

Chapter 2. Summary and Comparison of Alternatives

2.1 What's in Chapter 2?

Chapter 2 describes how the problems within the Interstate 70 (I-70) Mountain Corridor (the Corridor) are used to develop a wide range of alternatives for transportation improvements, how those alternatives are evaluated, and how that evaluation leads to a Preferred Alternative. **Chapter 1, Purpose and Need** documents the existing and future transportation problems in the Corridor, while this chapter describes and analyzes alternatives to address the problems and identifies the Preferred Alternative. As described in **Chapter 1, Purpose and Need**, the transportation problems result in project needs, and the project purpose and need is expressed as a long-term 2050 purpose and need, supported by data from the 2035 and the 2050 planning horizons. The 2050 planning horizon is used as the target for meeting the project needs and was developed based on public input and interest in a long-range vision for transportation solutions in the Corridor. The year 2035 projections are based on available projections from a variety of sources, provide the foundation for developing and evaluating alternatives, and provide a milestone allowing projections to 2050. In addition to the needs, criteria are identified to define what is important to project stakeholders and to help in comparing the attributes and impacts of the alternatives.

As described in this chapter, the evaluation process resulted in 22 alternatives, including the No Action Alternative and 21 Action Alternatives, including the Preferred Alternative. **Section 2.5** discusses the more than 200 alternative elements evaluated and explains which were eliminated and why. **Section 2.6** discusses the alternatives that were advanced and describes the components of the Action Alternatives and the No Action Alternative. **Section 2.7** describes the Preferred Alternative, how it was developed, and the process that will be used to implement improvements. The 22 alternatives analyzed (shown at the right) represent the reasonable range of alternatives for analysis in this Tier 1 document. Not all of these alternatives fully meet the purpose and need for this project but are all evaluated at the Tier 1 level to present a full comparison of the transportation tradeoffs and environmental impacts for decision makers and the public. **Section 2.8** summarizes a comparison of the 22 alternatives that are fully evaluated. **Section 2.8** also compares the subset of these alternatives that fully meet the project's purpose and need.

The purpose and need requires enough capacity to meet the 2050 demand. Today, the I-70 highway does not

Project Purpose and Need

The purpose for transportation improvements is to increase capacity, improve accessibility and mobility, and decrease congestion for 2050 to destinations along the I-70 Mountain Corridor as well as for interstate travel, while providing for and accommodating environmental sensitivity, community values, transportation safety, and ability to implement the proposed solutions for the Corridor.

Project Alternatives Analyzed

- No Action Alternative
- Minimal Action Alternative
- Rail with Intermountain Connection
- Advanced Guideway System
- Dual-mode Bus in Guideway
- Diesel Bus in Guideway
- Six-Lane Highway 55 miles per hour
- Six-Lane Highway 65 miles per hour
- Reversible/high occupancy vehicle/high occupancy toll Lanes
- Combination Six-Lane Highway with Rail and Intermountain Connection
 - ◆ Build Transit with Highway Preservation
 - ◆ Build Highway with Transit Preservation
- Combination Six-Lane Highway with Advanced Guideway System
 - ◆ Build Transit with Highway Preservation
 - ◆ Build Highway with Transit Preservation
- Combination Six-Lane Highway with Dual-mode Bus in Guideway
 - ◆ Build Transit with Highway Preservation
 - ◆ Build Highway with Transit Preservation
- Combination Six-Lane Highway with Diesel Bus in Guideway
 - ◆ Build Transit with Highway Preservation
 - ◆ Build Highway with Transit Preservation
- Preferred Alternative

Chapter 2. Summary and Comparison of Alternatives

have sufficient capacity to meet demand, and the lack of capacity will worsen in the future. The excess demand is partially spread to other times and days, but part of the demand is unmet as some users will cancel their desired trip. Unmet demand is based on the desire to take a trip using the I-70 Mountain Corridor based on current travel conditions in good weather. Because of the unmet demand, there is not a linear relationship between adding capacity and reducing congestion. When capacity is added to the system, in general, it fills up with the unmet demand, and conditions remain congested. The 2050 purpose and need is intended to provide enough capacity to have a transportation network that still has some ability to operate. This is measured as the ability of the alternatives to accommodate the 2050 travel demand. The single mode alternatives: No Action, Minimal Action, Rail with Intermountain Connection, Advanced Guideway System, Dual-mode Bus in Guideway, Diesel Bus in Guideway, Six-Lane Highway, Reversible High Occupancy Vehicle (HOV)/High Occupancy Toll (HOT) Lanes, do not meet the 2050 travel demand on the east side of the Eisenhower-Johnson Memorial Tunnels. The Preferred Alternative Minimum Program of Improvements does not meet the 2050 travel demand either. The Combination Alternatives, including the Preferred Alternative (if the Maximum Program of Improvements is fully implemented) are the only alternatives that meet the 2050 travel demand. See discussion in **Section 2.8.1, Transportation Considerations**, on unmet demand.

Chapter 2 also:

- Summarizes information from other chapters of this document to explain how decisions were made in the evaluation and screening of alternatives and in the consensus-building process to develop the Preferred Alternative.
- Discusses the role of stakeholders in the alternatives development and evaluation process, and the role of the Collaborative Effort in identifying a Preferred Alternative.
- Provides information on how Tier 1 alternatives differ from Tier 2 alternatives.

2.2 How were alternatives developed?

As described in **Chapter 1, Purpose and Need**, the project needs are based on understanding the transportation problems and the future demands of the Corridor. Alternatives were developed based on the ability to address the transportation needs developed in a manner that provides for and accommodates the following considerations: environmental sensitivity, community values, transportation safety, and the ability to implement.

The process to identify potential transportation improvements began with the Corridor Vision in the *I-70 Corridor Major Investment Study* (MIS) (Colorado Department of Transportation [CDOT], 1998). The project team used the MIS Corridor Vision and the information and suggestions identified through the Programmatic Environmental Impact Statement (PEIS) public scoping process to initiate the development of alternatives. A systematic screening process with public and agency input led to the development of alternatives. Alternatives consist of various components based on the seven alternative element families, shown in the box. Each alternative element addresses either a specific need in the Corridor or Corridorwide issues. Each family of elements provides relative advantages or disadvantages in consideration of the project needs. For example, some elements better improve capacity while others enhance mobility and accessibility.

Alternative Element Families

- Transportation Management
- Localized Highway Improvements
- Fixed Guideway Transit
- Rubber Tire Transit
- Highway
- Alternate Routes
- Aviation

When alternative elements are evaluated based on the project needs and evaluation criteria, some elements rise to the top and some are eliminated from further consideration. During the evaluation process, alternative elements can be revised or enhanced. Alternative elements that do not achieve

performance screening criteria are either enhanced or eliminated. Ultimately, alternative elements advanced are combined to form the components of Action Alternatives from which a Preferred Alternative is developed. As noted previously, some alternatives were advanced for consideration in this document even though they do not fully meet the purpose and need for this project. These alternatives are evaluated and compared at the Tier 1 level to present a full range of the transportation tradeoffs and environmental impacts for decision makers and the public.

The development of the Preferred Alternative used an engaged process called the Collaborative Effort. The Collaborative Effort team was comprised of 27 members representing varied stakeholders of the I-70 Mountain Corridor including the lead agencies and was formed to develop and reach a Consensus Recommendation for Corridor improvements (see **Section 2.4** and **Section 2.7** for more information about the Collaborative Effort).

The Collaborative Effort team's Consensus Recommendation became the Preferred Alternative and includes the following elements: non-infrastructure components, an Advanced Guideway System, specific highway improvements, and other highway improvements that formed the Minimum Program of Improvements. The Collaborative Effort team recognized, however, that the Minimum Program of Improvements may not provide adequate highway capacity to meet long-term transportation needs. Based on information available today, additional highway capacity is needed to meet the 2050 purpose and need. To address these needs, highway capacity improvements were added to the Minimum Program of Improvements to comprise the Maximum Program of Improvements with the condition that, prior to taking action to add capacity, the Collaborative Effort team must review and consider certain "triggers." The Maximum Program of Improvements is comprised of all of the improvements in the Minimum Program plus six-lane highway capacity from the Eisenhower-Johnson Memorial Tunnels to Floyd Hill, additional interchange modifications at four interchanges in the Idaho Springs area, and an additional curve safety modification project near Fall River Road. With these additional highway capacity elements, the Preferred Alternative meets the 2050 purpose and need. The Minimum Program of Improvements alone will not meet the 2050 purpose and need. The components of the Preferred Alternative and the trigger process that guides its implementation are described in **Section 2.7.1** and **Section 2.7.2**.

2.3 What process was used to evaluate and screen alternatives?

This project started in 2000. The initial alternative screening is for the horizon year of 2025, using 2000 as a base year for purposes of comparison. The 2000 information provides a valid snapshot of conditions in the Corridor because there have been no major infrastructure changes to the Corridor and the needs of the users of the Corridor have not changed. In 2009, the comparative analysis of alternatives was updated to reflect current long range planning horizon year of 2035. A longer planning horizon of 2050 is also used to compare alternatives in the PEIS.

The alternative elements were evaluated based on their ability to address the project purpose and need, and on how well those elements met environmental, community, transportation safety, and implementation criteria for the Corridor (see **Chapter 1, Purpose and Need** for more information on the purpose and need). This evaluation used three sequential levels of screening:

- Level 1 screening uses an initial conceptual level of evaluation and screening based on purpose and need.
- Level 2 screening uses criteria based on purpose and need and Corridor issues applied to many alternative elements at a greater level of detail.
- Level 3 screening uses detailed screening and refinement of the remaining alternative elements.

The criteria developed for the needs measure the effectiveness of each alternative element. These criteria generally increase in detail at each level of screening. Alternative elements examined were either eliminated from further consideration through screening or advanced as representative of a group of

Chapter 2. Summary and Comparison of Alternatives

similar elements and combined into full alternatives for analysis in this document. Some elements were retained for consideration in Tier 2 and not evaluated in this document, but informed what was evaluated.

The evaluation and screening levels are summarized below:

- **Level 1** screening studies are broad in concept and focus on identifying alternative elements that address the project needs to increase capacity, improve accessibility and mobility, and decrease congestion. Safety criterion is included at this level because of the interrelationship among safety, mobility, accessibility, and congestion (see **Chapter 1, Purpose and Need** for more information on safety). At this stage, alternative elements are conceptual and evaluation is based on the suitability of technology and mode, rather than location and design; therefore, ability to implement environmental and community value criteria are not applied.
- **Level 2** screening studies build on Level 1 studies and include a greater depth of analysis for alternative elements addressing capacity, mobility and accessibility, congestion, and safety. Level 2 screening also incorporates qualitative and quantitative criteria related to implementation (cost, technology, and constructability), environmental sensitivity, and community values. General location and design concepts are evaluated at this stage.
- **Level 3** screening focuses on the refinement of alternative elements remaining after Level 2 screening and their reasonableness for use in the Corridor. Some alternative elements are eliminated and others advanced for evaluation in this document. Some elements are retained for consideration in Tier 2 but are not evaluated in this document because the ones evaluated are representative of the modes. Some design considerations are developed in more detail to qualitatively assess the ability to implement alternative alignments; environmental and community impacts; and travel demand performance. At this level, representative improvements are grouped to allow for an evaluation of a reasonable range of alternatives in this document.

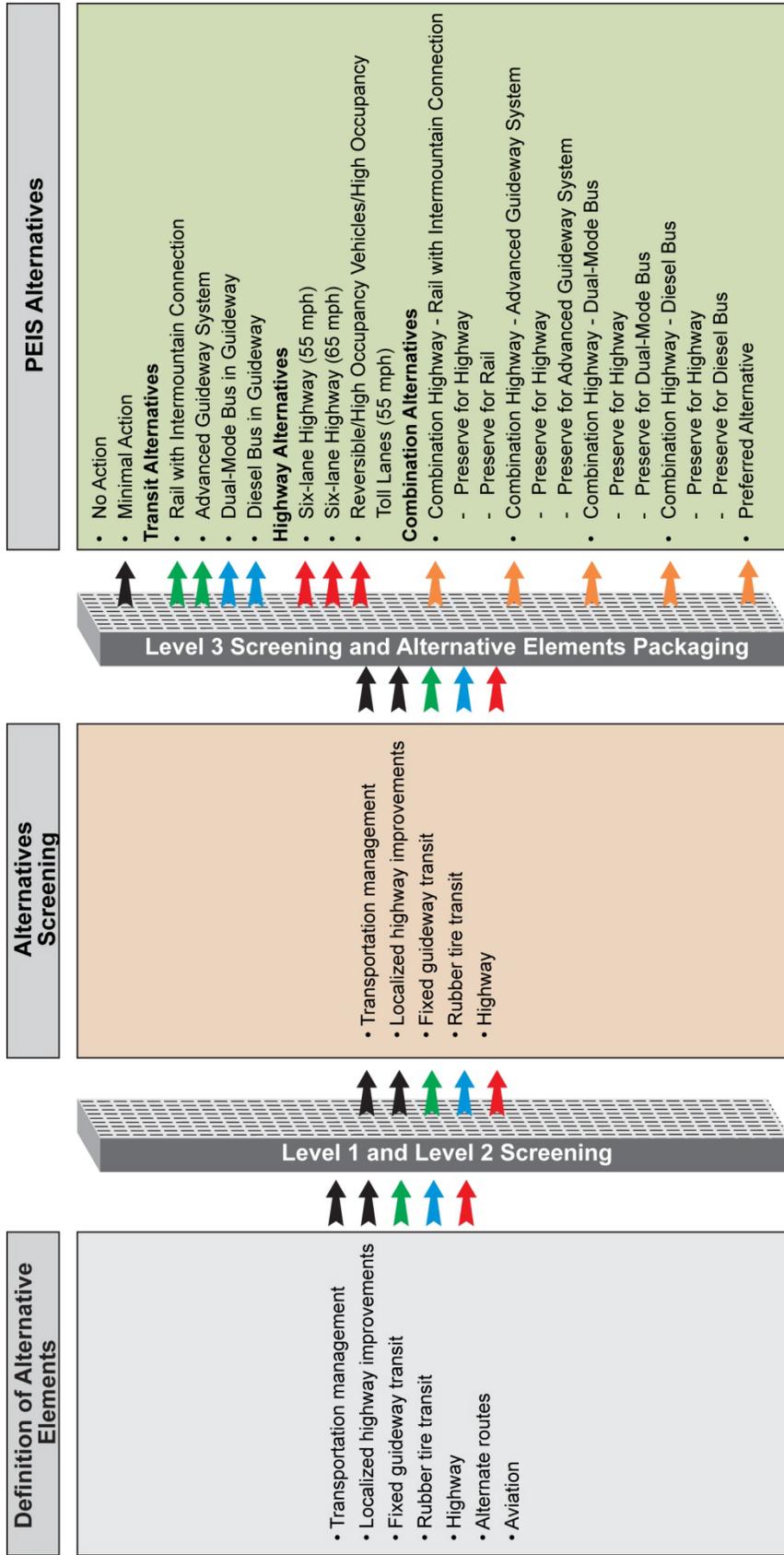
Alternatives Development, Evaluation, and Screening Process Highlights:

- The entire alternatives development, evaluation, and screening process involves public and agency involvement, as discussed in **Section 2.4**.
- The process is based on the purpose and need for the project while providing for and accommodating environmental sensitivity, community values, transportation safety, and ability to implement the proposed solutions for the Corridor.
- The process looks at a wide range of alternative elements and results in a set of Action Alternatives, which were used to develop a Preferred Alternative.
- This rigorous process comparatively evaluates all alternative elements and carries forward those that best meet the purpose and need for the project and best address the evaluation criteria. This document fully evaluates the No Action Alternative and 21 Action Alternatives, including the Preferred Alternative.

Overall, alternative elements that have the ability to meet the purpose and need for the project (while also addressing environmental sensitivity, community values, transportation safety, and ability to implement) were advanced. Due to the topographically restricted nature of the Corridor caused by the mountainous terrain, this generally resulted in alternative elements being developed to fit within existing right-of-way to the extent feasible to minimize environmental impacts, costs, and implementation challenges.

More detailed information on the alternatives development, evaluation, and screening process is found in the *I-70 Mountain Corridor PEIS Transportation Analysis Technical Report* (CDOT, March 2011) and the *I-70 Mountain Corridor PEIS Alternatives Development and Screening Technical Report* (CDOT, March 2011).

Figure 2-1. Alternatives Screening Process



Screening and Packaging of Alternatives

- ▲ Minimal Action Elements Common to All Alternatives
- ▲ Fixed Guideway Transit Elements
- ▲ Rubber Tire Transit Elements
- ▲ Highway Elements
- ▲ Combination of Transit and Highway Elements

mph = Miles per Hour

Note: See Section 2.5 for more screening details.

2.4 How were public and agency stakeholders involved in the development and screening of alternatives?

An extensive public and agency involvement process guided and collected input to the alternatives development, evaluation, and screening process. The process included numerous meetings with a variety of stakeholders within the Corridor to discuss possible alternatives, the evaluation of alternatives, and the refinement of alternatives.

Throughout alternatives development, evaluation, and screening, the project team met with the Federal Interdisciplinary Team, which was made up of the federal cooperating agencies, stakeholder groups, individual stakeholders, transit groups, and state, regional, and local agencies. In addition, several public open houses and workshops held at key points in the screening process provided information and progress updates to Corridor stakeholders. Eight public open houses held throughout the Corridor during Level 1 screening introduced the public to the project, purpose and need, evaluation process, potential Corridor improvements, and solicited input on Corridor issues. During Level 2 screening, two public workshops discussed the screening criteria and methodology that would be used for screening, and three open houses presented the screening results.

Project newsletters provided updates on the evaluation and screening process and on project issues. These newsletters were sent to approximately 1,300 individuals on the project mailing list. A total of four mailed newsletters presented the alternatives screening process and results.

The lead agencies conducted a reevaluation of alternatives based on updated data and additional public input to develop the Preferred Alternative in a collaborative process with stakeholders. The Collaborative Effort team provided a recommendation that became the Preferred Alternative, as described in **Section 2.2**.

Chapter 6, Public and Agency Involvement, provides more detailed information on public and agency involvement.

Collaborative Effort

The development of the Preferred Alternative used an engaged process called the Collaborative Effort. The Collaborative Effort team, a 27-member group representing varied stakeholders of the I-70 Mountain Corridor, worked closely in evaluating and discussing the results of the alternatives development, evaluation, and screening process to formulate not only a recommended Preferred Alternative but also a long-term stakeholder engagement process to guide transportation improvements into the future.

2.5 Which alternative elements were eliminated and why?

The evaluation and screening process resulted in the development, evaluation, and screening of more than 200 alternative elements (see **Figure 2-1**). The following describes each alternative element and the process. Alternative elements were:

- Eliminated from further consideration during the screening process,
- Advanced for further evaluation, or
- Retained, but not evaluated in this document. This category applies to those elements that were identified during the alternatives evaluation process but are similar enough to alternative elements advanced that the Tier 1 analysis encompasses the evaluation of these elements. The elements advanced represent the retained elements and a reasonable range of alternatives for analysis in this document. The retained alternative elements can be reconsidered during Tier 2 processes.

The alternative elements are categorized by seven alternative element families:

- Transportation management
- Localized highway improvements
- Fixed guideway transit

- Rubber tire transit
- Highway
- Alternate routes
- Aviation

Tunnels are also considered separately because they are major infrastructure projects that apply to highway and transit families. More detail and background on the alternatives development and screening process are found in the *I-70 Mountain Corridor PEIS Alternatives Development and Screening Technical Report* (CDOT, March 2011).

As a result of the evaluation and screening process, the lead agencies advanced approximately 80 alternative elements. In addition, the lead agencies retained approximately 10 alternative elements as similar to those advanced and may be reconsidered at Tier 2 as needed. These alternative elements represent the reasonable range of alternatives evaluated in this document. The alternative elements advanced combined to form the components of the Action Alternatives. An Action Alternative is a package of transportation components evaluated on its ability to address the project needs and evaluation criteria. **Section 2.6** discusses the Action Alternatives developed as a result of this screening process.

2.5.1 Transportation Management Alternative Elements

Ten transportation management alternative elements were evaluated. Transportation management strategies include transportation demand management, intelligent transportation systems, and transportation systems management. These strategies reduce the severity and duration of congestion and enhance overall mobility by improving the balance between the demand for travel on the Corridor with the capacity of the I-70 highway to handle travel demand with minimal construction activities. Level 3 screening eliminated the following three transportation management elements (see **Table 2-1**) because they do not respond efficiently to the purpose and need of reducing congestion and improving mobility and safety in an efficient manner.

- **Bicycle improvements** alone do not have the ability to remove substantial traffic from the Corridor in order to reduce congestion. For the vast majority of trips in the Corridor, bicycling is not a reasonable option because of the mountainous terrain, weather conditions throughout much of the year, and length of the Corridor. For overnight trips and some recreational trips (for example, skiing or camping) bicycling does not provide a valid option for enough travelers to reduce congestion on the Corridor. This alternative element was eliminated but included as part of mitigation strategies.
- **Limited access frontage roads (Clear Creek County)** were considered in only Clear Creek County due to the amount of congestion along the Corridor through this area. The existing frontage roads are used to bypass I-70 highway traffic during periods of heavy congestion. This alternative element was eliminated because frontage roads along the Corridor are considered state and federal highways, and access cannot be limited or restricted to Clear Creek County residents or a particular vehicle type. In addition, this alternative element at most diverts two percent of traffic along the Hidden Valley to Bakerville stretch of the I-70 highway, which is not enough traffic to change operations or reduce travel time in the Corridor. Long-haul transit on frontage roads does not provide attractive travel conditions compared to travel on the Corridor.

Chapter 2. Summary and Comparison of Alternatives

- Winter Park Ski Train** provided train service on an existing line from Denver Union Station to Winter Park during the ski season and was predominately used by skiers accessing the Winter Park Ski Resort in Grand County. This alternative element was eliminated due to the volume of freight trains through the Moffat Tunnel, which allows for a maximum of two Winter Park ski trains to run in each direction. Two trains to Winter Park, a single destination, do not remove enough traffic to change operations or reduce travel time in the Corridor. The seat capacity for one train is 750 seats. An additional train provides a 1,500 total seat capacity. No additional trips would be possible due to freight use on this line and inadequate ventilation for more frequent passenger train service. The travel demand in 2035 on a winter Saturday westbound at the Twin Tunnels was estimated at 5,100 vehicle trips at peak hour, which would be at a Level of Service F for three hours. The demand would be over capacity by 1,700 vehicles. The ski train only accounts for a reduction of 600 vehicles at peak hour. Since the initial consideration of this alternative element, the Winter Park ski train service was discontinued in 2009 due to lack of funding.

Table 2-1. Transportation Management Alternative Elements

Transportation Management Alternative Element	Screened – Level 1 Screening	Screened – Level 2 Screening	Screened – Level 3 Screening	Advanced for Action Alternative Development
Ramp Metering				✓
Slow Moving Vehicle Plan				✓
Peak Spreading Vehicle Occupancy Incentives				✓
Park-n-Rides				✓
Enhanced Traveler Information				✓
Bicycle Improvements*			X	
Limited Access Frontage Roads (Clear Creek County)			X	
Parking Operations and Incentives Plan				✓
Winter Park Ski Train			X	
Buses in Mixed Traffic				✓

✓ = carried forward for analysis; X = eliminated

* Element can be revisited during Tier 2 for mitigation.

2.5.2 Localized Highway Improvements Alternative Elements

Localized highway improvements focus on reducing Corridor congestion and improving overall mobility on the existing I-70 highway by making spot improvements to specific locations along the Corridor rather than adding capacity throughout the Corridor. This alternative element family includes an integrated package of strategies that maximize the operational efficiency, safety, and person-moving capacity of the Corridor by correcting structural and functional deficiencies of interchanges, curves, and localized areas of congestion. Localized highway improvements include interchange modifications, curve safety modifications, and auxiliary lanes. **Table 2-2** lists the improvements considered and advanced as part of the Action Alternatives. For more information on localized highway improvements see Section 4.3 of the *I-70 Mountain Corridor PEIS Alternatives Development and Screening Technical Report* (CDOT, March 2011).

Chapter 2. Summary and Comparison of Alternatives

Forty interchanges were evaluated during the screening process. Each interchange location was analyzed based on volume-to-capacity ratio (representing traffic flow conditions at the interchange) and weighted hazard index (crash rate) to determine whether or not improvements were needed. If an interchange's volume-to-capacity ratio indicated that it could not handle the current or projected volume and/or the weighted hazard index indicated that it had a higher crash rate than the statewide average, the interchange was identified as a problematic area needing improvement.

The following interchanges, eliminated in Level 3 screening, continue to have good traffic operations (good volume-to-capacity ratio) and better than average safety characteristics (low crash rate) and do not appear to require improvements through 2035. These interchange locations may be re-examined and monitored as the Preferred Alternatives is constructed. If changes are needed at these interchanges, CDOT is committed to work with the stakeholders and follow the I-70 Mountain Corridor Context Sensitive Solutions process (see **Appendix A, Context Sensitive Solutions**).

- Dotsero (milepost 133)
- Officer Gulch (milepost 198)
- Herman Gulch (milepost 218)
- Bakerville (milepost 221)
- Lawson (milepost 233)
- Dumont (milepost 235)
- Hidden Valley (milepost 243)
- El Rancho (milepost 251)
- Chief Hosa (milepost 253)
- Genesee (milepost 254)

Since publication of the Revised Draft PEIS in September 2010 (and in response to comments on the Revised Draft PEIS), the lead agencies reviewed the interchange improvement criteria again and determined that four interchanges previously characterized as not requiring improvements, met the criteria for improvement in 2035. As a result, the following interchanges have been included in the localized highway improvements alternative elements: Vail (milepost 176), Vail East Entrance (milepost 180), Vail Pass (milepost 190), and Evergreen Parkway/State Highway 74 (milepost 252).

Five curve safety modification locations were evaluated with one eliminated. Curve safety improvements east of Wolcott were eliminated in Level 3 screening based on its weighted hazard index and design speed and did not warrant any modifications.

Fourteen auxiliary lane locations were evaluated, resulting in elimination of two. The auxiliary lanes evaluated at Chief Hosa to Genesee and United States Highway (US) 6 to Hyland Hills were eliminated because their weighted hazard index and design did not warrant an auxiliary lane in either location.

