SD DEPARTMENT OF TRANSPORTATION

LAZELLE STREET

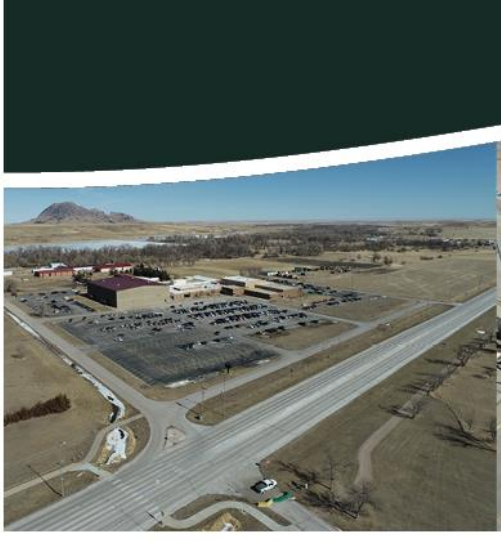
14A 34

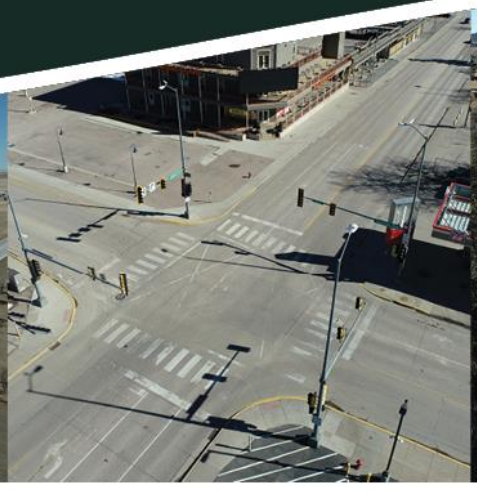
CORRIDOR STUDY

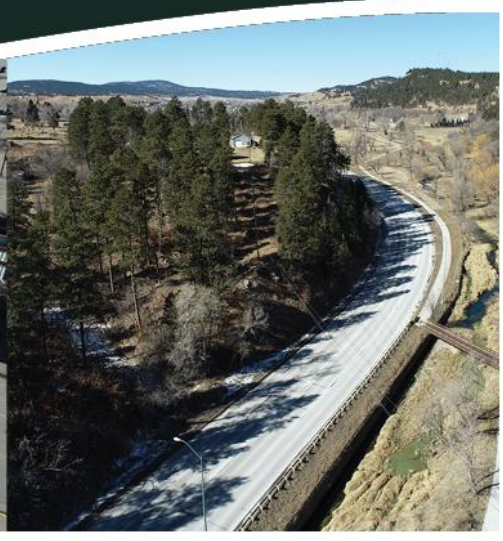
Technical Report

Prepared by:

JEO CONSULTING GROUP







US14A/SD34 (Lazelle Street) Corridor Study Technical Report

City of Sturgis and Meade County, South Dakota

Prepared for:

SD DEPARTMENT OF TRANSPORTATION

South Dakota Department of Transportation
Office of Project Development
700 E. Broadway Avenue
Pierre, SD 57501

In conjunction with:
Federal Highway Administration

Prepared by:
JEO Consulting Group, Inc.
2000 Q Street, Suite 500
Lincoln, NE 68503

In association with:
Ferber Engineering Company, Inc.
Confluence

October 28, 2022

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 [or Metropolitan Planning Program, Section 104(f)] of Title 23, U.S. Code. The contents of this report do not necessarily reflect the official views or policy of the U.S. Department of Transportation.

The South Dakota Department of Transportation (SDDOT) provides services without regard to race, color, gender, religion, national origin, age, or disability, according to the provisions contained in SDCL 20-13, Title VI of the Civil Rights Act of 1964, the Rehabilitation Act of 1973, as amended, the Americans With Disabilities Act of 1990 and Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, 1994.

To request additional information on the SDDOT's Title VI/Nondiscrimination policy or to file a discrimination complaint, please contact the Department's Civil Rights Office at 605-773-3540.

Table of Contents

List of Figures

List of Tables

Appendices

Appendix A. Methods and Assumptions Document

Appendix B. Existing Conditions Assessment Report

Appendix C. Traffic Control Plan Sturgis Rally – 2020

Appendix D. Intelligent Transportation Systems (ITS) Assessment Technical Memo

Appendix E. Future Traffic Volume Projections Technical Memo

Appendix F. Future No-Build Traffic Operations Analysis Technical Memo

Appendix G. Predictive Safety Analysis of Feasible Alternatives Technical Memo

Appendix H. Summary of Feasible Alternatives Technical Memo

Appendix I. Aesthetics, Streetscape and Entryways Technical Memo

Appendix J: Alternative Evaluation Matrices Technical Memo

Appendix K. Benefit to Cost Analysis of Alternatives Technical Memo

Appendix L. Traffic Operations Analysis of Feasible Alternatives Technical Memo

Appendix M. Environmental Screening Report

Appendix N. Construction Phasing Strategies Technical Memo

Appendix O. Public and Stakeholder Meetings Reports

List of Acronyms and Abbreviations

AASHTO	American Association of State Highway Transportation Officials
ADT	Average Daily Traffic
APE	Area of Potential Effect
BCA	Benefit-Cost Analysis
BCR	Benefit-Cost Ratio
CMF	Crash Modification Factor
CRF	Crash Reduction Factor
DDI	Diverging Diamond Interchange
DOT	Department of Transportation
EB	Eastbound
EJ	Environmental Justice
EPA	US Environmental Protection Agency
ETT	Experienced Travel Time
FFS	Free Flow Speed
FHWA	Federal Highway Administration
F+I	Fatal and Injury (crashes)
FY	Fiscal Year
GIS	Geographic Information System
HCM	Highway Capacity Manual
HCS	Highway Capacity Software
HSM	Highway Safety Manual
I-90	Interstate 90
IHSDM	Interactive Highway Safety Design Model
ITS	Intelligent Transportation Systems
LIRO	Left-In/Right-Out
LOS	Level of Service
LWCF	Land and Water Conservation Fund
mph	miles per hour

MRM	Mileage Reference Marker
MUT	Median U-Turn
MUTCD	Manual on Uniform Traffic Control Devices
NB	Northbound
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NRHP	National Register of Historic Places
PDO	Property Damage Only (crash)
PFFS	Percent of Free-Flow Speed
PHF	Peak Hour Factor
PTSF	Percent Time Spent Following
RCI	Reduced Conflict Intersection
RIRO	Right-In/Right-Out
ROW	Right-of-Way
SAT	Study Advisory Team
SB	Southbound
SD	South Dakota
SDDOT	South Dakota Department of Transportation
SDGFP	South Dakota Game Fish and Parks
SPUI	Single-Point Urban Interchange
STIP	Statewide Transportation Improvement Program
TSM&O	Transportation Systems Management and Operations
TWLTL	Two-Way Left-Turn Lane
USFWS	United States Fish and Wildlife Service
UST	Underground Storage Tank
WB	Westbound
WCSC	Worst-Case Stop Control

Executive Summary

In 2021, the South Dakota Department of Transportation (SDDOT), in partnership with the Federal Highway Administration, City of Sturgis, and Meade County commenced a study to identify needed improvements to a nearly six-mile-long corridor of US14A and SD34. The study corridor, referred to as Lazelle Street within the city limits of Sturgis, includes:

- US14A from the west Sturgis city limit to the I-90 (Exit 30) junction within Sturgis
- SD34 from the Exit 30 junction to the east Sturgis city limit, east of Blanche Street
- SD34 from the east Sturgis city limit to the intersection with Fort Meade Way, east of Sturgis

The purpose of this corridor study was to evaluate existing and anticipated future conditions to identify potential improvements to the study corridor and associated intersections.

The study used a detailed process to fulfill its identified objectives. A study advisory team (SAT) was created to guide the development of the corridor study and was comprised of representatives of the agencies identified above. Additionally, public and stakeholder involvement was instrumental to the study process. In summary, the overall corridor study process consisted of the following milestones:

- Documentation of deficiencies and needs
- Development of alternative solutions
- Identification of consultant study team recommendations

This report, and the referenced technical memorandums developed throughout the study process, provides documentation of the corridor study process and the recommendations formulated by the consultant study team based on technical analyses and public input.

Summarized in **Table ES-1**, recommendations of the consultant study team are provided (noted in green text) for each of the eight segments identified throughout this corridor study and as presented in previous technical memorandums. For situations where the consultant study team recommends specific alternatives not be implemented, these are also noted (in red text). Project planning timelines are defined as follows:

- Short-term: 8-12 years (based on current programming, 8 years is the soonest any alternative would likely be implemented)
- Mid-term: 13-18 years
- Long-term: 18+ years

Table ES-1 – Consultant Study Team Recommendations

Segment	Alternatives	Planning Timeline
US14A (West City Limits to Moose Drive)	A0: No-build A1: 3-lane A2: 5-lane **A3: 4-lane Divided (Raised Median) with Turn lanes**	Long-term
Avalanche Road Development	**B0: No-build** B1: I-90 Viaduct B2: Avalanche Road Realignment (Option 1) B3: Avalanche Road Realignment (Option 2)	Long-term
Exit 30 and Avalanche Road Intersections	C0: No-build **C1: Intersection Improvements** **C2: Westbound On-Ramp Folded Diamond** C3: Single-point Urban Interchange (SPUI) C4: Diverging Diamond Interchange (DDI)	Short-term (Timing in line with full build-out of Avalanche development)
Lazelle Street Urban Area (Main Street to Blanche Street)	D1: 3-lane **D2: 4-lane Undivided** D3: 5-lane D4: 5-lane (west of Middle Street) / 4-lane Divided w/o Turn Lanes (east of Middle Street) **D5: 5-lane Offset Alignment**	Short-term
S-Curves	**E1: Raised Vertical Profile** E2: Realignment (Option 1) E3: Realignment (Option 2)	Mid-term
Ft. Meade / VA Hospital	F1: Intersection Improvements F2: Realign Comanche Road F3: Custer Avenue (east) **F4: Reduced Conflict Intersections**	Short- to mid-term
SD34 (Ft. Meade to SD79)	G1: Divided Highway with Depressed Median **G2: Divided Highway with Depressed Median & Cable Median Barrier**	Long-term
Junction Avenue (Lazelle Street to Main Street)	**H1: Geometric Improvements at Lazelle Street & Junction Avenue** H2: Junction Avenue & Main Street – Roundabout H3: Junction Avenue & Main Street – Two-way Stop Control **H4: Junction Avenue & Main Street - Signalization**	Short-term

1.0 Introduction

1.1 Background

The South Dakota Department of Transportation's (SDDOT) pavement management system identified segments of US Highway 14 Alternate (US14A) and South Dakota Highway 34 (SD34) in Meade County, also known as Lazelle Street in Sturgis and coinciding with South Dakota Highway 79 (SD79) from the I-90 (Exit 30) junction to the intersection with SD79, to undergo major rehabilitation or reconstruction in the 2028 to 2040 timeframe. The purpose of this corridor study was to evaluate existing and anticipated future conditions to identify potential improvements to the study corridor. With the large fluctuation in traffic volumes between normal conditions and conditions during the annual Sturgis Motorcycle Rally (Rally), it is prudent to ensure that the correct typical section(s) and intersection enhancements are provided to accommodate normal traffic demand while also considering Rally traffic conditions. However, specific analyses of Rally conditions were not performed as part of this corridor study.

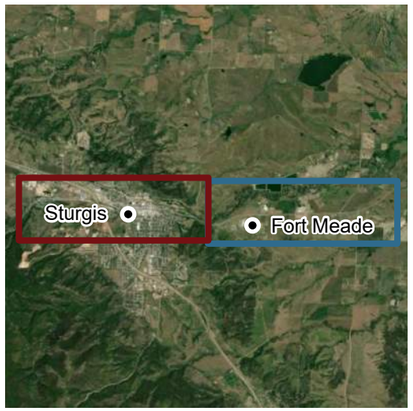
The study identified future improvements for the next 30 years and fulfilled the following objectives:

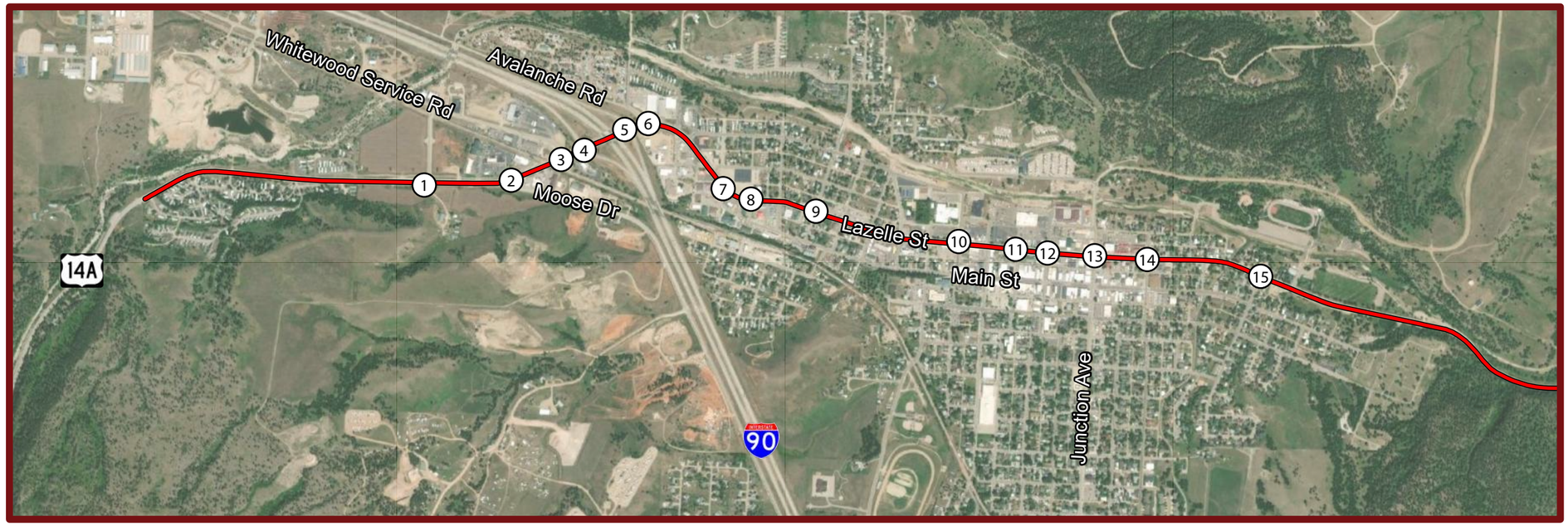
- Determine potential intersection configurations for all identified study intersections along the study corridor
- Determine the need for through lane capacity modifications and turning lanes along mainline US14A/SD34
- Develop potential access management improvements
- Determine project limits, prioritization, and timing for construction within shortened construction seasons
- Create environmental scan documentation
- Create final products for use by the SDDOT, City of Sturgis, and Meade County which will guide implementation of recommended improvements

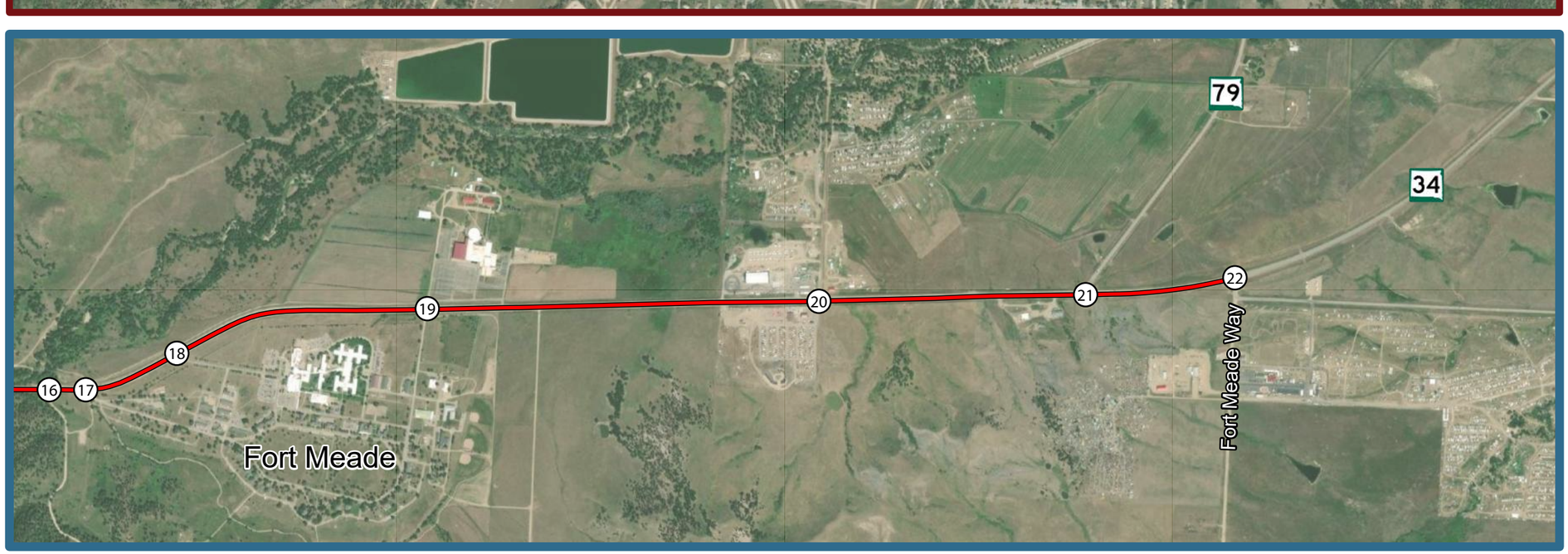
1.2 Study Area

Figure 1 illustrates the study corridor beginning at the west city limit of Sturgis and continuing east to the intersection with Fort Meade Way. The study corridor, referred to as Lazelle Street within the city limits of Sturgis, includes:

- **US14A** from the west Sturgis city limit to the I-90 (Exit 30) junction within Sturgis
- **SD34** from the Exit 30 junction within Sturgis to the intersection with Fort Meade Way, east of Sturgis
- **22 study intersections** located in the corridor segments above







(#) Study Area Intersections

Project Corridor

1: 20th Street
2: Moose Drive
3: Whitewood Service Rd
4: I-90 EB Ramp Terminal
5: I-90 WB Ramp Terminal
6: Avalanche Road
7: Main Street
8: 11th Street
9: 9th Street
10: 4th Street
11: Harley-Davidson Way
12: 1st Street
13: Junction Avenue
14: Middle Street
15: Nellie Street
16: Horse Soldier Road
17: Custer Avenue (West)
18: Comanche Road
19: Custer Avenue (East)
20: Glencoe Drive
21: SD79
22: Fort Meade Way

0 500 1000 2000 US Feet

N

Figure 1

Study Corridor

1.3 Study Process

This study used a detailed process to fulfill its identified objectives. A study advisory team (SAT) was created and comprised of representatives from SDDOT, City of Sturgis, Meade County, and Federal Highway Administration. The SAT guided the development of the corridor study with a total of seven meetings held with the consultant study team. Additionally, public and stakeholder involvement was instrumental in the study process. Two public meetings and two rounds of individual stakeholder meetings were conducted with property and business owners along the study corridor. Furthermore, a project-specific website was maintained throughout the duration of the corridor study providing interested parties a mechanism to obtain project information and updates, including project team contact information, and an online comment portal during the two public comment periods.

