

**APPENDIX E DETAILED-LEVEL SCREENING ANALYSIS**

**STATE HIGHWAY 9 AND U.S. HIGHWAY 6 IMPROVEMENTS  
AT THE  
INTERSTATE 70 SILVERTHORNE/DILLON INTERCHANGE**

**DETAILED-LEVEL SCREENING ANALYSIS**

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**Prepared for:**

Colorado Department of Transportation  
Region 1

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## 1. PROJECT AND REPORT OVERVIEW

The Colorado Department of Transportation (CDOT) began the State Highway 9 (SH 9) and U.S Highway 6 (US 6) Improvement Project at the Silverthorne/Dillon Interchange in early 2010. AECOM, a consulting firm, was hired to assist in the environmental project development and project delivery. The project team composed of CDOT and AECOM staff members has gathered information, developed preliminary interchange improvement alternatives and options, and performed feasibility-level and concept-level screening analysis.

This report builds on the Feasibility and Concept-Level screening processes and presents the findings of the project team's "Detailed-Level Screening Analysis." These evaluation processes were based on the I-70 Mountain Corridor Context Sensitive Solutions (CSS) program's 6-Step Process, which is the starting point for all projects on the I-70 Mountain Corridor.

The 6 Steps are:

### Step 1: Define Desired Outcomes and Actions

Using the CSS Guidance and other relevant materials, this step establishes the project goals and actions. It also defines the terms to be used and decisions to be made.

### Step 2: Endorse the Process

This step establishes participants, roles, and responsibilities for each team. The process is endorsed by discussing, possibly modifying, and then finalizing with all teams the desired outcomes and actions to be taken.

### Step 3: Establish Criteria

This step establishes criteria, which provides the basis for making decisions consistent with the desired outcomes and project goals. The criteria measure support for the Core Values for the I-70 Mountain Corridor.

### Step 4: Develop Alternatives or Options

The Project Staff works with the Project Leadership Team, stakeholders, and the public to identify alternatives or options relevant to the desired outcomes, project-specific vision, and goals.

Step 5: Evaluate, Select, and Refine Alternative or Option

The process of analyzing and evaluating alternatives applies the criteria to the alternatives or options in a way that facilitates decision making. This may be a one-step or multi-step process depending on the complexity of the alternatives and the decision.

Step 6: Finalize Documentation and Evaluate Process

Documentation should be continuous throughout the process. Final documentation will include each of the previous steps, final recommendations, and the process evaluation.

These steps are intended to provide a clear and repeatable process that is fair and understandable. The order of the steps is as important as the activities within each step.

The six CSS steps were implemented in three phases (See Figures 1 and 2):

## Project Evolution – CSS Process

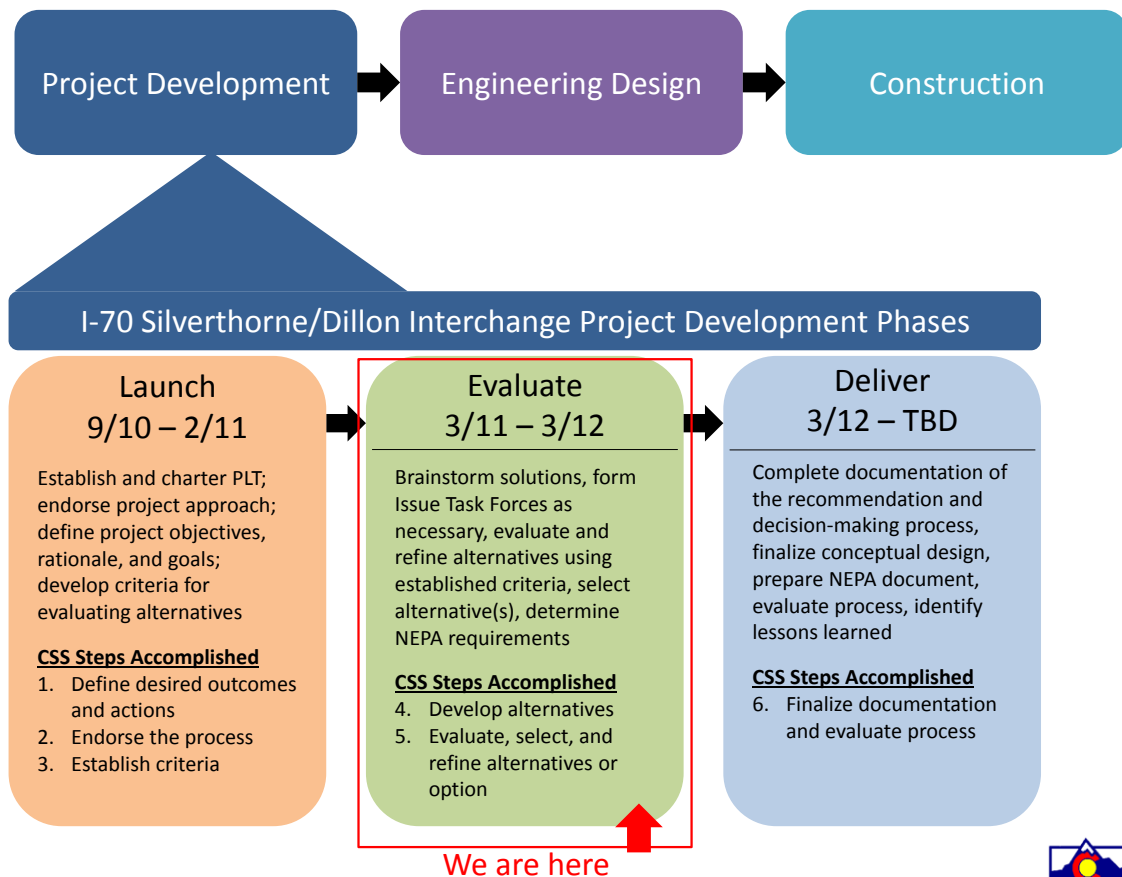
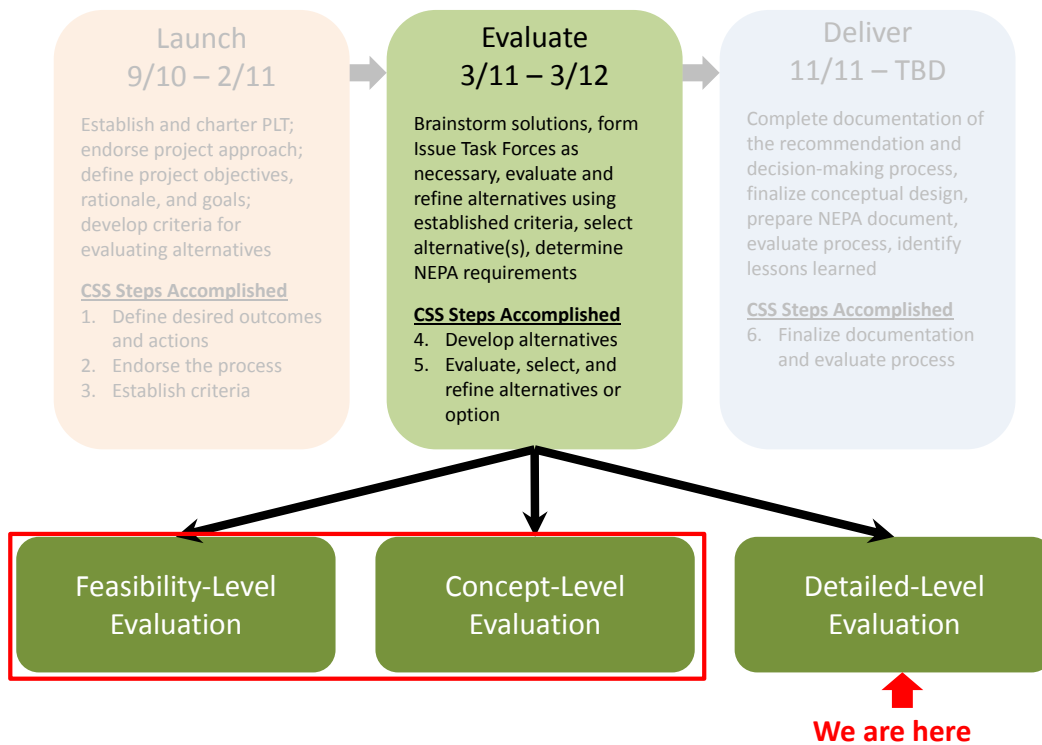


Figure 1 Six CSS Process Steps and the Three Project Phases: Launch, Evaluate and Deliver

## Evaluate Phase



*I-70 Silverthorne/Dillon Interchange Project  
 "Results through Partnerships"*



**Figure 2 Evaluate Phase Description**

After completion of the Feasibility and Conceptual-level Screening process, the project team refined the alternatives and options. Sections 1 and 2 of this report provide project background and describe the alternatives and options that have been considered. Section 3 presents the criteria, comparative evaluations and recommendations. Section 4 presents next steps.

The Public Involvement Process Report, presented in *Appendix F of the PEL Study*, provides an overview of the public involvement process and activities and presents documentation for the primary outreach efforts that were used to support the Purpose and Need, develop and screen alternatives and options through the feasibility and conceptual-level process. These efforts included the involvement of the Project Leadership Team (PLT), public meetings, small group meetings, and project communications



directing participants to the project's website and opportunities to participate. The small group meetings involved public agencies, business community representatives and other stakeholders, and elected officials. Meeting summaries were prepared to clarify key issues addressed at these meetings and the input obtained from the participants.

The members of the PLT include:

Dan Burroughs, Town of Dillon Town Engineer  
Bill Linfield, Silverthorne Public Works Director  
Thad Noll, Summit County Assistant County Manager  
Steve Swanson, Blue River Watershed Group  
Melinda Urban, FHWA, Operations Engineer and Civil Rights Program Manager  
Grant Anderson, P.E., CDOT Region 1 Resident Engineer  
Peter Kozinski, P.E., CDOT Region 1 Program Engineer  
Tyler Weldon, P.E., CDOT Region 1 Project Manager  
Chuck Attardo, CDOT Region 1, Environmental Manager  
R.A. Plummer, P.E, AICP, AECOM  
Alan Eckman, P.E., PTOE, AECOM  
Tom Schilling, Intermountain Corporate Affairs

## **2. ALTERNATIVES AND OPTIONS CONSIDERED**

### **2.1 Plans and Descriptions**

Appendix A presents plan, profile and other preliminary drawings for the interchange Alternatives and Options that moved forward as a result of the Feasibility and Conceptual-Level evaluations and those alternatives that were previously eliminated from further consideration. The drawings for those alternatives and options screening in this evaluation identify the physical engineering requirements to build the alternatives and options, summarize the right of way requirements and provide selected impact analysis details.

Three alternatives are considered in the Detailed-Level analysis:

1. Improved Diamond
2. Single Point Urban Interchange
3. Diverging Diamond

The options considered include:

1. Eastbound Off-Ramp:
  - A - One Way Ramp
  - B - Two Way Frontage Road
2. Westbound On-Ramp:
  - A - Improved Grade
  - B - Improved Grade, Extended Ramp with Access for Wildernest Neighborhood
  - C - Improved Grade and 2-Lane On-ramp over Blue River
3. SH 9/Wildernest Intersection:
  - A – Conventional Intersection Ultimate
  - B – Roundabout Intersection
  - C – Conventional Intersection Interim
4. US 6/Little Beaver Trail Intersection
  - A – Conventional
  - B – Roundabout
5. Advanced Intersection Signal Timing and Equipment

Details about the alternatives and options are provided in Section 3.2.1 and in Appendix A.

In addition, a continuous eastbound auxiliary Lane from Frisco to Silverthorne/Dillon was considered because it was recommended as an early action item in the I-70 Mountain Corridor Final EIS.

## **2.2 Purpose and Need**

The alternatives and options were considered to fully address interchange operations and the project's purpose and need. The following bullets highlight the key needs of the project:

### **SAFETY**

- High crash risks along SH 9 and US 6, particularly at and near intersections.
- Backups onto I-70, particularly from the eastbound off ramp, substantially increase I-70 safety risks and accident rates.
- High speeds and speed differences involving merging interchange ramp traffic and through traffic on I-70 create safety issues and accidents, particularly in association with the eastbound off ramp and westbound on ramp.
- Cycling on local sidewalks along SH 9 and US 6 and evidence of shortcuts across I-70 ramps and lanes creates safety issues despite the presence of the Blue River Trail.

### **CAPACITY**

- The number and density of signalized and unsignalized local access points and turning movements within close proximity to the I-70 interchange ramps causes much of the congestion along SH 9 and US 6 as well as difficulty accessing I-70.
- Skewed intersections, split phase signals and necessary green time for pedestrian movements, particularly at the SH 9/Wilderness intersection, limit through and left turn movement green times, resulting in reduced traffic capacity along SH 9 and US 6.
- Motorists using the westbound off ramp who plan to turn left onto Wilderness at the SH 9/Wilderness intersection are required to weave across two SH 9 through lanes in a short distance.
- The southbound left turn movement from SH 9 to eastbound I-70 has inadequate capacity/storage.
- Motorists using the eastbound off ramp turning right onto US 6 are required to negotiate southbound weaving vehicle movements on US 6 associated with the close proximity of the nearest interchange and intersection immediately to the south.
- Motorists using the westbound on ramp must weave into one lane over a short distance before merging with I-70 westbound traffic. This weave and merge is complicated by a steep grade.

## **MULTIMODAL CONNECTIVITY**

- Existing local bus service and future transit service are important and should not be limited or precluded by future improvement plans.
- Direct access for pedestrians and cyclists under I-70 is limited because some sidewalks and crosswalk transitions are in poor condition and/or are difficult to use in the winter.

The project's purpose and need is presented in *Appendix B of the PEL Study*.

The following discussion provides some important clarifications about the Alternatives and Options and how they relate to each other.

### **2.3 Compatibilities**

Some of the Options are incompatible with certain Alternatives. In summary:

- The Eastbound Off-ramp Option B Two Way Frontage Road is incompatible with the Single Point Urban Interchange.
- The Eastbound Off-ramp Option A One Way Ramp has limited compatibility with the Single Point Urban Interchange.
- The Eastbound Off-ramp Option B Two Way Frontage Road has limited compatibility with the Diverging Diamond interchange.

### **2.4 Construction Limits and the Alternative and Option Comparisons**

In order to create appropriate comparisons between the Alternatives and Options, construction limits for each component needed to be determined. These limits helped to clarify constructions costs and impacts attributable to each Alternative and Option (See Appendix A). The alternatives and options represent possible components of an overall package of improvements that would be constructed in phases over time as funding for each component, or more than one component, becomes available. Each component addresses a portion of the project's purpose and need.

The Alternatives are directly comparable. The options are directly comparable with the following exceptions:

- Westbound On-Ramp Option A (reduced steep ramp grade) is an early phase of Option C which addresses grade in addition to safe merging taper length.
- SH 9/Wilderness Intersection Option C (interim improvement) is an early phase of Option A(the ultimate intersection design)

An interim improvement cannot be directly compared to an ultimate improvement, but there are measurable benefits to building these components.

## **2.5 Improvement Interdependencies**

Phased improvements to existing transportation facilities are often interdependent. The comparative analysis in this report assumes that the Wilderrest improvement would be constructed before or at the same time as the interchange improvements, and that the other improvements could be constructed at any time.

## **2.6 Supplemental Details**

Appendix items B - F provide additional details about the Alternatives and Options in specific technical areas. Appendix items B - F are as follows:

- B. Water Quality Requirements and Improvements
- C. Cost Estimates and Breakdowns
- D. Wetlands Effects Exhibits
- E. Construction Phasing Summary
- F. Traffic Modeling Results

### **3. DETAILED-LEVEL EVALUATION**

The feasibility-level, concept-level and detailed-level criteria used to evaluate alternatives and options were derived from the I-70 Context Sensitive Solutions process developed as part of the I-70 Mountain Corridor EIS process.

#### **3.1 Summary Findings**

The outcome of the screening analysis provides a clear and distinct advantage for one alternative relative to the other two, and justification for specific improvement options to be implemented in concert with the recommended interchange alternative. Based on the evaluation and observations made in Section 3.2.1, the following improvements are recommended:

- Diverging Diamond Intersection, Alternative C
- Westbound On-ramp -Improved Grade, Options A and C\*
- SH 9/Wilderness Intersection, Options A and C\*
- US 6/Little Beaver, Option A, Conventional Intersection

\*The Westbound On Ramp Option A (improved grade) and Option C (improved grade and two-lane on ramp over the Blue River) are related in that Option A provides a phased implementation that allows early action that can later be expanded to include Option C buildout. This offers flexibility to implementation depending on the construction funding available. At the SH 9/Wilderness intersection, Option A is the ultimate buildout design and Option C (interim) is the phased implementation that allows early action that can later be expanded to include Option C buildout.

The rationales for selecting the Diverging Diamond alternative and associated options are described in Section 3.2.2. In summary, the Diverging Diamond resolves many of the issues at the interchange in 2035 and when combined with the selected options fully addresses the project's purpose and need.

#### **3.2 Evaluation and Observations**

The discussions in Section 3.2 support the summary findings made in Section 3.1, compare potential improvement alternatives and options, and provide recommendations for improvements.

### 3.2.1 Description and Evaluation of Alternatives and Options

The following evaluation and observations compare the alternatives and options and provide supporting details. Appendixes B through F provide details and exhibits referenced in the discussions. The discussions address:

- SH 9 and US 6 Improvement Alternatives at the I-70 Interchange
- Interchange Ramp Improvement Options
- SH 9 and US 6 Intersection Improvement Options

The evaluation criteria applied to the project are based on the I-70 Context Sensitive Solutions program criteria adapted for the project by the project team with support from the Project Leadership Team (PLT) and the public. Table 1 clarifies the relationships between the evaluation categories, issues identified by the PLT, and the Detailed-Level Evaluation Criteria applied in the following discussion.

The Detailed-Level criteria were established in March of 2011. The criteria are as follows:

#### *Sustainable Operations Criteria*

Capital Cost  
Life Cycle Costs  
Level of Project Phasing Relative to Available Budget  
Length of Roadway Requiring More Lighting and Maintenance

#### *Safety Criteria*

Number of Traffic Conflict Points (Improvement to High Accident Locations)  
Conflict Points: Bike, Pedestrian and Motor Vehicles  
Effectiveness in Inclement Weather  
Number of Features Resulting in High Maintenance

#### *Healthy Environment Criteria*

Acres of New Right of Way  
Acres of Wetland/Riparian Disruption  
Air Quality: Hours of Delay  
Noise: Number of Sensitive Receptors/Impacts  
Acres of Wildlife Habitat Disruption  
Acres Fisheries Habitat Disruption  
Acres of Wildlife Linkage Zones  
Number of Recreation Resource Impacts, including Section 4(f) and 6(f) Resources

***Historic Context Criteria***

Number of Paleontological Resources  
Number of Archaeological Resources  
Number of Historic Resources

***Communities Criteria***

Support for Economic Investments  
Supported by the Community  
Number of Businesses Impacted  
Number of Business Access Points Hindered/Eliminated  
Number of Homes Impacted  
How Well Are Construction Impacts Minimized?  
Environmental Justice: Equitable or Inequitable Effects

***Mobility and Accessibility Criteria***

Traffic Congestion  
How Much Shorter are Ramp Backups than Existing or No Build Conditions?  
Potential Number of Person Trips on Alternative Modes  
Potential for Enhanced Bicycle/Pedestrian Usage  
How well are Summit Stage/Local Transit Service and Stops Accommodated?

***Aesthetics Criteria***

Support for CSS Aesthetic Guidance

Tables 2 through 7 summarize the evaluation of the alternatives and options.



