Chapter 2. Description and Comparison of Alternatives

The alternatives presented in this chapter were developed through public and agency involvement, committee participation with screening and alignment studies, travel demand modeling, technical and cost analyses, and environmental impact assessments and mitigation strategies.

The I-70 Corridor Major Investment Study (MIS), completed in 1998, represented a starting point for developing alternatives for the Corridor. The MIS includes an integration of one or more of the following transportation elements: a high-speed Fixed Guideway Transit (FGT), Rubber Tire Transit (RTT), highway and interchange improvements, Transportation System Management (TSM), alternate routes, and aviation. While following the multimodal intent of the MIS for the Corridor, the PEIS provides an independent screening and analysis of alternatives to be compliant with the Council on Environmental Quality (CEQ) regulations on the implementation of the National Environmental Policy Act (NEPA).

Chapter 2 provides information on the alternatives, set out in the following sections:

- 2.1, Screening of Alternatives – A discussion of the process of screening of alternatives
- 2.2, Description of Alternatives and Operation – A description of alternatives carried forward for more detailed analysis, including their operations characteristics and plans
- 2.3, Comparison of Alternatives – Comparative analyses of these alternatives including the No Action alternative and 20 action alternatives
- 2.4, Grouping of Alternatives – A discussion of the process used in grouping preferred alternatives and the results of the grouping
- 2.5, Permit Requirements – A discussion of possible federal and state permit requirements necessary for the implementation of any of the project alternatives

A preferred alternative will be identified in the Final PEIS and may consist of one alternative, or a combination of alternatives (which may consist of components of various alternatives) that have been advanced during the PEIS process. When finalized, an alternative for the Corridor will be selected, and the Record of Decision (ROD) will be issued.

2.1 Screening of Alternatives

The screening of alternatives was conducted in a sequential process, including the following three levels of analysis:

- **Level 1** screening studies were broad in concept and focused on identifying alternatives that would address the need to increase capacity, improve accessibility and mobility, decrease congestion. At this stage, alternatives were conceptual, and evaluation was based on the suitability of technology and mode, rather than location and design; therefore, environmental and community value criteria were not applied.
- **Level 2** screening studies were built on Level 1 studies to include a greater depth of analysis for alternative capacity, mobility, accessibility, and safety. Level 2 also incorporated criteria related to implementation (cost, technology, and constructibility), environmental sensitivity, and community values. General location and design concepts were evaluated at this stage.
- **Level 3** screening studies focused on the refinement of alternatives remaining after Level 2 screening. More detailed design considerations were developed to qualitatively assess alternative alignments, environmental and community impacts, and travel demand performance. Level 3 screening occurred in an incremental fashion as the alternatives evolved.

Level 1 and Level 2 screening were conducted during 2000 and 2001 based on an analysis of issues and alternatives identified through scoping, federal interdisciplinary team meetings, Mountain Corridor Advisory Committee and Technical Advisory Committee (MCAC/TAC) meetings, and public open houses. During this timeframe, the PEIS study team reviewed a wide range of multimodal transportation alternatives to determine their ability to meet the purpose and need criteria established for the Corridor. Level 1 screening criteria focused on the ability to meet need and the project purpose of safety. Safety was included in Level 1 screening to address Transit alternatives because of the interrelationship between safety issues and mobility. Screening criteria focused on Transit alternatives, which would introduce a new mode of transportation into the Corridor.

Level 2 screening involved a more in-depth analysis than Level 1 screening by applying the project purposes of environmental sensitivity, respect for community values, safety, and ability to implement. Level 2 screening included qualitative and quantitative analysis of impacts on environmental resources, including wetlands, other waters of the US, and aquatic resources, to meet the requirements of Section 404 (b)(1) of the Clean Water Act. The qualitative analysis also addressed potential impacts on community value resources, such as recreation and historic properties.

Level 3 screening studies were conducted from late 2001 through early 2003. Alternative design and alignment studies determined the technical feasibility of the alternatives to operate in the Corridor. Input from several committees, as well as agency and small group meetings, greatly assisted this stage of alternative analysis, which resulted in 21 alternatives advancing for full analysis in the PEIS.

Supporting Documentation
- Appendix A, Environmental Analysis and Data
- Appendix B, Transportation Analysis and Data
- Appendix C, Description of the Travel Model
- Appendix D, Documentation of the I-70 Ridership Survey
- Appendix E, Operational Characteristics of Alternatives
- Appendix P, Public and Agency Involvement
- Appendix Q, Alternatives Identification and Screening

2.1.1 Alternatives Development

The development of alternatives for the Corridor evolved through several stages, as illustrated in Figure 2-1. During the Level 1 and Level 2 screening studies, alternatives were organized within seven “families,” consistent with the MIS for the Corridor. These included:

- **Aviation,** which represents improvements to airport service
- **Transportation System Management,** which includes strategies for improving mobility and reducing congestion in the Corridor with minimal construction activities
- **Localized Highway Improvements,** which includes interchange reconfiguration, curve safety modification, and auxiliary lanes
- **Fixed Guideway Transit,** which represents Rail alternatives
- **Rubber Tire Transit,** which represents Bus alternatives
- **Highway Widening,** which involves highway widening or other alterations to the roadway, including reversible lanes, movable medians, smart widening, structured lanes, and tunneled lanes
- **Alternate Routes,** which includes other road and rail networks between cities along the Front Range and destinations currently served by I-70

As part of all families, tunnel options that could accommodate various alternatives were considered (Level 1 and Level 2 screening of other alternatives established the need for tunnels, and details were refined at Level 3). In addition to the No Action alternative, a total of 20 action alternatives are evaluated in the I-70 PEIS as a result of three levels of screening, as shown on Figure 2-1. These alternatives include Minimal Action, 4 Transit alternatives, 3 Highway alternatives, and 12 Combination alternatives. The No Action alternative represents projects already approved and planned for construction within the 20-year planning horizon. Figure 2-1 illustrates the evolutionary process of the alternative families.

Figure 2-1. Evolution of Alternatives

Initial Families Under Consideration	Action Alternatives Retained for Full Evaluation in the PEIS
TRANSPORTATION SYSTEM MANAGEMENT LOCALIZED HIGHWAY IMPROVEMENTS	MINIMAL ACTION COMPONENTS ▪ Transportation management ▪ Interchange modifications ▪ Curve safety modifications (curve smoothing) ▪ Auxiliary lanes
FIXED GUIDEWAY TRANSIT (Rail Alternatives) RUBBER TIRE TRANSIT (Bus Alternatives)	TRANSIT ▪ Rail with Intermountain Connection (IMC) ▪ Advanced Guideway System (AGS) ▪ Dual-Mode Bus in Guideway ▪ Diesel Bus in Guideway
HIGHWAY WIDENING	HIGHWAY ▪ Six-Lane Highway 55 mph ▪ Six-Lane Highway 65 mph ▪ Reversible/HOV/HOT Lanes

	COMBINATION OF HIGHWAY AND TRANSIT
	▪ Six-Lane Highway with Rail and Intermountain Connection (IMC) (Build Simultaneously)
	  ▪ Build Rail and Preserve for Highway
	  ▪ Build Highway and Preserve for Rail
	▪ Six-Lane Highway with AGS (Build Simultaneously)
	  ▪ Build AGS and Preserve for Highway
	  ▪ Build Highway and Preserve for AGS
	▪ Six-Lane Highway with Dual-Mode Bus in Guideway (Build Simultaneously)
	  ▪ Build Dual-Mode Bus and Preserve for Highway
	  ▪ Build Highway and Preserve for Dual-Mode Bus
	▪ Six-Lane Highway with Diesel Bus in Guideway (Build Simultaneously)
	  ▪ Build Diesel Bus and Preserve for Highway
	  ▪ Build Highway and Preserve for Diesel Bus

AVIATION ALTERNATE ROUTES	SCREENED FROM FURTHER CONSIDERATION

The Alternate Routes "family" was screened out between Level 1 and Level 2 screening. It was determined that alternate routes would not remove enough traffic from the Corridor to alleviate the need to make improvements to I-70. In addition, the improvements to the existing roadways and the new roads and tunnels that would be required would result in substantial social and environmental impacts, as well as economic costs.

2.1.2 Screening Study Documentation

The alternatives developed and refined during the screening process are a result of committee, public, and agency input; MIS elements; and technical evaluation by FHWA, CDOT, and the consultant team. Alternatives intentionally represent a wide range of system characteristics to ensure that a full spectrum of modes of transportation would be considered for meeting the underlying project need and purposes as described in Chapter 1, Purpose of and Need for Action. The following tables summarize information on the approach, input, and results of the PEIS screening process, including assumptions, criteria, and thresholds.

- Table 2-1, Approach to Screening, provides information on the goals for, and approach to, screening studies, as well as more specific descriptions of each level of screening.
- Table 2-2, Public and Agency Involvement in Screening, summarizes public and agency involvement in screening studies.
- 2-3, Screening Rationale, describes which alternatives were screened in each level of study and the rationale for eliminating these alternatives from further consideration. These tables are extensive and include the following "sub-tables" by alternative category:
  - Minimal Action – Aviation Component
  - Minimal Action – Transportation Management Component
  - Minimal Action – Localized Highway Improvements Component
  - Transit – Fixed Guideway
  - Transit – Rubber Tire Transit
  - Highway – Six-Lane
  - Highway – Alternate Routes
  - Tunnel Options

Appendix Q, Alternatives Identification and Screening, describes Level 2 screening criteria used to evaluate purpose and need for options within the families of alternatives, and illustrates the comparative results for components under Minimal Action, as well as options within the FGT, RTT, and Highway families.

The level-by-level screening described in 2-3 focuses, in broad terms, on the rationale for eliminating an alternative and, consequently, the reasons why certain components were eliminated at each of the three levels. This table is complemented by Figure 2-2, Screening Results, which is a detailed graphic that tracks every component analyzed as part of the evolution of an alternative.

Table 2-1. Approach to Screening

	Overview	Goals for Screening and Results		
		Level 1 Screening	Level 2 Screening	Level 3 Screening, Results and Variances

APPROACH	Based on the issues and alternatives identified during scoping, three levels of alternatives analysis were conducted to determine which alternatives would meet the underlying need and project purposes sufficiently for examination in the PEIS. Criteria were established to evaluate, screen, and systematically narrow the range of alternatives to be considered in the PEIS. Alternatives examined were either eliminated through screening or advanced for full analysis in the Draft PEIS. Only criteria that were discerning factors are documented in 2-3. See Appendix Q for details.
	
	Level 2 screening included consideration of the requirements and procedures of the following acts:
	
	• **Section 4(f) of the Department of Transportation Act.** Provides protection for certain environmentally significant, publicly owned land areas including public parks, wildlife refuges, and waterfowl refuges. Protection is also afforded to historic sites of national, state, or local significance. Section 4(f) requires all possible planning to minimize harm to the protected area, including an analysis of alternatives to the use of such land.
	• **Section 106 of the National Historic Preservation Act.** Requires federal agencies to consider the effect of their federally funded projects on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register of Historic Places.
	• **Section 7 of the Endangered Species Act.** Requires federal agencies authorizing, funding, or carrying out actions to ensure that these actions are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. Section 7(a)(1) directs Federal agencies to utilize their authorities by carrying out programs for the conservation of species listed pursuant to the Act.
	• **Section 404 (b)(1) of the Clean Water Act.** Process requires federal agencies to select the alternatives that is deemed "practicable" and considered the least damaging to aquatic habitats if a Section 404 permit is required.
		The goal of the Level 1 screening was to:
		
		Identify options within each alternative family that would meet the project need in the I-70 Corridor. These alternative families were organized in response to the I-70 Major Investment Study (MIS) and public scoping.
		
		Alternative families included
		
		• Aviation
		• Transportation System Management (TSM)
		• Localized Highway Improvements
		• Fixed Guideway Transit (FGT)
		• Rubber Tire Transit (RTT)
		• Highway
		• Alternate Routes
		
		Level 1 screening criteria focused on options that would address the need of the project: increase capacity, improve accessibility and mobility, and decrease congestion in the I-70 Corridor. While Level 1 screening criteria focused the ability to meet need, the project purpose of safety was also addressed. Safety was included in Level 1 screening to address Transit alternatives because of the interrelationship between safety issues and mobility. Screening criteria focused on Transit alternatives, which would introduce a new mode of transportation into the Corridor.
			The goals of the Level 2 screening were to:
			
			Incorporate criteria that address the project need (capacity, mobility, accessibility, and congestion) and the purposes of the project (safety, implementation, environmental sensitivity, and community values). Implementation includes cost, technology, constructibility, and fuel and energy consumption for transit alternatives. Environmental criteria were established to evaluate, screen, and systematically narrow the range of alternatives to be considered in the PEIS, including consideration of Section 404 (b)(1) of the Clean Water Act and 4(f) provisions of the Department of Transportation Act.
			
			Assumptions used for the criteria are briefly summarized below:
			
			• **Capacity.** How well does the alternative provide the ridership and roadway or transit capacity to accommodate future demand?
			• **Accessibility.** How well does the alternative connect to local transportation systems and communities in the Corridor?
			• **Mobility.** How well does the alternative improve travel time and speed?
			• **Congestion.** How well does the alternative reduce congestion or remove vehicles from I-70 during peak congestion periods?
			• **Safety.** How well does the alternative provide safety measures appropriate to each family of alternatives based on the weighted accident rate as compared to the statewide average?
			• **Implementation.** Are alternatives reasonable, practical, and feasible?
			• **Environmental Sensitivity.** How well do the alternatives avoid or minimize conflicts with environmental issues?
			  • Water quality • Fishery resources
			  • Wetlands • Wildlife
			  • Waters of the US • Geologic hazards
			  • Threatened, endangered, and special status species
			• **Community Values.** How well do the alternatives avoid or minimize conflicts with issues identified by the public and agencies?
			  • Land Use • Noise
			  • Recreation • Historic and archaeological resources
			  • Federal management and scenic features/views
			
			Specific criteria were developed to provide a uniform and common performance basis with which to evaluate the options within each alternative family. It should be noted that the criteria used within each alternative family are family-specific and were not intended to compare the differences between families. The Level 2 screening process made extensive use of available data and mapping, a Geographic Information System (GIS) database, and TransCAD and VISSIM modeling for mobility and congestion analysis.
			
			The RAILSIM 7® Train Performance Calculator (TPC) was used to model speed and energy consumption for exclusive right-of-way portions of transit alternatives, both Rubber-Tire (RTT) bus and Fixed Guideway Transit (FGT) systems.
				The alternatives remaining after Level 2 screening were further analyzed to confirm their reasonableness as candidates for the Corridor. These studies were conducted from late 2001 through early 2003 and have included:
				
				• Alignment studies
				• Technical (cost and travel performance) analyses
				• Conceptual engineering
				• Tunnel studies
				• Environmental and community impact assessment (for example, initial consideration of Section 404 (b)(1) of the Clean Water Act for wetlands and other waters of the US, and section 106 of the Historic Preservation Act, and Section 4(f), during the screening process helped in avoiding or minimizing effects to aquatic resources and historic properties included in the evaluation)
				• Travel demand studies
				
				Engineering studies were conducted to refine the proposed alignment for the alternatives. This also included studies of various tunnel options for the transit alignments and proposed tunnel bores at the Eisenhower-Johnson Memorial Tunnels (EJMT) and Twin Tunnels. During the period of the engineering and alternative studies, several of the alternative components were modified to optimize the footprint and alignments of the options being considered.
				
				Results of Screening
				
				In addition to the No Action alternative, a total of 20 action alternatives are evaluated in the I-70 PEIS as a result of three levels of screening, These alternatives include Minimal Action, 4 Transit alternatives, 3 Highway alternatives, and 12 Combination alternatives. They are described in Section 2.2.
				
				Variances
				
				Alternatives dismissed from further consideration as a result of screening (Levels 1, 2, or 3) have been screened for application along these entire termini. In Tier 2, design features that may require a variance may be considered to avoid or minimize impacts.
				
				FHWA may approve design exceptions, or variances, on federal-aid projects for experimental features or where conditions warrant an exception. Determination to approve a project design that does not conform to the minimum criteria is to be made only after due consideration is given to project conditions and safety benefits for the dollar invested, compatibility with adjacent sections of roadway and the probable time before reconstruction of the section due to increased traffic demand or changed conditions.

Table 2-2. Public and Agency Involvement in Screening

	Overview	Public and Agency Outreach and Coordination Efforts		
		Level 1	Level 2	Level 3
PUBLIC AND AGENCY INVOLVEMENT IN SCREENING STUDIES	Extensive public and agency involvement activities accompanied the screening process, including meetings with the Mountain Corridor Advisory Committee (MCAC) and the Technical Advisory Committee (TAC), public open houses, and the federal interdisciplinary team. MCAC members included a cross section of people representing the user and host organizations in the Corridor with selected representation from the counties, municipalities, community associations, and special interest groups, while the TAC, which was formed and then later combined with the MCAC, included a cross section of federal, state, and local agencies. Public and agency participation in the screening process included issue identification and review and input on methods, criteria, and results. The results of each of the three levels of screening studies were documented in the following project newsletters: • Volume 1 – Number 2, published in September 2000 • Volume 2 – Number 1, published in March 2001 • Volume 2 – Number 2, published in June 2001 • Volume 3 – Number 1, published in May 2003 Articles from these newsletters documenting screening results and the summary purpose and need are also provided on the project website, www.I70mtncorridor.com. **Committee reviews of the screening studies came from the following:** • Historic Resources 4(f) and 6(f) committee (concerned with public park and recreational lands, wildlife and waterfowl refuges, and historic properties) • A Landscape Level Inventory of Valued Ecosystem Components (ALIVE) and Stream and Wetland Ecological Enhancement Program (SWEEP) committees • Mountain Corridor Advisory Committee (MCAC) and Technical Advisory Committee (TAC), combined into one committee in April 2001 Federal agency reviews came from the federal interdisciplinary team: • US Forest Service • US Fish and Wildlife Service • Bureau of Land Management • Federal Rail Administration • Federal Transit Administration • Federal Aviation Administration • US Army Corps of Engineers • Environmental Protection Agency • Federal Highway Administration • Federal Motor Carrier Safety Administration Key state agency involvement has included: • Office of Archaeology and Historic Preservation (OAHP) • Colorado Department of Public Health and Environment (CDPHE) • Colorado Division of Wildlife (CDOW) • Colorado Department of Transportation • Governor's Office of Management and Budget • Colorado Department of Local Affairs Transit coordination has come through meetings with: • Colorado Intermountain Fixed Guideway Authority (CIFGA) • FTA's Colorado Maglev Project • Colorado Passenger Rail Association • Colorado Association of Transit Agencies (CASTA) • ECO Transit, Summit Stage, Regional Transportation District Regional and local agencies and organization meetings and communications with: • Northwest Colorado Council of Governments (NWCCOG) • Denver Regional Council of Governments (DRCOG) • Clear Creek County I-70 Task Force • The nine counties in the Corridor study area • Municipal planners • Elected officials Nationally recognized travel demand experts on the Peer Review Team met on four occasions to review and critique the development of the Corridor travel demand modeling program.	**Advisory Committee Meetings** Three MCAC/TAC meetings were held between June and July 2000 addressing the following aspects of Level 1 screening: • Families of alternatives • Purpose and need • Issues identification • Screening results **Federal Interdisciplinary Team** Results of Level 1 screening were presented to the federal interdisciplinary team in April 2001. **Public Open Houses** Eight public open houses were held throughout the Corridor between February and July 2000. The intent of these meetings was to introduce the public to the project, process, and potential alternatives to be analyzed in the PEIS and to solicit input on issues and alternatives. **Newsletters** In the September 2000 newsletter, the initial recommendations for Level 1 screening were shared.	**Advisory Committee Meetings** Nine MCAC/TAC committee meetings were held between October 2000 and May 2001 addressing the following aspects of Level 2 screening: • Approach and process • Criteria • Alternative development • Issues • Screening results **Federal Interdisciplinary Team** Four federal interdisciplinary team meetings were held during the Level 2 screening, addressing topics similar to those listed above for the advisory committee meetings. **Public Workshops** On January 16 and 17, 2001, two public workshops were held that concentrated on the screening criteria, methodology, and alternatives under consideration during the Level 2 screening. These meetings were held to discuss Level 2 screening before it was initiated to ensure that the public and agencies felt comfortable with the process and alternatives being studied. Both workshops helped to better define specific screening criteria and the alternatives for further study. The January 16 meeting focused on the Transit and Highway alternatives. The January 17 meeting focused on interchange analysis, travel forecasts, and environmental screening criteria. **Public Open Houses** Results of the Level 2 screening were presented at open houses held on April 4, 7, and 11, 2001, in three locations along the Corridor. **Newsletters** The March 2001 newsletter provided the rationale for the Level 2 screening criteria. In the June 2001 newsletter, Level 2 screening results were disclosed, including those alternatives eliminated and those retained for further study.	**Advisory Committee Meetings** Five MCAC meetings were held between August 2001 and April 2003, each addressing aspects of Level 3 screening: • Alignment studies • Travel demand model and ridership survey • Travel demand model results • Preliminary environmental and community impact findings • Issues • Screening results Additional meetings were held with I-70 Committees, as well as agencies and organizations, during Level 3 alternatives refinement and screening. These meetings included the following entities: • ALIVE Committee • 4(F) Committee • US Army Corps of Engineers • US Forest Service • FTA's Colorado Maglev Project • Clear Creek County I-70 Task Force **Federal Interdisciplinary Team** Three federal interdisciplinary team meetings were held during the Level 3 screening addressing similar topics (as listed above for the advisory committee meeting). **Newsletters** The May 2003 newsletter provided the results of Level 3 screening. Several alternatives were eliminated as a result of issues related to alignment, technical and environmental studies. A July 2004 newsletter provided the results of CDOT and FHWA recommendations for a group of preferred alternatives. At the conclusion of Level 3 screening, 21 alternatives were retained for evaluation in the Draft PEIS. Descriptions and preliminary analysis of these alternatives were provided in a *Summary of Preliminary Findings*. This report was distributed to Advisory Committee members in a meeting on September 4, 2003, to orient members to the information provided and answer questions regarding the issue of grouping the alternatives into "preferred" and "not preferred" groups.