1.4 Methods and Assumptions

A *Methods and Assumptions* document was prepared at the onset of this study to serve as a historical record of the traffic operations analysis methods and assumptions incorporated into the corridor study. The most recent, amended version is provided as **Appendix A**.

2.0 Existing Conditions

An *Existing Conditions Assessment* report was prepared early in the study process. This assessment summarized characteristics of the study corridor and the broader study area. Outlined below is an overview of these characteristics. More detailed information may be found in the report, provided as **Appendix B**.

2.1 Regional Transportation Network

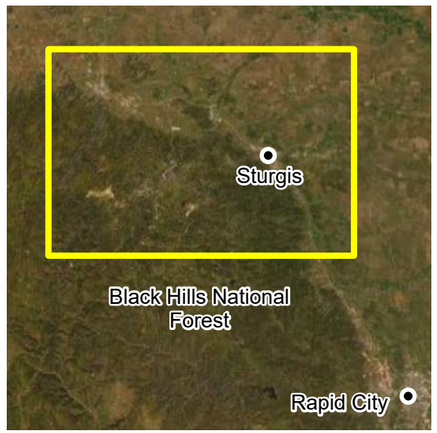
I-90 is an east-west transcontinental freeway and at 3,020 miles, the longest interstate highway in the United States. From west to east, I-90 connects Seattle, Washington to Boston, Massachusetts. Within South Dakota, I-90 begins west of Spearfish and continues to east of Sioux Falls. Throughout South Dakota, I-90 is primarily a four-lane freeway.

The western portion of the study corridor, west of the Exit 30 junction with I-90, is regionally known as US14A. US14A serves as the main connection between Sturgis and the cities of Deadwood and Lead while also providing an alternate route (other than I-90) to Spearfish. Between Cheyenne Crossing and Spearfish, US14A is also recognized as the Spearfish Canyon Scenic Byway.

SD34 is a state highway that parallels I-90 across the entire state of South Dakota. To the west, SD34 connects to Wyoming Highway 24, west of Belle Fourche, South Dakota. To the east, SD34 connects to Minnesota Highway 30, east of Egan, South Dakota.

SD79 is a state highway running north-south in western South Dakota, beginning at the Nebraska state line, coinciding with U.S. Highway 18 to Maverick Junction, and continuing to the North Dakota State line connecting to North Dakota Highway 22.

Figure 2 illustrates the geographic context of the regional transportation network with respect to the study area.



SD34
US14A
I-90
US85
US385
SD79

0 1 2 4 Miles

N

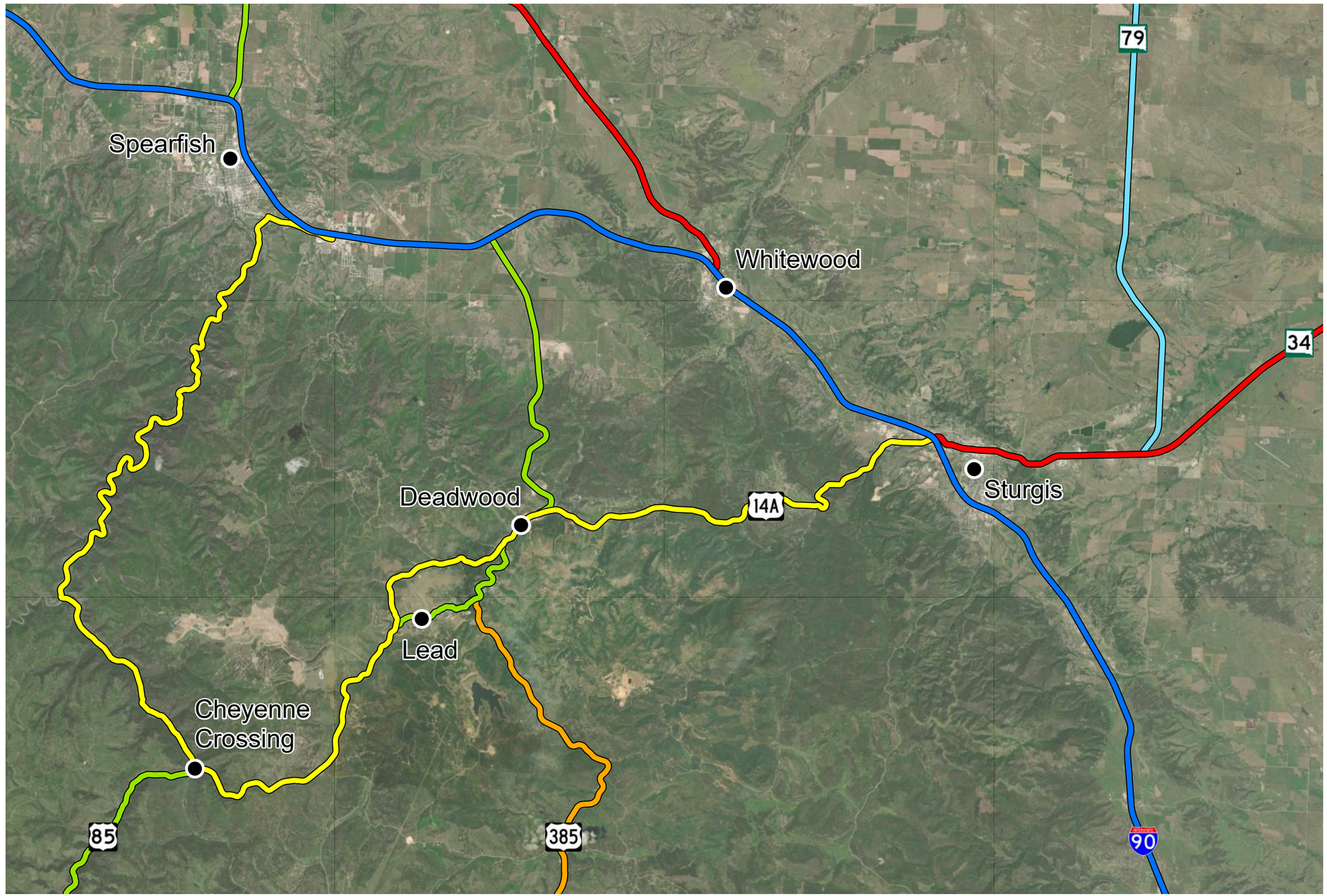


Figure 2

Regional Transportation Network

2.2 Local Transportation Network

Within the city limits of Sturgis, the project corridor is locally known as Lazelle Street. The project corridor is also referenced as US14A west of the I-90 (Exit 30) junction and SD34 east of the same junction. This corridor is the only continuous east-west street that spans the entire city of Sturgis. The western end of the study corridor provides connections to I-90 at Exit 30, Avalanche Road, and Moose Drive. The eastern end of the study corridor provides connections to SD79 and Fort Meade Way, as well as the major camping and concert/entertainment venues associated with the Rally. **Figure 3** illustrates the local transportation network.

2.3 Intersection Spacing and Access

Within the US14A/SD34 study limits, the corridor has been classified as "Urban Developed" from the west end of the project corridor to the east city limit; then, "Urban Fringe" from east city limit to SD79; and "Rural" between SD79 and Fort Meade Way. Spacing and density criteria, as per the SDDOT Road Design Manual, was used during the corridor study to identify opportunities for improved safety and mobility.

Figure 4 identifies non-intersection access points and the signalized intersections along the corridor

2.4 Traffic Volumes & Travel Patterns

2.4.1 Historic and Existing Traffic Volumes

SDDOT collects and maintains an assortment of traffic-related data, including daily traffic volumes, on highways statewide. **Figure 5** illustrates daily volumes dating back to 2012 for various segments of the project corridor. Some of these segments indicate a decrease in traffic volumes between 2018 and 2020, which is most likely attributable, in part, to the COVID-19 pandemic. Prior to 2020, average daily traffic volume growth was either flat or trending slightly upward, depending on the location along the project corridor.

SD34
US14A
I90
SD79

N

0 500 1000 2000
US Feet

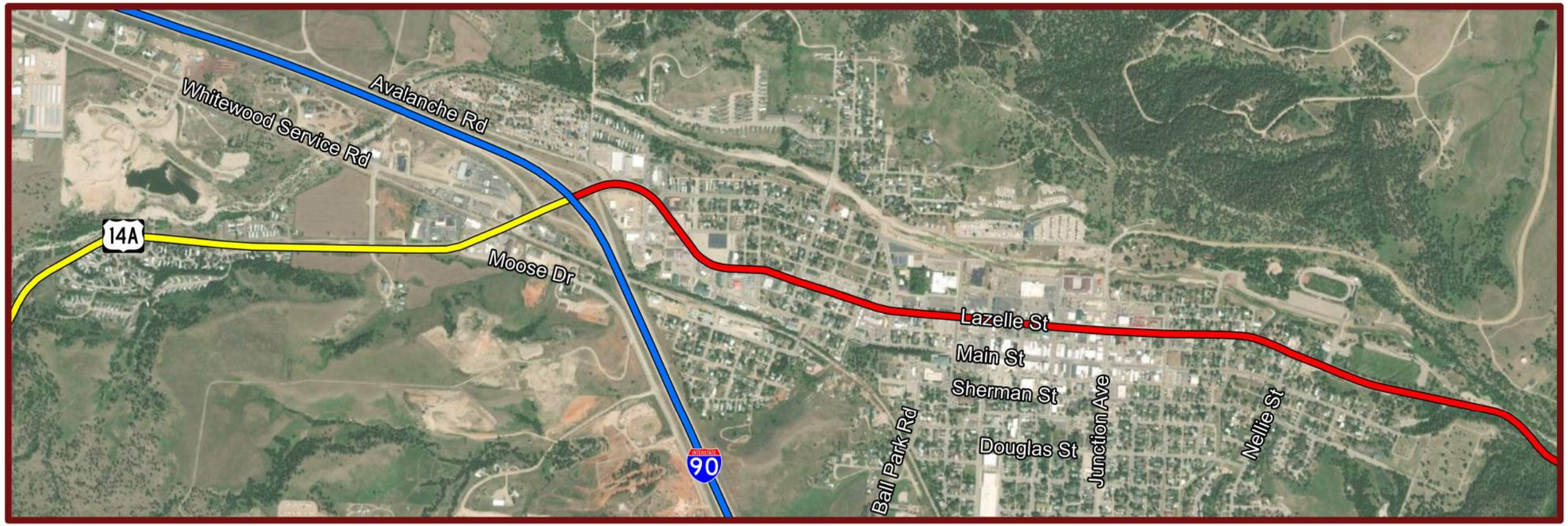
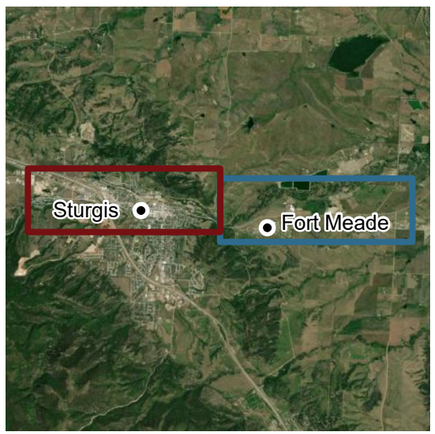
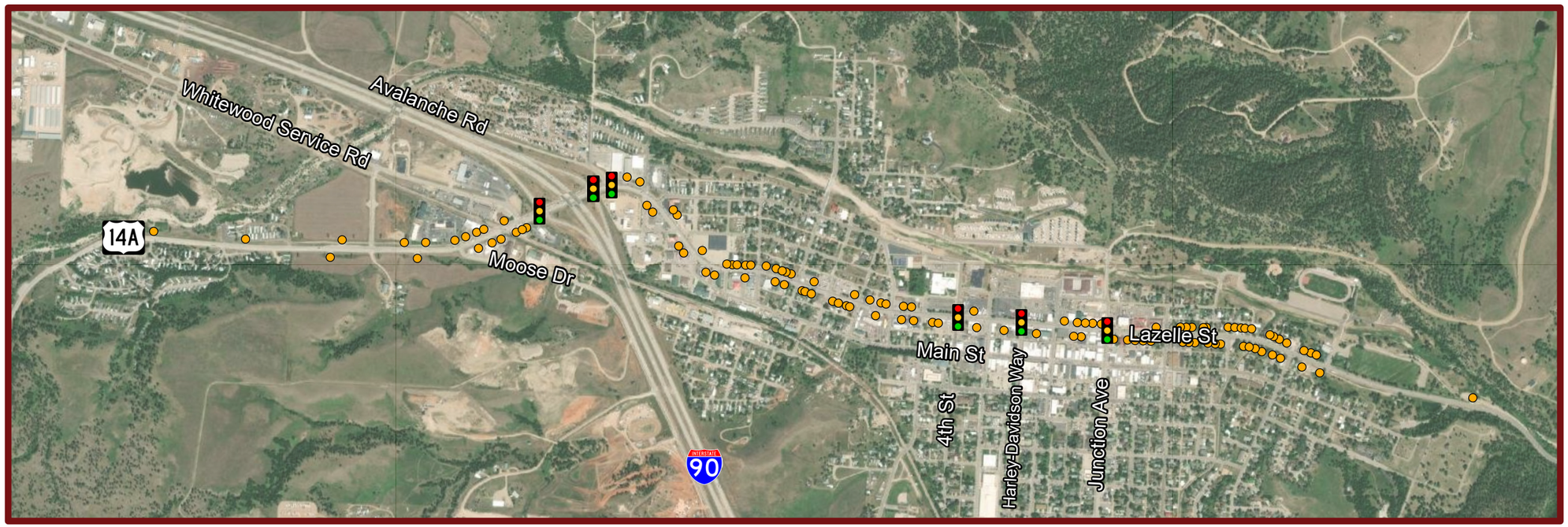


Figure 3

Local Transportation Network





- Access Points
- Signalized Intersection

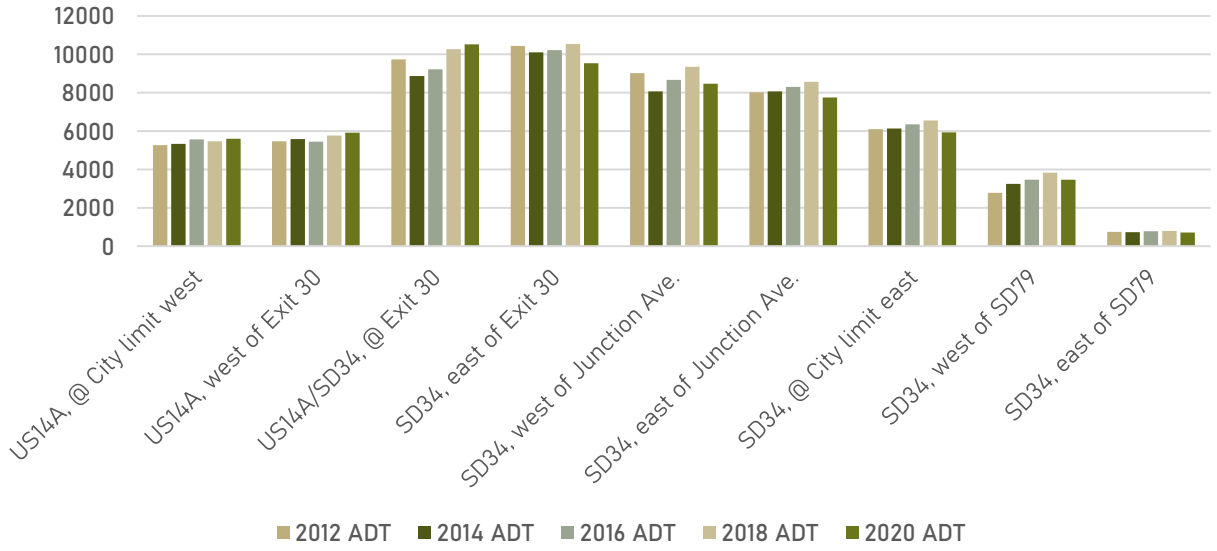
0 500 1000 2000
US Feet

N

Figure 4

Intersection Spacing and Access

Figure 5 – Historic Traffic Volumes



Existing (2021) traffic volumes were collected as part of the corridor study process. Volumes were collected in the form of 15-minute turning movement volumes at the 22 study area intersections and hourly/daily volumes at ten segments along the study corridor. **Figure 6a and 6b** illustrate the resulting AM and PM peak hour turning movement volumes and average daily traffic volumes.

2.4.2 Travel Patterns

Origin-destination (O-D) travel data was gathered using StreetLight Data, a computer application that uses smartphones as sensors to track and measure traffic activity of all modes. StreetLight Data produces reports that include traffic volumes, origin-destination information, and other transportation metrics.