**Table 1 Relationships between the Evaluation Categories, Issues Identified by the PLT and the Evaluation Criteria Metrics**

<b>EVALUATION CATEGORIES</b>	<b>KEY ISSUES FROM PLT MEETING SEPTEMBER 27, 2011</b>	<b>EVALUATION CRITERIA METRICS</b>
<b>Sustainable Operations</b>	None	<ul style="list-style-type: none"> <li>• Capital Costs</li> <li>• Life Cycle Costs</li> <li>• Level of Project Phasing Relative to Available Budget</li> <li>• Length of New Roadway Requiring More Lighting and Maintenance</li> </ul>
<b>Safety</b>	<ol style="list-style-type: none"> <li>1. Safety</li> <li>2. Incident Management</li> <li>3. Winter – design to include special attention to winter conditions</li> <li>4. Hazardous Materials Transport</li> <li>5. Pedestrians</li> <li>6. Bicycles</li> <li>7. Truck-runaways</li> </ol>	<p>1,2, 7 Number of Improved High Accident Locations</p> <p>1,5,6 Conflict Points Between Bike/Ped and Motor Vehicle Traffic</p> <p>3 Effectiveness in Inclement Weather</p> <p>1 Number of Design Features Requiring Difficult/Unsafe Maintenance</p>
<b>Healthy Environment</b>	<ol style="list-style-type: none"> <li>1. Water Quality</li> <li>2. Wildlife</li> <li>3. Wetland/Riparian: Straight Creek, Blue River</li> <li>4. Protection of Gold Medal Waters – Greenback Cutthroat Trout</li> <li>5. Threatened &amp; Endangered Species</li> <li>6. Noise</li> <li>7. Recreation, Section 4(f) Resources: public parks and wildlife refuges (See Historic Context)</li> <li>8. Land Use (right of way)</li> </ol>	<p>2 Acres of Wildlife Habitat Disruption</p> <p>2 Number of Linkage Interference Zones Impacted</p> <p>3 Acres of Wetland Habitat Disruption</p> <p>4,1 Acres Fisheries Habitat Disruption</p> <p>6 Number of Sensitive Receptors Impacts</p> <p>7 Number of Recreation Resource Impacts, including Section 4(f) and 6(f) Resources</p> <p>8 Acres of New Right of Way</p> <p>6 Delay at Signalized Intersections</p>

EVALUATION CATEGORIES	KEY ISSUES FROM PLT MEETING SEPTEMBER 27, 2011	EVALUATION CRITERIA METRICS
<b>Historic Context</b>	<ol style="list-style-type: none"> <li>1. Section 4(f) Resources: resources on or eligible for the National Register of Historic Places (See Healthy Environment) *</li> </ol>	<ol style="list-style-type: none"> <li>1 Number of Historical Resources <ul style="list-style-type: none"> <li>• Number of Paleontological Resources</li> <li>• Number of Archaeological Resources</li> </ul> </li> </ol>
<b>Communities</b>	<ol style="list-style-type: none"> <li>1. Politics</li> <li>2. Land Use</li> <li>3. Gateway design features</li> <li>4. Access- during construction</li> <li>5. Short Construction Season</li> <li>6. Provide local connectivity and potential local alternate access that may not require driving through the existing interchange intersections (enhanced local access by providing improved/new connections across I-70)</li> </ol>	<ol style="list-style-type: none"> <li>1,2,3 Level of Support Provided to Current and Ongoing Economic Investments</li> <li>2,4 Number of Businesses Impacted</li> <li>2,4,6 Number of Residential Units and Neighborhoods Impacted</li> <li>4,5 Level of Construction Impacts <ul style="list-style-type: none"> <li>• Equity of Effects (Environmental Justice Considerations)</li> </ul> </li> </ol>

EVALUATION CATEGORIES	KEY ISSUES FROM PLT MEETING SEPTEMBER 27, 2011	EVALUATION CRITERIA METRICS
<b>Mobility/ Accessibility</b>	<ol style="list-style-type: none"> <li>1. Congestion/Mobility</li> <li>2. User Diversity (local, regional, state, tourist, trucks, etc.)</li> <li>3. Access – permanent</li> <li>4. Pedestrians and Bicycles</li> <li>5. Transit – local and regional</li> <li>6. Dillon Dam Road</li> <li>7. Impacts to US 6 and SH 9 traffic and local traffic</li> <li>8. Provide local connectivity and potential local alternate access that may not require driving through the existing interchange intersections (enhanced local access by providing improved/new connections across I-70)</li> <li>9. Allowance for/Non Preclusion of Future Transit</li> </ol>	<p>1, 7 LOS ADT for US 6, SH 9 and I-70, Length of Interchange Ramp Backups, travel times</p> <p>3 Number of Access Points Hindered or Eliminated</p> <p>4 Potential for Enhanced Bike/Ped Use</p> <p>5,9 Number of Person Trips on Alternate Modes</p> <p>9 Level that Summit Stage/Local Transit Service is Accommodated</p> <p>2,6 How well does it serve local, regional, freight, and non-local drivers</p>
<b>Aesthetics</b>	<ol style="list-style-type: none"> <li>1. Aesthetics</li> <li>2. View Corridor</li> <li>3. Gateway Design Features</li> </ol>	1,2,3, Level of Support of I-70 CSS Aesthetic Goals and Guidance

\*No resources in the Study Area are on or eligible for inclusion in the National Register of Historic Places

TABLE 2: SUMMARY COMPARISON OF INTERCHANGE ALTERNATIVES	ALT. A	ALT. B	ALT. C
DETAILED-LEVEL EVALUATION CRITERIA	Improved Diamond Interchange	Single Point Urban Interchange	Diverging Diamond Interchange
<b>Sustainable Operations</b>			
Capital costs (\$)	\$12,377,000	\$32,667,000	\$5,411,000
Life-Cycle Costs (High, Moderate, Low)	High	High	Low
Level of Project Phasing Relative to Available Budget (Good, Fair, Poor)	Poor	Poor	Good
Length of Roadway Requiring More Lighting and Maintenance (High, Moderate, Low)	Low	Moderate	Moderate
<b>Safety</b>			
Number of Traffic Conflict Points (Improvement to High Accident Locations)	26	24	14
Number of Conflict Points: Bike, Pedestrian and Motor Vehicles (Bike + Ped)	38	38	24
Effectiveness in Inclement Weather (Good, Fair, Poor)	Fair	Poor	Fair
Number of Features Resulting in High Maintenance (High, Moderate, Low)	Low	Moderate	Low
<b>Healthy Environment</b>			
Acres of New Right of Way	0.45	0.525	0.3
Number of Partial Takes	4	6	4
Number of Full Takes/Business Displacements	0/0	0/0	0/0
Acres of Wetland/Riparian Disruption	0.384	0.428	0.145
Air Quality: Delay (High, Moderate, Low)	Low	Low	Low
Noise: Number of Sensitive Receptors (Locations)/Impacts (High, Moderate, Low)	1/Low	1/Low	1/Low
Acres of Wildlife Habitat Disruption	0.384	0.428	0.145
Acres Fisheries Habitat Disruption (Potential for Indirect or Temporary Effects)	0/Yes	0/Yes	0/Yes
Acres of Wildlife Linkage Zones	0	0	0
Number of Recreation Resource Impacts - Section 4(f) and 6(f) Resources	1	1	1
<b>Historic Context</b>			
Number of Paleontological Resources	1	1	0
Number of Archaeological Resources	0	0	0
Number of Historical Resources	0	0	0
<b>Communities</b>			
Support for Economic Investments (Good, Fair, Poor)	Good	Fair	Good
Supported by the Community (Yes/No/Tentative)	Tentative	Tentative	Tentative
Number of Businesses Impacted (Direct/Indirect)	0/1	0/2	0/1
Number of Business Access Points Hindered/Eliminated	3/0	4/0	3/1
Number of Homes Impacted	0	0	0
How Well Are Construction Impacts Minimized? (Good, Fair, Poor)	Poor	Poor	Good
Environmental Justice: Equitable or Inequitable Effects	Equitable	Equitable	Equitable
<b>Mobility and Accessibility (Vehicle, Bus, Bicycle, Pedestrian)</b>			
Traffic Congestion (Level of Service, Delay and Queuing)	Fair	Fair	Good
Ramp Backups: Queuing Average (EB Off/WB Off, Feet)	600/510	440/510	180/230
Potential Number of Person Trips on Alternative Modes (High, Moderate, Low)	Moderate	Moderate	Moderate
Potential for Enhanced Bicycle/Pedestrian Usage (High, Moderate, Low)	Moderate	Moderate	Moderate
How well are Summit Stage/Local Transit Service and Stops Accommodated? (Good, Fair, Poor)	Good	Good	Good
<b>Aesthetics</b>			
Support for CSS Aesthetic Guidance (Good, Fair, Poor)	Fair	Poor	Good
Green/Bold Text = Best/Favorable result for this evaluation criteria NA = Not Applicable TBD = To Be Determined			

<b>TABLE 3: SUMMARY COMPARISON OF EASTBOUND OFF-RAMP OPTIONS</b>	<b>OPTION A</b>	<b>OPTION B</b>
<b>DETAILED-LEVEL EVALUATION CRITERIA</b>	<b>One Way</b>	<b>Two Way Frontage</b>
<b>Sustainable Operations</b>		
Capital costs (\$)	\$7,831,000	<b>\$4,278,000</b>
Life-Cycle Costs (High, Moderate, Low)	High	<b>Moderate</b>
Level of Project Phasing Relative to Available Budget (Good, Fair, Poor)	Fair	<b>Good</b>
Length of Roadway Requiring More Lighting and Maintenance (High, Moderate, Low)	<b>Moderate</b>	<b>Moderate</b>
<b>Safety</b>		
Number of Traffic Conflict Points (Improvement to High Accident Locations)	<b>4</b>	7
Number of Conflict Points: Bike, Pedestrian and Motor Vehicles (Bike + Ped)	<b>4</b>	13
Effectiveness in Inclement Weather (Good, Fair, Poor)	<b>Fair</b>	<b>Fair</b>
Number of Features Resulting in High Maintenance (High, Moderate, Low)	<b>Moderate</b>	Moderate
<b>Healthy Environment</b>		
Acres of New Right of Way	<b>0.26</b>	1.71
Number of Partial Takes	<b>2 or 3</b>	4 to 5
Number of Full Takes/Business Displacements	<b>0/0</b>	<b>0/0</b>
Acres of Wetland/Riparian Disruption	<b>0.485</b>	0.928
Air Quality: Delay (High, Moderate, Low)	<b>Low</b>	<b>Low</b>
Noise: Number of Sensitive Receptors (Locations)/Impacts (High, Moderate, Low)	<b>1/Low</b>	<b>1/Low</b>
Acres of Wildlife Habitat Disruption	<b>0.485</b>	0.928
Acres Fisheries Habitat Disruption (Potential for Indirect or Temporary Effects)	<b>0.485</b>	0.928
Acres of Wildlife Linkage Zones	<b>0</b>	<b>0</b>
Number of Recreation Resource Impacts - Section 4(f) and 6(f) Resources	<b>1</b>	<b>1 Fatal Flaw</b>
<b>Historic Context</b>		
Number of Paleontological Resources	1	1
Number of Archaeological Resources	<b>0</b>	<b>0</b>
Number of Historical Resources	<b>0</b>	<b>0</b>
<b>Communities</b>		
Support for Economic Investments (Good, Fair, Poor)	<b>Good</b>	<b>Good</b>
Supported by the Community (Yes/No/Tentative)	<b>Tentative</b>	<b>Tentative</b>
Number of Businesses Impacted (Direct/Indirect)	<b>0</b>	1
Number of Business Access Points Hindered/Eliminated	<b>0/0</b>	<b>0/0</b>
Number of Homes Impacted	<b>0</b>	<b>0</b>
How Well Are Construction Impacts Minimized? (Good, Fair, Poor)	<b>Fair</b>	Poor
Environmental Justice: Equitable or Inequitable Effects	<b>Equitable</b>	<b>Equitable</b>
<b>Mobility and Accessibility (Vehicle, Bus, Bicycle, Pedestrian)</b>		
Traffic Congestion (Level of Service, Delay and Queuing)	<b>Fair</b>	<b>Fair</b>
Ramp Backups: Queuing Average (EB Off/WB Off, Feet)	<b>200/180</b>	<b>200/180</b>
Potential Number of Person Trips on Alternative Modes (High, Moderate, Low)	<b>NA</b>	<b>NA</b>
Potential for Enhanced Bicycle/Pedestrian Usage (High, Moderate, Low)	<b>Moderate</b>	Low
How well are Summit Stage/Local Transit Service and Stops Accommodated? (Good, Fair, Poor)	<b>Fair</b>	<b>Fair</b>
<b>Aesthetics</b>		
Support for CSS Aesthetic Guidance (Good, Fair, Poor)	<b>Fair</b>	<b>Fair</b>
<b>Green/Bold Text = Best/Favorable result for this evaluation criteria</b>		
NA = Not Applicable TBD = To Be Determined		

TABLE 4: SUMMARY COMPARISON OF WESTBOUND ON-RAMP OPTIONS	OPTION A	OPTION B	OPTION C
<b>DETAILED-LEVEL EVALUATION CRITERIA</b>	<b>Improved Grade</b>	<b>Extended Ramp with Direct Access for Wildernest</b>	<b>Improved Grade and 2-Lane On-Ramp</b>
<b>Sustainable Operations</b>			
Capital costs (\$)	<b>\$821,000</b>	\$11,212,000	<b>\$5,900,000</b>
Life-Cycle Costs (High, Moderate, Low)	<b>Low</b>	<b>High</b>	<b>High</b>
Level of Project Phasing Relative to Available Budget (Good, Fair, Poor)	<b>Good</b>	Poor	<b>Fair</b>
Length of Roadway Requiring More Lighting and Maintenance (High, Moderate, Low)	<b>Low</b>	<b>Moderate</b>	<b>Moderate</b>
<b>Safety</b>			
Number of Traffic Conflict Points (Improvement to High Accident Locations)	0	3	0
Number of Conflict Points: Bike, Pedestrian and Motor Vehicles (Bike + Ped)	0	5	0
Effectiveness in Inclement Weather (Good, Fair, Poor)	<b>Good</b>	<b>Good</b>	<b>Good</b>
Number of Features Resulting in High Maintenance (High, Moderate, Low)	<b>Low</b>	<b>High</b>	<b>High</b>
<b>Healthy Environment</b>			
Acres of New Right of Way	0	0.42	0
Number of Partial Takes	0	2	0
Number of Full Takes/Business Displacements	0/0	0/0	0/0
Acres of Wetland/Riparian Disruption	0	0.13	0.03
Air Quality: Delay (High, Moderate, Low)	<b>Low</b>	<b>Low</b>	<b>Low</b>
Noise: Number of Sensitive Receptors (Locations)/Impacts (High, Moderate, Low)	0/Low	13/Low	1/Low
Acres of Wildlife Habitat Disruption	0	0.13	0.03
Acres Fisheries Habitat Disruption (Potential for Indirect or Temporary Effects)	0	0.13	0.03
Acres of Wildlife Linkage Zones	0	0	0
Number of Recreation Resource Impacts - Section 4(f) and 6(f) Resources	0	1	1
<b>Historic Context</b>			
Number of Paleontological Resources	0	0	0
Number of Archaeological Resources	0	0	0
Number of Historical Resources	0	0	0
<b>Communities</b>			
Support for Economic Investments (Good, Fair, Poor)	Fair	<b>Good</b>	Fair
Supported by the Community (Yes/No/Tentative)	<b>Tentative</b>	<b>Tentative</b>	<b>Tentative</b>
Number of Businesses Impacted (Direct/Indirect)	0	0	0
Number of Business Access Points Hindered/Eliminated	0/0	0/0	0/0
Number of Homes Impacted	0	0	0
How Well Are Construction Impacts Minimized? (Good, Fair, Poor)	<b>Good</b>	Poor	<b>Fair</b>
Environmental Justice: Equitable or Inequitable Effects	<b>Equitable</b>	<b>Equitable</b>	<b>Equitable</b>
<b>Mobility and Accessibility (Vehicle, Bus, Bicycle, Pedestrian)</b>			
Traffic Congestion (Delay )	<b>Fair</b>	Good	<b>Fair</b>
Ramp Backups: Queuing Average (EB Off/WB Off, Feet)	<b>NA</b>	<b>NA</b>	<b>NA</b>
Potential Number of Person Trips on Alternative Modes (High, Moderate, Low)	<b>Moderate</b>	<b>Moderate</b>	<b>Moderate</b>
Potential for Enhanced Bicycle/Pedestrian Usage (High, Moderate, Low)	<b>Moderate</b>	<b>Moderate</b>	<b>Moderate</b>
How well are Summit Stage/Local Transit Service and Stops Accommodated? (Good, Fair Poor)	<b>Good</b>	<b>Good</b>	<b>Good</b>
<b>Aesthetics</b>			
Support for CSS Aesthetic Guidance (Good, Fair, Poor)	Fair	<b>Good</b>	<b>Good</b>
Green/Bold Text = Best/Favorable result for this evaluation criteria Options B and C are comparable. Option A is a phase of Option C.	NA = Not Applicable		

TABLE 5: SUMMARY COMPARISON OF SH 9/WILDERNEST OPTIONS	OPTION A	OPTION B	OPTION C
DETAILED-LEVEL EVALUATION CRITERIA	SH 9/ Wilderness Conventional Intersection Ultimate	SH 9/ Wilderness Intersection Roundabout	SH 9/ Wilderness Conventional Intersection Interim
<b>Sustainable Operations</b>			
Capital costs (\$)	\$1,949,000	\$2,404,000	\$368,000
Life-Cycle Costs (High, Moderate, Low)	Moderate	Moderate	Low
Level of Project Phasing Relative to Available Budget (Good, Fair, Poor)	Fair	Fair	Good
Length of Roadway Requiring More Lighting and Maintenance (High, Moderate, Low)	Moderate	High	Low
<b>Safety</b>			
Number of Traffic Conflict Points (Improvement to High Accident Locations)	64*	16*	60*
Number of Conflict Points: Bike, Pedestrian and Motor Vehicles (Bike + Ped)	100*	36*	94*
Effectiveness in Inclement Weather (Good, Fair, Poor)	Good	Good	Good
Number of Features Resulting in High Maintenance (High, Moderate, Low)	Low	Moderate	Low
<b>Healthy Environment</b>			
Acres of New Right of Way	0.43	1.00	0.07
Number of Partial Takes	4	4	1
Number of Full Takes/Business Displacements	0/0	4/8	0/0
Acres of Wetland/Riparian Disruption	0	0	0
Air Quality: Delay (High, Moderate, Low)	Low	Low	Low
Noise: Number of Sensitive Receptors (Locations)/Impacts (High, Moderate, Low)	1/Low	1/Low	1/Low
Acres of Wildlife Habitat Disruption	0	0	0
Acres Fisheries Habitat Disruption (Potential for Indirect or Temporary Effects)	0	0	0
Acres of Wildlife Linkage Zones	0	0	0
Number of Recreation Resource Impacts - Section 4(f) and 6(f) Resources	0	1	0
<b>Historic Context</b>			
Number of Paleontological Resources	0	0	0
Number of Archaeological Resources	0	0	0
Number of Historical Resources	0	0	0
<b>Communities</b>			
Support for Economic Investments (Good, Fair, Poor)	Fair	Poor	Good
Supported by the Community (Yes/No/Tentative)	Tentative	Tentative	Tentative
Number of Businesses Impacted (Direct/Indirect)	8/8	11/11	1-Jan
Number of Business Access Points Hindered/Eliminated	3/1	0/5	0/0
Number of Homes Impacted	0	0	0
How Well Are Construction Impacts Minimized? (Good, Fair, Poor)	Fair	Poor	Good
Environmental Justice: Equitable or Inequitable Effects	Equitable	Equitable	Equitable
<b>Mobility and Accessibility (Vehicle, Bus, Bicycle, Pedestrian)</b>			
Traffic Congestion (Level of Service, Delay and Queuing)	Good	Poor	Fair
Ramp Backups: Queuing Average (EB Off/WB Off, Feet)	NA	NA	NA
Potential Number of Person Trips on Alternative Modes (High, Moderate, Low)	Moderate	Moderate	Moderate
Potential for Enhanced Bicycle/Pedestrian Usage (High, Moderate, Low)	High	Moderate	High
How well are Summit Stage/Local Transit Service and Stops Accommodated? (Good, Fair Poor)	Moderate	Moderate	Moderate
<b>Aesthetics</b>			
Support for CSS Aesthetic Guidance (Good, Fair, Poor)	Good	Good	Good
Green/Bold Text = Best/Favorable result for this evaluation criteria Options A and B are comparable. Option C is a phase of Option A	NA = Not Applicable	*See Other Contributing Factors	

TABLE 6: SUMMARY COMPARISON OF US 6/LITTLE BEAVER OPTIONS	OPTION A	OPTION B
DETAILED-LEVEL EVALUATION CRITERIA	Conventional	Roundabout
<b>Sustainable Operations</b>		
Capital costs (\$)	TBD - MINOR	\$3,999,000
Life-Cycle Costs (High, Moderate, Low)	Low	High
Level of Project Phasing Relative to Available Budget (Good, Fair, Poor)	Good	Poor
Length of Roadway Requiring More Lighting and Maintenance (High, Moderate, Low)	Low	High
<b>Safety</b>		
Number of Traffic Conflict Points (Improvement to High Accident Locations)	56*	14*
Number of Conflict Points: Bike, Pedestrian and Motor Vehicles (Bike + Ped)	91*	27*
Effectiveness in Inclement Weather (Good, Fair, Poor)	Good	Fair
Number of Features Resulting in High Maintenance (High, Moderate, Low)	Low	Moderate
<b>Healthy Environment</b>		
Acres of New Right of Way	0	1.59
Number of Partial Takes	0	4
Number of Full Takes/Business Displacements	0/0	0/1
Acres of Wetland/Riparian Disruption	0	0
Air Quality: Delay (High, Moderate, Low)	Low	Low
Noise: Number of Sensitive Receptors (Locations)/Impacts (High, Moderate, Low)	0/Low	0/Low
Acres of Wildlife Habitat Disruption	0	0
Acres Fisheries Habitat Disruption (Potential for Indirect or Temporary Effects)	0	0
Acres of Wildlife Linkage Zones	0	0
Number of Recreation Resource Impacts - Section 4(f) and 6(f) Resources	0	0
<b>Historic Context</b>		
Number of Paleontological Resources	0	1
Number of Archaeological Resources	0	0
Number of Historical Resources	0	0
<b>Communities</b>		
Support for Economic Investments (Good, Fair, Poor)	Fair	Fair
Supported by the Community (Yes/No/Tentative)	Tentative	Tentative
Number of Businesses Impacted (Direct/Indirect)	0	1
Number of Business Access Points Hindered/Eliminated	0/0	4/2
Number of Homes Impacted	0	0
How Well Are Construction Impacts Minimized? (Good, Fair, Poor)	Good	Poor
Environmental Justice: Equitable or Inequitable Effects	Equitable	Equitable
<b>Mobility and Accessibility (Vehicle, Bus, Bicycle, Pedestrian)</b>		
Traffic Congestion (Level of Service and Delay)	Good	Poor
Ramp Backups: Queuing Average (EB Off/WB Off, Feet)	NA	NA
Potential Number of Person Trips on Alternative Modes (High, Moderate, Low)	Moderate	Moderate
Potential for Enhanced Bicycle/Pedestrian Usage (High, Moderate, Low)	High	Moderate
How well are Summit Stage/Local Transit Service and Stops Accommodated? (Good, Fair, Poor)	Moderate	Moderate
<b>Aesthetics</b>		
Support for CSS Aesthetic Guidance (Good, Fair, Poor)	NA	Good
<p><b>Green</b> Text = Best/Favorable result for this evaluation criteria</p> <p>NA = Not Applicable TBD = To Be Determined</p> <p>* See other contributing factors in the discussion.</p>		



