# Interstate 90 Exit 37
# Interstate Modification
# Justification Report

Interstate Modification
Justification Report (IMJR) for the
Interstate 90 Exit 37 (Pleasant
Valley Road) Interchange

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# EXECUTIVE SUMMARY

The South Dakota Department of Transportation (SDDOT) has initiated an assessment of the existing interchange on Interstate 90 (I-90) at Exit 37 (Pleasant Valley Road) near Sturgis, South Dakota. Hereinafter referred to as the Exit 37 Interchange. This Interchange Modification Justification Report (IMJR) is the result of several studies that have been completed to document the positive and negative impacts associated with a range of proposed alternatives for the existing interchange. This document was completed following the outline provided in the Federal Highway Administration's (FHWA's) August 2010 *Interstate System Access Informational Guide* and meets the requirements of the Policy on *Access to the Interstate System* established May 22, 2017.

## PURPOSE AND NEED FOR THE REQUEST

The purpose of the Exit 37 Interchange modification on I-90 is to address deficiencies in the current interchange geometry, improve safety and preserve future mainline I-90 expansion opportunities. The deficiencies identified resulted from a multitude of studies completed by SDDOT dating back to the year 2000. A summary of the studies completed and resulting deficiencies at the Exit 37 Interchange can be found in **Table 1-1** within this IMJR.

## PROPOSED MODIFICATION REQUEST

The proposed interchanged modification on I-90 at Exit 37 (referred to as Alternative 37-2), is a standard diamond interchange that removes the existing skew of Pleasant Valley Road and shortens the bridge over I-90, which needs replacement, and re-aligns the ramps to meet current design standards. The build alternative being proposed within this IMJR is shown in **Figure ES-1**.

## FHWA REQUIREMENTS

The FHWA has requirements that need to be addressed when evaluating changes to access points on interstate facilities (May 22, 2017 Policy). The requirements are part of a policy that was put in place to maintain high levels of safety and mobility on the Interstate System. The policy consists of two requirements that new access locations should meet. As this modification request is to maintain the existing Exit 37 Interchange's diamond interchange configuration, the following is the summarized response to each requirement. The full response to each requirement can be found in Chapter 9: Recommendations.

**1. An operational and safety analysis has concluded that the proposed change in access does not have a significant adverse impact on the safety and operation of the Interstate facility (which includes mainline lanes, existing, new, or modified ramps, ramp intersections with crossroad) or on the local street network based on both the current and the planned future traffic projections. The analysis should, particularly in urbanized areas, include at least the first adjacent existing or**

**proposed interchange on either side of the proposed change in access (23 Code of Federal Regulations 625.2(a), 655.603(d) and 771.111(f)). The crossroads and the local street network, to at least the first major intersection on either side of the proposed change in access, shall be included in this analysis to the extent necessary to fully evaluate the safety and operational impacts that the proposed change in access and other transportation improvements may have on the local street network (23 CFR 625.2(a) and 655.603(d)).**

**Requests for the proposed change in access must include a description and assessment of the impacts and ability of the proposed changes to safely and efficiently collect, distribute and accommodate traffic on the Interstate facility, ramps, intersection of ramps with crossroad, and local street network (23 CFR 625.2(a) and 655.603(d)). Each request should also include a conceptual plan of the type and location of the signs proposed to support each design alternative (23 U.S.C. 109(d) and 23 CFR 655.603(d)).**

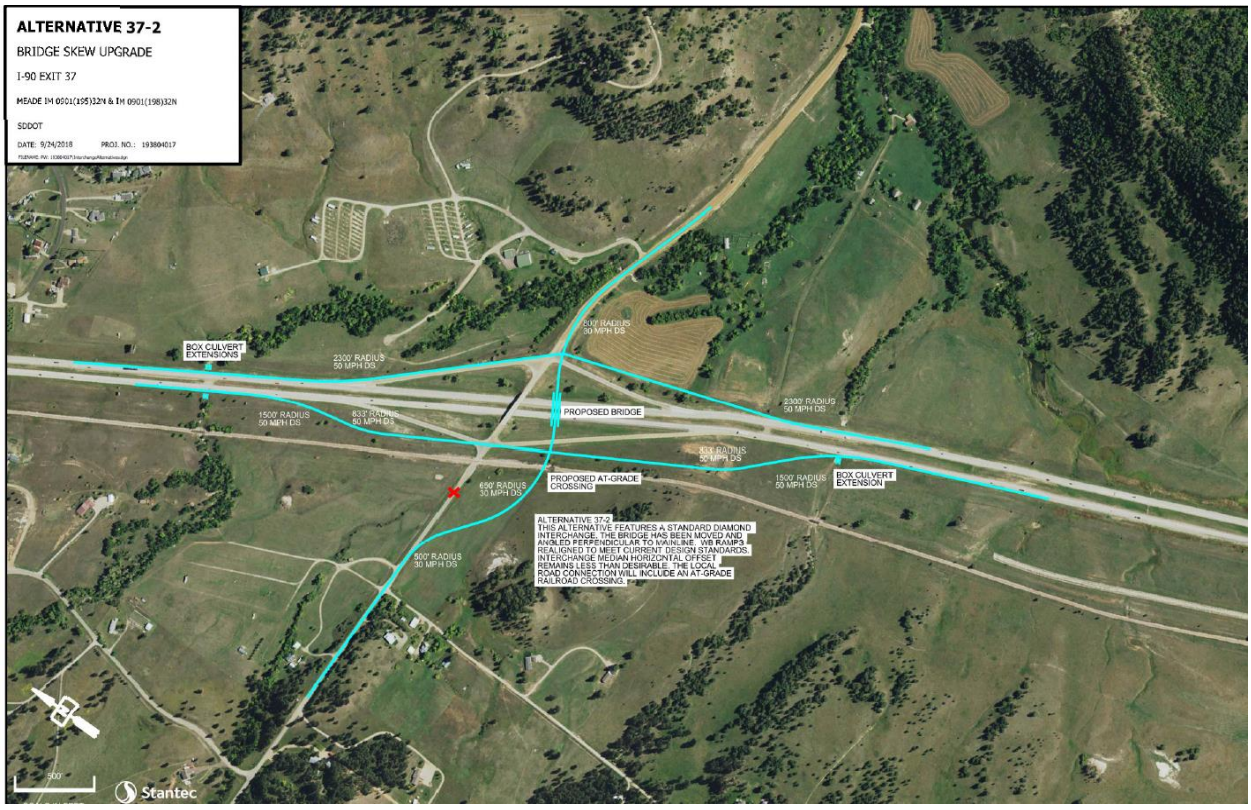
The operational analysis contained in this study indicate that mainline I-90 and ramp junction, and ramp terminal intersections are projected to operate within operational goals for both the Build and No Build scenarios through the planning horizon year of 2050.

An analysis of crash records for the most recent available five-year period (2012-2016) has been provided in the "Existing Safety Conditions" section of this report. The safety analysis indicates that there are no discernable or correctable crash patterns within the influence area of the Exit 37 Interchange. The relocated diamond interchange and reconstructed bridge would correct the existing bridge deficiencies, improve stopping sight distances and k-values for both the cross road and the interchange ramps and improve the descending grade on the west bound on-ramp to meet current design standards.

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

The access improvement will maintain a connection to a public road (Pleasant Valley Road) and will replace the current full access interchange with a reconfigured full access interchange. The reconfigured interchange will continue to provide for all traffic movements. The proposed interchange modification will meet or exceed current standards for Federal-aid projects on the Interstate system.

## Figure ES-1. I-90 and Exit 37 Interchange Modification Build Alternative (37-2)



# 1. INTRODUCTION

The South Dakota Department of Transportation (SDDOT) is working on implementing the recommendations for the *Interstate 90 (I-90) Black Hawk – Sturgis Corridor Preservation Study*.

As part of that progression, the SDDOT has reached the milestone to conduct a more detailed study of I-90 from Exit 32 to Exit 40 (**Appendix E)**. This includes analysis of the existing and future forecast traffic operations and geometrics of the existing I-90 mainline and interchanges, identified needs along the I-90 mainline and existing interchanges, proposed build alternatives to respond to the identified needs,, analysis of the proposed build alternatives under existing and future forecast year conditions as compared to existing conditions, and evaluation of all identified build alternatives as compared to the existing or no-build conditions. Based on the results of this study, SDDOT is requesting permission from the Federal Highway Administration (FHWA) to make modifications to I-90 and Exit 37 Interchange at Pleasant Valley Road. This Interstate Modification Justification Report (IMJR) is prepared on behalf of the SDDOT for submittal to the FHWA, specific to I-90 and Exit 37 Interchange modification request.

## BACKGROUND

**Table 1-1** provides an overview of the planning history of the Exits 34-40 interchange modification project.

**Table 1-1 Planning History**

| Year | Document/ Procedural Step | Exit 37 Interchange Findings |
|---|---|---|
| 2000 | *Decennial Interstate Corridor Study* | Identified concern of close service road spacing, recommended project to realign service roads. Identified similar concerns at nearby interchanges along the I-90 corridor. |
| 2004 | *I-90 Black Hawk to Sturgis Corridor Preservation Study* | Study was done to preserve transportation improvement opportunities amidst growth pressures along I-90 between Black Hawk and Sturgis. Addressed potential for widening of I-90 to six lanes and evaluated Exit 37 Interchange alternatives. |
| 2010 | *Decennial Interstate Corridor Study* | Reaffirmed Exit 37 Interchange concerns of close service road spacing and substandard interchange design. |
| 2014 | *Statewide Planning Process* | SDDOT included Exit 37 Interchange reconstruction in the Developmental Program of its statewide planning process and completed an EA reevaluation. |
| 2018 | *Structure Needs Memorandum* | Indicated low Structure Inventory Rating at Pleasant Valley Road over I-90. |
| 2019 | *I-90 Exit 32-40 Corridor Report* | Reaffirmed Exit 37 Interchange concerns of close service road spacing, substandard interchange design and deteriorating pavement conditions. |
| 2019 | *IMJR* | Will provide documentation of alternative needed for Federal approval of Exit 37 Interchange project. |

As shown, the SDDOT's ***2000 Decennial Interstate Corridor Study*** identified concerns with the existing Exit 37 Interchange configuration and determined that the I-90 corridor between Black Hawk and Sturgis would be one of the top segments of South Dakota's Interstate System to target for Improvement. The SDDOT responded by completing the ***Interstate 90 Black Hawk – Sturgis Corridor Preservation Study*** in 2004, which developed a single alternative for the Exit 37 Interchange. This alternative included a diamond interchange in its present location which would increase spacing between the ramp terminal intersections and would also address the geometric deficiencies identified. The ***I-90 Exit 32-40 Corridor Report*** developed three alternatives for Exit 37. Alternative #1 is identical to the alternative developed in the ***Interstate 90 Black Hawk – Sturgis Corridor Preservation Study.*** Alternative #2, which is the proposed alternative, is a standard diamond interchange that removes the existing skew of Pleasant Valley Road and shortens the bridge over I-90, which needs replacement, and re-aligns the ramps to meet current design standards. Alternative #3 would re-align mainline I-90 east to reduce the S-curve, allow for adequate space for the east bound on/off ramps and move the bridge to a more perpendicular angle to the mainline. The three (3) Exit 37 Interchange Build Alternatives (37-1, 37-2 and 37-3) are further described and shown in figures within Chapter 5 of this report.

## PURPOSE

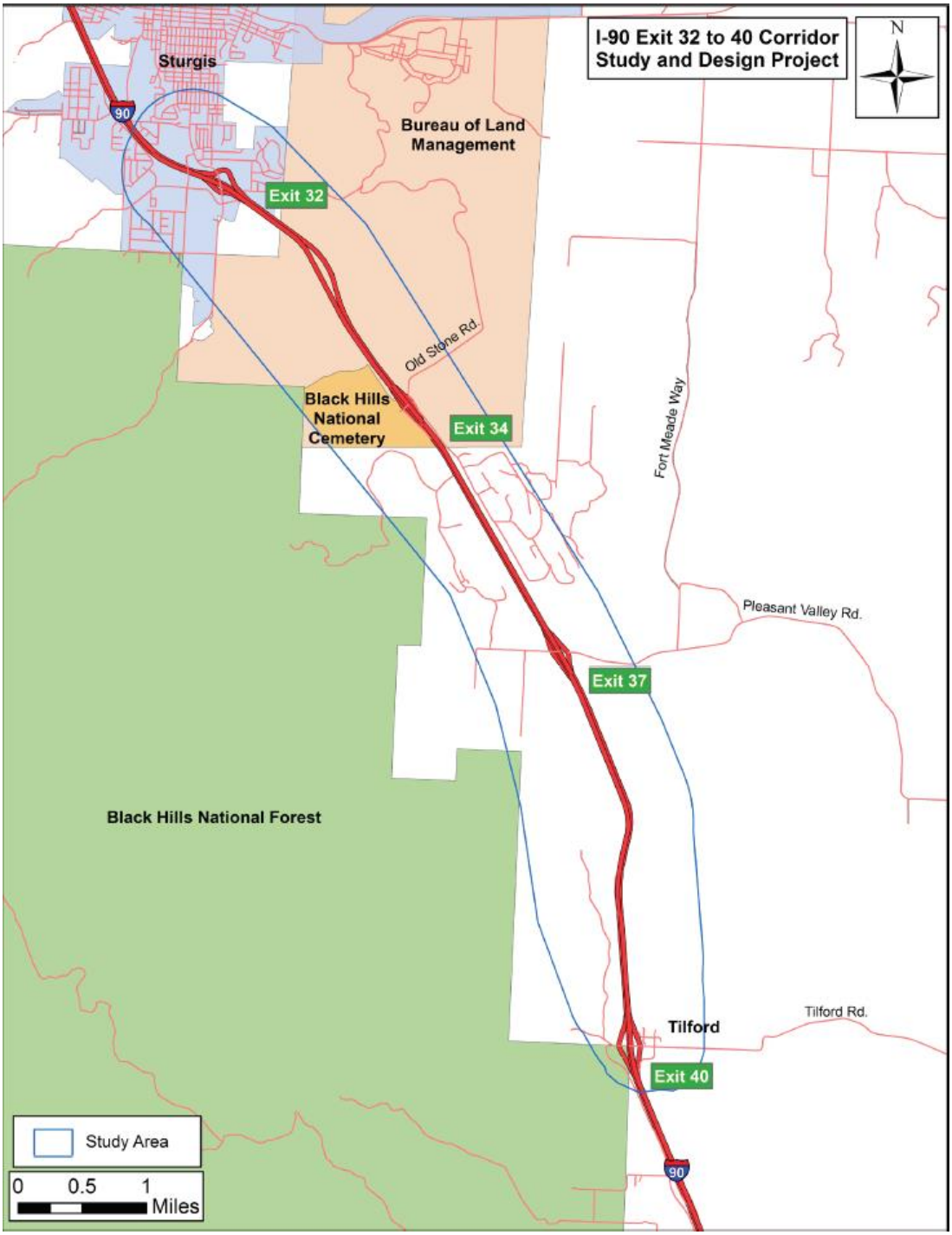
The purpose of the Exit 37 Interchange modification is to address deficiencies in the current interchange geometry, improve safety and preserve future mainline I-90 expansion opportunities.

## PROJECT LOCATION

Exit 37 is an existing interchange connection between I-90 and Pleasant Valley Road in the vicinity of the Black Hills National Cemetery, Sturgis and the unincorporated community of Tilford, South Dakota. The interchange is located approximately 37 miles to the east of the Wyoming state line and 5 miles southeast from the City of Sturgis, South Dakota. **Figure 1-1** depicts the location of the Exit 37 Interchange.

The current configuration of the Exit 37 Interchange is a skewed diamond interchange as shown in **Figure 1-2**. The proposed interchange modification would realign Pleasant Valley Road to create a perpendicular crossing of the Rapid City, Pierre and Eastern (RCP&E) Railroad and mainline I-90 to the south of the existing bridge. I-90 would continue to connect to Pleasant Valley Road via a diamond interchange configuration. The modified interchange would reduce the skew on Pleasant Valley Road and shorten the bridge over I-90. The result would improve safety and efficiency of the interchange and surrounding intersections.

## Figure 1-1 Study Area and Vicinity Map



## Figure 1-2 Current Exit 37 Interchange Configuration

# 2. METHODOLOGY

This IMJR demonstrates that the action associated with implementing the proposed project does not have any fatal flaws. Demonstrating that no fatal flaws exist does not endorse the action, but rather allows for the conclusion that the identified access alternatives are not flawed from the perspective of traffic operations and safety, as required by FHWA. Fatal flaws would include a proposed interchange modification that:

- Does not provide full access to roads.
- Would negatively impact interstate facility traffic operations and cannot be reasonably mitigated.
- Would negatively impact interstate facility/cross street safety and cannot be reasonably mitigated.
- Conflicts with or is inconsistent with local and regional plans.
- Would create the potential for environmental consequences which could not be mitigated.

## METHODS AND ASSUMPTIONS

This IMJR was developed through the following steps, which are detailed in a Methods and Assumptions Document which can be found in **Appendix A**.

1. Establishing an appropriate study area: the study area is documented in **Figure 1-1.** Study corridors include:
    - Exit 32 at Junction Avenue (SD 79)
    - Exit 34 at Pleasant Valley Drive/Blucksberg Drive/Old Stone Road
    - Exit 37 at Pleasant Valley Road
    - Exit 40 at 214th Street/Sturgis Road in Tilford

This study section also includes the Port of Entry facility located along I-90 eastbound between Exits 37 and 40.

2. Completing data collection. Conducting peak hour turning movement counts and daily traffic counts at the study area intersections and select roadway and interstate segments. Reviewing previous studies and available existing and future land use information for the study area.

Analyses was conducted for the following years/scenarios:

Analysis Years

- Base Year (2017)
- Opening Year (2023)
- Future No Build (2050)
- Future Build Design Year (2050)

Analysis Periods

Capacity and Level of Service analyses were conducted for the following analysis periods:

- Weekday A.M. Peak (heaviest 60 minutes between 0630-1000)
- Weekday P.M. Peak (heaviest 60 minutes between 1600-1800)

Data Collection:

- Intersection turning movement counts
- 24-hour directional volumes and vehicle classification counts along I-90
- Roadway geometry
- GIS/mapping
- Existing traffic signal timing plans
- Travel times/speeds

3. Addressing the FHWA requirements for interstate access modifications. This step includes completion of the necessary analyses and evaluations that document the benefits and impacts of the access modification as it relates to the FHWA requirements. These analyses included:

    - Preparing horizon year traffic forecasts. Average weekday daily and peak hour traffic forecasts for both the anticipated year of project completion (2023) and the planning horizon year (2050) were prepared for the study area interstate segments, interchanges, interstate ramp terminal intersections and adjacent arterial street intersections based on either the Urban Streets method (which includes both Signalized Intersections and Unsignalized Intersections) for urban areas and the Two-Lane Highway method for rural areas. The Exit 37 Interchange is rural. For future year analyses, Meade County Planning Office was consulted to

determine whether areas currently designated as rural might become urbanized in the future (which may affect the type of analysis performed).

- Analyzing current and future traffic operations along study area roadway segments. Capacity and Level of Service were determined using methods from the Highway Capacity Manual (HCM) 6th Edition. The HCM methods were implemented using the Highway Capacity Software Version 7.4. The HCM Freeway Facilities method was used to perform directional analyses of the I-90 study sections between Exits 32 and 40. The method evaluates the individual freeway components, basic freeway segments, ramp merge and diverge segments, and weaving segments – as a system.

- Reviewing the reported crash history data for the most recently available five-year period (2012-2016) to identify crash concentrations and trends at the current Exit 37 Interchange, mainline I-90 through the interchange and adjacent intersections along Pleasant Valley Road.

- Evaluating the potential future lane geometry and traffic control needed for the interchange modification. While there is a regional travel demand model for the Rapid City area maintained by the Rapid City Area Metropolitan Planning Organization (MPO), it does not cover the project study area. Additionally, there is no South Dakota statewide travel model from which future year traffic forecasts can be based. The SDDOT Inventory Management Office developed traffic growth rates per functional class and county that have been provided; these growth rates were the primary basis for developing future year project traffic forecasts.

This IMJR document is organized in accordance with section 3.5.3 of FHWA's *Interstate system access Information Guide, August 2010.*

# 3. EXISTING CONDITIONS

## DEMOGRAPHICS

Nestled at the foot of the Black Hills, the Exit 37 Interchange lies roughly 5 miles southeast of the City of Sturgis in Meade County, South Dakota. Within the 5-mile radius of the interchange are many single-family residences, numerous recreational areas, and the Black Hills National Cemetery.

## EXISTING LAND USE

The Exit 37 Interchange is surrounded by a mix of land uses. The area adjacent to the Interchange is primarily rural with single family residential, agricultural and land developed into recreational sites. Land uses in the City of Sturgis to the north and west of the interchange include commercial retail, church and residential. Sturgis, SD is home to the largest motorcycle rally in the world drawing a half a million people annually. Tilford, the unincorporated community to the south and east of the exit, is primarily residential.

