The largest potential annexation areas along the US14 Bypass are Priority 3, representing long term annexation.

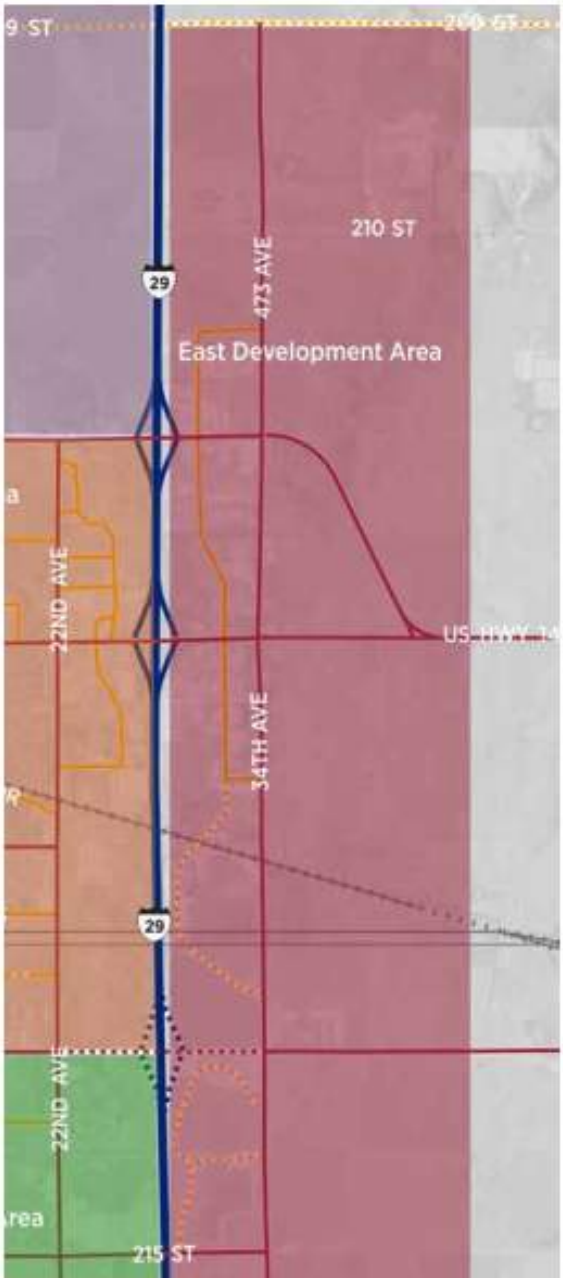


Figure 10: East Development Area

Source: Brookings, South Dakota, Comprehensive Plan 2040, April 2018. Page 70.

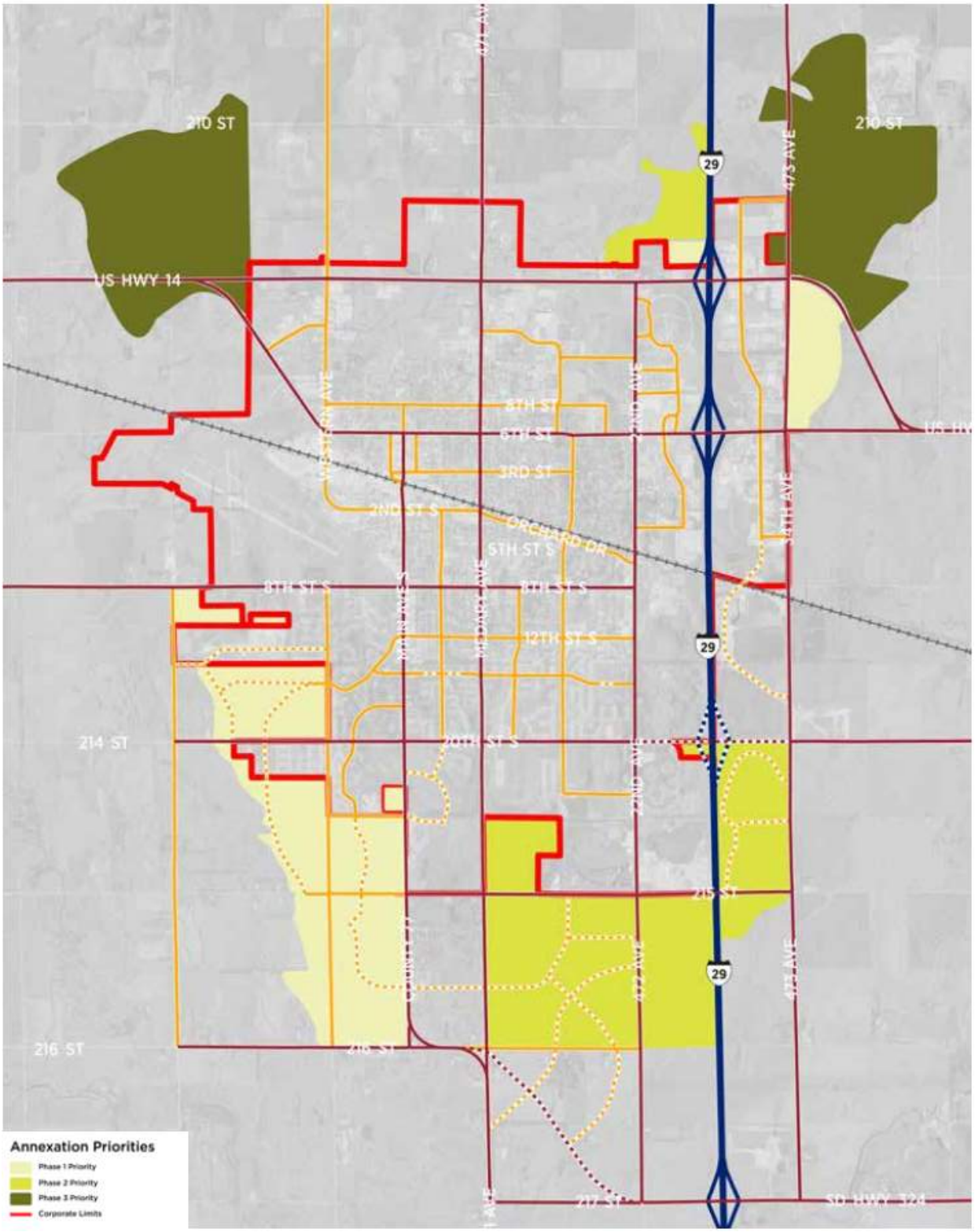


Figure 11: Annexation Priority Map

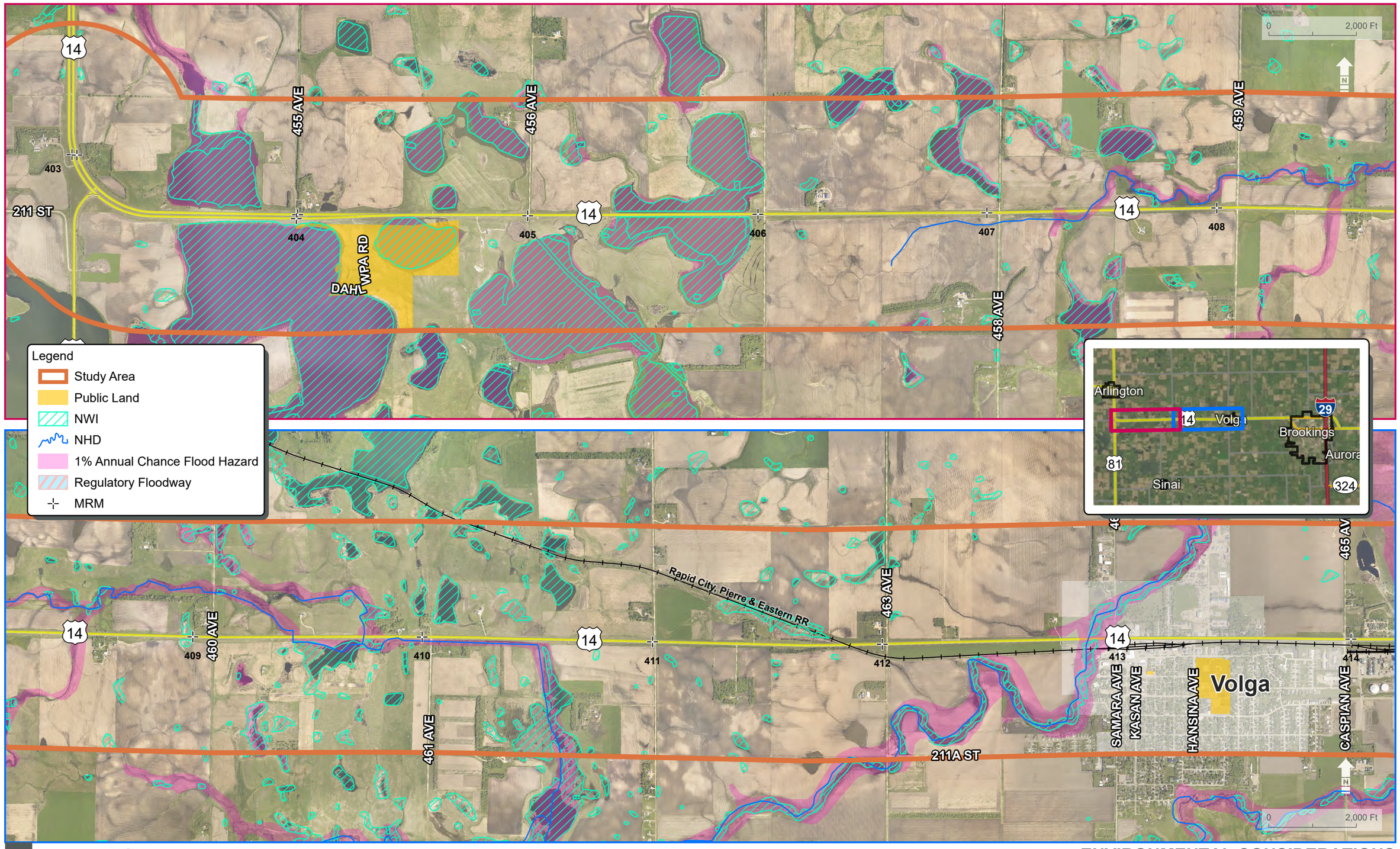
Source: Brookings, South Dakota, Comprehensive Plan 2040, April 2018. Page 183.

6. Environmental Overview

An environmental scan of the study area was conducted throughout the study process to identify direct, indirect, and cumulative impacts anticipated for the potential improvements. At the onset of this process, a map was created to illustrate environmental considerations during the concept and scenario development steps of the study. As shown in **Figure 12**, there is a considerable amount of floodplain, wetlands, and public land throughout the corridor.

The *US14 Corridor Environmental Overview* memo, included in **Appendix F**, summarizes findings from the scan regarding the following resources:

- Threatened and Endangered Species
- Wildlife
- Archaeological/Historical properties
- Section 4(f)/6(f)
- Wetlands and Other Waters of the U.S.
- Floodplain
- Noise
- Hazardous Materials
- Right of Way (ROW)



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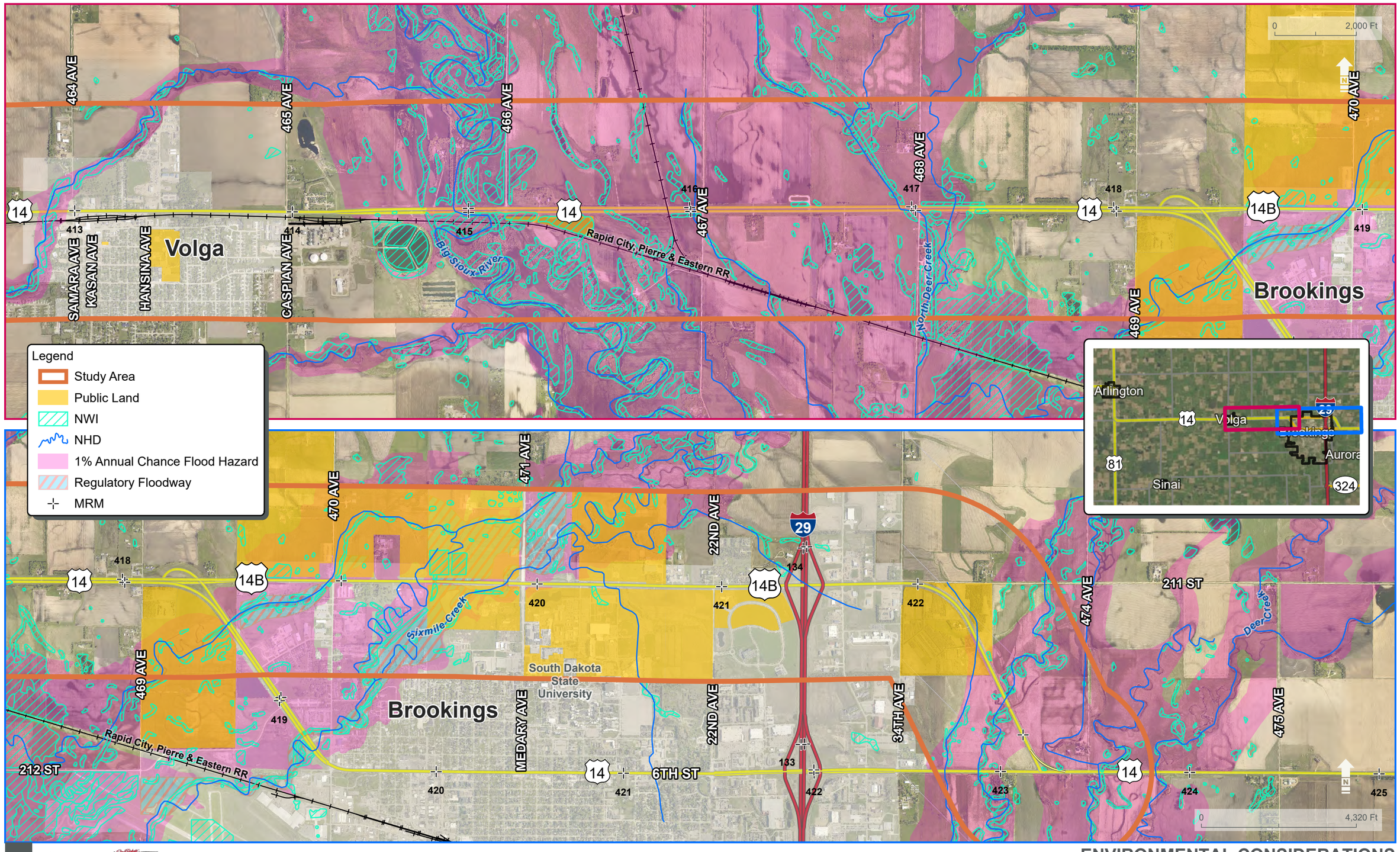

ENVIRONMENTAL CONSIDERATIONS

Figure 12, Page 2

US14 - US14 BYPASS CORRIDOR STUDY

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7. Traffic Forecasts

Traffic forecasts help assess future-year capacity and operational needs throughout the study area due to growth in traffic demand and/or changes in traffic patterns. For this study, forecast years include:

- Year 2024 – First Possible Year of Project Completion
- Year 2050 – Planning Horizon Year

The forecast development processes followed methodologies presented in *NCHRP 765: Analytical Travel Forecasting Approaches for Project-Level Planning and Design.* Forecast methodology and the source of growth rates differed based on whether the segment/intersection was located inside or outside of the Brookings growth area, as follows:

- 469th Avenue corridor and eastward
    - Growth rate source: Brookings Travel Demand Model (TDM)
- West of 469th Avenue
    - Growth rate source: SDDOT county-wide growth rates for Brookings County

The Brookings TDM is a Quick Response System II (QRS II) model that includes a 2015 base year and 2045 planning horizon. The model was last updated in 2015 as part of an I-29/20th Street South crossing/interchange feasibility study.

Growth rates derived from the Brookings TDM or county-wide growth factors were applied to the 2019 Existing Conditions traffic volumes to develop year 2024 and 2050 traffic volume sets. These daily and intersection traffic volumes are shown in **Figure 13**.

Additional information regarding the overall traffic forecasting process and a study-level review of the Brookings TDM is provided in **Appendix G**.

2024 AND 2050 TRAFFIC FORECASTS

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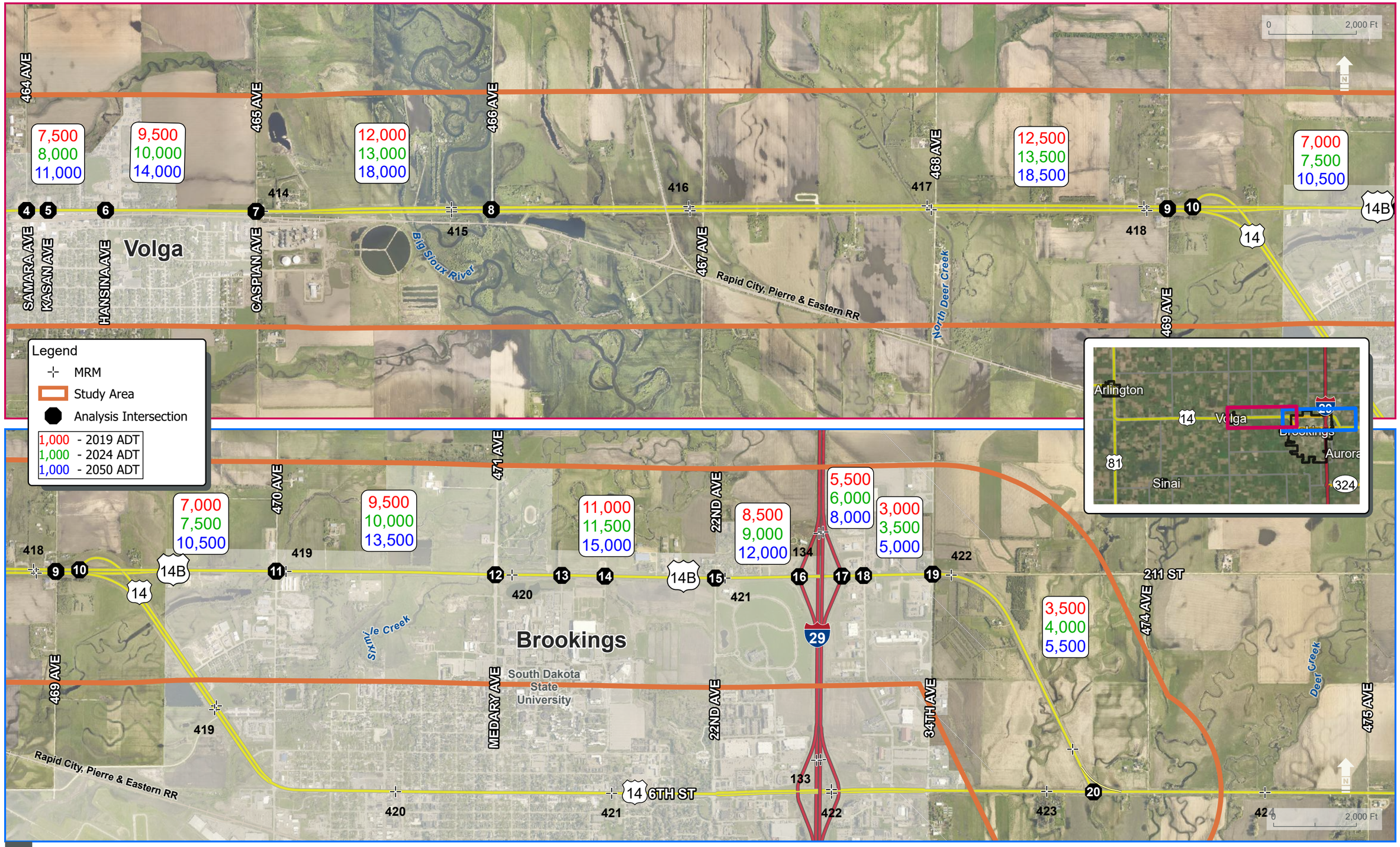

2024 AND 2050 TRAFFIC FORECASTS

Figure 13, Page 2

US14 - US14 BYPASS CORRIDOR STUDY

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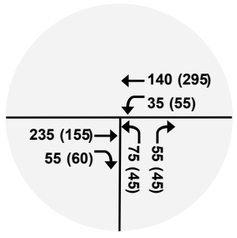
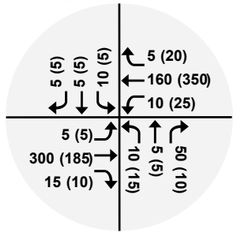
US14
West of Volga

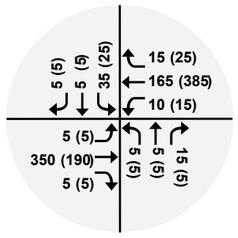
1 US14 & US81



2 US14 & Brookings Co. 11 / 458th Ave

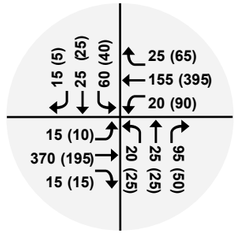


3 US14 & Brookings Co. 1 / 459th Ave

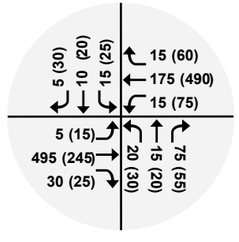


US14 in Volga and East

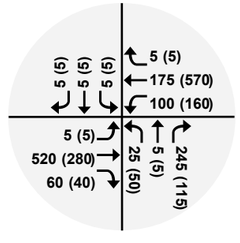
4 US14 & Brookings Co. 5 / 464th Ave / Samara Ave



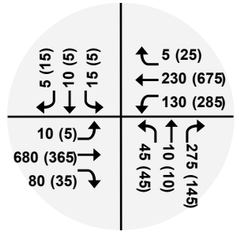
5 US14 & Kasan Ave



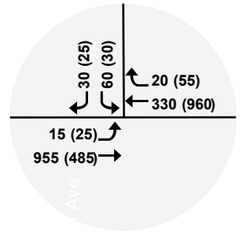
6 US14 & Hansina Ave



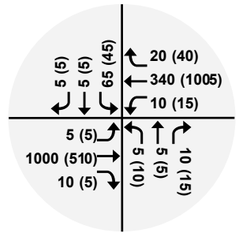
7 US 14 & Caspian Ave



8 US 14 & Brookings Co. 7 / 466th Ave

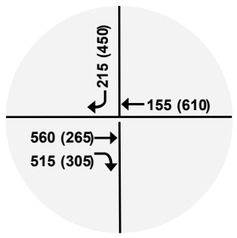


9 US 14 & Brookings Co. 9 / 16th Ave W / 469th Ave

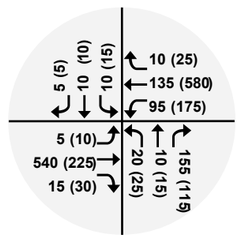


US14 Bypass

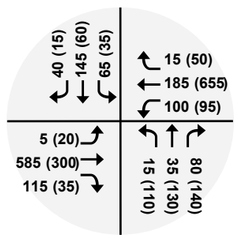
10 US14 & US14 Bypass (West)



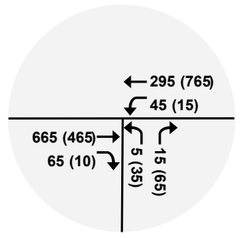
11 US14 Bypass & Western Ave



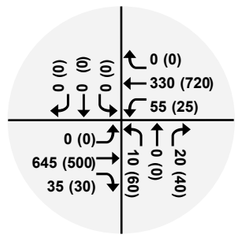
12 US14 Bypass & Medary Ave



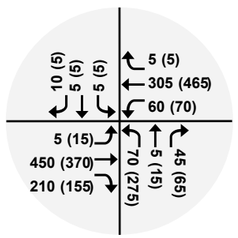
13 US14 Bypass & Stadium Rd



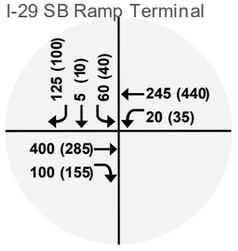
14 US14 Bypass & Jackrabbit Ave



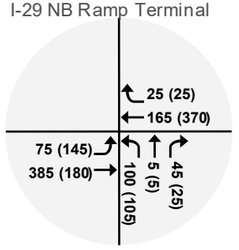
15 US14 Bypass & 22nd Ave



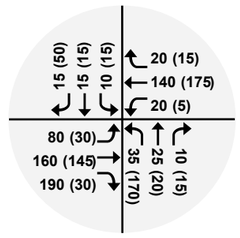
16 US14 Bypass & I-29 SB Ramp Terminal



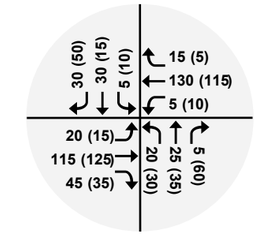
17 US14 Bypass & I-29 NB Ramp Terminal



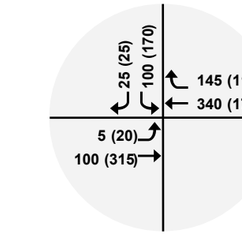
18 US14 Bypass & 32nd



19 US14 Bypass & 34th Ave



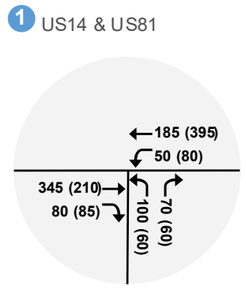
20 US14 & US14 Bypass (East)



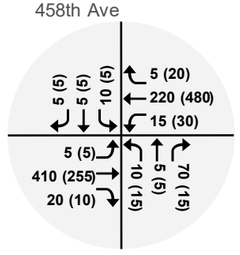
Legend

AM (PM) 2024 Peak Hour Volumes

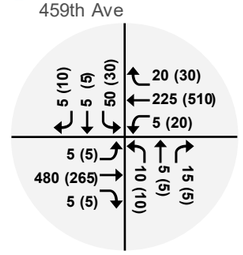
US14
West of Volga



1 US14 & US81

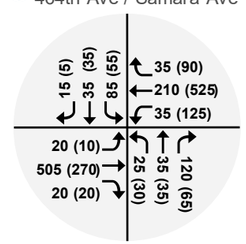


2 US14 & Brookings Co. 11 / 458th Ave

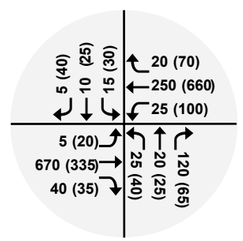


3 US14 & Brookings Co. 1 / 459th Ave

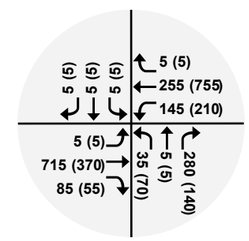
US14 in Volga and East



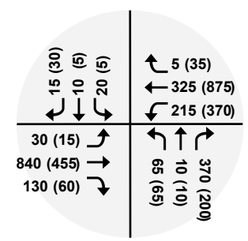
4 US14 & Brookings Co. 5 / 464th Ave / Samara Ave



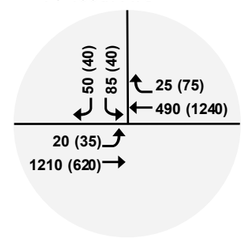
5 US14 & Kasan Ave



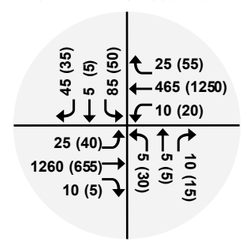
6 US14 & Hansina Ave



7 US14 & Caspian Ave

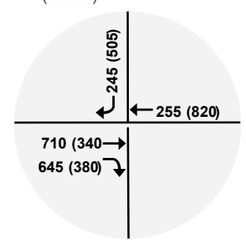


8 US14 & Brookings Co. 7 / 466th Ave

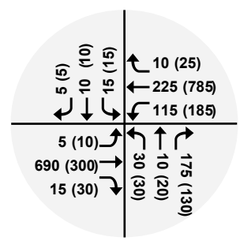


9 US14 & Brookings Co. 9 / 16th Ave W / 469th Ave

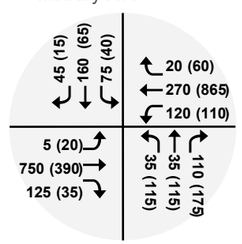
US14 Bypass



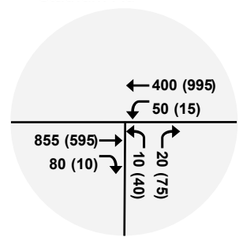
10 US14 & US14 Bypass (West)



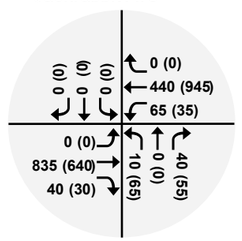
11 US14 Bypass & Western Ave



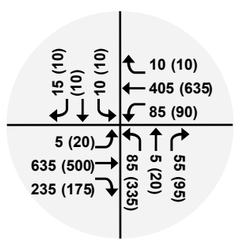
12 US14 Bypass & Medary Ave



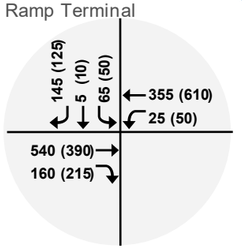
13 US14 Bypass & Stadium Rd



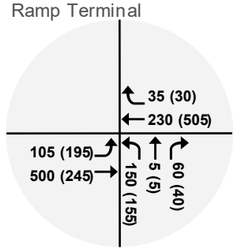
14 US14 Bypass & Jackrabbit Ave



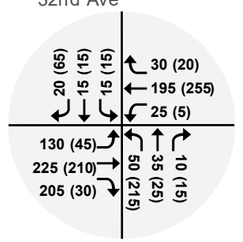
15 US14 Bypass & 22nd Ave



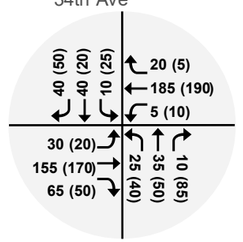
16 US14 Bypass & I-29 SB Ramp Terminal



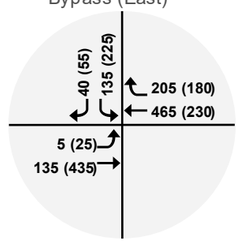
17 US14 Bypass & I-29 NB Ramp Terminal



18 US14 Bypass & 32nd Ave



19 US14 Bypass & 34th Ave



20 US14 & US14 Bypass (East)

Legend

AM (PM) 2050 Peak Hour Volumes

8. Analysis Methodology

8.1. Traffic Operations Analysis

Operation performance of highways and intersections is evaluated in terms of the quality of service, which describes how well a transportation facility operates from the traveler's perspective. Quality of service is usually measured with "Level of Service" (LOS), a letter grade like those used in school. A summary of LOS measures for different roadway facilities pertinent to this study are provided in **Figure 14**.

	Multilane Highway/Freeway
A	Free-flow operation **Density:** ≤11 passenger cars/mile/lane
B	Reasonably free- flow operation; minimal restriction on lane changes and maneuvers **Density:** >11–18 passenger cars/mile/lanez
C	Near free-flow operation; noticeable restriction onlane changes and other maneuvers **Density:** >18–26 passenger cars/mile/lane
D	Speed decline with increasing flows; significant restriction on lane changes and other maneuvers **Density:** >26–35 passenger cars/mile/lane
E	Facility operates at capacity; very few gaps for lane changes and other maneuvers; frequent disruptions and queues **Density:** >35–45 passenger cars/mile/lane
F	Unstable flow; operational breakdown **Density:** >45 passenger cars/mile/lane ***or*** Demand exceeds capacity

Levels Designation Scale:

LOS is presented through a familiar A to F scale, where "A" means the best operating condition and "F" the worst.

LOS Measures: 6th Edition of the Highway Capacity Manual (HCM6)

LOS Definitions: SDDOT Road Design Manual and HCM6

	Unsignalized Intersection	Signalized Intersection
A	Queuing is rare **Intersection Control Delay:** ≤10 seconds/vehicle	Very minimal queuing; excellent corridor progression and/ or short cycle lengths **Intersection Control Delay:** ≤10 seconds/vehicle
B	Occasional queuing **Intersection Control Delay:** >10–15 seconds/vehicle	Some queuing; good corridor progression and/or short cycle lengths **Intersection Control Delay:** >10–20 seconds/vehicle
C	Regular queuing **Intersection Control Delay:** >15–25 seconds/vehicle	Regular queuing; not all demand may be serviced on some cycles (cycle failure) **Intersection Control Delay:** >20–35 seconds/vehicle
D	Queue lengths increased **Intersection Control Delay:** >25–35 seconds/vehicle	Queue lengths increased; routine cycle failures **Intersection Control Delay:** >35–55 seconds/vehicle
E	Significant queuing **Intersection Control Delay:** >35–50 seconds/vehicle	Long queues, congested conditions; majority of cycles fail **Intersection Control Delay:** >55–80 seconds/vehicle
F	Volume to capacity ratio approaches 1.0; very long queues **Intersection Control Delay:** >50 seconds/vehicle	Volume to capacity ratio near 1.0; very long queues, almost all cycles fail **Intersection Control Delay:** >80 seconds/vehicle

Note: Unsignalized intersection control delay shown in figure for overall (or weighted) intersection delay. Two-way stop-control delay (TWSC) is measured from the worst-case stop-controlled approach with the same average delay (seconds/vehicle) thresholds.

Figure 14: Level of Service Descriptions

Peak hour LOS was calculated for study area intersections and roadway segments using Highway Capacity Software (HCS), Version 7 and methodology described in the *6th Edition of the Highway Capacity Manual* (HCM6). The following primary and secondary (supporting) operational measures were used for this study. LOS threshold tables specific to each measure is provided in **Appendix H**.

Table 8: Level of Service Measures

Roadway Feature	LOS Measure	Secondary Measures
Intersections	• Total (overall) intersection delay	• 95th percentile queues. • TWSC intersections: worst-case stop-control delay
I-29 Interchange ramp terminal intersections	• Signalized intersections: total (overall) intersection delay • TWSC intersections: worst-case stop-control delay • Overall interchange: experienced travel time (ETT)	• 95th percentile queues.
Urban street segments	• Travel speed as a percentage of base free flow speed	• Travel time
Multilane highway segments	• Vehicle density	
Two-lane highway segments	• Average travel speed (ATS) and percent time spent following (PTSF), 2016 methodology • Follower density, 2019 methodology	

Two-way stop-control delay (TWSC)

8.2. Level of Service Goals

Study LOS goals differ depending on whether the intersection or roadway segment is in an urban or rural area. A review was conducted of areas surrounding the US14/US14 Bypass intersections east and west to determine whether an urban or rural LOS goal was more applicable (**Appendix I**). The current Brookings urban area is defined as the city limits, previously shown in **Figure 1**, and does not include either US14/US14 Bypass intersection.

It was found that the west US14/US14 Bypass intersection was likely to exhibit urban development surrounding the intersection and northward as Brookings grows to the north. Conversely, development around the east US14/US14 Bypass intersection is anticipated to be minimal since the intersection is in the middle of floodplain and the City of Brookings maintains wellheads for their drinking water to the south of the intersection. Based on these findings, the following urban/rural LOS classification limits were used for this analysis:

Rural Area

- US14: west of 469th Avenue intersection
- US14/US14 Bypass east intersection

Urban Area

- US14 and US14 Bypass: 469th Avenue eastward to, but not including, US14/US14 Bypass (east) intersection

Minimum allowable LOS thresholds for this study are shown in **Table 9**.

Table 9: Level of Service Goals

Facility Type	Minimum Allowable LOS		Notes
	Rural Area	Urban Area	
Signalized Intersections	B	D	Individual movements allowed to operate at LOS D (rural) or LOS E (urban).
Two-Way Stop-Control Intersections	B	C	TWSC intersection LOS based on weighted average intersection delay. Worst-case stop-control approach delay and LOS may be lower than the minimum allowable LOS.
Interstate Ramp Terminal Intersections	B	C	TWSC ramp terminal intersection LOS based on worst-case stop-controlled approach delay.
Multilane Highway and Two-Lane Highway Segments	B	C	LOS B or better is desirable in urban areas.
Urban Street Segments	n/a	C	Applies to urban signalized corridors.

8.3. Predictive Safety Analysis

A predictive safety analysis was completed for the No Build conditions and each corridor scenario using the HSM method to evaluate expected safety of proposed intersection and roadway modifications. As stated in the HSM, "*The predictive method provides a quantitative measure of expected crash frequency under both existing conditions and conditions which have not yet occurred. This allows proposed roadway conditions to be quantitatively assessed…*" (HSM, 2010 version).

FHWA's Interactive Highway Safety Design Model (IHSDM) was the tool used to evaluate safety in the No Build and Build scenario conditions. Output includes the predicted average annual crash frequency over the analyzed timeframe (2024 – 2050). Crashes are categorized as fatal and injury crashes (F+I) and property damage only (PDO) crashes for both intersections and roadway segments.

9. Existing and Future No Build Conditions Traffic Analysis

An existing and future No Build condition traffic operations analysis was conducted to aid in identifying long-range traffic operational needs throughout the study area. Locations that do not meet LOS goals outlined for this study area are noted in **Bold Orange** text in the tables. Additional information regarding both analyses can be found in **Appendix J and K**.

9.1. Intersections

The following tables present a summary of intersection operations for the Existing, 2024 No Build, and 2050 No Build conditions.

Table 10: Intersection Operations – Existing Conditions

Intersection		Intersection Control	Measure	AM			PM		
				Delay (s/veh)	LOS	95th % Queue (veh)	Delay (s/veh)	LOS	95th % Queue (veh)
US14	US81	TWSC	**Overall**	**2.6**	**A**	-	**2.1**	**A**	-
			TWSC	*10.6*	*B*	*0.4*	*10.1*	*B*	*0.2*
	458th Ave	TWSC	**Overall**	**1.3**	**A**	-	**0.8**	**A**	-
			TWSC	*12.9*	*B*	*0*	*5*	*A*	*0*
	459th Ave	TWSC	**Overall**	**8.2**	**A**	-	**0.6**	**A**	-
			TWSC	*13.9*	*B*	*0.3*	*13.2*	*B*	*0.1*
	Samara Ave	TWSC	**Overall**	**4.6**	**A**	-	**4.1**	**A**	-
			TWSC	*18.4*	*C*	*1*	*25.7*	*D*	*1*
	Kasan Ave	TWSC	**Overall**	**1.8**	**A**	-	**2.8**	**A**	-
			TWSC	*12.1*	*B*	*0.5*	*14.3*	*B*	*0.6*
	Hansina Ave	TWSC	**Overall**	**3.6**	**A**	-	**2.9**	**A**	-
			TWSC	*12.7*	*B*	*1.4*	*13.4*	*B*	*1.1*
	Caspian Ave	Signal	**Overall**	**21.1**	**C**	**10.6**	**23.7**	**C**	**10.7**
	466th Ave	TWSC	**Overall**	**0.9**	**A**	-	**0.7**	**A**	-
			TWSC	*12.7*	*B*	*0.6*	*15.7*	*C*	*0.4*
	469th Ave	TWSC	**Overall**	**0.7**	**A**	-	**0.5**	**A**	-
			TWSC	*15.4*	*C*	*0.5*	*20.9*	*C*	*0.3*
US14 Bypass	US14/US14 Bypass (west)	TWSC	**Overall**	**1.6**	**A**		**5**	**A**	-
			TWSC	*10.3*	*B*	*1.1*	*18.6*	*C*	*4.4*
	Western Ave	TWSC	**Overall**	**7.3**	**A**	-	**4.2**	**A**	-
			TWSC	*39.6*	*E*	*0.8*	*28.2*	*D*	*0.5*
	Medary Ave	Signal	**Overall**	**12.9**	**B**	**3.7**	**10**	**A**	**4.2**
	Stadium Road	TWSC	**Overall**	**0.7**	**A**	-	**1.1**	**A**	-
			TWSC	*15.3*	*C*	*0.2*	*15*	*C*	*0.8*
	Jackrabbit Ave	TWSC	**Overall**	**0.9**	**A**	-	**1.3**	**A**	-
			TWSC	*15.3*	*C*	*0.3*	*17.8*	*C*	*1*
	22nd Ave	Signal	**Overall**	**11.6**	**B**	**7.2**	**18.7**	**B**	**10.4**
	I-29 SB RTI	TWSC	**Overall**	**3.1**	**A**	-	**3**	**A**	-
			TWSC	*14.7*	*B*	*1.6*	*19.7*	*C*	*1.8*
	I-29 NB RTI	TWSC	**Overall**	**4.6**	**A**	-	**5.9**	**A**	-
			TWSC	*19*	*C*	*1.7*	*27.7*	*D*	*2.5*
	32nd Ave	TWSC	**Overall**	**3.4**	**A**	-	**8.7**	**A**	-
			TWSC	*16.4*	*C*	*0.5*	*23.4*	*C*	*3.4*
	34th Ave	TWSC	**Overall**	**3.4**	**A**	-	**4.6**	**A**	-
			TWSC	*11.6*	*B*	*0.1*	*11.1*	*B*	*0.5*
	US14 & US14 Bypass (east)	TWSC	**Overall**	**1.6**	**A**	-	**3.9**	**A**	-
			TWSC	*14.6*	*B*	*0.7*	*15.5*	*C*	*1.6*

TWSC: worst-case stop-control approach delay and 95th% queue. **Bold Orange**: does not meet LOS goal.
TWSC LOS goal based on: *TWSC approach delay* (I-29 RTIs) or **overall intersection delay** (all other intersections).

Table 11: Intersection Operations – 2024 No Build Conditions

Intersection		Intersection Control	Measure	AM			PM		
				Delay (s/veh)	LOS	95th % Queue (veh)	Delay (s/veh)	LOS	95th % Queue (veh)
US14	US81	TWSC	**Overall**	**2.9**	**A**	-	**2.2**	**A**	-
			TWSC	*11.1*	*B*	*0.6*	*10.6*	*B*	*0.3*
	458th Ave	TWSC	**Overall**	**2.1**	**A**	-	**1.6**	**A**	-
			TWSC	*14*	*B*	*0.2*	*15.1*	*C*	*0.2*
	459th Ave	TWSC	**Overall**	**2**	**A**	-	**1.6**	**A**	-
			TWSC	*16.7*	*C*	*0.5*	*18.5*	*C*	*0.5*
	Samara Ave	TWSC	**Overall**	**7.3**	**A**	-	**7.3**	**A**	-
			TWSC	*33.2*	*D*	*2.6*	*52.6*	*F*	*2.8*
	Kasan Ave	TWSC	**Overall**	**2.8**	**A**	-	**4.4**	**B**	-
			TWSC	*16.1*	*C*	*1.2*	*20.9*	*C*	*1.7*
	Hansina Ave	TWSC	**Overall**	**6.5**	**C**	-	**4.6**	**C**	-
			TWSC	*22.5*	*C*	*0.3*	*30.1*	*D*	*0.4*
	Caspian Ave	Signal	**Overall**	**33.1**	**C**	**18.7**	**17.3**	**C**	**8.1**
	466th Ave	TWSC	**Overall**	**1**	**A**	-	**1**	**A**	-
			TWSC	*14.7*	*B*	*0.9*	*22.9*	*C*	*1*
	469th Ave	TWSC	**Overall**	**1.5**	**B**	-	**1.8**	**A**	-
			TWSC	*20.5*	*C*	*1.2*	*40.9*	*E*	*1.8*
US14 Bypass	US14/US14 Bypass (west)	TWSC	**Overall**	**1.5**	**A**	-	**7**	**A**	-
			TWSC	*10*	*B*	*1*	*25.5*	*D*	*7*
	Western Ave	TWSC	**Overall**	**5.4**	**A**	-	**4.9**	**A**	-
			TWSC	*23.2*	*C*	*0.4*	*32.7*	*D*	*0.8*
	Medary Ave	Signal	**Overall**	**13.3**	**B**	**4.4**	**11**	**B**	**3**
	Stadium Road	TWSC	**Overall**	**0.7**	**A**	-	**1.4**	**A**	-
			TWSC	*14.8*	*B*	*0.2*	*16.8*	*C*	*1.1*
	Jackrabbit Ave	TWSC	**Overall**	**0.9**	**A**	-	**3.1**	**A**	-
			TWSC	*15.5*	*C*	*0.3*	*20.7*	*C*	*1.4*
	22nd Ave	Signal	**Overall**	**11.7**	**B**	**7.4**	**19.1**	**B**	**10.7**
	I-29 SB RTI	TWSC	**Overall**	**3.4**	**A**	-	**3.3**	**A**	-
			TWSC	*15.8*	*C*	*1.8*	*19.9*	*C*	*2*
	I-29 NB RTI	TWSC	**Overall**	**5**	**A**	-	**6.2**	**A**	-
			TWSC	*21.1*	*C*	*2.1*	*28*	*D*	*2.6*
	32nd Ave	TWSC	**Overall**	**3.3**	**A**	-	**6.8**	**B**	-
			TWSC	*15.1*	*C*	*0.4*	*17*	*C*	*2*
	34th Ave	TWSC	**Overall**	**3.5**	**A**	-	**4.7**	**A**	-
			TWSC	*12.4*	*B*	*0.2*	*11.4*	*B*	*0.5*
	US14 & US14 Bypass (east)	TWSC	**Overall**	**2.6**	**A**	-	**4.3**	**A**	-
			TWSC	*14.3*	*B*	*0.9*	*17*	*C*	*2*

TWSC: worst-case stop-control approach delay and 95th % queue. **Bold Orange**: does not meet LOS goal.
TWSC LOS goal based on: *TWSC approach delay* (I-29 RTIs) or **overall intersection delay** (all other intersections).

