

# US HIGHWAY 14A CORRIDOR STUDY INCLUDING I-90 EXIT 14



*Prepared for:*

**South Dakota Department of Transportation**  
700 East Broadway Avenue  
Pierre, South Dakota 57501



*Prepared by:*

**Felsburg Holt & Ullevig**  
6300 South Syracuse Way, Suite 600  
Centennial, CO 80111

*March 2012*

*FHU Reference No. 10-130-01*

## **DISCLAIMERS**

“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.”

“The South Dakota Department of Transportation provides services without regard to race, color, gender, religion, national origin, age or disability, according to the provisions contained in SDCL 20-13, Title VI of the Civil Rights Act of 1964, the Rehabilitation Act of 1973, as amended, the Americans With Disabilities Act of 1990 and Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations, 1994. To request additional information on the SDDOT’s Title VI/Nondiscrimination policy or to file a discrimination complaint, please contact the Department’s Civil Rights Office at 605-773-3540.”



**US Highway 14A Corridor Study Including I-90 Exit 14**

# TABLE OF CONTENTS

	<u>Page</u>
<b>EXECUTIVE SUMMARY</b> .....	<b>i</b>
<b>1.0 INTRODUCTION</b> .....	<b>1</b>
A. Project Background .....	1
B. Study Area .....	1
C. Project Purpose .....	3
D. Project Process .....	4
<b>2.0 INTERCHANGE OPTIONS STUDY</b> .....	<b>7</b>
A. Existing Conditions .....	7
B. Future (Year 2035) No Action Conditions .....	14
C. Alternatives .....	17
D. Environmental Analysis .....	34
<b>3.0 US HIGHWAY 14A CORRIDOR STUDY</b> .....	<b>37</b>
A. Existing Conditions .....	37
B. Future Conditions .....	43
C. Development of Alternatives .....	48
D. Screening of Alternatives .....	54
E. Colorado Boulevard Implementation Plan .....	55
<b>4.0 ACCESS CONTROL AND MANAGEMENT</b> .....	<b>57</b>
A. US 14A and Exit 14 Environs Access Management .....	57
B. US 14A – Colorado Boulevard Access Management .....	61
<b>5.0 CONCLUSIONS AND RECOMMENDATIONS</b> .....	<b>63</b>
A. Project Purpose .....	63
B. Interchange Options Study .....	63
C. US Highway 14A Corridor Study .....	63
D. Access Management .....	64

## LIST OF APPENDICES

- APPENDIX A PUBLIC MEETING SUMMARIES
- APPENDIX B PUBLIC COMMENTS AND RESPONSES
- APPENDIX C OPERATIONAL ANALYSIS WORKSHEETS
- APPENDIX D EXIT 14 INITIAL SCREENING CRITERIA AND MATRIX
- APPENDIX E SINGLE POINT INTERCHANGE RESEARCH
- APPENDIX F CONCEPTUAL CONSTRUCTION PHASING INFORMATION
- APPENDIX G EXIT 14 FINAL SCREENING MATRIX
- APPENDIX H INTERCHANGE NOISE ANALYSIS REPORT
- APPENDIX I POTENTIAL PARALLEL ALIGNMENT OPTIONS A-F
- APPENDIX J COLORADO BOULEVARD CORRIDOR – INITIAL ALTERNATIVES
- APPENDIX K ACCESS MANAGEMENT TECHNICAL MEMORANDUM AND ACCESS MEMORANDUM OF UNDERSTANDING



**US Highway 14A Corridor Study Including I-90 Exit 14**

**LIST OF FIGURES**

	<u>Page</u>
Figure 1-1 Study Area -----	2
Figure 2-1 I-90 Exit 14 Existing Configuration -----	8
Figure 2-2 I-90 Exit 14 Number of Crashes 2006-2009 -----	10
Figure 2-3 I-90 Exit 14 2009 Traffic Volumes -----	12
Figure 2-4 I-90 Exit 14 2009 Intersection Levels of Service -----	13
Figure 2-5 I-90 Exit 14 No Action 2035 Traffic Forecasts -----	15
Figure 2-6 I-90 Exit 14 No Action 2035 Levels of Service -----	16
Figure 2-7a I-90 Exit 14 Final Screening Options -----	27
Figure 2-7b I-90 Exit 14 Final Screening Options -----	28
Figure 2-8 I-90 Exit 14 Alternative 4/5 Year 2035 Traffic Volumes and Operations -----	31
Figure 2-9 I-90 Exit 14 Alternative 8 Year 2035 Traffic Volumes and Operations -----	32
Figure 2-10 I-90 Exit 14 Alternative 4: Single Point – I-90 Under 27 <sup>th</sup> Street – Shifted Bridge -----	35
Figure 3-1 US 14 A – Colorado Boulevard 2009 Existing Lane Configuration and Traffic Control -----	38
Figure 3-2 US 14 A – Colorado Boulevard Number of Crashes 2006-2009 -----	40
Figure 3-3 US 14 A – Colorado Boulevard 2009 Traffic Volumes -----	42
Figure 3-4 US 14 A – Colorado Boulevard 2009 Levels of Service -----	44
Figure 3-5 US 14 A – Colorado Boulevard 2035 Traffic Forecasts -----	45
Figure 3-6 US 14 A – Colorado Boulevard 2035 No Action Levels of Service -----	47
Figure 3-7 Dahl Road (Spearfish Canyon Road Realignment Connection) -----	50
Figure 3-8 US 14 A – Colorado Boulevard 2035 Levels of Service, 3-Lane with Roundabouts -----	52
Figure 3-9 US 14 A – Colorado Boulevard 2035 Levels of Service, 3-Lane with Signals -----	53
Figure 4-1 Existing and Proposed Control-of-Access -----	58
Figure 4-2 Recommended Configuration 27 <sup>th</sup> Street at Platinum -----	60
Figure 4-3 Recommended Access Management 27 <sup>th</sup> Street at Colorado -----	62

**LIST OF TABLES**

Table 2-1 Year 2009 and Year 2035 Intersection Level of Service Comparison -----	17
Table 2-2 Initial Interchange Alternatives -----	18
Table 2-3 Alternatives Eliminated in Initial Screening -----	26
Table 2-4 Final Screening Criteria and Measurement -----	29
Table 2-5 Over/Under Single-Point Geometric Comparison -----	30
Table 2-6 Final Interchange Screening Results -----	34
Table 3-1 Alternative Screening Matrix – Colorado Boulevard -----	54



## US Highway 14A Corridor Study Including I-90 Exit 14

# EXECUTIVE SUMMARY

## Introduction

### Project Background

Interstate 90 (I-90) Exit 14 and US Highway 14A (US 14A) work in tandem to form a vital transportation connection on the east side of the City of Spearfish, South Dakota. Exit 14 acts as a gateway to Spearfish, surrounded by vibrant commercial development. Paralleling I-90 on its south side, US Highway 14A is the most direct route from the Exit 14 area to downtown Spearfish, Black Hills State University (BHSU), and scenic Spearfish Canyon.

The US Highway 14A Interchange Options and Corridor Study was initiated by the South Dakota Department of Transportation (SDDOT) in May of 2009 to identify needs and make recommendations for the future of these important transportation facilities. To give appropriate attention to the distinct characteristics and needs of the Exit 14 interchange and the US 14A Corridor, each is provided with a separate chapter in this report. **Chapter 2** addresses the Exit 14 Interchange, and **Chapter 3** focuses on the US 14A Corridor.

### Study Area

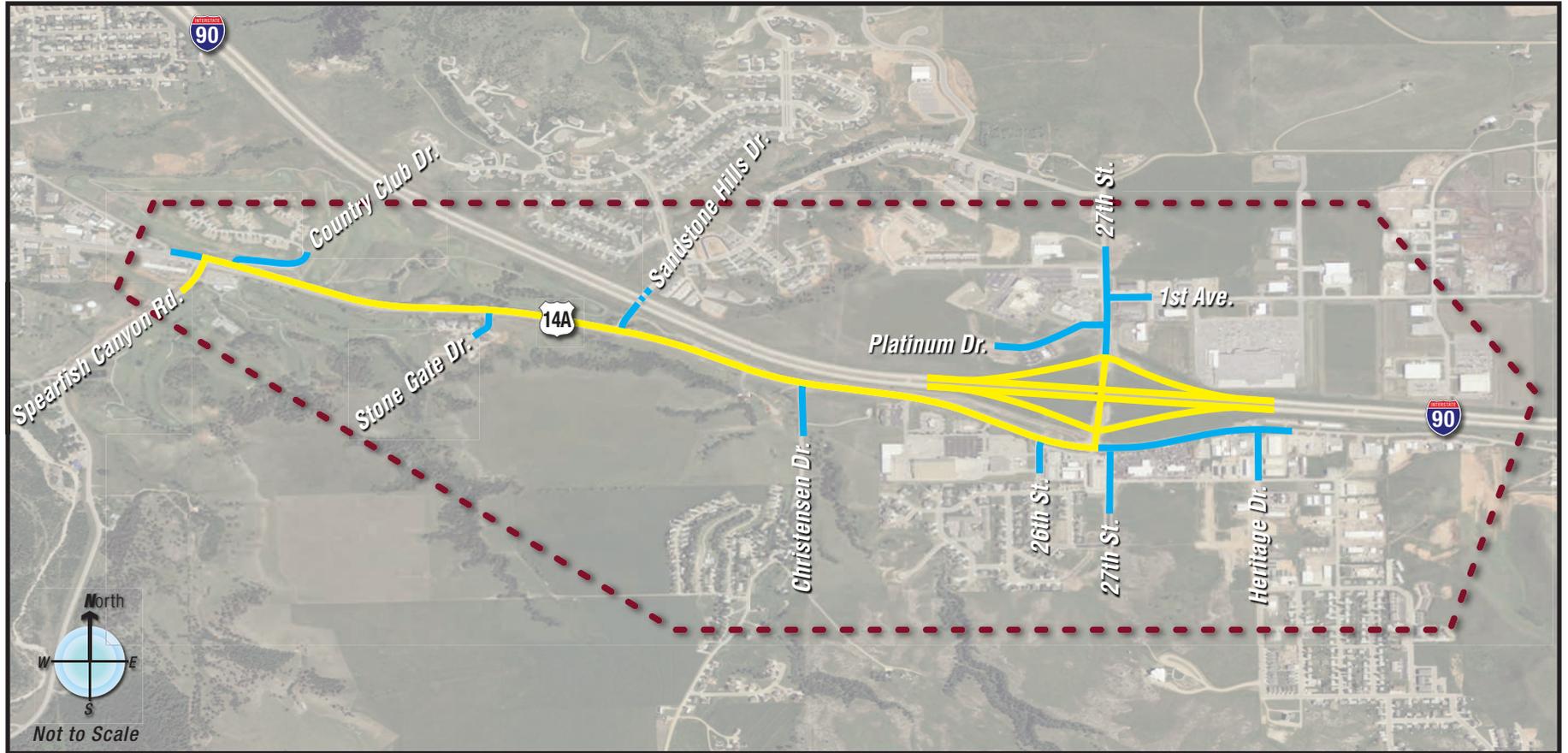
The project study area is depicted on **Figure ES-1**. The study area includes portions of the City of Spearfish and unincorporated Lawrence County. Land uses within the study area include undeveloped land, residential, commercial, industrial, and recreational properties. A mix of commercial uses surround the immediate Exit 14 interchange area and industrial properties mix in farther away from the interchange. The western portion of the study area is less densely developed.

The study roadways include the I-90 Exit 14 Interchange, 27<sup>th</sup> Street and US Highway 14A (US 14A or Colorado Boulevard) between Spearfish Canyon Road and Heritage Drive. The Exit 14 interchange is configured as a standard diamond interchange, with 27<sup>th</sup> Street passing above mainline I-90 via a 2-lane bridge. The ramp terminal intersections are signalized, and the south ramp terminal lies within 150 feet of the signalized 27<sup>th</sup> Street/US 14A intersection. The study area includes an approximate 1.8 mile section of US 14A/Colorado Boulevard.

## Project Purpose

The twofold purpose of the study is to:

1. Recommend a Most Technically Feasible Alternative for reconstruction of the I-90 / Exit 14 interchange. Funding for the reconstruction effort is currently included in the STIP for FY 2015, and the recommended Most Technically Feasible Alternative is anticipated to advance to the design stage soon after completion of this study.
2. Recommend a Most Technically Feasible Alternative for the US Highway 14A/Colorado Boulevard corridor between Spearfish Canyon Road and Heritage Drive. Most of this roadway surface was repaved in the Year 2011 and would likely be reconstructed when the current paved surface requires replacement, approximately 15-20 years into the future (Year 2025-2035).



**LEGEND**

- = South Dakota Department of Transportation (SDDOT) Roadways
- = City of Spearfish Roadways

Figure ES-1  
**Study Area**



## US Highway 14A Corridor Study Including I-90 Exit 14

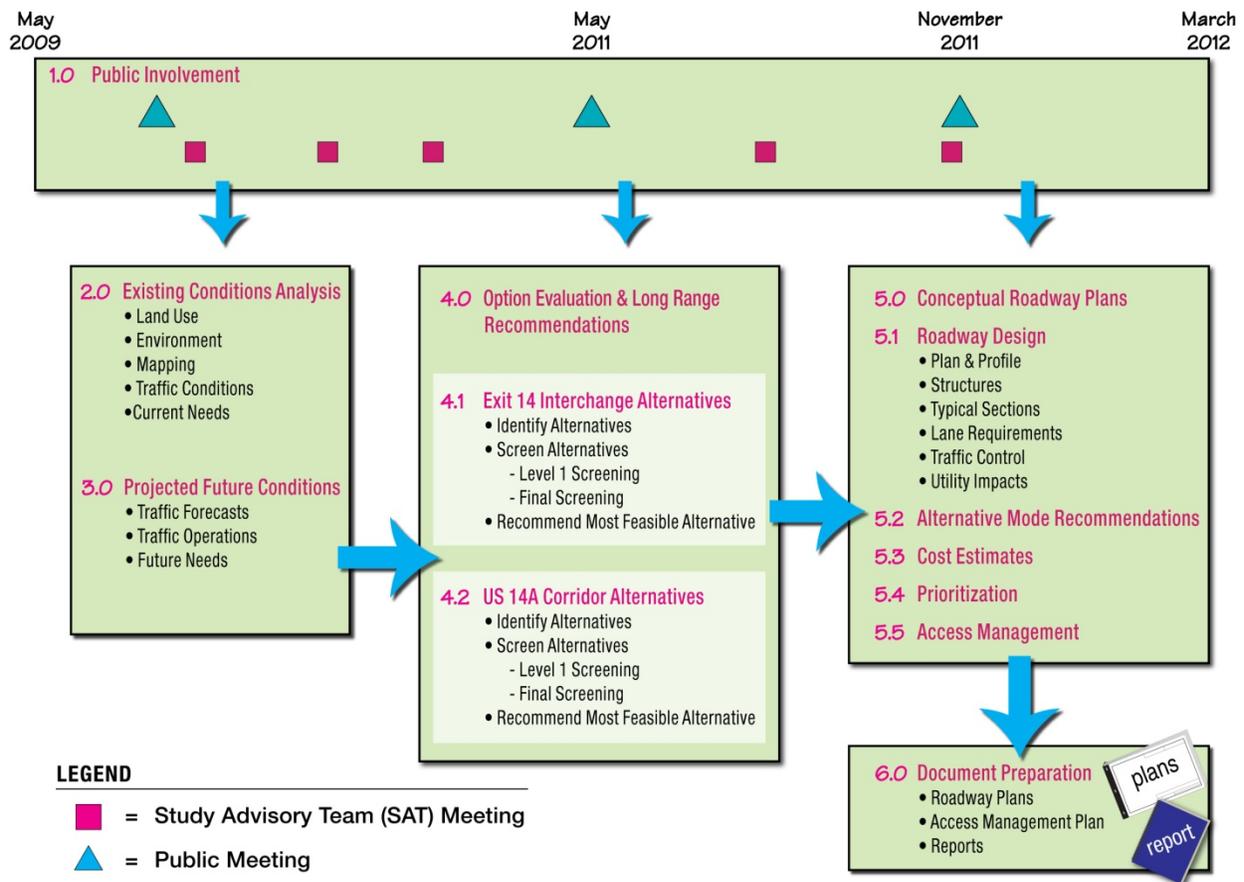
While closely related, recommendations for the interchange and the US 14A Corridor are kept independent of each other because the two facilities are on different schedules for future reconstruction.

### Project Process

The project effort was organized to study the interchange and the corridor in parallel fashion as two separate chapters of an overall evaluation. This “2-in-1” approach allowed the project team to blend elements of the study that could be shared such as public and stakeholder meetings while keeping recommendations for the interchange distinct from the US 14A corridor.

The SDDOT began the study in May of 2009 and held a kickoff public meeting in June of 2009. Upon completing initial traffic analyses and forecasts, the SDDOT engaged a consulting firm in October of 2010 to finish the project. The study is anticipated to be complete by March of 2012. The work flow diagram is illustrated on **Figure ES-2**. As shown, the project took place in six major tasks, beginning with analyses of existing and future traffic conditions.

**Figure ES-2 Work Flow Diagram**





## US Highway 14A Corridor Study Including I-90 Exit 14

### **Project Governance**

The project was initiated by SDDOT Staff, who continued to manage the project after handoff to the transportation consultant. A multi-agency Study Advisory Team (SAT) provided project oversight, meeting five times over the course of the project to make project decisions and review project documents. Agencies represented on the SAT included SDDOT, Federal Highway Administration (FHWA), The City of Spearfish, and Spearfish Canyon Country Club.

### **Public Involvement**

The public involvement process depicted on **Figure ES-2** centered on the three public open house meetings on weekday evenings at the City of Spearfish Council Chambers. At these meetings, the project team provided a brief presentation and attendees were given the opportunity to review project information and provide comments in conversations, comment sheets and individual correspondence.

As a part of the project public involvement efforts, the SDDOT conducted a public survey in August of 2009. The survey was an online survey, providing respondents with an opportunity to comment on current corridor issues, needs, and potential solutions. The project team received more than 200 comments from the public via this survey.

### **Interchange Options Study**

As previously discussed, the project was divided into two elements in order to appropriately address the distinctive elements of the Exit 14 Interchange and the US Highway 14A Corridor. This section addresses the Interchange Options Study performed for Interstate 90 Exit 14.

Interstate 90 Exit 14 lies in the east-central portion of the City of Spearfish, and provides access between I-90 and the immediate densely developed commercial area, as well as connecting to US Highway 14A, a route to downtown Spearfish and Spearfish Canyon. This important interchange handles a significant amount of traffic, and future growth is anticipated to place an additional strain on the interchange ramps, cross-road and intersections. The South Dakota Department of Transportation (SDDOT) has recognized the needs at Exit 14, placing the interchange in the Statewide Transportation Improvement Program (STIP) for reconstruction in the Year 2015.

A study of interchange options has been undertaken to evaluate existing and future needs, develop options for reconstructing the interchange to address those needs, and recommend a Most Technically Feasible interchange Alternative to be advanced to the design phase following completion of this study.

### **Existing and Future Conditions**

#### **Roadway Network**

Shown on **Figure ES-3**, Roadway facilities within the interchange study area include Interstate 90 (I-90), 27<sup>th</sup> Street, Platinum Drive, 1<sup>st</sup> Avenue, Colorado Boulevard, and 26<sup>th</sup> Street.



## US Highway 14A Corridor Study Including I-90 Exit 14

Figure ES-3 Exit 14 Interchange Area



### Interchange Traffic Conditions

#### Traffic Safety

The project team developed analyses of recent crash history and existing and future traffic operations to identify issues to be addressed by a range of reconstruction alternatives. Records for the four years between 2006 and 2009 show a total of 26 crashes at the two closely-spaced signalized intersections south of Exit 14 (Intersections 2 and 4 in **Figure ES-3**), likely caused in part by the close intersection spacing. Crash experience was slightly reduced on the north end of the interchange, where 9 crashes occurred at the north ramp terminal and 7 at the 27<sup>th</sup> Street/1<sup>st</sup> Avenue intersection.



## US Highway 14A Corridor Study Including I-90 Exit 14

### Traffic Volumes and Operations

27<sup>th</sup> Street carries approximately 11,000 Vehicles Per Day (vpd) through the interchange area. Colorado Boulevard carries approximately 8,000 vpd. The Exit 14 interchange ramps to and from the west carry more traffic than the east ramps at approximately 4,000 vpd each.

Operational analyses of the intersections noted in **Figure ES-3** indicated that all movements and intersections are currently operating acceptably during peak hours, at Level of Service (LOS) C or better.

Year 2035 Traffic forecasts were completed for the interchange area, showing that 27<sup>th</sup> Street traffic volumes are anticipated to nearly triple and Colorado Boulevard traffic volume roughly double over the next 25 years, straining the capacity of Exit 14. These increased traffic volumes result in worsening traffic operations at the study intersections, including a Level of Service F result at the south ramp terminal intersection for a Year 2035 No Action condition.

**Table ES-1 Year 2035 and Year 2009 Intersection Level of Service Comparison**

Intersection	AM(PM ) Peak Hour Intersection Level of Service	
	2009	2035
26 <sup>th</sup> Street/Colorado Boulevard	b(b) <sup>1</sup>	b(c)
N. 27 <sup>th</sup> Street/Colorado Boulevard	C(C) <sup>2</sup>	D(E)
S. 27 <sup>th</sup> Street/Colorado Boulevard	b(b)	c(f)
27 <sup>th</sup> Street/South Ramp Terminal	B(B)	C(F)
27 <sup>th</sup> Street/ North Ramp Terminal	A(A)	B(C)
27 <sup>th</sup> Street/Platinum Drive	b(c)	f(f)
27 <sup>th</sup> Street/1 <sup>st</sup> Avenue	A(B)	C(C)
<sup>1</sup> Lowercase letters depict LOS results for critical movements at unsignalized intersections		
<sup>2</sup> Capital letters depict signalized intersection LOS results		

In summary, operational analyses of Year 2035 traffic volumes and the No Action interchange configuration reveal the following points of congestion:

- ▶ South side of interchange: The 27<sup>th</sup> Street intersections with the south ramp terminal intersection and Colorado Boulevard are anticipated to operate poorly by the Year 2035 as individual intersections. Due to their close spacing, congestion at one will affect the other, and vice versa.
- ▶ Movements at the intersection of 27<sup>th</sup> Street with Platinum Drive will operate poorly, particularly the eastbound left turn movement from Platinum onto 27<sup>th</sup> Street.

Congestion at these locations would likely have a negative effect on the entire Exit 14 area, with the potential for queues to spill over across multiple intersections.

### Multimodal Conditions

Multimodal travel through the interchange occurs on a regular basis, as the interchange is located at a popular commercial junction in the City of Spearfish. The recreational trail system terminates at the 27<sup>th</sup> Street / Colorado Boulevard intersection, but pathways and sidewalks are lacking throughout most of the interchange area. Users of the trail must cross 27<sup>th</sup> or Colorado



## US Highway 14A Corridor Study Including I-90 Exit 14

Boulevard at-grade. Bicyclists and pedestrians seeking to cross I-90 along 27<sup>th</sup> Street must utilize the existing shoulders, which do not offer protection from vehicular traffic.

### Geometric Deficiencies

A major current geometric deficiency at the interchange is control of access. The SDDOT desires to provide a distance of 660 feet between ramp terminal intersections and the nearest access. Both north and south sides of the interchange include accesses closer than the desired 660 feet, and the south side includes a major signalized intersection within 150 feet.

## Interchange Alternatives

### Alternatives Development

The process of identifying a Most Technically Feasible Interchange Alternative began with the development of a range of alternatives crafted to address safety, geometric, multimodal and operational issues at the interchange. The initial alternatives were evaluated based on a series of performance and implementation criteria for alternative screening, which occurred in two steps. The initial screening step utilized a generalized analysis to reach a short list of final alternatives. A final, more detailed screening using some of the same criteria allowed the project team to reach a final recommended Most Technically Feasible Alternative.

A total of 14 initial alternatives were developed, including the No Action alternative. The alternatives are listed in **Table ES-2**.

**Table ES-2 Initial Interchange Alternatives**

#	Alternative
0	No Action
1	Standard Diamond
2	Roundabout Diamond
3	Single-Point, I-90 Under
4	Single-Point, I-90 Under Shifted Bridge
5	Single-Point, I-90 Over Shifted 27 <sup>th</sup>
6	Tight Diamond
7	Roundabout Tight Diamond
8	Tight Diamond, Shifted Bridge
9	Roundabout Tight Diamond, Shifted Bridge
10	25-mph Partial Cloverleaf, Shifted Bridge
11	30-mph Partial Cloverleaf, Shifted Bridge
12	Modified Partial Cloverleaf, Shifted Bridge
13	Roundabout Partial Cloverleaf, Shifted Bridge

### Alternatives Evaluation

The fourteen alternatives were evaluated based on a series of performance and implementation criteria, listed as follows:



## US Highway 14A Corridor Study Including I-90 Exit 14

### Performance Criteria

Capacity – reduce stops/delay  
 Safety – offset intersections  
 Signal Operation and Spacing  
 Geometric Design  
 Pedestrian and Bicycle Safety  
 Local Mobility and Accessibility  
 Colorado Boulevard Continuity

### Implementation Criteria

Constructability –Vertical/Detours  
 Construction Cost  
 Regional Consistency  
 Environmental/Right-of-way

A qualitative evaluation was utilized to provide a rating for each alternative for each criterion.

### Initial Screening Results

**Table ES-3** summarizes the results of the initial screening, as depicted in the preceding initial screening tables.

Alternatives advancing to final screening were:

- ▶ Alternative 0 – No Action
- ▶ Alternative 4 – Single-Point, I-90 Under Shifted Bridge
- ▶ Alternative 5 – Single-Point, I-90 Over Shifted 27<sup>th</sup>
- ▶ Alternative 8 – Tight Diamond, Shifted Bridge

These Alternatives are graphically depicted on **Figure ES-4a and ES-4b**.

**Table ES-3 Alternatives Eliminated in Initial Screening**

#	Alternative	Primary Reason(s) for Elimination
1	Standard Diamond	Offset intersection and detours during construction are a concern along with close signal and access spacing
2	Roundabout Diamond	Would require a multi-lane roundabout
3	Single-Point, I-90 Under	Offset intersection and detours during construction are a concern
6	Tight Diamond	Offset intersection and detours are a concern, as well as signal spacing
7	Roundabout Tight Diamond	Several multi-lane roundabouts required
9	Roundabout Tight Diamond, Shifted Bridge	Several multi-lane roundabouts required in proximity
10	25-mph Partial Cloverleaf, Shifted Bridge	The tight cloverleaf is a safety concern as well as proximity of ramps to Colorado Boulevard
11	30-mph Partial Cloverleaf, Shifted Bridge	Would break continuity of Colorado Boulevard and impact local access
12	Modified Partial Cloverleaf, Shifted Bridge	Would break continuity of Colorado Boulevard and impact local access
13	Roundabout Partial Cloverleaf, Shifted Bridge	Multi-lane roundabouts required in proximity



## US Highway 14A Corridor Study Including I-90 Exit 14

As shown in **Table ES-3**, the two most common reasons for eliminating alternatives were:

1. Failure to correct the current offset intersection of 27<sup>th</sup> Street with Colorado Boulevard: This offset intersection represents a current safety problem, and detracts from the role of 27<sup>th</sup> Street as an arterial roadway in the City of Spearfish roadway network. None of the surviving alternatives would leave this offset intersection in place.
2. Construction of one or more multi-lane roundabouts: There are currently no roundabouts along any state highway in the State of South Dakota, and the SDDOT is highly unlikely to construct the first state highway roundabout at Exit 14, an area likely to experience significant traffic congestion in the future. The need for multiple multi-lane roundabouts with some alternatives further decreases the likelihood of implementation.

### **Final Screening**

Upon reaching a short list of four alternatives, the project team utilized a final screening evaluation to reach a recommended Most Technically Feasible Alternative.

Operational analyses indicated that the surviving build alternatives would provide acceptable intersection traffic operations by the Year 2035. However, Alternative 8, the Tight Diamond, would introduce one more signalized intersection than the other alternatives.

Analyses of interchange geometrics, sight distance and roadway curvature gave a slight edge to Alternative 5, which would provide a sag vertical curve through the interchange along 27<sup>th</sup> Street as opposed to the crest vertical curve of Alternatives 4 and 8.

A particularly important criterion to local residents and businesses is the construction phasing and schedule for each alternative. A comparative analysis demonstrated that Alternative 4 could be constructed in approximately 100 fewer days than Alternative 5, and would provide additional flexibility to help keep ramps open during construction. Alternative 8 would require a similar phasing scheme to Alternative 4.

Considering these analyses along with additional criteria, the project team selected Alternative 4, Single-Point, I-90 under shifted bridge, as the Most Technically Feasible Interchange Alternative.

