South Dakota Department of Transportation

Interchange Modification Justification Report

Interstate 90 Exit 14
(US14 Alternate / 27th Street - Spearfish)

August 23, 2013
Revised October 31, 2013

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

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EXECUTIVE SUMMARY

The South Dakota Department of Transportation (SDDOT), in cooperation with the City of Spearfish, has initiated an assessment of the existing interchange on Interstate 90 (I-90) at 27th Street in Spearfish, South Dakota. The interchange, known as Exit 14, is also a terminal point for US Highway 14 Alternate (US14A), a primary tourist route of the Northern Black Hills and a federally designated scenic byway as the route through scenic Spearfish Canyon. With increasing commercial and industrial development to the north and east of the interchange over the past ten years, the interchange has transformed from a relatively quiet interchange on the urban fringe of Spearfish serving primarily tourists to becoming the hub of regional activity during the peak hours of travel. This change in land use and the future development plans of the City of Spearfish led the South Dakota Department of Transportation (SDDOT) to initiate a corridor study of the entire US14A highway corridor through Spearfish, including the Exit 14 interchange in 2009. This corridor study demonstrated the need to reconfigure the existing diamond interchange to a single point interchange (SPI) to improve safety and traffic operations along both 27th Street and the parallel Colorado Boulevard corridors.

This interchange modification justification report (IMJR) is the culmination of several steps that have been completed to document the benefits and impacts associated with a range of modification alternatives for the existing interchange. This document was completed following the outline provided in the Federal Highway Administration's (FHWA) August 2010 *Interstate System Access Informational Guide* and meets the requirements of the *Access to the Interstate System* policy printed in the Federal Register on August 27, 2009.

FHWA REQUIREMENTS

FHWA policy has developed requirements to be addressed when evaluating changes to access points on interstate facilities (Federal Register, Volume 74, Number 165, August 27, 2009). 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 eight requirements that new access locations should meet. As this modification request is to reconfigure the existing Exit 14 interchange from a diamond interchange to a SPI, the following is the summarized response to each requirement. The full response to each requirement can be found in Chapter 9: Recommendations.

1. *The need being addressed by the request cannot be adequately satisfied by existing interchanges to the Interstate, and/or local roads and streets in the corridor can neither provide the desired access, nor can they be reasonably improved (such as access control along surface streets, improving traffic control, modifying ramp terminals and intersections, adding turn bays or lengthening*

storage) to satisfactorily accommodate the design-year traffic demands (23 CFR 625.2(a)).

This modification request is to reconfigure an existing interchange. No additional access to the Interstate System is being requested. The *South Dakota Decennial Interstate Corridor Study* indicated that the mainline segments of I-90 adjacent to the interchange will operate at level of service A or B through 2030. The reconfiguration of the existing interchange will have a negligible effect on the Interstate's traffic operations when compared with the existing interchange's configuration. Most of the Interstate System benefit will be seen in the anticipated reduction in crashes at the interchange's ramp terminal intersections.

2. *The need being addressed by the request cannot be adequately satisfied by reasonable transportation system management (such as ramp metering, mass transit, and HOV facilities), geometric design, and alternative improvements to the Interstate without the proposed change(s) in access (23 CFR 625.2(a)).*

This modification request is to reconfigure the geometrics of an existing interchange. No additional access to the Interstate System is being requested. Existing characteristics and development in the vicinity of the existing interchange limited the cost feasible options for interchange reconfiguration.

The US14A Corridor Study initially developed thirteen build alternatives, which were then narrowed down to three feasible alternatives, a tight diamond configuration similar to the existing and two variations of a single-point urban interchange. All three build alternatives proposed a shift in the 27th Street alignment over I-90 to eliminate the existing off-set intersection of 27th Street with Colorado Boulevard.

The single point interchange concept was eventually selected primarily for the improvement to traffic operations along both 27th Street and the parallel Colorado Boulevard, including the nearby intersection of 27th Street and Colorado Boulevard by consolidating the two intersections of the existing diamond design into one intersection shifted towards the centerline of mainline I-90. This will vastly improve the spacing between the ramp terminal intersection and the existing intersections of 27th Street. The increase in distance between the intersections improves the operation of all crossroad intersections, including the ramp terminal intersection by providing additional queue space for left turns.

There are no areas within the State of South Dakota that will consistently experience congestion levels extreme enough to make ramp metering or HOV facilities economically feasible in the foreseeable future.

3. *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 shall, 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, 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 a 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 must 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 *South Dakota Decennial Interstate Corridor Study* indicated that the mainline segments of I-90 adjacent to the interchange will operate at level of service A or B through 2030. The reconfiguration of the existing interchange is believed to have a negligible effect on the Interstate's traffic operations when compared with the existing interchange's configuration.

4. *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)).*

The access improvement will maintain a connection to a public road (US14A / 27th Street) 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.

5. *The proposal considers and is consistent with local and regional land use and transportation plans. Prior to receiving final approval, all requests for new or revised access must be included in an adopted Metropolitan Transportation Plan, in the adopted Statewide or Metropolitan Transportation Improvement Program*

(STIP or TIP), and the Congestion Management Process within transportation management areas, as appropriate, and as specified in 23 CFR part 450, and the transportation conformity requirements of 40 CFR parts 51 and 93.

The proposed interchange improvement is consistent with local land use plans, the STIP, and local transportation plans.

6. *In corridors where the potential exists for future multiple interchange additions, a comprehensive corridor or network study must accompany all requests for new or revised access with recommendations that address all of the proposed and desired access changes within the context of a longer-range system or network plan (23 U.S.C. 109(d), 23 CFR 625.2(a), 655.603(d), and 771.111).*

Both the *South Dakota Interstate Corridor Study* completed in February 2001 and the 2010 *South Dakota Decennial Interstate Corridor Study* indicated no need for any future interchange additions along the segments of Interstate 90 between Exit 14 and the adjacent exits. During the public participation process of both the recently completed *US14A Corridor Study* and the *Spearfish Area Master Transportation Plan Study*, the idea for a new interchange between Exit 14 and Exit 17 was brought forth by the public. This idea was quickly dismissed due to minimum interchange spacing requirements and conflicts with the runways of the Black Hills / Clyde Ice Field Airport, which is located just north of I-90 approximately half way between Exit 14 and Exit 17.

7. *When a new or revised access point is due to a new, expanded, or substantial change in current or planned future development or land use, requests must demonstrate appropriate coordination has occurred between the development and any proposed transportation system improvements (23 CFR 625.2(a) and 655.603(d)). The request must describe the commitments agreed upon to assure adequate collection and dispersion of the traffic resulting from the development with the adjoining local street network and Interstate access point (23 CFR 625.2(a) and 655.603(d)).*

The proposed interchange modification is the result of relatively new and the planned future development of the City of Spearfish. Both the *US14A Corridor Study* and the *Spearfish Area Master Transportation Plan Study* were jointly coordinated by SDDOT, City of Spearfish, and FHWA staff.

The reconfiguration of the interchange is being proposed to address future traffic growth relative to the anticipated future population growth of the entire Spearfish Area. The *US14A Corridor Study* calls for the eventual reconstruction of the Colorado Boulevard corridor, which parallels mainline I-90 when traffic and condition warrants. Unfortunately, both terrain restraints of the Northern Black Hills and the location of a nearby federally

designated wilderness area create a geographic bottleneck that limits the amount of parallel corridors to operationally support I-90 that can be feasibly constructed.

8. *The proposal can be expected to be included as an alternative in the required environmental evaluation, review and processing. The proposal should include supporting information and current status of the environmental processing (23 CFR 771.111)*.

The proposed revised access is included in the STIP for 2015 and the status of the environmental process is tracking consistent as other projects believed to be a type II categorical exclusion programmed for the same year.

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Chapter 1: INTRODUCTION

The South Dakota Department of Transportation (SDDOT), in cooperation with the City of Spearfish, initiated an assessment of the existing interchange on Interstate 90 (I-90) at 27th Street in Spearfish, South Dakota, as part of the *US14A Corridor Study*. The interchange, known as Exit 14, is also a terminal point for US Highway 14 Alternate (US14A), a primary tourist route of the Northern Black Hills and a federally designated scenic byway as the route through scenic Spearfish Canyon. With increasing commercial and industrial development to the north and east of the interchange over the past ten years, the interchange has transformed from a relatively quiet interchange on the urban fringe of Spearfish that served primarily tourists to also becoming the hub of regional commercial activity during the peak hours of local travel. This change in land use and the future development plans of the City of Spearfish led the South Dakota Department of Transportation (SDDOT) to initiate the *US14A Corridor Study* in 2009. The *US14A Corridor Study* was a corridor study of the entire US14A highway corridor through Spearfish, including the Exit 14 interchange. This corridor study demonstrated the need to reconfigure the existing diamond interchange to a single point interchange (SPI) to improve safety and traffic operations along both 27th Street and the parallel Colorado Boulevard corridors, including the ramp terminal intersections.

This interchange modification justification report (IMJR) is the culmination of several steps that have been completed to document the benefits and impacts associated with a range of modification alternatives for the existing interchange. This document was completed following the outline provided in the Federal Highway Administration's (FHWA) August 2010 *Interstate System Access Informational Guide* and meets the requirements of the *Access to the Interstate System* policy printed in the Federal Register on August 27, 2009.

Background

The existing 27th Street interchange was first identified as having some minor geometric needs by the 2001 *South Dakota Interstate Corridor Study*. These geometric issues were determined to be minor enough to not require immediate attention given the existing and the projected traffic levels at the time.

In the time since that study concluded, commercial and industrial development, spurred on the by the opening of a Wal-Mart Supercenter in the northeast quadrant of the interchange in 2005, has expanded both north and east of the interchange. This has led to a noticeable increase in traffic volumes and congestion at the interchange and along both the 27th Street and Colorado Boulevard corridors. With the increasing congestion came an outcry to make improvements from business owners and the general public, prompting a hodgepodge of reactive, band-aid types of traffic operational fixes to be applied to both corridors, which included the signalization of four intersections along the 27th Street crossroad, including the two ramp terminal intersections.

It became apparent that there was a need to develop a proactive plan by evaluating the existing interchange configuration and the US14A highway corridor through the City of Spearfish by analyzing the traffic operations for the anticipated future traffic levels given the new development patterns and determine corrective measures. This evaluation, done as part of the *US14A Corridor Study*, has demonstrated the need to reconfigure the existing diamond interchange to a single point interchange (SPI) to improve safety and traffic operations along both the 27th Street crossroad and the parallel to mainline Colorado Boulevard corridors.

Purpose

Increasing traffic congestion along the 27th Street and Colorado Boulevard corridors indicates that it is appropriate to evaluate the existing interchange configuration and analyze its operation for the anticipated future traffic levels.