Table 12: Intersection Operations – 2050 No Build Conditions

Intersection		Intersection Control	Measure	AM			PM		
				Delay (s/veh)	LOS	95th % Queue (veh)	Delay (s/veh)	LOS	95th % Queue (veh)
US14	US81	TWSC	**Overall**	**3.2**	**A**	**1**	**6.4**	**A**	**0.6**
			TWSC	*13.1*	*B*	*1*	*14.3*	*B*	*0.6*
	458th Ave	TWSC	**Overall**	**2.4**	**A**	**0.9**	**1.7**	**A**	**0.5**
			TWSC	*18.4*	*C*	*0.3*	*20*	*C*	*0.2*
	459th Ave	TWSC	**Overall**	**2.5**	**A**	**1.2**	**2.3**	**A**	**3**
			TWSC	*25.1*	*D*	*1.2*	*27.8*	*D*	*1*
	Samara Ave	TWSC	**Overall**	**44.8**	**E**	**12**	**51.4**	**F**	**10.8**
			TWSC	*317.6*	*F*	*12*	*527.4*	*F*	*10.8*
	Kasan Ave	TWSC	**Overall**	**4.8**	**A**	**3.6**	**11.7**	**B**	**5.6**
			TWSC	*28.8*	*D*	*3.6*	*68.5*	*F*	*5.6*
	Hansina Ave	TWSC	**Overall**	**18.8**	**C**	**12.8**	**16.1**	**C**	**10.6**
			TWSC	*85*	*F*	*12.8*	*107.8*	*F*	*10.6*
	Caspian Ave	Signal	**Overall**	**88.1**	**F**	**45.8**	**33.7**	**C**	**15.9**
	466th Ave	TWSC	**Overall**	**1.7**	**A**	**2.2**	**2.1**	**A**	**2.9**
			TWSC	*21.5*	*C*	*2.2*	*47.3*	*E*	*2.9*
	469th Ave	TWSC	**Overall**	**~**	**F**	**0.1**	**6.1**	**A**	**5.4**
			TWSC	*~*	*F*		*106.3*	*F*	*5.4*
US14 Bypass	US14/US14 Bypass (west)	TWSC	**Overall**	**1.4**	**A**	**1.3**	**17**	**A**	**14.9**
			TWSC	*10.9*	*B*	*1.3*	*68.7*	*F*	*14.9*
	Western Ave	TWSC	**Overall**	**10**	**A**	**5.6**	**9.2**	**A**	**6**
			TWSC	*89.7*	*F*	*1.9*	*61*	*F*	*1.4*
	Medary Ave	Signal	**Overall**	**12.9**	**B**	**8.3**	**10**	**A**	**5.6**
	Stadium Road	TWSC	**Overall**	**0.8**	**A**	**0.4**	**1.6**	**A**	**1.8**
			TWSC	*18.8*	*C*	*0.4*	*23.2*	*C*	*1.8*
	Jackrabbit Ave	TWSC	**Overall**	**1.1**	**A**	**0.4**	**2.2**	**A**	**2.4**
			TWSC	*23.8*	*C*	*0.7*	*32*	*D*	*2.4*
	22nd Ave	Signal	**Overall**	**15.4**	**B**	**12.7**	**26.0**	**C**	**14.7**
	I-29 SB RTI	TWSC	**Overall**	**3.9**	**A**	**2.8**	**5.9**	**A**	**4.7**
			TWSC	*21.7*	*C*	*2.8*	*41.8*	*E*	*4.7*
	I-29 NB RTI	TWSC	**Overall**	**9.6**	**A**	**5.3**	**26**	**D**	**9.8**
			TWSC	*46.9*	*E*	*5.3*	*155.1*	*F*	*9.8*
	32nd Ave	TWSC	**Overall**	**4.7**	**A**	**1**	**12.4**	**B**	**5.6**
			TWSC	*23.7*	*C*	*1*	*37.9*	*E*	*5.6*
	34th Ave	TWSC	**Overall**	**4**	**A**	**0.7**	**5.3**	**A**	**0.9**
			TWSC	*14.4*	*B*	*0.4*	*13.3*	*B*	*0.9*
	US14 & US14 Bypass (east)	TWSC	**Overall**	**3.5**	**A**	**2**	**8.3**	**A**	**5.5**
			TWSC	*19.7*	*C*	*2*	*33.3*	*D*	*5.5*

TWSC: worst-case stop-control approach delay and 95th % queue. **Bold Orange**: does not meet LOS goal.
TWSC LOS goal based on: *TWSC approach delay* (I-29 RTIs) or **overall intersection delay** (all other intersections).

9.2. Highway Segments

Summaries of highway segment operations for the Existing, 2024 No Build, and 2050 No Build conditions are provided in the following tables.

Table 13: Highway Segment Operations – Existing Conditions

	From	To	Length (mi)	Hwy Type	AM LOS		PM LOS	
					EB	WB	EB	WB
US14	MRM 402.94	US81	0.15	Multilane	A	A	A	A
	US81	458th Ave	3.96	Multilane	A	A	A	A
	458th Ave	459th Ave	1.04	2 Lane	B	B	A	B
	459th Ave	Samara Ave	4.90	2 Lane	B	A	A	B
	Samara Ave	Kasan Ave	0.09	Multilane	A	A	A	A
	Kasan Ave	Hansina Ave	0.27	Multilane	A	A	A	A
	Hansina Ave	Caspian Ave	0.63	Multilane	A	A	A	A
	Caspian Ave	466th Ave	1.19	Multilane	A	A	A	A
	466th Ave	469th Ave	2.93	Multilane	A	A	A	A
	469th Ave	US14 Bypass	0.09	Multilane	B	A	A	A
US14 Bypass	US14 Bypass	Western Ave	0.77	2 Lane	**E**	C	**D**	**D**
	Western Ave	Medary Ave	0.97	2 Lane	**E**	**D**	**D**	**E**
	Medary Ave	Jackrabbit Ave	0.49	2 Lane	**E**	**E**	**D**	**E**
	Jackrabbit Ave	22nd Ave	0.41	2 Lane	**E**	**E**	**E**	**E**
	22nd Ave	I-29 SB Ramp Terminal	0.39	2 Lane	**E**	**E**	**E**	**E**
	I-29 SB Ramp Terminal	I-29 NB Ramp Terminal	0.19	2 Lane	**D**	**D**	**D**	**E**
	I-29 NB Ramp Terminal	32nd Ave	0.20	2 Lane	**D**	**D**	**D**	**D**
	32nd Ave	34th Ave	0.22	2 Lane	C	C	C	C
	34th Ave	US14	1.41	2 Lane	C	C	C	C

Bold Orange: does not meet LOS goal.

Table 14: Highway Segment Operations – 2024 No Build Conditions

	From	To	Length (mi)	Hwy Type	AM LOS		PM LOS	
					EB	WB	EB	WB
US14	MRM 402.94	US81	0.15	Multilane	A	A	A	A
	US81	458th Ave	3.96	Multilane	A	A	A	A
	458th Ave	459th Ave	1.04	2 Lane	**C**	B	B	**C**
	459th Ave	Samara Ave	4.90	2 Lane	**C**	B	B	**C**
	Samara Ave	Kasan Ave	0.09	Multilane	A	A	A	A
	Kasan Ave	Hansina Ave	0.27	Multilane	A	A	A	A
	Hansina Ave	Caspian Ave	0.63	Multilane	B	A	A	B
	Caspian Ave	466th Ave	1.19	Multilane	A	A	A	A
	466th Ave	469th Ave	2.93	Multilane	B	A	A	B
	469th Ave	US14 Bypass	0.09	Multilane	B	A	A	B
US14 Bypass	US14 Bypass	Western Ave	0.77	2 Lane	**D**	C	**D**	**D**
	Western Ave	Medary Ave	0.97	2 Lane	**D**	**D**	**E**	**E**
	Medary Ave	Jackrabbit Ave	0.49	2 Lane	**E**	**D**	**E**	**E**
	Jackrabbit Ave	22nd Ave	0.41	2 Lane	**E**	**E**	**E**	**E**
	22nd Ave	I-29 SB Ramp Terminal	0.39	2 Lane	**E**	**E**	**E**	**E**
	I-29 SB Ramp Terminal	I-29 NB Ramp Terminal	0.19	2 Lane	**E**	**D**	**D**	**D**
	I-29 NB Ramp Terminal	32nd Ave	0.20	2 Lane	**D**	**D**	**D**	**D**
	32nd Ave	34th Ave	0.22	2 Lane	C	C	C	C
	34th Ave	US14	1.41	2 Lane	B	B	B	B

Bold Orange: does not meet LOS goal.

Table 15: Highway Segment Operations – 2050 No Build Conditions

	From	To	Length (mi)	Hwy Type	AM LOS		PM LOS	
					EB	WB	EB	WB
US14	MRM 402.94	US81	0.15	Multilane	A	A	A	A
	US81	458th Ave	3.96	Multilane	A	A	A	A
	458th Ave	459th Ave	1.04	2 Lane	B	B	B	**D**
	459th Ave	Samara Ave	4.90	2 Lane	**D**	B	B	**D**
	Samara Ave	Kasan Ave	0.09	Multilane	B	A	A	B
	Kasan Ave	Hansina Ave	0.27	Multilane	B	A	A	B
	Hansina Ave	Caspian Ave	0.63	Multilane	B	A	A	B
	Caspian Ave	466th Ave	1.19	Multilane	B	A	A	B
	466th Ave	469th Ave	2.93	Multilane	B	A	A	B
	469th Ave	US14 Bypass	0.09	Multilane	B	A	A	B
US14 Bypass	US14 Bypass	Western Ave	0.77	2 Lane	**E**	C	**E**	**E**
	Western Ave	Medary Ave	0.97	2 Lane	**E**	**E**	**E**	**E**
	Medary Ave	Jackrabbit Ave	0.49	2 Lane	**E**	**E**	**E**	**E**
	Jackrabbit Ave	22nd Ave	0.41	2 Lane	**E**	**E**	**E**	**E**
	22nd Ave	I-29 SB Ramp Terminal	0.39	2 Lane	**E**	**E**	**E**	**E**
	I-29 SB Ramp Terminal	I-29 NB Ramp Terminal	0.19	2 Lane	**E**	**E**	**E**	**E**
	I-29 NB Ramp Terminal	32nd Ave	0.20	2 Lane	**D**	**D**	**D**	**D**
	32nd Ave	34th Ave	0.22	2 Lane	**D**	**D**	**D**	**D**
	34th Ave	US14	1.41	2 Lane	C	C	C	C

Bold Orange: does not meet LOS goal.

9.3. Planning Turn Lane Warrants

Future-year peak hour traffic volumes were reviewed to identify planning-level timeframes for if/when turn lanes may be warranted at unsignalized intersections. Methodology for this review followed the vehicular volume criterion outlined in Chapter 15 of the *SDDOT Road Design Manual*. This review does not necessitate installation of a new turn lane or removal of an existing turn lane as there are additional criterion and considerations that ultimately factor into the decision.

The following tables identify turn lanes that may be warranted within the 2050 Planning Horizon as well as a planning-level year of need to help guide timelines for future improvements. Turn lanes shown to be warranted by year 2035, representing a potential short-term need, are highlighted in gray. Additional information on this review is provided in **Appendix L**.

Table 16: Unsignalized Intersection Turn Lane Volume Warrants – US14 Rural Area

US14 Intersection	Posted Speed Limit	Eastbound		Westbound	
		Left Turn	Right Turn	Left Turn	Right Turn
US81	65	n/a	Existing *(2050)*	Existing *(By 2024)*	n/a
458th Ave / CR11	65	*	Does Not Meet	**By 2024**	Does Not Meet
459th Ave / CR1	65	*	Does Not Meet	**By 2024**	**2025 - 2030**
Samara Ave	35	Existing *(2035-2040)*	Does Not Meet	Existing *(By 2024)*	Existing *(2030-2035)*
Kasan Ave	35	Existing *(2045-2050[1])*	Does Not Meet	Existing *(By 2024)*	**2035 - 2040[1]**
Hansina Ave	35	Existing *(Does Not Meet[1])*	**2030 - 2035**	Existing *(By 2024)*	Does Not Meet[1]
466th Ave / CR7	65	Existing *(By 2024)*	n/a	n/a	**By 2024**
469th Ave / CR9	65	**2025 - 2030**	Does Not Meet	Existing *(By 2024)*	**By 2024**

* Volume warrant not met, but volumes fall in special consideration area.
[1] Commercial driveway (not a public street).

Table 17: Unsignalized Intersection Turn Lane Volume Warrants – US14 Bypass (2-Lane)

US14 Bypass Intersection	Posted Speed Limit	Eastbound		Westbound	
		Left Turn	Right Turn	Left Turn	Right Turn
US14 (west)	55	n/a	Existing *(By 2024)*	n/a	n/a
Western Ave	55	*	Does Not Meet	Existing *(By 2024)*	**By 2024**
Stadium Ave	55	n/a	Existing *(By 2024)*	Existing *(By 2024)*	n/a
Jackrabbit Ave	55	n/a	Existing *(By 2024)*	Existing *(By 2024)*	n/a
22nd Ave	55	Existing *(By 2024)*	Existing *(By 2024)*	Existing *(By 2024)*	Does Not Meet
I-29 SB RTI	55	n/a	Existing *(By 2024)*	**By 2024**	n/a
I-29 NB RTI	55	**By 2024**	n/a	n/a	**2030 - 2035**
32nd Ave	55	Existing *(By 2024)*	Existing *(By 2024)*	Existing *(By 2024)*	Does Not Meet
34th Ave	55	Existing *(2045-2050)*	Existing *(2045-2050)*	Existing *(Does Not Meet)*	Does Not Meet
US14 (east)	65	Existing *(By 2024)*	n/a	n/a	Existing *(By 2024)*

* Volume warrant not met, but volumes fall in special consideration area.

9.4. Planning Signal Warrants

A planning-level traffic signal warrant review was conducted for intersections in and around the Brookings and Volga areas to identify approximate timeframes for when traffic volumes may warrant a traffic signal. This traffic signal warrant review uses guidelines presented in Chapter 4C of the *2009 Manual on Uniform Traffic Control Devices* (MUTCD). Similar to the turn lane warrant review, findings from this review do not necessitate installation. Typically, signals are installed after counted, existing traffic volumes meet a qualifying warrant threshold(s).

Hourly planning-level traffic volumes were developed to review Warrant 1 (eight-hour vehicular volumes) and Warrant 2 (four-hour vehicular volume). Warrant 3 (peak hour) was not considered as special conditions required for the warrant were not found along the corridor.

Hourly traffic volumes collected in 2019 were forecasted to years 2024 and 2050 based on growth factors reflected in the 2024 and 2050 peak hour No Build condition traffic volumes.

Table 18 summarizes findings from the 2024 and 2050 No Build condition warrant review. Intersections shown to reach warrant thresholds in year 2024 represent short-term needs for potential changes in traffic control while an intersection not meeting warrant thresholds until later in the 2050 Planning Horizon represent long-range considerations. Additional information regarding the warrant review process and findings is presented in **Appendix M**.

Table 18: Future Year No Build Condition Traffic Signal Warrant Review

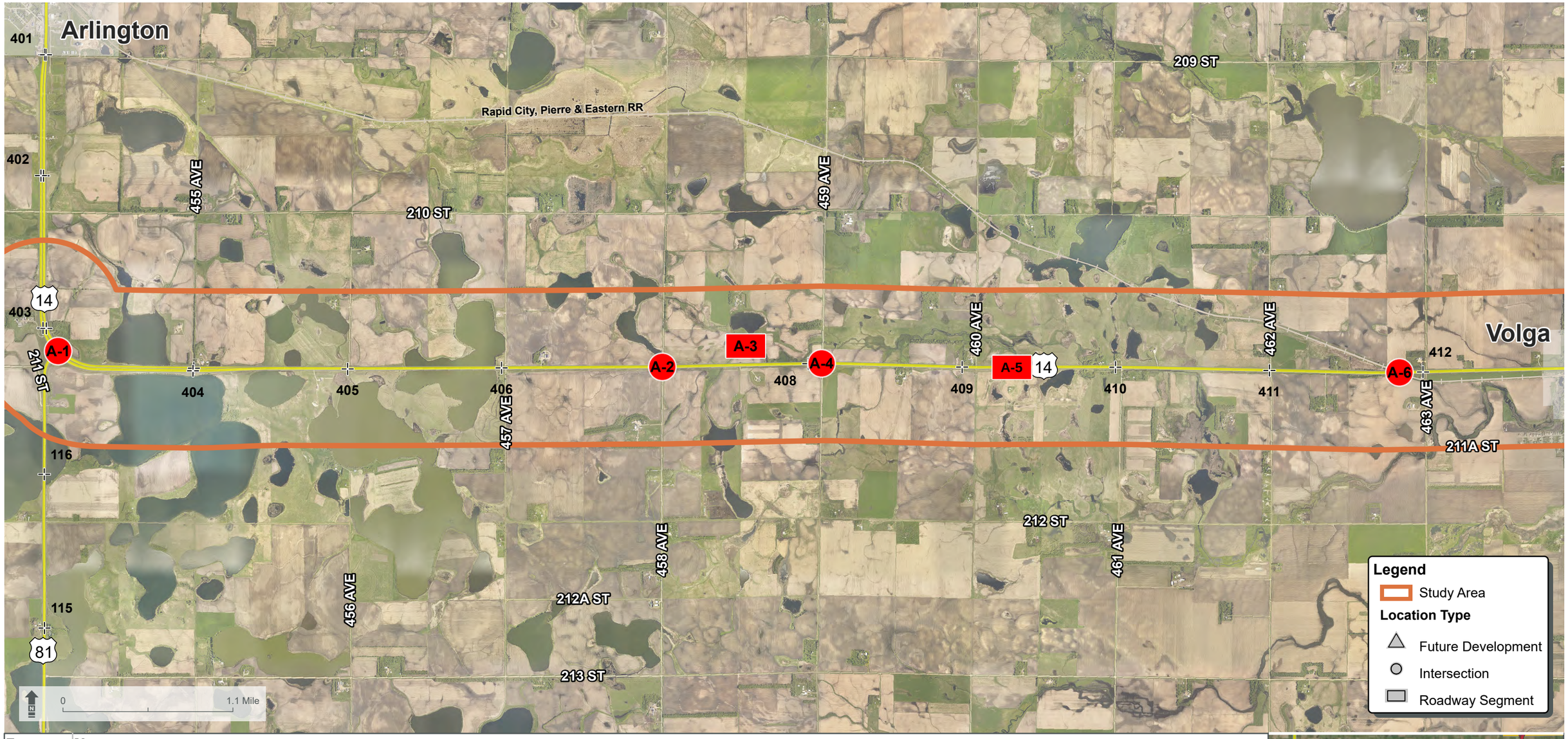
US14 Bypass Intersection	Traffic Signal Warrant Met	
	2024	2050
CR 5 / Samara Avenue		X
Kasan Avenue		X
Hansina Avenue	X	X
Western Avenue	X	X
Stadium Road		
Jackrabbit Avenue		X
22nd Avenue	X	X
I-29 SB Ramp Terminal		X
I-29 NB Ramp Terminal	X	X
32nd Avenue		
34th Avenue		
US14/US14 Bypass (east)		X

Warrant 3 Peak Hour not considered in this summary.

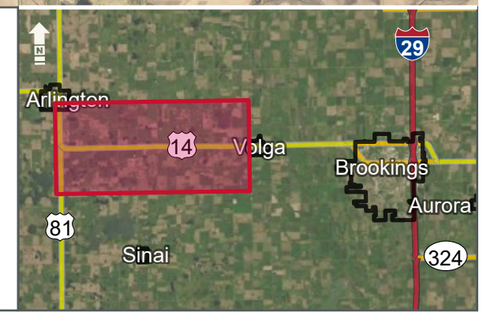
10. Identification of Transportation Issues and Needs

The culmination of study process Step 1 was the first set of public and stakeholder meetings. Four daytime stakeholder meetings with local landowners, business owners, and local organization representatives, and two evening public meetings were held in Brookings and Volga on June 26 and 27, 2019. The focus of these meetings was to present data-driven transportation needs identified through preliminary analyses and gather feedback from the public and stakeholders on what they see as existing and long-range issues throughout the corridor. A summary is provided in **Appendix N**.

Overarching transportation issues and needs identified by the study stakeholders, public, SAT, and analysis completed in Step 1 are summarized in **Figure 15**.



Feature	Note
A-1	US81 intersection - crash history.
A-2	458th Ave intersection - crash history, need for turn lanes.
A-3	Segment between 458th Ave and 459th Ave - crash history, blowing snow.
A-4	459th Ave intersection - crash history, need for turn lanes.
A-5	2-lane segment - head-on crash history, traffic operations, volume-limited opportunities to pass, and need to review number of lanes.
A-6	RR crossing - visibility during inclement weather.



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Feature	Note	Feature	Note	Feature	Note
B-1	Samara Ave intersection - traffic operations and cross-section transition.	B-6	Future development areas - North of US14.	D-1	Access - density, crash history, and spacing between US14 and 469th Ave.
B-2	5-lane segment, north side - access density.	C-1	Segment bridges - icy road conditions.	D-2	WB US14/US14 Bypass intersection - crash history.
B-3	Hansina Ave intersection - traffic operations and bicycle/ pedestrian safety.	C-2	US14/466th Ave intersection - need for turn lane.	D-3	Interchange - does not accomodate all movements and limited connectivity to local network.
B-4	5-lane segment - multimodal facility connectivity.	C-3	RR crossing - visibility during inclement weather.	D-4	Future development areas - surrounding intersection and northward.
B-5	Caspian Ave intersection - traffic operations.	C-4	Multimodal connectivity between Volga and Brookings.		

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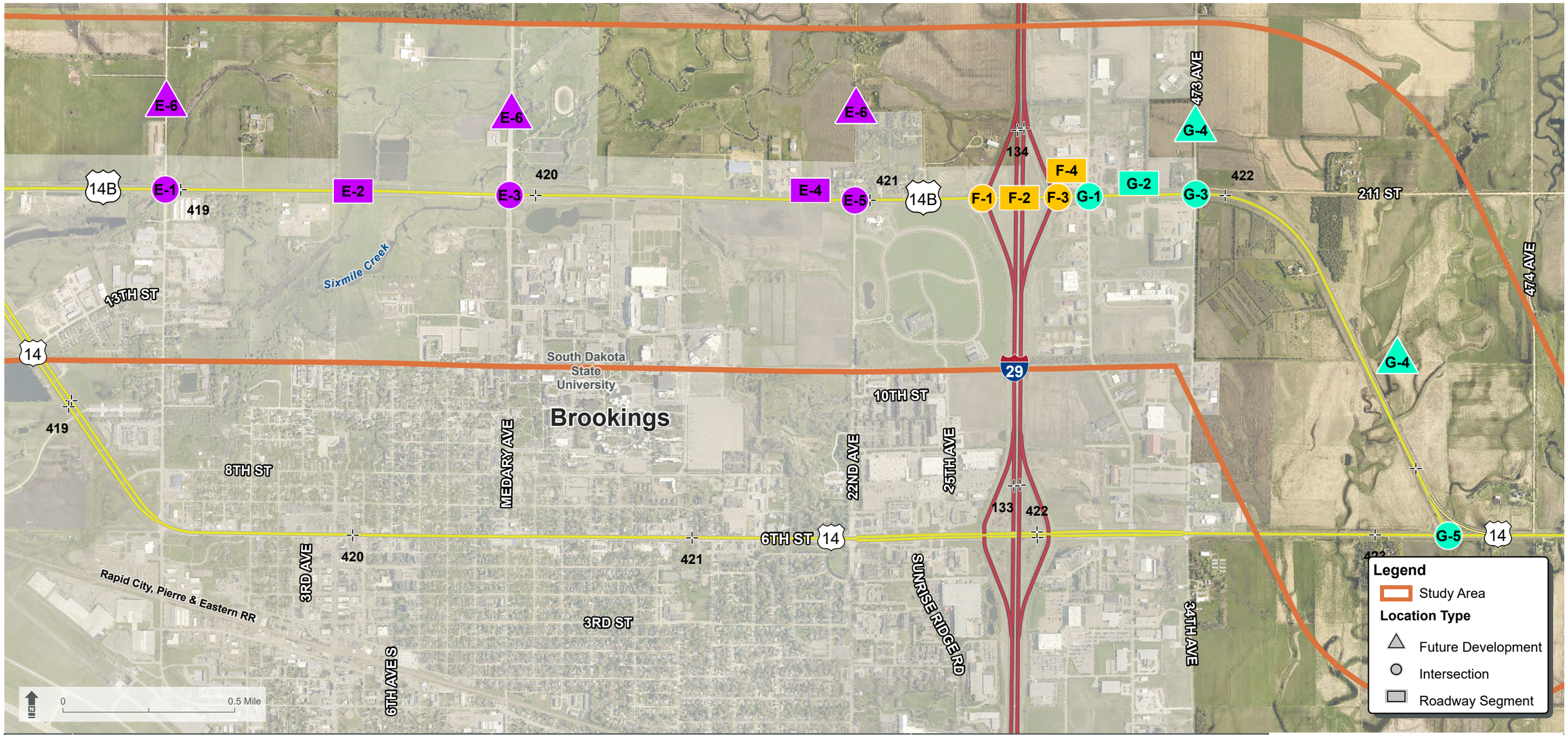
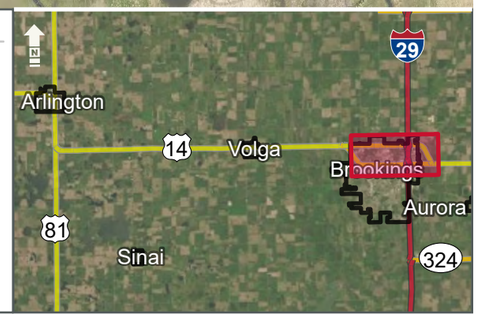


Feature	Note	Feature	Note	Feature	Note
E-1	Western Ave intersection - traffic operations.	E-6	SDSU Football game day traffic - Pre-game queing on US14 Bypass, postgame delay on US14 Bypass, speed differential, traffic information, and route reliability/ functionality.	G-1	32nd Ave intersection - high truck volumes, North/South leg widths, large truck/trailer combinations.
E-2	Segment - traffic operations, number of lanes, and speed.			G-2	Between 32nd Ave and 34th Ave - access density, future number of lanes, and WB right turn lanes.
E-3	Medary Ave Intersection - traffic operations.			G-3	34th Ave intersection - high truck volumes, timeframe of future traffic signal.
E-4	22nd Ave intersection area - access density.	F-1	I-29 SB ramp terminal intersection - turn lanes, accomodation of large vehicles.	G-4	Future industrial and mixed-use development.
E-5	22nd Ave intersectin - traffic operations and crash history.	F-2	Bridge - narrow width, large vehicle combinations, sight distance.	G-5	US14 (East) Intersection - intersectin skew and crash history.
		F-3	I-29 NB ramp terminal intersection - traffic operations, turn lanes, and accommodation of large vehicles.		



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11. Concept Development

Study process Step 2 began with the first SAT workshop on September 24, 2020, to brainstorm potential concepts to address identified transportation issues and needs.

The US14-US14 Bypass corridor was subdivided into the following segments for the concept development phase:

A. US14 West of Volga
B. US14 in Volga
C. US14 between Volga and 469th Avenue
D. US14 Bypass

Potential typical sections with different number of lanes, median widths, and urban/rural elements were identified for each of the four segments to establish a framework for concept development. Over 44 different intersection and segment conceptual layouts were generated throughout the corridor. Each intersection concept includes warranted turn lanes and was developed to meet LOS goals established for this study. A preliminary cost was calculated for each concept, though all costs were considered illustrative given the different corridor cross-sections each could be paired with in a larger scenario.

The full set of conceptual layouts is presented in the *Intersection and Corridor Concepts* memo in **Appendix O**.

Study process Step 2 concluded with the second set of stakeholder and public meetings, where conceptual layouts were presented for feedback. Supplemental meetings were also held with SDSU representatives and members of the East Brookings Business & Industry Association (EBBIA) to discuss concepts and access management. Feedback from these meetings aided in further refinement and evaluation of concepts in preparation for the development of corridor scenarios.

12. Corridor Scenario Development

Following the second set of stakeholder and public meetings, the SAT reconvened to develop feasible corridor scenarios reflective of potential future projects as part of study process Step 3. Key considerations in this collaborative step of the study process included preliminary traffic operations and safety analyses, public and stakeholder feedback, preliminary assessments of cost, constructability, and feasibility, and input from the SAT and others within the SDDOT. Meeting minutes from the workshop, including reasons for eliminating certain concepts from further consideration, are included in **Appendix P**.

The seven corridor scenario segments are shown in **Figure 16**. A compiled list of all scenarios with layouts is provided in the *Feasible Scenarios* memo in **Appendix P**.

Figure 16: US14-US14 Bypass Corridor Scenario Segments

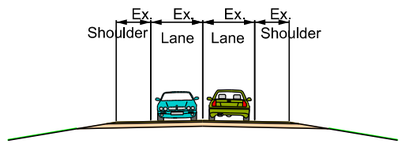
Supporting analysis documentation for each of the corridor scenarios is provided in the following technical memos and reports:

- *Corridor Scenario 2050 Traffic Operations Analysis* technical memo **(Appendix Q)**
- *Corridor Scenario 2024 Traffic Operations Analysis* technical memo **(Appendix R)**
- Predictive Safety Analysis for US14-US14 Bypass Corridor Study Area technical memo **(Appendix S)**
- *Public Meeting #3 Summary Report* **(Appendix N)**

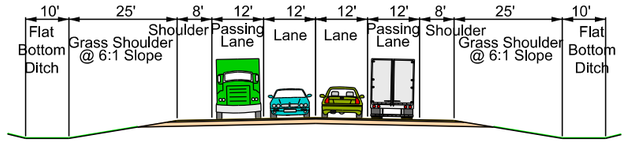
13. Typical Section Options

Typical sections applicable to the seven corridor scenarios are shown in **Figure 17.**

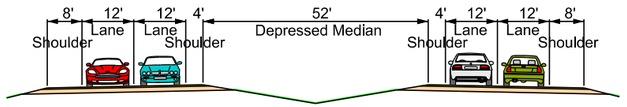
Segment A: US14 West of Volga



A-1: Existing

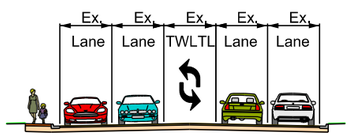


A-2: Truck Passing Lanes and Blowing Snow

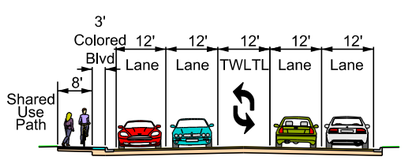


A-3: 4 Lane Divided - Depressed Median

Segment B: US14 in Volga

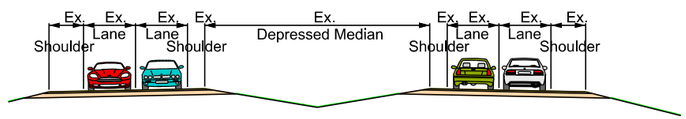


B-1: Existing

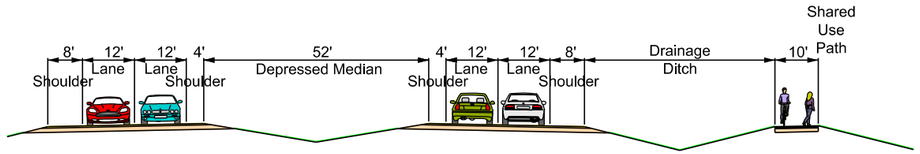


B-2: Shared Use Path

Segment C: US14 between Volga and US14 Bypass

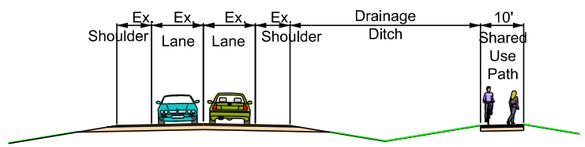


C-1: Existing

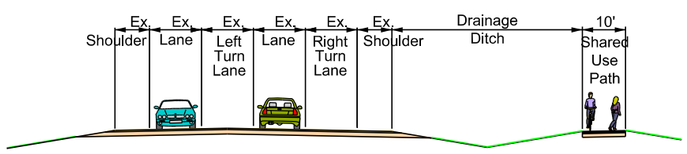


C-1: Shared Use Path

Segment D: US14 Bypass (Applicable to Corridor Scenarios D, E, F, and G)

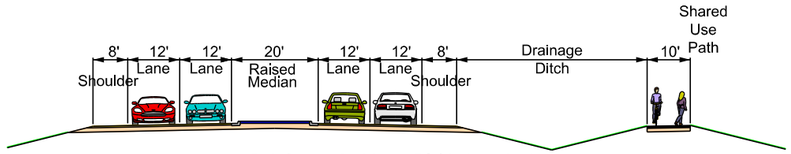


D-1: Existing

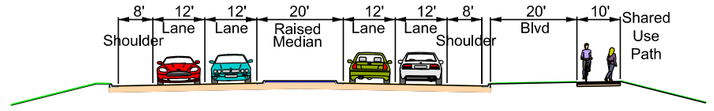


D-1: Existing with Turn Lanes

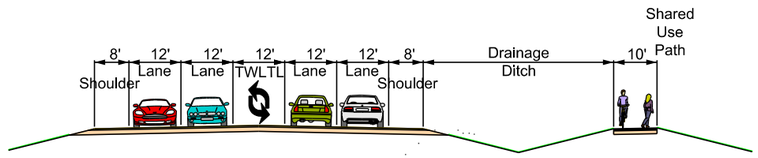
Segment D: US 14 Bypass (Continued)



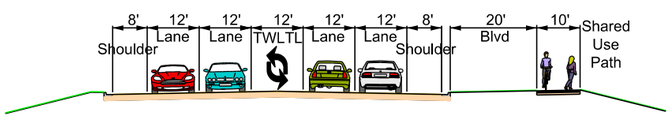
D-2 Option A: 4 Lane Divided - Suburban



D-2 Option B: 4 Lane Divided - Urban



D-3 Option A: 5 Lane - Suburban



D-3 Option B: 5 Lane - Urban

Figure 17

US 14 / US 14 Bypass
Typical Sections

US14 / US14B Corridor Study

Brookings, SD

U.S. Department of Transportation
Federal Highway Administration

14. US14 West of Volga Scenarios

Primary transportation needs driving US14 west of Volga scenario development centered on intersection and segment capacity and safety, including:

- Improve safety at the US14 intersections with US81, 458th Avenue, and 459th Avenue.
- Improve safety and capacity along 2-lane US14 segments.

Four scenarios were developed to address these needs, and include:

Scenario A: Maintain 2-Lane Highway with Intersection Improvements

- *Warranted turn lanes at 458th Avenue and 459th Avenue intersections.*
- *Reflects 2021 project programmed in the 2021-2024 Statewide Transportation Improvement (STIP) project.*

Scenario B: Maintain 2-Lane Highway with Passing Lanes and Intersection Improvements

- *Warranted turn lanes at 458th Avenue and 459th Avenue intersections.*
- *Two westbound 1.5-mile passing lanes east of 459th Avenue.*
- *One eastbound 1.5-mile passing lane plus 0.5-mile extension of multiline west of Volga.*

Scenario C: Maintain 2-Lane Highway with Passing Lanes and Intersection Improvements

- *Warranted turn lanes at 458th Avenue and 459th Avenue intersections.*
- *One westbound 1.5-mile passing lane west of 459th Avenue and one east of 459th Avenue.*
- *One eastbound 1.5-mile passing lane plus 0.5-mile extension of multiline west of Volga.*

Scenario D: Multi-lane Divided Highway with Intersection Improvements

- *Warranted turn lanes at 458th Avenue and 459th Avenue intersections.*

All four scenarios include planned US81 intersection improvements as part of a 3.43-mile US14 corridor segment reconstruction project programmed for 2023.

Intersection Option: US14/US81 Intersection Improvements

- *Narrow US14 median and reconstruct intersection.*
- *US14 mainline reconstruction.*
- *Reflects programmed 2023 STIP project.*

Figure 18 through **Figure 22** provide an overview of the proposed scenario improvements, with corridor layouts typically focusing on the 458th Avenue and 459th Avenue intersections. Full scenario layouts are provided in **Appendix P**.