<b>TABLE 7: ADVANCED SIGNAL TIMING AND AUXILIARY LANE SUMMARY</b>		
<b>DETAILED-LEVEL EVALUATION CRITERIA</b>	<b>Advanced Signal Timing</b>	<b>Auxiliary Lane</b>
<b>Sustainable Operations</b>		
Capital costs (\$)	\$250,000	TBD
Life-Cycle Costs (High, Moderate, Low)	Low	Moderate
Level of Project Phasing Relative to Available Budget (Good, Fair, Poor)	Good	Fair
Length of Roadway Requiring More Lighting and Maintenance (High, Moderate, Low)	NA	High
<b>Safety</b>		
Number of Traffic Conflict Points (Improvement to High Accident Locations)	NA	0
Number of Conflict Points: Bike, Pedestrian and Motor Vehicles (Bike + Ped)	NA	0
Effectiveness in Inclement Weather (Good, Fair, Poor)	Good	Fair
Number of Features Resulting in High Maintenance (High, Moderate, Low)	Low	Moderate
<b>Healthy Environment</b>		
Acres of New Right of Way	0	TBD
Number of Partial Takes	0	TBD
Number of Full Takes/Business Displacements	0/0	0/0
Acres of Wetland/Riparian Disruption	0	TBD
Air Quality: Delay (High, Moderate, Low)	Low	Low
Noise: Number of Sensitive Receptors (Locations)/Impacts (High, Moderate, Low)	NA	29/Low
Acres of Wildlife Habitat Disruption	0	TBD
Acres Fisheries Habitat Disruption (Potential for Indirect or Temporary Effects)	0	0/Low
Acres of Wildlife Linkage Zones	0	0
Number of Recreation Resource Impacts - Section 4(f) and 6(f) Resources	0	0
<b>Historic Context</b>		
Number of Paleontological Resources	0	1
Number of Archaeological Resources	0	0
Number of Historical Resources	0	0
<b>Communities</b>		
Support for Economic Investments (Good, Fair, Poor)	NA	NA
Supported by the Community (Yes/No/Tentative)	Tentative	Tentative
Number of Businesses Impacted (Direct/Indirect)	0/0	0/0
Number of Business Access Points Hindered/Eliminated	0/0	0/0
Number of Homes Impacted	0	0
How Well Are Construction Impacts Minimized? (Good, Fair, Poor)	Good	Fair
Environmental Justice: Equitable or Inequitable Effects	Equitable	Equitable
<b>Mobility and Accessibility (Vehicle, Bus, Bicycle, Pedestrian)</b>		
Traffic Congestion (Level of Service, Delay and Queuing)	Good	Good
Ramp Backups: Queuing Average (EB Off/WB Off, Feet)	NA	0
Potential Number of Person Trips on Alternative Modes (High, Moderate, Low)	NA	NA
Potential for Enhanced Bicycle/Pedestrian Usage (High, Moderate, Low)	NA	NA
How well are Summit Stage/Local Transit Service and Stops Accommodated? (Good, Fair Poor)	NA	NA
<b>Aesthetics</b>		
Support for CSS Aesthetic Guidance (Good, Fair, Poor)	NA	Fair

NA = Not Applicable TBD = To Be Determined

## **INTERCHANGE ALTERNATIVES**

Three interchange alternatives were evaluated:

- A – Improved Diamond Interchange
- B – Single Point Urban Interchange (SPUI)
- C – Diverging Diamond Interchange (DDI)

### **Description**

#### **A – Improved Diamond Interchange**

The Improved Diamond interchange alternative maintains the existing interchange design type. This requires widening US 6 and SH 9 to provide double left turn lanes onto the interstate in both directions, removing the existing I-70 bridge, and building a new 464 foot long bridge using a “four pre-stressed box girder” design. The new bridge would be 60 feet wider than the existing bridge allowing for three through lanes in each direction on I-70. The replacement of the existing bridges would likely be done under staged construction (See Appendix E). A buffer zone would be provided between the curb and gutter and the relocated 10 foot sidewalk. Pedestrian movements would be similar to existing conditions.

#### **B – Single Point Urban Interchange (SPUI)**

The Single Point Urban Interchange would change the existing interchange type by replacing two primary traffic signals with one signal in the middle of the interchange under the I-70 bridge. The new signal would control all turn and through movements. To provide sufficient space for the SPUI, the I-70 bridge would be removed and a larger bridge would be constructed. Five structure types were evaluated for the I-70 bridge. The only feasible solution involves a 435 foot long cable stayed bridge. Pedestrian movements will be similar to what exists now and a 10 feet or more buffer zone is provided between the US 6/SH 9 mainline and the relocated sidewalk.

The I-70 Silverthorne/Dillon interchange is not an ideal location for a SPUI, since they are not recommended where roadway skews are less than 60 degrees. The skew at this interchange is closer to 34 degrees. The large skew results in a long I-70 structure and extended periods needed to clear the intersection between conflicting signal phases. The extended clearance times resulting from the skew angle reduce the efficiency of this type of interchange at this location.

An advantage of the SPUI is that the relocated ramp from westbound I-70 to SH 9 provides an additional 150 feet for the weave and storage for left turns from SH 9 to Wildernest Road. This design feature would delay the need to improve the Wildernest/SH 9 intersection. A disadvantage of the SPUI is that it does not allow straight through movements from the eastbound off-ramp to the eastbound on-ramp.

## **C – Diverging Diamond Interchange (DDI)**

The Diverging Diamond, or also known as the Double Crossover Diamond, is an innovative interchange design. The Diverging Diamond is particularly advantageous in situations of heavy left-turn and through volumes on the crossroad. The Diverging Diamond concept involves having opposing traffic switches sides of the road through the interchange area between the interchange ramps. This allows free flow left hand turns onto I-70, which eliminates the left turn signal phase. The signal –controlled crossovers operate in two-phase compared to conventional three-phase in a convention diamond. Eliminating this signal phase allows more green time for through movements on US 6/SH 9, thereby increasing its capacity.

A Diverging Diamond design allows the through and left turn to be combined under the bridge structure thus allowing the existing bridge to remain. The advantage of this alternative is the low cost, since there is ample service life remaining on the I-70 bridges. These bridges are rated 89 out of 100, so they do not need to be replaced at this time.

The Town of Silverthorne has requested a new color for the paint on the outside girders of the existing bridge. The new paint would be included as part of this alternative. The color would be selected in the future in accordance with the I-70 Crest of the Rockies aesthetics guidance.

The Diverging Diamond provides access to businesses on either side of the interchange with fewer weaving conflicts. One disadvantage is that the Diverging Diamond does not allow straight through movements from the eastbound off-ramp to the eastbound on-ramp.

One concern with this alternative is the unusual movements through the intersection may be somewhat confusing for a location that has a high level of tourist traffic. The design includes increased signing, specific geometry, and simple channelization techniques such as tall glare screens to guide travelers. The movements are quite intuitive through the crossover. This design is viable for skew angles from 90 to 34 degrees.

Cyclists traveling north and south under the existing bridge would use vehicle lanes and/or share the 10 foot sidewalks between the traffic signals with pedestrians as shown in Appendix A. The Blue River Trail would also be available to pedestrians and cyclists. Appendix A also shows a separate configuration with five to six foot bike lanes in both directions alongside the north and southbound travel lanes. This separate configuration would fit under the bridge, but would require additional right of way and add environmental impacts.

Note:

These interchange improvements would need to be constructed after or at the same time as the SH 9/Wilderness improvements to achieve the traffic performance presented in this discussion (See Appendix F).

## **Detailed-Level Evaluation**

### ***Sustainable Operations Criteria***

#### **Capital Cost**

The capital cost for the interchange alternatives has been estimated as follows:

Alternative A – Improved Diamond:	\$12,377,000
Alternative B – SPUI:	\$32,667,000
Alternative C – Diverging Diamond:	\$ 5,411,000

Cost estimate details are provided in Appendix C.

#### **Life Cycle Costs**

The assessment of the relative differences between the life cycle costs of the interchange alternatives is based primarily on the long-term maintenance and replacement costs of the planned improvements. The alternatives with the highest square footage of new bridge and pavement are projected to have higher life cycle costs than alternatives that minimize the creation of new facilities and take full advantage of the life cycle of existing facilities.

Alternatives A and B both require replacement of the I-70 bridge and additional paving requirements relative to Alternative C. The replacement of the I-70 bridge prior to the end of its lifespan effectively adds to the lifecycle costs of the interchange facilities. Alternative C does not require bridge replacement and can be constructed without adding much additional pavement.

#### **Level of Project Phasing Relative to Available Budget**

The requirements for construction phasing are presented in Appendix E.

Alternatives A and B could be phased by building the bridge structures in the first phase and building the interchange roadway improvements in a second phase. The interim bridge improvements would not provide any immediate safety or mobility improvements along SH 9 or US 6, but would improve travel conditions on I-70. Alternative C would likely be constructed in one phase because there is no interim improvement that would function independently. Alternative C is substantially less expensive than Alternative A and B, so finding sufficient funding for Alternative C would be easier than for Alternatives A and B.

## Length of Roadway Requiring More Lighting and Maintenance

The length of roadway involved with the three interchange alternatives is similar. Alternatives B and C may require slightly more lighting and more sophisticated lighting than the improved diamond alternative due to the unusual operations of the SPUI and Diverging Diamond designs and the need to keep signs and travel routes well defined under the I-70 bridge. Corresponding maintenance requirements would be moderate for Alternatives B and C and low for Alternative A. Other maintenance (repairs, snow removal, etc.) would be similar for the alternatives.

### *Safety Criteria*

#### **Number of Traffic Conflict Points (Improvement to High Accident Locations)**

The number of conflict points with each interchange alternative would be as follows:

Improved Diamond:	26
SPUI:	24
Diverging Diamond:	14

Alternative A, the improved diamond, would leave existing accident locations and conflict points generally unchanged. Alternative B (SPUI) would create new operational characteristics at the interchange. The Diverging Diamond (Option C) would create the fewest conflict points, thereby eliminating some accident locations.

#### **Conflict Points: Bike, Pedestrian and Motor Vehicles**

The alternatives create the following number of conflicts for cyclists and pedestrians:

	Cyclists	Pedestrians
Improved Diamond:	26	12
SPUI:	24	14
Diverging Diamond	14	10

The SPUI (Alternative B) creates the most pedestrian conflicts and allows for higher vehicle speeds at crossings and unsignalized free right turns onto the on-ramps. Although the DDI (Alternative C) creates unusual/unfamiliar travel patterns, routes for pedestrians and cyclists can be accommodated and create conditions similar to those of an improved diamond (See Appendix A).

## Effectiveness in Inclement Weather

SH 9, US 6 frequently experience severe weather driving conditions, especially in the winter. A variety of factors influence roadway operations during inclement weather, such as:

- Steep grades and sharp curves
- Intersection conflict points
- Unconventional travel patterns, especially in locations with “unfamiliar drivers”
- Snow and ice - covered vs. uncovered stretches of roadway
- Lane conditions

The safety of the grades and curves are similar for each of the alternatives. Each alternative would meet applicable engineering standards and requirements. The SPUI’s curves would be slightly safer than those associated with the Improved Diamond and Diverging Diamond because of increased horizontal radii.

As described previously, the Diverging Diamond has fewer conflict points (14) than the Improved Diamond (26) and SPUI (24).

Unconventional travel patterns and the relatively high number of visitors using the interchange are important safety factors. While signage, lighting, and other design features would guide motorists unfamiliar with a Diverging Diamond design, a common perception may be that the Diverging Diamond design could present slightly higher safety risks than the more familiar improved diamond configuration. More specifically, according to a U.S. Department of Transportation Federal Highway Administration (FHWA) TechBrief (Publication No. FHWA-HRT-07-048), “one of the greatest safety concerns with the Diverging Diamond design was the possibility that drivers would persist in bearing to the right at the crossovers, despite geometric, marking, and signage cues to induce them to bear left.” However, the FHWA simulation, performed as part of preparing the TechBrief, “suggests that this concern is not warranted.” As part of the simulation, “no drivers stayed to the right at the crossovers and other types of driver errors were no more likely with the DDI... configurations than with a conventional diamond interchange.” With the Diverging Diamond, the presence of medians, signs and other design elements will give clear guidance to motorists and substantially reduce the potential for head on collisions. Although signage, lighting and other design features would also guide motorists through the unconventional SPUI design, more risks may be present for the SPUI because this interchange design creates more potential for head-on collision risks.

The difference between covered and uncovered stretches of SH 9 and US 6 may also be important. The new bridge required for the SPUI would cover more of SH 9 and US 6. More bridge coverage means less direct snow on the road, but it also means darker conditions, less clearing from sunlight, and more complex drainage conditions. Icy conditions are especially prevalent in low areas where runoff may accumulate, which is the case at under the I-70 bridge. With the SPUI, the main intersection would be under the new bridge. With the Diverging Diamond and Improved Diamond, the main intersections

would not be under the bridge. A disadvantage of the larger bridge with the SPUI and Improved Diamond would be the potential for more ice on the longer I-70 bridge span and associated maintenance problems.

Travel-way width and weaving are also additional safety considerations. With the Diverging Diamond, there are fewer lanes for vehicles to potentially weave across, which leads to fewer potential vehicle conflicts, and should result in a safety improvement over that expected with a SPUI or Improved Diamond interchange. The Diverging Diamond also provides for more lane clarity and more positive channelization of traffic due to reduced width of the travel-way and channelization islands, which should be beneficial from a safety point of view especially during times of inclement weather where positive guidance is most needed. The SPUI and Improved Diamond would have much wider travel-ways between the curb faces and many more lanes and lane markings, which could be obscured by snow.

Overall, Alternatives A and B would be considered fair in terms of safety during inclement weather, while Alternative C (Diverging Diamond) would be considered good.

### **Number of Features Resulting in High Maintenance**

The features of the alternatives are generally similar in terms of maintenance requirements. The SPUI traffic signal would be more difficult to maintain than the signals for the other alternatives because of its central location under the new I-70 bridge in the middle of SH 9/US 6 traffic. However, the SPUI would only require one traffic signal, while maintenance of two signals would be needed for the other two alternatives. More lighting would be needed for the SPUI and Diverging Diamond. Icing under the existing bridge occurs. The Improved Diamond and SPUI may increase icing problems due to the larger bridges associated with these alternatives.

For snow removal, both the Improved Diamond Interchange and the SPUI have a wide footprint required for the double left hand turn lanes and their associated storage. For the Diverging Diamond, the paved area is much less and easier to plow in one pass. With the Diverging Diamond, logistics need to be worked through to determine if snow will be pushed to the outside or the median between the crossover signals. In addition, the Diverging Diamond would require more signage, more lights and more maintenance on the bridges that would not be replaced.

## Healthy Environment Criteria

### Acres of New Right of Way

ROW requirements, takes and business displacements for Options A, B and C are shown in Table 8.

**Table 8 Right of Way, Takes and Business Displacements from the Interchange Alternatives**

ALTERNATIVE	ACRES	FULL TAKES	PARTIAL TAKES	BUSINESS DISPLACEMENTS
<b>A Improved Diamond</b>	0.45	0	4	0
<b>B SPUI</b>	0.525	0	6	0
<b>C Diverging Diamond</b>	0.3	0	4	0

All three of the proposed alternatives were designed to tie into the Town of Silverthorne's proposed design for a double left turn at Wildercrest Road, and provide 10 foot shared path sidewalks along SH 9. This resulted in varying levels of impacts to the businesses along the west side of SH 9 between Wildercrest and I-70. To reduce these impacts, strategies such as 11 foot turn lanes or building only 6 foot wide sidewalks can be used in further design to minimize encroachment and possibly maintain operation of these businesses for both Alternatives A and C. Alternative B has the greatest risk of not being able to avoid permanent impacts.

Alternative A: A total of 0.45 acres of ROW is required in three locations along US 6 and SH 9:

- 0.24 acres involving Conoco and ReMax (Acorn Sub and Sheldon Roush Sub, respectively)
- 0.10 acres involving public land (at eastbound on ramp to Denver)
- 0.11 acres involving Shamrock Gas Station (Celestial Sub) and public land at Straight Creek

This ROW is needed because the median is widened to provide double left turns and storage for left turns onto I-70. These impacts are at the current roadway grades, and mainly impact landscaping. At the old Remax building, minor changes may need to be made to parking. At the Conoco gas station minor changes may be needed where the outer gas bay may be affected.

Alternative B: A total of 0.525 acres of ROW is required along US 6 and SH 9:

- 0.18 acres involving Conoco and ReMax (Acorn Sub and Sheldon Roush Sub, respectively)
- 0.09 acres involving Shell (Riverview Sub #1)
- 0.11 acres involving public land (at eastbound on ramp to Denver)
- 0.12 acres involving Shamrock Gas Station (Celestial Sub) and public land at Straight Creek
- 0.025 acres involving Burger King and garage entry below Subway & Dairy Queen (Summit Plaza)

This ROW is needed since the median is widened to provide double left turns and storage for left turns onto I-70. Additionally, because of the large skew, the stop bars for the turn lanes are pushed back



almost 500 feet from their current location, which pushes the required widening outside the existing interchange ramps. Along US 6, additional right of way is needed on undeveloped parcels between the proposed ramps and Stephens Way, near the Straight Creek crossing. Two parcels are required along US 6 (0.11 acres and 0.12 acres). Along Stephens Way, a small sliver of 0.025 acres is needed mainly for remaining roadway transitions and tying in the proposed sidewalk. Along SH 9, 0.09 acres of the Shell gas station property are shown as impacted. This ROW take is minor in nature, and is the result of replacing the existing 6 foot sidewalk with a 10' sidewalk in almost the same location it exists now. Along the west side of SH 9, two parcels are impacted for a total of 0.18 acre (includes sidewalk). These impacts are at the current roadway grades, and mainly impact landscaping. At the old Remax building, minor changes may need to be made to parking, and at the Conoco gas station, the outer gas bay may be affected.

Alternative C: A total of 0.3 acres of ROW is required along US 6 and SH 9:

- 0.09 acres involving Conoco and ReMax (Acorn Sub and Sheldon Roush Sub, respectively)
- 0.10 acres involving public land (at eastbound on ramp to Denver)
- 0.11 acres involving Shamrock Gas Station (Celestial Sub) and public land at Straight Creek

The ROW is needed to provide the necessary minimum angle of 30 degrees at the crossovers for the diverging diamond. Along US 6, additional right of way is needed on undeveloped parcels between the proposed ramps and Stephens Way, near the Straight Creek crossing (0.10 acre and 0.11 acres). Along SH 9 north of the interchange, two parcels are impacted for a total of 0.09 acre. These impacts are at the current roadway grades, and mainly impact landscaping at the old Remax building and Conoco gas station.

Note:

The ROW totals reflect the interchange needs, including ROW needed to connect to upgraded intersections.

### **Acres of Wetland/Riparian Disruption**

Wetland impacts are delineated in Appendix D.

With Alternative A, there are 0.384 acres of wetland impacts along Straight Creek and the Eastbound On-Ramp. Along US 6, 0.041 acres are impacted along Straight Creek (upstream) where the box needs to be lengthened. Downstream impacts are similar, but additional impacts along the ramp are needed for ramp widening. This results in 0.343 acres of ROW impact. Construction of a retaining wall could reduce impacts at this location.

With Alternative B, there are 0.428 acres of wetland impacts for this alternative along Straight Creek and the Eastbound On-Ramp. Along US 6, 0.053 acres are impacted along Straight Creek (upstream) where

the box needs to be lengthened. On the other side of US 6, 0.375 acres are impacted. These are fairly evenly split between those along Straight Creek where the entry ramp from westbound US 6 onto I 70 requires the box be widened, and those along the ramp required for ramp widening. Construction of a retaining wall along the on-ramp could reduce impacts at that location, but not as effectively as in Alternative A.

With Alternative C, there are 0.145 acres of wetland impacts for this alternative along Straight Creek and the Eastbound On-Ramp. Along US 6, 0.024 acres are impacted near Straight Creek where the box culvert needs to be lengthened. On the other side of US 6, impacts of 0.121 acres are required. This impact is similar to the impacts identified for Alternatives A and B; however, there are fewer impacts along the eastbound on-ramp.

### **Air Quality: Hours of Delay**

Overall, air quality conditions are best for an alternative with the least amount of hours where operations occur under Level of Service C (congested) conditions. The improved diamond and SPUI provide the most overall capacity and slightly fewer hours under LOS C conditions. The Diverging Diamond provides adequate capacity in 2035, but offers slightly more hours of operation at LOS C.

### **Noise: Number of Sensitive Receptors/Impacts**

The Noise Analysis for the project included mapping noise sensitive receptors and noise contours to clarify noise effects. Noise-sensitive receptors are generally considered where humans are engaged in activities, or are using land areas, that may be subject to the stress of significant interference from noise. A noise sensitive receptor is any location where highway traffic noise may be detrimental to the enjoyment and functional use of the property as defined by the Noise Abatement Criteria (NAC). The number of noise sensitive receptors within 500 feet of the construction footprint of each alternative was estimated. For all three alternatives, the Straight Creek open space is the only noise sensitive receptor within 500 feet of the estimated construction footprint.

Existing noise levels at Straight Creek are relatively high based on their proximity to I-70. Noise levels from Interstate 70, the dominant noise source in the area, would be influenced by bridge reconstruction (Alternatives A and B) and by encroachment of the eastbound on ramp (Alternatives A, B and C). These improvements would move the near lane closer. However, the associated changes at receptor locations, with and without these improvements, would not be expected to be substantially different (<3dB). Alternative C, Diverging Diamond, would not require bridge reconstruction.

Overall, Alternatives A, B, and C do not present travel conditions that would create noise levels that would differ substantially at sensitive receptors in the vicinity. The operational footprints of the interchanges are similar and sensitive receptors are far enough away that the differences would be inconsequential. The difference in hours of LOS C, worst case operational noise conditions, would be inconsequential.

### **Acres of Wildlife Habitat Disruption**

Alternatives A, B, and C would have similar impacts on wildlife. These impacts would be minor and would correlate directly with wetland effects (See previous discussion of Acres of Wetland/Riparian Disruption).