Project Location

Exit 14 is an existing connection between I-90 and 27th Street in Spearfish, South Dakota. The interchange is also a terminal point for US Highway 14 Alternate (US14A), a primary tourist route of the Northern Black Hills and a federally designated scenic byway as the route through scenic Spearfish Canyon. Exit 14 is located approximately 14 miles east of the Wyoming state line and 43 miles west of the I-90/I-190 System Interchange. Figure 1 shows the location of Exit 14. Exit 14 is currently the only I-90 service interchange serving the Black Hills Airport (Clyde Ice Field). 27th Street becomes US Highway 14 Alternate at the interchange, traversing south and west along Colorado Boulevard leaving the Spearfish City Limits south of I-90 approximately 1 ½ miles west of the interchange. US14A connects to US85, a NHS route 18 miles to the south of I-90.

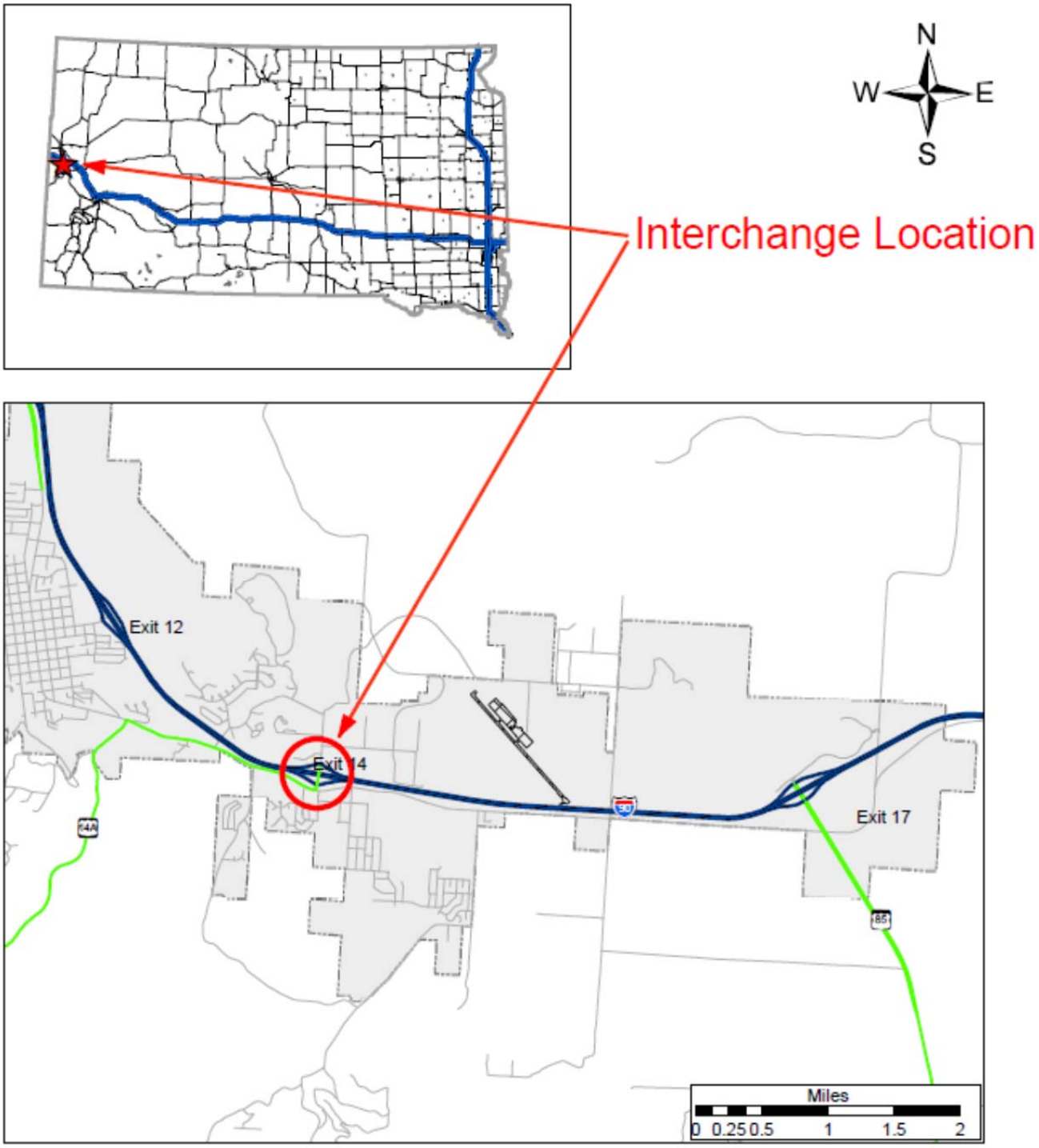

Figure 1: Project Location

The current configuration for Exit 14 is a typical diamond interchange as shown in Figure 2. The proposed interchange modification would replace the diamond interchange at Exit 14 with a SPI. The result would be a more efficient interchange that dramatically improves the operational service of North 27th Street while slightly improving the operational service of the Interstate.

Figure 2: Existing Configuration

Chapter 2: METHODOLOGY

This interchange modification justification report (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 the Federal Highway Administration (FHWA). Fatal flaws would include a proposed interchange modification that:

- Does not provide full access to public 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.

As the Exit 14 Interchange was analyzed as part of the *US14A Corridor Study*, this IMJR was developed using data previously collected and analyzed as part of the *US14A Corridor Study*. The use of data from the *US14A Corridor Study* was agreed upon with the South Dakota Division of FHWA on June 18, 2012. Given the determination by the South Dakota Division of FHWA that an IMJR document would not be needed while the *US14A Corridor Study* was on-going (emails dated May 28, 2009 and January 26, 2012), results from the *South Dakota Decennial Interstate Corridor Study*'s analyses of the adjacent interchanges, mainline Interstate, and ramp merge and diverge movements were used when needed.

Traffic Analysis output reports from the *US14A Corridor Study* that were used as the analyses in this IMJR report are included in Appendix B. Traffic analysis result tables used from the *South Dakota Decennial Interstate Corridor Study* are included in Appendix F.

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

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Chapter 3: EXISTING CONDITIONS

Demographics

The existing Exit 14 interchange primarily provides the eastern commercial and industrial areas of Spearfish access to the Interstate system. The interchange currently serves an area of large employment north of I-90 and some commercial and residential neighborhoods, primarily south of I-90.

Existing Land Use

Within the Spearfish city limits, land use surrounding the Exit 14 interchange is zoned primarily commercial in all four quadrants immediately adjacent to 27th Street. Industrial zoned areas east are located east of 27th Street, primarily north of I-90. Residential, residential planned unit development, and agricultural zoned areas are located beyond the commercial strip. The current City of Spearfish zoning map showing the land use is depicted in Figure 3 below.

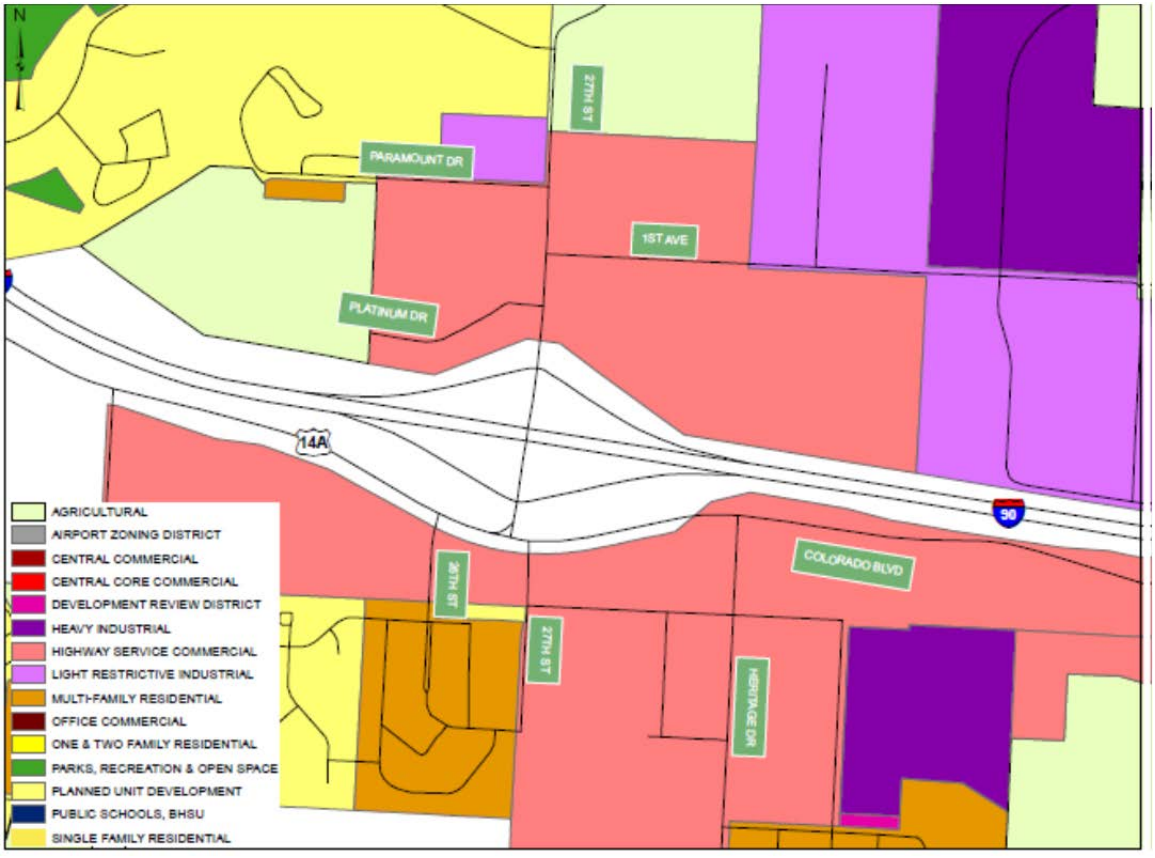

Figure 3 Current Zoning

Existing Roadway Network

I-90 is the primary east-west route and 27th Street is the primary north-south route through the study area. While Colorado Boulevard provides additional east-west support to I-90, 27th Street currently has no supporting arterial routes north of I-90 in the study area. The existing roadway network is shown along with the Federal functional classification map in Figure 4.

I-90 currently has 2 lanes in each direction through the study area. 27th Street currently has one through lane in each direction from Colorado Boulevard north to beyond the study area, with a center turn lane both north and south of the interchange. Colorado Boulevard has two westbound lanes, one eastbound lane, and a center turn lane from the intersection with 27th Street west past the western most access of the Heritage Plaza Shopping Center, where it transition into a typical one lane in each direction with a center turn lane. East of the intersection with 27th Street, Colorado Boulevard quickly transitions into a typical one lane in each direction roadway. All other roadways in the study area are currently one lane in each direction.