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Table 2-3. Screening Rationale

	Overview	Results			Alternatives Retained for Evaluation in the PEIS
		Level 1	Level 2	Level 3	
MINIMAL ACTION – Aviation Component	Aviation family alternatives identified for consideration were intended to address ways to help meet future travel demand and increase mobility. Primary aviation alternatives included: • Development of new airports in the Corridor • Development of new heliport and short takeoff-and-landing (STOL) facilities • Development of Walker Field (Grand Junction) into a Western Slope regional hub airport • Development of aviation systems management and subsidy programs • Improvement of existing commercial aviation airports through advanced technology to allow additional flights Aviation alternatives were evaluated for technological feasibility and logistical application. While implementation was an initial consideration based on land suitability for new aviation facilities or expansion of existing facilities, there is insufficient need to develop new airports or expand on existing facilities; therefore, implementation was not a factor in screening. Level 1 screening criteria for aviation were analyzed for their ability to optimize travel in the I-70 Corridor and included: • **Capacity.** To determine the potential of an alternative to offer additional capacity, consideration was given to the type of improvements that would be needed and whether the airport has suitable land available for construction and expansion • **Accessibility.** Proximity to major activity centers in the Corridor • **Mobility.** Reduction in travel time and number of vehicle miles. For an airport to remain viable as an improvement to I-70, it must be able to remove traffic from I-70 during peak travel periods to reduce congestion. • **Congestion.** Positive impact in the reduction of the number of vehicles traveling on I-70 during peak travel periods • **Safety.** Assessment of whether the airport is located in areas relatively free of major topographical and meteorological conditions that would hamper air safety Level 2 screening focused on two criteria: • **Technology.** Navigational improvement and radar surveillance • **Capacity.** Number of persons removed from travel in the Corridor during winter ski season Criteria for environmental sensitivity and community values were not applied to the aviation components because alternatives at Level 2 screening were limited to technology options at existing airports or subsidy programs to enhance ridership, and did not warrant environmental analysis. Ultimately aviation was screened from consideration in the PEIS in Level 3 screening.	The following alternatives were eliminated due to the absence of demand for greater airport capacity and ability to reduce congestion on I-70 during peak travel demand periods: • Development of new airports was screened out due to the lack of accessibility or sufficient air travel demand • Development of new heliport and STOL facilities was screened out due to smaller aircraft that carry too few passengers and are less equipped to deal with mountain weather conditions. • Development of Walker Field into a Western Slope regional hub was not considered viable because it is currently underutilized compared to Hayden, Rifle, and Glenwood Springs airports, which are successful for general aviation purposes. The aviation alternative was included as a component of the Minimal Action alternative at the end of Level 1 screening.	The primary concept for improving the efficiency of aviation in the western portion of the Corridor is to improve the instrumentation at Aspen/Pitkin County Airport, Eagle County Airport, and Yampa Valley Regional Airport. Improved detection through aviation surveillance radar would increase the number of flight landings, particularly during inclement weather. These advanced technology options were retained for further study. Seat subsidy programs to ensure the highest level of airline use were retained for further study.	Improvement of existing commercial aviation airports through advanced technology was screened from consideration at Level 3 because it is considered to be part of Eagle County Airport plans regardless of action on I-70.	No aviation alternatives were retained for consideration in the PEIS; however, enhancements to radar equipment at Eagle County Airport are part of the No Action alternative.

Table 2-3. Screening Rationale (continued)

<table>
<tr><th rowspan="2"></th><th rowspan="2">Overview</th><th colspan="3">Results</th><th rowspan="2">Alternatives Retained for Evaluation in the PEIS</th></tr>
<tr><th>Level 1</th><th>Level 2</th><th>Level 3</th></tr>
<tr>
<td>MINIMAL ACTION – Transportation Management Component</td>
<td>The objective of transportation management is to create more efficient use of existing transportation facilities through improved management and operation of vehicles and the roadway. Transportation management provides an approach to help solve congestion and mobility issues that doesn't involve major capacity additions. Primary transportation management elements include:
• Transportation demand management (TDM). Designed to increase efficiency of roadway systems by reducing the demand for vehicular traffic, especially during peak hours, and changing the typical traffic behavior patterns. Includes ridesharing, flexible work hours, telecommuting, alternative transportation use, and parking controls.
• Intelligent transportation systems (ITS). Any application of electronics and/or communications technologies to increase the operational efficiency of the transportation network or provide a service to benefit the traveling public.
• Transportation systems management (TSM). Monitoring, improving, and maintaining the overall physical operation of I-70; attempts to improve or increase the supply of capacity provided by the existing infrastructure in the Corridor. Includes incident management programs, trucking operations plan, improved maintenance, access management, TSM for transit.
• Incident Management. Investigating the medium-range and long-range objectives of the CDOT Incident Management Plan that was completed for the Corridor. Most of the medium- and long-range objectives do not have established funding sources. This was not included in the screening process.</td>
<td colspan="2">Screening focused on the compatibility with current or future characteristics of the Corridor. Additionally, the potential to reduce the risk of accidents in problematic areas was analyzed.
All Transportation Management alternatives were carried through Level 1 and 2 screening because in addition to potentially providing benefit on their own or in combination with each other, they can be combined with alternatives from other families to help address the complex congestion and mobility problems in the Corridor. The TM family was included as a component of Minimal Action at the end of Level 2 screening. Transportation management concepts included the following:
• Ramp metering. This alternative would include alterations near certain highway interchanges, as necessary, to set up a ramp metering operation such as currently exists at many locations in the Denver metropolitan area.
• Slow-moving vehicle plan. This alternative would increase capacity on I-70 for peak-hour, peak-direction travel by limiting to certain lanes those vehicles that cannot maintain a specified minimum speed throughout the steep grades that are present on this highway. Additional facilities that would help improve slow-moving-vehicle travel at all other times, such as chain-up, rest area, weigh-in motion, and automatic vehicle identification facilities, would be proposed as part of this alternative.
• Peak spreading incentives. Through the coordinated efforts of stakeholders throughout the Corridor, this alternative would reduce peak-hour travel through the use of incentives to alter people's travel behavior.
• Rideshare parking lots. This alternative would construct additional rideshare parking lots, similar to the one at the Morrison interchange (milepost 259) that would allow people to rideshare, thereby reducing the number of vehicles on the highway.
• Enhanced traveler information. This alternative would involve exploring the benefit of providing additional traveler and agency information related to I-70 travel. Ideas that provide useful information to the users at convenient places, such as at home, on the road, or at ski areas would be investigated.
• Bicycle improvements. This alternative would improve the continuity and safety of bicycle travel throughout the Corridor.
• Frontage road transit (limited access). This alternative would be limit travel on the frontage roads between Hidden Valley and Bakerville to usage by transit vehicles and Clear Creek County residents during peak travel hours. Electronic card-controlled access gates would control access. This would be an effort to increase transit usage in the Corridor by decreasing transit vehicle travel times.
• Mountain Corridor Parking Operations Plan. Through the coordinated efforts of stakeholders throughout the Corridor, this alternative would increase the difficulty and cost of parking private vehicles at major mountain destinations. This would be an effort to increase transit usage in the Corridor by making it less desirable to drive private vehicles to major mountain destinations.
• Winter Park Ski Train. This alternative would include improvements to this existing service to potentially provide some relief to the I-70 Corridor.
• Buses in mixed traffic. This alternative would investigate introducing more frequent Corridor-wide bus service. Possible changes would include reduced travel cost, increased frequency, increased number of pickup points, increased destinations, and increased express service.
• Frontage roads (Clear Creek). This alternative would make the frontage road contiguous throughout Clear Creek County.</td>
<td>Several Transportation Management elements were eliminated because it was determined that they would not remove substantial traffic volume from I-70 that would reduce congestion during peak travel demand periods or change highway capacity. Elements eliminated during Level 3 screening included:
• Bicycle improvements. Because bicycle improvements are not anticipated to remove substantial traffic from I-70, the alternative was, therefore, eliminated but has been retained as part of mitigation strategies.
• Frontage road transit (limited access). This alternative was eliminated because frontage roads along I-70 are considered state and federal highways; therefore, access cannot be limited or restricted to Clear Creek County residents or a particular vehicle type. Long-haul transit on frontage roads would not provide attractive travel conditions as compared to travel on I-70.
• Winter Park Ski Train. This alternative was eliminated due to the volume of freight trains through the Moffat Tunnel, which would allow for only one additional Winter Park ski train run in each direction. It, therefore, would not remove substantial traffic from I-70.
• The Incident Management Plan is assumed to be part of future management of the Corridor.</td>
<td>Transportation management components retained for consideration in the PEIS have been consolidated into one group of components under the Minimal Action alternative that is included with other family alternatives.
• Ramp metering
• Slow-moving vehicle plan
• Peak spreading incentives
• Rideshare parking lots (Gypsum, Edwards, Avon, Vail Transportation Center, Keystone)
• Enhanced traveler information
• Mountain Corridor parking operations plan
• Buses in mixed traffic
• Frontage roads (Clear Creek). Frontage roads in Clear Creek are discontinuous from Hidden Valley to US 6, and no access from Fall River Road to the frontage road system exists. The Clear Creek Community wants the frontage road to be completed and access to Fall River Road restored. Concepts for completing a frontage road would depend on a final alternative. Development of a continuous frontage road and the Fall River Road connection in Clear Creek County has been retained for future consideration at the Tier 2 level but is not to be evaluated in the PEIS.</td>
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Table 2-3. Screening Rationale (continued)

<table>
<tr><th rowspan="2"></th><th rowspan="2">Overview</th><th colspan="3">Results</th><th rowspan="2">Alternatives Retained for Evaluation in the PEIS</th></tr>
<tr><th>Level 1</th><th>Level 2</th><th>Level 3</th></tr>
<tr>
<td>MINIMAL ACTION – Localized Highway Improvements Component</td>
<td>Localized highway elements, identified between Glenwood Springs and C-470, considered for study in the PEIS included the following:
• Interchange reconfiguration. Modify interchanges as necessary to improve capacity in merging and weaving sections for more efficient entry onto or exit from I-70
• Curve safety modification. Replace tight curves with smooth curves that match the design speed of the surrounding stretches of the highway, improving safety and reducing incident-related congestion
• Auxiliary lanes. Provide additional lanes in key locations to address localized congestion
The localized highway elements were identified on the basis of:
• Capacity. Traffic performance/congestion quantified by characteristics such as volume/capacity (V/C) ratios (described below)
• Safety. Quantified by weighted hazard index (described below)
Mobility and congestion are functions of the V/C ratio, which represents traffic flow conditions within a segment or at a specific location. The current volume on I-70 and the future predicted volumes on I-70 from TransCAD were used as input to the VISSIM model that simulates traffic flow characteristics on the interchange ramps or highway to produce a V/C ratio. If the V/C ratio was greater than 1, the element was identified as a problematic area and was retained for analysis in the PEIS.
Weighted hazard index (WHI) compares the weighted accident rate, measured as weighted accidents (higher weight given to a higher severity accident) per million vehicle miles of travel, at a location to the statewide average weighted accident rate for similar roadways and determines if the observed rate is higher than the statewide average. If a WHI is greater than zero, it signifies that the location in question has a higher weighted accident rate than the statewide average and is, therefore, a potentially problematic area in terms of either the number of accidents observed or their severity. Improvements at these locations were retained for analysis in the PEIS.
The localized highway elements were analyzed in terms of capacity, traffic performance, safety and public interest. If either the WHI was greater than zero or the V/C ratio was greater than 1, the element was retained for analysis in the PEIS. For the interchange analysis, an additional criterion was added for the case where modeled traffic backed up from the ramps onto the mainline under the year 2025 baseline scenario.
V/C ratio and WHI values for localized highway improvements are presented in Appendix Q.</td>
<td colspan="2">Localized highway elements were not screened at the Level 1 or Level 2 stages because it was determined that these local elements would become a part of Corridor-wide capacity improvement alternatives. The Localized Highway Improvements family was included as a component of Minimal Action at the end of Level 2 screening.</td>
<td>Each localized highway element was screened separately during the Level 3 screening study.
• Curve safety modification. Four locations of concern for curve safety were retained for full analysis in the PEIS. The need was based on mobility where the speed on the curves was less than the surrounding portions of the highway, and safety issues where the WHI was greater than zero, ranging from 1.9 to 7.0.
• Auxiliary lanes. Eleven auxiliary lanes were retained for analysis in the PEIS. The need was assessed on the basis of capacity and mobility where the V/C ratio exceeded 1 and on safety issues where the WHI exceeded zero, ranging from 0.3 to 2.8.
• Interchange reconfiguration. A total of 40 interchanges throughout the Corridor were considered for improvement. Assessment of the need for improvement focused on capacity (current or future traffic performance/congestion), safety problems, and local public interest. Based on a V/C ratio less than 1 and WHI less than zero, the following interchanges would not require any improvements and were eliminated from further consideration:
- Dotsero (milepost 133)
- Wolcott (milepost 156)
- Vail (milepost 176)
- Vail East Entrance (milepost 180)
- Vail Pass (Shrine Pass Road) (milepost 190)
- Officers Gulch (milepost 198)
- Herman Gulch (milepost 218)
- Bakerville (milepost 221)
- Lawson (milepost 233)
- Dumont (milepost 235)
- Hidden Valley (milepost 243)
- El Rancho (milepost 251)
- Evergreen Parkway/SH 74 (milepost 252)
- Chief Hosa (milepost 253)
- Genesee (milepost 254)</td>
<td>Although the Minimal Action alternative does not meet need (2025 demand) it has been retained based on a commitment to the public to evaluate a minimal action alternative in the PEIS
Minimal Action alternative components related to Localized Highway Improvements retained for consideration in the PEIS are listed below:
Interchange modifications
• Glenwood (milepost 116)
• Gypsum (milepost 140)
• Eagle and Spur Road (milepost 147)
• Edwards and Spur Road (milepost 163)
• Avon (milepost 167)
• Minturn (milepost 171)
• Vail West (milepost 173)/ Simba Run
• Copper Mountain (milepost 195)
• Frisco/Main Street (milepost 201)
• Frisco/SH 9 (milepost 203)
• Silverthorne (milepost 205)
• Loveland Pass (milepost 216)
• Silver Plume (potentially move west ramps to milepost 224) (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 248)
• Lookout Mountain (milepost 256)
• Morrison (milepost 259)
Curve safety modifications (formerly curve smoothing)
• West of Wolcott (mileposts 155 to 156)
• Dowd Canyon (mileposts 170 to 173)
• Fall River Road (mileposts 237 to 238)
• East of Twin Tunnels (mileposts 242 to 245)
Auxiliary lanes
• Avon to Post, Uphill (eastbound lane) (mileposts 167 to 168)
• West side of Vail Pass, Downhill (westbound) (mileposts 180 to 190)
• West side of Vail Pass, Uphill (eastbound) (mileposts 180 to 190)
• EJMT to Herman Gulch, Downhill (eastbound) (mileposts 215 to 218)
• Bakerville to EJMT, Uphill (westbound) (mileposts 215 to 221)
• Georgetown to Silver Plume, Uphill (westbound) (mileposts 226 to 228)
• Silver Plume to Georgetown, Downhill (eastbound) (mileposts 226 to 228)
• Downieville to Empire, Uphill (westbound) (mileposts 232 to 234)
• Empire to Downieville, Downhill (eastbound) (mileposts 232 to 234)
• Black Hawk Tunnel off-ramp to Hidden Valley, Uphill (westbound) (mileposts 243 to 244)
• Morrison to Chief Hosa, Uphill (westbound) (mileposts 253 to 259)
V/C ratio and WHI values for retained alternatives are shown in Appendix Q.</td>
</tr>
</table>

Table 2-3. Screening Rationale (continued)