### **Acres Fisheries Habitat Disruption**

Alternatives A, B, and C would have no direct effects on the Blue River fisheries. However, construction requirements along Straight Creek present the potential for temporary water quality impacts that could have minor incremental impacts on the downstream Blue River fisheries. Standard CDOT construction practices and Section 404 Clean Water Act permit requirements and other water quality features of the project, permit requirements and associated mitigation would be expected to avoid, minimize and mitigate these effects for all three alternatives (See Appendix B).

### **Acres of Wildlife Linkage Zones**

No designated wildlife linkage zones would be disrupted. Alternatives A, B, and C would have similar impacts on wildlife movement along the Straight Creek Corridor during construction. Long term opportunities for wildlife movement along Straight Creek under US 6 would be similar.

### **Number of Recreation Resource Impacts, including Section 4(f) and 6(f) Resources**

The Blue River trail is a valuable community recreation resource providing access to the Blue River for fishing and enjoyment of the river corridor. Based on these uses and functions of the Blue River Trail, it is protected under Section 4(f) of the Department of Transportation Act. The Blue River Trail was defined as a Section 6(f) resource in the Final PEIS for the I-70 Mountain Corridor. No impact to the trail is anticipated with any of the alternatives.

The Town of Silverthorne acquired a parcel of land (approximately 3 acres) for open space between US 6, the I-70 eastbound on-ramp and the rear parcel boundary of the First Bank building. The Town of Silverthorne zoning map designates the site as Open Space. This area is effectively managed for open space, habitat protection and stormwater management purposes. This qualifies this area as a Section 4(f) resource (wildlife refuge). Much of this area is also considered a wetland by the US Army Corps of Engineers.

The unavoidable effects on this Section 4(f) resource from the alternatives are less than the overall effects defined for wetlands because the wetland losses occur on both sides of US 6. The Section 4(f) would impacts would be as follows:

Alternative A 0.343 acres

Alternative B 0.375 acres

Alternative C 0.121 acres (less impact along the eastbound on-ramp)

These unavoidable impacts would not have a substantive impact on the roles or functions of this resource. The requirements of the Clean Water Act Section 404 permit for fill in wetlands would require mitigation to offset the project requirements. Based on these considerations, this impact could also be addressed with de minimis approach and associated documentation.

### ***Historic Context Criteria***

#### **Number of Paleontological Resources**

Paleontological resources exist in the project vicinity and could be encountered during deep excavations associated with bridge reconstruction required for Alternatives A and B. Alternative C only requires surface level construction activities.

#### **Number of Archaeological Resources**

There are no known archaeological resources within the construction footprint. Most of the area has been subject to prior and substantial earthwork. None of the alternatives would be expected to encounter archaeological resources.

#### **Number of Historic Resources**

There are no historic resources within the project study area.

### ***Communities Criteria***

#### **Support for Economic Investments**

This criterion primarily involves the ability of an alternative to support economic vitality involving existing land uses and commercial operations in the interchange area, especially those that are dependent on I-70, SH 9 and US 6 access and future opportunities to enhance these areas. An alternative that displaces important businesses, degrades aesthetic or recreation conditions, or does not provide opportunities for “Gateway” design features would have adverse impacts on prior economic investments in the area and current and future economic vitality.

Alternatives A, B and C maintain access to existing commercial properties, vacant land development sites, and sites with redevelopment potential. Due to right of way requirements, Alternative B (SPUI) provides slightly less support for past economic investments. The large medians provided by the Diverging Diamond design would provide space for Town of Silverthorne Gateway theme improvements.

### **Supported by the Community**

Community support for interchange improvements and the three alternatives has been expressed at the project's public meetings and by the Project Leadership Team. The public will have another opportunity to comment on the three interchange alternatives at the public meeting on June 13, 2012.

### **Number of Businesses Impacted**

With Alternative A, the Improved Diamond, SH 9 is widened to accommodate double left turn lanes onto the interstate in both directions. In the southbound direction, the widening of SH 9, north of the interchange, results in partial property takes along the west side of SH 9. These takes would be minimal and would accommodate the construction of a new 10 foot sidewalk adjacent to SH 9. There is the potential for the loss of several parking spaces in the ReMax building parking lot adjacent to SH 9, but the functionality of the lot should remain. There are no anticipated property takes or changes to business access along SH 9 southbound, south of the interchange. Access from Stephens Way remains the same as it is today. There are no anticipated property takes or changes to business access along SH 9 northbound, on either side of the interchange.

With Alternative B, the Single Point Urban Interchange (SPUI), the two signals are replaced with one signal in the middle of the interchange that controls all movement through the interchange. In the southbound direction, north of the interchange, SH 9 is widened between Wildercrest and the westbound on-ramp and the curb line moves 4 feet west into the existing property. The change in curb line, along with the construction of the 10 foot sidewalk, would push the access points to the existing businesses (gas station and ReMax building) into the existing parking lot area. While access could remain in place from SH 9 southbound, parking capacity of the lot would be reduced and internal circulation of the lot impacted. It may not be feasible to provide parking and adequate circulation in the remaining lot area. In order to reduce the right-of-way impacts, the sidewalk width could be 6 feet rather than 10 feet and circulation within the lot could remain viable with a reduced parking level. In the southbound direction, south of the interchange, the widening of SH 9 does not impact the operation of Stephens Way and access to existing businesses remains intact. In the northbound direction, south of the interchange, there are no impacts to existing businesses or access points along SH 9. North of the interchange, the widening of SH 9 northbound impacts the existing landscape and benches located between the westbound off-ramp and the existing business access. This landscape design would need to be modified to accommodate the change in curb line. Business access to the gas station and Wendy's would remain intact.

With Alternative C, the Diverging Diamond, opposing traffic switches sides of the road through the interchange area between the ramps. With Alternative C, the proposed curb lies within the existing curb line and SH 9 would not be required to be widened. In the southbound direction, the southernmost access point serving the ReMax building would likely be lost due to the proximity of the cross over. By modifying the 10 foot sidewalk to 6 feet, the existing fence line could remain intact and there would be minor impacts at the existing property line. These details would be clarified during the Final Design phase of the project.

### **Number of Homes Impacted**

Alternatives A, B and C would have no effects on residential properties.

### **How Well Are Construction Impacts Minimized?**

Construction requirements are presented in Appendix E.

The Improved Diamond alternative results in a high complexity of construction as it will require bridge and pavement widening of I-70 crossovers to accommodate head-to-head I-70 traffic . Maintaining two lanes of through traffic and one left turn lane on SH 9 will also require temporary pavement and striping.

The Alternative B (SPUI) also results in a high complexity of construction as the existing bridge will need to be widened and temporary pavement will be needed. During construction, closure of one direction of the I-70 bridge will require traffic to be moved to the other direction of the I-70 bridge. Falsework for the cable-stayed structure will require SH 9 to be reduced to one-lane traffic in each direction. Traffic shifts on SH 9 and reduction of ramp lanes will be required during construction. Temporary pavement and striping will also be required. The proposed eastbound off-ramp and westbound on-ramp will be 6 to 8 feet lower than existing grade requiring earthwork and shoring for the detour pavements.

The Diverging Diamond alternative results in a moderate level complexity of construction. The I-70 bridge would not be reconstructed and most of the work involves asphalt, curb and gutter improvements along with new signs and signals. During the final phase of construction, SH 9 traffic will be shifted or detoured to Wildercrest Road/Stephens Way. Continual modifications will be required at the ramps throughout the construction process. SH 9 restrictions to turning movements to and from the ramps will be needed. There will also be elevation differences between the existing and proposed ramps.

### **Environmental Justice: Equitable or Inequitable Effects**

Based on previous demographic assessments and consultation with local officials, some of the housing units in the project vicinity is defined or managed as low income housing units. Two examples include:

Blue River Apartments	1251 Adams Avenue	78 Units
Sierra Madre Villa	1081 Adams Avenue	61 Units

These housing units are located approximately 0.8 miles north of the study area boundary.

Alternatives A, B and C do not create direct impacts on residential properties and the indirect effects would be considered minor. Overall, the alternatives would not create effects that would be considered inequitable in relation to environmental justice considerations (disproportionate effects on low-income, minority, other persons or groups referenced in CDOT and other guidance and regulations).

**Mobility and Accessibility Criteria**

The interchange improvements would need to be constructed after or at the same time as the SH 9/Wilderness improvements to achieve the traffic performance presented in this discussion.

**Traffic Congestion**

Under “No Build” or “No Action” conditions, traffic delay in 2035 at the I-70 interchange and along SH 9 and US 6 is expected to be excessive, producing Level of Service E and F conditions involving key movements (See Table 9 and Appendix F).

**Table 9 Level of Service (LOS) Comparison between 2010 and 2035 Conditions for the No Action Alternative**

Location	2010 LOS	2035 LOS
WB I-70 On Ramp	A	B*
EB I-70 Off Ramp	C	F
WB I-70 Off Ramp	B	F
EB I-70 On Ramp	B	A*
WB I-70 and SH 9 Ramp Intersection	B	F
EB I-70 and US 6 Ramp Intersection	C	F
6th and SH 9 Intersection	B	D
5th and SH 9 Intersection	A	C
4th and SH 9 Intersection	B	D
3rd and SH 9 Intersection	A	D
Nike Driveway and SH 9 Intersection	A	E
Wilderness and SH 9 Intersection	D	F
Stephens and US 6 Intersection	A	C
Little Beaver Trail and US 6 Intersection	B	C
Anenome Trail and US 6 Intersection	A	B
Dillon Ridge Road and US 6 Intersection	C	D

\*These levels of service are good only because of heavy upstream traffic bottlenecks.

Based on traffic modeling analysis (See Appendix F) and the information in Table 10, the Diverging Diamond’s overall performance is superior to the performance that would be expected from the Improved Diamond and SPUI. Overall, intersection efficiency unique to the Diverging Diamond’s design at the I-70 Silverthorne/Dillon interchange provides a high level of operations, less delay and corresponding travel time reductions.

**Table 10 Overall Travel Results for the Interchange Alternatives**

EVALUATION CRITERIA	Alternative A	Alternative B	Alternative C
	Improved Diamond Interchange	Single Point Urban Interchange	Diverging Diamond Interchange
Overall Rating (Good, Fair, Poor)	Fair	Fair	<b>Good</b>
Level of Service (LOS) Assumes SH 9/Wilderness Ultimate is complete	LOS D	LOS D	<b>LOS C</b>
Average Delay Per Vehicle During the Peak Hour in Seconds	45.6	39.3	<b>28.0</b>
Queuing Average Eastbound Off (feet)	600	440	<b>180</b>
Queuing Average Westbound Off (feet)	510	510	<b>230</b>
Average Daily Traffic (ADT)	62,600 without I-70 through  117,600 with I-70 through	62,600 without I-70 through  117,600 with I-70 through	62,600 without I-70 through  117,600 with I-70 through
Delay Total (hours)*	462	421	<b>359</b>
Interchange/Intersection Delay per veh (sec)*	46	39	<b>28</b>
NB, Through Travel Time Dillon and Silverthorne (secs)*	538	480	<b>417</b>
SB, Through Travel Time Silverthorne and Dillon (secs)*	466	399	<b>380</b>
From I-70 WB through Travel Time to Dillon (secs)*	381	310	<b>268</b>
From I-70 EB through Travel Time to Silverthorne (secs)*	319	294	<b>284</b>
Silverthorne to EB Travel Time I-70 (secs)*	329	328	<b>279</b>
Dillon to WB Travel Time I-70 (secs)*	515	447	<b>351</b>

\*Definitions are provided as follows:



Measure	Definition *
Delay Total (hours)	Total amount of vehicular delay, measured in hours
Interchange/Intersection Delay per veh (sec)	Average delay experienced by each vehicle passing through the interchange/intersection
NB, Through Travel Time Dillon and Silverthorne (secs)	The average time it will take to travel from Dillon Dam Road to 6 <sup>th</sup> Avenue in Silverthorne
SB, Through Travel Time Silverthorne and Dillon (secs)	The average time it will take to travel from 6 <sup>th</sup> Avenue to Dillon Dam Road in Silverthorne
From I-70 WB through Travel Time to Dillon (secs)	The average time it will take to travel from below the Eisenhower Tunnel to the Interchange and to Dillon Dam Road
From I-70 EB through Travel Time to Silverthorne (secs)	The average time it will take to travel between Frisco and Silverthorne to 6 <sup>th</sup> Avenue in Silverthorne
Silverthorne to EB Travel Time I-70 (secs)	The average time it will take to travel from 6 <sup>th</sup> Avenue in Silverthorne to below the Eisenhower Tunnel
Dillon to WB Travel Time I-70 (secs)	The average time it will take to travel from Dillon Dam Road to Westbound I-70 between Silverthorne and Frisco

\* All definitions are for the one hour peak period on a Saturday afternoon in August of 2035

More specifically, the performance of the Diverging Diamond had the following benefits:

- Inadequate eastbound off-ramp capacity and resulting in backups onto I-70 could be resolved by the efficient 2035 operations of the Diverging Diamond interchange design itself.
- Diverting Wilderrest development traffic away from the interchange was not needed to address interchange performance in 2035.
- 2035 traffic at the US 6/Little Beaver Trail Intersection performed efficiently and safely with a Diverging Diamond interchange in place.
- 2035 ramp intersection performance improved enough that eastbound exit ramp backups onto I-70 were eliminated.

#### **How Much Shorter are Ramp Backups than Existing or No Build Conditions?**

Table 9 clarifies how eastbound and westbound off-ramp queuing lengths would differ. In summary, the Diverging Diamond (Alternative C) results in far shorter queues than the other alternatives and Alternatives A and B generate similar queues.

#### **Potential Number of Person Trips on Alternative Modes**

The interchange alternatives would not differ in terms of their influence on the number of persons using alternative modes of travel.

## Potential for Enhanced Bicycle/Pedestrian Usage

With Alternative A, a new 10 foot sidewalk would be constructed along SH 9 in both the northbound and southbound directions, between Wildercrest Road and Little Beaver Trail. The new wider sidewalk would remain adjacent to the roadway, outside of the interchange area. Pedestrian and bicycle movement through the interchange area, although more comfortable with the wider sidewalk, would remain the same as it is today. Pedestrians southbound would cross three at-grade pedestrian crossings including two westbound on-ramps and the eastbound off-ramp. In the northbound direction, pedestrians would cross two eastbound on-ramps and the westbound off-ramp at grade. The 10 foot sidewalk improvement in the northbound direction, between the existing bus stop and the eastbound on-ramp would result in an impact to the bridge for the bike path and the relocation of the bike path to run adjacent to roadway. The development of the 10 foot sidewalk to accommodate both pedestrian and bicycle movement is consistent with the Town of Silverthorne plans for connectivity in the area.

With Alternative B, SPUI, a 10 foot sidewalk would be constructed along the outside of the interchange and pedestrian movement would be similar to today's conditions, although the number and location of pedestrian crossings would increase. In the southbound direction, pedestrians would cross the first westbound on-ramp under free flow conditions, they would cross the second westbound on-ramp unsignalized, but in synch with the signal at the center of the interchange, some distance away. Pedestrians would continue southbound on the sidewalk adjacent to the roadway, cross the eastbound off-ramp at a signalized pedestrian crossing, and finally cross the second eastbound off-ramp at a final signalized pedestrian crossing. Therefore, in the southbound direction, there would be four pedestrian crossings, two of which would be signalized. In the northbound direction, there would be pedestrian crossings of two eastbound on-ramps under free flow conditions, a signalized pedestrian crossing of the first westbound off-ramp and a signalized pedestrian crossing of the second westbound off-ramp. Pedestrians northbound would move through a total of four crossings, two of which would be signalized. With Alternative B, pedestrian movement would be similar in pattern to today's conditions, but the number of pedestrian crossings required to navigate the interchange would increase. The construction of the 10 foot sidewalk to accommodate pedestrian and bicycle movement would be consistent with the Town of Silverthorne's connectivity plans.

With Alternative C, Diverging Diamond, pedestrian movement through the interchange area would look similar to the movements made today. Southbound pedestrians would cross the westbound on-ramp in synch with the SH 9 southbound signal just north of the interchange. This eliminates the need for pedestrians to cross under free-flow turning movements as with today's conditions. Pedestrians proceed to the second signalized crossing along a 10 foot bicycle/pedestrian path for the length of the interchange. Pedestrians use a signalized crossing at the south end of the new sidewalk. The same conditions would apply on the other side of interchange. Cyclists would follow travel lanes through the interchange as shown in Appendix A. Shared use of the 10 foot path would be likely until cyclists become familiar with the new interchange configuration. Snow plow operational requirements require further study.

## **How Well are Summit Stage/Local Transit Service and Stops Accommodated?**

With Alternatives A, B and C access to transit would remain the same as it is now. The bus stop located on SH 9 northbound just south of the interchange would remain intact.

## **Number of Business Access Points Hindered or Eliminated**

A total of three access points are hindered by Alternatives A and C, while Alternative B hinders four access points. The SPUI is more compact and creates the best access opportunities. The improved diamond requires the most weaving, which hinders access. The Diverging Diamond requires the least amount of weaving along SH 9 and US 6 and likely closes one access to the ReMax building nearest to the interchange. This detail would be clarified during the Final Design phase of the project.

## ***Aesthetics Criteria***

### **Support for CSS Aesthetic Guidance**

Primary sources for evaluating aesthetic issues are the CSS Aesthetic Guidance, the Crest of the Rockies, Silverthorne – Area of Special Attention Report and local policies. The most applicable goals and objectives in the Area of Special Attention Report include enhancing the community gateway into Silverthorne and Dillon, providing lighting along SH 9 and US 6 and nearby I-70 chain stations, restricting stockpiling of construction materials in scenic areas, and improving consistency in design and color schemes for roadway structures (sound walls, retaining walls, barriers, guardrails, bridges and wildlife fences).

The potential for Alternatives A, B and C to comply with the CSS Aesthetic Guidance, the Area of Special Attention Report goals and objectives and local policies is similar. Each alternative has unique opportunities and could be designed to adhere to the requirements and conform to local design policies. Alternative A would generate the fewest ground level differences from existing conditions, but requires a new bridge that would be the subject of considerable community interest and concern. The SPUI doesn't create opportunities for enhancements and requires motorists to pass through a relatively long concrete tunnel created by the increased bridge size. The Diverging Diamond provides the most opportunity for aesthetic enhancements by providing larger medians. The new bridges associated with the SPUI and improved diamond would create substantial community gateway opportunities. Alternative C, the Diverging Diamond, would be a unique facility in Colorado making it a potential attraction for certain travelers. However, the required signage needed to create safe operation and the select of the right paint and aesthetic features might present some design challenges.

## EASTBOUND OFF-RAMP IMPROVEMENT OPTIONS

Two options were evaluated:

A – One Way Ramp

B – Two Way Frontage Road

### Description

Early during the alternative analysis process, a split diamond interchange was discussed. Although a true split diamond interchange is not feasible at this location due to the steep uphill grades for I-70 west of Silverthorne, the concept can be applied to the eastbound off-ramp. In both Option A and Option B, the eastbound off-ramp departs I-70 about 1500 feet earlier than its current location, and the existing off-ramp and gore is removed. Both options can improve traffic mobility within the existing interchange on US 6 and SH 9 by rerouting 15% of the ramp volumes onto Stephens Way for access to Lowes, the Summit Place shopping center, the factory outlet centers and nearby development. It also relieves some of the traffic volume for the left turn off SH 9 onto Wildercrest Road, which is the most prevalent congestion problem outside the immediate interchange area.

With Option A, the eastbound off-ramp traffic will exit I-70 and travel on a one-way, 0.5 mile long ramp, that connects into US 6 at its current location. A 645 foot long four span bridge will travel over S. Adams Avenue, the Blue River and Stephens Way. After crossing Stephens Way, the ramp will basically follow the existing exit ramp alignment. About 400 feet from the intersection with US 6, a connection is made to Stephens Way, which allows ramp traffic with local destinations to exit and avoid the interchange area. Depending on the selected interchange alternative, traffic on Stephens Way may also be allowed to access the one-way ramp at this location. Four bridge alternatives were evaluated. A spliced bulb-tee girder design is the most economical bridge type for this location.

With Option B, the eastbound off-ramp traffic will exit I-70 and travel on a 0.5 mile long one-way ramp and two-way frontage road before connecting into US 6 at its current location. The 5.8% one-way ramp will connect to an at-grade intersection with S. Adams Avenue before flattening out. To maintain a ramp grade of less than 6%, S Adams Avenue would need to be raised about 6 feet. Existing S. Adams Avenue that travels under I-70 and connects to Wildercrest Road will need to be abandoned since adequate clearance can't be met under the existing structures. At this location, a two way frontage road begins. This frontage road crosses the Blue River on a new 113 foot long structure before being intersected by Stephens Way, which would be reconstructed to connect Wildercrest Road to the Frontage Road. The frontage road continues along the existing Stephens Way alignment before connecting to the existing eastbound off-ramp about 500 feet from its current connection to US 6. As in Option A, a two-way connection is provided to existing Stephens Way. In essence, the two way frontage road replaces Stephens Way. Of the four structure types reviewed for the Blue River, a pre-stressed box girder design was determined the least expensive structure that would accommodate the connection to Wildercrest Road, and yet provide 2 feet of freeboard over the Blue River.

Both Option A and B will require reconstruction of the existing Summit Stage stop by the Factory Outlet stores along Stephens Way.

Option A results in one new conflict point where the ramp connection is made to Stephens Way. This connection is located where traffic is already slowing down, and by diverting traffic off US 6 and SH9, should improve overall mobility and safety in the interchange area. Option B results in three new conflict points, but eliminates the connection of S. Adams Avenue to Wildercrest Road. The new intersections of the eastbound off-ramp and S. Adams Avenue and the Connector Road to the Frontage Road could be somewhat confusing since roads on either side are one-way roadways. The new intersection of Stephens Way and the Frontage Road will be signal controlled. Although traffic is taken off US 6 and SH 9, overall safety improvements for the interchange may not be realized. Overall mobility in the interchange area will be improved.

Options A and B can be built independently, or in conjunction with some of the proposed alternatives. Unlike the westbound options, there are limitations and details in design that would make each option more practical with one alternative or another. For example, Option B, the Two-way Frontage Road would not work with the SPU. Another example would be whether the connector road between the ramp and Stephens Way would be built with a one-way or two-way connector.