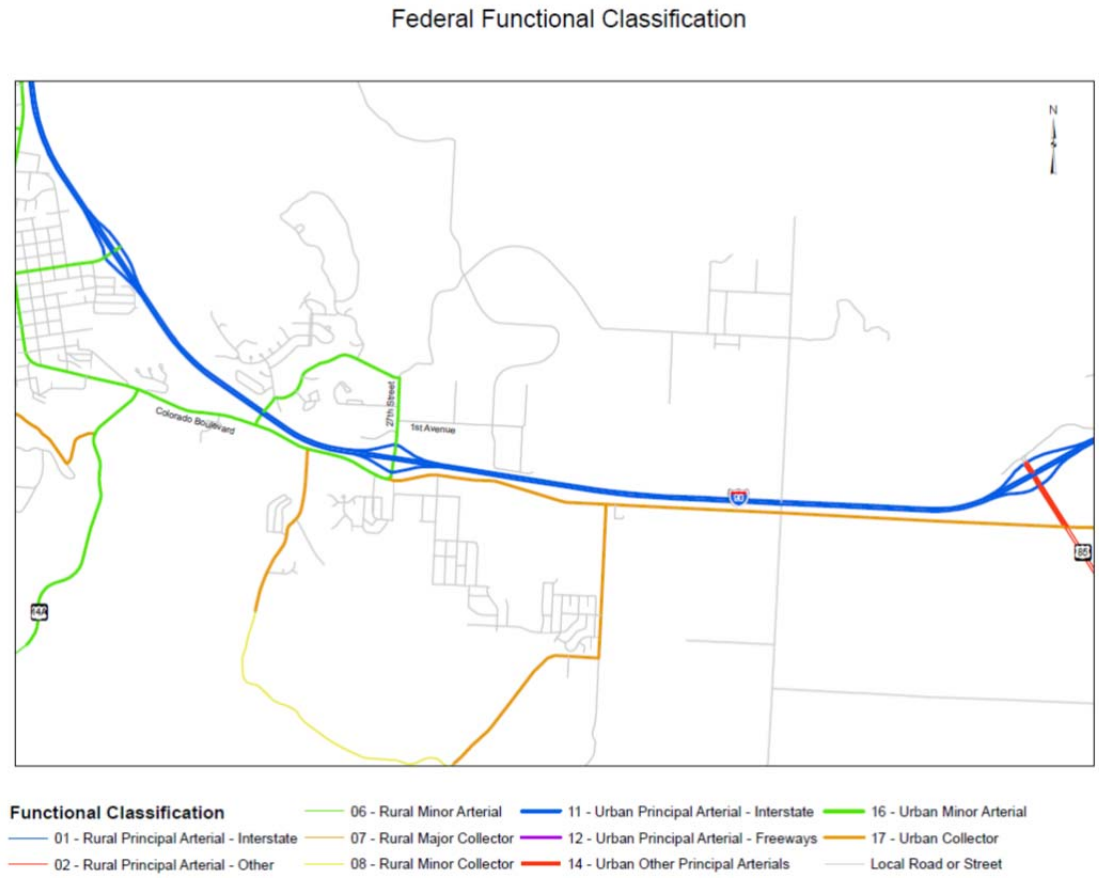

Figure 4

Alternative Travel Modes

The Exit 14 Interchange's influence area is currently served by Prairie Hills Transit, the transit provider for the Spearfish Area. Prairie Hills Transit is a "24 hour in advance request to ride" provider and provides a curb-to-curb shared ride transportation service throughout Lawrence County. Prairie Hills Transit also provides a daily shuttle service from Spearfish to Rapid City with designated loading areas, but none are located within the Exit 14 interchange's influence area.

The Black Hills – Clyde Ice Field Airport is located about 1 mile east of the interchange, providing general aviation passenger and air freight services to the northern Black Hills of South Dakota. The location of the airport's runway is shown in gunmetal blue in Figure 5.

At present, a recreational sidepath trail runs along Colorado Boulevard south of the interchange from 27th Street to the west. The City intends to eventually extend the trail to the east along Colorado Boulevard to US85 (Exit 17).

There is intermittent sidewalk along 27th Street within the Exit 14 Interchange's influence area, but there is no separated pedestrian facility within the interchange itself. Pedestrians are forced to use a painted shoulder alongside the travel lanes in areas where sidewalk is missing.

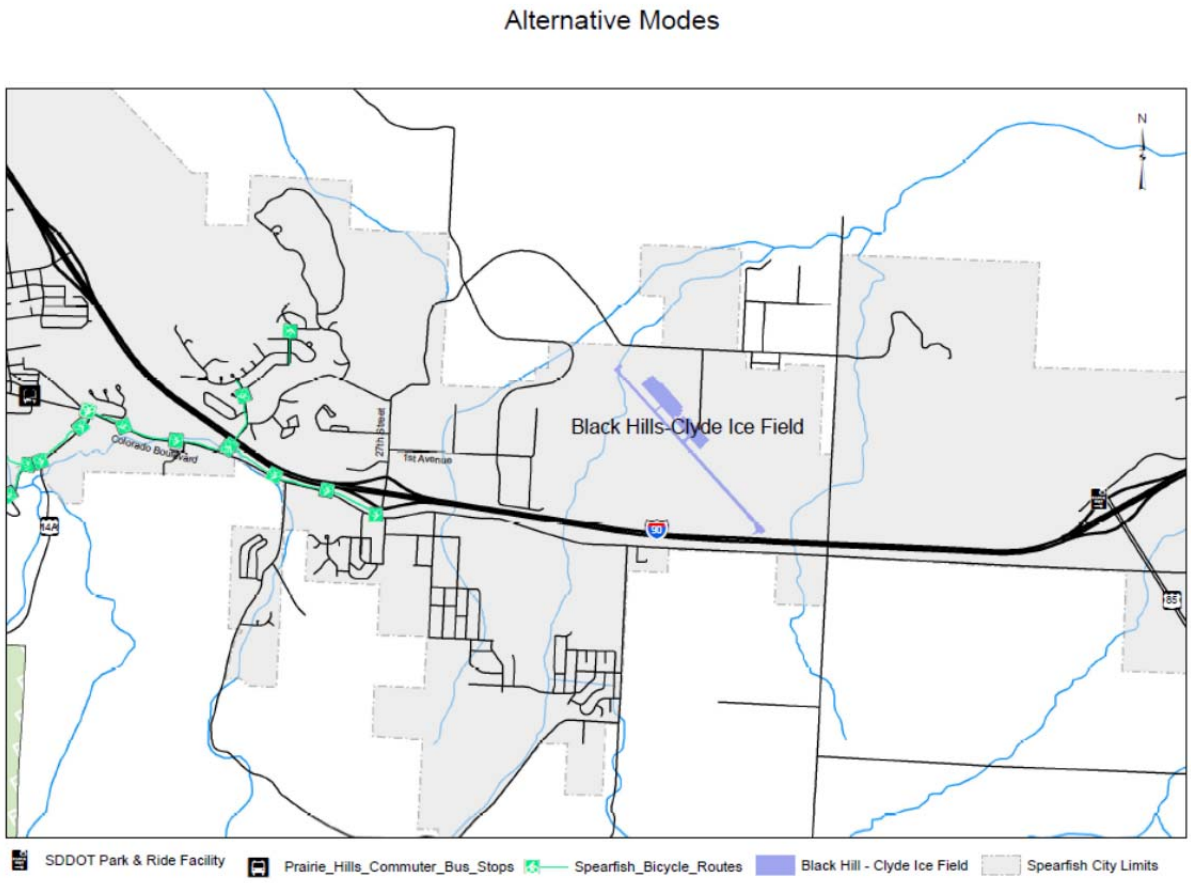

Figure 5

Interchanges

I-90 Exit 14: 27th Street

The existing interchange for I-90 and 27th Street is a diamond configuration, with a spacing of approximately 800’ centerline to centerline between the interchange ramp intersections along 27th Street. Both intersections are presently signalized. All ramps were originally designed as single lane ramps, but both off-ramps have since been re-striped for two lanes near the 27th Street intersection by reducing the shoulder width to less than standard. The westbound off-ramp was re-striped to have the inside lane provide for exclusive left turns and the outside lane provide for straight and right turn movements. The eastbound off-ramp has been re-striped to have the outside lane provide for exclusive right turns and the inside lane provide for left turn and straight movements. The cross section of 27th Street was initially a two lane section. However, numerous projects have expanded the roadway section to provide for left and right turn lanes at numerous intersections. The aerial photo in Figure 6 shows the configuration of the existing 27th Street interchange.

Figure 6: Existing I-90 / 27th Street Interchange Configuration

On the north side of the interchange, 27th Street is a two lane section with left and / or right turn lanes at the intersections with the I-90 Westbound Ramp Terminal, Platinum Drive and 1st Avenue. The centerline of the unsignalized intersection of East Platinum Drive and 27th Street is located only 300' north of the westbound ramp intersection centerline. In addition, a driveway to the property located on the east side of 27th Street is also located at the intersection.

South of the interchange, 27th Street is a two lane section with right turn lanes. The centerline of the signalized intersection of US14A/Colorado Boulevard and 27th Street is located about 200' south of the eastbound ramp intersection centerline.

I-90 Exit 12: Jackson Boulevard

The adjacent interchange west of the I-90/27th Street interchange is Exit 12: Jackson Boulevard. The interchange is a typical diamond configuration, but the crossroad terminates at the Westbound Ramp Terminal intersection. The interchange is shown in Figure 7 below.

Figure 7: Existing I-90/ Jackson Boulevard Interchange Configuration

I-90 Exit 17: US85 / Lead-Deadwood

The adjacent interchange east of the I-90/27th Street interchange is the interchange between I-90 and US Highway 85, a NHS route. The interchange is a typical diamond configuration. The aerial photo in Figure 8 shows the configuration of the existing I-90 / US85 interchange.

Figure 8: Existing I-90 / US85 Interchange Configuration

Potential Adjacent Interchanges

Numerous comments at the public meetings for both the *US14A Corridor Study* and the *Spearfish Area Master Transportation Plan Study* suggested an additional I-90 interchange between Exit 14 and Exit 17. Most of those suggestions requested an interchange at Rainbow Road, which currently is an underpass crossing of I-90 approximately 11,700 feet east of Exit 14 and 7,800 feet west of Exit 17. Although this location would meet FHWA interchange spacing requirements of one mile within an urban area, this location is also located within the Runway Protection Zone (RPZ) of both the primary and one of the crosswind runways of the Black Hills – Clyde Ice Field. It is highly unlikely an interchange at this location would garner the support of the Federal Aviation Administration (FAA) or approval from the FHWA as long as the airport remains at its present location.

Existing Data

The data used to create this document came from a combination of data sources belonging to the South Dakota Department of Transportation, the City of Spearfish, and the South Dakota Department of Public Safety. Much of the data came through the *US14A Corridor Study*, as per discussions held between the SDDOT and FHWA on June 18, 2012. Supplemental data from the *South Dakota Decennial Interstate Corridor Study* was used when needed. The most recent data available was used.

Operational Performance

A limited traffic operations study was conducted as part of the *US14A Corridor Study*. The south limit of the study was the offset intersections of 27th Street and Colorado Boulevard. The northern limit was the intersection of 27th Street and 1st Avenue. Intersections analyzed were both intersections of 27th Street and Colorado Boulevard, 27th Street and the I-90 eastbound ramp terminal, 27th Street and the I-90 westbound ramp terminal, 27th Street and Platinum Drive, and 27th Street and 1st Avenue. The intersections of Colorado Boulevard and 26th Street and Colorado Boulevard and Heritage Drive were also analyzed as part of the Colorado Boulevard portion of the US14A Corridor Study but are not included in this document. The South Dakota Decennial Interstate Corridor Study indicated that the mainline segments of I-90 adjacent to the interchange will operate at level of service A or B through 2030. The reconfiguration of the existing interchange is believed to have a negligible effect on the Interstate's traffic operations when compared with the existing interchange's configuration.