	Overview	Results			Alternatives Retained for Evaluation in the PEIS
		Level 1	Level 2	Level 3	
TRANSIT – Fixed Guideway	This group of alternatives was initially referred to as **Fixed Guideway Transit (FGT)**. Options considered under the FGT consisted of six vehicle technologies. Several existing and advanced guideway technology systems were analyzed under different terrain conditions, alignments, and capacity (one versus two tracks) described below. Figure 2-2 illustrates in detail the various alternatives investigated, which in broad terms may be combined as follows: • Light Rail Transit (LRT) (Single or Double Track) - Diesel Multiple Unit (DMU) - Electric Multiple Unit (EMU) • Heavy Rail Transit (HRT) (Single or Double Track) - DMU - EMU • Passenger Railroad (PRR) (Single or Double Track) - Diesel Locomotive - EMU • Advanced Guideway System (AGS) (Single or Double Track) - High Speed Maglev - CIFGA Monorail - Low Speed Urban Maglev • Conventional Monorail (Double Track) EMU • Automatic Guideway Transit (AGT) EMU • Existing Passenger Rail - Intermountain Connection (IMC) - Winter Park Ski Train Service Expansion - Glenwood Springs Service Options within each of these groups included operation on two grade alignments: 4 percent and 6 percent. Additionally, Light Rail and AGS options included existing I-70 alignment or 7 percent grade. The 4 percent and 6 percent grade alignments would deviate from the highway as needed to maintain a consistent grade. **Criteria used in Level 1 screening included:** • **Capacity.** In maximum theoretical passengers per hour • **Accessibility.** Access to Corridor communities • Mobility. Average vehicle speed and Corridor travel time including boarding time and dwell time • **Congestion.** Must reduce congestion during peak hour travel periods • **Safety.** Whether or not an operator was present in the vehicle to deal with incidents or issues as they arise. Level 1 screening criteria focused on the ability to meet need and the project purpose of safety. Safety was included in Level 1 screening to address Transit alternatives because of the interrelationship between safety issues and mobility. Screening criteria focused on Transit alternatives, which would introduce a new mode of transportation into the Corridor. **Criteria used in Level 2 screening included:** • **Capacity.** Ability to provide seats for all peak-hour passengers in peak direction, based on conceptual ridership plan • **Mobility.** Average speed • **Safety.** Considered the relative potential for crashes • **Accessibility.** Transfers required between transportation modes • **Implementation.** Technology, cost, energy limitations, and constructibility • **Environmental sensitivity.** Conflicts with water quality, wetlands, wildlife, threatened, endangered, and special status species, and geologic hazards • **Community values.** Conflicts with noise, recreation, historic resources and scenic features/views Level 2 screening criteria are further described in Appendix Q. RAILSIM 7® TPC was used to model train performance over three different grade alignments from C-470 to Vail. The highway grade has maximum grades of 7.2 percent. The TPC was used as a screening tool to: • Verify the capabilities of various technologies of rolling stock on the mountain grades • Ensure support of predicted ridership • Develop vehicle-trip-time predictions for the FGT alignments (required to calculate operating costs and fleet size requirements) • Predict energy consumption (kWh for electrically powered trains and gallons of fuel for diesel-powered trains; kWh was also an input for sizing the electrical distribution system).	Two technologies have been studied under the AGS alternative: • The Colorado Intermountain Fixed Guideway Authority (CIFGA) – monorail • Federal Transit Administration (FTA) – Low Speed Urban Maglev Both systems have similar descriptions of conceptual performance characteristics; however, the CIFGA's version of the monorail, consisting of steel wheels on steel rails driven by a linear induction motor, has not progressed beyond the concept phase, and is not considered a proven technology. CIFGA was unable to model, design, or test its conceptual monorail before its sunset on December 31, 2003. As a result, the costs and descriptions of performance characteristics of the monorail could not be verified through the PEIS studies. If the descriptions of the monorail system and performance characteristics could be realized, it could be a candidate AGS technology for the Corridor. However, it would be considered a long-term development program that could take potentially many years of development before implementation. The FTA is researching the possibility of introducing magnetically levitated low speed technology (up to 100 mph) for urban transportation in the US, and the I-70 Corridor as a research study in the Colorado Maglev Project. The Japanese have spent considerable time developing and testing systems and optimizing High Speed Surface Transport 100L technology. This technology is being deployed in Nagoya, Japan, to be operational for the World Expo in 2005. The 100L system in its current form would not function efficiently in the Corridor and would not meet the speed and grade requirements specified for the AGS transit alternative. However, the development of CHSST Series 200L is being researched by the Colorado Maglev Project and may be able to meet the physical constraints in the Corridor. Developing this Series 200L technology and adapting it to the Corridor would also be considered a long-term undertaking. The advisory committees initially recommended eliminating high-speed magnetic levitation (maglev) because it is unable to follow the existing highway grades and curves due to the technology's high-speed operation. This technology would most likely have to bypass some I-70 communities to operate at their designed speed. At the request of the advisory committees, a low-speed version of the maglev technology was retained for further analysis. Automated Guideway Technology (AGT) systems, by their very nature, are designed to function without an operator physically at the controls. These systems are intended for operation in restricted environments where emergency assistance would be available on short notice. The remoteness and physical difficulties of accessing an AGT right-of-way in many parts of the Corridor would make this option unsuited to passenger safety needs. The short-haul system for AGT was eliminated based on safety because it would not have an operator on board. Long-haul systems were retained but were included under the heavy rail transit or AGS alternatives. AGT was also screened out due to implementation considerations because it would not be a suitable technology for the Corridor.	Electric power for the Electric Rail alternatives. Light rail transit (LRT), heavy rail transit (HRT), and passenger railroad electric multiple unit (PRR-EMU) would impose a substantial cost burden for either a single- or double- track alignment. Because capacity would nearly double for a two-track alignment, analyses indicate that this Corridor would best be served by a double-track alignment. Therefore, the following single-track options were eliminated for low capacity, and double-track options were retained for further study: • LRT electric single-track 4 percent, 6 percent, and 7 percent grade • HRT electric single-track 4 percent and 6 percent grade • PRR electric single-track 4 percent and 6 percent grade Electric rail alternatives would perform equally well at 4 percent or 6 percent grades with little difference in speed or capacity. Because the 4 percent grade would require substantial tunneling to accommodate new alignments, the following electric rail alternatives on 4 percent grades were eliminated due to cost, constructibility, and environmental/community impacts associated with a new alignment: • LRT electric double-track 4 percent grade • HRT electric double-track 4 percent grade • PRR electric double-track 4 percent grade • AGS electric double-track 4 percent grade Diesel rail alternatives (except Light Rail Transit) would perform marginally to poorly for speed and, in some cases, not at all on the 6 percent alignment. Therefore, the following diesel heavy rail and diesel passenger rail on 6 percent grades were eliminated due to mobility and technology: • HRT diesel single-track and double-track 6 percent grade • PRR diesel single-track and double-track 6 percent grade Due to the high tunneling costs, new alignments, and the lack of any substantial improvement in operational characteristics, the following diesel rail alternatives on 4 percent grades were eliminated due to cost and environmental impacts associated with a new alignment: • LRT diesel single- and double-track 4 percent grade • HRT diesel single- and double-track 4 percent grade • PRR diesel single- and double-track 4 percent grade LRT was simulated for 6 and 7 percent grades. Because these units were able to negotiate 7 percent grades for short distances, consistent with the I-70 alignment, rail transit on the 6 percent grade alignment was eliminated and replaced with the same mode on the highway alignment. The reduced operating efficiency of the 7 percent grade alignment was not seen to justify the increased capital costs and environmental effects associated with the tunneling and structures required for the 6 percent grade alignment causing the elimination of: • LRT diesel single- and double-track 6 percent grade • LRT electric double-track 6 percent grade The LRT system would be relatively less expensive to construct. It would be the only mode that theoretically could be operated alongside highway operations in tunnels. It also operated successfully during simulation on the existing highway grade. Therefore, LRT was retained for further consideration, but only as a double-track, electric and diesel version operating on the highway grade. The FGT alternatives would have a high potential for conflict at the 6 percent grade alignment for water quality, wetlands, fish habitat, threatened, endangered, and special status species, geologic hazards and historic resources. The highway alignment would have a lesser potential for impact to wetlands than the 6 percent grade. Noise impacts would be less for the electric powered units, and the elevated AGS would have the greatest impact to scenic features and views (see Appendix Q). • Winter Park Ski Train Service Expansion and Glenwood Springs Service were eliminated because increase service to Winter Park and Glenwood Springs through existing facilities was considered impractical and difficult to implement.	• Light rail, electric and diesel, transit double-track on 7 percent grade was eliminated due to relatively limited system capacity. • Conventional monorail, passenger rail multiple unit, and heavy rail on 6 percent grade were eliminated due to slower travel time, grade limitations west of Silverthorne, and alignment conflicts with local land uses.	FGT alternatives retained for consideration in the PEIS are listed below: • **Rail with IMC** – (Heavy rail, double-track). The electric rail double track was retained between the Vail Transportation Center and C-470. The Intermountain Connection (IMC) is an existing track from Dowd Canyon past Eagle on which a commuter-oriented DMU service could be employed between Eagle County Airport and Vail Transportation Center. A new IMC section would be constructed from Dowd Canyon east to Vail, and a new rail line would be constructed from Vail to C-470. Rail service to ECA would require a mode change at Vail. • **Advanced Guideway System (AGS).** The western terminus for AGS was extended to Eagle County Airport due to public interest, while the eastern terminus was held at C-470 in spite of requests to extend to DIA. (This was done to maintain consistency with the DRCOG planned transit network. However, the travel demand model has always considered a theoretical direct connection to DIA and determined a 10 percent ridership increase due to a direct connection between C-470 and DIA.)

Table 2-3. Screening Rationale (continued)

	Overview	Results – Level 1	Results – Level 2	Results – Level 3	Alternatives Retained for Evaluation in the PEIS
TRANSIT – Rubber Tire Transit	This group of alternatives was initially referred to as **Rubber Tire Transit (RTT).** Alternatives within the RTT family consisted of: • Bus in mixed traffic (later became a part of Minimal Action) - Diesel • Bus in High Occupancy Vehicle (HOV) lane - Diesel - Electric - Dual-Mode • Bus in separated transitway - Diesel - Electric - Dual-Mode • Bus in guideway - Diesel - Electric - Dual-Mode • Bus Rapid Transit - Diesel - Dual-Mode A transitway (a special HOV lane in which only buses would be allowed) or a guideway (a narrow transitway, where buses would be steered by a device that tracks the edge of a guideway) may be provided in both directions or as a single lane for peak-direction-only service. Bus routes may be structured to provide express service (for example, C-470 to Vail with no or limited intermediate stops), or to simulate rail operation by stopping at each proposed station. Direct bus service to Winter Park, Loveland, Arapahoe Basin, Breckenridge and Glenwood Springs was included. Initially, the same grade alignments used for FGT were used for the RTT analysis. After review, the existing I-70 alignment was used for the RTT analysis, with transit proposed in the median. **Criteria used in Level 1 screening included:** • **Capacity.** In maximum theoretical passengers per hour • **Accessibility.** Access to Corridor communities • **Mobility.** Average vehicle speed and Corridor travel time including boarding time and dwell time • **Congestion.** Must reduce congestion during peak hour travel periods • **Safety.** Whether or not an operator was present in the vehicle to deal with incidents or issues as they arise **Criteria used in Level 2 screening included:** • **Capacity.** Ability to provide seats for all peak-hour passengers in peak direction, based on conceptual ridership plan. • **Mobility.** Average speed • **Safety.** Considered the relative potential for crashes. • **Accessibility.** Transfers required between transportation modes • **Implementation.** Technology, cost, energy limitations, and constructibility • **Environmental sensitivity.** Conflicts with water quality, wetlands, wildlife, threatened, endangered, and special status species, and geologic hazards • **Community values.** Conflicts with noise, recreation, historic resources and scenic features/views Level 2 screening criteria are further described in Appendix Q.	Many bus transit options included the possibility of operating along a special lane or guideway in the direction of peak traffic and having vehicles returning or operating in the off-peak direction use the regular travel lanes. At the request of the advisory committees, all RTT options advanced into the Level 2 screening.	• **Bus in Mixed Traffic** would produce average speeds of 36 mph, which is just above the minimum Level 2 screening threshold of 30 mph. Based on preliminary data from the user survey, it would be unlikely to attract sufficient riders to make any substantial impact to the highway congestion. The Bus in Mixed Traffic alternative was eliminated as a single-mode alternative but was retained as part of the Minimal Action alternative. • **Bus in HOV Lanes** (marked or separated) could be combined with the Highway HOV analyses. The HOV lanes would not be built solely for transit use and were eliminated due to high cost, low capacity, and low demand for ridership. • **Electric Bus in Transitway and Guideway** alternatives were eliminated due to accessibility problems. The Electric Bus alternatives would require two separate transfers for passengers because buses cannot operate more than short distances off the Corridor and, therefore, was not considered a suitable technology. These RTT alternatives would have a high potential for conflict with wildlife and threatened, endangered, and special status species due to structural barriers to wildlife crossings, noise of diesel engines, and impacts on historic resources. Bus in Transitway would have greater impact to aquatic habitat and land use than Bus in Guideway alternatives because of its wider footprint.	• **Diesel and Dual-Mode Bus in Transitway** alternatives would have similar performance to that of the Bus in Guideway alternative but were eliminated due to the relatively wider footprint of the transitway resulting in greater impacts to aquatic habitat and land use. • **Peak-Direction-Only Diesel and Dual-Mode Bus in Guideway** alternatives were eliminated because they would not meet the mobility criteria due to lack of schedule dependability for a bus operating in off-peak direction, in mixed traffic, on a highway that would be subject to congestion. • **Bus Rapid Transit (BRT)** system would be limited to service along the I-70 Corridor. BRT was eliminated because it was determined to be advantageous for Bus to leave the Corridor and to increase the accessibility and potential of this transit mode.	RTT alternatives retained for consideration in the PEIS are listed below: • **Dual-Mode Bus in Guideway** was retained between Silverthorne and C-470. • **Diesel Bus in Guideway** was retained between Silverthorne and C-470. Bus alternatives would include a mode connection from Jefferson Station in a dedicated guideway from C-470 to Silverthorne. Between EJMT and Silverthorne, guideway would accommodate uphill, eastbound bus traffic only. Bus would continue in mixed traffic for remainder of trip.

Table 2-3. Screening Rationale (continued)

	Overview	Results – Level 1	Results – Level 2	Results – Level 3	Alternatives Retained for Evaluation in the PEIS
HIGHWAY – 6-lane	Primary Highway alternatives included: • Standard six-lane horizontal widening (12-foot shoulders) • Six-lane highway widening (reduced shoulder width) • Smart widening (horizontal widening with barrier separated/variable shoulder) • Structured lanes • Flex lanes • Reversible/HOV/HOT Lanes • Movable median • Tunneled lanes • Parallel routes Level 1 screening focused on the **problematic area analysis,** which identified areas with mobility, safety and maintenance concerns. Level 1 screening criteria included: • **Capacity.** The roadway cross section (number of lanes, lane drop area), vehicle use (volume, slow-moving trucks) and roadway geometry (steep grades, tunnels) • **Mobility.** Level of Service (LOS), travel time, and travel speed • **Congestion.** Options that would reduce congestion during peak travel periods • **Safety.** Analyses include criteria for roadway geometry (horizontal curves, vertical curves) and accident-prone areas (high number of incidents, fatalities, rockfall zones, and ice buildup/snowpacked areas). Level 2 screening criteria (see Appendix Q) expanded on Level 1 criteria and included: • **Capacity.** Volume/capacity (V/C) ratio between proposed traffic volume and proposed highway capacity • **Mobility.** Calculated free-flow speed from VISSIM model • **Congestion.** Duration of congested hours • **Safety.** Safety improvements measured by reduction in accidents and ability to address roadway deficiencies • **Implementation.** Screening criteria for cost and constructibility coupled with engineering judgment to provide an initial determination of how each element fared in its reasonableness and practicality • **Environmental sensitivity.** Potential for conflict with geologic hazards, water quality, wildlife, fishery resources, wildlife habitat and crossings, and threatened, endangered, and special status species • **Community values.** Potential for conflict with land use, recreation, historic resources, noise, and federal management scenic features and views Accessibility was added as a criteria during Level 3 screening to address impacts of alternatives on local traffic movement. Assumptions for the Highway alternatives are provided in Appendix Q.	All Highway alternatives were carried forward from Level 1 screening because they all would address the current and forecasted problematic areas.	The following alternatives had termini from EJMT and Floyd Hill (mileposts 214 to 247): • **Standard Six-Lane Horizontal Widening** would include 12-foot shoulder widths and would serve heavy vehicle traffic conditions. This option was eliminated as a uniform design feature due to constructibility and high potential for conflict with environmental and community resources. The Corridor is confined by narrow canyons and the existing highway's close proximity to Clear Creek. Criteria for elimination included the greatest potential for conflict with water quality, fish habitat, geologic hazards, threatened, endangered, and special status species, historic resources, and community values. • **Smart Widening** would provide the same travel lanes as standard highway widening but would include less than standard shoulder and median width, as well as clear zone distances. Smart Widening was eliminated as a Corridor-wide alternative due to safety concerns associated with variable shoulder widths and nonconformity with AASHTO safety standards. Potential for conflict to water quality, threatened, endangered, and special status species, and geologic hazards would be less than that for the standard Six-Lane Highway alternative but still would rate between "greatest potential for conflict" and "intermediate potential for conflict." Impacts on fish habitat and historic resources would be the same as those for the standard Six-Lane Highway alternative. • **Flex Lanes** would offer a narrow platform width of 90 feet by using a 16-foot flex lane shoulder that is used as a 12-foot-wide travel lane with a 4-foot shoulder during peak volumes in the peak direction, and as a wide shoulder at other times. A control device such as a lane closure gate and message signing would be used during peak hours when the lane would function as a standard travel lane. Flex lanes were eliminated for all segments due to safety criteria because of the problem with lane balance for sections of the highway on either side of the flex lane section. The 4-foot shoulder width would not meet AASHTO design standards and would be incompatible with CDOT's *Incident Management Plan*, which requires sufficient shoulder width to operate emergency vehicles. A 4-foot-wide shoulder would not allow broken-down vehicles to get out of the flow of traffic, which is a concern especially for commercial trucks. • **Tunneled Lanes** would include construction of additional lanes under the existing highway utilizing a cut and cover type of construction. This alternative was eliminated due proximity to Clear Creek and presence of mine tailings. This type of construction was anticipated to experience technical difficulty built near these features (a major waterway and mine tailings. • **Parallel Route** north of Idaho Springs between Fall River Road and the Hidden Valley interchange (a two-lane multipurpose roadway) was eliminated because it would not meet the need criteria of reducing congestion between the EJMT and Floyd Hill and because it would not be possible to continue west of Idaho Springs due to steep terrain at the Fall River Road area. Additionally, parallel routes would not improve capacity without environmental conflicts to water quality associated with a new alignment.	• **Structured Lanes** could be either stacked or terraced to minimize the footprint and thereby substantially reduce the impact on environmental and community resources while providing additional travel lanes. Structured lanes were eliminated, except in Idaho Springs, because the benefit of the narrower footprint gained from structuring lanes would be outweighed by its cost. In many locations, the alignment or direction of highway widening (to the north or south of the existing highway) could be adjusted to avoid sensitive resources. • **Six-Lane Horizontal Widening** within Idaho Springs was eliminated due to anticipated impacts on environmental and community values. Criteria for elimination included the greatest potential for conflict with water quality, fish habitat, geologic hazards/mining, historic resources, and community values. Six-Lane Highway Widening would be added in the Dowd Canyon area from mileposts 170 to 173, to address capacity issues. This was determined as a result of a feasibility study conducted during the PEIS preparation. Six-Lane Highway Widening between Empire Junction and Floyd Hill only was eliminated from further analysis because it would address congestion in only a small segment of the Corridor and does not meet the underlying need of the project. • **Movable Median** would use a five-lane highway with the third lane reversing by use of a movable median between Empire and Floyd Hill. A specially equipped vehicle would lift portable barrier segments and shift them laterally to produce a new lane configuration. This alternative was eliminated due to loss in the travel time it would take to clear the traffic lanes and move the median. The resulting impact on traffic movement warranted elimination of this alternative from further consideration.	Six-lane highway alternatives retained for consideration in the PEIS are listed below: • **Six-Lane Highway 55 mph.** Alternative would include highway widening at Dowd Canyon and from EJMT to Floyd Hill. An additional tunnel bore would be made at the EJMT and Twin Tunnels, and structured lanes would be used through Idaho Springs. • **Six-Lane Highway 65 mph.** This alternative would be similar to the 55 mph alternative but with two new tunnel bores at Dowd Canyon, a new westbound tunnel bore from Hidden Valley to Twin Tunnels, and a new eastbound tunnel bore from Hidden Valley to Floyd Hill. • **Reversible/HOV/HOT Lanes.** Reversible lanes would be used from the west portal of the EJMT to Floyd Hill.

Table 2-3. Screening Rationale (continued)

	Overview	Results			Alternatives Retained for Evaluation in the PEIS
		Level 1	Level 2	Level 3	
HIGHWAY – Alternate Routes	Sixteen **Alternate Routes** were identified with eastern termini ranging from Fort Collins to Pueblo and western termini at various points along I-70 west of the Continental Divide as far west as Wolcott in Eagle County. These 16 Alternate Routes would connect the central Rocky Mountains with the four principal cities along the Front Range. Three Alternate Routes would connect with Fort Collins, seven with Denver and DIA, four with Colorado Springs, and two with Pueblo. 1. Fort Collins to Wolcott via Walden (SH 14 and SH 131) 2. Fort Collins to Wolcott via Kremmling (US 34) 3. Fort Collins to Copper Mountain via Kremmling (US 34 and SH 9) 4. Denver to Wolcott via Moffat Tunnel (SH 72, US 40, and US 34) 5. Denver to Copper Mountain via Moffat, Berthoud, and Jones Pass Tunnels (SH 72 and SH 9) 6. Denver to Wolcott via Berthoud Pass Tunnel (US 40 and US 34) 7. Denver to Copper Mountain via Jones Pass Tunnel (SH 9) 8. Denver to Copper Mountain via Hoosier Pass (surface) (US 285 and SH 9) 9. Denver to Copper Mountain via Georgia Pass Tunnel (US 285) 10. Denver to Minturn via Buena Vista (US 285 and US 24) 11. Colorado Springs to Copper Mountain via Hoosier Pass (surface) (US 24 and SH 9) 12. Colorado Springs to Copper Mountain via Hoosier Pass Tunnel (US 24 and SH 9) 13. Colorado Springs to Minturn via Buena Vista (US 24) 14. Colorado Springs to Copper Mountain via Buena Vista (US 24 and SH 91) 15. Pueblo to Copper Mountain via Hoosier Pass (surface) (US 50 and SH 9) 16. Pueblo to Copper Mountain via Hoosier Pass Tunnel (US 50 and SH 9) To determine if a particular Alternate Route would provide sufficient benefits to I-70, the following basic criteria were applied during Level 1 screening: • **Capacity.** Ability to develop sufficient capacity of an alternate route to constitute a viable alternative to I-70 • **Accessibility.** Ability to provide meaningful access to destination points in and out of the Corridor • **Mobility.** The Alternate Route must provide a discernible benefit to motorists to encourage them to divert from I-70. Such a benefit may be a shorter travel distance but more typically involves a reduced travel time, especially during peak demand periods. • **Congestion.** The Alternate Route must have some reasonable potential to divert a substantial volume of traffic off the Corridor that would reduce congestion during peak travel times These criteria, by the nature of the Level 1 screening process, were qualitative, with sufficient quantitative support to justify the basic conclusions. Level 2 screening incorporated increasingly more detailed quantification, building on the first level by a more in-depth analysis of mobility, and incorporating criteria related to implementation (cost, constructibility, and technology). Level 2 screening also incorporated analysis for environmental sensitivity and community values. The criteria for mobility included evaluation of travel time, speed, hours of congestion, and system capacities based on operating scenarios rather than on maximum theoretical capacities. The safety criteria included safety upgrade requirements for alternate routes. Level 2 screening criteria are further described in Appendix Q.	Level 1 screening eliminated alternatives that clearly would not meet the capacity criteria – reasonable potential to divert a substantial volume of traffic off the Corridor that would reduce congestion during peak travel times • Alternate Routes 1, 4, 5, 6, 7, 8, and 10 between the Denver metropolitan area and the central Rocky Mountains all would involve travel distances more than 20 miles longer than a comparable vehicle trip along I-70. In addition, travel times via all seven alternate routes would be greater than via I-70 during off-peak travel periods. These routes were eliminated from further consideration because they would not provide suitable accessibility to the Corridor or the capacity to constitute a viable alternative to I-70. Therefore, these alternatives were not considered attractive enough to divert traffic from I-70. • Alternate Routes 2, 3, 11, 12, 13, 14, 15, and 16 would have a low percentage of travelers originating from the Front Range area and were eliminated because they would have virtually no potential to divert any substantial traffic volume off of the I-70 Corridor. • During peak travel periods, two Alternate Routes may be able to provide competitive travel times with the I-70 Corridor. These Alternate Routes are: - A new Alternate Route along SH 58, SH 93, and SH 72 to Rollinsville in conjunction with a new tunnel (paralleling the Moffat Tunnel) that would eventually connect to Winter Park - Alternate Route 9, US 285 to Jefferson, in conjunction with a new tunnel under Georgia Pass connecting to SH 9 north of Breckenridge and continuing on to Frisco and I-70	The two Alternate Routes carried into Level 2 screening were further analyzed to determine their feasibility. The feasibility analysis included a more detailed analysis of travel times and traffic diversion along with consideration of cost and potential impacts. The analysis showed neither route would remove enough traffic from the I-70 Corridor to improve travel conditions and avoid the need to pursue mobility enhancements to I-70. In addition, the improvements to the existing roadways and the new roads and tunnels that would be required would result in large social and environmental impacts, as well as high costs due to tunneling. At the beginning of Level 2 screening, the information on Alternate Routes was presented at public workshops in January 2001 and at Advisory Committee meetings in February 2001, with the recommendation that Alternate Routes be screened out. Attendees at each forum endorsed this recommendation.	All Alternate Routes were eliminated in Level 1 and Level 2 screening.	No Alternate Route alternatives were retained for consideration in the PEIS.