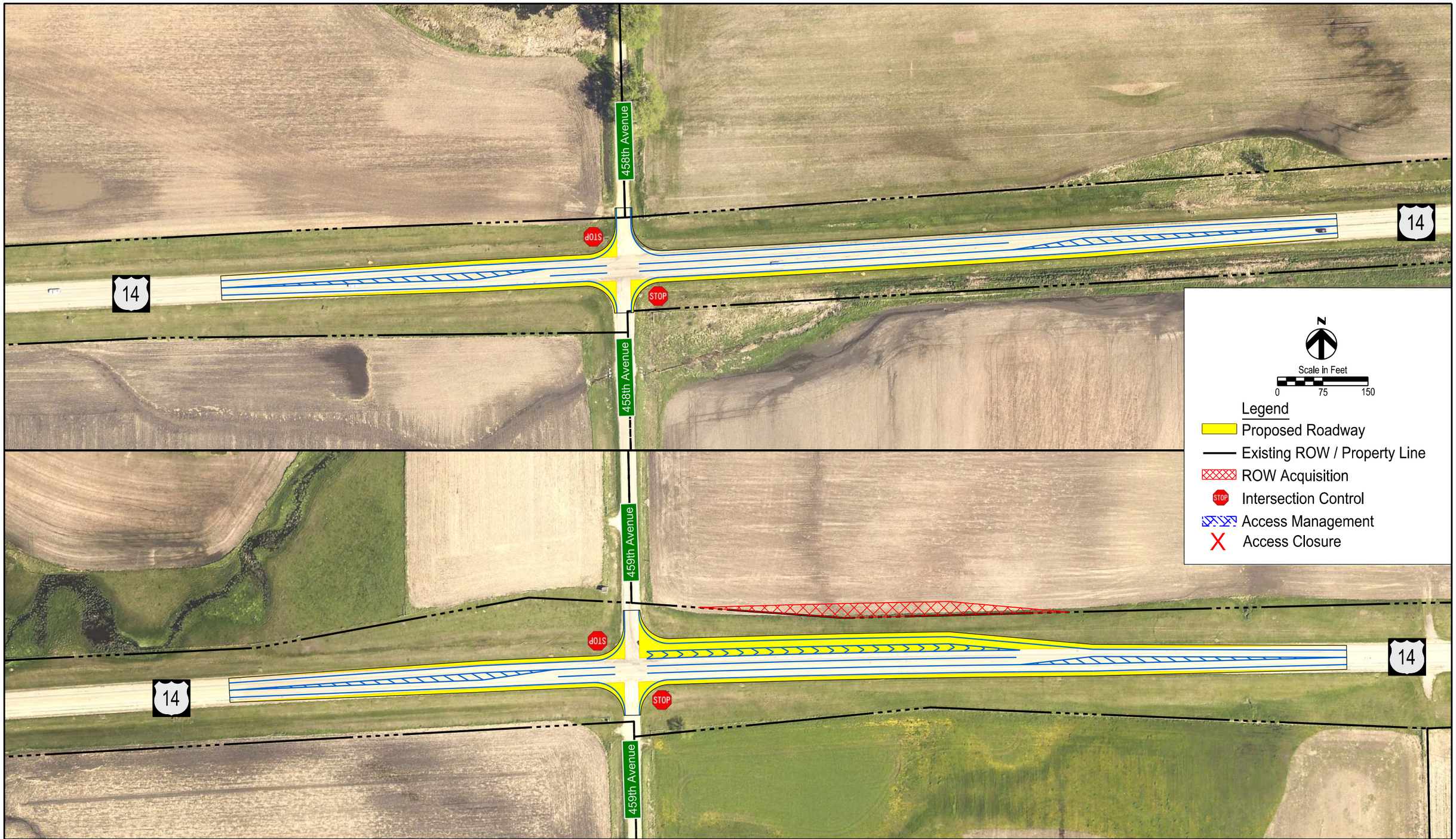
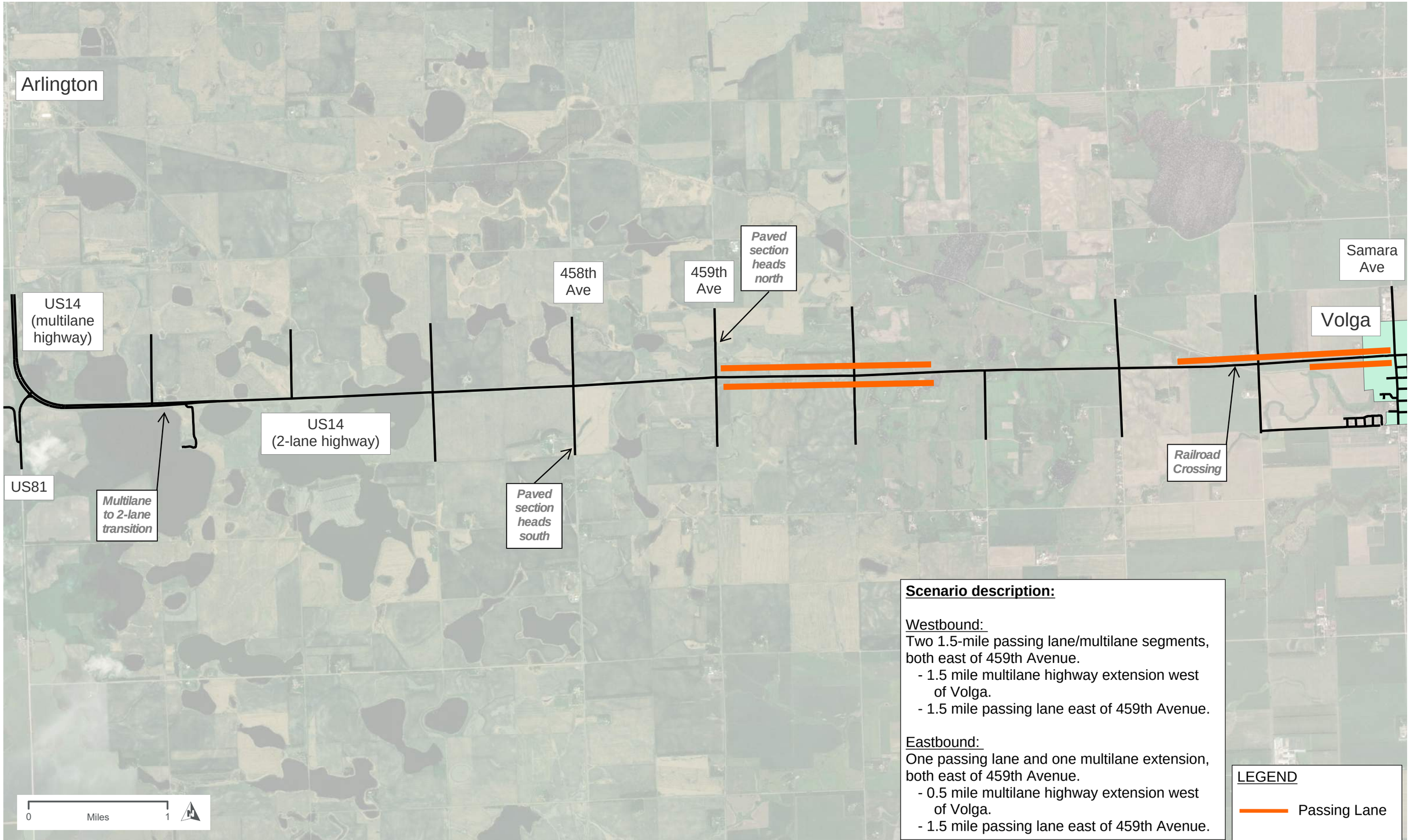


Figure			
18	US14 West of Volga Scenarios Maintain 2-Lane Highway with Intersection Improvements US14 / US14B Corridor Study — Brookings, SD	Scenario US14 West of Volga - Scenario A

U.S. Department of Transportation
Federal Highway Administration



Passing Lane Scenario B

US14-US14 BYPASS CORRIDOR STUDY

Figure 19, Page 1

SOURCE: PASSING LANE OPTIMIZATION TECHNICAL MEMO

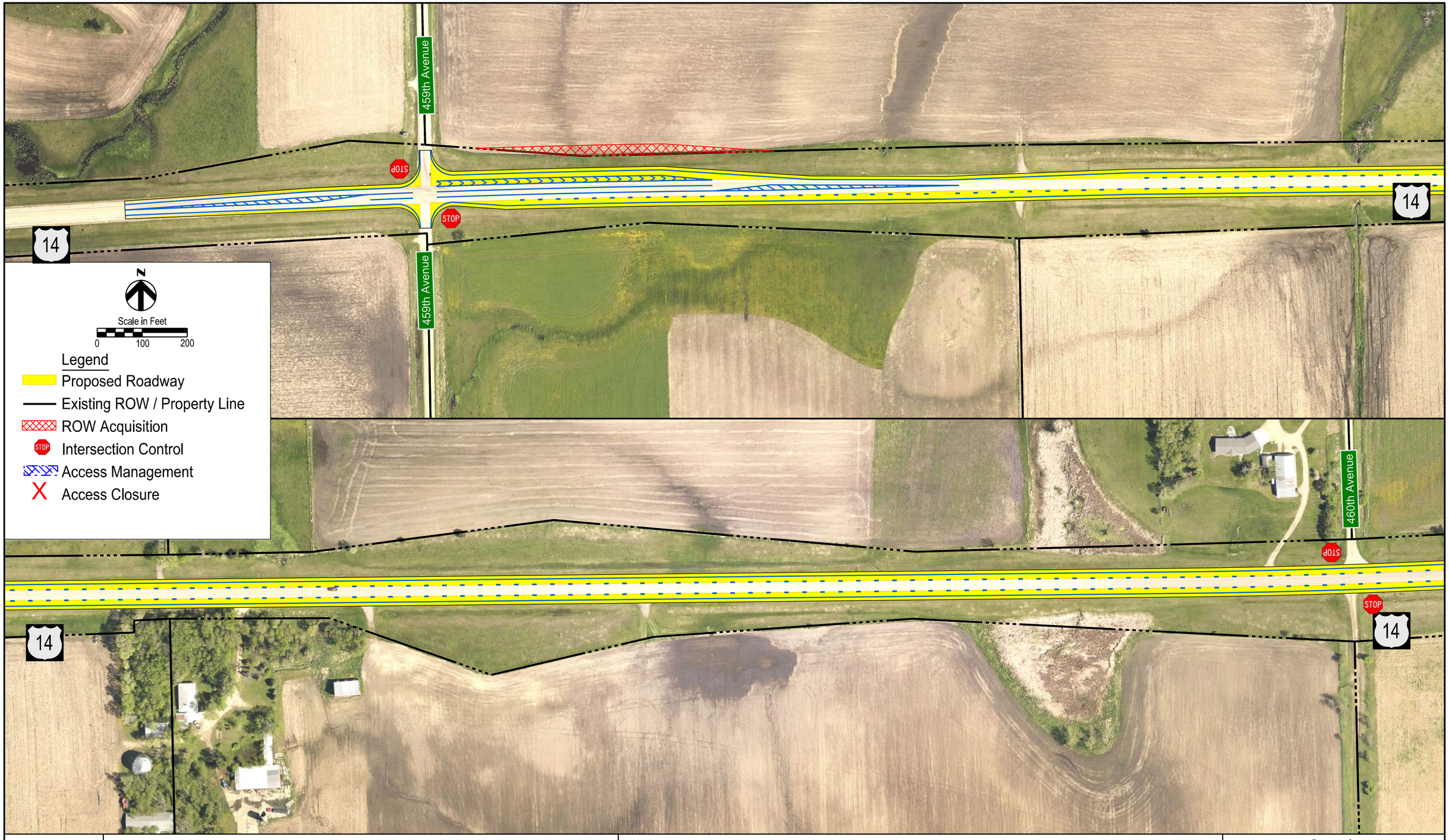
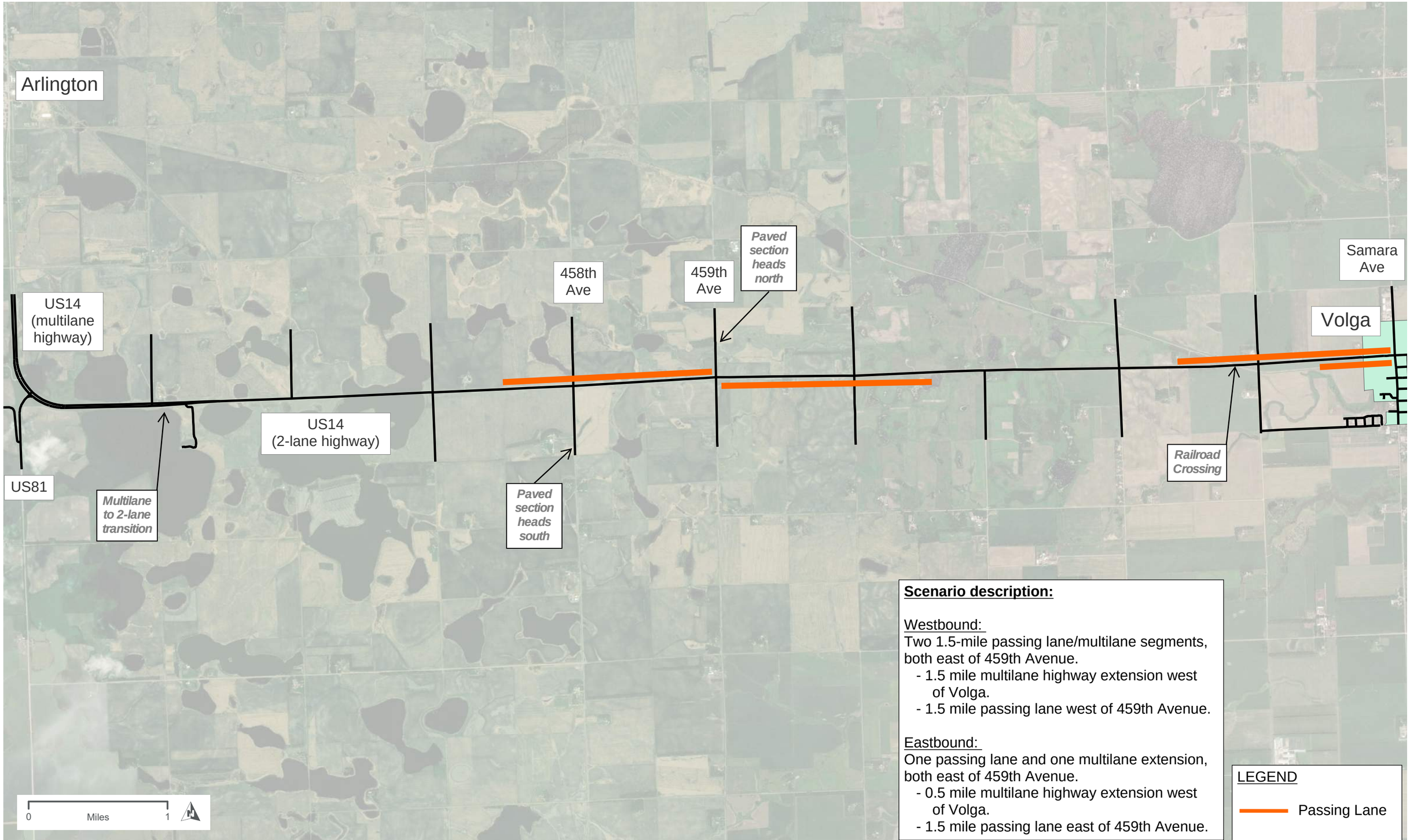


Figure 19	HDR · South Dakota DOT · brookings · Volga · U.S. Department of Transportation Federal Highway Administration	US14 West of Volga Scenarios Two WB Passing Lanes East of 459th Avenue US14 / US14B Corridor Study — Brookings, SD	Scenario US14 West of Volga - Scenario B



Passing Lane Scenario C

US14-US14 BYPASS CORRIDOR STUDY

SOURCE: PASSING LANE OPTIMIZATION TECHNICAL MEMO

Figure
20

U.S. Department of Transportation
Federal Highway Administration

US14 West of Volga Scenarios
Two WB Passing Lanes, 1 East and 1 West of 459th Avenue
US14 / US14B Corridor Study
Brookings, SD

Scenario
US14 West of Volga - Scenario C

Figure 20	HDR · SD DOT · brookings SOUTH DAKOTA · Volga SOUTH DAKOTA · U.S. Department of Transportation Federal Highway Administration	US14 West of Volga Scenarios Two WB Passing Lanes, 1 East and 1 West of 459th Avenue US14 / US14B Corridor Study — Brookings, SD	Scenario US14 West of Volga - Scenario C

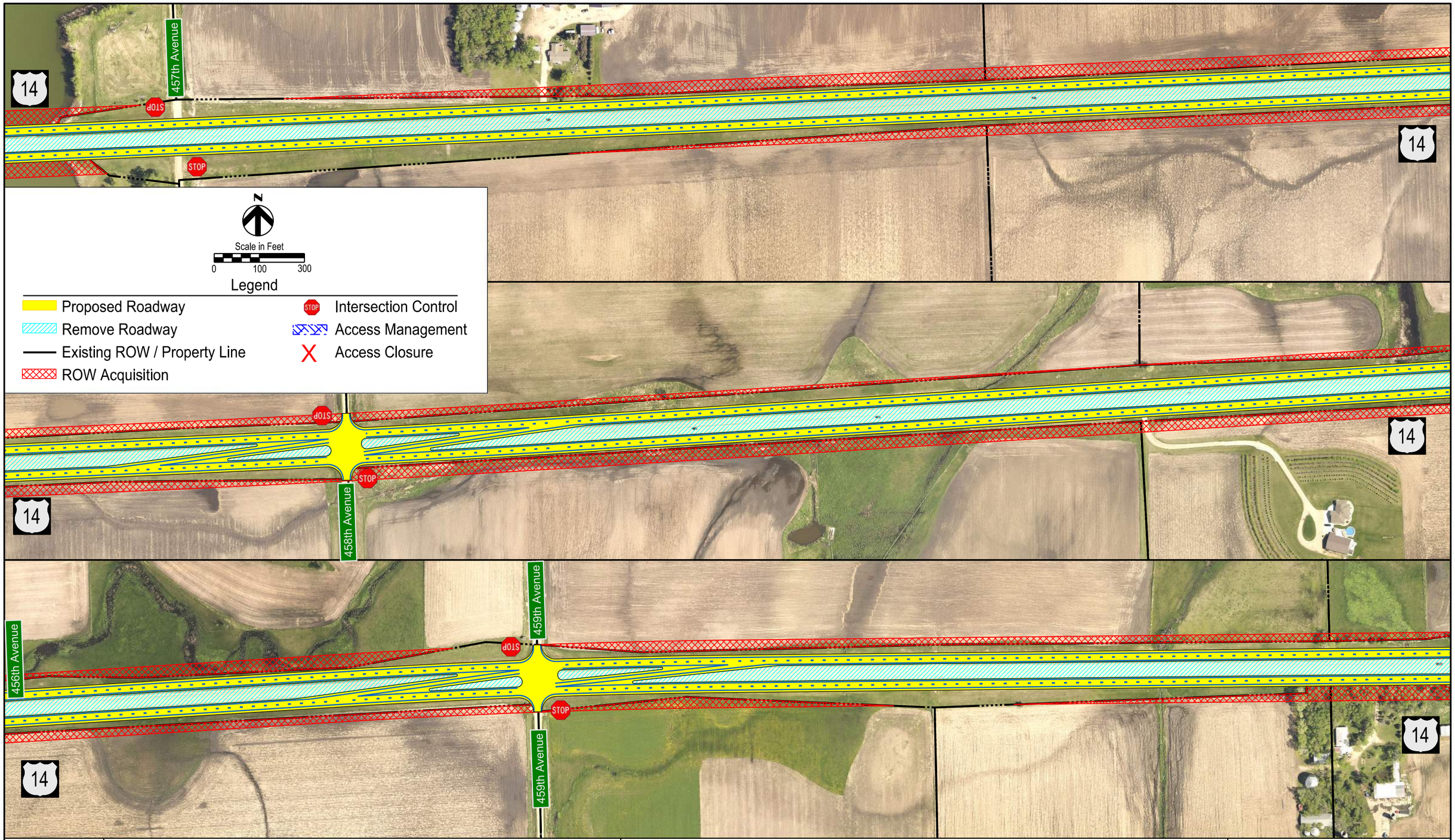


Figure 21

US14 West of Volga Scenarios
4-Lane Divided with Intersection Improvements

US14 / US14B Corridor Study

Brookings, SD

Scenario

US14 West of Volga - Scenario D

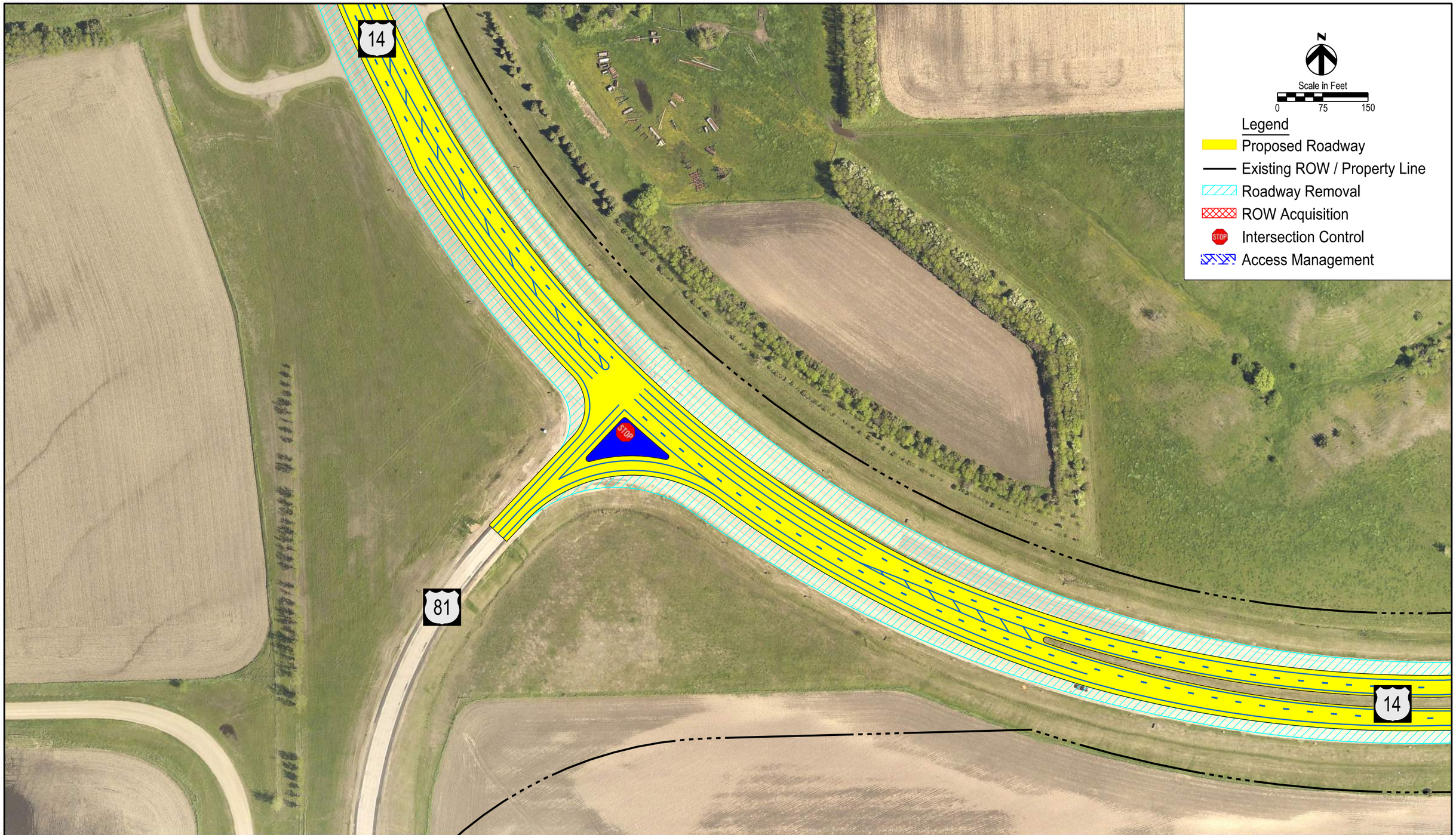


Figure			
22	US14 West of Volga Concepts US14/US81 Intersection Improvements - Narrow US14 Median US14 / US14B Corridor Study — Brookings, SD	Scenario US14/US81 Intersection - Option A

U.S. Department of Transportation
Federal Highway Administration

14.1. Design Notes

Parallel offset right turn lane shown at 458th Avenue and 459th Avenue intersections were shown in the figures to reflect larger pavement footprint. A tapered offset turn lane design is also applicable.

Scenarios B, C, and D all exhibit a similar multilane highway design immediately west of Volga to facilitate a potential incremental build-out of the corridor.

14.2. Traffic Operations Analysis

Year 2050 Build condition traffic operations for the three US14 analysis intersections are shown in the following tables. All three intersections are all expected to operate with LOS A. The greatest side-street delay occurs at the 459th Avenue intersection approaches.

Table 19: US14 West of Volga Intersection Operations – 2-Lane Highway (2050 Build)

US14 Intersection		US14 Section	Intersection Control	Measure	AM		PM	
					Delay (s/veh)	LOS	Delay (s/veh)	LOS
Scenario A, B, and C	US81	Multilane	TWSC	**Overall**	**4.0**	**A**	**2.7**	**A**
				TWSC	*17.0*	*C*	*14.2*	*B*
	458th Ave	2-lane	TWSC	**Overall**	**2.4**	**A**	**1.7**	**A**
				TWSC	*19.1*	*C*	*20.2*	*C*
	459th Ave	2-lane	TWSC	**Overall**	**2.5**	**A**	**2.0**	**A**
				TWSC	*25.0*	*C*	*26.5*	*D*

TWSC: worst-case stop-control approach delay.

Table 20: US14 West of Volga Intersection Operations – Multilane Highway (2050 Build)

US14 Intersection		US14 Section	Intersection Control	Measure	AM		PM	
					Delay (s/veh)	LOS	Delay (s/veh)	LOS
Scenario D	US81	Multilane	TWSC	**Overall**	**4.0**	**A**	**2.7**	**A**
				TWSC	*17.0*	*C*	*14.2*	*B*
	458th Ave	Multilane	TWSC	**Overall**	**2.0**	**A**	**1.3**	**A**
				TWSC	*15.2*	*C*	*18.0*	*C*
	459th Ave	Multilane	TWSC	**Overall**	**1.9**	**A**	**1.7**	**A**
				TWSC	*17.2*	*C*	*22.8*	*C*

TWSC: worst-case stop-control approach delay.

The required number of US14 mainline lanes through the existing 2-lane highway segment was reviewed through an incremental process documented in two memos. The first memo provided a preliminary analysis of different passing lane lengths and locations using HCS and IHSDM analysis tools. The second memo was geared towards optimization of passing lane lengths and locations, and was the impetus for corridor scenarios B and C. Both are provided in **Appendix T**. A summary of the lane optimization LOS measures used in the layouts is shown in **Table 21**.

Table 21: US14 West of Volga Segment Operations (2050 Build)

Scenario	From	To	Length (mi)	Hwy Type	AM LOS		PM LOS	
					EB	WB	EB	WB
All	MRM 402.94	2-Lane	4.0	Multilane	A	A	A	A
A	458th Ave	Volga	8.75	2-Lane	C	A	B	C
B	458th Ave	Volga	8.75	2-Lane w/ Passing Lanes	C	A	B	C
C	458th Ave	Volga	8.75	2-Lane w/ Passing Lanes	C	A	B	C
D	458th Ave	Volga	8.75	Multilane	A	A	A	A

The greatest operational benefit of passing lanes was realized when there are two westbound passing lanes located east of 459th Avenue. This correlates to the greatest segment volume: westbound PM peak hour between 459th Avenue and Volga. Heading westbound, the first passing lane extends approximately 1.5 miles west out of Volga to allow motorists to overtake slower vehicles in the rural area instead of within Volga. The second westbound passing lane starts approximately 1.5 miles east of 459th Avenue to provide a second opportunity to pass along the high-volume segment.

In the eastbound direction, a passing lane was shown to have less benefit than the westbound direction due to lower volumes. Both scenarios B and C include one eastbound passing lane east of 459th Avenue and extends the multilane section west out of Volga for approximately 0.5 miles. Little operational benefit was found from providing a full-length passing lane segment approaching a community. However, a short extension does provide an opportunity for vehicles to position themselves in the desired lane prior to entering Volga.

The multilane section provides the greatest operational benefit to corridor traffic, however, there is a significant cost and potential environmental impact associated with the scenario.

14.3. Predictive Safety Analysis

Results from the predictive safety analysis are shown in **Table 22**.

Table 22: US14 West of Volga Predicted Crashes per Year

Scenario	F & I Crashes	Change from No Build *+ increase - decrease*	Total Crashes	Change from No Build *+ increase - decrease*
No Build (baseline)	6.6	-	17.9	-
Scenario A	4.9	*-1.7*	14.3	*-3.6*
Scenario B	5.3	*-1.3*	14.6	*-3.3*
Scenario C	5.2	*-1.4*	14.3	*-3.6*
Scenario D	6.8	*+0.2*	13.0	*-4.9*

The 2-lane highway scenarios (A, B, and C) all show similar decreases in number of F&I crashes and total crashes. The multilane divided scenario (D) shows nearly the same frequency of F&I crashes, but is expected to provide the greatest reduction in total crashes.

14.4. Potential Impacts and Public Comment

The potential for environmental and property impacts increases as the corridor becomes wider from Scenario A to D. In scenario A, improvements are focused on US14 turn lanes at 458th Avenue and 459th Avenue intersections and thus potential impacts to wetlands and adjacent property are minimal. Passing lane Scenarios B and C widen the corridor footprint with construction of passing lanes; however, the existing ROW width minimizes impacts to adjacent properties and most of the potential wetland impacts are within existing ROW. The passing lanes also avoid corridor widening through the lakes and other waterways on the western half of this segment. The multilane corridor Scenario D has the most significant property and environmental impact as ROW would be needed on one or both sides of the corridor to accommodate the wider cross-section.

Public and stakeholder feedback was supportive of both programmed STIP projects and potential scenario improvements. While a multilane highway was generally desired, commenters also recognized the cost associated with that magnitude of project.

14.5. Future Pavement and Structure Needs Summary

A summary of upcoming major investment needs along the corridor segment includes:

- Structures
    - N/A, no bridge structures are located on this segment
- Roadway pavement (*SDDOT Needs Book* timeframe)
    - US14 mill an overlay (2030 – 2035)

The US14 mill and overlay need identified in the 2030-2035 timeframe may be a good opportunity to tie passing lane improvements into a larger corridor segment project.

14.6. Evaluation Summary and Scenario Recommendations

Table 23 presents an evaluation summary matrix of traffic operations, predictive safety, ROW and cost, and potential environmental impact measures. The overarching benefits and drawbacks of each scenario are summarized in **Table 24**.

Based on a review of the evaluation matrix, benefits and drawbacks, and timelines for next major investment needs, long-range recommendations and potential timelines are summarized in **Table 25**.

Table 23: US14 West of Volga Corridor Scenario Summary Matrix

Scenario	Traffic Operations				Predictive Safety		ROW & Costs		Environmental Impacts
	Includes warranted turn lanes?	**Intersection Operations (2050 LOS)**	**US14 Corridor Operations (2050 LOS)**	**Corridor Reliability & Driver Expectancy**	**F&I Crashes**	**Total Crashes**	**ROW Acquisition**	**Construction & ROW Costs**	**Potential Impacts**
	Yes/No	*AM / PM*	*AM / PM*	*5 - Best 3 - Middle 1 - Least*	*Average Annual # Crashes*	*Average Annual # Crashes*	*Acres*	*$ mil*	*Low, Medium, High*
Scenario A	Yes	LOS A or better	B / C	3	4.9	14.3	< 0.5	$0.5	Low
Scenario B	Yes	LOS A or better	B / C	4	5.3	14.6	3.5	$6.0	Medium - Wetlands
Scenario C	Yes	LOS A or better	B / C	4	5.2	14.3	3.5	$6.5	Medium - Wetlands
Scenario D	Yes	LOS A or better	A / A	5	6.8	13.0	47	$39.5	High - Wetlands
No Build	No	LOS A or better	B / C	2	6.6	17.9	0	0	Low
US14/US81 Intersection Option	n/a	LOS A or better	-	-	-	-	< 0.5	$8.3*	Low

* Programmed 2021-2024 STIP cost for PCN 05HU, which includes reconstruction of US14/US81 intersection.

Table 24: US14 in Volga Corridor Scenario Benefits and Drawbacks

Scenario	Benefits	Drawbacks
No Build (baseline)	• No environmental impacts, cost, or property impacts.	• Does not provide additional passing opportunities. • Does not improve corridor safety. • Does not improve corridor capacity. • Does not provide warranted intersection turn lanes.
Scenario A	• Adds warranted intersection turn lanes. • Greatest predicted reduction in crashes. • Low cost and ROW impact.	• Does not provide additional passing opportunities. • Limited improvement to corridor capacity.
Scenario B	• Adds 1.5 mile passing lanes. • Adds warranted intersection turn lanes. • Best operations of passing lane scenarios. Passing lanes are constructed along the highest-volume segments. • Predicted reduction in crashes. • Increases corridor reliability.	• Medium environmental impact to wetlands.
Scenario C	• Adds 1.5 mile passing lanes. • Adds warranted intersection turn lanes. • Predicted reduction in crashes. • Increases corridor reliability.	• Medium environmental impact to wetlands.
Scenario D	• Best corridor traffic operations. • Adds warranted intersection turn lanes. • Predicted reduction in total crashes. • Best corridor operations and reliability.	• Predicted increase in higher severity crashes. • High environmental impacts to wetlands. • High cost and ROW needs.

Table 25: US14 West of Volga Recommendations

Corridor Scenario: Passing lane Scenario B

Cross-section: Maintain existing 2-lane highway with recommended improvements

Timeline:

2024 and earlier

- Construct Scenario A and B warranted turn lanes at 458th Avenue and 459th Avenue intersections (2021 STIP project PCN 06K2).
- Reconstruct US14/US81 intersection and US14 multilane section (2023 STIP project PCN 05HU).

2025 – 2030

- Construct Scenario B passing lanes.

Beyond 2040 (long-range)

- Reconstruct as Scenario D multilane section.

15. US14 in Volga Scenarios

The existing 5-lane section through Volga provides ample mainline capacity through the 2050 Planning Horizon. However, as Volga continues to grow to the north and south of US14, increased traffic volumes accessing the corridor put pressure on existing intersections. Needs supporting the development of corridor scenarios for this segment include:

- Provide long-range intersection layouts that address future capacity and safety needs.
- Identify future intersection turn lanes and traffic control modifications.
- Provide a framework of future improvements to guide development.
- Improve safety through access management.
- Improve bicycle and pedestrian route continuity and connectivity (i.e. future signalized crossing locations of US14).

Three scenarios were developed for the US14 segment through Volga:

Scenario A: Existing 5-Lane with Intersection Improvements

- *Maintain existing 5-lane section.*
- *Samara Avenue, Hansina Avenue, and Caspian Avenue intersection improvements.*

Scenario B: Existing 5-Lane with Intersection Improvements (Extend Multilane West of Volga)

- *Maintain existing 5-lane section.*
- *Samara Avenue, Hansina Avenue, and Caspian Avenue intersection improvements.*
    - *Extend multilane highway west of Samara Avenue.*

Scenario C: Existing 5-Lane with Intersection Improvements (Extend Two Westbound Lanes West of Volga)

- *Maintain existing 5-lane section.*
- *Samara Avenue, Hansina Avenue, and Caspian Avenue intersection improvements.*
    - *Extend two westbound lanes west of Samara Avenue.*

All three scenarios include the same improvements to Hansina Avenue, Caspian Avenue interactions, shown in **Figure 23** through **Figure 25**. The primary differences are located at the Samara Avenue intersection, with three variations to number of lanes entering and existing the intersection from/to the west. Each variation brings unique benefits to intersection operations and are applicable to a corresponding US14 west of Volga multilane segment improvement.

Each of the scenarios support long-range goals identified in the corridor study's **Bicycle and Pedestrian Plan** and the **Access Plan**.

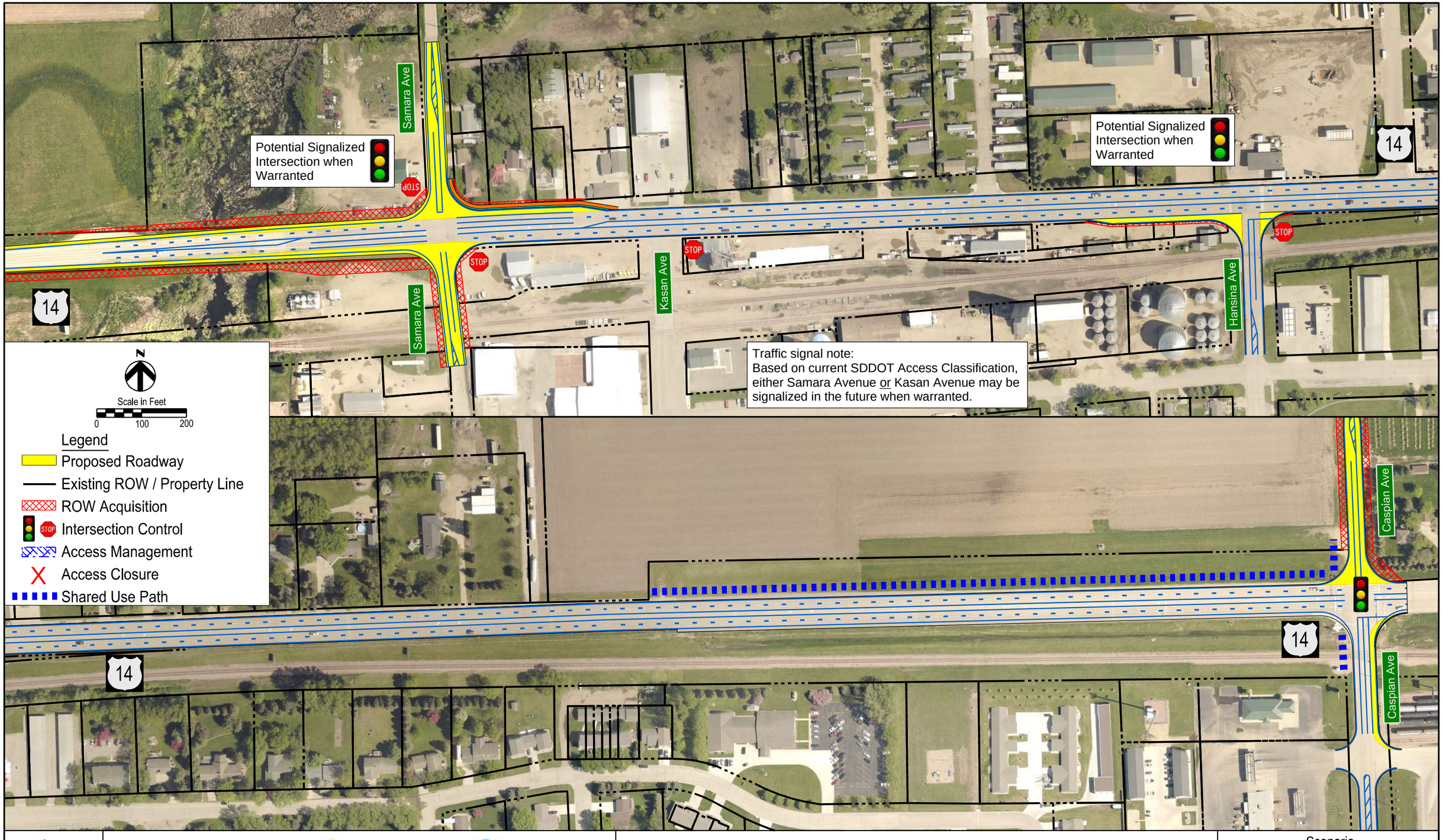


Figure 23

HDR | South Dakota DOT | brookings | Volga | U.S. Department of Transportation Federal Highway Administration

US14 in Volga Scenarios: Existing 5-Lane with Intersection Improvements

US14 / US14B Corridor Study

Brookings, SD

Scenario
US14 in Volga
Scenario A

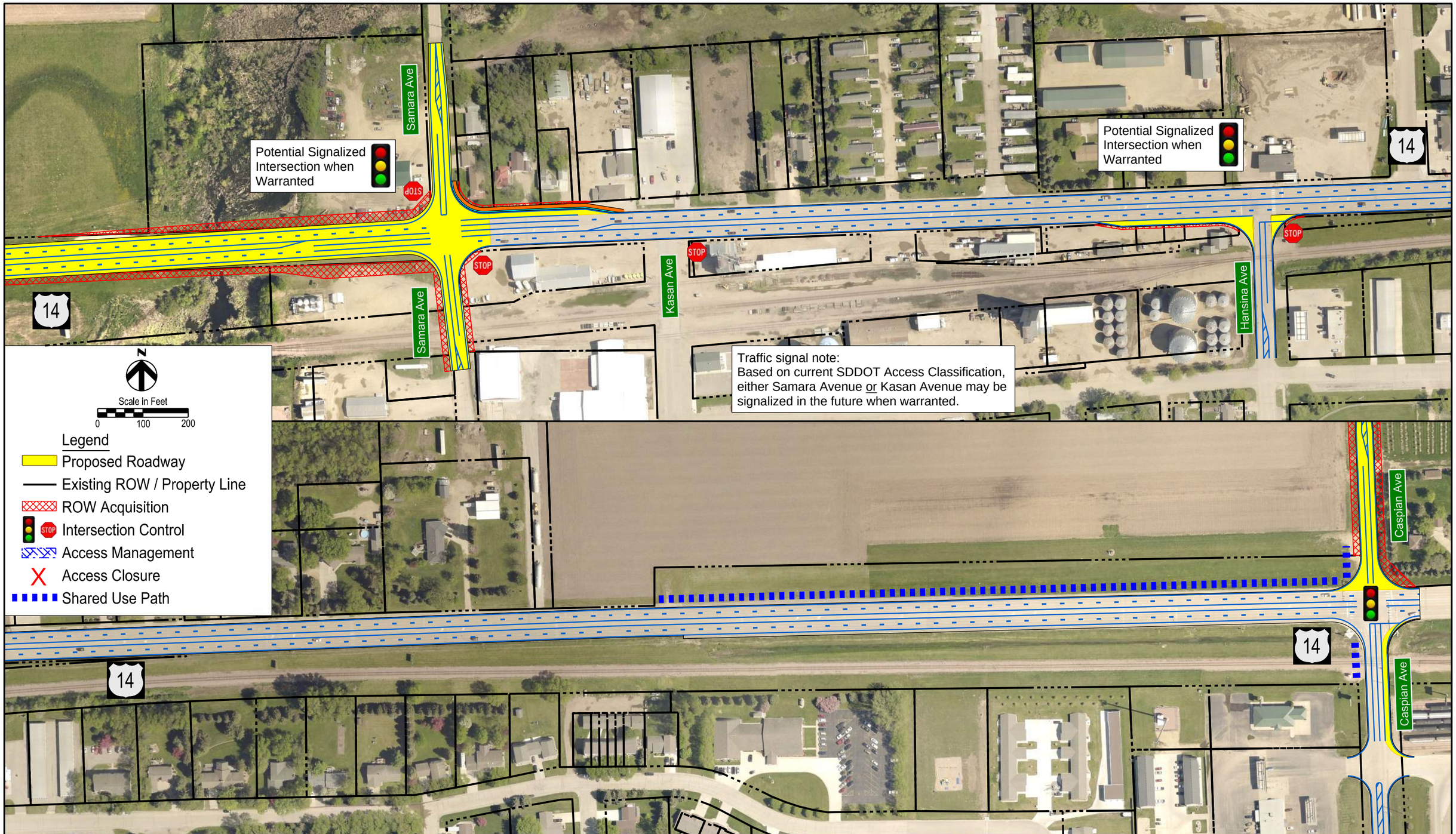


Figure 24

US14 in Volga Scenarios: Existing 5-Lane with Intersection Improvements
Extend Multilane West of Samara Avenue

US14 / US14B Corridor Study

Brookings, SD

Scenario
US14 in Volga
Scenario B

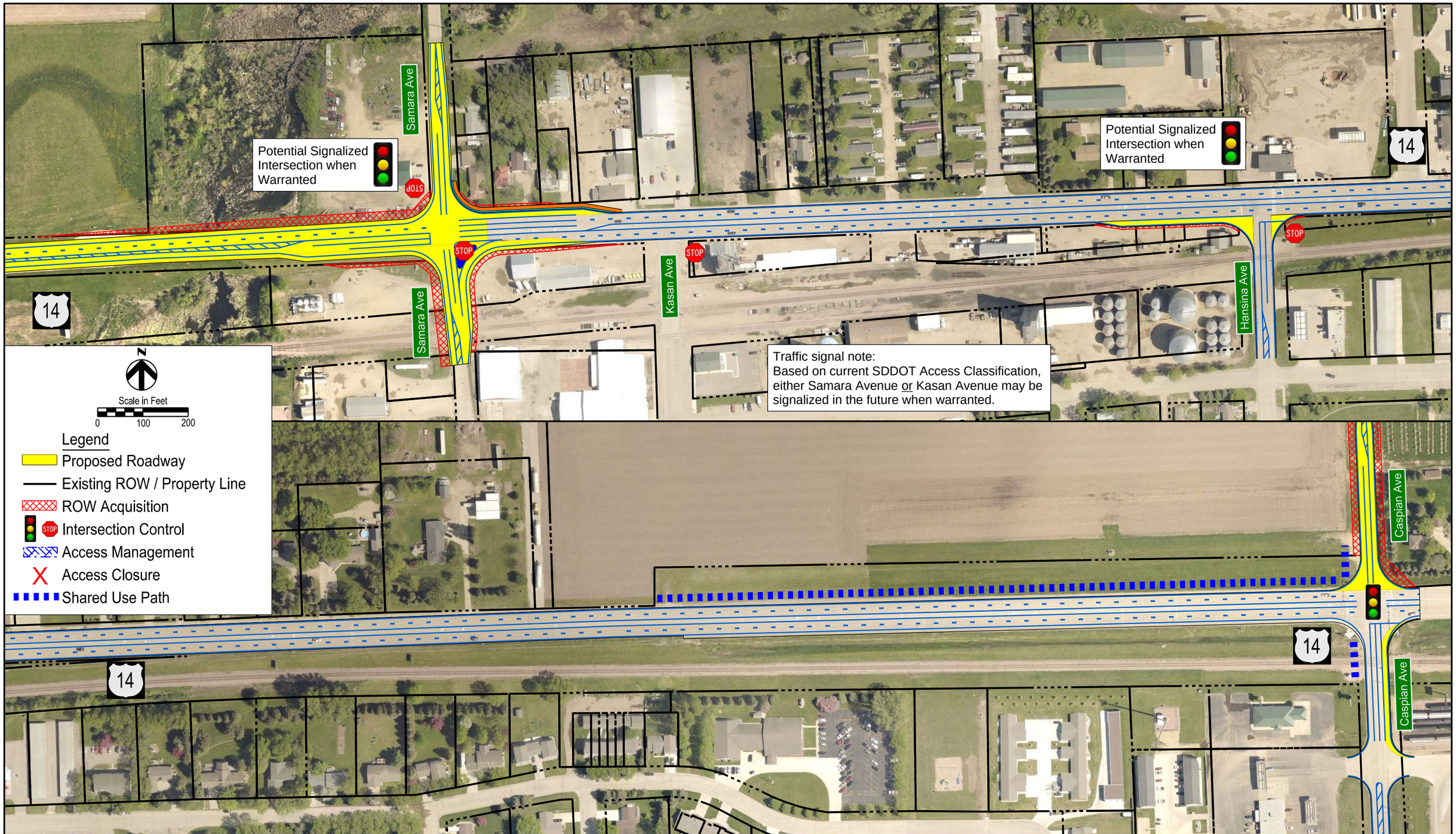


Figure 25

US14 in Volga Scenarios: Existing 5-Lane with Intersection Improvements
Extend Two Lanes West of Samara Avenue

US14 / US14B Corridor Study

Brookings, SD

Scenario
US14 in Volga
Scenario C

15.1. Traffic Operations Analysis

The 2050 Planning Horizontraffic operations analysis assumes signalization of US14 intersections with Samara Avenue and Hansina Avenue, per findings in the planning-level traffic signal warrant analysis. The following intersection and corridor summary tables reflect a signalized corridor.

Table 26: US14 in Volga Intersection Operations (2050 Build)

US14 Intersection		US14 Section	Intersection Control	Measure	AM		PM	
					Delay (s/veh)	LOS	Delay (s/veh)	LOS
Scenarios A, B, C	Samara Ave *Scenarios A and B*	Multilane	Signal	**Overall**	**11.0**	**B**	**9.1**	**A**
	Samara Ave *Scenario C*	Multilane	Signal	**Overall**	**11.0**	**B**	**8.4**	**A**
	Kasan Ave	Multilane	TWSC	**Overall**	**2.9**	**A**	**7.3**	**B**
				TWSC	*23.7*	*C*	*73.2*	*F*
	Hansina Ave	Multilane	Signal	**Overall**	**17.3**	**B**	**11.0**	**B**
	Caspian Ave	Multilane	Signal	**Overall**	**34.9**	**C**	**19.9**	**B**

TWSC: worst-case stop-control approach delay.

Table 27: US14 in Volga Segment Operations (2050 Build)

Scenario	From	To	Length (mi)	Hwy Type	AM LOS		PM LOS	
					EB	WB	EB	WB
A, B, C	Samara Ave	Hansina Ave	1.0	Multilane Urban	C	A	B	A
				Travel Time (sec)	*135*	*108*	*111*	*110*

As shown, the identified improvements will provide long-range capacity for the US14 corridor in Volga. Samara Avenue, Hansina Avenue, and Caspian Avenue intersections are expected to achieve LOS C or better with future signalization and turn lane improvements.

The greatest constraint to corridor capacity is at the Caspian Avenue intersection in the AM peak hour. High eastbound through and northbound right turn commute traffic, plus high truck percentages, push overall intersection delay up to LOS C. While LOS C exceeds the rural intersection LOS B goal for this study, the intersection functions more like an urban intersection with a mix of high commute traffic and heavy vehicles from surrounding industry.