As the *US14A Corridor Study* was started prior to the release of 2010 edition of the *Highway Capacity Manual* (HCM2010), Level of Service (LOS) for intersections was completed according to the 2000 edition of the *Highway Capacity Manual*. Each lane of traffic has a delay associated with it and therefore a correlating LOS. The weighted average delay for each of these lanes of traffic for an intersection is the intersection LOS. LOS categories range from LOS "A" (best) to "F" (worst) as shown in Table 1.

Table 1

Level of Service Description

Level of Service	SIGNALIZED Intersection Control Delay (sec)	Intersection LOS Description
A	≤ 10.0	Free flow, insignificant delays.
B	10.1-20.0	Stable operation, minimal delays.
C	20.1-35.0	Stable operation, acceptable delays.
D	35.1-55.0	Restricted flow, regular delays.
E	55.1-80.0	Maximum capacity, extended delays. Volumes at or near capacity. Long queues form upstream from intersection.
F	> 80.0	Forced flow, excessive delays. Represents jammed conditions. Intersection operates below capacity with low volumes. Queues may block upstream intersections.

Source: *Highway Capacity Manual*, Transportation Research Board, 2000

The SDDOT typically triggers capacity improvements when the LOS is below C on mainline highway corridors and below a LOS of D at intersections and ramp junctions.

As congestion is more often dictated by actions at intersections and ramp junctions, analysis on those movements was done independently. Table 2 summarizes the results of the existing traffic analysis on the 27th Street intersections.

Table 2: 27th Street Intersections Existing Level of Service

Intersection / Movement	AM Peak LOS*	PM Peak LOS*
27th Street / 1st Avenue	A	B
27th Street / Platinum Drive**	B	B
27th Street / I-90 Westbound Ramp	A	A
27th Street / I-90 Eastbound Ramp	B	B
27th Street / Colorado Boulevard (West)	C	C
27th Street / Colorado Boulevard (East)**	B	B

Note: *Average Intersection LOS shown, individual movements may be different.
**Unsignalized, Minor Road Stop Only Intersection, 27th Street / Colorado Boulevard has zero delay, LOS = A.

Although the current average daily LOS along 27th Street is acceptable, there are numerous events in the Spearfish Area held throughout the year. During these events, the LOS at the 27th Street intersections with the ramp terminals and Colorado Boulevard have been observed to operate at a much lower LOS.

Existing Safety Conditions

Twenty-one (21) crashes (reported for calendar years 2009, 2010, & 2011) were determined to be within the 27th Street interchange influence area. Zero (0) crashes were classified as a fatality during the reporting period. Three (3) crashes were classified as an Injury accident. Ten (10) of the reported crashes were found to be related to the ramp terminal intersections with 27th Street, including all 3 Injury classified accidents. Four (4) of the reported crashes associated to mainline I-90 were classified as animal hits. This data is shown in Table 3.

Table 3: Crash Classification* for Reported Crashes 2009-2011

Classification	Mainline	Ramps	Ramp Terminal Intersections	Crossroad	Total
Fixed Object	0	1	1 (1 I/F)	0	2 (1 I/F)
Animal	4	0	0	0	4
Pedestrian	0	0	0	0	0
Bicycle	0	0	0	0	0
Parked Car	0	0	0	0	0
Over Turn	0	2	0	0	2
Other Single Vehicle	1	0	0	0	1
Rear End	0	2	6 (2 I/F)	0	8 (2 I/F)
Head ON	0	0	0	0	0
Angle	0	0	3	0	3
Sideswipe, same direction	0	0	0	1	1
Sideswipe, opposite direction	0	0	0	0	0
Other Multiple Vehicle	0	0	0	0	0
Total	5	5	10 (3 I/F)	1	21

(I//F) = Number Classified as an Injury/Fatality Accident

* Classification based upon Interchange Safety Analysis Tool (ISAT) methodology.

Figure 9 shows the location of all reported crashes for calendar years 2009, 2010, & 2011, including those outside of the 27th Street interchange's influence area.

Crash Location & Severity

2009, 2010, & 2011

Figure 9

Existing Environmental Constraints

A quick perusal of the area surrounding the existing 27th Street interchange shows that the most potential environmental constraint could be contaminated soils caused by a leaking storage tank from the gas stations immediately south of the interchange. Figure 10 shows the location of the known environmental constraints within ½ mile of the 27th Street interchange.

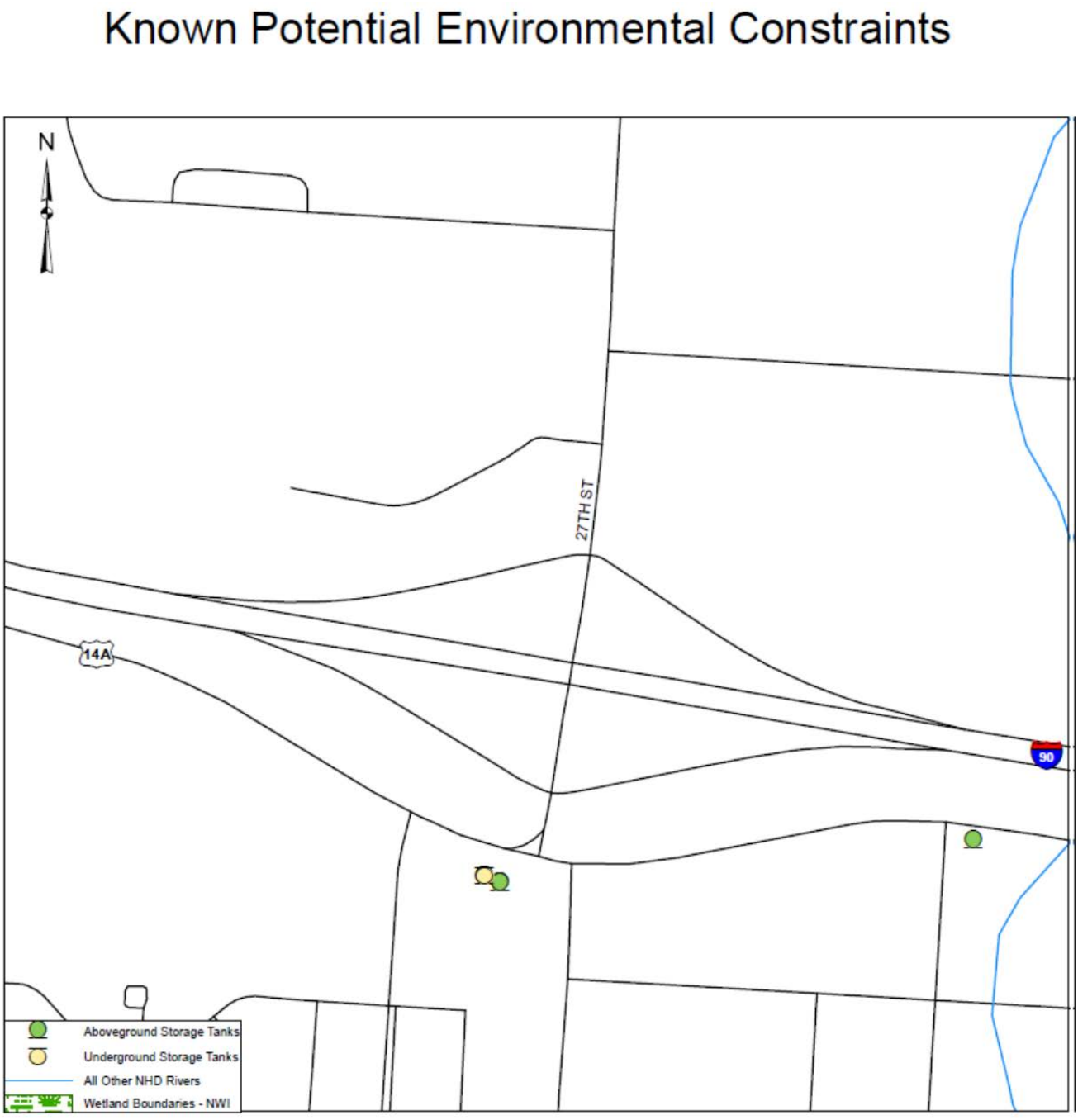

Figure 10

Chapter 4: NEED

While the need to reconfigure an existing interchange is primarily for geometric, safety and traffic capacity reasons, the timing of such projects in South Dakota typically is controlled by the need to replace the existing pavement and/or structure(s). A combination of these five base need types defines the overall need for an interchange reconfiguration.

Geometric

Since the interchange's construction between 1971 and 1973, geometric design standards have changed. As a result, though built to meet or exceed standards of the day, some geometric characteristics of the existing interchange no longer meet today's standards. The *2000 Interstate Corridor Study* found some minor geometric issues with the interchange. Some of these geometric deficiencies were addressed along with a 27th Street project in 2005. Those geometric issues found during the 2000 Interstate Corridor Study that were not addressed in 2005 include:

- The inslopes for all of the ramps are 4:1.
- The total width for all of the ramps is 24'.
- The right shoulder width for all of the ramps is 3'.
- Proximity of adjacent intersections to the ramp intersections are much less than desirable.

Pavement

The need to replace or rehabilitate the pavement is often the driving force behind the timing of when the majority of construction projects on the state highway system occur. The pavement of the existing I-90 mainline under Exit 14 is Continuously Reinforced Concrete (CRC) built in 1973 and has been showing signs of reactive cracking throughout the surface. The crossroad and ramps are asphalt surfaced constructed in 1972 and 1973. The crossroad was last resurfaced with asphalt in 2008. As the I-90 mainline pavement structure is now in need of replacement, it is appropriate to evaluate existing and future traffic operations of the existing interchange configuration before placing a new pavement surface with the expectations for a 40 to 50 year pavement service life.

Safety

The Exit 14 interchange ranked 50th out of the 62 interchanges evaluated in Phase 1 of the 2000 Interstate Corridor Study, so was not seen as an immediate need at the time. Since then, land use changes surrounding the interchange have increased traffic levels through the interchange, and crashes have increased accordingly. The Exit 14 interchange was omitted from the *2010*

Decennial Update to the Interstate Corridor Study as it was already under study for replacement when that study started.

Structural

The need to replace or rehabilitate a structure is the second most critical consideration behind the timing of construction projects on South Dakota's state highway system. Although the structure at the existing Exit 14 interchange currently has a Federal Sufficiency Rating of 94.0, it is currently classified as structurally deficient. This is primarily due to a poor deck condition rating.