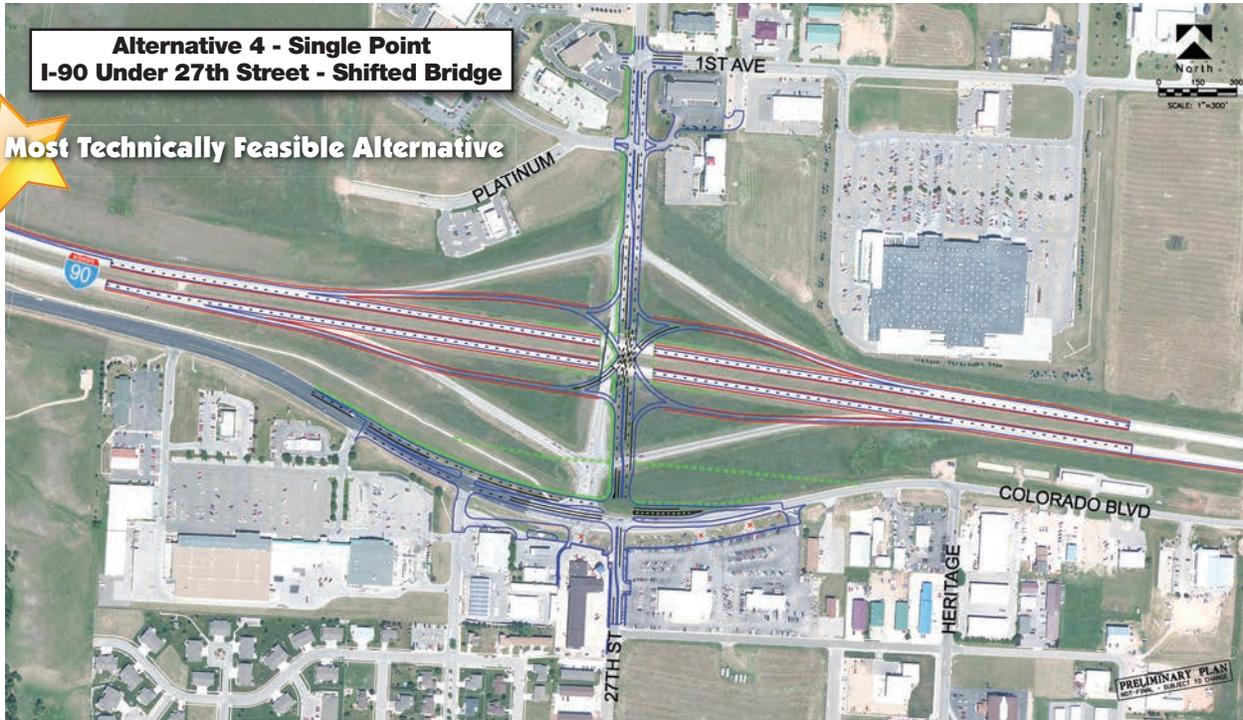


Figure ES-4a  
**I-90 Exit 14**  
**Final Screening Options**

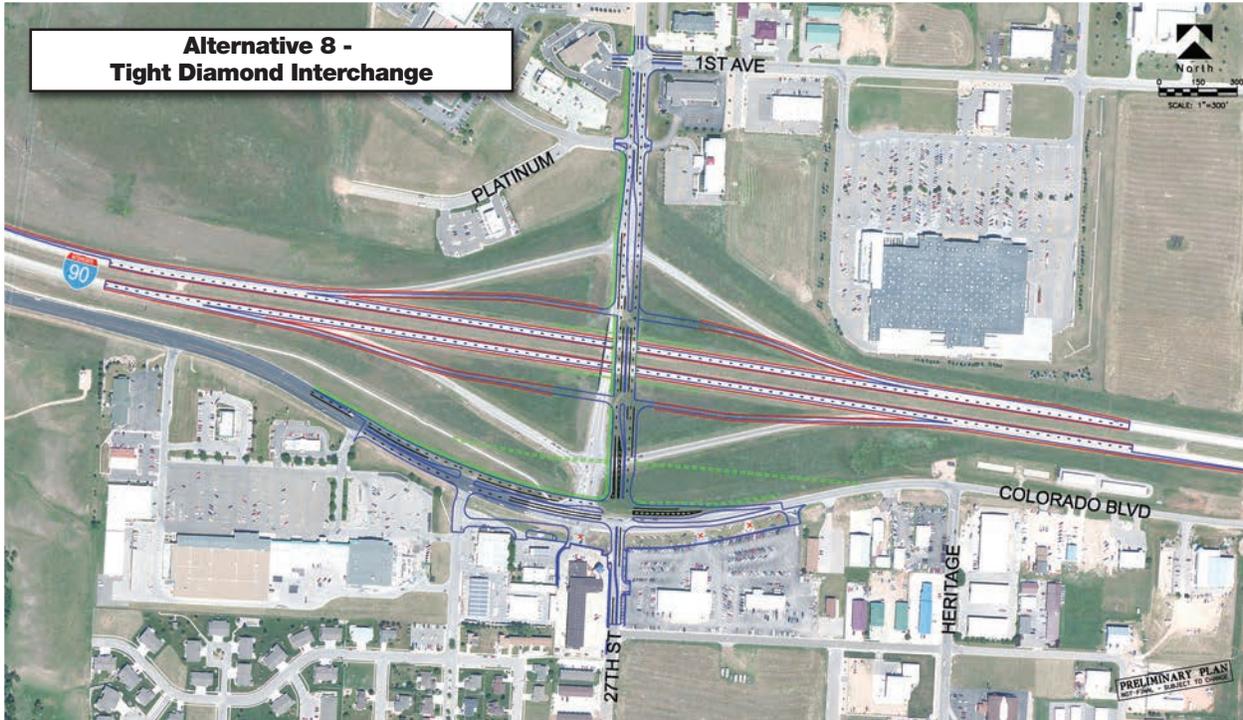
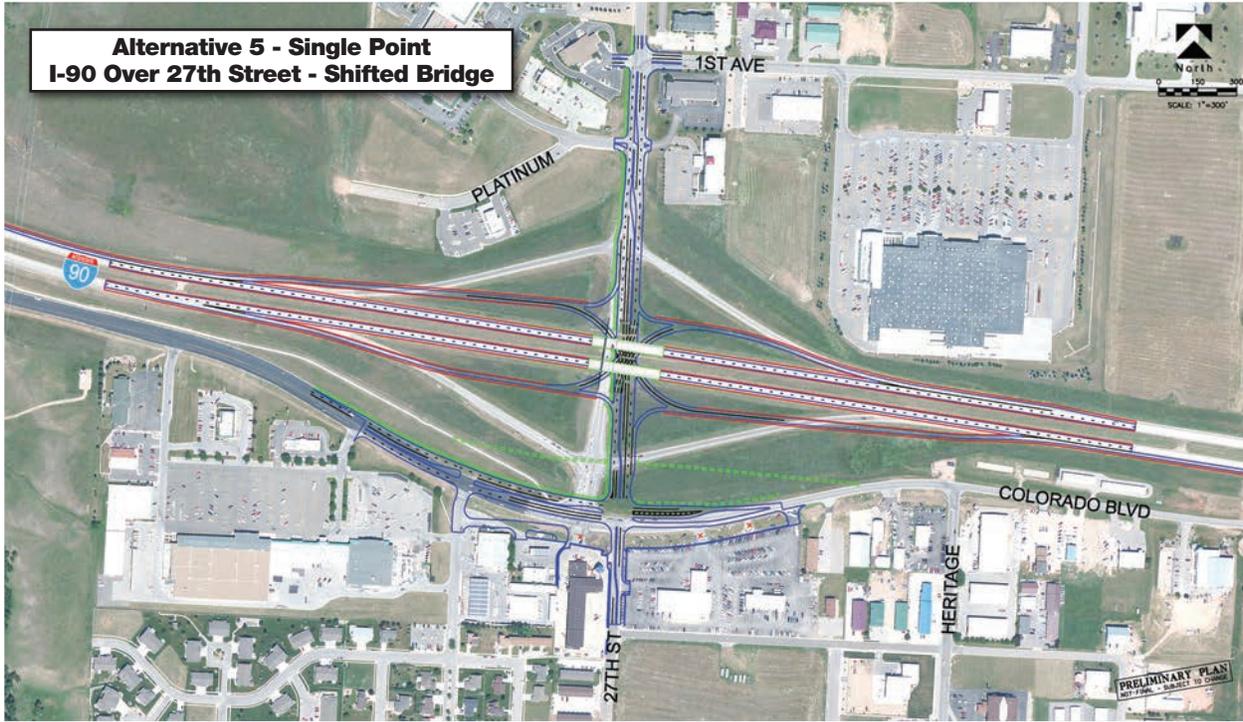


Figure ES-4b  
**I-90 Exit 14**  
**Final Screening Options**



## US Highway 14A Corridor Study Including I-90 Exit 14

# US Highway 14A Corridor Study

## Existing Conditions

### Corridor Study Area

US Highway 14A (US 14A) is currently classified as a Minor Arterial on the statewide *Functional Classification Map* and an Intermediate Arterial on SDDOT's *Highway Access Classifications Map*. The roadway has a posted speed limit of 45 miles per hour and has gentle rolling terrain.

Colorado Boulevard is generally a three-lane asphalt roadway, resurfaced in 2011, with open drainage on both sides. There is curb and gutter along a portion of the south side of Colorado Boulevard within the most intense commercial frontage from 27<sup>th</sup> Street to Christensen Drive.

The land uses on the south side of Colorado Boulevard from Heritage Drive to Christensen Drive are commercial in nature, many of which are oriented to visitors and other highway users. The greatest density is in the block between 26<sup>th</sup> and 27<sup>th</sup> Street where four businesses are located within 500 feet of frontage. The highway frontage west of Christensen Drive is a mixture of recreation (golf course) and residential land uses, with direct access to Colorado Boulevard limited to T-type intersections, almost all public streets.

There is a bicycle / pedestrian trail along the north side of Colorado Boulevard from Spearfish Canyon Road to 27<sup>th</sup> Street where it currently terminates on the northwest corner. A stream runs parallel to Colorado Boulevard west of Christensen Drive, which together with the golf course and bike trail somewhat restrict the highway right-of-way.

**Figure ES-5** depicts the existing lane configurations and traffic control within the study area. There are currently two signalized intersections along Colorado Boulevard, 27<sup>th</sup> Street and Spearfish Canyon Road. The other intersections are STOP-sign controlled.

### Safety

The crash history for the four year period from January 1, 2006 through December 31, 2009 was provided by the SDDOT. The intersection of 27<sup>th</sup> Street and Colorado Boulevard had the greatest number of crashes reported (12), which averages 3 crashes per year. One-half or six of the crashes involved left turns. Other intersections experienced fewer collisions, with the next highest concentration in the midblock section between 26<sup>th</sup> Street and Christensen Drive, with left turns representing one half of the collisions.

The greatest number of reported collisions along any mid-block segment was the area between Country Club Drive and Stone Gate Drive which had eight reported crashes in the four year period. Half of the collisions (4) along this segment were deer collisions. The more recent SDDOT *2010 Highway Needs and Project Analysis Report* shows crash rates along Colorado Boulevard of 0.90 to 2.16 crashes per million vehicle miles (MVM). This compares to the statewide average of 3.30 crashes per MVM for similar Minor Arterials in urban areas.



## US Highway 14A Corridor Study Including I-90 Exit 14

### Traffic Conditions

Historic traffic counts were provided by SDDOT within the study area. The most recent average annual daily traffic (AADT) volumes are shown in **Figure ES-6**. The annual average traffic volumes along Colorado Boulevard within the study area are fairly consistent in the range of 7,100-9,750 along the corridor, with the higher numbers on the west end. The traffic volumes drop off sharply east of Heritage Drive. The highest volume cross street is 27<sup>th</sup> Street north of Colorado Boulevard with over 11,000 vehicles per day (vpd), followed by Heritage Drive (3,130 vpd) and Spearfish Canyon Road (2,635 vpd) on the outer boundaries of the study area.

The heaviest peak hour movements are at the intersection of 27<sup>th</sup> Street and Colorado Boulevard. This reflects the nature of the surrounding commercial area, particularly the influence of the Walmart store on 1<sup>st</sup> Avenue north of I-90 and east of 27<sup>th</sup> Street.

Traffic operations at the critical study intersections controlled by either traffic signals or stop signs were analyzed utilizing the Synchro traffic analysis software program. All of the study intersections operate at acceptable levels of service, LOS C or better, in both the AM and PM peak hours. It should be noted that individual turning movements and delay can vary significantly during the peak tourist season, especially in August when some businesses report activity as much as twice the average of the remaining months of the year.

### **Future Conditions**

The forecasted Year 2035 average daily traffic volumes along Colorado Boulevard between 27<sup>th</sup> Street and Spearfish Canyon Road are generally in the range of 18,500 to 21,000 vpd, or approximately double the traffic in 2009. Consistent growth and distribution patterns are shown on 27<sup>th</sup> Street, Heritage Drive, Sandstone Hills Drive, Spearfish Canyon Road, and Colorado Boulevard on each end of the study corridor.

Utilizing the peak hour traffic forecasts for the year 2035, operations at the critical study intersections were analyzed utilizing the Synchro traffic analysis software program. All of the study intersections operate at acceptable levels of service, LOS C or better, in both the AM and PM peak hours with the exception of the intersection of 27<sup>th</sup> Street and Colorado Boulevard. Individual movements at other stop controlled intersections are shown to be operating at a poorer level of service.

The intersection of 27<sup>th</sup> Street and Colorado Boulevard is projected to operate at LOS D in the AM peak hour and LOS E in the PM peak hour. The northbound approach along 27<sup>th</sup> Street is also shown to operate at LOS F in the PM peak hour. To address operational and safety deficiencies at the offset 27<sup>th</sup> Street/Colorado Boulevard intersection, alternatives to improve the operations near these intersections were evaluated and would be upgraded as part of the reconstruction of I-90 Exit 14.

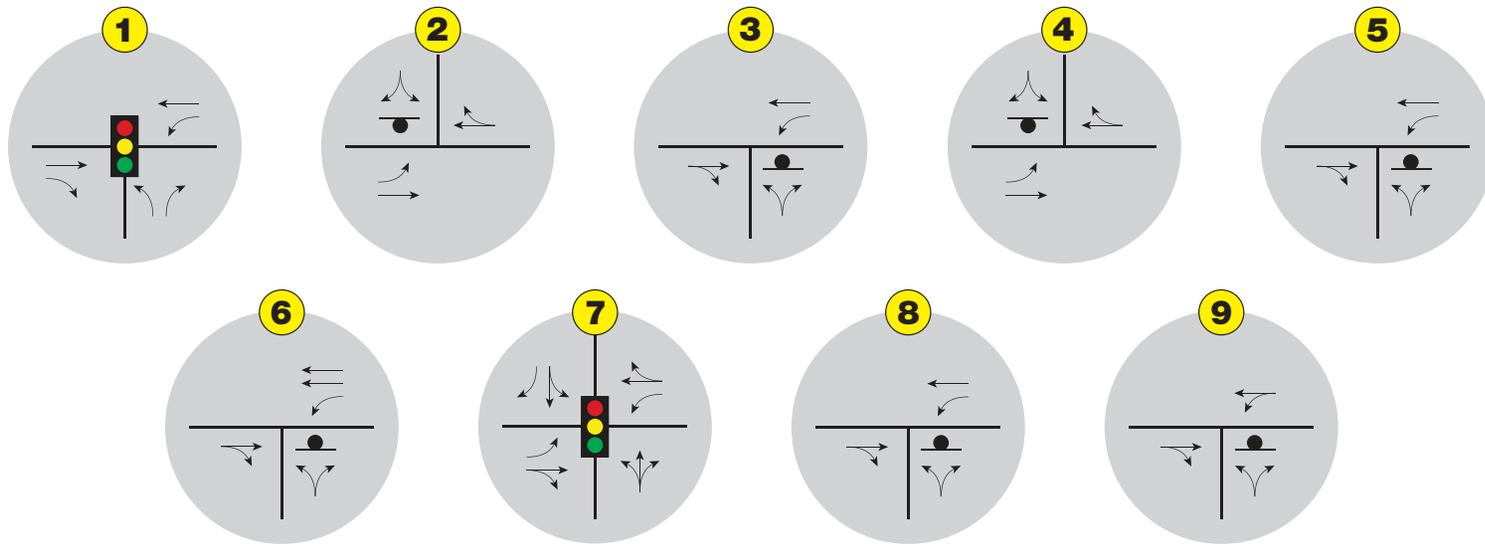
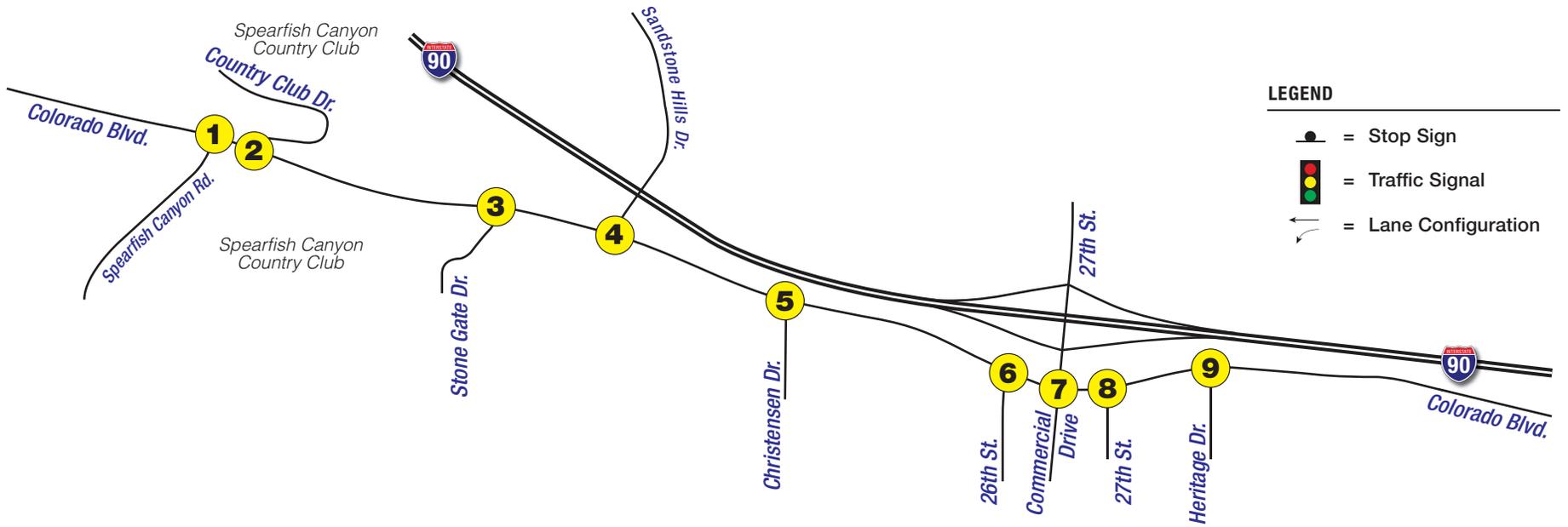


Figure ES-5  
**2009 Existing Lane Configuration  
 and Traffic Control**

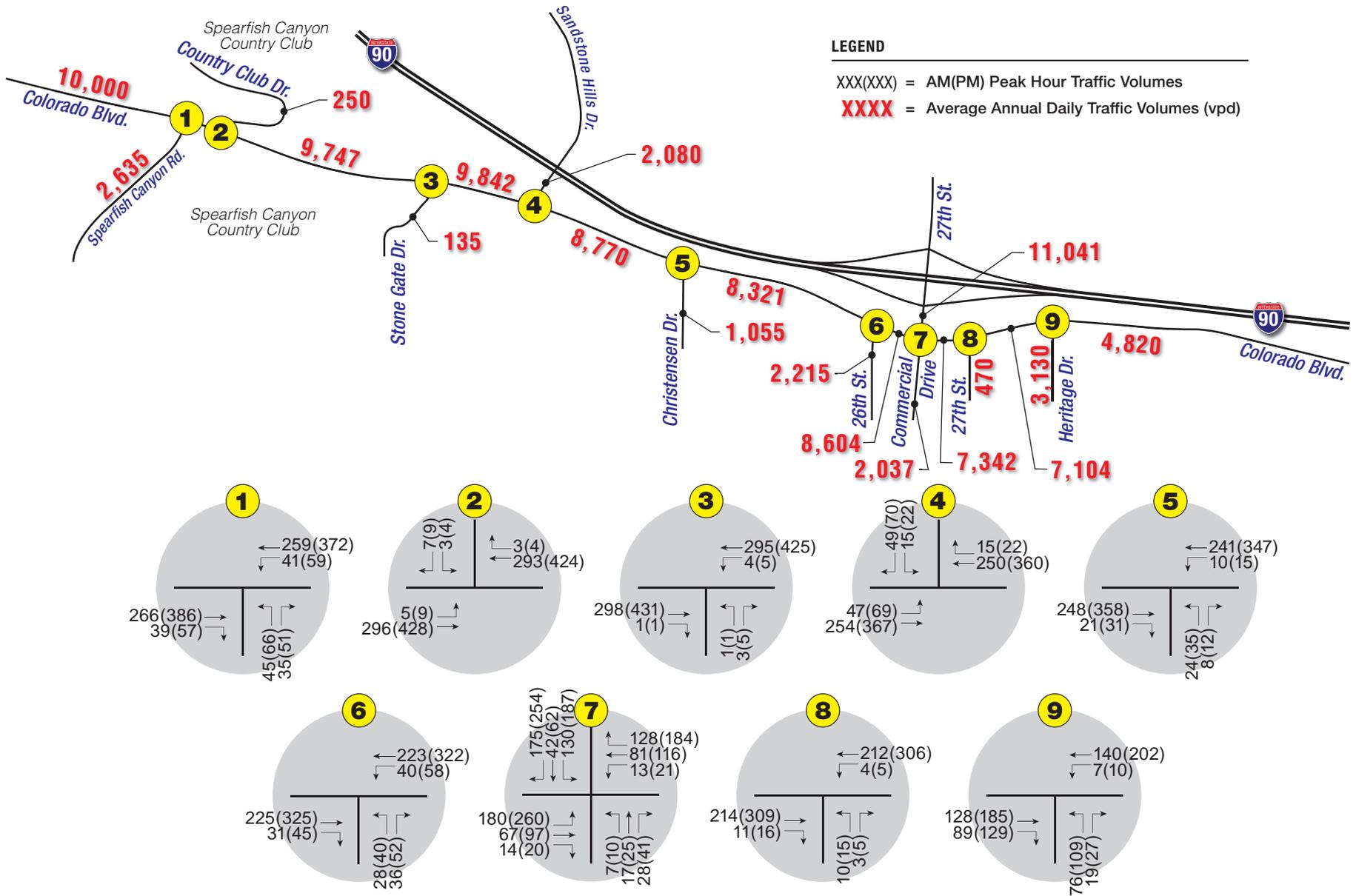


Figure ES-6  
**2009 Traffic Volumes**



## US Highway 14A Corridor Study Including I-90 Exit 14

### Development of Alternatives

#### Parallel Alignment Analysis

One of the tasks identified as part of the US Highway 14A Corridor Study was the analysis of potential parallel roadway corridor to provide an alternate travel route within 3,200 feet of Colorado Boulevard between 27<sup>th</sup> Street and Spearfish Canyon Road. Five distinct alignments (Alternatives A-F) were overlaid on aerial and contour maps, and analyzed.

In examining each of the alternatives it became clear that the terrain south of Colorado Boulevard presents major challenges in attempting to develop a new roadway that would be as direct as Colorado Boulevard. In reviewing the 2035 traffic forecasts it was also apparent that a reasonably direct alternate route (Alternative A) would at most attract and divert 2,000-2,500 vehicles per day. The cost to develop a direct alternate route would also be high due to the amount of cuts and fills that would be necessary.

Other routes that would better fit within the terrain (Alternatives B-E) would add considerable travel distance and would therefore divert fewer trips from the existing alignment of Colorado Boulevard. These routes would provide reasonable alignments for minor arterials and collector streets to be included as development occurs within the area south of Colorado Boulevard. Development of these local streets would avoid directing additional local traffic onto the highway corridor.

The alternatives are offered for further consideration as potential parallel alignments, but a Most Technically Feasible Alternative parallel alignment is not selected in this corridor study effort.

#### US 14A / Colorado Boulevard Corridor Alternatives

Four alternatives were considered for Colorado Boulevard in the future.

**No Action-** The first alternative, the No Action, would assume no reconstruction beyond that occurring as a direct result of the Exit 14 redesign, covered in a separate section of this report. The recent resurfacing of Colorado Boulevard in 2011 and the installation of the traffic signal at Spearfish Canyon Road should extend the life of the remaining portion of Colorado Boulevard 10-15 years into the future.

**Three-Lane with Roundabouts-**The first build alternative that was considered involved retaining Colorado Boulevard as a three-lane roadway along the majority of the roadway except for the Exit 14 environs. Roundabouts would be constructed at each of the major cross streets; Heritage Drive, Christensen Drive, Sandstone Hills Drive, and Spearfish Canyon Road. At Spearfish Canyon Road the roundabout construction would not occur until such time as the existing traffic signal warranted upgrading.

**Three-Lane with Signals-** The second build alternative would also retain the existing three-lane configuration along most of the Colorado Boulevard corridor. It anticipated that the installation of the signals would not take place at each of the intersections until such time as the minimum warrants for a traffic signal, as contained in the latest edition of the MUTCD, were met.

**Four-Lane with Signals-**The third build alternative that was developed and evaluated was a four-lane option with left turn lanes at the major cross streets. This alternative was provided to



## US Highway 14A Corridor Study Including I-90 Exit 14

evaluate the need for long-term preservation of right-of-way and setbacks as development occurs.

**Spearfish Canyon Road Intersection-** A separate alternative, which could be incorporated into any of the above build alternatives, involved the realignment of Spearfish Canyon Road south of Colorado Boulevard. This alternative was screened from further consideration early in the process since the realignment of Dahl Road would create access issues with the gas station on the northeast corner of the new intersection. This would likely require the acquisition or at least the reorientation of the pump islands in order to mitigate impacts.

### **Evaluation of Alternatives**

**No Action-** The No Action Alternative would result in delays for specific movements as discussed previously. These delays would be even greater during the peak traffic months of June, July, and particularly August.

**Build Alternatives-**Each of the build alternatives would operate acceptably through the Year 2035. All intersections and movements would operate at an acceptable level of service with the exception of the southbound movement at Country Club Drive would operate at LOS F in the PM peak hour.

### **Screening of Alternatives**

A detailed screening matrix shown in **Table ES-4** was developed to evaluate the various options for implementing improvements to Colorado Boulevard in the future.



**US Highway 14A Corridor Study Including I-90 Exit 14**

**Table ES-4 Alternative Screening Matrix – Colorado Boulevard**

Alternative	Advantages	Disadvantages
<b>No Action</b>	<ul style="list-style-type: none"> <li>• Lowest construction cost</li> </ul>	<ul style="list-style-type: none"> <li>• Limited traffic capacity with STOP sign control and 2 travel lanes</li> </ul>
<b>3-Lane with Signals</b>	<ul style="list-style-type: none"> <li>• Improved safety and capacity</li> <li>• Minimal Right-of-way required</li> <li>• Protected bike/ped crossings</li> </ul>	<ul style="list-style-type: none"> <li>• Higher costs of signal maintenance</li> <li>• Stops and delays for through traffic</li> </ul>
<b>3-Lane with Roundabouts</b>	<ul style="list-style-type: none"> <li>• Improved capacity</li> <li>• Improved safety with less severe crash types</li> <li>• Reduce number of signals</li> <li>• Improved circulation</li> </ul>	<ul style="list-style-type: none"> <li>• Bike/ped crossings more challenging</li> <li>• Likely first Spearfish roundabouts</li> <li>• Some Right-of-way and construction impacts</li> </ul>
<b>4-Lane with Signals</b>	<ul style="list-style-type: none"> <li>• Greatest traffic capacity</li> <li>• Improved safety</li> <li>• Protected bike/ped crossings</li> </ul>	<ul style="list-style-type: none"> <li>• Higher construction and maintenance costs</li> <li>• Utility and Right-of-way Impacts</li> </ul>

The 3-Lane with Roundabouts Alternative rated slightly above the 3-Lane with Traffic signals Alternative. The capacity and safety categories were the primary difference between the alternatives. Roundabouts are becoming increasingly the preferred control at major intersections since they have shown reduced crash experience and dramatic reductions in crash severity. This is primarily due to the design converting the higher speed left turn and right angle conflicts into low speed right turn merge conflicts.

Roundabouts have also demonstrated an ability to handle drastic fluctuations in traffic flows efficiently. This is a particular advantage in areas such as the US 14A Corridor which experiences seasonal variations in traffic. The alternative of relying on traffic signals requires greater monitoring and adjustments in signal timing to allow for the frequent shifts in traffic flows.

**Colorado Boulevard Implementation Plan**

The recommended most technically feasible alternative for future improvements along Colorado Boulevard, beyond those included in the reconstruction of Exit 14, are shown in **Figure ES-7**. It is recommended that the construction of the roundabouts would take place at such time as the minimum warrants for traffic signals, as contained in the latest edition of the MUTCD, are met at each of the critical intersections At Spearfish Canyon Road the roundabout construction would not occur until such time as the existing traffic signal warranted upgrading.



Figure ES-7  
**Recommended Most Feasible Corridor Alternative**  
**3 Lane with Roundabouts**



## US Highway 14A Corridor Study Including I-90 Exit 14

# Access Control and Management

## Introduction

While making recommendations related to the future of Exit 14 and the US 14A corridor, the study concurrently addressed Access Management considerations. The SDDOT Road Design Manual (Chapters 13 and 17) contains specific criteria to be followed in the design of Interchange and Intermediate Urban Roadways. These chapters from the Road Design Manual were applied to the extent possible in the design of the Exit 14 Interchange on I-90 and along the Colorado Boulevard (US 14A) corridor. Input received from area stakeholders, who would be directly impacted from the project, was also weighed in developing access design.

## Exit 14 Interchange Area Access Management

The existing and proposed control-of-access locations for the US 14A interchange on I-90 have been identified in interchange layouts. Access points should be limited to those shown on the final concept plans for the US 14A interchange. The proposed 600-foot spacing between the new Single Point Interchange signal and the Colorado Boulevard signal is less than the minimum 660 feet. Control of Access should be maintained within the entire distance. Control of Access should also be applied to the frontage along Colorado Boulevard within 660-feet of 27<sup>th</sup> Street to maintain desirable operation of the intersection, thus avoiding operational breakdowns that could back-up into the interchange.

### North of Exit 14 Interchange

The Manual criteria were applied to the extent possible in the design of access points along 27<sup>th</sup> Street between Exit 14 and 1<sup>st</sup> Avenue. It is recommended that Control of Access be applied to the entire frontage of 27<sup>th</sup> Street from the interchange north to 1<sup>st</sup> Avenue, with one opening centered on Platinum Drive that should not be considered for a traffic signal. A traffic signal would be undesirable at this location since it would not meet spacing requirements, provide the necessary stacking, or allow signal progression between the interchange and 1<sup>st</sup> Avenue.

The access to the motels on the east side of 27th Street, in line with Platinum, is recommended to be configured as a directional access with right-in/right-out on 27<sup>th</sup> Street and left turn-in/left turn-out on 1<sup>st</sup> Avenue. There is an existing access easement along the south side of the north motel parcel which could be utilized between the motels and the stub right of way south of 1<sup>st</sup> Avenue.

The recommended treatment north of Exit 14 would provide reasonable and safe operations to and from the adjoining properties to 2035 and beyond without the need to revisit the access issues in the future, reconstruct 27<sup>th</sup> Street, or reeducate drivers. A cost-sharing should be considered to encourage the extension of Platinum as a public street to Paramount Drive in coordination with the project.

### Access Management South of Exit 14 Interchange

The SDDOT Design Manual mentions that reconstruction which adds a nontraversable median offers opportunities for encouraging joint access agreements. Cross access easements that permit on-site circulation between adjacent properties decrease the number of vehicle trips that would normally use the abutting roadway. Property owners unable to meet driveway spacing



## US Highway 14A Corridor Study Including I-90 Exit 14

standards should be required to the extent possible to provide joint and cross access easements. These principles were applied to the area south of Exit 14 to configure safe and efficient property access.

The interchange plan shown on **Figure ES-8** shows the existing access on the south side of Colorado Boulevard in line with existing 27<sup>th</sup> Street closed redirecting access for the Speedy Mart to 26<sup>th</sup> Street. **Figure ES-8** shows the recommended concept plan provide a frontage road along the south side of Colorado Boulevard between 26<sup>th</sup> Street and 27<sup>th</sup> Street. This requires a realignment of Colorado Boulevard to the north in order to facilitate the turning movements and circulation for the convenience store/ filling station.