The Kasan Avenue intersection measures LOS F from the northbound approach in the PM peak hour. However, the overall intersection measures LOS B. It is anticipated that traffic will reroute to either Samara Avenue or Hansina Avenue traffic signals if a gap is needed to complete a turn onto US14.

An exploratory analysis was conducted at the Samara Avenue and Hansina Avenue intersections to 1) identify TWSC LOS with proposed intersection turn lane improvements and identify whether there is a need for signalization, and 2) determine which variation of Samara Avenue intersection options provide greater TWSC capacity.

Table 28: US14 in Volga Exploratory TWSC Intersection Operations (2050 Build)

US14 Intersection		US14 Section	Intersection Control	Measure	AM		PM	
					Delay (s/veh)	LOS	Delay (s/veh)	LOS
Scenarios A, B, C	Samara Ave *Scenarios A and B*	Multilane	TWSC	**Overall**	**7.4**	**A**	**12.0**	**B**
				TWSC	*34.9*	*D*	*99.7*	*F*
	Samara Ave *Scenario C*	Multilane	TWSC	**Overall**	**7.0**	**A**	**15.2**	**A**
				TWSC	*63.6*	*F*	*148.7*	*F*
	Hansina Ave	Multilane	TWSC	**Overall**	**8.6**	**A**	**18.3**	**C**
				TWSC	*66.3*	*F*	*122.3*	*F*

TWSC: worst-case stop-control approach delay.

Both Samara Avenue intersection options achieve overall intersection LOS goals for the study at LOS B or better. However, the southbound stop-controlled approaches reach high LOS F delays ranging from 1 to 2.5 minutes in length. Samara Avenue intersection options A and B provides the least delay of the three and represents the best options to prolong acceptable TWSC operations.

The Hansina Avenue intersection measures LOS C in the PM peak hour and thus does not meet study LOS goals of B or better.

15.2. Predictive Safety Analysis

Table 29 presents results from the IHSDM predictive safety analysis. All three corridor scenarios demonstrate a safety benefit to the corridor, with scenarios A and C showing the greatest expected reduction in crashes. Scenario B's reduction is less due to the extension of a multilane highway westward out of Volga.

Table 29: US14 in Volga Predicted Crashes per Year

Scenario	F & I Crashes	Change from No Build *+ increase - decrease*	Total Crashes	Change from No Build *+ increase - decrease*
No Build (baseline)	4.3	-	12.9	-
Scenario A	3.8	*-0.5*	11.8	*-1.1*
Scenario B	3.9	*-0.4*	12.7	*-0.2*
Scenario C	3.9	*-0.4*	11.8	*-1.1*

15.3. Potential Impacts and Public Comment

Environmental impacts are likely minimal along this corridor segment. Potential improvements are primarily focused at the main intersections and generally limited to potential turn lanes and/or traffic signals.

Property impacts are anticipated with any of the potential turn lanes and will likely factor into the feasibility of implementation. The Caspian Avenue northbound right turn lane will require coordination with the railroad and additional ROW.

It will be important to coordinate intersection improvements with future development in order to provide adequate capacity at the development's opening day. There are currently individual side-street movements that are approaching elevated levels of delay and additional development will further decrease levels of safety and traffic operations without intersection improvements.

Public and stakeholder feedback generally focused on traffic signal needs at the Hansina Avenue intersection (for both vehicular and bike/ped traffic) and maintaining acceptable traffic operations and safety at the US16/Caspian Avenue intersection. The need for other intersection improvements were also acknowledged. In general, there was support for the potential improvements presented in the three scenarios.

15.4. Future Pavement and Structure Needs

A summary of upcoming major investment needs along the corridor segment includes:

- Structures
    - N/A, no bridge structures are located on this segment
- Roadway Pavement (*SDDOT Needs Book* timeframe)
    - Pavement restoration (2025 – 2035)
    - Pavement (PCCP) reconstruction (2035 – 2040)

15.5. Evaluation Summary and Recommendations

Table 30 presents an evaluation summary matrix of traffic operations, predictive safety, ROW and construction costs, route connectivity, and potential environmental impact measures. The overarching benefits and drawbacks of each scenario are summarized in **Table 31**.

Based on a review of the evaluation matrix, benefits and drawbacks, and timelines for next major investments along the corridor, long-range recommendations and potential timelines are summarized in **Table 32**.

Table 30: US14 in Volga Corridor Scenario Summary Matrix

Scenario	Traffic Operations				Predictive Safety		ROW & Costs		Route Connectivity	Environmental Resources
	Intersections Meet LOS Goals?	**2050 Samara Ave Stop-Control Intersection Operations***	**2050 US14 Corridor Operations**	**Corridor Reliability & Driver Expectancy**	**F&I Crashes**	**Total Crashes**	**ROW Acquisition**	**Construction & ROW Costs**	**Compatibility with US14 West of Volga Scenarios**	**Potential Impacts**
	Yes / No	*LOS AM / PM*	*LOS AM / PM*	*5 - Best 3 - Middle 1 - Least*	*Average Annual # Crashes*	*Average Annual # Crashes*	*Acres*	*$ mil*	*5 - Best 3 - Middle 1 - Least*	*Low, Medium, High*
Scenario A	Yes	A / B	C / B **	4	3.8	11.8	2	$1.5	4	Low
Scenario B	Yes	A / B	C / B **	5	3.9	12.7	2.5	$3.5	5	Low
Scenario C	Yes	A / B	C / B **	4	3.9	11.8	2	$3.5	4	Low
No Build	No	E / F	LOS B or better	3	4.3	12.9	0	0	2	Low

* 2050 Samara Ave Stop-Control Intersection Operations column assesses the scenario's ability to prolong acceptable TWSC operations.

** Corridor LOS measure reflects signalized intersections at Samara Avenue, Hansina Avenue, and Caspian Avenue.

Table 31: US14 in Volga Corridor Scenario Benefits and Drawbacks

Scenario	Benefits	Drawbacks
No Build (baseline)	• No environmental impacts, cost, or property impacts.	• Does not improve corridor safety. • Does not improve corridor capacity. • Does not provide warranted intersection turn lanes.
Scenario A	• Adds warranted intersection turn lanes. • Improves traffic operations. • Greatest predicted reduction in crashes. • Lowest cost of three scenarios.	• Does not extend multiple lanes west of Volga.
Scenario B	• Adds warranted intersection turn lanes. • Improves traffic operations. • Predicted reduction in crashes. • Extends multiple lanes west of Volga and best accommodates potential future passing lanes or multilane segment. • Provides best driver expectancy and corridor reliability by extending a consistent 5-lane corridor west through Samara Ave intersection and west of Volga.	• Slightly higher ROW impacts than other scenarios.
Scenario C	• Adds warranted intersection turn lanes. • Northbound Samara Ave free right turn. • Improves traffic operations. • Greatest predicted reduction in crashes.	• Southbound Samara Ave intersection approach delay.

Table 32: US14 in Volga Recommendations

Corridor Scenario: Scenario B

Cross-section: Maintain existing 5-lane urban section

Timeline:

The ultimate build-out of US14 west of Volga is likely a multilane corridor (with either a 4-lane divided or 2-lane with passing lane section) and Scenario B best reflects this progression. It is recommended that all improvements at Samara Avenue intersection and westward point towards a multilane corridor regardless of implementation timeline and priority.

2025 - 2030

- Construct Caspian Avenue northbound right turn lane to provide a LT, T, RT configuration.
- Construct Hansina Avenue traffic signal and eastbound right turn lane (or provide room for eastbound right turn lane if not yet warranted).

2030 – 2040

- Reconstruct Samara Avenue intersection and plan for future signalized (when warranted).
    - Reconstruct as part of US14 west of Volga project if it occurs earlier.

Development driven

- Reconstruct north leg of Caspian Avenue intersection in conjunction with future development.
- Coordinate access management with City of Volga and future development to address access density on north side of US14, east of Samara Avenue.

16. US14 Volga to Brookings Scenarios

Much of the transportation need discussion along this segment focused on pavement management and operations (i.e. pavement ride quality, preservation of existing pavement and structures), motorist information related to weather, and roadway friction on bridge decks and approach slabs. The lone capacity and safety improvement focused on adding a volume-warranted westbound right turn lane at 466th Avenue to remove right turning traffic from the through movement. This movement has a propensity to involve large, slow-moving trucks.

One scenario was developed for the US14 segment between Volga and just west of 469th Avenue.

Scenario A: Existing 4-Lane Divided with Intersection Improvements

- *Maintain existing 4-lane divided section.*
- *466th Avenue Westbound right turn lane.*

16.1. Design Notes

Parallel offset right turn lane was shown in the layout figure to reflect larger footprint. A tapered offset turn lane design is also applicable.

Two shared-use path options were developed for this segment and are further discussed in the **Bicycle and Pedestrian Plan** section as one is off the existing US14 alignment.

Figure			
26	US14 - Volga to US14 Bypass Scenarios 466th Avenue Intersection Improvements US14 / US14B Corridor Study	Brookings, SD	Scenario 466th Avenue Intersection - Option A

16.2. Traffic Operations Analysis

466th Avenue intersection traffic operations are expected to exhibit LOS A through the 2050 Planning Horizon, as shown in **Table 33**. The southbound approach does start to exhibit longer delays in the PM peak hour due to the higher westbound commute traffic.

Table 33: US14 Volga to Brookings Intersection Operations (2050 Build)

US14 Intersection		US14 Section	Intersection Control	Measure	AM		PM	
					Delay (s/veh)	LOS	Delay (s/veh)	LOS
Scenario A	466th Ave	Multilane	TWSC	**Overall**	**1.6**	**A**	**1.7**	**A**
				TWSC	*20.6*	*C*	*37.8*	*E*

TWSC: worst-case stop-control approach delay.

16.3. Predictive Safety Analysis

The addition of a 466th Avenue intersection right turn lane is expected to provide a slight improvement to overall corridor predicted crashes, as shown in **Table 34** IHSDM predictive safety results. Specific to results at the 466th Avenue intersection, the right turn lane provides a 20 percent reduction in predicted F&I crashes and 10 percent reduction in total crashes.

Table 34: US14 Volga to Brookings Predicted Crashes per Year

Scenario	F & I Crashes	Change from No Build *+ increase - decrease*	Total Crashes	Change from No Build *+ increase - decrease*
No Build (baseline)	5.5	-	11.8	-
Scenario A	5.4	*-0.1*	11.6	*-0.2*

16.4. Potential Impacts and Public Comment

Environmental and property impacts are anticipated to be minimal with construction of a westbound right turn lane at the 466th Avenue intersection. There may be some wetland impacts due to widening of the roadway, but all improvements should be contained within existing ROW.

There was limited feedback from public and stakeholders along this segment. In general, projects already in development (i.e. advanced warning at the railroad crossing) and pavement preservation addressed many of the public's concerns. No opposition was stated for construction of the Scenario A westbound right turn lane.

16.5. Future Pavement and Structure Needs Summary

A summary of upcoming major investment needs along the corridor segment includes:

- Structures
    - Westbound structures (6): constructed 1978 (42 years)
    - Eastbound structures (6): constructed 2001 (19 years)
    - Approach slab repair and chip seals (2022 – 2023 STIP)
- Roadway Pavement (*SDDOT Needs Book* timeframe)
    - PCC pavement grinding (2023 STIP)
    - PCCP resurfacing of select segments (2034-2035)
    - RR crossing: advanced warning flashing signs (2021 STIP)

Using a 75-year bridge service life, the eastbound and westbound structures will likely not be due for replacement within the 2050 Planning Horizon.

16.6. Evaluation Summary and Recommendations

Table 35 presents an evaluation summary matrix of traffic operations, predictive safety, ROW and construction costs, and potential environmental impact measures. The overarching benefits and drawbacks of each scenario are summarized in **Table 36**.

Based on a review of the evaluation matrix, benefits and drawbacks, and timelines for next major investments along the corridor, long-range recommendations and potential timelines are summarized in **Table 37**.

Table 35: US14 Volga to Brookings Corridor Scenario Summary Matrix

Scenario	Traffic Operations				Predictive Safety		ROW & Costs		Environmental Resources
	466th Ave Intersection Operations (2050 LOS)	**Corridor Operations (2050 LOS)**	**Includes All Warranted Turn Lanes?**	**Corridor Reliability & Driver Expectancy**	**F&I Crashes**	**Total Crashes**	**ROW Acquisition**	**Construction & ROW Costs**	**Potential Impacts**
	AM / PM	*AM / PM*	*Yes / No*	*5 - Best 3 - Middle 1 - Least*	*Average Annual # Crashes*	*Average Annual # Crashes*	*Acres*	*$ mil*	*Low, Medium, High*
Scenario A	A / A	LOS B or better	Yes	5	5.4	11.6	< 0.5	< $0.5	Medium - Floodplain, Wetlands
No Build	A / A	LOS B or better	No	4	5.5	11.8	0	0	Low

Table 36: US14 Volga to Brookings Scenario Benefits and Drawbacks

Scenario	Benefits	Drawbacks
No Build (baseline)	• No environmental impacts, cost, or property impacts.	• Does not improve corridor safety. • Does not improve corridor capacity. • Does not provide warranted intersection turn lanes.
Scenario A	• Adds warranted westbound right turn lane at 466th Ave. • Improves traffic operations. • Predicted reduction in crashes. • Low cost and ROW impact.	• Potential floodplain and wetland impacts.

Table 37: US14 Volga to Brookings Recommendations

Corridor Scenario: Scenario A

Cross-section: Maintain existing rural 4-lane divided

Timeline:

2025 – 2030

- Construct westbound right turn lane at 466th Avenue.

17. US14/US14 Bypass (West) Intersection Scenarios

Transportation needs guiding development of US14/US14 Bypass (west) intersection scenarios focused on:

- Providing a long-range intersection framework that guides future capacity and safety improvements, network connectivity, and development/redevelopment access.
- Improving safety through access management along US14.
- Improving network connectivity by providing for all movements between US14, US14 Bypass, and 469th Avenue at a single intersection.

Throughout the early stages of the study, the following key considerations emerged to help drive concept and scenario development and set expectations for the intersection:

A. Existing interchange structure is 50 years old and has 25+ years of service life remaining. Therefore, large-scale modifications at this location are likely not immediate.
B. Long-range intersection plan should encompass all movements and tie US14 to/from Brookings with 469th Avenue. This will provide a continuous north/south route between Brookings proper and future Brookings development north of US14 Bypass.
C. Future traffic volumes do not warrant a grade-separated interchange; an at-grade intersection provides ample capacity at a fraction of the cost.

Four at-grade intersection options were carried forward from the concept stage:

Option B: At-grade 'T' Intersection

- *Removes grade-separated interchange.*
- *Constructs at-grade 'T' intersection to maximize spacing from 469th Avenue.*
    - *Eastbound right turn options: free or signalized.*

Option C-ii: At-grade Intersection at 469th Avenue

- *Removes grade-separated interchange.*
- *Reroute US14 to 469th Avenue and construct at-grade 4-leg intersection.*
    - *Eastbound right turn options: free or signalized.*
- *Rearage road option north of US14 to remove existing access points.*

Option C-iii (west): At-grade Intersection with 469th Avenue Connection (west)

- *Removes grade-separated interchange.*
- *Constructs at-grade 4-leg intersection in vicinity of existing interchange.*
    - *Eastbound right turn options: free or signalized.*
- *North 469th Avenue east/west connection tight with US14.*
- *Rearage road option north of US14 to remove existing access points.*

Option C-iii (north): At-grade Intersection with 469th Avenue Connection (north)

- *Removes grade-separated interchange.*
- *Constructs at-grade 4-leg intersection in vicinity of existing interchange.*
- *Eastbound right turn options: free or signalized.*
- *North 469th Avenue connections sweeps northward from intersection.*
- *Rearage road option north of US14 to remove existing access points.*

Layouts for the four intersection options are shown in **Figure 27** through **Figure 30**.

The at-grade 'T' intersection (Option B) is the lone scenario that does not provide direct connectivity to 469th Avenue. Intersection turn lane improvements would be required at the existing US14/469th Avenue intersection with this option. The three variations of Option C were developed to provide the direct north/south connection to 469th Avenue with varying levels of impact to adjacent parcels. All four intersection options include a variation where the eastbound right turn is a free movement or pulled in tight at the signalized intersection.

17.1. Design Notes

All layouts assumed no impact to existing US14 structures south of existing interchange.

North/south US14/469th Avenue horizontal curves were set to the following design speeds:

- Scenario B: 55 mph (south of US14)
- Scenario C-ii: 40 mph immediately south of US14 intersection and 45 mph north of US14 structures
- Scenario C-iii (west): 40 mph for both curves north of US14 and 45 mph for curve south of US14
- Scenario C-iii (north): 55 mph for both curves north of US14 and 45 mph for curve south of US14

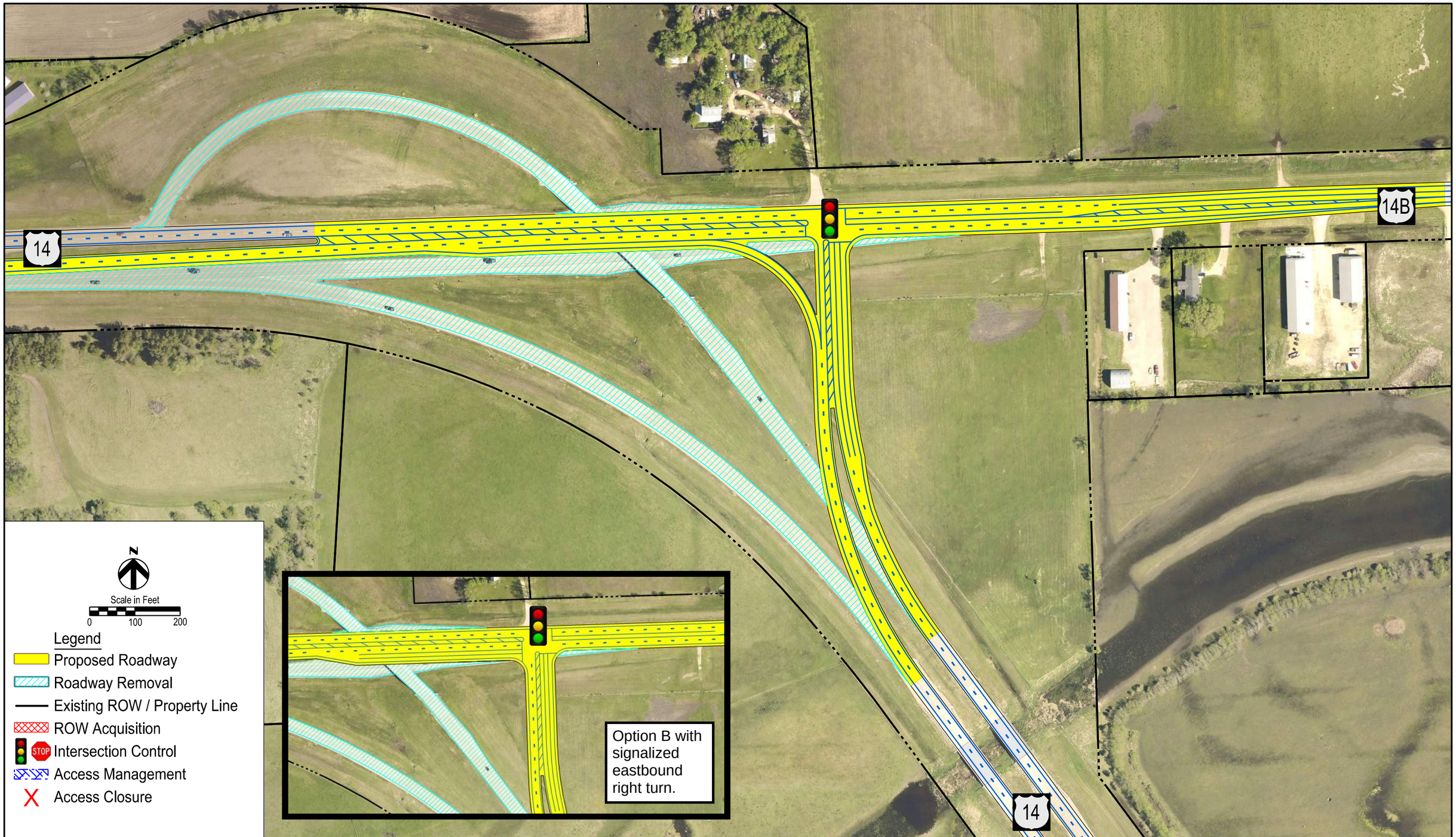


Figure 27

U.S. Department of Transportation
Federal Highway Administration

US14 - Volga to US14 Bypass Scenarios
US14/US14B (West) At-Grade T Intersection

US14 / US14B Corridor Study

Brookings, SD

Scenario
US14/US14 Bypass (West) Intersection - Option B

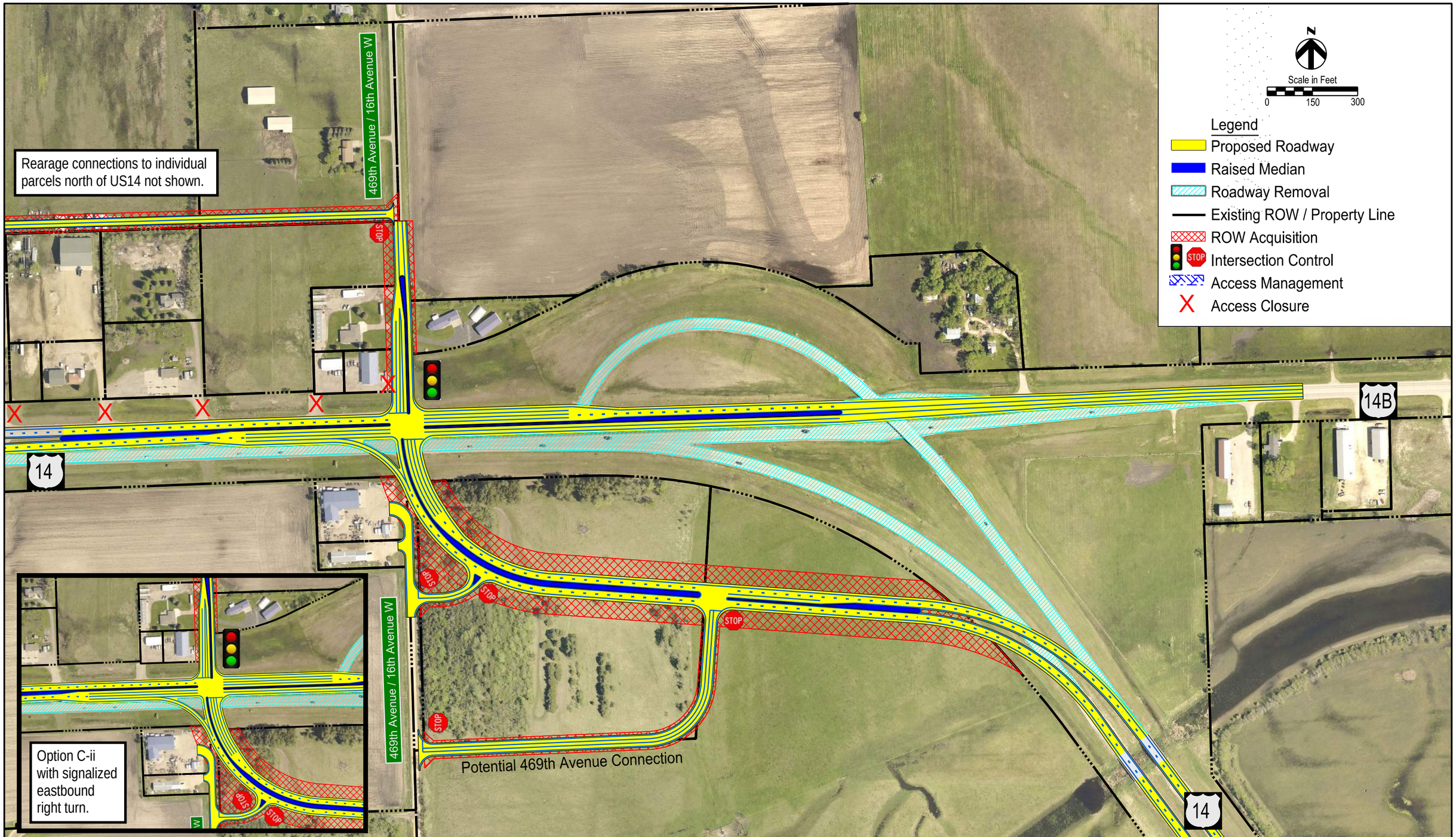


Figure 28	U.S. Department of Transportation Federal Highway Administration	US14 - Volga to US14 Bypass Scenarios US14/US14B (West) At-Grade Intersection at 469th Avenue US14 / US14B Corridor Study — Brookings, SD	Scenario US14/US14 Bypass (West) Intersection - Option C-ii

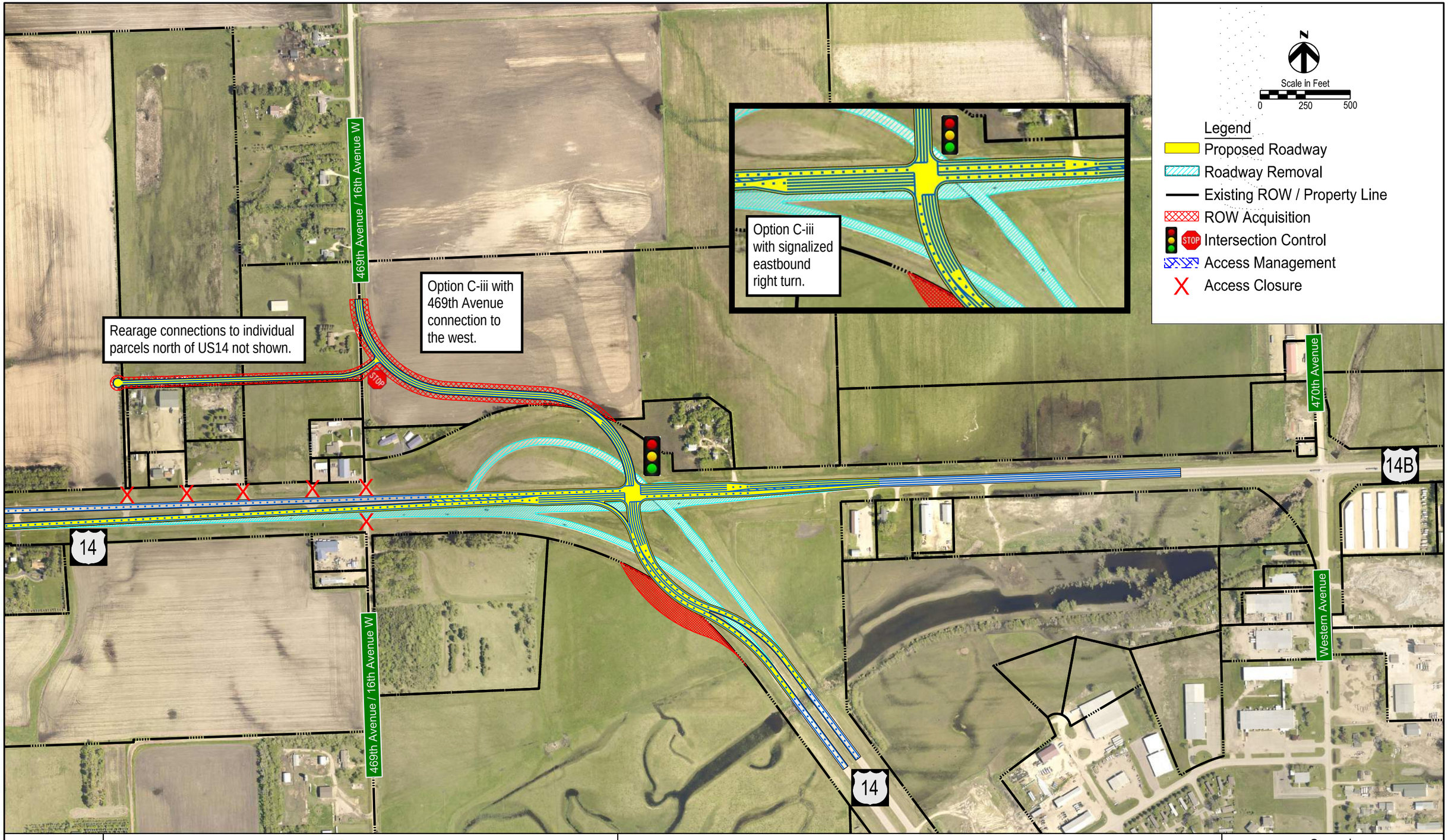


Figure 29

US14 - Volga to US14 Bypass Scenarios
US14/US14B (West) At-Grade Intersection with 469th Avenue Connection (West)

US14 / US14B Corridor Study

Brookings, SD

Scenario

US14/US14 Bypass (West) Intersection - Option C-iii (west)

Option C-iii with 469th Avenue connection to the north.

Option C-iii with signalized eastbound right turn.

Rearage connections to individual parcels north of US14 not shown.

469th Avenue / 16th Avenue W

470th Avenue

Western Avenue

14

14B

STOP

N

Scale in Feet

0 250 500

Legend

- Proposed Roadway
- Roadway Removal
- Existing ROW / Property Line
- ROW Acquisition
- Intersection Control
- Access Management
- Access Closure

Figure 30	US14 - Volga to US14 Bypass Scenarios US14/US14B (West) At-Grade Intersection with 469th Avenue Connection (North) US14 / US14B Corridor Study — Brookings, SD	Scenario US14/US14 Bypass (West) Intersection - Option C-iii (north)

U.S. Department of Transportation
Federal Highway Administration

17.2. Traffic Operations Analysis

The Year 2050 traffic operations analysis summary of the four intersection scenarios is provided in **Table 38**. It is anticipated that the at-grade US14/US14 Bypass (west) intersection would need to be signalized upon opening. Only intersection Option B maintains a TWSC intersection at US14/469th Avenue.

All four options result in LOS C or better signalized intersection operations. The primary drawback to Option B is that while the overall main intersection delay is less than Option C, it does not provide direct connectivity to 469th Avenue and thus places notable delay on the southbound 469th Avenue stop-controlled approach. Option C brings all movements to a single, signalized intersection. The benefit of an eastbound free right turn movement is evident, particularly in the AM peak hour with a commute volume into Brookings.

Table 38: US14/US14 Bypass (West) Intersection Operations (2050 Build)

US14 Intersection		US14 Section	Intersection Control	Measure	AM		PM	
					Delay (s/veh)	LOS	Delay (s/veh)	LOS
Option B	469th Avenue	Multilane	TWSC	**Overall**	**3.2**	**A**	**2.2**	**A**
				TWSC	*57.6*	*F*	*24.9*	*C*
	US14/US14 Bypass (west) *EB RT Signalized*	Multilane	Signal	**Overall**	**11.0**	**B**	**13.3**	**B**
	US14/US14 Bypass (west) *EB RT Free*	Multilane	Signal	**Overall**	**8.0**	**A**	**12.3**	**B**
Option C	US14/US14 Bypass (west) *EB RT Signalized*	Multilane	Signal	**Overall**	**19.8**	**B**	**23.7**	**C**
	US14/US14 Bypass (west) *EB RT Free*	Multilane	Signal	**Overall**	**14.4**	**B**	**21.9**	**C**

TWSC: worst-case stop-control approach delay.

17.3. Predictive Safety Analysis

Table 39 presents results from the IHSDM predictive safety analysis. In consideration to the anticipated development surrounding the intersection and north of US14, this scenario was analyzed as an urban setting in the IHSDM.

Table 39: US14/US14 Bypass (West) Intersection Predicted Crashes per Year

Intersection Option	F & I Crashes	Change from No Build *+ increase - decrease*	Total Crashes	Change from No Build *+ increase - decrease*
No Build (baseline)	5.0	-	9.8	-
Option B	2.6	*-2.4*	8.1	*-1.7*
Option C-ii	1.7	*-3.3*	5.9	*-3.9*
Option C-iii	1.6	*-3.4*	5.2	*-4.6*

Options C-ii and C-iii provide significant safety benefits to the area and stand out in comparison to the No Build condition and Option B. Both provide nearly a 66 percent predicted reduction in F&I crashes in conjunction with development/redevelopment in the area. Total crashes are expected to be reduced by 38 to 47 percent.

17.4. Potential Impacts and Public Comment

The potential impacts to surrounding property varies across the four intersection options. The at-grade 'T' intersection Option B results in the least impact as the intersection is reconstructed entirely within existing ROW. Conversely, Option C-iii (north) has notable impact to property north of US14.

Much of the land north and south of US14 Bypass, east of 469th Avenue, is either owned by the State of South Dakota or SDSU (State of South Dakota Board of Regents) as shown in **Figure 31**. Intersection options requiring new ROW south of US14 will impact State of South Dakota property. Intersection options requiring new ROW north of US14 will impact SDSU property.

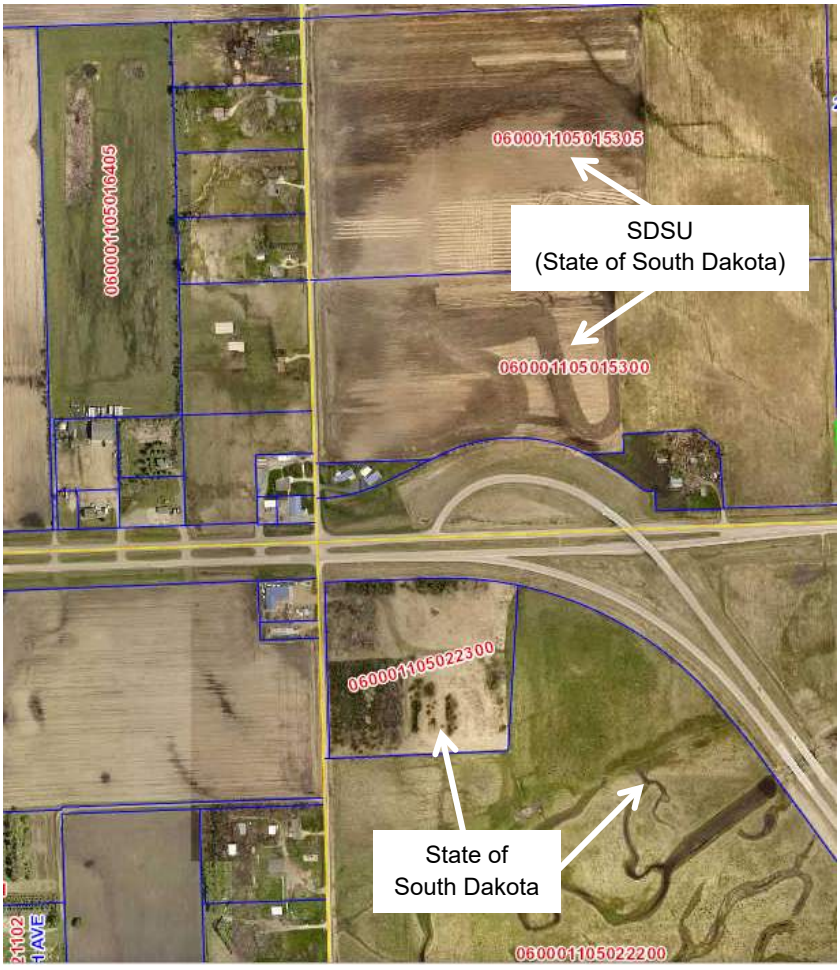


Figure 31: US14/US14 Bypass (West) Intersection State of South Dakota Land Ownership

Map and data source: Beacon, Schneider Corporation

The study team met with SDSU representatives in conjunction with both the second and third public meetings. Representatives were also part of the study stakeholder meetings. SDSU provided formal comments as part of both study milestones.

In a letter dated December 10, 2019, (see *Public Meeting #2 Summary Report* in **Appendix N**) SDSU stated:

> *"At significant expense and value, SDSU owns and uses real property that is located contiguously north and south of the US14 - US14 Bypass Corridor. This real property and its use are critical to the mission of SDSU to support South Dakota's number one industry-agriculture-now and for the next 100 years. In this location, SDSU maintains agriculture service, teaching, and research facilities. SDSU has made significant investments in unique agricultural real property and state-of-the-art facilities north of the US14 – US14 Bypass Corridor. Thus, it is important that SDSU's ownership and use of its property are not infringed by the US14 – US14 Bypass Corridor project."*

Intersection Option C-ii was developed in response to discussion with SDSU regarding the potentially significant impacts to their property in Options C-iii (west) and Options C-iii (north). After reviewing the new option, SDSU states strong preference for Option C-ii in the same letter.

Other property and business owners surrounding the intersection did not provide any comments regarding the intersection options.

All four intersection options are designed to avoid the existing floodplain south of US14 Bypass.

17.5. Future Pavement and Structure Needs Summary

A summary of upcoming major investment needs along the corridor segment includes:

- Structures
  - US14 interchange structure: constructed 1970 (50 years)
- Roadway Pavement (*SDDOT Needs Book* timeframe)
  - Mix of short segment reconstruction and overlay needs through year 2035

Using a 75-year bridge service life, the existing interchange bridge may reach the end of its service life within the 2050 Planning Horizon.

17.6. Evaluation Summary and Recommendations

Table 40 presents an evaluation summary matrix of traffic operations, predictive safety, ROW and construction costs, and potential impact to private property and environmental resource measures. Overarching benefits and drawbacks of each scenario are summarized in **Table 41**.

Based on a review of the evaluation matrix, benefits and drawbacks, and timelines for next major investments along the corridor, long-range recommendations and potential timelines are summarized in **Table 42**.

Table 40: US14/US14 Bypass (West) Intersection Scenario Summary Matrix

Scenario	Traffic Operations			Predictive Safety		ROW & Costs			Environmental Resources
	2050 Intersection Operations	**Route Connectivity and Continuity**	**North/south traffic need to travel on US14?**	**F&I Crashes**	**Total Crashes**	**ROW Acquisition**	**Construction & ROW Costs**	**Impact to Private Property**	**Potential Impacts**
	LOS AM / PM	*5 - Best 3 - Middle 1 - Least*	*Yes / No*	*Average Annual # Crashes*	*Average Annual # Crashes*	*Acres*	*$ mil*	*5 - least 3 - middle 1 – most*	*Low, Medium, High*
Option B	A / B	3	Yes	2.6	8.1	< 0.5	$4.75	5	Low
Option C-ii	B / C	5	No	1.7	5.9	14.5**	$8.0	5	Low
Option C-iii (west)	B / C	4	No	1.6	5.2	7.0	$8.0	3	Low
Option C-iii (north)	B / C	4	No	1.6	5.2	18.5***	$11.0	2	Low
No Build	A / A*	2	No	5.0	9.8	0	0	5	Low

* Does not provide for all movements.

** Primarily State of South Dakota property.

*** Primarily South Dakota State University property; land currently designated as essential to their mission as a land grant university.

Table 41: US14/US14 Bypass (West) Intersection Scenario Benefits and Drawbacks

Scenario	Benefits	Drawbacks
No Build (baseline)	• No environmental impacts, cost, or property impacts.	• Does not improve intersection safety. • Does not improve intersection capacity. • Does not provide for all movements. • Requires north/south traffic (US14 south / 469th Ave north) to travel on US14.
Option B	• Provides best US14/US14 Bypass intersection operations. • Provides for all US14 / US14 Bypass movements. • Least cost and ROW impact. • Maximizes separation from 469th Ave corridor.	• Does not improve 469th Ave intersection operations. • Requires north/south traffic (US14 south / 469th Ave north) to travel on US14. • Least predicted reduction in crashes.
Option C-ii	• Best north/south connectivity (US14 south / 469th Ave north). • Provides for all movements (US14 / US14 Bypass / 469th Ave). • Low impact to SDSU property. • Reduction in predicted crashes.	• Impact to State of South Dakota property.
Option C-iii (west)	• North/south connectivity (US14 south / 469th Ave north). • Provides for all movements (US14 / US14 Bypass / 469th Ave). • Greatest reduction in predicted crashes.	• Moderate impact to SDSU property. • 40 mph design speed for both horizontal curves north of US14.
Option C-iii (north)	• Best north/south connectivity (US14 south / 469th Ave north). • Provides for all movements (US14 / US14 Bypass / 469th Ave). • Provides a higher speed, sweeping curve to the north. • Greatest reduction in predicted crashes.	• Greatest impact to SDSU property. • Highest cost and ROW needs.

Table 42: US14/US14 Bypass (West) Intersection Recommendations

Corridor Scenario: Intersection Option C-ii

- Consider Options C-iii (west) and C-iii (north) if property ownership and/or land use priorities change in the future.

Cross-section: 4-Lane Divided - Suburban

- 4-Lane Divided – Urban section where needed at intersections and constrained ROW

Timeline:

2030 - 2040

- Reconstruct as at-grade intersection when:
  - US14 Bypass is being reconstructed (anticipated 2030-2035),
  - Existing structure is at end of service life (anticipated 2040+), and/or
  - Development north of US14 Bypass reaches a point where advantageous to provide direct north/south connectivity (future).

Interim

- Coordinate access management with City of Brookings and future development to address access density west of 469th Avenue through redevelopment and other opportunities.

18. US14 Bypass – US14 (west) to I-29 Scenarios

With the study's initial focus centered on short-term improvements to the 22nd Avenue intersection, other overarching transportation needs guiding the development of corridor segment scenarios include:

- Improve safety and traffic operations at 22nd Avenue intersection.
- Determine long-range capacity and safety improvements at other US14 Bypass intersections and along corridor segments.
- Improve US14 Bypass route reliability and functionality.
- Identify improvements to benefit SDSU event traffic management.

Three corridor scenarios, shown in **Figure 32** through **Figure 34**, were developed to cover the spectrum from maintaining the existing 3-lane section to reconstructing with a multilane section and raised median.