Structurally, the bridge is currently in good condition. The concrete stringer/girder bridge was built in 1971 with a deck overlay and rail retrofit done in 1985 and a diaphragm repair done in 1992. Deck overlays typically have a service life of 20 to 25 years, therefore the current deck overlay is approaching the end of its service life and the structure will soon be due for rehabilitation or replacement. It is appropriate to evaluate the existing and future traffic operations of the existing interchange configuration before placing a new structure with the expectations for a 75 year structure service life.

Traffic

The existing traffic operations evaluation showed that on a normal day, none of the interchange or crossroad intersections are experiencing any major traffic operational issues, with a LOS of B or C. However, many events are held in the Spearfish area, and when those events occur, traffic operations at the interchange do suffer. Details pertaining to the existing traffic operations evaluation can be found in Chapter 3: Existing Conditions of this report.

When the existing (No Build) configuration is evaluated for the 20 year planning horizon, the interchange and crossroad intersections are anticipated to deteriorate to a LOS of E or F in the average PM peak hour. This indicates that the intersections within the interchange area will need to be modified sometime within the next 20 years. It would be appropriate to look to modify those intersections when reconstructing pavement and bridge structures. Details pertaining to the future traffic operational evaluations on the existing configuration can be found in Chapter 6: Future Year Traffic.

Chapter 5: ALTERNATIVES

Alternatives for the Exit 14 interchange were developed and evaluated as part *US14A Corridor Study*. The *US14A Corridor Study* initially developed 13 configuration options for the interchange area. Many of those 13 interchange configuration options developed would require a large footprint and were quickly found to be cost prohibited and dismissed. After the *US14A Corridor Study*'s second public meeting, those 13 configuration options were reduced to three build alternatives for further evaluation. Those three build alternatives, in addition to the No Build Alternative, are described below. A brief description of all 13 can be found in Appendix C.

Alternative 0: No Build

This alternative does not alter the current configuration of the existing Exit 14 interchange or apply any improvements along Exit 14 or mainline I-90 and results in strictly removing and replacing the pavement and structure repairs.

Alternative 1: Single Point Interchange with 27th Street Shifted over I-90.

This alternative modifies the existing interchange's configuration from the typical diamond to a single point interchange. This configuration also pivots the 27th Street crossroad over I-90 to align the offset intersection between Colorado Boulevard and 27th Street south of the interchange to improve traffic operations at those two intersections. The vertical alignment of the crossroad and mainline will also be adjusted to reduce the amount of vertical curvature at the single point intersection. The 27th Street crossroad will also be widened to accommodate 2 lanes of traffic in each direction with left turn lanes where left turns will be allowed. The ramps will also need to be completely regraded to accommodate the adjustments to the mainline and crossroad as well as increase the ramp width to today's standard.

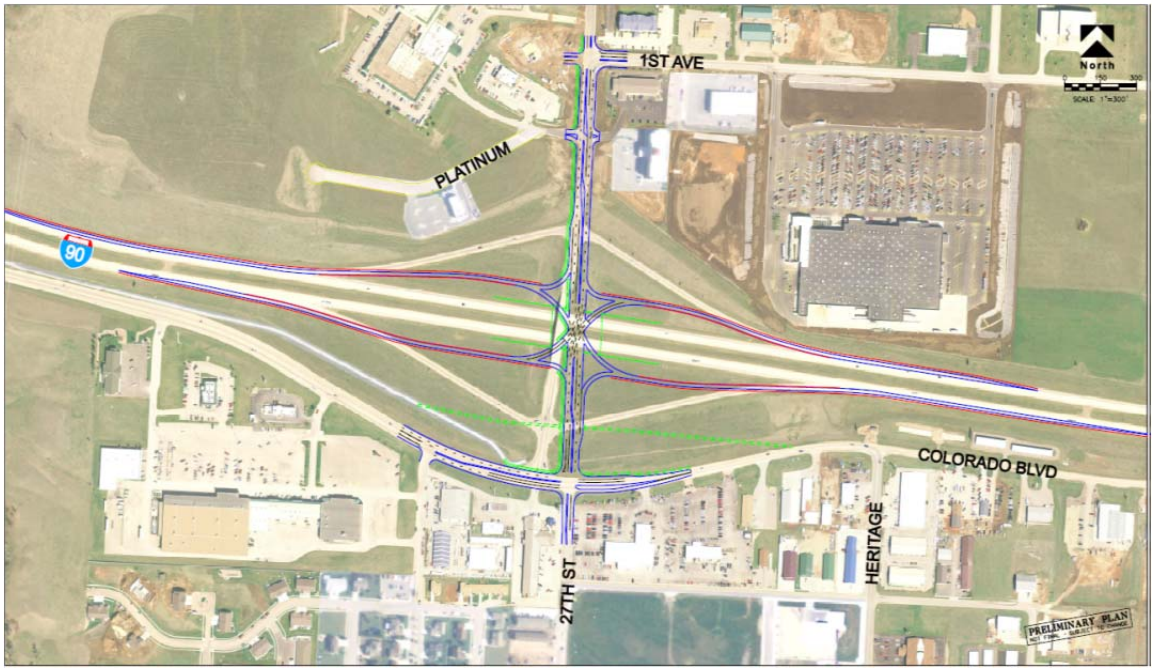

Figure 11: Alternative 1

Alternative 2: Single Point Interchange with 27th Street Shifted under I-90.

This alternative modifies the existing interchange's configuration from the typical diamond to a single point interchange. This configuration also inverts the crossroad over I-90 to have the crossroad go under I-90, while pivoting the 27th Street crossroad to align the offset intersection between Colorado Boulevard and 27th Street south of the interchange to improve traffic operations at those two intersections. The 27th Street crossroad will also be widened to accommodate 2 lanes of traffic in each direction with left turn lanes where allowed. The ramps will also need to be completely regraded to accommodate the adjustments to the mainline and crossroad as well as increase the ramp width to today's standard.

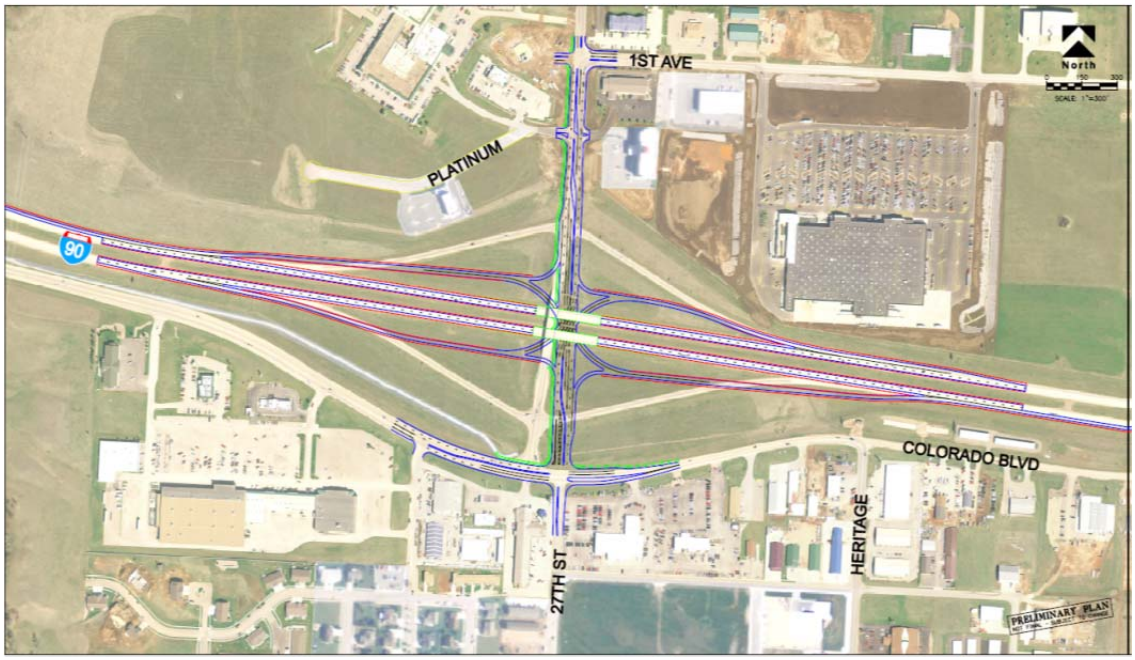

Figure 12: Alternative 2

Alternative 3: Tight Diamond Interchange 27th Street Shifted.

This alternative modifies the existing interchange's configuration from the typical diamond to a tight diamond interchange. This configuration will also pivot the 27th Street crossroad to align the offset intersection between Colorado Boulevard and 27th Street south of the interchange to improve traffic operations at those two intersections. The 27th Street crossroad will also be widened to accommodate 2 lanes of traffic in each direction with left turn lanes where allowed. The ramps will also need to be completely regraded to accommodate the adjustments to the mainline and crossroad as well as increase the ramp width to today's standard.

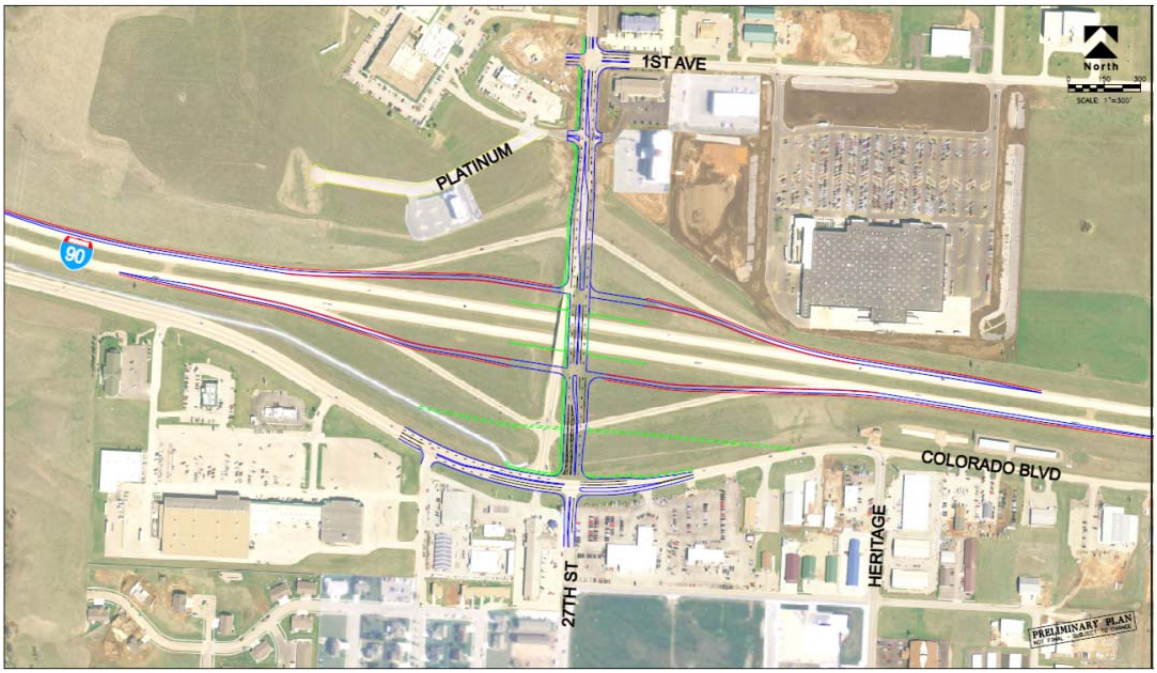

Figure 13: Alternative 3

Further details on the above alternatives can be found in Chapter 7: Alternatives Analysis.