Chapter 2. Summary and Comparison of Alternatives

Table 2-2. Localized Highway Improvement Alternative Elements

Localized Highway Improvement Alternative Elements	Screened – Level 1 Screening	Screened – Level 2 Screening	Screened – Level 3 Screening	Advanced for Action Alternative Development
Interchange Modifications				
Glenwood Springs (MP 116)				✓
Dotsero (MP 133)			X	
Gypsum (MP 140)				✓
Eagle and Spur Road (MP 147)				✓
Wolcott (MP 156)				✓
Edwards and Spur Road (MP 163)				✓
Avon (MP 167)				✓
Minturn (MP 171)				✓
Vail West / Simba Run (MP 173)				✓
Vail (MP 176)				✓
Vail East (MP 180)				✓
Vail Pass (Shrine Pass Road) (MP 190)				✓
Copper Mountain (MP 195)				✓
Officers Gulch (MP 198)			X	
Frisco / Main St. (MP 201)				✓
Frisco / SH 9 (MP 203)				✓
Silverthorne (MP 205)				✓
Loveland Pass (MP 216)				✓
Herman Gulch (MP 218)			X	
Bakerville (MP 221)			X	
Silver Plume (Potentially Move West Ramps to MP 224) (MP 226)				✓
Georgetown (MP 228)				✓
Empire (MP 232)				✓
Lawson (MP 233)			X	
Downieville (MP 234)				✓
Dumont (MP 235)			X	
Fall River Road (MP 238)				✓
Idaho Springs West (MP 239)				✓
Idaho Springs / SH 103 (MP 240)				✓
Idaho Springs East (MP 241)				✓
Hidden Valley (MP 243)			X	
Base of Floyd Hill / US 6 (MP 244)				✓

Chapter 2. Summary and Comparison of Alternatives

Localized Highway Improvement Alternative Elements	Screened – Level 1 Screening	Screened – Level 2 Screening	Screened – Level 3 Screening	Advanced for Action Alternative Development
Hyland Hills (MP 247)				✓
Beaver Brook (MP 248)				✓
El Rancho (MP 251)			X	
Evergreen Parkway / SH 74 (MP 252)				✓
Chief Hosa (MP 253)			X	
Genesee (MP 254)			X	
Lookout Mountain (MP 256)				✓
Morrison (MP 259)				✓
Curve Safety Modifications				
East of Wolcott (MP 158-159)			X	
West of Wolcott (MP 155–156)				✓
Dowd Canyon (MP 170–173)				✓
Fall River Road (MP 237–238)				✓
East of Twin Tunnels (MP 242–245)				✓
Auxiliary Lanes				
Avon to Post Boulevard, Uphill (EB) (MP 167–168)				✓
West Side of Vail Pass, Downhill (WB) (MP 180–190)				✓
West Side of Vail Pass, Uphill (EB) (MP 180–190)				✓
Frisco to Silverthorne (EB) (MP 202.7–205.1)				✓
EJMT to Herman Gulch, Downhill (EB) (MP 215–218)				✓
Bakerville to EJMT, Uphill (WB) (MP 215–221)				✓
Georgetown to Silver Plume, Uphill (WB) (MP 226–228)				✓
Silver Plume to Georgetown, Downhill (EB) (MP 226-228)				✓
Downieville to Empire, Uphill (WB) (MP 232–234)				✓
Empire to Downieville, Downhill (EB) (MP 232–234)				✓
US 6 Off-ramp to Hidden Valley Off-ramp, Uphill (WB) (MP 243–244)				✓
US 6 to Hyland Hills, Uphill (EB) (MP 244-247)			X	
Chief Hosa to Genesee, Flat (EB) (MP 252-253)			X	
Morrison to Chief Hosa, Uphill (WB) (MP 253–259)				✓

✓ = carried forward for analysis; X = eliminated

Key to Abbreviations/Acronyms

EB = eastbound
WB = westbound

EJMT = Eisenhower-Johnson Memorial Tunnels
US = United States Highway

MP = milepost

Chapter 2. Summary and Comparison of Alternatives

2.5.3 Fixed Guideway Transit Alternative Elements

The Fixed Guideway Transit alternative element family includes elements related to four major transit modes. They were analyzed for appropriateness for use in the Corridor by:

- General mode:
 - Automated Guideway Transit
 - Rail (including light rail transit and heavy rail transit)
 - Passenger Railroad (locomotive hauled)
 - Advanced Guideway System (such as monorail and magnetic levitation)
- Capacity (single-track and double-track)
- Propulsion type (diesel and electric)
- Alignment grade (4 percent, 6 percent, and 7 percent) capabilities

Because of the differences in ability of modes to operate on different grades, along with the widely varying capital costs, Fixed Guideway Transit systems were evaluated on alignments with various maximum grades and considered both single-track and double-track operations. The existing I-70 highway contains grades up to approximately 7 percent. To address limitations of technologies to handle the steep highway grade, alignments with grades of 4 percent and 6 percent were developed; these alignments leave the highway for much of their routes to maintain consistent grades and as a result require substantial tunneling and new right-of-way.

Corridor constraints considered in the evaluation of Fixed Guideway Transit alternative elements include:

- Grades limit vehicle performance
- Curves limit speed
- Right-of-way size limits land available for infrastructure
- Mountain climate and terrain limit choice of power systems

Of the variations of Fixed Guideway Transit evaluated, two, Rail and Advanced Guideway System, were advanced as representative of the various technologies along with one existing system, the Intermountain Connection. (The Intermountain Connection Alternative was combined with the Rail Alternative to become a complete Transit alternative.) Alternative elements were eliminated for the reasons described below and at various screening levels described in **Table 2-3**. The following explanation summarizes the primary reason that the elements were eliminated from further consideration, although many failed on more than one measure. For example, all single-track elements were eliminated because they cannot meet passenger capacity needs, but some of the technologies were found to be unsuitable for use in the Corridor regardless of capacity provided. The *I-70 Mountain Corridor PEIS Alternatives Development and Screening Technical Report* (CDOT, March 2011) provides additional details on the evaluation of Fixed Guideway Transit alternative elements.

- Automated Guideway Transit Alternative Elements. Automated guideway transit systems are designed to function without an operator at the controls in controlled or restricted environments (such as indoors) where if a problem arises and a driver is not on board, emergency assistance is available on short notice (such as in densely populated areas). Since the I-70 Mountain Corridor has physical constraints and remote areas and emergency assistance is not available on short notice in certain areas, this system was determined unsafe for operation in the Corridor and was eliminated.
- Transit alternative elements that do not have the ability to meet the peak-hour peak-direction capacity requirement of 4,900 passengers were eliminated. This capacity criterion is the minimum needed to adequately provide transit service and meaningfully reduce highway congestion in the

Chapter 2. Summary and Comparison of Alternatives

peak hours and in the peak direction. Alternative elements eliminated under this criterion include all the Light Rail Transit, all of the single-track, and two of the Passenger Railroad elements.

- Diesel Heavy Rail Transit double track at both 4 percent and 6 percent grades do not provide reasonable travel times and were eliminated. With an average speed of less than 35 miles per hour (mph), Corridor travel time is more than 3.5 hours, which is not an attractive alternative to automobile travel.
- Fixed Guideway Transit alternative elements that do not have sufficient power or brakes to operate reliably on the grades in the Corridor were eliminated. These elements include the double-track electric and diesel passenger railroad locomotive hauled alternative elements for both 4 percent and 6 percent grades.
- Other Fixed Guideway Transit alternative elements with 4 percent and 6 percent grades were eliminated because the technologies not eliminated for other reasons are able to operate alongside the highway at steeper grades. The flatter grades (4 percent and 6 percent) result in severe environmental impacts on wetlands, streams, National Forest System land, wildlife habitat (including lynx habitat, vegetation, water quality, and private property). These alignments also require substantial amounts of tunneling at considerable cost and logistical challenges. Problems constructing tunnels and new alignments in mountainous terrain include steep and unstable slopes, cliffs, and rivers.

Table 2-3. Fixed Guideway Transit Alternative Elements

Fixed Guideway Transit Alternative Element	Screened – Level 1 Screening	Screened – Level 2 Screening	Screened – Level 3 Screening	Advanced for Action Alternative Development
Existing I-70 Highway Alignment (7 percent Grade) – Diesel Power				
Light Rail Transit – Single-Track		X		
Light Rail Transit – Double-Track			X	
Existing I-70 Highway Alignment (7 percent Grade) – Electric Power				
Light Rail Transit – Single-Track		X		
Light Rail Transit – Double-Track			X	
Advanced Guideway System (urban maglev)				✓
Automated Guideway Transit (all grades and propulsion types)	X			
Heavy Rail Transit – Double-Track* (MP 176–260)				✓
6 percent Grade Alignment – Diesel Power				
Light Rail Transit – Single-Track		X		
Light Rail Transit – Double-Track			X	
Heavy Rail Transit – Single-Track		X		
Heavy Rail Transit – Double-Track		X		
Passenger Railroad – Locomotive Hauled – Single-Track		X		
Passenger Railroad – Locomotive Hauled – Double-Track		X		

Chapter 2. Summary and Comparison of Alternatives

Fixed Guideway Transit Alternative Element	Screened – Level 1 Screening	Screened – Level 2 Screening	Screened – Level 3 Screening	Advanced for Action Alternative Development
6 percent Grade Alignment – Electric Power				
Light Rail Transit – Single-Track		X		
Light Rail Transit – Double-Track		X		
Heavy Rail Transit – Single-Track		X		
Passenger Railroad Electric Multiple Unit – Single-Track		X		
Passenger Railroad Electric Multiple Unit – Double-Track			X	
4 percent Grade Alignment – Diesel Power				
Light Rail Transit – Single-Track		X		
Light Rail Transit – Double-Track		X		
Heavy Rail Transit – Single-Track		X		
Heavy Rail Transit – Double-Track		X		
Passenger Railroad – Locomotive Hauled – Single-Track		X		
Passenger Railroad – Locomotive Hauled – Double-Track		X		
4 percent Grade Alignment – Electric Power				
Light Rail Transit – Single-Track		X		
Light Rail Transit – Double-Track		X		
Heavy Rail Transit – Single-Track		X		
Heavy Rail Transit – Double-Track		X		
Passenger Railroad Electric Multiple Unit – Single-Track		X		
Passenger Railroad Electric Multiple Unit – Double-Track		X		
Existing Rail Facility				
Intermountain Connection (MP 142–176)**				✓
Passenger Railroad – Winter Park Service Track		X		
Passenger Railroad – Glenwood Springs Service Track		X		

* Heavy Rail Transit was evaluated for both 6 percent and 7 percent grades. When operational modeling confirmed that the Electric Heavy Rail Transit could handle 7 percent grades of the I-70 highway alignment, the 6 percent grade alignment (which required more tunnels and had a larger construction footprint) was eliminated.

** Combined with Electric Heavy Rail to form complete Transit alternative.

✓ = carried forward for analysis; X = eliminated

Key to Abbreviations/Acronyms

maglev = magnetic levitation

MP = milepost

2.5.4 Rubber Tire Transit Alternative Elements

Rubber Tire Transit alternative elements focus on bus operations. Buses are self-powered vehicles designed for commercial use, capable of operating on roadways, and carry more than six passengers. Rubber Tire Transit alternative elements are categorized by:

- Propulsion type (diesel, electric, and dual-mode)
- Facility use (regular travel lanes, HOV lanes, and guideway or transitway)
- Direction of facility operation (peak direction only and both directions)

A guideway (a narrow facility where buses are steered by a device that tracks the edge of the guideway) or transitway (a separated facility where only buses are allowed) could be provided in a two-lane facility operating in both directions or in a single-lane facility operating in the peak direction only with buses operating in mixed traffic in the non-peak direction. The existing I-70 highway alignment is used with Rubber Tire Transit proposed in the median.

The following were eliminated at various screening levels as shown in **Table 2-4**:

- **Bus in mixed traffic** was eliminated as a single-mode alternative because of low average speeds and low capacity. This alternative element uses buses operating within the general traffic lanes of the Corridor. Because the buses have no lane priority, speeds are limited by traffic conditions. This element is unlikely to make any substantial impact on highway congestion.
- **Bus in HOV lanes** was eliminated due to low transit capacity and low demand for ridership. High occupancy vehicle lanes include either a third lane or separated lanes that are restricted to HOVs, such as buses and vehicles carrying at least three persons. This alternative element was designed for use by an I-70 Mountain Corridor bus system and allows other HOVs to use the lane(s).
- **Bus (diesel or dual-mode) in transit-way – peak direction only** alternative elements were eliminated because they do not meet the mobility criterion due to lack of off-peak schedule dependability. Buses traveling in the off-peak direction are not on the guideway and are operating in mixed traffic, subject to highway congestion and cannot provide reliable off-peak service. The peak direction only alternatives would require nearly as much right-of-way width as the both direction alternatives, and would provide less operational flexibility.
- **Bus (diesel or dual-mode) in guideway – peak direction only** alternative elements were eliminated because capacity needs require bi-directional operation to meet 2050 travel demand.
- **Electric bus in transitway and guideway** was eliminated due to accessibility problems. This alternative element required two separate transfers for passengers because electric buses (which operate by power provided from an overhead wire infrastructure) cannot operate more than short distances off the Corridor; therefore, electric buses were not considered a suitable technology in comparison with other bus technologies.

One rubber tire alternative element, Bus in Guideway, is advanced and represents several similar elements that have relatively minor footprint and operational differences. It was assumed reasonable to evaluate the Bus in Guideway alternative element as representative of all of these elements because it moves a similar number of people, minimizes impacts on resources, and potentially meets the 2050 travel demand when combined with Highway Alternative elements. If selected as the preferred mode, these alternative elements, and possibly other specific bus technologies, can be further evaluated in Tier 2 processes. The Rubber Tire Transit alternative elements considered similar to the Bus in Guideway alternative element include:

- Diesel or dual-mode bus in transitway—both directions
- Diesel or dual-mode bus in either transitway or guideway—both directions, using online stations

Chapter 2. Summary and Comparison of Alternatives

For the purposes of this evaluation, a system with online stations (stations on the guideway or transitway) is defined as bus rapid transit (BRT).

Table 2-4. Rubber Tire Transit Alternative Elements

Rubber Tire Transit Alternative Element	Screened – Level 1 Screening	Screened – Level 2 Screening	Screened – Level 3 Screening	Advanced for Action Alternative Development
Bus in Mixed Traffic		X		
Bus in HOV Lanes		X		
Bus in Transitway or Guideway – Diesel or Dual-mode – Both directions (Guideway assumed as most reasonable for evaluation)				✓
Bus in Transitway or Guideway – Diesel or Dual-mode - Peak direction only		X - Transitway	X - Guideway	
Bus in Transitway or Guideway – Electric		X		

✓ = carried forward for analysis; X = eliminated

Key to Abbreviation/Acronyms

HOV = high occupancy vehicle

2.5.5 Highway Improvement Alternative Elements

This alternative element family focuses on adding highway capacity in areas where it is warranted in the Corridor. Six primary highway improvements were considered by Corridor location defined by physical and community characteristics. The locations are based on areas within the Corridor that warrant consideration of highway capacity improvements related to mobility, safety, and maintenance concerns. Not all areas of the Corridor require capacity improvements, and many of these locations were considered for localized highway improvements such as interchange modifications, curve safety modifications, and auxiliary lanes (see **Section 2.5.2**). Within each location, all or some of the improvements were considered and evaluated based on the conditions and constraints within that location.

Primary Highway Improvements

- Six-lane highway capacity:
 - ◆ Horizontal widening
 - ◆ Vertical widening
- Flex lanes
- Reversible/HOV/HOT lanes
- Movable median
- Parallel route
- Silverthorne Tunnel

Within each location, one or two of the highway improvements were advanced and fell into two of the improvement alternative elements:

- Six-lane highway capacity
- Reversible/High Occupancy Vehicle (HOV)/High Occupancy Toll (HOT) lanes

Several highway improvement alternative elements were eliminated at differing levels of screening, as shown in **Table 2-5**, and are discussed by location. In locations where the following highway improvements were considered, they were eliminated for the following reasons:

- **Flex lanes** offer a narrower roadway width (90 feet) and provide a 16-foot flex lane shoulder used as a 12-foot-wide travel lane and 4-foot shoulder during peak volumes in the peak direction, and as a wide shoulder at other times. Control devices (such as a lane closure gate and message signing) are used during peak hours when the lane would function as a standard travel lane. Flex

lanes are eliminated for all locations due to poor safety as a result of inconsistent lane balance for sections of the highway on either side of the flex lane section. The 4-foot shoulder width does not meet design standards and is incompatible with CDOT's Incident Management Plan, requiring sufficient shoulder width to operate emergency vehicles. A 4-foot shoulder does not allow broken-down vehicles to get out of the flow of traffic, which is a concern in the Corridor (especially for commercial trucks).

- **Movable median** uses a five-lane highway with the reversible third lane using a movable median between Empire and Floyd Hill. A specially equipped vehicle lifts portable barrier segments and shifts them laterally to produce a new lane configuration. This element was eliminated in all locations due to the reduction of mobility as a result of loss in the travel time it would take to clear the traffic lanes and move the median and because future travel demand is more balanced with heavy traffic both directions so a reversible lane does not meet travel needs.
- **Parallel route** north of Idaho Springs between Fall River Road and the Hidden Valley interchange (a two-lane multipurpose roadway) was eliminated because it does not meet the need criteria of reducing congestion between the Eisenhower-Johnson Memorial Tunnels and Floyd Hill and because it is impossible to continue west of Idaho Springs due to steep terrain at the Fall River Road area. This was eliminated in the three highway locations where it was considered.
- **Silverthorne Tunnel** was considered between Silverthorne and Empire Junction as an alternate to the existing highway between Empire and Silverthorne. At a proposed length of 25 miles, this tunnel would be among the longest tunnel ever constructed. It was eliminated because of major constructability challenges and lack of local access to communities such as Georgetown, Silver Plume, and Bakerville.

Some of the highway improvements considered have footprint and configuration differences. For six-lane horizontal highway widening, three options were considered:

- Standard shoulder width (12-foot shoulders)
- Variable shoulder width (8-foot to 10-foot shoulders)
- Smart widening (reduced shoulders, medians, and clear zones widths)

Six-lane highway capacity was also considered in a vertical configuration for use in tightly constrained areas of the Corridor (such as Idaho Springs). Three vertical options were considered:

- Structured lanes where one direction of travel is elevated directly above
- Cantilevered lanes where one direction of travel is elevated and terraced (to the side)
- Tunneled lanes where one direction of travel is below grade

It is reasonable to evaluate the variable shoulder option as representative of the horizontal widening for the majority of locations in the Corridor because it moves a similar number of people as the other options, is consistent with American Association of State Highway and Transportation Officials design standards for shoulder width by providing 8 to 10 foot shoulders, and minimizes impacts on resources due to the reduced shoulder width. Structured lanes are a reasonable representation of the vertical options because it moves a similar number of people as the other options, minimizes impacts on adjacent resources, and has fewer impacts associated with past mining operations. The tunneled lane option posed greater challenges because required construction activity would encounter greater impacts associated with water quality and hazardous material from past mining operations. For purposes of analysis in this document, structured lanes are evaluated in the West Idaho Springs to East Idaho Springs area only because the benefit of the narrower footprint gained outweighed the cost of construction. In many locations, the alignment or direction of highway improvements could be adjusted to avoid sensitive resources. The six-lane highway capacity (either horizontal or vertical options) could be further evaluated in Tier 2.

Chapter 2. Summary and Comparison of Alternatives

Table 2-5. Highway Improvement Alternative Elements

Highway Improvement Alternative Element	Screened – Level 1 Screening	Screened – Level 2 Screening	Screened – Level 3 Screening	Advanced for Action Alternative Development
Eagle-Vail to Vail West (MP 169–MP 173)				
Six-Lane Highway – I-70 Highway Alignment				✓
Silverthorne to Empire Junction (MP 205–MP 232)				
Silverthorne Tunnel		X		
Eisenhower Johnson Memorial Tunnel to Silver Plume (MP 215.5–MP 226)				
Six-Lane Horizontal Widening – Variable Shoulder (8 feet to 10 feet) as representative				✓
Reversible/HOV/HOT Lanes				✓
Flex Lanes		X		
Silver Plume to Georgetown (MP 226–MP 228)				
Six-Lane Horizontal Widening – Variable Shoulder (8 feet to 10 feet) as representative				✓
Reversible/HOV/HOT Lanes				✓
Flex Lanes		X		
Georgetown to Empire Junction (MP 228–MP 232)				
Six-Lane Horizontal Widening – Variable Shoulder (8 feet to 10 feet) as representative				✓
Reversible/HOV/HOT Lanes				✓
Flex Lanes		X		
Empire Junction to West Idaho Springs (MP 232–MP 239)				
Six-Lane Horizontal Widening – Variable Shoulder (8 feet to 10 feet) as representative				✓
Movable Median			X	
Reversible/HOV/HOT Lanes				✓
Flex Lanes		X		
West Idaho Springs to East Idaho Springs (MP 239–MP 241)				
Structured Lanes as representative				✓
Movable Median			X	
Reversible/HOV/HOT Lanes				✓
Flex Lanes		X		
Parallel Routes		X		
East Idaho Springs to Twin Tunnels (MP 241–MP 242)				
Six-Lane Horizontal Widening – Variable Shoulder (8 feet to 10 feet) as representative				✓
Movable Median			X	
Reversible/HOV/HOT Lanes				✓

Chapter 2. Summary and Comparison of Alternatives

Highway Improvement Alternative Element	Screened – Level 1 Screening	Screened – Level 2 Screening	Screened – Level 3 Screening	Advanced for Action Alternative Development
Flex Lanes		X		
Parallel Routes		X		
Twin Tunnels to US 6 (MP 242–MP 244)				
Six-Lane Horizontal Widening – Variable Shoulder (8 feet to 10 feet) as representative				✓
Movable Median			X	
Reversible/HOV/HOT Lanes				✓
Flex Lanes		X		
Parallel Routes		X		
US 6 to Floyd Hill (MP 244–MP 247)				
Six-Lane Horizontal Widening – Variable Shoulder (8 feet to 10 feet) as representative				✓
Movable Median			X	
Reversible/HOV/HOT Lanes				✓
Flex Lanes		X		

✓ = carried forward for analysis; X = eliminated

Key to Abbreviations/Acronyms

HOT = High Occupancy Toll
mph = miles per hour

HOV = High Occupancy Vehicle
WB = westbound

MP = milepost
US = United States Highway

2.5.6 Alternate Route Alternative Elements

Seventeen alternate routes were developed and evaluated to determine if the travel times and speeds could be competitive enough to attract enough Corridor travelers such that no mobility improvements are needed on the Corridor. The routes are shown on **Table 2-6** and described in detail in the *I-70 Mountain Corridor PEIS Alternatives Development and Screening Technical Report* (CDOT, March 2011).

Although there was substantial interest in alternate routes and many were considered in this process, none met the purpose and need for this project. Fifteen of the 17 alternate routes were eliminated in Level 1 screening because they either had substantially longer travel times or were located too far away from the primary origination of travel to improve mobility or reduce congestion on the Corridor.

Two of the alternate routes were examined in more detail in Level 2 screening, however neither of these advanced beyond Level 2. Alternate Route 17 from Golden to Winter Park via a new tunnel was eliminated at Level 2 screening due to much larger capital costs and because of noticeably longer travel times. Alternate Route 9 from Denver to Copper Mountain via a new tunnel under Georgia Pass was eliminated at Level 2 screening because of greater environmental impacts and longer travel times during uncongested travel periods in the Corridor.

Chapter 2. Summary and Comparison of Alternatives

Table 2-6. Alternate Route Alternative Elements

Alternate Route Alternative Element	Screened – Level 1 Screening	Screened – Level 2 Screening	Screened – Level 3 Screening	Advanced for Action Alternative Development
Alternate Route 1: Fort Collins to Wolcott via Walden (SH 14 and SH 131)	X			
Alternate Route 2: Fort Collins to Wolcott via Kremmling (US 34)	X			
Alternate Route 3: Fort Collins to Copper Mountain via Kremmling (US 34 and SH 9)	X			
Alternate Route 4: Denver to Wolcott via Moffat Tunnel (SH 72, US 40, and US 34)	X			
Alternate Route 5: Denver to Copper Mountain via Moffat, Berthoud and Jones Pass Tunnels (SH 72 and SH 9)	X			
Alternate Route 6: Denver to Wolcott via Berthoud Pass Tunnel (US 40 and US 34)	X			
Alternate Route 7: Denver to Copper Mountain via Jones Pass Tunnel (SH 9)	X			
Alternate Route 8: Denver to Copper Mountain via Hoosier Pass (surface) (US 285 and SH 9)	X			
Alternate Route 9: Denver to Copper Mountain via Georgia Pass Tunnel (US 285)		X		
Alternate Route 10: Denver to Minturn via Buena Vista (US 285 and US 24)	X			
Alternate Route 11: Colorado Springs to Copper Mountain via Hoosier Pass (surface) (US 24 and SH 9)	X			
Alternate Route 12: Colorado Springs to Copper Mountain via Hoosier Pass Tunnel (US 24 and SH 9)	X			
Alternate Route 13: Colorado Springs to Minturn via Buena Vista (US 24)	X			
Alternate Route 14: Colorado Springs to Copper Mountain via Buena Vista (US 24 and SH 91)	X			
Alternate Route 15: Pueblo to Copper Mountain via Hoosier Pass (surface) (US 50 and SH 9)	X			
Alternate Route 16: Pueblo to Copper Mountain via Hoosier Pass Tunnel (US 50 and SH 9)	X			
Alternate Route 17: Golden to Winter Park via New Tunnel Parallel to Moffat Tunnel (SH 58, SH 93, and SH 72)		X		

X = eliminated

Key to Abbreviations/Acronyms

SH = State Highway US = United States Highway

2.5.7 Aviation Alternative Elements

Aviation alternative elements focus on ways to help meet future travel demand and increase mobility by expanding or improving air service in the Corridor. The six aviation alternative elements evaluated were eliminated in various screening levels as shown in **Table 2-7** and described below. In general, they were eliminated due to the absence of demand for greater airport capacity and ability to reduce congestion or improve mobility and accessibility, or address safety on the I-70 highway during peak travel demand periods.

- Improving existing commercial service aviation facilities through advanced technology was eliminated from consideration at Level 3 screening because the capacity of commercial service is sufficient in the Corridor and improvements are part of Eagle County Regional Airport plans, regardless of action on the Corridor. Capacity at commercial service airports is sufficient, if not abundant, and is underutilized for eight months out of the year (most facilities are designed for peak winter season).
- Improving existing general aviation facilities to accommodate commercial operations was combined with the improvement of existing commercial service aviation facilities due to the minor difference between the two elements and also was eliminated in Level 3 screening for the same reasons.
- Developing aviation systems management and subsidy programs was eliminated due to the absence of demand for greater airport capacity and its inability to reduce congestion on the Corridor during peak travel demand periods. The Eagle County Regional Airport discontinued incentive programs and seat guarantees due to less seasonal fluctuations and growth in enplanements over the past ten years.
- Developing new airports in the Corridor was eliminated due to the lack of accessibility (e.g., not able to be sited in proximity to major activity centers) or sufficient air travel demand and inability to reduce congestion on the Corridor during peak travel demand periods. Aviation experts in the Corridor indicated that commercial service capacity is not an issue in the Corridor. With planned improvements at existing airports, there would be an estimated reduction of 500 person trips per day within the next 15 years. This reduction would provide minimal effects to the volume of traffic on the I-70 highway during peak travel demand periods.
- Developing new heliport and short take-off and landing facilities was eliminated because smaller aircraft carry too few passengers, are less equipped to deal with mountain weather conditions, and are unable to reduce congestion on the Corridor during peak travel demand periods because they divert an insignificant number of cars from the highway. Additionally, vertical flight aircraft operate at half the speed of conventional aircraft and are noisier during take-off and landing. From a safety perspective, these aircraft are less equipped to deal with the extremes of mountain weather conditions (compared to conventional aircraft).
- Developing Walker Field into a Western Slope regional hub airport was eliminated because it is currently underutilized compared to Hayden, Rifle, Aspen, Eagle County, and Glenwood Springs airports, and because it is unable to reduce congestion on the Corridor during peak travel demand periods. Prior to the development of the other Corridor airports, Walker Field served as a gateway airport. However, it is not likely it will resume that position in light of the capacities of the other airports and the technological advances making it safer to use the smaller, regional commercial service airports. Additionally, shifting the transport of goods from truck to aircraft historically has shown to minimally affect highway congestion given the small increase in capacity relative to the enormous cost (for example, one plane carries about as much cargo as one truck).