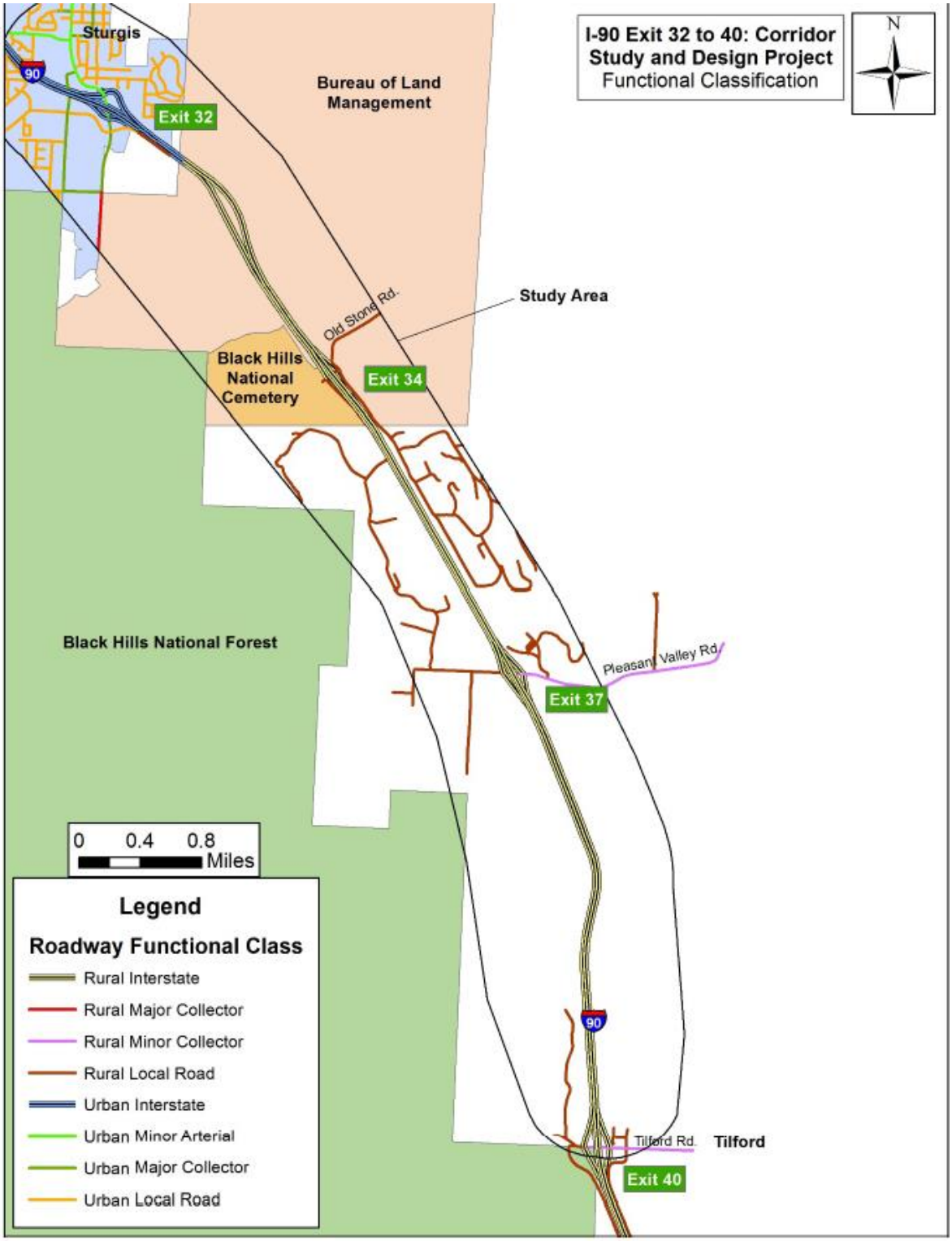
## EXISTING ROADWAY NETWORK

The following roadways comprise the primary roadway network surrounding the Exit 37 Interchange. **Figure 3-1** depicts the roadways and the federal functional classification.

**Interstate 90:** I-90 is an interstate freeway with two travel lanes in each direction extending across state lines. Although it is oriented on a north-south alignment through the interchange, it is designated as an east-west interstate.

**Pleasant Valley Road:** Pleasant Valley Road (Meade County Road 8) is the cross road for the Exit 37 Interchange. It is classified as a Rural Local Road west of the Exit 37 Interchange and as a Rural Minor Collector on the east and provides access to homes and recreational areas on both sides of the interstate.

## Figure 3-1 Existing Roadway Network



# ALTERNATIVE TRAVEL MODES

### Bus Transit

Prairie Hill Transit provides weekday bus service by request between various communities along the I-90 corridor and Rapid city. Riders must contact Prairie Hills to schedule trips. Inter-state transit is provided daily along I-90 by Jefferson Bus Lines between Rapid City and Billings, Montana. No stops are provided in the vicinity of the Exit 37 Interchange.

### Airports

There are several airports in the vicinity of the Exit 37 Interchange, the closest of which is the Sturgis Municipal Airport, located 6 miles north east of Exit 37. The nearest commercial airport is the Rapid City Regional Airport, located approximately 33 miles to the southeast of Exit 37.

### Railroad

The RCP&E Railroad is a Class II freight railroad affiliated with the Genesee & Wyoming, Inc. rail company. The RCP&E rail line parallels I-90 on its west side through the interchange area and crosses Pleasant Valley Road at grade to the west of the Exit 37 interchange.

### Bicycle/Pedestrian

Exit 37 crosses I-90 in such a location that bicycle, and pedestrian travel is not desired. There are some residences near this interchange, but nothing directly adjacent. There are no commercial sites or institutions adjacent to the interchange that would attract pedestrian or cyclist trips to cross I-90. Additionally, the Pleasant Valley Road bridge over I-90 is unsafe for pedestrian usage due to narrow width. In addition, the at-grade railroad crossing west of the interchange does not have a dedicated pedestrian facility for pedestrians to cross the tracks.

# INTERCHANGES

### I-90 Exit 37 Interchange: Pleasant Valley Road

The existing interchange at I-90 and Pleasant Valley Road (Exit 37) is a skewed diamond configuration, with a spacing of approximately 680 feet between the interchange ramp intersections along Pleasant Valley Road. Both ramp terminal intersections are currently controlled with STOP signs on the ramps. All ramps were originally designed and striped as single lane ramps. Pleasant Valley Road has a two-lane cross-section. The existing bridge over mainline I-90 does not provide pedestrian or bicycle facilities. There is an at-grade crossing of the RCP&E Railroad that is located approximately 120 feet to the west of the west (eastbound I-90) ramp terminal intersection. The existing Exit 37 Interchange configuration is shown on the aerial photo in **Figure 3-2.**

**Figure 3-2 Existing Configuration – I-90 Exit 37 Interchange**

### I-90 Exit 34 Interchange: Old Stone Road

The adjacent interchange, I-90 Exit 34, is located 2.26 miles northwest of the I-90 Exit 37 Interchange. The existing interchange of I-90 and Old Stone Road (Exit 34) is a diamond interchange with a spacing of approximately 400 feet between the interchange ramp intersections along Old Stone Road. Both ramp terminal intersections are currently controlled with STOP signs on the ramps. All ramps were originally designed and striped as single lane ramps. Old Stone Road has a two-lane cross-section. There is an at-grade crossing of the RCP&E Railroad that is located approximately 150 feet to the west of the west (eastbound I-90) ramp terminal intersection. The existing Exit 34 Interchange configuration is shown in **Figure 3-3.**

**Figure 3-3. Existing Configuration – I-90 Exit 34 Interchange**

### I-90 Exit 40 Interchange: 214th Street

The adjacent interchange, I-90 Exit 40, is located 3.18 miles southeast of the I-90 Exit 37 Interchange. The interchange is a diamond configuration, with a spacing of approximately 900 feet between the interchange ramp intersections along 214th Street. Both ramp terminal intersections are currently controlled with STOP signs on the ramps. All ramps were originally designed and striped as single lane ramps. 214th Street has a two-lane cross-section. There is an at-grade crossing of the RCP&E Railroad that is located approximately 925 feet to the east of the east (westbound I-90) ramp terminal intersection. The existing Exit 40 Interchange configuration is shown in **Figure 3-4.**

**Figure 3-4 Existing Configuration I-90 Exit 40 Interchange**

# EXISTING DATA

### Traffic Volumes

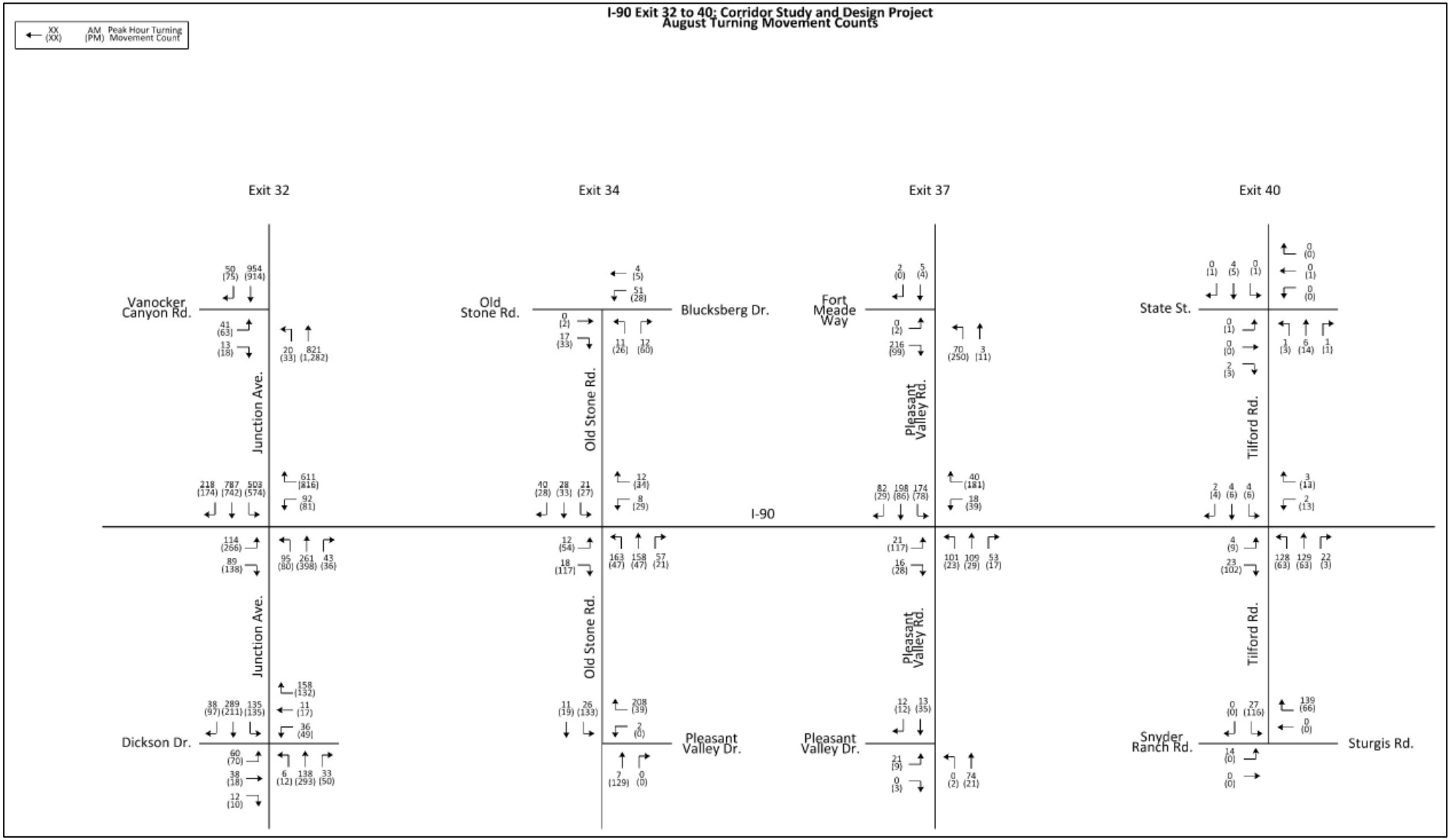
Year 2017 existing traffic volumes were obtained from two sources:

1. Interstate 90 mainline 24-hour directional volumes were obtained at permanent automatic traffic recorder (ATR) stations from the SDDOT. Traffic counts were obtained for the week of September 11-14, 2017 and included vehicle classification data.

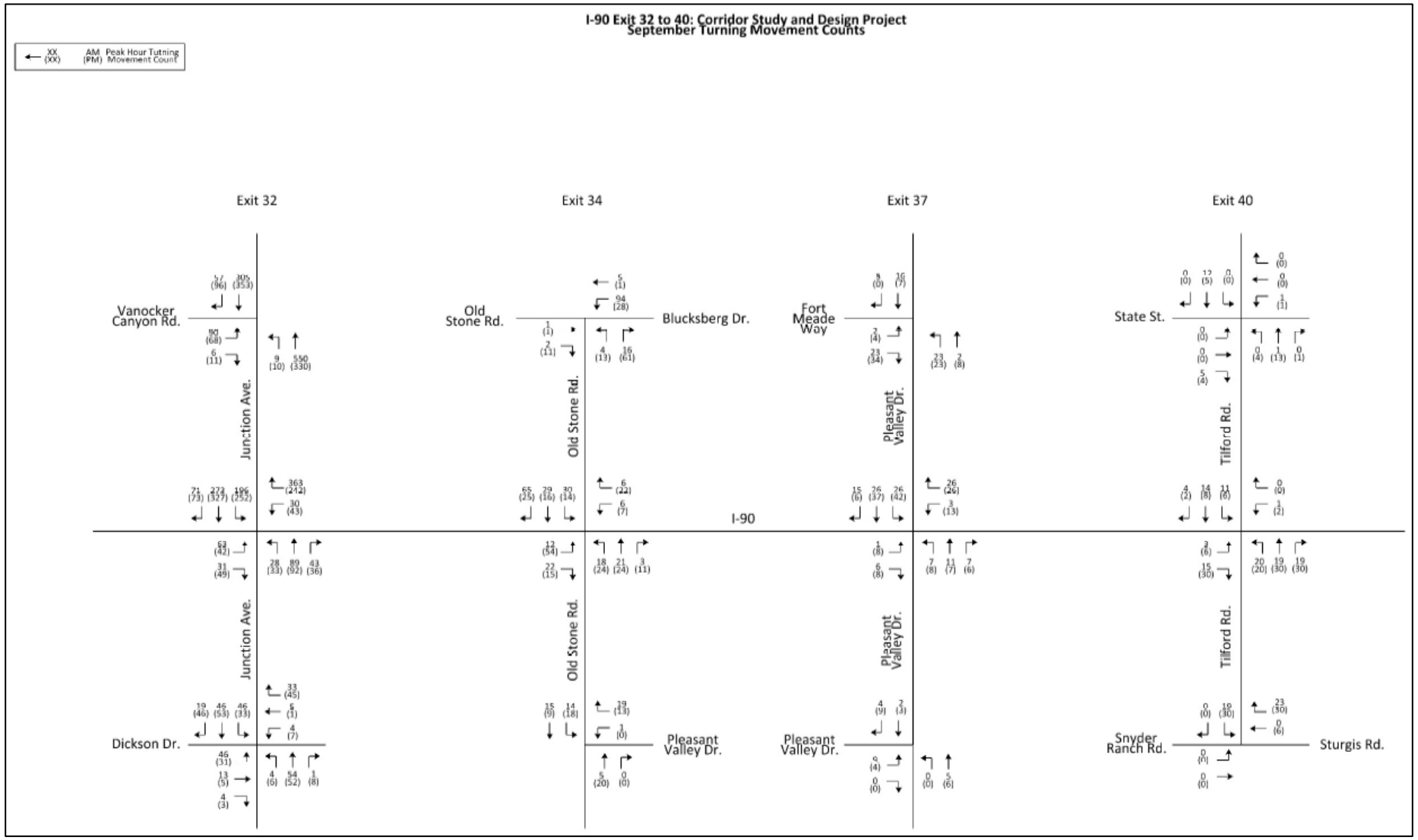
2. Hourly intersection turning movement counts were collected by the consultant team on two occasions – August 8-9, 2017, **Figure 3-5** (during the Sturgis Motorcycle Rally), and again on September 12, 2017, **Figure 3-6**. The counts collected during the Sturgis Rally (between 9:00 a.m. and 9:00 p.m.) were collected for reference purposes only and were provided to SDDOT to supplement turning movement counts collected during the Sturgis Rally from previous years. The counts obtained on September 12, 2017 were collected from 6:30 a.m. to 7:00 p.m. and were used as inputs to the intersection analyses. Both sets of counts included vehicle classification data.

The I-90 directional counts were corrected for daily and seasonal variation based on factors developed by the SDDOT from data collected at the weigh-in-motion station within the corridor ("WIM 901"). These are scaling factors that equate traffic counts by month of the year for which they are collected to an annual average daily traffic (AADT) volume. Year 2017 average daily traffic volumes (ADT) for I-90 mainline study segments are shown in **Figure 3-7.**

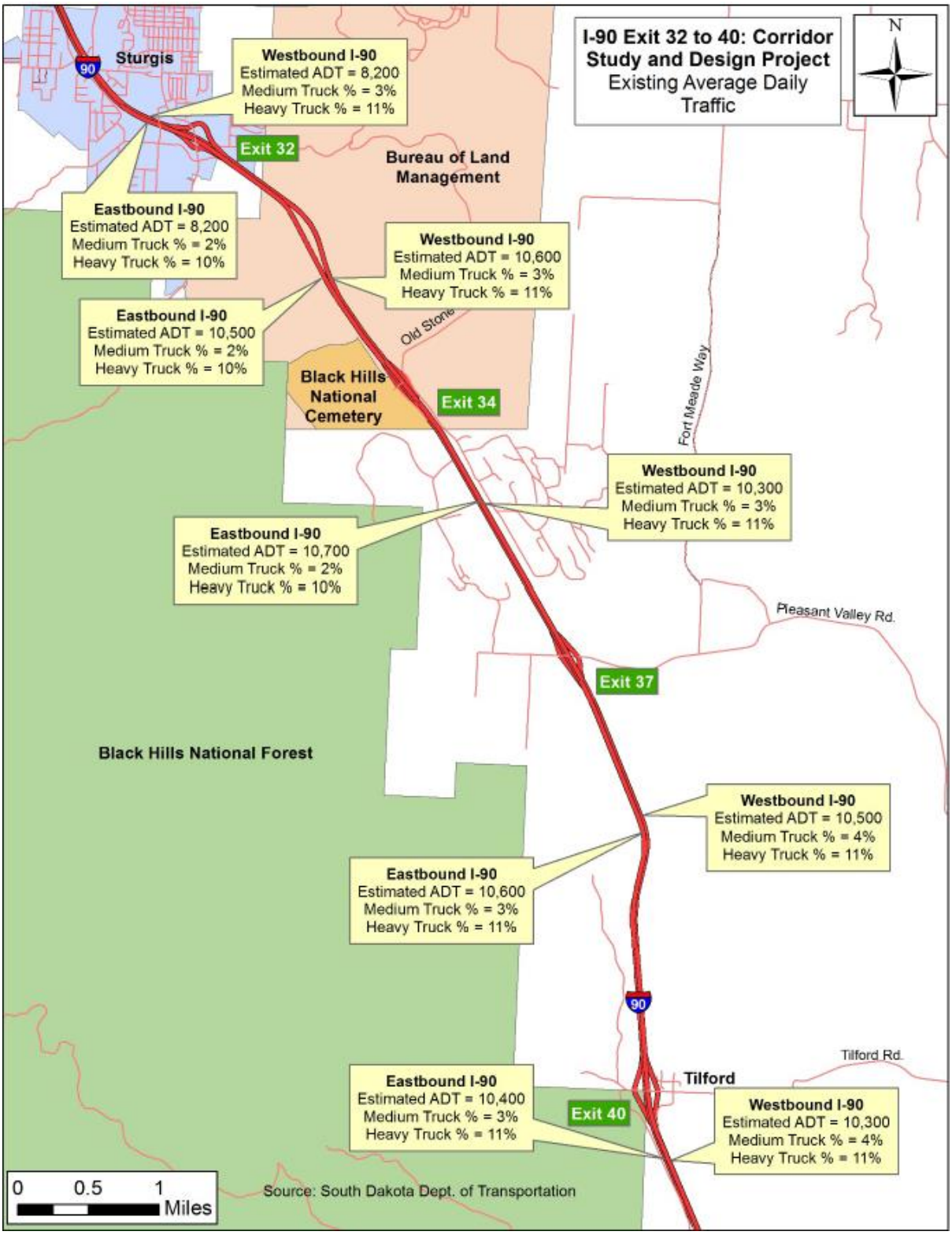
## Figure 3-5 August 2017 Turning Movement Counts



## Figure 3-6 September 2017 Turning Movement Counts



## Figure 3-7 Existing Average Daily Traffic and Truck Percentages



### Traffic Crash Data

Historical crash data were collected along the study area for the five-year period between 2012 and 2016 and constitute the "Analysis Period" for this report. The information included location and severity along with basic information about type and contributing factors.