Table 2-3. Screening Rationale (continued)

	Overview	Results: Level 2	Results: Level 3	Tunnel Requirements Associated with Alternatives Retained for Evaluation in the PEIS
TUNNEL OPTIONS (Local tunnel options considered along with seven families of alternatives)	**Tunnel requirements** were considered along with alternative development and refinement. Due to the topography of the Corridor, enhancements to existing tunnels and construction of new tunnels would be required to accommodate most alternatives. These tunnel components were considered as options that could accommodate various alternatives. Tunnels studied included: New proposed tunnels: • Dowd Canyon Tunnel • Silverthorne Tunnel • Silverthorne to Empire Tunnel • Loveland Pass Tunnel • Silver Plume Tunnels - Silver Plume - North Tunnel - Georgetown Incline Tunnel - FGT • Georgetown Incline Tunnel - Highway • Twin Tunnels to Hidden Valley • Hidden Valley to Floyd Hill Third bores at existing tunnels: • Eisenhower-Johnson Memorial Tunnels • Twin Tunnels Tunnels were not addressed in Level 1. Level 2 screening focused on: • **Capacity.** Improvements to road geometry and transit alignment considerations for curves and steep grades • **Mobility.** Further evaluation of the differences in time and speed that would make an alternative attractive • **Implementation.** Consideration of cost, as well as geologic and engineering constraints • **Environmental/community value factors.** Impacts on water quality, recreation areas, wildlife crossings, threatened, endangered, and special status species, historic resources, and land use Level 3 screening focused on the same criteria but refined them, on a site-specific, localized basis as required.	Tunnels were not addressed in Level 1 screening. In Level 2 screening, several alternatives with tunneling requirements were eliminated. • **Silverthorne Tunnel – Evaluated for 6 percent grade Transit alternatives.** The area surrounding the towns of Silverthorne and Frisco would present the greatest challenge due to the presence of Dillon Reservoir, steep topography, and adverse subsurface conditions. A tunnel located from mileposts 205.5 to 207.7 along the north side of the interstate would have been required to maintain these grades. The tunnel for the 6 percent alignment would have been approximately 11,500 feet in length and required excavation in thick unconsolidated glacial sediments (with high groundwater elevation issues). The constructibility of tunneling in these conditions was examined but questioned due to geologic hazards and engineering construction difficulties in shale and fault zones. This option was eliminated because of these geologic and engineering issues, impacts on the surrounding communities, and environmental impacts on wildlife, fisheries, and water quality. • **Silverthorne to Empire Tunnel.** A new tunnel between Empire Junction and Silverthorne was proposed to avoid steep grades at the Continental Divide. This option was screened out because it would not meet implementation criteria due to high tunneling costs. • **Loveland Pass Tunnel (Snake Creek Alignment) – Evaluated for Transit alternatives.** From 1938 to 1945, a pilot bore was constructed under Loveland Pass to evaluate the suitability of this site to construct a Continental Divide crossing for what later became I-70. Consideration for this site was later abandoned and the Straight Creek alignment was adopted as the preferred location for the crossing. This alignment led to what is now known as the Eisenhower-Johnson Memorial Tunnels (EJMT). The Loveland bore alignment was considered for capacity improvements, particularly for the FGT alternatives. Because of the elevation of both the existing east and west portals, the grade required for the tunnel approach would be too steep for the practical operation of FGT systems. In addition, the US Forest Service strongly discouraged another transportation corridor location across or through the Continental Divide. • **Alternate Route Tunnels.** Various locations to construct tunnels that cross the Continental Divide were considered but eliminated due to considerable environmental impacts. Alignments ranged from Georgia Pass to the south to Rawlins Pass to the north. • **Eisenhower-Johnson Memorial Tunnels.** Most of the alternatives considered to date have included crossing the Continental Divide near the existing EJMT. Techniques for widening the existing tunnels were considered but eventually eliminated due to extensive impacts on traffic and constructibility. The existing tunnels utilized a multiple drift system for support through the Loveland Shear Zone before the installation of the final tunnel lining. All of the existing support systems would be removed during the widening process, leaving an unsupported portion of tunnel for an undesirable length of time. Staging the new support system with the removal of the existing systems, coupled with the extremely difficult ground conditions, led to the conclusion that widening the existing EJMT would not be a feasible alternative. • **Silver Plume Tunnels.** Tunnel alternatives were considered from Georgetown to Silver Plume. The steep climb between the two towns is commonly referred as Georgetown Hill or the Georgetown Incline. The historic metal mining activity in this area was primarily confined to the Republican Mountain belt north of Silver Plume. However, some activity occurred along the Incline from the Silver Plume to the Georgetown interchange along the north side of I-70. The Republican Mountain, Brown Gulch and Silver Gulch area is riddled with mine workings, particularly the area north of Silver Plume. Most of these workings fall within the NHL district. The extent of the mine workings underground is not known but is considered to be extensive. Mine workings that would potentially be affected by the tunnel alternatives include Burleigh Tunnel, Diamond Tunnel, Pelican Mine, Dunkirk Mine, Pay Rock Mine, Silver Plume Mine, Snowdrift Mine, Ashby Tunnel, Peru Tunnel, Lebanon Tunnel, and other orphan mine sites. The Burleigh Tunnel, one of the sites identified in Operable Unit 3 of the Clear Creek/Central City Superfund Site, has been identified as a source for elevated levels of zinc in Clear Creek. Three general tunnel alignments were considered in the Georgetown Incline area. The following summarizes the alternatives and their respective engineering constraints. - **Silver Plume – North Tunnel, FGT alignment.** The first alignment was proposed for the Rail with IMC or AGS alternatives only and was proposed to bypass the town of Silver Plume to the north. The west portal for the tunnel alternative would be located near the Burleigh Tunnel. Mining workings along the Silver Plume–North alignment contain multiple drifts, and unstable openings would be encountered during the tunnel excavation. The location and extent of mine workings are not known. Mine workings encountered during construction of the new bore would require many of the workings to be plugged and closed with a cementitious material. As with the Burleigh Tunnel, the new tunnel would provide a drainage conduit for water containing heavy metals. The cost to mitigate potential mine collapse and poor water quality is not known. As a result of these constraints, the Silver Plume North tunnel was eliminated from further consideration. - **Georgetown Incline Tunnel, FGT alignment.** The second tunnel alignment would have provided a platform for the Rail with IMC and AGS alternatives that must operate on a 6 percent grade or less. Mine workings would also be encountered along this alignment. This alternative was eliminated due to the desire for rail to operate within the existing highway alignments and due to the screening of all Rail/AGS systems limited by a maximum of 6 percent grade. - **Georgetown Incline Tunnel, Highway alignment.** This tunnel alignment would have provided a single three-lane bore for the Highway Widening alternatives. The westbound traffic was proposed to travel in the new tunnel, and eastbound traffic would follow the existing I-70 alignment. Most long highway tunnels (greater than 800 feet) operate at grades of 3 percent or less to reduce vehicle emissions, thus reducing ventilation system requirements. The type of ventilation system is not known. Some systems may require a ventilation facility to be constructed at one or both portals. Level of noise from ventilation system is not known. Mine workings would be encountered. Mine workings would be closed and stabilized to mitigate for potential collapse. Groundwater encountered in the tunnel would require a water treatment facility. Extent of mine openings and groundwater contamination are not known. Cost to mitigate potentially unstable mine workings and poor water quality are not known. Road icing poses a problem at tunnel portals, and when combined with steep grades, can lead to major safety issues. For these reasons, the highway tunnel was limited to a 4 percent grade, which would result in a longer tunnel. The alternative was eliminated for grade and safety reasons, potential unforeseen conditions and the uncertainty in the level of mitigation required, and for potential impacts to the existing mine workings.	**Eisenhower-Johnson Memorial Tunnels** • New tunnel bores to the north and south of the existing EJMT were considered. To avoid destabilizing rock around the existing bores, which would continue to carry traffic during construction, new bores would have to be located at least 120 to 250 feet from the existing tunnels. A new south bore was anticipated to have been approximately 10,500 feet long and a north bore approximately 13,725 feet long. Both bores would result in impacts to the Loveland Ski Area. The construction of a south bore would result in considerable impacts to the function of the Loveland Ski Area. Therefore, the proposed bore to the south of the existing tunnel was eliminated at this level of analysis.	Tunnels required to accommodate alternatives that were retained for consideration in the PEIS are listed below: • **Third bore at Eisenhower-Johnson Memorial Tunnels (associated with all alternatives).** The proposed third tunnel bore would be located to the north of the existing tunnel bores. • **Third bore at Twin Tunnels (associated with all alternatives).** The proposed third tunnel bore would be located to the south of the existing tunnel bore. • **New tunnel requirements (associated with Six-Lane Highway 65 mph alternative).** To accommodate the Six-Lane Highway 65 mph alternative, three new tunnels would be required in addition to new bores at the EJMT and Twin Tunnels, as follows: - **Dowd Canyon.** The new tunnels in this location would consist of two new three-lane tunnels – one to accommodate westbound traffic, the other for eastbound traffic. These tunnels are anticipated to be approximately 7,200 feet long. - **Twin Tunnels to Hidden Valley.** The new tunnel in this location would consist of one new three-lane tunnel that would accommodate westbound traffic only. This tunnel is anticipated to be approximately 1,400 feet long. Eastbound would roughly follow the existing alignment but would require curve safety modification in select locations to maintain the 65 mph design speed. - **Hidden Valley to Floyd Hill.** The new tunnel in this location would consist of one new three-lane tunnel that would accommodate eastbound traffic only. This tunnel is anticipated to be approximately 5,500 feet long.

Minimal Action Alternative

Minimal Action Alternative	Screened - Level 1 Screening	Screened - Level 2 Screening	Screened - Level 3 Screening	Retained for Draft PEIS
Aviation				
Improve Existing Commercial Aviation Airports Through Advanced Technology to Allow Additional Flights (Included in Local Airport Planning)			X	
Develop System Management and Subsidy Programs			X	
Develop New Airports in the Mountain Corridor	X			
Develop Heliport and Short Takeoff and Landing (STOL) Facilities	X			
Develop Walker Field (the Grand Junction Airport) into a West Slope Regional Hub Airport	X			
Transportation System Management				
Ramp Metering				●
Slow Moving Vehicle Plan				●
Peak Spreading Incentives				●
Rideshare Parking Lots (Gypsum, Edwards, Avon, Vail Transit Center, Keystone)				●
Enhanced Traveler Information				●
Bicycle Improvements (See Mitigation Strategies)			X	
Frontage Road Transit (limited access)			X	
Maintain Corridor Parking Operations Plan				●
Winter Park Ski Train Service Expansion			X	
Buses in Mixed Traffic (mp 176-260)				●
Frontage Roads (Clear Creek)				● *
Interchange Modifications				
Glenwood Springs (mp 116)				●
Dotsero (mp 133)			X	
Gypsum (mp 140)				●
Eagle and Spur Road (mp 147)				●
Wolcott (mp 156)			X	
Edwards and Spur Road (mp 163)				●
Avon (mp 167)				●
Minturn (mp 171)				●
Vail West / Simba Run (mp 173)				●
Vail (mp 176)			X	
Vail East (mp 180)			X	
Vail Pass (Shrine Pass Road) (mp 190)			X	
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)				●
Hyland Hills/Beaver Brook (mp 247-248)				●
El Rancho (mp 251)			X	
Evergreen Parkway / SH 74 (mp 252)			X	
Chief Hosa (mp 253)			X	
Genesee (mp 254)			X	
Lookout Mountain (mp 256)				●
Morrison (mp 259)				●

* Retained for future consideration at Tier 2 but not evaluated in the PEIS

Minimal Action Alternative

Minimal Action Alternative	Screened - Level 1 Screening	Screened - Level 2 Screening	Screened - Level 3 Screening	Retained for Draft PEIS
Curve Safety Modifications				
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, 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)				●
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)				●
Black Hawk Tunnel Off-ramp to Hidden Valley Off-ramp, Uphill (WB) (mp 243-244)				●
Morrison to Chief Hosa, Uphill (WB) (mp 253-259)				●

KEY TO ABBREVIATIONS
BRT - Bus Rapid Transit
Both - 2 Directions of Travel
Peak - 1 Direction of Travel
mp - Milepost
EB - Eastbound
WB - Westbound

Figure 2-2. Screening Results

Transit Alternatives

Rail and Advanced Guideway System Alternatives

Transit Alternatives	Screened - Level 1 Screening	Screened - Level 2 Screening	Screened - Level 3 Screening	Retained for Draft PEIS
Existing I-70 Alignment (7% Grade) - Diesel Power				
Light Rail Transit - Single Track		X		
Light Rail Transit - Double Track			X	
Existing I-70 Alignment (7% Grade) - Electric Power				
Light Rail Transit - Single Track		X		
Light Rail Transit - Double Track			X	
Advanced Guideway System (AGS) (Formerly CIFGA Monorail)(mp 142-260)				●
AGS/High Speed Maglev	X			
Automated Guideway Transit	X			
Heavy Rail Transit - Double Track (Moved from 6% Alignment)(mp 176-260)				●
6% 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		
6% 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	
Advanced Guideway System - Conventional Monorail - Double Track			X	
4% 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% 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		
Advanced Guideway System - 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		

Rubber Tire Transit Alternatives

Transit Alternatives	Screened - Level 1 Screening	Screened - Level 2 Screening	Screened - Level 3 Screening	Retained for Draft PEIS
Bus/Van in Mixed Traffic		X		
Bus in HOV Lanes			X	
Transitway				
Diesel Bus - Both			X	
Diesel Bus - Both/BRT			X	
Dual Mode Bus (Diesel/Electric) - Peak			X	
Dual Mode Bus (Diesel/Electric) - Both/BRT			X	
Electric Bus - Both		X		
Guideway				
Diesel Bus - Peak (Single)			X	
Diesel Bus - Both (mp 205-260)				●
Diesel Bus - Both/BRT			X	
Dual Mode Bus (Diesel/Electric) - Peak			X	
Dual Mode Bus - Both (mp 205-260)				●
Dual Mode Bus (Diesel/Electric) - Both/BRT			X	
Electric Bus - Both		X		
Electric Bus - BRT		X		

Highway Alternatives

I-70 - Highway Options by Segment

Highway Alternatives	Screened - Level 1 Screening	Screened - Level 2 Screening	Screened - Level 3 Screening	Retained for Draft PEIS
1) EAGLE-VAIL TO VAIL WEST (mp 169-173)				
6-Lane Highway - I-70 Alignment				●
New Tunnel - Dowd Canyon to Accommodate 65 mph Design Speeds				●
2) EJMT (mp 213.5-215.5)				
Third Tunnel Bore				●
3) EJMT TO SILVER PLUME (mp 215.5-226)				
Horizontal Widening - 12' Shoulder		X		
6-Lane Horizontal Widening - Variable Shoulder (8'-10')				●
Reversible/HOV/HOT Lanes				●
Flex Lanes		X		
Silver Plume Tunnel		X		
Smart Widening		X		
4) SILVER PLUME TO GEORGETOWN (mp 226-228)				
Horizontal Widening - 12' Shoulder		X		
6-Lane Horizontal Widening - Variable Shoulder (8'-10')				●
Structured Lanes			X	
Reversible/HOV/HOT Lanes				●
Flex Lanes		X		
Smart Widening		X		
5) GEORGETOWN TO EMPIRE JUNCTION (mp 228-232)				
Horizontal Widening - 12' Shoulder		X		
6-Lane Horizontal Widening - Variable Shoulder (8'-10')				●
Reversible/HOV/HOT Lanes				●
Flex Lanes		X		
Smart Widening		X		
6) EMPIRE JUNCTION TO WEST IDAHO SPRINGS (mp 232-239)				
Horizontal Widening - 12' Shoulder		X		
6-Lane Horizontal Widening - Variable Shoulder (8'-10')				●
Structured Lanes			X	
Movable Median			X	
Reversible/HOV/HOT Lanes				●
Flex Lanes		X		
Smart Widening		X		
7) WEST IDAHO SPRINGS TO EAST IDAHO SPRINGS (mp 239-241)				
Horizontal Widening - 12' Shoulder		X		
6-Lane Horizontal Widening - Variable Shoulder (8'-10')			X	
Structured Lanes				●
Movable Median			X	
Reversible/HOV/HOT Lanes				●
Flex Lanes		X		
Parallel Routes		X		
Smart Widening		X		
Tunneled Lanes		X		

KEY TO ABBREVIATIONS
mp - Milepost
HOT - High Occupancy Toll Lanes
HOV - High Occupancy Vehicle Lanes

Figure 2-2. Screening Results

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Highway Alternatives

Highway Alternatives	Screened - Level 1 Screening	Screened - Level 2 Screening	Screened - Level 3 Screening	Retained for Draft PEIS
8) EAST IDAHO SPRINGS TO TWIN TUNNELS (mp 241-242)				
Horizontal Widening - 12' Shoulder		X		
6-Lane Horizontal Widening - Variable Shoulder (8'-10')				●
Structured Lanes			X	
Movable Median			X	
Reversible/HOV/HOT Lanes				●
Flex Lanes		X		
Parallel Routes		X		
Smart Widening		X		
9) TWIN TUNNELS (mp 242)				
Third Tunnel Bore				●
10) TWIN TUNNELS TO US 6 (mp 242-244)				
Horizontal Widening - 12' Shoulder		X		
6-Lane Horizontal Widening - Variable Shoulder (8'-10')				●
Structured Lanes			X	
Movable Median			X	
Reversible/HOV/HOT Lanes				●
Flex Lanes		X		
Parallel Routes		X		
New Tunnel - WB Hidden Valley to Twin Tunnels to Accommodate 65 mph Design Speeds				●
Smart Widening		X		
11) US 6 TO FLOYD HILL (mp 244-247)				
Horizontal Widening - 12' Shoulder		X		
6-Lane Horizontal Widening - Variable Shoulder (8'-10')				●
Structured			X	
Movable Median			X	
Reversible/HOV/HOT Lanes				●
Flex Lanes		X		
New Tunnel - EB Floyd Hill to Accommodate 65 mph Design Speeds				●
Smart Widening		X		

Combination Alternatives

Combination Alternatives	Screened - Level 1 Screening	Screened - Level 2 Screening	Screened - Level 3 Screening	Retained for Draft PEIS
6-Lane Highway with Rail and IMC (mp 142-260)				●
6-Lane Highway with AGS (mp 142-260)				●
6-Lane Highway with Diesel Bus in Guideway (mp 169-173 and 205-260)				●
6-Lane Highway with Dual-Mode Bus in Guideway (mp 169-173 and 205-260)				●

Alternate Routes

Alternate Routes	Screened - Level 1 Screening	Screened - Level 2 Screening	Screened - Level 3 Screening	Retained for Draft PEIS
Fort Collins to Wolcott via Walden (SH 14 and SH 131)	X			
Fort Collins to Wolcott via Kremmling (US 34)	X			
Fort Collins to Copper Mountain via Kremmling (US 34 and SH 9)	X			
Denver to Wolcott via Moffat Tunnel (SH 72, US 40, and US 34)	X			
Denver to Copper Mountain via Moffat, Berthoud and Jones Pass Tunnels (SH 72 and SH 9)	X			
Denver to Wolcott via Berthoud Pass Tunnel (US 40 and US 34)	X			
Denver to Copper Mountain via Jones Pass Tunnel (SH 9)	X			
Denver to Copper Mountain via Hoosier Pass (surface)(US 285 and SH 9)	X			
Denver to Copper Mountain via Georgia Pass Tunnel (US 285)		X		
Denver to Minturn via Buena Vista (US 285 and US 24)	X			
Colorado Springs to Copper Mountain via Hoosier Pass (surface) (US 24 and SH 9)	X			
Colorado Springs to Copper Mountain via Hoosier Pass Tunnel (US 24 and SH 9)	X			
Colorado Springs to Minturn via Buena Vista (US 24)	X			
Colorado Springs to Copper Mountain via Buena Vista (US 24 and SH 91)	X			
Pueblo to Copper Mountain via Hoosier Pass (surface)(US 50 and SH 9)	X			
Pueblo to Copper Mountain via Hoosier Pass Tunnel (US 50 and SH 9)	X			
Golden to Winter Park via New Tunnel Parallel to Moffat Tunnel (SH 58, SH 93, and SH 72)		X		

Tunnel Options

Tunnel Options	Screened - Level 1 Screening	Screened - Level 2 Screening	Screened - Level 3 Screening	Retained for Draft PEIS
NEW PROPOSED TUNNELS				
Dowd Canyon Tunnel				●
Silverthorne Tunnel		X		
Silverthorne to Empire Tunnel		X		
Loveland Pass Tunnel		X		
Silver Plume Tunnels				
Silver Plume - North Tunnel		X		
Georgetown Incline Tunnel - FGT		X		
Georgetown Incline Tunnel - Highway		X		
Twin Tunnels to Hidden Valley				●
Hidden Valley to Floyd Hill				●
THIRD BORES AT EXISTING TUNNELS				
EJMT				●
Twin Tunnels				●

Figure 2-2. Screening Results

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2.2 Description of Alternatives and Operations

The alternative descriptions provide a profile of project alternatives, including the No Action alternative. This information is to be used in conjunction with the comparison of alternatives provided in section 2.3, which explores the impacts on environmental sensitivity and community values associated with the implementation of each alternative, and highlights differences between alternatives through a resource-by-resource comparison. Section 2.3 also includes a comparison of alternatives based on mobility, safety, and cost.