Chapter 6: FUTURE YEAR TRAFFIC

A limited traffic operations study was conducted as part of the *US14A Corridor Study*. The south limit of the study was the offset intersections of 27th Street and Colorado Boulevard. The northern limit is the intersection of 27th Street and 1st Avenue. Intersections analyzed were both intersections of 27th Street and Colorado Boulevard, 27th Street and the I-90 eastbound ramp terminal, 27th Street and the I-90 westbound ramp terminal, 27th Street and Platinum Drive, and 27th Street and 1st Avenue. The intersections of Colorado Boulevard and 26th Street and Colorado Boulevard and Heritage Drive were also analyzed as part of the Colorado Boulevard portion of the *US14A Corridor Study*, but are not included in this document. Interstate mainline and ramp merge and diverge movements were not analyzed as part of the *US14A Corridor Study.* The *South Dakota Decennial Interstate Corridor Study* indicated that the mainline segments of I-90 adjacent to the Exit 14 interchange and the adjacent interchange's ramp merge and diverge movements will operate at level of service A or B through 2030. The reconfiguration of the existing interchange is believed to have a negligible effect on the Interstate's traffic operations when compared with the existing interchange's configuration. At the request of FHWA, the ramp merge and diverge movements for the proposed reconfiguration of Exit 14 were analyzed by the design consultant using traffic data from the *US14A Corridor Study,* the *South Dakota Decennial Interstate Corridor Study,* and the *Spearfish Area Master Transportation Plan*.

As the *US14A Corridor Study* was started prior to the release of 2010 edition of the Highway Capacity Manual (HCM2010), Level of Service (LOS) for intersections was completed according to the 2000 edition of the Highway Capacity Manual. Each lane of traffic has a delay associated with it and therefore a correlating LOS. The weighted average delay for each of these lanes of traffic for an intersection is the intersection LOS.

Alternative 0: No Build

As congestion is more often dictated by actions at intersections and ramp junctions, analysis on those movements were done independently. Table 4 summarizes the results of the future (2035) traffic analysis on the 27th Street intersections.

Table 4: 27th Street Intersections Future No Build Level of Service

Intersection / Movement	AM Peak LOS*	PM Peak LOS*
27th Street / 1st Avenue	C	C
27th Street / Platinum Drive**	**F**	**F**
27th Street / I-90 Westbound Ramp	B	C
27th Street / I-90 Eastbound Ramp	C	**F**
27th Street / Colorado Boulevard (West)	**D**	**E**
27th Street / Colorado Boulevard (East)**	C	**F**

Note: *Average Intersection LOS shown, individual movements may be different.
**Unsignalized, Minor Road Stop Only Intersection, 27th Street / Colorado Boulevard has zero delay, LOS = A.

Alternative 1: Single Point Interchange with 27th Street Shifted over I-90.

Table 5: 27th Street Intersections Future Alternative 1 Level of Service

Intersection / Movement	AM Peak LOS*	PM Peak LOS*
27th Street / 1st Avenue	B	B
27th Street / Platinum Drive**	B	B
27th Street / Single Point Ramp Terminal	B	C
27th Street / Colorado Boulevard	B	C

Note: *Average Intersection LOS shown, individual movements may be different.
**Unsignalized, Minor Road Stop Only Intersection, 27th Street has zero delay, LOS = A.

Table 6: Exit 14 Future Ramp Merge/Diverge Level of Service – Alternative 1

Travel Direction	Ramp Movement	AM Peak Ramp Level of Service	PM Peak Ramp Level of Service
Eastbound	Exit Ramp Diverge	C	C
	On Ramp Merge	B	A
Westbound	Exit Ramp Diverge	B	B
	On Ramp Merge	B	B

Alternative 2: Single Point Interchange with 27th Street Shifted under I-90.

Table 7: 27th Street Intersections Future Alternative 2 Level of Service

Intersection / Movement	AM Peak LOS*	PM Peak LOS*
27th Street / 1st Avenue	B	B
27th Street / Platinum Drive**	B	B
27th Street / Single Point Ramp Terminal	B	C
27th Street / Colorado Boulevard	B	C

Note: *Average Intersection LOS shown, individual movements may be different.
**Unsignalized, Minor Road Stop Only Intersection, 27th Street has zero delay, LOS = A.

Alternative 3: Tight Diamond Interchange 27th Street Shifted.

Table 8: 27th Street Intersections Future Alternative 3 Level of Service

Intersection / Movement	AM Peak LOS*	PM Peak LOS*
27th Street / 1st Avenue	B	B
27th Street / Platinum Drive**	B	B
27th Street / I-90 Westbound Ramp	A	B
27th Street / I-90 Eastbound Ramp	A	B
27th Street / Colorado Boulevard	B	C

Note: *Average Intersection LOS shown, individual movements may be different.
**Unsignalized, Minor Road Stop Only Intersection, 27th Street has zero delay, LOS = A.

Chapter 7: ALTERNATIVES ANALSYIS

Conformance with Transportation Plans

All three build alternatives evaluated conform with current local and state transportation plans.

The existing Exit 14 interchange was first identified as having some minor geometric needs by the *2000 Statewide Interstate Corridor Study*. An interchange improvement project for the Exit 14 interchange has been in the Statewide Transportation Improvement Program (STIP) in some form since 2010, and is in both the current 2013-2017 and tentative 2014-2017 STIP for Federal fiscal year 2015.

Compliance with Policies and Engineering Standards

Alternative 0 (No Build) by its definition will not address the known geometric needs of the existing interchange. As such, if Alternative 0 (No Build) is followed, the interchange will not comply with the current South Dakota design standards for inslopes (4:1 versus 6:1 standard), total ramp width (24' versus 25' standard), and the right shoulder width (3' versus 8' standard). All three build alternatives will correct these existing geometric issues.

Without major modification to the City of Spearfish street network and extensive right of way acquisition, the desirable 660' distance between the southernmost ramp terminal intersection and the 27th Street / Colorado Boulevard intersection cannot be achieved. Alternative 0 (No Build) will maintain the approximately 150' distance between the eastbound ramp terminal intersection radius and the Colorado Boulevard intersection radius. Alternative 1 & 2 (Single Point interchanges) will increase this distance to approximately 600' between the Colorado Boulevard and ramp terminal intersection signals, however with ramp turn lanes, results in obtaining only the AASHTO minimum 100' from the eastbound on-ramp right turn lane radius to intersection radius. Alternative 3 (Tight Diamond) will increase this distance to only approximately 350' centerline to centerline, but increases the ramp radius to intersection radius to 250'.

The installation of a raised center median along 27th Street for all three build alternatives will improve the full access spacing north of the interchange along 27th Street away from the interchange's ramp terminals for all three build options. Alternatives 1 & 2 will move the first full access median opening to be provided north of the single point ramp terminal intersection approximately 1050' centerline to centerline to the at the intersection with 1st Avenue. Alternative 3 will provide for approximately 900'. The installation of the median will convert the currently full access intersection with Platinum Drive to a ¾ access, eliminating

the left turn from Platinum Drive to northbound 27th Street and converting the one private driveway that currently shares the full access with Platinum Drive into a right in – right out only access. The intersection with Platinum Drive will be located approximately 700' centerline to centerline north of the single point ramp terminal (370' westbound on-ramp right turn lane radius to Platinum Drive radius). The SDDOT already has control of access rights along 27th Street between Colorado Boulevard and Platinum Drive. Further discussion on control of access can be found in Appendix E.

Environmental Impacts

Considering that no additional right-of-way is anticipated to be acquired related to interchange configuration, it is anticipated that the environmental impacts specific to any interchange modification compared to Alternative 0 (No Build) will be negligible. Properties that will be acquired are related to removing previously permitted business access points along Colorado Boulevard. It is believed to be a type II, categorical exclusion project regardless of the alternative chosen.

As part of the US14A Corridor Study, a basic noise analysis was conducted. The results indicate that given the land use types surrounding the interchange, the noise impacts will be within acceptable limits within the planning horizon and that no abatement measures need to be taken. A cursory review of historical properties was also done as part of the US14A Corridor Study and no historical properties were found to be in the vicinity of the interchange.

Safety

Upon reviewing the reported crash data shown in Table 3 of Chapter 3, one can easily ascertain that nearly half (48%) of all the crashes within the interchange's influence area and 100% of the injury/fatality classified crashes during the reporting period (2009, 2010, & 2011) are ramp terminal intersection related. Since Alternative 0 (No Build) and Alternative 3 (Tight Diamond) do not reduce the number of intersections along 27th Street, one can presuppose that either alternative will have minimal affect on the intersection related accidents. Out of the remaining 11 reported crashes within the interchange's influence area, 4 (19%) were classified as animal hits which would occur regardless of interchange configuration.

Alternatives 1& 2 (Single Point) will reduce the number of signalized intersections along 27th Street and within the interchange's influence area by 1. A comparison of four interchanges previously reconfigured in South Dakota from a diamond configuration to a single point configuration indicates a 37.4% reduction in the number of crashes that occur within the interchange influence area when comparing the 3 years prior to conversion with the 3 years after conversion. It is anticipated that a conversion from the existing diamond to a single point

configuration at the Exit 14 interchange will result in a similar reduction in the total number of crashes occurring within the Exit 14 interchange's influence area.

In addition, the single point configuration requires a center median be installed along 27th Street leading into the interchange's ramp terminal intersection. The installation of the center median further reduces the number of full access intersections and access points along 27th Street. A crash prediction analysis for the 27th Street corridor indicates that the installation of the center median will lead to a reduction in the projected crash rate caused by accesses from 1.676/year to 1.1038/year.

Operational Performance

A limited traffic operations study was conducted as part of the *US14A Corridor Study*. Interstate mainline and ramp merge and diverge movements were not analyzed as part of the *US14A Corridor Study* and are not included in this document as the result of discussions held between SDDOT and FHWA on June 18, 2012. There are no currently observed issues with those movements, and it is anticipated that there will be minimal effect on those movements by any of the build options.

Where the build alternatives show a real improvement on traffic operations is along the 27th Street crossroad corridor. If the existing configuration and signal timings remain as today (Alternative 0: No Build), 4 of the 6 intersections along 27th Street are expected to operate at a LOS of E or worse in the PM Peak and the I-90 Eastbound ramp terminal intersection is anticipated to operate at LOS F in the PM peak in the future (2035) analysis year. Improvements anticipated to be made along 27th Street with this interchange modification project will improve the traffic operations at each major intersection along 27th Street.

Alternative 3 (Tight Diamond) does show better future operational performance at the I-90 ramp terminal intersections than Alternatives 1&2 (Single Points) show for the lone I-90 ramp terminal intersection. However, Alternatives 1&2 provide for a better corridor level of service along 27th Street.