Over the Analysis Period, there were 423 crashes in the study area. Of these, two resulted in fatalities, 21 resulted in incapacitating injuries, and 46 resulted in non-incapacitating injuries. Additional analysis of the collected crash data is presented later within this report.

## EXISTING YEAR 2017 OPERATIONAL PERFORMANCE

Existing traffic operations were assessed using methods prescribed in the Highway Capacity Manual (HCM) 6th Edition. Operations were assessed for existing weekday a.m. and p.m. peak hour traffic conditions based on traffic counts and other data collected in September 2017. "Operations" were quantified based on performance measures associated with analytical methods for the following facility types within the project study area:

- Freeway Facilities (Chapter 10)
- Two-Way STOP-Controlled Intersections (Chapter 20)

### I-90 Freeway Segments

The Interstate 90 mainline was evaluated using the Freeway Facilities methodology for the HCM. The method analyzes an extended length of freeway composed of continuously connected basic freeway, weaving, merge, and diverge segments. The methodology analyzes the connected segments over a set of sequential 15-minute time periods. The HCM core freeway facility method generates the following performance measures for each segment and time period:

- Capacity
- Free-flow speed
- Demand-to-capacity (D/C) and volume-to-capacity (V/C) ratios
- Average speed (space mean speed)
- Average density
- Travel time (minutes per vehicle)
- Vehicle miles traveled (VMT)
- Vehicle hours of travel (VHT)
- Vehicle hours of delay (VHD)

- Motorized vehicle level of service for each component and for the facility

Additionally, space mean speed, average density, travel time, VMT, VHT, VHD, and LOS are aggregated in each time interval across all segments in the facility. Performance measures are not aggregated across time periods.

Freeway Facilities analyses of existing condition were performed for the a.m. peak period (7:00 – 8:30 a.m.) and for the p.m. peak period (4:00 – 5:30 p.m.), as determined from the traffic counts. The Freeway Facilities method is a directional analysis. For individual segments, the following performance measures are reported: average travel speed (mph), density (pc/mi/ln), LOS, and demand-to-capacity ratio (D/C). For the a.m. and p.m. peak in both the eastbound and westbound directions, these are summarized in **Appendix B.**

According to the HCM, studies on LOS perception by rural travelers indicate the presence of lower-density thresholds in comparison to urban freeway travelers. The Freeway Facilities method presents different LOS thresholds, both based on the same density criterion, for urban versus rural areas, as shown in **Table 3-1.** These different thresholds apply only to the facility-level analysis. For the individual segments, the LOS thresholds are defined for the different components, including basic segments, merge and diverge segments, etc. and do not differentiate between urban vs. rural. The majority of the I-90 study section is located outside the Sturgis city limits, thus the entire corridor was evaluated as a rural facility. Facility results by time period are presented in **Table 3-2.** Overall facility results are presented in **Table 3-3.**

**Table 3-1 LOS Criteria for Urban and Rural Freeway Facilities**

| LOS | Freeway Facility Density (pc/mi/ln) | |
|---|---|---|
| | Urban | Rural |
| A | ≤ 11 | ≤ 6 |
| B | > 11 – 18 | > 6 – 14 |
| C | > 18 – 26 | > 14 – 22 |
| D | > 26 – 35 | > 22 – 29 |
| E | > 35 – 45 | > 29 – 39 |
| F | > 45 or<br>Any component D/C > 1.00 | > 39 or<br>Any component D/C > 1.00 |

## Table 3-2 Facility Results by Time Period

| A.M. Peak | | Eastbound | | | | Westbound | | | |
|---|---|---|---|---|---|---|---|---|---|
| Period | Time | Speed (mi/hr) | Density (pc/mi/hr) | Travel Time (min) | LOS | Speed (mi/hr) | Density (pc/mi/hr) | Travel Time (min) | LOS |
| 1 | 7:00 – 7:15 | 70.1 | 1.6 | 9.3 | A | 71.3 | 1.2 | 9.4 | A |
| 2 | 7:15 – 7:30 | 70.1 | 1.6 | 9.3 | A | 71.3 | 1.6 | 9.4 | A |
| 3 | 7:30 – 7:45 | 70.2 | 1.6 | 9.3 | A | 71.3 | 1.6 | 9.4 | A |
| 4 | 7:45 – 8:00 | 70.2 | 1.2 | 9.3 | A | 71.3 | 1.4 | 9.4 | A |
| 5 | 8:00 – 8:15 | 70.1 | 1.2 | 9.3 | A | 71.2 | 1.4 | 9.4 | A |
| 6 | 8:15 – 8:30 | 70.2 | 1.3 | 9.3 | A | 71.3 | 1.3 | 9.4 | A |
| **P.M. Peak** | | **Eastbound** | | | | **Westbound** | | | |
| Period | Time | Speed (mi/hr) | Density (pc/mi/hr) | Travel Time (min) | LOS | Speed (mi/hr) | Density (pc/mi/hr) | Travel Time (min) | LOS |
| 1 | 16:00 – 16:15 | 69.1 | 1.8 | 9.3 | A | 71.0 | 1.6 | 9.4 | A |
| 2 | 16:15 – 16:30 | 70.1 | 1.8 | 9.3 | A | 71.0 | 1.6 | 9.4 | A |
| 3 | 16:30 – 16:45 | 70.1 | 1.7 | 9.3 | A | 71.0 | 1.5 | 9.4 | A |
| 4 | 16:45 – 17:00 | 70.2 | 1.6 | 9.3 | A | 71.0 | 1.6 | 9.4 | A |
| 5 | 17:00 – 17:15 | 70.1 | 1.7 | 9.3 | A | 71.0 | 1.8 | 9.4 | A |
| 6 | 17:15 – 17:30 | 70.2 | 1.4 | 9.3 | A | 71.0 | 1.9 | 9.4 | A |

## Table 3-3 Overall Facility Results

| Analysis Direction | Space Mean Speed (mi/hr) | Average Travel Time (min) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|
| **A.M. Peak** | | | | |
| Eastbound | 70.1 | 9.3 | 1.4 | A |
| Westbound | 71.3 | 9.4 | 1.4 | A |
| **P.M. Peak** | | | | |
| Eastbound | 70.0 | 9.4 | 1.7 | A |
| Westbound | 71.0 | 9.4 | 1.6 | A |

The results indicate, both at the segment level and at the facility level, the study section of Interstate 90 operates at an acceptable level of service during typical weekday a.m. and p.m. peak hours. For this analysis, "typical" means no inclement weather, incidents, work zone activities, or special events.

**Unsignalized Intersections**

Existing conditions for selected unsignalized intersections in the study area were also evaluated, using the Two-Way Stop-Control method identified in the HCM 6th Edition. The method computes delay and LOS for those movements required to yield right-of-way, such as the left-turn movement on the major street approach and the side-street approaches. The following intersections were evaluated:

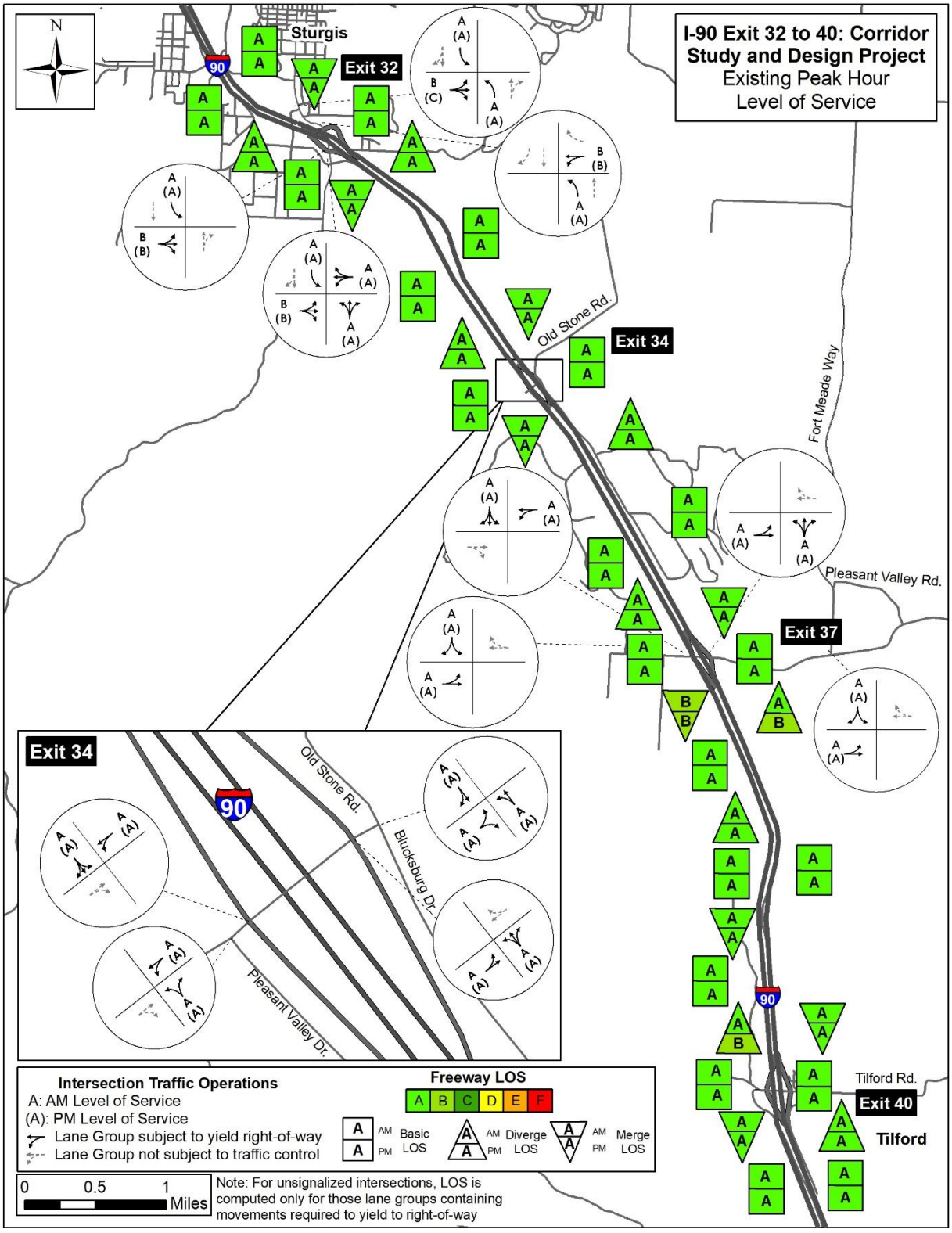
- Junction Avenue at Vanocker Canyon Road
- Junction Avenue at Dickson Drive
- Junction Avenue at I-90 Eastbound Ramps (Exit 32)
- Junction Avenue at I-90 Westbound Ramps (Exit 32)
- Horse Soldier Road (Old Stone Road) at I-90 Eastbound Ramps (Exit 34)
- Horse Soldier Road (Old Stone Road) at I-90 Westbound Ramps (Exit 34)
- Horse Soldier Road (Old Stone Road) at Blucksberg Drive
- Horse Soldier Road (Old Stone Road) at Pleasant Valley Drive
- Pleasant Valley Road at I-90 Eastbound Ramps (Exit 37)
- Pleasant Valley Road at I-90 Westbound Ramps (Exit 37)
- Pleasant Valley Road at Pleasant Valley Drive
- Pleasant Valley Road at Fort Meade Way

The Junction Avenue intersections with I-90 ramps (Exit 32) are signalized only during the motorcycle rally. They operate as unsignalized intersections with STOP-control on the exit ramp approaches during the remainder of the year. It should also be noted that turning movement counts were collected at Exit 40 as part of the evaluation of the Exit 37 interchange. However, Exit 40 was under construction at the time. For this reason, the following locations were not included in the analysis of the corridor:

- Sturgis Road-Tilford Road at Snyder Ranch Road
- Tilford Road at I-90 Eastbound Ramp (Exit 40)
- Tilford Road at I-90 Eastbound Ramp (Exit 40)
- Tilford Road at State Street

Existing delay and levels of service for the a.m. and p.m. peak at these intersections are shown in **Figure 3-8.**

## Figure 3-8 Existing Peak Hour Delay and LOS



### Existing Deficiencies and Needs

There are no existing capacity deficiencies, for the I-90 mainline or for the crossroads that form its service interchanges within the study area. For typical weekday a.m. and p.m. peak periods, with one exception, all facilities operated at Level-of-Service B or better. The one exception was the STOP-controlled minor street approach of eastbound Vanocker Canyon Road at Junction Avenue, which operates at LOS D during the a.m. peak and LOS C during the p.m. peak.

## EXISTING SAFETY CONDITIONS

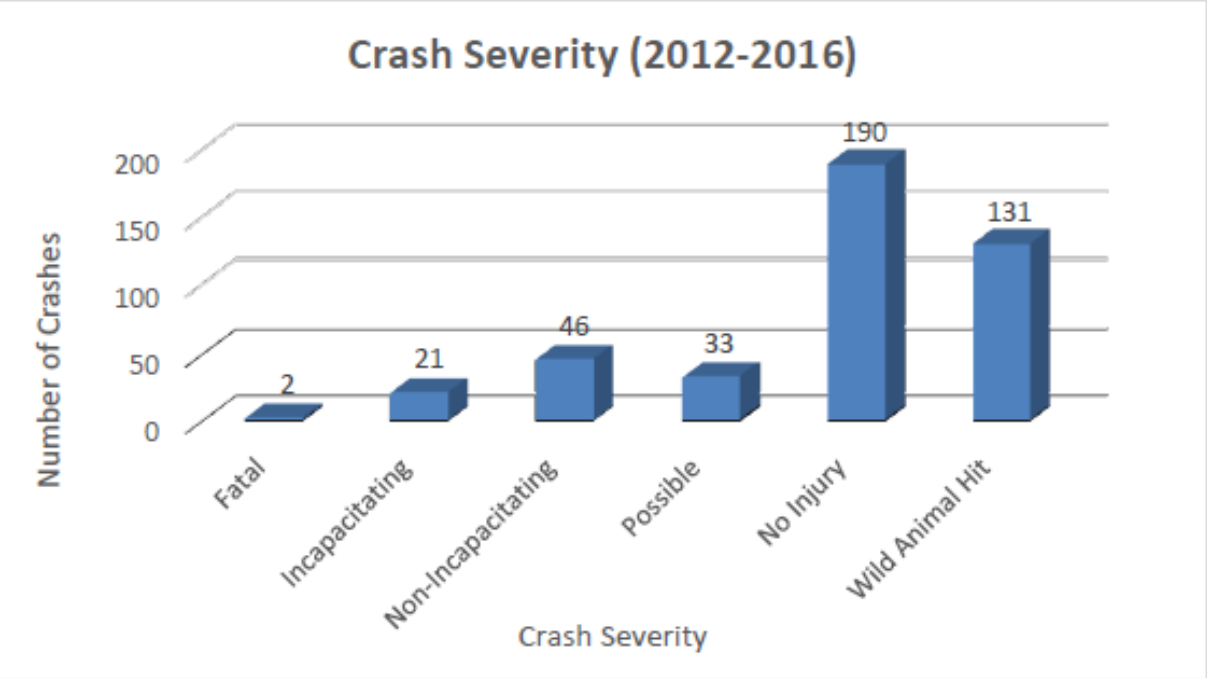
### Crash History

Historical crash data were collected along the study area for the five-year period between 2012 and 2016 and constitute the "Analysis Period" for this report.

### Crash Severity

Over the Analysis Period, there were 423 crashes in the study area. Of these, two resulted in fatalities, 21 resulted in incapacitating injuries, and 46 resulted in non-incapacitating injuries. It should be noted that 131 crashes were designated as "wild animal hit" crashes. Although this is not typically a crash severity category, it was included to highlight crashes that would be difficult to mitigate with safety improvements to the roadway.

**Figure 3-9 Distribution of Crashes by Severity**



Crashes were evaluated by severity and by type. Crashes were also evaluated by location – first by segment, then by shorter 0.3-mile "spots."

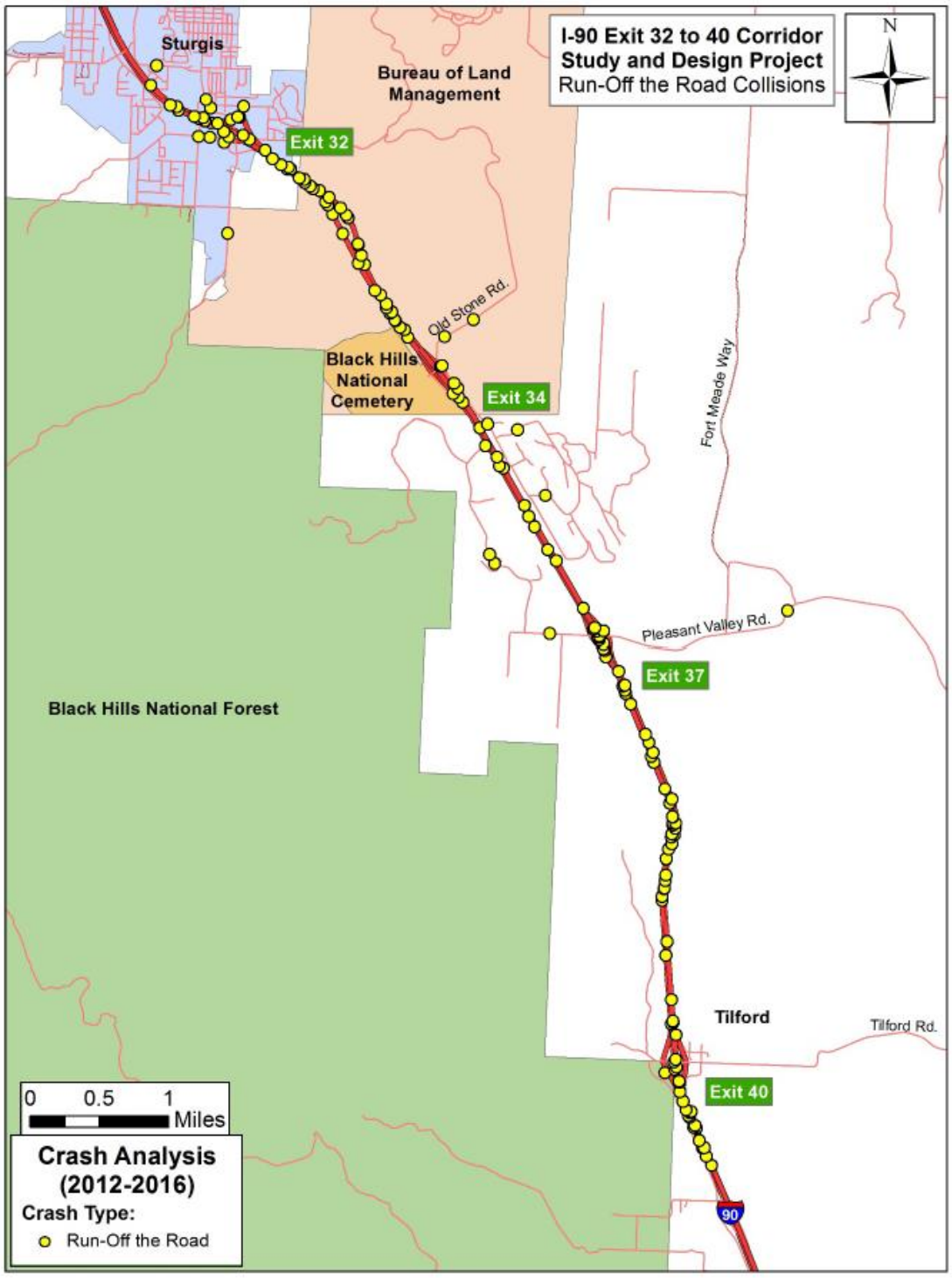
### Crash Type

To better understand the crash history along this corridor, the crash types were examined based on the "Manner of Collision" field in the crash reports. Single vehicle crashes were the most common crash type (281 crashes, 66%) and were predominately run-off-the-road incidents. Animal collisions were the second most commonly reported crash type, however many of these collisions were coded as single vehicle collisions. Of the 423 crashes, 167(39%) were coded as run-off-the-road collisions (ROR), which was the most common crash event. **Figure 3-11** summarizes the ROR collisions by location. There is a cluster of collisions at the horizontal curve (MRM 38.0-38.7) between Exit 37 and Exit 40. Of the 34 total collisions at this curve, 15 were ROR incidents and 19 occurred during wet weather conditions, (of the 15 ROR collisions, 12 occurred during wet weather conditions). **Figure 3-12** and **Figure 3-13** summarize the distribution of crashes by type and severity.