O-D data collection allowed the consultant study team to:

- Gain an understanding of the amount of through traffic that uses the study corridor
- Identify the local/regional highway road(s) motorists use to access the study corridor
- Identify where Fort Meade area (including the VA Hospital) traffic is coming from and going to

The O-D data summarized in **Table 1** was collected during "normal" conditions; when schools were in session, minimal tourist traffic was present along the project corridor, and outside of the Rally timeframe. **Figure 7** illustrates the external stations in which origin and destination pairs were defined, as referenced in **Table 1**.

More detail on the O-D data, including results relative to the Fort Meade area, may be found in the Existing Conditions Assessment report, provided as **Appendix B**.

- (#) Study Area Intersections
- Project Corridor
- Signalized Intersection
- U Unsignalized Intersection
- AM (PM) Peak Hour Volumes
- XXXX Average Daily Volumes

0 500 1000 2000 Feet

N

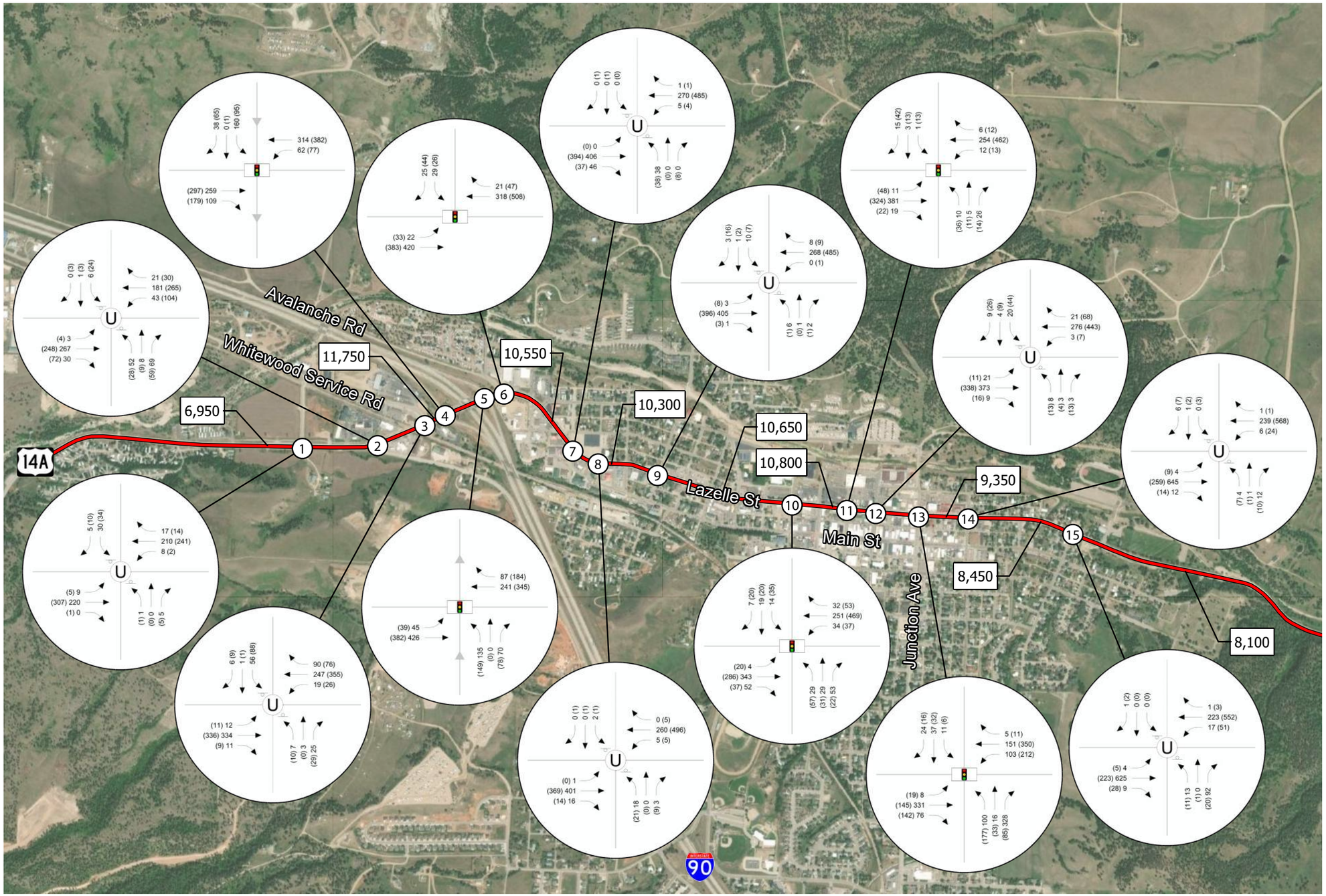


Figure 6a

Existing Peak Hour Traffic Volumes

- (#) Study Area Intersections
- Project Corridor
- Signalized Intersection
- (U) Unsignalized Intersection
- AM (PM) Peak Hour Volumes
- XXXX Average Daily Volumes

N

0 500 1000 2000 Feet

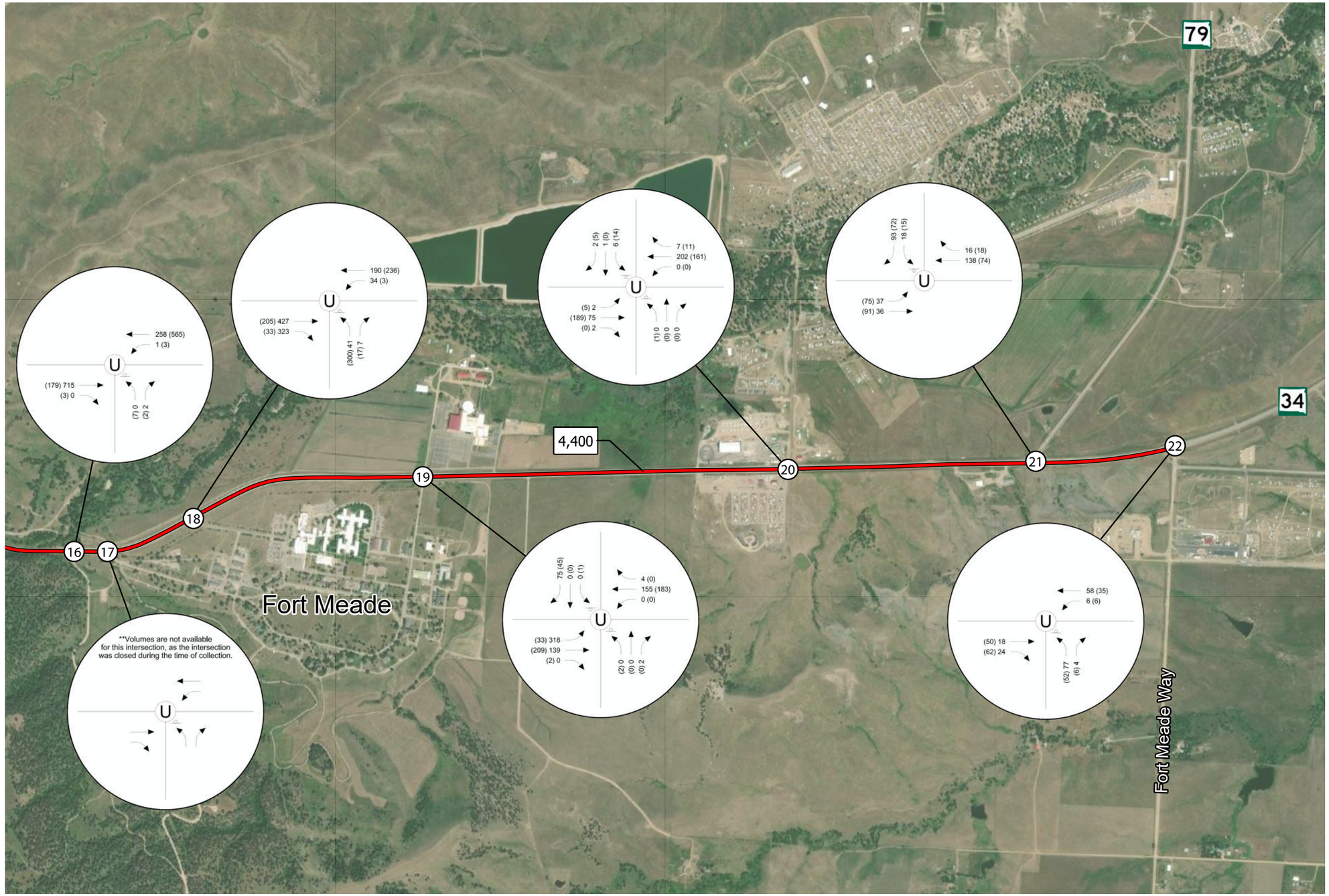


Figure 6b

Existing Peak Hour Traffic Volumes

Table 1 – Study Area Origins-Destinations

Entering Study Area At...	No. of Entering Vehicles (daily average)	1 – US14A	2 – Whitewood Serv. Rd	3 – West I-90	4 – Avalanche Rd	5 – 128th Ave	6 – SD79	7 – SD34	8 – Ft. Meade Way	9 – Horse Soldier Rd	10 – East I-90	11 – Junction Ave	TOTAL EXTERNAL	TOTAL INTERNAL
	Exiting Study Area At...													
1 – US14A	2,999	-	1.37%	3.17%	0.37%	0.37%	4.13%	0.73%	0%	0.20%	35.71%	1.30%	**47.35%**	**52.65%**
2 – Whitewood Service Rd	684	4.39%	-	1.32%	1.02%	0%	0%	0.88%	0%	0%	14.04%	1.75%	**23.39%**	**76.61%**
3 – West I-90	6,459	1.30%	0.28%	-	0.15%	0.25%	1.24%	1.36%	0.06%	0%	57.33%	0.9%	**62.87%**	**37.13%**
4 – Avalanche Rd	306	2.29%	5.88%	4.25%	-	0%	0%	2.29%	0%	0%	15.03%	0%	**29.74%**	**70.26%**
5 – 128th Ave	313	2.24%	1.92%	4.15%	0%	-	0%	2.24%	0%	0%	18.85%	0%	**29.39%**	**70.61%**
6 – SD79	1,402	10.56%	0.78%	4.64%	0%	0.50%	-	2.64%	5.21%	0.86%	23.4%	0.93%	**49.5%**	**50.5%**
7 – SD34	516	5.43%	0.97%	13.37%	1.36%	0%	7.17%	-	2.91%	0%	4.26%	2.33%	**37.79%**	**62.21%**
8 – Ft. Meade Way	294	1.70%	0%	0%	0%	0%	32.99%	3.06%	-	0%	1.36%	0%	**39.12%**	**60.88%**
9 – Horse Soldier Rd	135	9.63%	0%	8.15%	0%	0%	0%	0%	0%	-	0%	0%	**17.78%**	**82.22%**
10 – East I-90	10,005	11.39%	0.93%	36.66%	0.46%	0.73%	3.52%	0.28%	0.04%	0%	-	0.57%	**54.58%**	**45.42%**
11 – Vanocker Canyon Rd	403	4.22%	0%	21.84%	0%	0%	0%	0%	0%	0%	12.41%	-	**38.46%**	**61.54%**

(#) External O-D Stations
Fort Meade O-D Zone
Project Corridor

N

0 1000 2000 4000
Feet

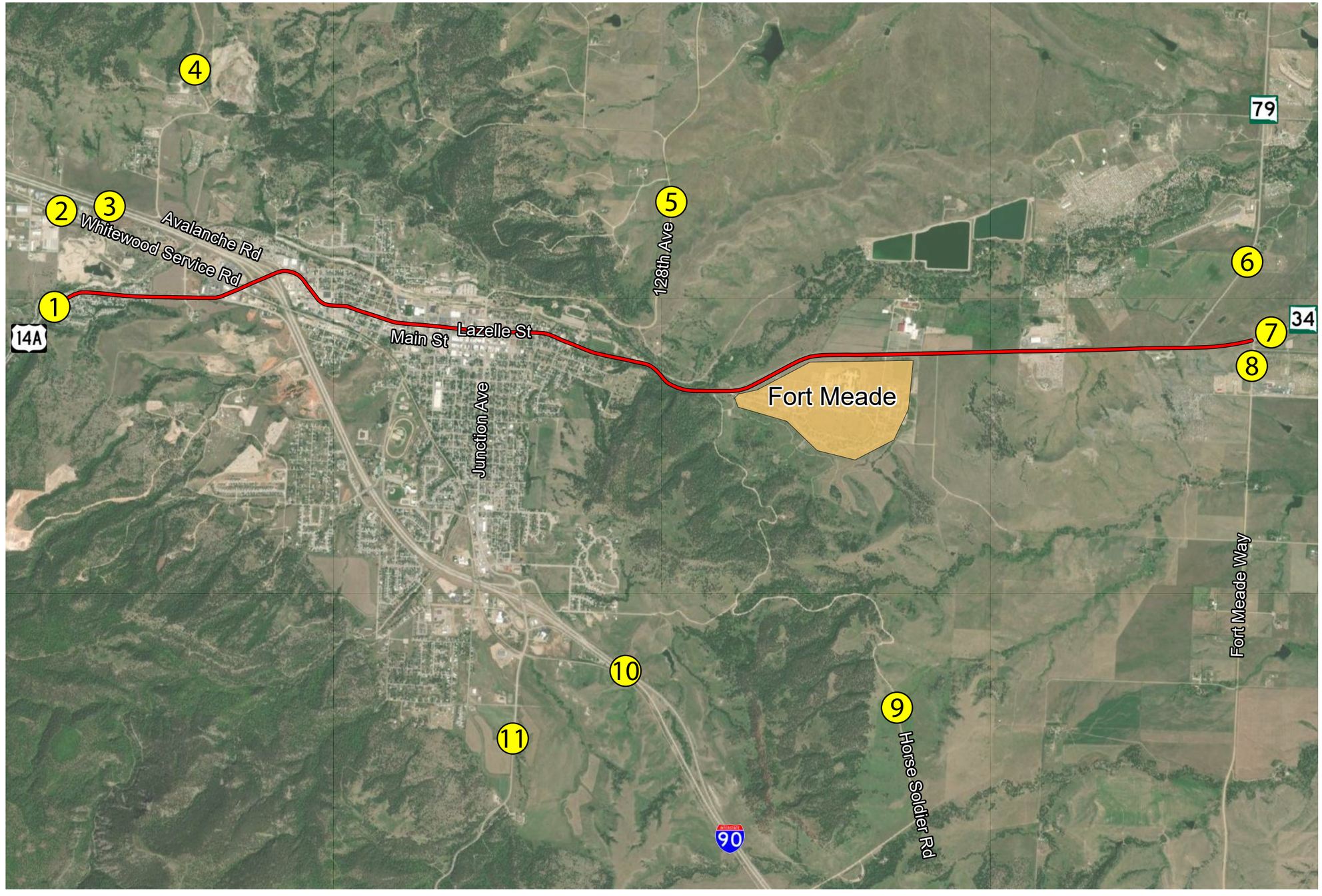


Figure 7

Origin-Destination Study

2.5 Network Characteristics

Various additional elements of the study corridor were inventoried to provide an assessment of the existing conditions. These elements included:

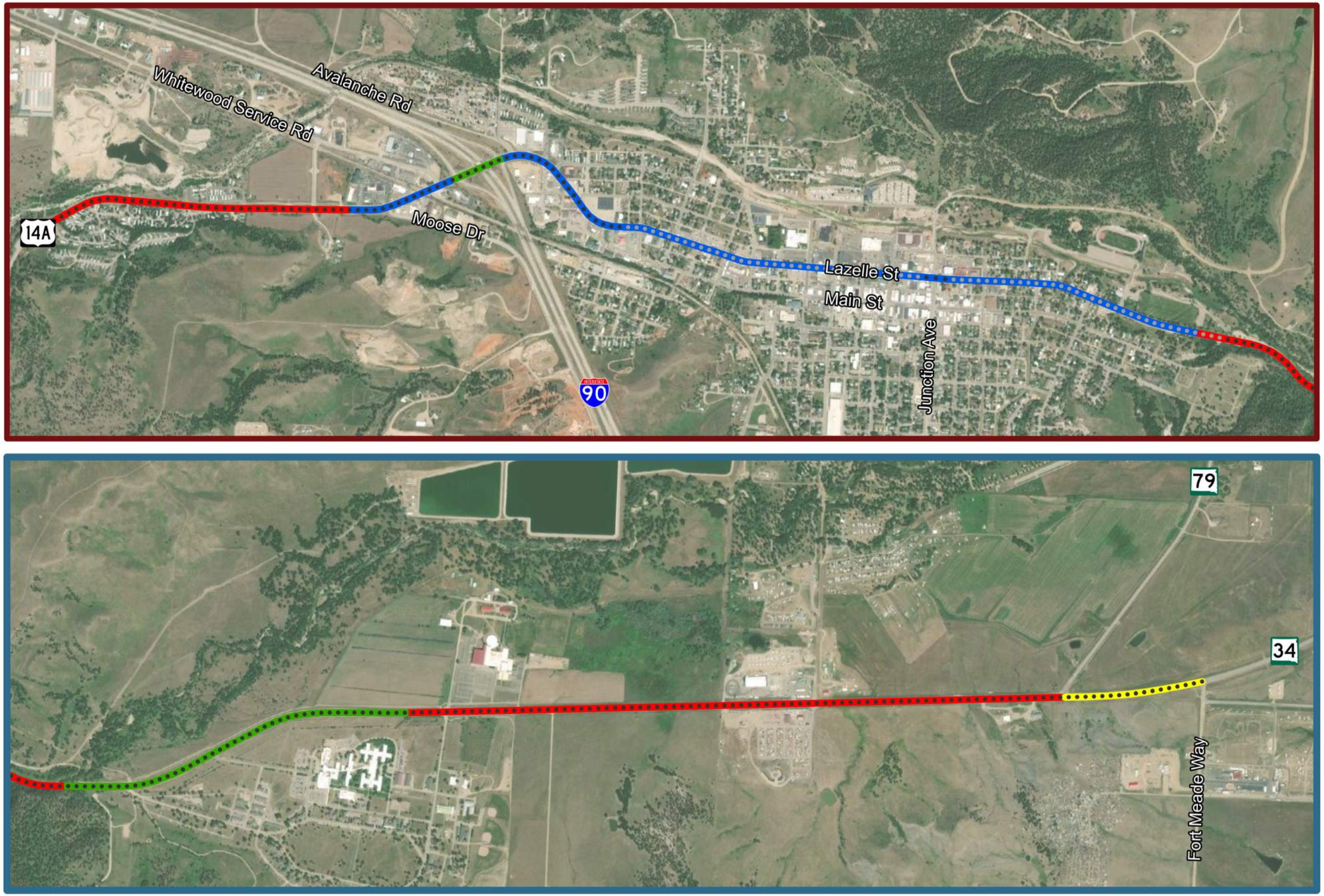
- Existing roadway sections (**Figure 8**)
- Intersection lane configurations and traffic control (**Figure 9a and 9b**)
- Right-of-way widths (**Figure 10**)
- Existing pavement type and condition (**Figure 11**)
- Intersection sight distance, including turns to and from minor roads (**Appendix B**)
- Horizontal curvature (**Figure 12**) and associated superelevation rates (**Table 2**)

Table 2 – Horizontal Curve Data

Curve No.	Existing Radius	Existing Superelevation Rate	Meet Posted Speed Limit Criteria?	Meet 5 mph Above Posted Criteria?
1	849 ft.	6.0%	Yes	Yes
2	5,730 ft.	2.0%	Yes	Yes
3	849 ft.	Normal Crown	Yes	Yes
4	637 ft.	Normal Crown	Yes	No
5	509 ft.	Normal Crown	No	No
6	478 ft.	No Data (0.0%) *	No	No
7	573 ft.	No Data (Normal Crown) *	Yes	No
8	573 ft.	No Data (Normal Crown) *	Yes	No
9	2,865 ft.	No Data (3.0%) *	Yes	Yes
10	955 ft.	No Data (5.6%) *	Yes	Yes
11	573 ft.	No Data (10.0%) *	No	No
12	1,146 ft.	No Data (5.2%) *	Yes	Yes
13	1,433 ft.	No Data (4.6%) *	Yes	Yes
14	1,433 ft.	No Data (4.6%) *	Yes	Yes
15	6,800 ft.	3.0%	Yes	Yes

2.6 Rally Event Traffic Management

To maintain safe and efficient traffic operations during the Rally, SDDOT developed, and continues to enhance annually, a Rally Traffic Control Plan with the goal to efficiently provide a safe traveling experience for all travelers in and around the Black Hills through the duration of the Rally. Details on SDDOT's efforts to support the 2020 Rally traffic are included in the *Traffic Control Plan Sturgis Rally – 2020 report*, provided as **Appendix C**.