Access to the Howard Johnson Motel and attached Pizza Ranch would similarly involve the driveway closure on Colorado Boulevard and access focused towards an improved median divided 27<sup>th</sup> Street. The design provides a directional right-in/right-out access at the north end of their parcel and a full movement access in line with 4<sup>th</sup> Avenue.

The connection is not provided between the Howard Johnson and the Speedy Mart to address the concerns of the motel owners, that the truck traffic from the Speedy Mart was not compatible with their operation.

The access control plan shown on **Figure ES-8** would involve the closure of two existing driveways to the car dealer east of 27<sup>th</sup> Street while retaining a third access to the parcel. Observations during the study showed two of the three driveways were frequently blocked by parked display vehicles, evidence that the property can operate with fewer driveways. An access would be maintained on 27<sup>th</sup> Street south of Colorado Boulevard as a right-in / right-out driveway.

### **US 14A – Colorado Boulevard Access Management**

U.S. Highway 14A is classified as an Intermediate Urban roadway from the I-90 interchange to Spearfish Canyon Road, and on Spearfish Canyon Road approximately ½ mile south of Colorado Boulevard. The SDDOT access location criteria specifies ½ mile signal spacing, ½ mile between full movement access, ¼ mile between directional access, with 660 feet minimum between unsignalized access spacing. One access per block face right-in/right-out is preferred with denial of direct access whenever other access is available.

Access management should follow the future Colorado Boulevard plans, except where any additional access is acquired as a result of Right of Way acquisition. A draft memorandum of understanding between the City of Spearfish and State of South Dakota Department of Transportation concerning access management along U.S. Highway 14A is included in **Appendix J**.



Figure ES-8  
**Recommended Access Management  
27th Street at Colorado Boulevard**



## US Highway 14A Corridor Study Including I-90 Exit 14

# 1.0 INTRODUCTION

## A. Project Background

Interstate 90 (I-90) Exit 14 and US Highway 14A (US 14A) work in tandem to form a vital transportation connection on the east side of the City of Spearfish, South Dakota. Exit 14 acts as a gateway to Spearfish, surrounded by vibrant commercial development. Paralleling I-90 on its south side, US Highway 14A is the most direct route from the Exit 14 area to downtown Spearfish, Black Hills State University (BHSU), and scenic Spearfish Canyon.

The US Highway 14A Interchange Options and Corridor Study was initiated by the South Dakota Department of Transportation (SDDOT) in May of 2009 to identify needs and make recommendations for the future of these important transportation facilities. Recent growth in the area has triggered significant increases in traffic volumes, and additional future growth will continue to strain the capacity of Exit 14 and US 14A.

To give appropriate attention to the distinct characteristics and needs of the Exit 14 interchange and the US 14A Corridor, each is provided with its own chapter in this report. **Chapter 2** addresses the Exit 14 Interchange, and **Chapter 3** focuses on the US 14A Corridor.

## B. Study Area

The project study area is depicted on **Figure 1-1**. The study area includes portions of the City of Spearfish and unincorporated Lawrence County.

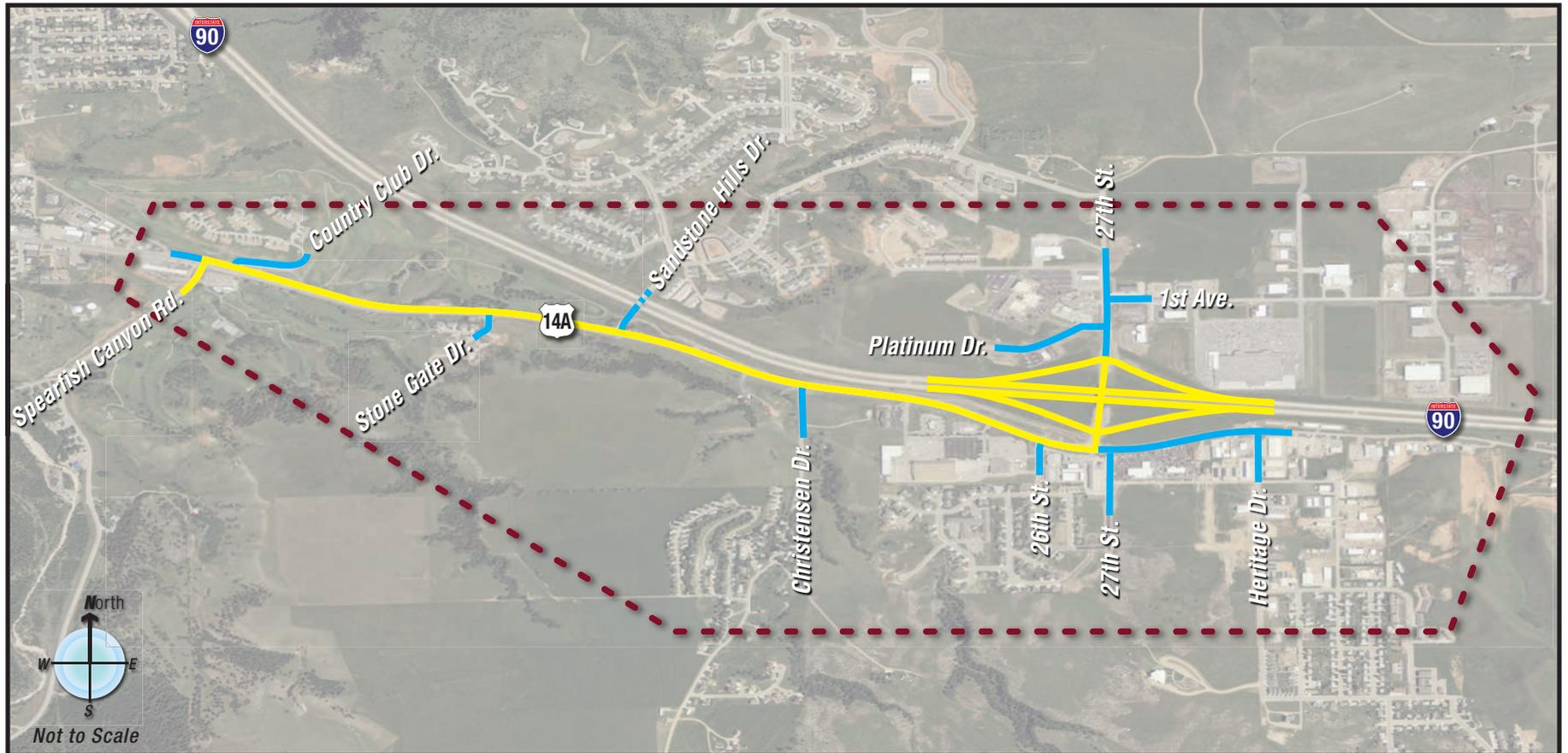
### Land Use

Land uses within the study area include undeveloped land, residential, commercial, industrial, and recreational properties. A mix of hotels, restaurants, and retail uses surround the immediate Exit 14 interchange area and industrial properties mix in farther away from the interchange.



**Less dense portion of US 14A Corridor**

The western portion of the study area is less densely developed, featuring the Spearfish Canyon Country Club golf course. The Canyon Gate and Sandstone subdivisions lie adjacent to golf holes. Retail properties occupy the area immediately west of the US 14A/Spearfish Canyon Road intersection.



**LEGEND**

-  = South Dakota Department of Transportation (SDDOT) Roadways
-  = City of Spearfish Roadways

Figure 1-1  
**Study Area**



## US Highway 14A Corridor Study Including I-90 Exit 14

### **Roadway Network**

The study roadways include the following:

**Interstate 90 Exit 14:** The Exit 14 interchange is configured as a standard diamond interchange, with 27<sup>th</sup> Street passing above mainline I-90 via a 2-lane bridge. The interchange ramps are single-lane ramps. An approximate 5 foot shoulder is provided across the bridge, with no pedestrian accommodations. The ramp terminal intersections are signalized, and the south ramp terminal lies within 150 feet of the signalized 27<sup>th</sup> Street/US 14A intersection.



**Closely spaced intersections south of Exit 14**

**US Highway 14A/Colorado Boulevard:** The study area includes an approximate 1.8 mile section of US 14A/Colorado Boulevard. The state highway portion lies between Spearfish Canyon Road and 27<sup>th</sup> Street and the city street portion includes segments east of 27<sup>th</sup> Street and west of Spearfish Canyon Road. Colorado Boulevard is classified as an arterial in the *Spearfish Area Master Transportation Plan* (July 2011). The City of Spearfish recreation trail parallels US 14A from 27<sup>th</sup> Street to Spearfish Canyon Road, where it turns to the south.

**27<sup>th</sup> Street:** 27<sup>th</sup> Street is the cross road at the Exit 14 interchange. It is an arterial roadway extending north-south through the study area, providing 2 travel lanes. 27<sup>th</sup> Street does not currently provide continuity beyond the study area, but facilitates access to the major retail destinations around the interchange. South of Exit 14, 27<sup>th</sup> Street intersects with US 14A in an offset fashion. Sidewalks parallel portions of 27<sup>th</sup> Street but are not continuous.

### **C. Project Purpose**

The twofold purpose of the study is to:

1. Recommend a Most Technically Feasible Alternative for reconstruction of the I-90 / Exit 14 interchange. Funding for the reconstruction effort is currently included in the STIP for FY 2015, and the recommended Most Technically Feasible Alternative is anticipated to advance to the design stage soon after completion of this study.
2. Recommend a Most Technically Feasible Alternative for the US Highway 14A/Colorado Boulevard corridor between Spearfish Canyon Road and Heritage Drive. Most of this roadway surface was repaved in the Year 2010 and would likely be reconstructed when the current paved surface requires replacement, approximately 15-20 years into the future (Year 2030-2035).

While closely related, recommendations for the interchange and the US 14A Corridor are kept independent of each other because the two facilities are on different schedules for future reconstruction.



## US Highway 14A Corridor Study Including I-90 Exit 14

### D. Project Process

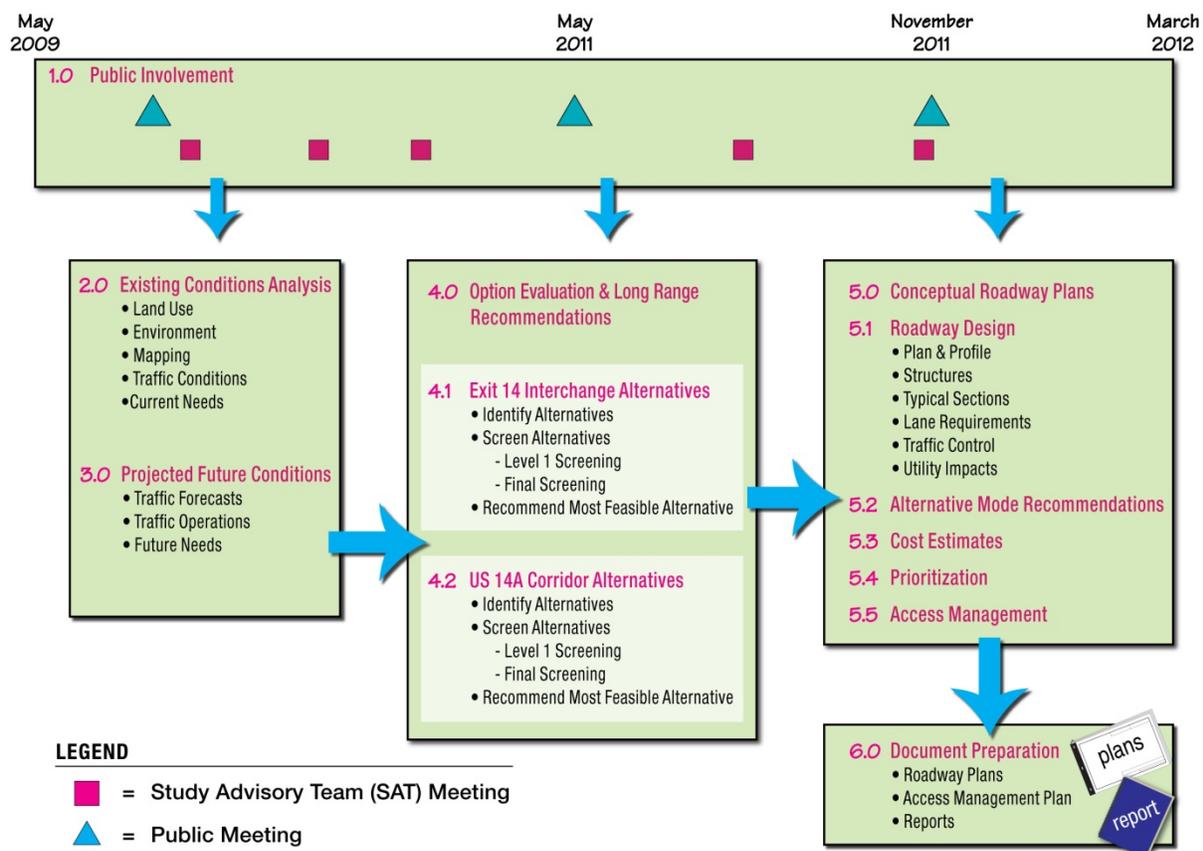
The project effort was organized to study the interchange and the corridor in parallel fashion as two separate chapters of an overall evaluation. This “2-in-1” approach allowed the project team to blend elements of the study that could be shared such as public and stakeholder meetings while keeping recommendations for the interchange distinct from the US 14A corridor.

#### Work Flow

The SDDOT began the study in May of 2009 and held a kickoff public meeting in June of 2009. Upon completing initial traffic analyses and forecasts, the SDDOT engaged a consulting firm in October of 2010 to finish the project. The study is anticipated to be complete by March of 2012.

The work flow diagram is illustrated on **Figure 1-2**. As shown, the project took place in six major tasks, beginning with analyses of existing and future traffic conditions. Alternatives for the interchange and corridor were developed and screened in Task 4, and Task 5 yielded conceptual roadway designs for roadway reconstruction and access management recommendations. The work tasks were supported throughout with a parallel Public Involvement Process (Task 1.0).

**Figure 1-2 Work Flow Diagram**





## US Highway 14A Corridor Study Including I-90 Exit 14

### **Project Governance**

The project was initiated by SDDOT Staff, who continued to manage the project after handoff to the transportation consultant. A multi-agency Study Advisory Team (SAT) provided project oversight, meeting five times over the course of the project to make project decisions and review project documents. Agencies represented on the SAT included SDDOT, Federal Highway Administration (FHWA), The City of Spearfish, and Spearfish Canyon Country Club.

### **Public Involvement**

The public involvement process depicted on **Figure 1-2** centered on the three public open house meetings on weekday evenings at the City of Spearfish Council Chambers. At these meetings, the project team provided a brief presentation and attendees were given the opportunity to review project information and provide comments in conversations, comment sheets and individual correspondence. Meeting summaries were developed for these meetings and are included in **Appendix A** to this document.



**Discussion at the first public meeting**

The initial public meeting was held on June 25, 2009. The purpose of this meeting was to gather input from the general public on corridor issues and potential solutions. The meeting was attended by 32 people.

The second public meeting was held on May 5, 2011 to update the public on study progress and gather input on the alternatives developed and screened to a short list of surviving options.



Individual meetings with project stakeholders (corridor business and land owners) were held during the day leading up to the meeting. A total of more than 400 invitation letters were mailed to stakeholders in advance of these meetings and approximately 20 meetings were held. At these meetings, the project team provided an overview of analyses and findings, and solicited feedback from stakeholders about study recommendations. The meetings provided a forum for communication between the project team and many of the entities most directly affected by the outcomes of the study.

### **Browsing display boards at Public Meeting**

The third and final public meeting was held on November 15, 2011. The purpose of the meeting was to present the recommendations to be included in the US 14A Interchange Options and Corridor Study. Similar to the second meeting, 17 meetings were held with individual project stakeholders during the day leading up to the evening public open house. The project team delivered a presentation on the draft study recommendations, and meeting attendees were given the opportunity to provide their perspective on the information presented.



## **US Highway 14A Corridor Study Including I-90 Exit 14**

As a part of the project public involvement efforts, the SDDOT conducted a public survey in August of 2009. The survey was an online survey, providing respondents with an opportunity to comment on current corridor issues, needs, and potential solutions. The project team received more than 200 comments from the public via this survey.

A summary of public comments received and responses to those comments is provided in **Appendix B**.



## US Highway 14A Corridor Study Including I-90 Exit 14

# 2.0 INTERCHANGE OPTIONS STUDY

Interstate 90 Exit 14 lies in the east-central portion of the City of Spearfish, and provides access between I-90 and the immediate densely developed commercial area, as well as connecting to US Highway 14A, a route to downtown Spearfish and Spearfish Canyon. Originally constructed in the early 1970's, this important interchange handles a significant amount of traffic, and future growth is anticipated to place an additional strain on the interchange ramps, cross-road and intersections. The South Dakota Department of Transportation (SDDOT) has recognized the needs at Exit 14, placing the interchange in the Statewide Transportation Improvement Program (STIP) for reconstruction in the Year 2015.

A study of interchange options has been undertaken to evaluate existing and future needs, develop options for reconstructing the interchange to address those needs, and recommending a Most Technically Feasible interchange Alternative to be advanced to the design phase following completion of this study.

The analyses, findings and recommendations of the interchange study are outlined in this Chapter, which includes the following sub-sections:

- A. Existing Conditions
- B. Future Year (2035) No Action Conditions
- C. Alternatives
- D. Environmental Analysis

## A. Existing Conditions

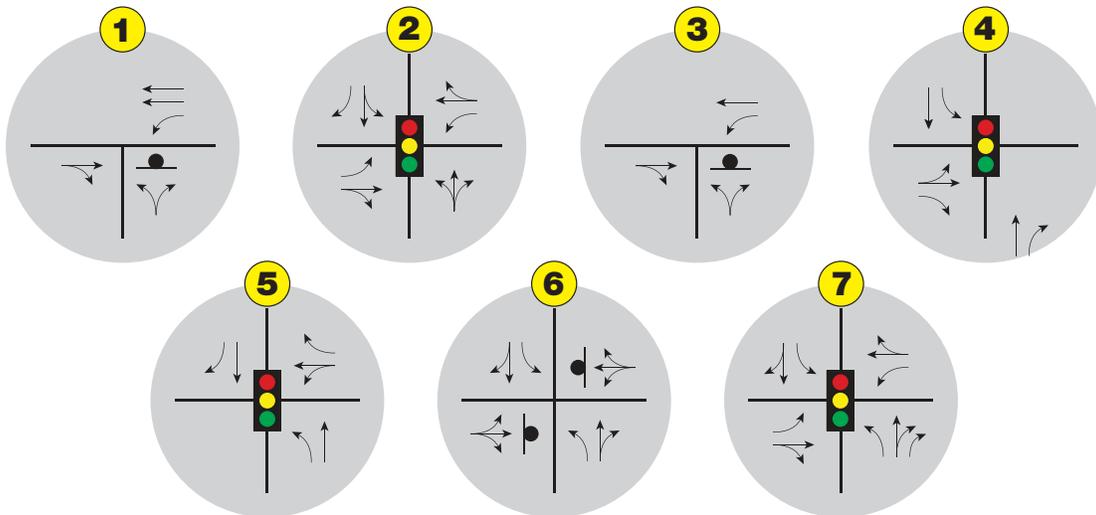
### Roadway Network

Shown on **Figure 2-1**, Roadway facilities within the interchange study area include:

**Interstate 90:** Interstate 90 (I-90) is the east-west interstate corridor in the state of South Dakota, and ranges beyond state lines to connect Boston, Massachusetts and Seattle, Washington. There are five I-90 interchanges that serve the City of Spearfish. Three lie west of Exit 14 and only Exit 17 lies east of Exit 14. I-90 provides two travel lanes in each direction through the interchange area and is posted at 75 Miles Per Hour (mph).

**Exit 14 Interchange:** The Exit 14 interchange is currently constructed as a standard diamond interchange. Mainline I-90 travels beneath the 27<sup>th</sup> Street overpass. The ramp terminal intersections lie approximately 800 feet apart, and are controlled with traffic signals. Single-lane interchange ramps connect with the ramp terminal intersections.

**27<sup>th</sup> Street:** 27<sup>th</sup> Street is the interchange cross road and an arterial roadway in the City of Spearfish's Master Transportation Plan. 27<sup>th</sup> Street has limited continuity beyond the interchange area, extending north from the interchange to Windmill Drive. South of the interchange, 27<sup>th</sup> Street intersects with Colorado Boulevard at a signalized intersection, and connects to a driveway into a hotel restaurant property south of Colorado Boulevard. 27<sup>th</sup> Street continues as a City of Spearfish arterial offset from its location north of Colorado Boulevard, extending south approximately ¼ mile.



**LEGEND**

- = Stop Sign
- = Traffic Signal
- = Lane Configuration

Figure 2-1  
**I-90 Exit 14**  
**Existing Configuration**



## US Highway 14A Corridor Study Including I-90 Exit 14

**Platinum Drive:** Platinum Drive provides local access to 27<sup>th</sup> Street from the east for two existing hotels and from the west for an existing hotel and convention center, two restaurants, and approximately 35 acres of undeveloped, commercially zoned land in the beginning stages of development.

**1<sup>st</sup> Avenue:** First Avenue is a collector roadway that intersects with 27<sup>th</sup> Street approximately 700 feet north of the north interchange ramp terminal. It provides access east of 27<sup>th</sup> Street to a major retail center and additional industrial employment centers farther east. It is a two-lane road.

**Colorado Boulevard/US Highway 14A:** Colorado Boulevard parallels the south side of I-90, and intersects with 27<sup>th</sup> Street at a signalized intersection 150 feet south of the south ramp terminal intersection. Through the interchange area, Colorado Boulevard is a four-lane highway west of 27<sup>th</sup> and a two lane highway east.

**26<sup>th</sup> Street:** 26<sup>th</sup> Street is a north-south local roadway west of 27<sup>th</sup> Street, providing access to a number of local retail properties.

Intersection lane geometry and traffic control are depicted on **Figure 2-1**.

### **Traffic Safety**

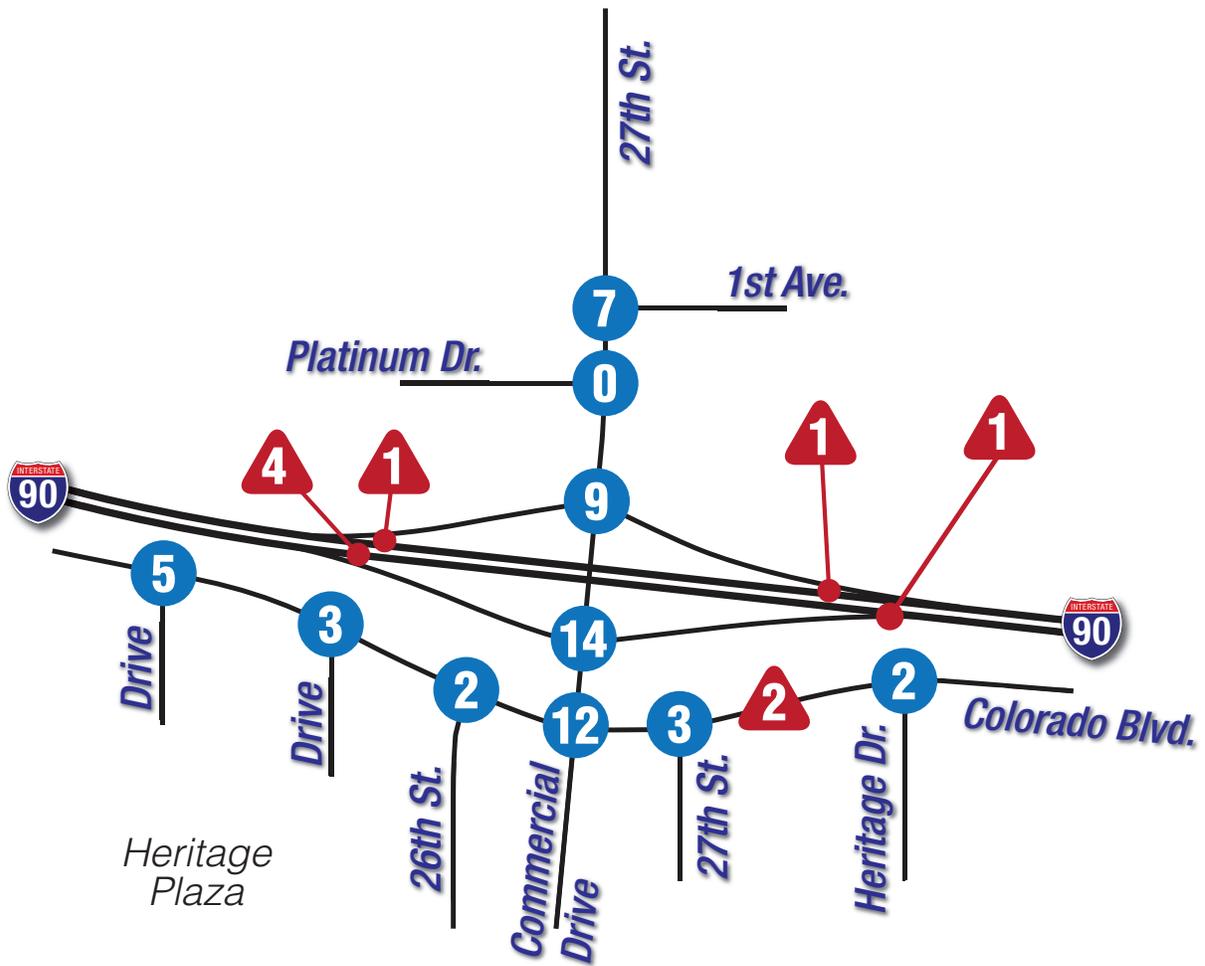
The project team completed an analysis of crash history in the vicinity of the interchange. **Figure 2-2** depicts crash experience at the study intersections for the four years between 2006 and 2009, described as follows:

**27<sup>th</sup> Street/Colorado Boulevard:** Between the years of 2006 and 2009 (4 years), a total of 12 crashes occurred at the intersection of Colorado Boulevard with 27<sup>th</sup> Street, 6 of which were related to left turn movements. This intersection carries significant traffic volumes and is located very close to the interchange, creating multiple conflict points and driver confusion.

**27<sup>th</sup> Street/South ramp terminal:** Fourteen crashes occurred at the south ramp terminal intersection, eight of which were rear-end collisions. Close spacing between signalized intersections, like that of Colorado Boulevard and the south ramp terminal, can increase frequency of rear-end collisions.

**North of Exit 14:** Crash experience was slightly reduced on the north end of the interchange, where 9 crashes occurred at the north ramp terminal and 7 at the 27<sup>th</sup> Street/1<sup>st</sup> Avenue intersection.

Intersections along 27<sup>th</sup> Street through the interchange area totaled 42 crashes, and demonstrated the highest accident frequency of any of the intersections analyzed along Colorado Boulevard for the US 14A Corridor Study.



**LEGEND**

- = Intersection Crashes
- = Roadway Segment Crashes
- X** = Number of Crashes

Figure 2-2  
**I-90 Exit 14**  
**Number of Crashes**  
**2006 - 2009**



## US Highway 14A Corridor Study Including I-90 Exit 14

### **Traffic Conditions**

#### Traffic Volumes

Existing traffic volume information was provided by SDDOT Staff and compiled into the information shown on **Figure 2-3**. As shown, 27<sup>th</sup> Street carries approximately 11,000 Vehicles Per Day (vpd) through the interchange area. Colorado Boulevard carries approximately 8,000 vpd. The Exit 14 interchange ramps to and from the west carry more traffic than the east ramps at approximately 4,000 vpd each. **Figure 2-3** also depicts weekday AM and PM peak hour intersection turning movement counts conducted between the Years 2006 and 2009. The counts were conducted during the Summer-fall time frame to capture typically higher summer conditions, and balanced to ensure accuracy between adjacent intersections.