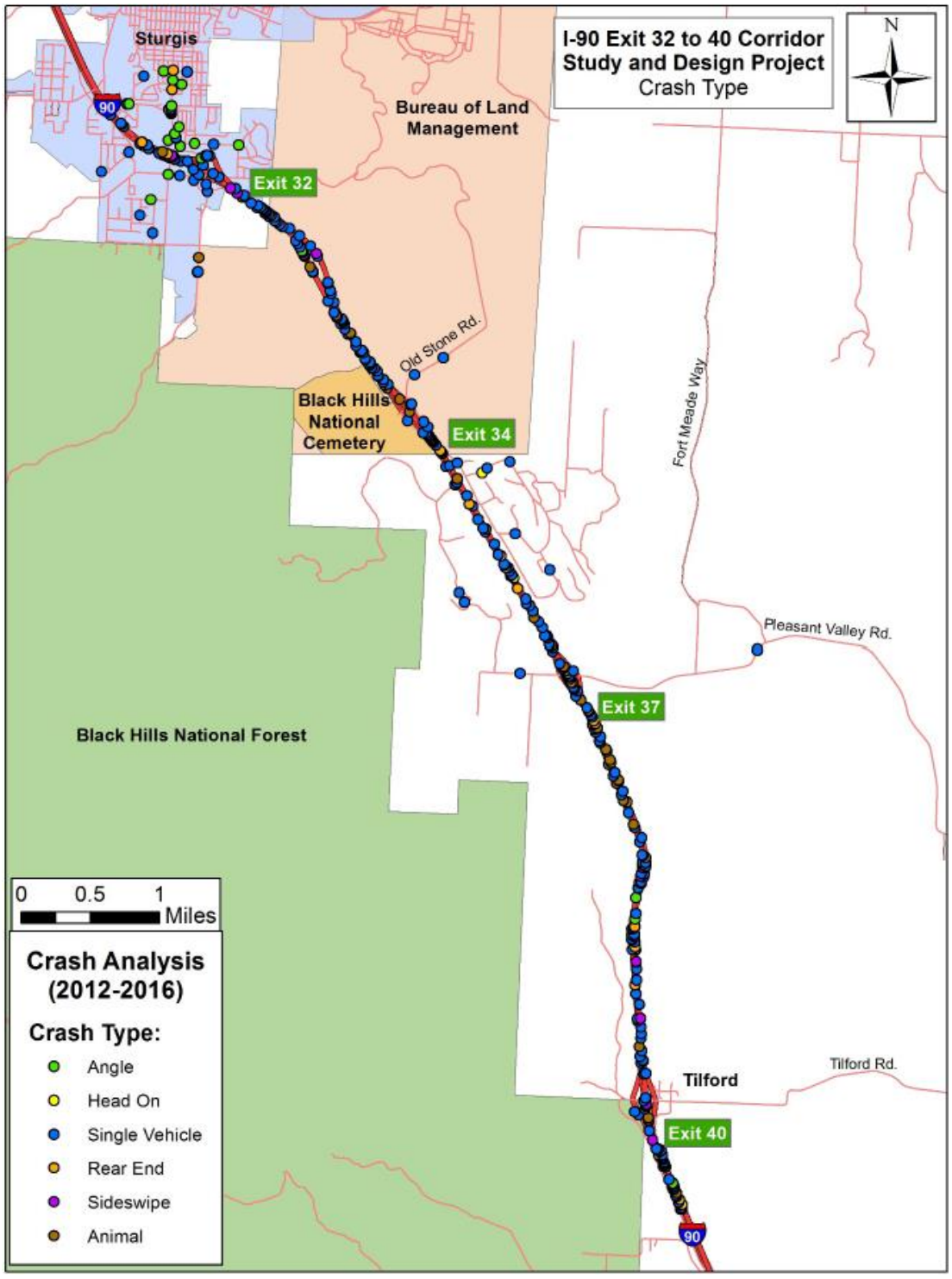
A map of the top five crash "hot spots" is shown in **Figure 3-14.** The two segments with the highest and second highest crash frequencies, Spot 4 and Spot 8, can be considered as locations for further study. The spots with the third and fourth highest crash frequencies, Spot 7 and Spot 16, are both located near interchanges. Spot 7 is located near Exit 34 and Spot 16 is located near Exit 40. The most common crash type at Spot 7 was animal collisions and the most common crash type at Spot 16 was single vehicle collisions. The spot with the fifth highest crash frequency was Spot 11, which also could be considered for further study.

The full crash analysis completed for the corridor can be found in **Appendix C**.

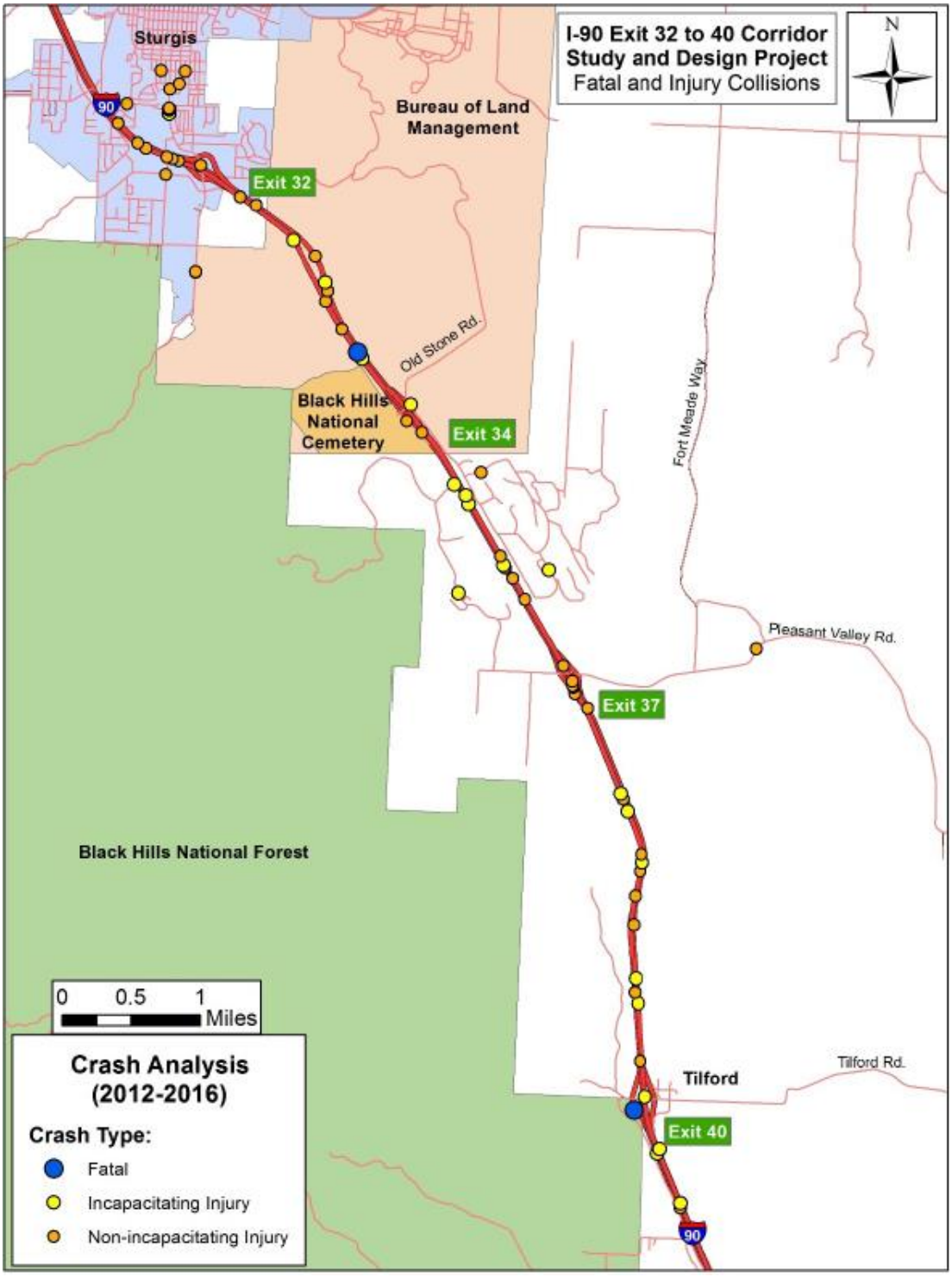
**Figure 3-10 Run-off-the-Road Crashes by Location**



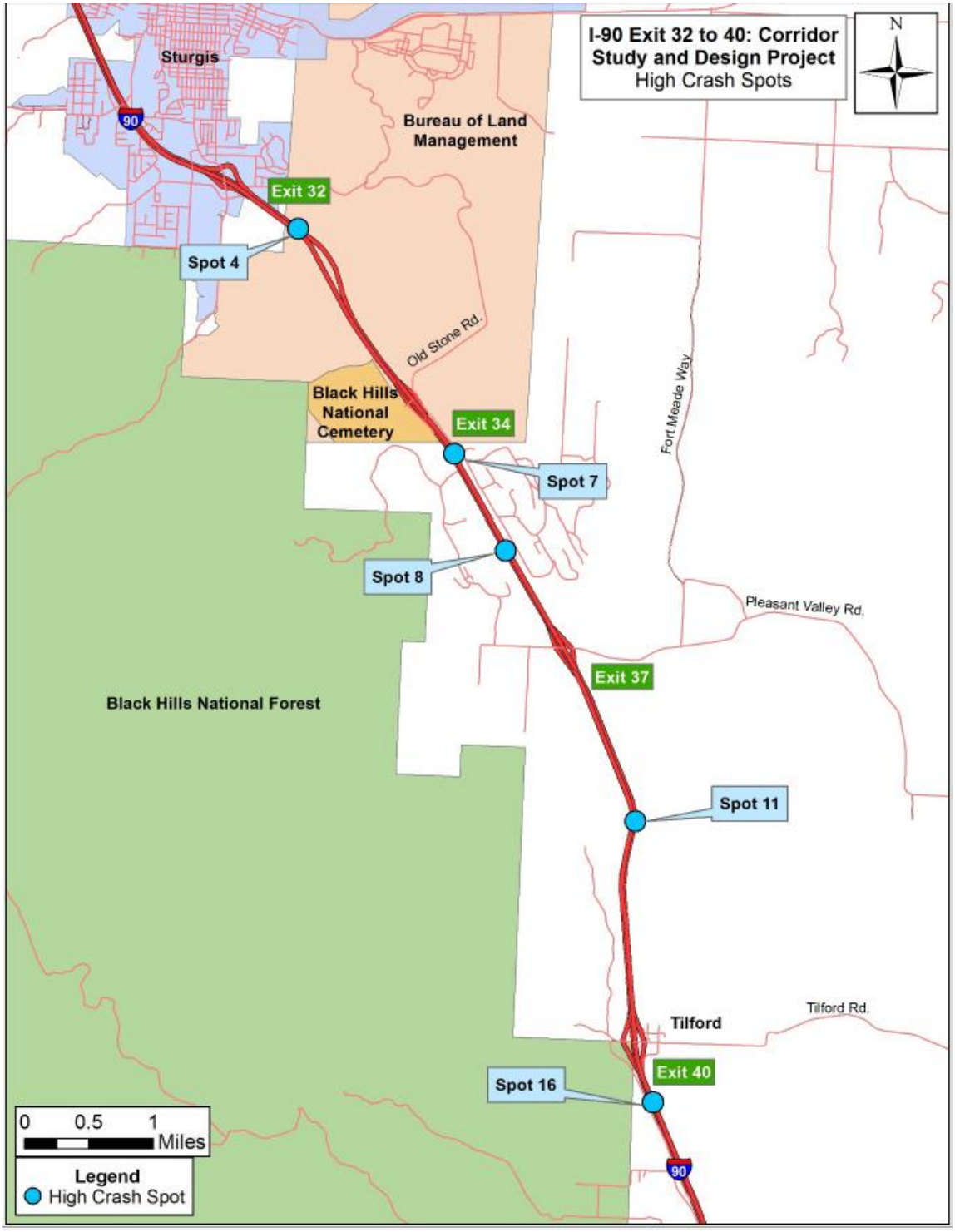
## Figure 3-11 Crashes by Type



## Figure 3-12 Crashes by Severity



## Figure 3-13 Top 5 Crash "Hot Spots"



# EXISTING ENVIRONMENTAL CONSTRAINTS

An Environmental Assessment (EA) is being conducted in 2019 for the entire I-90 corridor from Exit 32 to Exit 40, in response to upcoming construction needs along the corridor. The EA will evaluate environmental impacts associated with the alternatives for the study area which includes the Exit 37 Interchange and will determine the preferred alternative.

# 4. NEED

## GEOMETRIC

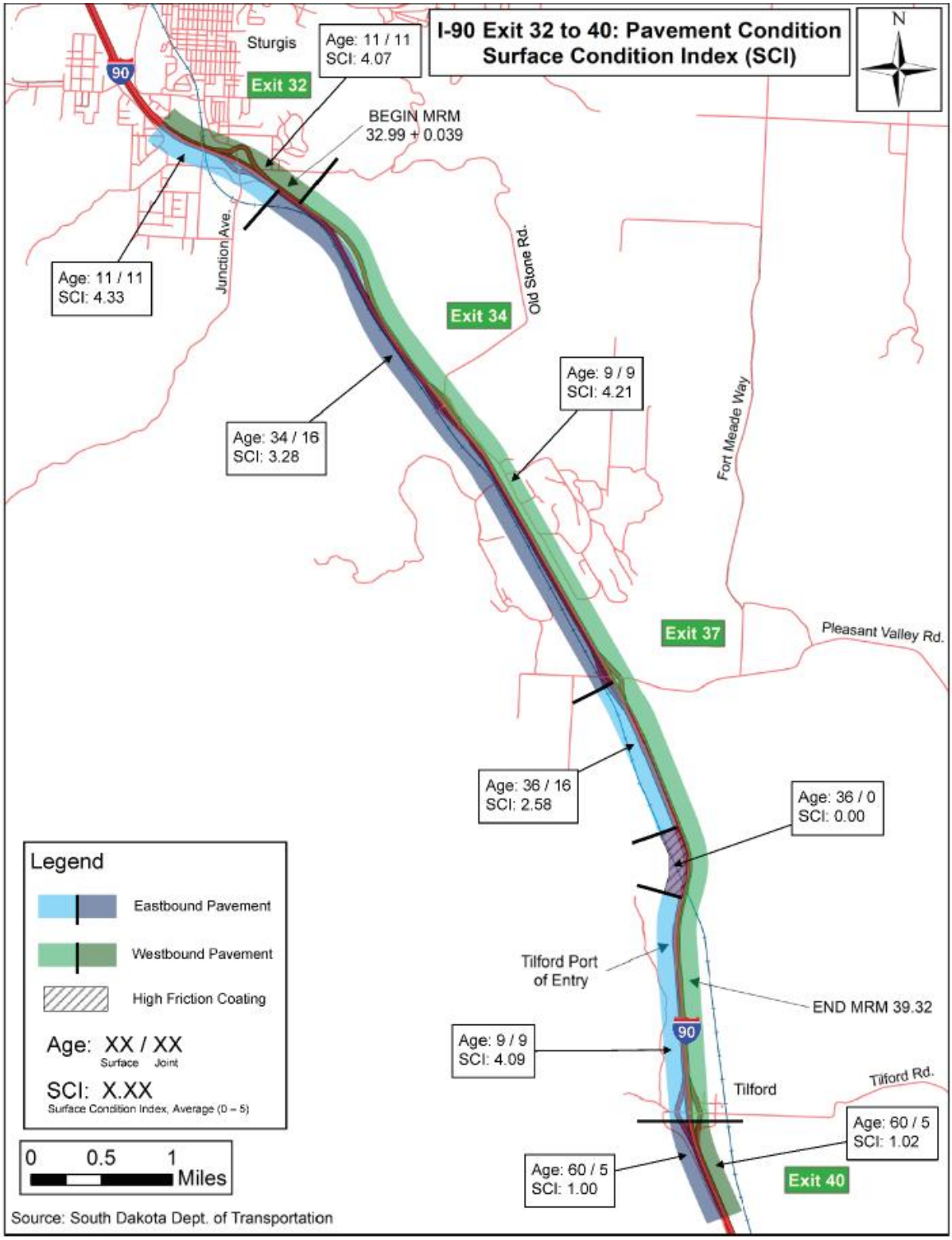
The following substandard conditions would persist when Exit 37 Interchange conditions are analyzed in comparison to the current *South Dakota Department of Transportation Road Design Manual:*

- 5.6% grade on west bound on ramp exceeds maximum grade. (5%)
- Lane width measured at 13 feet (minimum 15 foot)
- The minimum right shoulder width measured at 4 feet along ramps (8 feet standard)
- Substandard inslopes measured at 4:1 (6:1 standard)
- Substandard ramp K values.
- Minimum ramp stopping sight distance measured at 331 feet (425 feet standard)
- Substandard minimum ramp intersection sight distance.
- Substandard cross road K values
- Minimum cross road sight distance measured at 178 feet (standard 425 feet)
- Median horizontal offset less than minimum distance (550 feet)

## PAVEMENT

The need to replace or rehabilitate the pavement is often the driving force behind the timing of many construction projects on the state highway system. The SDDOT has determined the pavement in the eastbound lanes of I-90 between Exits 32 and 40 will require replacement before 2025. A pavement condition survey was conducted by SDDOT in 2017 and the surface condition index (SCI) was calculated for each segment. The study area pavement conditions and approximate ages are shown in **Figure 4-1.**

## Figure 4-1 Pavement Condition Surface Condition Index



# SAFETY

The Exit 37 interchange ranked 56th of 62 interchanges evaluated in Phase 1 of the *2000 Interstate Corridor Study* and 19th of 126 interchanges in the *2010 Interstate Corridor Study*. Neither study noted Exit 37 as a high crash location. A review of reported crashes between the Year 2012 and Year 2016 revealed no significant recurring crash patterns.

# STRUCTURAL

The Exit 37 bridge (Pleasant Valley Road) is a 4-span, haunched, steel plate girder bridge constructed in 1963. It is supported on concrete sill abutments on timber piles and piers consisting of a concrete cap beam on two columns on individual spread footings. The deck has a considerable amount of delamination, which is a condition that impacts the performance of the structure and maintenance costs. Although the structure carries a sufficiency rating of 96.7, its inventory rating is HS 18.3 (33.0 tons). The geometry, condition of primary components, and load carrying capacity, need to be considered in the measure of the bridge's performance.

# TRAFFIC

The updated future traffic forecasts and operational analyses completed for the IMJR indicate that the Exit 37 interchange and study area intersections, are projected to operate acceptably through the 2050 design year.

The analyses indicate that the No Build and Build scenarios are anticipated to operate comparably; however, the Build scenario provides the ability to correct substandard interchange geometries.

Previous traffic analysis of the interchange resulted in similar finding, described as follows:

- The *Interstate 90 Black Hawk – Sturgis Corridor Preservation Study* concluded that traffic operations are not currently an issue at the Exit 37 interchange. When the existing (No Build) configuration was evaluated for the year 2025, the interchange ramp terminal intersections with the crossroad indicated no anticipated deterioration of LOS during the average AM and PM peak hours. The Study also indicated that mainline capacity may require an expansion of mainline from 2 through lanes to 3 through lanes in each direction sometime beyond the planning horizon. This potential future expansion of mainline I-90 capacity could not be accommodated with the current Exit 37 bridge.

- *South Dakota Department of Transportation Decennial Interstate Corridor Study* completed in February 2001 evaluated projected year 2010 and 2020 traffic conditions at the Exit 37 interchange and concluded that all ramp merge/diverge movements and ramp terminal intersections are projected to operate at LOS B or better through the year 2020.

# 5. ALTERNATIVES

One alternative for the Exit 37 interchange (Alt 37-1) was initially developed and evaluated as part of the *Interstate 90 Black Hawk – Sturgis Corridor Preservation Study*. Two additional alternatives were developed as part of the I-90 Exit 32 to 40 Corridor Study (Alts 37-2 and 37-3).

## NO BUILD ATERNATIVE

The No Build Alternative would maintain the Exit 37 Interchange in its current configuration. The interchange would retain its current geometry to include a substandard grade on the WB on-ramp, narrow lane widths, narrow right shoulders, steep inslopes and ramp and crossroad K values and stopping sight distances that do not meet current design standards.