If built independently prior to interchange reconstruction (using any of the alternatives under consideration), only about 5% to 20% of the improvements would need to be rebuilt in the future.

### **Detailed-Level Evaluation**

#### ***Sustainable Operations Criteria***

##### **Capital Cost**

Option A:	\$7,831,000
Option B:	\$4,278,000

##### **Life Cycle Costs**

Option A would have a higher life cycle cost because of the extended bridge necessary for this alternative relative to the shorter bridge required for Option B.

##### **Level of Project Phasing Relative to Available Budget**

Options A and B would likely be constructed in one phase because there are no interim improvements that would function independently, or provide any travel benefit. Under both options, the structures could be built as a separate construction project prior to the remaining roadway being built. Actual connections to I-70 and the existing ramp would need to be built at the same time since multiple exit

points from I-70 would not be allowed by FHWA. The access facilities necessary to connect the Wilderrest neighborhood to the ramp and I-70 could be constructed after ramp construction as a separate phase, but this connection is a fundamental purpose of the extended ramp making that possibility illogical. Option A is more difficult to select as an early action project than Option B because of the high cost of the improvements.

### **Length of Roadway Requiring More Lighting and Maintenance**

Options A and B provide similar roadway lengths and similar lighting and maintenance requirements because their footprints are similar.

### ***Safety Criteria***

#### **Number of Traffic Conflict Points (Improvement to High Accident Locations)**

Option A results in one new conflict point where Option B results in three new conflict points. The total number of conflict points would be as follows:

Option A:	4
Option B:	7

With Option B, the new intersections of the eastbound off-ramp and S. Adams Avenue and the Connector Road to the Frontage Road could be somewhat confusing since roads on either side are one-way.

#### **Conflict Points: Bike, Pedestrian and Motor Vehicles**

The Eastbound Off-Ramp options create the following number of conflicts for cyclists and pedestrians:

	Cyclists	Pedestrians
Option A:	4	0
Option B:	7	6

Option A would include one long bridge that would pass directly over the Blue River Trail providing sufficient room for pedestrians and cyclists to pass under. Option B requires two new at-grade crossings of the Blue River Trail with roadways. Refer to the following heading for more information “Number of Recreation Resource Impacts, including Section 4(f) and 6(f) Resources.”

## Effectiveness in Inclement Weather

Options A and B would result in similar operations and safety issues during inclement weather. The one-way roads and shorter bridge associated with Option B would be slightly safer, but more conflict points would be created.

## Number Features Resulting in High Maintenance

Options A and B would create similar features resulting in the same general level of maintenance.

## Healthy Environment Criteria

### Acres of New Right of Way

ROW requirements, takes and business displacements for Options A and B are shown in Table 11.

**Table 11 Right of Way, Takes and Business Displacements from Eastbound Off-ramp Options**

ALTERNATIVE	ACRES	FULL TAKES	PARTIAL TAKES	BUSINESS DISPLACEMENTS
<b>A One Way Ramp</b>	0.26	0	2-3	0
<b>B Two Way Frontage</b>	1.71	0	4-5	0

Option A: Two to three parcels will be impacted, requiring 0.26 acres of additional right-of-way.

0.15 acres of Summit County

0.109 acres involving Outlets at Silverthorne (Silverthorne Factory Stores)

A wall is provided along the proposed off-ramp to limit impacts to only 0.15 acres for the business along S. Adams Avenue. At the location where the Connector Road ties into a raised Stephens Way, a wall will be built to minimize impacts to existing parking. Right-of-way necessary to build this wall is 0.11 acres, and will impact either one or two parcels. The Summit Stage stop will also require minor modifications due to grade changes.

Option B: The plans do not show delineation for individual parcels outside of CDOT right-of-way, but it is estimated that four to six parcels totaling 1.71 acres will be impacted with this Option. Two parcels totaling 0.78 acres will be impacted along the off-ramp and Frontage Road west of the Blue River Summit County. This includes the business west of S. Adams Avenue, and the vacant land between S. Adams Avenue and the river. The area south of the proposed Frontage Road and east of the Blue River will result in another 0.93 acre impact from two to four parcels (Outlets at Silverthorne). One or two vacant parcels along the river will need takes for widening, and includes a small area for re-grading and relocating the Blue River Trail. At the location where the Connector Road ties into an elevated Stephens

Way, a wall will be built to minimize impacts to existing parking at one or two parcels. As with Option A, the Summit Stage stop will also require minor modifications due to grade changes.

### **Acres of Wetland/Riparian Disruption**

Overall wetland impacts for Option A are 0.485 acre. As the new off-ramp exits I-70, it crosses a major creek under I-70, resulting in 0.339 acres of impacts along the creek and roadside ditch. If a wall is built in this area, the impact could be reduced about 0.10 acres. Another 0.111 acres is impacted along the ditch prior to South Adams Avenue. The remaining 0.035 acres of impact are on both sides of the Blue River as the ramp crosses the Blue River on a long bridge. Most of these impacts are indirect impacts due to shading from the proposed long bridge.

Option B: Overall wetland impacts for this Option are 0.928 acre. As the new off-ramp exits I-70, it crosses a major creek under I-70, resulting in 0.616 acres of impacts along the creek and roadside ditch. If a wall is built in this area, the impact could be reduced about 0.30 acres. Another 0.128 acre is impacted along the ditch prior to South Adams Avenue. The remaining impacts of 0.184 acre are on both sides of the Blue River as the Frontage Road crosses the Blue River and forms a new intersection which connects to Wildercrest Road.

Potential temporary construction phase impacts on wetlands would be easily avoided, minimized and mitigated through standard and best management practices for stormwater management (sediment and water quality control measures, See Appendix B).

### **Air Quality: Hours of Delay**

Options A and B would create similar delay and levels of service so air quality conditions would be similar.

### **Noise: Number of Sensitive Receptors/Impacts**

The number of noise sensitive receptors within 500 feet of the construction footprint of the eastbound off ramp options was estimated. For Option A and B, the Blue River, Blue River Trail and Straight Creek are located within 500 feet of the estimated construction footprint. Existing noise levels at these sensitive receptors are relatively high already based on their proximity to I-70. New bridge construction over the Blue River would increase noise exposure along the river and trail. This change would be similar under Options A and B. The noise level changes at receptor locations, with and without bridge construction, would not be expected to be substantially different (< 3dB). Noise levels at the ball field adjacent to the foot of the dam (over 1,500 feet away) would not be expected to change.



### **Acres of Wildlife Habitat Disruption**

No direct losses of habitat would occur from Options A and B. However, Options A and B would both create new bridges over the Blue River creating the same incremental indirect impacts on wildlife and fisheries.

### **Acres Fisheries Habitat Disruption**

No direct losses of habitat would occur from Options A and B. However, Options A and B would both create new bridges over the Blue River creating the same incremental indirect impacts on fisheries.

### **Acres of Wildlife Linkage Zones**

Options A and B would both create new bridges over the Blue River creating the same incremental impacts on wildlife movement. No designated wildlife linkage zones would be impacted.

### **Number of Recreation Resource Impacts, Including Section 4(f) and 6(f) Resources**

Option A would include one long bridge that would pass directly over the Blue River Trail, a Section 4(f) and 6(f) resource providing sufficient room for pedestrians and cyclists to pass under. However, bridge construction would involve a temporary detour when the path must be closed. The detour would likely use a new route along Adams Avenue with a temporary river crossing located between the new bridge and the upper end of the Blue River by the Dillon Reservoir dam. The new off-ramp would also pass over the detour route. Provisions to maintain access along the detour route would need to include coordinated timing for route closures.

Option B requires two new at-grade crossings of the Blue River Trail with roadways. One crossing will occur at the intersection of Stephens Way and the other will occur at the Frontage Road. For added safety, both crossings will have a signal so the crossing will be protected. The construction disruption may not require trail closure or at least a far shorter trail closure than Option A.

As a Section 4(f) resource, impacts from Option B would not be allowed because Option A provides a feasible and prudent alternative to the impacts on the trail caused by Option B. Option A would need to be implemented in a manner that includes all possible planning to minimize harm to the property. This would include incorporating a wide range of measures to ensure construction period trail disruptions are minimized, temporary trail detours are available, signed and safe, and overall trail usability and safety are not compromised.

## *Historic Context Criteria*

### **Number of Paleontological Resources**

Paleontological resources are known to exist in the area. Excavations for the new bridge footings could encounter fossils.

### **Number of Archaeological Resources**

No archaeological resources are known to exist in the area. Excavations for the new bridge footings could encounter previously unknown resources.

### **Number of Historic Resources**

None.

## *Communities Criteria*

### **Support for Economic Investments**

Options A and B would create conditions that support past economic investments in a similar manner.

### **Supported by the Community**

Community support for interchange improvements has been expressed at the project's public meetings and by the Project Leadership Team. The public will have another opportunity to comment on the improvements at the public meeting on June 13, 2012.

### **Number of Business Impacted**

Under Option A, the EB off-ramp is extended over Adams Ave, the Blue River and Stephens Way. However, a connector road links the ramp with Stephens Way further east allowing drivers to circle back to Wildernd Road and access existing land uses. Creating access between Stephens Way and Wildernd Road maintains ease of access to future land uses in the area.

Under Option B, the off-ramp becomes a two-way road at the signalized intersection with River Road. This option provides access to both Wildernd Road and Stephens Way and does not impact existing land uses or business access. However, ROW requirements involve one business. This option maintains the viability of future redevelopment options throughout the area by maintaining easy access to area land uses.

### **Number of Business Access Points Hindered/Eliminated**

None.

### **Number of Homes Impacted**

None.

### **How Well Are Construction Impacts Minimized?**

The Eastbound Off-Ramp Option A results in a moderate level of complexity where temporary closures of Adams Avenue and Stephens Way will be required for construction of the off-ramp bridge over Adams Avenue, the Blue River and Stephens Way. Additional construction activities would include:

- Temporary ramp detour pavement will be constructed
- Stephens Way will be reconstructed
- Off-ramp traffic will be shifted
- A retaining wall will be built.

The proposed ramp will be approximately 10 feet lower than the existing ramp at certain locations.

Eastbound Off-Ramp Option B results in a high complexity of construction as it will require temporary pavement for the detour eastbound off-ramp and a temporary retaining wall. Additional construction requirements would include temporarily closing Stephens Way, the Adams Avenue and Wildernest Road intersection and one lane of the existing eastbound off-ramp. There are right-of-way impacts with this option.

### **Environmental Justice: Equitable or Inequitable Effects**

The impacts would be equitable.

### ***Mobility and Accessibility Criteria***

#### **Traffic Congestion**

The two eastbound off-ramp options would result in similar delay and travel time benefits with a slight advantage going to Option B because Dillon traffic can connect to Wildernest Road via S. Adams (See Table 12). Option A only allows traffic to bypass the interchange in one direction. Option B allows traffic in both directions to avoid the interchange.

Options A and B would provide traffic flow at LOS A. Travel times and vehicle miles traveled with Option A (One Way Frontage Road) would be slightly higher than with Option B (Two Way Frontage with a signalized ramp intersection signal because Option A provides better access under I-70 to Wildernest Road.

**Table 12 Overall Travel Results for the Eastbound Off-Ramp Options**

EVALUATION CRITERIA	Option A:	Option B:
	One-Way Frontage Road	Two-Way Frontage Road
Overall Rating (Good, Fair, Poor)	Fair	Fair
Delay Total - Change for Options (hours)	-15.3	<b>-15.5</b>
Interchange/Intersection Delay per veh (sec)	NA	NA
NB, Through Travel Time Dillon and Silverthorne (secs)	-8	<b>-16</b>
SB, Through Travel Time Silverthorne and Dillon (secs)	<b>-14</b>	-11
From I-70 WB through Travel Time to Dillon (secs)	-3	<b>-4</b>
From I-70 EB through Travel Time to Silverthorne (secs)	-8	<b>-9</b>
Silverthorne to EB Travel Time I-70 (secs)	-14	<b>-16</b>
Dillon to WB Travel Time I-70 (secs)	<b>0</b>	<b>0</b>

**How Much Shorter are Ramp Backups than Existing or No Build Conditions?**

Ramp backups would be eliminated due to increased off-ramp length. The effective length of each ramp is similar so the results for Options A and B would be the same.

**Potential Number of Person trips on Alternative Modes**

Not Applicable.

**Potential for Enhanced Bicycle and Pedestrian Usage**

Refer to the Section 4(f) Resources discussion.

### **How Well are Summit Stage/Local Transit Service and Stops Accommodated?**

Both Option A and B will require reconstruction of the existing Summit Stage stop by the Factory Outlet stores along Stephens Way.

### ***Aesthetics Criteria***

#### **Support for CSS Aesthetic Guidance**

The potential for Options A and B to comply with the CSS Aesthetic Guidance, the Area of Special Attention Report goals and objectives and local policies is similar. Each alternative has similar opportunities and could be designed to adhere to the requirements and conform to local design policies. The new bridges over the Blue River would be the subject of considerable community interest and concern.

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## WESTBOUND ON-RAMP IMPROVEMENT OPTIONS

Three options were evaluated:

A – Improved Ramp Access Grade

B – Improved Ramp Access and Grade Extended Ramp with Direct Access for Wilderdest Neighborhood

C - Improved Grade and 2-Lane On-ramp over Blue River

### **Description:**

Options A, B and C are similar near SH 9, but the alignments diverge to the west on I-70 (See Appendix A). Option A was proposed to reduce the grade of the ramp serving I-70. Option B also improves the grade (to 4.5 % from 6%), but was designed to respond to input from public seeking improved I-70 access to and from the Wilderdest neighborhood. Option C provides both grade improvements and an extended ramp with 2-lanes. The 2-lane on-ramp will provide standard merge and acceleration lengths reducing the probability that cars from the ramp will enter existing through lanes on I-70 prior to gaining adequate speeds, and will allow motorists to pass slower moving vehicles that can't accelerate on the improved, but still steep grades as quickly as necessary. All options would provide safety enhancements and improve traffic operations on the SH 9 to I-70 westbound on-ramp. No conflict points would be eliminated, but Option C would improve the weave where the ramp joins I-70.

Currently, uphill grades for the ramp are at 5% and quickly steepen to 6%. Vehicles turning onto the ramp from southbound SH 9 yield to left turning vehicles from northbound SH 9, and then often have difficulty accelerating again on these steep and often icy grades. All three options provide a sag vertical curve off the SH 9 mainline prior to beginning the climb, additional width for the merge and a larger radius for the right turn off of southbound SH 9. The grade is improved to 4.5% for Options A and C. The grade improvement with Option B is 3%. Option B has a flatter grade since its first critical clearance point is as it crosses Stephens way near the Blue River.

With Option A, the ramp alignment is pushed slightly away from I-70 and the gore connection to I-70 is moved slightly closer to the Blue River Bridge. Since the I-70 sag is located on the Blue River Bridge, the ramp does not need to climb as much, allowing the flatter grade. A small retaining wall (or Guard Rail Type 7 "F" shape) between I-70 and the ramp will be required to protect the new difference in grades between the roadways before the new gore location. The guard rail may have an impact on sight distance for vehicles merging onto I-70; although an additional safety concern, it should still be acceptable since this ramp becomes a continuous lane on I-70 west of the interchange. The overall safety issues at the merge are not addressed with this Option.

With Option B, the ramp alignment is separated from I-70, but parallel to it until after the Blue River crossing. From there west, it is connected to I-70, but separated from mainline traffic by a concrete median barrier. After approximately one mile, a secondary access off Wilderdest Road (just east of Fawn Court) is provided for traffic from the Wilderdest neighborhood. Shortly after this secondary access, the ramp merges with I-70 mainline traffic.

Although the logical location for this Wildercrest Road slip ramp would be where there is currently a graded emergency access, this location does not work because of the proximity of Fawn Court and buildings it serves. The next feasible location for this connection is about 900 feet east, but this location requires some high retaining walls and a 6% grade on the slip ramp between relocated Wildercrest Road and I-70. Considerable grading is needed west and east of the Blue River Bridge to establish a foundation for the new ramp. This alternative requires a 551 foot long four span bridge over the Blue River, Stephens Way and South Adams Avenue. Utilizing a steel girder or spliced girder structure will result in bridge deck depths of 6 to 7 feet.

Option B provides slightly more interchange capacity since traffic from the Wildercrest neighborhood going westbound on I-70 does not need to travel through the interchange, since it can access I-70 near Fawn Court. A second advantage of Option B is that by moving the ramp access ½ mile west, it allows the current three lanes on westbound I-70 bridge over the Blue River to be striped to accommodate three through lanes on I-70. This would eliminate the need to replace the Blue River bridge if I-70 is ever restriped to three lanes between the westbound off and on-ramps. Pushing the gore point further to the west requires construction of a new independent bridge over Stephens Way, Adams Avenue and the Blue River. The new bridge would be 28 feet wide.

Pushing the gore point further down the road than in Option A, results in better sight distance, and is equivalent to what exists now. This option best addresses mobility and possible causes of accidents on I-70. This option widens the existing 550 feet long bridge by 28 feet, which provides adequate width for an extended 2-lane ramp across the bridge, and 3 through lanes on I-70 in the future. With the longer 2-lane ramp, vehicles can better attain freeway speeds prior to the merge with I-70, and allowance is made to pass slower moving vehicles such as trucks without entering existing high speed through lanes on I-70.

Note:

I-70 is currently configured with a 6-foot inside shoulder, two 12-foot through lanes, a 12-foot acceleration lane, and a 6-foot outside shoulder creating a total roadway width of 48 feet. The new eastbound bridge deck will include a 10 foot inside shoulder, three 12 foot through lanes, and two 12 foot acceleration lanes, and a 6 foot outside shoulder creating a total roadway with of 76 feet (28 additional feet). An additional 12 foot through lane would be provided with this improvement to address the long-term possibility of providing three west bound lanes on mainline I-70 to address safety and/or capacity needs in the future.

Options A, B and C can be built independently, or in conjunction with any of the proposed alternatives being advanced. If built independently prior to interchange reconstruction (using any of the alternatives under consideration), about 60% of the improvements for Option A, 5% of the improvements for Option B, or 10% of Option C would need to be rebuilt in the future.

## **Detailed-Level Evaluation**

### ***Sustainable Operations Criteria***

#### **Capital Cost**

Option B is far more expensive than Option A because it includes a much longer ramp and a new bridge structure along I-70 which spans the Blue River, Stephens Way and S. Adams Avenue. The cost for Option C falls halfway in between the other two options since it provides a widened bridge, but the extended length of the ramp is much less.

The total cost estimates are as follows:

Option A:	\$ 821,000
Option B:	\$11,212,000
Option C:	\$ 5,900,000

#### **Life Cycle Costs**

Option A has the lowest life cycle costs because this option is far simpler than Options B and C. Options B and C require new bridges and far more ramp facilities that would contribute to life cycle costs. Option B would have slightly more life cycle cost than Option C, but Option B allows I-70 over the Blue River Bridge to be striped with three lanes in each direction, thereby increasing the life cycle of that bridge. A bridge widening would be needed with Option C.

#### **Level of Project Phasing Relative to Available Budget**

Options A and B would likely be constructed in one phase because there are no interim improvements that would function independently. The access facilities necessary to connect the Wilderrest neighborhood to the ramp and I-70 could be constructed after ramp construction as a separate phase, but this connection is a fundamental purpose of the extended ramp making that possibility illogical. Option B is more difficult to select as an early action project than Option A because of the high cost of the Option B improvements necessary to provide the additional ramp length and Wilderrest connection.

#### **Length of Roadway Requiring More Lighting and Maintenance**

Option A requires the least amount of lighting and maintenance because this option is far simpler and shorter than Options B and C. Lighting and maintenance requirements for Options B and C would be similar.



## Safety Criteria

### Number of Traffic Conflict Points (Improvement to High Accident Locations)

The number of conflicts associated with the Westbound On-Ramp options is as follows:

Option A:	0
Option B:	3
Option C:	0

All three options produce safety benefits. The benefits are highest for Options B and C because they both improve merge distances. Option C would be preferred over Option B because Option B is unconventional and introduces new conflict and differential speed concerns on the new combined westbound on-ramp. Option C is better than Option A because it not only improves the ramp grade, but also provides additional space and distance for slow moving vehicles to be passed on the ramp without merging in to I-70 mainline traffic, thereby maximizing the safety benefit to I-70.

### Conflict Points: Bike, Pedestrian and Motor Vehicles

The Westbound Off-Ramp options create the following number of conflicts for cyclists and pedestrians:

	Cyclists	Pedestrians
Option A:	0	0
Option B:	3	2
Option C:	0	0

No conflict points are added or removed by Options A and C. Option B adds conflicts by increasing travel on Wildernest. This change would not be offset by diversion of vehicles away from conflict points at the interchange.

### Effectiveness in Inclement Weather

All three options improve operations under inclement conditions. Option C provides the most benefits.

### Number of Features Resulting in High Maintenance

Options B and C introduce additional structures and facilities that would require far more maintenance than Option A.

## Healthy Environment Criteria

### Acres of New Right of Way

ROW requirements and takes for Options A, B and C are shown in Table 13.

**Table 13 Right of Way, Takes and Business Displacements from the Westbound On-ramp Options**

OPTION	ACRES	FULL TAKES	PARTIAL TAKES	BUSINESS DISPLACEMENTS
A - Improved Grade	0	0	0	0
B – Access to Wilderndest	0.42	0	2	0
C – Two Lane Ramp	0	0	0	0

Option A can be designed to avoid ROW impacts. To avoid impacts, the existing curb section along SH 9 will be matched, and the sidewalk would not be widened.