The following alternative descriptions include:

Alternative Overview	Physical Description
	Footprint
	Ability to meet need
	Implementation
	Safety
	Alternative Corridor Map and Alignment
Cross Sections	Alternative Cross Section Illustrations
	Tunnel Configurations
Operations Description	Characteristics
	Plan

Alternative Overviews provide alternative termini and highlight important features of the alternative. The alternative overviews include descriptions of the **footprint** and provide the total transportation corridor width for each alternative. It is important to note that the "total transportation corridor width" includes the existing highway in addition to improvements associated with alternatives. The description of each alternative's **ability to meet project need** focuses on the ability to accommodate future 2025 travel demand. The description of alternative **implementation** provides total estimated capital cost, cost-effectiveness, and construction difficulty. The discussion of **safety** addresses the number of high-accident areas for each alternative and the overall fatality rates associated with alternative modes of transportation. **Alternative termini** are illustrated on each overview sheet along with a graphic of the diagrammatic alignment features, which indicate the alternative's alignment in context to existing I-70.

Alternative Cross Sections illustrate the proposed template width in relation to the existing highway template. These provide an elevation view of sections and are organized into Transit, Highway, Combination, and Preservation alternatives. Dimensions are provided for each alternative, showing the overall transportation corridor width, and the lane, shoulder, and paved ditch widths. Tunnel configurations detail and illustrate the location and layout of the tunnels.

Operations Descriptions present the characteristics for Highway and Transit alternatives, as well as the operating issues relating to proposed tunnels. In addition, a discussion of operating plans for the Transit alternatives is provided.

An alternatives alignment features figure provides additional pertinent information related to the configuration of project alternatives. Figure 2-3, Alternative Alignment Features, provides a plan view orientation of each alternative. This figure provides the alignment of project alternatives in relationship to existing eastbound and westbound highway lanes. This figure also illustrates where alternatives are on grade or elevated on structures, and the location of third tunnel bores and new tunnel bores.

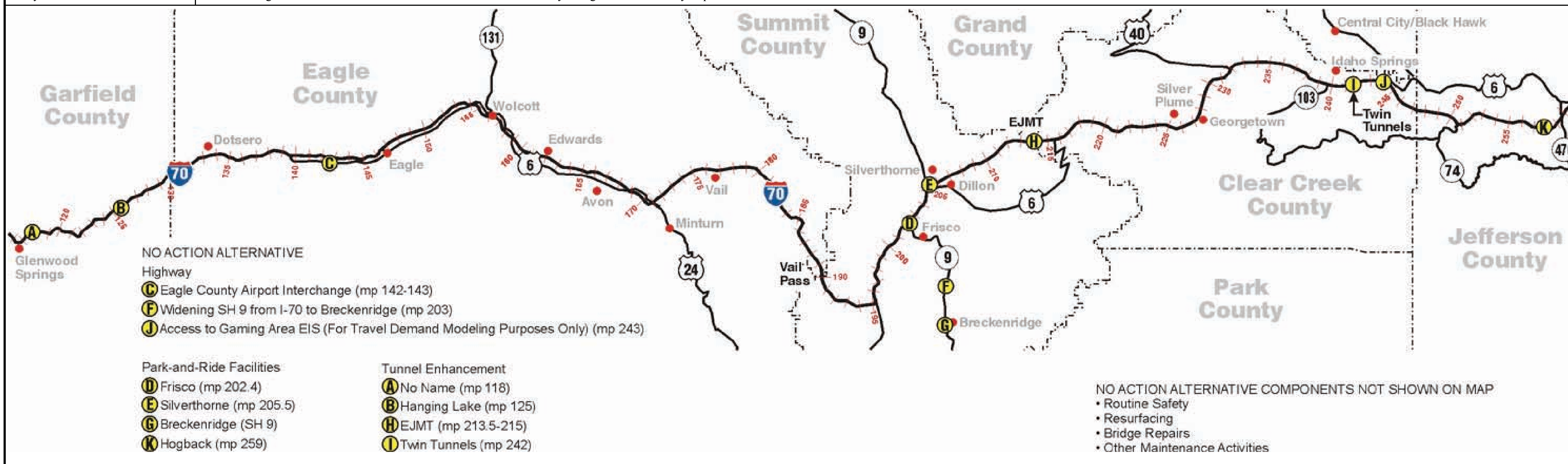
Project alternatives described and illustrated in the following section include:

- No Action
- Minimal Action
- Rail with IMC
- AGS
- Diesel Bus in Guideway
- Dual-Mode Bus in Guideway
- Six-Lane Highway 55 mph
- Six-Lane Highway 65 mph
- Reversible/HOV/HOT Lanes
- Combination Six-Lane Highway with Rail and IMC
    - Build Transit with Highway Preservation
    - Build Highway with Transit Preservation
- Combination Six-Lane Highway with AGS
    - 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

No Action Alternative Overview

Physical Description	The No Action alternative would consist of projects on the existing network. This would include ongoing highway maintenance and any other projects that have a committed source of funding within the 20-year plan, including the Eagle County Airport interchange, SH 9, gaming area access, and the Hogback parking facility. The highway components assumed under the No Action alternative are illustrated in the figure below. Corridor-wide maintenance would include safety and signage improvements, bridge reconstruction and replacement, road resurfacing, rockfall mitigation, tunnel enhancement projects, sediment control, and routine maintenance.
	• **Ongoing highway maintenance.** Corridor-wide maintenance would include safety and signage improvements, bridge reconstruction and replacement, road resurfacing, rockfall mitigation, tunnel enhancement projects, sediment control, and routine maintenance.
	• **Access to the gaming (gambling) area of Gilpin County.** This access assumes two new connections to the gaming areas via I-70, both within Clear Creek County:
	  • **Black Hawk Tunnel.** A new tunnel connection to I-70 at US 6 is assumed for travel demand modeling purposes. A *Gaming Area Access Draft Environmental Impact Statement* (EIS) with improvements to SH 119 to Black Hawk and Central City is under development.
	  • **Central City Parkway.** A new roadway connection at the existing Hidden Valley interchange. It has been under construction since 2003 and is expected to be completed in 2004/05.
	Due to increased access to gaming, the No Action alternative would not adequately address safety and congestion when combined with 2025 projections. There is currently a lack of continuity for local residents and emergency services access between Floyd Hill and the Hidden Valley interchange. Topography makes the development of local access difficult through this portion of Clear Creek Canyon. Under the No Action alternative, continuity of the frontage road and access for emergency response service may become more difficult due to the increased traffic volume to I-70 due to gaming access combined with projected 2025 traffic. The issue of Emergency Response access as it would relate to gaming access is being examined under the *Gaming Area Access EIS*, with consultation between Central City, Black Hawk, Clear Creek County, and CDOT. Depending on the outcome of the I-70 PEIS, options of a frontage road could be examined as a part of the I-70 Tier 2 process.
	• **Hogback parking facility.** Additional capacity for rideshare opportunities would be provided at the Morrison exit (milepost 259) through expansion of existing facilities. The existing Hogback parking facility in Jefferson County is an important strategic site and supports the MIS vision to maximize the utility of I-70 without major capacity changes. This carpool lot is highly utilized and is well recognized as a strategic location for ridesharing. Two of the four existing parking lots located at the I-70/US 40/SH 26-interchange area will be redeveloped, increasing parking from approximately 500 to approximately 1,000 spaces with the option of increasing the spaces further to 1,400 if necessary. An environmental assessment and a design have been completed. This project awaits construction funding.
	• **Eagle County Airport interchange.** Direct access between Eagle County Airport and I-70 is intended to provide a direct link between I-70 and the airport and bypass the population centers of Eagle and Gypsum. Increases in airport passengers, especially for winter recreation and appreciable increases in area population, necessitate this link. Projections of traffic volumes to 2025 indicate that without the direct access to the Eagle County Airport, severe traffic congestion will occur on local road systems. This project has been evaluated under an environmental assessment.
	• **SH 9 - Frisco to Breckenridge.** Upgrading SH 9 to four lanes is the selected alternative as approved in the project's Record of Decision released in 2004. The first project, which involves a new roundabout at SH 9 and Park Avenue, is intended to be under construction in 2004.
	The US 6 frontage road system in Eagle County is also being studied independently of the I-70 PEIS. Study results have determined that capacity improvements on US 6 are warranted to meet future travel needs (unfunded).

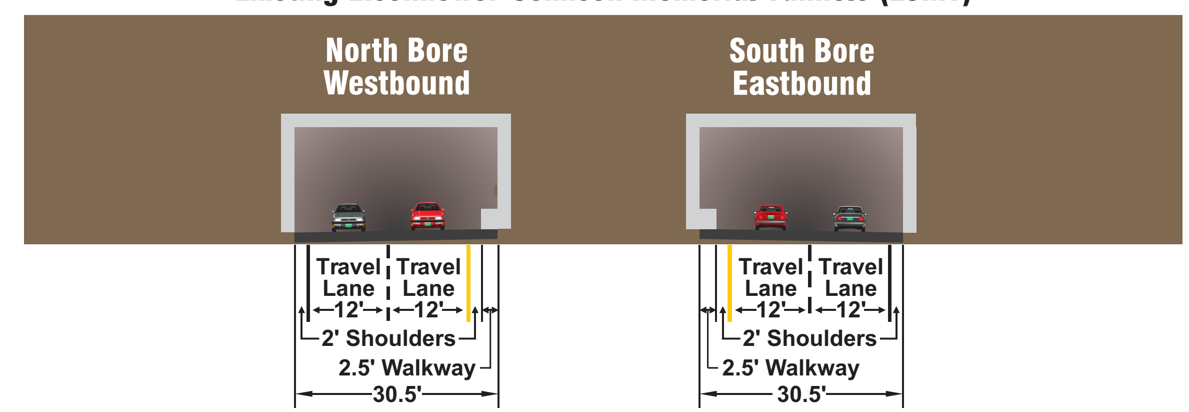
Footprint	Footprints would be the same as the current conditions except at areas where approved projects would take place. The Corridor length would extend between Glenwood Springs and C-470, a total of 144 miles.
Ability to meet project need	The No Action alternative would not have the capacity to accommodate the 2025 projected travel demand or relieve congestion and, therefore, would not meet the underlying need for the project. The No Action alternative would not accommodate baseline travel demand (-4%), and would reach the ultimate network capacity by 2010 under trend assumptions, or 2020 under the optimistic assumptions (see section 2.3 for description of trend and optimistic assumptions).
Implementation	Project Specific
Safety	Number of high accident areas addressed = none. Greatest overall fatality rating because no safety improvements would be made.



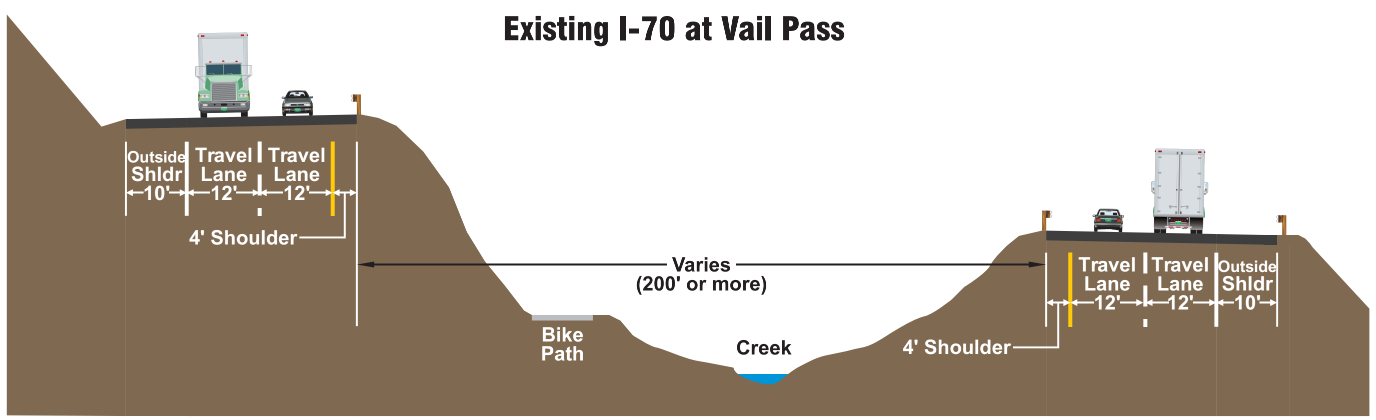
No Action - Cross Sections

The No Action alternative, which mostly represents the existing condition, would be highly variable in lane configuration, profile, and section layout. The cross section would vary from a very wide median containing a creek and bike path near Vail Pass to a barrier median in Idaho Springs. Through most of the Corridor, the eastbound and westbound directions would be at the same elevation, but through select areas there would be a split profile. Vail Pass has a split profile although it is not as noticeable because of the very large median. From the east portal of the Twin Tunnels to the US 6 interchange at the base of Floyd Hill, there is a split profile with elevation differences ranging from 1 to 5 feet. A more extreme split profile exists through Mount Vernon Canyon from approximately milepost 252 to milepost 258. Here eastbound and westbound are vertically split by nearly 30 feet and an almost vertical slope between inside shoulders. Adding to this complicated area is US 40 to the north, which is separated from westbound I-70 by a similar 30-foot vertical, and near-vertical slope. The existing Twin Tunnels is currently a bottleneck because it has virtually no shoulders, making drivers slow down. In addition, there are curves with a design speed below 55 mph from the east portals of the Twin Tunnels to the US 6 interchange, and in the area of Fall River Road. Additionally, grades over 6 percent exist on Vail Pass, along Straight Creek between Silverthorne and the West Portal of the EJMT, as well as on Floyd Hill. On the relatively long stretch between the Hogback (milepost 259) and Hyland Hills (milepost 247), the grades are not as severe but are still close to 6 percent.

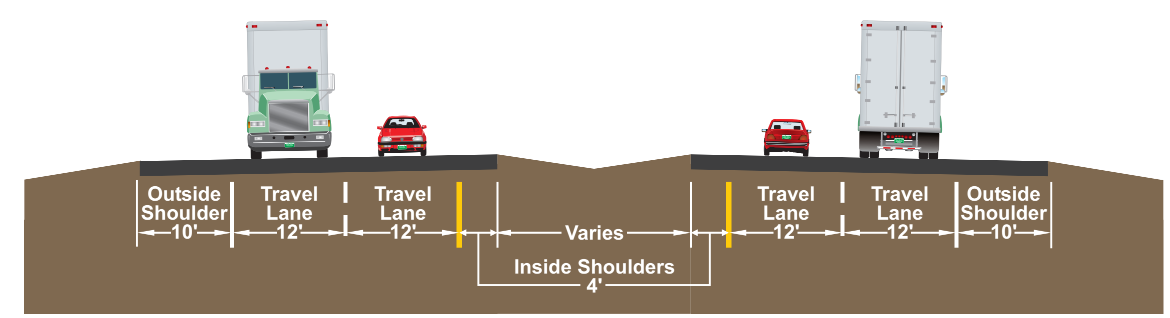
Existing Eisenhower-Johnson Memorial Tunnels (EJMT)



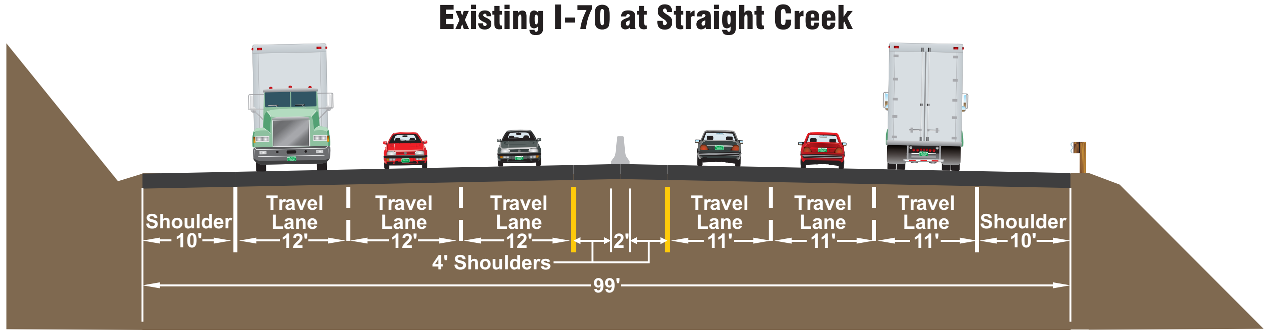
Existing I-70 at Vail Pass



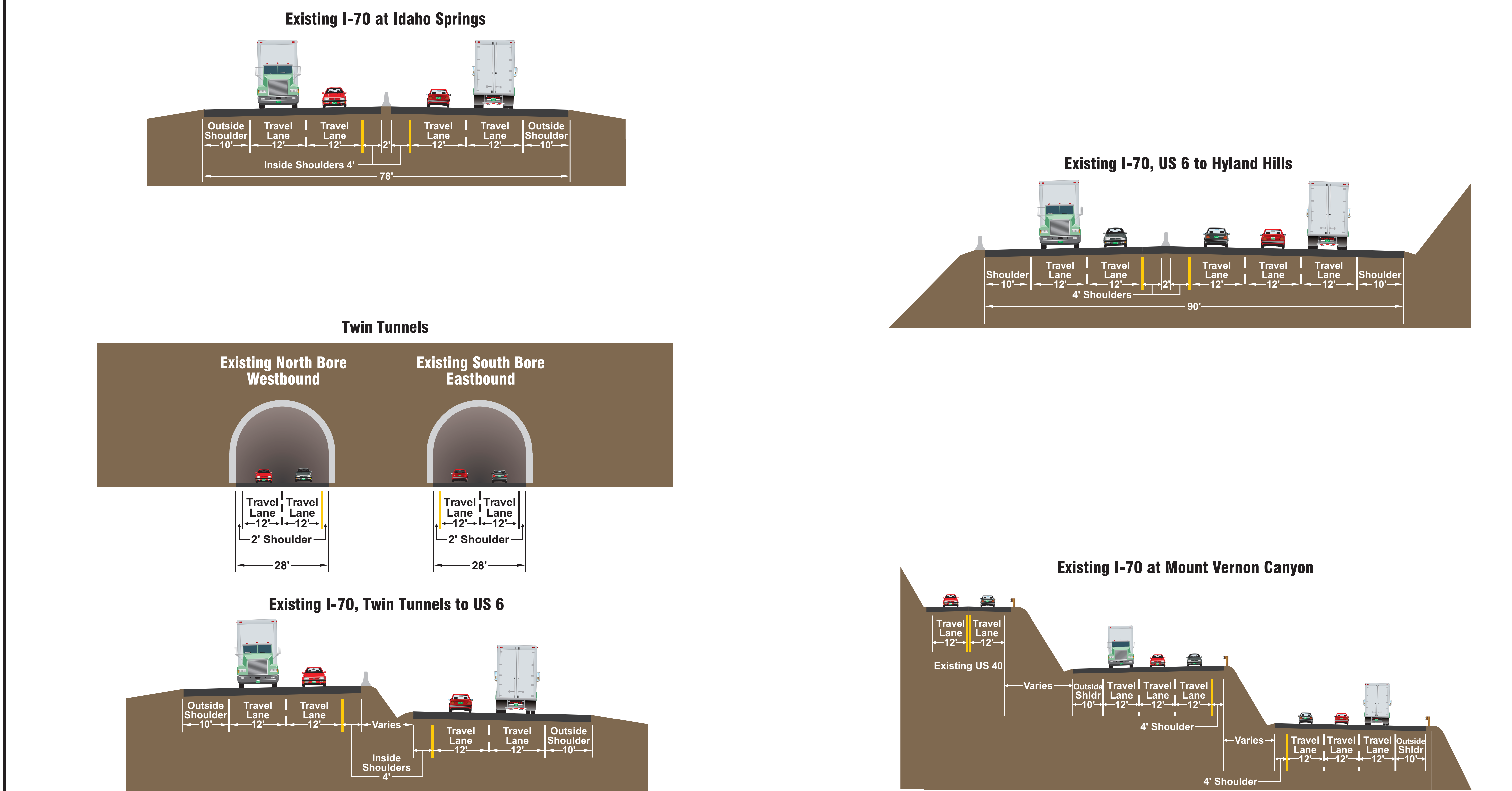
Existing I-70, EJMT to Fall River



Existing I-70 at Straight Creek



No Action - Cross Sections



No Action - Operations Description

Characteristics:

Day-to-day activities of a highway department may include:

- Removing trash
- Providing information through variable message signs (VMS)
- Ensuring that tunnels and roadways operate safely
- Detecting and removing incidents/breakdowns
- Responding to extreme weather conditions that might affect highway operations

Longer-term maintenance activities include:

- Inspection and upkeep of the physical infrastructure
- Activities to minimize impacts of the highway on the surrounding environment

CDOT maintenance procedures address:

- Snow and ice control
- Roadway surface
- Roadside facilities
- Roadside appearance
- Tunnels

These procedures are intended to provide safe travel conditions, maintain transportation system structures, and provide water quality controls such as erosion prevention and drainage structure upkeep.