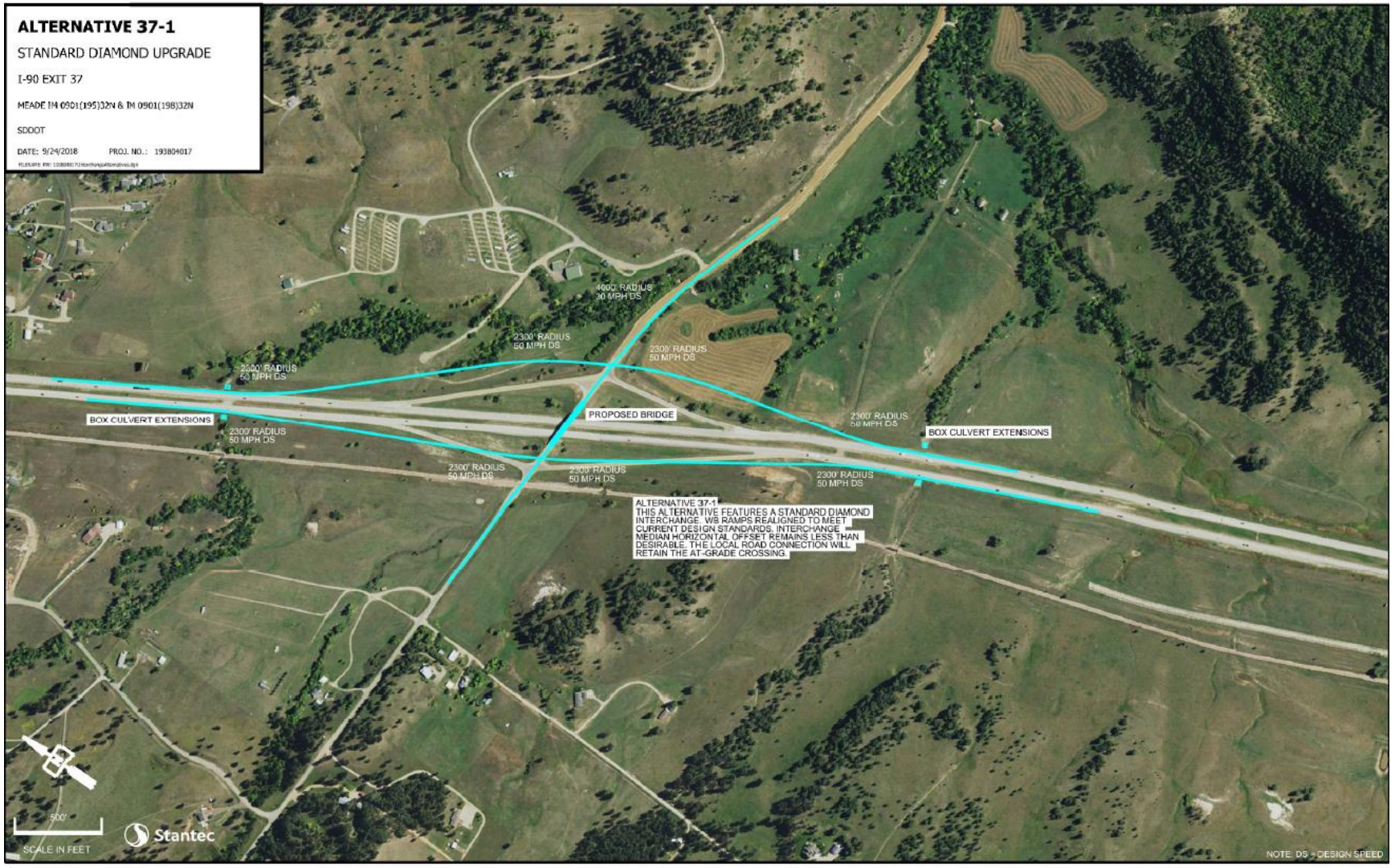
## INTERCHANGE BUILD ATERNATIVES

Shown in **Figure 5-1,** Alternative 37-1 would involve constructing a new diamond interchange at the same location and on the same alignment as the existing Exit 37 Interchange. The alternative includes a new overpass bridge, box culvert extensions, ramps, and local road tie-ins. The westbound ramps are shifted east to allow greater median horizontal offset at the overpass. The eastbound ramps shift closer to the bridge creating greater separation between the ramp and railroad tracks to the west. The alignment of Pleasant Valley Road changes slightly east of the bridge. Box culvert extensions are added at all four ramps near the merge points. The railroad crossing remains at-grade. A single skewed local road bridge (Pleasant Valley Road) will span mainline I-90. The bridge will remain in the same location as the existing bridge which increases the span length. The railroad crossing will maintain the same location as the existing crossing.

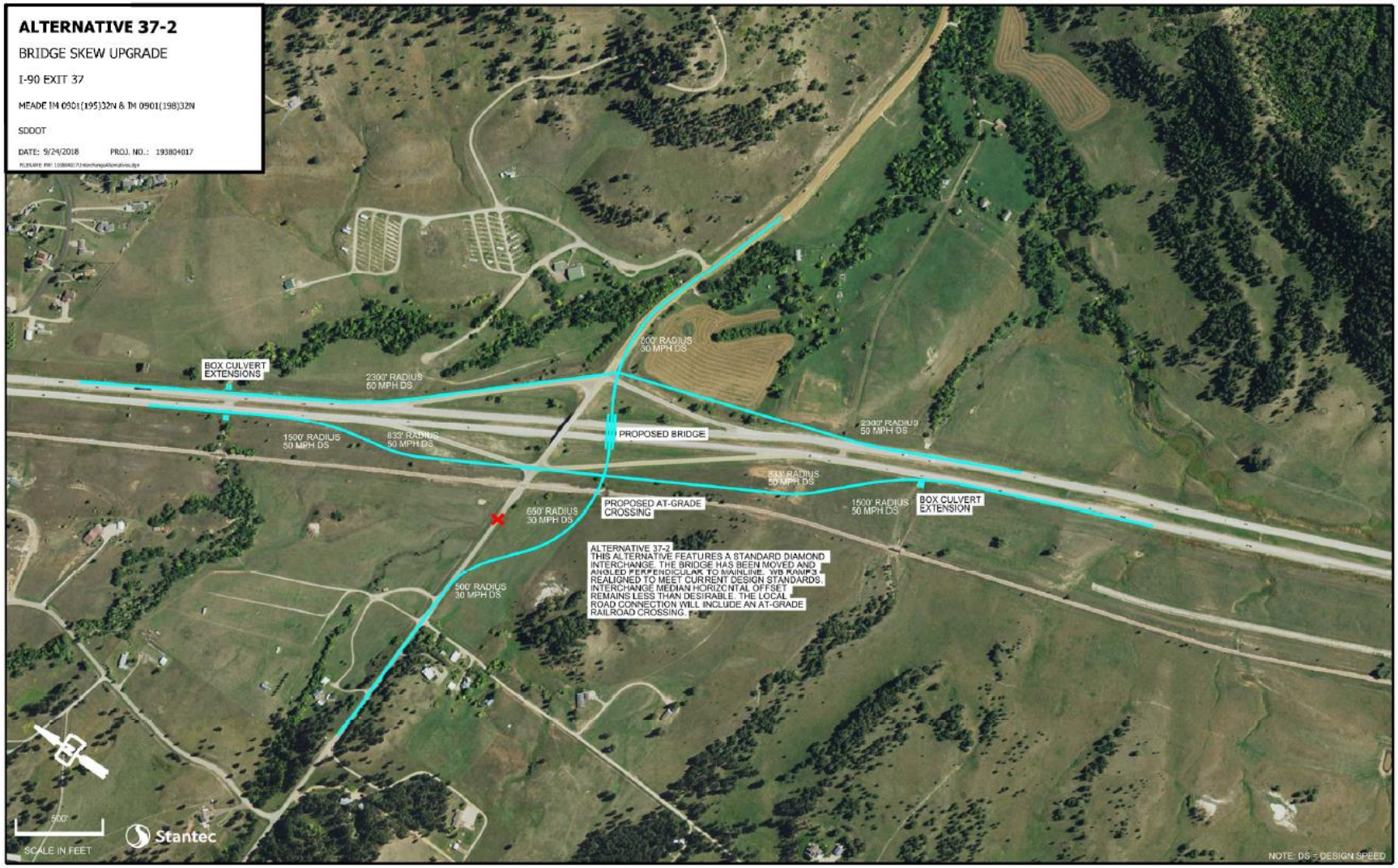
Shown in **Figure 5-2,** Alternative 37-2 was identified as the Exit 37 Interchange build alternative. This alternative involves constructing a new diamond interchange in the same general location as the existing Exit 37 Interchange. The alternative includes a new overpass bridge, box culvert extensions, ramps, railroad crossing, and local road tie-ins. The ramps are shifted to allow greater median horizontal offset at the overpass. A new bridge is installed over the interstate mainline south of the existing bridge. Pleasant Valley Road is realigned to match the new bridge location. Box culvert extensions are added at three of the four ramps. The railroad crossing location changes but remains at-grade. A single, slightly skewed local road bridge will span mainline I-90. It is relocated approximately 250 feet south of the existing bridge.

Alternative 37-2 corrects the existing geometric deficiencies for the ramps. The eastbound off ramp would move approximately 360-feet west of its current location (closer to Exit 34 from today's conditions). The eastbound on ramp would move approximately 812-feet to the east (closer to Exit 40 from today's conditions). The westbound on ramp would move approximately 115-feet to the east (further from Exit 34 from today's conditions). The westbound off ramp would move approximately 565-feet to the west (further from Exit 40 from today's conditions)

## Figure 5-1 Alternative 37-1 I-90 Exit 37 Interchange



## Figure 5-2 Alternative 37-2 I-90 Exit 37 Interchange (Build Alternative)



Shown in **Figure 5-3,** Alternative 3 involves constructing a new diamond interchange at generally the same location as existing Exit 37. The alternative includes new interstate mainline in both directions (realigned to the east), a new overpass bridge, a box culvert extension, ramps, railroad crossing, and local road tie-ins. Mainline I-90 is realigned to allow more separation between the ramps, bridge, and railroad tracks. All the ramps are shifted to match the new bridge location. A new perpendicular bridge is built southeast of the existing bridge. Pleasant Valley Road is realigned to match the new bridge location. A box culvert extension is added at the westbound on-ramp. The railroad crossing location changes but remains at-grade.

A single, perpendicular local road bridge will span mainline I-90. It is relocated approximately 300 feet southeast to remove the large skew of the existing bridge.

Exit 34 is planned to be reconstructed in the future after the Exit 37 Interchange project. The reconstruction of the Exit 34 Interchange will likely not occur before the 2024 construction season. Multiple I-90 and Exit 34 Interchanges are currently being considered for a future construction project (currently nine (9) build alternative concepts). At this time, it is uncertain what year or what alternative will be proposed for constructed at I-90 and Exit 34. In order to consider how the proposed Exit 37 Interchange (Build Alternative 37-2) will operate with a future Exit 34 Interchange, we have developed a graphic of the worst-case scenario alternative where Exit 34 would be shifted to the southeast of its current location (closer to the Exit 37 Interchange), shown in **Figure 5-4**. The Exit 37 Interchange Alternative will be constructed in advance of the Exit 34 Interchange, so approval of the modification of a build alternative for Exit 34 would be requested under a separate future IMJR.

The westbound on ramp and the eastbound off ramp at Exit 40 are planned to be reconstructed in the Year 2022. The Exit 40-1 proposed build alternative being considered is shown in **Figure 5-5.** This build alternative matches the same footprint of the existing interchange and is proposed to fix slight geometric deficiencies for the westbound on ramp and the eastbound off ramp. Because the proposed alternative would be replacing in kind what exists today, it is anticipated that an IMJR is not required for the future Exit 40 Interchange ramp improvements.

## TRANSPORTATION SYSTEM MANAGEMENT ALTERNATIVE

There are no areas within the State of South Dakota that will consistently experience congestion levels extreme enough for Transportation System Management (TSM) measures such as ramp metering or high occupancy vehicle (HOV) facilities to be economically feasible in the foreseeable future.

## Figure 5-3 Alternative 37-3 I-90 Exit 37 Interchange

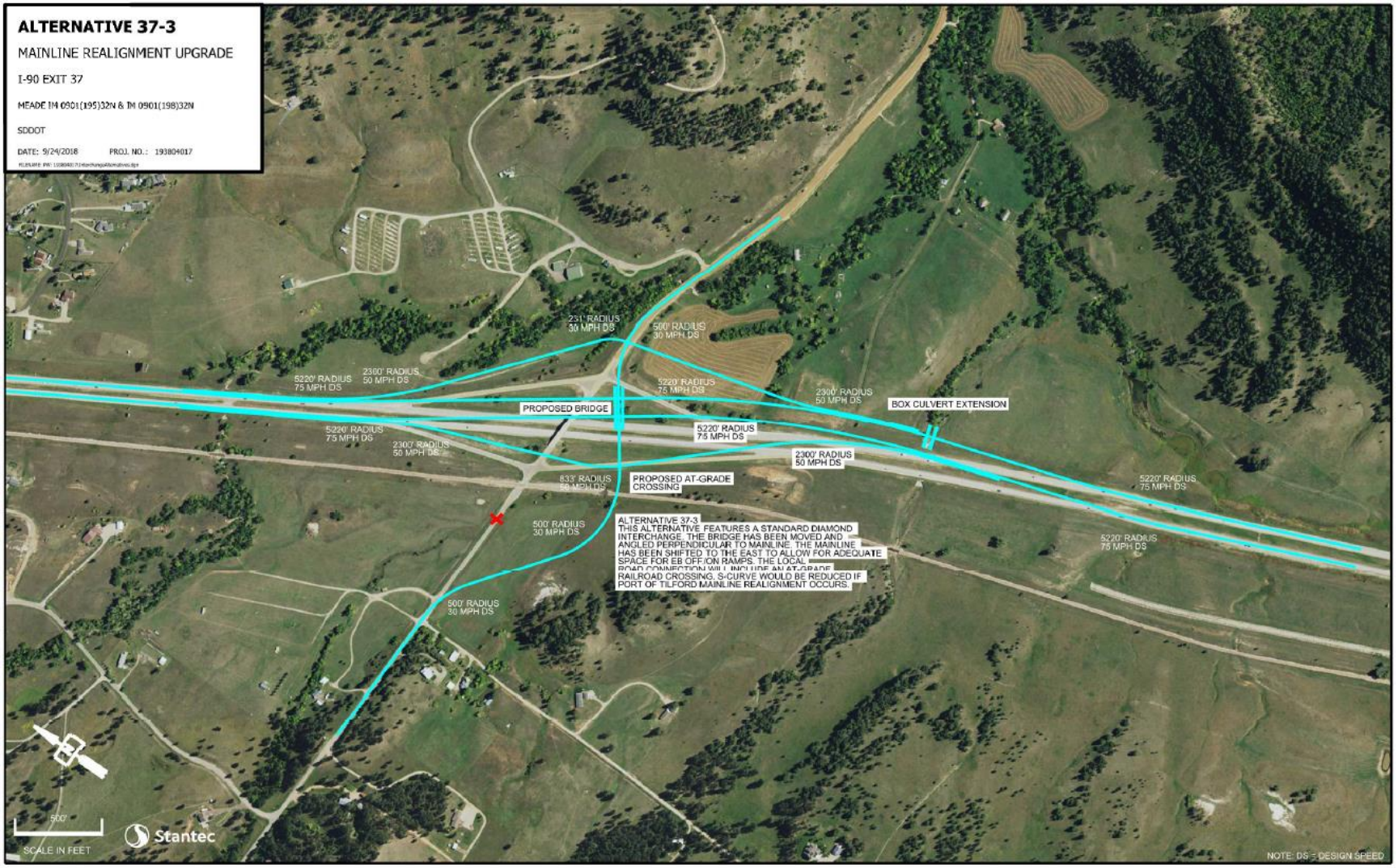
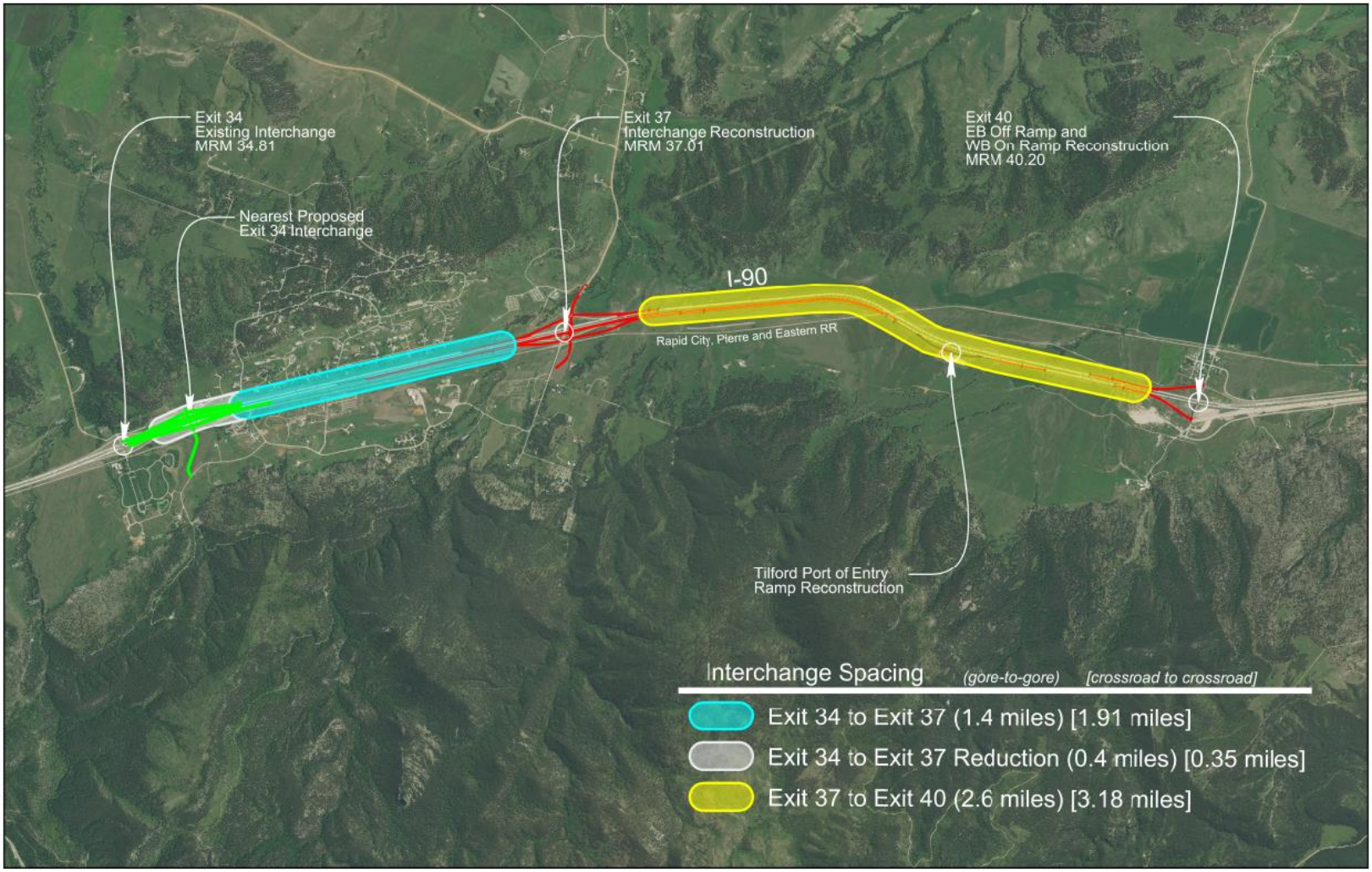


**Figure 5-4 Interchange Spacing between Alternative 37-2 (Alternative) Interchange and Exit 34 Interchange Alternative with Closest Spacing to Exit 37**



## Figure 5-5 Alternative 40-1 I-90 Exit 40 Interchange

# 6. FUTURE DESIGN YEAR 2050 TRAFFIC GROWTH AND ANALYSIS

## TRAVEL DEMAND FORECASTING

The IMJR Methods and Assumptions Document describes the growth projection methodology used in the study. While there is a regional travel demand model for the Rapid City area maintained by the Rapid City Metropolitan Planning Organization (MPO), it does not cover the project study area. Additionally, there is no South Dakota statewide travel model from which future year traffic forecasts can be based. The SDDOT Inventory Management Office have developed traffic growth rates per functional class and county that have been provided; these growth rates will be the primary basis for developing future year project traffic forecasts.