Option B requires acquisition of 0.42 acres of ROW. Along SH 9, 0.04 acres are required to improve the ramp radius and provide a 10 foot sidewalk (ReMax (at westbound on ramp). For Option B, the toe of the slope on the north side of I-70 would remain inside Right of Way until the proximity of the slip ramp. Currently available ROW records end there, but if the 300 foot width from existing centerline is projected through the remaining impacted area, it is assumed we will need additional acquisition of 0.38 acres in the slip ramp area (assume 2 owners). Fill retaining walls are needed between I-70 and Wilderndest Road west of the Blue River, to avoid impacts to Wilderndest Road, and cut walls are required near the slip ramp access (See Appendix A).

For Option C, the toe of the slope on the north side of I-70 would remain inside existing ROW, but a short fill retaining wall is needed between I-70 and Wilderndest Road west of the Blue River.

The need for temporary construction staging areas for Options A, B and C would be similar, except that the western end of Option B and a small portion of Option C would require additional staging area along Wilderndest Road west of the Blue River.

### Acres of Wetland/Riparian Disruption

Option A would not impact existing wetlands or require work within close proximity to the Blue River. Options B would impact 0.13 acres of wetlands. Option C would impact 0.03 acres of wetlands. Options B and C impact wetlands by including a new bridge over the Blue River. With Option B, the bridge requires a new 28 foot wide structure over the Blue River. Option C requires widening the existing structure by 30 feet. The new structures present the potential for effects on wetlands during construction and long-term impacts associated with increased shade (less exposure to direct sunlight). For Options B and C, the impacts in this location would be 0.03 acres. For Option C, impacts to another 0.10 acres of wetlands would also occur near the Wilderndest development.

Potential temporary construction phase impacts on wetlands would be avoided, minimized and mitigated through implementation of Section 404 Clean Water Act permitting and the application of standard and best management practices for stormwater management (sediment and water quality control measures).

#### **Air Quality: Hours of Delay**

The air quality impacts of Options A, B and C are similar and minor.

#### **Number of Sensitive Receptor Impacts - Noise**

The number of noise sensitive receptors within 500 feet of the construction footprint of the westbound on ramp options was estimated. For Options A, B and C, the Blue River/Blue River Trail is the primary noise sensitive receptor within 500 feet of the estimated construction footprint. However, Options B and C also influence noise levels in the Wilderdest neighborhood. The noise effects of Option A are inconsequential due to their distance from the Blue River and Blue River Trail. The ramp extensions associated with Options B and C would incrementally increase noise along the Blue River. Noise impacts further west along I-70 would be minor because I-70 mainline traffic would continue to remain the dominant noise source (< 3dB) after the traffic enters I-70. Planned improvements providing I-70 access to the Wilderdest neighborhood would be closer to more noise sensitive receptors.

#### **Acres of Wildlife Habitat Disruption**

No direct wildlife impacts would occur with Option A. Indirect impacts from Options B and C would be similar and minor.

#### **Acres of Fisheries Habitat Disruption**

No fisheries impacts would occur with Option A. New bridges over the Blue River with Option B and C would impact fisheries during the construction period and would add 28 feet of bridge deck over the Blue River, incrementally reducing solar access and degrading existing fishing sites.

#### **Acres of Wildlife Linkage Zones**

No impacts on designated wildlife linkages zones would occur with Options A, B and C.

#### **Number of Recreation Resource Impacts, including Section 4(f) and 6(f) Resources**

Option A does not cause construction period effects to the Blue River Trail. Options B and C require construction over the Blue River Trail creating the potential for temporary closure, rerouting and/or travel/use disruption during construction. Neither option would create substantive long term effects on the trail.

If Option A and B served exactly the same purposes, this comparison and Section 4(f) and 6(f) requirements would clearly point to Option A as preferred. However, because of the added purpose served by Options B and C, a direct connection to the Wildernest community, a direct comparison would not be entirely appropriate.

### ***Historic Context Criteria***

#### **Number of Paleontological Resources**

Option A would not present the potential to encounter paleontological resources. Options B and C could encounter fossils as part of bridge founding construction.

#### **Number of Archaeological Resources**

Option A would not present the potential to encounter archaeological resources. Options B and C could encounter archaeological resources as part of bridge founding construction, but the probability is extremely low.

#### **Number of Historic Resources**

No historic resources are present in the area.

### ***Communities Criteria***

#### **Support for Economic Investments**

Option A would have no impact on past economic investments or existing for future economic vitality and would not provide opportunities for aesthetic enhancements. Option B would have a moderate positive impact by enhancing access to the Wildernest neighborhood, diverting some traffic away from the interchange that doesn't support local commercial activity, and by providing opportunities for aesthetic enhancements. Option C would have little to no impact on past economic investments or existing for future economic vitality, but would provide opportunities for aesthetic enhancements.

#### **Supported by the Community**

Community support for interchange improvements has been expressed at the project's public meetings and by the Project Leadership Team. The public will have another opportunity to comment on the improvements at the public meeting on June 13, 2012.

### **Number of Businesses Impacted**

Under Option A, there are no impacts to business access or existing businesses. Under Option B, the extended ramp and frontage road increase local access to Wildernest, but construction may disrupt business access along Wildernest. Option B allows Wildernest residents access to I-70 without having to utilize the Silverthorne interchange. This would decrease the level of traffic congestion near the interchange and to and from existing businesses in the area. Option C may disrupt business access along Wildernest during construction. Option C doesn't provide improved I-70 access for Wildernest residents.

### **Number of Business Access Points Hindered or Eliminated**

Options A, B and C would not directly hinder or eliminate business access points.

### **Number of Homes Impacted**

Options A, B C have no residential impacts. With Option B, construction period disruption to residential access is required to increased access for the Wildernest neighborhood.

### **How Well Are Construction Impacts Minimized?**

Option A involves a relatively low level of construction complexity. Option A will require temporary shoring between the proposed and existing on-ramp. One lane of the on-ramp and the southbound SH 9 turn lane to the westbound on-ramp will be temporarily closed as the new ramp and retaining wall are being constructed. Options B and C would increase the level of construction complexity by requiring new bridges over the Blue River, Stevens Way and Adams Avenue. Option B also includes disruption to Wildernest Road.

### **Environmental Justice: Equitable or Inequitable Effects**

The impacts would be equitable.

### ***Mobility and Accessibility Criteria***

#### **Traffic Congestion – Levels of Service (LOS), Travel Times and Vehicle Miles Traveled**

Options A and C improve safety, but do not substantially increase mobility or accessibility (See Table 14). Option B improves access from the Wildernest neighborhood and incrementally increases mobility within the interchange area by diverting some westbound I-70 trips from the Wildernest neighborhood away from the interchange. Option A doesn't change existing conditions. Options B and C would reduce total delay and improve overall operating conditions.

**Table 14 Overall Travel Results for the Westbound On-Ramp Options**

EVALUATION CRITERIA	Option A: Improved Grade	Option B: Improved Grade, Extended Ramp with Direct Access for Wildernest Neighborhood	Option C: Improved Grade and 2-Lane On-Ramp over Blue River
Overall Rating (Good, Fair, Poor)	Fair	Good	Fair
Delay Total - Change for Options (hours)	No Change	-24.1	No Change
Interchange/Intersection Delay per veh (sec)	No Change	No Change	No Change
NB, Through Travel Time Dillon and Silverthorne (secs)	No Change	-2	No Change
SB, Through Travel Time Silverthorne and Dillon (secs)	No Change	-20	No Change
From I-70 WB through Travel Time to Dillon (secs)	No Change	No Change	No Change
From I-70 EB through Travel Time to Silverthorne (secs)	No Change	-2	No Change
Silverthorne to EB Travel Time I-70 (secs)	No Change	-20	No Change

Option A would provide little to no improvement to overall interchange delay, but would improve safety. Option B allows traffic from the Wildernest neighborhood direct access to westbound I-70 allowing them to avoid the interchange completely resulting in better interchange operations. The direct connection to the Interstate possible with Option B would provide substantial time savings for these motorists. Option C would provide minor improvement to overall interchange delay, but would significantly improve safety on this ramp and for I-70 through traffic.

**How Much Shorter are Ramp Backups than Existing or No Build Conditions?**

Not Applicable.

**Potential Number of Person Trips on Alternative Modes**

Not Applicable.

### **Potential for Enhanced Bicycle/Pedestrian Usage**

Options A, B and C would not impact pedestrian or bicycle use. Construction disruption with Options B and C would occur.

### **How Well are Summit Stage/Local Transit Service and Stops Accommodated?**

Not Applicable.

### ***Aesthetics Criteria***

#### **Support for CSS Aesthetic Guidance**

The potential for Options A, B and C to comply with the CSS Aesthetic Guidance, the Area of Special Attention Report goals and objectives and local policies is similar. Each alternative has unique opportunities and could be designed to adhere to the requirements and conform to local design policies. Option A presents the fewest opportunities because of the simplicity of this improvement. The new bridges over the Blue River included with Options B and C would be the subject of considerable community interest and concern. The features of Option B would be of particular concern to the residents of the Wildernest neighborhood.

## SH 9/WILDERNEST INTERSECTION OPTIONS

Three options were evaluated:

- A – Conventional Intersection, Ultimate
- B – Roundabout Intersection
- C – Conventional Intersection Interim

### Description

Option A reconstructs the conventional intersection with primary improvements including widening SH 9 by adding a second left turn lane from northbound SH 9 onto Wilderdest Road, and providing an improved (straight) alignment from Wilderdest Road to Rainbow Drive. Option B replaces the existing conventional intersection with a roundabout. Option C reconstructs only the Rainbow Drive leg of the existing intersection, which results in better alignment of Rainbow Drive with Wilderdest Road. The Option A and C alignment improvements allow simultaneous left turns of these roadways, eliminating the need for split phasing which results in greater intersection capacity. Option C utilizes improvements completed by the Town of Silverthorne during the summer of 2011, but does not provide the ultimate double left turn from SH 9 to Wilderdest Road.

Currently, motorists using the westbound off-ramp who plan to turn left onto Wilderdest Road at the SH9/Wilderdest intersection are required to weave across two SH 9 through lanes in a short distance. Options A and B provide safety enhancements and improve overall traffic operations for this movement. Option A provides improvements to the current weave distance across SH 9 by adding storage capacity. The double left turn will also result in a shorter left turn cycle, allowing more time for other movements in the intersection. The improved alignment, which eliminates the skew between Wilderdest Road and Rainbow Drive, also provides additional safety enhancements.

Option B eliminates this weave movement completely since vehicles can stay in the right hand lane and utilize the roundabout. Option C does not provide any direct improvements to this weave, but elimination of the split phase for lefts turns off Rainbow Drive and Wilderdest Road will allow a longer left turn cycle for the SH 9 to Wilderdest Road movement, which may provide an indirect improvement by clearing out vehicles from the left hand turn lane during high congestion hours.

Options A and B assume some kind of interchange alternative is built in conjunction with their improvements to the intersection. Actual intersection improvements are only shown about 200 feet towards the I-70 interchange. Options A and B can be built independently (without an interchange improvement), but if they are built independently, an additional transition segment will need to be built to tie them into existing SH 9 laneage. This segment of SH 9 can be built without superelevation since it is a low speed urban highway, and curvature is flat enough.



Option C is an early phase of Option A. Option C has the advantage that it is not tied to any interchange improvements. It can be built independently.

Note:

The future performance of this intersection is linked to additional improvements to Wildernest extending to the Wildernest/Stevens Way intersection. The improved operations and Levels of Service reflected in the following evaluate would be recognized when the Town of Silverthorne improves Wildernest to provide a 2-lane section extending to Stephens Way. This future 2-lane widening is consistent with the Silverthorne Transportation Plan and drawings that define the ultimate Wildernest roadway section.

### **Detailed-Level Evaluation**

#### ***Sustainable Operations Criteria***

##### **Capital Cost**

Full depth pavements are assumed in all reconstructed areas since widening and centerline alignment vary from existing. For Option A, it is hoped that more detailed design could result in the ability to revise grades to utilize the existing pavement structure on at least one side of the roadway.

Option A:	\$1,949,000
Option B:	\$2,404,000
Option C:	\$ 368,000

##### **Life Cycle Costs**

The life cycle costs for Options A and B would be similar, with the roundabout presenting slightly higher life cycle costs. The interim design, Option C, presents a slightly lower life cycle costs than Options A and B.

##### **Level of Project Phasing Relative to Available Budget**

Options A, B and C would all likely be constructed in one phase because there are no interim improvements that would function independently. Options A and B both can be built without an Interchange Alternative, but if they are built independently, an additional transition segment will need to be built to tie them into existing SH 9 laneage. Construction of Option C can be built with or without an Interchange Alternative, with no additional costs or transitions.

## Length of Roadway Requiring More Lighting and Maintenance

Option B would require more paving, lighting and maintenance than Options A and C.

### *Safety Criteria*

#### **Number of Traffic Conflict Points (Improvement to High Accident Locations)**

The number of conflict points for the three intersection options is as follows:

Option A:	64
Option B:	16
Option C:	60

The convention intersections, Options A and B, would have similar accident locations, but the interim solution would slightly increase the potential for accidents by allowing one more protected permissive left turn. The Roundabout would have fewer conflict points, different accident locations, but overall the safety conditions would be similar to the conventional alternatives.

#### **Conflict Points: Bike, Pedestrian and Motor Vehicles**

The SH 9/Wilderness intersection options create the following number of conflicts for cyclists and pedestrians:

	Cyclists	Pedestrians
Option A:	64	36
Option B:	16	20
Option C:	60	34

Bicycle and pedestrian conflicts would be similar for Options A and C. The roundabout would provide additional conflicts associated with free moving traffic and yield conditions at all conflict points.

#### **Effectiveness in Inclement Weather**

Operations in inclement weather would be similar for Options A and C.

#### **Number of Features Resulting in High Maintenance**

Maintenance requirements would be similar for Options A, B and C. The roundabout would require slightly more maintenance.

## Healthy Environment Criteria

### Acres of New Right of Way

ROW requirements, takes and business displacements for Options A, B and C are shown in Table 15.

**Table 15 ROW Requirements, Takes and Business Displacements for the SH 9/Wilderness Intersection Options**

OPTION	ACRES	FULL TAKES	PARTIAL TAKES	BUSINESS DISPLACEMENTS
<b>A Conventional - Ultimate</b>	0.43	0	4	0
<b>B Roundabout</b>	1.00	3	4	8
<b>C Conventional - Interim</b>	0.07	0	1	0

Option A: New ROW would be acquired at three of the four quadrants of the intersection involving a total of 0.43 acres. At Wendy's (Riverview Sub #1, 0190), 0.16 acres would be required. This requirement would displace landscaped areas and about seven parking spaces on the north side of Wendy's. At the 7-Eleven (Riverview Sub #1, 201), 0.14 acres of ROW would be needed. This would require removal of one set of gas pumps and would eliminate one access point to this property. At the building providing space for five businesses (Riverview Sub, 181), 0.13 acres of new ROW would be required. This requirement would change site circulation patterns and would eliminate as many as nine parking spaces. The driveway access along Wilderness would need to be removed or relocated closer to the building (further west). The loss of this parking would adversely impact the existing businesses and would impact their viability. Factory outlet parking behind the building may provide an option to compensate for the loss of parking.

Option B: Five properties, involving eight business displacements, would be impacted with Option B for a total of 1.00 acres. By the Wendy's, 0.34 acres would be required. This acquisition would result in a loss of parking and the drive-through operation. These impacts would substantially impact the viability of this business. The 7-Eleven would have 0.20 acres of impact and would lose both gas pump sites. This would likely require a relocation or buy-out of the business. The southwest quadrant would have 0.45 acres of impact which would require removal of the building and displacement of the five businesses and the Conoco Station. A total of 0.01 acres would be needed to tie the proposed sidewalk into the existing sidewalk.

Further review of the State Highway Access Code and analysis of final design phase details for the improvement and the site planning adjustments would be needed to draw the conclusion about business displacement from Options A and B.

Option C: Option C requires a total of 0.07 acres of ROW from the Wendy's parcel. This ROW impact would only involve landscaped areas.

**Acres of Wetland/Riparian Disruption**

Options A, B and C would not impact wetlands.

**Air Quality: Hours of Delay**

Impacts on air quality with Options A, B and C would be minor. Options A and B would provide more efficient operations which would slightly improve air quality.

**Noise: Number of Sensitive Receptors/Impacts**

The Blue River and Blue River trail are located within 500 feet of the planned improvements at the SH 9/ Wildernest intersection. Due to topography, noise impacts from Options A, B and C would be minor (< 3dB) and similar.

**Acres of Wildlife Habitat Disruption**

Options A, B and C would not impact wildlife.

**Acres of Fisheries Habitat Disruption**

Options A, B and C would not impact wildlife.

**Acres of Wildlife Linkage Zones**

Options A, B and C would not impact designated wildlife linkages zones.

**Number of Recreation Resource Impacts, including Section 4(f) and 6(f) Resources**

There are no direct impacts to the Blue River Trail from Options A and C. The Trail access pathway north of the 7-Eleven would need to be reconstructed to adjust the grade with Option B. The existing sidewalks across the bridge over the Blue River will be relocated and the landscaping will be impacted with Options A and B.

## *Historic Context Criteria*

### **Number of Paleontological Resources**

Options A, B and C would not be expected to impact paleontological resources.

### **Number of Archaeological Resources**

Options A, B and C would not impact be expected to impact archaeological resources.

### **Number of Historic Resources**

Options A, B and C would not impact historic resources.

## *Communities Criteria*

### **Support for Economic Investments**

Options A would create minor impacts on past economic investments and contribute in minor ways to future economic vitality and opportunities for aesthetic enhancements. Option B would generate considerable business impacts that would detract from prior investments. However, Option B disruptions might encourage redevelopment and allow for considerable aesthetic improvements, especially within the center area of the roundabout. Option C would also create considerable business impacts, but those effects and enhancement opportunities would be less than those associated with Option B. (See Number of Businesses Impacted).

### **Supported by the Community**

Community support for interchange improvements and past intersection improvements has been expressed at the project's public meetings and by the Project Leadership Team. The public will have another opportunity to comment on improvements at the public meeting on June 13, 2012.

### **Number of Businesses Impacted**

Under Option A, the five existing businesses in the building in the southwest quadrant of the intersection would be impacted by the expansion of the ROW required for widening to add a 2<sup>nd</sup> left turn lane from SH 9 to Wildernest Road and a 10 foot a sidewalk along SH 9. Access from SH 9 southbound to the properties would remain, however parking capacity would be impacted. With the geometric changes to the intersection, business access from Wildernest Road would also be impacted. The existing driveway, located on Wildernest would be moved west 15 feet and be adjacent to the existing building. The new access point would result in the loss of parking at the front of the businesses along SH 9 and change parking lot circulation patterns. This would impact the viability of these existing roadway dependent businesses and impact future redevelopment options for the property.

The northwest quadrant of the intersection is also impacted by the widening of Wildercrest. The right of way pushes into the property line displacing one set of pumps for business operation of the existing 7-Eleven and forcing the access point to the property to be located further west along Wildercrest Road in combination with other properties. Future development options would be limited due to the size of the developable property and reduced access to the property. In the southeast quadrant of the intersection (Wendy's), the landscaped area adjacent to the existing Wendy's would be impacted along with about six parking spaces. Business access to the property would remain intact and the drive-through operation would remain. These details would be addressed during the Final Design process.

Under Option B, all four corners of the intersection would be impacted by the roundabout configuration displacing eight businesses. The parking capacity and drive-thru operations of the existing Wendy's restaurant would be impacted. In the southwest quadrant, the ROW line would push into the property requiring the relocation of the five existing businesses and the Conoco gas station. In the northwest quadrant, the ROW line would move into the property impacting the access to the property and the viability of the business operation. The 7-Eleven gas pumps would be eliminated. The right-of-way required to accommodate the roundabout configuration coupled with changes in business access would impact the viability of today's business operations at three corners of the intersection, and affect future redevelopment options for these properties.

Under Option C, minor impacts on the landscaped areas of the Wendy's property would occur. These impacts will not disrupt business operations.

#### **Number of Business Access Points Hindered or Eliminated**

Option A eliminates one access point to the 7-Eleven on the northwest corner, and hinders or requires changes to the 2 access points for the building with the 5 businesses on the southwest corner of the intersection. Option B eliminates five access points. Option C does not impact or hinder any access points to businesses. (See Business Impacts for additional details).

#### **Number of Homes Impacted**

Options A, B and C would not result in impacts to residential properties.

#### **How Well Are Construction Impacts Minimized?**

Option A has a moderate level of construction complexity and disruption. Option B would require a high level of construction complexity and disruption as it will require temporary pavement, multiple detours and lane closures, and a temporary signal during phases of construction. Option C requires a low level of construction complexity and disruption. Temporary pavement would be required to allow for shifts in traffic to the other direction of SH 9 as the intersection is being reconstructed. Construction of the sidewalk, curb and gutter, islands and final striping will be completed in the final phase of construction.

## **Environmental Justice: Equitable or Inequitable Effects**

No inequitable effects are anticipated.

### ***Mobility and Accessibility Criteria***

#### **Traffic Congestion – Levels of Service (LOS), Travel Times and Vehicle Miles Traveled**

Options A, B and C improve traffic operations in 2035 relative to the No Action condition, but the conventional designs (Options A and C) perform better than Option B, the roundabout design (See Table 16).

The convention intersection (Option A) performs much better than the roundabout design (Option B) at the SH 9/Wilderness intersection because the high through volumes on SH 9 are delayed through the roundabout design. In other nearby mountain communities, where roundabouts are in place, there is far less through traffic and a higher turning proportion which is a condition that is more effectively handled by a roundabout design.

Note:

The future performance of this intersection is linked to additional improvements to Wilderness extending to the Wilderness/Stevens Way intersection. The improved operations and Levels of Service reflected in the following evaluate would be recognized when the Town of Silverthorne improves Wilderness to provide a 2-lane section extending to Stephens Way. This future 2-lane widening is consistent with the Silverthorne Transportation Plan and drawings that define the ultimate Wilderness roadway section.