- Four-Lane Undivided
- Five-Lane with TWLTL
- Four-Lane Divided
- Two-Lane
- 9' Lanes
- 12' Lanes

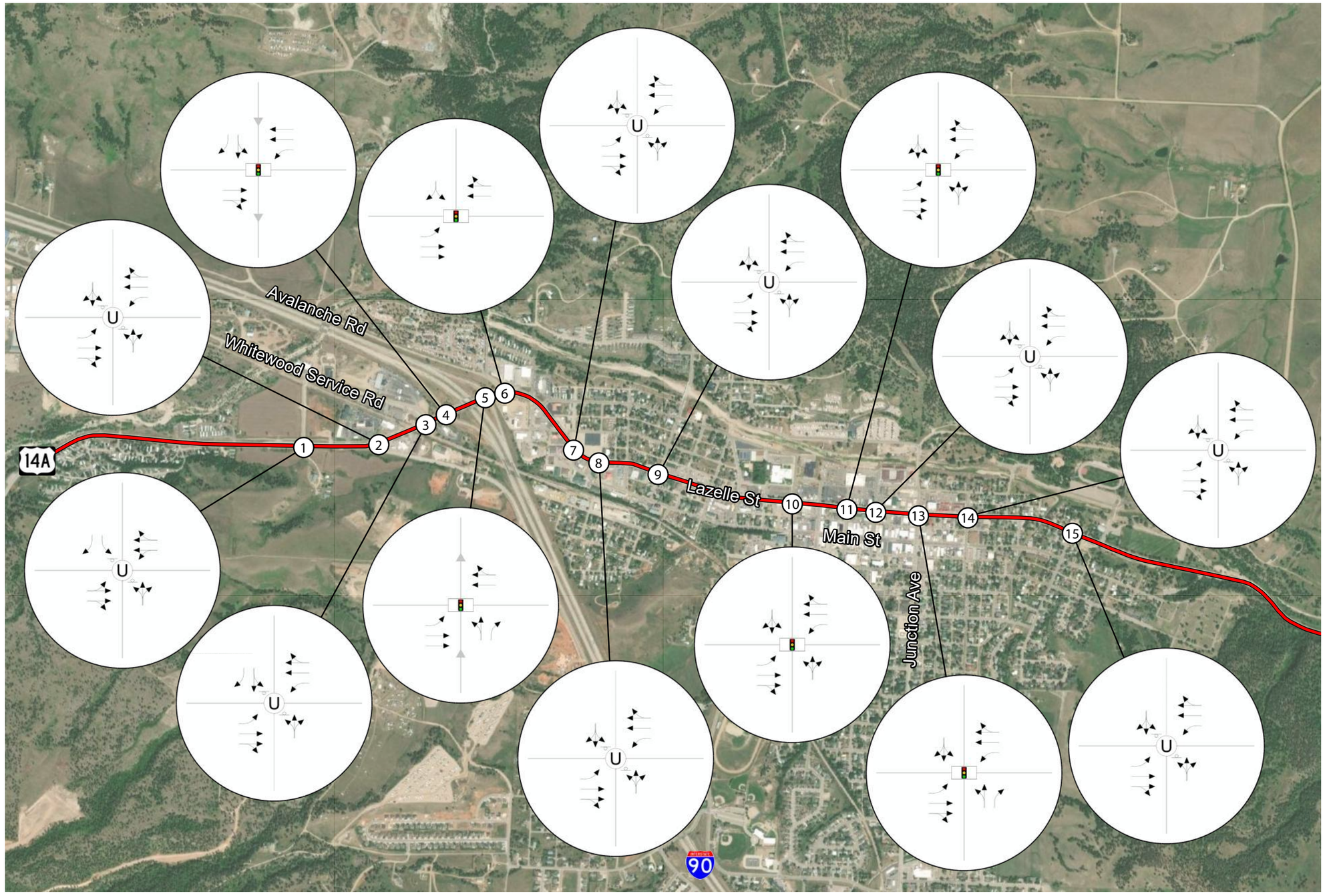
*See Figure 9 for Intersection Lane Configurations

N

0 500 1000 2000 US Feet

Figure 8

Existing Roadway Typical Sections



(#) Study Area Intersections
Project Corridor
Signalized Intersection
U Unsignalized Intersection
Approach Movements

N

0 500 1000 2000
Feet

Figure 9a

Existing Intersection Lane Configurations and Traffic Control

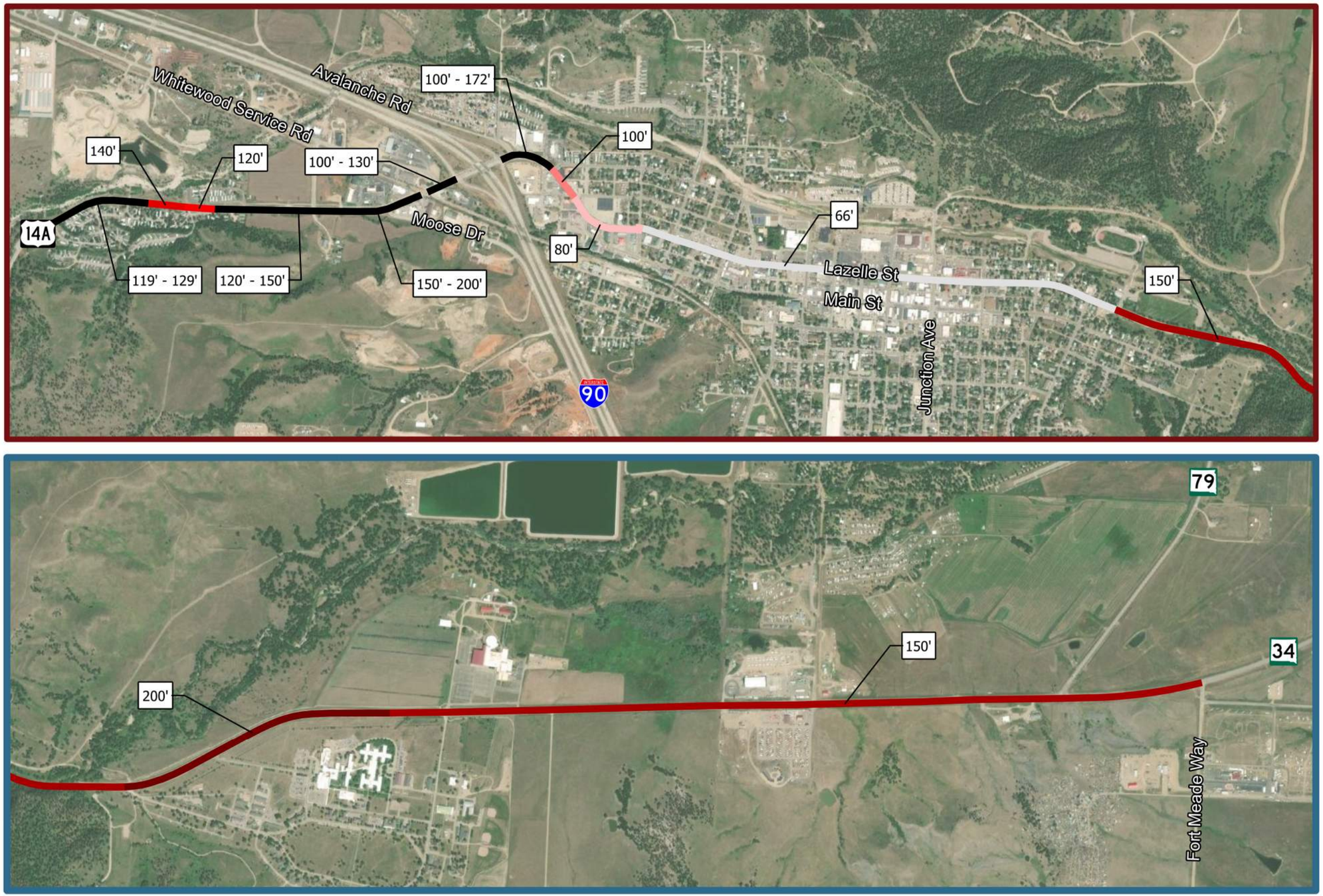
- (#) Study Area Intersections
- Project Corridor
- Signalized Intersection
- (U) Unsignalized Intersection
- Approach Movements

N

0 500 1000 2000 Feet

Figure 9b

Existing Intersection Lane Configurations & Traffic Control



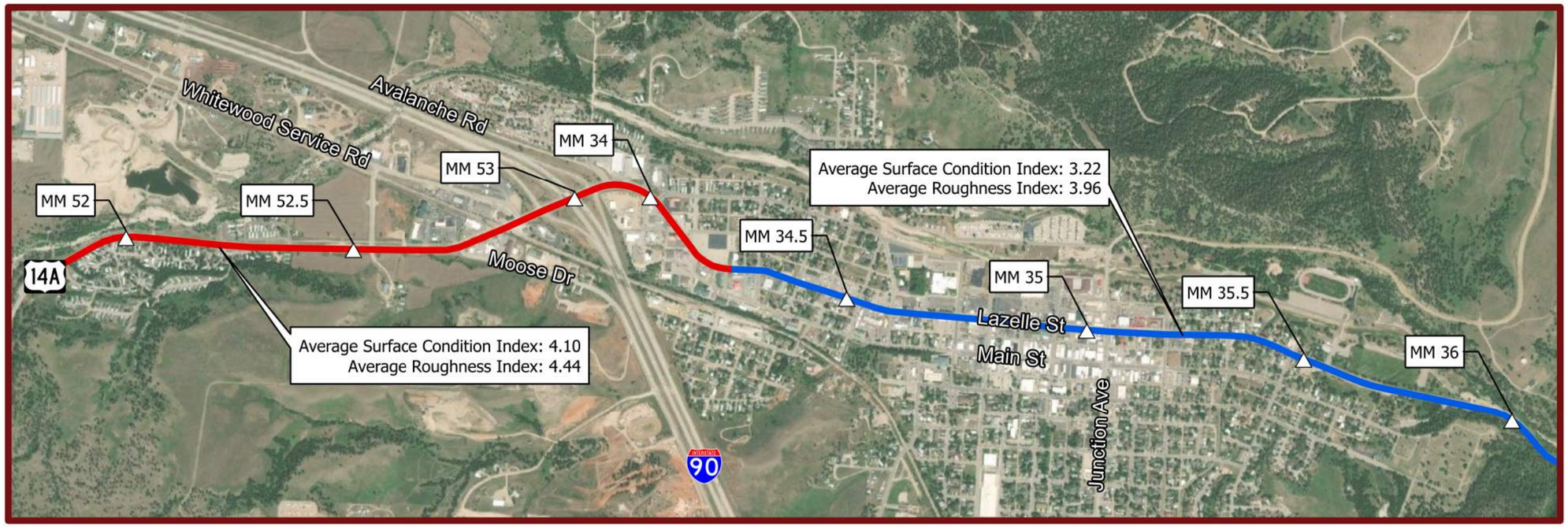
66' ROW Width
80' ROW Width
100' ROW Width
120' ROW Width
140' ROW Width
150' ROW Width
200' ROW Width
ROW Width Varies

N

0 500 1000 2000
US Feet

Figure 10

Existing Right-of-Way



Concrete
Bituminous with Concrete Curb & Gutter
Bituminous
Mile Markers

N

0 500 1000 2000
US Feet

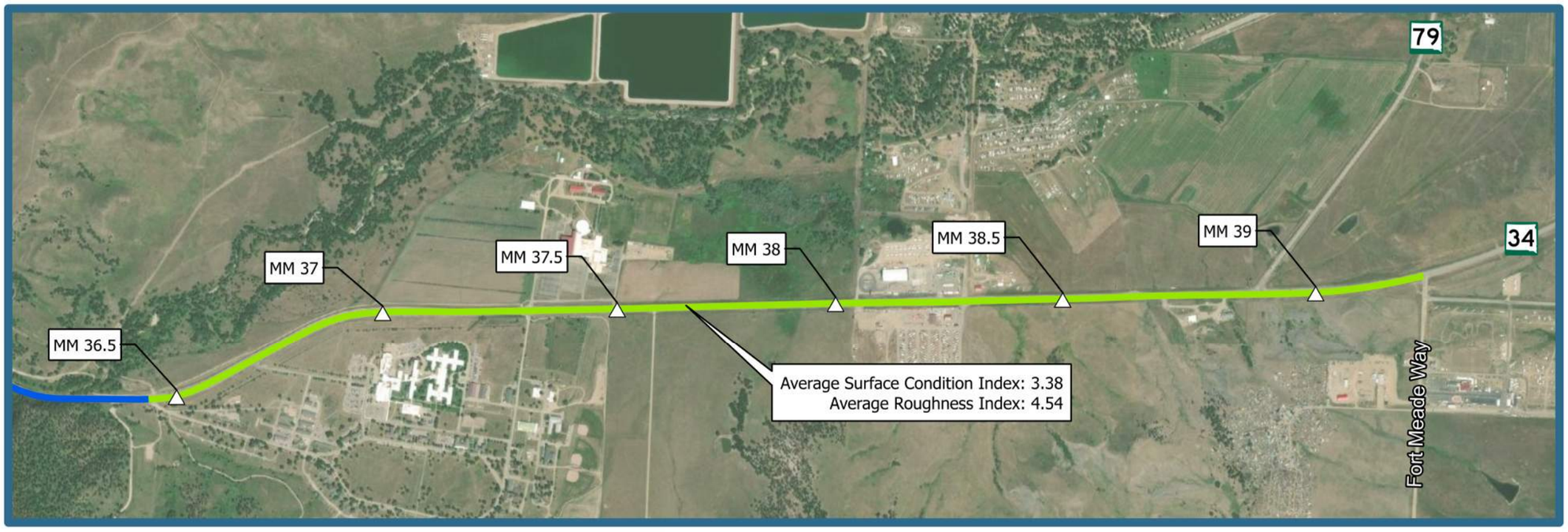


Figure 11

Existing Pavement Type & Condition

Project Corridor

N

0 500 1000 2000
US Feet

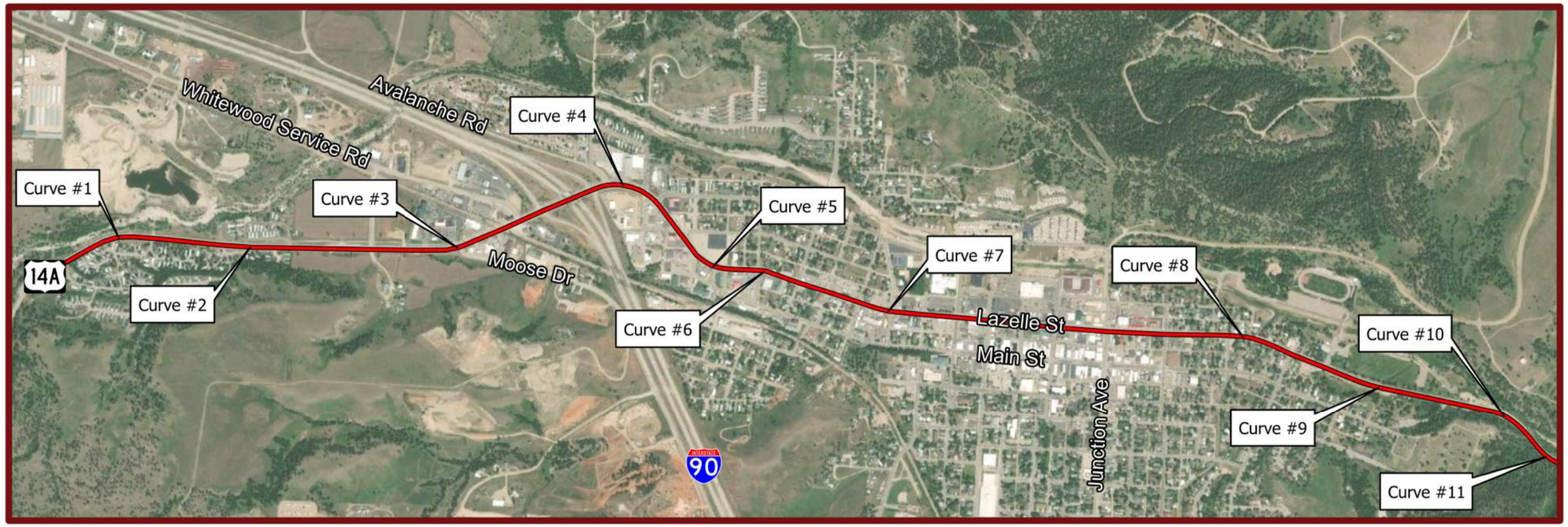


Figure 12

Horizontal Curves

2.7 ITS Infrastructure

SDDOT has implemented intelligent transportation systems (ITS) technology throughout the state to improve operations and safety and provide enhanced traveler information. Details on the existing ITS infrastructure along the study corridor may be found in the *Intelligent Transportation Systems (ITS) Assessment* technical memo, provided as **Appendix D**.