#### Traffic Operations

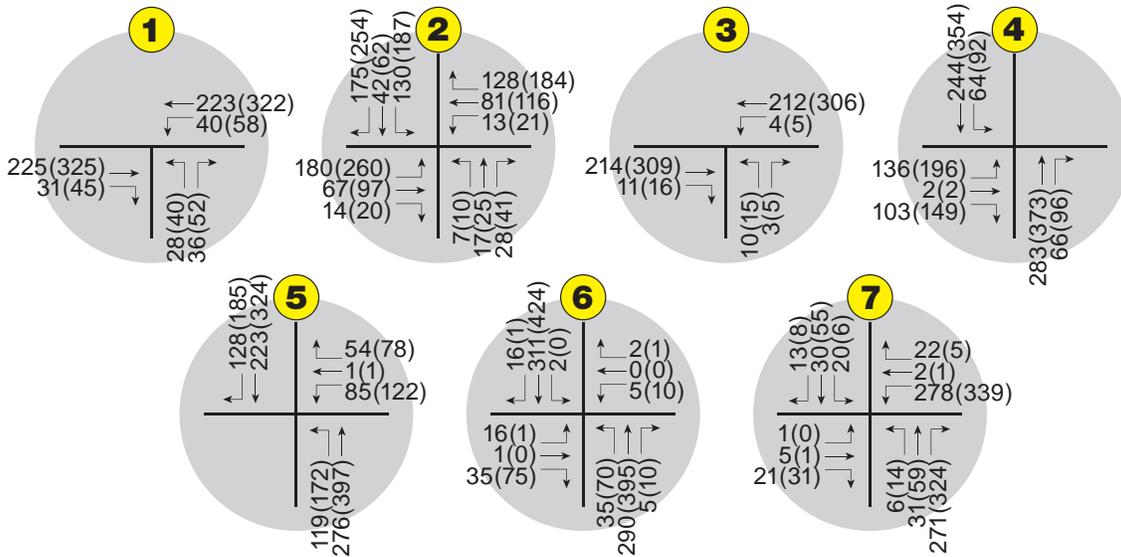
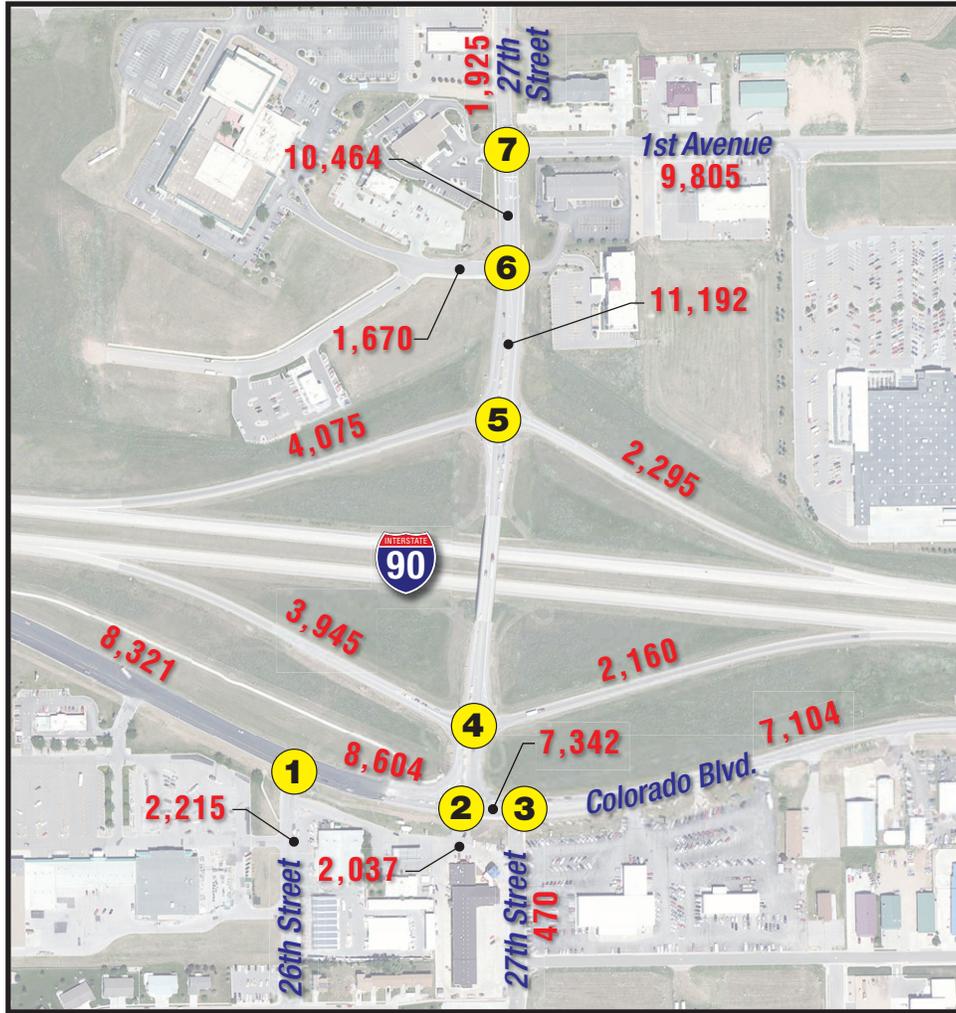
Analysis of traffic operations in the study area utilized methods documented in the Highway Capacity Manual (HCM), Transportation Research Board (TRB), 2000 Edition. The result of such an analysis is a Level of Service (LOS) rating, which is a qualitative assessment of the traffic flow for a given roadway facility. Level of Service is described by a letter designation ranging from “A” to “F”, with LOS A representing essentially uninterrupted flow, and LOS F representing a breakdown of traffic flow with excessive congestion and delay. For analysis of a signalized intersection, a LOS rating is calculated for an intersection as a whole. Level of Service analysis of an unsignalized intersection yields a LOS rating for each critical vehicular movement. The Synchro software analysis package and methodology was utilized to calculate LOS ratings for ramp terminal and the other study intersections.

The project team conducted operational analyses of the interchange and surrounding intersections based on the Year 2009 traffic volumes shown on **Figure 2-3**. The results are shown on **Figure 2-4**. As shown, all intersections and movements currently operate at LOS C or better during peak hours. **Appendix C** provides LOS Worksheets for existing conditions.

### **Geometric Deficiencies**

The Exit 14 Interchange was analyzed in the Year 2000 Interstate Corridor Study completed by consultants on behalf of the SDDOT. The study stated that “The geometric deficiencies are minor, and can be corrected at some future date.” Deficiencies noted in the study included inadequate lane and shoulder widths, substandard side slopes, slightly substandard sight distance along 27<sup>th</sup> Street and accesses too close to the interchange. A project was completed by the SDDOT in 2005 to install traffic signals at the ramp terminal intersections, resurface the off ramps and 27<sup>th</sup> Street bridge, and widen narrow shoulders.

A major current geometric deficiency at the interchange is control of access. The SDDOT desires to provide a distance of 660 feet between ramp terminal intersections and the nearest access. Both north and south sides of the interchange include accesses closer than the desired 660 feet, and the south side includes a major signalized intersection within 150 feet.



**LEGEND**

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes  
 XXXX = Average Annual Daily Traffic Volumes (vpd)

Figure 2-3  
**I-90 Exit 14**  
**2009 Traffic Volumes**

**LEGEND**

- X/X = AM/PM Peak Hour Signalized Intersection Level of Service
- x/x = AM/PM Peak Hour Unsignalized Intersection Level of Service
- = Stop Sign
- 🚦 = Traffic Signal
- ↔ = Lane Configuration

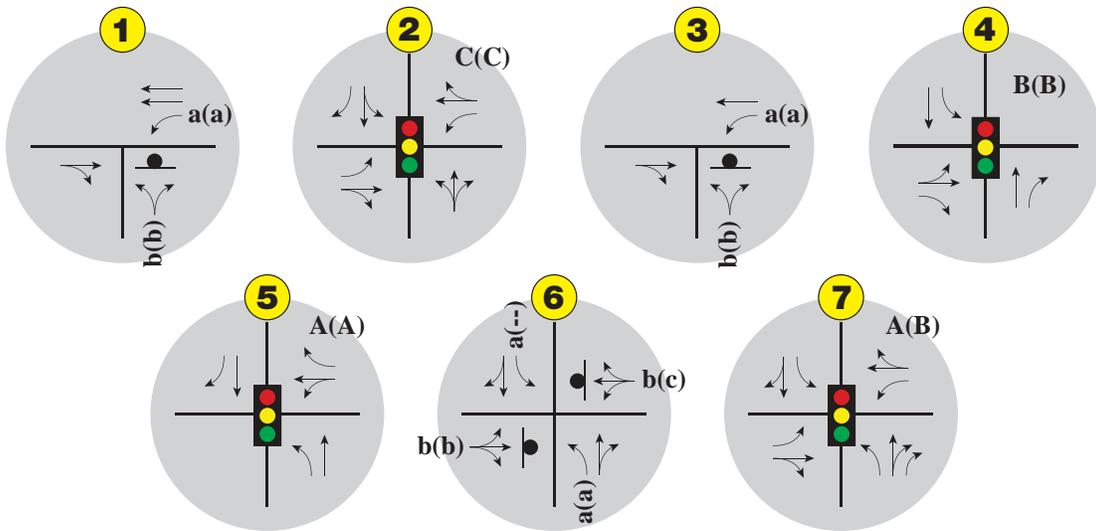
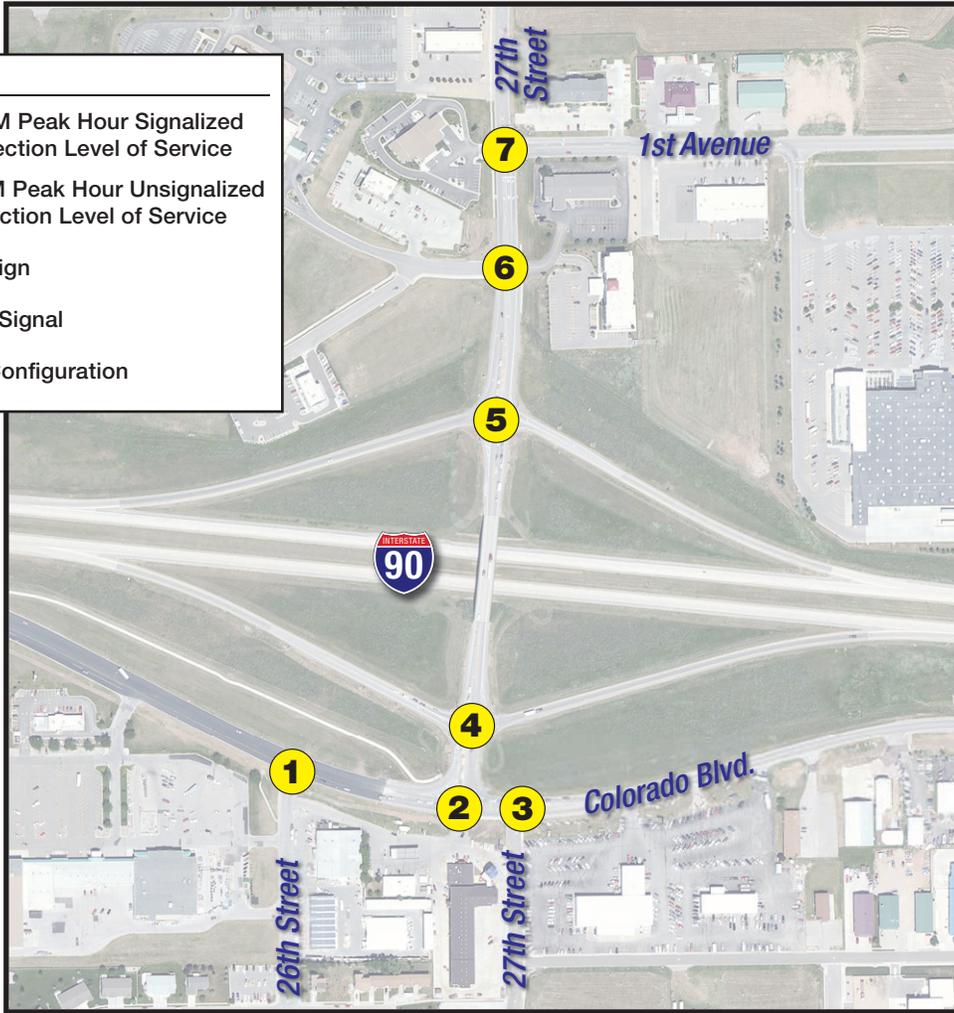


Figure 2-4  
**I-90 Exit 14**  
**2009 Intersection Levels of Service**



## US Highway 14A Corridor Study Including I-90 Exit 14

### **Multimodal Conditions**

Multimodal travel through the interchange occurs on a regular basis, as the interchange is located at a popular commercial junction in the City of Spearfish. The recreational trail system terminates at the 27<sup>th</sup> Street / Colorado Boulevard intersection, but pathways and sidewalks are lacking



throughout most of the interchange area. Users of the trail must cross 27<sup>th</sup> or Colorado Boulevard at-grade. Bicyclists and pedestrians seeking to cross I-90 along 27<sup>th</sup> Street must utilize the existing shoulders, which do not offer protection from vehicular traffic. As addressed in the Spearfish Area Master Transportation Plan, the City of Spearfish plans to extend the trail east of 27<sup>th</sup> Street to the Exit 17 area along the Colorado Boulevard alignment.

**A bicyclist negotiates the interchange area.**

### **B. Future (Year 2035) No Action Conditions**

The project team performed a Year 2035 No Action analysis to evaluate performance of the existing interchange configuration into the long term future.

### **Traffic Forecasts**

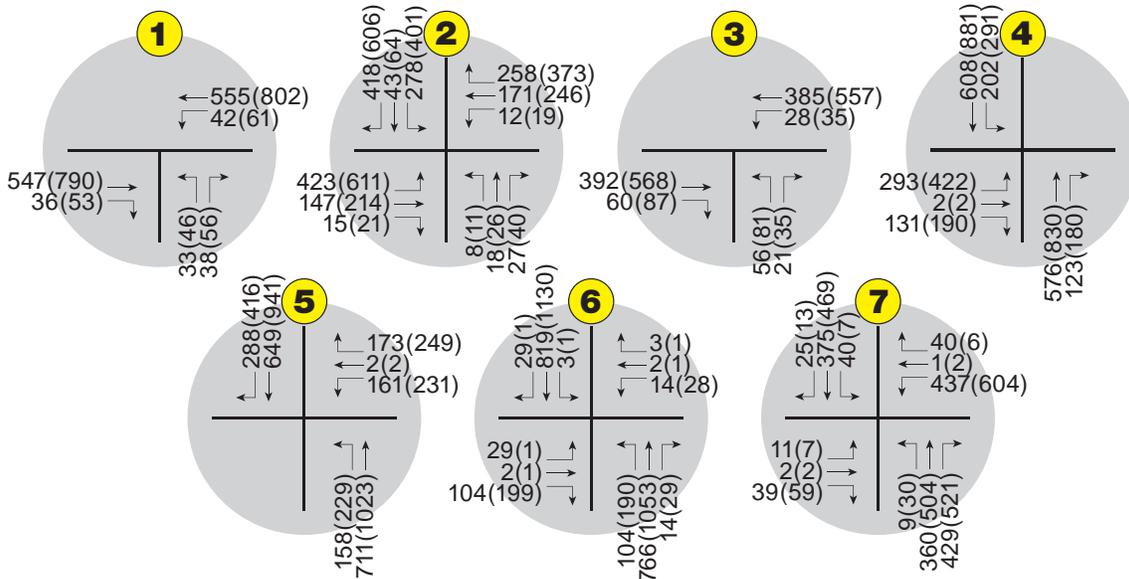
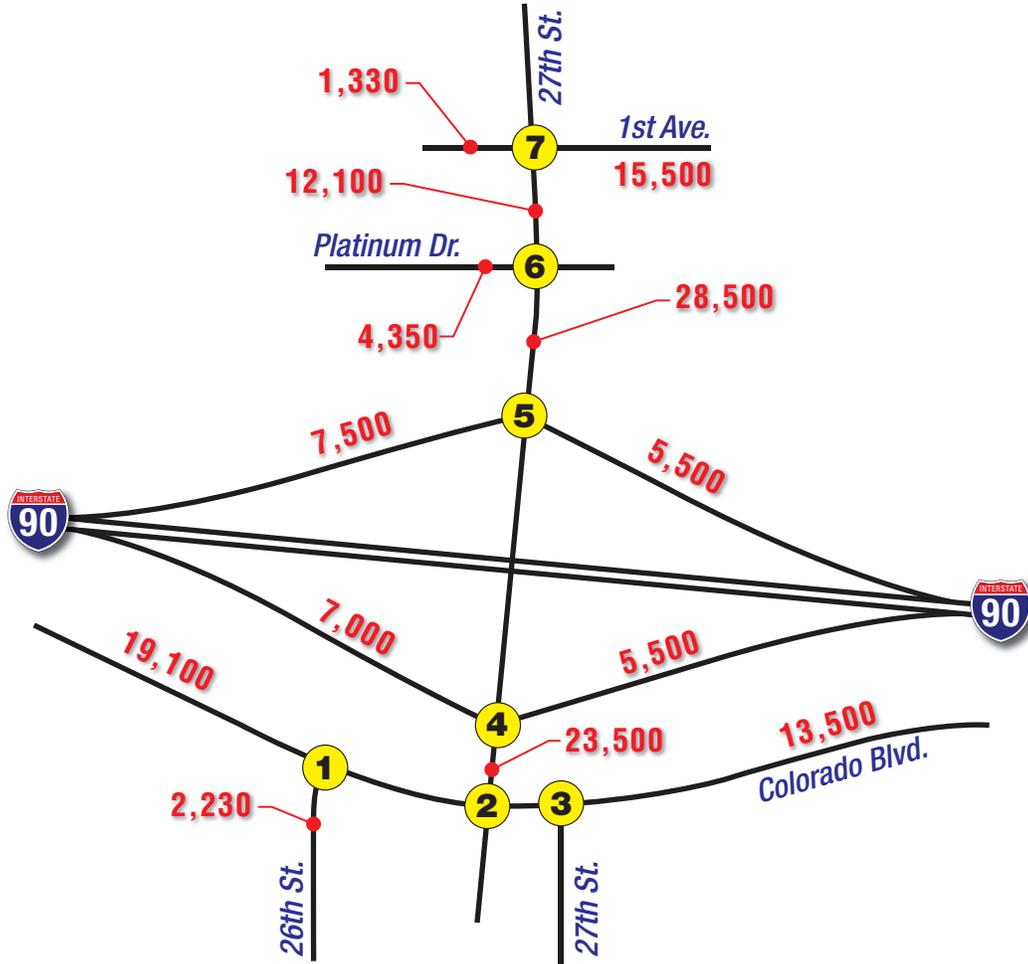
Traffic forecasts for the Year 2035 were completed based on information provided in the *Spearfish Area Master Transportation Plan* (Felsburg Holt & Ullevig, July 2011). The forecasts were developed based on land use projections provided by City of Spearfish Planning Staff. Particularly north of I-90, the Exit 14 area is one of several growth areas in the City, and is expected to continue to grow as a commercial center, adding more than 1.5 Million Square Feet of commercial industrial, retail, and office uses in the long term future.

Year 2035 daily and peak hour traffic forecasts are shown on **Figure 2-5**. Daily volumes along 27<sup>th</sup> Street are anticipated to nearly triple by the Year 2035, reaching 28,500 vpd north of the interchange and 23,500 vpd south. Colorado Boulevard is anticipated to carry approximately two times existing traffic levels by the Year 2035.

### **Traffic Operations**

Year 2035 traffic operations for the No Action alternative are shown on **Figure 2-6**. As shown, the south ramp terminal intersection is anticipated to deteriorate to LOS F during the PM peak hour, and the 27<sup>th</sup> Street/Colorado Boulevard would operate at LOS E. **Table 2-1** provides a comparison of Year 2035 traffic operations with Year 2009 results. As shown, conditions are anticipated to worsen at all study intersections as the current intersection lane configurations and traffic control strain to accommodate higher traffic volumes.

**Appendix C** provides LOS Worksheets for Year 2035 No Action conditions.

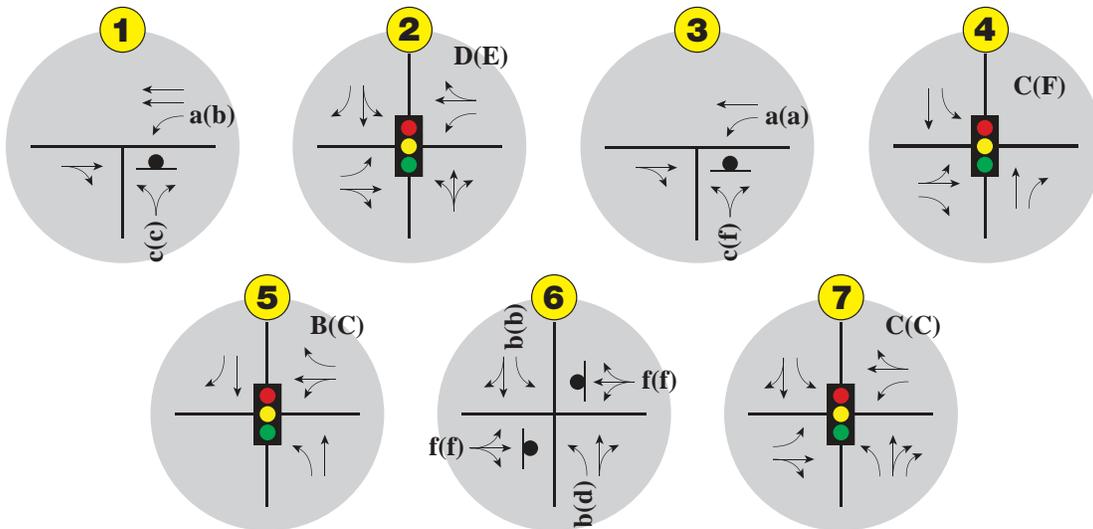
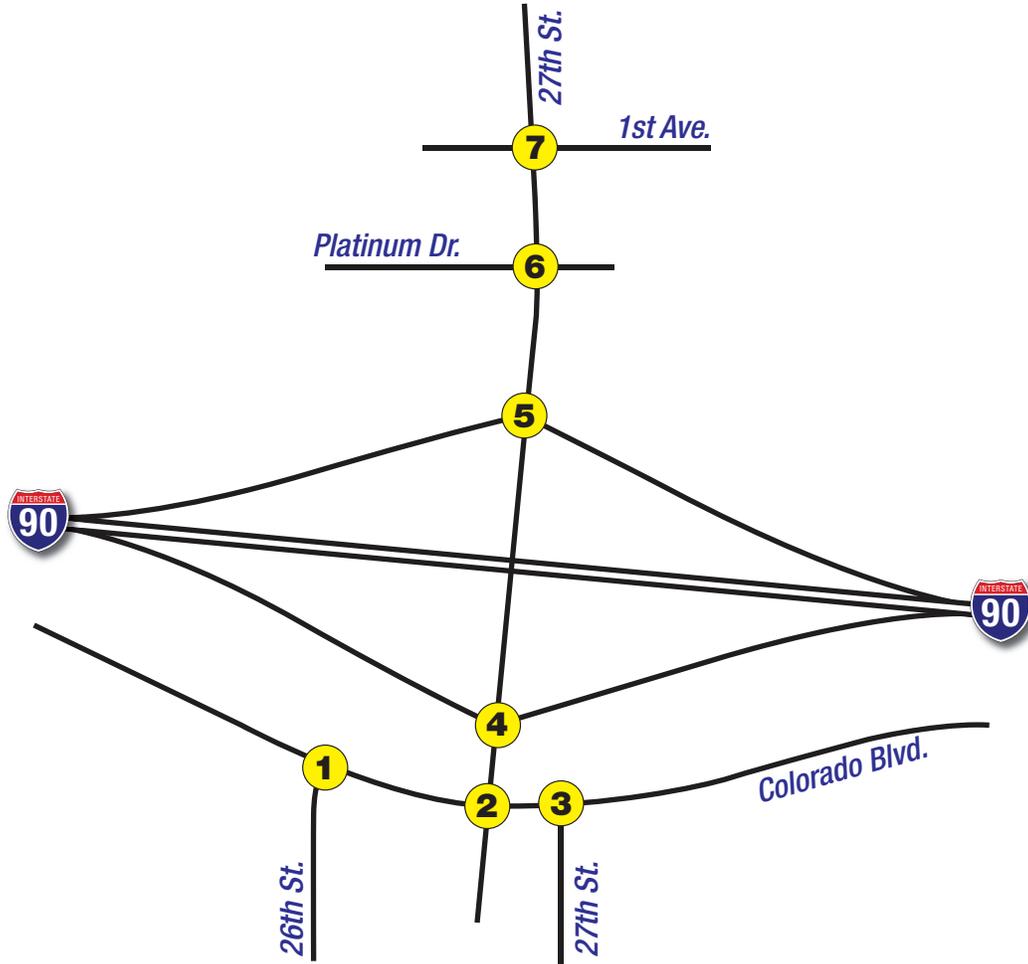


**LEGEND**

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes  
**XXXX** = Average Annual Daily Traffic Volumes (vpd)

Figure 2-5

**I-90 Exit 14 No Action  
2035 Traffic Forecasts**



**LEGEND**

- = Stop Sign
- = Traffic Signal
- = Lane Configuration

Figure 2-6  
**I-90 Exit 14 No Action  
2035 Levels of Service**



**US Highway 14A Corridor Study Including I-90 Exit 14**

The Year 2035 operational results show that individual intersections are anticipated to operate poorly in the long term future, and congestion at the closely spaced signalized intersections south of Exit 14 is likely to also worsen because of the proximity of the intersections. Queues extending upstream from one intersection are likely to interfere with the adjacent intersection.

**Table 2-1 Year 2009 and Year 2035 Intersection Level of Service Comparison**

Intersection	AM(PM ) Peak Hour Intersection Level of Service	
	2009	2035
26 <sup>th</sup> Street/Colorado Boulevard	b(b) <sup>1</sup>	b(c)
N. 27 <sup>th</sup> Street/Colorado Boulevard	C(C) <sup>2</sup>	D(E)
S. 27 <sup>th</sup> Street/Colorado Boulevard	b(b)	c(f)
27 <sup>th</sup> Street/South Ramp Terminal	B(B)	C(F)
27 <sup>th</sup> Street/ North Ramp Terminal	A(A)	B(C)
27 <sup>th</sup> Street/Platinum Drive	b(c)	f(f)
27 <sup>th</sup> Street/1 <sup>st</sup> Avenue	A(B)	C(C)
<sup>1</sup>	Lowercase letters depict LOS results for critical movements at unsignalized intersections	
<sup>2</sup>	Capital letters depict signalized intersection LOS results	

In summary, operational analyses of Year 2035 traffic volumes and the No Action interchange configuration reveal the following points of congestion:

- ▶ South side of interchange: The 27<sup>th</sup> Street intersections with the south ramp terminal intersection and Colorado Boulevard are anticipated to operate poorly by the Year 2035 as individual intersections. Due to their close spacing, congestion at one will affect the other, and vice versa.
- ▶ Movements at the intersection of 27<sup>th</sup> Street with Platinum Drive will operate poorly, particularly the eastbound left turn movement from Platinum onto 27<sup>th</sup> Street.

Congestion at these locations would likely have a negative effect on the entire Exit 14 area, with the potential for queues to spill over across multiple intersections.

**C. Alternatives**

The process of identifying a Most Technically Feasible Interchange Alternative began with the development of a range of alternatives. These alternatives were evaluated based on a series of performance and implementation criteria for alternative screening, which occurred in two steps. The Initial screening step utilized a generalized analysis of all 14 alternatives to reach a short list of final alternatives. A final, more detailed screening using some of the same criteria allowed the project team to reach a final recommended Most Technically Feasible Alternative.

**Alternative Development**

Possessing the results of current and forecasted future traffic conditions analyses, the project team developed a list of interchange reconstruction alternatives for consideration. Completion of existing and Year 2035 No Action traffic analyses provided a starting point for the development of interchange reconstruction alternatives.

A total of 14 alternatives were developed, including the No Action alternative. The alternatives are listed in **Table 2-2**.



## US Highway 14A Corridor Study Including I-90 Exit 14

**Table 2-2 Initial Interchange Alternatives**

#	Alternative
0	No Action
1	Standard Diamond
2	Roundabout Diamond
3	Single-Point, I-90 Under
4	Single-Point, I-90 Under Shifted Bridge
5	Single-Point, I-90 Over Shifted 27 <sup>th</sup>
6	Tight Diamond
7	Roundabout Tight Diamond
8	Tight Diamond, Shifted Bridge
9	Roundabout Tight Diamond, Shifted Bridge
10	25-mph Partial Cloverleaf, Shifted Bridge
11	30-mph Partial Cloverleaf, Shifted Bridge
12	Modified Partial Cloverleaf, Shifted Bridge
13	Roundabout Partial Cloverleaf, Shifted Bridge

### **Evaluation of Alternatives**

The fourteen alternatives were evaluated based on a series of performance and implementation criteria, listed as follows:

#### Performance Criteria

- ▶ Capacity – reduce stops/delay
- ▶ Safety – offset intersections
- ▶ Signal Operation and Spacing
- ▶ Geometric Design
- ▶ Pedestrian and Bicycle Safety
- ▶ Local Mobility and Accessibility
- ▶ Colorado Boulevard Continuity

#### Implementation Criteria

- ▶ Constructability –Vertical/Detours
- ▶ Construction Cost
- ▶ Regional Consistency
- ▶ Environmental/Right-of-way

A qualitative evaluation was utilized to provide a rating for each alternative for each criterion. The criteria and rating system are provided in **Appendix D**.

### **Initial Screening of Alternatives**

The initial screening of alternatives is depicted on the following pages, which provide a tabulation of advantages and disadvantages associated with each alternative, and a recommendation for advancement or elimination from further consideration.