Future year (both Opening Year and Design Year) intersection turning movement forecasts will be developed based on methods describe in *NCHRP Report 765, Analytical Travel Forecasting Approaches for Project-Level Planning and Design.*

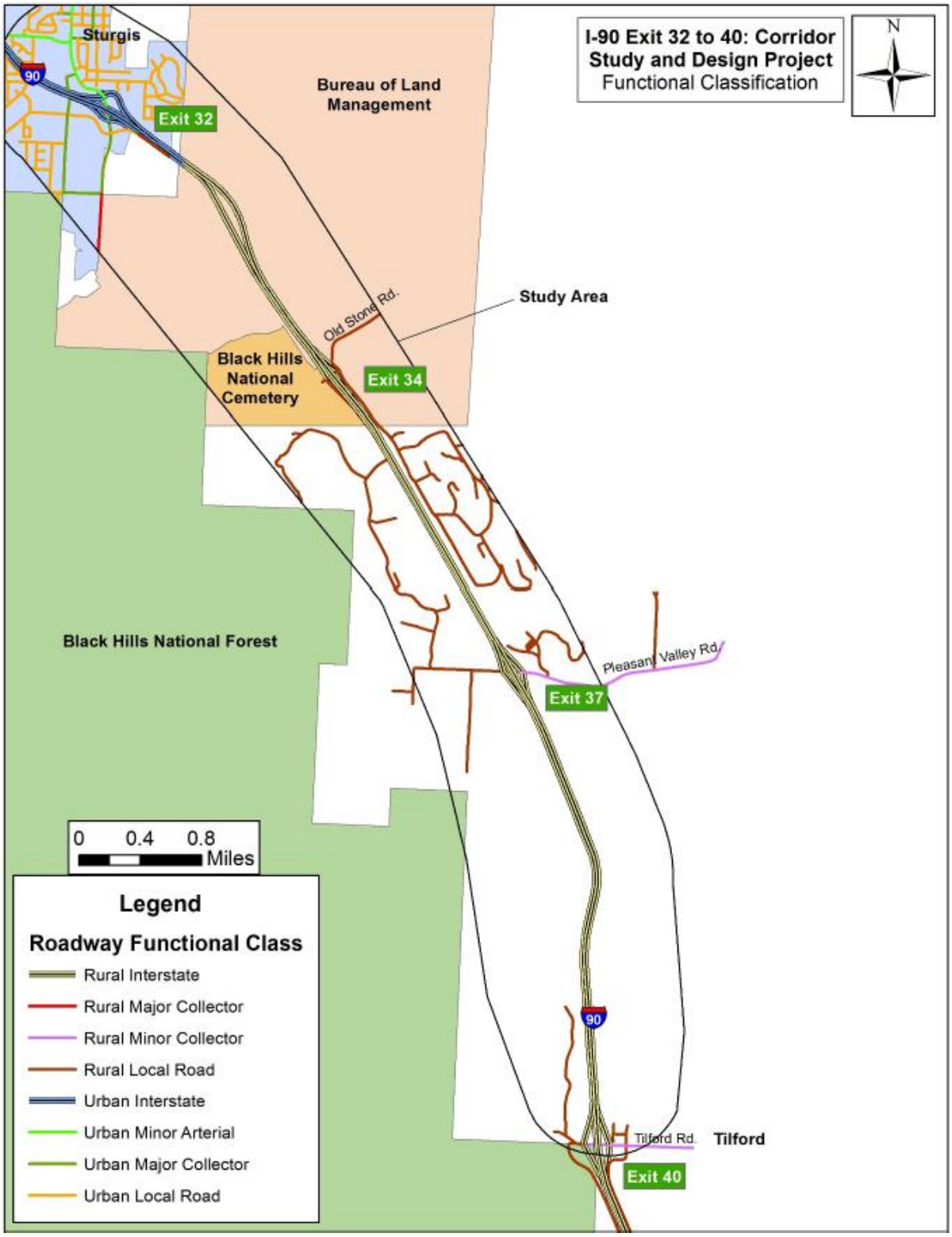
The project area is an approximate 10-mile section of Interstate 90 from northwest of Exit 32 in Sturgis to southeast of Exit 40 at Tilford. It includes four service interchanges with I-90:

- Exit 32, SR 79, Vanocker Canyon Road/Junction Avenue
- Exit 34, Black Hills National Cemetery/Pleasant Valley Drive
- Exit 37, Pleasant Valley Road
- Exit 40, Tilford Road

A map of the study area roadway network and functional classification is shown in **Figure 6-1.** Interstate 90 is the only Principal Arterial through the study area. At Exit 32, Junction Avenue is functionally classified as a Minor Arterial through the interchange, then transitions to a Major Collector south of I-90 as it become Vanocker Canyon Road. Pleasant Valley Road (Exit 37) and Tilford Road (Exit 40) are Minor Collectors and Pleasant Valley Drive (Exit 34) is a local road.

All four interchanges are service interchanges of a diamond configuration and are unsignalized with STOP-control only on the exit ramp approach. At Exit 32, only during the Sturgis Motorcycle Rally, temporary signals are installed.

**Figure 6-1 Study Area Roadway Network and Functional Classification**



Chapter 3 within this report identified the methodology for conducting base Year 2017 existing traffic volumes along with Figures showing the results of the existing traffic volumes (both ADT volumes and peak hour turning movement volumes). These base Year 2017 existing traffic volumes were utilized as the basis in which the growth factors were applied to develop growth forecast year traffic volumes.

## GROWTH FACTORS

Based on the *Methods and Assumptions* document prepared by Stantec and submitted in November 2017, growth factors developed by the SDDOT Inventory Management Office are the primary basis for developing future year traffic forecasts. This memorandum can be found in **Appendix D**. These growth factors, shown in **Table 6-1,** are broken down into 20-, 25-, 30-, and 35-year values for both rural and urban interstates.

**Table 6-1 SDDOT Growth Factors**

| Area/Facility Type | 20-year | 25-year | 30-year | 35-year |
|---|---|---|---|---|
| Rural Interstate | 1.267 | 1.325 | 1.390 | 1.455 |
| Rural Arterials/ Collectors/Locals | 1.339 | 1.425 | 1.510 | 1.595 |
| Urban Interstate | 1.407 | 1.500 | 1.600 | 1.700 |
| Urban Arterials/ Collectors/Locals | 1.235 | 1.300 | 1.360 | 1.420 |

The 2023 opening year forecasts were developed by computing an average annual growth rate (agr) from the 20-year growth factors, then projecting that average annual growth rate for six years (2017 to 2023) as shown in the following equation:

$$Year\ 2023\ Forecast = Year\ 2017\ Volume * (1+agr)^6$$

The 2050 (33) year growth factor was computed using an interpolation of the 30- and 35- year factors established by SDDOT and applied to the existing (year 2017) seasonally adjusted traffic volumes.

The growth factors used in developing the opening year 2023 and design year 2050 forecasts are summarized in **Table 6-2.**

### Table 6-2 Summary of Growth Factors

| Area/Facility Type | Annual Growth Rate | Year 2023 Growth Factor* | Year 2050 Growth Factor* |
|---|---|---|---|
| Rural Interstate | 1.19% | 1.074 | 1.429 |
| Rural Arterials/ Collectors/Locals | 1.47% | 1.092 | 1.561 |
| Urban Interstate | 1.72% | 1.108 | 1.660 |
| Urban Arterials/ Collectors/Locals | 1.06% | 1.065 | 1.396 |
| *Applied to 2017 traffic volumes adjusted for day of week and month | | | |

## MAINLINE AVERAGE DAILY TRAFFIC FORECASTS

Mainline average daily traffic forecasts were developed by applying the 2023 and 2050 growth factors to existing traffic volumes adjusted for day of week and month. These forecast volumes are shown in **Tables 6-3 and 6-4** and **Figures 6-2** and **6-3.**

### Table 6-3 Opening Year (2023) Average Daily Traffic Forecasts

| Location | Type | Direction | 2017 Adjusted ADT | 2023 ADT | MT% | HT% |
|---|---|---|---|---|---|---|
| West of Exit 32 | Urban Interstate | Eastbound | 8,200 | 9,100 | 2% | 10% |
| | | Westbound | 8,200 | 9,100 | 3% | 11% |
| Between Exit 32 & 34 | Rural Interstate | Eastbound | 10,500 | 11,300 | 2% | 10% |
| | | Westbound | 10,600 | 11,400 | 3% | 11% |
| Between Exit 34 & 37 | Rural Interstate | Eastbound | 10,700 | 11,500 | 2% | 10% |
| | | Westbound | 10,300 | 11,100 | 3% | 11% |
| Between Exit 37 & 40 | Rural Interstate | Eastbound | 10,600 | 11,400 | 3% | 11% |
| | | Westbound | 10,500 | 11,300 | 4% | 11% |
| East of Exit 40 | Rural Interstate | Eastbound | 10,400 | 11,200 | 3% | 11% |
| | | Westbound | 10,300 | 11,100 | 4% | 11% |

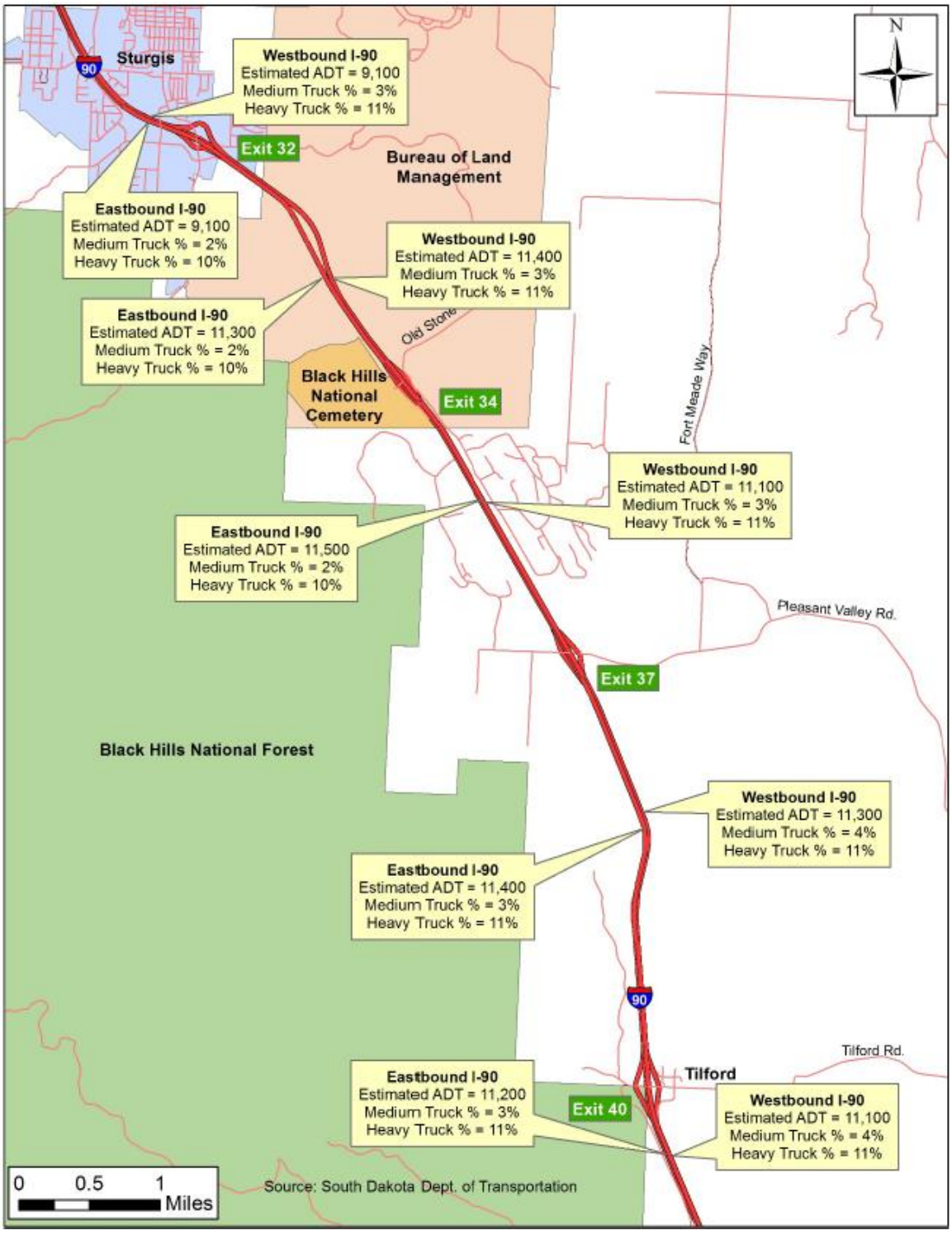
MT = Medium Trucks; HT = Heavy Trucks

## Table 6-4 Design Year (2050) Average Daily Traffic Forecasts

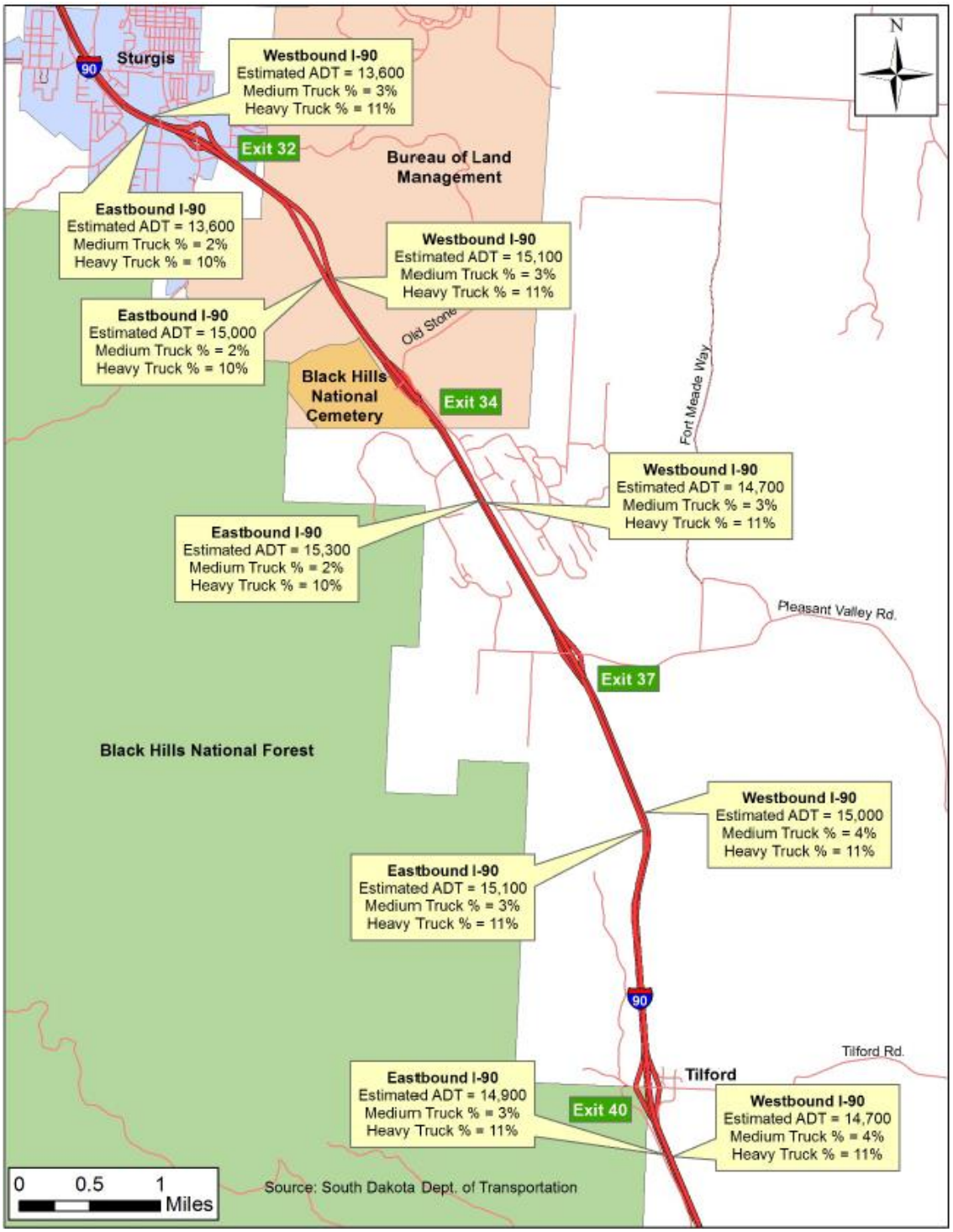
| Location | Type | Direction | 2017 Adjusted ADT | 2050 ADT | MT% | HT% |
|---|---|---|---|---|---|---|
| West of Exit 32 | Urban Interstate | Eastbound | 8,200 | 13,600 | 2% | 10% |
| | | Westbound | 8,200 | 13,600 | 3% | 11% |
| Between Exit 32 & 34 | Rural Interstate | Eastbound | 10,500 | 15,000 | 2% | 10% |
| | | Westbound | 10,600 | 15,100 | 3% | 11% |
| Between Exit 34 & 37 | Rural Interstate | Eastbound | 10,700 | 15,300 | 2% | 10% |
| | | Westbound | 10,300 | 14,700 | 3% | 11% |
| Between Exit 37 & 40 | Rural Interstate | Eastbound | 10,600 | 15,100 | 3% | 11% |
| | | Westbound | 10,500 | 15,000 | 4% | 11% |
| East of Exit 40 | Rural Interstate | Eastbound | 10,400 | 14,900 | 3% | 11% |
| | | Westbound | 10,300 | 14,700 | 4% | 11% |

MT = Medium Trucks; HT = Heavy Trucks

## Figure 6-2 Opening Year (2023) Average Daily Traffic Forecasts



## Figure 6-3 Design Year (2050) Average Daily Traffic Forecasts



# PEAK HOUR FORECASTS

Year 2023 and Year 2050 a.m. and p.m. peak hour traffic forecasts were developed for:

- I-90 mainline directional segments
- Intersection turning movements

In both cases, existing (September 2017) traffic counts were adjusted for day of week and month based on 2017 seasonal adjustment factors developed by SDDOT for WIM Station 901. These adjusted volumes then were multiplied by the corresponding growth factors shown previously in **Table 6-2.**

For turning movements at I-90 ramp intersections with cross streets, the application of different growth factors to different approaches (interstate ramp vs. arterial or collector) resulted in "unbalanced" intersection volumes (i.e. entering and departing traffic volumes were not in agreement). The Iterative Directional Method as documented in NCHRP Report 765[1] was used to alternatively balance entering traffic and departing traffic volumes until an acceptable level of convergence was reached.

Opening year 2023 a.m. and p.m. peak hour turning movement traffic forecasts are shown in **Figure 6-4.** Design year 2050 a.m. and p.m. peak hour turning movement traffic forecasts are shown in **Figure 6-5.**