Evaluation Matrix

Table 9: Evaluation Matrix

	Alternative 0 No Build	Alternative 1 Single Point Over	Alternative 2 Single Point Under	Alternative 3 Tight Diamond
Meets all SDDOT Geometric Design Criteria	No	Yes	Yes	Yes
Meets SDDOT Access Criteria	No	No	No	No
Ramp Terminal Signal to Colorado Boulevard Signal Distance	150’	600’	600’	350’
Lowest Ramp Terminal Intersection Level of Service, 2035	F	C	C	B
ROW Impacts	None	Minimal*	Minimal*	Minimal*
Environmental Impacts	None	Minimal	Minimal	Minimal
Safety Improvement	None	Some	Some	Minimal
Bicycle / Pedestrian Improvements	None	Better	Good	Best
Estimated Construction Time	NA	540 days	640 days	540 days

* Right-of-way acquisitions needed for the intersection of Colorado Boulevard and 27th Street would occur with all build alternatives.

Coordination

The SDDOT has a long history of public involvement in the development of transportation plans and projects. Public Meetings were held as part of the *US14A Corridor Study* on June 25, 2009; May 5, 2011; and November 15, 2011. Individual meetings with land and business owners within the corridor study's study area were also held as part of the study. The SDDOT had a webpage for the *US14A Corridor Study*, a screenshot of which can be seen in Figure 14. The final report from the *US14A Corridor Study* is available for viewing and/or download at www.sddot.com/transportation/highways/planning/specialstudies/us14a/FinalReport_NoAppendices.pdf

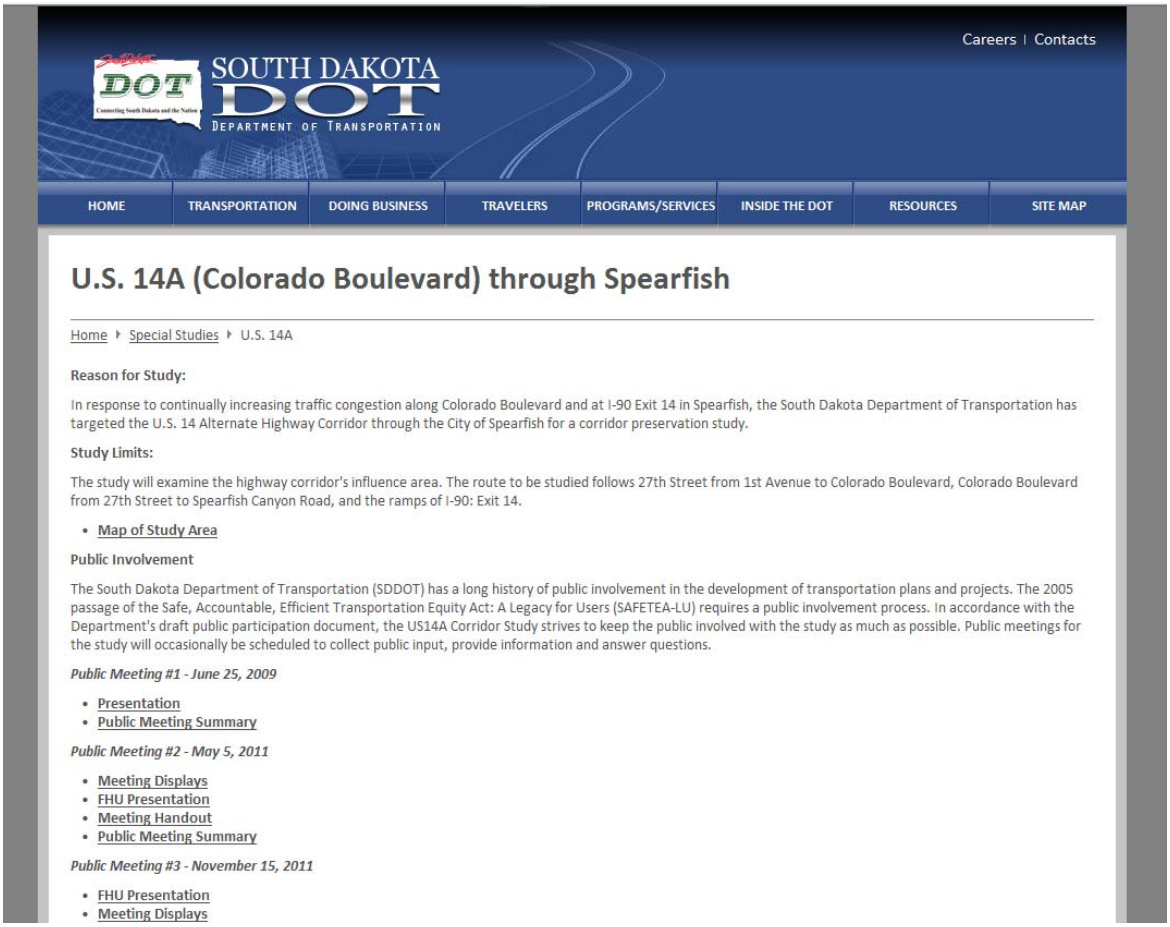

Figure 14: Screenshot of US14A Corridor Study Webpage

Specific to the interchange project, a public meeting was held on November 13, 2012. Land owner meetings were held on May 18 & 19, 2010 with 13 landowners directly affected by the Exit 14 Interchange project. The summary document from that meeting can be found in Appendix A.

After the open house was held, a webpage was established that provided access to the presentation and displays shown at the July 13, 2010, public open house. A screenshot of the project webpage can be seen in Figure 15. As the project development process continues, future public meetings will be held as necessary.

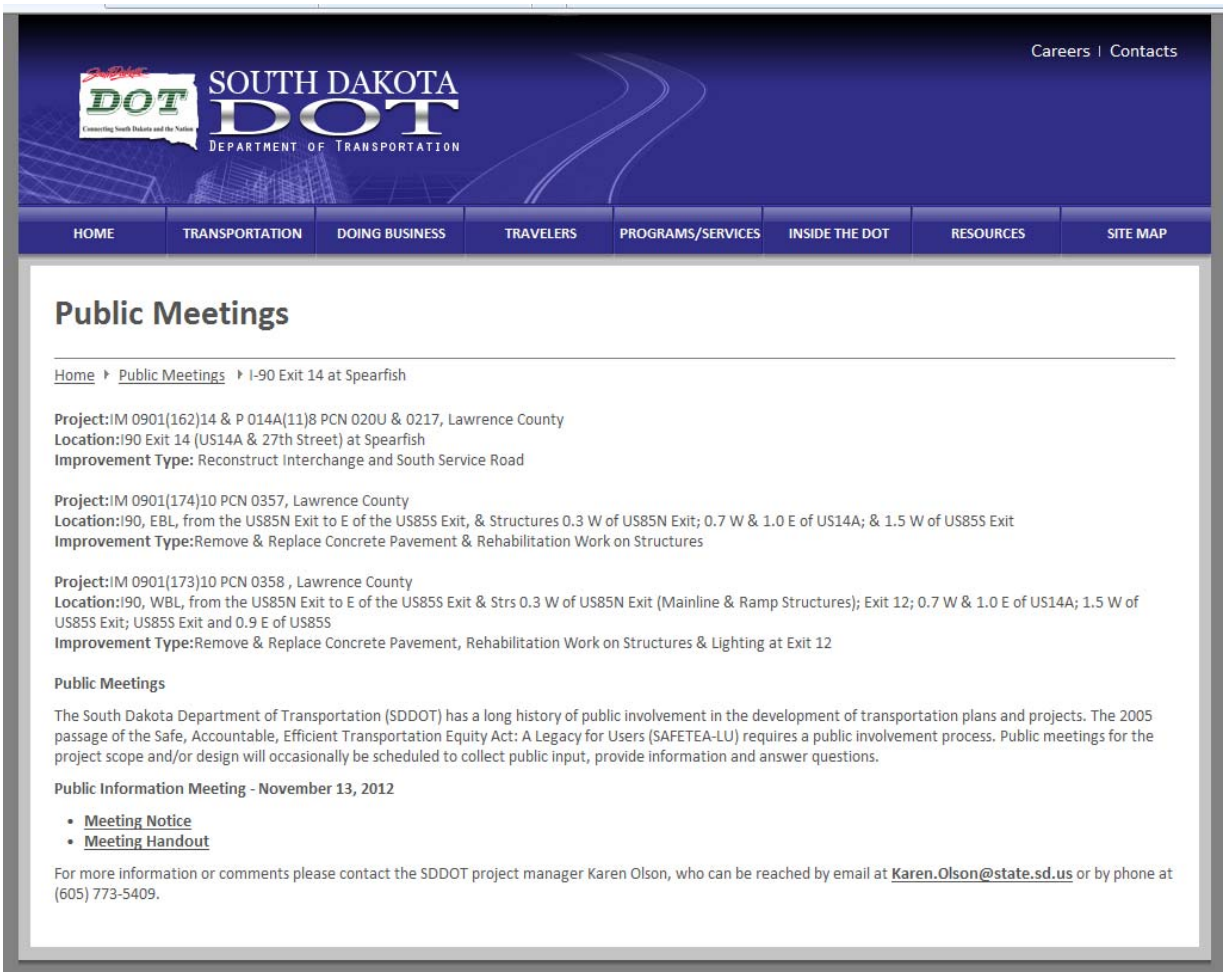

Figure 15: Screenshot of IM 0901(162)14 Project Webpage

Chapter 8: FUNDING PLAN

The planned project to replace the existing Exit 14 Interchange is currently estimated to cost $18.398 million (in 2012 dollars). The SDDOT is currently anticipating funding the project with the combination of funding sources as shown in Table 9.

Table 10 : Anticipated Funding Allocation Breakdown

State Funding Category	Federal Funding Category	Federal Funds	State Funds	Total Funds
Interstate	National Highway Performance Program	$17.545 Million	$2.789 Million	$20.334 Million
State Highway Urban	Surface Transportation Program	$3.194 Million	$0.863 Million	$4.057 Million
Total		$20.739 Million	$3.652 Million	$24.391 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 2015, the inflated estimated cost for the overall project is $25.376 Million.

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Chapter 9: RECOMMENDATIONS

This modification request is to reconfigure the existing Exit 14 interchange from a diamond configuration to a single point urban configuration, as shown in Figure 11 (Alternate 1) in Chapter 5.

This recommendation addresses the eight policy requirements for new or revised access points to the existing Interstate system published in the Federal Register Volume 74 Number 165; August 27, 2009.

1. The need being addressed by the request cannot be adequately satisfied by existing interchanges to the Interstate, and/or local roads and streets in the corridor can neither provide the desired access, nor can they be reasonably improved (such as access control along surface streets, improving traffic control, modifying ramp terminals and intersections, adding turn bays or lengthening storage) to satisfactorily accommodate the design year traffic demands (23 CFR 625.2(a)).

This modification request is to reconfigure an existing interchange. No additional access to the Interstate System is being requested. The South Dakota Decennial Interstate Corridor Study indicated that the mainline segments of I-90 adjacent to the interchange will operate at level of service A or B through 2030. The reconfiguration of the existing interchange will have a negligible effect on the Interstate's traffic operations when compared with the existing interchange's configuration. Most of the Interstate System benefit will be seen in the anticipated reduction in crashes at the interchange's ramp terminal intersections.