Chapter 2. Summary and Comparison of Alternatives

Table 2-7. Aviation Alternative Elements

Aviation Alternative Element	Screened – Level 1 Screening	Screened – Level 2 Screening	Screened – Level 3 Screening	Advanced for Action Alternative Development
Improve Existing Commercial Service Aviation Facilities Through Advanced Technology (Included in Local Airport Planning)			X	
Improve Existing General Aviation Facilities to Accommodate Commercial Operations*			X	
Develop Aviation Systems Management and Subsidy Programs			X	
Develop New Airports in the Corridor	X			
Develop Heliport and Short Takeoff and Landing Facilities	X			
Develop Walker Field (Grand Junction) into a Western Slope Regional Hub Airport	X			

X = eliminated

* Alternative element combined with "Improve Existing Commercial Service Aviation Facilities Through Advanced Technology" alternative element, which was eliminated during Level 3 screening.

2.5.8 Tunnel Alternative Elements

Tunnels were evaluated in order to improve mobility or provide additional capacity in specific locations for both highway and transit alternative elements. Several highway and transit improvements evaluated require the use of new or expansion of existing tunnels. Tunnels were used to improve geometry and address safety problems where design speed and roadway geometry required. Due to the cost and impact of tunnel facilities, a set of tunnel alternative elements was evaluated in support of the highway and transit elements and at existing tunnels that do not provide adequate capacity (see *I-70 Mountain Corridor PEIS Alternatives Development and Screening Technical Report*, [CDOT, March 2011]). Of the various tunnels evaluated, the following five were eliminated in Level 2 as shown in **Table 2-8**.

- Silverthorne Tunnel was eliminated because of:
 - Specific severe geologic and engineering issues
 - Impacts on the surrounding communities
 - Environmental impacts on wildlife, fisheries, and water quality
- Silverthorne to Empire Tunnel was evaluated at part of the highway improvement alternative elements (see **Section 2.5.5**) and was eliminated due to its very long length (25 miles) resulting in:
 - Very difficult implementation
 - Extremely high costs
 - Limited access to communities and destinations in-between
 - Potential safety problems of emergency access within the tunnel
- Loveland Pass Tunnel (evaluated for Fixed Guideway Transit) was eliminated because the grade required for the tunnel approach would be too steep for the practical operation of fixed guideway transit systems.

Chapter 2. Summary and Comparison of Alternatives

- Silver Plume Tunnel North (evaluated for Fixed Guideway Transit) was eliminated because:
 - Numerous mine tunnels in the area provide a drainage conduit for water containing toxic heavy metals, potentially resulting in severe water contamination
 - It results in potential mine collapse posing safety hazards to the traveling public
- Mount Vernon Canyon Tunnel was evaluated with the 4 percent grade Fixed Guideway Transit alternative elements. This tunnel was eliminated because the retained Fixed Guideway Transit systems can operate at a 6 percent grade, and this 6.2-mile-long tunnel would result in unnecessary and substantial environmental impacts and costs.

The following two tunnels were not eliminated but were found to have severe issues in encountering existing mining tunnels containing water with heavy metals. Unforeseen conditions within the existing tunnels create construction and operational safety issues.

- Georgetown Incline Tunnel (evaluated for fixed guideway transit with 6 percent grades or less)
- Georgetown Incline Tunnel (evaluated for highway alignment)

During Tier 2, tunnels could be considered as mitigation. While the following tunnels were evaluated, other tunnel elements could still be considered during Tier 2 processes if appropriate.

Table 2-8. Tunnel Alternative Elements

Tunnel Alternative Element	Screened – Level 1 Screening	Screened – Level 2 Screening	Screened – Level 3 Screening	Advanced for Action Alternative Development
Proposed New Tunnels				
Dowd Canyon Tunnel				✓
Silverthorne Tunnel		X		
Silverthorne to Empire Tunnel - Highway		X		
Loveland Pass Tunnel – FGT		X		
Silver Plume Tunnels				
Silver Plume - North Tunnel – FGT		X		
Georgetown Incline Tunnel – FGT				✓ *
Georgetown Incline Tunnel – Highway				✓ *
Twin Tunnels to Hidden Valley				✓
Hidden Valley to Floyd Hill				✓
Mount Vernon Canyon Tunnel - FGT		X		
Third Bores at Existing Tunnels				
Eisenhower-Johnson Memorial Tunnels				✓
Twin Tunnels				✓

✓ = carried forward for analysis; X = eliminated

Key to Abbreviations/Acronyms

FGT = Fixed Guideway Transit

EJMT = Eisenhower-Johnson Memorial Tunnels

* RTier 2 but not fully evaluated in Tier 1 due to issues with historic mining, water quality, safety.

2.6 What alternatives were advanced?

The screening process considered and evaluated more than 200 alternative elements. These alternative elements combined, modified, or enhanced to form the components of 21 Action Alternatives (including the Preferred Alternative) advanced for analysis in this document. These Action Alternatives represent a reasonable range of alternatives. While this document identifies potential modes, technologies that fit within the identified mode will need to be evaluated at Tier 2.

This section describes 20 of the Action Alternatives and the No Action Alternative. **Section 2.7** describes the Preferred Alternative. Many of the alternatives share common components, and some alternatives simply provide different combinations of the same transit or roadway improvements.

For presentation in this chapter, first, the No Action Alternative and the Minimal Action Alternative are described in detail. Following the Minimal Action Alternative description, the remaining alternative components forming the other Action Alternatives are described to fully complete a description of all components contained in the Action Alternatives.

The No Action Alternative includes previously committed or reasonably foreseeable transportation improvements in the Corridor common to all Action Alternatives. The Minimal Action Alternative includes a large number of transportation improvements contained in all Action Alternatives and forms a good basis for discussion. Some Minimal Action Alternative improvements are moving forward as early action projects.

2.6.1 History and Context of Advanced Alternatives

A history of evaluating and advancing the Action Alternatives is important to understand and explains why this document fully evaluates so many alternatives. When the project was initiated in 2000, the horizon year for the project was 2025. At that time, 20 Action Alternatives were under consideration (the Preferred Alternative had not been developed). Each of these Action Alternatives had overall network capacity to reach the 2025 horizon and strong potential to meet the purpose and need. Only the Minimal Action Alternative did not meet the 2025 horizon year network capacity. However, the Minimal Action Alternative was carried forward because it:

- Forms the basis of localized improvements common to all Action Alternatives
- Includes only localized improvements
- Provides a comparison with other Action Alternatives that all provide continuous longer distance and capacity improvements

As the project progressed and stakeholders became more involved, the lead agencies and stakeholders went through a detailed review process and decided to extend the horizon year to a 2050 as a long-range vision for improvements in the Corridor. **Chapter 1, Purpose and Need** discusses this process. The 2050 planning horizon recognized that many factors could occur during the intervening years to substantially change conditions along the Corridor. To address the uncertainty of projecting so far in the future, the Preferred Alternative was developed using an incremental and adaptive approach to transportation improvements. The Preferred Alternative defines travel mode, capacity, and general location in a broad program of improvements and provides a process by which improvements and needs are periodically reviewed.

The evaluation shows that many Action Alternatives do not meet the purpose and need for the project based on the 2050 planning horizon. Similarly, the evaluation shows that the Preferred Alternative has the best opportunity to meet the purpose and need while minimizing impacts based on information available today. **Section 2.7** discusses the incremental and adaptive approach included in the Preferred Alternative. This approach takes into consideration that future conditions could change and require consideration of

transportation improvements included in any Action Alternative. **Section 2.8** provides a comparison of the Action Alternatives.

2.6.2 No Action Alternative

The No Action Alternative includes only ongoing highway maintenance and improvements with committed funding sources highly likely to be implemented by the 2035 planning horizon. The No Action Alternative is assessed and used as a baseline for environmental analysis and represents what would exist if no action were taken based on this National Environmental Protection Act (NEPA) process. None of the improvements included in the Action Alternatives would be completed under the No Action Alternative.

Figure 2-2 shows the No Action Alternative improvements by area. These improvements include highway improvements, park-and-ride facilities, tunnel enhancements, and general improvements.

Highway Improvements

Highway improvements include the following:

- Eagle County Regional Airport Interchange – A new interchange providing a direct connection between the Eagle County Regional Airport and the I-70 highway located between milepost 142 and milepost 143.
- SH 9 – Upgrades a nine-mile segment of SH 9 between Frisco and Breckenridge from two to four lanes.
- US 6 – Includes pavement overlay and shoulder widening on US 6 between milepost 153 and milepost 158.

Park-and-Ride Facilities

Two locations are identified for new park-and-ride facilities:

- Silverthorne (milepost 206)
- Breckenridge (SH 9)

Tunnel Enhancements

Tunnel enhancements (without increased capacity) are planned for the:

- Hanging Lake Tunnel in Glenwood Canyon
- Eisenhower-Johnson Memorial Tunnels

General Improvements

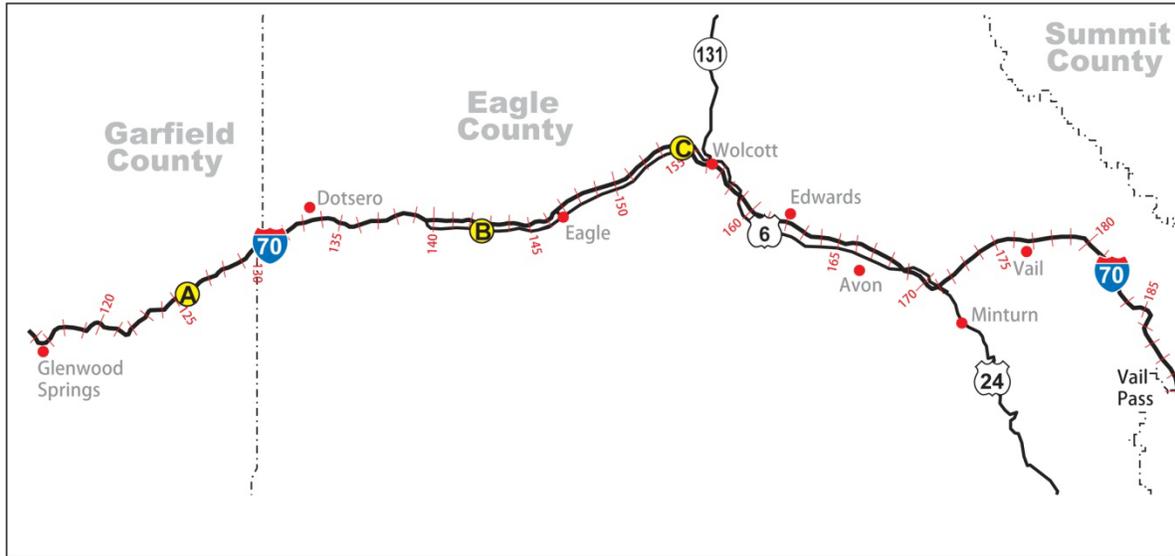
General improvements include the following:

- Routine safety improvements
- Resurfacing
- Bridge repairs
- Other maintenance activities
- Sediment control

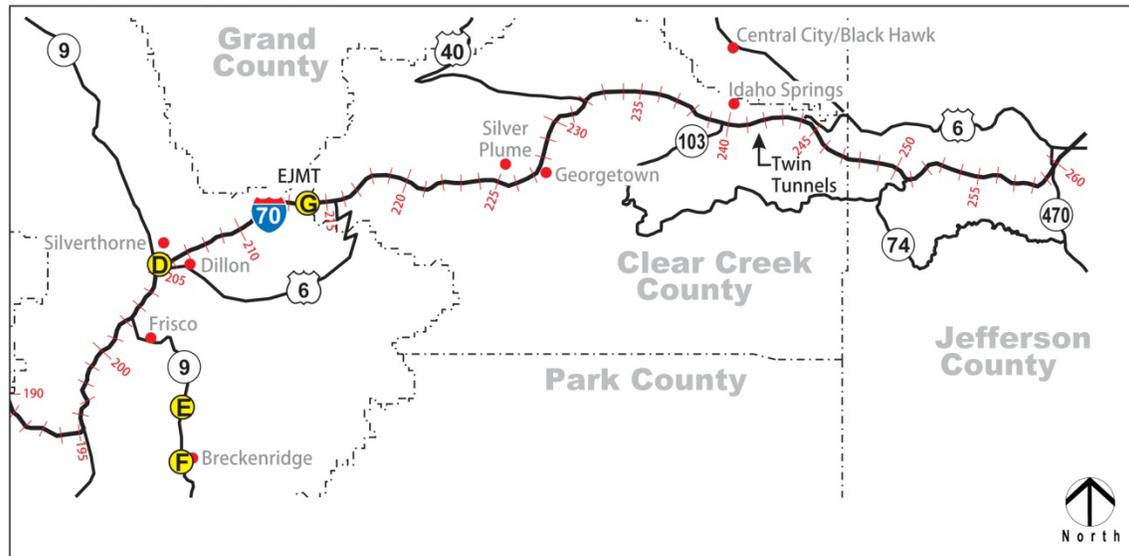
Chapter 2. Summary and Comparison of Alternatives

Figure 2-2. No Action Alternative

Western Portion of Corridor



Eastern Portion of Corridor



Highway

- B** Eagle County Regional Airport Interchange
- C** US 6 Improvements
- E** Widening SH 9 from I-70 to Breckenridge

Park-and-Ride Facilities

- D** Silverthorne
- F** Breckenridge

Tunnel Enhancement

- A** Hanging Lake
- G** EJMT

GENERAL IMPROVEMENTS NOT SHOWN ON MAP

- Routine Safety
- Resurfacing
- Bridge Repairs
- Other Maintenance Activities
- Sediment Control

Note: EJMT = Eisenhower-Johnson Memorial Tunnels

2.6.3 Minimal Action Alternative

The Minimal Action Alternative provides a range of local transportation improvements along the Corridor without providing major increased highway capacity or dedicated transit components. The Minimal Action Alternative addresses specific roadway problem areas identified throughout the Corridor. These improvements include:

- A transportation management program
- Interchange modifications
- Auxiliary lanes for slow-moving vehicles
- Curve safety modifications
- Sediment control programs
- Frontage road improvements
- Bus service in mixed traffic

Figure 2-2 shows these improvements by area. All or portions of this alternative are added to the other Action Alternatives and some could proceed as early action projects (see **Introduction** of this document).

Transportation Management Program

The Transportation Management Program includes components identified as part of the transportation management family and includes minor improvements to improve operational efficiency without major capacity additions. Transportation management includes:

- Transportation Demand Management (TDM)
- Transportation System Management (TSM)
- Intelligent Transportation Systems (ITS)

What is TDM / TSM / ITS?

- TDM increases roadway effectiveness by encouraging traveler behaviors, such as ridesharing and telecommuting, that reduce vehicular demand during peak periods.
- TSM improves the operation of the physical roadway infrastructure, through the use of ramp metering (based on traffic conditions, traffic signals regulate the amount of traffic entering freeways) and traffic operations plans.
- ITS uses advanced applications of electronics and communications to achieve TSM and TDM goals, such as enhanced traveler information and variable message signs.

Interchange Modifications

Most of the interchanges in the I-70 Mountain Corridor are structurally deficient, functionally obsolete, or will be by 2035. Thirty interchange locations along the Corridor were identified as needing improvements and are included as part of this alternative. The existing or future problems at each interchange vary widely and are described further in the *I-70 Mountain Corridor PEIS Transportation Analysis Technical Report* (CDOT, March 2011). The interchanges are:

- | | |
|--|---|
| <ul style="list-style-type: none"> ■ Glenwood Springs (milepost 116) ■ Gypsum (milepost 140) ■ Eagle and Spur Road (milepost 147) ■ Wolcott (milepost 157) ■ Edwards and Spur Road (milepost 163) ■ Avon (milepost 167) ■ Minturn (milepost 171) ■ Vail West / Simba Run (milepost 173) ■ Vail (milepost 176) ■ Vail East (milepost 180) ■ Vail Pass (Shrine Pass Road) (milepost 190) ■ Frisco/Main Street (milepost 201) ■ Frisco/SH 9 (milepost 203) ■ Silverthorne (milepost 205) ■ Lookout Mountain (milepost 256) | <ul style="list-style-type: none"> ■ Loveland Pass (milepost 216) ■ Copper Mountain (milepost 195) ■ Silver Plume (milepost 226) ■ Georgetown (milepost 228) ■ Empire (milepost 232) ■ Downieville (milepost 234) ■ Fall River Road (milepost 238) ■ Idaho Springs West (milepost 239) ■ Idaho Springs/SH 103 (milepost 240) ■ Idaho Springs East (milepost 241) ■ Base of Floyd Hill/US 6 (milepost 244) ■ Hyland Hills (milepost 247) ■ Beaver Brook (milepost 247) ■ Evergreen Parkway (milepost 252) ■ Morrison (milepost 259) |
|--|---|

Chapter 2. Summary and Comparison of Alternatives

Five of the interchanges in the above list do not require improvements in 2025 but based on review of safety and capacity needs in 2035 and 2050 would warrant replacement under the longer timeframe and were added to the Minimal Action Alternative (and other Action Alternatives). These include the Wolcott interchange at milepost 157, three interchanges in the Vail area (at mileposts 176, 180, and 190), and the Evergreen Parkway interchange at milepost 252. While minor effects may occur to the environmental resources at these locations, the effects are not anticipated to be significant and would not change the comparative analysis or the recommendation at the Tier 1 level. New capacity and crash data will be used to evaluate interchange improvements in Tier 2 processes.

Auxiliary Lanes

Auxiliary lane improvements proposed in 12 locations throughout the Corridor are part of the Minimal Action Alternative. Auxiliary lanes for slow-moving vehicles, primarily located in areas of steep grades, increase the capacity of a highway for relatively short lengths. The following lists include the locations for proposed eastbound and westbound auxiliary lanes. The description of the locations clarifies the list presented in the Revised Draft PEIS so that the descriptions are consistent with descriptions presented in **Table 2-2** and the Consensus Recommendation (see **Appendix C, Consensus Recommendation**).

Eastbound auxiliary lanes are located:

- Avon to Post Boulevard, Uphill
- West Side of Vail Pass, Uphill

- Frisco to Silverthorne
- Eisenhower-Johnson Memorial Tunnels to Herman Gulch, Downhill
- Silver Plume to Georgetown, Downhill
- Empire to Downieville, Downhill

Westbound auxiliary lanes are located:

- West Side of Vail Pass, Downhill
- Bakerville to Eisenhower-Johnson Memorial Tunnels, Uphill
- Georgetown to Silver Plume, Uphill
- Downieville to Empire, Uphill

- US 6 Off-ramp to Hidden Valley Off-ramp, Uphill
- Morrison to Chief Hosa, Uphill

Curve Safety Modifications

Curve safety modifications are proposed in four locations in the Corridor and include increasing the design speed on mainline curves to more closely match the design speed on adjoining sections of the I-70 highway. Locations include:

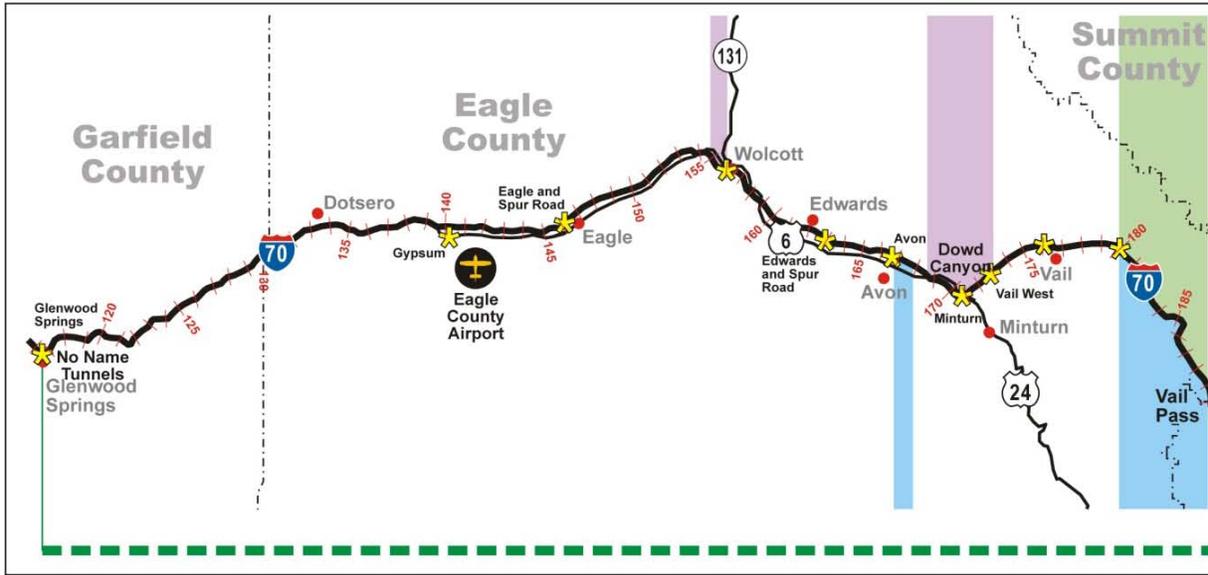
- West of Wolcott (milepost 155 to milepost 156)
- Dowd Canyon (milepost 170 to milepost 173)
- Fall River Road (milepost 237 to milepost 238)
- East of the Twin Tunnels (milepost 242 to milepost 245)

Other Improvements

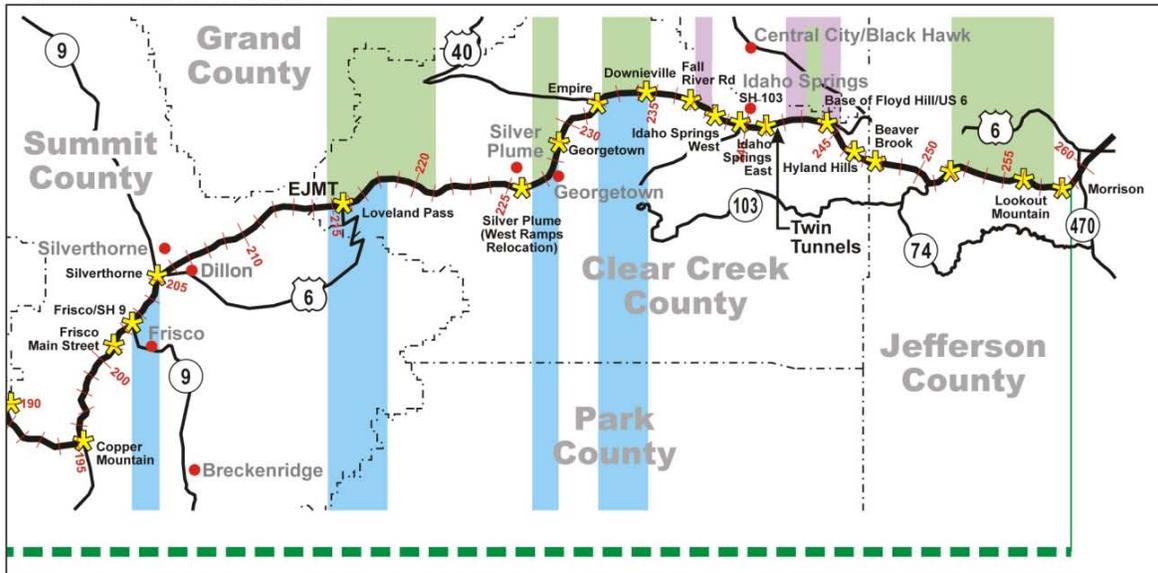
- Hidden Valley to US 6 Frontage Road (two lanes between milepost 243 and milepost 244) provides a new frontage road to improve emergency and local access.
- Idaho Springs to Hidden Valley Frontage Road improvements include rebuilding or repaving portions of the road to higher design standards to improve emergency and local access.
- Bus Service in Mixed Traffic, although eliminated as a standalone alternative, is part of the Minimal Action Alternative to provide a Corridorwide transit option where none currently exists. Such a service connects existing operators such as Roaring Fork Transportation Authority, ECO Transit, Summit Stage, Regional Transportation District, and private operators.

Figure 2-3. Minimal Action Alternative

Western Portion of Corridor



Eastern Portion of Corridor



-  Potential Interchange Modification Locations
 -  Eastbound Auxiliary Lane Locations
 -  Westbound Auxiliary Lane Locations
 -  Curve Safety Modifications
 -  Bus in Mixed Traffic System (Service Coordinated with/Provided by Local Transit Agencies)
- Note: EJMT = Eisenhower-Johnson Memorial Tunnels

2.6.4 Action Alternative Components

Following are descriptions of the remaining alternative components that form the Action Alternatives and the figures depicting them (**Figures 2-5 through 2-10**). The Action Alternatives have been developed to a sufficient level of conceptual design and specification to allow for a first tier analysis. The termini, general location and footprint, mode description, type of propulsion, and operation planning for each component are based on FHWA standards, and existing types of transit systems or research concepts appropriate for the Corridor. There are also tunnel concepts required for the performance and operation of each Transit, Highway, and Combination alternative. The *I-70 Mountain Corridor PEIS Alternatives Development and Screening Technical Report* (CDOT, March 2011) presents more information on these alternative components.

Action Alternative components are categorized below by Minimal Action Alternative components, Transit alternative components, Highway alternative components, and Tunnel alternative components common to many or all Action Alternatives. These Action Alternative components function as standalone alternatives or as Combination alternatives including components from both the Transit and Highway alternatives.

Minimal Action Alternative Components

The various alternative components contained in the Minimal Action Alternative discussed previously (transportation management, interchange modifications, auxiliary lanes, curve safety modifications, and other improvements) are included in each of the Action Alternatives, except as described below:

- All Action Alternatives with six-lane highway capacity (Highway alternatives and Combination alternatives) have auxiliary lane improvements in only the following locations:
 - Eastbound Avon to Post Boulevard
 - Both directions on the west side of Vail Pass
 - Eastbound Frisco to Silverthorne
 - Westbound Morrison to Chief Hosa

Auxiliary lanes are not needed in locations where six lanes are provided. The Preferred Alternative includes five additional locations in Clear Creek County where auxiliary lanes would be provided in the Minimum Program of Improvements that would be replaced by six-lane capacity if the Preferred Alternative is fully implemented.

- Transit alternatives do not have curve safety modifications at Dowd Canyon and only have auxiliary lane improvements at eastbound Eisenhower-Johnson Memorial Tunnels to Herman Gulch and westbound Downieville to Empire.
- With the Six-Lane Highway (65 mph) Alternative only, the curve safety modification at Dowd Canyon is replaced by tunnels.