Various transit modes and services currently operate in the I-70 Corridor. Some transit providers target specific trip-making niches, while others serve a broader customer base. These transit operators may be generally described as follows:

- Local public transit agencies such as:
  - The Roaring Fork Transportation Authority (RFTA)
  - The Eagle County Regional Transportation Authority (ECO Transit)
  - Summit Stage
  - Avon/Beaver Creek Transit
  - The Town of Breckenridge
  - The Town of Vail
  - Lift shuttle in Winter Park
  - RTD regional service
- Private shuttle vans and charter vans from DIA
- Intercity Greyhound buses and Amtrak trains
- Private buses to the Gaming Area
- Charter buses
- Ski Train

In Colorado, snow and ice control for travel safety is one of the highest priorities of all the maintenance activities. Existing winter maintenance practices include the following:

- Snow is moved as far away from the highway template as possible in the high elevation areas of the Corridor.
- Once the snow is plowed to the shoulder during the initial snowstorm, it is later moved further off the shoulder using heavy equipment such as loaders or bulldozers.
- Snow blowers are occasionally used to remove excess snow.
- Liquid deicers are used to reduce the quantity of salt/sand mixture used.

CDOT uses various products and techniques for the most effective treatment of snow, slush, ice, and black ice. Products used include sand, salt, a sand/salt mixture, and various liquid anti-icers and deicers. Most of the liquid anti-icers and deicers are mineral salt compounds in liquid form, such as magnesium chloride, that lower the freezing point of the moisture on the roadways.

Plan:

- The No Action alternative assumes that existing operators would continue to be responsive to passenger demands. Some expansion of fleets would be expected, but no major capital improvements would be considered.
- Existing operators may try to cooperate more closely in the future. For example, ECO Transit has expressed interest in expanding its routes to connect with RFTA and Summit Stage. The No Action alternative assumes a new route from Vail to Glenwood Springs, which would allow connections with RFTA Valley and Grand Hogback (Rifle to Glenwood Springs) services.

Minimal Action Alternative Overview

Physical Description	The Minimal Action alternative would provide a diverse range of limited transportation improvements along the Corridor. These would include (1) a transportation management program that includes Travel Demand Management (TDM), Transportation System Management (TSM), and Intelligent Transportation Systems (ITS); (2) interchange modifications; (3) auxiliary lanes for slow-moving vehicles; (4) curve safety modifications; (5) sediment control programs; and (6) high-frequency bus service in mixed traffic. All or portions of this alternative would be added to other action alternatives.
Footprint	This alternative would expand the I-70 footprint primarily from the auxiliary lanes and curve safety modifications shown on the map below. Auxiliary lanes would increase the width of the eastbound or westbound lanes with one additional 12-foot lane. The interchange modifications would vary greatly among locations. The modifications would mitigate interchange-related problems and range from extension of the existing ramps to complete interchange reconstruction. Complete interchange reconstruction may also alter the I-70 footprint.
Ability to meet project need	Because traffic congestion in Clear Creek County principally occurs because of the movement of people between the Denver metropolitan area and Summit, Eagle, and Grand counties, any alternative that does not increase capacity or reduce auto use would not relieve congestion and would not meet the underlying need for the project. An approximate 65 percent (of person trips) increase in travel demand is expected in Clear Creek County under the Baseline scenario. The bus element of this alternative is not expected to carry more than approximately 4 percent of travelers during the peak hours. Under these congested hours, buses would not be able to go any faster than autos and, therefore, may not attract the desired ridership because of the congestion. Local transit agencies exist in Eagle and Summit counties, but not in Clear Creek County. As described in detail in section 2.2.1 and Appendix B, Transportation Analysis and Data, it was determined that the Minimal Action alternative would not adequately address the purpose and need. However, many of these components have been included with other action alternatives. The Minimal Action alternative would not accommodate baseline travel demand (-2%), and would reach the ultimate network capacity by 2015 under trend assumptions, or 2025 under the optimistic assumptions (see section 2.3 for description of trend and optimistic assumptions).
Implementation	Total estimated capital costs (total of all Minimal Action components) = $1.31 billion Among the least cost-effective (annualized capital cost plus annual O&M cost less annual farebox receipts per annual person mile of travel beyond that of No Action) alternatives = $1.45 per person mile. Construction difficulty (construction duration and impact) = least impact. Construction activities would be dispersed along the Corridor and would be implemented based on the priority established for interchanges, auxiliary lanes, and curve safety modifications. Transportation management, aviation operation, sediment control, and bus service programs are largely non-construction alternatives. As a result, implementation of Minimal Action components would result in localized disruption of Corridor communities and the traveling public. Summary = lowest-cost action alternative. Would improve safety but would result in only localized congestion relief and a moderate amount of traffic suppression.
Safety	Number of high accident areas addressed = intermediate number (Wolcott curve, Vail Pass, Silverthorne interchange, plus partial improvements in Dowd Canyon, east of the EJMT, and at the base of Floyd Hill). Intermediate fatality rating – more fatalities per 100 million person miles than the Transit and Combination alternatives, and fewer than the Highway alternatives.

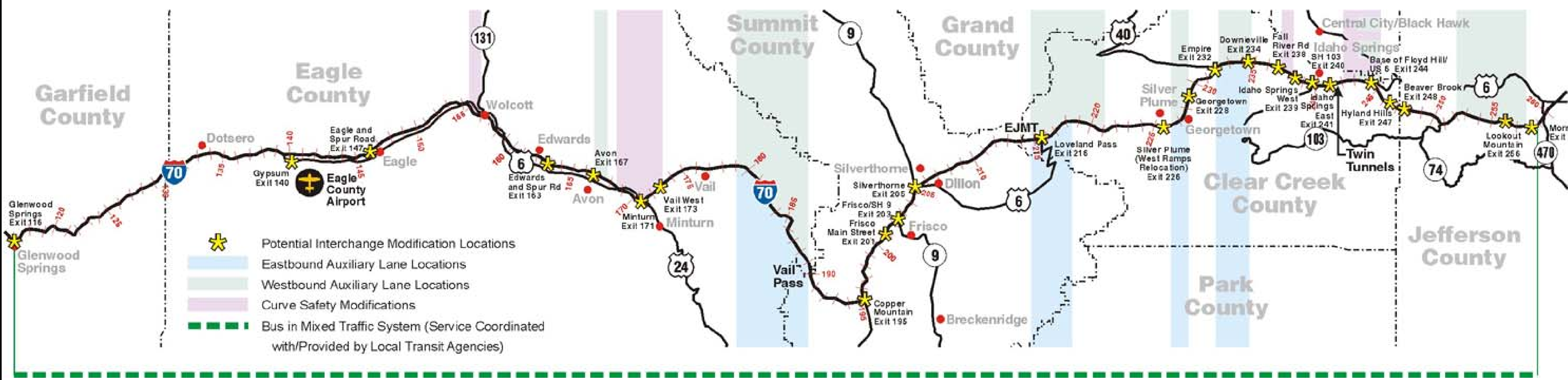


Table 2-4. Minimal Action Components Associated with each Build Alternative

				Transit Alternatives				Highway Alternatives			Combination Transit/Highway Alternatives											
			1	2	3	4	5	6	7	8	9			10			11			12		
			Minimal Action Alternative	Rail with IMC	Advanced Guideway System	Dual-Mode Bus in Guideway	Diesel Bus in Guideway	6-Lane Highway 55 mph	6-Lane Highway 65 mph	Reversible/ HOV/HOT Lanes	6-Lane Highway with Rail and IMC			6-Lane Highway with AGS			6-Lane Highway with Dual-Mode Bus in Guideway			6-Lane Highway with Diesel Bus in Guideway		
											9-Combination Build Simultaneously	*9a-Transit with Highway Preservation*	*9b-Highway with Transit Preservation*	*10-Combination Build Simultaneously*	*10a-Transit with Highway Preservation*	*10b-Highway with Transit Preservation*	*11-Combination Build Simultaneously*	*11a-Transit with Highway Preservation*	*11b-Highway with Transit Preservation*	*12-Combination Build Simultaneously*	*12a-Transit with Highway Preservation*	*12b-Highway with Transit Preservation*
	Base Cost of Mainline Alternative (Billions)		**See Total**	**$4.38**	**$5.62**	**$2.94**	**$2.73**	**$1.74**	**$1.98**	**$1.85**	**$5.83**	**$5.62**	**$2.36**	**$7.97**	**$7.79**	**$2.20**	**$3.71**	**$3.48**	**$2.24**	**$3.50**	**$3.27**	**$2.24**
	Location	**MA Cost (Millions)**																				
Minimal Action Components – Interchange	Glenwood Springs (mp 116)	$15	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Gypsum (mp 140)	$2	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Eagle & Spur Road (mp 147)	$10	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Edwards & Spur Road (mp 163)	$14	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Avon (mp 167)	$4	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Minturn (mp 171)	$15	■	■	■	■	■	□	□	□	□	■	□	□	■	□	□	■	□	□	■	□
	Vail West (mp 173) / Simba Run	$5	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Copper Mountain (mp 195)	$2	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Frisco / Main St. (mp 201)	$2	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Frisco / SH 9 (mp 203)	$10	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Silverthorne (mp 205)	$15	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Loveland Pass (mp 216)	$2	■	■	■	■	■	□	□	□	□	■	□	□	■	□	□	■	□	□	■	□
	Silver Plume (mp 226)	$4	■	■	■	■	■	□	□	□	□	■	□	□	■	□	□	■	□	□	■	□
	Georgetown (mp 228)	$8	■	■	■	■	■	□	□	□	□	■	□	□	■	□	□	■	□	□	■	□
	Empire (mp 232)	$1	■	■	■	■	■	□	□	□	□	■	□	□	■	□	□	■	□	□	■	□
	Downieville (mp 234)	$2	■	■	■	■	■	□	□	□	□	■	□	□	■	□	□	■	□	□	■	□
	Fall River Road (mp 238)	$4	■	■	■	■	■	□	□	□	□	■	□	□	■	□	□	■	□	□	■	□
	Idaho Springs West (mp 239)	$4	■	■	■	■	■	□	□	□	□	■	□	□	■	□	□	■	□	□	■	□
	Idaho Springs / SH 103 (mp 240)	$6	■	■	■	■	■	□	□	□	□	■	□	□	■	□	□	■	□	□	■	□
	Idaho Springs East (mp 241)	$5	■	■	■	■	■	□	□	□	□	■	□	□	■	□	□	■	□	□	■	□
	Base of Floyd Hill / US 6 (mp 244)	$10	■	■	■	■	■	□	□	□	□	■	□	□	■	□	□	■	□	□	■	□
	Hyland Hills / Beaver Brook (mp 247 / mp 248)	$2	■	■	■	■	■	□	□	□	□	■	□	□	■	□	□	■	□	□	■	□
	Lookout Mountain (mp 256)	$10	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Morrison (mp 259)	$1	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Curve Safety	West of Wolcott (mp 155-156)	$18	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Dowd Canyon (mp 170-173)	$245	■					□	*	□	□		□	□		□	□		□	□		□
	Fall River Road (mp 237-238)	$10	■	■	■	■	■	□	□	□	□	■	□	□	■	□	□	■	□	□	■	□
	East of Twin Tunnels (mp 242-245)	$137	■	■	■	■	■	□	□	□	□	■	□	□	■	□	□	■	□	□	■	□
Auxiliary Lane	Avon to Post, Uphill (EB) (mp 167-168)	$3	■					■	■	■	■		■	■		■	■		■	■		■
	West side of Vail Pass, Downhill (WB) (mp 180-190)	$135	■					■	■	■	■		■	■		■	■		■	■		■
	West side of Vail Pass, Uphill (EB) (mp 180-190)	$135	■					■	■	■	■		■	■		■	■		■	■		■
	EJMT to Herman Gulch, Downhill (EB) (mp 215-218)	$5	■	■	■	■	■					■			■			■			■	
	Bakerville to EJMT, Uphill (WB) (mp 215-221)	$9	■																			
	Georgetown to Silver Plume, Uphill (WB) (mp 226-228)	$6	■																			
	Silver Plume to Georgetown, Downhill (EB) (mp 226-228)	$6	■																			
	Downieville to Empire, Uphill (WB) (mp 232-234)	$17	■	■	■	■	■					■			■			■			■	
	Empire To Downieville, Downhill (EB) (mp 232-234)	$17	■																			
	Black Hawk Tunnel Off-ramp to Hidden Valley Off-ramp (WB) (mp 244-243)	$20	■																			
	Morrison to Chief Hosa, Uphill (WB) (mp 253-259)	$100	■					■	■	■	■		■	■		■	■		■	■		■
	Transportation Management	$104	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Misc.	Other items in the Corridor	$64	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Idaho Springs East to Hidden Valley (improve existing frontage road)	$4	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Buses in Mixed Traffic	$100	■																			
	Black Gore Creek Sediment Control	$20	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Total cost of Minimal Action Components (Billions)		**$1.30**	**$0.53**	**$0.53**	**$0.53**	**$0.53**	**$0.67**	**$0.67**	**$0.67**	**$0.67**	**$0.53**	**$0.67**	**$0.67**	**$0.53**	**$0.67**	**$0.67**	**$0.53**	**$0.67**	**$0.67**	**$0.53**	**$0.67**
	Total cost of Alternative with Minimal Action Components (Billions)		**$1.30**	**$4.91**	**$6.15**	**$3.47**	**$3.26**	**$2.41**	**$2.65**	**$2.52**	**$6.50**	**$6.15**	**$3.03**	**$8.64**	**$8.32**	**$2.87**	**$4.38**	**$4.01**	**$2.91**	**$4.17**	**$3.80**	**$2.91**

■ Alternative includes this Minimal Action Component

(blank) Alternative doesn't include this Minimal Action Component

□ Alternative includes this Minimal Action Component as part of the Base Cost

* Tunnel at Dowd Canyon achieves minimal action component of curve smoothing

Minimal Action (Bus in Mixed Traffic Component) - Operations Description

Characteristics:

The Bus in Mixed Traffic routes would generally consist of express services with at most one intermediate stop. Five new routes are assumed, which would serve recreational destinations also served by private shuttle vans from DIA.

- Route A: Jefferson Station to Keystone, with a stop at the Silverthorne Station
- Route B: Jefferson Station to Breckenridge, also stopping at the Frisco Station
- Route C: Jefferson Station to Copper Mountain
- Route D: Jefferson Station to Vail Transportation Center, with a stop in Idaho Springs
- Route E: Jefferson Station to Winter Park, serving a stop at the transportation center in the Town of Winter Park and a stop at the base of the ski lifts

If an I-70 transit system is included in the preferred alternative, existing carriers would serve as feeders to the new long-haul system. Local operators may need to buy more or larger buses, increase frequencies, and hire more employees.

Plan:

- The Vail route would have the greatest demand (and therefore, the shortest headway), followed by the Breckenridge route.
- The highest demand would occur on winter weekends, when all routes would operate at 20-minute headways during peak periods.
- Because this alternative would introduce buses between Denver and Vail, some of the ECO routes in the Corridor west of Vail would see increased ridership.
- The new bus routes could take riders away from Summit Stage.

The route structure map follows a convention used by many transit operators, including Breckenridge Free Ride, Copper Mountain Resort, Keystone Resort, RTD, Summit Stage, and Town of Vail Transit. Each route is shown by a uniquely colored line. Stops served by a route are indicated by a white circle (for this map) or other symbol.

The Bus in Mixed Traffic route structure would be oriented as an express service between Corridor destinations and the Front Range hub at Jefferson Station. A passenger from the Front Range would locate his or her destination stop and refer to the corresponding color in the key to determine his or her route.

Travelers may use the Bus in Mixed Traffic between Corridor locations by transferring at Jefferson Station. In this case, the traveler would determine which set of routes to use as above. For example, an IntraWest employee traveling from Copper Mountain to Winter Park would first board the C bus and then change at Jefferson Station to the E bus. However, because of the travel time involved, not many Corridor travelers are expected to make transfers on the Bus in Mixed Traffic system.

Bus in Mixed Traffic Route Structure

Local Safety and Capacity Improvements Associated with Minimal Action and Other Action Alternatives

Several of the local highway safety and capacity improvements that are included in the Minimal Action alternative would also be combined with the other action alternatives on a selected basis, to improve the performance of the traffic operations of those alternatives and provide a way to make vital localized improvements. These improvements, referred to throughout this PEIS as “Minimal Action components,” include interchange modifications, curve safety modifications, and auxiliary lanes.

Interchanges

As shown on Table 2-4, improvements to 24 interchanges throughout the Corridor are proposed as part of the Minimal Action alternative. Interchange improvements would help address safety issues and improve capacity issues on ramps and local cross streets throughout the Corridor. Traffic on certain interchange off-ramps currently back up into the I-70 mainline during peak hours; this problem is projected to occur at several other interchanges unless improvements are made. This problem is particularly dangerous due to the possible high-speed differential between the mainline through traffic and the exiting traffic.

These improvements would help decrease congestion on not only the I-70 mainline but also the roads that come up to meet with I-70. The nature of the work would vary at the interchanges from minor auxiliary lane extensions, to signalization, to complete reconstruction, with individual cost estimates ranging from $1 million to $15 million. All of the interchanges listed on Table 2-4 would also be improved as part of the Transit, Highway, and Combination alternatives. The difference is that the costs of the interchange improvements within the sections being widened would be included in the base cost of the alternative.

Curve Safety Modifications

As shown on Table 2-4, curve safety modifications are proposed in four locations throughout the Corridor as part of the Minimal Action alternative. Curve safety modifications would include increasing the design speed on mainline curves so that they more closely match with the design speed on adjoining sections of I-70. When a driver goes from a section of I-70 that has had a design speed of 70 mph for the last 10 miles into a curve that has a design speed of 55 mph, this can come as a surprise. This is called “violating driver expectancy.” The data indicate an increased frequency of injury and fatality crashes in these areas. Incident-related congestion can also result, where the temporarily reduced highway capacity can no longer handle the demand.

All alternatives would include curve safety modifications at West of Wolcott. The Minimal Action component of curve safety modification at Dowd Canyon would also be part of the Highway and Combination alternatives. It was not included with the Transit alternatives because the $245 million cost would increase the overall cost of those alternatives, without substantially improving the travel time characteristics. The improvements at Fall River Road, for $10 million, and Twin Tunnels to US 6, for $137 million, would be included with all alternatives, either as a base cost for Highway alternatives or as a Minimal Action component added to the Transit alternatives.

Auxiliary Lanes

As shown on Table 2-4, auxiliary lane improvements are proposed in 11 locations throughout the Corridor as part of the Minimal Action alternative. Auxiliary lanes would increase the capacity of a highway for relatively short lengths. They would be used to increase the capacity of short highway sections that would otherwise act as bottlenecks. An example would be the two lanes westbound from Silverthorne to Frisco. A third lane would be added at the Silverthorne interchange and that lane would become the Frisco/SH 9 off-ramp. This third lane would provide additional capacity up the steep hill. For this study, several auxiliary lanes would be added in the Minimal Action alternative, and several of these would be selectively added with the other action alternatives, based on the amount of traffic operations improvements they would be expected to provide and their cost.

The Transit alternatives would reduce the highway demand by varying amounts. This reduction would help to mitigate the need for some of the auxiliary lanes; only those lanes that provided a good cost-benefit ratio or solved a critical safety problem would be added. The westbound lane from Downieville to Empire Junction was shown in traffic simulation runs to substantially improve travel times. This results from the high volume of truck traffic getting back onto I-70 from the weigh station limits capacity, as does the heavy amount of traffic shifting to the right lane to exit at Empire Junction. A positive attribute of this lane would be that it extends to an interchange, Empire Junction, where a substantial amount of traffic exits I-70. Thus, this local capacity improvement would not simply “push the problem down the road” a few miles.

The Six-Lane Highway (55 mph or 65 mph) alternatives would address congestion problems by adding capacity, rather than reducing traffic demand. This could cause problems in areas outside the sections where widening would be proposed. To help mitigate this, a fourth lane would be included westbound from the Morrison interchange. This lane would continue past the top of the hill at Genesee and connect into the exit-only lane at the Evergreen Parkway. Additionally, a third lane would be included in each direction on the west side of Vail Pass. The eastbound direction would be primarily to help relieve congestion, and the westbound direction would be primarily to improve safety. These auxiliary lanes would extend from the Vail East Entrance interchange to the Shrine Pass interchange.

The Combination alternatives would have Highway and Transit improvements, or they would build one and preserve for the other. The Combination alternatives build simultaneously (both modes) would have the Vail Pass auxiliary lanes, but not the one from Morrison to Chief Hosa; it was decided that the transit systems would reduce the highway demand enough to negate the need for the auxiliary lane. The Transit with Highway preservation alternatives would have the same auxiliary lanes as the Highway-only alternatives. The Highway with Transit preservation alternatives would have the auxiliary lane from Morrison to Chief Hosa, but not the ones on Vail Pass.