## Figure 6-4 Opening Year 2023 A.M. and P.M. Peak Hour Traffic Forecasts

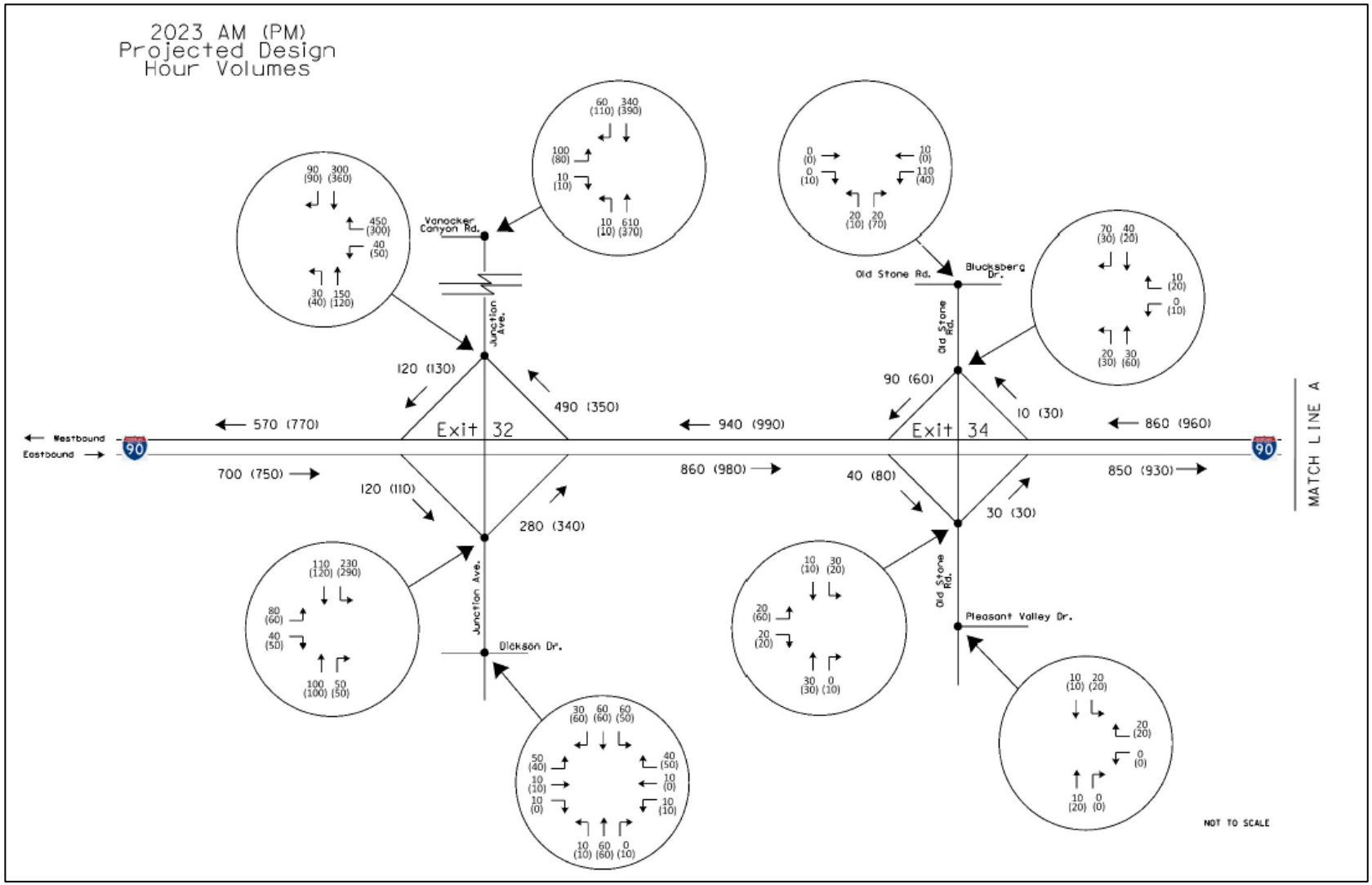


**Figure 6-4 (cont.) Opening Year 2023 A.M. and P.M. Peak Hour Traffic Forecasts**

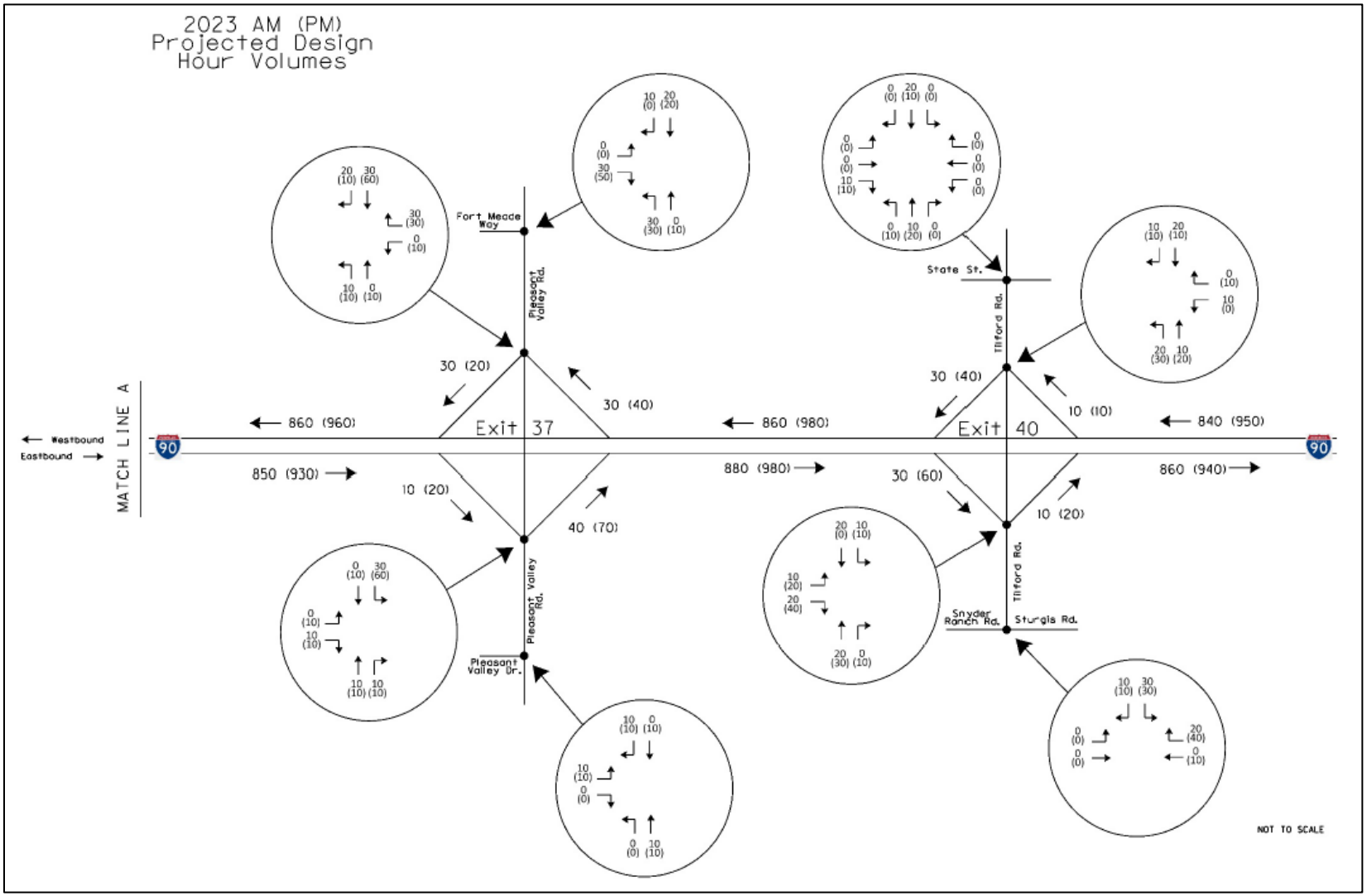


**Figure 6-5 Design Year 2050 A.M. and P.M. Peak Hour Traffic Forecasts**

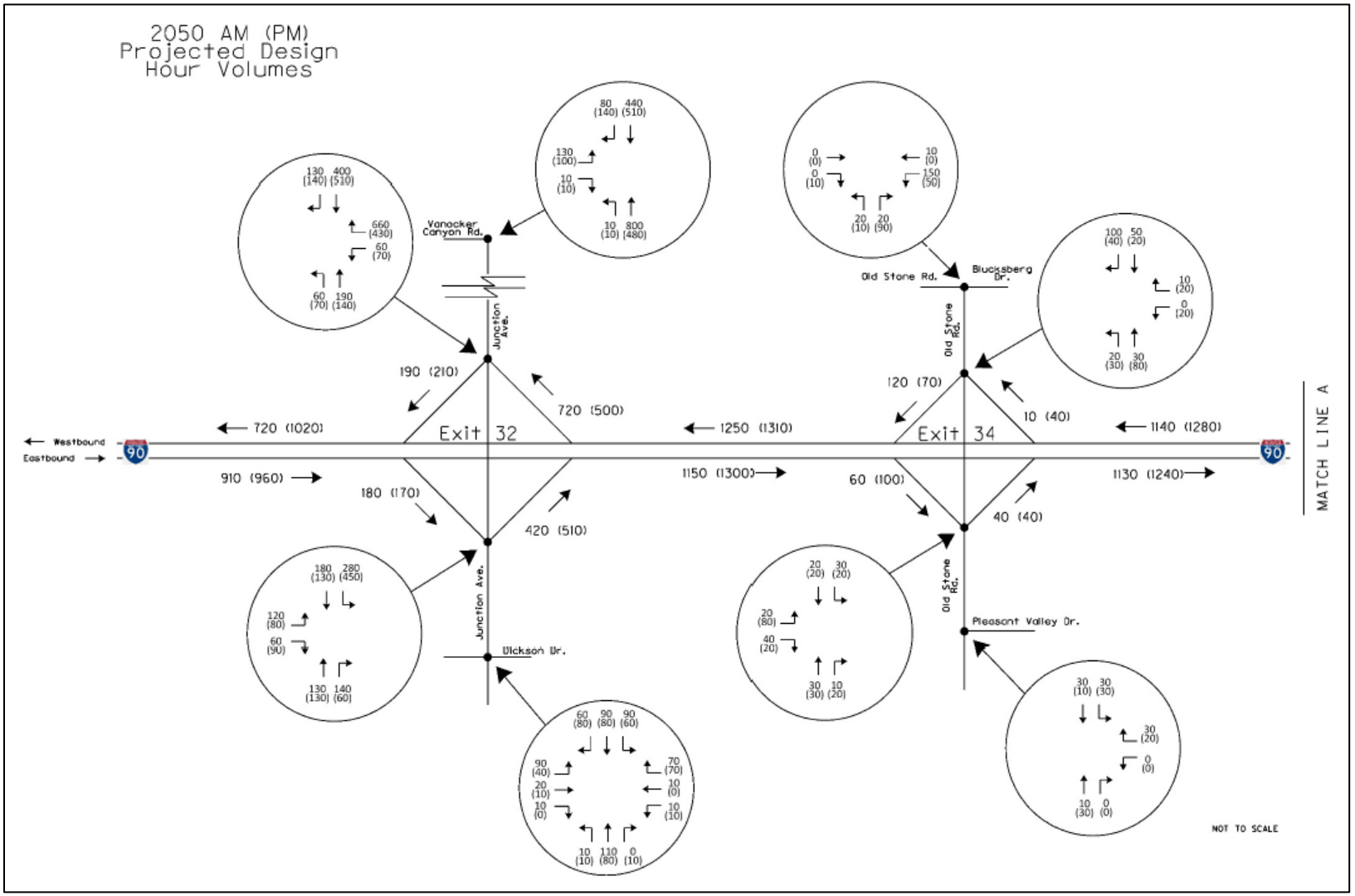
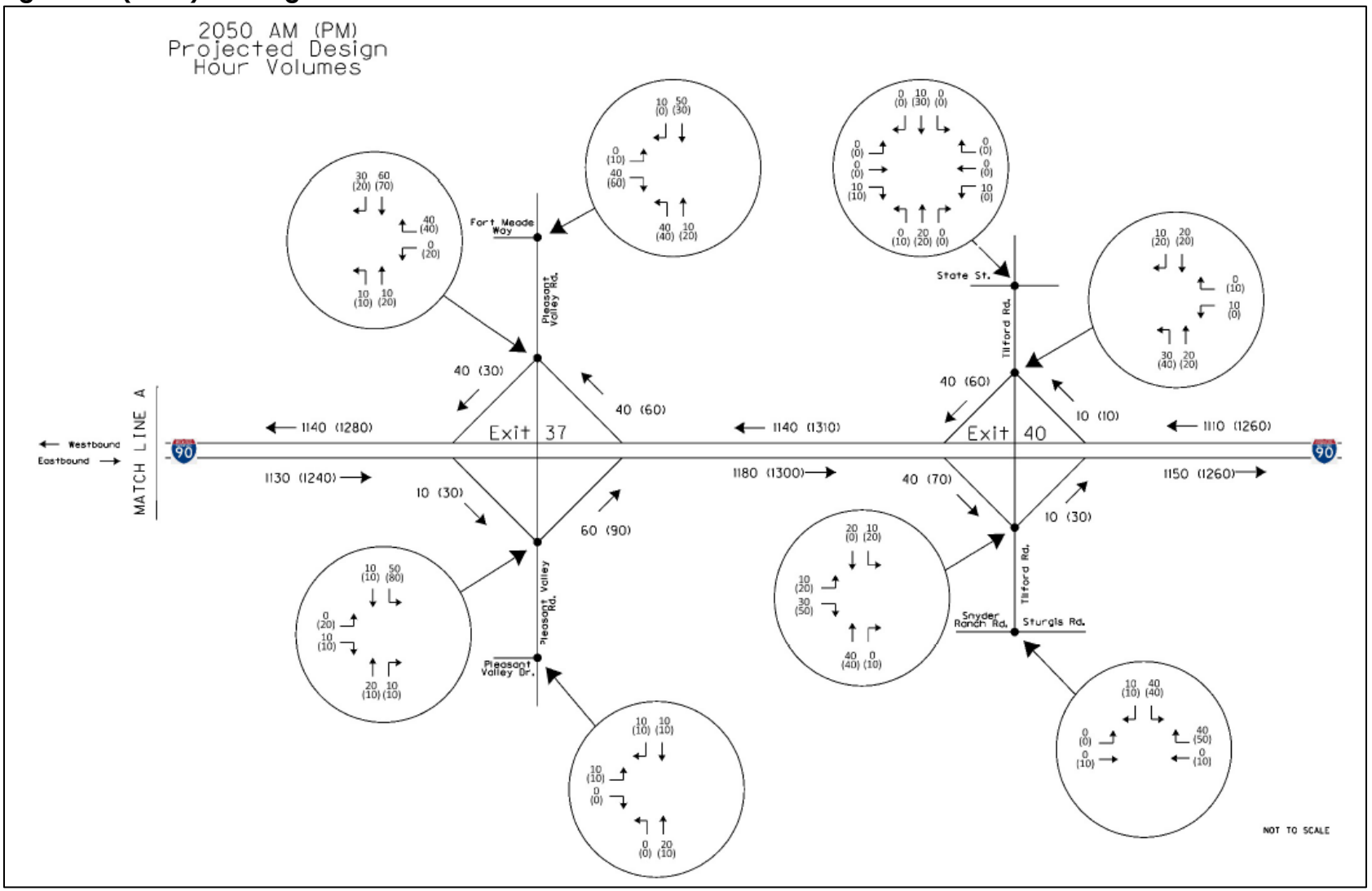


**Figure 6-5 (cont.) Design Year 2050 A.M. and P.M. Peak Hour Traffic Forecasts**



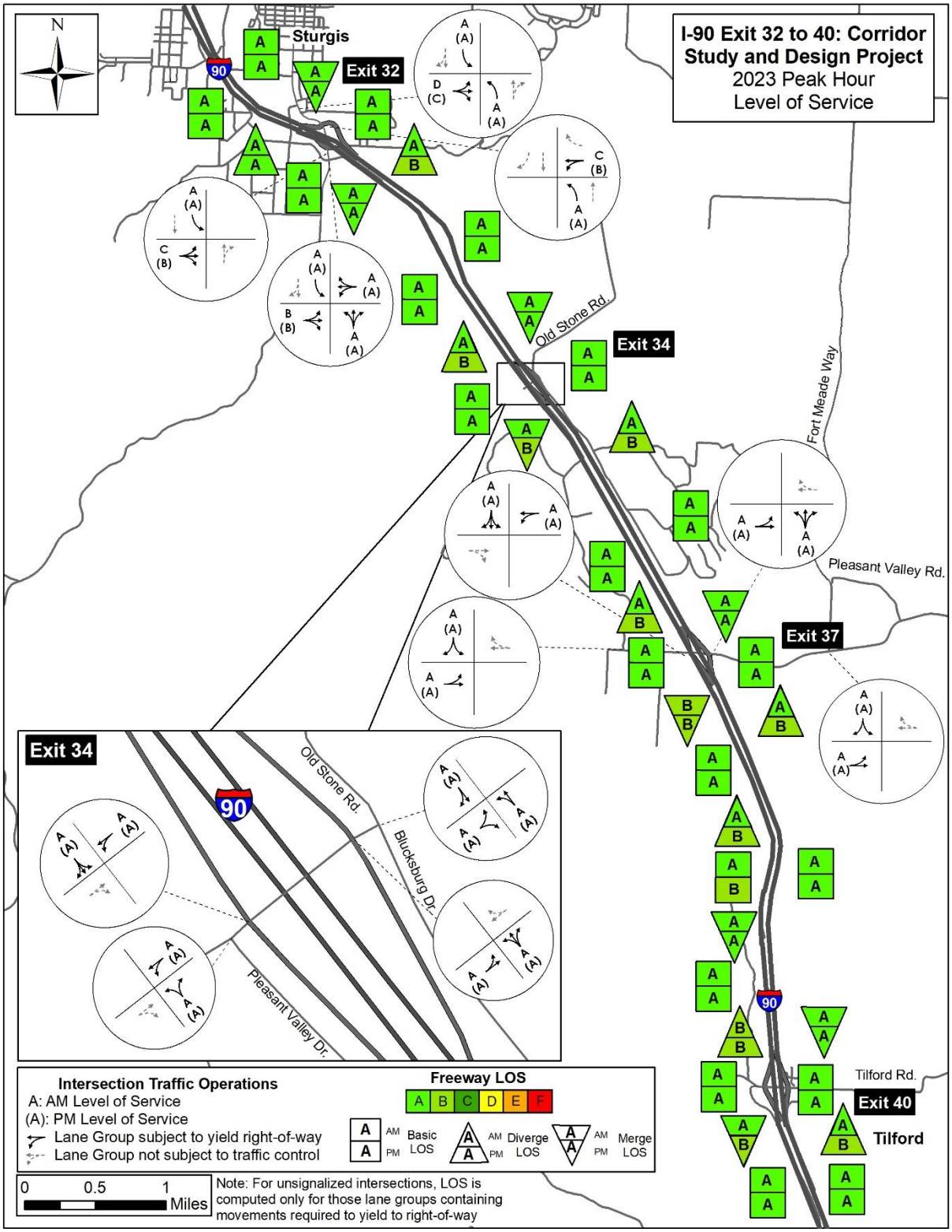
# DESIGN YEAR 2050 AND OPENING YEAR 2023 PEAK HOUR INTERSECTION ANALYSIS

Highway Capacity Software 7th Edition (HCS7) was used to implement the procedures defined in the Highway Capacity Manual (HCM) 6th Edition. The HCS All-Way Stop Controlled (AWSC) and Two-Way Stop Controlled (TWSC) tools were used to evaluate the intersections.

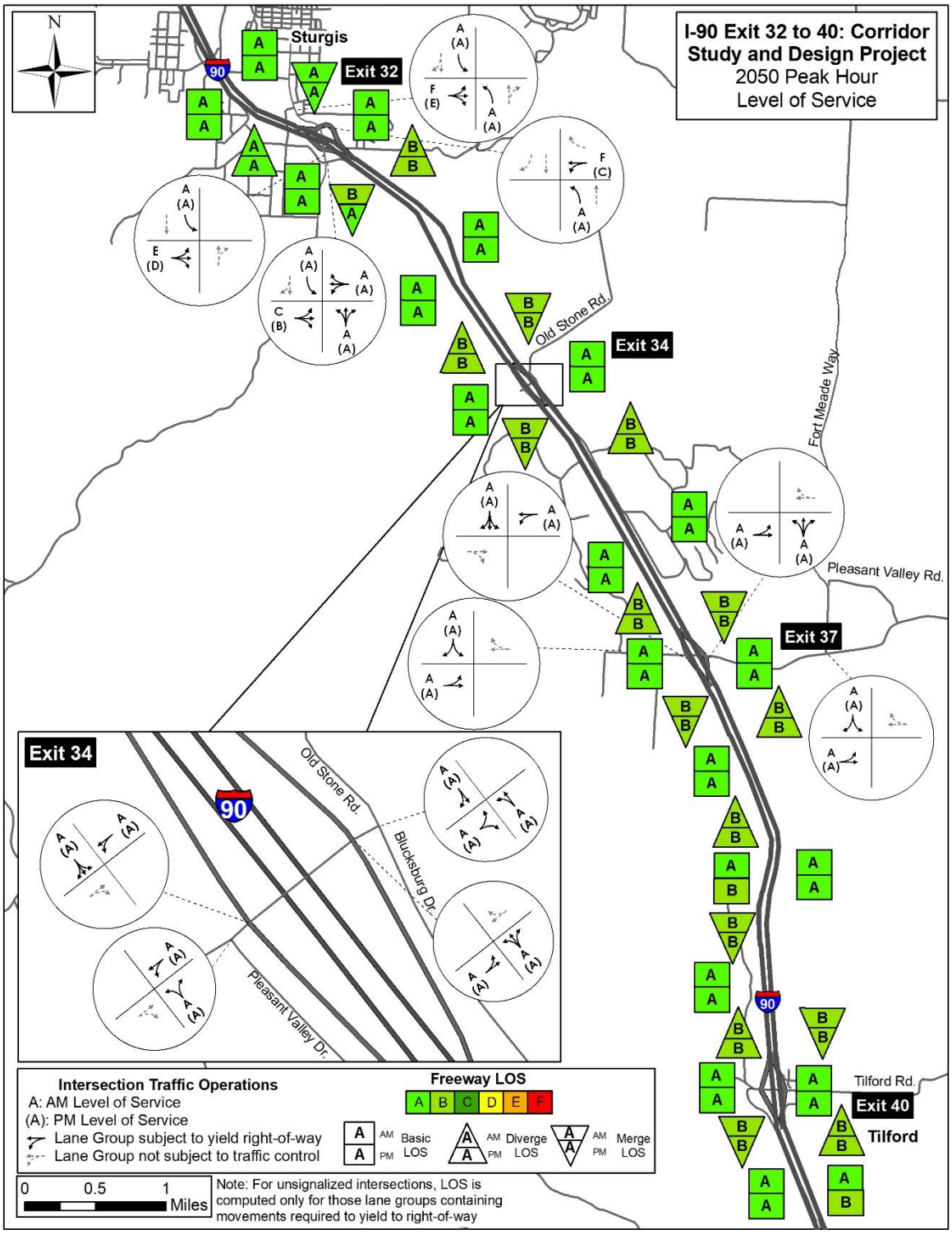
Interchange AM and PM peak hour analyses were performed for the eastbound and westbound directions for the Base Year (2017), the opening year (2023), and the Design Year (2050). The results for the Base Year (2017) analysis were previously shown in Chapter 3 of this report. The Design Year 2050 analysis represents both the 2050 No Build and 2050 Build Alternative scenarios. This is because there are no proposed changes to the traffic control or intersection lanes and turn lane geometries between the No-Build and Build Scenarios.

It should be noted that Exit 40 was under construction during traffic count collection and was not included in the intersection analyses. **Figure 6-6** presents the 2023 a.m. and p.m. peak hour intersection delay and LOS. **Figure 6-7** presents the 2050 a.m. and p.m. peak hour intersection delay and LOS for both the 2050 Design Year No-Build and Build Alternative scenarios.

## Figure 6-6 Opening Year (2023) Peak Hour Delay & LOS



## Figure 6-7 Design Year (2050) Peak Hour Delay & LOS



# I-90 FREEWAY SEGMENTS

As previously explained within Chapter 3 of this report, the Interstate 90 mainline was evaluated using the Freeway Facilities methodology for the HCM. The full analysis can be found in the Traffic Operation for Feasible Scenarios Report, **Appendix B**.