Figure 2 shows the existing configuration of Exit 14. The 2001 *Interstate Corridor Study* reviewed the existing interchange characteristics. Existing geometric features were reviewed using the as-built plans for this interchange. Some of the geometric deficiencies for the interchange include the inslopes for the on-ramps being 4:1. The width for each ramp is only 24' and should be widened. Probably the most critical feature at this interchange is the proximity of adjacent access points to the ramp intersections. Street intersections are located only 150' south of the interchange for Colorado Boulevard and 400' to the north for Platinum Drive. The bridge for Exit 14 is classified as structurally deficient with a deck rating of Poor.

Structurally, except for the deck, the bridge over the Interstate is currently in good condition. It is a concrete stringer/girder bridge built in 1971 with a deck overlay done in 1985. Deck overlays typically have a service life of 20 to 25 years, so the current deck overlay is approaching the end of its service life and the structure will soon be due for rehabilitation or replacement.

2. The need being addressed by the request cannot be adequately satisfied by reasonable transportation system management (such as ramp metering, mass transit, and HOV facilities), geometric design, and alternative improvements to the Interstate without the proposed change(s) in access (23CFR 625.2(a)).

This modification request is to reconfigure the geometrics of an existing interchange. No additional access to the Interstate System is being requested. Existing characteristics and development in the vicinity of the existing interchange limited the cost feasible options for interchange reconfiguration.

The US14A Corridor Study initially developed thirteen build alternatives, which were then narrowed down to three feasible alternatives, a tight diamond configuration similar to the existing and two variations of a single-point urban interchange. All three build alternatives proposed a shift in the 27th Street alignment over I-90 to eliminate the existing off-set intersection of 27th Street with Colorado Boulevard.

The single point interchange concept was eventually selected primarily for the improvement to traffic operations along both 27th Street and the parallel Colorado Boulevard, including the nearby intersection of 27th Street and Colorado Boulevard by consolidating the two intersections of the existing diamond design into one intersection shifted towards the centerline of mainline I-90. This will vastly improve the spacing between the ramp terminal intersection and the existing intersections of 27th Street. The increase in distance between the intersections improves the operation of all crossroad intersections, including the ramp terminal intersection by providing additional queue space for left turns.

There are no areas within the State of South Dakota that will consistently experience congestion levels extreme enough to make ramp metering or HOV facilities economically feasible in the foreseeable future.

3. 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 shall, 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, 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 a 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 must 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 South Dakota Decennial Interstate Corridor Study indicated that the mainline segments of I-90 adjacent to the interchange will operate at level of service A or B through 2030. The reconfiguration of the existing interchange is believed to have a negligible effect on the Interstate's traffic operations when compared with the existing interchange's configuration.

As they were developed through the *US14A Corridor Study*, only interchange alternatives that progressed to the third phase of the planning corridor study were developed enough to perform a traffic operations analysis along the crossroad. This led to three alternatives; a tight diamond configuration and two variations of a single-point interchange, being analyzed. The single point interchange variation that maintains the crossroad over I-90 is the recommended option.

Single Point Design Alternative Over I-90 (Recommended Option)

Figure 11 shows the most technically feasible design of a single point interchange with the crossroad over I-90. The interstate mainline would need to be lowered through the interchange area. The single point interchange concept consolidates all interchange turning movements into a single intersection, as shown on Figure 11. The installation of a single point interchange at Exit 14 would represent a departure from the typical I-90 interchange in the Spearfish area. As there are other single point interchanges already in the Rapid City area along I-90 at Exits 58, 60, and 61, it is anticipated that the time necessary for local drivers to adjust to the new configuration will be short.

The intersection LOS results along the 27th Street corridor north and south of the interchange are shown for the year 2035 in Table 5

A before and after comparison of the three year crash history at other interchanges in South Dakota that have been reconfigured from a diamond to a single point shows a reduction in total crashes of 37.4% and a reduction in those crashes classified as fatal or injury of 33.8%. Although there may be an initial increase in crashes due to driver unfamiliarity, it can be anticipated that a similar reduction in crashes will occur at the Exit 14 interchange upon its conversion from a diamond to a single point configuration.

One of the key factors that can affect the safety and operations of an interchange is the permanent signing associated with the interchange. As the proposal is for

replacement of an existing interchange, not much change in permanent signing is anticipated from the permanent signing that is currently in place. The permanent signing plan for the recommended single point interchange can be shown in Figure 16. The full preliminary signing plan showing the approach signing along the Interstate mainline and the 27th Street crossroad is shown in Appendix #.

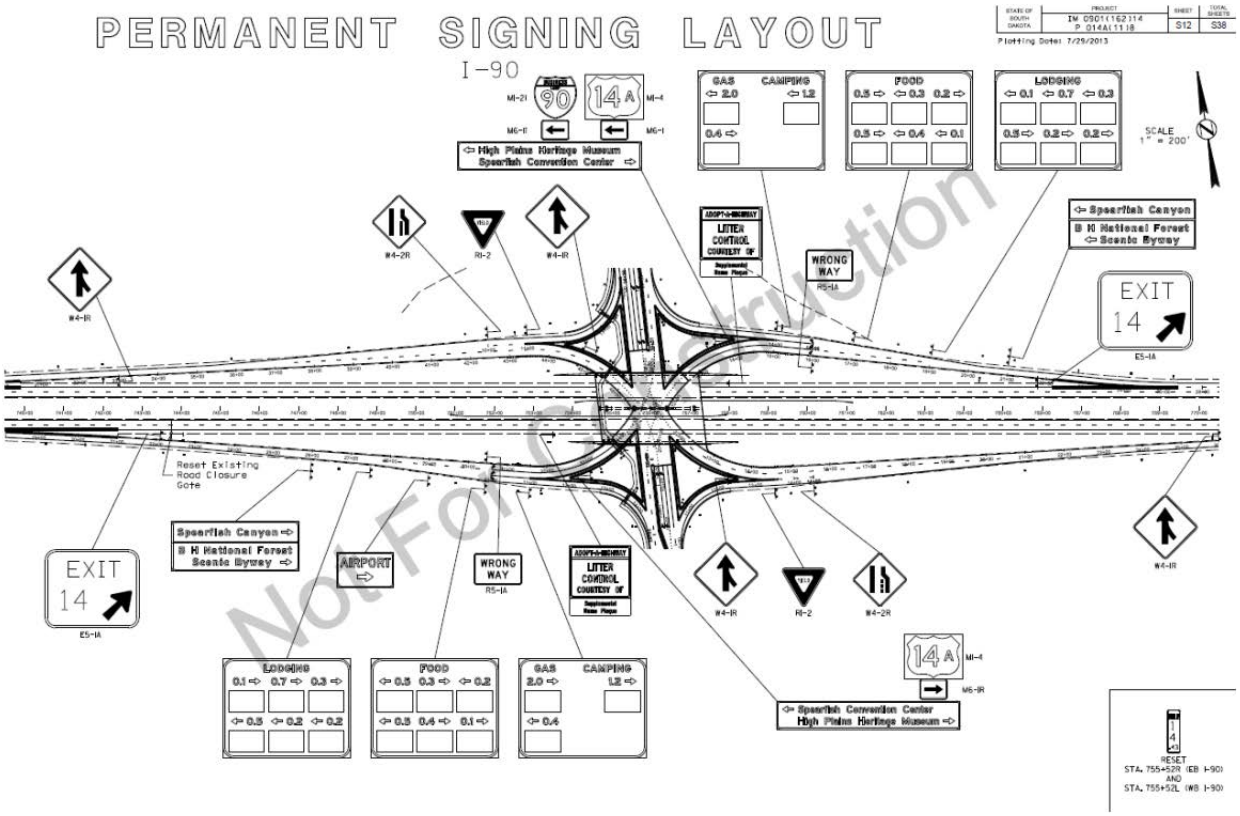

Figure 16: Permanent Signing Plan

4. 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)).

The access improvement will maintain a connection to a public road (US14A / 27th Street) 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.

5. The proposal considers and is consistent with local and regional land use and transportation plans. Prior to receiving final approval, all requests for new or revised access must be included in an adopted Metropolitan Transportation Plan, in the adopted Statewide or Metropolitan Transportation Improvement Program (STIP or TIP), and the Congestion Management Process within transportation management areas, as appropriate, and as specified in 23 CFR part 450, and the transportation conformity requirements of 40 CFR parts 51 and 93.

The proposed interchange improvement is consistent with local land use plans, the STIP, and local transportation plans.

6. In corridors where the potential exists for future multiple interchange additions, a comprehensive corridor or network study must accompany all requests for new or revised access with recommendations that address all of the proposed and desired access changes within the context of a longer-range system or network plan (23 U.S.C. 109(d), 23 CFR 625.2(a), 655.603(d), and 771.111).

Both the *South Dakota Interstate Corridor Study* completed in February 2001 and the 2010 *South Dakota Decennial Interstate Corridor Study* indicated no need for any future interchange additions along the segments of Interstate 90 between Exit 14 and the adjacent exits. During the public participation process of both the recently completed *US14A Corridor Study* and the *Spearfish Area Master Transportation Plan Study*, the idea for a new interchange between Exit 14 and Exit 17 was brought forth by the public. This idea was quickly dismissed due to minimum interchange spacing requirements and conflicts with the runways of the Black Hills / Clyde Ice Field Airport, which is located just north of I-90 approximately half way between Exit 14 and Exit 17.

7. When a new or revised access point is due to a new, expanded, or substantial change in current or planned future development or land use, requests must demonstrate appropriate coordination has occurred between the development and any proposed transportation system improvements (23 CFR 625.2(a) and 655.603(d)). The request must describe the commitments agreed upon to assure adequate collection and dispersion of the traffic resulting from the development with the adjoining local street network and Interstate access point (23 CFR 625.2(a) and 655.603(d)).

The proposed interchange modification is the result of relatively new and the planned future development of the City of Spearfish. Both the *US14A Corridor Study* and the *Spearfish Area Master Transportation Plan Study* were jointly coordinated by SDDOT, City of Spearfish, and FHWA staff.

The reconfiguration of the interchange is being proposed to address future traffic growth relative to the anticipated future population growth of the entire Spearfish

Area. The *US14A Corridor Study* also calls for the eventual reconstruction of the Colorado Boulevard corridor, which parallels mainline I-90, when traffic and condition warrants. Unfortunately, both terrain restraints of the Northern Black Hills and the location of a nearby federally designated wilderness area create a geographic bottleneck that limits the amount of parallel corridors to operationally support I-90 that can be feasibly constructed.

8. The proposal can be expected to be included as an alternative in the required environmental evaluation, review and processing. The proposal should include supporting information and current status of the environmental processing (23 CFR 771.111).

The proposed revised access is included in the Tentative 2014-2017 STIP for 2015 and the status of the environmental process is tracking consistent as other projects believed to be a type II categorical exclusion programmed for the same year.