Transportation Management

The TSM/TDM/ITS component, with $104 million shown, would cover the ideas that have been studied as part of the Transportation Management family. TSM stands for Transportation System Management and generally includes minor improvements to an existing facility to improve operational efficiency. These ideas generally seek to improve travel conditions by increasing capacity. Promising ideas included as part of the component are ramp metering, enhanced traveler information, enhanced incident management, and a slow-moving vehicle plan. While CDOT is already conducting a certain level of all of these ideas on their highway system, this component would include funding to increase their usage in the Corridor above that which would otherwise be possible.

The slow-moving vehicle plan would provide facilities for commercial truckers, such as rest areas, while including certain restrictions. For this study, slow-moving vehicles are defined as:

- Vehicle, or combination of vehicles, with a gross vehicle weight of 12,001 or more pounds
- Vehicle that is drawing a trailer or semitrailer, regardless of size

This is similar to the vehicle definition in laws restricting left lane use in the states of Utah and Washington. This vehicle definition would allow for straightforward enforcement, although there may be some restricted vehicles with higher performance capabilities than non-restricted vehicles.

These restrictions would probably limit slow-moving vehicles from using the left lane when there are three or more lanes in one direction. Restrictions involving limitations on peak-period usage by slow-moving vehicles during a several-hour period on weekends have been investigated using traffic simulation. Due to the increased capacity provided by the exclusion of these vehicles from the traffic stream, substantial reductions in congestion have been observed. There are, however, serious questions about the legality of time-based restrictions, which could preclude implementation.

TDM stands for Travel Demand Management and generally tries to reduce peak-hour travel demand by modifying travel behavior. Promising ideas included as part of the component are increased provision of park-and-ride facilities, peak spreading incentives and a Corridor parking operations plan. Rideshare parking lots, such as the one at the Morrison interchange, would reduce vehicle trips on I-70 by increasing the occupancy of vehicles. Peak spreading incentives would attempt to encourage travelers that otherwise might have gone during peak periods to go at other time; for example, reduced campground fees for users arriving on Thursday night or staying through Sunday night on peak season non-holiday weekends. A Corridor parking operations plan would look at the supply and cost of parking in the Corridor. In concert with Corridor facility managers, the plan would try to moderate parking demand with disincentives such as fees, while encouraging transit usage from locations where parking was more available. This would reduce the need for expensive new mountain parking facilities while reducing the vehicular travel demand on I-70.

Miscellaneous

Additional local safety improvements that are associated with Minimal Action and other action alternatives would cover a various areas. Except for the bus in mixed traffic component, all would be included with each alternative. The category titled “other items in the Corridor” would include about $45 million dollars for small improvements that are not specifically identified by location. These would include safety improvements, other auxiliary lanes, other interchange upgrades and improvements to existing chaindown areas. The Black Gore Creek Sediment Control component, for $20 million, would provide environmental mitigation funds for improvements that CDOT has committed to making.

The buses in mixed traffic component, for $100 million, would be presented only as part of the Minimal Action alternative. It would provide increased bus service in the Corridor. Unlike the Bus in Guideway alternatives, there would be no new capacity improvements included. The buses in mixed traffic component would not be included with the Transit alternatives because they all would include a more extensive transit system. It would not be included with the Highway or Combination alternatives because it would not provide travel time improvement commensurate with the added cost.

Table 2-5 lists local safety and capacity improvements from the Minimal Action alternative and their benefits.

Table 2-5. Highway Safety and Capacity Improvements – Minimal Action Components Included in Action Alternatives

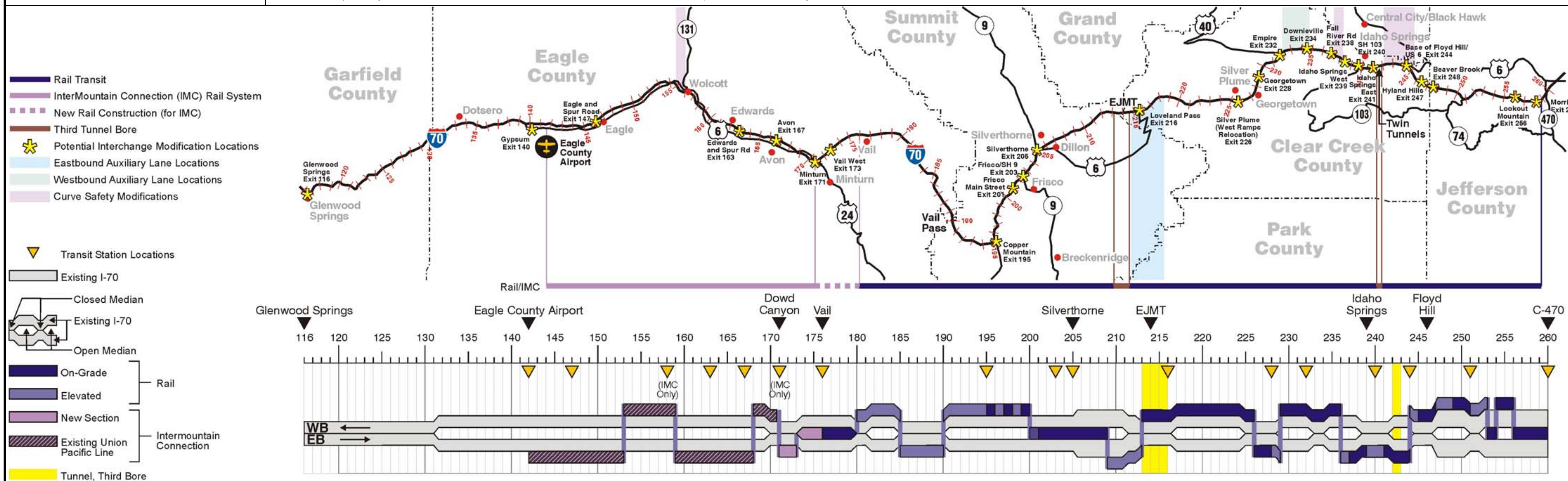
Minimal Action Component	Benefit
Interchanges	
Glenwood Springs (milepost 116): Interchange improvements would constitute the westernmost local safety and capacity improvement.	Improvements to the Glenwood Springs Interchange would involve upgrades to all existing ramps, including widening and lengthening, and signalization of the interchanges on SH 82 at the bottom of the I-70 ramps.
Gypsum (milepost 140): Extensive development in western Eagle County is expected to result in excess travel demand at this currently unsignalized interchange.	This improvement would also provide more storage, to prevent traffic from backing up onto the I-70 mainline.
Eagle and Spur Road (milepost 147): As with the Gypsum interchange, this interchange is expected to see demands increasing with local development.	Improvements would reconstruct the interchange and increase the capacity of the spur road that connects I-70 and US 6.
Edwards and Spur Road (milepost 163): Continued development in Edwards would result in increased congestion at this interchange.	Improvements would reconstruct the interchange and increase the capacity of the spur road that connects I-70 and US 6.
Avon (milepost 167): The westbound off-ramp at Avon is anticipated to have traffic backing up onto the I-70 mainline in the future.	The Avon interchange would be modified to create more capacity for this movement.
Minturn (milepost 171): The Minturn interchange is a partial-cloverleaf on a mainline curve. Tight ramp loops and the curves in the mainline contribute to a substantial accident rate. The eastbound off-ramp also has safety issues resulting from a single approach lane for both the through traffic to Minturn and the traffic turning right to go to Vail.	A separate right turn lane for the eastbound on-ramp traffic would be provided, along with other minor reconstruction elements to improve safety and capacity.
Vail West (milepost 173): The roundabouts at Vail West Entrance carry heavy volumes of both local and regional traffic. As a result, traffic currently backs up onto eastbound I-70. The improvement would primarily involve construction of the “Simba Run” underpass, which would connect the north and south frontage roads between Vail West Entrance and Vail Main Entrance (milepost 176).	This component would relieve local traffic pressures on the interchange roundabouts and would lengthen an inadequate eastbound on-ramp acceleration lane.
Copper Mountain (milepost 195): Unusual geometry and grades contribute to a greater-than-average accident rate at this interchange.	This local improvement would modify this interchange—also known as Wheeler Junction—to provide greater safety and capacity.
Frisco/Main Street (milepost 201): Without improvement, off-ramp traffic at Main Street on the west side of Frisco is expected to back onto the I-70 mainline during peak hours.	This component would replace the current stop signs with traffic signals and provide appropriate turn bays.
Frisco/SH 9 (milepost 203): This improvement would provide a two-lane eastbound on-ramp and acceleration lane up to near the scenic overlook (milepost 202.5 to 203).	This would allow southbound traffic on SH 9 to use both lanes throughout the town of Frisco, which would help to reduce or eliminate queuing at the multiple traffic signals. It would also increase westbound off-ramp ramp storage.
Silverthorne (milepost 205): The interchange with US 6 and SH 9 near Dillon and Silverthorne currently experiences congestion and many accidents on the intersecting highways.	Rebuilding the interchange—likely as a single-point urban interchange (SPUI)—would mitigate congestion and safety issues.
Loveland Pass (milepost 216): This improvement would provide longer acceleration and deceleration lanes at the Loveland Pass interchange.	This would result in greater capacity and safer merging.
Silver Plume (milepost 226): The current westbound ramps at Silver Plume are short and very close to existing development, which produces noise concerns.	For this study, it is assumed that these ramps would be moved to the location about 1 mile to the west where I-70 goes over the frontage road. At this new location, greater ramp capacity could be provided.
Georgetown (milepost 228): Proposed improvements would signalize the ramps, provide turn bays, and build a roundabout at Argentine Street.	Improvements would improve capacity and safety.
Empire (milepost 232): US 40 joins I-70 at a trumpet interchange east of Empire. The I-70 mainline curves at this interchange, and the eastbound ramps have short acceleration and deceleration lanes.	This component would improve safety and capacity by providing longer eastbound acceleration and deceleration lanes.
Downieville (milepost 234): The north side of the Downieville interchange has two unsignalized intersections within about 50 feet of each other, where the crossroad meets up with the westbound ramps and then the frontage road. The intersections have limited capacity and often cause long queues on the frontage road today. Future traffic is expected to back onto the main I-70 roadway.	This component would provide greater ramp and intersection capacity.

Minimal Action Component	Benefit
Fall River Road (milepost 238): Minor ramp modifications would be made. Additionally, a spur road would be constructed over Clear Creek to connect the interchange with the frontage road.	Improvements at the Fall River Road interchange would address both safety and capacity issues. Spur road would remove local traffic from I-70 and improve local access.
Idaho Springs West (milepost 239): Improvements would increase capacity at the intersection of the ramps and the frontage road.	Traffic flow would be improved at ramp intersections.
Idaho Springs/SH 103 (milepost 240): Ramps would be widened and left-turn bays would be provided on the crossroad.	Traffic flow would be improved at ramp intersections. Safety improvements would also be made to protect the heavy pedestrian movements at this location.
Idaho Springs East (milepost 241): This interchange would be rebuilt with sufficiently long acceleration and deceleration lanes.	The two loop off-ramps with 15 mph advisory speeds would be replaced, allowing safer and more efficient movement of local traffic. Currently, heavy eastbound on-ramp volume blocks traffic using the eastbound off-ramp during peak hours.
Base of Floyd Hill/US 6 (milepost 244): This interchange would be rebuilt with right-handed exit and entrance ramps to improve safety.	Reconstruction of the interchange may also result in a safer, higher design speed curve on the I-70 mainline. These improvements would also increase capacity at the interchange.
Hyland Hills and Beaver Brook (mileposts 247 and 248): The Hyland Hills (milepost 247) and Beaver Brook (milepost 248) interchanges would be improved.	Improvements would increase capacity of the ramps and the intersections with local roads (Hyland Hills Road and Bergen Park Road).
Lookout Mountain (milepost 256): This interchange would be rebuilt.	The rebuilt interchange would accommodate future increases in demand.
Morrison (milepost 259): An additional left turn lane would be added at this interchange for eastbound on-ramp traffic.	This would improves performance of intersections under I-70.
Curve Safety Modifications	
West of Wolcott (milepost 155 to 156): The curve west of the Wolcott interchange is posted with advisory speeds as low as 60 mph, when the speed limit on adjacent portions of I-70 is 75 mph. As a result of this violation of driver expectancy, this section has an above-average accident rate.	Curve safety modification improves safety.
Dowd Canyon (milepost 170 to 173): This narrow canyon accommodates the Eagle River, Gore Creek, and I-70. The tight curves here have some of the highest accident rates in the Corridor.	
Fall River Road (milepost 237 to 238): Curve safety modification near Fall River Road would bring this portion of I-70 to the same design speed as surrounding portions.	
East of Twin Tunnels (milepost 242 - 245): The portion of I-70 between the Twin Tunnels (milepost 242) and milepost 245 has several curves with design speeds lower than adjacent portions of the roadway. With the heavy demand here, accidents frequently result.	
Auxiliary Lanes	
Avon to Post Blvd. Eastbound lane (mileposts 167 to 168): I-70 between Avon (milepost 167) and Post Blvd. (milepost 168) is uphill. Traffic merging from the Avon on-ramp has difficulty accelerating on the grade and finding sufficient gaps for merging. Traffic attempting to get from I-70 to the Post Blvd. off-ramp creates a problematic weaving issue.	An auxiliary lane between these two interchanges would increase safety and improve capacity.
West of Vail Pass Eastbound and Westbound (mileposts 180 to 190): An additional lane in both directions would be built between Vail East Entrance (milepost 180) and the Shrine Pass interchange (milepost 190), just east of the Vail Pass summit.	The eastbound auxiliary lane would provide additional capacity by allowing more space for fast-moving vehicles to pass slow-moving vehicles struggling with the steep grades. The westbound lane would primarily be a safety improvement, reducing the likelihood of rear-end collisions with slow-moving vehicles and also providing an increase in roadway capacity. Reducing the frequency of accidents would also reduce the delay associated with clearing the disabled vehicles.

Minimal Action Component	Benefit
EJMT to Herman Gulch Eastbound (mileposts 215 to 218): The eastbound lanes from the EJMT's east portal to Herman Gulch currently experience an above-average accident rate related to narrow shoulders, steep grades, and an unexpected left-lane drop before the Loveland Pass on-ramp merge.	This component would provide three standard, continuous eastbound lanes to address the safety and congestion issues in this portion of I-70.
Bakerville to EJMT Westbound (mileposts 215 to 221): Steep grades westbound from the Bakerville interchange (milepost 221) to the east portal of the EJMT (milepost 215) cause large disparities in speed between vehicles in different weight classes. These differences in speed reduce capacity and make rear-end accidents more likely.	Lane would improve capacity and safety.
Silver Plume to Georgetown Eastbound and Westbound (mileposts 226 to 228): Georgetown Hill has 6 percent grades and a 90-degree curve.	The westbound lane would primarily increase capacity, and the eastbound lane would primarily improve safety.
Empire to Downieville Eastbound and Westbound (mileposts 232 to 234): Auxiliary lanes would be built in both directions between Empire Junction (milepost 232) and Downieville (milepost 234). Westbound, trucks are accelerating as they climb uphill on the ramp from the Downieville Weigh Station. At the same time, vehicles wanting to exit on US 40 begin to move into the right lane. Eastbound, traffic merging from Empire Junction and trucks slowing to exit at the weigh station cause unexpected lane changes, which result in frequent rear-end collisions.	Auxiliary lanes would mitigate safety and capacity issues caused by steep grades.
Black Hawk Tunnel to Hidden Valley Westbound (mileposts 243 to 244): This project adds a third (auxiliary) lane to accommodate expected increases in gaming traffic from the US 6 interchange (milepost 244) to the Hidden Valley interchange (milepost 243), where the future Central City Parkway will be accessed. No improvement is proposed eastbound because ramp metering at Hidden Valley is planned to manage the traffic entering I-70 eastbound.	Lane would accommodate expected increases in gaming traffic from the US 6 interchange to the Hidden Valley interchange.
Morrison to Chief Hosa Westbound (mileposts 253 to 259): A fourth lane westbound would be provided from the Morrison on-ramp (milepost 259) connecting to the existing fourth (auxiliary) lane, which starts at the Chief Hosa interchange (milepost 253) and exits at the Evergreen Parkway exit (milepost 252).	The auxiliary lane would provide additional capacity up this steep section with 6 percent grades and the highest traffic volumes in the Corridor. The low-volume Chief Hosa westbound on-ramp would be rebuilt using a taper configuration.
Other	
Hidden Valley to US 6 Frontage Road: A new two-lane frontage road would be built from the Hidden Valley interchange (milepost 243) to the US 6 interchange (milepost 244). Planning and design would depend on preferred alternative. Frontage road improvements in this area have been deferred until Tier 2.	A new frontage road would improve emergency and local access. The existing bicycle path on the former US 6 right-of-way would be accommodated in the new design.
Idaho Springs East to Hidden Valley Frontage Road: Portions of the existing frontage road would be paved or rebuilt to higher design standards.	An upgraded frontage road would improve emergency and local access under all weather conditions.
TSM/TDM/ITS	TSM improves the operation of the physical roadway infrastructure by means such as ramp metering, incident management, and optimized maintenance activities. TDM increases roadway effectiveness by encouraging traveler behaviors that reduce vehicular demand during peak periods. ITS involves novel applications of electronics and communications technologies to achieve TSM and TDM goals.
Buses in Mixed Traffic	Buses in mixed traffic would provide a Corridor-wide transit option where none currently exists. Such a service would also connect existing operators such as RFTA, ECO Transit, Summit Stage, and RTD
Black Gore Creek Sediment Control (mileposts 180 to 190): This component also affects the western side of Vail Pass and is proposed initially as an environmental mitigation measure.	Having better control of runoff from snowmelt might allow CDOT maintenance crews to use more deicers, thus improving safety.

Rail with IMC Alternative Overview

Physical Description	The Rail with IMC alternative would provide transit service from C-470 to the Eagle County Airport. Access to transit in the Corridor from the Denver metropolitan area would be through a transfer station near C-470. Rail transit would consist of: (1) an on-grade electric facility with elevated sections where needed between Vail and C-470, combined with (2) the Intermountain Connection (IMC), which involves upgrading the existing Union Pacific Railroad (UPRR) track from the Minturn interchange to Eagle County Airport (requires new track from Vail to the Minturn interchange). The electric Rail alignment would be adjacent to I-70, with portions in the median. New tunnel bores would be required at the Twin Tunnels and EJMT.
Footprint	Rail with IMC would use an existing single track from Eagle to Minturn (IMC) and require a new single track (20 feet wide) from Eagle County Airport to Eagle, and from Minturn to Frisco. A double track (34 feet wide) would be required from Frisco to C-470.
Ability to meet project need	The Rail with IMC and AGS alternatives (see below) would have similar demand characteristics because they would have similar station locations and feeder bus requirements. Both alternatives would depend on bus service connecting from stations to the respective resort communities and destinations along I-70. AGS ridership is expected to be approximately 5 percent more than rail ridership due to system attractiveness. Rail would have about 20 percent longer travel times and may have longer headways than AGS because Rail trainsets would be longer and carry more seats than AGS. However, longer headways would avoid reliability ("bunching") problems associated with frequencies. Because growth in auto use is expected with these alternatives, congestion along the highway even with the alternative in place would be worse than it is today. If local governments encourage additional pedestrian-oriented developments, transit-oriented attractions and use Travel Demand Management methods to manage auto use during peak travel times, this congestion could be reduced. Between Vail and Avon, these Transit alternatives should substantially reduce congestion at Dowd Canyon. West of Edwards to Glenwood Springs, I-70 is expected to operate at an acceptable level of service in 2025 and these alternatives would have little effect on overall travel in this area. Beyond 2025, with additional travel behavior changes, these systems would continue to accommodate additional travel on I-70. The Rail with IMC alternative would accommodate baseline travel demand (+4 percent), and would reach the ultimate network capacity by 2030 under trend assumptions, or 2065 under the optimistic assumptions (see section 2.3 for description of trend and optimistic assumptions).
Implementation	Total estimated capital costs = $4.91 billion (of which $0.53 billion = Minimal Action components included in capital cost). Intermediate cost-effectiveness (annualized capital cost plus annual O&M cost less annual farebox receipts per annual person mile of travel beyond that of No Action) = $1.14 per person mile. Construction difficulty (construction duration and impact) = intermediate impact. Construction of the rail system would be accomplished primarily away from I-70 travel lanes, which would minimize traffic disruption, and the alignment for the rail system would be located to minimize community disruption. Summary = high ultimate capacity and well-established technology; however, operation in adverse weather conditions may require further study. Potential induced traffic may lead to undesired growth.
Safety	Number of high accident areas addressed = intermediate number (Wolcott curve and Silverthorne interchange, plus partial improvements east of the EJMT and at the base of Floyd Hill). Overall fatality rating would be lower than that of the Dual-Mode Bus in Guideway alternative and higher than that of the AGS alternative.