Current ITS technology used within the study corridor include:

- Permanent dynamic message signs (DMS) eastbound and westbound in advance of the I-90 exits to Sturgis
- During the Rally, a mix of portable DMS, speed sensors, and queue detection technology
- During the Rally, a network of arterial monitoring cameras is used at select signalized intersections to support communications infrastructure

The City of Sturgis and SDDOT both utilize fiber optic communications; **Figure 13** illustrates the combined state/city ITS network in proximity to the study corridor.

2.8 Multi-Modal Facilities

Various multi-modal facilities within the study corridor were inventoried to provide an assessment of the existing conditions. These facilities include:

- Trails and sidewalks, including pedestrian crossings, as illustrated in **Figure 14**
- Transit
- Railroad

2.9 Utilities

Private utility companies along the project corridor were invited to provide feedback as part of the corridor study. Engaged facilities included:

- Black Hills Energy (Power)
- Butte Electric Cooperative (Power)
- Montana-Dakota Utilities (Gas)
- Midcontinent Communications (Telecomm)
- SDN Communications (Fiber-Optic Communications)
- Vast Broadband (Telecomm)
- WBI Energy (Gas)

More detail on the information summarized in the Existing Conditions section of this report may be found in the *Existing Conditions Assessment* report, provided as **Appendix B**.

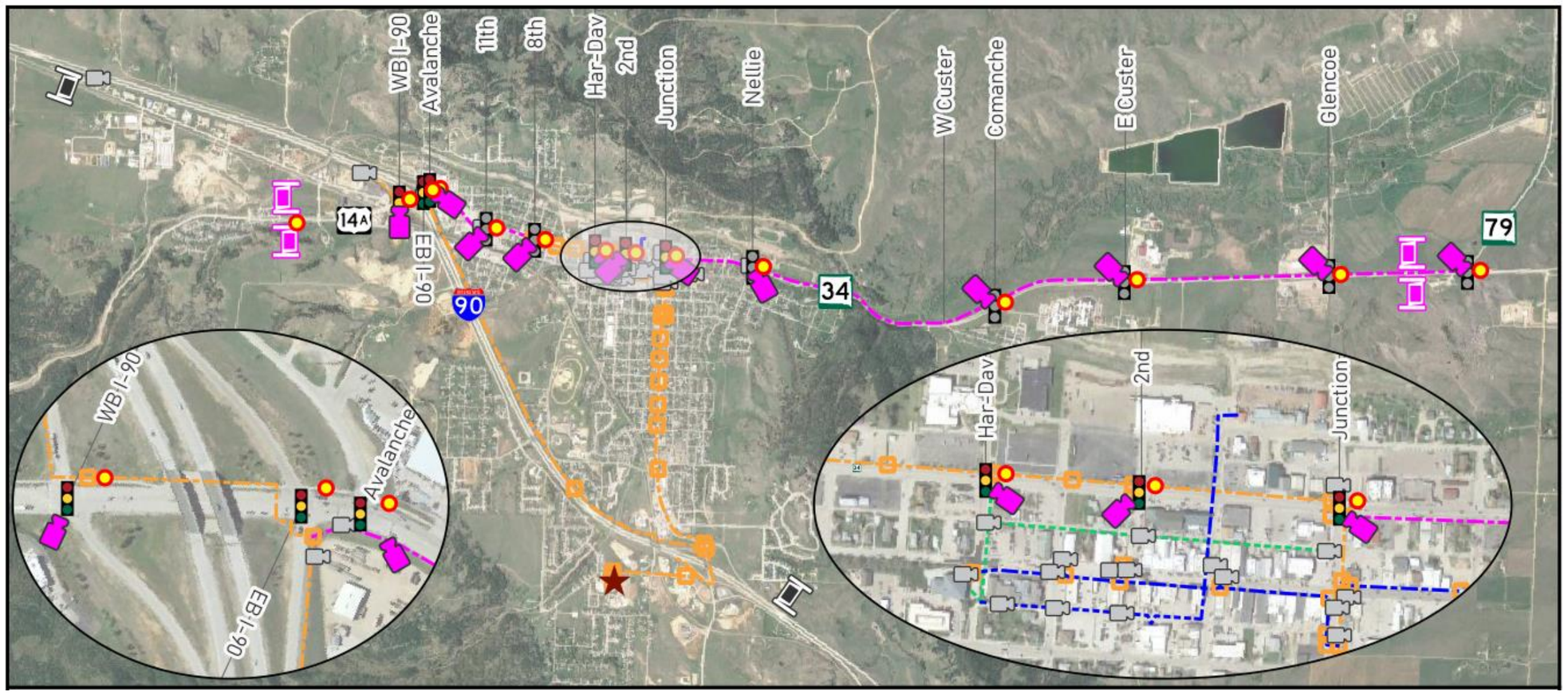
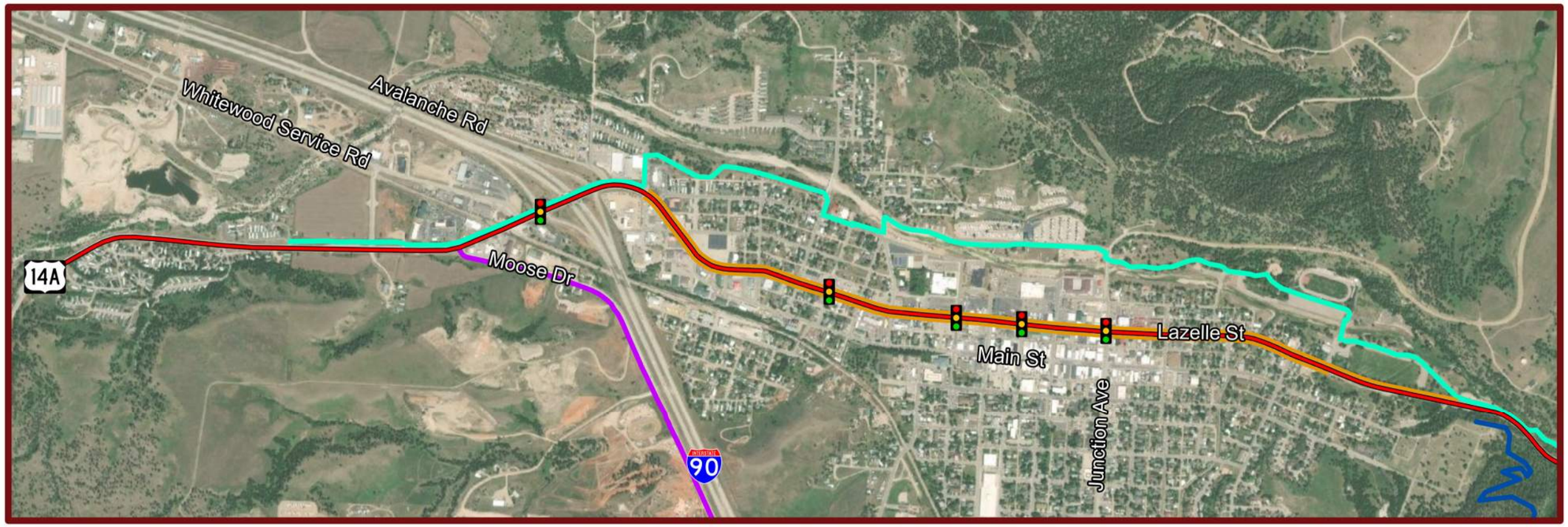


Figure 13

Existing ITS Network



Project Corridor
Centennial Bike Path
Moose Drive Bike Path
Fort Meade Trail
Seventh Cavalry Trail
Signalized Crossing
Unsignalized Crossing
Existing Sidewalk

N

0 500 1000 2000
US Feet

Figure 14

Existing Pedestrian and Bicycle Facilities

2.10 Traffic Operations & Safety Analysis

2.10.1 Intersection and Corridor Operations

Traffic operations analyses for project area intersections and corridor segments were performed in accordance with methodologies defined in the project's *Methods and Assumptions* document provided as **Appendix A**. The measure of effectiveness (MOE) used for this analysis was Level of Service (LOS). LOS is a qualitative assessment of the highway's operating conditions and relates to a measurement reflecting the relative ease of traffic flow on a scale of A through F.

The results of this exercise indicate that for existing (2021) conditions, the intersection of Lazelle Street & Junction Avenue does not satisfy LOS criteria as the northbound right-turn lane operates at LOS D during the AM Peak time period. Additionally, operational issues were observed along Junction Avenue between the signalized intersection at Lazelle Street and the all-way stop intersection at Main Street.

A summary of this evaluation is provided in the *Existing Conditions Assessment* report, provided as **Appendix B**.

2.10.2 Turn Lane Warrants

To determine needs for left-turn and right-turn lanes at intersections along the project corridor, both SDDOT guidelines (for signalized and unsignalized intersections) and the National Cooperative Highway Research Program (NCHRP) Report 457: Evaluating Intersection Improvements: An Engineering Study Guide were evaluated. A summary of this evaluation is provided in the *Existing Conditions Assessment* report, provided as **Appendix B** which illustrates that turn lane criteria is satisfied at the study corridor intersections of Whitewood Service Road (westbound right-turn lane) and Comanche Road (eastbound right-turn lane and westbound left-turn lane).

2.10.3 Crash History

A review of reported crashes for the years 2016-2020 was performed to assess the level of safety along the project corridor. From this review, a total of 206 crashes were reported along the project corridor, 106 of which were at, or influenced by, one of the 22 study area intersections. Of the remaining 100 crashes, 26 were at other intersections along the study corridor while the remaining 74 crashes were along street segments within the study corridor, but between intersections. Furthermore, of the 206 crashes, 36 occurred during one of the motorcycle rallies in 2016-2020.

Of all the intersection crashes, only two study corridor intersections experienced an average of two or more crashes per year over the five-year reporting period. These include the intersection at Moose Drive, which experienced a total of 10 reported crashes during this five-year period, and the intersection at Junction Avenue which experienced a total of 12 reported crashes during the same time period. All study corridor intersections experienced a crash rate less than one crash per million entering vehicles except for the intersection at Fort Meade Way which experienced a rate of 1.39 crashes per million entering vehicles. A summary of this evaluation is provided in the *Existing Conditions Assessment* report, provided as **Appendix B**.

3.0 Traffic Forecasts

The methodology to develop future traffic volumes is documented in the project's *Methods and Assumptions* document, provided as **Appendix A**. Future traffic volumes were developed for the following year scenarios:

- Year 2028 – first year of anticipated construction
- Year 2040
- Year 2050

In addition to increased traffic volumes based on general population growth and historic traffic volume changes, future traffic forecasts developed for this corridor study also take into consideration anticipated traffic generated by a proposed and active residential development along Avalanche Road, west of the study corridor. This proposed development is residential in nature and at full build-out, is proposed to consist of more than 600 single-family units and more than 350 multi-family units. Year 2028, 2040, and 2050 AM and PM peak traffic volumes and detailed information regarding the overall volume forecasting process are provided in the *Future Traffic Volume Projections* technical memo provided as **Appendix E**.

4.0 Future No-Build Analysis

For this study, "no-build" represents the existing transportation system being evaluated under various future traffic volume conditions. These conditions, or horizon years, were 2028, 2040, and 2050. Detailed information on the "no-build" analysis was incorporated into the *Future No-Build Traffic Operations Analysis* technical memo provided as **Appendix F** and the *Predictive Safety Analysis of* ***Feasible*** *Alternatives* technical memo, provided as **Appendix G**.

4.1 Traffic Operations Analysis

Traffic operations analyses for project area intersections and corridor segments were performed in accordance with methodologies defined in the project's *Methods and Assumptions* document provided as **Appendix A**. The measure of effectiveness (MOE) used for this analysis is Level of Service (LOS), which is a qualitative assessment of a highway's operating conditions and relates to a measurement reflecting the relative ease of traffic flow on a scale of A through F. The result of this exercise indicates:

- The corridor intersections with Avalanche Road and Junction Avenue are anticipated to exceed the LOS thresholds identified in the M&A document.
- Eight (8) study corridor intersections with two-way stop control are anticipated to exceed the target LOS thresholds in future years. In all cases, this is due to one side street approach, or movement, exceeding LOS D.
- It should be noted that additional microsimulation analysis is needed to better evaluate the effects of turn bay overflow and queue spill back on adjacent through-lane movements and upstream intersections.
- Multiple intersection approaches satisfy either, or both, SDDOT or National Cooperative Highway Research Program (NCHRP) criteria for left- and right-turn lanes.

Detailed information on intersection LOS, queuing, and turn lane evaluation results is provided in the *Future No-Build Traffic Operations Analysis* technical memo provided as **Appendix E**.

4.2 Safety Analysis

A predictive crash analysis was completed based on methods of the Highway Safety Manual (HSM). The purpose of the HSM is to measure different alternatives in quantitative terms of expected crash frequency to allow for a level comparison of safety with respect to the no-build scenario. The Interactive Highway Safety Design Model (IHSDM) software was the tool used to evaluate safety in the "no build" and "build" scenarios. Detailed information on the predictive crash analysis results for the no-build condition is available in the *Predictive Safety Analysis of* ***Feasible*** *Alternatives* technical memo, provided as **Appendix F**.

5.0 Identification of Needs

The identification of needs process built upon corridor deficiencies as reported in the *Existing Conditions Assessment* report, provided as **Appendix B** and the *Future No-Build Traffic Operations Analysis* technical memo, provided as **Appendix E**. Additionally, SAT review and discussion with the consultant study team and input received from the first public meeting in October 2021 was critical to the identification process.

5.1 Summary of Deficiencies

Detailed information and figures further documenting the following deficiencies may be found in the *Existing Conditions Assessment* report, provided as **Appendix B**.

- Surface condition
  - Pavement types and surface condition and roughness (or rideability) along the study corridor fall below standard
- Lane width
  - Lanes from 11th Street to Regency Street fall below standard
- Right-of-way (ROW) width
  - ROW widths from 10th Street to Blanche Street fall below City of Sturgis standard
- Horizontal curvature
  - Roadway horizontal curves, including superelevation rates, fall below standard
- Intersection sight distance
  - Five locations fall below standard
- Traffic operations
  - Intersection movements falling below the identified LOS thresholds, turn-lane warrant criteria, and/or excessive vehicle queuing turn or lanes that fall below minimum standard length
- Intersection Spacing
  - Spacing between signalized intersections and between unsignalized intersections that does not satisfy DOT criteria
- Access Density
  - West of 20th Street and along the entire project corridor east of the east city limit fall below standard
- Bicycle and pedestrian facilities
  - Narrow and immediately at the back of curb sidewalk space along Lazelle Street between 13th Street and Blanche Street
  - Lack of designated bicycle and pedestrian crossings near mid-eastern portion of project corridor
- Technology
  - Improvements needed to enhance special event traffic management
- Corridor Aesthetics
  - Identified as a priority by members of the SAT to enhance the existing corridor

6.0 Development of Alternatives

The process for developing alternatives began through the recognition that the deficiencies and needs could be grouped into unique geographic sections throughout the study corridor. As a result, eight segments were developed for which solutions and ultimately project alternatives, were grouped. Details of these segment deficiencies and needs, and a host of additional information regarding the alternatives were documented in the *Summary of Feasible Alternatives* technical memo, provided as **Appendix H**. Details on the aesthetics components developed for the study corridor were documented in the *Aesthetics, Streetscape and Entryways* technical memo, provided as **Appendix I**. A condensed summary of these segments and their alternatives is provided below.

6.1 Segment A: US14A (West City Limits to Moose Drive)

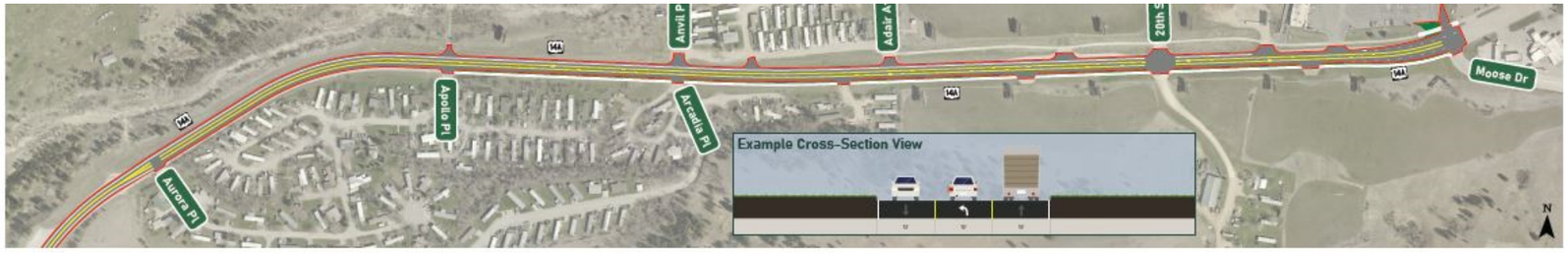
US14A is presently an undivided, four-lane highway/street from the west city limit of Sturgis to Moose Drive.