Scenario A: Existing 3-Lane with Intersection Improvements

- *Maintain one lane in each direction plus warranted intersection turn lanes.*
- *22nd Avenue intersection improvements with consideration of frontage roads.*
- *Western Avenue, Medary Avenue, Stadium Road, Jackrabbit Avenue, and 25th Avenue intersection improvements.*
    - *Stadium Road and Jackrabbit Avenue maintained as full access.*

Scenario B: Multilane Hybrid (4-Lane Divided and 5-Lane) with Intersection Improvements

- *Two through lanes in each direction with combination of 4-lane divided and 5-lane sections.*
- *22nd Avenue intersection improvements with consideration of frontage roads.*
- *Western Avenue, Medary Avenue, Stadium Road, Jackrabbit Avenue, and 25th Avenue intersection improvements.*
    - *Stadium Road ¾ access and Jackrabbit Avenue full access.*

Scenario C: 4-Lane Divided with Intersection Improvements

- *Two through lanes in each direction with a 4-lane divided section.*
- *22nd Avenue intersection improvements with consideration of frontage roads.*
    - *US14 Bypass alignment shifted south through intersection.*
- *Western Avenue, Medary Avenue, Stadium Road, Jackrabbit Avenue, and 25th Avenue intersection improvements.*
    - *Stadium Road ¾ access and Jackrabbit Avenue full access.*

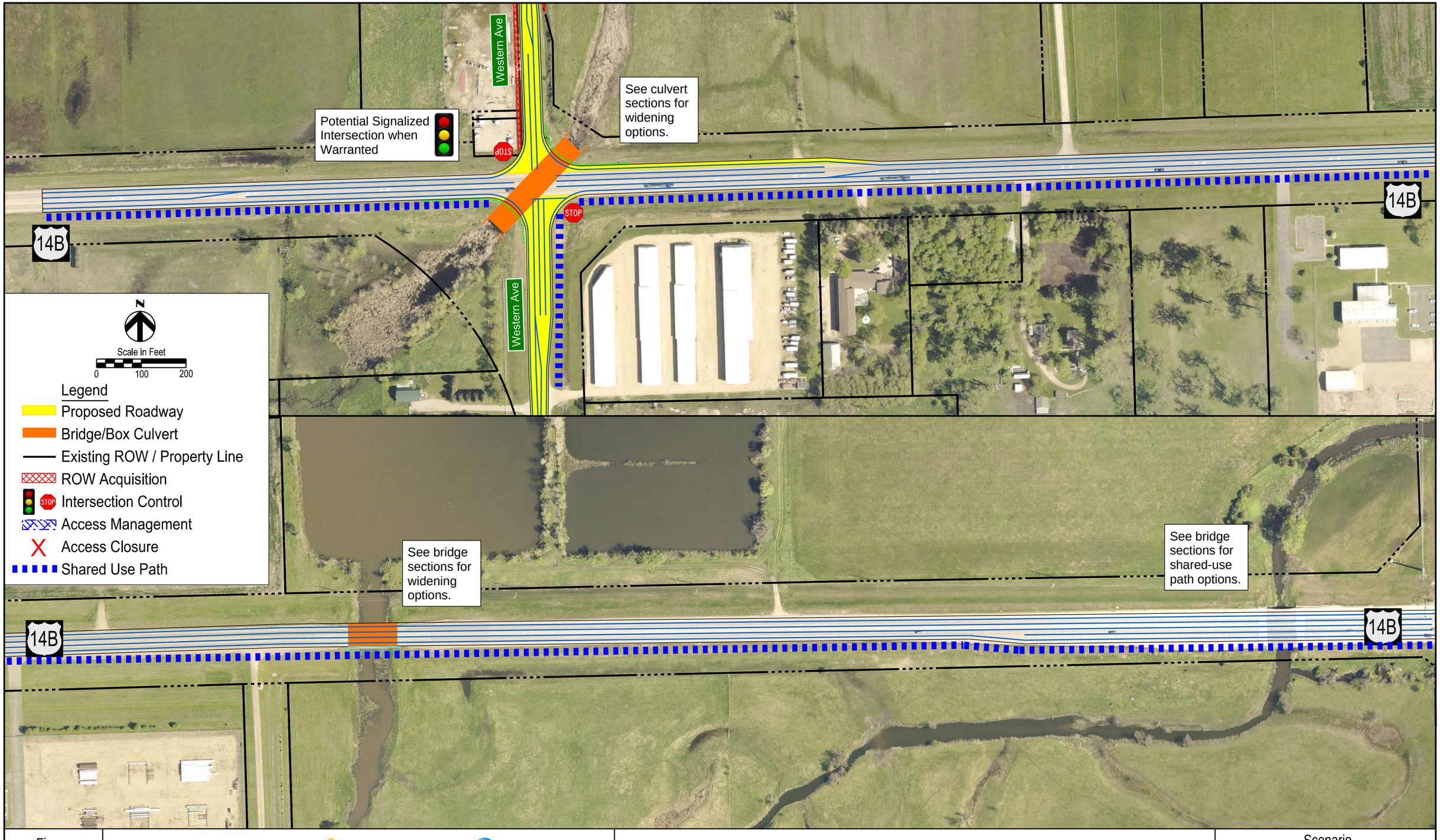


Figure 32

U.S. Department of Transportation
Federal Highway Administration

US14 Bypass - US14 (West) to I-29 Scenarios
Existing 3-Lane with Intersection Improvements

US14 / US14B Corridor Study

Brookings, SD

Scenario
US14 Bypass - US14 (West) to I-29
Scenario A

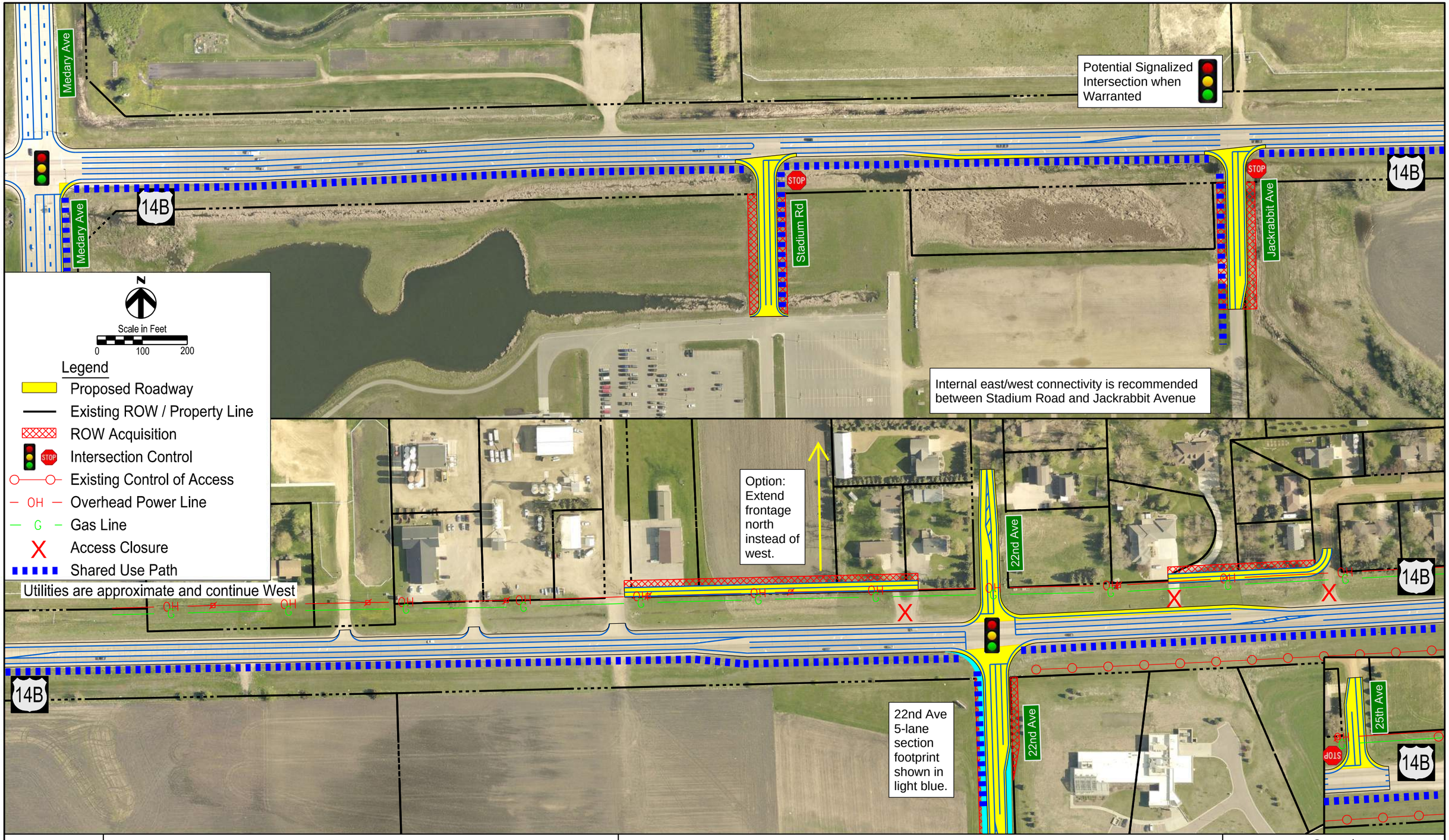


Figure 32	HDR · SD DOT · brookings SOUTH DAKOTA · Volga SOUTH DAKOTA · U.S. Department of Transportation Federal Highway Administration	US14 Bypass - US14 (West) to I-29 Scenarios Existing 3-Lane with Intersection Improvements US14 / US14B Corridor Study — Brookings, SD	Scenario US14 Bypass - US14 (West) to I-29 Scenario A

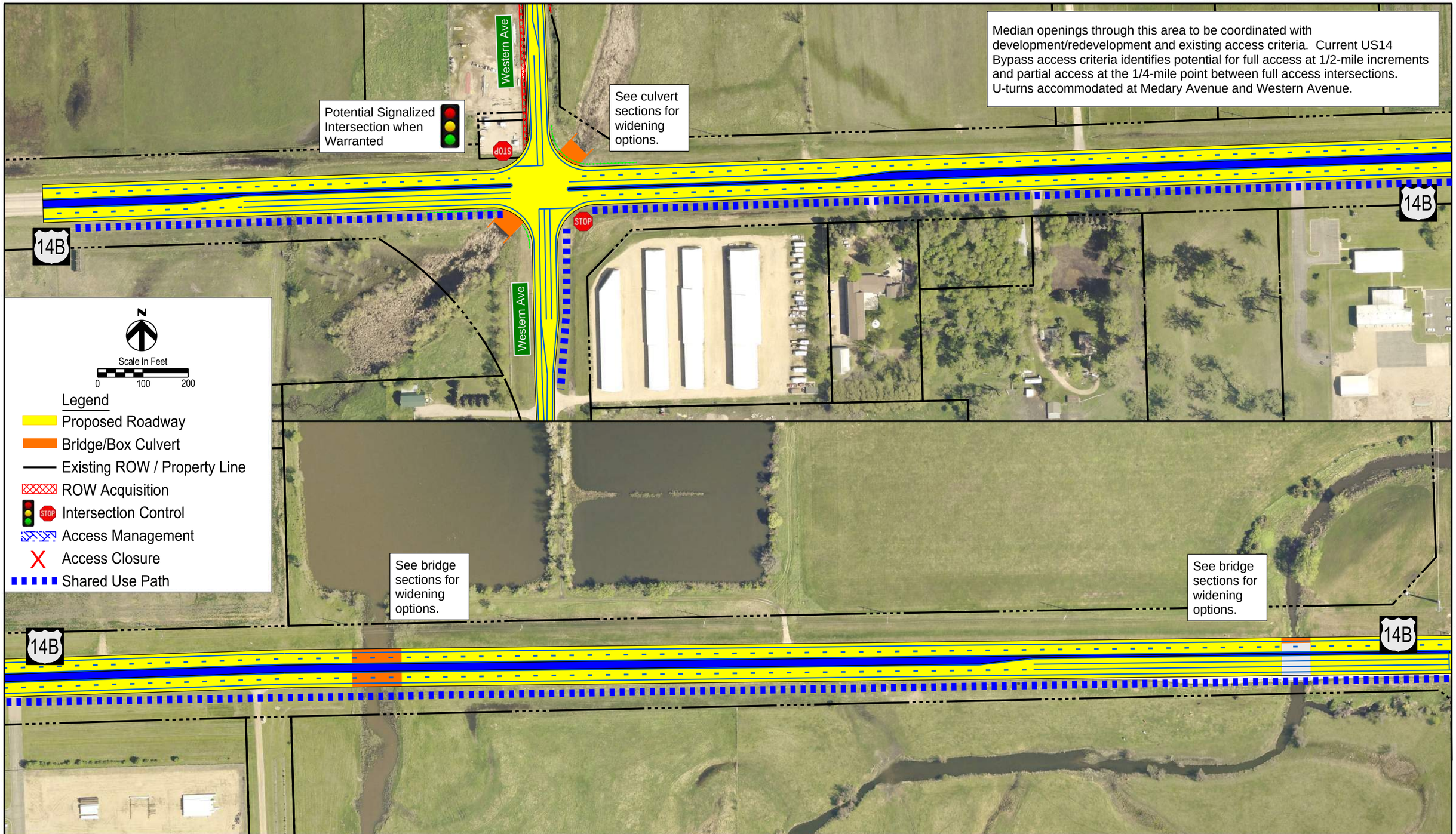


Figure 33

U.S. Department of Transportation
Federal Highway Administration

US14 Bypass - US14 (West) to I-29 Scenarios
Multilane Hybrid (4-Lane Divided and 5-Lane) with Intersection Improvements

US14 / US14B Corridor Study

Brookings, SD

Scenario
US14 Bypass - US14 (West) to I-29
Scenario B

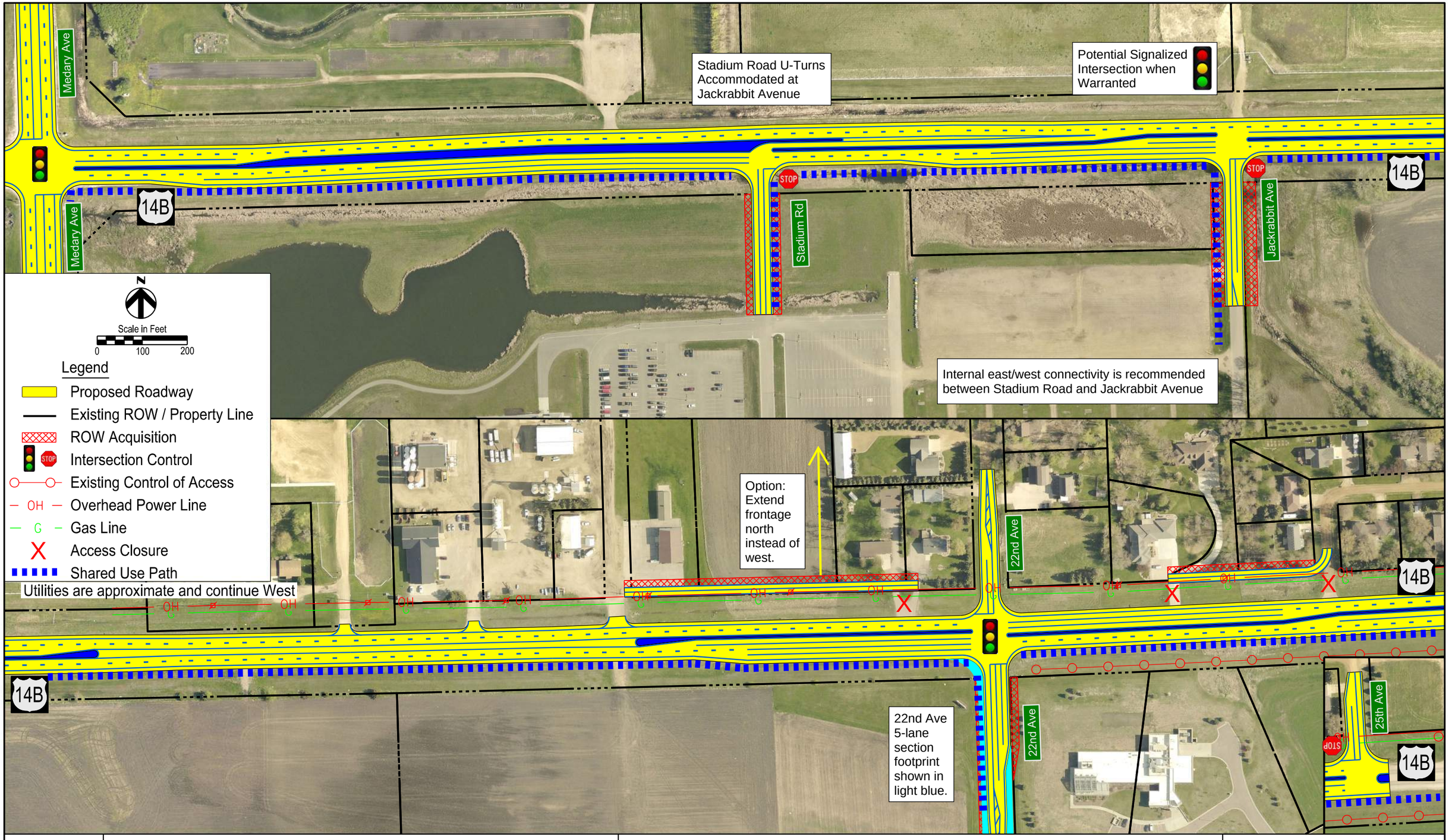


Figure						
33	HDR	South Dakota DOT	brookings	Volga	U.S. Department of Transportation Federal Highway Administration	US14 Bypass - US14 (West) to I-29 Scenarios Multilane Hybrid (4-Lane Divided and 5-Lane) with Intersection Improvements US14 / US14B Corridor Study — Brookings, SD	Scenario US14 Bypass - US14 (West) to I-29 Scenario B

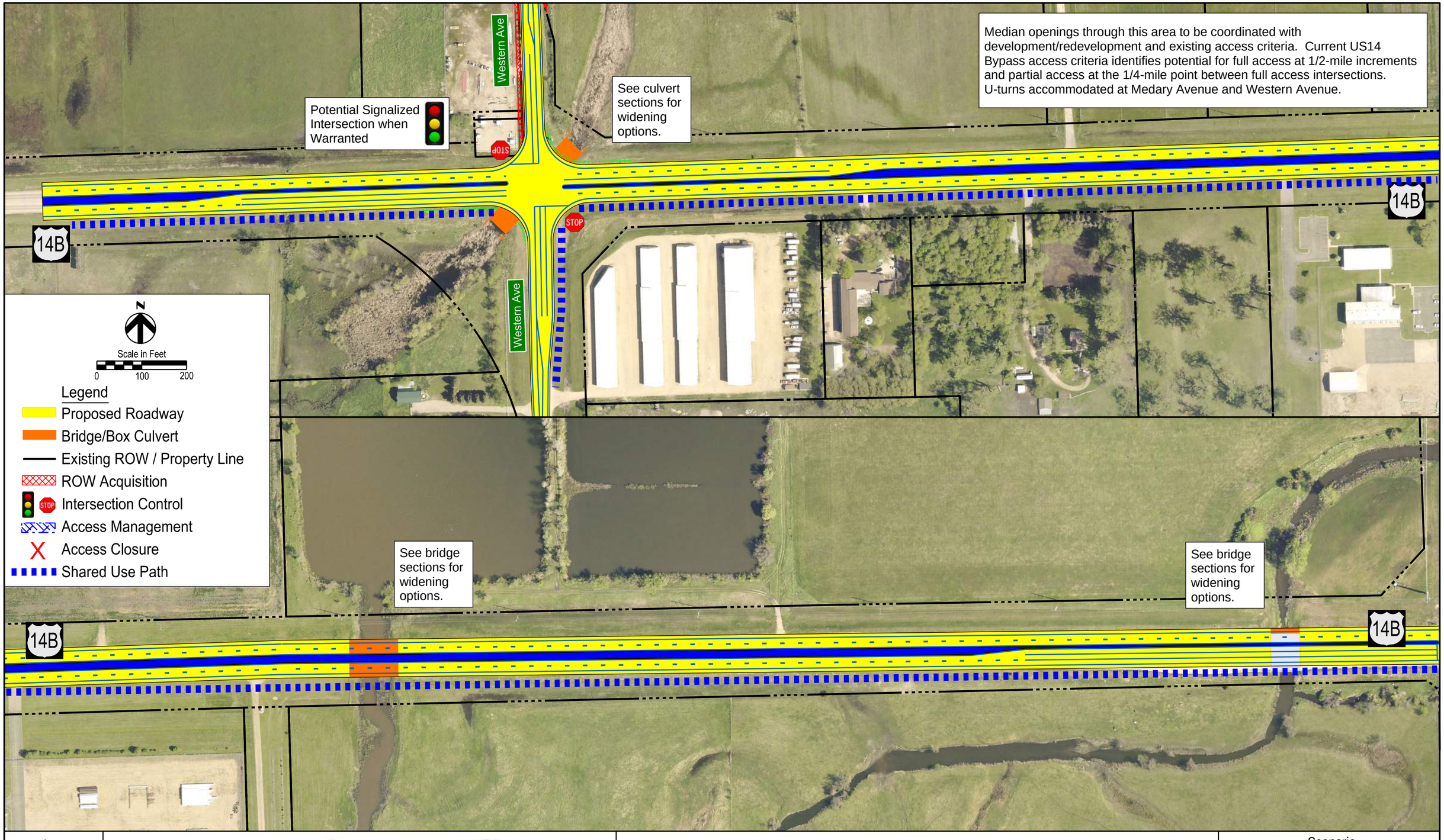


Figure 34	HDR · South Dakota DOT · brookings SOUTH DAKOTA · Volga SOUTH DAKOTA · U.S. Department of Transportation Federal Highway Administration	US14 Bypass - US14 (West) to I-29 Scenarios 4-Lane Divided with Intersection Improvements US14 / US14B Corridor Study Brookings, SD	Scenario US14 Bypass - US14 (West) to I-29 Scenario C

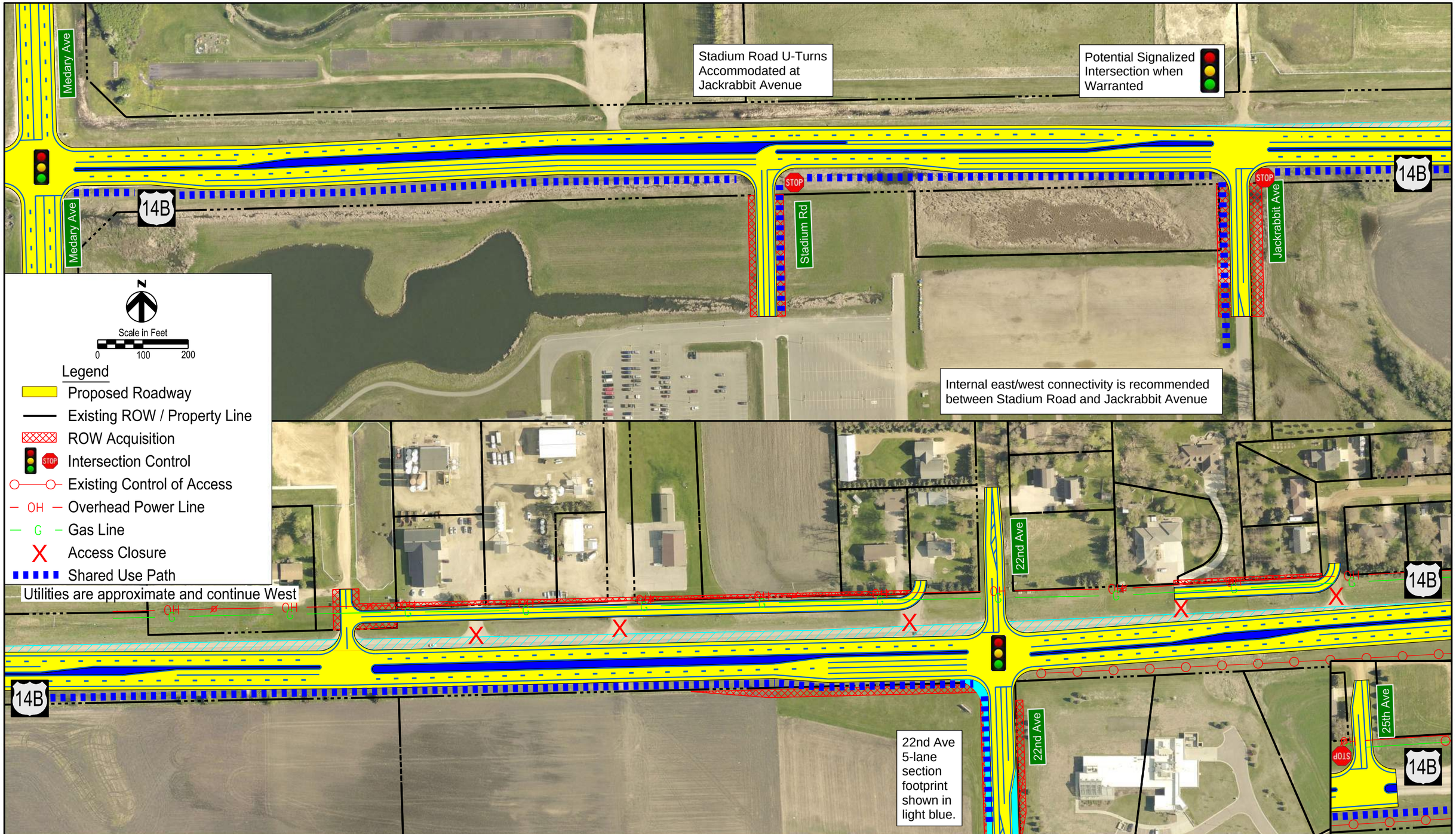


Figure						
34	HDR	SD DOT	brookings SOUTH DAKOTA	Volga SOUTH DAKOTA	U.S. Department of Transportation Federal Highway Administration	US14 Bypass - US14 (West) to I-29 Scenarios 4-Lane Divided with Intersection Improvements US14 / US14B Corridor Study Brookings, SD	Scenario US14 Bypass - US14 (West) to I-29 Scenario C

18.1. Design Notes

Per current SDDOT access criteria signal spacing, Western Avenue and Jackrabbit Avenue have been identified for future signalization when warranted. Medary Avenue and 22nd Avenue intersections are both currently signalized.

Frontage roads in the northwest and northeast quadrants of the 22nd Avenue intersection were incorporated into all three scenarios to remove access points from the intersection functional area (see **Access Plan** section for more information). Existing utilities along the ROW line and existing development setbacks pose notable constraints to the feasibility, location, and extent of these connections. Scenario A and B frontage roads are shown north of existing utilities/ROW line, which limits how far west the connection may go. Scenario C frontage roads are shifted south in order to extend the western frontage road further west through all access points. If frontage roads are carried forward, potential impacts to utilities and future frontage road ownership and maintenance responsibilities will need to be identified in design.

The City of Brookings has identified a long-range plan to reconstruct the 22nd Avenue corridor from US14 Bypass southward through 20th Street South. The first segment, south of US14/6th Street, was completed in 2020. The northern segment that ties into US14 Bypass is anticipated to be the final segment and thus each 22nd Avenue intersection layout reflects a short-term southern leg build-out and a long-term 5-lane section footprint.

Both the suburban and urban cross-sections are applicable to the three scenarios, with the primary difference being whether the section has outside curb and gutter with storm sewer (urban) or no curb and gutter and roadside ditches (suburban). Both sections include a raised center median where applicable. Regardless of the selected section, there will likely be areas where it will be beneficial to alter the outer cross-section due to drainage needs or ROW constraints.

In all instances, each major intersection is planned to accommodate U-turns. Mid-segment left turns restricted by raised medians will be accommodated via U-turns at adjacent major intersections. A mid-segment U-turn location may be needed east of US14/US14 Bypass (west) interchange if an at-grade intersection is not constructed as part of the US14 Bypass project. A potential location would be the ½-mile point between 469th Avenue and Western Avenue, east of the interchange. This will shorten the out of the way travel to access existing development while the interchange is in place and a median is extended west of Western Avenue.

The existing US14 Bypass alignment and profile is straight and flat. Access spacing will likely play a key role in determining design speed. In general, all layouts were developed assuming a 60 mph design speed for a posted speed of 55 mph. Access spacing may influence a lower speed limit in the future.

A shared-use path is proposed along the south side of the corridor throughout all US14 Bypass corridor scenarios to provide off-street east/west bicycle/pedestrian route continuity. Connectivity to existing and future SDSU and City of Brookings bicycle/pedestrian facilities is further described in the **Bicycle and Pedestrian Plan** section.

18.2. Structures

A review of structure needs and potential modifications associated with each of the three scenarios are summarized in the following.

18.2.1. Western Avenue Intersection Box Culvert

The box culvert running diagonally from southwest to northeast under the Western Avenue intersection would need to be extended as part of the proposed improvements.

Scenario A:

- Extend northeast outlet approximately 19 feet to meet 30-foot clear zone.
- No extension of southwest outlet required. Appears to have sufficient length for southern pedestrian path over southwest outlet with minor grading.

Scenario B and C:

- Extend northeast outlet approximately 26 feet to meet 30-foot clear zone.
- Extend southwest outlet approximately 21 feet to meet 30-foot clear zone.

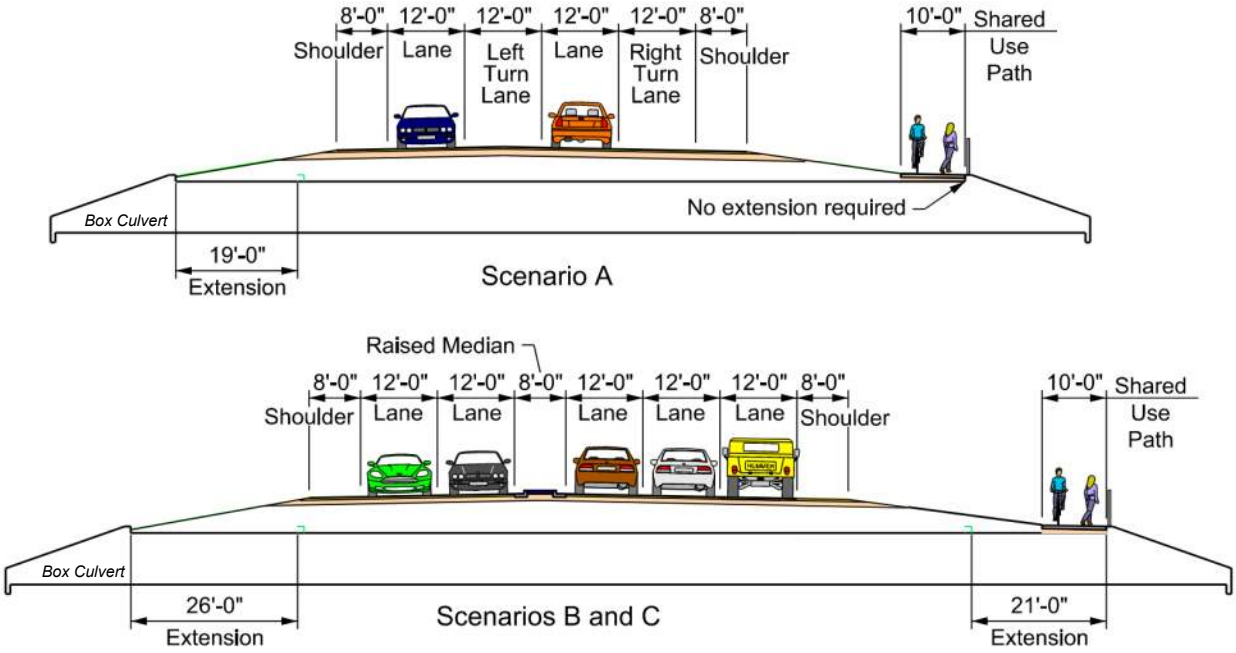


Figure 35: US14 Bypass/Western Avenue Intersection Box Culvert Typical Sections

18.2.2. Structure East of Western Avenue (# 06-166-150)

The existing structure east of Western Avenue accommodates the existing 3-lane section, but needs to be modified or replaced with any of the proposed scenarios. Due to the notable widening required in Scenarios B and C, it will be important to determine whether it is more economical to widen or replace this structure during design.

Scenario A:

- Add shared-use path.
- Widen by 19 feet to the south.

Scenario B and C:

- Add lanes, raised median, and shared-use path.
- Widen 51 feet, 20 feet to the north and 31 feet to the south.

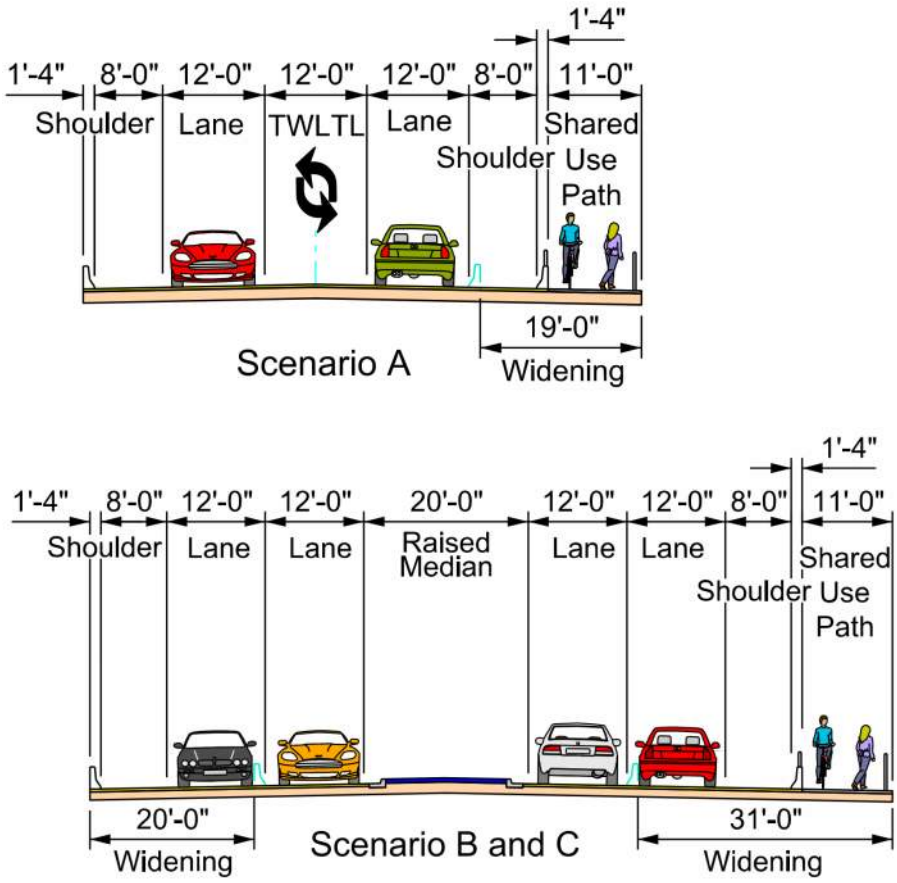


Figure 36: US14 Bypass/Structure # 06-166-150 Typical Sections

18.2.3. Structure West of Medary Avenue (# 06-169-150)

The existing structure west of Medary Avenue already exhibits a 5-lane section and would need minor widening to add a raised median and shared-use path.

Scenario A:

- No widening required to add shared use path.
- Add traffic barrier for shared use path and reduce shoulder width to 6 feet.
- Increase height of outside Jersey Barrier.

Scenario B and C:

- Add shared use path and raised median.
- Widen 11-feet 4 inches to the north.
- Add traffic barrier for shared use path.
- Increase height of outside Jersey Barrier.

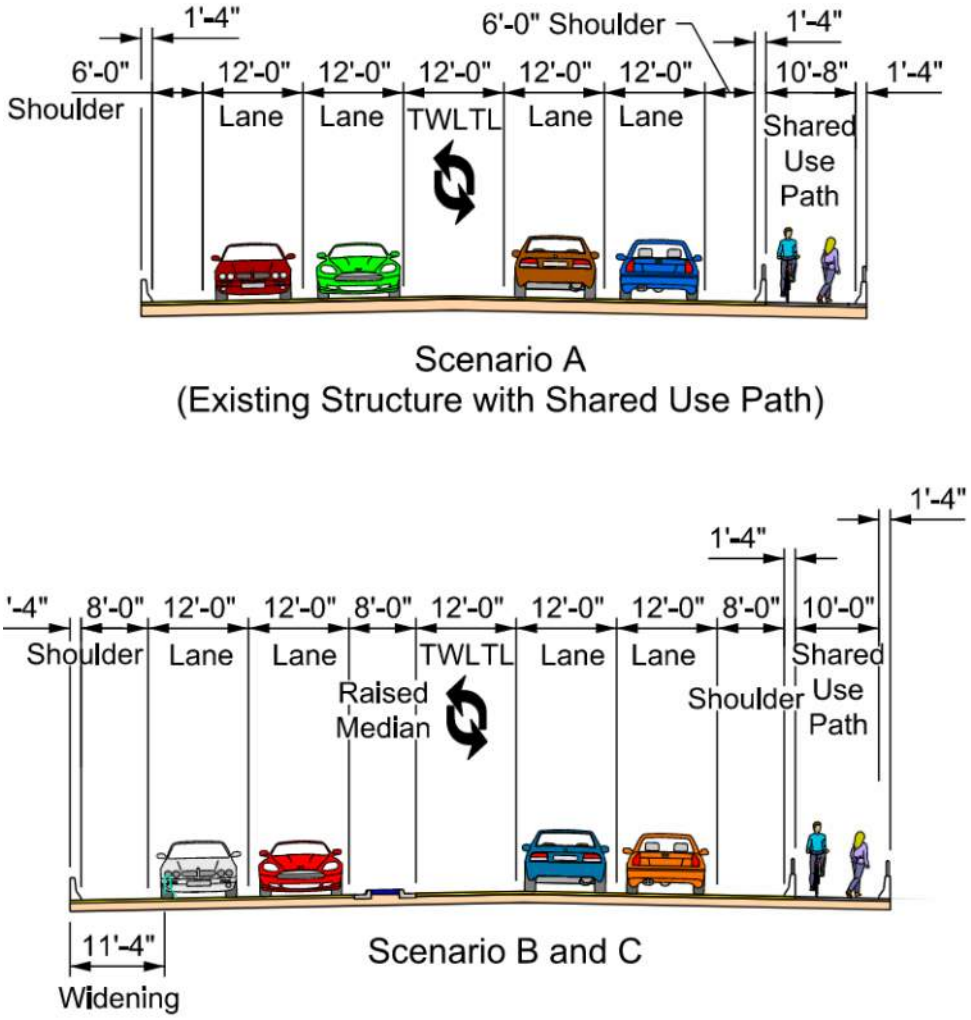


Figure 37: US14 Bypass/Structure # 06-169-150 Typical Sections

18.3. Traffic Operations Analysis

Year 2050 intersection traffic operations are shown in **Table 43**. Consistent with the **Access Plan** and potential future signalized intersection locations, Stadium Road intersection was analyzed as TWSC and Jackrabbit Avenue was analyzed as signalized.

Table 43: US14 Bypass – UW14 (West) to I-29 Intersection Operations (2050 Build)

US14 Bypass Intersection		US14 Section	Intersection Control	Measure	AM		PM	
					Delay (s/veh)	LOS	Delay (s/veh)	LOS
Scenario A	Western Avenue	3-Lane	Signal	**Overall**	**23.6**	**C**	**15.0**	**B**
	Medary Avenue	3-Lane	Signal	**Overall**	**28.1**	**C**	**31.6**	**C**
	Stadium Road	3-Lane	TWSC	**Overall**	**0.8**	**A**	**1.3**	**A**
				TWSC	*18.0*	*C*	*18.7*	*C*
	Jackrabbit Avenue	3-Lane	Signal	**Overall**	**7.9**	**A**	**8.8**	**A**
	22nd Avenue	3-Lane	Signal	**Overall**	**16.1**	**B**	**33.1**	**C**
Scenarios B, C	Western Avenue	Multilane	Signal	**Overall**	**13.8**	**B**	**11.1**	**B**
	Medary Avenue	Multilane	Signal	**Overall**	**22.7**	**C**	**23.0**	**C**
	Stadium Road	Multilane	TWSC	**Overall**	**0.8**	**A**	**1.1**	**A**
				TWSC	*17.6*	*C*	*15.6*	*C*
	Jackrabbit Avenue	Multilane	Signal	**Overall**	**3.1**	**A**	**7.7**	**A**
	22nd Avenue	Multilane	Signal	**Overall**	**14.8**	**B**	**25.4**	**C**

TWSC: worst-case stop-control approach delay.

The greatest capacity constraints occur at the Medary Avenue and 22nd Avenue intersections within a 3-lane section, particularly in the PM peak hour. At both intersections, the volume to capacity (v/c) ratio is near 1.0 for the westbound through movements. A v/c ratio that exceeds 1.0 indicates intersection failure due traffic demand exceeding available capacity. The following findings are important considerations in maintaining a 3-lane corridor:

- Medary Avenue intersection
  - Northbound right turn lane needed for right turn overlap to meet movement LOS goal (AM and PM).
  - Westbound through nearly at capacity with single through lane (PM).
- 22nd Avenue intersection
  - Westbound through nearing capacity with volume/capacity ratio of 0.95 (PM).
- During these peak times, any upward fluctuation of traffic will likely cause intersection failure due to minimal excess capacity beyond this study's 2050 Planning Horizon traffic volumes.

Scenarios B and C address intersection capacity limitations and provide ample, long-term capacity for the corridor. Specific to the Medary Avenue and 22nd Avenue intersections, multilane section delay is nearly 25 percent less than the 3-lane section.

95th percentile queue lengths are also an important consideration at the 22nd Avenue intersection, with longer queues potentially leading to:

- Greater risk of rear-end crashes due to unexpectedness of back of queue point.
- Greater intersection functional area footprint, which leads to longer median lengths if balancing 4-lane divided and 5-lane cross-sections.

- Greater intersection delay, as longer signal phase durations are needed for the high-volume movements. This leads to greater delay on other approaches, or long queues not clearing within a respective cycle (cycle failure).

A summary of 22nd Avenue intersection 2050 95th percentile queues for select movements is shown in **Table 44**. The Scenario B and C multilane segment best manages queues, particularly in the PM peak hour. The westbound PM peak hour queue is 280 feet (approximately 11 vehicles) less with a multilane section compared to the 3-lane section. The corresponding eastbound queue is reduced by 191 feet.

Table 44: 22nd Avenue Intersection 95th Percentile Queues (2050 Build)

Scenario	US14 Bypass Section	Movement	95th % Queue (ft.)		Difference from Scenario A	
			AM	PM	AM	PM
Scenario A	3-Lane	EB Thru	278	373	-	-
		WB Thru	203	563	-	-
		NB LT	94	359	-	-
Scenarios B and C	Multilane	EB Thru	180	182	*-98*	*-191*
		WB Thru	83	283	*-120*	*-280*
		NB LT	83	273	*-11*	*-86*

95th percentile queues measured in HCS. Table shows approach movements with the greatest measured queue.

The US14 Bypass corridor segment was also analyzed in terms of segment LOS. **Table 45** and **Table 46** present the intersection to intersection and overall facility LOS and measured travel time. The I-29 ramp terminal intersections were included in the HCS model to fully understand corridor-level operations and are illustrative in this section. Further discussion on the interchange is provided in the next section.

Table 45: US14 Bypass – US14 (West) to I-29 Scenario A Segment Operations (2050 Build)

	From	To	Length (mi)	Hwy Type	AM LOS		PM LOS	
					EB	WB	EB	WB
Scenario A	US14 (west)	Western Ave	0.8-1.0	3-Lane	B	A	A	B
	Western Ave	Medary Ave	1.0	3-Lane	B	A	A	A
	Medary Ave	Jackrabbit Ave	0.5	3-Lane	A	B	B	C
	Jackrabbit Ave	22nd Ave	0.5	3-Lane	B	A	C	A
	22nd Ave	I-29 SB RTI	0.4	3-Lane	A	B	A	C
	I-29 SB RTI	I-29 NB RTI	0.2	3-Lane	C	B	B	C
				Facility LOS	*B*	*A*	*B*	*B*
				Travel Time (sec)	*313*	*273*	*297*	*345*

Segment and Facility LOS based on percent of base free-flow speed.

Table 46: US14 Bypass – US14 (West) to I-29 Scenario B and C Segment Operations (2050 Build)

	From	To	Length (mi)	Hwy Type	AM LOS		PM LOS	
					EB	WB	EB	WB
Scenarios B and C	US14 (west)	Western Ave	0.8-1.0	3-Lane	A	A	A	B
	Western Ave	Medary Ave	1.0	3-Lane	A	A	A	A
	Medary Ave	Jackrabbit Ave	0.5	3-Lane	A	B	A	C
	Jackrabbit Ave	22nd Ave	0.5	3-Lane	B	A	C	A
	22nd Ave	I-29 SB RTI	0.4	3-Lane	A	B	A	D
	I-29 SB RTI	I-29 NB RTI	0.2	3-Lane	B	B	B	C
Facility LOS					*A*	*A*	*A*	*B*
Travel Time (sec)					*275*	*269*	*276*	*318*
Difference from Scenario A 3-Lane Corridor (sec)					*-38*	*-4*	*-21*	*-27*

Segment and Facility LOS based on percent of base free-flow speed.

The Scenario B and C corridor provides notable improvements in LOS and overall facility travel time for the high-volume peak hour directions. In the morning, the high-volume eastbound travel time is reduced by 38 seconds. In the afternoon, the westbound travel time is reduced by 27 seconds. Overall facility LOS was also improved one letter grade from LOS B (Scenario A) to LOS A (Scenarios B and C) for the corresponding directions.

18.4. Predictive Safety Analysis

Table 47 presents results from the IHSDM predictive safety analysis.

Table 47: US14 Bypass – US14 (West) to I-29 Intersection Predicted Crashes per Year

Scenario	F & I Crashes	Change from No Build *+ increase - decrease*	Total Crashes	Change from No Build *+ increase - decrease*
No Build (baseline)	4.8	-	14.7	-
Scenario A	3.7	*-1.1*	12.3	*-2.4*
Scenario B	3.6	*-1.2*	11.2	*-3.5*
Scenario C	3.4	*-1.4*	10.7	*-4.0*

All three proposed scenarios provide safety benefits in comparison to the No Build condition. The predictive safety analysis demonstrates benefits associated with center medians restricting turn movements to/from driveway access points. The transition from Scenario A to Scenario C illustrates increasing levels of safety due to increased access management and fewer driveway conflict points.