## US Highway 14A Corridor Study Including I-90 Exit 14

# 0. No Action

Alternative	Category	Advantages	Disadvantages	Advance Option? If No, Why Not?
<b>No Action</b>	<i>Performance – Safety/Capacity</i> ↓	<ul style="list-style-type: none"> <li>Maintains continuity of Colorado Blvd.</li> </ul>	<ul style="list-style-type: none"> <li>Congestion would continue to increase</li> <li>Safety would likely decrease with congestion</li> <li>Offset intersection at 27th St. / Colorado Blvd.</li> <li>Further economic development discouraged</li> <li>Close spacing of signals</li> </ul>	<p style="text-align: center;">↑ YES</p> <p>No-action must be carried forward as an alternative.</p>
	<i>Implementation – Cost/Construction</i> ↑	<ul style="list-style-type: none"> <li>Lowest construction cost</li> </ul>	<ul style="list-style-type: none"> <li>Discourages regional development</li> </ul>	
<p><b>RATING SYMBOLS:</b></p> <p>GOOD = ↑</p> <p>FAIR = ↔</p> <p>POOR = ↓</p>				

# 1. Standard Diamond

Alternative	Category	Advantages	Disadvantages	Advance Option? If No, Why Not?
<b>Alternative 1 Standard Diamond</b>	<i>Performance – Safety/Capacity</i> ↓	<ul style="list-style-type: none"> <li>Would reduce congestion at interchange</li> <li>Maintains continuity of Colorado Blvd.</li> </ul>	<ul style="list-style-type: none"> <li>Offset intersection at 27th St. / Colorado Blvd.</li> <li>Close spacing of signals</li> </ul>	<p style="text-align: center;">↓ NO</p> <p>Offset intersection and detours during construction are a concern.</p>
	<i>Implementation – Cost/Construction</i> ↔	<ul style="list-style-type: none"> <li>Minimal environmental impacts &amp; right-of-way</li> <li>Moderate construction cost</li> </ul>	<ul style="list-style-type: none"> <li>Detours and closures during construction</li> </ul>	
<p><b>RATING SYMBOLS:</b></p> <p>GOOD = ↑</p> <p>FAIR = ↔</p> <p>POOR = ↓</p>				

## US Highway 14A Corridor Study Including I-90 Exit 14

### 2. Roundabout Diamond

Alternative	Category	Advantages	Disadvantages	Advance Option? If No, Why Not?
<b>Alternative 2 Roundabout Diamond</b>	<i>Performance – Safety/Capacity</i> ↓	<ul style="list-style-type: none"> <li>Would reduce congestion at interchange</li> <li>Maintains continuity of Colorado Blvd.</li> <li>Eliminates traffic signals</li> </ul>	<ul style="list-style-type: none"> <li>Multi-lane roundabouts, one five legged required</li> <li>Bicyclist and pedestrian movements more challenging</li> </ul>	<p style="text-align: center;">↓</p> <p style="text-align: center;"><b>NO</b></p> <p>Would require a multi-lane roundabout.</p>
	<i>Implementation – Cost/Construction</i> ↔	<ul style="list-style-type: none"> <li>Less bridge widening needed</li> </ul>	<ul style="list-style-type: none"> <li>Detours and closures during construction</li> </ul>	
<p><b>RATING SYMBOLS:</b></p> <p>GOOD = ↑</p> <p>FAIR = ↔</p> <p>POOR = ↓</p>				

### 3. Single Point I-90 Under

Alternative	Category	Advantages	Disadvantages	Advance Option? If No, Why Not?
<b>Alternative 3 Single Point I-90 Under</b>	<i>Performance – Safety/Capacity</i> ↔	<ul style="list-style-type: none"> <li>Would improve capacity and safety</li> <li>Would reduce the number of traffic signals</li> <li>Would maintain the continuity of Colorado Blvd.</li> </ul>	<ul style="list-style-type: none"> <li>Offset intersection at 27th St. / Colorado Blvd.</li> <li>Bicyclist and pedestrian movements more challenging</li> </ul>	<p style="text-align: center;">↔</p> <p style="text-align: center;"><b>NO</b></p> <p>Offset intersections and detours during construction are a concern.</p>
	<i>Implementation – Cost/Construction</i> ↔	<ul style="list-style-type: none"> <li>Would be consistent with other I-90 interchanges in South Dakota</li> <li>Minimal environmental impacts &amp; right-of-way</li> </ul>	<ul style="list-style-type: none"> <li>Detours and closures during construction</li> <li>Cost of structure higher due to size of bridge</li> </ul>	
<p><b>RATING SYMBOLS:</b></p> <p>GOOD = ↑</p> <p>FAIR = ↔</p> <p>POOR = ↓</p>				



## US Highway 14A Corridor Study Including I-90 Exit 14

### 4. Single Point - I-90 Under 27th - Shifted Bridge

Alternative	Category	Advantages	Disadvantages	Advance Option? If No, Why Not?
<b>Alternative 4</b> <b>Single Point</b> <b>I-90 Under 27<sup>th</sup> Street</b> <b>Shifted Bridge</b>	<i>Performance – Safety/Capacity</i> 	<ul style="list-style-type: none"> <li>• Would significantly improve capacity and safety</li> <li>• Would reduce the number of traffic signals</li> <li>• Would maintain the continuity of Colorado Blvd.</li> <li>• Eliminates offset intersections at Colorado Blvd.</li> </ul>	<ul style="list-style-type: none"> <li>• Bicyclist and pedestrian movements more challenging</li> </ul>	 YES
	<i>Implementation – Cost/Construction</i> 	<ul style="list-style-type: none"> <li>• Would be consistent with other I-90 interchanges in South Dakota</li> <li>• Could be constructed in phases to reduce closures</li> </ul>	<ul style="list-style-type: none"> <li>• Cost of structure higher due to size of bridge</li> </ul>	
<b>RATING SYMBOLS:</b> GOOD = FAIR = POOR =				

### 5. Single Point - I-90 Over 27th - Shifted Bridge

Alternative	Category	Advantages	Disadvantages	Advance Option? If No, Why Not?
<b>Alternative 5</b> <b>Single Point</b> <b>I-90 Over 27<sup>th</sup> Street</b> <b>Shifted Bridge</b>	<i>Performance – Safety/Capacity</i> 	<ul style="list-style-type: none"> <li>• Would significantly improve capacity and safety</li> <li>• Would reduce the number of traffic signals</li> <li>• Would maintain the continuity of Colorado Blvd.</li> <li>• Eliminates offset intersections at Colorado Blvd.</li> <li>• Flattens the grades along 27th St.</li> </ul>	<ul style="list-style-type: none"> <li>• Bicyclist and pedestrian movements more challenging</li> </ul>	 YES
	<i>Implementation – Cost/Construction</i> 	<ul style="list-style-type: none"> <li>• Would be consistent with other I-90 interchanges in South Dakota</li> <li>• Dual mainline structures less costly than single large structure</li> </ul>	<ul style="list-style-type: none"> <li>• Significant re-grading efforts along mainline I-90</li> </ul>	
<b>RATING SYMBOLS:</b> GOOD = FAIR = POOR =				

## US Highway 14A Corridor Study Including I-90 Exit 14

### 6. Tight Diamond

Alternative	Category	Advantages	Disadvantages	Advance Option? If No, Why Not?
<b>Alternative 6 Tight Diamond</b>	<i>Performance – Safety/Capacity</i> ↔	<ul style="list-style-type: none"> <li>Would improve capacity and safety</li> <li>Bicyclist and pedestrian movements less challenging</li> <li>Would maintain the continuity of Colorado Blvd.</li> </ul>	<ul style="list-style-type: none"> <li>Offset intersection at 27th St / Colorado Blvd.</li> <li>Close spacing of three signals</li> </ul>	 <b>NO</b> Offset intersections and detours are a concern as well as signal spacing.
	<i>Implementation – Cost/Construction</i> ↑	<ul style="list-style-type: none"> <li>Minimal environmental impacts &amp; right-of-way</li> </ul>	<ul style="list-style-type: none"> <li>Cost of bridge higher due to six lanes</li> </ul>	
<b>RATING SYMBOLS:</b> GOOD = ↑ FAIR = ↔ POOR = ↓				

### 7. Roundabout Tight Diamond

Alternative	Category	Advantages	Disadvantages	Advance Option? If No, Why Not?
<b>Alternative 7 Roundabout Tight Diamond</b>	<i>Performance – Safety/Capacity</i> ↓	<ul style="list-style-type: none"> <li>Would reduce congestion at interchange</li> <li>Would maintain the continuity of Colorado Blvd.</li> <li>Eliminates traffic signals</li> </ul>	<ul style="list-style-type: none"> <li>Several multi-lane roundabouts required</li> <li>Bicyclist and pedestrian movements more challenging</li> </ul>	 <b>NO</b> Several multi-lane roundabouts required.
	<i>Implementation – Cost/Construction</i> ↓	<ul style="list-style-type: none"> <li>Allows for a more narrow bridge across I-90</li> </ul>	<ul style="list-style-type: none"> <li>Would be difficult to construct without detours</li> <li>More environmental impacts and right-of-way</li> </ul>	
<b>RATING SYMBOLS:</b> GOOD = ↑ FAIR = ↔ POOR = ↓				

## 8. Tight Diamond Shifted Bridge

Alternative	Category	Advantages	Disadvantages	Advance Option? If No, Why Not?
<b>Alternative 8 Tight Diamond Shifted Bridge</b>	<i>Performance – Safety/Capacity</i> ↑	<ul style="list-style-type: none"> <li>• Would significantly improve capacity and safety</li> <li>• Would maintain the continuity of Colorado Blvd.</li> <li>• Eliminates offset intersections at Colorado Blvd.</li> <li>• Bicyclist and pedestrian movements less challenging</li> </ul>	<ul style="list-style-type: none"> <li>• Close spacing of three signals</li> </ul>	 YES
	<i>Implementation – Cost/Construction</i> ↑	<ul style="list-style-type: none"> <li>• Could be constructed in phases to avoid closures</li> <li>• Minimal environmental impacts &amp; right-of-way</li> </ul>	<ul style="list-style-type: none"> <li>• Cost of bridge higher due to six lanes</li> </ul>	
<b>RATING SYMBOLS:</b> GOOD = ↑ FAIR = ↔ POOR = ↓				

## 9. Roundabout Tight Diamond Shifted Bridge

Alternative	Category	Advantages	Disadvantages	Advance Option? If No, Why Not?
<b>Alternative 9 Roundabout Tight Diamond Shifted Bridge</b>	<i>Performance – Safety/Capacity</i> ↑	<ul style="list-style-type: none"> <li>• Would improve capacity and safety</li> <li>• Would maintain the continuity of Colorado Blvd.</li> <li>• Eliminates offset intersections at Colorado Blvd.</li> <li>• Eliminates traffic signals</li> </ul>	<ul style="list-style-type: none"> <li>• Bicyclist and pedestrian movements more challenging</li> <li>• Several multi-lane roundabouts required</li> </ul>	 NO Several multi-lane roundabouts required in proximity.
	<i>Implementation – Cost/Construction</i> ↔	<ul style="list-style-type: none"> <li>• Allows for a more narrow bridge across I-90</li> </ul>	<ul style="list-style-type: none"> <li>• Vertical grades approaching roundabouts</li> </ul>	
<b>RATING SYMBOLS:</b> GOOD = ↑ FAIR = ↔ POOR = ↓				

## US Highway 14A Corridor Study Including I-90 Exit 14

# 10. 25-mph Partial Cloverleaf Shifted Bridge

Alternative	Category	Advantages	Disadvantages	Advance Option? If No, Why Not?
<b>Alternative 10</b> <b>25-mph</b> <b>Partial Cloverleaf</b> <b>Shifted Bridge</b>	<i>Performance – Safety/Capacity</i> 	<ul style="list-style-type: none"> <li>• Would significantly improve capacity and safety</li> <li>• Would maintain the continuity of Colorado Blvd.</li> <li>• Potentially eliminates one traffic signal</li> </ul>	<ul style="list-style-type: none"> <li>• Close intersection spacing along 27th St.</li> <li>• Tightness of curvature on ramp (25-mph)</li> </ul>	 <b>NO</b> The tight cloverleaf is a concern as well as close proximity of ramps to Colorado Blvd.
	<i>Implementation – Cost/Construction</i> 	<ul style="list-style-type: none"> <li>• Could be constructed in phases to avoid closures</li> <li>• Minimal environmental impacts &amp; right-of-way</li> </ul>	<ul style="list-style-type: none"> <li>• Increased construction costs for ramps and bridge work</li> </ul>	
<b>RATING SYMBOLS:</b> GOOD = FAIR = POOR =				

# 11. 30-mph Partial Cloverleaf Shifted Bridge

Alternative	Category	Advantages	Disadvantages	Advance Option? If No, Why Not?
<b>Alternative 11</b> <b>30-mph</b> <b>Partial Cloverleaf</b> <b>Shifted Bridge</b>	<i>Performance – Safety/Capacity</i> 	<ul style="list-style-type: none"> <li>• Would significantly improve capacity and safety</li> </ul>	<ul style="list-style-type: none"> <li>• Would break the continuity of Colorado Blvd.</li> <li>• Impacts local access and circulation</li> </ul>	 <b>NO</b> Breaks continuity of Colorado Blvd. and impacts local access.
	<i>Implementation – Cost/Construction</i> 	<ul style="list-style-type: none"> <li>• Could be constructed in phases to avoid closures</li> </ul>	<ul style="list-style-type: none"> <li>• More environmental and right-of-way impacts</li> <li>• More roadway reconstruction on Colorado Blvd. &amp; ramps</li> </ul>	
<b>RATING SYMBOLS:</b> GOOD = FAIR = POOR =				



## US Highway 14A Corridor Study Including I-90 Exit 14

### 12. Modified Partial Cloverleaf Shifted Bridge

Alternative	Category	Advantages	Disadvantages	Advance Option? If No, Why Not?
<b>Alternative 12</b> <b>Modified Partial Cloverleaf Shifted Bridge</b>	<i>Performance – Safety/Capacity</i> ↔	<ul style="list-style-type: none"> <li>Would significantly improve capacity and safety</li> <li>Eliminates one traffic signal</li> </ul>	<ul style="list-style-type: none"> <li>Would break the continuity in Colorado Blvd.</li> <li>Impacts local access and circulation</li> </ul>	 <b>NO</b> Breaks continuity of Colorado Blvd. and impacts local access.
	<i>Implementation – Cost/Construction</i> ↔	<ul style="list-style-type: none"> <li>Could be constructed in phases to avoid closures</li> </ul>	<ul style="list-style-type: none"> <li>Different than other interchanges in the region</li> <li>More environmental and right-of-way impacts</li> <li>More roadway reconstruction on Colorado Blvd. &amp; ramps</li> </ul>	
<b>RATING SYMBOLS:</b> GOOD = ↑ FAIR = ↔ POOR = ↓				

### 13. Roundabout Partial Cloverleaf Shifted Bridge

Alternative	Category	Advantages	Disadvantages	Advance Option? If No, Why Not?
<b>Alternative 13</b> <b>Roundabout Partial Cloverleaf Shifted Bridge</b>	<i>Performance – Safety/Capacity</i> ↓	<ul style="list-style-type: none"> <li>Would significantly improve capacity and safety</li> <li>Eliminates traffic signals</li> <li>Would maintain the continuity of Colorado Blvd.</li> </ul>	<ul style="list-style-type: none"> <li>Bicyclist and pedestrian movements more challenging</li> <li>Multi-lane roundabouts required</li> </ul>	 <b>NO</b> Multi-lane roundabouts required.
	<i>Implementation – Cost/Construction</i> ↓	<ul style="list-style-type: none"> <li>Allows for a more narrow bridge across I-90</li> </ul>	<ul style="list-style-type: none"> <li>Different than other interchanges in the region</li> <li>More environmental and right-of-way impacts</li> <li>More roadway reconstruction on ramps</li> </ul>	
<b>RATING SYMBOLS:</b> GOOD = ↑ FAIR = ↔ POOR = ↓				



**US Highway 14A Corridor Study Including I-90 Exit 14**

**Initial Screening Results**

**Table 2-3** summarizes the results of the initial screening, as depicted in the preceding initial screening tables.

**Table 2-3 Alternatives Eliminated in Initial Screening**

#	Alternative	Primary Reason(s) for Elimination
1	Standard Diamond	Offset intersection and detours during construction are a concern along with close signal and access spacing
2	Roundabout Diamond	Would require a multi-lane roundabout
3	Single-Point, I-90 Under	Offset intersection and detours during construction are a concern
6	Tight Diamond	Offset intersection and detours are a concern, as well as signal spacing
7	Roundabout Tight Diamond	Several multi-lane roundabouts required
9	Roundabout Tight Diamond, Shifted Bridge	Several multi-lane roundabouts required in proximity
10	25-mph Partial Cloverleaf, Shifted Bridge	The tight cloverleaf is a safety concern as well as proximity of ramps to Colorado Boulevard
11	30-mph Partial Cloverleaf, Shifted Bridge	Would break continuity of Colorado Boulevard and impact local access
12	Modified Partial Cloverleaf, Shifted Bridge	Would break continuity of Colorado Boulevard and impact local access
13	Roundabout Partial Cloverleaf, Shifted Bridge	Multi-lane roundabouts required in proximity

As shown in **Table 2-3**, the two most common reasons for eliminating alternatives were:

3. Failure to correct the current offset intersection of 27<sup>th</sup> Street with Colorado Boulevard: This offset intersection represents a current safety problem, and detracts from the role of 27<sup>th</sup> Street as a arterial roadway in the City of Spearfish roadway network. None of the surviving alternatives would leave this offset intersection in place.
4. Construction of one or more multi-lane roundabouts: There are currently no roundabouts along any state highway in the State of South Dakota, and the SDDOT is highly unlikely to construct the first state highway roundabout at Exit 14, an area likely to experience significant traffic congestion in the future. The need for multiple multi-lane roundabouts with some alternatives further decreases the likelihood of implementation.

Alternatives advancing to final screening were:

- ▶ Alternative 0 – No Action
- ▶ Alternative 4 – Single-Point, I-90 Under Shifted Bridge
- ▶ Alternative 5 – Single-Point, I-90 Over Shifted 27<sup>th</sup>
- ▶ Alternative 8 – Tight Diamond, Shifted Bridge

These Alternatives are graphically depicted on **Figure 2-7a** and **Figure 2-7b**.

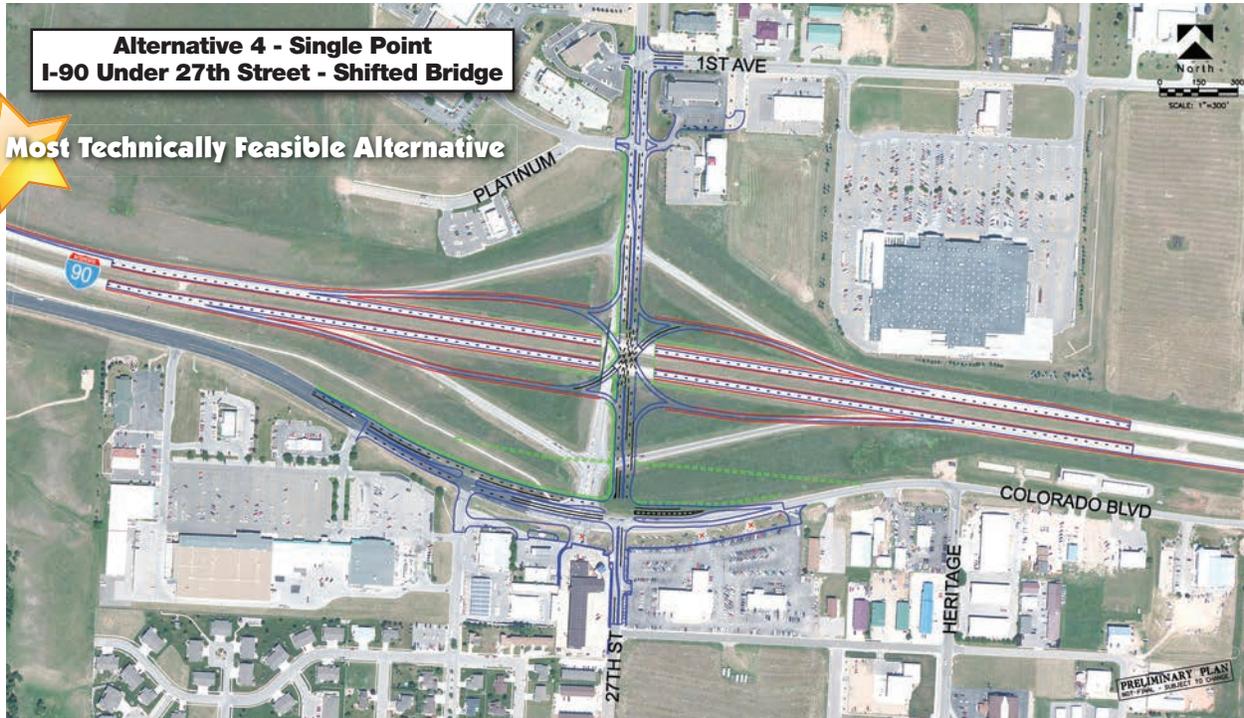


Figure 2-7a  
**I-90 Exit 14**  
**Final Screening Options**

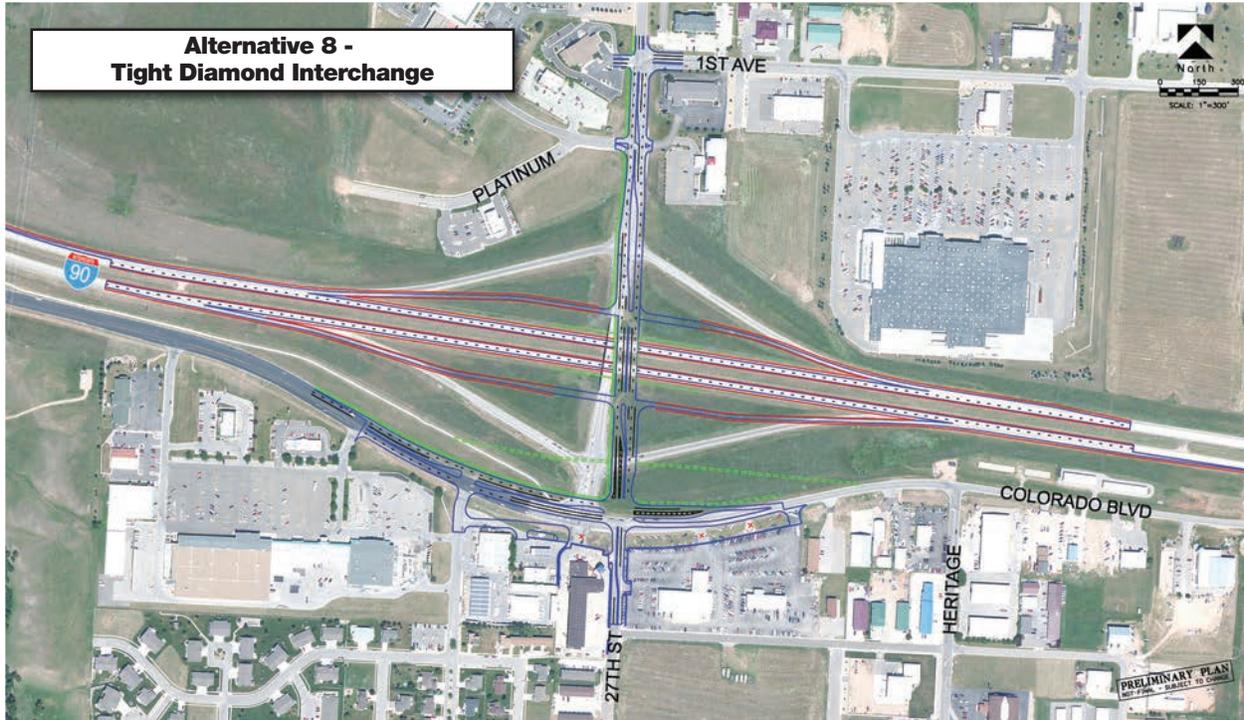
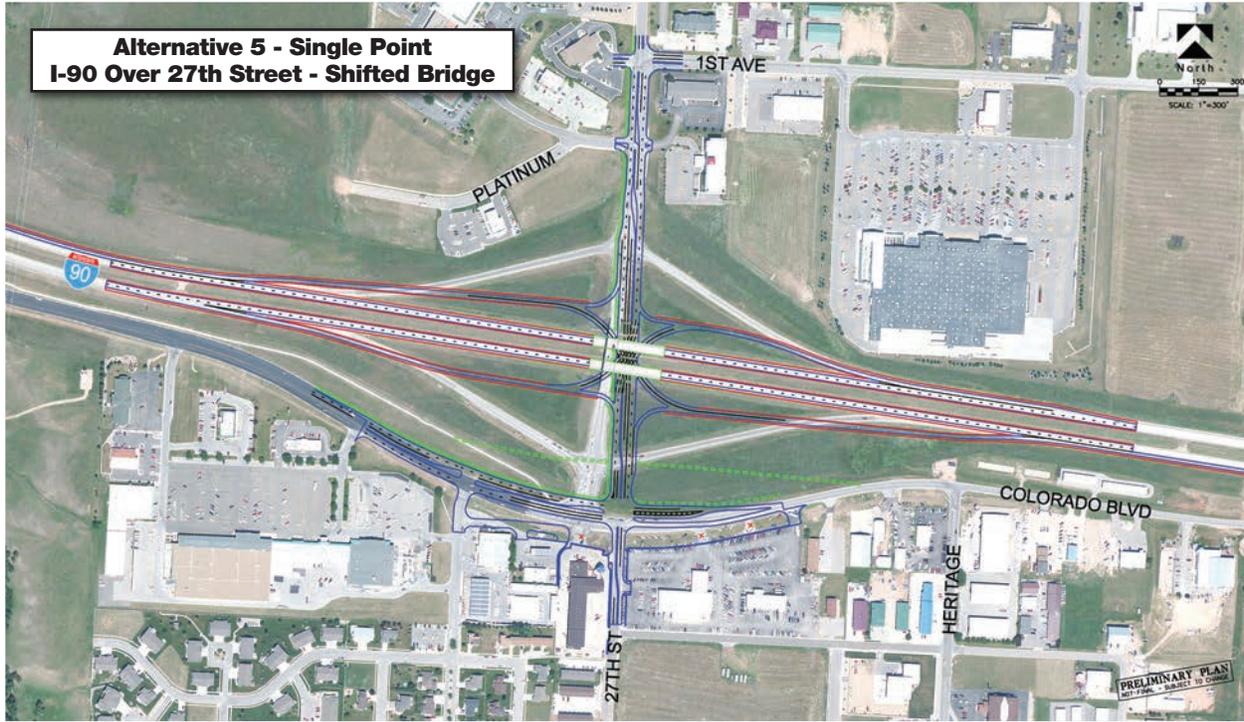


Figure 2-7b  
**I-90 Exit 14**  
**Final Screening Options**



**US Highway 14A Corridor Study Including I-90 Exit 14**

**Final Screening**

Upon reaching a short list of four alternatives, the project team utilized a final screening evaluation to reach a recommended Most Technically Feasible Alternative. **Table 2-4** provides a listing of the criteria and a description of how each was measured in final screening.

**Table 2-4 Final Screening Criteria and Measurement**

Criteria	Measurement
<b>Performance</b>	
Capacity	<ul style="list-style-type: none"> <li>• Intersection Level of service analyses</li> </ul>
Safety	<ul style="list-style-type: none"> <li>• Ability to correct current safety problems</li> <li>• Number of intersection conflict points</li> </ul>
Geometrics/Driver Familiarity	<ul style="list-style-type: none"> <li>• Conformity with accepted standards for roadway curvature</li> <li>• Ability to improve signal spacing</li> </ul>
Pedestrian/Bicycle Needs	<ul style="list-style-type: none"> <li>• Compatibility with recreational trail system.</li> <li>• Enhancements to multimodal safety crossing I-90</li> </ul>
Development	<ul style="list-style-type: none"> <li>• Ability to foster safe and efficient access to local properties</li> </ul>
Environmental	<ul style="list-style-type: none"> <li>• Air quality impacts</li> </ul>
<b>Implementation</b>	
Utilities	<ul style="list-style-type: none"> <li>• Anticipated impacts to utilities</li> <li>• Relocations required</li> </ul>
Cost	<ul style="list-style-type: none"> <li>• Estimated Construction cost</li> </ul>
Right-of-Way	<ul style="list-style-type: none"> <li>• Right-of-way acquisition required</li> </ul>
Constructability	<ul style="list-style-type: none"> <li>• Ability to keep interchange ramps open during construction.</li> <li>• Time period required to complete construction.</li> <li>• Detour impacts</li> </ul>

A number of criteria required a more detailed evaluation for final screening. These detailed evaluations are described in the following sections.

**Operational Analysis**

As shown in **Table 2-4**, the Performance category included a Capacity criterion, which provided an evaluation of Year 2035 intersection Level of Service for each of the remaining alternatives. The results of this analysis are described as follows for each alternative.

**No Action Alternative:** The No Action Alternative was analyzed in the initial future operational evaluation. The evaluation revealed a number of congestion points in the interchange area anticipated to occur with Year 2035 traffic forecasts. The south ramp terminal and 27<sup>th</sup> Street / Colorado Boulevard intersections would operate at LOS F and LOS E during the PM peak hour, and movements at the 27<sup>th</sup> Street/Platinum Drive intersection would operate at LOS F.

**Alternatives 4 and 5:** Alternatives 4 and 5 are both Single-point configurations, though the vertical position of I-90 and 27<sup>th</sup> Street is switched between the two. It was found that each of the study intersections would operate at LOS C or better during peak hours, a marked improvement over the No Action. Year 2035 traffic forecasts and LOS for Alternatives 4 and 5 are depicted on **Figure 2-8**.



**US Highway 14A Corridor Study Including I-90 Exit 14**

**Alternative 8:** Alternative 8, Tight Diamond, was also found to operate acceptably by the Year 2035. All intersections in the interchange study area would operate at LOS C or better, and the two ramp terminal intersections would both operate at LOS B or better during peak hours. Though operations would be acceptable, Alternative 8 was rated below the Single-Point options in traffic operations because two intersections represent more potential for traffic signal progression complexity and associated traffic congestion. Year 2035 traffic operations for Alternative 8 are shown on **Figure 2-9**. **Appendix C** provides LOS Worksheets for the Build Interchange Alternatives.

**Geometric Design**

Geometric design was identified by the Study Advisory Team (SAT) as a key criteria for evaluating the differences between Alternatives 4 and 5. Alternative 4, by sending 27<sup>th</sup> Street over I-90, would introduce a crest vertical curve culminating at the central signalized intersection. Alternative 5 would provide a sag vertical curve with the central signalized intersection located at the bottom of the curve.

The geometric advantages and disadvantages associated with each configuration are summarized in **Table 2-5**.

**Table 2-5 Over/Under Single-Point Geometric Comparison**

Alternative	Advantages	Disadvantages
Alternative 4: I-90 under 27 <sup>th</sup> Street (crest vertical curve)	<ul style="list-style-type: none"> <li>• Would match existing grades and current over/under</li> <li>• Off-ramps on a uphill grade, assisting deceleration leaving I-90</li> <li>• Signal located on top level, where surface is even lighting surface</li> </ul>	<ul style="list-style-type: none"> <li>• Difficulty of driver navigation through wide intersection on a crest vertical curve</li> <li>• Larger structure can hinder melting of snow and ice along I-90 mainline</li> <li>• Signal can get lost against scenic background</li> </ul>
Alternative 5: I-90 over 27 <sup>th</sup> Street (sag vertical curve)	<ul style="list-style-type: none"> <li>• Two smaller structures may be built instead of one large structure of Alternative 4</li> <li>• Signal won't fade into scenic background</li> </ul>	<ul style="list-style-type: none"> <li>• Off-ramp grades increase braking and hinder acceleration</li> <li>• Signal exposed to uneven lighted surface</li> </ul>

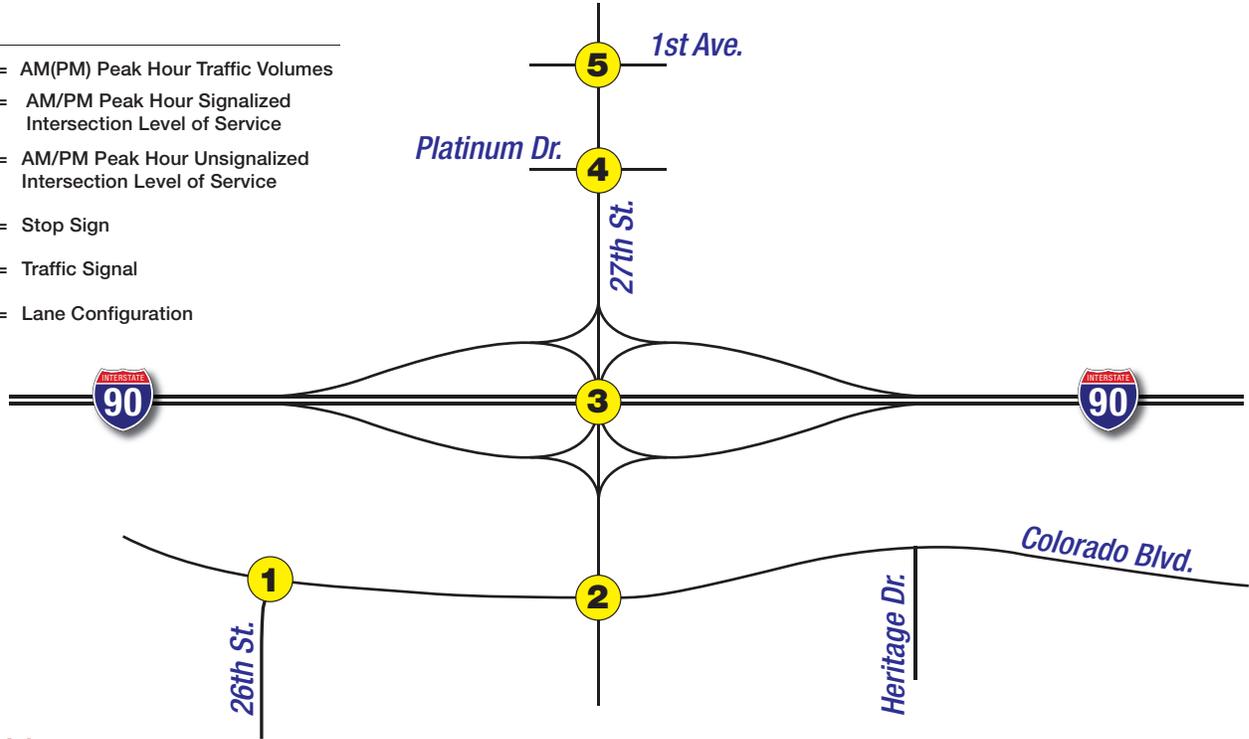
In addition to the comparative analysis shown in **Table 2-5**, SDDOT Staff provided the project team with a comparison of accidents at the nine single point interchanges in South Dakota for the three year period of time following the interchange's opening to traffic. Overall, whether the interchange has the intersection on the structure or under the structure(s) didn't show a significant effect on the average number of accidents per interchange, but did suggest that the type of accidents might be affected by whether the intersection is on the structure or beneath.