- Action Alternatives, except the Minimal Action Alternative, do not include bus in mixed traffic because a more extensive transit system is provided, and buses operating in mixed traffic do not provide travel time improvement commensurate with the added cost.

Transit Alternative Components

Three Transit Alternative components advanced through screening for consideration in this document. All Transit alternative components, unless noted, operate between the west end of the Corridor at the Eagle County Regional Airport to the east end of the Corridor where they connect to the Regional Transportation District West Corridor light rail line Jeffco Government Center light rail station near C-470, a distance of approximately 118 miles. Transit alignments follow the general I-70 highway alignment (but do not necessarily always remain within the highway right-of-way).

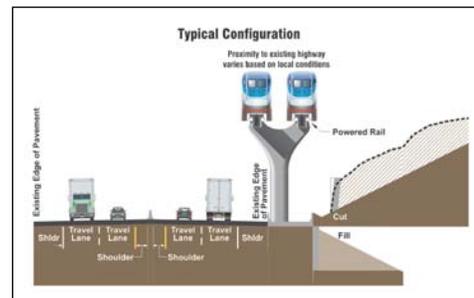
- **Rail with Intermountain Connection** is a Transit alternative component that combines a new heavy rail transit system with an upgraded Intermountain Connection that uses existing track in the Eagle area. It is a primarily on-grade electric facility adjacent to the I-70 highway with portions in the median. Where needed, it could include elevated sections to minimize the footprint and avoid sensitive resources. The Rail with Intermountain Connection assumes an electric multiple unit technology and is intended to be representative of established technologies that were available when the study began in 2000. The Intermountain Connection involves upgrading the existing Union Pacific Railroad track between the Minturn interchange and the Eagle County Regional Airport and add new track between Minturn and Vail.
- **Advanced Guideway System** is generally a high-speed fixed guideway transit system. It is capable of being fully elevated for its length. It is located along the general alignment of the I-70 highway. It could be located north, south, or in the median of the I-70 highway (but not necessarily always in the highway right-of-way). The specific technology for the Advanced Guideway System has not been defined but is intended to represent a modern, “state-of-the-art” transit system. For the purposes of analysis in this document, the advanced guideway technology is assumed to be an urban magnetic levitation (maglev) transit system. However, the actual technology would be identified in feasibility studies and related Tier 2 processes.

Potential Transit Station Locations (for all Transit alternatives)

- Eagle County Regional Airport
- Town of Eagle
- Edwards/Wolcott
- Avon/Beaver Creek
- Vail
- Copper Mountain
- Frisco
- Silverthorne
- Loveland
- Georgetown
- Empire
- Idaho Springs
- US 6 / Gaming Station
- El Rancho
- Jeffco Government Center light rail station near C-470



Rail with Intermountain Connection



Advanced Guideway System

Chapter 2. Summary and Comparison of Alternatives

- **Bus in Guideway (Dual-Mode and Diesel)** consists of a bidirectional guideway generally located within the median of the I-70 highway. The guideway is dedicated to special buses with guideway attachments such as guide wheels used for steering control permitting a narrow guideway and safer operations. The specific technology and alignment would be determined in a Tier 2 process. Two vehicle types are considered in this document: dual-mode and diesel. The dual-mode buses use electric power in the guideway and diesel power when outside the guideway in the general purpose lanes. The diesel buses use diesel power at all times, both in the guideway and outside the guideway. In addition to serving Corridor destinations, buses can drive outside the guideway in general purpose lanes and provide continuous routing, without transfers, between several Denver metropolitan area locations and off-Corridor destinations (such as Central City, Black Hawk, Winter Park Resort, Keystone Resort, Arapahoe Basin Ski Area, and Breckenridge).

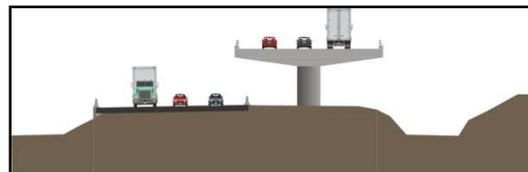


Bus in Guideway

Highway Alternative Components

Highway alternative components incorporated into some of the Action Alternatives include six-lane highway capacity for 55 mph and 65 mph options and reversible/HOV/HOT lanes. Both the 55 mph and 65 mph design speeds are included in the Tier 1 analysis and retained for further analysis in Tier 2 when more detailed designs are developed and evaluations are conducted. The two design speeds are included to establish Corridor consistency and address deficient areas within the Corridor. The 55 mph design speed establishes a consistent design speed throughout the Corridor, which currently doesn't exist. The 65 mph design speed improves mobility better and addresses safety deficiencies in key locations such as Dowd Canyon and the Twin Tunnels. Both the 55 mph and the 65 mph design speed options are augmented by curve safety improvements, but the 65 mph design speed constructs tunnels in two of the locations: Dowd Canyon and Floyd Hill/Hidden Valley.

- **Six-Lane Highway (55 mph and 65 mph)** – This component includes six-lane highway capacity in two locations on the Corridor by providing an additional lane in each direction in the following locations:
 - Dowd Canyon (Eagle-Vail to Vail West) between milepost 169 and milepost 173
 - Eisenhower-Johnson Memorial Tunnels to Floyd Hill (milepost 213.5 to milepost 247)



Structured Lanes

This component is primarily on grade, except in Idaho Springs, where structured lanes are assumed to minimize impacts.

- **Reversible / HOV/ HOT Lanes** – A reversible lane facility accommodates HOV and HOT lanes and changes traffic flow directions as needed to accommodate peak traffic demand. High occupancy toll lanes allow HOVs (3 or more persons) to use the facility for free, while lower occupancy vehicles use the facility for a fee. The alternative would add two reversible traffic lanes from the west side of the Eisenhower-Johnson Memorial Tunnels to just east of Floyd Hill. From the Eisenhower-Johnson Memorial Tunnels to US 6, two lanes are included with one lane continuing to US 6 and the other lane to the east side of Floyd Hill. The only entry and exit points for the lanes are at US 6 and the Empire Junction interchange. This component includes one additional general purpose lane in each direction at Dowd Canyon (milepost 169 to milepost 173) but these lanes are not barrier-separated or reversible. This alternative also includes 55 mph and

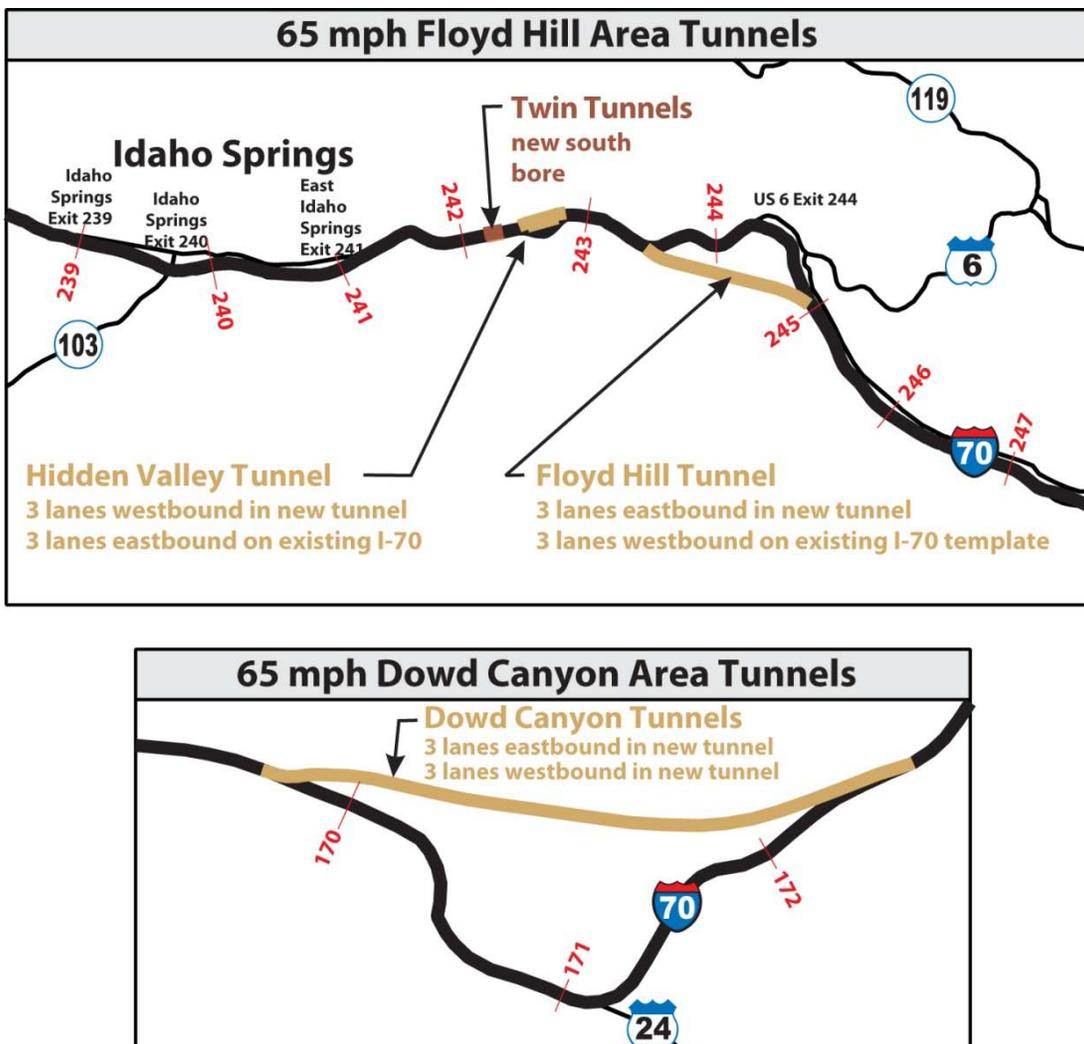
65 mph design options and assumes a structured configuration in Idaho Springs to minimize community impacts.

Tunnels Common to Many or All Action Alternatives

The Action Alternatives include new or rebuilt tunnels.

- For all Action Alternatives (Highway, Transit, and Combination), except the Minimal Action Alternative, new (third) tunnel bores are required at both the Eisenhower-Johnson Memorial Tunnels and the Twin Tunnels to accommodate capacity improvements.
- For the Six-lane Highway 65 mph Alternative, three new tunnels are required to accommodate the capacity and higher speed. The locations are in the Dowd Canyon area and the Floyd Hill area (westbound Hidden Valley Tunnel and eastbound Floyd Hill Tunnel). **Figure 2-3** shows these tunnels.

Figure 2-4. 65 mph Local Tunnel Alternatives



Combination Alternatives and Preservation Options

All Transit alternative components are combined with the 55 mph six-lane highway capacity to create Combination alternatives. The 55 mph design speed is used with the Transit alternative components because the 55 mph design results in less impact, and the higher design speed is not needed to address capacity needs since transit service is alleviating capacity issues in the Corridor. Each Combination alternative includes variations that construct the transit and preserve the six-lane highway footprint or construct the six-lane highway and preserve the transit footprint. More specifically, preservation options include space for additional modes in the Corridor and do not preclude the ability to construct additional modes in the future.

Preservation options included in the Combination alternatives evaluated:

- Rail with Intermountain Connection with Highway Preservation
- Advanced Guideway System with Highway Preservation
- Bus in Guideway (dual-mode and diesel) with Highway Preservation
- Highway with Rail with Intermountain Connection Preservation
- Highway with Advanced Guideway System Preservation
- Highway with Bus in Guideway (Dual-mode and Diesel) Preservation

2.6.5 Description of the Action Alternatives

Figures 2-5 through 2-10 display various components of the Action Alternatives (except the Preferred Alternative which is discussed in **Section 2.7**) resulting from the screening process. All alternatives contain:

- Single components or
- Combination of components from
 - Minimal Action Alternative
 - Transit alternatives
 - Six-lane Highway alternatives

The Action Alternatives do not include bus service in mixed traffic that is part of the Minimal Action Alternative. The reason is that all the Transit alternatives include a more extensive transit system, and bus service in mixed traffic does not provide travel time improvement commensurate with the added cost as part of the Highway alternatives. All transit components extend from Eagle County Regional Airport to the Jeffco Government Center light rail station for the Regional Transportation District's West Corridor. Six-lane highway capacity is included in specific locations within the Corridor: between the Eisenhower-Johnson Memorial Tunnels and Floyd Hill and in the area of Dowd Canyon. The figures show the three major components (Minimal Action, Transit, and Highway) included in the alternative, where they are included within the Corridor, and variations of these components. **Table 2-9** summarizes how the selected components of the Minimal Action Alternative are incorporated into each Transit, Highway, or Combination alternative described below.

Variations in Minimal Action Alternative Components Among Action Alternatives

The Action Alternatives include some or all components described in the Minimal Action Alternative. In some cases, the Minimal Action Alternative components are designed differently because of the particular characteristics of the alternative. In other cases, certain Minimal Action Alternative components are not needed due to a particular alternative's ability to provide capacity or safety improvements. These variations are discussed below and summarized in **Table 2-9**.

Chapter 2. Summary and Comparison of Alternatives

Transit alternatives (including the Transit with Highway Preservation alternatives) do not include the Dowd Canyon curve safety component because the high cost increases the overall cost of those alternatives without substantially improving the travel time characteristics. Because these Transit alternatives reduce the overall highway demand, only two of the 12 auxiliary lane improvements are needed at:

1. Eisenhower-Johnson Memorial Tunnels to Herman Gulch eastbound
2. Downieville to Empire westbound

Because the Highway alternatives (including Combination alternatives that package highway in combination with transit or highway with transit preservation) increase capacity instead of reducing demand on the highway, some of the auxiliary lanes are not needed. Only one of the seven auxiliary lanes east of the Eisenhower-Johnson Memorial Tunnels is included in the Highway alternatives. This is the Morrison to Chief Hosa westbound auxiliary lane. For the Six-lane Highway 65 mph Alternative, curve modifications at Dowd Canyon is not needed because a new tunnel for six lane capacity for the I-70 highway would be constructed in this area, avoiding Dowd Canyon.

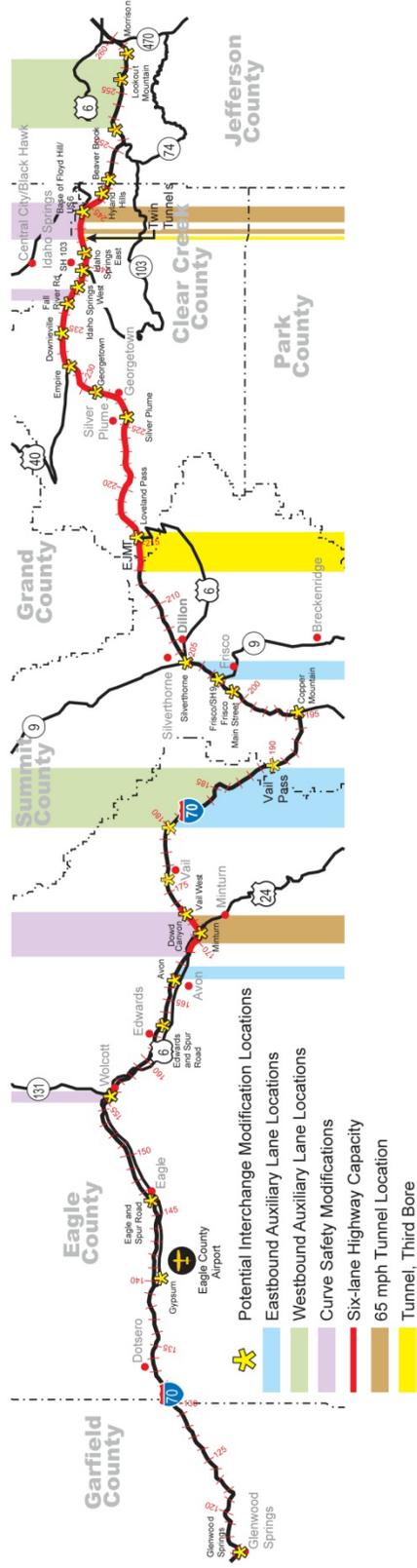
Figure 2-6. Major Components of Highway Alternatives

Glenwood Springs (MP 116)	Eagle County Airport (MP 143)	Dowd Canyon (MP 170-173)	EJMT (MP 215)	Twin Tunnels (MP 242)	Floyd Hill (MP 247)	C-470 (MP 260)
<p>See Map below and Table 2-9 for Minimal Action Components</p> <p>See Map below and Table 2-9 for Minimal Action Components</p> <p>See Map below and Table 2-9 for Minimal Action Components</p>						
<p>Six-lane Highway capacity for 55 mph</p> <p>Six-lane Highway capacity for 65 mph</p> <p>Reversible/HOV/HOT Lanes 55 mph</p>						

Six-lane Highway 55 mph Alternative – Includes selected components of the Minimal Action Alternative with the 55 mph highway capacity from Floyd Hill to Eisenhower-Johnson Memorial Tunnels and at Dowd Canyon.

Six-lane Highway 65 mph Alternative – Includes selected components of the Minimal Action Alternative, with the 65 mph highway capacity from Floyd Hill to Eisenhower-Johnson Memorial Tunnels and Dowd Canyon. Also includes additional tunnels beyond the Six-lane Highway 55 mph Alternative in the Floyd Hill area and Dowd Canyon to accommodate the higher speed.

Reversible/High Occupancy Vehicle/High Occupancy Toll Lanes Alternative – Includes selected components of the Minimal Action Alternative with Reversible/High Occupancy Vehicle/High Occupancy Toll Lanes between Floyd Hill and Eisenhower-Johnson Memorial Tunnels and Dowd Canyon.

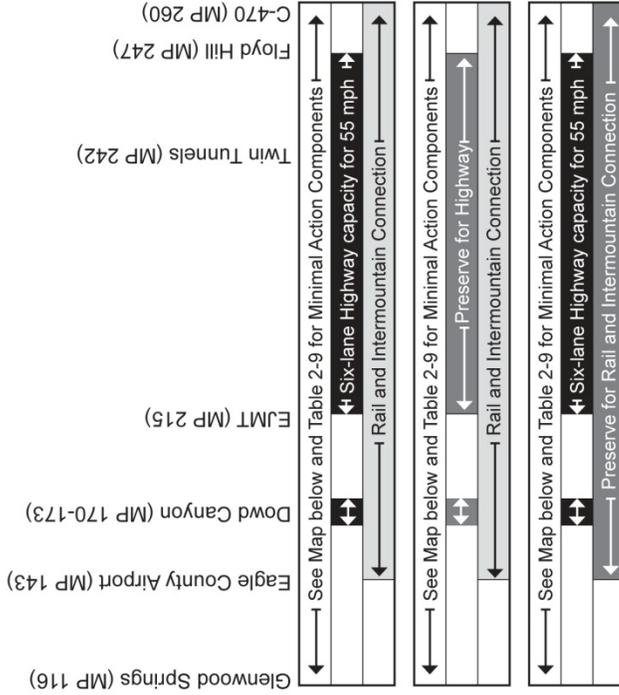


Note: EJMT = Eisenhower-Johnson Memorial Tunnels
 MP = milepost
 mph = miles per hour

Note: Curve safety modifications at Dowd Canyon only occur with the 55 mph alternative.

Chapter 2. Summary and Comparison of Alternatives

Figure 2-7. Major Components of Combination Six-lane Highway with Rail and Intermountain Connection Alternative



Combination Six-lane Highway with Rail and Intermountain Connection Alternative – Includes selected components of the Minimal Action Alternative, with the 55 mph Six-lane highway capacity between Floyd Hill and Eisenhower-Johnson Memorial Tunnels and Dowd Canyon, and the Rail and Intermountain Connection transit component.

Combination Six-lane Highway with Rail and Intermountain Connection, Preserve for Highway Alternative – Same as the Combination Six-lane Highway with Rail and Intermountain Connection Alternative but only preserves the footprint for the six-lane highway component.

Combination Six-lane Highway with Rail and Intermountain Connection, Preserve for Transit Alternative – Same as the Combination Six-lane Highway with Rail and Intermountain Connection Alternative but only preserves the footprint for the Rail and Intermountain Connection transit component.

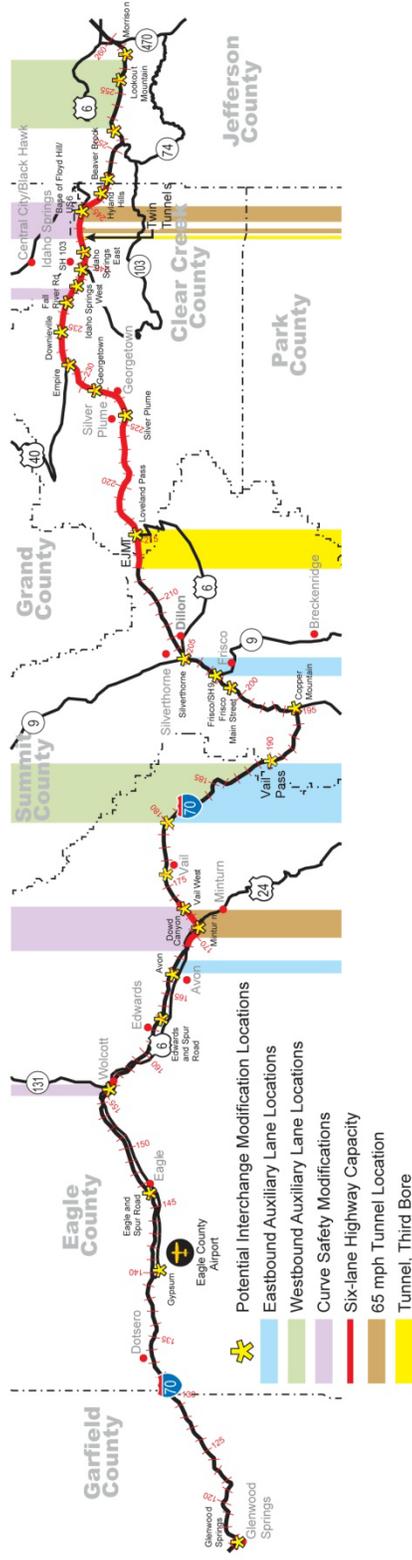
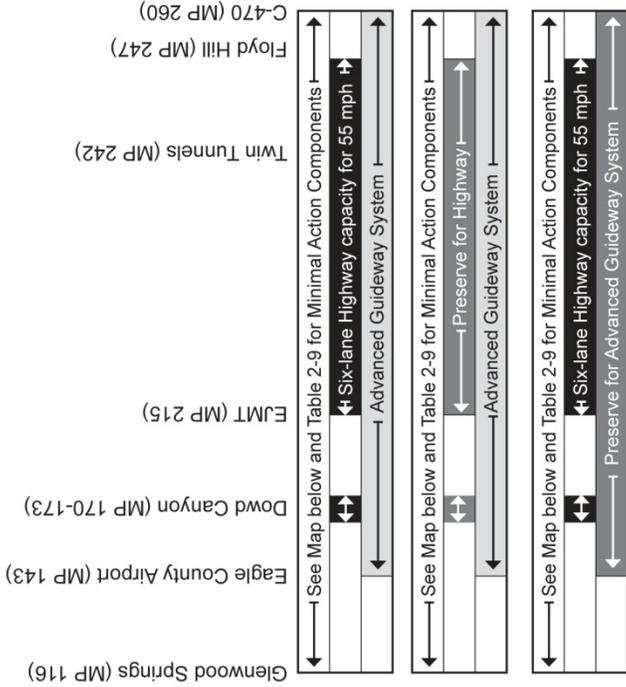


Figure 2-8. Major Components of Combination Six-lane Highway with Advanced Guideway System



Combination Six-lane Highway with Advanced Guideway System Alternative – Includes selected components of the Minimal Action Alternative, with the 55 mph six-lane highway capacity between Floyd Hill and Eisenhower-Johnson Memorial Tunnels and Dowd Canyon, and the Advanced Guideway System transit component.

Combination Six-lane Highway with Advanced Guideway System, Preserve for Highway Alternative – Same as the Combination Six-lane Highway with Advanced Guideway System Alternative but only preserves the footprint for the six-lane highway component.

Combination Six-lane Highway with Advanced Guideway System, Preserve for Transit Alternative – Same as the Combination Six-lane Highway with Advanced Guideway System Alternative but only preserves the footprint for the Advanced Guideway System transit component.

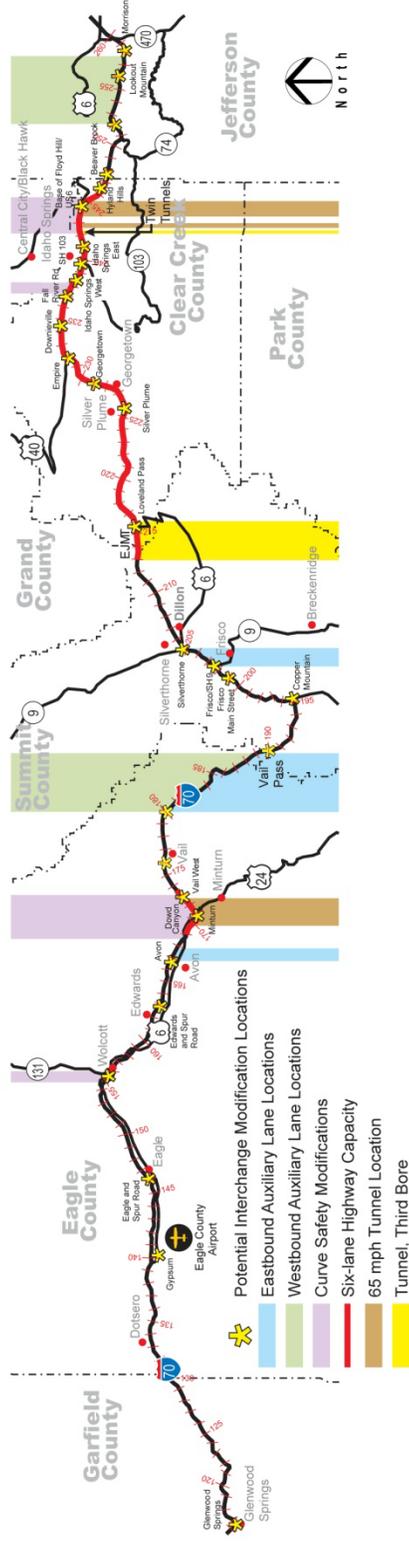


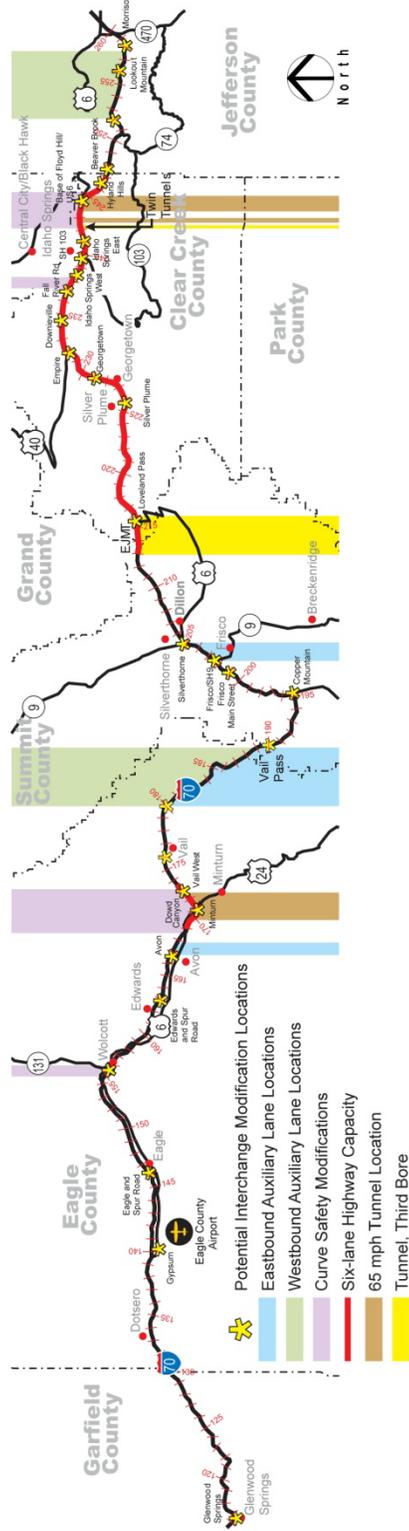
Figure 2-9. Major Components of Combination Six-lane Highway with Dual-Mode Bus in Guideway

Glenwood Springs (MP 116)	Eagle County Airport (MP 143)	Dowd Canyon (MP 170-173)	EJMT (MP 215)	Twin Tunnels (MP 242)	Floyd Hill (MP 247)	C-470 (MP 260)
↓ See Map below and Table 2-9 for Minimal Action Components ↓						
↓ Six-lane Highway capacity for 55 mph ↓						
↓ Dual-Mode Bus in Guideway ↓						
↓ See Map below and Table 2-9 for Minimal Action Components ↓						
↓ Preserve for Highway ↓						
↓ Dual-Mode Bus in Guideway ↓						
↓ See Map below and Table 2-9 for Minimal Action Components ↓						
↓ Six-lane Highway capacity for 55 mph ↓						
↓ Preserve for Dual-Mode Bus in Guideway ↓						

Combination Six-lane Highway with Dual-Mode Bus in Guideway Alternative – Includes selected components of the Minimal Action Alternative, with the 55 mph six-lane highway capacity between Floyd Hill and Eisenhower-Johnson Memorial Tunnels and Dowd Canyon, along with the bus in guideway transit components. The bus technology for this alternative is dual-mode.