The primary difference between Scenario B and C is related to whether a 5-lane section or median section is provided through access points west of 22nd Avenue. Including a median section reduces annual F&I crashes by 0.2 (1 every 5 years) and total crashes by 0.5.

A supplemental analysis was run for Scenario B to illustrate the safety implications of not constructing frontage roads in the vicinity of 22nd Avenue intersection.

Table 48: US14 Bypass – US14 (West) to I-29 Intersection Predicted Crashes per Year (No Frontage Roads Supplement)

Scenario	F & I Crashes	Change from No Build *+ increase - decrease*	Total Crashes	Change from No Build *+ increase - decrease*
No Build (baseline)	4.8	-	14.7	-
Scenario B	3.6	*-1.2*	11.2	*-3.5*
Scenario B (supp) *No frontage roads*	4.2	*-0.6*	11.8	*-2.9*

The IHSDM results show that maintaining driveway access near the 22nd Avenue intersection still results in a reduction in crashes throughout the corridor scenario, but at a lesser degree than Scenario B. However, the IHDSM analysis does not differentiate driveway turn restrictions such as full access vs. right-in right-out (RIRO) access. Extending a median through the intersection functional area and prohibiting left turns in and out of these access points would likely result in a realized crash benefit somewhere between Scenario B and supplemental Scenario B analyses. Most importantly, a median eliminates left turn movements that often result in high severity angle crashes.

As reflected in the scenario layouts, it is recommended that a median be extended along US14 Bypass within the 22nd Avenue intersection functional area to prohibit left turns in and out of any functional area access points. Additional information is provided in the **Access Plan** section.

18.5. US14 Bypass Reliability and Functionality

Scenarios B and C exhibit a notable improvement to corridor reliability, functionality, and supporting the original intent of the US14 truck bypass, by providing two through lanes in each direction. Associated benefits of a multilane corridor include:

- Provides ample additional capacity to accommodate traffic fluctuations.
    - Scenario A intersections are shown to be at the upper limit of available capacity with Year 2050 traffic volumes.
- Best accommodates unanticipated changes in land use, traffic patterns, and future development.
- Provides greater flexibility to maintain traffic during roadway maintenance and preservation activities, consistent with the intent of the purpose of a truck bypass.
- Provides greatest flexibility for SDSU football gameday traffic management.
    - Minimizes gameday impacts to pass-through bypass traffic.

18.6. Potential Property and Utility Impacts

At Western Avenue, there is a natural gas sub-station in the northwest quadrant and electrical transmission tower in the northeast quadrant. Available width between these two facilities is approximately 70 feet. Future improvements to the north leg of the intersection will need to fit within this available width or will result in impacts to one or both utilities.

Figure 38: US14 Bypass/Western Avenue Intersection – North Leg

Map source: Google Earth

At 22nd Avenue, the same pipeline and overhead transmission line runs along the northern ROW line and creates challenges for implementing frontage roads without creating significant utility conflicts. An example of these limitations is shown in **Figure 39**. Further, the setback of existing buildings also restricts placement of frontage roads outside of existing ROW without necessitating a full acquisition. Per current City of Brookings zoning, development in this area must maintain at least 50-foot setback between roadway ROW and building face.

Figure 39: US14 Bypass/22nd Avenue Intersection – North Leg

Map source: Google Earth

Scenario A and B frontage roads are located outside of the existing US14 Bypass ROW, north of the existing utilities. Existing building setbacks west of 22nd Avenue limit the extent of the western frontage road. These two scenarios result in the greatest impact to parcels north of US14 Bypass, but minimize impacts to SDSU property on the south side.

Scenario C shifts the US14 Bypass southward to fit frontage roads within existing ROW. This allows the frontage roads to be carried further west and not impact building setback limitations. Property impacts are lessened to parcels north of US14 Bypass, but the scenario initiates greater ROW acquisition needs from SDSU property to the south.

The *SDDOT Road Design Manual* states that desired separation between mainline roadway and frontage road should be 250 feet or greater, with a minimum of 150 feet. Due to existing development, this is not achievable in the northwest quadrant unless the frontage road ties into 22nd Avenue to the north (Scenario A and B option). The minimum separation is achieved in the northeast quadrant if the frontage road ties into Sunnybrook Drive as shown in the layouts.

Regardless of scenario, the SDDOT and City of Brookings will need to determine ownership and maintenance responsibilities of the frontage roads if implemented. This determination will also play a role in frontage road design standards and access management.

18.7. Future Pavement and Structure Needs Summary

A summary of upcoming major investment needs along the corridor segment includes:

- Structures
  - Western Avenue box culvert: constructed 1967 (53 years) and extended in 2015.
  - Bridge east of Western Avenue: constructed 1967 (53 years)
  - Bridge west of Medary Avenue: constructed 1968 (52 years)
  - Approach slab repair and chip seals (2022 – 2023 STIP)
- Roadway Pavement (*SDDOT Needs Book* timeframe)
  - 22nd Avenue intersection improvements (2025-2028 developmental STIP)
  - PCCP reconstruction from Medary Avenue to 34th Avenue (2029-2035)

Using a 75-year bridge and structure life with good maintenance, all three structures may be nearing replacement at the end of the 2050 Planning Horizon.

Currently, the SDDOT Needs Book shows a need to reconstruct the US14 Bypass corridor eastward from Medary Avenue in the 2029 to 2035 timeframe. This would be an opportune time to provide long-term capacity improvements through this corridor segment.

18.8. Public Comment

Public comment on the three proposed scenarios primarily focused on three topics:

1. Number of lanes
2. Access and property impacts
3. Bicycle and pedestrian facility connectivity

Across the second and third public meetings, the greatest public and stakeholder support has been for a multilane corridor. Comments have noted planning for the future, improving reliability for trucks and other heavy vehicles, improving SDSU football gameday traffic management, and maintaining the original intent of the bypass. Conversely, there were comments that indicated recent intersection improvements work well and funding should be focused elsewhere, like the I-29 interchange bridge.

Comments from the final public meeting often centered on access and property impacts. Business owners with existing access points between Jackrabbit Avenue and 22nd Avenue did not support Scenario C with the median across their access points. In a collective letter, they indicated concern for the high volume of large trucks and truck-trailer combinations accessing their facilities and the difficulties these trucks would have making U-turns at adjacent intersections.

Homeowners surrounding the 22nd Avenue intersection expressed concern of the frontage roads due to potential property impacts and the creation of dead ends at their driveways. Other landowners supported some type of frontage road to provide access to their parcel from the US14 Bypass ROW. SDSU expressed hesitations in supporting Scenario C because of potential impacts to their property from the US14 Bypass alignment shift.

The shared-use path proposed on the south side of US14 Bypass was supported by public and stakeholders, including SDSU and Daktronics. Beneficial connectivity was noted between residential and business areas, and existing and future bicycle/pedestrian facilities.

18.9. Evaluation Summary and Recommendations

Table 49 presents an evaluation summary matrix of intersection and corridor traffic operations, predictive safety, ROW and construction costs, and potential environmental resource impact measures. The overarching benefits and drawbacks of each scenario are summarized in **Table 50**.

Based on a review of the evaluation matrix, benefits and drawbacks, and timelines for next major investments along the corridor, long-range recommendations and potential timelines are summarized in **Table 51**.

Table 49: US14 Bypass – US14 (West) to I-29 Scenario Summary Matrix

Scenario	Traffic Operations					Predictive Safety		ROW & Costs		Environmental Resources
	2050 22nd Ave Intersection Operations	**2050 Medary Ave Intersection Operations**	**2050 Corridor Operations**	**Corridor Reliability & Driver Expectancy**	**Event Traffic Management and Operations**	**F&I Crashes**	**Total Crashes**	**ROW Acquisition**	**Construction & ROW Costs**	**Potential Impacts**
	LOS AM / PM	*LOS AM / PM*	*LOS AM / PM*	*5 - Best 3 - Middle 1 - Least*	*5 - Best 3 - Middle 1 - Least*	*Average Annual # Crashes*	*Average Annual # Crashes*	*Acres*	*$ mil*	*Low, Medium, High*
Scenario A	B / C	C / C	B / B	4	3	3.7	12.3	2.5	$7.0 (A) $14.0 (B)	Medium – Wetlands, Floodplain
Scenario B	B / C	C / C	A / B	5	5	3.6	11.2	2.5	$24.5	Medium to High – Floodway, Floodplain, Wetlands, T&E (Topeka Shiner)
Scenario C	B / C	C / C	A / B	5	5	3.4	10.7	3.5	$25.0	Medium to High – Floodway, Floodplain, Wetlands, T&E (Topeka Shiner)
No Build	B / C *	D / C	E / E	3	2	4.8	14.7	0	0	Low

* Analyzed as isolated signal with 2020 temporary signal and NB RT lane improvements.
Scenario A costs: A) no mainline reconstruction, B) includes mainline reconstruction.

Table 50: US14 Bypass – US14 (West) to I-29 Scenario Benefits and Drawbacks

Scenario	Benefits	Drawbacks
No Build (baseline)	• No environmental impacts, cost, or property impacts.	• Does not improve corridor safety. • Does not improve corridor capacity. • Does not provide warranted intersection turn lanes and traffic signals.
Scenario A	• Adds warranted turn lanes and traffic signals. • Improves traffic operations • Frontage roads remove driveways from 22nd Ave intersection. • Predicted reduction in crashes. • Lowest cost and ROW impact of three scenarios.	• Limited addition capacity for traffic fluctuations and growth. • Long intersection queues. • Route reliability and event traffic limitations. • Medium environmental impacts due to intersection turn lanes and bridge widening for shared-use path.
Scenario B	• Multilane provides best traffic operations, route reliability, and event traffic management. • Additional capacity for traffic fluctuations and growth. • Best manages intersection queues. • Adds warranted turn lanes and traffic signals. • Reduces predicted crashes. • Frontage roads remove driveways from 22nd Avenue intersection. • Allows flexibility of dual left turn lanes from crossroad if needed in future.	• Greater cost than No Build and Scenario A. • Medium to high environmental impacts due to intersection turn lanes and bridge widening for shared-use path.
Scenario C	• Greatest reduction in predicted crashes. • Multilane provides best traffic operations, route reliability, and event traffic management. • Additional capacity for traffic fluctuations and growth. • Best manages intersection queues. • Adds warranted turn lanes and traffic signals. • Frontage roads remove driveways from 22nd Avenue intersection. • Allows flexibility of dual left turn lanes from crossroad if needed in future.	• Greater cost than No Build and Scenario A. • Medium to high environmental impacts due to intersection turn lanes and bridge widening for shared-use path.

Table 51: US14 Bypass – US14 (West) to I-29 Scenario Recommendations

Corridor Scenario: Scenario B

Cross-section: 4-Lane Divided - Suburban

- 4-Lane Divided – Urban section where needed at intersections and constrained ROW

Timeline:

2024

- Reconstruct 22nd Avenue intersection to reflect Scenario B.
  - Stripe for single eastbound and westbound through lanes, plus turn lanes.
  - Build out limits:
    - At minimum, project limits should encompass 22nd Avenue intersection functional area footprint (extend median through entirety of intersection turn lanes on US14 Bypass).
    - West leg considerations: extend through first access point west of median with option to extend to western-most access and build-out 5-lane section limits.
    - East leg: consider reconstruction through 25th Avenue intersection if extension of utilities and development is likely before 2035. Potential new interchange profile will be a consideration if reconstructing 25th Avenue.
- Address access within 22nd Avenue intersection functional area.
  - Top priority: extend US14 Bypass median through intersection functional area.
  - Goal: remove access points within intersection functional area via frontage roads.

2025 – 2030

- Signalize Western Avenue when warranted and add northbound right turn lane.

2030 – 2035

- Reconstruct US14 Bypass from US14 (west) to I-29.

19. US14 Bypass/I-29 Interchange (Exit 133) Scenarios

One of the primary goals for this study regarding the US14 Bypass/I-29, Exit 133, interchange was to identify what future improvements are required and their relationship with improvements at the 22nd Avenue intersection. It was found through the concept development phase that large-scale capacity improvements were not needed at this interchange. Maintaining a diamond-type interchange footprint plus ramp terminal intersection improvements delivered ample future capacity. Transportation needs identified along the US14 Bypass within the interchange include:

- Improve bridge functionality due to narrow width.
- Improve traffic operations at interchange ramp terminal intersections.
    - Includes improving event traffic management and flexibility for traffic fluctuations.
- Increase spacing between northbound ramp terminal intersection and 32nd Avenue.
    - Existing spacing approximately 460 feet, desired spacing is 660 feet.
- Facilitate US14 Bypass route continuity through interchange.

Three interchange scenarios, shown in **Figure 40** through **Figure 42**, were developed to address these needs.

Scenario A: Maintain Existing Bridge with Ramp Terminal Improvements

- *Maintains existing 2-lane bridge (no bridge widening).*
- *Ramp terminal intersection improvements.*
- *Two options to tie into US14 Bypass beyond ramp terminals.*

Scenario B: 3-Lane Cross-Section across Bridge with Ramp Terminal Improvements

- *Modified compressed diamond interchange type.*
    - *Northbound ramp terminal shifted west to increase spacing from 32nd Avenue.*
- *3-lane section across bridge (new bridge).*
- *Ramp terminal intersection improvements.*
- *Two options to tie into US14 Bypass beyond ramp terminals.*
- *Shared-use path on south side.*

Scenario C: 4-Lane Divided with Intersection Improvements

- *Modified compressed diamond interchange type.*
    - *Northbound ramp terminal shifted west to increase spacing from 32nd Avenue.*
- *4-lane divided section across bridge (new bridge).*
- *Ramp terminal intersection improvements.*
- *Two options to tie into US14 Bypass beyond ramp terminals.*
- *Shared-use path on south side.*

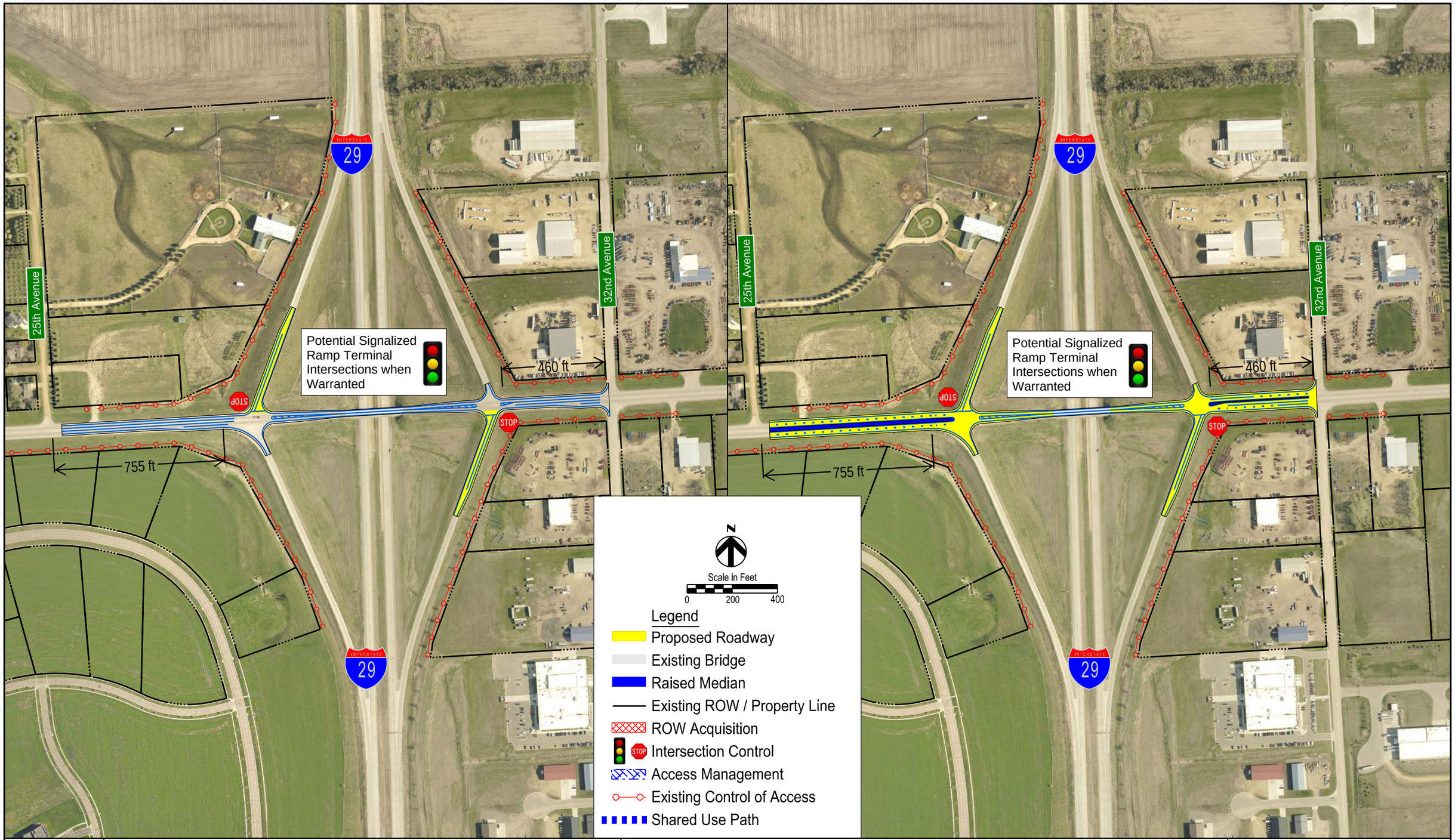


Figure
40

U.S. Department of Transportation
Federal Highway Administration

US14 Bypass - I-29 Exit 133 Interchange Scenarios
Maintain Existing Bridge with Ramp Terminal Improvements

US14 / US14B Corridor Study

Brookings, SD

Scenario
US14 Bypass - I-29 Exit 133
Interchange
Scenario A

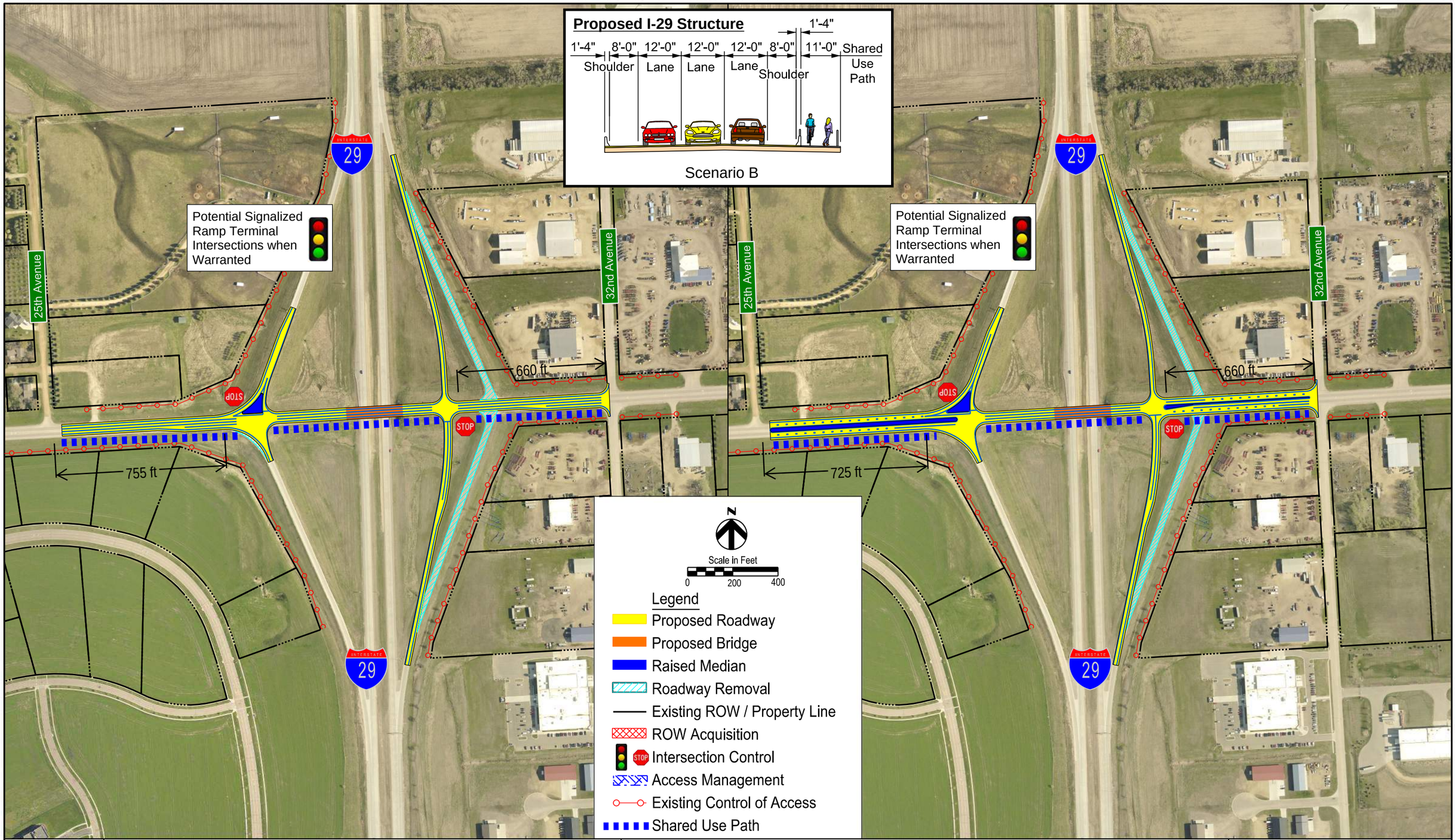


Figure 41	HDR · South Dakota DOT · brookings · Volga · U.S. Department of Transportation Federal Highway Administration	US14 Bypass - I-29 Exit 133 Interchange Scenarios 3-Lane Cross-Section Across Bridge with Ramp Terminal Improvements US14 / US14B Corridor Study — Brookings, SD	Scenario US14 Bypass - I-29 Exit 133 Interchange Scenario B

N

Scale in Feet

0 150 300

Legend

- Proposed Roadway
- Proposed Bridge
- Raised Median
- Mountable Curb
- Roadway Removal
- Existing ROW / Property Line
- ROW Acquisition
- Intersection Control
- Shared Use Path
- Existing Control of Access

Potential Signalized Ramp Terminal Intersections when Warranted

INTERSTATE 29

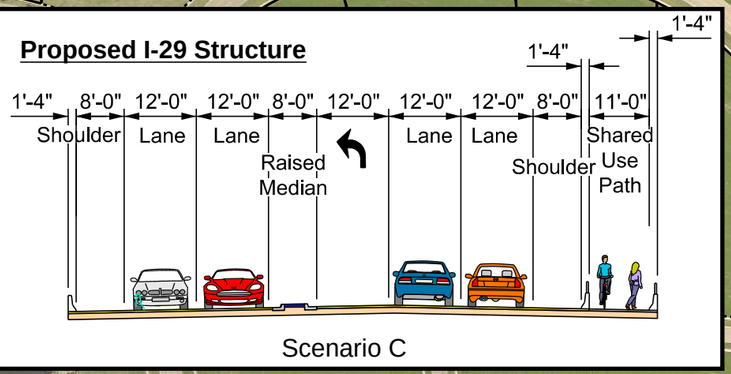
32nd Avenue

660 ft

710 ft

STOP

Proposed I-29 Structure



Scenario C

Figure 42		US14 Bypass - I-29 Exit 133 Interchange Scenarios Multilane Cross-Section Across Bridge with Ramp Terminal Improvements US14 / US14B Corridor Study — Brookings, SD	Scenario US14 Bypass - I-29 Exit 133 Interchange Scenario C

HDR | South Dakota DOT | brookings SOUTH DAKOTA | Volga SOUTH DAKOTA | U.S. Department of Transportation Federal Highway Administration

19.1. Design Notes

The modified compressed diamond interchange configuration provides approximately 660 feet separation between the northbound ramp terminal intersection and 32nd Street. This is an increase of approximately 200 feet from the existing 460 feet.

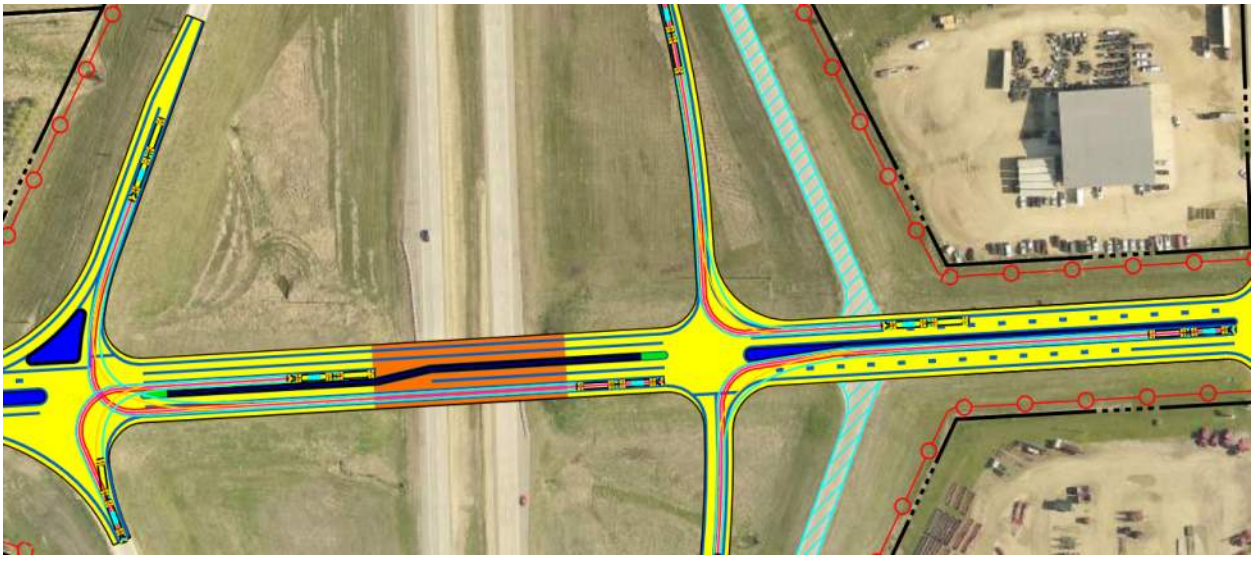
Scenario A was developed with short-term ramp terminal intersection improvements in mind, illustrating how a reconstructed US14 Bypass corridor east and/or west of the interchange could tie into the existing interchange. This scenario is likely most applicable where a US14 Bypass project precedes an interchange project that replaces the existing bridge.

Scenario B and C incorporates a shared-use path to provide connectivity across I-29.

A conceptual profile, provided in **Appendix P**, was developed for a new interchange at 60 mph design speed using GIS-based contours. For planning purposes of future project construction limits, the roadway profiles are shown to tie into existing US14 Bypass grade around the 25th Avenue and 32nd Avenue intersections.

I-29 and the US14-US14 Bypass corridor between Huron, SD, and I-29 have both been identified as a Longer Combination Vehicle (LCV) route. The *SDDOT Road Design Manual*, Chapter 12, recommends intersections of two LCV routes should accommodate a WB109D AASHTO design vehicle (Rocky Mountain Double). Ramp terminal intersections for both Scenario B and C have been designed to accommodate WB109D turning movements, with most restrictive turn paths shown for Scenario C in **Figure 43.**

.



Scenario C shown.

Figure 43: WB109D AASHTO Design Vehicle (Rocky Mountain Double) Turn Paths

19.2. Structures

The existing structure over I-29 was constructed in 1966. While it could be widened, the current age, condition, and substandard width on and below the bridge will likely qualify it for replacement funding. Typical sections for Scenario B and C structures reflect bridge replacement.

It was assumed that the structure would be replaced with a two-span prestressed girder bridge with span lengths near 125 feet as was used for I-29 Exit 132. Total deck width would be 65'-8" for Scenario B and 89'-0" for Scenario C. Total length for both would be 255'-0".

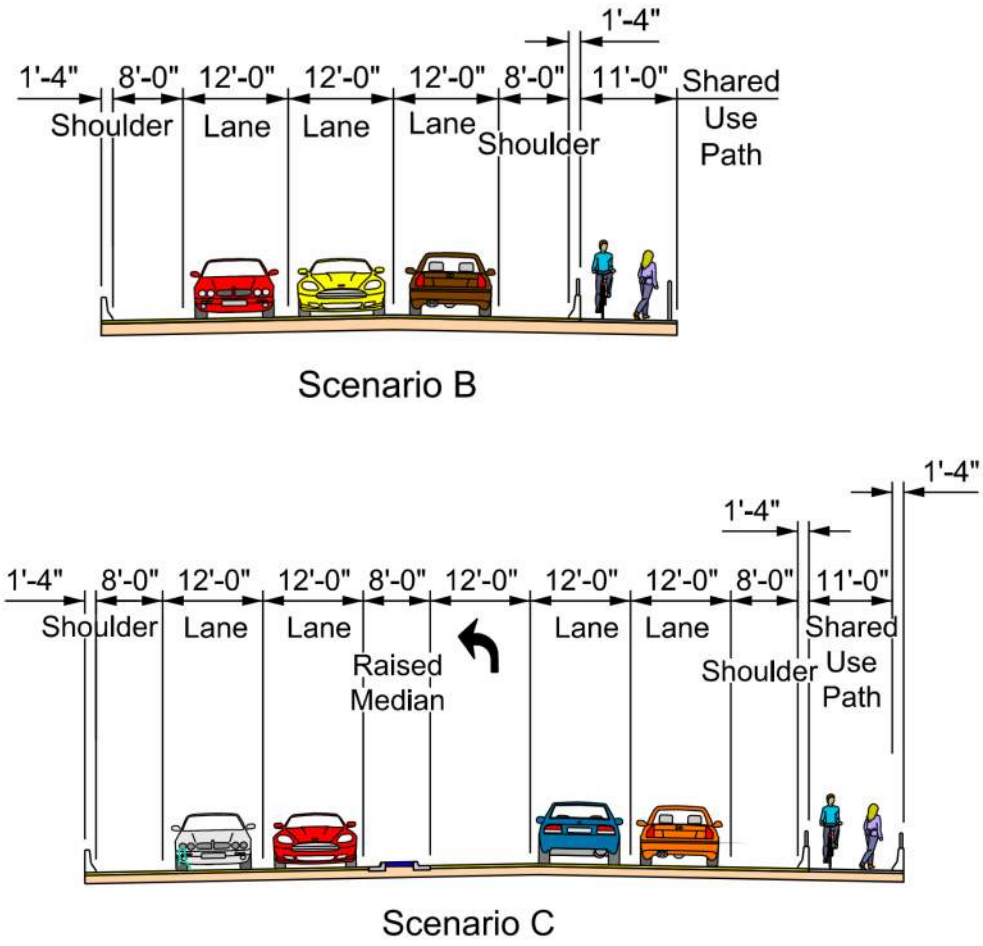


Figure 44: US14 Bypass/I-29 Interchange Exit 133 Structure Typical Sections

19.3. Traffic Operations Analysis

Year 2050 traffic operations for the US14 Bypass scenario intersections is provided in **Table 52**. The results illustrate large-scale improvements are not needed to just improve ramp terminal intersection or overall interchange operations. Simply signalizing the ramp terminal

intersections and splitting ramp terminal intersection approach turn lanes in Scenario A achieves LOS B through the 2050 Planning Horizon.

Scenarios B and C build upon Scenario A modifications to further improve US14 Bypass route connectivity with left turn lanes on US14 Bypass. Scenario C provides the best overall traffic operations in terms of individual intersection and overall interchange delay.

Table 52: US14 Bypass/I-29 Interchange Ramp Terminal Operations (2050 Build)

US14 Bypass Intersection		US14 Bypass Lanes on Bridge	Intersection Control	Measure	AM		PM	
					Delay (s/veh)	LOS	Delay (s/veh)	LOS
Scen. A	I-29 SB RTI	2-Lane	Signal	**Overall**	**10.0**	**A**	**12.8**	**B**
	I-29 NB RTI	2-Lane	Signal	**Overall**	**12.2**	**B**	**13.8**	**B**
	I-29 Interchange	2-Lane	Signal	**ETT**	**16.3**	**B**	**18.3**	**B**
Scen. B	I-29 SB RTI	3-Lane	Signal	**Overall**	**9.1**	**A**	**11.4**	**B**
	I-29 NB RTI	3-Lane	Signal	**Overall**	**12.0**	**B**	**11.9**	**B**
	I-29 Interchange	3-Lane	Signal	**ETT**	**17.7**	**B**	**20.0**	**B**
Scen. C	I-29 SB RTI	Multilane	Signal	**Overall**	**9.0**	**A**	**8.0**	**A**
	I-29 NB RTI	Multilane	Signal	**Overall**	**10.4**	**B**	**9.8**	**A**
	I-29 Interchange	Multilane	Signal	**ETT**	**16.4**	**B**	**15.0**	**A**

19.4. Predictive Safety Analysis

Table 53 presents results from the IHSDM predictive safety analysis.

Table 53 US14 Bypass/I-29 Interchange Predicted Crashes per Year

Scenario	F & I Crashes	Change from No Build *+ increase* *- decrease*	Total Crashes	Change from No Build *+ increase* *- decrease*
No Build (baseline)	1.0	-	3.0	-
Scenario A	1.2	*+0.2*	3.2	*+0.2*
Scenario B	1.2	*+0.2*	3.3	*+0.3*
Scenario C	1.2	*+0.2*	3.2	*+0.2*

All three interchange scenarios exhibit similar predicted crashes as the No Build condition. Slight increases between the No Build and three interchange scenarios are associated with signalizing the northbound ramp terminal intersection in the three scenarios. However, the northbound ramp terminal intersection will not be signalized until warranted by traffic volumes and the extended period of TWSC is not reflected in the predictive safety analysis. Overall, Scenario C provides the best safety results of the three scenarios.

19.5. Future Pavement and Structure Needs Summary

A summary of upcoming major investment needs along the corridor segment includes:

- Structures
  - I-29 interchange: constructed 1966 (54 years)
- Roadway Pavement (*SDDOT Needs Book* timeframe)
  - PCCP reconstruction from Medary Avenue to 34th Avenue (2029-2035)

Similar to other structures along US14 and the US14 Bypass, with good maintenance, the I-29 interchange structure will likely be nearing the end of its life towards the end of this study's 2050 Planning Horizon. The existing structure is at an age where it is likely too old to incorporate any significant widening.

US14 Bypass 2029 to 2035 reconstruction needs extend through the interchange and reflect an opportune time for capacity improvements as part of the new roadway segment.

19.6. Public Comment

Throughout the concept and interchange scenario development, public and stakeholder comments typically focused on four main topics:

1. Spacing between northbound ramp terminal intersection and 32nd Avenue intersection
2. Full access 32nd Avenue intersection
3. Bridge width and number of lanes
4. Truck turning movements

At the second set of stakeholder and public meetings, a variety of interchange and 32nd Avenue intersection concepts were presented for feedback. Some concepts addressed spacing with 32nd Avenue by closing or restricting access at that intersection. Other concepts shifted the location of the northbound ramp terminal intersection to the west. Stakeholders in the area, many from the EBBIA, expressed strong support for concepts that addressed spacing by shifting the northbound ramp terminal intersection westward and maintaining full access at 32nd Avenue. This feedback was the primary impetus for identifying the modified compressed diamond interchange type for Scenarios B and C.

Public and stakeholders identified existing bridge width as one of the primary transportation needs along the US14 Bypass. There was notable support for a widened cross-section and additional turn lanes, particularly the multilane cross-section, to improve route reliability and continuity.

Several comments stated a need to provide adequate truck turn movements in the interchange with any of the proposed scenarios. Based on this feedback, Scenarios B and C were fine-tuned to provide even greater flexibility for LCVs and wind blade configurations from what was initially presented to the public in the third public meeting. Medians incorporated in the two scenarios do not hinder truck turning movements within the interchange.

19.7. Evaluation Summary and Recommendations

Table 54 presents an evaluation summary matrix of interchange traffic operations, intersection spacing, predictive safety, ROW and construction costs, and potential impacts to environmental resources measures. The overarching benefits and drawbacks of each scenario are summarized in **Table 55**.

Based on a review of the evaluation matrix, benefits and drawbacks, and timelines for next major investments along the corridor, long-range recommendations and potential timelines are summarized in **Table 56**.

Prioritization of this interchange in the *SDDOT 2020 Interstate Decennial Study* will play a significant role in timeframe for improvements at this interchange, as it balances priorities of all interstate and interchange needs throughout South Dakota. When a timeframe for implementation is identified, potential interchange improvements will need to be further studied through an Interchange Modification Justification Report (IMJR) and the appropriate environmental documentation.

Table 54: US14/US14 Bypass (West) Intersection Scenario Summary Matrix

Scenario	Traffic Operations	Turn Lanes	Intersection Spacing	Predictive Safety		ROW & Costs		Environmental Resources
	2050 Interchange ETT	Provide All Warranted Turn Lanes?	Spacing between I-29 NB Ramp and 32nd Ave	F&I Crashes	Total Crashes	ROW Acquisition	Construction & ROW Costs	Potential Impacts
	LOS AM / PM	*Yes / No*	*Feet*	*Average Annual # Crashes*	*Average Annual # Crashes*	*Acres*	*$ mil*	*Low, Medium, High*
Scenario A	B / B	No	460	1.2	3.2	< 0.5	$1.5 - $3.0	Low
Scenario B	B / B	Yes	660	1.2	3.3	< 0.5	$7.5 - $10	Low
Scenario C	B / A	Yes	660	1.2	3.2	< 0.5	$10	Low
No Build	-	No	450	1.0	3.0	0	0	Low

ETT: Experienced Travel Time (accounts for delay of all routes through interchange and cumulative delay of passing through multiple signalized intersections).

Table 55: US14 Bypass/I-29 Interchange Scenario Benefits and Drawbacks

Scenario	Benefits	Drawbacks
No Build (baseline)	• No environmental impacts, cost, or property impacts.	• Does not improve corridor capacity, continuity or reliability. • Does not provide warranted intersection turn lanes and traffic signals. • Does not increase width of bridge. • Does not increase spacing with 32nd Ave (460 ft.).
Scenario A	• Short-term traffic operations improvements. • Lowest cost due to no bridge replacement.	• Does not increase spacing with 32nd Ave (460 ft.). • Limited additional capacity. • No US14 Bypass left turn lanes. • Does not address stakeholder bridge width concerns. • No shared-use path across I-29.
Scenario B	• Provides 660 ft. spacing between I-29 NB ramp terminal and 32nd Ave. • Improves traffic operations. • Replaces existing bridge. • Provides wider bridge, US14 Bypass left turn lanes, and shared-use path.	• One through lane in each direction results in some limitations to capacity and potential route continuity disruption.
Scenario C	• Provides 660 ft. spacing between I-29 NB ramp terminal and 32nd Ave. • Best traffic operations of all scenarios. • Multilane route continuity through interchange. • Replaces existing bridge. • Provides wider bridge, US14 Bypass left turn lanes, and shared-use path.	• Greater cost than other scenarios.

Table 56: US14 Bypass/I-29 Interchange Scenario Recommendations

Corridor Scenario: Scenario C

Cross-section: 4-Lane Divided - Suburban

- 4-Lane Divided – Urban section where needed at intersections and constrained ROW

Timeline:

2030 - 2035

- Reconstruct interchange in conjunction with US14 Bypass reconstruction project(s).

Interim

- Signalize ramps when warranted and channelize approaches as needed to extend acceptable operations to year of reconstruction (estimated year of need in the 2024-2030 timeframe).

20. US14 Bypass – I-29 to US14 (East) Scenarios

Intersection and corridor traffic operations from a LOS standpoint are not primary drivers for need along the US14 Bypass corridor segment east of I-29. Traffic drops off significantly east of I-29 and then again east of 34th Avenue. However, this segment has high truck volumes with two important industrial area intersections. Planned industrial development to the north and northeast, along with potential mixed-use development east of 34th Avenue, will lead to higher volumes within the 2050 Planning Horizon. Transportation needs identified along this corridor segment include:

- Maintain safe and efficient access to/from the industrial area.
- Maintain functionality of US14 Bypass.
- Improve traffic operations and safety at the US14/US14 Bypass (east) intersection.
- Identify a long-range plan for the segment to help guide development access and local network improvements.

Two corridor scenarios, provided in **Figure 45** and **Figure 46**, were developed to address these needs.

Scenario A: Maintain Existing 3-Lane with Intersection Improvements

- *Maintain existing 3-lane section between 32nd Avenue and 34th Avenue.*
- *Maintain existing 2-lane section between 34th Avenue and US14 (east).*
- *Intersection improvements.*
- *Shared-use path along south side of corridor.*

Scenario B: 4-Lane Divided (32nd Avenue to 34th Avenue) with Intersection Improvements

- *4-lane divided section between 32nd Avenue and 34th Avenue.*
- *Maintain existing 2-lane section between 34th Avenue and US14 (east) (similar to what is shown for Scenario A).*
- *Intersection improvements.*
- *Shared-use path along south side of corridor.*

Two access options, **Figure 47**, were developed to increase spacing between US14 Bypass and 18th Street/211th Street at 34th Avenue. One option shifts 18th Street/211th Street roadway northward to provide desired 250 feet spacing from US14 Bypass. A second option identifies a potential intersection along the US14 Bypass horizontal curve approximately ¼ mile east of 34th Avenue.

Three US14/US14 Bypass (east) intersection options were also developed, applicable to the No Build and two corridor scenarios, and are shown in **Figure 48** through **Figure 50**.

US14/US14 Bypass (East) Intersection Option A: Intersection Improvements (Existing Configuration)

- *Southbound right turn lane.*
- *Southbound to eastbound left turn acceleration lane on US14.*

US14/US14 Bypass (East) Intersection Option B: Intersection Improvements (Free Right Turns)

- *Reflects more of a rural type intersection with sweeping, free right turns.*
- *Improves southbound approach skew.*
- *Southbound free right turn lane.*
- *Maintains a westbound free right turn lane.*
- *Southbound to eastbound left turn acceleration lane on US14.*

US14/US14 Bypass (East) Intersection Option C: Intersection Improvements (Urban Intersection)

- *Reflects more of an urban type intersection with all turn lanes tight at the intersection.*
- *Southbound and westbound right turn lane.*
- *Southbound to eastbound left turn acceleration lane on US14.*

20.1. Design Notes

The north and south legs of the 32nd Avenue intersection were widened to better accommodate large vehicles. Stakeholder feedback noted current challenges with large trucks being able to turn from US14 Bypass to the north and not conflict with southbound vehicles at the stop bar. Turning paths for a Wind Blade Trailer Special Transport vehicle are shown in **Figure 51** for the more restrictive Scenario A corridor scenario.

The future I-29 Exit 133 interchange profile may require modifications to the 32nd Avenue intersection, depending on design speed and future grade. See **Appendix P** for conceptual interchange profiles and potential gradeline modification needs at the 32nd Avenue intersection.

Three access options are presented for a mid-segment access point between 32nd Avenue and 34th Avenue: full, ¾, and RIRO. This access is located at existing 33rd Avenue ROW.

Many of the intersection improvements in this area will be driven by future development. While not shown to be warranted by study volumes, westbound right turn lanes at 34th Avenue are incorporated to address the anticipated need. Similarly, while study volumes do not show a need, 34th Avenue intersection is identified as a future signalized intersection when warranted by traffic volumes per current SDDOT criteria. 32nd Avenue is noted as a stop-controlled intersection due to its proximity to the I-29 Exit 133 northbound ramp terminal intersection (potential future signalized intersection).

A shared-use path is continued on the south side of Scenarios A and B to provide bicycle/pedestrian connectivity with US14 Bypass to the west.