**Appendix E** contains research performed by the project team on the subject of the relative safety impacts of single-point interchanges on crest vertical curves.

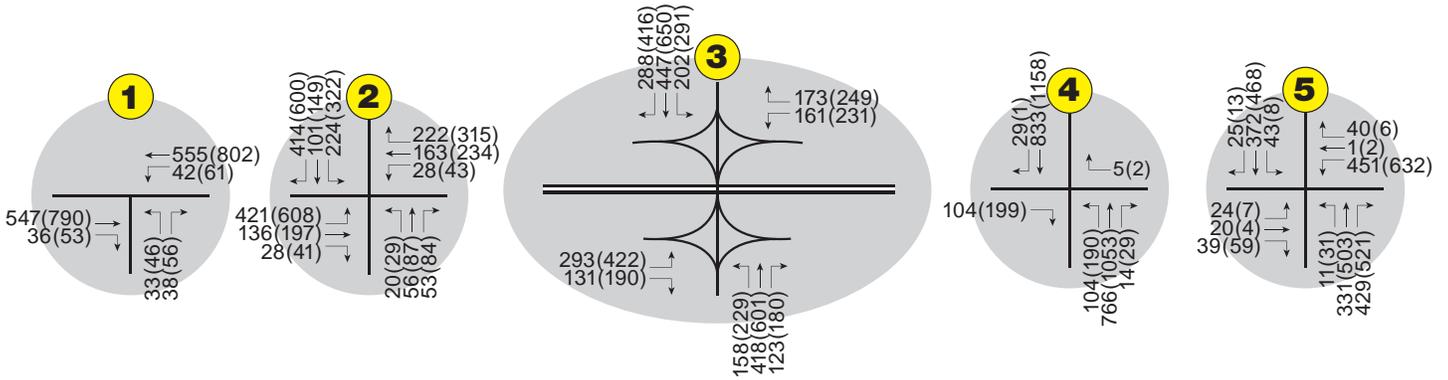


**LEGEND**

- XXX(XXX) = AM(PM) Peak Hour Traffic Volumes
- X/X = AM/PM Peak Hour Signalized Intersection Level of Service
- x/x = AM/PM Peak Hour Unsignalized Intersection Level of Service
- = Stop Sign
- 🚦 = Traffic Signal
- ↔ = Lane Configuration



**Traffic Volumes**



**Levels of Service**

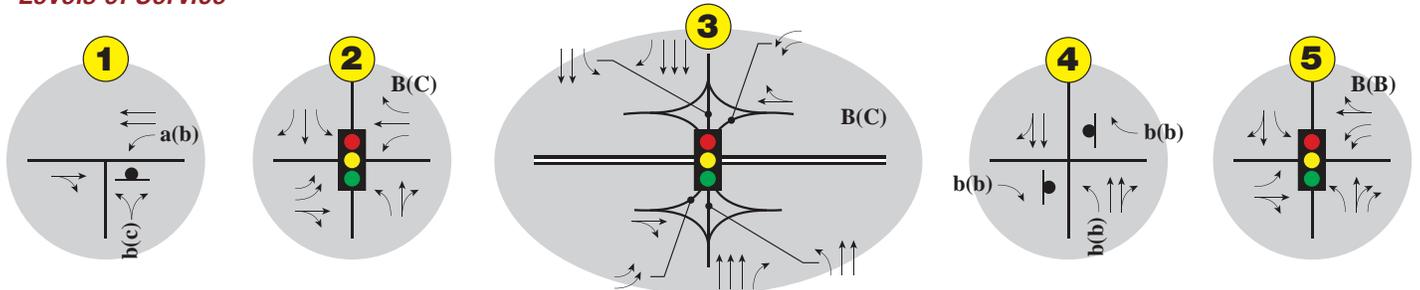
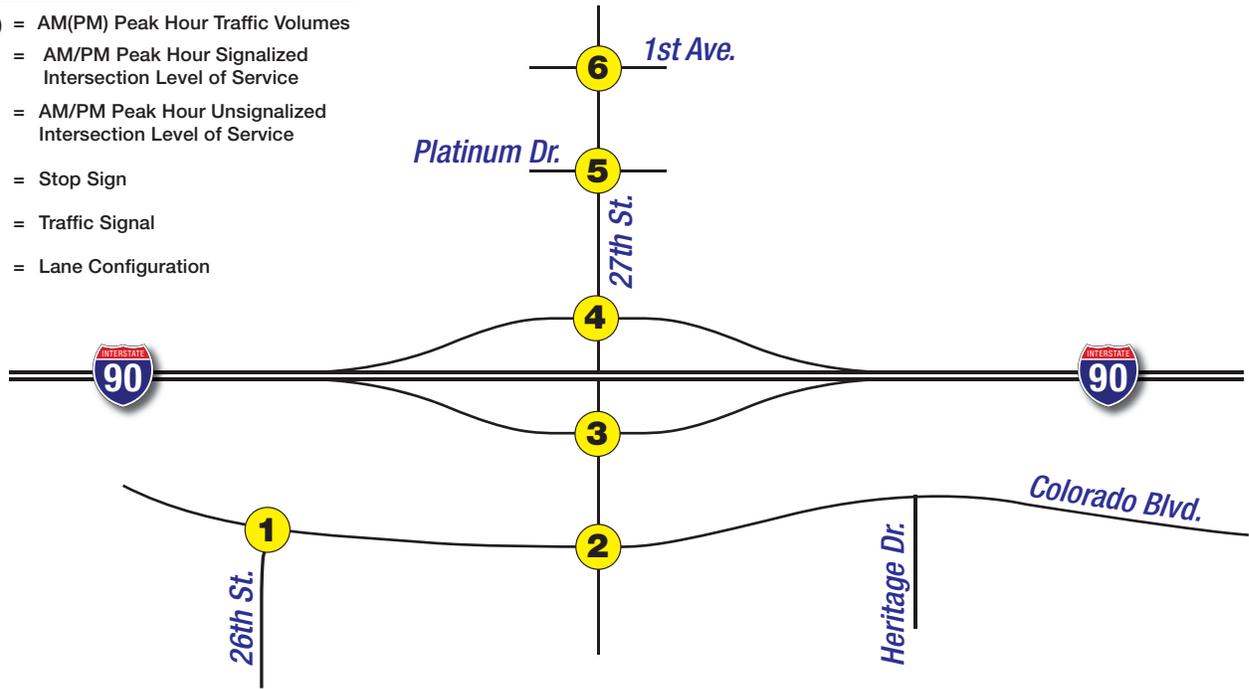


Figure 2-8

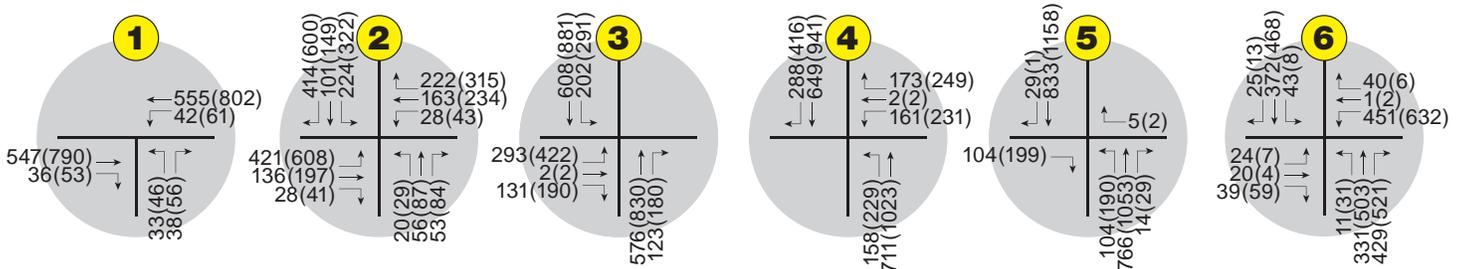
**I-90 Exit 14 Alternatives 4 & 5  
2035 Volumes and Operations**

**LEGEND**

- XXX(XXX) = AM(PM) Peak Hour Traffic Volumes
- X/X = AM/PM Peak Hour Signalized Intersection Level of Service
- x/x = AM/PM Peak Hour Unsignalized Intersection Level of Service
- = Stop Sign
- 🚦 = Traffic Signal
- ↔ = Lane Configuration



**Traffic Volumes**



**Levels of Service**

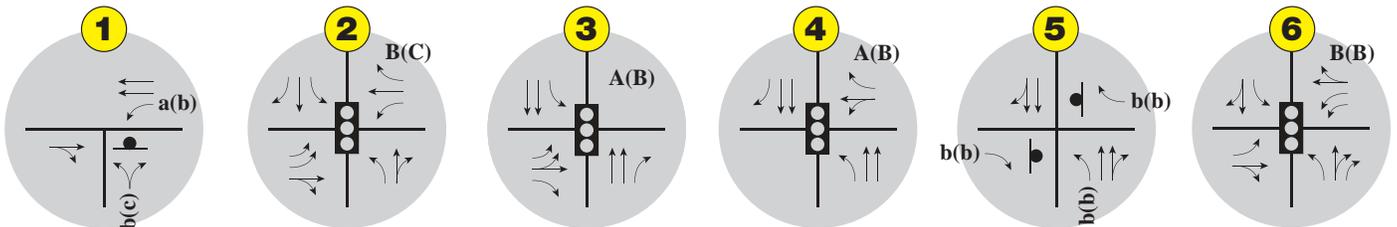


Figure 2-9

**I-90 Exit 14 Alternative 8 Tight Diamond  
2035 Volumes and Operations**



## US Highway 14A Corridor Study Including I-90 Exit 14

Based on the available information, the project team determined that Alternative 5 possessed a small advantage over Alternative 4 in the geometric criterion.

### Constructability

A concern frequently mentioned by members of the public and project stakeholders was the need to minimize the time duration of construction activities and the anticipated disturbance to interchange ramps and interstate crossing during construction. To address this question, the project team performed a preliminary analysis of construction phasing and scheduling for Alternatives 4 and 5 (it was determined that Alternative 8 construction impacts would be similar to Alternative 4).

The analysis showed that alternatives 4 and 8 would be the least impactful during construction, with an estimated total schedule of 18 months to construct. The complexity of a temporary bridge and switching mainline and cross road grades would add approximately 100 days to the construction schedule and increase the difficulty associated with keeping ramps open. Therefore, Alternatives 4 and 8 were rated higher than Alternative 5 on constructability.

Of note, properties north of the interchange are dependent upon 27<sup>th</sup> Street for direct, reasonable vehicular access. However, it is anticipated that 27<sup>th</sup> Street will need to be completely closed for certain time periods during construction for any of the alternatives under consideration.

**Appendix F** provides construction phasing concepts and descriptions for Alternatives 4 and 5.

### Bicycle and Pedestrian Needs

The No Action Alternative poses some difficulties for bicyclists and pedestrians seeking to safely navigate the interchange area. The Spearfish trail currently terminates at the northeast corner of the signalized Colorado Boulevard/27<sup>th</sup> Street intersection and non-motorized travelers are faced with several difficult intersection crossings. In addition, the 27<sup>th</sup> Street bridge over I-90 provides little space for bicycle and pedestrian travelers.

Alternative 4 provides several enhancements over the No Action Alternative. Reconstruction of 27<sup>th</sup> Street over I-90 would create an opportunity for a trail underpass of 27<sup>th</sup> Street north of Colorado Boulevard, setting the stage for the City of Spearfish's future extension of the trail east along Colorado Boulevard to Exit 17. This opportunity would also be provided by Alternative 8, but would not be possible with Alternative 5.

Getting across I-90 will be improved to varying degrees by each alternative. Each alternative is proposed to provide sidewalk connections over the bridge. The separate signalized intersections of Alternative 8 would be the simplest and safest for non-motorized travel, while the single-point intersection of alternatives 4 and 5 is difficult to negotiate.

Alternative 8 was rated best in the category of bicycle and pedestrian needs.



**US Highway 14A Corridor Study Including I-90 Exit 14**

**Final Screening Results**

**Table 2-6** depicts the advantages and disadvantages noted for each alternative. The detailed screening results are included in **Appendix G**.

**Table 2-6 Final Interchange Screening Results**

Alternative	Estimated Construction Cost	Advantages	Disadvantages
<b>No Action</b>	\$3.09 M	<ul style="list-style-type: none"> <li>Least Expensive</li> </ul>	<ul style="list-style-type: none"> <li>Inadequate traffic capacity</li> <li>Maintains substandard offset 27<sup>th</sup> intersection</li> </ul>
<b>Alternative 4</b>	\$17.93 M	<ul style="list-style-type: none"> <li>Improved capacity and safety</li> <li>Trail underpass potential</li> <li>More efficient construction schedule</li> </ul>	<ul style="list-style-type: none"> <li>Vertical curve at intersection, large structure</li> <li>Higher construction cost</li> </ul>
<b>Alternative 5</b>	\$18.04 M	<ul style="list-style-type: none"> <li>Improved capacity and safety</li> <li>Simpler mainline structures</li> <li>Vertical curves along 27<sup>th</sup></li> </ul>	<ul style="list-style-type: none"> <li>Higher construction cost</li> <li>Complicated construction phasing and more construction time</li> </ul>
<b>Alternative 8</b>	\$14.13 M	<ul style="list-style-type: none"> <li>Lower construction cost</li> </ul>	<ul style="list-style-type: none"> <li>Multiple closely spaced signalized intersections</li> </ul>

Based on overall ratings, the project team selected Alternative 4 as the Most Technically Feasible Interchange Alternative. The Most Technically Feasible Alternative is shown on **Figure 2-10**.

**D. Environmental Analysis**

**Noise Analysis**

At the request of SDDOT Staff, the project team performed preliminary resource evaluation of potential noise impacts related to implementation of the recommended Most Technically Feasible Alternative. Field measurements of existing conditions provided a baseline for comparisons, and a noise model was built to replicate the anticipated effects of the Recommended Most Technically Feasible Alternative on noise receptors in the vicinity of the interchange.

Existing (2011) conditions and 2035 conditions with the Recommended Alternative were evaluated for potential traffic noise impacts in the vicinity of the I-90/27<sup>th</sup> Street interchange. The primary land uses in the study area were Categories E, F and G. The noise results indicated that there would be no noise impacts in the study area. Therefore, there was no need to evaluate noise abatement measures.



Most Technically Feasible Alternative

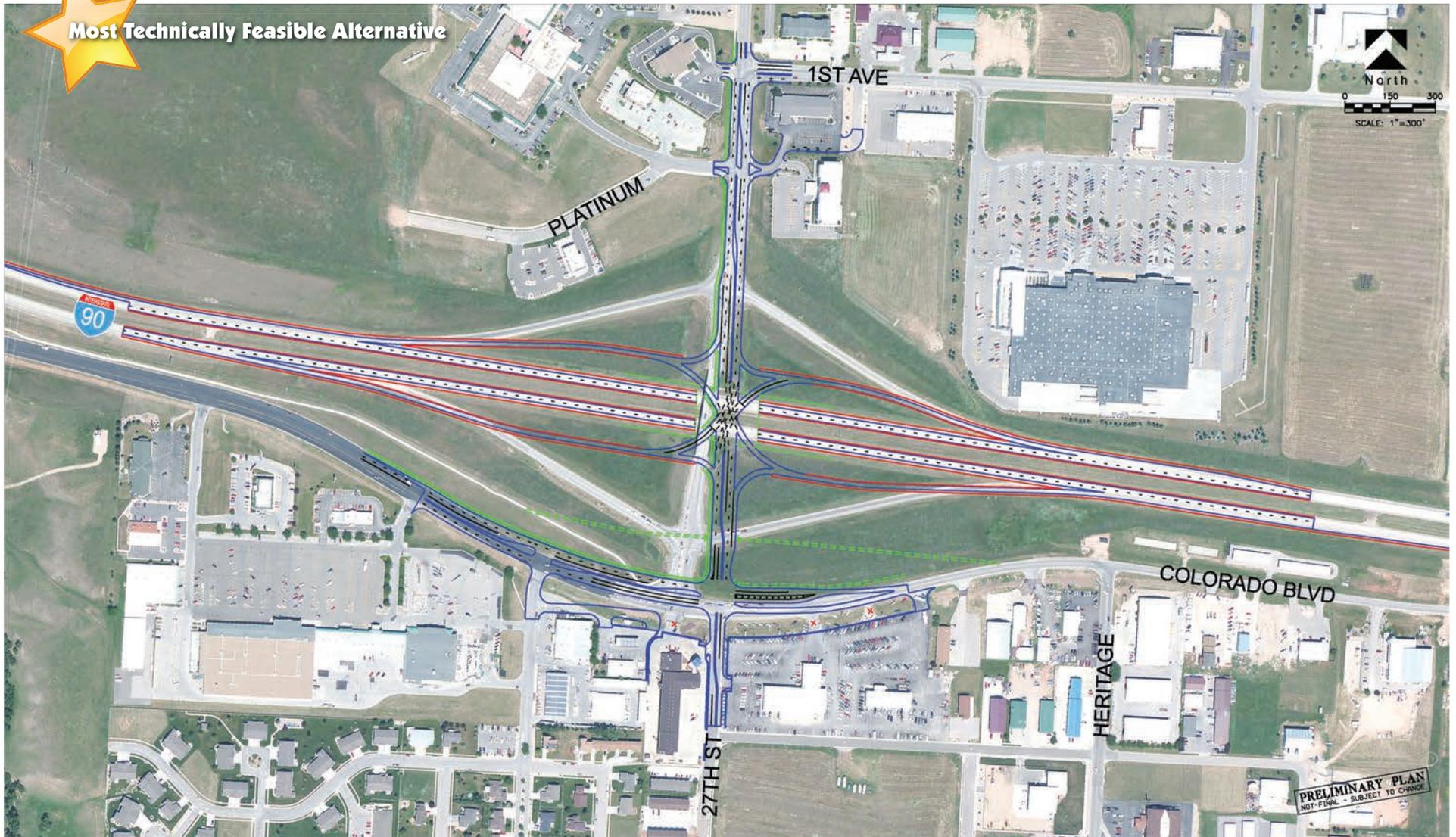


Figure 2-10

**I-90 Exit 14 Alternative 4:  
Single Point - I-90 Under 27th Street - Shifted Bridge**



## US Highway 14A Corridor Study Including I-90 Exit 14

A full noise analysis report is provided in **Appendix H**.

### **Historic Properties**

A cursory review of Lawrence County records was completed to identify any historic properties in the interchange area. None were found.



## US Highway 14A Corridor Study Including I-90 Exit 14

### 3.0 US HIGHWAY 14A CORRIDOR STUDY

#### A. Existing Conditions

The following sections briefly describe the existing roadway, traffic, land uses, and access conditions within the Colorado Boulevard portion of the US Highway 14A corridor. US 14A is currently classified as a Minor Arterial on the statewide *Functional Classification Map* and an Intermediate Arterial on SDDOT's *Highway Access Classifications Map*. The roadway has a posted speed limit of 45 miles per hour and has gentle rolling terrain.

Colorado Boulevard is generally a three-lane asphalt roadway, resurfaced in 2011, with open drainage on both sides. There is curb and gutter along a portion of the south side of Colorado Boulevard within the commercial frontage from 27<sup>th</sup> Street to Christensen Drive.

The land uses on the south side of Colorado Boulevard from Heritage Drive to Christensen Drive are commercial in nature, many of which are oriented to visitors and other highway users. The greatest density is in the block between 26<sup>th</sup> and 27<sup>th</sup> Street where four businesses are located within 500 feet of frontage.

The highway frontage west of Christensen Drive is a mixture of recreation (golf course) and residential land uses, with direct access to Colorado Boulevard limited to T-type intersections, almost all public streets.

Sight distance is generally good along Colorado Boulevard except for southbound Country Club Drive when westbound traffic queues at the signal at Spearfish Canyon Road limit visibility for vehicles attempting to make a left turn onto Colorado Boulevard.

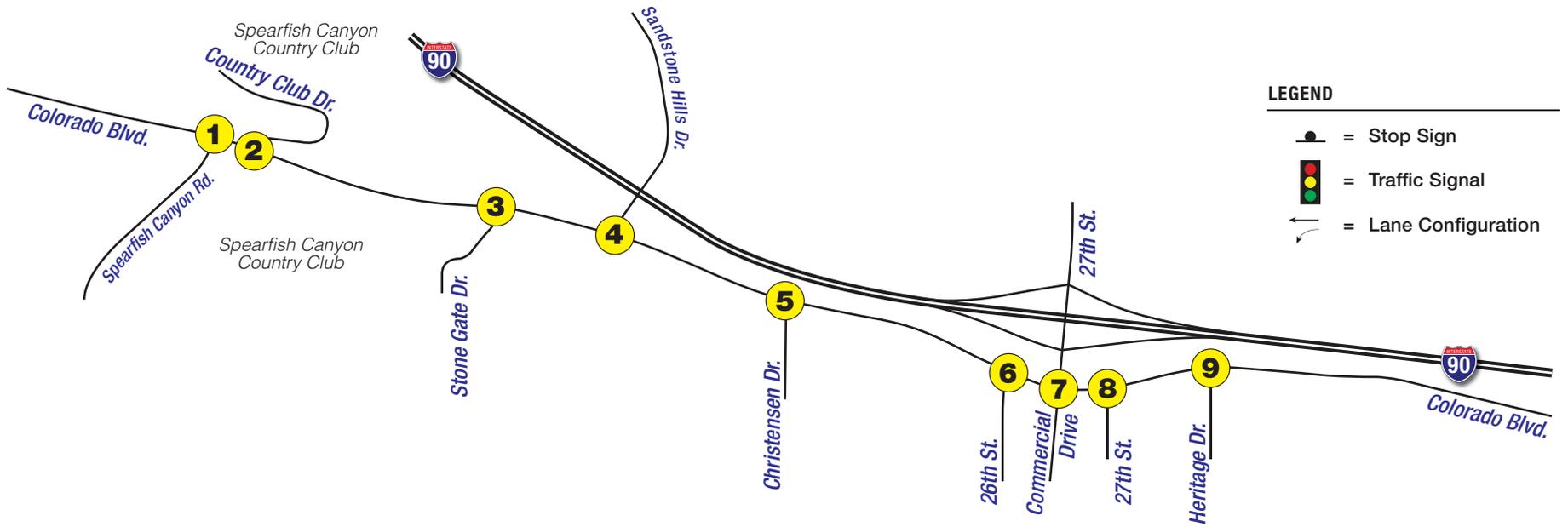
There is a bicycle / pedestrian trail along the north side of Colorado Boulevard from Spearfish Canyon Road to 27<sup>th</sup> Street where it currently terminates on the northwest corner.

A stream runs parallel to Colorado Boulevard west of Christensen Drive, which together with the golf course and bike trail somewhat restrict the highway right-of-way.

#### **Lane Configurations / Traffic Control**

As mentioned above Colorado Boulevard is generally a three-lane roadway with one through lane in each direction and painted left turn lanes at each of the intersecting roadways. From 27<sup>th</sup> Street to west end of the frontage with the Heritage Plaza Shopping Center there is an additional westbound through lane as well as supplemental right turn lanes at each of the entrances to the shopping center.

**Figure 3-1** depicts the existing lane configurations and traffic control within the study area. There are currently two signalized intersections along Colorado Boulevard, 27<sup>th</sup> Street and Spearfish Canyon Road. At the intersection with 27<sup>th</sup> Street the northbound approach is a shared access for three of the businesses on the south side of Colorado Boulevard with stacking for only two vehicles (50 feet) provided. The "Stop" sign controlled south leg of 27<sup>th</sup> Street is offset to the east of the traffic signal, with only two vehicle stacking provided there as well. An additional westbound through lane is introduced leaving the intersection to handle the heavy southbound to westbound right turn movement as a free flow movement.



**LEGEND**

-  = Stop Sign
-  = Traffic Signal
-  = Lane Configuration

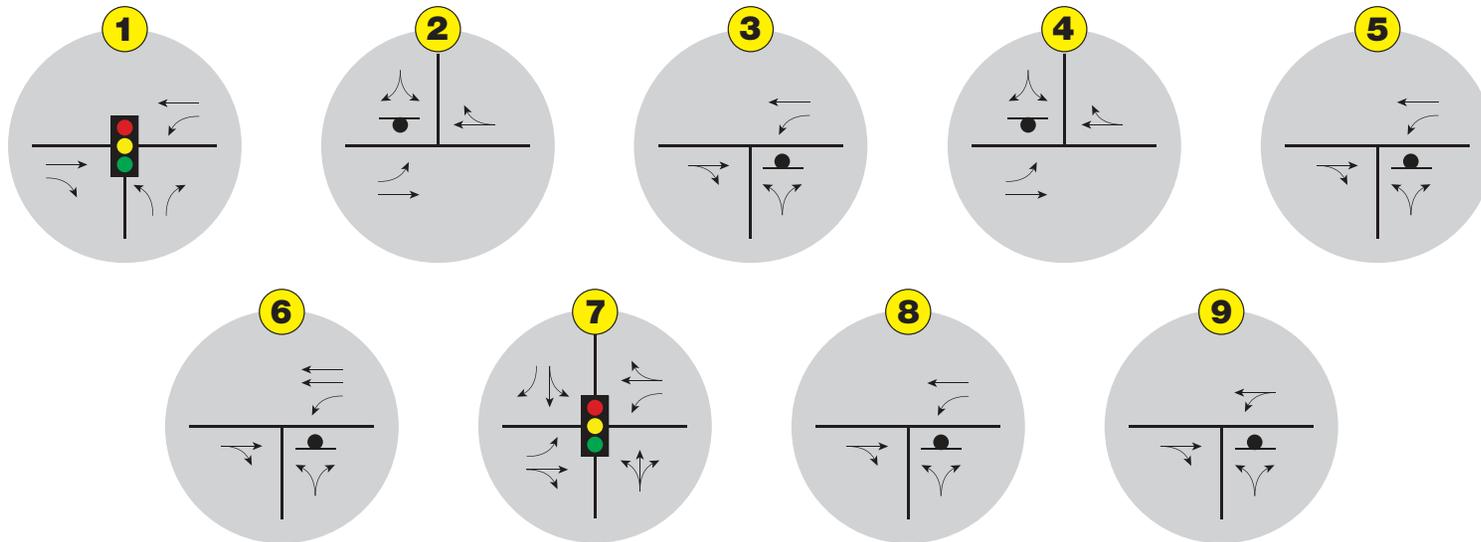


Figure 3-1  
**US 14A - Colorado Boulevard**  
**2009 Existing Lane Configuration**  
**and Traffic Control**



## US Highway 14A Corridor Study Including I-90 Exit 14

The signalized intersection with Spearfish Canyon Road has two northbound lanes separating the right and left turns. The east leg of that intersection has limited storage (150 feet) for westbound left turns competing with eastbound left turns at Country Club Drive. The steep grades in Country Club Drive limit the ability to shift the access further east to increase this separation. A similar situation, though not as severe, exists between the south leg of the intersection and the driveway into the Spearfish Country Club. Consideration was given to shifting Spearfish Canyon Road to the west which is discussed later in this report.

The single entry lanes on each of the cross streets of the remaining intersections are controlled by “Stop” signs.

### **Safety**

The crash history for the four year period from January 1, 2006 through December 31, 2009 was provided by the SDDOT. A summary of the reported collisions in the Colorado Boulevard corridor are depicted in **Figure 3-2** by intersection and segment.

The intersection of 27<sup>th</sup> Street and Colorado Boulevard had the greatest number of crashes reported (12), which averages 3 crashes per year. One-half or six of the crashes involved left turns.

Safety concerns at this intersection include the close spacing of signals with the signal at the eastbound off-ramp of I-90. The downgrade approaching the intersection from the north and the

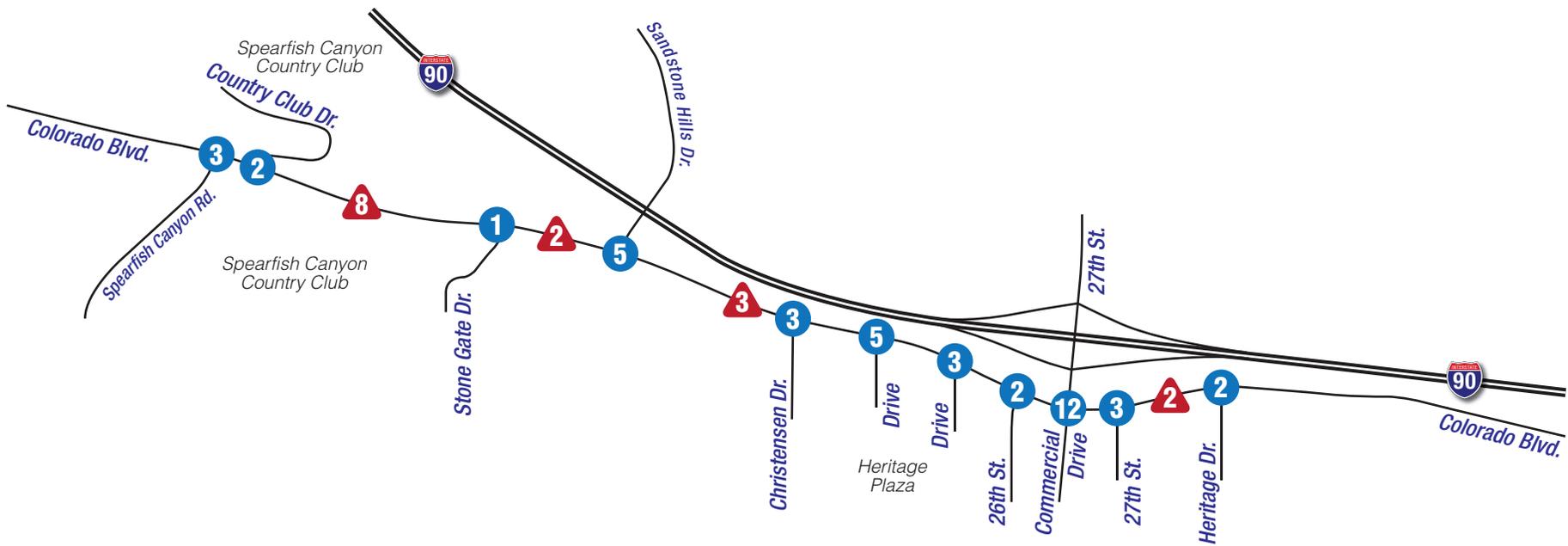


off-set intersection with 27<sup>th</sup> Street south of Colorado Boulevard were also identified as other concerns that should be improved in any future reconstruction. Other intersections experienced fewer collisions, with the next highest concentration being the two driveways to the Heritage Plaza which had a total of eight or two per year.