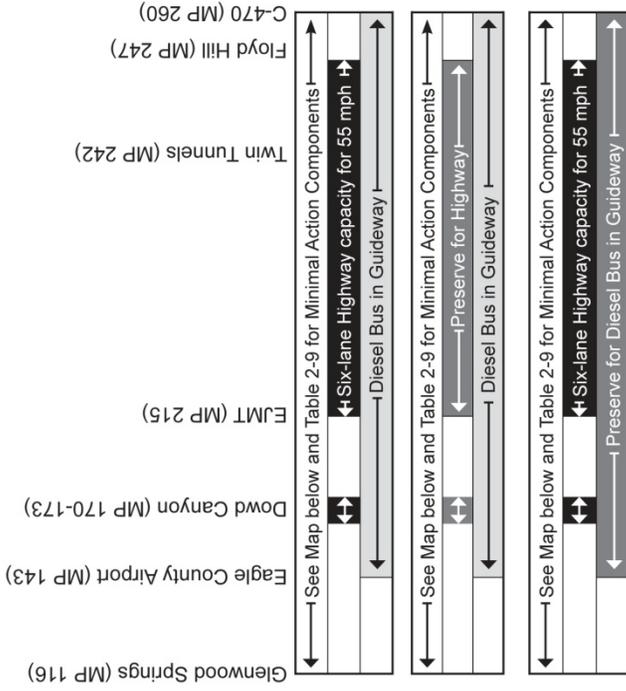
Combination Six-lane Highway with Dual-Mode Bus in Guideway, Preserve for Highway Alternative – Same as the Combination Six-lane Highway with Dual-Mode Bus in Guideway Alternative but only preserves the footprint for the six-lane highway component.

Combination Six-lane Highway with Dual-Mode Bus in Guideway, Preserve for Transit Alternative – Same as the Combination Six-lane Highway Dual-Mode Bus in Guideway Alternative but only preserves the footprint for the bus in guideway (dual mode) transit component.



Note: EJMT = Eisenhower-Johnson Memorial Tunnels
 MP = milepost
 mph = miles per hour
 Dowd Canyon curve safety improvements not included in Preserve for Highway Alternative

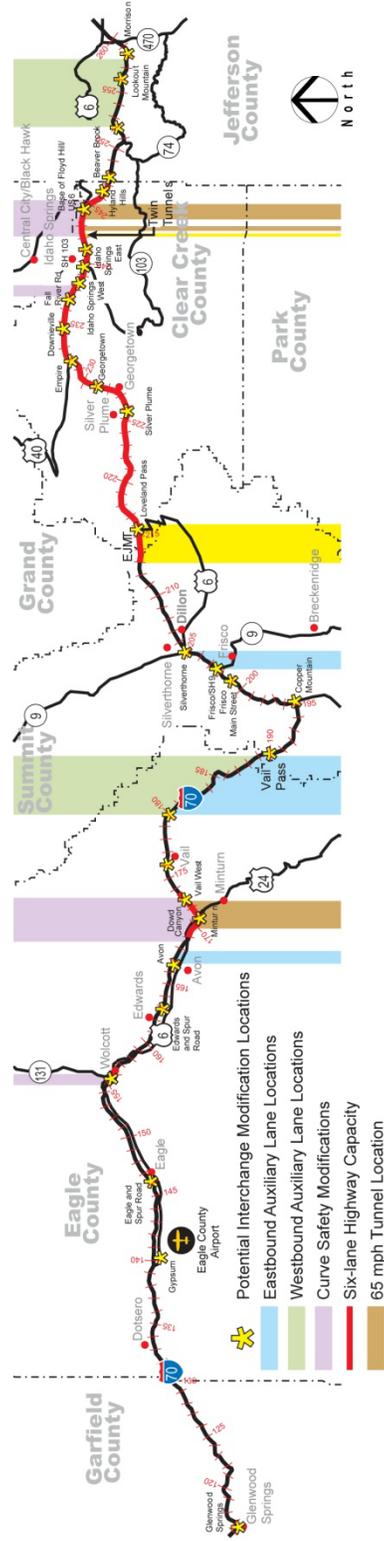
Figure 2-10. Major Components of Combination Six-lane Highway with Diesel Bus in Guideway



Combination Six-lane Highway with Diesel Bus in Guideway Alternative – Includes selected components of the Minimal Action Alternative, with the 55 mph six-lane highway capacity between Floyd Hill and Eisenhower-Johnson Memorial Tunnels and Dowd Canyon, along with the bus in guideway transit component. The bus technology for this alternative is diesel.

Combination Six-lane Highway with Diesel Bus in Guideway, Preserve for Highway Alternative – Same as the Combination Six-lane Highway with Diesel Bus in Guideway Alternative but only preserves the footprint for the six-lane highway component.

Combination Six-lane Highway with Diesel Bus in Guideway, Preserve for Transit Alternative – Same as the Combination Six-lane Highway Diesel Bus in Guideway Alternative but only preserves the footprint for the bus in guideway (diesel) transit component.



Note: EIJMT = Eisenhower-Johnson Memorial Tunnels

MP = milepost

mph = miles per hour

Dowd Canyon curve safety improvements not included in Preserve for Highway Alternative

Chapter 2. Summary and Comparison of Alternatives

Table 2-9. Minimal Action Components Associated with Action Alternatives

Minimal Action Component	Transit Alternatives	Highway Alternatives	Combination Alternatives	Preservation Options	
				Transit with Highway Preservation	Highway with Transit Preservation
Interchanges					
Glenwood Springs (MP 116)					
Gypsum (MP 140)					
Eagle & Spur Road (MP 147)					
Wolcott (MP 157)					
Edwards & Spur Road (MP 163)					
Avon (MP 167)					
Minturn (MP 171)					
Vail West (MP 173) / Simba Run					
Vail (MP 176)					
Vail East (MP 180)					
Vail Pass (East Shrine Pass Road) (MP 190)					
Copper Mountain (MP 195)					
Frisco / Main St. (MP 201)					
Frisco / SH 9 (MP 203)					
Silverthorne (MP 205)					
Loveland Pass (MP 216)					
Silver Plume (MP 226)					
Georgetown (MP 228)					
Empire (MP 232)					
Downieville (MP 234)					
Fall River Road (MP 238)					
Idaho Springs West (MP 239)					
Idaho Springs / SH 103 (MP 240)					
Idaho Springs East (MP 241)					
Base of Floyd Hill / US 6 (MP 244)					
Hyland Hills (MP 247)					
Beaver Brook (MP 248)					
Evergreen Parkway / SH 74 (MP 252)					
Lookout Mountain (MP 256)					
Morrison (MP 259)					
Curve Safety Modifications					
West of Wolcott (MP 155–156)					
Dowd Canyon (MP 170–173)		55 mph only*			
Fall River Road (MP 237–238)					

Chapter 2. Summary and Comparison of Alternatives

Minimal Action Component	Transit Alternatives	Highway Alternatives	Combination Alternatives	Preservation Options	
				Transit with Highway Preservation	Highway with Transit Preservation
East of Twin Tunnels (MP 242–245)					
Auxiliary Lanes					
Avon to Post Boulevard, Uphill (EB) (MP 167–168)					
West side of Vail Pass, Downhill (WB) (MP 180–190)					
West side of Vail Pass, Uphill (EB) (MP 180–190)					
Frisco to Silverthorne (EB) (MP 202.7–205.1)					
EJMT to Herman Gulch, Downhill (EB) (MP 215–218)					
Bakerville to EJMT, Uphill (WB) (MP 215–221)					
Georgetown to Silver Plume, Uphill (WB) (MP 226–228)					
Silver Plume to Georgetown, Downhill (EB) (MP 226–228)					
Downieville to Empire, Uphill (WB) (MP 232–234)					
Empire to Downieville, Downhill (EB) (MP 232–234)					
US 6 Off-ramp to Hidden Valley Off- ramp (WB) (MP 244–243)					
Morrison to Chief Hosa, Uphill (WB) (MP 253–259)					
Transportation Management					
Transportation Management					
Other					
Idaho Springs to Hidden Valley (improve existing frontage road)					
Hidden Valley to US 6 (new frontage road)					
Buses in Mixed Traffic					
Black Gore Creek, Straight Creek and Clear Creek Sediment Control					

* 65 mph includes tunnels at Dowd Canyon to accommodate higher speed.

Blue shaded cells indicate elements that are included, while white cells indicate that elements are not included.

Key to Abbreviations/Acronyms

EB = eastbound EJMT = Eisenhower-Johnson Memorial Tunnels
 MP = milepost mph = miles per hour WB = westbound

2.7 What was the decision making process for identifying the Preferred Alternative?

The lead agencies adopted the Preferred Alternative for the I-70 Mountain Corridor based on the Consensus Recommendation developed by the Collaborative Effort team. The Collaborative Effort team is a 27-member group, including the lead agencies, representing varied interests of the Corridor charged with reaching consensus on a recommended transportation solution for the I-70 Mountain Corridor. The Consensus Recommendation of the Collaborative Effort team became the Preferred Alternative identified in this document.

The Collaborative Effort process and the Consensus Recommendation adhere to the purpose and need and provide for the long-range transportation needs beyond 2035 by establishing a vision for 2050. The Consensus Recommendation identifies a 2050 Vision for a multimodal solution, with transit and highway improvements based on proven needs to enhance the Corridor, its environment, and its communities. The criteria below informed the Collaborative Effort team's recommendation and will serve as criteria of effectiveness moving forward:

- The solution should improve safety and mobility for all users.
- The solution should be responsive and adaptive to broader global trends that will affect the way we make travel decisions in the future.
- The solution will meet the purpose and need and all environmental and legal requirements.
- The solution should preserve, restore, and enhance community and cultural resources.
- The solution should preserve and restore or enhance ecosystem functions.
- The solution should be economically viable over the long term.

The Consensus Recommendation is multimodal and includes Advanced Guideway System, non-infrastructure components, highway improvements (which are very similar to the proposed Minimal Action Alternative), and short sections of additional highway capacity improvement. This package of improvements is referred to as the Minimum Program of Improvements. The Advanced Guideway System and the limited highway improvements alone from the Consensus Recommendation do not meet the 2050 unmet demand. To be able to meet the 2050 travel demand (based on information available today), additional highway capacity is needed. Therefore the Preferred Alternative includes the improvements identified specifically by the Collaborative Effort in the Consensus Recommendation, the triggers and ongoing stakeholder coordination, as well as the additional improvements comprising the Maximum Program of Improvements that could occur if the triggers were engaged.

The Consensus Recommendation is fully evaluated and referred to in this document as the Preferred Alternative.

2.7.1 What is the Preferred Alternative?

The Preferred Alternative is a multimodal solution and includes three main components identified by the Collaborative Effort team: non-infrastructure components, the Advanced Guideway System, and highway improvements. A specific Advanced Guideway System technology has not been identified and will be in subsequent feasibility studies or Tier 2 processes. The Preferred Alternative is presented as a range of improvement options from a Minimum Program of Improvements to a Maximum Program of Improvements. The Minimum Program of Improvements is detailed below.

1. **Non-infrastructure Related Components** – Non-infrastructure related components can begin in advance of major infrastructure improvements to address some of the issues in the Corridor today. These strategies and the potential tactics for implementation require actions and leadership

by agencies, municipalities, and other stakeholders beyond the lead agencies. The strategies include, but are not limited to:

- Increased enforcement
- Bus, van, or shuttle service in mixed traffic
- Programs for improving truck movements
- Driver education
- Expanded use of existing transportation infrastructure in and adjacent to the Corridor
- Use of technology advancements and improvements to increase mobility without additional infrastructure
- Traveler information and other ITS
- Shift passenger and freight travel demand by time of day and day of week
- Convert day trips to overnight stays
- Promote high occupancy travel and public transportation
- Convert single occupancy vehicle commuters to high occupancy travel and/or public transportation
- Implement transit promotion and incentives
- Other TDM measures to be determined

2. **Advanced Guideway System**– An Advanced Guideway System is a central part of the Preferred Alternative and includes the commitment to the evaluation and implementation of an Advanced Guideway System within the Corridor, including a vision of transit connectivity beyond the study area and local accessibility to such a system.

Additional information is necessary to advance implementation of an Advanced Guideway System in the Corridor:

- feasibility of high-speed rail passenger service
- potential station locations and local land use considerations
- transit governance authority
- alignment
- technology
- termini
- funding requirements and sources
- transit ridership
- potential system owner/operator
- interface with existing and future transit systems
- role of an Advanced Guideway System in freight delivery both in and through the Corridor

The Colorado Department of Transportation is committed to provide funding for studies in support of the additional information to assist stakeholders with evaluation and implementation of an Advanced Guideway System. With its new Division of Transit and Rail, CDOT has secured some funding for these studies.

3. **Highway Improvements** – The following highway improvements are needed to address current Corridor conditions and future demands. These improvements will be planned taking into consideration all elements of the Preferred Alternative and local land use planning. The following safety, mobility, and capacity components are not listed in order of priority, are not subject to the parameters established for future capacity components, do not represent individual projects, and may be included in more than one description. They are listed in two categories. All of the improvements in both categories are included in the Minimum Program of Improvements. The “specific highway improvements” are called out specifically for the triggers for future highway and non-Advanced Guideway System transit improvements

Chapter 2. Summary and Comparison of Alternatives

- Specific highway improvements are:
 - ◆ Six-lane component from Floyd Hill through the Twin Tunnels including a bike trail and frontage roads from Idaho Springs to Hidden Valley and Hidden Valley to US 6
 - ◆ Empire Junction (US 40 and I-70) interchange improvements
 - ◆ Eastbound auxiliary lane from Eisenhower-Johnson Memorial Tunnels to Herman Gulch
 - ◆ Westbound auxiliary lane from Bakerville to the Eisenhower-Johnson Memorial Tunnels
- Other highway improvements are:
 - ◆ Truck operation improvements (pullouts, parking, and chain stations)
 - ◆ Curve safety improvements west of Wolcott
 - ◆ Safety and capacity improvements in Dowd Canyon
 - ◆ Interchange improvements at the following locations:**
 - East Glenwood Springs
 - Gypsum
 - Eagle County Airport (as cleared by the FONSI and future 1601 process) – part of the No Action Alternative
 - Eagle
 - Edwards
 - Avon
 - Minturn
 - Vail West
 - Copper Mountain
 - Frisco/Main Street
 - Frisco/SH9
 - Silverthorne
 - Loveland Pass
 - Georgetown
 - Downieville
 - Fall River Road
 - Base of Floyd Hill/US 6
 - Hyland Hills
 - Beaver Brook
 - Lookout Mountain
 - Morrison
- Auxiliary lanes:
 - ◆ Avon to Post Boulevard (Exit 168) (eastbound)
 - ◆ West of Vail Pass (eastbound and westbound)
 - ◆ Frisco to Silverthorne (eastbound)
 - ◆ Morrison to Chief Hosa (westbound)

** After reevaluating safety and capacity needs in 2035 and 2050, five interchanges were added to the list of interchange modifications included in the Minimal Action Alternative and carried forward to the Preferred Alternative Minimum Program of Improvements. These include the Wolcott interchange at milepost 157, three interchanges in the Vail area (at mileposts 176, 180, and 190), and the Evergreen Parkway interchange at milepost 252. While minor effects may occur to the environmental resources at these locations, the effects are not anticipated to be significant and would not change the comparative analysis or the recommendation at the Tier 1 level. New capacity and crash data will be used to evaluate interchange modifications in Tier 2 processes. The lead agencies have coordinated with the Collaborative Effort team regarding the addition of these five interchanges in the Minimal Action Alternative and carried forward to the Preferred Alternative.

The non-infrastructure components, Advanced Guideway System, specific highway improvements, and other highway improvements identified above comprise the **Minimum Program of Improvements**. In developing the Preferred Alternative, the Collaborative Effort team recognized that the Minimum Program of Improvements may not provide adequate highway capacity to meet long-term transportation needs. Based on information available today, the Minimum Program of Improvements alone does not meet the 2050 purpose and need for the Corridor, and additional highway capacity is required. To address long-term needs, additional highway capacity improvements were added to the Minimum Program of Improvements to comprise the Maximum Program of Improvements with the condition that prior to

taking action to add capacity, the Collaborative Effort team must review and consider certain “triggers” (see **Section 2.7.2**). The use of triggers described in the Preferred Alternative is consistent with the vision of the Corridor, which recognizes that future travel demand and behavior is uncertain and that additional transportation solutions should be based on proven need. The triggers create a mechanism for defining specific timing and nature of the capacity improvements on the Corridor.

The **Maximum Program of Improvements** includes of all of the components of the Minimum Program of Improvements plus six-lane capacity from the Eisenhower-Johnson Memorial Tunnels to the Twin Tunnels, four additional interchange modifications in the Idaho Springs area, and a curve safety modification project at Fall River Road. These additional improvements comprise the Maximum Program of Improvements that could occur if the triggers were engaged. Based on information available today and for the purposes of NEPA disclosure, all of the improvements identified in the Maximum Program of Improvements are needed for the Preferred Alternative to meet the 2050 purpose and need. The Maximum Program is similar to the Combination Six-lane Highway with Advanced Guideway System Alternative. The difference between the Combination Six-lane Highway with Advanced Guideway System Alternative and the Preferred Alternative Maximum Program is the inclusion of the triggers.

Triggers for Long-Term Improvements

- Triggers create a mechanism for defining the specifics of future transportation solutions consistent with the Corridor vision.
- Triggers are used to evaluate the future needs to meet 2050 demand and are based on completion of specific highway improvements, feasibility of Advanced Guideway System, and global, regional, and local trends.
- Triggers are described in more detail in **Section 2.7.2**.

The six-lane highway capacity improvements included with the Preferred Alternative Maximum Program include both 55 mph and 65 mph design options. Both design speed options are advanced for consideration in Tier 2. The selected design option will be determined in Tier 2 when more detailed designs are developed. The 55 mph option uses the existing I-70 highway alignment. The 65 mph design requires additional tunnels at Dowd Canyon, Hidden Valley, and Floyd Hill. At Dowd Canyon, two tunnels are required for eastbound and westbound traffic as shown in **Figure 2-3**. These tunnels accommodate three lanes in each direction. At Hidden Valley and Floyd Hill, two new tunnels are required—one for westbound traffic just east of the Twin Tunnels near Hidden Valley and one for eastbound traffic at Floyd Hill as shown in **Figure 2-3**. Each of these tunnels accommodates three lanes in one direction. Traffic in the other direction uses the existing I-70 highway configuration.

Table 2-10 lists and **Figure 2-4** illustrates the improvements associated with the Preferred Alternative.

Table 2-10. Components of Preferred Alternative

Transportation Components	Preferred Alternative			
	Minimum Program 55 mph	Minimum Program 65 mph	Maximum Program 55 mph	Maximum Program 65 mph
Transportation Management				
Transportation Management				
Advanced Guideway System				
Advanced Guideway System (MP 142–MP 260)				
Highway Improvements				
Specific Highway Improvements				
Six-Lane Highway Floyd Hill through				

Chapter 2. Summary and Comparison of Alternatives

Transportation Components	Preferred Alternative			
	Minimum Program 55 mph	Minimum Program 65 mph	Maximum Program 55 mph	Maximum Program 65 mph
Twin Tunnels with Bike Trail and Frontage Roads from Idaho Springs to Hidden Valley to US 6				
Empire Junction Interchange (MP 232)				
EB Auxiliary Lane – EJMT to Herman Gulch				
WB Auxiliary Lane – Bakerville to EJMT				
Other Highway Improvements – Interchanges				
Glenwood Springs (MP 116)				
Gypsum (MP 140)				
Eagle County Airport (part of No Action)				
Wolcott (MP 157)				
Eagle & Spur Road (MP 147)				
Edwards & Spur Road (MP 163)				
Avon (MP 167)				
Minturn (MP 171)				
Vail West (MP 173) / Simba Run				
Vail (MP 176)				
Vail East (MP 180)				
Vail Pass (East Shrine Pass Road (MP 190)				
Copper Mountain (MP 195)				
Frisco / Main St. (MP 201)				
Frisco / SH 9 (MP 203)				
Silverthorne (MP 205)				
Loveland Pass (MP 216)				
Silver Plume (MP 226)				
Georgetown (MP 228)				
Downieville (MP 234)				
Fall River Road (MP 238)				
Idaho Springs West (MP 239)				
Idaho Springs / SH 103 (MP 240)				
Idaho Springs East (MP 241)				
Base of Floyd Hill / US 6 (MP 244)				
Hyland Hills (MP 247)				
Beaver Brook (MP 248)				
Evergreen Parkway / SH 74 (MP 252)				
Lookout Mountain (MP 256)				

Chapter 2. Summary and Comparison of Alternatives

Transportation Components	Preferred Alternative			
	Minimum Program 55 mph	Minimum Program 65 mph	Maximum Program 55 mph	Maximum Program 65 mph
Morrison (MP 259)				
Other Highway Improvements – Curve Safety Modifications				
West of Wolcott (MP 155–MP 156)				
Dowd Canyon (MP 170–MP 173)				
Fall River Road (MP 237–MP 238)				
East of Twin Tunnels (MP 242–MP 245)	Included in Six-Lane Highway Widening			
Other Highway Improvements – Auxiliary Lanes				
Avon to Post Boulevard, Uphill (EB) (MP 167–MP 168)				
West side of Vail Pass, Downhill (WB) (MP 180–MP 190)				
West side of Vail Pass, Uphill (EB) (MP 180–MP 190)				
Frisco to Silverthorne (EB) (MP 202.7– MP 205.1)				
Morrison to Chief Hosa, Uphill (WB) (MP 253–MP 259)				
Tunnels				
Dowd Canyon				
EJMT – third bore				
Twin Tunnels – third bore				
Hidden Valley Tunnel WB				
Floyd Hill Tunnel EB				
Other Improvements				
Truck operation improvements (pullouts, parking, and chain stations)				
Black Gore Creek, Straight Creek and Clear Creek Sediment Control				

Blue shaded cells indicate elements that are included, while white cells indicate that elements are not included.

Key to Abbreviations/Acronyms

EB = eastbound

EJMT = Eisenhower-Johnson Memorial Tunnels

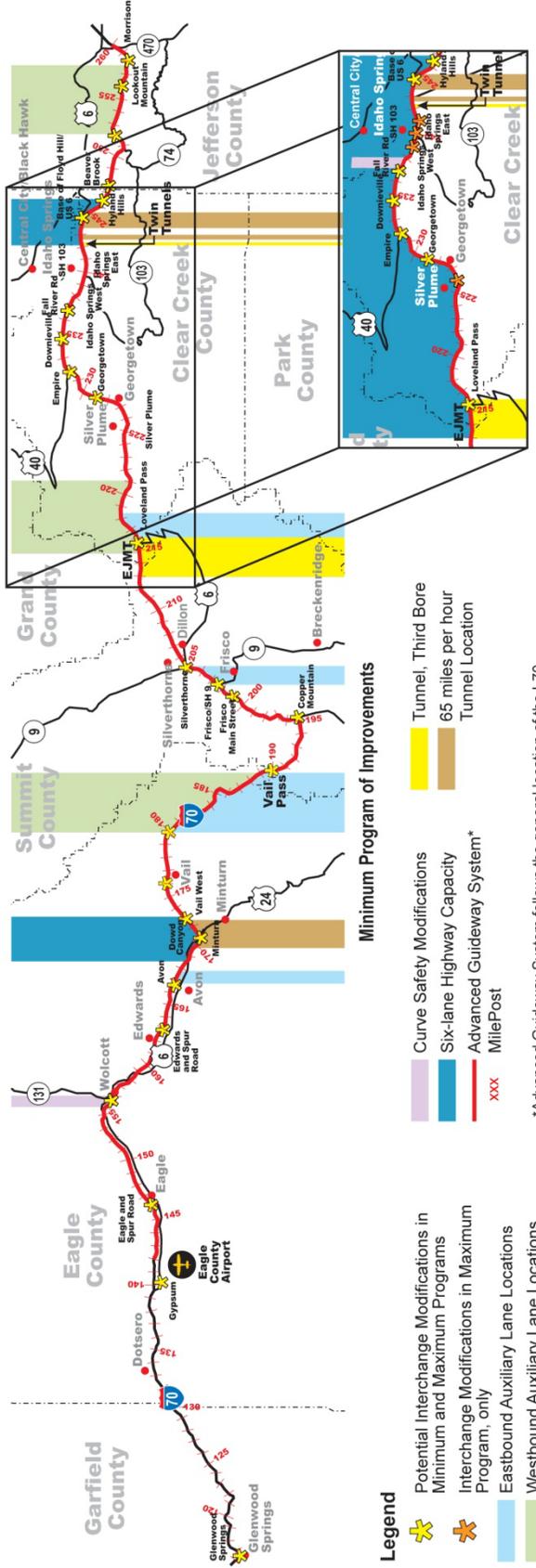
MP = milepost

mph = miles per hour

WB = westbound

US = United States Highway

Figure 2-11. Preferred Alternative



This figure illustrates the locations of the transportation components of the Preferred Alternative. Transportation improvements for the Preferred Alternative are characterized as a range from a Minimum Program of Improvements to a Maximum Program of Improvements. The Minimum Program includes all the improvements in the base map, while the Maximum Program includes all the improvements on the base map plus those in the call out map. In developing the Preferred Alternative, the Collaborative Effort team reached consensus that the Preferred Alternative should include the elements in the Minimum Program of Improvements. The Minimum Program of Improvements, however, does not provide adequate highway capacity to meet a 2050 purpose and need based on information available today. To meet the 2050 purpose and need, additional highway capacity was added to the Minimum Program of Improvements to comprise the Maximum Program of Improvements with the condition that adding this additional highway capacity requires consideration of "triggers" prior to taking action. For NEPA documentation and analysis purposes, all of the improvements identified in the Maximum Program of Improvements are assumed to be needed for the Preferred Alternative to meet the 2050 purpose and need. The review and trigger processes that guide the planning decisions for implementing the Preferred Alternative are described in Section 2.7.2.