Identified deficiencies include reduced traffic flow and safety due to the number of access locations, and reduced traffic flow and safety from left-turning movements occurring within through-movement travel lanes. The evaluation of these deficiencies led to the development of the following alternatives, as illustrated in **Figure 15**:

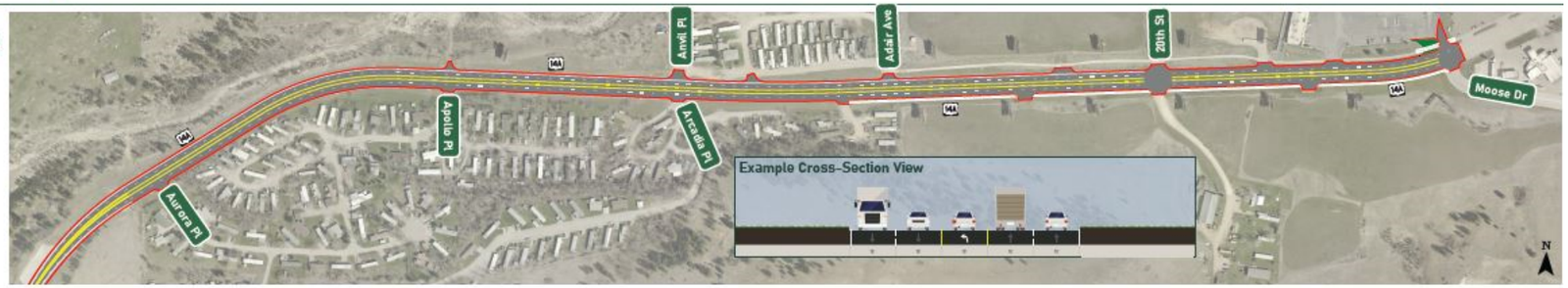
- A0: No-build
- A1: Three-lane
  - One travel lane in each direction with center left-turn lane
- A2: Five-lane
  - Two travel lanes in each direction with center left-turn lane
- A3: Four-lane Divided (Raised Median) with Turn Lanes
  - Two travel lanes in each direction with raised center median and select left-turn lanes

Figure 15 – Segment A: US14A (West City Limits to Moose Drive) Alternatives

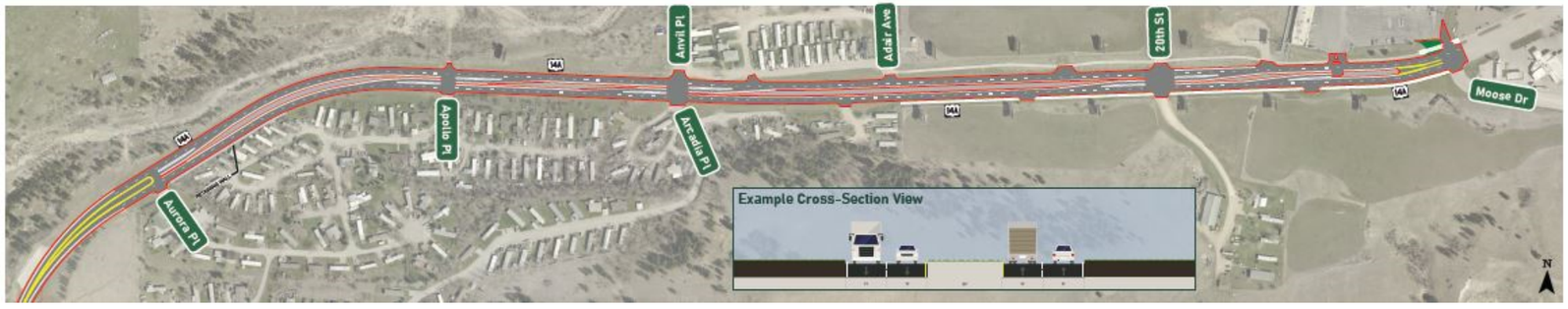
A1: Three-Lane



A2: Five-Lane



A3: Four-Lane with Raised Median



6.2 Segment B: Avalanche Road Development

Alternatives associated with these segments were developed to address deficiencies generated by the proposed residential development along Avalanche Road described previously in this report. The anticipated traffic generated by this development results in additional vehicle delays at multiple intersections and adds to existing and future traffic operations inefficiencies resulting from closely spaced signalized intersections at and near Exit 30. The evaluation of these deficiencies led to the development of the following alternatives, as illustrated in **Figure 16**:

- B0: No-build
- B1: I-90 Viaduct
  - Viaduct spanning I-90 connecting to proposed residential development
- B2: Avalanche Road Realignment (Option 1)
  - New roadway realigning Avalanche Road along north side of Bear Butte Creek
- B3: Avalanche Road Realignment (Option 2)
  - New roadway realigning Avalanche Road to Silver Street

6.3 Segment C: Exit 30 and Avalanche Road Intersections

This corridor segment is presently a five-lane section of Lazelle Street with closely-spaced signalized intersections at the Exit 30 eastbound ramps, westbound ramps, and Avalanche Road.

Identified deficiencies include vehicular delays resulting from future traffic volume growth along the corridor, traffic congestion at signalized intersections at and near I-90 (Exit 30), and existing traffic signals not satisfying current SDDOT design criteria for signalized intersection spacing. The evaluation of these deficiencies led to the development of the following alternatives, as illustrated in **Figure 17**:

- C0: No-build
- C1: Intersection Improvements
  - Improvements to the existing intersection locations, and signalized traffic control with right-turn lanes added on the eastbound approach of the eastbound ramps; the westbound approach of the westbound ramps; and the westbound approach at Avalanche Road
- C2: Westbound On-Ramp Folded Diamond
  - Relocation of I-90 westbound ramps to Avalanche Road intersection
- C3: Single-Point Urban Interchange (SPUI)
  - Reconstruction of Exit 30 interchange into a SPUI
- C4: Diverging Diamond Interchange (DDI)
  - Reconstruction of Exit 30 interchange into a DDI

In terms of the intersections that experience benefit, there is commonality between alternatives of segments B and C such that when evaluating alternatives, these two segments were considered collectively.

Figure 16 – Segment B: Avalanche Road Development Alternatives

B1: Interstate 90 (I-90) Viaduct

B2: Avalanche Road Realignment No. 1

B3: Avalanche Road Realignment No. 2

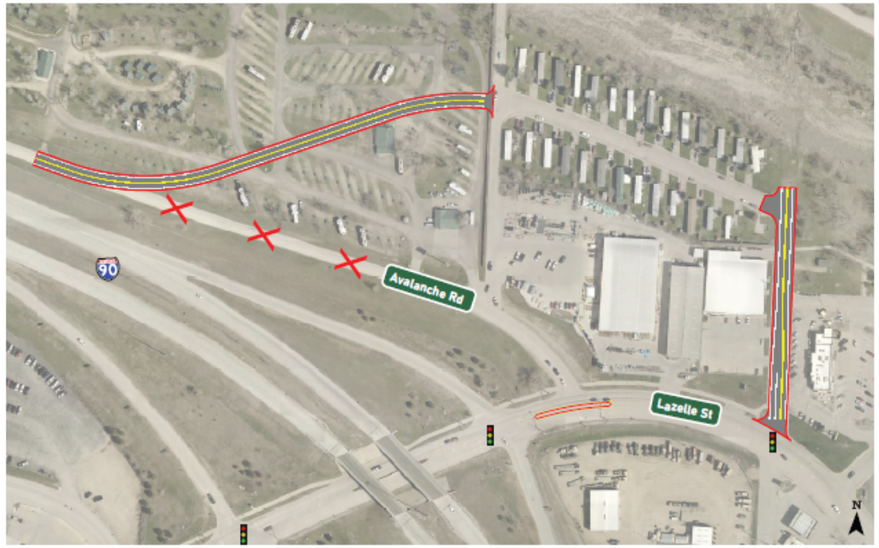
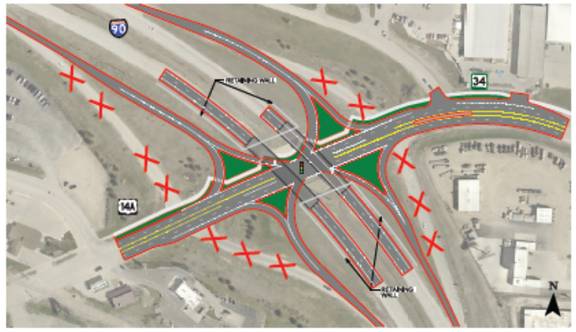


Figure 17 – Segment C: Exit 30 and Avalanche Road Intersections Alternatives

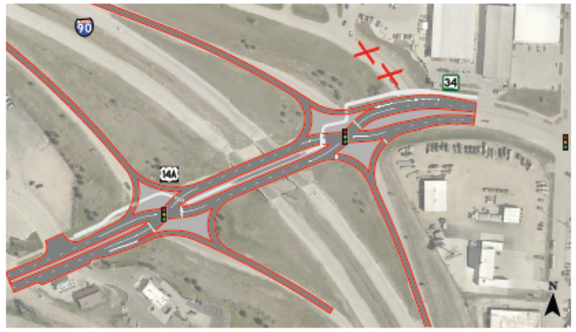
C1: Intersection Improvements

C2: Westbound On-ramp Folded Diamond

C3: Single-point Urban Interchange (SPUI)



C4: Diverging Diamond Interchange (DDI)



6.4 Segment D: Lazelle Street Urban Area (Main Street to Blanche Street)

Presently, this corridor segment is a five-lane section of Lazelle Street, from Main Street to Blanche Street, with excessively narrow (9-ft) existing travel lanes.

Identified deficiencies include existing travel lanes do not satisfy current SDDOT design criteria for lane width, traffic congestion at signalized intersections, poor bicycle and pedestrian mobility, and reduced traffic flow and safety with current quantity and spacing of street access points. The evaluation of these deficiencies led to the development of the following alternatives, as illustrated in **Figure 18**:

- D0: No-build
- D1: Three-lane
  - One travel lane in each direction with center left-turn lane
- D2: Four-lane Undivided
  - Two travel lanes in each direction with no center turn lane; opposing directions of travel are divided simply by a double-yellow line and left-turn movements must occur from the inside through lane of travel
- D3: Five-lane
  - Two travel lanes in each direction with center left-turn lane
- D4: Five-lane (west of Middle Street) / 4-lane Divided w/o Turn Lanes (east of Middle Street)
  - Two travel lanes in each direction with center left-turn lane west of Middle Street and a four-lane section divided by a 4-ft median east of Middle Street; within the divided section, left-turns to and from side streets and driveways would be prohibited
- D5: Five-lane Offset Alignment
  - Two travel lanes in each direction with center left-turn lane with alignment shifted six feet to the north, east of 9th Street

Figure 18 – Segment D: Lazelle Street Urban Area (Main Street to Blanche Street) Alternatives

D1: 3-Lane

D2: 4-Lane

D3: 5-Lane

D4: 5-Lane (west of Middle St) and 4-Lane Divided without turn lanes

D5: 5-Lane Offset Alignment

6.5 Segment E: S-Curves

This corridor segment is presently a four-lane undivided section of SD34 from Regency Street to Custer Avenue. Identified deficiencies include horizontal curvature that does no satisfy current SDDOT design criteria, road overtopping and poor drainage of stormwater caused by flooding from the adjacent Bear Butte Creek, and roadway icing due to hillside shade effects. The evaluation of these deficiencies led to the development of the following alternatives, as illustrated in **Figure 19**:

- E0: No-build
- E1: Raised Vertical Profile
  - Three-feet elevation raise on existing alignment
- E2: Realignment (Option 1)
  - Realignment beginning at the west end of the existing S-Curve, tangent to existing SD34, and connecting to the existing highway alignment east of Comanche Road. At Comanche Road, left-turn and right-turn lanes would be constructed. This alternative would require two structures to be built over Bear Butte Creek
- E3: Realignment (Option 2)
  - Realignment beginning at the west end of the existing S-Curve, tangent to existing SD34, and connecting to the existing highway alignment west of Custer Avenue (east). Additionally, Custer Avenue (west) could be realigned and connect to Horse Soldier Road, thus reducing one access point within this segment. At Comanche Road, left-turn and right-turn lanes would be constructed. This alternative would require two structures to be built over Bear Butte Creek.

6.6 Segment F: Ft. Meade/VA Hospital

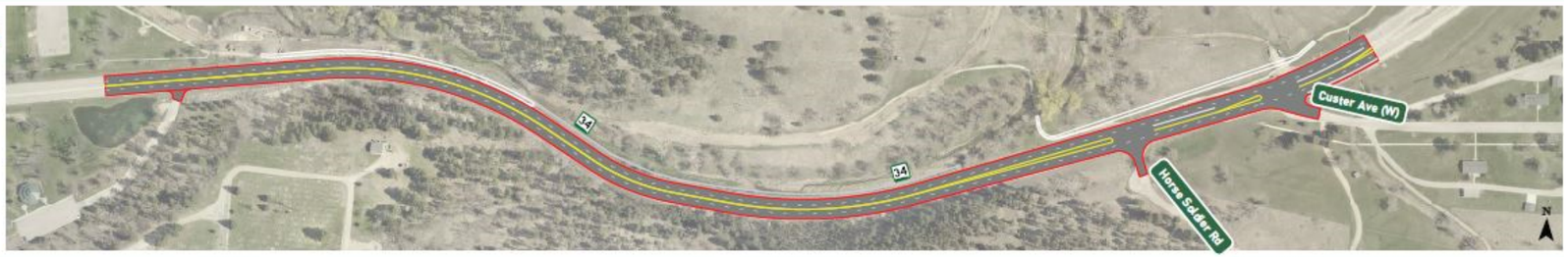
This corridor segment consists of three roadway connections of the Fort Meade VA Hospital area to SD34 including Custer Avenue (west), Comanche Road, and Custer Avenue (east), the latter of which also provides access to Sturgis Brown High School on the north side of SD34.

Identified deficiencies include traffic delays within the Fort Meade VA Hospital segment of the corridor, and skewed approaches between SD34 and both Custer Avenue (west) and Comanche Road. The evaluation of these deficiencies led to the development of the following alternatives, as illustrated in **Figure 20**:

- F0: No-build
- F1: Intersection Improvements
  - Added turn lanes, as warranted by SDDOT criteria, at each of the three intersections: including an eastbound offset right-turn lane at all three intersections and a westbound left-turn lane at the Comanche Road intersection.
- F2: Realign Comanche Road
  - Realignment with eastbound offset right-turn lane and westbound left-turn lane
- F3: Custer Avenue (east)
  - Added right-turn lanes and traffic signal control
- F4: Reduced Conflict Intersections (RCIs)
  - Construction of RCIs to allow left-turning movement from SD34. Through and left-turning movements across or onto SD34 would require a right-turn and U-turn

Figure 19 – Segment E: S-Curves Alternatives

E1: Raised Vertical Profile

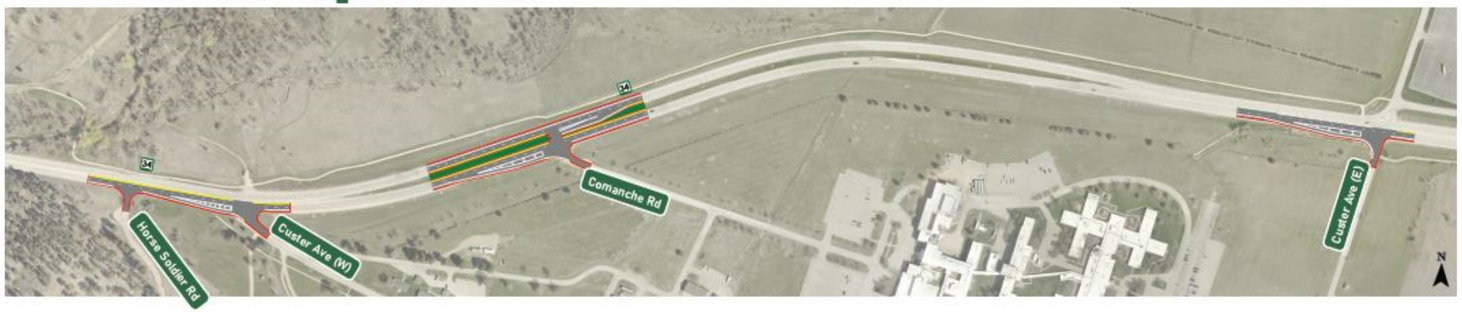


E2: S Curves Realignment No. 1

E3: S Curves Realignment No. 2

Figure 20 – Segment F: Ft. Meade/VA Hospital Alternatives

F1: Intersection Improvements



F2: Comanche Road Realignment

F3: Custer Avenue East

F4: Reduced Conflict Intersections

6.7 Segment G: SD34 (Ft. Meade to SD79)

Presently, this corridor segment is primarily an undivided, four-lane section of SD34 from near the Fort Meade/VA Hospital area to SD79.

Identified deficiencies include reduced safety along a high-speed highway with multiple access locations, and reduced traffic safety from left-turning movements occurring from the through-movement travel lanes. The evaluation of these deficiencies led to the development of the following alternatives, as illustrated in **Figure 21**:

- G0: No-build
- G1: Divided Highway with Depressed Median
  - Four-lane divided highway with depressed center median
- G2: Divided Highway with Depressed Median and Cable Median Barrier
  - Four-lane divided highway with depressed center median and cable median barrier

6.8 Segment H: Junction Avenue (Lazelle Street to Main Street)

This corridor segment is located just off the Lazelle Street corridor alignment. However, Junction Avenue, between Lazelle Street and Main Street influences and is influenced by traffic operations along the study corridor of Lazelle Street.