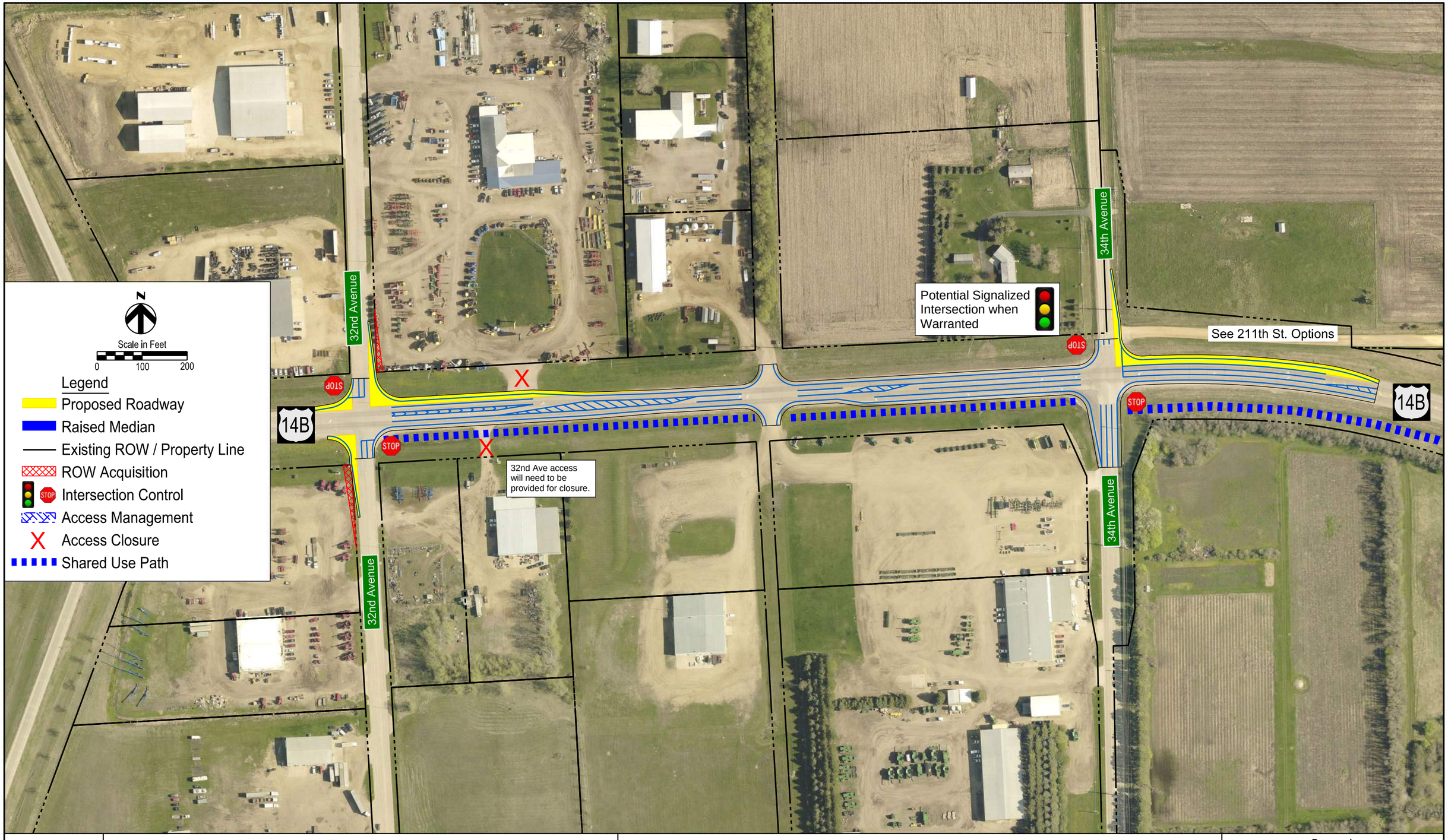


Figure 45

U.S. Department of Transportation
Federal Highway Administration

US Bypass - I-29 to US14 (East) Scenarios
Existing 3-Lane Cross-Section with Intersection Improvements

US14 / US14B Corridor Study

Brookings, SD

Scenario
US14 Bypass - I-29 to US14 (East)
Scenario A

Figure 45

U.S. Department of Transportation
Federal Highway Administration

US14 Bypass - I-29 to US14 (East) Scenarios
Existing 2-Lane Cross-Section

US14 / US14B Corridor Study

Brookings, SD

Scenario
US14 Bypass - I-29 to US14 (East)
Scenarios A and B

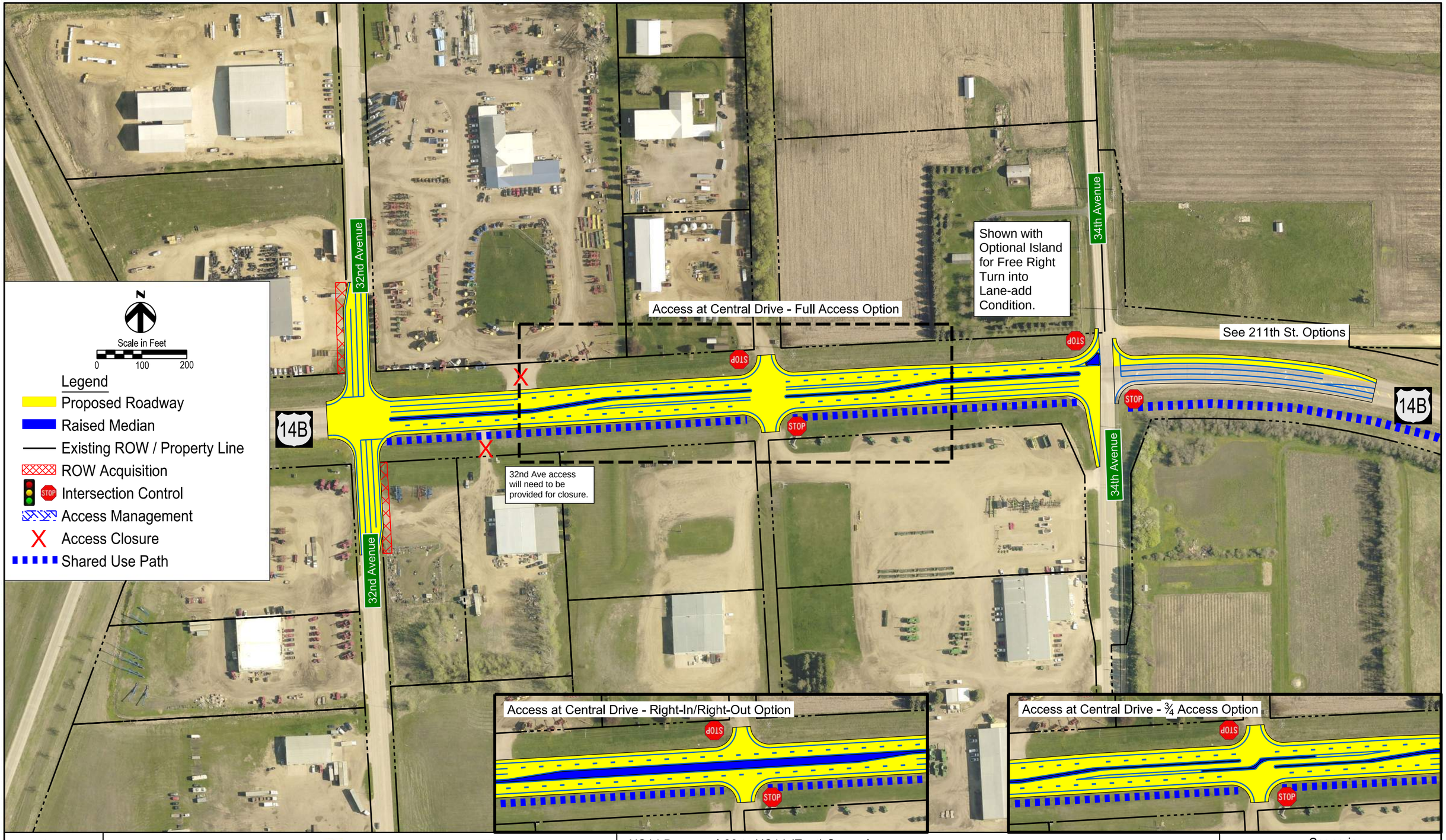


Figure			
46	US14 Bypass - I-29 to US14 (East) Scenarios 4-Lane Divided Cross-Section with Intersection Improvements US14 / US14B Corridor Study — Brookings, SD	Scenario US14 Bypass - I-29 to US14 (East) Scenario B	

HDR · South Dakota DOT · brookings · Volga · U.S. Department of Transportation · Federal Highway Administration

N

Scale in Feet
0 100 200

Legend
- Proposed Roadway
- Roadway Removal
- Existing ROW / Property Line
- ROW Acquisition
- Intersection Control
- Access Management
- Access Closure

STOP

250 ft

211th Street

14B

34th Avenue

Intersection option shown at US14 Bypass 1/4 spacing from 34th Avenue.

Figure 47

HDR | South Dakota DOT Connecting South Dakota and the Nation | brookings SOUTH DAKOTA | Volga SOUTH DAKOTA You'll love it here! | U.S. Department of Transportation Federal Highway Administration

US14 Bypass - I-29 to US14 (East) 211th Street / 18th Street Intersection Options

US14 / US14B Corridor Study

Brookings, SD

Scenario
US14 Bypass - I-29 to US14 (East)
211th Street / 18th Street
Intersection Options

N

Scale in Feet

0 125 250

Legend

- Proposed Roadway
- Raised Median
- Existing ROW / Property Line
- ROW Acquisition
- Intersection Control
- Access Closure
- Shared Use Path

14B

Potential Signalized Intersection when Warranted

STOP

14

14

Figure 48	HDR; South Dakota DOT; brookings South Dakota; Volga South Dakota; U.S. Department of Transportation Federal Highway Administration	US14 Bypass - I-29 to US14 (East) Scenarios Intersection Improvements (Existing Configuration) US14 / US14B Corridor Study — Brookings, SD	Scenario US14/US14 Bypass (East) Intersection - Option A

N

Scale in Feet

0 125 250

Legend

- Proposed Roadway
- Roadway Removal
- Existing ROW / Property Line
- ROW Acquisition
- Intersection Control
- Access Closure
- Shared Use Path

14B

Potential Signalized Intersection when Warranted

STOP

14

14

Figure

49

HDR

South Dakota DOT Connecting South Dakota and the Nation

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U.S. Department of Transportation
Federal Highway Administration

US14 Bypass - I-29 to US14 (East) Scenarios
Intersection Improvements (Free Right Turns)

US14 / US14B Corridor Study

Brookings, SD

Scenario
US14/US14 Bypass (East)
Intersection - Option B

Figure
50

U.S. Department of Transportation
Federal Highway Administration

US14 Bypass - I-29 to US14 (East) Scenarios
Intersection Improvements (Urban Intersection)

US14 / US14B Corridor Study

Brookings, SD

Scenario
US14/US14 Bypass (East)
Intersection - Option C

N

Scale in Feet

0 50 100

Legend

Proposed Roadway

Raised Median

Existing ROW / Property Line

32nd Avenue

14B

32nd Avenue

14B

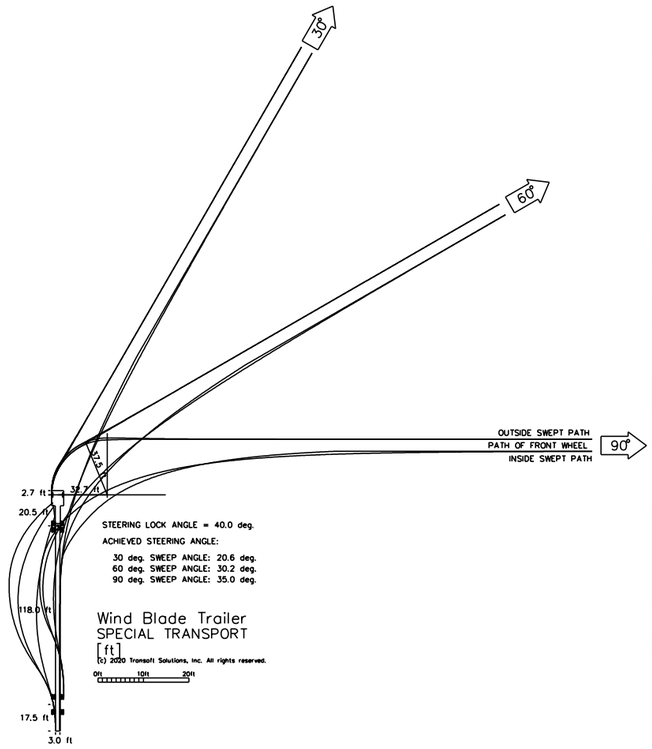


Figure 51	32nd Avenue Intersection Wind Blade Trailer Turn Paths Scenario A US14 / US14B Corridor Study Brookings, SD	U.S. Department of Transportation Federal Highway Administration	Wind Blade Turn Paths US14 Bypass - I-29 to US14 (East) Scenario A

20.2. Traffic Operations Analysis

Year 2050 traffic operations are shown in **Table 57**.

Table 57: US14 Bypass – I-29 to US14 (East) Operations (2050 Build)

US14 Intersection		US14 Section	Intersection Control	Measure	AM		PM	
					Delay (s/veh)	LOS	Delay (s/veh)	LOS
Scenario A	32nd Ave	Multilane	TWSC	**Overall**	**4.1**	**A**	**13.5**	**B**
				TWSC	*19.9*	*C*	*42.6*	*E*
	34th Ave	2-lane	TWSC	**Overall**	**3.3**	**A**	**4.8**	**A**
				TWSC	*11.6*	*B*	*12.1*	*B*
Scenario B	32nd Ave	Multilane	TWSC	**Overall**	**4.3**	**A**	**8.8**	**A**
				TWSC	*22.7*	*C*	*26.1*	*D*
	34th Ave	2-lane	TWSC	**Overall**	**3.3**	**A**	**4.8**	**A**
				TWSC	*11.6*	*B*	*12.1*	*B*
Scenarios A and B	US14/US14 Bypass (East) – Options A and B	2-lane	Signal	**Overall**	**9.2**	**A**	**11.1**	**B**
	US14/US14 Bypass (East) – Option C	2-lane	Signal	**Overall**	**10.4**	**A**	**12.2**	**A**

TWSC: worst-case stop-control approach delay.

Each scenario addresses long-term study intersection capacity needs within this segment. Local network connectivity between 32nd Avenue and 34th Avenue will be important to provide opportunities for internal industrial area access to the potential future signal at 34th Avenue.

20.3. Predictive Safety Analysis

Predictive safety results for the US14 Bypass segments of 32nd Avenue to 34th Avenue and 34th Avenue to US14 (east) are shown in the following tables.

Table 58: US14 Bypass – 32nd Avenue to 34th Avenue Predicted Crashes per Year

Scenario	F & I Crashes	Change from No Build *+ increase - decrease*	Total Crashes	Change from No Build *+ increase - decrease*
No Build (baseline)	1.1	-	2.9	-
Scenario A	0.8	*-0.3*	2.2	*-0.7*
Scenario B	0.8	*-0.3*	2.2	*-0.7*

Table 59: US14 Bypass – 34th Avenue to US14 (East) Predicted Crashes per Year

Scenario	F & I Crashes	Change from No Build *+ increase - decrease*	Total Crashes	Change from No Build *+ increase - decrease*
No Build (baseline)	1.2	-	3.2	-
US14/US14 Bypass (East) – Option A	1.2	*0*	3.0	*-0.2*
US14/US14 Bypass (East) – Option C	1.1	*-0.1*	2.9	*-0.3*
US14/US14 Bypass (East) – Option C	0.6	*-0.6*	1.6	*-1.6*

All scenarios and intersection options are expected to reduce predicted crashes along this US14 Bypass segment. The mid-segment access options in Scenario B were analyzed in the IHDSDM model. However, due to limitations on how driveways are analyzed, the variations in access restrictions are not differentiated in the model.

All three US14/US14 Bypass (east) intersections also show predictive improvements to intersection safety. The greatest improvement is shown with Option C. However, the magnitude of the improvement primarily corresponds to the assumption that the urban intersection layout will be driven by more of an urbanization of the surrounding area. This switches the safety performance function (SPF) in the IHSDM model from a rural setting to an urban setting.

20.4. Future Pavement and Structure Needs Summary

A summary of upcoming major investment needs along the corridor segment includes:

- Structures
  - Structure north of US14: constructed 1967 (53 years)
- Roadway Pavement (*SDDOT Needs Book* timeframe)
  - PCCP reconstruction from Medary Avenue to 34th Avenue (2029-2035)
  - PCCP resurfacing from 34th Avenue to US14: (2029-2035)
  - Mill and overlay on US14 (2027)

The structure just north of US14 will be nearing the end of its service life around this study's 2050 Planning Horizon. However, the structure is on the lowest-volume US14 Bypass segment and no widening needs have been identified at the structure.

The segment from 34th Avenue westward is part of the overarching reconstruction needs between Medary Avenue and 34th Avenue and represents an opportune time to implement long-term capacity improvements. The segment between 34th Avenue and US14 (east) shows a need for resurfacing in the same general timeframe.

20.5. Public Comment

The study team received a considerable amount of feedback from land and business owners along this segment. The EBBIA was instrumental in organizing a supplemental meeting with business and landowners in the area after the second set of public and stakeholder meetings as well as encouraging comments. Common concerns expressed throughout the concept and scenario development process that helped guide refinement and evaluation included:

- Maintain 32nd Avenue intersection as full access.
- Not interested in medians and U-turns.
    - Anticipate considerable route diversion to US14/6th Street in lieu of making a U-turn, thus defeating the purpose of a US14 Bypass.
- Maintain existing driveway access points.
- Identify future signalized intersection locations.

Support for the corridor scenarios generally favored additional lanes, whether it was adding turn lanes or reconstructing as a multilane segment.

20.6. Evaluation Summary and Recommendations

Table 60 presents an evaluation summary matrix of interchange traffic operations, intersection spacing, predictive safety, ROW and construction costs, and potential impacts to environmental resources measures. The overarching benefits and drawbacks of each scenario are summarized in **Table 61**.

Based on a review of the evaluation matrix, benefits and drawbacks, and timelines for next major investments along the corridor, long-range recommendations and potential timelines are summarized in **Table 62**.

Table 60: US14 Bypass – I-29 to US14 (East) Scenario Summary Matrix

Scenario	Central Driveway Access Treatment (33rd Ave ROW)	Traffic Operations	Predictive Safety		ROW & Costs		Environmental Resources
		2050 Intersection Operations	F&I Crashes	Total Crashes	ROW Acquisition	Construction & ROW Costs	Potential Impacts
		LOS AM / PM	*Average Annual # Crashes*	*Average Annual # Crashes*	*Acres*	*$ mil*	*Low, Medium, High*
Scenario A	Full	LOS B or better	0.8	2.2	< 0.5	$0.5	Low
Scenario B	RIRO	LOS B or better	0.8	2.2	< 0.5	$2.5	Low
	Full	LOS B or better	0.8	2.2	< 0.5	$2.5	Low
	¾	LOS B or better	0.8	2.2	< 0.5	$2.5	Low
Corridor No Build	Full	LOS B or better	1.1	2.9	0	0	Low
Intersection Option A	-	LOS B or better	1.2	3.0	< 0.5	$0.5	Low
Intersection Option B	-	LOS B or better	1.1	2.9	< 0.5	$0.75	Low
Intersection Option C	-	LOS B or better	0.6	1.6	< 0.5	$1.0	Low
Intersection No Build	-	LOS B or better	1.2	3.2			Low
Realignment Option A	-	-	-	-	4.5	$0.75	Low
Realignment Option B	-	-	-	-	1.0	$0.5	Low

Central driveway access control showed negligible differences in predictive safety due to low volumes. It is expected that if 33rd Avenue is constructed in the future and volumes increase accordingly; the treatment of this access will have more of an impact on predictive safety results.

Table 61: US14 Bypass – I-29 to US14 (East) Scenario Benefits and Drawbacks

Scenario	Benefits	Drawbacks
No Build (baseline)	• No environmental impacts, cost, or property impacts.	• Does not improve corridor capacity, continuity or reliability. • Does not provide warranted intersection turn lanes and traffic signals.
Scenario A	• Improves traffic operations. • Widens 32nd Avenue approaches. • Reduces predicted crashes. • Lowest cost.	• Limited additional capacity. • Route reliability and continuity limitations.
Scenario B	• Multilane corridor west of 34th Ave provides best traffic operations, route continuity, and reliability. • Capacity for traffic fluctuations and growth. • Reduces predicted crashes. • Provides access options at central driveway.	• Cost.
US14/US14 Bypass (East) Intersection – Option A	• Improves traffic operations. • Reduces predicted crashes. • Lowest cost of three options.	• Does not improve intersection skew.
US14/US14 Bypass (East) Intersection – Option B	• Improves traffic operations. • Reduces predicted crashes. • Improves intersection skew. • Provides 'free' right turn movements.	• Not set up for urban setting. • Greatest amount of new pavement of three options.
US14/US14 Bypass (East) Intersection – Option C	• Improves traffic operations. • Reduces predicted crashes. • Improves intersection skew. • Configures intersection for future signalized urban intersection.	• All movements will be signal controlled if signalized in future.

Table 62: US14 Bypass – I-29 to US14 (East) Recommendations

Corridor Scenario: Scenario B

Cross-section: 4-Lane Divided - Suburban

- 4-Lane Divided – Urban section where needed at intersections and constrained ROW

Timeline:

2030 - 2035

- Reconstruct in conjunction with US14 Bypass reconstruction project(s).
  - Mid-segment access: provide full access unless alternate local access is provided to mid-segment parcels.
  - Coordinate 211th Street/18th Street access with City of Brookings and future development:
    - Realign north to increase spacing from US14 Bypass.
    - Coordinate diagonal connection to US14 Bypass at ¼ mile point east of 34th Avenue.

Beyond 2040

- Reconstruct US14/US14 Bypass (east) intersection as urban intersection.

Interim

- Signalize 34th Avenue when warranted.
  - Likely driven by future development, not shown to be warranted within 2050 Planning Horizon.

21. ITS Recommendations

The recommended Intelligent Transportation System (ITS) plan focuses on three primary areas of transportation systems management and operations (TSMO) needs to compliment potential capital improvements:

- Railroad crossing safety improvements
- Event traffic management and traffic incident management (TIM)
- Visibility monitoring and traveler information systems

The ITS process tracked with the overarching study process of stakeholder/public meetings and SAT workshops. Recommendations were developed as part of a November 1, 2019, meeting with SDDOT and City of Brookings staff. Discussions centered on the three focus areas and potential implementations, leading to recommendations contained herein. Further discussion on this process is provided in the *ITS Recommendations* technical memo in **Appendix U**. Recommended locations for ITS deployment are shown in **Figure 52**.

Focus Area 1: Railroad crossing safety improvements

Need: Crash history and weather-related visibility issues at crossing between Volga and Brookings.

Need: Weather-related visibility issues at crossing west of Volga.

Recommendation: Advanced Warning System (AWS) with flashing beacons be installed in advance of both crossings to raise motorist awareness of the railroad crossing's status. AWS leads to driver speed reduction and situational awareness, leading to crash mitigation and improved driver safety.

Focus Area 2: Event traffic management and traffic incident management (TIM)

Need: Provide motorist information during event days such as SDSU football game days, SDSU move-in days, SDSU Hobo Days (homecoming), and other community events/festivals.

Recommendation: ITS deployments to provide roadway monitoring capabilities at high crash or event traffic locations, greater information dissemination capabilities, and infrastructure installations to support ITS devices:

- CCTV cameras.
- Dynamic message signs (DMS) (small format, off-shoulder locations).
- Communications and power infrastructure.

Need: Interagency coordination for event traffic management and TIM.

Recommendation: Organize/reorganize regional TIM and event management team.

Focus Area 3: Visibility monitoring and traveler information systems

Need: Visibility loss due to fog and blowing snow along segments west of Volga and between Volga and Brookings.

Recommendation: Road Weather Information Stations (RWIS) equipped with visibility sensors, atmospheric sensors, and road weather condition detection for the purpose of collecting real-time weather data.

22. Blowing Snow Recommendations

At the onset of the study, several problematic blowing and drifting snow areas were identified by the SAT, SDDOT maintenance staff, public, and study stakeholders. The unexpectedness of slippery road conditions was the most frequently cited concern, such as nighttime/morning refreeze or continual depositing of snow on the roadway well after the winter weather event has ended and the remainder of the corridor is at normal driving conditions. A winter-weather crash analysis found that the problematic locations identified anecdotally aligned with higher winter-weather crash locations.

It is recommended that a multi-faceted approach of the following design and seasonal operations measures be considered to address blowing and drifting snow:

Roadway typical sections

- Height above surrounding terrain for fill sections.
- Barn roof design for large fill sections.
- Flat-bottom ditches for cut sections.

Safety barriers

- Concrete barriers considerations; poor performance for blowing and drifting snow.
- W-beam considerations; poor performance for blowing and drifting snow.
- Box-beam and cable rail considerations; better performance for blowing and drifting snow.

Snow fences

- Structural snow fence
- Living snow fence
- Seasonal snow fence
- V-plowing

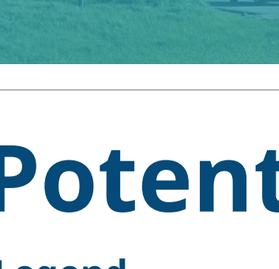
A snow fence implementation plan, shown in **Figure 53**, was identified for areas that would benefit from installation of snow fences as a short-term solution. Long-term, incorporating blowing snow design considerations into the typical section and safety barrier design is recommended. Further discussion is provided in the *Blowing Snow Analysis* technical memo provided in **Appendix V**.

Potential ITS Devices

Legend

- Proposed CCTV
- Proposed Small DMS
- Proposed RWIS
- Railroad Crossing
- Existing Large DMS

N



US14 Bypass @ Stadium Road

US14 Bypass @ I-29 Interchange

I-29 at 6th Street Interchange

Volga

Brookings

211th St

18th St

14

29

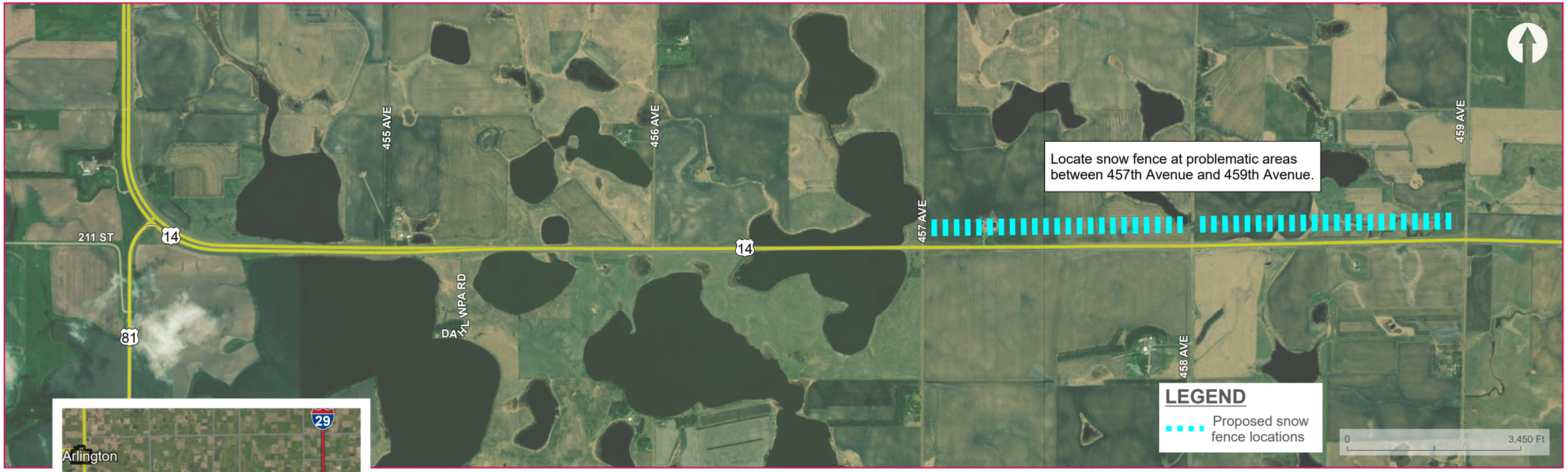
ITS DEVICE BENEFITS:

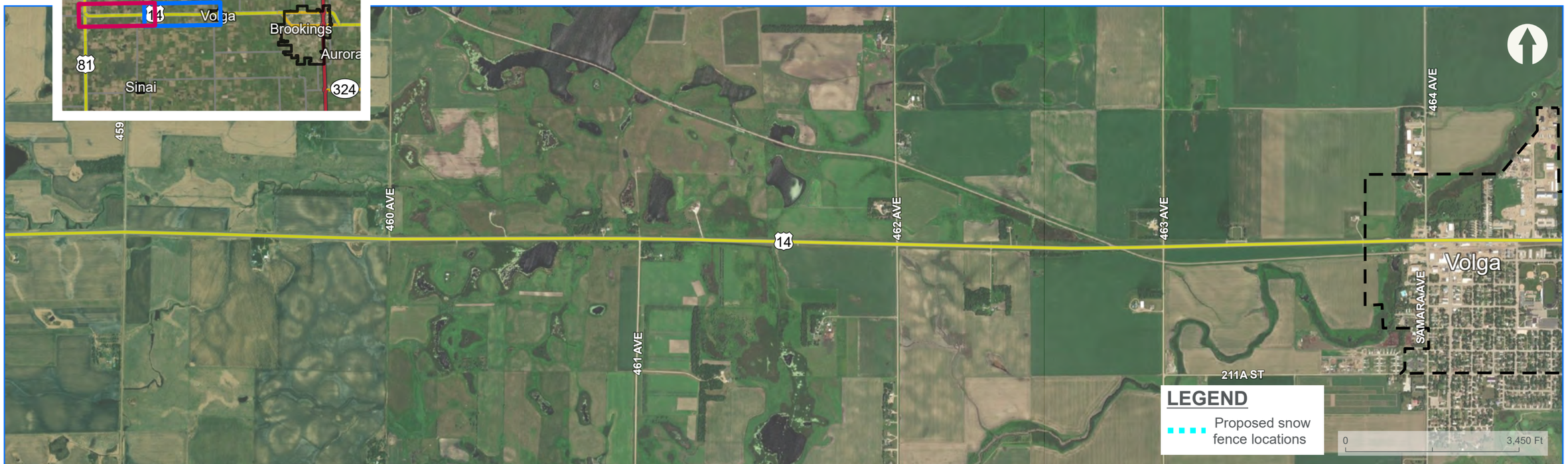
CCTV:
Real-Time Traffic Monitoring

DMS:
Advance Warning for Travel Conditions

RWIS:
Road Condition Traveler Information and O&M Planning

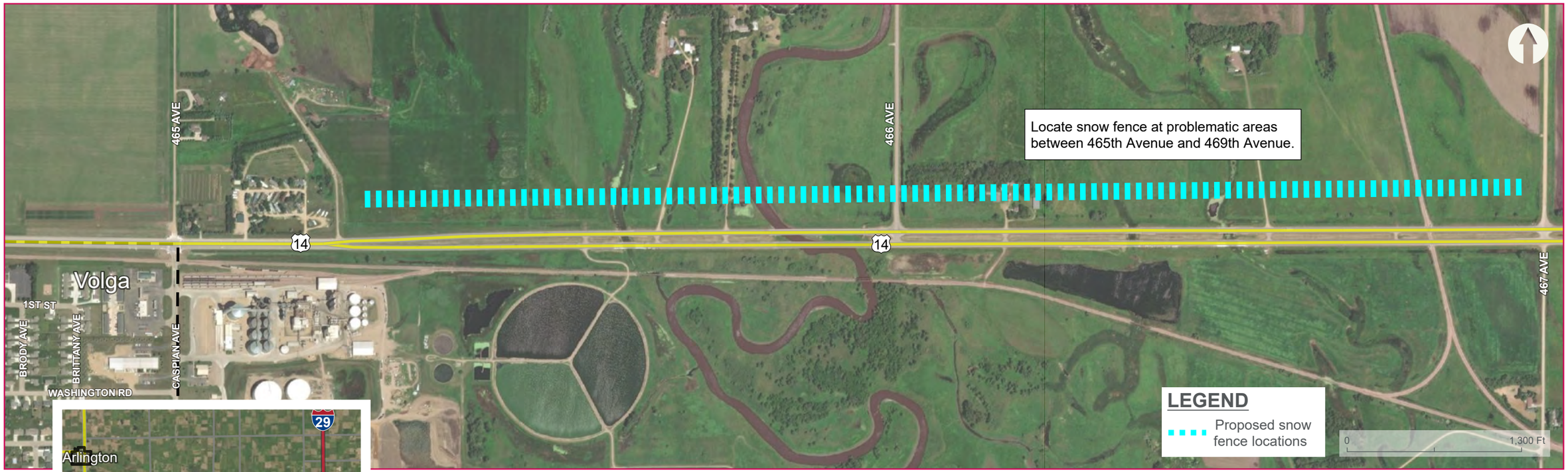
Visibility Sensor:
Fog Detection

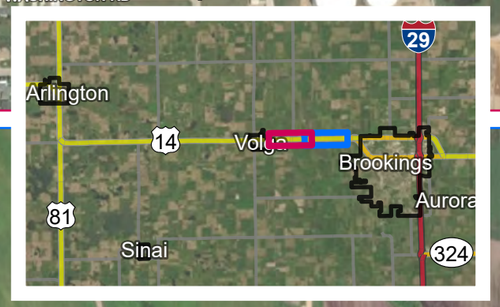




RECOMMENDED SNOW FENCE LOCATIONS

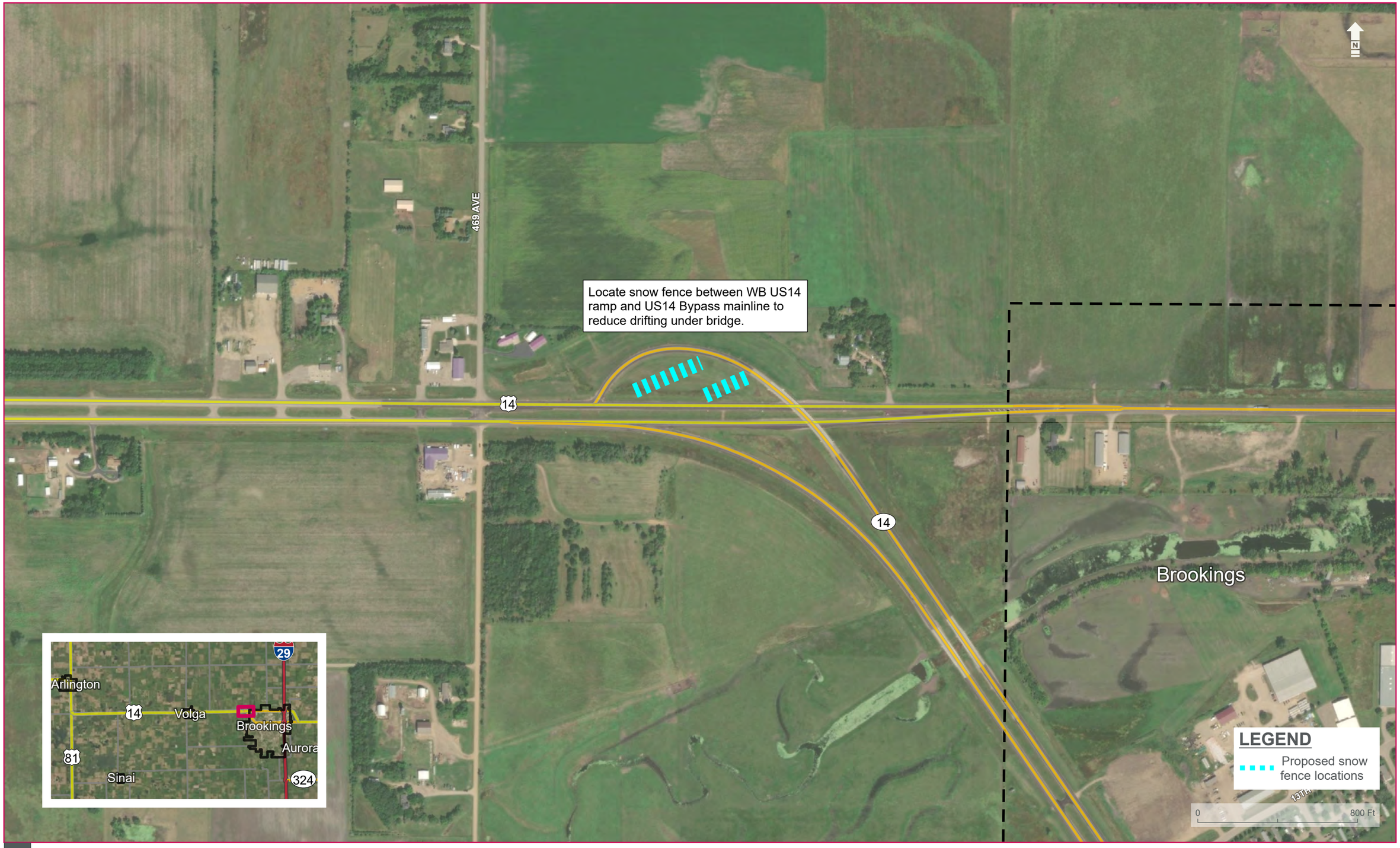
FIGURE 53, PAGE 1





RECOMMENDED SNOW FENCE LOCATIONS

FIGURE 53, PAGE 2



RECOMMENDED SNOW FENCE LOCATIONS

FIGURE 53, PAGE 3

Locate snow fence between SB I-29 off-ramp and I-29 mainline to reduce drifting under bridge.

22ND AVE
SUNNYBROOK DR
25TH AVE
RESEARCH PARK WAY
Brookings
14
29
32ND AVE
473 AVE
211 ST
34TH AVE

LEGEND
Proposed snow fence locations
0
620 Ft

Arlington
Volga
Brookings
Aurora
Sinai
81
324

474 AVE
211 ST
473 AVE
34TH AVE
Brookings

LEGEND
Proposed snow fence locations
0
960 Ft

RECOMMENDED SNOW FENCE LOCATIONS

FIGURE 53, PAGE 4

23. Bicycle and Pedestrian Plan

The **Bicycle and Pedestrian Plan** recommendations present a long-range plan for bicycle and pedestrian facilities along the urban and developing areas of the US14-US14 Bypass corridor. This plan serves as an overarching guide for incorporating shared-use path facilities in future projects and promote a continuous and connected network. Connections are shown to existing facilities as well as future, planned facilities identified by SDSU and the *Brookings Bicycle Master Plan* (2017).

23.1. Bicycle and Pedestrian Plan

The **Bicycle and Pedestrian Plan** focuses on the following long-range goals for three primary segments, as shown in **Figure 54**.

In Volga

- Continuous shared-use path on the north side of US14 through the City of Volga.
- Future signalized crossing locations.

Volga to Brookings

- Shared-use path between Volga and Brookings.
- Route options include:
    - South side of US14 and
    - Railroad alignment.

US14 Bypass

- Continuous shared-use path on the south side of US14 Bypass.
- Potential connections to existing and planned City of Brookings and SDSU bicycle and pedestrian facilities.

23.2. Volga to Brookings Route Options

Two shared-use path route options were reviewed between Volga and Brookings, both identified as part of previous planning studies, are shown in **Figure 55**. The US14 alignment, Option A, shared-use path is located along the southern US14 ROW line. The railroad alignment, Option B, shared-use path is located along the north side of the railroad ROW.

One of the primary challenges of either alignment is the number and length of water crossings between Volga and Brookings. Existing structures would need to be widened or new structures would need to be built at all crossings, as shown in **Figure 55**. High-level cost estimates for structure modifications alone range between $6.5 and $9 million.

Another challenge with the railroad alignment option is the location of the trail. While the existing line provides an attractive alignment between Volga and Brookings, additional ROW would need to be acquired along the existing rail ROW and crossings would likely need to be planned. There were hesitations expressed by the SAT regarding the desirability of

constructing a path alongside an active railroad track. If this option is considered in the future, the railroad should be consulted during the early stages to further gauge feasibility.

A third option not evaluated as part of this study would be to follow an existing Brookings County road south of Volga, one that potentially has fewer or shorter water crossings.

A summary of benefits and drawbacks of each option is summarized in **Table 63**. It is recommended that all options be maintained for future consideration with respect to the benefits and drawbacks of each. Future implementation of a shared-use path between Volga and Brookings is likely based on an opportunistic approach through incremental improvements and/or grant funding.

Table 63: US14 Volga to Brookings Shared-Use Path Options Benefits and Drawbacks

Scenario	Benefits	Drawbacks
Option A (US14 Alignment)	• Follows existing, highly traveled highway corridor. • Minimal ROW required. • Bridge structures in place, widening required. • Ties into future US14 Bypass shared-use path.	• Cost. • Bridge widening required on all structures. • One railroad crossing.
Option B (Railroad Alignment)	• Follows a more 'scenic' rural alignment.	• Cost. • Extensive ROW required. • Bridge widening required for US14 structures and new bridges required along railroad alignment. • Follows active railroad line. • One or two railroad crossings.

Potential Signalized Intersection Crossing when Warranted.

Potential Signalized Intersection Crossing when Warranted.

INDUSTRIAL DR

14

413

Rapid City, Pierre & Eastern RR

Existing US14 crossing and potential southward connection.

Potential US14 crossing and southward connections.

SAMARA AVE

Volga

MARVIN AVE

1ST ST

HANSINA AVE

LINCOLN LN

0 440 Ft

Arlington

14

Volga

29

Brookings

Aurora

81

Sinai

324

Potential northward connection to future development.

465 AVE

Existing Signalized Intersection Crossing.

414

Potential southward connection.

CASPIAN AVE

1ST ST

LEGEND

Shared Use Path Route

0 350 Ft

BICYCLE AND PEDESTRIAN PLAN - US14 IN VOLGA

FIGURE 54, PAGE 1

US14 - US14 BYPASS CORRIDOR STUDY

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BICYCLE AND PEDESTRIAN PLAN - US14 IN VOLGA

FIGURE 54, PAGE 2

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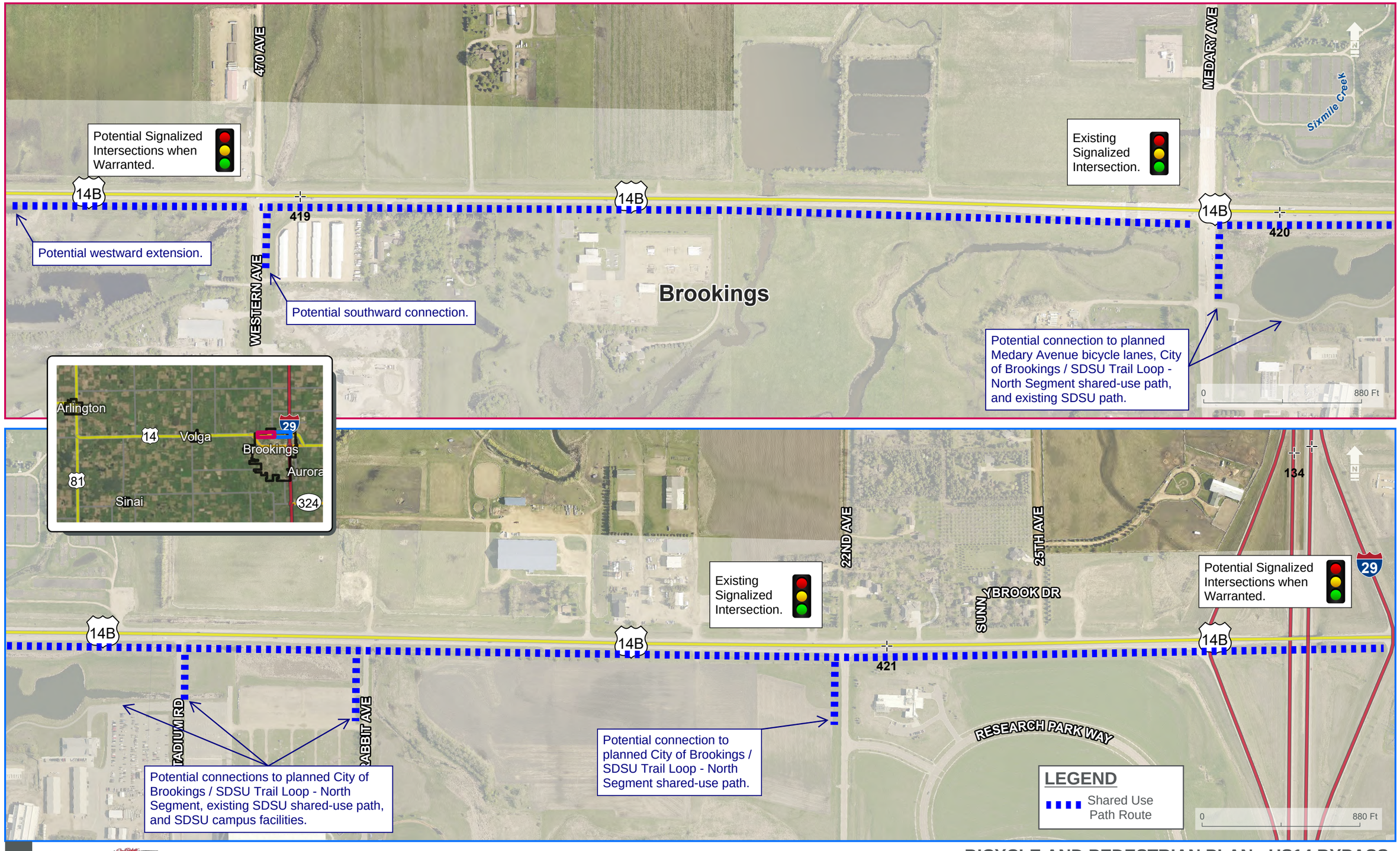
US14 - US14 BYPASS CORRIDOR STUDY



BICYCLE AND PEDESTRIAN PLAN - US14 BYPASS

FIGURE 54, PAGE 3

\\SXF-SRV01\ENG\GIS\PROJECTS\SDDOT\US14_CORRIDORSTDY\MAP_DOCS\DRAFT\US14.APRX DATE: 10/13/2020

22ND AVE

25TH AVE

SUNNY BROOK DR

32ND AVE

473 AVE

34TH AVE

14B

421

423

29

Potential Signalized Intersections when Warranted.