Additions to Maximum Program of Improvements

The Maximum Program of Improvements includes all the Minimum Program of Improvements plus the additions shown here, including six-lane highway capacity from Eisenhower-Johnson Memorial Tunnel to the Twin Tunnels, four additional interchange modifications in Clear Creek County, and curve safety modifications at Fall River Road.

2.7.2 What are the triggers for additional highway capacity improvements?

The Preferred Alternative is responsive and adaptive to future trends within the Corridor. The use of triggers is consistent with the needs of the Corridor and recognizes that future travel demand and behavior is uncertain and that additional transportation solutions should be based on proven need. The triggers create a mechanism for defining specific future transportation solutions consistent with the Corridor vision. Additional highway capacity improvements (described in **Section 2.7.1**) and non-Advanced Guideway System transit capacity improvements may proceed if and when:

- The “specific highway improvements” are complete and an Advanced Guideway System is functioning from the Front Range to a destination beyond the Continental Divide, OR
- The “specific highway improvements” are complete and Advanced Guideway System studies that answer questions regarding the feasibility, cost, ridership, governance, and land use are complete and indicate that Advanced Guideway System cannot be funded or implemented by 2025 or is otherwise deemed unfeasible to implement, OR
- Global, regional, local trends or events, such as climate change, resource availability, and/or technological advancements, have unexpected effects on travel needs, behaviors, and patterns and demonstrate a need to consider other improvements.

The Colorado Department of Transportation will convene a committee that retains the Collaborative Effort member profile to check in at least every two years to review progress made on the above triggers. At these check-in points, the committee will:

- Review the current status of all projects
- Identify unmet needs in the Corridor
- Consider the triggers in evaluating the need for additional capacity improvements beyond those specified

In 2020, the committee will thoroughly reassessment the overall purpose and need, effectiveness of the improvements, and study results and global trends before implementing additional transportation improvements. This reevaluation will occur regardless of the status of the triggers. At this time, the full range of improvement options may be reconsidered to address the needs in the Corridor.

2.8 How do the alternatives compare?

As presented earlier, 22 alternatives emerged from the alternatives evaluation and screening process. This includes the No Action Alternative and 21 Action Alternatives including the Preferred Alternative.

Following is a comparison of the alternatives and justification leading to the identification of the Preferred Alternative. This comparison provides information on transportation impacts demonstrating how the 22 alternatives do or do not address the purpose and need for the project. The comparison includes safety, environmental, community, and implementation information and shows relevant information key to differentiating among alternatives.

The transportation impacts information summarizes key metrics for evaluating the alternatives and is consistent with the transportation problems documented in **Chapter 1, Purpose and Need**. For comparison purposes, the Preferred Alternative is presented as a range. Unless noted, the range varies from the Minimum Program 55 mph to the Maximum Program 65 mph. The *I-70 Mountain Corridor PEIS Transportation Analysis Technical Report* (CDOT, March 2011) provides the comparison of all 22 alternatives.

Chapter 2. Summary and Comparison of Alternatives

More information on transportation impacts and supporting information on comparison information is found in the following technical reports:

- *I-70 Mountain Corridor PEIS Alternatives Development and Screening Technical Report* (CDOT, March 2011)
- *I-70 Mountain Corridor PEIS Safety Technical Report* (CDOT, March 2011)
- *I-70 Mountain Corridor PEIS Travel Demand Technical Report* (CDOT, March 2011)

Environmental and community comparison information is based on the alternatives evaluation contained in **Chapter 3, Affected Environment and Environmental Consequences**.

2.8.1 Transportation Comparisons

Consistent with the transportation problems and horizon years identified in **Chapter 1, Purpose and Need**, several transportation metrics were evaluated for 2035 and 2050 conditions. This section summarizes these evaluations and includes the following metrics:

- Peak period peak direction highway travel time for weekends and weekdays
- Peak direction congestion for weekends and weekdays
- Unmet demand (or additional trips accommodated) in relation to Corridor congestion
- Transit share (the amount of travelers using transit)

The above metrics are not reliable enough to project beyond year 2035. Therefore, for the 2050 travel demand, a different metric measure, the year in which network capacity is reached, is used to measure alternative comparisons.

Overall, these transportation comparisons show how well alternatives address the project purpose and need. These comparisons show that only the Combination alternatives can meet the 2050 vision for the purpose and need and support the identification of the Preferred Alternative.

Preferred Alternative Comparison

A comparison of the Preferred Alternative shows that it provides the opportunity to meet the defined needs of the project, while minimizing impacts because its triggered phasing process allows the alternative to:

- Provide for the short-term needs in the Corridor;
- Provide the most capacity to accommodate unmet demand;
- Minimize travel time, improving mobility and accessibility to destinations served by the I-70 Mountain Corridor; and
- Reduce congestion in the Corridor more than other alternatives, lowering the overall hours of poor operations.

Peak Period Peak Direction Travel Time

Figure 2-12 shows year 2035 peak period peak direction highway travel time comparisons by alternative for weekend and weekday travel. This travel time is broken into travel time between the western portion (Glenwood Springs to Silverthorne) and the eastern portion (Silverthorne to C-470) of the Corridor. As discussed in **Chapter 1**, the weekend and weekday periods used for analysis are typical peak period conditions that occur throughout much of the year. Free-flow and year 2000 travel times are also shown for comparison.

Figure 2-12 also shows that highway travel times vary substantially among the alternatives and between weekends and weekdays. The Preferred Alternative travel times range from better than the Transit alternatives to about the same as the Combination alternatives. During peak weekend conditions, the No Action Alternative has the longest travel times, followed closely by the Minimal Action Alternative. Overall, weekend travel times tend to be longer than weekday travel times for the eastern portion of the Corridor, while weekday travel times tend to be longer than weekend travel times for the western portion of the Corridor.

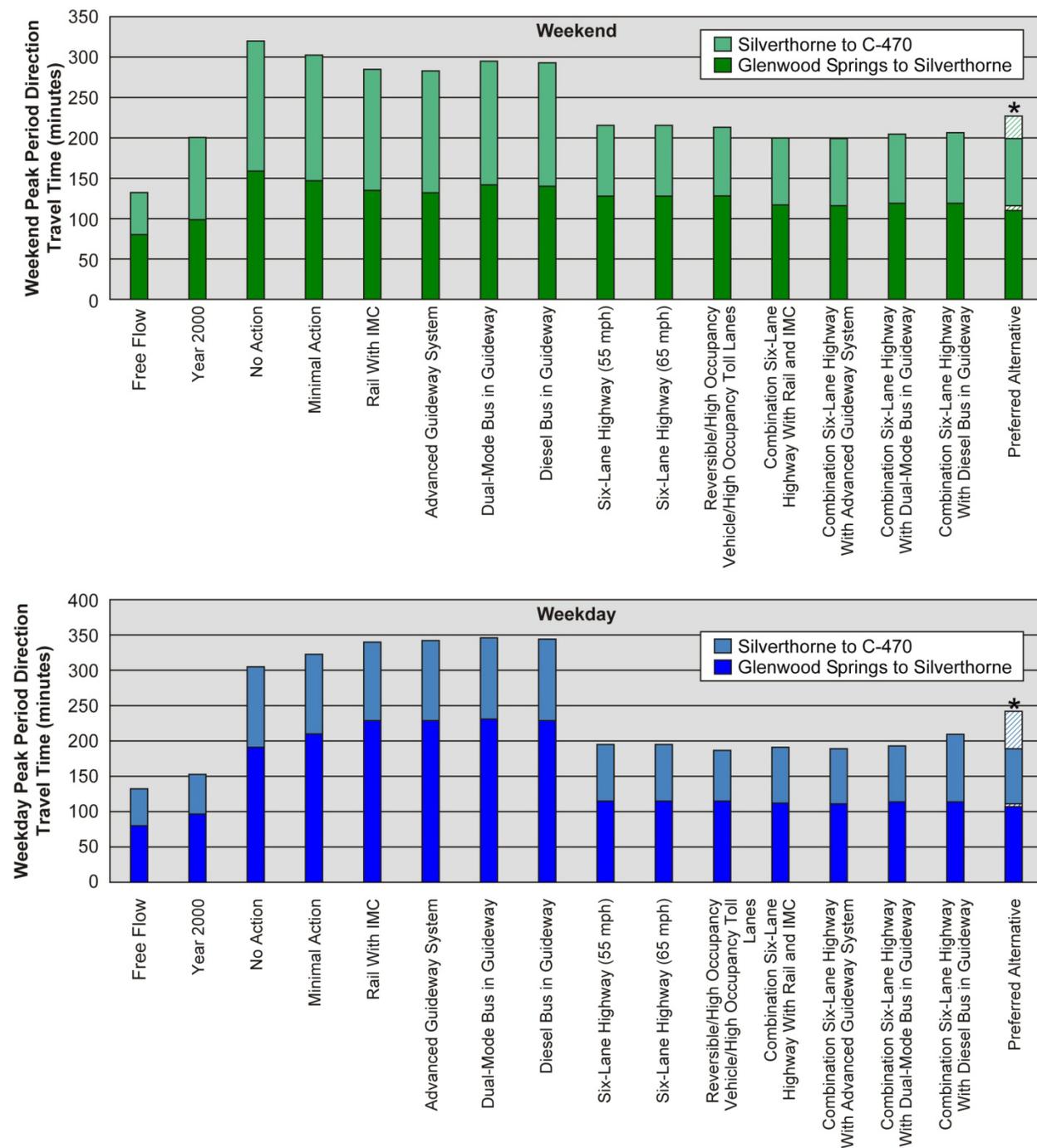
For peak period weekend conditions, the average Corridor highway travel time for the Preferred Alternative ranges between approximately 200 and 220 minutes. This compares to the No Action Alternative, with an average highway travel time of approximately 320 minutes; the Minimal Action Alternative, with an average highway travel time of approximately 300 minutes; the Transit alternatives, with a range of average highway travel time between approximately 285 and 295 minutes; the Highway alternatives, with a range of average highway travel time between approximately 210 and 215 minutes; and the Combination alternatives, with a range of average highway travel time between approximately 200 and 205 minutes.

For peak period weekday conditions, the average Corridor highway travel time for the Preferred Alternative ranges between approximately 190 and 250 minutes. This compares to the No Action Alternative, with an average highway travel time of approximately 305 minutes; the Minimal Action Alternative, with an average highway travel time of approximately 325 minutes; the Transit alternatives, with a range of average highway travel time between approximately 340 and 345 minutes; the Highway alternatives, with a range of average highway travel time between approximately 190 and 195 minutes; and the Combination alternatives, with a range of average travel time between approximately 190 and 210 minutes.

What is the Peak Period?

The peak period, in transportation terms, refers to the time of day when demand for travel is at its highest. This period is frequently called rush hour and is usually represented by high levels of congestion and stop and go conditions. Rush hour occurs in the morning and evening when most people are commuting to and from work. For this study, the morning peak period is from 6:00 a.m. to 10:00 a.m. and the evening peak period is from 3:00 p.m. to 7:00 p.m.

Figure 2-12. 2035 Peak Period – Peak Direction Travel Time by Alternative



* The travel times for the Preferred Alternative are presented as ranges. The solid bar alone shows the travel time if the Preferred Alternative is fully implemented. The solid and hatched bars together show the travel time of the Minimum Program only. They are presented as ranges because the adaptive management component of the Preferred Alternative allows it to be implemented based on future needs and associated triggers for further action. Section 2.7.2 of this document describes the triggers for implementing components of the Preferred Alternative.

Peak Direction Congestion

Figure 2-13 shows 2035 peak direction hours of congestion along the Corridor for weekend and weekday travel. Congestion is defined as Level of Service F conditions and indicates stop-and-go traffic. The amount of congestion over the course of a day varies by location along the Corridor. For comparison purposes, the hours of congestion at representative locations along the Corridor are summed for each alternative. As with travel times, hours of congestion are shown separately for the Eastern and Western portions of the Corridor (west and east of Silverthorne). Congestion shown in **Figure 2-13** is for the general purpose highway lanes of the Corridor and does not measure transit within a dedicated facility. Travelers on transit may experience congestion at their origin and destination stations but can expect consistent travel time on the transit system. As discussed in **Chapter 1, Purpose and Need**, the weekend and weekday periods used for analysis are typical peak conditions occurring throughout much of the year.

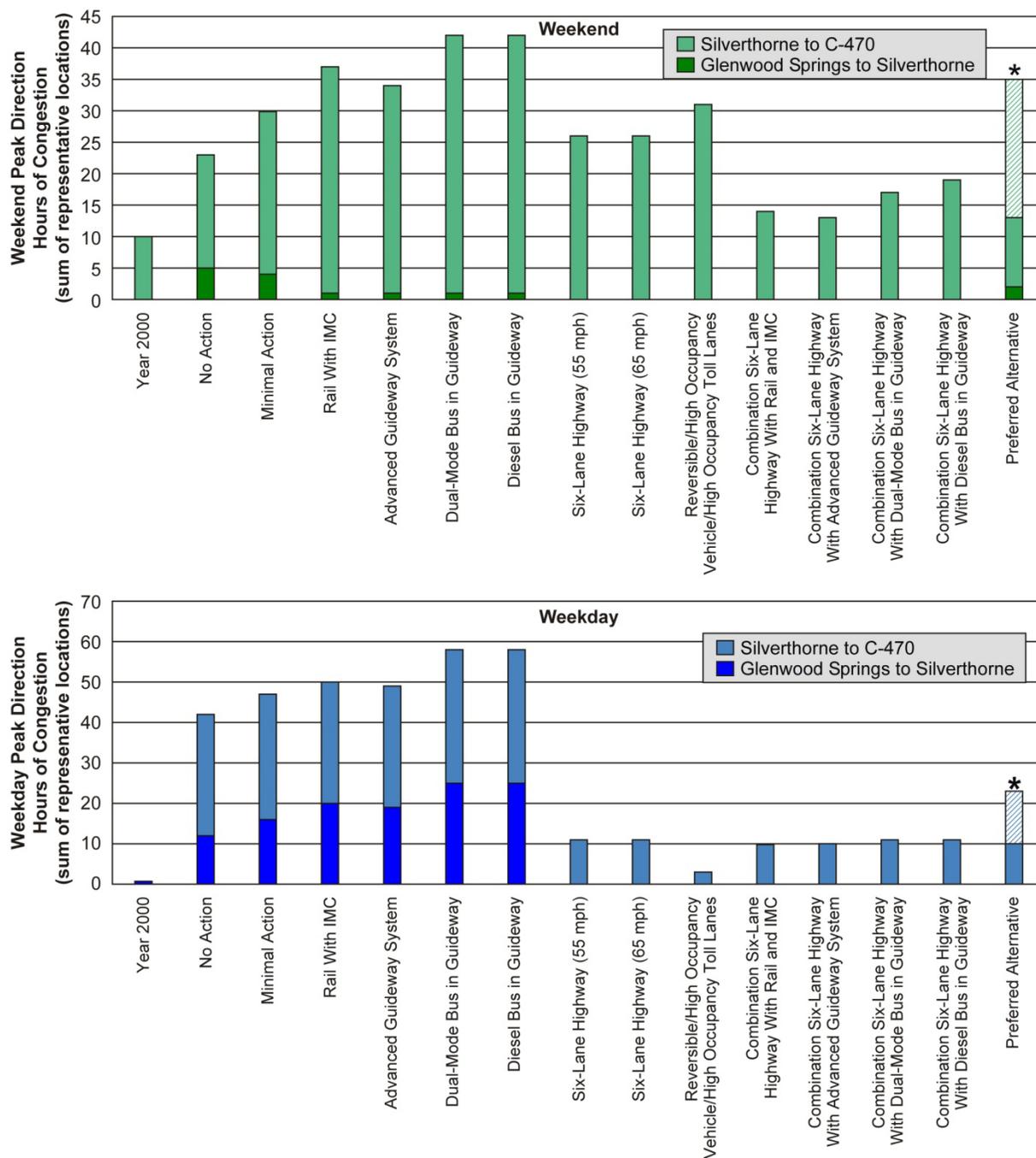
Figure 2-13 shows that congestion varies substantially among alternatives and between weekends and weekdays. Transit improvements slightly increase highway congestion by attracting more person trips to the Corridor. By increasing capacity, six-lane highway components reduce congestion. For weekend conditions, the Preferred Alternative has congestion ranging from about the same as that of the Transit alternatives to about the same as that of the Combination alternatives. For weekday conditions, the Preferred Alternative has congestion ranging from better than that of the Transit alternatives to about the same as that of the Combination alternatives. The Minimal Action Alternative has more congestion than that of the No Action Alternative because the localized highway improvements attract more trips, but Corridor capacity improvements are not included.

For peak direction weekend conditions, the Preferred Alternative total hours of congestion at representative locations along the Corridor ranges between 13 and 35 hours. This compares to the No Action Alternative, with 23 hours of congestion; the Minimal Action Alternative, with 30 hours of congestion; the Transit alternatives, with a range of congestion between 34 and 42 hours; the Highway alternatives, with a range of congestion between 26 and 31 hours; and the Combination alternatives, with a range of congestion between 13 and 19 hours.

For peak direction weekday conditions, the Preferred Alternative total hours of congestion at representative locations along the Corridor ranges between 10 and 23 hours. This range compares to the No Action Alternative range of 42 hours of congestion; the Minimal Action Alternative, with 47 hours of congestion; the Transit alternatives, with a range of congestion between 50 and 58 hours; the Highway alternatives, with a range of congestion between 3 and 11 hours; and the Combination alternatives, with a range of congestion between 10 and 11 hours.

Congestion is forecast to occur in different parts of the Corridor depending on the alternative, the time of day, and the direction of travel. In general, weekend westbound direction congestion occurs primarily in Jefferson County and weekend eastbound congestion occurs primarily in Clear Creek County. For weekday, traffic congestion is forecast to occur primarily in Eagle County, followed closely by Jefferson County and Clear Creek County.

Figure 2-13. 2035 Peak Direction Hours of Congestion by Alternative



*The hours of congestion for the Preferred Alternative are presented as ranges. The solid bar alone shows the hours of congestion if the Preferred Alternative is fully implemented. The solid and hatched bars together show the hours of congestion of the Minimum Program only. They are presented as ranges because the adaptive management component of the Preferred Alternative allows it to be implemented based on future needs and associated triggers for further action. Section 2.7.2 of this document describes the triggers for implementing components of the Preferred Alternative.

Unmet Demand

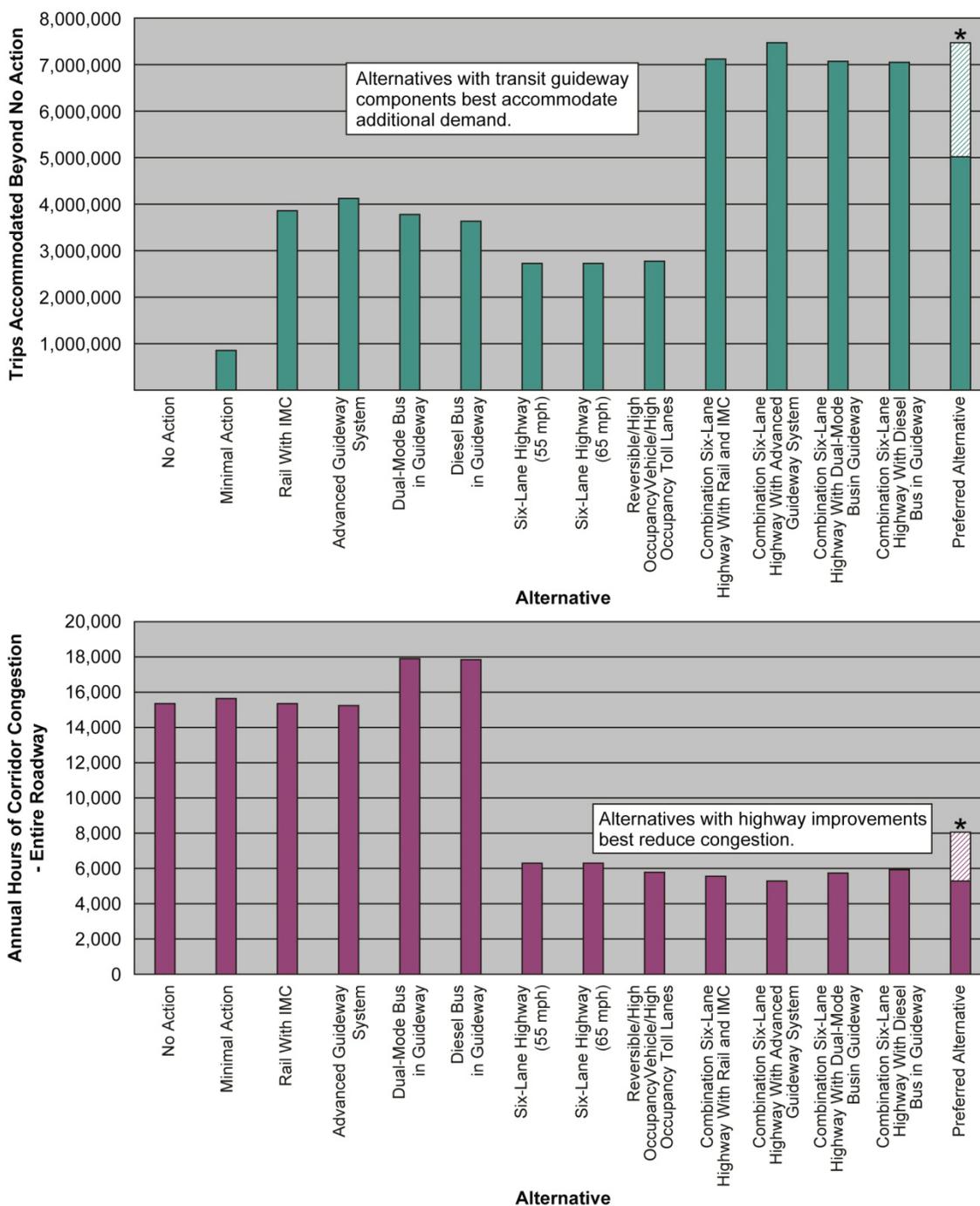
Improved travel conditions along the Corridor reduce the amount of unmet demand and increase the amount of trip demand that can be accommodated. **Figure 2-14** shows the annual number of trips forecast to be accommodated beyond the No Action Alternative, alongside the level of annual Corridor congestion. Alternatives reducing unmet demand by accommodating more trips best meet the capacity need of the project. The Preservation alternatives are not shown because they operate like other alternatives. For example, the Combination Six-lane Highway with Transit Preservation Alternatives operate like the Six-lane Highway (55 mph) Alternative. For comparison purposes, the level of Corridor congestion is shown in terms of total hours of congestion over the course of a year.

Figure 2-14 shows that the ability of an alternative to provide additional capacity, measured by the amount of additional trips accommodated, does not directly relate to the ability of an alternative to reduce congestion. This is because of the effects of unmet demand. For example, the Transit alternatives accommodate more than 3.5 million additional trips per year but do not reduce congestion. The Highway alternatives provide less additional capacity than the Transit alternatives, measured by the number of additional trips accommodated, but do a much better job at reducing congestion. The Combination alternatives do a good job at providing increased capacity, as measured by the additional trips accommodated, and reducing overall congestion. The Preferred Alternative accommodates between 5 million and almost 7.5 million trips per year beyond the No Action Alternative. This range compares to the Minimal Action Alternative, which accommodates less than 1 million additional trips per year, and the Highway alternatives, which accommodate between 2.5 million and 3 million additional trips per year. The Combination alternatives, including highway and transit improvements, accommodate more than 7 million trips per year beyond the No Action Alternative.

Unmet Demand

Unmet demand occurs when travelers choose to not make a trip because of severe congestion conditions, long travel times, or other unsatisfactory conditions. Current and future projected travel demand exceeds the capacity of the Corridor. This unmet demand occurs along the I-70 Mountain Corridor under current conditions. When additional travelers choose not to make a trip due to worse conditions in the future, this unmet demand increases. Increasing person trip capacity in the Corridor allows demand to be met. This can be measured by the number of person trips accommodated in the Corridor beyond the No Action Alternative.

Figure 2-14. Corridor Congestion and Additional Demand Accommodated by Alternative



* The additional trips accommodated and the annual hours of congestion shown for the Preferred Alternative are presented as ranges. In the upper graph, the solid and hatched bars together show the additional trips accommodated if the Preferred Alternative is fully implemented, while the solid bar alone shows the trips that could be accommodated by the Minimum Program only. In the lower graph, the solid bar alone shows the annual hours of congestion if the Preferred Alternative is fully implemented, while the solid and hatched bars together show the annual hours of congestion of the Minimum Program only. These values are presented as ranges because the adaptive management component of the Preferred Alternative allows it to be implemented based on future needs and associated triggers for further action. Section 2.7.2 of this document describes the triggers for implementing components of the Preferred Alternative.