**Table 16 Overall Travel Results for the SH 9/Wilderness Intersection Options**

EVALUATION CRITERIA	Option A:	Option B:	Option C:
	Conventional Intersection  Ultimate	Roundabout	Conventional Intersection  Interim
Overall Rating (Good, Fair, Poor)	Good	Poor	Fair
Level of Service	C	F	D
Delay (average delay in second per vehicle)	34.3	78.2	37.6
Average Daily Traffic	49,400	49,400	49,400
Delay Total - Change for Options (hours)	NA	89.0	17.0
Interchange/Intersection Delay per veh (sec)	34.3	78.2	37.6
NB, Through Travel Time Dillon and Silverthorne (secs)	NA	+113	+5
SB, Through Travel Time Silverthorne and Dillon (secs)	NA	+123	+9
From I-70 WB through Travel Time to Dillon (secs)	NA	0	0
From I-70 EB through Travel Time to Silverthorne (secs)	NA	+253	+13
Silverthorne to EB Travel Time I-70 (secs)	NA	+85	+2

**Potential Number of Person trips on Alternative Modes**

Not Applicable

**How Much Shorter are Ramp Backups than Existing or No Build Conditions?**

Not Applicable.



## **Potential for Enhanced Bicycle/Pedestrian Usage**

With Options A and C, pedestrian and bicycle movement through the intersection would be accommodated with pedestrian phases at the signal. Pedestrians would cross Wildercrest Road right hand turning movement as a single pedestrian leg, utilizing a pedestrian island and making this pedestrian movement visible to the drivers on Wildercrest.

With Option B, pedestrian and bicycle movement through the roundabout would be difficult because of the roundabout bypass lanes on each leg of the roundabout. Pedestrian and bicycle crossings would need to occur outside of circulating pattern of the roundabout, some distance back of the integration of the bypass lanes.

## **How Well are Summit Stage/Local Transit Service and Stops Accommodated?**

No long-term impacts on transit use would be expected.

## ***Aesthetics Criteria***

### **Support for CSS Aesthetic Guidance**

Options A, B and C provide substantial opportunities to comply with the CSS Aesthetic Guidance, the Area of Special Attention Report goals and objectives and local policies. The design of the central island associated with the roundabout would be the subject of considerable community interest and concern.

## US 6/LITTLE BEAVER TRAIL INTERSECTION OPTIONS

Two options were evaluated:

A – Conventional Intersection

B – Roundabout Intersection

### Description

Option A requires no widening to existing roadways in the intersection area. Proposed changes are to striping and signing only. On southbound US 6, the far right lane should be striped as a through lane rather than having a solid line typical of a mandatory turn lane. For northbound US 6, the outside third lane approaching Little Beaver Trail should be signed for through or right turn (not mandatory right turn), and striping should be changed to reflect this condition. This improvement could be implemented as part of the next pavement overlay process.

Option B constructs a roundabout at the existing intersection of Little Beaver Trail and SH 6. The primary reason a roundabout is being considered at this location, is if the signal at Stephens Way needs to be eliminated for one of the proposed alternatives to function properly. Also, since there are numerous closely spaced signals along this corridor, it can be studied whether eliminating this signal may result in improved signal progression through the corridor. If the signal at Stephens Way is eliminated, vehicles will not be able to turn left onto US 6/SH 9. Instead, they will head south on US 6, to the roundabout, where they will be able to reverse direction for access to northbound US 6 and ultimately I-70. Designing a roundabout at this location is difficult since existing grades approaching from the east are near 6%, and generally accepted design criteria for roundabouts recommend a maximum grade of 4%. Flattening the grade approaching Little Beaver Trail results in up to a 9 foot raise in the existing grade elevation. This requires increasing grades north of the intersection from 4% to 6% through the Stephens Way intersection. Access to the Diamond Shamrock on Stephens Way will require a only minimal grade change at the entrance access. At Little Beaver Trail, the roundabout is centered on US 6, and moved slightly to avoid the large cut and impacts to the Super 8 Motel. This location requires acquisition of the Phillips 66 gas station, impacts much of the parking in the Summit Place shopping center, and impacts all of the parking between Office Max and US 6.

Option B results in no new conflict points, and provides a benefit by eliminating the poorly placed Phillips 66 access points on the corner of Little Beaver Trail and US 6. This location of this roundabout provides some local mobility benefits, but no regional mobility benefits. Overall safety of Option B is compromised with steep grades in and out of the roundabout. In particular, southbound vehicles slowing down or stopping at the Stephens Way intersection/signal, will be faced with 6% grades. Pedestrian safety is also compromised at roundabouts, and could be of particular concern since this is located at the entrance to a strip mall and near Summit Stage stops, which would introduce heavier than normal pedestrian traffic.

## **Detailed-Level Evaluation**

### ***Sustainable Operations Criteria***

#### **Capital Cost**

Option A	TBD (minor)
Option B	\$3,999,000

#### **Life Cycle Costs**

Reconstruction of the intersection to create a roundabout prior to the end of the useful life of the existing intersection would generate high life cycle costs for Option B.

#### **Level of Project Phasing Relative to Available Budget**

Option A would be implemented in one phase.

Option B can be built independently, or in conjunction with the proposed alternatives or the Advanced Intersection Signal Timing Option. Option B would likely be built in one Phase because there are no interim improvements that would function independently when building a roundabout. The large grade changes will make staging this construction project difficult and expensive. If built independently prior to interchange reconstruction (using any of the alternatives under consideration), only about 15% of the improvements would need to be rebuilt in the future

#### **Length of Roadway Requiring More Lighting and Maintenance**

Additional lighting for the roundabout may be needed. Alternative A would require no additional lighting. Maintenance of the roundabout would be more involved than for the existing conventional intersection.

### ***Safety Criteria***

#### **Number of Traffic Conflict Points (Improvement to High Accident Locations)**

The number of conflict points to the US 6/Little Beaver intersection is as follows:

Option A	56
Option B	14

Option A would not change existing conflict points. Even with fewer conflict points, the roundabout would present a slightly higher potential for accidents due to the relatively steep grades associated with US 6 and the movement of trucks, including those carrying hazardous materials, through the curves.

**Conflict Points: Bike, Pedestrian and Motor Vehicles**

The US 6/Little Beaver intersection options create the following number of conflicts for cyclists and pedestrians:

	Cyclists	Pedestrians
Option A	56	35
Option B	14	13

The roundabout would be more difficult and less safe for southbound (uphill) cyclists along US 6, and for pedestrians trying to cross unimpeded traffic at the intersection.

**Effectiveness in Inclement Weather**

The roundabout could be designed to address inclement weather, but the grades above and below the intersection and the curves would present challenges, especially for large trucks.

**Number of Features Resulting in High Maintenance**

The roundabout would include more features requiring maintenance, but would not include a traffic signal.

*Healthy Environment Criteria*

**Acres of Right of Way**

ROW requirements, takes and business displacements for Options A and B are shown in Table 17.

**Table 17 Right of Way, Takes and Business Displacement from the US 6/Little Beaver Intersection Options**

ALTERNATIVE	ACRES	FULL TAKES	PARTIAL TAKES	BUSINESS DISPLACEMENTS
<b>A Conventional</b>	0	0	0	0
<b>B Roundabout</b>	1.59	0	4	1

At the intersection of Little Beaver Trail and US 6, all quadrants are impacted by construction of the roundabout. The ROW impacts for this option are very high at 1.59 acres. Along US 6, 0.08 acres is required to provide widening for the Summit Stage pullout. Across the road along Stephens Way, 0.22 acres is needed to bring the road back to existing grades. This results in temporary access impacts to both Burger King and the Diamond Shamrock gas station. A total of 0.06 acres is needed for the approach area to the Super 8 hotel. However, ROW requirement does not impact Super 8's function or access. A total of 0.19 acres is required at the Phillips 66 station. This will impact its ability to function, which is likely to result in a displacement. A total of 1.04 acres is required in the Summit Place shopping mall. This eliminates parking, creates impacts to circulation, and impacts accessibility to the parking area between US 6 and the Office Max building. To avoid impacts to Office Max parking, the location of the spur of the roundabout could be moved, but this would impact other parking spaces. The free right turn could require speed control to minimize vehicle pedestrian conflicts in the parking area in front of the OfficeMax. The final design process would optimize the design to minimize parking and access impacts. The requirements of the Uniform Relocation Act would be applied to resolve remaining property impact issues and retain the freight access route on the US 6 side of OfficeMax.

#### **Acres of Wetland/Riparian Disruption**

Options A and B would have no impacts on wetlands.

#### **Air Quality: Hours of Delay**

The operational conditions associated with the two intersection types would generate similar air pollutant emission levels.

#### **Noise: Number of Sensitive Receptors/Impacts**

No noise sensitive receptors are located within 500 feet of the planned improvements. The operational noise from the two intersection types would be similar.

#### **Acres of Wildlife Habitat Disruption**

Options A and B would have no impacts on wildlife.

#### **Acres of Fisheries Habitat Disruption**

Options A and B would have no impacts on fisheries.

#### **Acres of Wildlife Linkage Zones**

Options A and B would have no impacts on designated wildlife linkage zones.

## **Number of Recreation Resource Impacts, including Section 4(f) and 6(f) Resources**

Options A and B would have no impacts on Section 4(f) or 6(f) resources.

### ***Historic Context Criteria***

#### **Number of Paleontological Resources**

Earthmoving needed to construct the roundabout could encounter fossils.

#### **Number of Archaeological Resources**

Earthmoving for the roundabout would present increased potential to encounter archaeological resources, but this potential is low.

#### **Number of Historic Resources**

Options A and B would have no impacts on historic resources.

### ***Communities Criteria***

#### **Support for Economic Investments**

No long-term impacts on economic investments would be expected from Option A. Option B business disruptions would detract from past economic investments, but would allow for considerable aesthetic improvements, especially within the center area of the roundabout (See Number of Businesses Impacted).

#### **Supported by the Community**

Community support for interchange improvements has been expressed at the project's public meetings and by the Project Leadership Team. The public will have another opportunity to comment on the improvements at the public meeting on June 13, 2012.

#### **Number of Businesses Impacted**

The Beaver Trail roundabout requires the widening of US 6 in both the northbound and southbound directions, as well as the widening of cross streets Summit Place and Little Beaver Trail. This widening pushes the ROW into existing property lines and impacts businesses along US 6. The existing access point to businesses west of US 6 would be eliminated with the widening and with the addition of a retaining wall. The expansion of the ROW would encroach into the Office Max property. Because of the operational considerations of the roundabout, a driveway would not be allowed on Summit Place in proximity to the Office Max parcel.

### **Number of Business Access Points Hindered or Eliminated**

The roundabout would eliminate two access points at Phillips 66 and would hinder access to:

- Office Max
- Summit Place shopping center (considered one access).
- Burger King
- Diamond Shamrock.

### **Number of Homes Impacted**

Options A and B would have no impacts on residential properties.

### **How Well Are Construction Impacts Minimized?**

Option A requires a very low level of construction disruption.

The Roundabout results in a high complexity of construction because it would be approximately nine feet higher than the existing intersection grade and because it has a large footprint. The roundabout requires temporary pavement, multiple detours and lane closures, and a temporary signal during phases of construction.

### **Environmental Justice: Equitable or Inequitable Effects**

The effects of the roundabout would be considered equitable.

### ***Mobility and Accessibility Criteria***

### **Traffic Congestion – Levels of Service (LOS), Travel Times and Vehicle Miles Traveled**

Options A and B provide adequate capacity in 2035, but the conventional design provides better overall performance as shown in Table 18.

**Table 18 Overall Travel Results for the US 6/Little Beaver Trail Intersection Options**

EVALUATION CRITERIA	Option A: Conventional Intersection	Option B: Roundabout
Overall Rating (Good, Fair, Poor)	Good	Poor
Level of Service	B	F
Average Daily Traffic	39,600	39,600
Delay Total - Change for Options (hours)	16.9	109.8
Interchange/Intersection Delay per veh (sec)	17.9	116.5
NB, Through Travel Time Dillon and Silverthorne (secs)	NA	+145
SB, Through Travel Time Silverthorne and Dillon (secs)	NA	+111
From I-70 WB through Travel Time to Dillon (secs)	NA	+61
From I-70 EB through Travel Time to Silverthorne (secs)	NA	No Change
Silverthorne to EB Travel Time I-70 (secs)	NA	No Change

The convention intersection (Option A) performs much better than the roundabout design (Option B) at the US 6/Little Beaver intersection because the high through volumes on SH 9 are delayed through the roundabout design. US 6 is a major truck route and a hazardous materials transportation corridor. The roundabout design is not ideal for heavy trucks because the design results in adverse crowns and tight turning radii.

**How Much Shorter are Ramp Backups than Existing or No Build Conditions?**

Not Applicable.

**Potential Number of Person trips on Alternative Modes**

Not Applicable



### **Potential for Enhanced Bicycle/Pedestrian Usage**

Pedestrian and bicycle movement through the roundabout would be accommodated in a method standard to roundabout operation. Pedestrians would cross one leg at a time with cross walks located roughly 25 feet back from the circulating pattern. Southbound (uphill) travel on a bicycle along US 6 would be challenging with the roundabout design.

### **How Well are Summit Stage/Local Transit Service and Stops Accommodated?**

Transit service would operate in the same way it does under existing conditions.

### ***Aesthetics Criteria***

#### **Support for CSS Aesthetic Guidance**

The roundabout design provides substantial opportunities to comply with the CSS Aesthetic Guidance, the Area of Special Attention Report goals and objectives and local policies. The design of the central island would be the subject of considerable community interest and concern.

## ADVANCED INTERSECTION SIGNAL TIMING AND EQUIPMENT OPTION

### Description

With this option, queue detectors (video cameras, traffic loops or new detection technology) would be installed at the interchange approaches to allow extra time for extended vehicle queues and associated backups to disperse. Queue detectors are designed to detect vehicle stacking that will impede traffic flow if not cleared. Each queue detector is linked to a vehicle detector. A queue detector must sense a programmable duration of constant presence before activating. Once the queue detector has activated, it must sense a programmable duration of no presence before it deactivates. Once a queue detector is activated it can alter the controllers pattern mode, initiate a preempt, alter signal group max times, or adjust transit priority operation.

With queue detection, queues that build due to incidents, inclement weather, or unexpected travel demand can be more quickly dispersed. Incident management comes at a price to the efficiency of other movements so under normal to marginally congested conditions, overall system delay may increase slightly. However, if there are the types of incidents described above, there can be significant improvement in overall traffic operations during incident periods.

Since the operations analysis of this study assumes non-incident conditions, quantifying the impact to system delay during the modeled scenarios is difficult to ascertain; however, it is anticipated that the overall impact will be slight. During incident times, the reduction of interchange delay through implementation of queue detection can be significant given the type, location, and duration of the incident but it has the potential of reducing delay by upwards of 50% or more for some types of incidents and high traffic volume conditions.

Advanced signal design would be incorporated into the signal systems for all three Alternatives during the final design process.

### Detailed-Level Evaluation

#### *Sustainable Operations Criteria*

##### **Capital Cost**

\$250,000

##### **Life Cycle Costs**

Life cycle costs would be low.

**Level of Project Phasing Relative to Available Budget**

This option could be implemented in phases.

**Length of Roadway Requiring More Lighting and Maintenance**

Not Applicable.

***Safety Criteria***

**Number of Traffic Conflict Points (Improvement to High Accident Locations)**

Not Applicable.

**Conflict Points: Bike, Pedestrian and Motor Vehicles**

Not Applicable.

**Effectiveness in Inclement Weather**

Advanced signal timing systems would provide incident management benefits during inclement weather, tunnel closure, etc.

**Number of Features Resulting in High Maintenance**

None.

***Healthy Environment Criteria***

**Acres of New Right of Way**

Not Applicable

**Acres of Wetland/Riparian Disruption**

Not Applicable

**Air Quality: Hours of Delay**

Not Applicable.

**Noise: Number of Sensitive Receptors/Impacts**

Not Applicable.

**Acres of Wildlife Habitat Disruption**

Not Applicable.

**Acres Fisheries Habitat Disruption**

Not Applicable.

**Acres of Wildlife Linkage Zones**

Not Applicable.

**Number of Recreation Resource Impacts, including Section 4(f) and 6(f) Resources**

Not Applicable.

***Historic Context Criteria***

**Number of Paleontological Resources**

Not Applicable.

**Number of Archaeological Resources**

Not Applicable.

**Number of Historic Resources**

Not Applicable.

***Communities Criteria***

**Support for Economic Investments**

Not Applicable.

## **Supported by the Community**

Community support for interchange improvements has been expressed at the project's public meetings and by the Project Leadership Team. The public will have another opportunity to comment on the three interchange alternatives at the public meeting on June 13, 2012.

### **Number of Businesses Impacted**

Not Applicable.

### **Number of Business Access Points Hindered or Eliminated**

Not Applicable.

### **Number of Homes Impacted**

Not Applicable.

### **How Well Are Construction Impacts Minimized?**

Not Applicable.

### **Environmental Justice: Equitable or Inequitable Effects**

Not Applicable.

## ***Mobility and Accessibility Criteria***

### **Traffic Congestion – Levels of Service (LOS), Travel Times and Vehicle Miles Traveled**

Advanced signal systems would improve mobility and accessibility during incident conditions. There would be no benefits traffic benefits during normal traffic operations. Substantial benefits would be anticipated during an incident or high volume traffic conditions.

### **How Much Shorter are Ramp Backups than Existing or No Build Conditions?**

Not Applicable.

### **Potential Number of Person trips on Alternative Modes**

Not Applicable.

**Potential for Enhanced Bicycle/Pedestrian Usage**

Not Applicable.

**How Well are Summit Stage/Local Transit Service and Stops Accommodated?**

Not Applicable.

***Aesthetics Criteria***

**Support for CSS Aesthetic Guidance:**

Not Applicable.

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## EASTBOUND AUXILIARY LANE FROM FRISCO TO SILVERTHORNE

Another project, along with the I-70 Silverthorne interchange, that was identified as an early action project as part of the I-70 Mountain Corridor EIS process was the construction of a continuous eastbound auxiliary lane on the south side of I-70 from the Frisco interchange to the Silverthorne/Dillon interchange (milepost 202.7 – 205.1). An auxiliary lane typically extends between a highway on-ramp and off-ramp. They are added to reduce impacts from heavy on-ramp traffic merging with a highway through lane.

The auxiliary lane is intended to address safety and capacity needs. In summary, the I-70 Mountain Corridor PEIS Safety Technical Report, dated August 2010 and reissued March 2011, states the following about auxiliary lanes and the need for this improvement.

Auxiliary lanes were analyzed and given a priority rating of A, B, or C based on the criteria below:

A = meets both of the following criteria:

- Weighted Hazard Index (WHI) greater than 2.50 and
- Substandard geometry

B = Meets either of the following criteria:

- WHI greater than 2.50 or
- Substandard geometry

C = neither of the following criteria:

- WHI greater than 2.50 nor
- Substandard geometry

The Frisco to Silverthorne auxiliary lane was given a priority rating of B with a WHI of 0.23, which reflects substandard geometry in this section of I-70. The substandard geometry involves steep grades and sharp curves.

More specifically, the addition of an eastbound auxiliary lane would improve I-70 capacity and would help address high speeds and speed differences along I-70, especially those involving merging interchange ramp traffic. The Final EIS defines the problem and proposed improvement as follows:

**Problem:** Travel demand west of Silverthorne from local trips combined with through traffic results in Level of Service (LOS) F for eastbound travel between Frisco and Silverthorne.

**Improvement:** An eastbound auxiliary lane is added between Frisco and Silverthorne... The addition of an eastbound auxiliary lane improves traffic operations and substantially reduces the number of hours of LOS F in the Frisco/Silverthorne area - congestion.

The auxiliary lane is described in general terms in the I-70 Mountain Corridor EIS. Although no design drawings have been prepared for this option, the facility has been characterized as follows for purposes of the Detailed-Level screening analysis:

- **New Lane:** A new 12 foot wide travel lane from the Frisco interchange eastbound on-ramp to the Silverthorne/ Dillon interchange eastbound off-ramp constructed adjacent to the southernmost lane of I-70. Vehicles in the auxiliary lane would be in an exit only situation near the interchange. Exit only and speed reduction signs would be needed west of the gore point.
- **Pave Shoulder:** The existing paved shoulder would be replaced alongside the new lane.
- **Scenic Area:** The scenic overlook has 18 diagonal parking spaces for automobiles and nine parallel parking spaces for large vehicles (trucks and recreational vehicles). Reconstruction of the overlook would be needed when the auxiliary lane next to it is constructed. The entry ramp and exit ramp to the scenic area would be replaced with the same design. The scenic overlook parking area would be reconstructed to provide the same amount of parking. The scenic overlook visitor facilities would be replaced.
- **Grading:** Earthwork involving cuts into the hillside and fill to create room for the new lane, shoulder and scenic overlook facilities would be required.
- **Stormwater Management:** New stormwater management facilities would be needed along the entire length of the new auxiliary lane. These facilities would include energy dissipation, detention and other features to address water quality impacts from new paving and earthwork.
- **Phasing:** The project could be built in phases, with the first phase constructed east of the scenic overlook.

Key environmental issues that would be apply to the auxiliary lane project include: potential effects on the scenic overlook area , slope grading requirements and visual effects, and changes to drainage conditions and related effects on stormwater flow, wetlands and other biological issues.

Note:

The level of baseline data available for the footprint of the auxiliary lane is lower than for the core project Study Area and there is no design drawing for this facility. As a result, the following analysis is less detailed than the other analyses.

### **Detailed-Level Evaluation**

#### ***Sustainable Operations Criteria***

#### **Capital Cost**

To be Determined



## **Life Cycle Costs**

This improvement adds a considerable amount of new paving and stormwater management infrastructure to the associated segment of I-70.

## **Level of Project Phasing Relative to Available Budget**

The auxiliary lane could be built in two phases.

## **Length of Roadway Requiring More Lighting and Maintenance**

Lighting requirements for the auxiliary lane will be defined in the future. Some lighting may be needed at and within the scenic area to provide safe ingress, egress, internal circulation, and merging operations. I-70 maintenance requirements will increase and may include periodic stormwater management activities to assure water quality and stormwater management hydraulic requirements are met.