### **Looking south at the Colorado/27<sup>th</sup> intersection**

The greatest number of reported collisions along any mid-block segment was the area between Country Club Drive and Stone Gate Drive which had eight reported crashes in the four year period. Half of the collisions (4) along this segment were deer collisions.

The more recent SDDOT *2010 Highway Needs and Project Analysis Report* shows crash rates along Colorado Boulevard of 0.90 to 2.16 crashes per million vehicle miles (MVM). This compares to the statewide average of 3.30 crashes per MVM for similar Minor Arterials in urban areas.



**LEGEND**

-  = Intersection Crashes
-  = Roadway Segment Crashes
- X** = Number of Crashes

Figure 3-2  
**US 14A - Colorado Boulevard**  
**Number of Crashes**  
**2006 - 2009**



## US Highway 14A Corridor Study Including I-90 Exit 14

### **Traffic conditions**

Historic traffic counts were provided by SDDOT within the study area. The most recent average annual daily traffic (AADT) volumes are shown in **Figure 3-3**. These volumes are the adjusted averages for the calendar year. It should be recognized that there will be periods in the peak tourist season when those volumes are considerably higher. The traffic volumes along Colorado Boulevard within the study area are fairly consistent in the range of 7,100-9,750 along the corridor, with the higher numbers on the west end. The traffic volumes drop off sharply east of Heritage Drive.

The highest volume cross street is 27<sup>th</sup> Street north of Colorado Boulevard with over 11,000 vehicles per day (vpd), followed by Heritage Drive (3,130 vpd) and Spearfish Canyon Road (2,635 vpd) on the outer boundaries of the study area.

The 24-hour traffic volumes don't show the complete picture. The most recent (2009) AM and PM peak one hour traffic volumes, also shown in **Figure 3-3**, reveal intersections where there are higher turning movements. The heaviest peak hour movements are at the intersection of 27<sup>th</sup> Street and Colorado Boulevard and include the following:

<u>Direction</u>	<u>Movement</u>	<u>Period</u>	<u>Volume</u>
Eastbound	Left Turns	PM Peak	260
Southbound	Right Turns	PM Peak	254
Southbound	Left Turns	PM Peak	187
Westbound	Right Turns	PM Peak	184
Eastbound	Left Turns	AM Peak	180
Southbound	Right Turns	AM Peak	175
Southbound	Left Turns	AM Peak	130
Westbound	Right Turns	AM Peak	128

It is not unusual to see complementary movements in the opposite direction when comparing turning movements. However, they generally occur in different time periods, for instance a heavy outbound left turn in the AM period and a heavy inbound right turn in the PM period. This would be the case along most commuter routes in larger cities. What is unusual at the 27<sup>th</sup> Street intersection is that both complimentary movements occur during the same peak period.

This reflects the nature of the surrounding commercial area, particularly the influence of the Walmart store on 1<sup>st</sup> Avenue north of I-90 and east of 27<sup>th</sup> Street. Unlike commuter trips, peak commercial trips are more likely to occur to and from a traffic generator in the same period. The *Spearfish Area MTP O/D Survey* conducted in September of 2010 indicated that 9,000-11,000 vehicles per day travel to and from the Walmart store. The study further found that 30% or 2,700-3,300 of those vehicles use Colorado Boulevard as their route to and from the store.

The complementary trips allow the signal timing to be set more efficiently by providing overlaps between the non-conflicting movements. It should be noted that individual turning movements can vary significantly during the peak tourist season, especially in August when some businesses report activity as much as twice the average of the remaining months of the year.

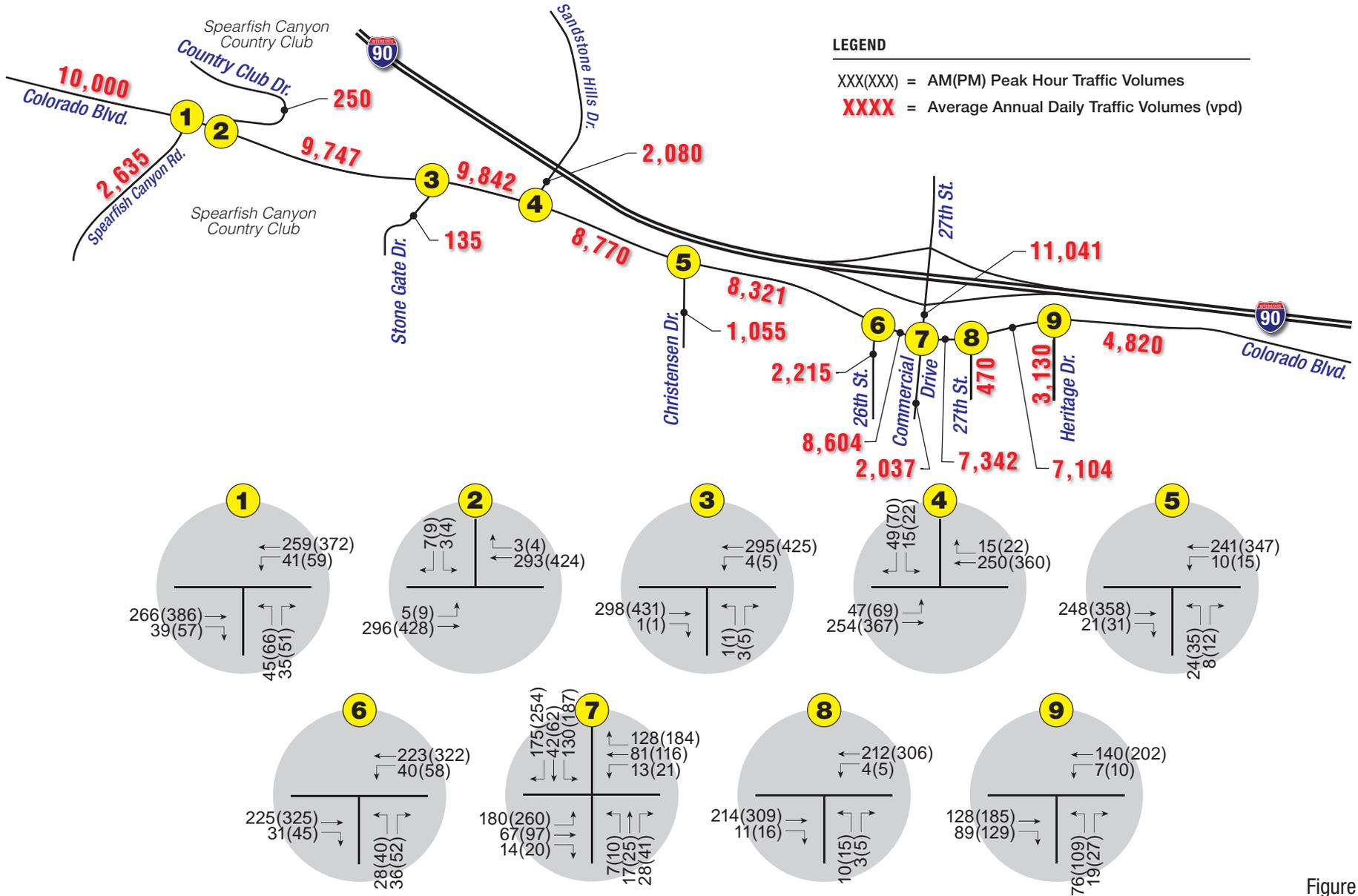


Figure 3-3  
**US 14A - Colorado Boulevard  
 2009 Traffic Volumes**



## US Highway 14A Corridor Study Including I-90 Exit 14

### **Operational Analysis**

Traffic operations at the critical study intersections controlled by either traffic signals or stop signs were analyzed utilizing the Synchro traffic analysis software program. **Figure 3-4** illustrates the lane geometry, traffic control, and the levels of service (LOS) for the 2009 traffic conditions. All of the study intersections operate at acceptable levels of service, LOS C or better, in both the AM and PM peak hours. Capacity analysis worksheets for 2009 traffic conditions are provided as supporting documents to this report (**Appendix C**).

It should again be noted that individual turning movements and delay can vary significantly during the peak tourist season, especially in August when some businesses report activity as much as twice the average of the remaining months of the year.

### **B. Future Conditions**

#### **Spearfish Future Land Use Plan**

Proposed future land use and the future 2035 daily traffic forecast information, available from the *Spearfish Area Master Transportation Plan* (July 2011), was utilized in this study.

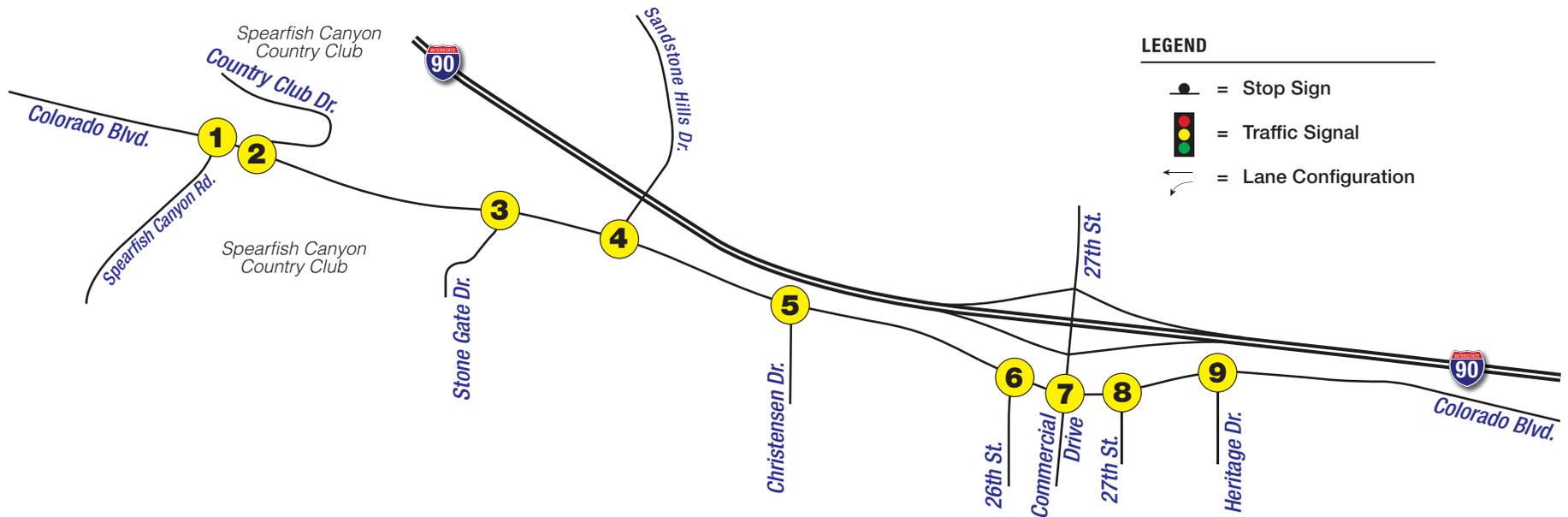
#### **Future Traffic Forecasts/Operations**

The 2035 forecasts are shown in **Figure 3-5**. The resulting average daily traffic volumes along Colorado Boulevard between 27<sup>th</sup> Street and Spearfish Canyon Road are generally in the range of 18,500 to 21,000 vpd, or approximately double the traffic in 2009. Consistent growth and distribution patterns are shown on 27<sup>th</sup> Street, Heritage Drive, Sandstone Hills Drive, Spearfish Canyon Road, and Colorado Boulevard on each end of the study corridor.

The future 24 hour forecasts were converted to peak hour turning movement volumes. The AM and PM peak traffic projections are also shown in **Figure 3-5**. The heaviest peak hour movements are once again at the intersection of 27<sup>th</sup> Street and Colorado Boulevard and include the following:

<u>Direction</u>	<u>Movement</u>	<u>Period</u>	<u>Volume</u>
Eastbound	Left Turns	PM Peak	611
Southbound	Right Turns	PM Peak	606
Southbound	Left Turns	PM Peak	401
Westbound	Right Turns	PM Peak	373
Eastbound	Left Turns	AM Peak	423
Southbound	Right Turns	AM Peak	418
Southbound	Left Turns	AM Peak	278
Westbound	Right Turns	AM Peak	258

As was the case in reviewing the 2009 volumes complimentary movements in the opposite direction are clearly visible when comparing turning movements. This reflects the nature of the surrounding commercial area, particularly the influence of continued growth in the Walmart area north of I-90 and east of 27<sup>th</sup> Street.



**LEGEND**

- = Stop Sign
- = Traffic Signal
- = Lane Configuration

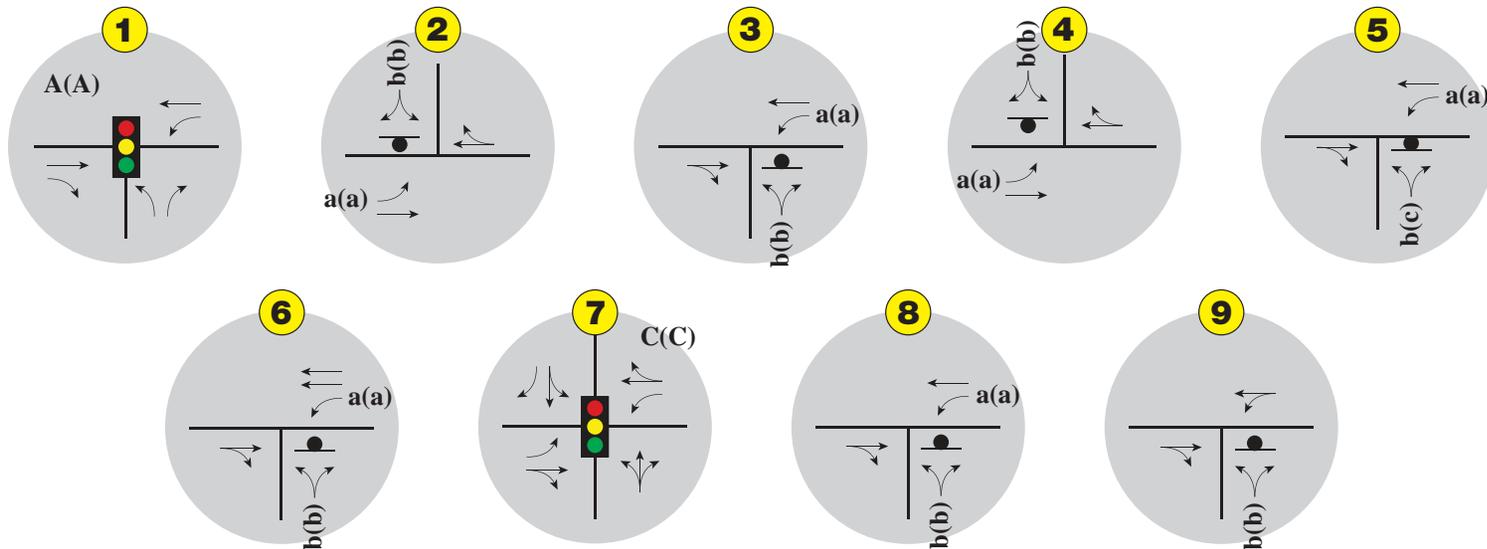


Figure 3-4  
**US 14A - Colorado Boulevard  
 2009 Levels of Service**



**LEGEND**

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes  
 XXXX = Average Annual Daily Traffic Volumes (vpd)

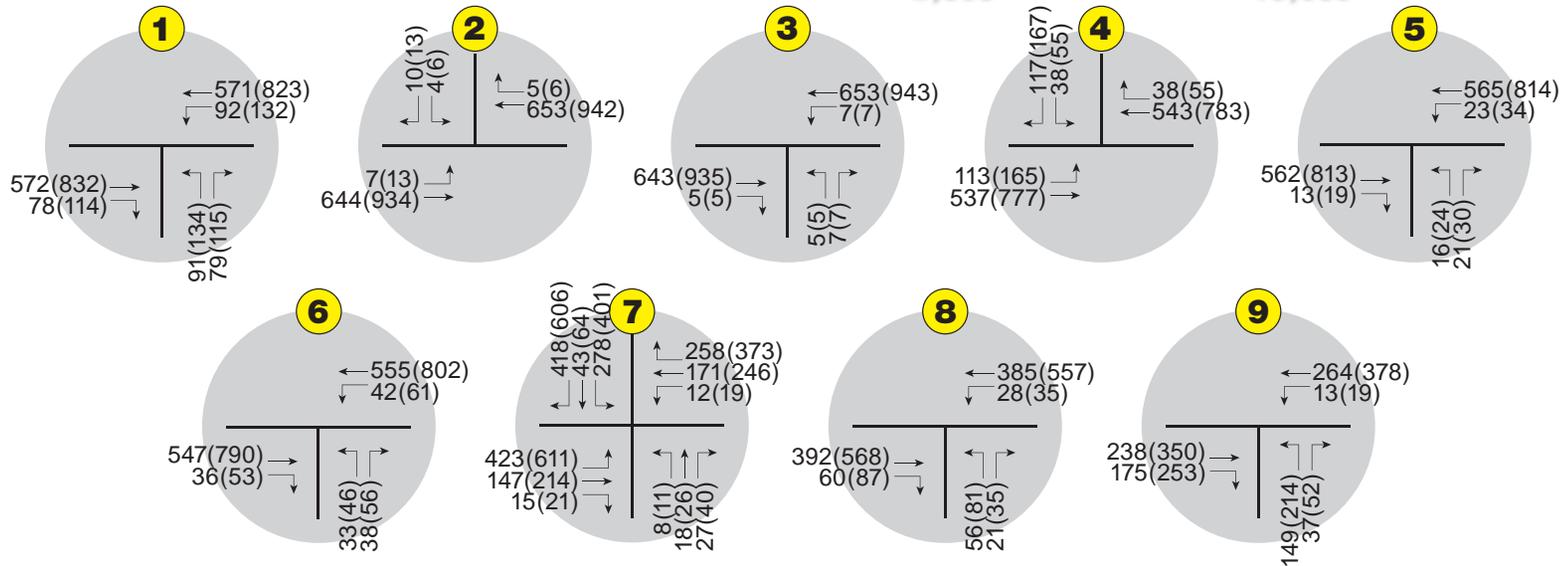
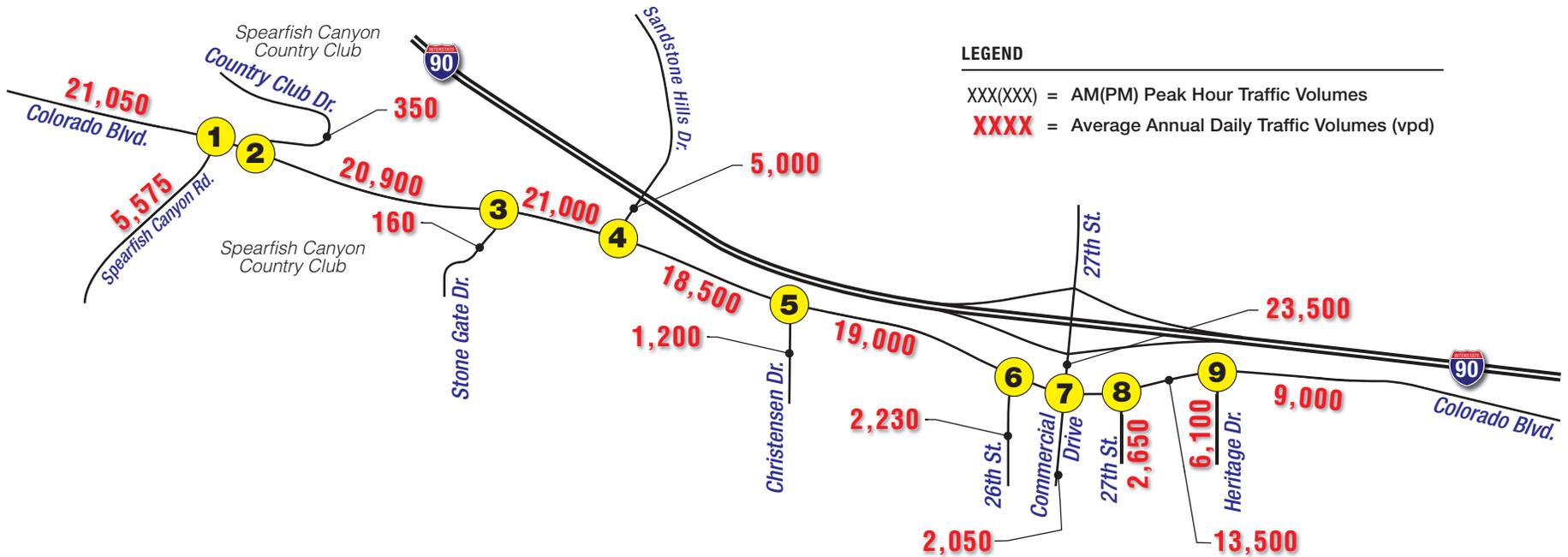


Figure 3-5  
**US 14A - Colorado Boulevard  
 2035 Traffic Forecasts**



## US Highway 14A Corridor Study Including I-90 Exit 14

Other heavier movements are noted at Heritage Drive, eastbound right turns and northbound left turns; as well as the intersection of Sandstone Hills Drive with major turning movements being the eastbound left turn and southbound right turn.

The intersection of Spearfish Canyon Road show several major turning movements including the west bound left turn, the northbound right and left turns, and the eastbound right turn.

The increase turning movements from the south leg of 27<sup>th</sup> Street, although less than some other movements would be a concern given the off-set alignment and short storage between the two legs of 27<sup>th</sup> Street.

It should again be noted that individual turning movements would be expected to vary significantly during the peak tourist season, especially in August.

### **Future Operational Analysis**

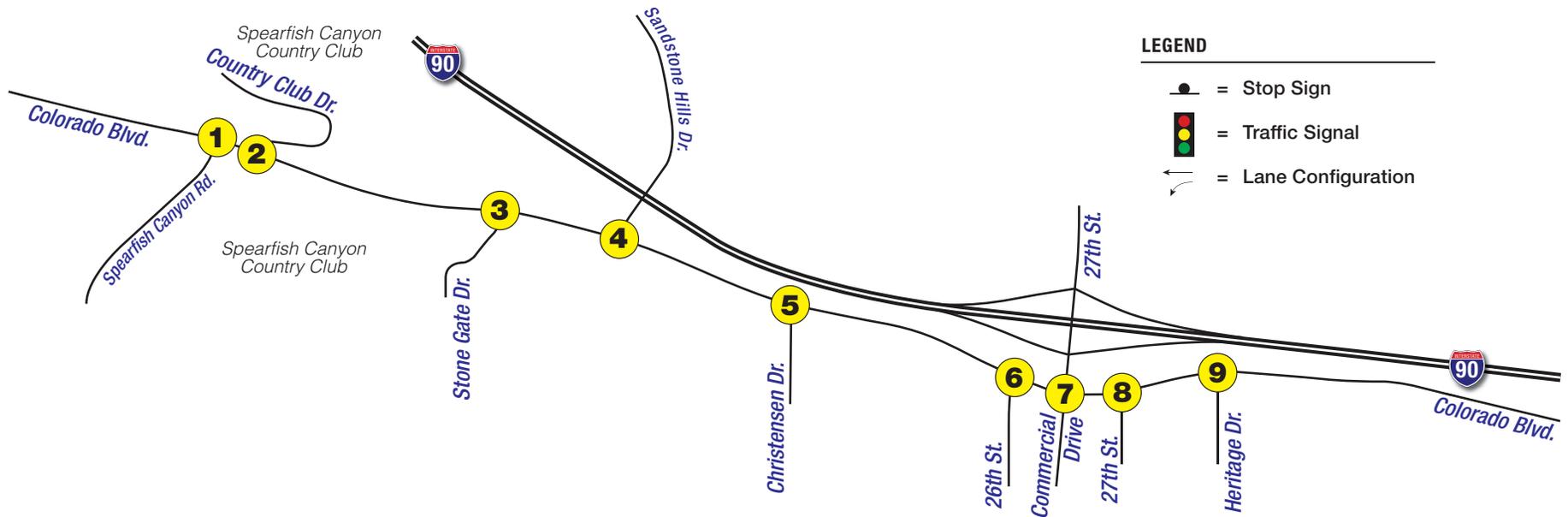
Utilizing the peak hour traffic forecasts for the year 2035, operations at the critical study intersections were analyzed utilizing the Synchro traffic analysis software program. **Figure 3-6** illustrates the lane geometry, traffic control, and the levels of service (LOS) for the 2035 traffic conditions under the No Action option. All of the study intersections operate at acceptable levels of service, LOS C or better, in both the AM and PM peak hours with the exception of the intersection of 27<sup>th</sup> Street and Colorado Boulevard. Individual movements at other stop controlled intersections are also shown to be operating at a poorer level of service.

The intersection of 27<sup>th</sup> Street and Colorado Boulevard is projected to operate at LOS D in the AM peak hour and LOS E in the PM peak hour. The northbound approach along 27<sup>th</sup> Street is also shown to operate at LOS F in the PM peak hour. The projected traffic volumes at this intersection would likely meet the traffic signal warrant thresholds prior to 2035. Given the close spacing of the intersection to the signal on the north leg of 27<sup>th</sup> Street, a second traffic signal would cause more operational problems than it would solve. Since the northbound left turn volume is moderately high (**Figure 3-5**), this movement could not be prohibited as problems developed in the future. It would be most desirable to eliminate the offset in 27<sup>th</sup> Street at Colorado Boulevard, combining the two intersections into one signalized intersection. Alternatives to improve the operations near these intersections were evaluated and would be upgraded as part of the reconstruction of I-90 Exit 14.

The northbound movement of Heritage Drive is shown as LOS F in the PM peak hour. The projected traffic volumes at this intersection would likely meet the warrant thresholds for a traffic signal prior to 2035.

The northbound movement of Christensen Drive is shown as LOS E in the PM peak hour. The projected traffic volumes at this intersection may approach the warrant thresholds for a traffic signal near 2035.

The southbound movement of Sandstone Hills Drive is shown as LOS D in the PM peak hour. The projected traffic volumes at this intersection would likely meet the warrant thresholds for a traffic signal prior to 2035.



**LEGEND**

-  = Stop Sign
-  = Traffic Signal
-  = Lane Configuration

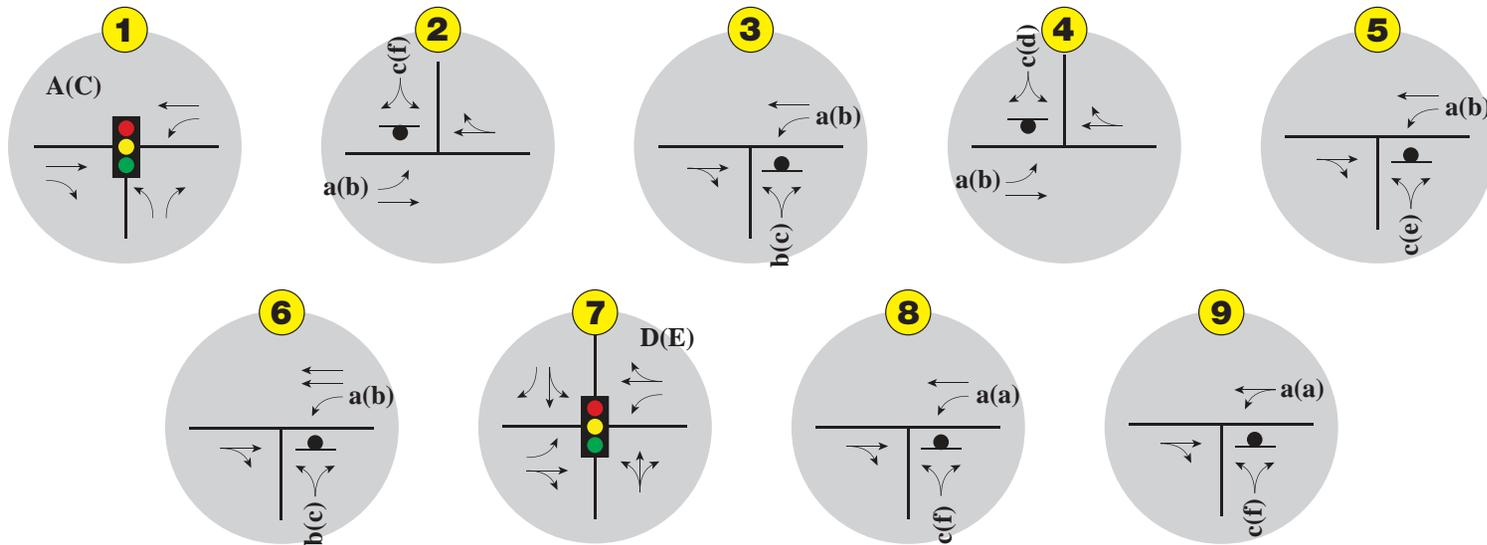


Figure 3-6

**US 14A - Colorado Boulevard  
2035 No-Action Levels of Service**



## US Highway 14A Corridor Study Including I-90 Exit 14

The southbound movement of Country Club Drive at Colorado Boulevard is shown as LOS F in the PM peak hour. This is primarily due to the lack of gaps for left turns given the close spacing of the intersection to Spearfish Canyon Road. Since the southbound left turn volume is only six vehicles (**Figure 3-5**), this minor movement would be prohibited if problems developed in the future.

Capacity analysis worksheets for 2035 traffic conditions are provided as supporting documents in **Appendix C**.

## C. Development of Alternatives

### Parallel Alignment Analysis

One of the tasks identified as part of the US Highway 14A Corridor Study was the analysis of potential parallel roadway corridor to provide an alternate travel route within 3,200 feet of Colorado Boulevard between 27<sup>th</sup> Street and Spearfish Canyon Road. Five distinct alignments (Alternatives A-F) included in **Appendix I** were overlaid on aerial and contour maps, and analyzed.

In examining each of the alternatives it became clear that the terrain south of Colorado Boulevard presents major challenges in attempting to develop a new roadway that would be as direct as Colorado Boulevard. In reviewing the 2035 traffic forecasts it was also apparent that a reasonably direct alternate route (Alternative A) would at most attract and divert 2,000-2,500 vehicles per day. The cost to develop a direct alternate route would also be high due to the amount of cuts and fills that would be necessary.