Transit Share

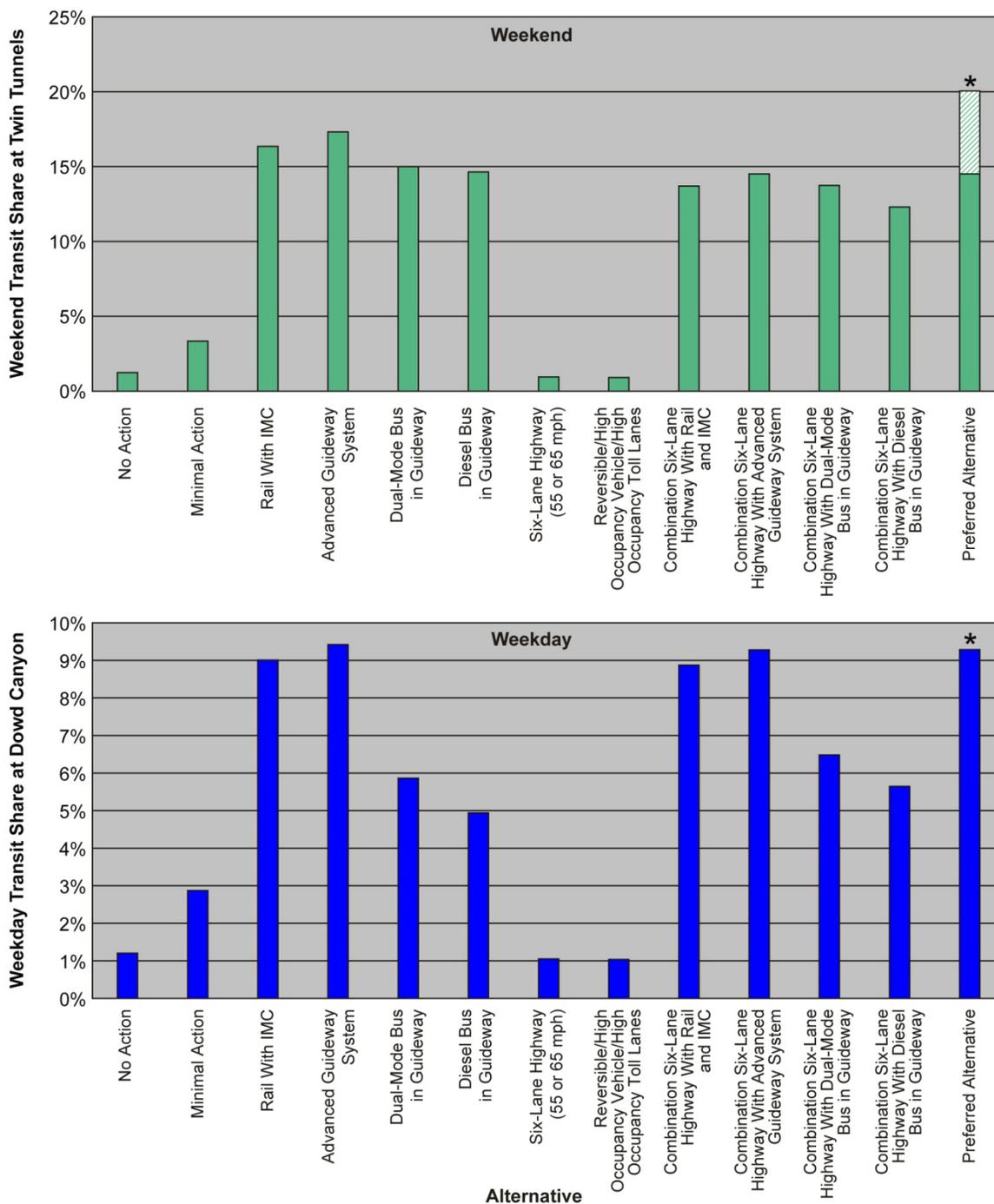
Figure 2-15 shows the peak direction transit share by alternative for weekend and weekday travel. To adequately demonstrate the difference among alternatives, locations along the Corridor with a relatively high amount of travel demand were selected for comparison. For weekends, the Twin Tunnels are shown as a representative location. For weekdays, Dowd Canyon is shown as a representative location. The transit share demonstrates the ability of the alternatives to provide modal choices and remove vehicular traffic from the Corridor.

Figure 2-15 shows that Action Alternatives with transit provide much higher transit shares than Highway alternatives. Furthermore, Transit alternatives provide higher transit share than the Combination alternatives on weekends because the higher levels of congestion on the Corridor experienced with the Transit alternatives limits the amount of highway traffic, making transit appear more attractive and increasing transit share. Similarly, the Preferred Alternative Minimum Program of Improvements provides higher transit share on weekends (20 percent) than if the Preferred Alternative is fully implemented (14.5 percent).

For peak direction weekend conditions, the Preferred Alternative transit share ranges between 14.5 percent and 20 percent. This compares to the No Action Alternative with a 1.2 percent transit share; the Minimal Action Alternative with a 3.3 percent transit share; the Transit alternatives with a range of transit share between 14.6 percent and 17.3 percent; the Highway alternatives with a transit share of 0.9 percent; and the Combination alternatives with a range of transit share between 12.3 percent and 14.5 percent.

For peak direction weekday conditions, the Preferred Alternative transit share is expected to be 9.3 percent at Dowd Canyon for either the Minimum or Maximum Programs. This compares to the No Action Alternative with a 1.2 percent transit share; the Minimal Action Alternative with a 2.9 percent transit share; the Transit alternatives with a range of transit share between 4.9 percent and 9.4 percent; the Highway alternatives with a range of transit share between 1.0 percent and 1.1 percent; and the Combination alternatives with a range of transit share between 6.5 percent and 9.3 percent.

Figure 2-15. Transit Share by Alternative



* The weekend transit share for the Preferred Alternative is presented as a range. The solid bar alone shows the transit share if the Preferred Alternative is fully implemented. The solid and hatched bars together show the transit share for the Minimum Program only. The weekday share does not include a range because the weekday transit share does not increase with full implementation of the Preferred Alternative. The value for the weekend share is presented as a range because the adaptive management component of the Preferred Alternative allows it to be implemented based on future needs and associated triggers for further action. Section 2.7.2 of this document describes the triggers for implementing components of the Preferred Alternative.

Safety Comparisons

Alternatives are evaluated for how well they improve safety for I-70 Mountain Corridor travelers. Alternatives that include a Fixed Guideway Transit component provide a safer means of transportation for travelers than highway vehicle travel. National crash rates for rail modes are markedly lower than the comparable rates for motor vehicles (crash rate statistics of fatalities and injuries per passenger mile indicate that Fixed Guideway Rail Transit is approximately 100 times safer than automobile travel [National Transportation Statistics 2010, Bureau of Transportation Statistics, United States Department of Transportation, 2010]). Buses operating in general purpose lanes are on average safer than automobile travel but result in more crashes than rail technologies in fixed guideways.

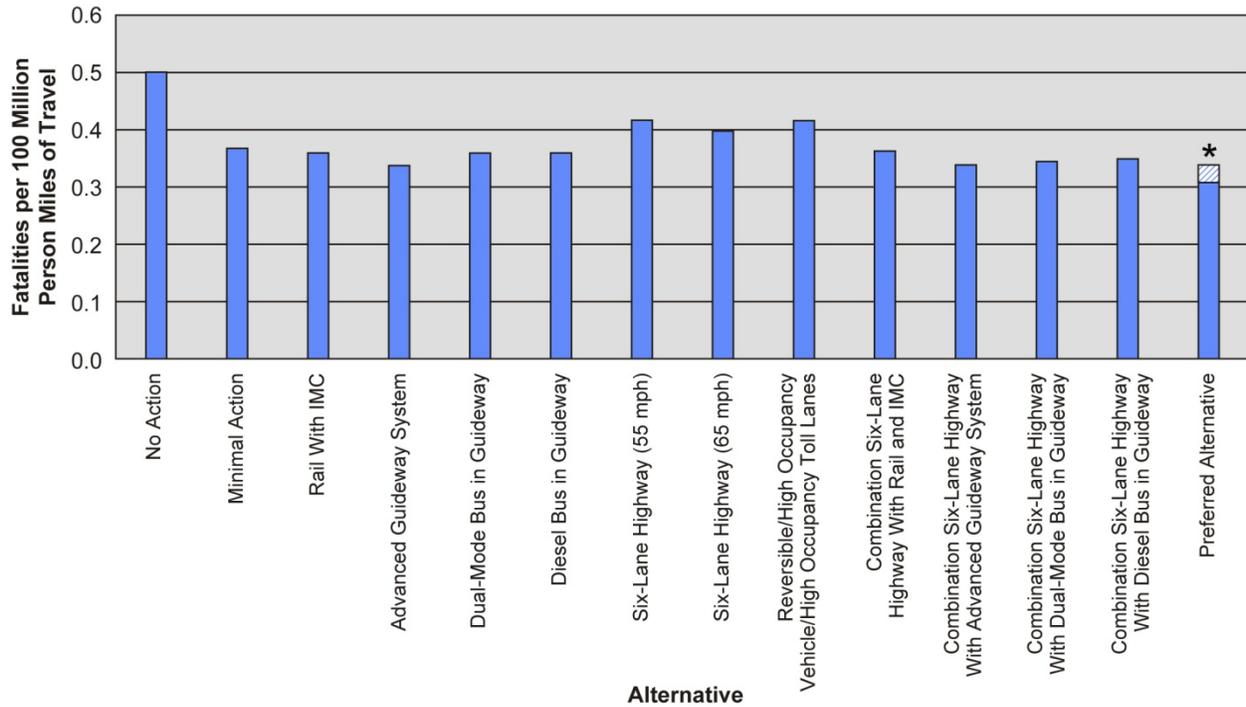
A number of Minimal Action highway components included in all of the Action Alternatives were developed to address safety problem areas as discussed in **Section 1.12.3**, and as shown in **Figure 1-10**. For this reason, highway safety is similar among the Action Alternatives. Some notable safety problem areas in the Corridor addressed by all Action Alternatives include:

- Wolcott curve
- Dowd Canyon (not included with the Transit Alternatives)
- Silverthorne Interchange
- Eisenhower-Johnson Memorial Tunnels to Herman Gulch (eastbound)
- Base of Floyd Hill (Twin Tunnels to the US 6 interchange).

Figure 2-16 shows the overall multimodal fatality rate by alternative. A comparison of fatality rates was used to measure safety performance consistently among the transportation modes. These blended rates reflect the relative amount of person trips using each mode and are based on projected fatalities per mode per 100 million person miles of travel.

The No Action Alternative is projected to have the highest fatality rate at 0.50 per 100 million person miles. By comparison, the Minimal Action Alternative, with its components that address most highway safety problems, has a fatality rate of 0.37. Highway alternatives are estimated to have fatality rates ranging between 0.40 and 0.42. Higher fatality rates are related to higher travel speeds under the Highway alternatives as compared with the Minimal Action Alternative, which maintains congestion and associated lower travel speeds. Alternatives with transit, reflecting different transit technologies and usage, have fatality rates ranging from 0.31 to 0.36. The Combination alternatives, including the Preferred Alternative, have projected fatality rates ranging from 0.31 to 0.36 per 100 million person miles.

Figure 2-16. Fatality Rates by Alternative



* The fatality rate for the Preferred Alternative is presented as a range. The solid and hatched bars together show the fatality rate if the Preferred Alternative is fully implemented. The solid bar alone shows the fatality rate of the Minimum Program only. They are presented as ranges because the adaptive management component of the Preferred Alternative allows it to be implemented based on future needs and associated triggers for further action. Section 2.7.2 of this document describes the triggers for implementing components of the Preferred Alternative.

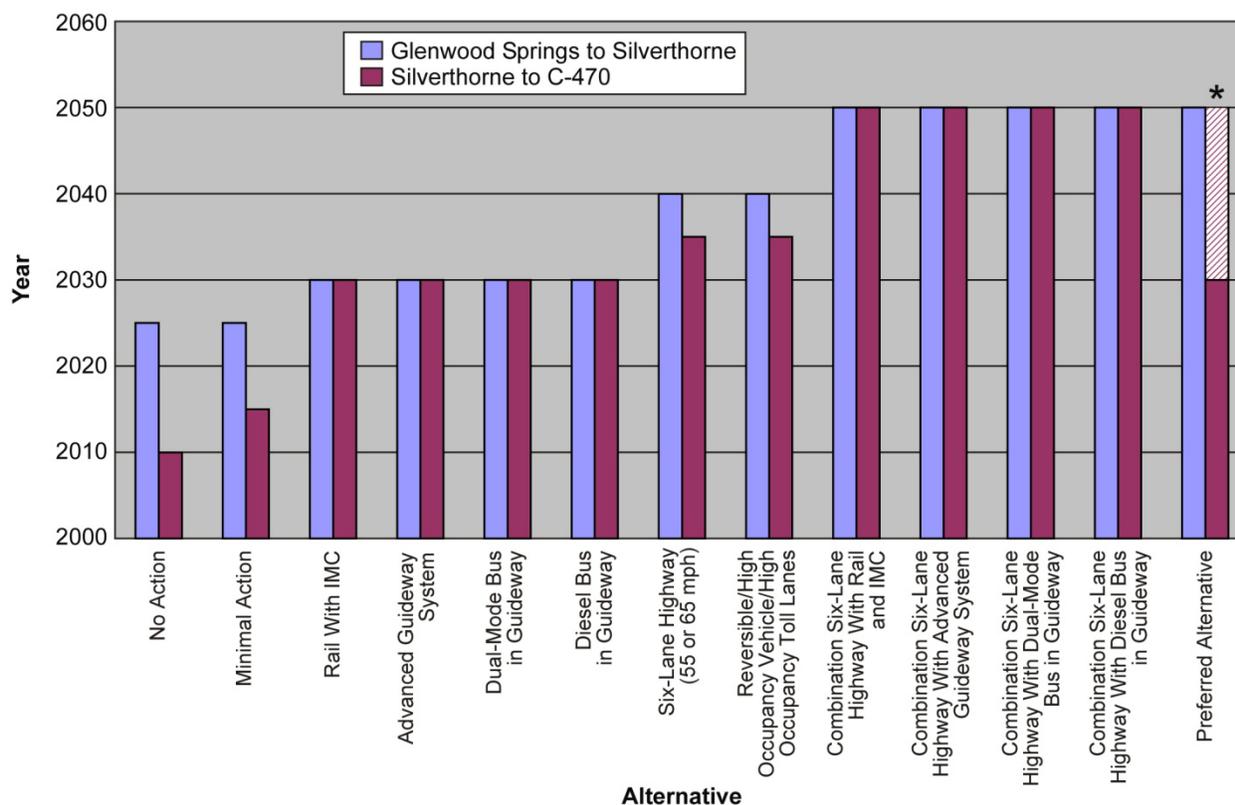
Year Network Capacity is Reached

The ability of the alternatives to accommodate the 2050 travel demand is measured by the year network capacity is reached. Whereas the transportation metrics discussed previously are based on 2035 travel demand model results derived from population and employment data the year network capacity is reached and the 2050 travel demand is based on projections for these data. These projections are less reliable due to the uncertainties of growth and travel assumptions beyond the year 2035, but provide a relative comparison between alternatives.

Figure 2-17 shows the year network capacity is reached by alternative. The network capacity measures congestion tolerance and is defined as the demand and capacity when average highway travel speed on the Corridor drops to 30 mph. The year network capacity is reached is rounded to the nearest 5 years due to the inherent uncertainties of the forecast. The network capacity is shown separately for the portions of the Corridor west and east of Silverthorne.

Figure 2-17 shows that the only alternatives with network capacity to accommodate the 2050 travel demand are the Combination alternatives and the Preferred Alternative. The No Action Alternative reaches network capacity between 2010 and 2025. The Minimal Action Alternative performs slightly better but still reaches network capacity in the eastern portion of the Corridor by 2015. The Transit alternatives reach network capacity in 2030, and the Highway alternatives reach network capacity between 2035 and 2040. The Combination alternatives provide a network capacity to 2050 if both transit and highway elements are constructed. If the transit Corridor is preserved, these Combination alternatives perform like Highway alternatives, and if highway improvements are preserved, these alternatives perform like Transit alternatives. For the Preferred Alternative, the year network capacity is reached ranges from 2030 to 2050 for east of Silverthorne and 2050 for west of Silverthorne due to the peak recreation travel demand.

Figure 2-17. Year at Network Capacity by Alternative



*The year that the Preferred Alternative will reach network capacity is presented as a range. For the western portion of the Corridor (between Glenwood Springs and Silverthorne), the solid bar alone shown shows the year at network capacity for both the Minimum and Maximum Programs of the Preferred Alternative. For the eastern portion of the Corridor (between Silverthorne and C-470), the solid bar alone shown shows the year at network capacity for the Minimum Program only, and the solid and hatched bars together show the year at network capacity if the Preferred Alternative is fully implemented. The Minimum Program does not meet the 2050 purpose and need because, based on the information available today, it will reach network capacity as soon as 2030. The value is presented as a range because the adaptive management component of the Preferred Alternative allows it to be implemented based on future needs and associated triggers for further action. Section 2.7.2 of this document describes the triggers for implementing components of the Preferred Alternative.

2.8.2 Which alternatives evaluated meet the project’s purpose and need?

Only the Combination alternatives meet the 2050 purpose and need. As described above and illustrated in **Figure 2-17** and **Table 2-11**, these alternatives, including the Preferred Alternative, are the only alternatives capable of providing adequate network capacity in 2050. The Minimal Action Alternative, Highway alternatives, and Transit alternatives reach network capacity between 2015 and 2035, with the Minimal Action Alternative performing most poorly, followed by the Highway alternatives and Transit alternatives. Network capacity is a measure of congestion tolerance and is generally defined as the capacity when average travel speed on the Corridor drops to 30 mph. At speeds less than 30 miles per hour, the needs to improve mobility and relieve congestion are not met. For the Preferred Alternative to be able to meet the 2050 purpose and need, based on information available today, all of the improvements identified in the Maximum Program of Improvements are assumed to be needed. The Preferred Alternative includes a process for reviewing the effectiveness of improvements and implementing improvements incrementally in response to needs and triggers (as described in **Section 2.7.2**).

Table 2-11. Comparison of Action Alternatives

Alternative	No Action	Minimal Action	Highway Alternatives	Transit Alternatives	Combination Alternatives	Preferred Alternative
Peak Period Travel Time (weekend) (minutes)	320	302	213 to 215	283 to 295	199 to 206	199 to 221
Peak Period Travel Time (weekday) (minutes)	305	323	187 to 195	340 to 346	189 to 209	189 to 238
Peak Direction Hours of Congestion (weekend) (hours)	23	30	26 to 31	34 to 42	13 to 19	13 to 35
Peak Direction Hours of Congestion (weekday) (hours)	42	47	3 to 11	49 to 58	10 to 11	10 to 23
Trips Accommodated Beyond No Action (# of trips)	0	853,244	2,726,687 to 2,772,697	3,634,162 to 4,123,675	7,049,489 to 7,470,210	5,017,153 to 7,470,210
Annual Hours of Congestion (hours)	15,354	15,641	5,778 to 6,291	15,242 to 17,896	5,283 to 5,927	5,283 to 8,053
Transit Share (weekend) (percent)	1.2	3.3	0.9	14.6 to 17.3	12.3 to 14.5	14.5 to 20.0
Transit Share (weekday) (percent)	1.2	2.9	1.0 to 1.1	4.9 to 9.4	5.6 to 9.3	9.3
Fatality rates (per 100 million PMT)	0.50	0.37	0.40 to 0.42	0.34 to 0.36	0.34 to 0.36	0.31 to 0.34
Year at Network Capacity (western portion)	2025	2025	2040	2030	2050	2050
Year at Network Capacity (eastern portion)	2010	2015	2035	2030	2050	2030 to 2050
Meets 2050 Purpose and Need	NO	NO	NO	NO	YES	YES*

* Preferred Alternative meets 2050 purpose and need only if fully implemented. Based on information available today, the Minimum Program of Improvements does not meet the 2050 purpose and need.

2.8.3 How do the Combination alternatives compare?

The four Combination alternatives, including the full implementation of the Preferred Alternative, are similar in that all include the same Minimal Action Alternative components. The primary difference between the Combination alternatives is the transit components. With the exception of the Preferred Alternative, the highway components are the same for all of the Combination alternatives (if the Preferred Alternative is fully implemented). The Minimum Program of Improvements includes less highway capacity, but to meet the 2050 purpose and need, based on information available today, the Maximum Program of Improvements is needed. The Maximum Program of Improvements includes the same highway improvements as other Combination alternatives and is similar to the Combination Six-Lane Highway with Advanced Guideway System Alternative, except that the Preferred Alternative includes consideration of triggers. Because the transit components primarily distinguish the Combination alternatives, this summary focuses on the relative advantages and unique disadvantages of each transit component.

Chapter 2. Summary and Comparison of Alternatives

Combination Highway and Rail with Intermountain Connection Alternative

A primary advantage of the Combination Highway and Rail with Intermountain Connection Alternative is that Rail is a proven technology in multiple applications around the world. At the west end of the Corridor, the Intermountain Connection uses an existing corridor already established for freight rail use and is thus consistent with current and historic land uses. The Combination Highway and Rail with Intermountain Connection Alternative has slightly lower overall travel times, attracts a slightly higher transit share, and results in fewer construction impacts to motorists compared with the Combination Bus in Guideway alternatives.

Some of the relative disadvantages of the Combination Highway and Rail with Intermountain Connection Alternative include lower operating speeds on the Intermountain Connection section, more impacts related to the wider footprint of the improvements, and unproven operation in environments similar to the I-70 Mountain Corridor. Using the existing rail alignment of the Intermountain Connection section between the Vail area and Eagle County Airport results in lower operating speeds than other transit technologies due to curves in the existing rail alignment. The Combination Six-Lane Highway with Rail with Intermountain Connection Alternative has the widest footprint and, therefore, results in the most impacts associated with the construction footprint. High speed rail has not operated in environments like the I-70 Mountain Corridor, specifically steep grades and winter weather.

Combination Highway and Advanced Guideway System

The Combination Six-Lane Highway with Advanced Guideway System has many advantages compared to other Combination alternatives. It has the fewest hours of congestion, considering both weekend and weekday travel. It has the highest transit share and accommodates the most additional trips beyond the No Action Alternative. It has slightly lower travel times than other Combination alternatives, has the lowest fatality rate, and creates the fewest construction impacts for motorists.

Concerns about the Combination Six-Lane Highway with Advanced Guideway System result from its limited application in the United States and world. Revenue service for the Advanced Guideway System may be unproven, depending on the specific technology identified. (For instance, maglev systems do not have a revenue history.) The Advanced Guideway System also has the highest projected capital cost.

Combination Highway and Dual-Mode/Diesel Bus in Guideway Alternatives

Bus in Guideway Alternatives provide the most flexibility in construction and phasing as buses can operate within highway mixed traffic in sections not yet completed or in sections under construction. Bus technologies also have the advantage of being proven generally and for use in the Corridor. Bus technologies are also less expensive than rail technologies.

Although more flexible than rail options, the Bus in Guideway Alternatives attract a lower transit share and have slightly longer travel times. Along with the Combination Six-Lane Highway with Rail with Intermountain Connection Alternative, Bus in Guideway Alternatives have wider footprint and more impacts associated with that construction footprint. Diesel buses in particular have the highest air and noise emissions of the transit technologies evaluated.

Preferred Alternative

The Preferred Alternative is similar to the Combination Six-Lane Highway with Advanced Guideway System Alternative. It has the fewest hours of congestion, considering both weekend and weekday travel. It has the highest transit share and accommodates the most additional trips beyond the No Action Alternative. It has slightly lower travel times than other Combination alternatives, has the lowest fatality rate, and creates the fewest construction impacts for motorists. An additional benefit of the Preferred Alternative is that it is responsive and adaptive to future trends within the Corridor. Triggers are used as a mechanism for defining the specifics of future transportation solutions consistent with the Corridor

vision. The adaptive approach allows improvements to be implemented incrementally based on current needs and, therefore, provides the best opportunity to meet the purpose and need while minimizing impacts.

2.8.4 Environmental and Community Resource Impact Comparisons

The following summary compares environmental and community resource impacts among the alternatives. The focus is on a discernable and relevant comparison among the alternatives, particularly with the Preferred Alternative. These comparisons support the evaluation process that led to the identification of the Preferred Alternative. **Chapter 3, Affected Environment and Environmental Consequences** provides a complete evaluation of resources.

Impacts used in this document are presented before applying mitigation strategies. The lead agencies assumed that the application of mitigation strategies at Tier 2 improves adverse impacts by means of further avoidance, minimization, or enhancement of the qualities of resource conditions.

Overarching Impact Observations

Overarching impact observations are as follows:

- The Minimal Action Alternative typically has the fewest environmental impacts of the Action Alternatives. However, the Minimal Action Alternative does not meet the 2050 project purpose and need.
- The Preferred Alternative has a range of impacts. The low end of this range, under the Minimum Program, equates to the low end of impacts across alternatives, although the Minimum Program does not meet the 2050 purpose and need based on the information available today. Even at the low end of impacts, the Preferred Alternative comes closer to meeting the purpose and need than the Minimal Action Alternative.
- The Combination alternative impacts are predominantly at the higher end of the range of impacts, both because of the larger footprints and because indirect effects of induced growth are greatest among the Combination alternatives. The Combination alternatives are the only alternatives that meet the 2050 purpose and need. The high end of the Preferred Alternative range of impacts, under the Maximum Program, is predominantly at the lower end of the Combination alternatives' range of impacts. However, the triggers built into the Preferred Alternative limit the extent of the impacts. Impacts are minimized because construction of transportation improvements is triggered incrementally when it is needed.
- Typically, among the Highway and Transit alternatives, the Rail with Intermountain Connection has the most environmental impacts. Similarly, among the Combination alternatives, either the Combination Six-lane Highway with Rail with Intermountain Connection or the Combination Six-lane Highway with Bus in Guideway has the greatest impact, depending on the resource.
- Impacts for all Action Alternatives are greatest in areas where existing right-of-way is constrained and natural and community resources are closest to the areas of improvements, such as in the Idaho Springs area.
- For the Preferred Alternative, the lower end of the range of impacts summarized below is typically for the Minimum Program 55 mph and the higher end of the range of impacts is typically for the Maximum Program 65 mph, unless otherwise noted.

Impact Mitigation

Impacts of all alternatives represent those before applying mitigation strategies.

Mitigation strategies, discussed in **Chapter 3**, will be determined in Tier 2 processes when transportation improvements are defined on a localized level.

Chapter 2. Summary and Comparison of Alternatives

- Unless noted, there are no impacts associated with the No Action Alternative. However, the No Action Alternative results in greater levels of highway congestion, which increase carbon monoxide and some particulate air emissions. The No Action Alternative does not provide more options for travel in the Corridor. The No Action Alternative does not provide for methods to improve water quality from highway runoff and road sanding operations nor does it provide for wildlife crossings.

Wetlands

Action Alternative impacts range from a low of 15 acres of wetland and waters of the U.S. impacts for the Advanced Guideway System Alternative to 37 acres of impacts for the Combination Six-lane Highway with Rail with Intermountain Connection Alternative. The Preferred Alternative ranges from 16 acres to 32 acres of wetland and waters of the U.S. impact. Direct impacts to high-value fen wetlands are avoided by all of the Action Alternatives.

Biological Resources

Vegetation

Alternatives with the largest footprint (the Highway alternatives and the Combination alternatives) have the greatest impact on vegetation (ranging between approximately 225 acres to 325 acres, respectively) because roadway expansion causes the greatest amount of land disturbance. The Advanced Guideway System Alternative has the fewest direct impacts (approximately 150 acres) due to its smaller footprint. The Preferred Alternative has a range of potential impacts (between approximately 200 and 225 acres) comparable to nearly all the Action Alternatives.

Wildlife

Direct impacts on wildlife include loss of habitat due to construction and the increased barrier effect due to new roadway or transit improvements. The greatest impact is from the Highway and Combination alternatives. The Preferred Alternative has a range of potential impacts comparable to nearly all other Action Alternatives.