## ***Safety Criteria***

### **Number of Traffic Conflict Points (Improvement to High Accident Locations)**

There are no traffic conflict points associated with the auxiliary lane.

Rest area ingress and egress ramps during and after construction and the merge into I-70 traffic after the rest stop are locations with accident potential. Adherence to design standards and requirements tailored to the vertical and horizontal curves along I-70 should be sufficient to address safety issues.

### **Conflict Points: Bike, Pedestrian and Motor Vehicles**

None.

### **Effectiveness in Inclement Weather**

Operations along the auxiliary lane should be similar to existing conditions along I-70 and within the rest area. These conditions are serious during inclement weather due to steep grades and horizontal curves.

### **Number of Features Resulting in High Maintenance**

Stormwater management activities to assure water quality and hydraulic requirements are met may be relatively high.

## **Healthy Environment Criteria**

### **Acres of New Right of Way**

Although a design is not available for the auxiliary lane, it appears that this improvement could be constructed with little to no need for additional ROW.

### **Acres of Wetland/Riparian Disruption**

Direct and indirect effects on wetlands may occur along I-70. Further field review, delineation and review of detailed design drawings would be needed to assess impacts on wetlands.

### **Air Quality: Hours of Delay**

No substantive air quality issues would be associated with the auxiliary lane improvement.

### **Noise: Number of Sensitive Receptors/Impacts**

A total of 29 noise sensitive receptors are located within 500 feet of the construction footprint of the auxiliary lane. Noise at these receptors is already high based on existing I-70 traffic and in some instances intervening local traffic. Consequently, expected noise increases at the receptors would be expected to be minor (< 3dB).

Noise levels within the scenic area would not change substantially, except during the construction process when incidental noise levels associated with earthmoving and paving occur. Typical construction period mitigation measures, high background noise levels and low expectations for a quiet environment in this location should minimize the significance of increased noise levels during construction. Facility enhancements that reduce noise exposure at the scenic overlook interpretive area may be an appropriate measure to incorporate into the auxiliary lane project.

### **Acres of Wildlife Habitat Disruption**

Indirect effects may be expected from construction activity. These effects could be addressed by adhering to standard CDOT practices for addressing stormwater volumes and water quality.

### **Acres of Fisheries Habitat Disruption**

Indirect effects may be expected from construction activity. These effects could be addressed by adhering to standard CDOT practices for addressing stormwater volumes and water quality.

### **Acres of Wildlife Linkage Zones**

Indirect effects may be expected from construction activity.

### **Number of Recreation Resource Impacts, including Section 4(f) and 6(f) Resources**

There are no obvious Section 4(f) or 6(f) resources along this portion of I-70.

### ***Historic Context Criteria***

#### **Number of Paleontological Resources**

The potential to encounter important paleontological resources during earthwork is high.

#### **Number of Archaeological Resources**

The potential to encounter archaeological resources during earthwork exists. Further literature and database review is needed.

#### **Number of Historic Resources**

Further literature and database review is needed to confirm this finding.

### ***Communities Criteria***

#### **Support for Economic Investments**

Past investment in the scenic area and related benefits would be retained.

#### **Supported by the Community**

Community support for interchange improvements has been expressed at the project's public meetings and by the Project Leadership Team. The public will have another opportunity to comment on the proposed improvements at the public meeting on June 13, 2012.

#### **Number of Businesses Impacted**

None.

#### **Number of Business Access Points Hindered or Eliminated**

Access to and from the rest area would be blocked during construction.

**Number of Homes Impacted**

None.

**How Well Are Construction Impacts Minimized?**

Minor impacts on traffic flow on I-70 would be expected to provide adequate safety to construction workers. No disruption to commercial or residential areas would occur. Reconstruction of the scenic area would close the facility.

**Environmental Justice: Equitable or Inequitable Effects**

The impacts of the auxiliary lane improvement would be equitable.

*Mobility and Accessibility Criteria*

**Traffic Congestion – Levels of Service (LOS), Travel Times and Vehicle Miles Traveled**

The auxiliary lane would substantially increase in capacity along I-70 between the two interchanges, would reduce weaving requirements along I-70 involving local trips (interchange to interchange), and would slightly reduce safety issues associated with off-ramp backups onto I-70.

Levels of Service would be expected to be LOS A. Travel times would be approximately three minutes between interchanges. The auxiliary lane would be approximately three miles in length. Overall VMT would not be substantively influenced by the new lane.

**How Much Shorter are Ramp Backups than Existing or No Build Conditions?**

The auxiliary lane would not impact queuing on the ramps directly, but it would help handle ramp backups during inclement weather reducing congestion on eastbound I-70.

**Potential Number of Person Trips on Alternative Modes**

Not Applicable.

**Potential for Enhanced Bicycle/Pedestrian Usage**

Not Applicable.

**How Well are Summit Stage/Local Transit Service and Stops Accommodated?**

Not Applicable.

## *Aesthetics Criteria*

### **Support for CSS Aesthetic Guidance**

The auxiliary lane could be designed to adhere to the CSS aesthetic guidance, address the Area of Special Attention Report goals and objectives and conform to local design policies, but the earthwork would be extensive especially east of the scenic area.

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### 3.2.2 Recommended Package of Improvements

The detailed-level screening analysis compares the alternatives and options using CSS-based screening criteria. The outcome of the analysis provides a clear and distinct advantage for one interchange alternative relative to the other two, and justification for specific improvement options to be implemented together with the recommended interchange alternative.

Based on the evaluation and observations made in Section 3.2.1, the following improvements are recommended:

- Diverging Diamond Intersection, Alternative C
- Westbound On-ramp -Improved Grade, Options A and C\*
- SH 9/Wilderness Intersection, Options A and C\*
- US 6/Little Beaver, Option A, Conventional Intersection\*\*
- Advanced Intersection Signal Timing and Equipment\*\*

\*The Westbound On Ramp Option A (improved grade) and Option C (improved grade and two-lane on ramp over the Blue River) are related in that Option A provides a phased implementation that allows early action that can later be expanded to include Option C buildout. This offers flexibility to implementation depending on the construction funding available. At the SH 9/Wilderness intersection, Option A is the ultimate buildout design and Option C (interim) is the phased implementation that allows early action that can later be expanded to include Option C buildout

\*\* Implemented as part of the Diverging Diamond

The rationale for selecting the Diverging Diamond alternative can be summarized as follows:

The Diverging Diamond creates:

- Traffic operations that would be more efficient thereby generating less overall delay than the other alternatives in 2035
- The Diverging Diamond design creates fewer safety conflicts and risks than the other alternatives
- Fewer ROW requirements, business access disruptions and reduces losses of parking compared to the other alternatives
- Lower construction costs, life cycle costs and construction phase disruption because the Diverging Diamond does not require reconstruction and expansion of the existing I-70 bridge

With respect to the options, the following findings provide the rationale for each of the options that are recommended in the packages or were eliminated from further consideration:

- **Eastbound Off-Ramp Options:** The purpose and need for eastbound off-ramp options (inadequate off-ramp capacity resulting in backups onto I-70) could be resolved by the efficient operations of the Diverging Diamond interchange design itself. Related weaving and accidents on eastbound I-70 near the interchange could be addressed by the auxiliary lane from the auxiliary lane east of the scenic area. These findings eliminated further consideration of Eastbound Off-ramp Options A and B.

- **Westbound On-Ramp Options:** The benefits of providing direct access to I-70 for westbound motorists with origins within the Wilderndest development did not justify the unconventional design requirements necessary to make this connection and the additional costs. In addition, the Diverging Diamond design does not require this diversion of traffic to achieve adequate operational conditions in 2035. These findings eliminated further consideration of Westbound On-ramp Option B.
- **SH 9/Wilderndest Intersection Options:** The capacity and safety of the roundabout did not compare favorably with improvements to the conventional intersection design for motorists, cyclists or pedestrians. The footprint for the roundabout required considerably more right of way and business displacement and disruption than the other Options. The roundabout was also more costly than the conventional intersection improvements. These findings eliminated further consideration of Option B, a roundabout, at the SH 9/Wilderndest intersection.
- **US 6/Little Beaver Trail Intersection Options:** Option A involved no substantive physical improvements to this intersection while Option B involved a roundabout at this location. Option A performed efficiently and safely with the Diverging Diamond, so the highly disruptive and expensive roundabout design offers inadequate benefits to justify its impacts and costs. These findings eliminated further consideration of Option B, a roundabout, at the US 6/Beaver Trail intersection.
- **Advanced Intersection Signal Timing and Equipment:** This improvement will be incorporated into the Diverging Diamond signal timing system such that optimized operations of this design will result during normal conditions, inclement weather and when traffic volumes are unusually high (tunnel closure for reasons other than weather).

In summary, the Diverging Diamond interchange with an optimized signal design, conventional SH 9/Wilderndest intersection improvements (interim and ultimate) and westbound on-ramp improvements (grade improvement and two-lane ramp) were recommended.

As separate improvements, each component provides benefits. As a package, these improvements working together fully address the project's purpose and need and offer flexibility for potential funding and implementation. Table 19 presents the overall findings for the project components in total. Table 21 presents linkages between the project's purpose and need, the detailed level screening criteria and project outcomes. Table 22 presents 2035 Level of Service with completion of the proposed package of improvements.

TABLE 19: SUMMARY THE DETAILED-LEVEL CRITERIA FINDINGS FOR THE PROPOSED IMPROVEMENTS		PROPOSED IMPROVEMENTS			
DETAILED-LEVEL EVALUATION CRITERIA		Diverging Diamond Interchange	Option C: Improved Grade and 2-Lane On-Ramp over Blue River	Option A: SH 9/ Wildernest Conventional Intersection Ultimate	Auxiliary Lane
<b>Sustainable Operations</b>					
Capital costs (\$)		\$5,411,000	\$5,900,000	\$1,949,000	TBD
Life-Cycle Costs (High, Moderate, Low)		Low	High	Moderate	Moderate
Level of Project Phasing Relative to Available Budget (Good, Fair, Poor)		Good	Fair	Fair	Fair
Length of Roadway Requiring More Lighting and Maintenance (High, Moderate, Low)		Moderate	Moderate	Moderate	High
<b>Safety</b>					
Number of Traffic Conflict Points (Improvement to High Accident Locations)		14	0	64*	0
Number of Conflict Points: Bike, Pedestrian and Motor Vehicles (Bike + Ped)		24	0	100*	0
Effectiveness in Inclement Weather (Good, Fair, Poor)		Good	Good	Good	Fair
Number of Features Resulting in High Maintenance (High, Moderate, Low)		Low	High	Low	Moderate
<b>Healthy Environment</b>					
Acres of New Right of Way		0.3	0	0.43	TBD
Number of Partial Takes		4	0	4	TBD
Number of Full Takes/Business Displacements		0/0	0/0	0/0	0/0
Acres of Wetland/Riparian Disruption		0.145	0.03	0	TBD
Air Quality: Delay (High, Moderate, Low)		Low	Low	Low	Low
Noise: Number of Sensitive Receptors (Locations)/Impacts (High, Moderate, Low)		1/Low	1/Low	0/Low	29/Low
Acres of Wildlife Habitat Disruption		0.145	0.03	0	TBD
Acres Fisheries Habitat Disruption (Potential for Indirect or Temporary Effects)		0/Yes	0.03	0	0/Low
Acres of Wildlife Linkage Zones		0	0	0	0
Number of Recreation Resource Impacts - Section 4(f) and 6(f) Resources		1	1	0	0
<b>Historic Context</b>					
Number of Paleontological Resources		0	0	0	1
Number of Archaeological Resources		0	0	0	0
Number of Historical Resources		0	0	0	0
<b>Communities</b>					
Support for Economic Investments (Good, Fair, Poor)		Good	Fair	Fair	NA
Supported by the Community (Yes/No/Tentative)		Tentative	Tentative	Tentative	Tentative
Number of Businesses Impacted (Direct/Indirect)		0/1	0	8/8	0/0
Number of Business Access Points Hindered/Eliminated		3/1	0/0	3/1	0/0
Number of Homes Impacted		0	0	0	0
How Well Are Construction Impacts Minimized? (Good, Fair, Poor)		Good	Fair	Fair	Fair
Environmental Justice: Equitable or Inequitable Effects		Equitable	Equitable	Equitable	Equitable
<b>Mobility and Accessibility (Vehicle, Bus, Bicycle, Pedestrian)</b>					
Traffic Congestion (Level of Service, Delay and Queuing)		Good	Fair	Good	Good
Ramp Backups:Queuing Average (EB Off/WB Off, Feet)		220/240	NA	NA	0
Potential Number of Person Trips on Alternative Modes (High, Moderate, Low)		Moderate	Moderate	Moderate	NA
Potential for Enhanced Bicycle/Pedestrian Usage (High, Moderate, Low)		Moderate	Moderate	High	NA
How well are Summit Stage/Local Transit Service and Stops Accommodated? (Good, Fair Poor)		Good	Good	Moderate	NA
<b>Aesthetics</b>					
Support for CSS Aesthetic Guidance (Good, Fair, Poor)		Good	Good	Good	Fair
NA = Not Applicable TBD = To Be Determined					



**Table 20 Linkages between the Project’s Purpose and Need, the Detailed-Level Screening Criteria and Project Outcomes**

PROJECT NEEDS	CRITERIA THAT ADDRESS THE PROJECT NEEDS	OUTCOMES THAT ADDRESS THE PROJECT NEEDS
<b>SAFETY</b>		
High crash risks exist along SH 9 and US 6, particularly at and near intersections.	Number of Traffic Conflict Points (Improvement to High Accident Locations)	The Diverging Diamond interchange has the lowest number and intensity of conflict points at the interchange ramp intersections. The signals can be operated as 2-phase operation with no conflicts for the heavy left turn demand.
Backups onto I-70, particularly from the eastbound off ramp, substantially increase I-70 safety risks and accident rates.	Traffic Congestion(LOS, Delay, and Queuing)  Number of Traffic Conflict Points (Improvement to High Accident Locations)	The Diverging Diamond design’s signalized ramp intersection and the continuous eastbound auxiliary lane between the I-70/Frisco and I-70 Silverthorne/Dillon interchange provides additional capacity and safety to address eastbound travel on I-70 to and through the eastbound off ramp.
High speeds and speed differences involving merging interchange ramp traffic and through traffic on I-70 create safety issues and accidents, particularly in association with the eastbound off ramp and westbound on ramp.	Number of Traffic Conflict Points (Improvement to High Accident Locations)  Effectiveness in Inclement Weather	The Improved Grade and 2-Lane On-Ramp over Blue River (Westbound On-Ramp, Option C) and the eastbound auxiliary lane improvements address ramp weaving and merging issues, and provide additional recovery space for drivers where road grade and curves are most intense which is exacerbated during adverse weather.
Cycling on local sidewalks along SH 9 and US 6 and evidence of shortcuts across I-70 ramps and lanes creates safety issues despite the presence of the Blue River Trail.	Number of Conflict Points: Bike, Pedestrian vs. Motor Vehicles  Potential for Enhanced Bicycle/Pedestrian Usage  How Well Are Construction Impacts Minimized?	The Diverging Diamond interchange has the lowest number of conflict points for cyclists and pedestrians vs. motorists.  The proposed package of improvements minimizes construction period impacts and does not affect long-term operations of the Blue River Trail which results in greater potential for maintaining and enhancing bicycle/pedestrian usage of this trail.
<b>CAPACITY</b>		
The number and density of signalized and unsignalized local access points and turning movements within close proximity to the I-70 interchange ramps serves existing commercial development, but causes much of the congestion along SH 9 and US 6 as well as difficulty accessing I-70.	Traffic Congestion (LOS, Delay, and Queuing)  Number of Business Access Points Hindered/ Eliminated  How Well Are Construction Impacts Minimized?  Number of Businesses Impacted  Support for Economic Investments	The Diverging Diamond design provides the most favorable overall traffic operations, while also having the least impact to business properties and access.  The proposed phased improvements at the SH9/Wilderness intersection provide the most favorable operational advantages. Eliminating the split-phasing at the intersection results in much improved intersection efficiency. The Diverging Diamond interchange provides the most favorable additional capacity and safety at the interchange intersections.  The construction of the proposed improvements has the least duration and magnitude of traffic impacts and least business access impacts during construction.  The Diverging Diamond does not displace existing businesses and provides the most favorable opportunities for “gateway” aesthetic features supported by the community.

<p>Skewed intersections, split phase signals and necessary green time for pedestrian movements, particularly at the SH 9/Wilderness intersection, limit through and left turn movement green times, resulting in reduced traffic capacity along SH 9 and US 6.</p>	<p>Traffic Congestion(LOS, Delay, and Queuing)</p>	<p>The proposed interim and ultimate designs for the SH 9/Wilderness intersection eliminate the requirement for split phasing and provide adequate capacity for 2035 conditions.</p>
<p>Motorists using the westbound off ramp who plan to turn left onto Wilderness at the SH 9/Wilderness intersection are required to weave across two SH 9 through lanes in a short distance.</p>	<p>Traffic Congestion(LOS, Delay, and Queuing)</p>	<p>The Diverging Diamond interchange provides the most favorable solution for improving the weaving between the interchange ramps and the nearest intersections. This is accomplished by providing exclusive right turn signal phasing at the interchange intersections, thereby reducing weaving conflicts with US 6 and SH 9.</p>
<p>The southbound left turn movement from SH 9 to eastbound I-70 has inadequate capacity/ storage.</p>	<p>Traffic Congestion(LOS, Delay, and Queuing)</p>	<p>The Diverging Diamond interchange provides the most favorable solution for increasing turning capacity at the interchange intersections.</p>
<p>Motorists using the eastbound off ramp turning right onto US 6 are required to negotiate southbound weaving vehicle movements on US 6 associated with the close proximity of the nearest interchange and intersection immediately to the south.</p>	<p>Traffic Congestion(LOS, Delay, and Queuing)</p> <p>Ramp Backups: Queuing Average (EB Off/WB Off, Feet)</p>	<p>The Diverging Diamond reduces weaving requirements and signalizes left and right turn movements</p> <p>The Diverging Diamond interchange has the lowest queuing lengths on the ramps, thereby reducing operational and safety impacts to I-70.</p>
<p>Motorists using the westbound on ramp must weave into one lane over a short distance before merging with I-70 westbound traffic. This weave and merge is complicated by a steep grade.</p>	<p>Traffic Congestion(LOS, Delay, and Queuing)</p>	<p>The westbound on ramp grade fix and two lane design increases weave distances and increases ramp travel speeds and merge efficiencies.</p>
<p><b>MULTIMODAL CONNECTIVITY</b></p>		
<p>Existing local bus service and future transit service are important and should not be limited or precluded by future improvement plans.</p>	<p>Potential Number of Person Trips on Alternative Modes</p> <p>How well are Summit Stage/Local Transit Service and Stops Accommodated?</p>	<p>The proposed improvements would have temporary and minor impacts on existing bus routes and facilities, but have beneficial long-term effects on the ability of a bus network to operate efficiently in the interchange area. There are no impacts to existing local transit stops.</p>

<p>Direct access for pedestrians and cyclists under I-70 is limited because some sidewalks and crosswalk transitions are in poor condition and/or are difficult to use in the winter.</p>	<p>Conflict Points: Bike, Pedestrian and Motor Vehicles</p> <p>Potential for Enhanced Bicycle/Pedestrian Usage</p> <p>Number of Recreation Resource Impacts, including Section 4(f) and 6(f) Resources</p>	<p>The Diverging Diamond interchange has the lowest number of conflict points for cyclists and pedestrians vs. motorists.</p> <p>The proposed package of improvements minimizes construction period impacts and does not affect long-term operations of the Blue River Trail which results in greater potential for maintaining and enhancing bicycle/pedestrian usage of this trail.</p>
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**Table 21 2035 Level of Service (LOS) with the Proposed Improvements**

Location	2035 LOS
WB I-70 Merge at Silverthorne	C
EB I-70 Diverge at Silverthorne	C
WB I-70 Diverge at Silverthorne	D
EB I-70 Merge at Silverthorne	B
WB I-70 and SH 9 Ramp Intersection	B
EB I-70 and US 6 Ramp Intersection	B
6th and SH 9 Intersection	C
5th and SH 9 Intersection	A
4th and SH 9 Intersection	B
3rd and SH 9 Intersection	A
Nike Driveway and SH 9 Intersection	A
Wilderness and SH 9 Intersection	C
Stephens and US 6 Intersection	A
Little Beaver Trail and US 6 Intersection	B
Anenome Trail and US 6 Intersection	A
Dillon Ridge Road and US 6 Intersection	C

The overall cost of the program of the packages would be as follows:

Diverging Diamond Intersection, Alternative C	\$ 5,412,000
Westbound On-Ramp -Improved Grade, Option C	\$ 5,900,000
SH 9/Wilderness Intersection - Interim, Option A + C	\$ 2,317,000
<b>TOTAL</b>	<b>\$13,629,000*</b>

\*Estimate attributes costs for Westbound On-Ramp Option C only because it is likely that this improvement would not be constructed in phases. Estimate attributed costs for Options A and C at the SH 9/Wilderness intersection because it is likely that they would be phased. Estimate includes US 6/Little Beaver improvements and advanced signal systems within the estimate for the Diverging Diamond. Estimate doesn't include engineering, construction management or ROW acquisition costs.

#### **4. NEXT STEPS**

This document concludes the alternative screening process and advances an improvement package for SH 9 and US 6 at the I-70 Silverthorne/Dillon interchange. The proposed improvements have not been evaluated in relation to the National Environmental Policy Act (NEPA). This step requires having the project construction funding in place. At this time, funding for final design and construction is still being identified, so the next steps involve activities that would streamline that process once the funding is secured.

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## **APPENDIX**

- A. Alternative and Option Designs
- B. Water Quality Requirements and Improvements
- C. Cost Estimates and Breakdowns
- D. Wetlands Effects Exhibits
- E. Construction Phasing Summary
- F. Traffic Modeling Methodology and Results

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