Identified deficiencies include poor intersection geometrics at the intersection of Lazelle Street & Junction Avenue, and deficient intersection operations along Junction avenue, between Lazelle Street and Main Street. The evaluation of these deficiencies led to the development of the following alternatives, as illustrated in **Figure 22**:

- H0: No-build
- H1: Geometric Improvements at Lazelle Street & Junction Avenue
  - Modifications to curb return radii to better accommodate paths of turning vehicles
- H2: Junction Avenue & Main Street – Roundabout
  - Construction of a single-lane roundabout at the intersection
- H3: Junction Avenue & Main Street – Two-way Stop Control
  - Removal of existing stop control on the northbound and southbound (Junction Avenue) approaches
- H4: Junction Avenue & Main Street – Signalization
  - Construction of a traffic signal at the intersection of Junction Avenue & Main Street

Figure 21 – Segment G: SD 34 (Ft. Meade to SD79) Alternatives

G1: Divided Highway with Depressed Median

G2: Divided Highway with Depressed Median and Cable Median Barrier

Example Cable Median Barrier

Figure 22 – Segment H: Junction Avenue (Lazelle Street to Main Street) Alternatives

H1: Geometric Improvements at Lazelle St & Junction Ave

H2: Junction Ave & Main St Roundabout

H3: Junction Ave & Main St Two-way Stop

H4: Junction Ave & Main St Signalized Intersection

7.0 Alternatives Analysis

The project alternatives for corridor segments A through H were analyzed through multiple technical evaluations. An *Alternative Evaluation Matrices* technical memo, as provided as **Appendix J,** was prepared based on a compilation of these technical evaluations.

The following criteria were evaluated to quantify the ability for potential project alternatives to address the defined deficiencies and to compare those potential project alternatives.

- Satisfies Purpose and Need
  - Preliminary Purpose and Need statements were identified as summarized in the *Summary of Feasible Alternatives* technical memo, provided as **Appendix G**
- Benefit-Cost (B/C) Ratio
  - Values resulting from the B/C analysis as summarized in the *Benefit to Cost Analysis of Feasible Alternatives* technical memo, provided as **Appendix K**
- Traffic Safety
  - This criterion presents the total number of reduced crashes predicted for each alternative as compared to the no-build alternative over the 23-year period 2028 to 2050, including the percentage of both total crashes and Fatal+Injury crashes. More detailed information is shown in the *Predictive Safety Analysis of Feasible Alternatives* technical memo, provided as **Appendix F**
- Traffic Operations
  - This criterion presents the estimated annual vehicle-hours of delay saved, as compared to the no-build alternative. Values for delay saved are reported for the AM and PM peak-hour time periods combined over 250 weekdays in a year and for each of the 2028, 2040 and 2050 horizon years as shown in the *Traffic Operations Analysis of Feasible Alternatives* technical memo, provided as **Appendix L**
- Right-of-Way Impacts
  - Right-of-way impacts in acres and number of total takes (i.e., full property acquisitions)
- Potential Environmental Impacts
  - Potential environmental impacts as summarized in the *Environmental Screening* Report, provided as **Appendix M**
- Floodplain or Floodway Impacts
  - Impacts to Bear Butte Creek and/or Vanocker Creek floodplain and/or floodway
- Constructability, maintenance & operations
  - For both constructability and maintenance and operations, an assessment of complexity is reported for each segment. Assessment scores are as follows: 5-difficult, 3-moderate, 1-simple as summarized in the *Construction Phasing Strategies* technical memo, provided as **Appendix N**
- Multi-modal Considerations
  - Each alternative is subjectively and comparatively scored based on the multi-modal benefits that are derived. Assessment scores are as follows: 5-difficult, 3-moderate, 1-simple.
- Total Project Cost
  - Year 2028 project costs inclusive of construction, right-of-way acquisition, contingency, and engineering as summarized in the *Summary of Feasible Alternatives* technical memo, provided as **Appendix G**

- Public Input
  - Key public input collected at the June 21, 2022, public meeting More detailed information on the public outreach may be found in the *Public Meeting* reports, provided as **Appendix O**

7.1 Corridor Segment Alternatives Analysis

Tables 3 – 10 summarize the alternatives evaluation analysis of potential project alternatives by corridor segment.

Table 3 – Segment A: US14A (West City Limits to Moose Drive)

Build Alternative	Satisfies Purpose & Need		B/C Ratio	Traffic Safety	Traffic Operations	Right-of-Way Impacts	Potential Environmental Impacts	Floodplain or Floodway Impacts	Constructability, maintenance & operations	Multi-modal Considerations	Total Project Cost (2028 $)	Public Input
	Improve Safety	Improve Traffic Operations		Reduced Crashes 2028-2050	Annual Reduced Delay (vehicle-hours)				5 – Difficult 3 – Moderate 1 - Simple	5 – Significant 3 – Moderate 1 – Minimal		
Alternative A1: 3-lane	Yes	Yes	1.61	Total: 26.53 33.6% Fatal+Injury: 12.77 43.0%	2028: 9 2040: 5 2050: 12	No ROW Acquisition	HAZMAT: Known spills and inactive tank site SECTION 4(F): Multiple existing bike paths and proposed bike path T&E: Potential impacts to species.	Impacts to Bear Butte Creek Floodplain	Constructability: 1 Maintenance & Operations (0.9 Miles): 1	3 Includes short segment of additional sidewalk	$4.5 Million	No major risks identified; supported through public comments
Alternative A2: 5-lane	Yes	Yes	0.43	Total: 4.76 6.0% Fatal+Injury: 4.53 15.3%	2028: 14 2040: 15 2050: 30	No ROW Acquisition	SOCEOECONOMIC: Alternative would displace 6 properties HAZMAT: Known spills and inactive tank site SECTION 4(f): Multiple existing bike paths and proposed path T&E: Potential impacts to species	Impacts to Bear Butte Creek Floodplain	Constructability: 3 Maintenance & Operations (0.9 Miles): 1	3 Includes short segment of additional sidewalk	$5.7 Million	No major risks identified; supported through public comments
Alternative A3: 4-lane Divided with Turn Lanes	Yes	Yes	1.26	Total: 33.78 42.7% Fatal+Injury: 14.47 48.7%	2028: 14 2040: 15 2050: 30	No ROW Acquisition	SOCEOECONOMIC: Alternative would displace 6 properties HAZMAT: Known spills and inactive tank site SECTION 4(f): Multiple existing bike paths and proposed path T&E: Potential impacts to species	Impacts to Bear Butte Creek Floodplain	Constructability: 3 Maintenance & Operations (0.9 Miles): 1	3 Includes short segment of additional sidewalk	$6.5 Million	No major risks identified; supported through public comments

Table 4 – Segment B: Avalanche Road Development

Build Alternative	Satisfies Purpose & Need	B/C Ratio	Traffic Safety	Traffic Operations	Right-of-Way Impacts	Potential Environmental Impacts	Floodplain or Floodway Impacts	Constructability, maintenance & operations	Multi-modal Considerations	Total Project Cost (2028 $)	Public Input
	Improve Traffic Operations		Reduced Crashes 2028-2050	Annual Reduced Delay (veh-hours)				5 – Difficult 3 – Moderate 1 - Simple	5 – Significant 3 – Moderate 1 – Minimal		
Alternative B1: I-90 Viaduct	Yes	< 0	Total: -48.66 -16.1% Fatal+Injury: -17.69 -16.6%	2028: 962 2040: 3,664 2050: 4,859	2.43 acres, 1 total take	SOCEOECONOMIC: Alternative would displace multiple properties in a low-income area NWI: Potential impacts to wetland/WOUS resources	Impacts to Bear Butte Creek Floodplain & Floodway	Constructability: 3 Maintenance & Operations (0.5 Miles): 3	NA	$13.8 Million	Risk of controversy based on impacts to businesses/properties identified through stakeholder outreach
Alternative B2: Avalanche Road Realignment (Option 1)	Yes	< 0	Total: -150.56 -49.9% Fatal+Injury: -55.02 -51.6%	2028: 556 2040: 2,715 2050: 3,386	5.05 acres	NWI: Potential impacts to wetland/WOUS resources. T&E: Potential impacts to species SECTION 4(f): Existing bike path and public park in area	Impacts to Bear Butte Creek Floodplain & Floodway	Constructability: 3 Maintenance & Operations (0.93 Miles): 3	NA	$9.1 Million	Risk of controversy based on impacts to businesses/properties identified through stakeholder outreach
Alternative B3: Avalanche Road Realignment (Option 2)	Yes	< 0	Total: -139.25 -46.2% Fatal+Injury: -44.33 -41.6%	2028: 556 2040: 2,715 2050: 3,386	1.87 acres	SOCEOECONOMIC: Alternative would acquire property in a low-income area SECTION 4(f): Existing bike path and public park in area	Impacts to Bear Butte Creek Floodplain	Constructability: 1 Maintenance & Operations (0.31 Miles): 1	NA	$3.5 Million	Risk of controversy based on impacts to businesses/properties identified through stakeholder outreach

Table 5 – Segment C: Exit 30 and Avalanche Road Intersections

Build Alternative	Satisfies Purpose & Need		B/C Ratio	Traffic Safety	Traffic Operations[1]	Right-of-Way Impacts	Potential Environmental Impacts	Floodplain or Floodway Impacts	Constructability, maintenance & operations	Multi-modal Considerations	Total Project Cost (2028 $)	Public Input
	Improve Traffic Operations	Improve Traffic Signal Spacing		Reduced Crashes 2028-2050	Annual Reduced Delay (vehicle-hours)				5 – Difficult 3 – Moderate 1 - Simple	5 – Significant 3 – Moderate 1 – Minimal		
Alternative C1: Intersection Improvements	Yes, however only marginally	No	1.60	Total: 7.99 -5.4% Fatal+Injury: 4.98 8%	2028: 1,003 2040: 4,323 2050: 5,469 Signal spacing: 1	No ROW Acquisition	SECTION 4(f): Existing bike path in area	Impacts to Bear Butte Creek Floodplain	Constructability: 1 Maintenance & Operations (0.2 Miles): 1	1 No change	$3.2 Million	No major risks identified
Alternative C2: Westbound On-ramp Folded Diamond	Yes	Yes	< 0	Total: -25.46 -17.1% Fatal+Injury: -16.27 -26.1	2028: 878 2040: 3,511 2050: 4,296 Signal spacing: 3	0.15 acres 1 total take	SECTION 4(f): Existing bike path in area	Impacts to Bear Butte Creek Floodplain	Constructability: 5 Maintenance & Operations (1.2 Miles): 3	3 Fewer signalized intersections to cross	$14.2 Million	No major risks identified, supported through public comments
Alternative C3: Single-point Urban Interchange (SPUI)	Yes	Yes	1.60	Total: 101.29 68.0% Fatal+Injury: 48.16 77.3%	2028: 3,321 2040: -4,532 2050: -12,284 Signal spacing: 5	No ROW Acquisition	HAZMAT: Known spills sites in area SECTION 4(f): Existing bike path in area	Impacts to Bear Butte Creek Floodplain	Constructability: 5 Maintenance & Operations (0.8 Miles): 3	1 Higher speed vehicle movements for pedestrians to cross	$18.0 Million	Risk of controversy based on impacts to businesses/properties identified through stakeholder outreach
Alternative C4: Diverging Diamond Interchange (DDI)	Yes	Yes	3.67	Total: 52.39 35.2% Fatal+Injury: 31.54 50.6%	2028: 953 2040: 2,979 2050: 4,500 Signal spacing: 3	No ROW Acquisition	HAZMAT: Known spills sites in area	Impacts to Bear Butte Creek Floodplain	Constructability: 5 Maintenance & Operations (0.8 Miles): 3	5	$5.3 Million	Risk of controversy based on impacts to businesses/properties identified through stakeholder outreach

Table 6 – Segment D: Lazelle Street Urban Area (Main Street to Blanche Street)

Build Alternative	Satisfies Purpose & Need				B/C Ratio	Traffic Safety	Traffic Operations	Right-of-Way Impacts	Potential Environmental Impacts	Floodplain or Floodway Impacts	Constructability, maintenance & operations	Multi-modal Considerations	Total Project Cost (2028 $)	Public Input
	Lane Width Deficiency	Improve Traffic Safety	Pedestrian Mobility	Improve Traffic Operations		Reduced Crashes 2028-2050	Annual Reduced Delay (vehicle-hours)				5 – Difficult 3 – Moderate 1 - Simple	5 – Significant 3 – Moderate 1 – Minimal		
Alternative D1: 3-lane	Yes	Yes	Yes		0.39	Total: 35.28 6.2% Fatal+Injury: 14.03 7.0%	2028: -1,316 2040: -3,790 2050: -7,793	No ROW Acquisition	SECTION 4(f): Proposed bike path in area. Multiple parks along alignment HAZMAT: Known spills sites and active and inactive tank facility in area	Impacts to Bear Butte Creek & Vanocker Creek Floodplain & Floodway	Constructability: 5 Maintenance & Operations (1.5 Miles): 3	5	$15.5 Million	Risk of controversy based on impacts to Rally conditions
Alternative D2: 4-lane Undivided	Yes	No	No	No. Access points not addressed as part of the corridor study; to be considered with selected alternative during design	< 0	Total: -196.79 -34.6% Fatal+Injury: -78.39 -39.1%	2028: 620 2040: 815 2050: 2,442	0.63 acres	SOCIOECONOMIC: Alternative would impact private properties and vendor space SECTION 4(f): Proposed bike path in area. Multiple parks along alignment HAZMAT: Known spills sites and active and inactive tank facility in area	Impacts to Bear Butte Creek & Vanocker Creek Floodplain & Floodway	Constructability: 5 Maintenance & Operations (1.5 Miles): 3	1	$16.5 Million	Risk of controversy based on impacts to businesses/ properties
Alternative D3: 5-lane	Yes	Yes	Yes		0.06	Total: 3.01 0.5% Fatal+Injury: 0.46 0.2%	2028: 20 2040: 180 2050: 388	2.18 acres	SOCIOECONOMIC: Alternative would impact private properties and vendor space SECTION 4(f): Proposed bike path in area. Multiple parks along alignment HAZMAT: Known spills sites and active and inactive tank facility in area	Impacts to Bear Butte Creek & Vanocker Creek Floodplain & Floodway	Constructability: 5 Maintenance & Operations (1.5 Miles): 3	3	$19.3 Million	Risk of controversy based on impacts to businesses/ properties
Alternative D4: 5-lane (west of Middle Street) / 4-lane Divided without Turn Lanes (east of Middle Street)	Yes	Yes	Yes		0.09	Total: 9.27 1.6% Fatal+Injury: 1.21 0.6%	2028: 20 2040: 180 2050: 388	2.02 acres	SECTION 4(f): Proposed bike path in area. Multiple parks along alignment HAZMAT: Known spills sites and active and inactive tank facility in area	Impacts to Bear Butte Creek & Vanocker Creek Floodplain & Floodway	Constructability: 5 Maintenance & Operations (1.5 Miles): 3	3	$19.2 Million	Risk of controversy based on impacts to businesses/ properties

(continued) Table 6 – Segment D: Lazelle Street Urban Area (Main Street to Blanche Street)

Build Alternative	Satisfies Purpose & Need				B/C Ratio	Traffic Safety	Traffic Operations	Right-of-Way Impacts	Potential Environmental Impacts	Floodplain or Floodway Impacts	Constructability, maintenance & operations	Multi-modal Considerations	Total Project Cost (2028 $)	Public Input
	Lane Width Deficiency	Improve Traffic Safety	Pedestrian Mobility	Improve Traffic Operations		Reduced Crashes 2028-2050	Annual Reduced Delay (vehicle-hours)				5 – Difficult 3 – Moderate 1 - Simple	5 – Significant 3 – Moderate 1 – Minimal		
Alternative D5: 5-lane Offset Alignment	Yes	Yes	Yes	No. Access points not addressed as part of the corridor study; to be considered with selected alternative during design	0.06	Total: 3.01 0.5% Fatal+Injury: 0.46 0.2%	2028: 20 2040: 180 2050: 388	2.30 acres	SOCIOECONOMIC: Alternative would impact private properties and vendor space SECTION 4(f): Proposed bike path in area. Multiple parks along alignment HAZMAT: Known spills sites and active and inactive tank facility in area	Impacts to Bear Butte Creek & Vanocker Creek Floodplain & Floodway	Constructability: 5 Maintenance & Operations (1.5 Miles): 3	3	$19.4 Million	Risk of controversy based on impacts to businesses/ properties

Table 7 – Segment E: S-Curves

Build Alternative	Satisfies Purpose & Need			B/C Ratio	Traffic Safety	Traffic Operations	Right-of-Way Impacts	Potential Environmental Impacts	Floodplain or Floodway Impacts	Constructability, maintenance & operations	Multi-modal Considerations	Total Project Cost (2028 $)	Public Input
	Horizontal Curve Deficiency	Road Overtopping	Roadway Icing		Reduced Crashes 2028-2050	Annual Reduced Delay (vehicle -hours)				5 – Difficult 3 – Moderate 1 - Simple	5 – Significant 3 – Moderate 1 – Minimal		
Alternative E1 Raised Vertical Profile	No. Design exception would be required	Yes	No	0.30	Total: 4.82 8.7% Fatal+Injury: 3.6 11.6%	NA	No ROW Acquisition	SECTION 4(f): Multiple parks along alignment. Fort Meade Rec Area along Alignment. Bike Path along alignment. Multiple Hiking Trails along alignment NWI: Potential impacts to wetlands and WOUS HISTORICAL: Alternative is within the Fort Meade Historical District T&E: Potential impacts to species	Impacts to Bear Butte Creek Floodway & Floodplain	Constructability: 5 Maintenance & Operations (0.6 Miles): 1	NA	$6.6 Million	No major risks identified
Alternative E2 Realignment (Option 1)	Yes	Yes	Yes	0.41	Total: 13.19 23.7% Fatal+Injury: 8.12 26.1%	NA	11.32 acres	SECTION 4(f): Realignment of Bike Path and cutting through Centennial Trail. Cutting though Fort Meade Rec Area HISTORICAL: Alternative is within the Fort Meade Historical District NWI: Potential impacts to wetlands and WOUS T&E: Potential impacts to species	Impacts to Bear Butte Creek Floodway & Floodplain	Constructability: 3 Maintenance & Operations (0.8 Miles): 1	NA	$26.6 Million	Risk of controversy based on impacts and cost
Alternative E3 Realignment (Option 2)	Yes	Yes	Yes	0.43	Total: 24.1 43.4% Fatal+Injury: 14.26 45.9%	NA	15.28 acres	SECTION 4(f): Realignment of Bike Path and cutting through Centennial Trail. Cutting though Fort Meade Rec Area HISTORICAL: Alternative is within the Fort Meade Historical District NWI: Potential impacts to wetlands and WOUS T&E: Potential impacts to species	Impacts to Bear Butte Creek Floodway & Floodplain	Constructability: 3 Maintenance & Operations (1.2 Miles): 1	NA	$34.8 Million	Risk of controversy based on impacts and cost