The Colorado Department of Transportation examined habitat connectivity and animal-vehicle collisions through an interagency committee known as “A Landscape Level Inventory of Valued Ecosystem Components” (ALIVE). The committee identified 13 areas where the I-70 Mountain Corridor interferes with wildlife migration (including elk, mule deer, bighorn sheep, and Canada lynx). These locations are referred to as linkage interference zones. By focusing on areas of known migration and wildlife use, and creating wildlife crossings, animal-vehicle collisions can be reduced and habitat connectivity increased. A Memorandum of Understanding, signed in April 2008, details the responsibilities of each agency in addressing animal-vehicle collisions (see **Appendix E, ALIVE Memorandum of Agreement**).

Fisheries and Aquatic Species

Impacts on Gold Medal and “high-value” fisheries are greatest for the Combination alternatives and Rail with Intermountain Connection Alternative. The Preferred Alternative has a range of impacts comparable to the range of impacts between the Combination alternatives and Rail with Intermountain Connection Alternative.

Alternatives that add more traffic lanes, the Highway and Bus in Guideway Alternatives, require additional winter maintenance (such as the use of liquid deicers and traction sand), thereby leading to increased water quality impacts when compared to alternatives with less new roadway construction.

Protected Species

Table 2-12 summarizes the effects of alternatives on protected species determined to occur in the Corridor. It includes impact determinations for federally listed threatened and endangered species, species that are candidates for listing under the Endangered Species Act, United States Forest Service sensitive species and management indicator species, and Colorado state species of concern. Impact determinations are presented according to the agency-specific conventions for determinations as indicated in the key at the bottom of the table.

Water Quality

All Action Alternatives have an impact on water quality. This impact largely results from runoff from the I-70 highway and ranges from a low of a 2 percent increase to a high of a 43 percent increase in runoff. The Preferred Alternative ranges from a 16 percent to a 24 percent increase in runoff compared to the No Action Alternative.

Geologic Hazards

All the alternatives, including the No Action Alternative, result in disturbance of geologic hazards along the Corridor. All of the Action Alternatives include mitigation for geologic hazards helping reduce the risks of disturbance to sensitive areas. The Preferred Alternative includes construction in areas susceptible to landslides, rockfall hazards, and poor rock quality. The elevated portions of the Advanced Guideway System allow debris or other materials to pass under the track with less effect on operations.

Historic Properties

As many as 76 different properties could be directly affected by one or more of the Action Alternatives. These properties include individual historic and archaeological sites as well as historic districts. Of the identified properties, only the No Action Alternative does not directly affect any historic properties. The Action Alternatives potentially affect between 48 and 70 historic properties. The Minimal Action Alternative affects the fewest, and the Combination alternatives affect the most. The impacts for the Preferred Alternative fall within the range of the other Action Alternatives. The actual number of historic properties affected could be higher or lower depending on the final eligibility determinations of these properties and the additional properties that could be identified through Tier 2 surveys. In addition Tier 2 processes will be evaluating alignments and alternatives that may avoid and minimize the potential impacts presented here. Based on the surveys conducted to date, the Preferred Alternative affects between 57 and 67 historic properties. The 55 mph option of the Preferred Alternative affects more properties than the 65 mph option. The Advanced Guideway System, Rail with Intermountain Connection, and Highway alternatives generally affect 51 to 56 potential historic resources, fewer than the Combination alternatives or the Preferred Alternative but slightly more than the Minimal Action Alternative, which affects 48. All of the Action Alternatives affect several additional linear resources, including highways, railroads, and agricultural ditches.

Table 2-12. Protected Species Impact Determinations

Impact Determination ^b				Impact Determination ^b					
Common Name	Scientific Name	Status ^a	No Action	All Action Alternatives	Common Name	Scientific Name	Status ^a	No Action	All Action Alternatives
Federally Listed Species									
Canada lynx	<i>Lynx canadensis</i>	FT	LAA, NCEL	LAA, PCEL	Boreal toad	<i>Bufo boreas boreas</i>	FS	MAIL, NCEL	MAIL, NCEL
Preble's meadow jumping mouse	<i>Zapus hudsonius preblei</i>	FT	LAA	LAA	Northern leopard frog	<i>Rana pipiens</i>	FS	MAIL, NCEL	MAIL, NCEL
Least tern	<i>Sterna antillarum</i>	FE	NE	LAA	Colorado River cutthroat trout	<i>Oncorhynchus clarki pleuriticus</i>	FS	MAIL	MAIL
Piping plover	<i>Charadrius melodus</i>	FT	NE	LAA	Bluehead sucker	<i>Catostomus discobolus discobolus</i>	FS	MAIL	MAIL
Whooping crane	<i>Grus americana</i>	FE	NE	LAA	Flannelmouth sucker	<i>Catostomus latipinnis</i>	FS	MAIL	MAIL
Yellow-billed cuckoo	<i>Coccyzus americanus</i>	FC	NE	NE	All FS-S plants analyzed except upswept moonwort	See Biological Report (Table BR-3)	FS	MAIL*	MAIL*
Bonytail chub	<i>Gila elegans</i>	FE	NE	LAA	Upswept Moonwort	<i>Botrychium ascendens</i>	FS	MAIL	MAIL / LRLV
Colorado pikeminnow	<i>Ptychocheilus lucius</i>	FE	NE	LAA	United States Forest Service Management Indicator Species				
Humpback chub	<i>Gila cypha</i>	FE	NE	LAA	White River National Forest				
Razorback sucker	<i>Xyrauchen texanus</i>	FE	NE	LAA	Elk	<i>Cervus elaphus</i>	FS	PEU	PEU
Pallid sturgeon	<i>Scaphirhynchus albus</i>	FE	NE	LAA	Virginia's warbler	<i>Vermivora virginiae</i>	FS	PEU	PEU
Greenback cutthroat trout	<i>Oncorhynchus clarki stornias</i>	FT, FS-	NE	LAA	All trout	All species	FS	PEU	PEU
Western prairie fringed orchid	<i>Platanthera praecleara</i>	MIS	NE	LAA	Aquatic macroinvertebrates	All species	FS	PEU	PEU
Ute ladies'-tresses orchid	<i>Spiranthes diluvialis</i>	FT	NE	LAA	Arapaho and Roosevelt National Forests				
State-Listed Species									
Common garter snake	<i>Thamnophis sirtalis</i>	SSC			Elk	<i>Cervus elaphus</i>	FS	PEU, HEU, NCEL	PEU
Midgert faded rattlesnake	<i>Crotalus oreganus concolor</i>	SSC			Mule deer	<i>Odocoileus hemionus</i>	FS	PEU, HEU, NCEL	PEU
United States Forest Service-Sensitive Species									
Pygmy shrew	<i>Sorex hoyi montianus</i>	FS	MAIL, NCEL	MAIL, NCEL	Bighorn sheep	<i>Ovis canadensis</i>	FS	PEU, HEU, NCEL	PEU
River otter	<i>Lontra canadensis</i>	FS	MAIL, NCEL	MAIL, NCEL	Hairy woodpecker	<i>Picoides villosus</i>	FS	PEU, HEU	PEU
American marten	<i>Martes americana</i>	FS	MAIL, NCEL	MAIL, PCEL	Pygmy nuthatch	<i>Sitta pygmaea</i>	FS	PEU, HEU	PEU
North American wolverine	<i>Gulo gulo luscus</i>	FS	MAIL, NCEL	MAIL, PCEL	Mountain bluebird	<i>Sialia currucoides</i>	FS	PEU, HEU	PEU
Fringed myotis	<i>Myotis thysanodes</i>	FS-S	MAIL	MAIL	Warbling vireo	<i>Vireo gilvus</i>	FS	PEU, HEU	PEU
Bighorn sheep	<i>Ovis canadensis</i>	FS	MAIL, NCEL	MAIL, PCEL	Wilson's warbler	<i>Wilsonia pusilla</i>	FS	PEU, HEU	PEU
Bald eagle	<i>Haliaeetus leucocephalus</i>	FS	MAIL	MAIL	Trout species (brook, brown)	<i>Salvelinus fontinalis and Bufo boreas boreas</i>	FS	PEU, HEU	PEU
Northern goshawk	<i>Accipiter gentilis</i>	FS	MAIL	MAIL	Boreal toad	<i>Bufo boreas boreas</i>	FS	PEU, HEU	PEU
American peregrine falcon	<i>Falco peregrinus anatum</i>	FS	MAIL	MAIL	Greenback cutthroat trout	<i>Oncorhynchus clarki stornias</i>	FT, FS	HEL	PEU
White-tailed ptarmigan	<i>Lagopus leucurus</i>	FS	MAIL	MAIL	* Action Alternatives have relatively greater impacts on occupied habitats than the No Action Alternative. Impacts associated with Action Alternatives increase proportionally based on the extent occupied areas are disturbed and recreational visitor use increases under each Action Alternative.				
Boreal owl	<i>Aegolius funereus</i>	FS	MAIL	MAIL	United States Forest Service Determinations NI = No Impact MAIL = May adversely impact individuals but not likely to result in a loss of viability in the Planning area nor cause a trend to federal listing LRLV = Likely to result in loss of species viability				
Flammulated owl	<i>Ortus flammeolus</i>	FS	MAIL	MAIL	Management Indicator Species Determinations PEU = Population Effects Unlikely HEU = Habitat Effects Unlikely PEL = Population Effects Likely HEL = Habitat Effects Likely				
Black swift	<i>Cypseloides niger</i>	FS	MAIL	MAIL					
Brewer's sparrow	<i>Spizella breweri</i>	FS	MAIL	MAIL					
American three-toed woodpecker	<i>Picoides tridactylus dorsalis</i>	FS	MAIL	MAIL					
Olive-sided flycatcher	<i>Contopus cooperi</i>	FS	MAIL	MAIL					

^b Impact Determinations
 Federal Determinations
 NE = No Effect
 LAA = Likely to Adversely Affect
 NLAA = May Affect, Not Likely to Adversely Affect
 Other PEIS Determinations
 PCEL = Positive Wildlife Crossing Effects Likely
 NCEL = Negative Wildlife Crossing Effects Likely

Chapter 2. Summary and Comparison of Alternatives

Recreational Properties

The Action Alternatives physically impact recreation resources adjacent to the I-70 highway, and indirectly affect resources farther afield, due to access and capacity changes. Up to five Section 6(f) resources could be impacted. In general, the Combination alternatives impact recreation resources the most because they have both the largest footprint and the biggest increase in capacity (and thus recreation use). Expanded access and mobility from the I-70 highway improvements continues to benefit developed commercial recreational facilities on National Forest System lands, while increased visitation to other National Forest System land areas (both developed recreational facilities and dispersed recreation areas) strains the integrity of the natural resources located within these recreational environments. The Transit alternatives have fewer direct impacts than the Highway alternatives but result in higher increases in visitation. The Highway alternatives have more direct impacts than the Transit alternatives, but result in only modest visitation increases because the former have less capacity than the Transit alternatives and therefore induce fewer recreation-oriented trips. The Preferred Alternative directly affects between approximately 65 and 90 recreation sites with the low end of the range similar to the Transit alternatives and the high end of the range similar to the Combination alternatives. The Highway alternatives' impacts fall in a range between the Transit and Combination alternatives.

Section 4(f) Properties

Section 4(f) properties include many historic, wildlife and waterfowl refuges, and recreational properties. The impacts for the Preferred Alternative range from 116 to 149 total properties (recreation and historic sites) compared to the range of impacts for other Combination alternatives from 147 to 154. The Minimal Action Alternative and single mode alternatives affect fewer properties but do not meet the 2050 purpose and need.

Air Quality

Air quality was evaluated for several pollutants and air toxics. Because pollutant emissions from vehicles are directly related to vehicle miles traveled, alternatives with higher vehicle miles traveled generally have higher total daily emissions. Transit alternatives that shift travel from cars to transit vehicles have lower emissions. For all alternatives (including the No Action Alternative), emissions of most criteria pollutants in 2035 are less than current day emissions, even though 2035 traffic volumes are higher than 2000 volumes. For instance, carbon monoxide emissions under the Preferred Alternative range from being 10 percent to 20 percent lower than current emissions and between 3 percent lower to 4 percent higher than emissions under the No Action Alternative. All of the Action Alternatives have carbon monoxide emissions approximately equal to or less than the 2035 baseline. Most are within a 7 percent to 9 percent range of the No Action Alternative, with the Rail with Intermountain Connection Alternative being the lowest at 7 percent less than the No Action Alternative and the Combination Six-lane Highway with Rail and Intermountain Connection Alternative being the highest at 9 percent greater emissions than the No Action Alternative. The Preferred Alternative is within these ranges. Emissions in the future are projected to be lower because stricter regulations are being implemented and older, higher-polluting vehicles continue to be replaced by newer, low-polluting vehicles. Emissions of re-entrained dust and greenhouse gases do not follow these trends of decreasing emissions because these pollutants are more related to vehicle miles traveled, and increases are expected accordingly.

Energy Consumption

Operational energy consumption is the amount of fuel and electricity used to power the vehicles using the transportation facility. Energy use during operations of any alternative is directly related to the gasoline and diesel consumption of automobiles, trucks, and buses, and to the propulsion energy generated for powering transit vehicles. The Action Alternatives improve traffic flow and increase average peak-hour speeds, reducing overall energy consumption. The variation in total operational energy consumption among the alternatives, compared to the No Action Alternative, ranges from no difference in the case of

Chapter 2. Summary and Comparison of Alternatives

Rail with Intermountain Connection and Advanced Guideway System Alternatives, to 17 percent higher in the case of the Combination Six-lane Highway with Diesel Bus in Guideway Alternative. The Preferred Alternative is among the lowest of all alternatives with expected increases ranging from 6 percent to 7 percent over the No Action Alternative by 2035.

Land Use (Right-of-Way)

The conceptual footprints of the Action Alternatives include the actual footprint of the transportation facility, 15-foot construction zones to each side of the facility, and additional 15-foot sensitivity zones beyond the construction zone. The Preferred Alternative has a range of impacts from 116 to 288 properties falling within the conceptual footprint. At the low end of the range, the Preferred Alternative results in fewer impacts than any other alternative. Among the remaining alternatives, between 220 (Minimal Action) and 312 (Combination Six-lane Highway with Rail and Intermountain Connection) properties fall within the conceptual footprint.

Noise

Commonly described on the decibel (dBA) scale, increases in noise levels of less than 3 dBA are generally considered imperceptible to humans. Increases of 3 to 5 dBA are considered noticeable, and increases of 10 dBA are perceived as a doubling of loudness. This holds true only when there is no change to the character of noise. Alternatives with this trait encompass the No Action, Bus in Guideway, and Highway alternatives. However, the Rail with Intermountain Connection and Advanced Guideway System Alternatives involve introducing noise sources with different frequency and time characteristics. Noise from these sources is likely noticeable even when it is less loud than the highway.

The No Action Alternative noise increases range from 0 dBA to 2 dBA. The Minimal Action Alternative noise increases range from 0 dBA to 4 dBA. The remaining Action Alternatives increase noise levels between 1 dBA (imperceptible) and 5 dBA (noticeable). The Preferred Alternative noise increases range between 1 dBA to 5 dBA, similar to those of the other Action Alternatives.

2.8.5 Implementation Comparisons

Alternatives were evaluated for how well they can be implemented. Total capital costs of construction and overall construction duration and impact are discussed below.

Total Capital Costs

Cost estimates were developed to provide comparable cost information across Action Alternatives on a Corridorwide level. The costs provide planning-level estimates for Tier 1 and provide a reasonable understanding of the current year funding levels considered in the evaluation process.

The improvements defined in the Action Alternatives answer the general location, mode, and capacity of improvements in the Corridor even though alignments are generally defined for purposes of impact analysis and costs. Because the actual alignment will not be defined in detail until a Tier 2 process, the cost estimates developed consider only major items and assume other items as a percentage of the major items. This is consistent with planning-level cost estimates and recognizes the inherent uncertainty with variations that occur during Tier 2 processes and design. Developing costs for current year has implications because over time the inflation rate is anticipated to substantially increase total costs.

While the Advanced Guideway System costs are not directly comparable to the high-speed transit cost estimates developed for the Rocky Mountain Rail Authority's high-speed rail study, there is a similarity because the Advanced Guideway System Alternative identified in this document has characteristics similar to those of the maglev system considered in the Rocky Mountain Rail Authority study. Because of this similarity, the two studies coordinated unit cost information for this particular technology. However,

Chapter 2. Summary and Comparison of Alternatives

the alignments are different, the stations are different, the operating characteristics are different, and the Rocky Mountain Rail Authority has an additional destination along the I-70 Mountain Corridor (Black Hawk/Central City gaming area). Furthermore, the Rocky Mountain Rail Authority study concluded that high-speed rail along the general I-70 Mountain Corridor should combine with high-speed rail along the Colorado Front Range between Pueblo and Fort Collins resulting in a different overall system.

Cost estimates for alternatives were developed in 2003 from preliminary design item costs, cost estimating contingency factors and other component costs. To update costs for this document, lead agencies used cost escalations for each alternative, using the Colorado Highway Construction Cost Index as a basis for determining long-term future cost escalation. This resulted in a current year cost (2010) of \$9.2 billion to \$11.2 billion dollars. The Advanced Guideway System cost estimates were established in conjunction with the Federal Transit Administration's Colorado Urban Maglev Project and were independently reviewed and confirmed by the Rocky Mountain Rail Authority as part of their High Speed Rail Feasibility Study. See the *I-70 Mountain Corridor PEIS Cost Estimating Technical Report* (CDOT, March 2011) for detail on estimated methodology and assumptions.

The process of escalating costs provides a uniform treatment of alternatives for relative comparison. The Colorado Department of Transportation updated the 2010 cost estimate based on a revised methodology to provide a more reasonable range of costs consistent with a Tier 1 document for the 21 Action Alternatives, including the Preferred Alternative. The revised methodology focuses on Year of Expenditure cost to a midyear of construction of 2020 for the Minimal Action, while all other alternatives assume midyear construction of 2025, which is the midpoint of the planning period (2050).

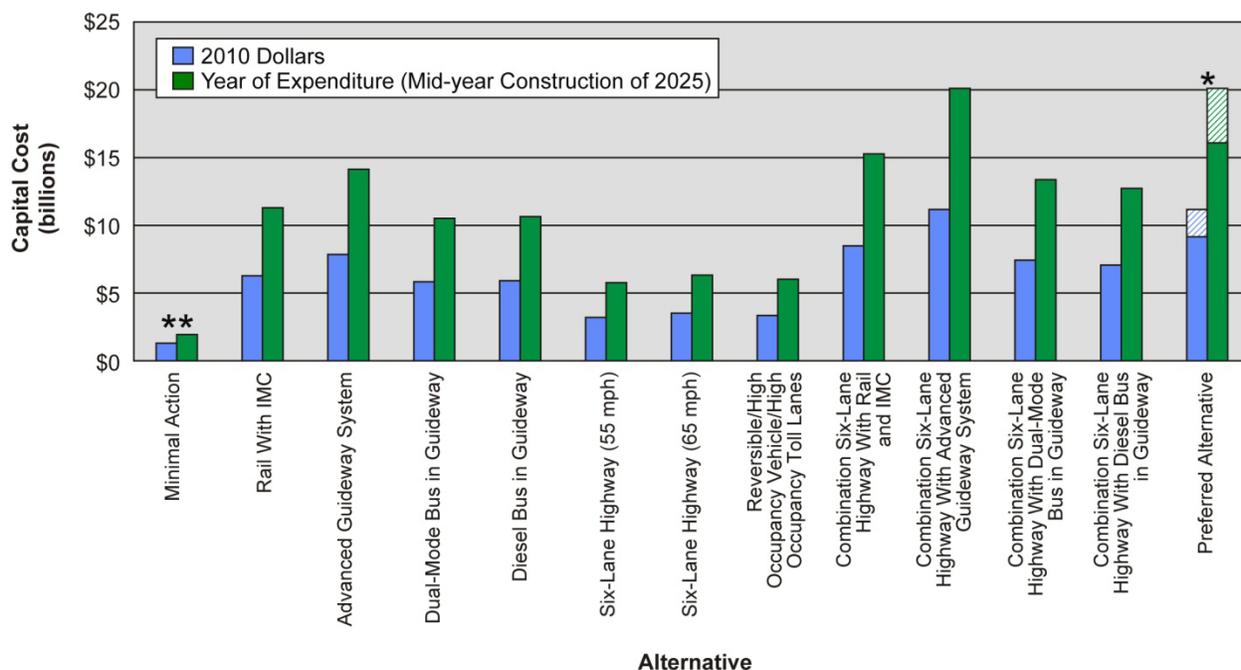
The Preferred Alternative identifies a minimum and maximum range of multimodal improvements ranging in cost from \$16.1 billion to \$20.2 billion (in year of expenditure with a midyear of construction of 2025).

The 21 Action Alternatives evaluated in this document range in cost from \$1.9 billion to \$20.2 billion (in year of expenditure with the midyear of construction of 2025, except for the Minimal Action which has a midyear of construction of 2020).

Figure 2-18 shows the total capital cost of construction for each alternative in current (2010) dollars and in year of expenditure. This does not include ongoing operations and maintenance costs or independently planned capital projects.

The No Action Alternative includes only projects that have existing or projected funding and are common to all Action Alternatives. Therefore, No Action Alternative costs are, for comparison purposes, zero. Combination alternatives have the highest cost, followed by Transit alternatives and then Highway alternatives. Although the transit and highway improvements extend over the same general area, transit costs tend to be higher. The Preferred Alternative has high comparative costs but best addresses the project purpose and need while minimizing environmental and community impacts. The adaptive management approach to this alternative proposes improvements only as needed. The *I-70 Mountain Corridor PEIS Cost Estimating Technical Report* (CDOT, March 2011) provides more detail on project costs by alternative.

Figure 2-18. Capital Costs by Alternative



* The cost for the Preferred Alternative is presented as a range. The solid and hatched bars together show the cost if the Preferred Alternative is fully implemented to meet the 2050 purpose and need. The solid bar alone shows the cost of the Minimum Program only. The cost is presented as a range because the adaptive management component of the Preferred Alternative allows it to be implemented based on future needs and associated triggers for further action. Section 2.7.2 of this document describes the triggers for implementing components of the Preferred Alternative.

** The methodology focuses on year of expenditure cost to a mid-year of construction of 2020 for the Minimal Action Alternative.

Construction Duration and Impact

The construction duration and impact is directly tied to the scope, complexity, and location of construction required. The No Action Alternative has the least construction duration and impact but results in ongoing traffic delays and congestion. The Minimal Action Alternative and Transit alternatives in separate guideways (Advanced Guideway System and Rail with Intermountain Connection) have less construction duration and impact than alternatives requiring highway construction. These alternatives have less construction within the existing I-70 highway footprint resulting in less traffic control and shorter construction duration. All alternatives that include six-lane highway capacity between the Eisenhower-Johnson Memorial Tunnels and Floyd Hill and in Dowd Canyon have the longest construction durations and largest construction impacts. The Minimum Program of the Preferred Alternative has less construction impacts than if the Preferred Alternative is fully implemented due to fewer highway improvements through Clear Creek County.

2.8.6 Summary

In general, the Combination alternatives provide the most capacity along the Corridor and best reduce congestion but also have the greatest environmental impacts. There is a tradeoff between meeting the needs of the project and direct impacts on resources.

Chapter 2. Summary and Comparison of Alternatives

The Transit and Highway alternatives have lower levels of improvements and result in higher levels of congestion than the Combination alternatives. The Preferred Alternative provides a range of increased capacity based on the triggers with the full implementation of the Maximum Program providing an equal amount of capacity compared to the Combination Six-lane Highway with Advanced Guideway System Alternative.

Overall, the Preferred Alternative provides the best opportunity to meet the project purpose and need while minimizing environmental and community impacts, improving safety, and reducing implementation challenges due to its phased and adaptive approach. Compared to the other Action Alternatives, the Preferred Alternative performs among the best in meeting the purpose and need of increasing capacity, improving mobility and accessibility, and reducing congestion. An evaluation of 2035 performance measures and the 2050 travel demand shows that only the Combination alternatives, including the Preferred Alternative if fully implemented, meet the performance measures of the purpose and need and accommodate the 2050 travel demand. The phased nature of the Preferred Alternative, including triggers and events that allow particular improvements to be made or considered, helps minimize the overall impact on the Corridor by carefully considering the ongoing need and feasibility of improvements as conditions change in the Corridor. Primarily for this reason, the Preferred Alternative best meets purpose and need while minimizing environmental and community impacts.

On a Corridorwide basis, the Preferred Alternative:

- Improves safety, mobility, and accessibility for all users
- Is responsive and adaptive to broader global trends that affect the way travel decisions are made in the future
- Meets the project purpose and need
- Can meet environmental and legal requirements
- Preserves, restores, and enhances community and cultural resources
- Preserves and restores or enhances ecosystem functions
- Is economically viable over the long term

2.9 How can the Preferred Alternative be implemented?

The Record of Decision will select a program of transportation improvements that identifies travel mode, future needed capacity, general location of the Preferred Alternative, and mitigation strategies for the Corridor. The Record of Decision also defines the process for subsequent Tier 2 processes, ensuring that the Corridor vision and programmatic guidance can be achieved. Projects included in the Tier 1 programmatic decision are required to follow a Tier 2 process that evaluates specific alignment alternatives, impacts, and commits to specific mitigation. Future studies, Tier 2 or pre-Tier 2 processes, may also determine the feasibility of some improvements, particularly given the challenging terrain and environmental constraints of the Corridor.

Studies will be completed to answer questions on the Advanced Guideway System regarding feasibility, cost, ridership, governance, and land use. If these studies show that Advanced Guideway System cannot be funded or implemented by 2025 or is otherwise deemed unfeasible to implement, other alternatives fully evaluated in the PEIS could be pursued. The determination of feasibility needs to include considerations of cost and benefits, safety, reliability, environmental impacts, technology, among other considerations. Discussions on determination of feasibility will involve the Collaborative Effort stakeholder committee and follow the I-70 Mountain Corridor Context Sensitive Solutions process.

The use of triggers in the Preferred Alternative recognizes that future travel demand and behavior are uncertain and that additional transportation solutions should be based on proven need. Subsequent projects will be evaluated in terms of how that project can move the program forward to meet transportation needs. The Collaborative Effort stakeholder committee will review progress made against the approved triggers, with check-ins at least every two years.

Chapter 2. Summary and Comparison of Alternatives

The triggers create a mechanism for defining the specifics of future transportation solutions consistent with the Preferred Alternative. They are decision points allowing for adaptive management that takes into account the current and future conditions of the transportation system. The outcome of the triggers could result in any of the following:

- Additional highway and non-Advanced Guideway System transit capacity improvements
- A determination that other alternatives evaluated in this document should be revisited (for example, a different transit mode is more feasible)
- No further action

In 2020, the overall purpose and need and the effectiveness of implementation of the Preferred Alternative will be thoroughly assessed regardless of the status of the triggers. As part of this assessment, the Collaborative Effort stakeholder committee (including the lead agencies) may reconsider the full range of improvements evaluated in this document, or pursue a new process because the context in which this Tier 1 decision was made is so changed that none of the alternatives evaluated in this document meets future transportation needs. Global, regional, and local trends such as peak oil, climate change, technological advances, and changing demographics could affect these future transportation needs.

More detail on the implementation of the Preferred Alternative can be found in the **Introduction**.