Other routes that would better fit within the terrain (Alternatives B-E) would add considerable travel distance and would therefore divert fewer trips from the existing alignment of Colorado Boulevard. These routes would provide reasonable alignments for minor arterials and collector streets to be included as development occurs within the area south of Colorado Boulevard. Development of these local streets would avoid directing additional local traffic onto the highway corridor.

Alternate D or Alternate E could be constructed in conjunction with or independent of either Alternate B or C providing some relief for residents of the subdivisions south and east of Exit 14 (Green Acres and Rolling Hills). These residents would have an option to avoid congestion near the intersection of 27<sup>th</sup> Street and Colorado Boulevard when traveling to western parts of Spearfish.

A possible extension of Sandstone Hills Drive was also considered as a means of providing future access to the land south of Colorado Boulevard (Alternative F) at the existing intersection of Colorado Boulevard and Sandstone Hills Drive. The grades in that area would require severe cuts or considerable meandering, similar to Country Club Drive, if a street connection were provided at that location. It is more likely that as land develops in that area it would feed into Christensen Drive, which is capable of handling additional traffic.

These alternatives are offered for further consideration as potential parallel alignments, but a Most Technically Feasible Alternative parallel alignment was not selected in this corridor study effort.



## US Highway 14A Corridor Study Including I-90 Exit 14

### **US 14A / Colorado Boulevard Corridor Alternatives**

Four alternatives were considered for Colorado Boulevard in the future.

**No Action-** The first alternative, the No Action, would assume no reconstruction beyond that occurring as a direct result of the Exit 14 redesign, covered in a separate section of this report. The recent resurfacing of Colorado Boulevard in 2011 and the installation of the traffic signal at Spearfish Canyon Road should extend the life of the remaining portion of Colorado Boulevard 10-15 years into the future.

**Three-Lane with Roundabouts-**The first build alternative (**Appendix J**) that was considered involved retaining Colorado Boulevard as a three-lane roadway along the majority of the roadway except for the Exit 14 environs. Roundabouts would be constructed at each of the major cross streets; Heritage Drive, Christensen Drive, Sandstone Hills Drive, and Spearfish Canyon Road. It anticipated that the construction of each roundabout would not take place at each major intersection until such time as the minimum warrants for a traffic signal, as contained in the latest edition of the MUTCD, were met at that location. At Spearfish Canyon Road the roundabout construction would not occur until such time as the existing traffic signal warranted upgrading.

**Three-Lane with Signals-** The second build alternative (**Appendix J**) would also retain the existing three-lane configuration along most of the Colorado Boulevard corridor. Traffic signals would be constructed at each of the major cross streets; Heritage Drive, Christensen Drive, Sandstone Hills Drive, and Spearfish Canyon Road. It anticipated that the installation of the signals would not take place at each of the intersections until such time as the minimum warrants for a traffic signal, as contained in the latest edition of the MUTCD, were met.

**Four-Lane with Signals-**The third build alternative (**Appendix J**) that was developed and evaluated was a four-lane option with left turn lanes at the major cross streets. This alternative was provided to evaluate the need for long-term preservation of right-of-way and setbacks as development occurs.

**Spearfish Canyon Road Intersection-** A separate alternative, which could be incorporated into any of the above build alternatives, involved the realignment of Spearfish Canyon Road south of Colorado Boulevard as shown on **Figure 3-7**. The goal in developing this concept was to eliminate the off-set between Spearfish Canyon Road and Country Club Drive as well as connect the driving range for the Spearfish Canyon Country Club to the remaining portion of the golf course. This alternative would also include realigning Dahl Road to avoid replacing one off-set alignment with another offset alignment. This alternative was screened from further consideration early in the process since the realignment of Dahl Road would create access issues with the gas station on the northeast corner of the new intersection. This would likely require the acquisition or at least the reorientation of the pump islands in order to mitigate impacts.

Idea dismissed from further consideration due to local development and access impacts and difficulty of construction



Figure 3-7  
**Dahl Road**  
**(Spearfish Canyon Road Realignment Connection)**



## US Highway 14A Corridor Study Including I-90 Exit 14

### Operational Analysis of Alternatives

**No- Build-** The No Build Alternative would result in delays for specific movements as depicted in Figure 3-6 and discussed previously. These delays would be even greater during the peak traffic months of June, July, and particularly August.

**Three-Lane with Roundabouts-** An operational analysis was conducted of the alternative that would add roundabouts at the major intersections as volumes warrant. The software program SIDRA was used to conduct this analysis and the results are depicted in **Figure 3- 8**. All intersections and movements would operate at an acceptable level of service with the exception of the southbound movement at Country Club Drive which remains at LOS F in the PM peak hour. As mentioned previously, this is primarily due to the lack of gaps for left turns given the close spacing of the intersection to Spearfish Canyon Road. Since the southbound left turn

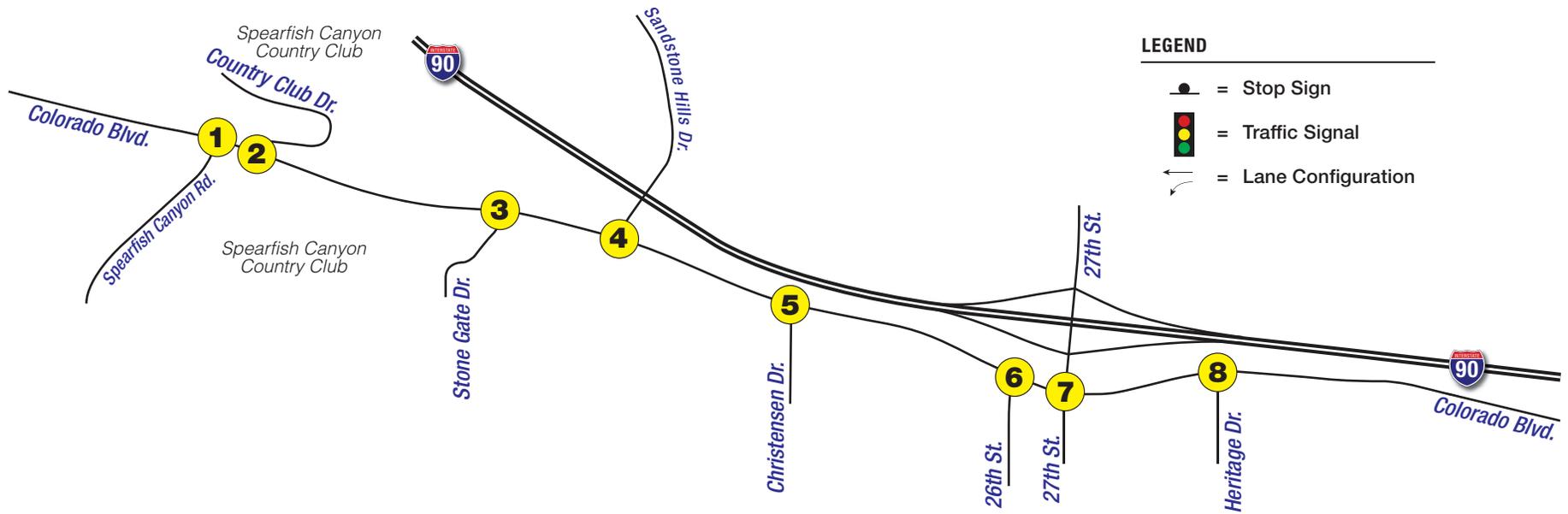


**Large vehicles travel through a roundabout in Edwards, Colorado**

volume is only six vehicles (**Figure 3-5**), this minor movement would be prohibited if problems developed in the future. A roundabout at Spearfish Canyon Road would allow convenient and legal U-turns to be made at that intersection. Properly designed roundabouts allow a variety of vehicle types to operate safely and efficiently in tourist areas experiencing wide fluctuations in traffic volumes without the need to modify signal timing. **Appendix C** provides LOS worksheets.

**Three-Lane with Signals-** An operational analysis was conducted for the three lane alternative with traffic signals installed at the critical intersections of Heritage Drive, Christensen Drive, Sandstone Hills Drive, and Spearfish Canyon Road. It anticipated that the installation of the signals would not take place at each of the intersections until such time as the minimum warrants for a traffic signal, as contained in the latest edition of the MUTCD, were met. The results of the analysis are shown in **Figure 3-9**. All intersections and movements would operate at an acceptable level of service with the exception of the southbound movement at Country Club Drive which remains at LOS F in the PM peak hour. As mentioned previously, this is primarily due to the lack of gaps for left turns given the close spacing of the intersection to Spearfish Canyon Road. This minor movement would be prohibited if problems developed in the future. **Appendix C** provides LOS worksheets.

**Four-Lane with Signals-**The third build alternative, the four-lane option with left turn lanes at the major cross streets, was not analyzed for capacity since the three lane alternatives showed acceptable operation. As mentioned previously, this alternative was provided to evaluate the need for long-term preservation of right-of-way and setbacks as development and not to handle projected traffic volumes. In order for the Colorado Boulevard corridor to handle higher traffic volumes than those evaluated within the 2035 planning horizon, further capacity improvements would be necessary at the intersection of 27<sup>th</sup> Street at Colorado Boulevard before the four-laning of Colorado Boulevard.



**LEGEND**

-  = Stop Sign
-  = Traffic Signal
-  = Lane Configuration

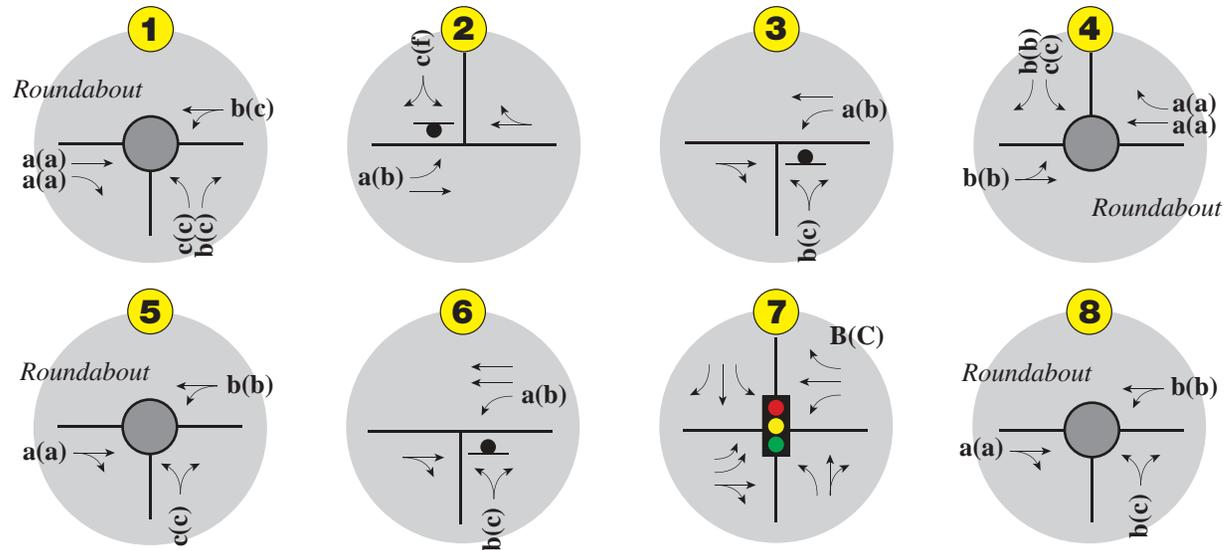
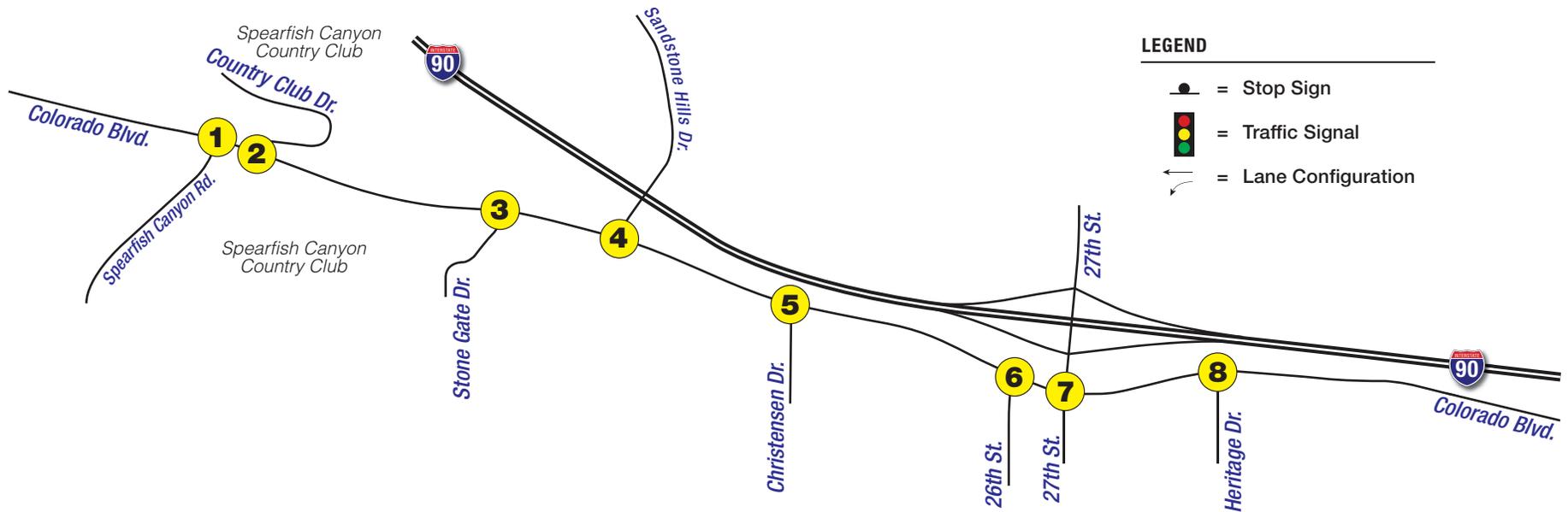


Figure 3-8

**US 14A - Colorado Boulevard  
2035 Levels of Service 3-Lane with Roundabouts**



**LEGEND**

-  = Stop Sign
-  = Traffic Signal
-  = Lane Configuration

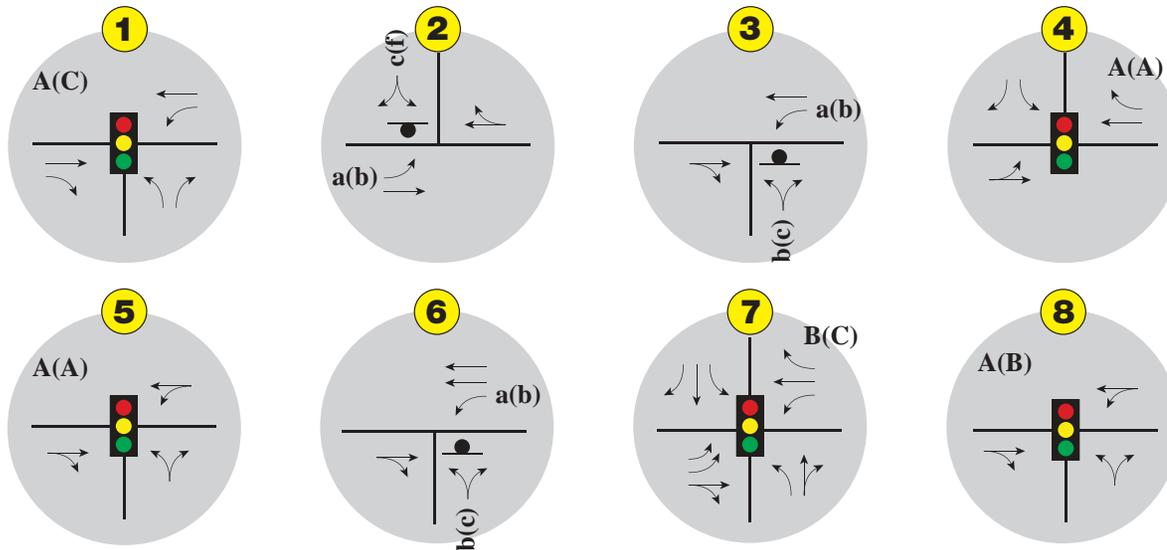


Figure 3-9

**US 14A - Colorado Boulevard  
2035 Levels of Service 3-Lane with Signals**



**US Highway 14A Corridor Study Including I-90 Exit 14**

**D. Screening of Alternatives**

**Screening Criteria and Matrix**

A detailed screening matrix shown below was developed to evaluate the various options for implementing improvements to Colorado Boulevard in the future.

**Table 3-1 Alternative Screening Matrix – Colorado Boulevard**

Alternative	Advantages	Disadvantages
<b>No Action</b>	<ul style="list-style-type: none"> <li>• Lowest construction cost</li> </ul>	<ul style="list-style-type: none"> <li>• Limited traffic capacity with STOP sign control and 2 travel lanes</li> </ul>
<b>3-Lane with Signals</b>	<ul style="list-style-type: none"> <li>• Improved safety and capacity</li> <li>• Minimal right-of-way required</li> <li>• Protected bike/ped crossings</li> </ul>	<ul style="list-style-type: none"> <li>• Higher costs of signal maintenance</li> <li>• Stops and delays for through traffic</li> </ul>
<b>3-Lane with Roundabouts</b>	<ul style="list-style-type: none"> <li>• Improved capacity</li> <li>• Improved safety with less severe crash types</li> <li>• Reduce number of signals</li> <li>• Improved circulation</li> </ul>	<ul style="list-style-type: none"> <li>• Bike/ped crossings more challenging</li> <li>• Likely first Spearfish roundabouts</li> <li>• Some Right-of-way and construction impacts</li> </ul>
<b>4-Lane with Signals</b>	<ul style="list-style-type: none"> <li>• Greatest traffic capacity</li> <li>• Improved safety</li> <li>• Protected bike/ped crossings</li> </ul>	<ul style="list-style-type: none"> <li>• Higher construction and maintenance costs</li> <li>• Utility and Right-of-way Impacts</li> </ul>

The 3-Lane with Roundabouts Alternative rated slightly above the 3-Lane with Traffic signals Alternative. The capacity and safety categories were the primary difference between the alternatives. Roundabouts are becoming increasingly the preferred control at major intersections since there have shown reduced crash experience and dramatic reductions in crash severity. This is primarily due to the design converting the higher speed left turn and right angle conflicts into low speed right turn merge conflicts.

Roundabouts have also demonstrated an ability to handle drastic fluctuations in traffic flows efficiently. This is a particular advantage in areas such as the US 14A Corridor which experiences seasonal variations in traffic. The alternative of relying on traffic signals requires greater monitoring and adjustments in signal timing to allow for the frequent shifts in traffic flows.



## US Highway 14A Corridor Study Including I-90 Exit 14

### E. Colorado Boulevard Implementation Plan

The recommended most technically feasible alternative for future improvements along Colorado Boulevard, beyond those included in the reconstruction of Exit 14, is shown in **Figure 3-10**. It is recommended that the construction of the roundabouts would take place at such time as the minimum warrants for traffic signals, as contained in the latest edition of the MUTCD, are met at each of the critical intersections. At Spearfish Canyon Road the roundabout construction would not occur until such time as the existing traffic signal warranted upgrading.



Figure 3-10  
**US 14A - Colorado Boulevard**  
**Recommended Most Feasible Corridor Alternative**  
**3 Lane with Roundabouts**



## US Highway 14A Corridor Study Including I-90 Exit 14

### 4.0 ACCESS CONTROL AND MANAGEMENT

#### A. US 14A and Exit 14 Environs Access Management

The SDDOT Road Design Manual (Chapters 13 and 17) contains specific criteria to be followed in the design of Interchange and Intermediate Urban Roadways, which is the classification for US 14A from I-90 to a point on Spearfish Canyon Road approximately ½ mile south of Colorado Boulevard. These chapters from the Road Design Manual were applied to the extent possible in the design of the Exit 14 Interchange on I-90 and along the Colorado Boulevard (US 14A) corridor. Input received from area stakeholders, who would be directly impacted from the project, was also weighed in developing access design.

It is important to note that the final access locations and movements will be defined in the design process for the interchange project and corridor. The technical memorandum provided in **Appendix K** summarizes the various access needs and options and provides recommendations for the purposes of this planning study.

#### **General**

The existing and proposed control-of-access locations for the US 14A interchange on I-90 are depicted in **Figure 4-1**. Access points should be limited to those shown on the final concept plans for the US 14A interchange.

The proposed 600-foot spacing south of the interchange between the new Single Point Interchange signal and the Colorado Boulevard signal is less than the minimum 660 feet. Control of Access should be maintained within the entire distance. Control of Access should also be applied to the frontage along Colorado Boulevard within 660-feet of 27<sup>th</sup> Street to maintain desirable operation of the intersection, thus avoiding back-ups and stacking into the Exit 14 interchange.

#### **Access Management Standards**

The SDDOT Road Design Manual has other access standards that are to be applied statewide in designing new roadways and modifications to existing roadways. As the Manual states “establishment and acquisition of control of access should not be confused with access management. Full access intersections and limited access intersections (right-in/right-out) may fall within the length of control of access.”

The access location criteria (Figure 17-1 of the Manual) specify that no access shall be provided on non-interstate routes within 1/8 mile (directional access) or 1/4 mile (full access) of ramp terminals. It does acknowledge that the design within developed areas should use retrofit techniques to improve access as much as possible where strict use of criteria may not be cost effective, and that adjacent properties abutting roadways should be encouraged to share a common approach road connection. *“The smoother traffic flow on the abutting street will help reduce vehicular crashes and increase egress capacity.”*



Figure 4-1  
**Existing and Proposed  
 Control-of-Access**



## US Highway 14A Corridor Study Including I-90 Exit 14

### **Access Management North of Exit 14 Interchange**

The Manual criteria were applied to the extent possible in the design of access points along 27<sup>th</sup> Street between Exit 14 and 1<sup>st</sup> Avenue. The proposed 1100-foot spacing north of the interchange between the new Single Point Interchange signal and the 1<sup>st</sup> Avenue signal meets the minimum spacing of 660 feet, but is less than the desirable spacing 1320 feet between signals.

The existing unsignalized intersection of Platinum Drive meets the minimum spacing for an access from the interchange but does not meet the criteria for signal spacing of 1320 feet (1/4 mile). Control of Access should therefore be applied to the entire frontage of 27<sup>th</sup> Street from the interchange north to 1<sup>st</sup> Avenue, with one opening centered on Platinum Drive that should not be considered for a traffic signal.

**Figure 4-2** shows the recommended configuration with 3/4 movement at Platinum, restricting left turn exits from the west. This concept was presented at the stakeholder and public information meetings on November 15, 2011. Through the public involvement process, the developers of the property west of 27<sup>th</sup> Street indicated their desire to have a full movement access, at least until such time as a street extension can be constructed north of Platinum to Tranquility Lane leading to 27<sup>th</sup> Street, where the Holiday Inn / Conference Center currently has a full movement access.

It is noted that the 27<sup>th</sup> Street and Platinum intersection was projected at Level of Service F in both the AM & PM peak hours by the year 2035 with full movements and stop sign control. A traffic signal would also be undesirable at this location since it would not meet spacing requirements, provide the necessary stacking, or allow signal progression between the interchange and 1<sup>st</sup> Avenue.

The access to the motels on the east side of 27<sup>th</sup> Street, in line with Platinum, was also shown at the public meeting on November 15, 2011 as a directional access with right-in/right-out on 27<sup>th</sup> Street (**Figure 4-2**) and left turn-in/left turn-out on 1<sup>st</sup> Avenue. There is an existing access easement along the south side of the north motel parcel which could be utilized between the motels and the stub right of way south of 1<sup>st</sup> Avenue.

The recommended treatment in **Figure 4-2** would provide reasonable and safe operations to and from the adjoining properties to 2035 and beyond without the need to revisit the access issues in the future, reconstruct 27<sup>th</sup> Street, or reeducate drivers. A cost-sharing should be considered to encourage the extension of Platinum as a public street to Paramount Drive in coordination with the project.



Figure 4-2  
**Recommended Configuration  
27th Street at Platinum Drive**



## US Highway 14A Corridor Study Including I-90 Exit 14

### **Access Management South of Exit 14 Interchange**

The SDDOT Design Manual mentions that reconstruction, which adds a nontraversable median, offers opportunities for encouraging joint access agreements. Cross access easements that permit on-site circulation between adjacent properties decrease the number of vehicle trips that would normally use the abutting roadway. Property owners unable to meet driveway spacing standards should be required to the extent possible to provide joint and cross access easements.

**Figure 4-3** is an expanded plan view of the frontage on the southwest corner of 27<sup>th</sup> Street and Colorado Boulevard. This plan shows the existing access on the south side of Colorado Boulevard in line with existing 27<sup>th</sup> Street closed redirecting access for the Speedy Mart to 26<sup>th</sup> Street. **Figure 4-3** shows the recommended concept plan provide a frontage road along the south side of Colorado Boulevard between 26<sup>th</sup> Street and 27<sup>th</sup> Street. This requires a realignment of Colorado Boulevard to the north in order to facilitate the turning movements and circulation for the convenience store/ filling station.

Access to the Howard Johnson Motel and attached Pizza Ranch would similarly involve the driveway closure on Colorado Boulevard and access focused towards an improved median divided 27<sup>th</sup> Street. The design provides a directional right-in/right-out access at the north end of their parcel and a full movement access in line with 4<sup>th</sup> Avenue.

The connection is not provided between the Howard Johnson and the Speedy Mart to address the concerns of the motel owners, that the truck traffic from the Speedy Mart was not compatible with their operation.

There are two existing access easements providing access to the Speedy Mart and shown in **Figure 4-3** which would need to be modified and / or rescinded.

The access control plan (**Figure 4-1**) would involve the closure of two existing driveways to the car dealer east of 27<sup>th</sup> Street while retaining a third access to the parcel. Observations during the study showed two of the three driveways were frequently blocked by parked display vehicles, evidence that the property can operate with fewer driveways. An access would be maintained on 27<sup>th</sup> Street south of Colorado Boulevard as a right-in / right-out driveway.

### **B. US 14A - Colorado Boulevard Access Management**

U.S. Highway 14A is classified as an Intermediate Urban roadway from the I-90 interchange to Spearfish Canyon Road, and on Spearfish Canyon Road approximately ½ mile south of Colorado Boulevard. The SDDOT access location criteria specifies ½ mile signal spacing, ½ mile between full movement access, ¼ mile between directional access, with 660 feet minimum between unsignalized access spacing. One access per block face right-in/right-out is preferred with denial of direct access whenever other access is available.

Access management should follow the future Colorado Boulevard plans, except where any additional access is acquired as a result of Right of Way acquisition. A draft memorandum of understanding between the City of Spearfish and State of South Dakota Department of Transportation concerning access management along U.S. highway 14A is included in **Appendix K**.



Figure 4-3  
**Recommended Access Management  
 27th Street at Colorado Boulevard**



## US Highway 14A Corridor Study Including I-90 Exit 14

# 5.0 CONCLUSIONS AND RECOMMENDATIONS

## A. Project Purpose

The US Highway 14A Interchange Options and Corridor Study was developed to accomplish the following two primary objectives:

1. Recommend a Most Technically Feasible Alternative for reconstruction of the I-90 / Exit 14 interchange. Funding for the reconstruction effort is currently included in the STIP for FY 2015, and the recommended Most Technically Feasible Alternative is anticipated to advance to the design stage soon after completion of this study.
2. Recommend a Most Technically Feasible Alternative for the US Highway 14A/Colorado Boulevard corridor between Spearfish Canyon Road and Heritage Drive. Most of this roadway surface was repaved in the Year 2011 and would likely be reconstructed when the current paved surface requires replacement, approximately 15-20 years into the future (Year 2025-2035).

The study was completed using a “2-in-1” approach that allowed the project team to blend elements of the study that could be shared such as public and stakeholder meetings while keeping recommendations for the interchange distinct from the US 14A corridor.

## B. Interchange Options Study

Analyses of conditions at the Exit 14 Interchange revealed safety issues, geometric deficiencies, and traffic congestion triggered by future growth. To address these issues, the project team generated 14 potential interchange reconstruction alternatives including the No Action Alternative. A series of evaluation criteria were used to screen the list to four surviving alternatives for final screening. The initial screening step was presented to the public at a public open house, and a series of meetings with project stakeholders was held to gather feedback on and refine the alternatives.

The final screening analysis included detailed evaluation of traffic operations, construction phasing and geometric design for each alternative. Based on this evaluation, Alternative 4, the Single-Point, I-90 Under Shifted Bridge has been selected as the Most Technically Feasible Interchange Alternative.

## C. US Highway 14A Corridor Study

Reconstruction of the US 14A Corridor is not anticipated to occur until the current roadway needs resurfacing, anticipated to occur between 2025 and 2035. The Corridor Study provided an evaluation of existing and future traffic conditions, traffic safety, access and geometrics. Currently, intersection traffic operations along the corridor are acceptable. Future growth to the Year 2035 was shown to increase congestion at some locations, but intersection operations would mostly remain acceptable.



## US Highway 14A Corridor Study Including I-90 Exit 14

Based on an assessment of current and future needs, the project team identified a number of options for addressing those needs with a future reconstruction effort. Alternatives developed for the corridor included different options for intersection traffic control and number of travel lanes. Two build options were developed that would retain the current number of travel lanes and provide either roundabout-type intersections, or, when signal warrants are met, signalized intersections. A third build alternative was identified that would widen the highway to provide 4 travel lanes and provide signalized control at the major intersections.

Based on an evaluation of traffic safety and operations, right-of-way impacts, multimodal accommodation and construction cost, the project team recommends that the US Highway 14A corridor be maintained as a mix of 2, 3, and 4-lane segments and that roundabouts be constructed at each major intersection independently as signal warrants are met at each of the major intersections, or as a group should pavement conditions warrant reconstruction.

In addition to addressing alternatives for US Highway 14A itself, the study included a preliminary evaluation of potential parallel routes along the south side of US 14A. The options are limited by severe topography in the area, but there are several opportunities for a supporting connection to be constructed should resources become available.

### D. Access Management

In support of the recommended alternatives, the project team developed schemes for access control and management surrounding the Exit 14 interchange and along the US Highway 14A corridor. The recommended access configurations are incorporated with the conceptual designs of the recommended alternatives.

It is important to note that the final access locations and movements will be defined in the design process for the interchange project and corridor. A technical memorandum provided in **Appendix K** summarizes the various access needs and options and provides recommendations for the purposes of this planning study.

In addition to the technical memorandum, **Appendix K** includes a draft Memorandum of Understanding (MOU) between the City of Spearfish and State of South Dakota concerning access management along US Highway 14A.