Design Year 2050 Analysis

HCS7 Freeway Facilities analyses were performed for the Design Year (2050) peak hour for both the eastbound and westbound directions. Single-period analyses were used since future traffic patterns cannot be assumed. The output tables provide a summary of the average speed, density in passenger cars per mile per lane, level of service (LOS), and demand-to-capacity ratio on each of the segments for peak hours. All mainline segments are expected to operate at LOS A or B in the year 2050, indicating no anticipated capacity issues.

Since the interchange alternatives did not affect the demand or capacity of the mainline and ramp sections, they did not affect the mainline analysis and were therefore not included in the design year analysis. A discussion of these alternatives can be found in the I-90 Interchange Analysis section of the full report.

Based on the Highway Capacity Software (HCS) freeway facilities analyses, the mainline section of I-90 between Exits 32 and 40 currently operates at an acceptable Level of Service (LOS). This indicates that there are no existing capacity issues on this portion of I-90. Similarly, the Design Year (2050) analyses showed an acceptable LOS on I-90, indicating that there are no capacity issues expected by the year 2050. Facility results are presented in **Table 6-5.**

**Table 6-5 I-90 Facility Results – Design Year 2050**

| Analysis Direction | Space Mean Speed (mi/hr) | Average Travel Time (min) | Density (pc/mi/ln) | LOS |
|---|---|---|---|---|
| **A.M. Peak** | | | | |
| Eastbound | 70.1 | 9.4 | 9.6 | B |
| Westbound | 71.2 | 9.4 | 9.5 | B |
| **P.M. Peak** | | | | |
| Eastbound | 69.0 | 9.5 | 10.5 | B |
| Westbound | 70.9 | 9.4 | 10.2 | B |

# CONCLUSION

The operational analysis results for the Design Year 2050 show no degradation to the I-90 Mainline, Ramps, or the Exit 37 Interchange intersections. Because the No-Build scenario is identical to the Build Alternative 37-2 for both intersection lanes and intersection control, there is no change to the Design Year 2050 intersection delay and LOS results between the two scenarios. The reconfigured ramps for the proposed Exit 37 Interchange are anticipated to be longer than the existing ramps and provide additional acceleration/deceleration length. This additional length is not anticipated to cause ramp junction merge/diverge LOS to change.

# 7. ALTERNATIVE ANALYSIS

The three build alternatives were examined to understand their relative performance and facilitate selection of an Alternative. This evaluation borrows and builds upon alternative analyses included in the 2000 and 2010 Interstate Corridor Studies, *I-90 Black Hawk – Sturgis Corridor Preservation Study,* and *I-90 Exit 32-40 Corridor Report. The alternatives were previously described in Chapter 5 of this report.*

## CONFORMANCE WITH TRANSPORTATION PLANS

Each of the interchange build alternatives conform with current local and state transportation plans and standards. The existing Exit 37 Interchange was first identified as having geometric needs in the 2000 Statewide Interstate Corridor Study. An interchange improvement is currently listed in the developmental program for the Statewide Transportation Improvement Program (STIP) for construction in the Year 2022. As noted previously, the need and proposed alternatives for an Exit 37 Interchange have been included in the 2000 and 2010 Interstate Corridor Studies, the I-90 Black Hawk-Sturgis Corridor Preservation Study and the Exit 32-40 Corridor Report.

## COMPLIANCE WITH POLICIES AND ENGINEERING STANDARDS – GEOMETRICS NEEDS

The No Build Alternative will not address the known geometric deficiencies of the existing interchange. The following substandard conditions would remain when analyzed in light of the current *South Dakota Department of Transportation Road Design Manual:*

- 5.6% grade on west bound on ramp exceeds maximum grade. (5%)
- Lane width measured at 13 feet (minimum 15 foot)
- The minimum right shoulder width measured at 4 feet along ramps (8 feet standard)
- Substandard in slopes measured at 4:1 (6:1 standard)
- Substandard ramp K values.
- Minimum ramp stopping sight distance measured at 331 feet (425 feet standard)
- Substandard minimum ramp intersection sight distance.
- Substandard cross road K values
- Minimum cross road sight distance measured at 178 feet (standard 425 feet)
- Median horizontal offset less than minimum distance (550 feet)

The proposed build alternative 37-2 would correct all geometric deficiencies except the median horizontal offset, which none of the Exit 37 Interchange build alternatives would correct. When compared to the other two build alternatives, the Build Alternative 37-2 corrected the most geometric issues/needs identified.

## ENVIRONMENTAL IMPACTS

An Environmental Assessment is planned for summer 2019 for the Exit 32-40 corridor. A Purpose and Need Document has been completed along with some of the required environmental studies. It is anticipated that once the EA is completed and approved, there will be a Finding of No Significant Impact (FONSI) and a Categorical Exclusion document can be created to address issues specific to the Exit 37 interchange.

A preliminary review of environmental impacts was completed as part of the Exit 32 to 40 Corridor Report, which can be found in **Appendix E**. As part of this review, wetland impacts between the three (3) build Exit 37 Interchange alternatives were analyzed and compared. This was completed to evaluate the three alternatives. The results of this comparative wetland impact analysis are shown in **Figure 7-1.** The results indicate that there are fewer environmental impacts for the build alternative 37-2, based on fewer wetland impacts.

**Table 7-1 Wetland Impact Results for Exit 37 Interchange Build Alternatives**

| | Alt 37-1 | Alt 37-2 | Alt 37-3 |
|---|---|---|---|
| Approximate Acres of Wetland Impacts | 2.0 | 1.0 | 2.5 |

## SAFETY

After review of the existing crash data summarized in the **Existing Safety Conditions** section, no specific, correctable crash patterns were identified near Exit 37. Although improvements to the ramps may serve as a proactive safety measure, each of the proposed build alternatives evaluated equivalently when reviewed against safety.

## OPERATIONAL PERFORMANCE

The No Build Alternative was shown to provide acceptable peak hour traffic operations for all mainline, ramp merge/diverge sections at Exit 37 through the Year 2050. Surface street intersection movements would also operate acceptably.

All the build alternatives would provide operational conditions equal to or better than the No Build Alternative, based both on traffic analyses included in the *I-90 Black Hawk – Sturgis Corridor Preservation Study* and updated analyses for design year 2050 in the Exit 32 to 40 Traffic Operations Analysis for Feasible Scenarios, found in **Appendix B.**

# COST AND RIGHT OF WAY IMPACTS

The No Build Alternative will cost $0 and will have no right of way impacts. The three build alternatives were conceptually analyzed for comparative and planning purposes as part of the I-90 Exit 32 to 40 Corridor Report. The results of this preliminary analysis indicate that the Exit 37 Interchange Build Alternative (37-2) is the lowest cost alternative, estimated at $7.57 Million. Although Alternative 37-1 shows the least acreage or right-of-way impacts, it evaluated lower than the alternative 37-2 because it had direct impacts to an adjacent residence. The Exit 37 Interchange alternative 37-2 does not impact an adjacent residence and requires minimal permanent right of way.

**Table 7-2 Preliminary Cost Estimates and Right of Way Impacts for Exit 37 Interchange Build Alternatives**

| | Alt 37-1 | Alt 37-2 | Alt 37-3 |
|---|---|---|---|
| Preliminary Cost Estimate | $10.15 M | $7.57 M | $13.52 M |
| Preliminary Right of Way Impacts - Temporary & Permanent | 20.3 Acres | 23.6 Acres | 26.2 Acres |

# CONSTRUCTABILITY REVIEW

When the three build alternatives for the Exit 37 Interchange were evaluated against one another, the Build Alternative 37-2 scored the highest due to the following:

- Room for construction staging.
- New bridge can be constructed while existing bridge is in use.
- New ramps can be constructed while existing ramps are in use.
- Minimal impact to railroad during construction but requires relocation of the railroad crossing.

# CONCLUSION

In summary, the No-Build Alternative for the Exit 37 Interchange is the least impactful. However, the No-Build Alternative does not address the need for the project to correct the geometric deficiencies identified.

When comparing the three Exit 37 Interchange Build Alternatives, the alternative 37-2 scored the highest amongst several evaluation criteria discussed both within this report. The results of the evaluation can be found in more detail in the I-90 Exit 32 to 40 Corridor Report (**Appendix E**) and are also summarized in **Table 7-3.**

**Table 7-3 I-90 Exit 37 Interchange – Alternative Evaluation Matrix**

| | | Evaluation Criteria | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Safety Improvements | Geometric Needs | Environmental Impacts | Cost | Traffic and Level of Service | Constructability Issues | Impact to existing land use or new development including access | Right of Way Impacts | Flexibility to accommodate future improvements or land use changes | Bicycle Facility Enhancement | Utility Impacts | Score |
| **Weight** | | **4.7** | **4.5** | **4.4** | **4.0** | **3.9** | **3.8** | **3.4** | **3.3** | **3.2** | **2.0** | **1.9** | |
| **Alternatives** | | | | | | | | | | | | | |
| **Exit 37** | 37-1 | 3 | 3 | 4 | 3 | 5 | 1 | 3 | 2 | 5 | 5 | 4 | **130.9** |
| | 37-2 | 5 | 4 | 5 | 4 | 5 | 4 | 4 | 4 | 5 | 5 | 4 | **174.6** |
| | 37-3 | 5 | 5 | 4 | 3 | 5 | 2 | 1 | 1 | 5 | 5 | 4 | **143** |

| | |
|---|---|
| 5 | Is most positive regarding the Evaluation Criteria |
| 4 | |
| 3 | Is neutral regarding the Evaluation Criteria |
| 2 | |
| 1 | Is least positive regarding the Evaluation Criteria |

# 8. FUNDING PLAN

The planned project that includes replacing the existing Exit 37 Interchange is currently estimated to cost $32.347 million (in 2019 dollars). The SDDOT is currently anticipating funding the project with the combination of funding sources as shown in **Table 8-1**.

### Table 8-1 Anticipated Funding Allocation Breakdown

| Project Number | State Funding Category | Federal Funding Category | Federal Funds | State Funds | Total Funds |
|---|---|---|---|---|---|
| IM FP 0901(195)36 PCN 021G | Interstate | National Highway Performance Program | $16.009 Million | $1.589 Million | $17.598 Million |
| IM FP 0901(195)36 PCN 021G | Interstate | Freight Program | $8.734 Million | $0.867 Million | $9.601 Million |
| IM FP 0901(195)36 PCN 021G | Interstate | NA | $0 Million | $5.148 Million | $5.148 Million |
| **Total** | | | $24.743 Million | $7.604 Million | $32.347 Million |

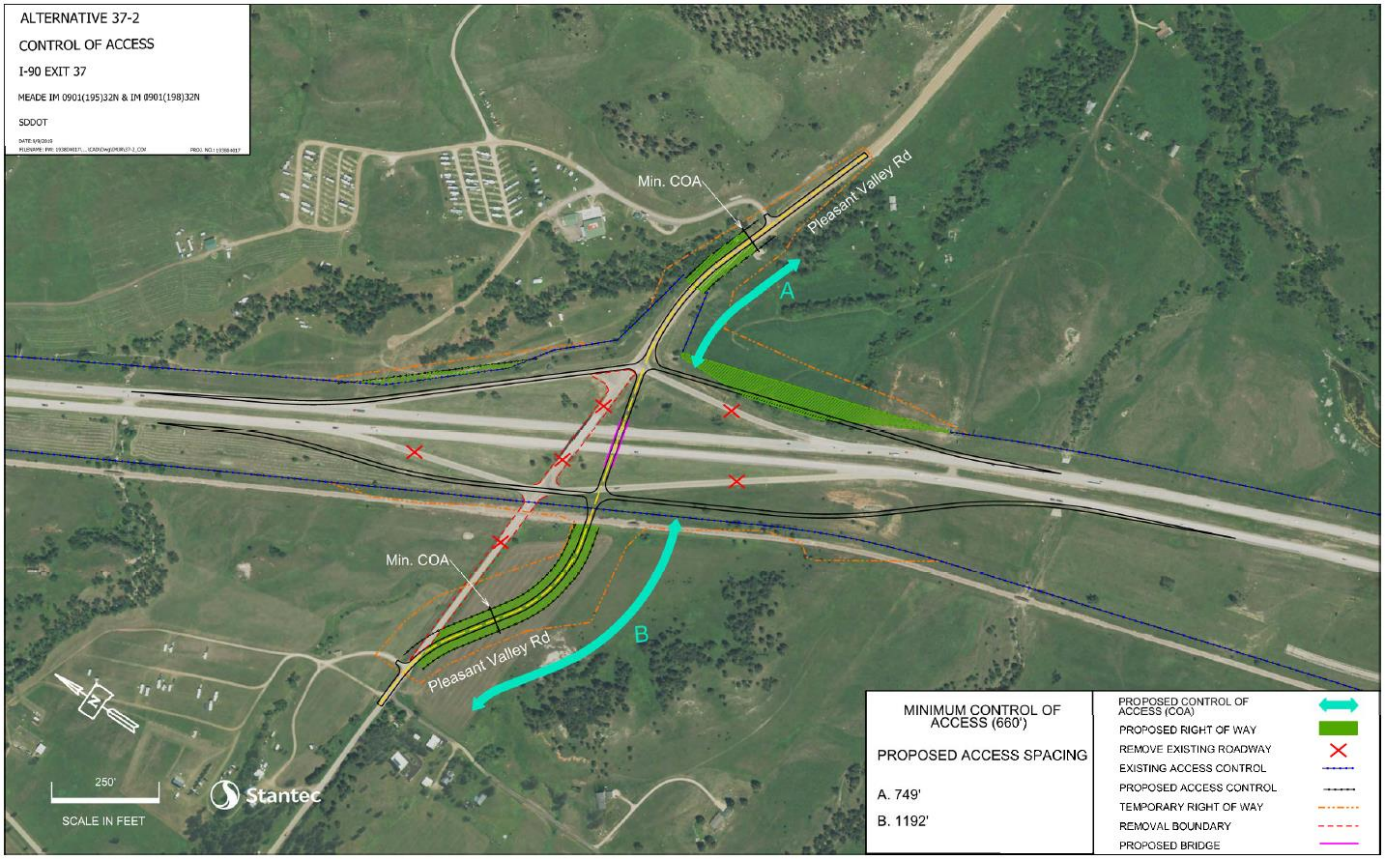
Note: As funding is fluid, category breakdown may be different at time of project authorization.

As the project is anticipated to be let to contract in Federal fiscal year 2022, the inflated estimated cost for the overall project is $35.012 Million.

# 9. RECOMMENDATIONS

This modification request is to reconfigure the existing Exit 37 Interchange, but maintain the diamond configuration, as shown in **Figure 9-1.**

**Figure 9-1 Alternative 37-2 (Alternative) I-90 Exit 37**



This recommendation addresses the two policy requirements for new or revised access points to the existing Interstate system published in the May 22, 2017 Policy on Access to the Interstate System issued by the Federal Highway Administration.

1. **An operational and safety analysis has concluded that the proposed change in access does not have a significant adverse impact on the safety and operation of the Interstate facility (which includes mainline lanes, existing, new, or modified ramps, ramp intersections with crossroad) or on the local street network based on both the current and the planned future traffic projections. The analysis should, particularly in urbanized areas, include at least the first adjacent existing or proposed interchange on either side of the proposed change in access (23 CFR 625.2(a), 655.603(d) and 771.111(f)). The crossroads and the local street network, to at least the first major intersection on either side of the proposed change in access, should be included in this analysis to the extent necessary to fully evaluate the safety and operational impacts that the proposed change in access and other transportation improvements may have on the local street network (23 CFR 625.2(a) and 655.603(d)).**

   **Requests for a proposed change in access should include a description and assessment of the impacts and ability of the proposed changes to safely and efficiently collect, distribute and accommodate traffic on the Interstate facility, ramps, intersection of ramps with crossroad, and local street network (23 CFR 625.2(a) and 655.603(d)). Each request should also include a conceptual plan of the type and location of the signs proposed to support each design alternative (23 U.S.C 109(d) and 23 CFR 655.603(d)).**

   The operational analysis contained in this study indicate that mainline I-90, ramp junctions, and ramp terminal intersections are all projected to operate within operational goals for both the Build and No Build scenarios through the planning horizon year of 2050.

   Interchange AM and PM peak hour analyses were performed for the eastbound and westbound directions for both the Base Year (2017) and the Design Year (2050). The Design Year 2050 analysis represents both the 2050 No Build and 2050 Build Alternative scenarios. This is because there are no proposed changes to the traffic control or intersection lanes and turn lane geometries between the No Build and Build Scenarios.

   For the I-90 mainline, the LOS remains unchanged for the Design Year 2050. It maintains LOS A throughout the study area from Exit 32 to Exit 40. At Exit 37, the intersections also maintain their LOS (A) while Control Delay increased by less than 1 sec/veh between the Base Year (2017) and Design Year (2050).

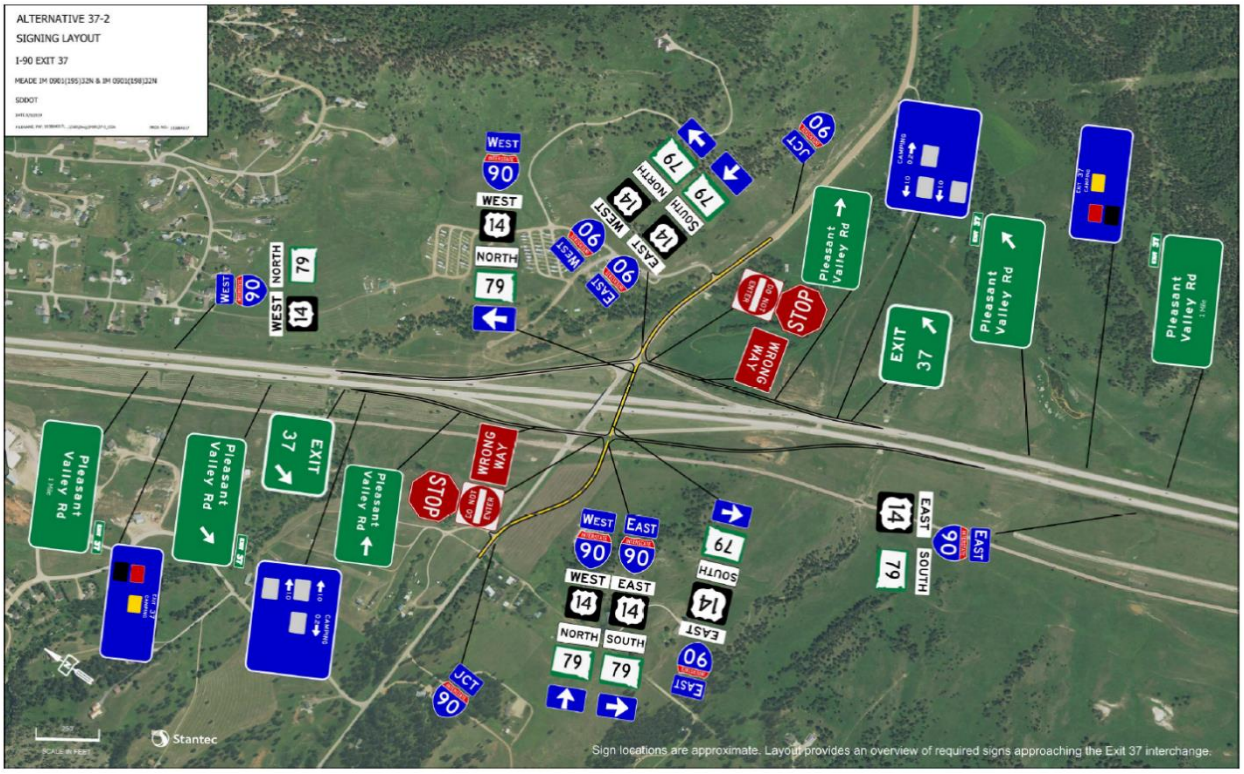
   An analysis of crash records for the five-year period of 2012-2016 has been provided in the "Existing Safety Conditions" section of this report. Crash occurrences were broken down into severity, location, and type. These categories were then plotted on a map of the study area to determine any areas of concern. The study area was broken down into

segments to better analyze patterns. The segments were analyzed based on their length, number of crashes, ADT, and facility type, and then compared to statewide averages. The safety analysis indicates that there are no apparent or correctable crash patterns within the influence area of the Exit 37 Interchange.

The relocated diamond interchange and reconstructed bridge would improve spacing between the ramp terminals, improve vertical sight distance and bring substandard geometric conditions of the interchange up to SDDOT specifications.

**Figure 9-2** depicts the proposed signs for the diamond interchange at Exit 37.

**Figure 9-2 Sign Layout I-90 Exit 37**




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

**ramps, etc. The report should describe whether future provision of a full interchange is precluded by the proposed design.**

The access improvement will maintain a connection to a public road (Pleasant Valley Road) and will replace the current full access interchange with a reconfigured full access interchange. The reconfigured interchange will continue to provide for all traffic movements. The improvement will meet or exceed current standards for Federal-aid projects on the Interstate system.