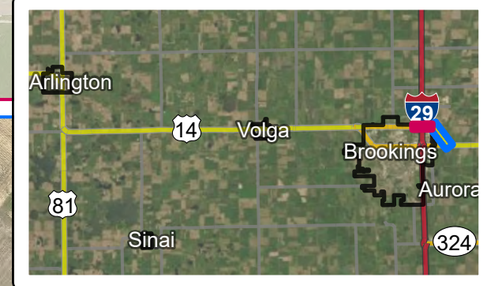
Potential Signalized Intersections when Warranted.

Potential southward connection to Allyn Frerichs Trail.

Brookings

RESEARCH PARK WAY

0 620 Ft



474 AVE

473 AVE

34TH AVE

14B

429

423

14

Potential extension of shared-use path to tie into future development. Limits dependent on future development access points and facilities to the south.

Brookings

LEGEND

Shared Use Path Route

0 880 Ft

HDR

SD DOT

BICYCLE AND PEDESTRIAN PLAN - US14 BYPASS

FIGURE 54, PAGE 4

US14 - US14 BYPASS CORRIDOR STUDY

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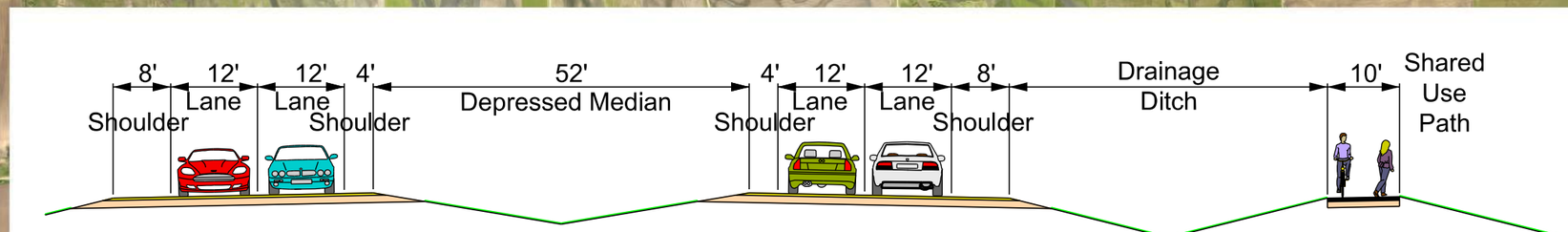


Option A: US 14 Alignment

N

Scale in Feet

0 1000 2000

Legend

- Shared Use Path - US 14 Alignment
- Shared Use Path - RR Alignment
- Intersection Control
- Access Management

Widen existing US14 bridge or construct new bridge for shared use path.

RR crossing.

Widen existing US14 bridge or construct new bridge for shared use path.

14

14B

14

Widen existing US14 bridge or construct new bridge for shared use path.

Construct bridge for water crossing.

RR crossing.

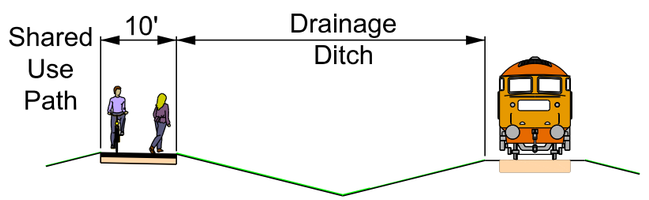
Construct bridge for water crossing.

Construct bridge for water crossing.

Construct bridge for water crossing.

Volga

brookings



Option B: RR Alignment

Figure 55	HDR · SD DOT · brookings · Volga · U.S. Department of Transportation Federal Highway Administration	US14 - Volga to US14 Bypass Scenarios Volga to Brookings Shared-Use Path Options US14 / US14B Corridor Study	Volga/Brookings Shared-use Path - Options A and B Brookings, SD

24. Access Plan

It is recommended that current access criteria shown in **Figure 57** be used as the foundation for an opportunistic approach to access management through future projects, development, and redevelopment. Current access criteria and access management techniques identified in the *SDDOT Road Design Manual* have been incorporated into corridor scenarios within this report.

The US14 segment in Volga and the US14 Bypass were reviewed in greater detail to identify sub-area considerations, access techniques, and local roadway network options to guide future access management.

24.1. US14 in Volga

US14 through Volga is classified as Urban Developed, with ¼-mile signal spacing, access density of 2 accesses/block face, and minimum driveway spacing of 100 feet.

24.1.1. Signalized Intersections

Existing and potential future signalized intersections, when warranted by traffic volumes, shown in **Figure 58** meet existing access criteria as follows:

- Samara Avenue or Kasan Avenue
- Hansina Avenue
- Mid-segment location between Hansina Avenue and Caspian Avenue
- Caspian Avenue
- Hansina Avenue

It is recommended that Samara Avenue be the future signalized intersection in lieu of Kasan Avenue due to the north/south continuity of Samara Avenue. If Kasan Avenue is identified for signalization in the future, it is recommended that all driveways within the intersection functional area be consolidated as a north leg of the intersection and a median be extended through the intersection functional area to prohibit left turns.

24.1.2. Samara Avenue Rearage Option

A Samara Avenue rearage road option was developed as part of the initial set of corridor concepts, shown as part of **Figure 58**. The rearage road concept identifies an option to incorporate local network improvements with future development and redevelopment in the area.

24.1.3. Hansina Avenue Industrial Road Intersection Offset

The Hansina Avenue and industrial road intersections exhibit a negative offset, where westbound Hansina Avenue intersection left turning vehicles conflict with eastbound industrial road intersection left turning vehicles. If traffic volumes reach a point where this creates operational and safety issues or the opportunity arises, it is recommended that the industrial road leg of the intersection be relocated as the north leg of Hansina Avenue.

24.2. US14 Bypass

Current access criteria along the US14 Bypass varies, being classified as Free Flow Urban west of 34th Avenue and Urban Fringe east of 34th Avenue. Access throughout the US14 Bypass corridor has been well-managed, however, there are pockets of higher density areas from historical rural development.

24.2.1. Signalized Intersections

Existing and potential future signalized intersections, when warranted by traffic volumes, shown in **Figure 59** meet current access criteria as follows:

- Future US14/US14 Bypass (west) intersection
- Western Avenue
- ½ point between Western Avenue and Medary Avenue
- Medary Avenue (existing traffic signal)
- Jackrabbit Avenue
- 22nd Avenue (existing traffic signal)
- I-29 southbound ramp terminal intersection
- I-29 northbound ramp terminal intersection
- 34th Avenue
- Up to three potential locations between 34th Avenue and US14 (east)
- US14/US14 Bypass (east) intersection

24.2.2. US14/US14 Bypass (West) and 469th Avenue

Access management of driveways directly west of 469th Avenue have been incorporated into the US14/US14 Bypass (west) intersection scenarios. However, given the potential timeframe for intersection scenario implementation, it is likely that an opportunistic approach geared towards the long-range vision for the area is plausible. Several access management techniques are applicable through this area:

- Access consolidation through combining or relocating driveways.
- Access relocation to 469th Avenue or ½-mile access west of 469th Avenue.
- Access relocation to potential rearage road.

Intersection Functional Area

A key element of the plan is to protect the intersection functional area, shown below, at major intersections within urban areas to minimize conflicts through queue and driver perception and maneuver distances. The functional area upstream of the physical intersection accounts for 1) distance traveled during the perception-reaction time, 2) deceleration distance while the driver maneuvers to a stop, and 3) queue storage. Downstream functional area typically accounts for stopping sight distance and is shorter than the upstream functional area.

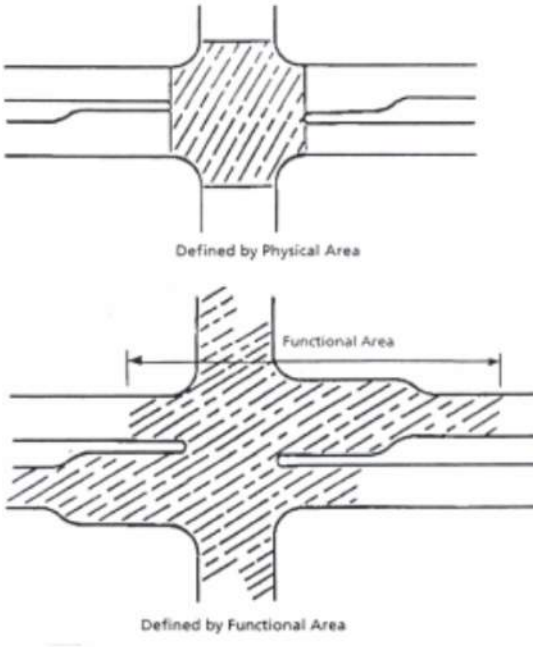


Figure 56: Intersection Physical Area and Functional Area

Source: SDDOT Road Design Manual

Each technique requires coordination with the City of Brookings and future development and redevelopment in the area.

24.2.3. 22nd Avenue Intersection

22nd Avenue intersection access management via frontage roads and raised medians has been incorporated into the three corridor scenarios. However, given the potential ROW, utility, and building conflicts of frontage roads, the following priorities leading into final design are identified for the intersection:

1. Extend raised median along US14 Bypass through the full intersection functional area to eliminate left turn movements.
2. Construct frontage roads to relocate access point(s) outside of functional area.

The intersection functional area varies between the three scenarios, as shown in **Figure 59**. The overall functional area footprint is considerably smaller in the multilane Scenarios B and C when compared to the 3-lane Scenario A.

24.2.4. I-29 Interchange

Existing Interstate system control of access (COA) is shown on I-29 Exit 133 interchange figures. Access points free of COA encumbrance within the overall interchange COA limits are located at:

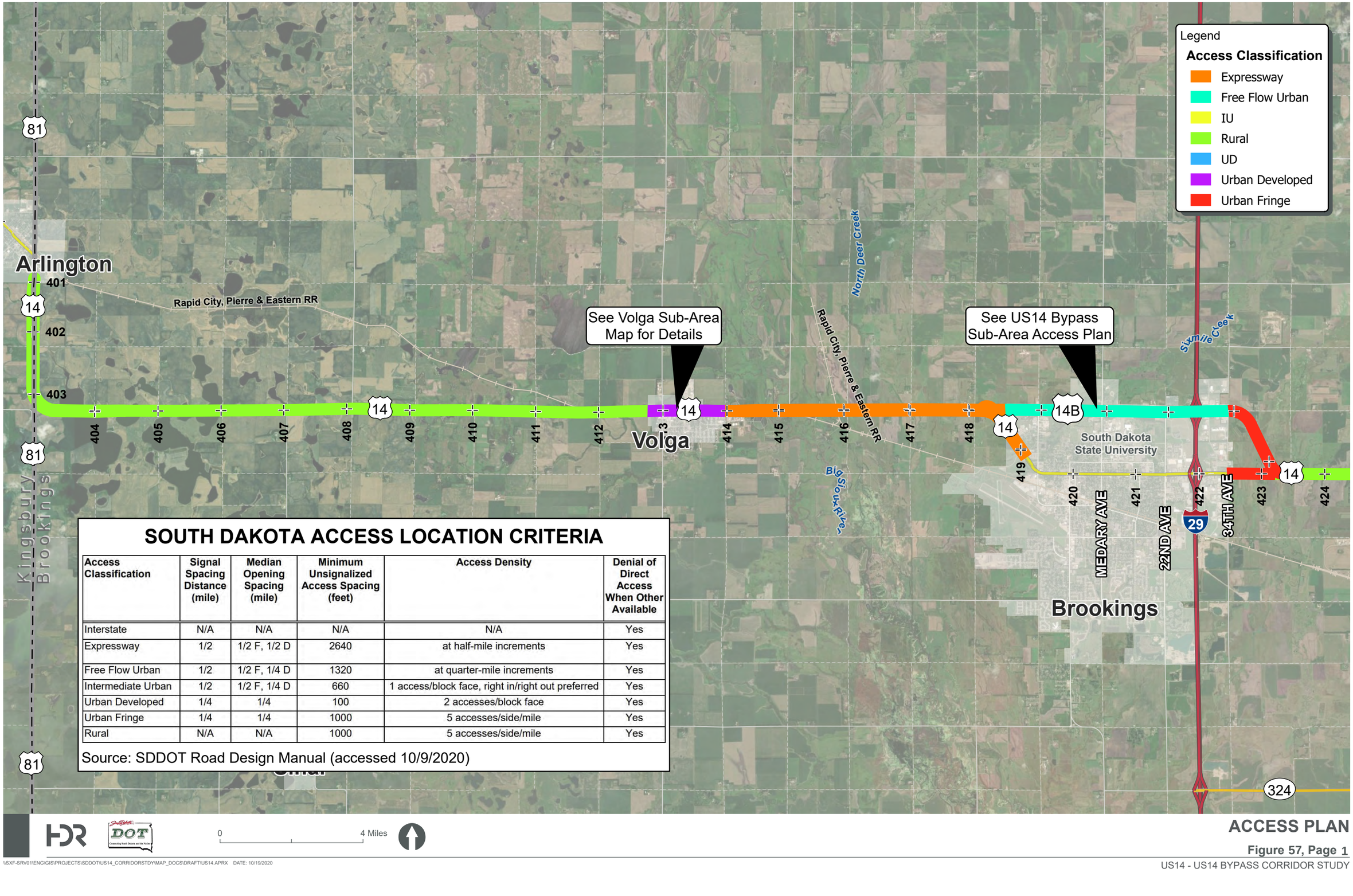
1. Parcel access approximately 220 feet east of 25th Avenue on north side of US14 Bypass
2. 32nd Avenue ROW north and south of US14 Bypass

COA limits will be further reviewed during the required I-29 interchange IMJR process to implement future modifications.

24.2.5. 32nd Avenue to US14 (East)

Access management considerations along US14 Bypass requires more of a balance of mobility and access due to existing industrial development, large vehicles, and a desire to keep large trucks on the US14 Bypass and not reroute to 6th Street/US14. Considerations for this area include:

- Strong desire by local business owners to not reroute trucks south to US14/6th Street due to primary intersection/access turn restrictions. Preference was stated to accommodate access for all movements via the US14 Bypass and limit need for U-turns.
- East-west local network improvements between 32nd Avenue and 34th Avenue will be important for internal connectivity to:
    - Potential future signalized intersection at 34th Avenue and
    - Providing for all intersection movements along US14 Bypass.
- Primary access points east of 34th Avenue are in ¼-mile increments per current SDDOT access criteria.



SOUTH DAKOTA ACCESS LOCATION CRITERIA

Access Classification	Signal Spacing Distance (mile)	Median Opening Spacing (mile)	Minimum Unsignalized Access Spacing (feet)	Access Density	Denial of Direct Access When Other Available
Interstate	N/A	N/A	N/A	N/A	Yes
Expressway	1/2	1/2 F, 1/2 D	2640	at half-mile increments	Yes
Free Flow Urban	1/2	1/2 F, 1/4 D	1320	at quarter-mile increments	Yes
Intermediate Urban	1/2	1/2 F, 1/4 D	660	1 access/block face, right in/right out preferred	Yes
Urban Developed	1/4	1/4	100	2 accesses/block face	Yes
Urban Fringe	1/4	1/4	1000	5 accesses/side/mile	Yes
Rural	N/A	N/A	1000	5 accesses/side/mile	Yes

Source: SDDOT Road Design Manual (accessed 10/9/2020)

0 4 Miles

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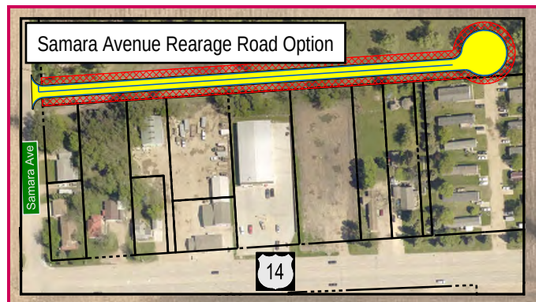
ACCESS PLAN



1-Mile Access
Samara Ave
Full Access
Traffic Signal*

See Samara Avenue rearage road option.

1/4-Mile Access
Hansina Ave
Full Access
Traffic Signal*

14

413

Rapid City, Pierre & Eastern RR

SAMARA AVE

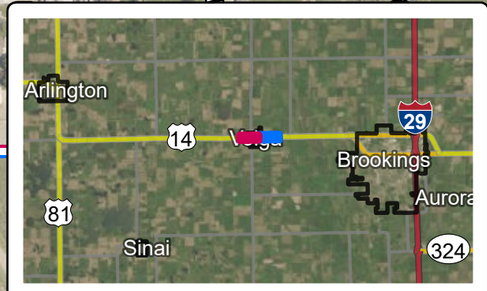
KASAN AVE

Volga

1ST ST

SINA AVE

2ND ST



Legend
- City Limits

Access Classification
- Expressway
- Free Flow Urban
- IU
- Rural
- UD
- Urban Developed
- Urban Fringe

1/4-Mile Access
Potential/Future
Full Access
Traffic Signal*

1/4-Mile Access
Potential/Future
Full Access
Traffic Signal*

1-Mile Access
Caspian Ave
Full Access
Traffic Signal

14

Rapid City, Pierre & Eastern RR

46

414

1ST ST

Volga

LINCOLN LN

WASHINGTON RD

JEFFERSON AVE

BRODY AVE

BRITTANY AVE

CASPIAN AVE

Urban Developed Access Criteria

Signal Spacing*: 1/4 mile
- 1-mile section line: Samara Avenue or Kasan Avenue
- 1/4 mile: Hansina Avenue
- 1/4 mile: Potential future intersection (1/2 mile west of Caspian Avenue)
- 1/4 mile: Potential future intersection (1/4 mile west of Caspian Avenue)
- 1-mile section line: Caspian Avenue

Minimum Unsignalized Access Spacing: 100 feet

Access Density: 2 accesses/block face

* when warranted by MUTCD traffic signal warrants.

0 0.1 Miles

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US14 IN VOLGA SUB-AREA ACCESS PLAN

Expressway Access Criteria

Signal Spacing*: 1/2 mile

Median Opening Spacing: 1/2 mile (full), 1/2 mile (partial)

Minimum Unsignalized Access Spacing: 1/2 mile

Access Density: at 1/2-mile increments

* when warranted by MUTCD traffic signal warrants.

1-Mile Access
468th Ave
Full Access
Traffic Signal*

1/2-Mile Access
Potential/Future
Full Access
Traffic Signal*

See 469th Avenue rearage road option in Intersection Options C-ii and C-iii.

0 1,000 Ft

North Deer Creek

417

418

468 AVE

469 AVE

14

14B

Legend
- City Limits
- **Access Classification**
- Expressway
- Free Flow Urban
- IU
- Rural
- UD
- Urban Developed
- Urban Fringe

Free Flow Urban Access Criteria

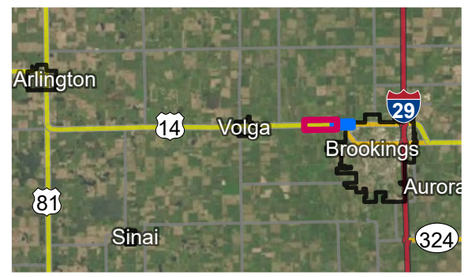
Signal Spacing*: 1/2 mile
- 1-mile section line: 469th Avenue (US14/US14 Bypass intersection)
- 1/2 mile: Potential future intersection
- 1-mile section line: Western Avenue

Median Opening Spacing: 1/2 mile (full), 1/4 mile (partial)

Minimum Unsignalized Access Spacing: 100 feet

Access Density: at 1/4-mile increments

* when warranted by MUTCD traffic signal warrants.



1-Mile Access
469th Ave
Full Access
Traffic Signal*

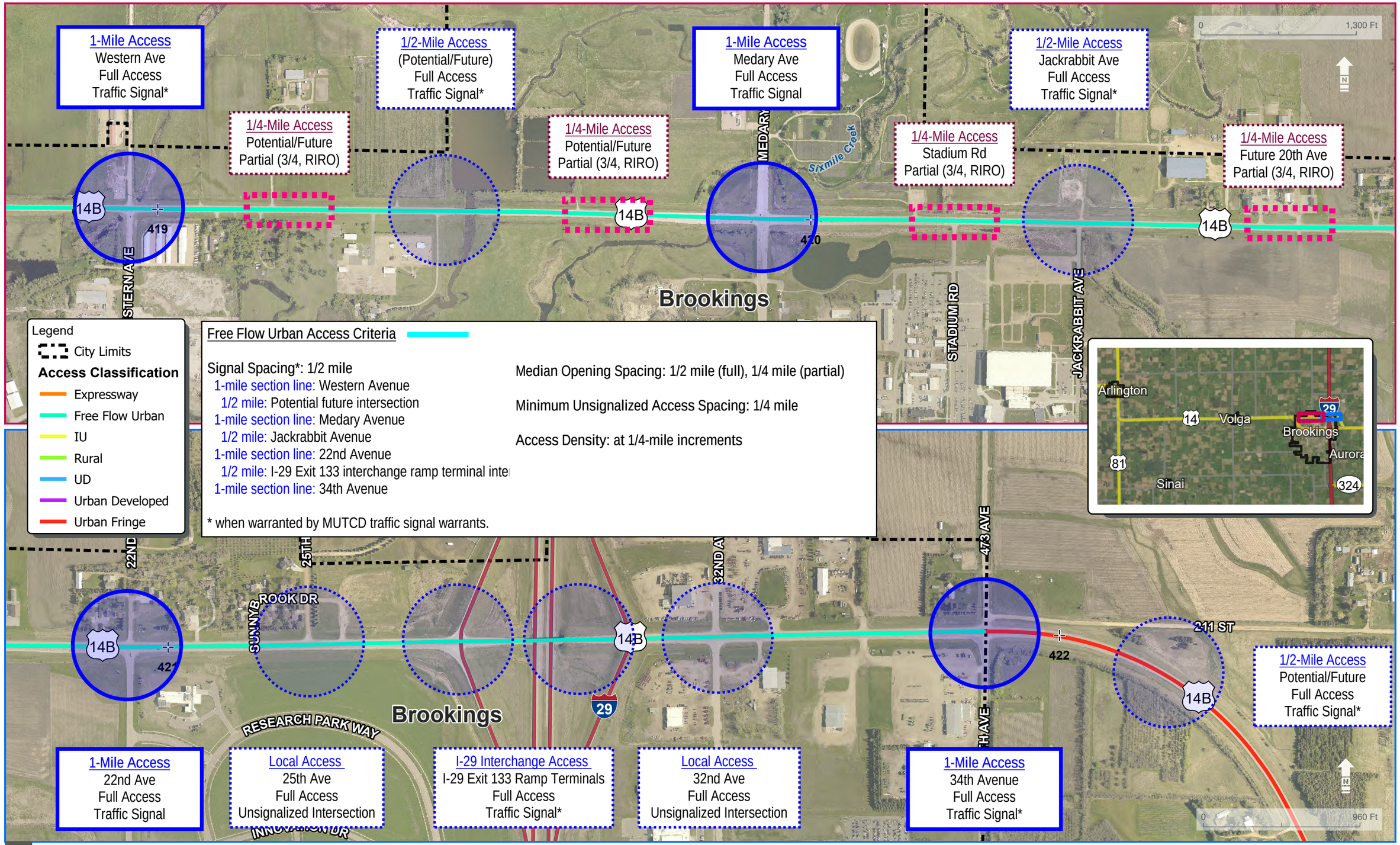
1/4-Mile Access
Potential/Future
Partial (3/4, RIRO)

1/2-Mile Access
Potential/Future
Full Access
Traffic Signal*

1/4-Mile Access
Potential/Future
Partial (3/4, RIRO)

Brookings

0 620 Ft


1-Mile Access
Western Ave
Full Access
Traffic Signal*
1/2-Mile Access
(Potential/Future)
Full Access
Traffic Signal*
1-Mile Access
Medary Ave
Full Access
Traffic Signal
1/2-Mile Access
Jackrabbit Ave
Full Access
Traffic Signal*
1/4-Mile Access
Potential/Future
Partial (3/4, RIRO)
1/4-Mile Access
Potential/Future
Partial (3/4, RIRO)
1/4-Mile Access
Stadium Rd
Partial (3/4, RIRO)
1/4-Mile Access
Future 20th Ave
Partial (3/4, RIRO)
0
1,300 Ft
N
14B
419
420
422
STERN AVE
MEDARY
Sixmile Creek
STADIUM RD
JACKRABBIT AVE
Brookings
Legend
City Limits
Access Classification
Expressway
Free Flow Urban
IU
Rural
UD
Urban Developed
Urban Fringe
Free Flow Urban Access Criteria
Signal Spacing*: 1/2 mile
1-mile section line: Western Avenue
1/2 mile: Potential future intersection
1-mile section line: Medary Avenue
1/2 mile: Jackrabbit Avenue
1-mile section line: 22nd Avenue
1/2 mile: I-29 Exit 133 interchange ramp terminal inte
1-mile section line: 34th Avenue
Median Opening Spacing: 1/2 mile (full), 1/4 mile (partial)
Minimum Unsignalized Access Spacing: 1/4 mile
Access Density: at 1/4-mile increments
* when warranted by MUTCD traffic signal warrants.
Arlington
14
Volga
29
Brookings
Aurora
81
Sinai
324
22ND
25TH
32ND AVE
473 AVE
SUNNYBROOK DR
RESEARCH PARK WAY
INNOVATION DR
211 ST
TH AVE
1/2-Mile Access
Potential/Future
Full Access
Traffic Signal*
1-Mile Access
22nd Ave
Full Access
Traffic Signal
Local Access
25th Ave
Full Access
Unsignalized Intersection
I-29 Interchange Access
I-29 Exit 133 Ramp Terminals
Full Access
Traffic Signal*
Local Access
32nd Ave
Full Access
Unsignalized Intersection
1-Mile Access
34th Avenue
Full Access
Traffic Signal*
0
960 Ft

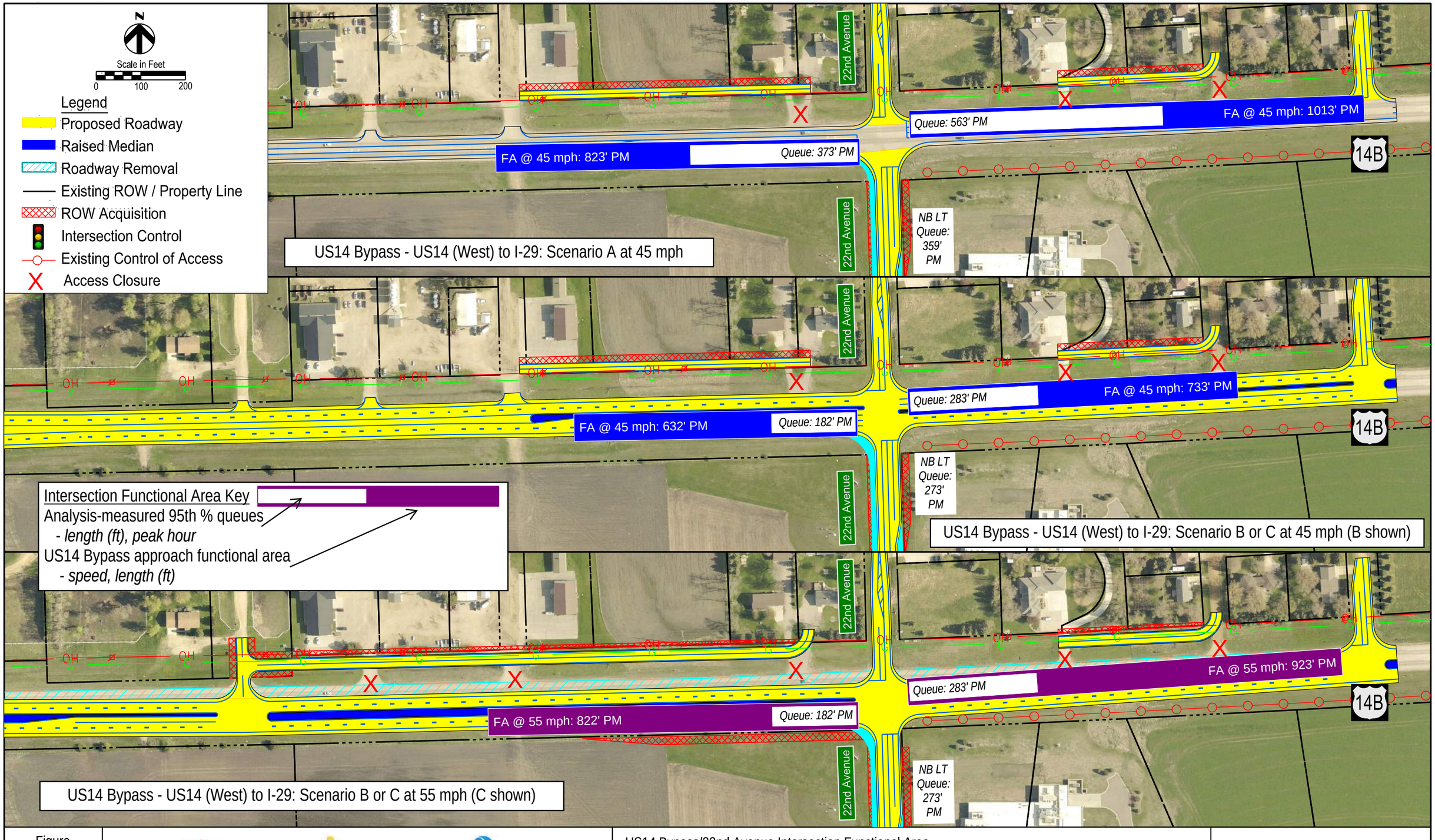


Figure 59	HDR · SD DOT · brookings · Volga · U.S. Department of Transportation Federal Highway Administration	US14 Bypass/22nd Avenue Intersection Functional Area Scenarios A, B, and C US14 / US14B Corridor Study — Brookings, SD	US14 Bypass/22nd Avenue Intersection Functional Area

25. Summary of Recommendations and Implementation Timelines

The following presents a summary of short-term, development driven, and long-range recommended capital improvements, generalized timeline, and planning-level costs as identified by this corridor study. Overarching US14 Bypass reconstruction projects are noted with **Bold Blue** in the tables and shown graphically in **Figure 60.**

Table 64: Recommendations and Planning Timelines (to Year 2040)

Planning Timeline	Improvement	Corridor Segment	Long-Range Segment Scenario	Construction & ROW Cost ($mil)
2024 and earlier	Construct warranted turn lanes at 458th Ave and 459th Ave intersections	US14 West of Volga	Scenario B	$0.5*
	Reconstruct US14/US81 intersection	US14 West of Volga	Scenario B	$8.3**
	Reconstruct 22nd Ave intersection	**US14 Bypass – US14 (west) to I-29**	**Scenario B**	**$3.5**
2025 – 2030	Construct US14 passing lanes	US14 West of Volga	Scenario B	$6.0
	Construct Caspian Ave NB RT lane	US14 in Volga	Scenario B	$0.5
	Construct Hansina Ave traffic signal (if warranted) and EB RT lane	US14 in Volga	Scenario B	< $0.5
	Construct 466th Ave WB RT lane	US14 Volga to Brookings	Scenario A	< $0.5
	Construct Western Ave traffic signal (if warranted) and NB RT lane	US14 Bypass – US14 (west) to I-29	Scenario B	< $0.5
2030 – 2035	**Reconstruct US14 Bypass from US14 (west) to 34th Ave** *Priorities:* *1. 22nd Ave intersection* *2a. Medary Ave to 22nd Ave* *2b. I-29 interchange* *3. US14 (west) to Medary Ave* *4. 32nd Ave to 24th Ave*	**US14 Bypass –** **US14 (west) to I-29** **I-29 interchange** **I-29 to US14 (east)**	**Scenario B** **Scenario C** **Scenario B**	**$24.5***** **$10.0** **$2.5**
2030 – 2040	Reconstruct Samara Ave intersection (consider with potential US14 passing lanes)	US14 in Volga	Scenario B	$2.0
	Reconstruct US14/US14 Bypass (west) at-grade intersection	**US14/US14 Bypass (west)**	**Scenario C-ii**	**$8.0**

* Programmed as part of 2021-2024 STIP project PCN 06K2.
** Programmed as part of 2021-2024 STIP project PCN 05HU, which includes US14/US81 intersection reconstruction.
*** Includes 22nd Avenue intersection reconstruction costs.

Table 65: Recommendations and Planning Timelines (Development Driven Projects)

Planning Timeline	Improvement	Corridor Segment	Long-Range Segment Scenario	Construction & ROW Cost ($mil)
Dependent on timeline of future projects and/or development.	Reconstruct north leg of Caspian Ave	US14 in Volga	Scenario B	$0.5
	Samara Ave rearage road	US14 in Volga	Scenario B, rearage road option	< $0.5
	Construct 469th Ave rearage road	US14/US14 Bypass (west)	Scenario C-ii, rearage option	$0.75
	Signalize 34th Ave intersection when warranted	US14 Bypass – I-29 to US14 (east)	Scenario B	< $0.5
	Realign 211th St/18th St northward	US14 Bypass – I-29 to US14 (east)	Scenario B, 211th St/18th St realignment option	$1.0

Projects identified in this table do not have a specific planning timeline. Future development/redevelopment and coordination with other area projects will dictate timeline.

Table 66: Recommendations and Planning Timelines (Long Range, Beyond Year 2040)

Planning Timeline	Improvement	Corridor Segment	Long-Range Segment Scenario	Planning Cost ($mil)
Long range: Beyond 2040	Construct multilane section	US14 West of Volga	Scenario D	$39.5
	Reconstruct US14/US14 Bypass (east) intersection	US14 Bypass – I-29 to US14 (east)	Scenario B, Intersection Option C	$1.0

Additional considerations and recommendations in conjunction with the identified capital improvements involve the following:

- ITS recommendations
- Blowing and drifting snow recommendations
- Bicycle and Pedestrian Plan
- Access Plan

SEGMENT A:
US14 West of Volga

Corridor Scenario:
Passing lane Scenario B

CROSS-SECTION:
Maintain existing 2-lane highway with recommended improvements

TIMELINE:

2024 and earlier
- Construct warranted turn lanes at 458th Ave and 459th Ave intersections (2021 STIP project)
- Reconstruct US14/US81 intersection and US14 multilane section (2023 STIP project)

2025–2030
★ Construct Scenario B passing lanes

Beyond 2040 (long-range)
- Reconstruct as Scenario D multilane section

SEGMENT B:
US14 in Volga

Corridor Scenario:
Scenario B

CROSS-SECTION:
Maintain existing 5-lane urban section

TIMELINE:

2025 - 2030
- Construct Caspian Ave northbound right turn lane to provide a LT, T, RT configuration
- Construct Hansina Ave traffic signal and eastbound right turn lane (or provide room for eastbound right turn lane)

2030–2040
★ Reconstruct and signalize Samara Ave intersection

SEGMENT C:
US14 Volga to Brookings

Corridor Scenario:
Scenario A

CROSS-SECTION:
Maintain existing rural 4-lane divided

TIMELINE:

2025–2030
★ Construct westbound right turn lane at 466th Ave

DETAIL:
- The mainline corridor of US14 between Volga and Brookings is not changing

SEGMENT D:
US14/US14 Bypass (West) Intersection

Corridor Scenario:
Intersection Option C-ii

CROSS-SECTION:
- 4-Lane Divided – Suburban
- 4-Lane Divided – Urban section where needed at intersections and constrained ROW

TIMELINE:

2030–2040
★ Reconstruct as at-grade intersection

SEGMENT E:
US14 Bypass – US14 (West) to I-29

Corridor Scenario:
Scenario B

CROSS-SECTION:
- 4-Lane Divided – Suburban
- 4-Lane Divided – Urban section where needed at intersections and constrained ROW

TIMELINE:

2024
★ Reconstruct 22nd Ave intersection

2025 – 2030
- Signalize Western Ave when warranted and add northbound right turn lane

2030 – 2035
★ Reconstruct US14 Bypass from US14 (west) to I-29

SEGMENT F:
US14 Bypass/ I-29 Interchange

Corridor Scenario:
Scenario C

CROSS-SECTION:
- 4-Lane Divided – Suburban
- 4-Lane Divided – Urban section where needed at intersections and constrained ROW

TIMELINE:

2030–2035
★ Reconstruct interchange in conjunction with US14 Bypass reconstruction project(s)

DETAIL:
- In the interim, signalize ramps and channelize approaches to extend acceptable operations to reconstruction year

SEGMENT G:
US14 Bypass – I-29 to US14 (East)

Corridor Scenario:
Scenario B

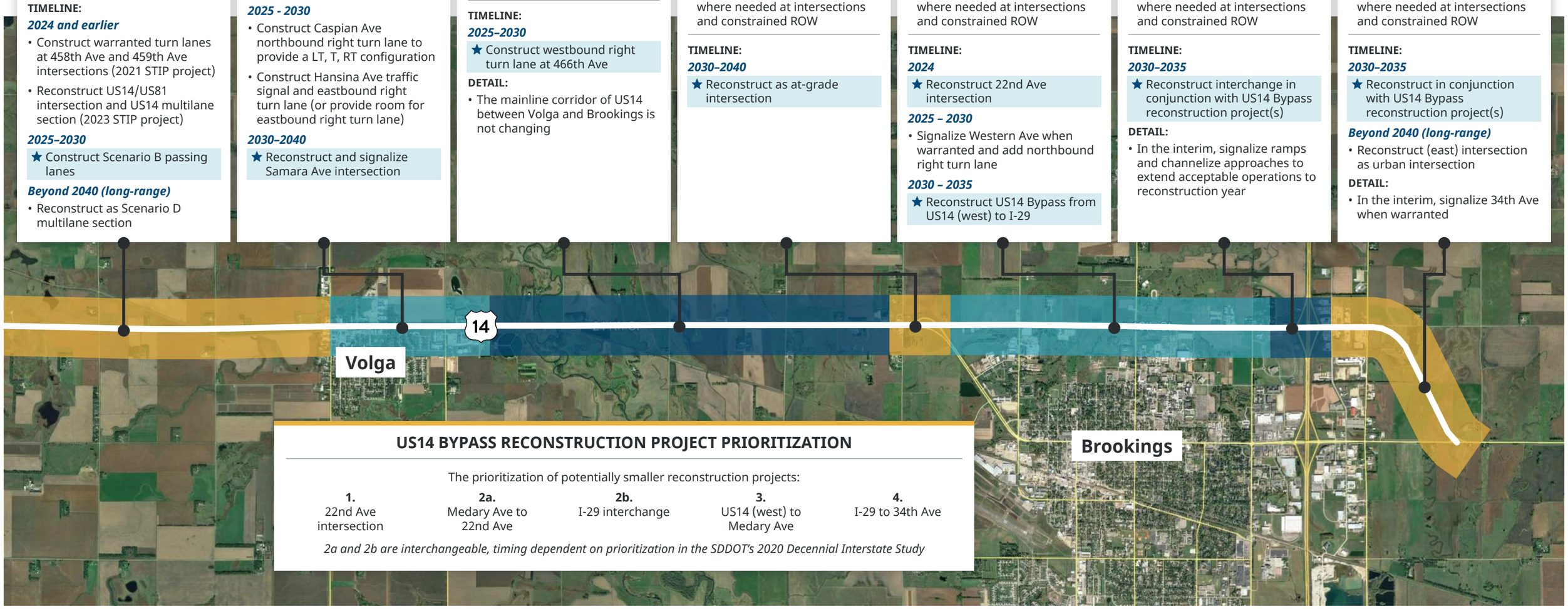
CROSS-SECTION:
- 4-Lane Divided – Suburban
- 4-Lane Divided – Urban section where needed at intersections and constrained ROW

TIMELINE:

2030–2035
★ Reconstruct in conjunction with US14 Bypass reconstruction project(s)

Beyond 2040 (long-range)
- Reconstruct (east) intersection as urban intersection

DETAIL:
- In the interim, signalize 34th Ave when warranted



US14 BYPASS RECONSTRUCTION PROJECT PRIORITIZATION

The prioritization of potentially smaller reconstruction projects:

1.	2a.	2b.	3.	4.
22nd Ave intersection	Medary Ave to 22nd Ave	I-29 interchange	US14 (west) to Medary Ave	I-29 to 34th Ave

2a and 2b are interchangeable, timing dependent on prioritization in the SDDOT's 2020 Decennial Interstate Study

★ Key project(s) within each segment

US14-US14 BYPASS LONG-RANGE PLAN SUMMARY

26. Appendix

A. Methods and Assumptions Document

B. StreetLight Origin-Destination Analysis Technical Memo

C. South Dakota State University Football Game Day Traffic Review Technical Memo

D. Crash History Review Technical Memo

E. Traffic and Reliability Analysis Technical Memo

F. US14 Corridor Environmental Overview Memo

G. Traffic Forecasts Technical Memo

H. HCM6 LOS Thresholds Tables

I. Urban or Rural Area Level of Service Classification Review Memo

J. Existing Conditions Traffic Operations Technical Memo

K. Future No Build Conditions Traffic Operations Technical Memo

L. 2024 and 2050 Planning Level Unsignalized Intersection Turn Lane Volume Warrants Review Technical Memo

M. 2024 and 2050 No Build Conditions Traffic Signal Warrant Review Technical Memo

N. Stakeholder and Public Meeting No's 1, 2, and 3 Summary Reports

O. Concept Development Information

Intersection and Corridor Concepts Memo
Concept Layouts
SAT Brainstorming Workshop Minutes

P. Corridor Scenario Development

Corridor Scenario Memo
Corridor Scenario Layouts
Planning-level Costs
SAT Feasible Scenario Workshop Minutes

Q. 2050 Corridor Scenario Traffic Operations Analysis

R. 2024 Corridor Scenario Traffic Operations Analysis

S. Predictive Safety Analysis for US14-US14 Bypass Corridor Study Area Technical Memo

T. US14 Passing Lane Technical Memos

Passing Lane Analysis Technical Memo
Passing Lane Optimization Analysis Technical Memo

U. ITS Recommendations Technical Memo

V. Blowing Snow Analysis Technical Memo

W. Access Inventory Spreadsheet