Table 8 – Segment F: Ft. Meade / VA Hospital

Build Alternative	Satisfies Purpose & Need		B/C Ratio	Traffic Safety	Traffic Operations	Right-of-Way Impacts	Potential Environmental Impacts	Floodplain or Floodway Impacts	Constructability, maintenance & operations	Multi-modal Considerations	Total Project Cost (2028 $)	Public Input
	Improve Traffic Operations	Improve Intersection Geometric Design		Reduced Crashes 2028-2050	Annual Reduced Delay (vehicle -hours)				5 – Difficult 3 – Moderate 1 - Simple	5 – Significant 3 – Moderate 1 – Minimal		
Alternative F1: Intersection Improvements	Yes	Yes	1.62	Total: 8.74 13.2% Fatal+Injury: 6.47 18.4%	2028: 39 2040: 103 2050: 241	No ROW Acquisition	SECTION 4(f): Alternative within Fort Meade Rec Area. Potential impact to Centennial Trail and Fort Meade Trail HISTORICAL: Alternative is within the Fort Meade Historical District	No Impacts	Constructability: 1 Maintenance & Operations (0.8 Miles): 1	NA	$2.3 Million	No major risks identified
Alternative F2: Realign Comanche Road	No	Yes	2.42	Total: 6.23 9.4% Fatal+Injury: 4.33 12.3%	2028: 1,060 2040: 1,495 2050: 2,319	No ROW Acquisition	SECTION 4(f): Alternative within Fort Meade Rec Area. Potential to impact Centennial Trail and Ford Meade Trail HISTORICAL: Alternative is within the Fort Meade Historical District	No Impacts	Constructability: 1 Maintenance & Operations (0.8 Miles): 1	NA	$1.4 Million	No major risks identified
Alternative F3: Custer Avenue (east)	Yes	Yes	< 0	Total: -82.26 -124.2% Fatal+Injury: -39.58 -112.7%	2028: -2,216 2040: -2,603 2050: -2,550	No ROW Acquisition	SECTION 4(f): Alternative within Fort Meade Rec Area. Potential impact to Centennial Trail and Bike Path, and Fort Meade Trail HISTORICAL: Alternative is within the Fort Meade Historical District	No Impacts	Constructability: 1 Maintenance & Operations (0.8 Miles): 3	NA	$2.0 Million	No major risks identified
Alternative F4: Reduced Conflict Intersections	Yes	Yes	0.40	Total: 21.97 33.2% Fatal+Injury: 11.79 33.6%	2028: -3,142 2040: -3,275 2050: -2,865	0.21 acres	SECTION 4(f): Alternative within Fort Meade Rec Area. Potential impact to Centennial Trail and Bike Path, and Fort Meade Trail HISTORICAL: Alternative is within the Fort Meade Historical District T&E: Potential impacts to species	Impacts to Bear Butte Creek Floodway & Floodplain	Constructability: 5 Maintenance & Operations (0.8 Miles): 1	NA	$11.2 Million	Risk of controversy; user education required

Table 9 – Segment G: SD34 (Ft. Meade to SD79)

Build Alternative	Satisfies Purpose & Need	B/C Ratio	Traffic Safety	Traffic Operations	Right-of-Way Impacts	Potential Environmental Impacts	Floodplain or Floodway Impacts	Constructability, maintenance & operations	Multi-modal Considerations	Total Project Cost (2028 $)	Public Input
	Improve Traffic Safety		Reduced Crashes 2028-2050	Annual Reduced Delay (vehicle -hours)				5 – Difficult 3 – Moderate 1 - Simple	5 – Significant 3 – Moderate 1 – Minimal		
Alternative G1: Divided Highway with Depressed Median	Yes	0.47	Total: 19.37 15.3% Fatal+Injury: 14.52 19.9%	NA	5.93 acres	SECTION 4(f): Alignment along the Centennial Bike Path and Fort Meade Trails. Alignment is within Fort Meade Rec Area HISTORICAL: Alternative is within the Fort Meade Historical District HAZMAT: Two known spill locations are within the area	No Impacts	Constructability: 3 Maintenance & Operations (1.9 Miles): 1	NA	$16.5 Million	No major risks identified
Alternative G2: Divided Highway with Depressed Median & Cable Median Barrier	Yes	0.62	Total: 21.88 17.3% Fatal+Injury: 19.41 26.6%	NA	5.93 acres	SECTION 4(f): Alignment along the Centennial Bike Path and Fort Meade Trails. Alignment is within Fort Meade Rec Area HISTORICAL: Alternative is within the Fort Meade Historical District HAZMAT: Two known spill locations are within the area	No Impacts	Constructability: 3 Maintenance & Operations (1.9 Miles): 1	NA	$16.5 Million	No major risks identified

Table 10 – Segment H: Junction Avenue (Lazelle Street to Main Street)

Build Alternative	Satisfies Purpose & Need		B/C Ratio	Traffic Safety	Traffic Operations	Right-of-Way Impacts	Potential Environmental Impacts	Floodplain or Floodway Impacts	Constructability, maintenance & operations	Multi-modal Considerations	Total Project Cost (2028 $)	Public Input
	Improve Traffic Operations	Improve Intersection Geometric Design		Reduced Crashes 2028-2050	Annual Reduced Delay (vehicle -hours)				5 – Difficult 3 – Moderate 1 - Simple	5 – Significant 3 – Moderate 1 – Minimal		
Alternative H1: Geometric Improvements at Lazelle Street & Junction Avenue	NA	Yes	0.00	Total: 0 0% Fatal+Injury: 0 0%	2028: 0 2040: 0 2050: 0	0.04 acres	SECTION 4(f): Alignment is along proposed bike path HAZMAT: Known spills and active tank site along alignment	Impacts to Bear Butte Creek Floodway & Floodplain	Constructability: 3 Maintenance & Operations (0.1 Miles): 1	NA	$1.3 Million	No major risks identified, supported through public comments
Alternative H2: Junction Avenue & Main Street – Roundabout	Yes	Yes, if H1 combined with H2	0.50	Total: 0 0% Fatal+Injury: 0 0%	2028: 910 2040: 2,173 2050: 6,075	0.06 acres, 2 total takes	SECTION 4(f): Alignment is along proposed bike path. HISTORICAL: Project is within Sturgis Commercial Block Historical District. Multiple Historical structures (Eligible, Ineligible, Unknown) in vicinity HAZMAT: Known spill location in area	Impacts to Bear Butte Creek Floodway & Floodplain	Constructability: 5 Maintenance & Operations (0.1 Miles): 1	5	$3.0 Million	No major risks identified
Alternative H3: Junction Avenue & Main Street – Two-way Stop Control	Yes	Yes, if H1 combined with H3	< 0	Total: -8.56 -12.3% Fatal+Injury: -4.82 -21.8%	2028: 1,352 2040: 2,798 2050: 6,556	No ROW Acquisition	SECTION 4(f): Alignment is along proposed bike path. HISTORICAL: Project is within Sturgis Commercial Block Historical District. Multiple Historical structures (Eligible, Ineligible, Unknown) in vicinity HAZMAT: Known spill location in area	Impacts to Bear Butte Creek Floodway & Floodplain	Constructability: 1 Maintenance & Operations (0.1 Miles): 1	1	$0.001 Million	No major risks identified
Alternative H4: Junction Avenue & Main Street – Signalization	Yes	Yes, if H1 combined with H4	2.60	Total: -5.08 -7.3% Fatal+Injury: -1.46 -6.6%	2028: 1,179 2040: 2,741 2050: 7,649	No ROW Acquisition	SECTION 4(f): Alignment is along proposed bike path. HISTORICAL: Project is within Sturgis Commercial Block Historical District. Multiple Historical structures (Eligible, Ineligible, Unknown) in vicinity HAZMAT: Known spill location in area	Impacts to Bear Butte Creek Floodway & Floodplain	Constructability: 1 Maintenance & Operations (0.1 Miles): 3	3	$0.6 Million	No major risks identified

8.0 Recommendations

Recommendations of the consultant study team for improvements to the study corridor consider a combination of the technical evaluation of traffic, safety, access management, potential for adjacent property impacts, input received through public engagement, and interactions with the SAT. Details of benefits and drawbacks of alternatives for each of the eight segments were documented in the *Summary of* ***Feasible*** *Alternatives* technical memo, provided as **Appendix G**.

Summarized in **Table 11**, recommendations of the consultant study team are provided (noted in green text) for each of the eight segments identified throughout this corridor study and as presented in previous technical memorandums. For situations where the consultant study team recommends specific alternatives not be implemented, these are also noted (in red text). Project planning timelines are defined as follows:

- Short-term: 8-12 years (based on current programming, 8 years is the soonest any alternative would likely be implemented)
- Mid-term: 13-18 years
- Long-term: 18+ years

Table 11 – Consultant Study Team Recommendations

Segment	Alternatives	Planning Timeline
US14A (West City Limits to Moose Drive)	A0: No-build A1: 3-lane A2: 5-lane **A3: 4-lane Divided (Raised Median) with Turn lanes**	Long-term
Avalanche Road Development	**B0: No-build** B1: I-90 Viaduct B2: Avalanche Road Realignment (Option 1) B3: Avalanche Road Realignment (Option 2)	Long-term
Exit 30 and Avalanche Road Intersections	C0: No-build **C1: Intersection Improvements** **C2: Westbound On-Ramp Folded Diamond** C3: Single-point Urban Interchange (SPUI) C4: Diverging Diamond Interchange (DDI)	Short-term (Timing in line with full build-out of Avalanche development)
Lazelle Street Urban Area (Main Street to Blanche Street)	D1: 3-lane **D2: 4-lane Undivided** D3: 5-lane D4: 5-lane (west of Middle Street) / 4-lane Divided w/o Turn Lanes (east of Middle Street) **D5: 5-lane Offset Alignment**	Short-term
S-Curves	**E1: Raised Vertical Profile** E2: Realignment (Option 1) E3: Realignment (Option 2)	Mid-term
Ft. Meade / VA Hospital	F1: Intersection Improvements F2: Realign Comanche Road F3: Custer Avenue (east) **F4: Reduced Conflict Intersections**	Short- to mid-term
SD34 (Ft. Meade to SD79)	G1: Divided Highway with Depressed Median **G2: Divided Highway with Depressed Median & Cable Median Barrier**	Long-term
Junction Avenue (Lazelle Street to Main Street)	**H1: Geometric Improvements at Lazelle Street & Junction Avenue** H2: Junction Avenue & Main Street – Roundabout H3: Junction Avenue & Main Street – Two-way Stop Control **H4: Junction Avenue & Main Street - Signalization**	Short-term

8.1 Segment A: US14A (West City Limits to Moose Drive)

For Segment A, which comprises the westernmost section of the study corridor to Moose Drive, the consultant study team recommends Alternative A3, which comprises a four-lane divided section including a raised median between opposing directions of travel and turn lanes at designated intersections. The three-lane section that is Alternative A1 provides benefits in that it has no impacts on adjacent properties and has the lowest on-going operations and maintenance costs. While the associated three-lane cross-section provides sufficient capacity for non-Rally conditions, the lessened through-lane capacity could result in increased travel times during the Rally or other high-volume conditions. Alternative A3 is recommended over Alternative A2 (5-lane) because of the added safety benefit provided by the raised median, which reduces the potential for head-on or sideswipe crashes by vehicles traveling in opposing directions.

Because neither the existing nor the future deficiencies documented for this segment are major, the implementation of Alternative A3 has been identified as a low-priority and noted as a long-term project.

8.2 Segment B: Avalanche Road Development

It should be noted that Segments B and C are overlapping, or have commonality, in terms of the intersections that experience benefits from the alternatives developed for each segment. As such, these two segments should be considered collectively. In terms of the alternatives developed to address deficiencies associated with Segment B, they received minimal support at the study corridor's second public meeting and significant opposition from one project stakeholder. It is for these reasons that the consultant team is initially recommending the no-build alternative (B0) for this segment. The alternative recommended for Segment C, as documented below, is anticipated to serve the project corridor through the initial years of the Avalanche Road residential development. Traffic conditions should continue to be monitored and alternatives associated with Segment B re-evaluated on an as-needed basis.

8.3 Segment C: Exit 30 and Avalanche Road Intersections

As mentioned above, alternatives associated with Segment C initially address deficiencies of both it and Segment B. That is not to say, however, that additional improvements (including any of the Segment B alternatives) will not be necessary in the future as the Avalanche Road Development reaches full build-out. Of the alternatives developed for Segment C, Alternative C1 (Intersection Improvements) is not recommended by the study consultant team for implementation as many of the left- and right-turn lanes cannot be constructed to meet minimum design standards and/or accommodate the anticipated vehicle queue lengths. Of the remaining alternatives, the consultant study team recommends implementation of Alternative C2 (Westbound On-ramp Folded Diamond). While this alternative may not achieve as great of a benefit/cost value as either Alternative C3 (Single-point Urban Interchange) or Alternative C4 (Diverging Diamond Interchange), it did receive the most support throughout the community engagement activities while also satisfying the deficiencies associated with this segment.

It is recommended that Alternative C2 be implemented in the short-term time frame with timing coincident with the continued build-out of the Avalanche Road residential development.

8.4 Segment D: Lazelle Street Urban Area (Main Street to Blanche Street)

The consultant recommendation for Segment D is Alternative D5, or a five-lane section with offset alignments and additionally, a changing typical section throughout the corridor to minimize impacts to abutting properties, This changing typical section could also include the consideration of a four-lane divided street as included with Alternative D4. While the consultant study team was not tasked with evaluating annual Rally conditions; based on real and anecdotal data available to our team and discussion with the SAT and stakeholders throughout the study, consideration of a 5-lane section was prudent going forward. This consideration is based on:

- the amount of Rally traffic
- the extended duration of the Rally, as compared to a special event of shorter duration
- other factors, such as economic impact to Sturgis and the surrounding Black Hills region

That stated, it is also noted that a three-lane section is more than adequate to handle anticipated future (typical) traffic volumes and would certainly be the consultant team recommendation if Rally conditions were not considered (see Junction Avenue, which carries a greater existing daily traffic volume than does Lazelle Street as an example). While the five-lane section concept appears feasible, there will undoubtedly be some areas of significant property impact (to be confirmed through further design) that may not be palatable to adjacent property owners or other project stakeholders, and these impacts will be greater if desired aesthetic treatments are included in the typical roadway section. The typical section, if a five-lane section is constructed, will almost certainly vary throughout the corridor to best fit within the existing or planned right-of-way, limit impacts to properties, satisfy ADA requirements, and maintain parking and/or desired vendor space in key areas.

It is recommended that Alternative D5 be implemented in the short-term time frame. This timeline is necessary to address the significantly deficient lane widths (easily the most commented deficiency by project stakeholders) and on-going maintenance and improvement needs of the existing pavement conditions.

The consultant study team does not recommend implementation of Alternative D2 (4-lane undivided) due to the inherent safety deficiencies associated with four-lane undivided transportation facilities (i.e., head-on/sideswipe crashes involving vehicles traveling in opposing directions and rear-end collisions with vehicles attempting to make left-turns from the four-lane undivided roadway).

8.5 Segment E: S-Curves

Alternatives E2 and E3, both of which incorporate a realignment of SD34 to address the horizontal curve deficiency, are not recommended and likely to be considered "not feasible" because of their impacts to property owned by the Bureau of Land Management (BLM). BLM properties are highly sensitive to transportation-related impacts which would be difficult to overcome during the National Environmental Policy Act (NEPA) process. Additionally, each of these alternatives are extremely costly to implement.

While Alternative E1 (Raised Vertical Profile) does not address either the horizontal curve or icing deficiencies, it does address the more frequent occurrence of roadway overtopping and undesirable highway stormwater drainage during rain events.

While the deficiencies addressed by Alternative E1 are of concern, their significance is not as great as those associated with other study corridor segments. As such, the implementation of Alternative E1 is identified as a mid-term project.

8.6 Segment F: Ft. Meade / VA Hospital

The consultant study team recommends Alternative F4 (Reduced Conflict Intersections) for this segment. In making this recommendation, the consultant acknowledges opposition that was expressed by a key stakeholder towards this alternative because of potential confusion that would be experienced by elderly drivers in navigating the system of reduced conflict intersections (which requires motorists to make a right-turn from a side street/driveway and a subsequent downstream U-turn rather than a direct left-turn from the side street/driveway). However, it is the consultant team's professional opinion that the other alternatives associated with this segment can exhibit safety deficiencies along high-speed, multi-lane highways when driven by elderly or younger drivers, both of which exist within this segment because of the VA Hospital and the local high school,

Alternative F4 should be implemented within the short- to-mid-term time frame. This implementation should also consider the need for pedestrians to cross SD34 and the need for educating local and regional motorists on how to navigate RCIs.

8.7 Segment G: SD34 (Ft. Meade to SD79)

For Segment G, Alternative G2 is recommended simply because of the added safety benefit provided to the segment by the cable median barrier.

Because neither the existing nor the future deficiencies documented for this segment are significant, the implementation of Alternative G2 has been identified as a low-priority project and noted as a long-term project.

8.8 Segment H: Junction Avenue (Lazelle Street to Main Street)

Two alternatives are recommended by the consultant study team for Segment H. Alternative H1, which includes geometric improvements at the intersection of Lazelle Street & Junction Avenue to accommodate the turning paths of large vehicles and vehicles pulling trailers. It is recommended that this alternative be implemented in the short-term and in conjunction with the implementation of the ultimate solution for Segment D.

Secondly, to address the traffic operational deficiencies along Junction Avenue between Lazelle Street and Main Street, it is recommended that Alternative H4, or signalization of the Main Street intersection, be implemented. This solution will help to manage traffic flows between the two intersections and help to prevent southbound traffic from queuing north into the Lazelle Street intersection. It is also recommended that this alternative be implemented in the short-term time frame.