Notes:
1) Placement of colored bars indicates whether that portion of the alternative would be on the north or south side or in the median of existing I-70.
2) Selected localized safety and capacity improvement components of Minimal Action are assumed to be included in each of the action alternatives (interchange modifications, auxiliary lanes, curve safety modifications).

Rail with IMC - Cross Sections

While the Rail with IMC alternative would be primarily on grade (for 83 miles), sections of this alternative would be elevated (35 miles) where necessary to minimize the footprint, to cross from one side of I-70 to the other, or to avoid sensitive resources. The elevated portions of rail would include piers spaced every 80 to 100 feet.

The electrified portion of this alternative (between Vail and C-470) would include catenary structures and conductors that would provide power to the rail (see cross sections below). The catenary structures would consist of poles, located every 80 to 100 feet for the entire length of the alternative, with a series of conductor wires strung between poles.

A photorealistic visual simulation of rail is provided on the following page. Additional visual simulations illustrating rail are provided in Appendix L.

The Rail with IMC alternative would require third tunnel bores at the existing EJMT and Twin Tunnels locations. Specific details are provided below.

EJMT

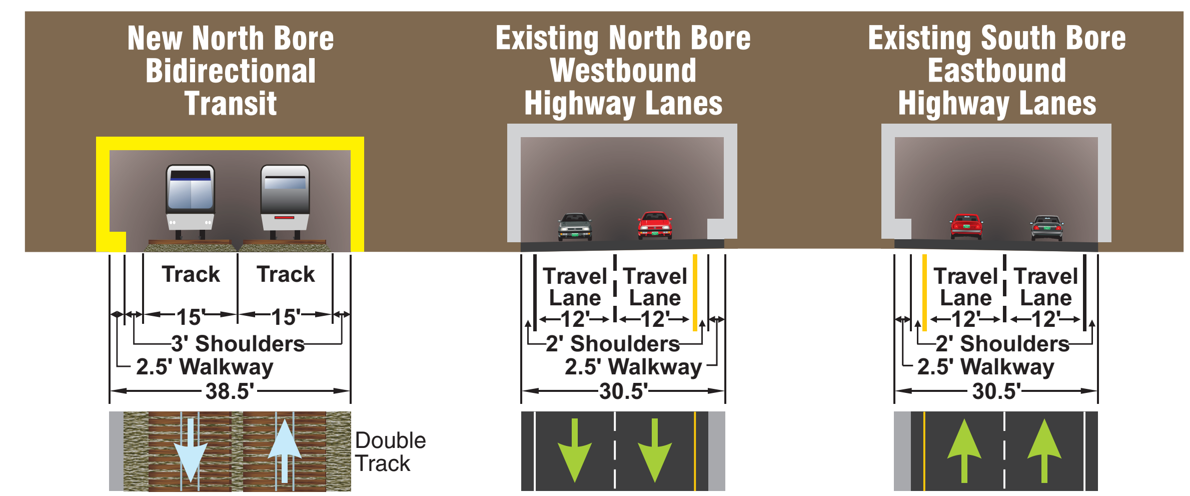
- The proposed third tunnel bore would be located to the north of the existing tunnel bores and would accommodate bidirectional rail. The proposed length of the tunnel would be 14,500 feet.
- The existing north bore would carry two lanes of westbound highway traffic.
- The existing south bore would carry two lanes of eastbound highway traffic.
- On the west side of the Continental Divide the new tunnel bore would require a cut-and-cover section to carry the rail line under the current highway configuration.
- Competent rock exists on the west side of the Continental Divide, and should require little if any tunnel support during excavation. On the east side, however, faulted and fractured bedrock has contributed to slope instability that caused a landslide during construction of the original tunnel. Additional geologic challenges on the east side would include the Loveland Fault and a section of clay fault gouge, creating very difficult tunneling conditions.
- The cut-and-cover on the east side of the Continental Divide would result in a relatively large excavation, with cut heights reaching 125 feet. Extensive stabilization would likely be required due to the height of the cuts and relatively poor condition of the subsurface material. All alternative alignments would have to be designed to avoid the existing landslide that was activated during the original north bore construction.

Twin Tunnels

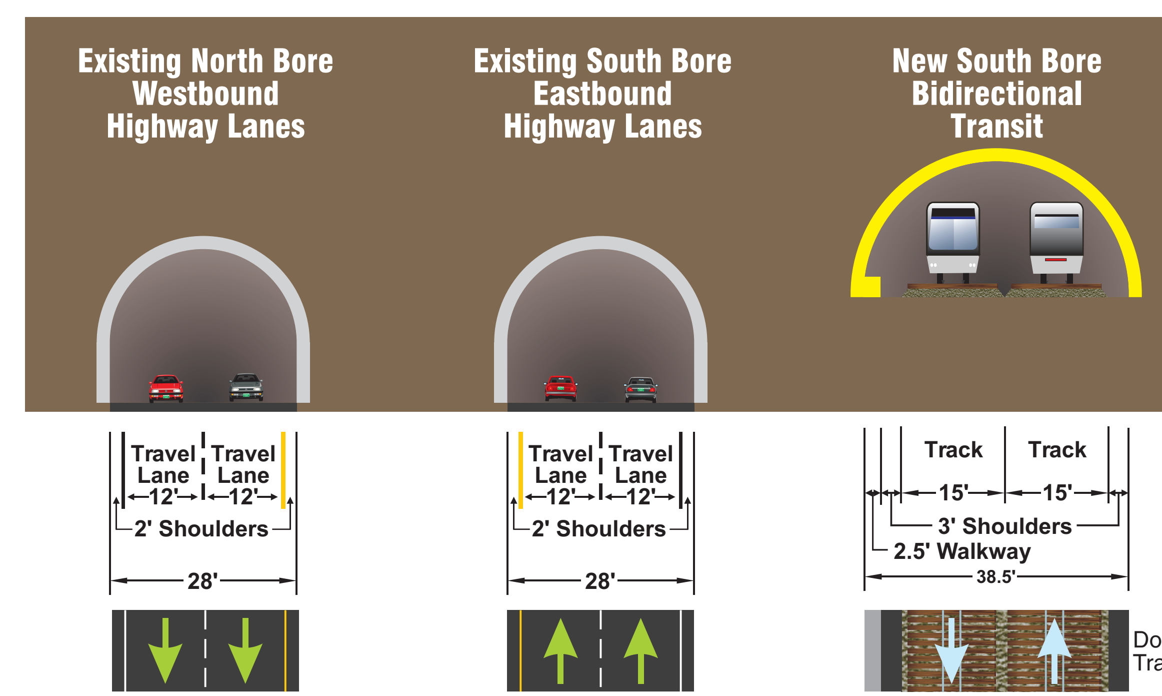
- The proposed third tunnel bore would be located to the south of the existing tunnel bores and would accommodate bidirectional rail.
- The existing north bore would carry two lanes of westbound traffic.
- The existing south bore would carry two lanes of eastbound traffic.
- Based on the relatively good condition of the subsurface material, conventional stabilization methods would likely be required for the proposed tunnel with a finished concrete lining. The proposed length of the tunnel would be approximately 740 feet and should not require an active ventilation system.
- Due to the difficult narrow terrain in the area and proximity to the existing I-70 alignment, construction staging may be difficult. The approach to the tunnel bore would need to be elevated to avoid impacts to the Scott Lancaster Memorial Bike Path bridge over Clear Creek. In the Tier 2 level of study, options for this tunnel approach could consider relocating the trail and keeping the eastbound tunnel approach on grade, which would reduce tunnel costs.

Rail with IMC

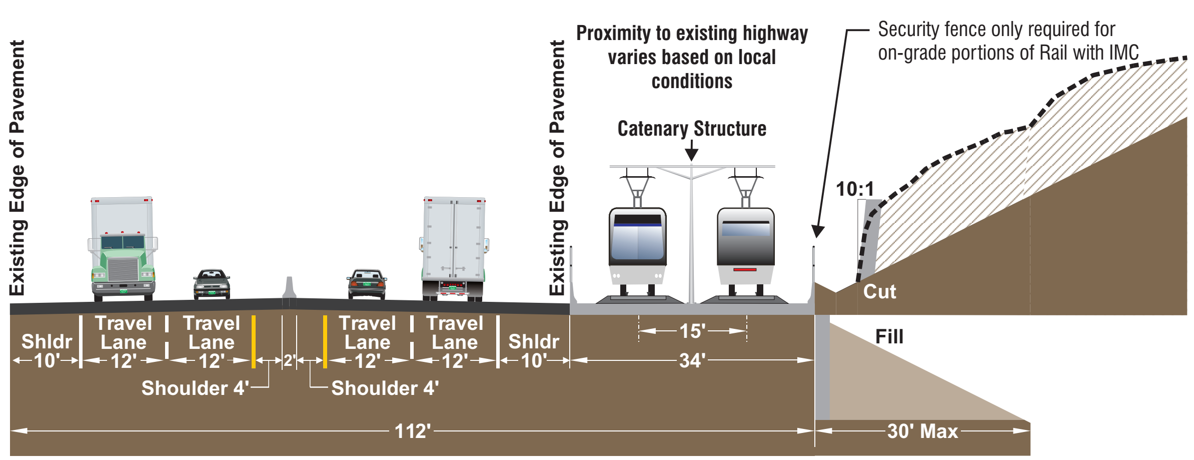
Eisenhower-Johnson Memorial Tunnels (EJMT)

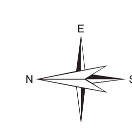


Twin Tunnels



Typical Configuration





Highway Lanes

Transit Tracks

New Tunnel Components

Note: All illustrations view from west to east.

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Rail with IMC

Rail with IMC - Operations Description

Characteristics:

The Rail with IMC alternative would consist of two components:

- The Intermountain Connection, a commuter-oriented diesel multiple-unit (DMU) service between Eagle County Airport and Vail Transportation Center
- An electric multiple-unit (EMU) service between Vail and Jefferson Station

Compared to other Transit alternatives, the IMC would provide greater local access through stations at:

- Wolcott
- Post Boulevard (Village at Avon)
- Eagle-Vail
- Dowd Canyon
- Vail Lionshead

Two standard-gauge tracks would be provided between Frisco Station and Jefferson Station. West of Frisco, where demand would be lower, a single track would be provided with passing sidings spaced to allow operation of up to four trains per hour each way.

The Vail-Jefferson line would operate "skip-stop" service during periods of high demand, to allow for faster long-distance trips. A "local" train making all stops would run at night and during other periods of low demand.

To reach off-Corridor destinations, passengers would transfer to:

- Summit Stage at Frisco or Silverthorne
- ECO Transit at Vail
- Shuttle buses between Empire Station and Winter Park Resort assumed to be provided by the rail operator
- Shuttle routes from the station at the junction of I-70 and US 6 near the base of Floyd Hill, to casinos in Black Hawk and Central City. These shuttles are assumed to be private contractors to casinos in much the same way that private bus operators currently provide service from the Denver metropolitan area.

Plan:

- Routes A and C, which stop at the Silverthorne, Georgetown, and US 6/Gaming stations, would have the greatest weekday frequencies.
- On winter weekends, Route A would offer the greatest frequency, while D trains, which stop at Loveland and Vail, would come the second-most-often.
- The IMC would offer a wider range of frequency on winter weekends than summer weekends, reflecting the distinct peaking of winter weekends, compared to the more sustained demand on summer weekends.
- Because of the new rail system, Summit Stage would need to dramatically increase frequencies, particularly to Breckenridge and Keystone.
- ECO Transit would see a smaller increase in ridership from transferring rail passengers.

The route structure map follows a convention used by many transit operators, including Breckenridge Free Ride, Copper Mountain Resort, Keystone Resort, RTD, Summit Stage, and Town of Vail Transit. Each route is shown by a uniquely colored line. Stops served by a route are indicated by a white circle (for this map) or other symbol.

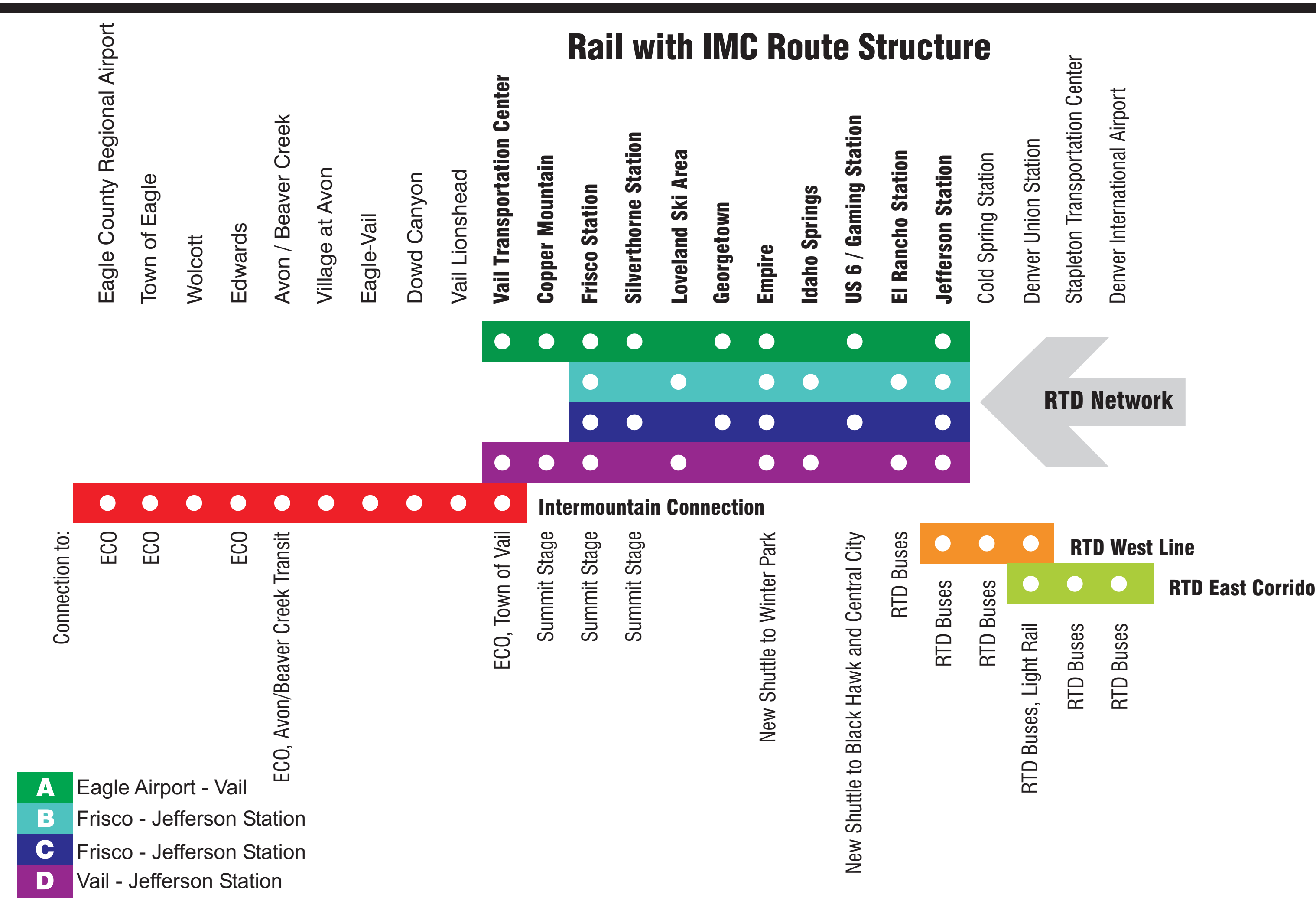
The IMC is shown as the red route at the lower left corner of the map. The IMC has a single local route, stopping at all the stations shown.

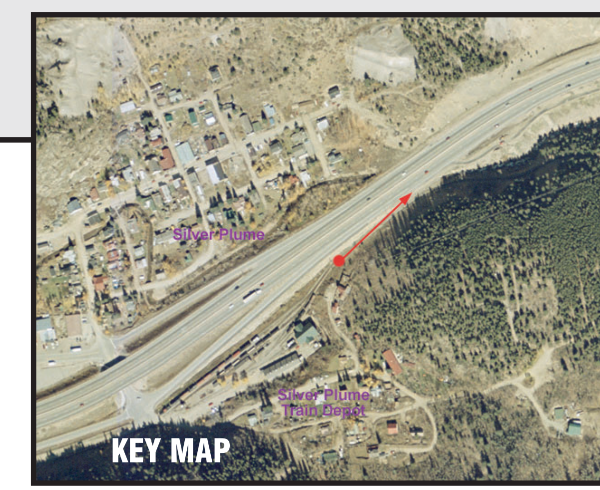
The Rail system would use four "skip-stop" routes to provide faster long-distance travel in the Corridor and to better match predicted demand levels. All four routes would always stop at Frisco Station, Empire Junction, and Jefferson Station. At other places along the Corridor, the train may serve one station and then skip the following station. For example, the A train would stop at Silverthorne Station, skip the Loveland Ski Area station, and then stop at Georgetown.

The A and C trains would have the same stop pattern between Frisco Station and Jefferson Station; the difference would be that the A train would continue west to Vail Transportation Center. Similarly, the B and D trains would have the same stop pattern, with the B train being "short-turned" at Frisco instead of continuing to Vail as the D train does.

As an example trip, someone traveling from Eagle-Vail to the Gaming Area would first take the IMC to Vail Transportation Center, change to an A train, then get off at the US 6/Gaming station to board a shuttle bus to the casinos. An El Rancho resident traveling to a second home in Silverthorne could first take a B or D train to Empire Junction and then change to an A or C train to complete the journey. If a snowboarder at Copper Mountain wanting to return home to Idaho Springs just missed the D train, she might find it faster to board an A train, and then change to a B train at Frisco or Empire Junction, rather than waiting for the next D train.

At night, the four routes would be replaced by a single route that would stop at every station from Vail to Jefferson.

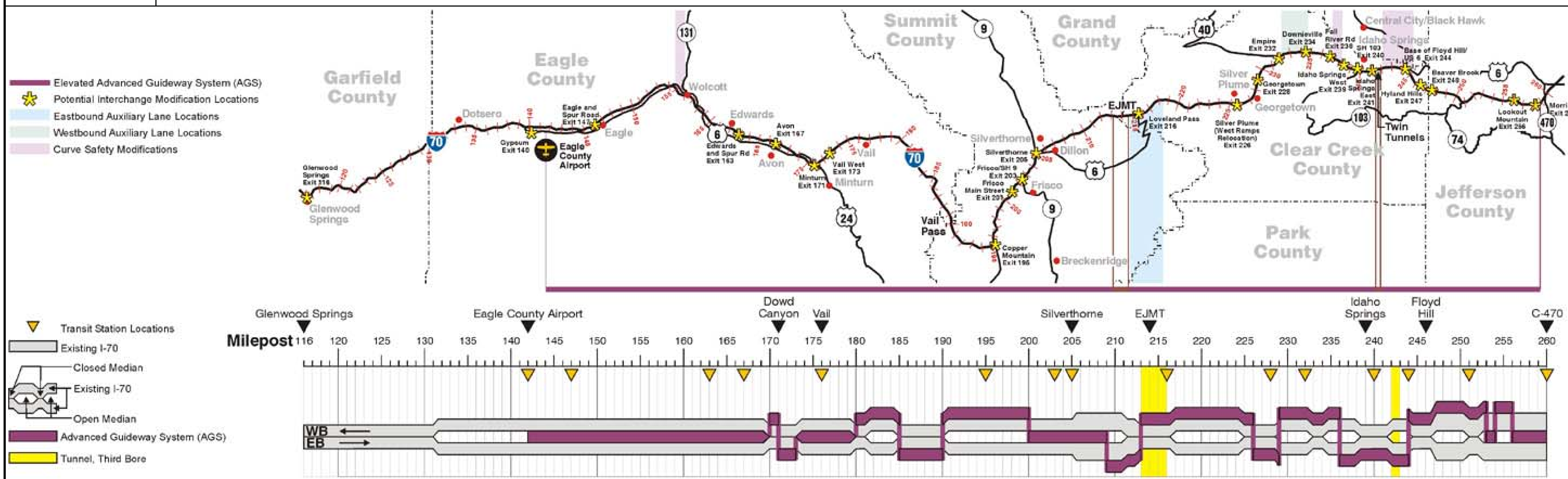




Rail with IMC Alternative Visual Simulation
View Looking East near Silver Plume Train Depot

Advanced Guideway System Alternative Overview

Physical Description	The Advanced Guideway System (AGS) alternative would provide transit service from C-470 to the Eagle County Airport, with a fully elevated system that would use new technologies providing higher speeds than rail technologies under study. The AGS evaluated in the I-70 PEIS is based on an urban magnetic levitation (maglev) system under research by the Federal Transit Administration (FTA). The system uses High Speed Surface Transportation (HSST) vehicles developed in Japan over the past 25 years, with a history of proven performance and certification by the Japanese government. The following would be prioritized for implementation: cost reduction, climate (all-weather operation), and performance/schedule dependability. The requirement to provide the lowest possible cost may be affected by Colorado's mountain climate. Severe winter conditions would necessitate additional performance requirements. Difficulties with traditional transit systems that are also pertinent to maglev systems would include third rail icing, motor failures, deep snow on tracks, door operation, and track switch freezing. The Colorado Maglev Program is reviewing design parameters and techniques to mitigate these constraints related to winter weather.
Footprint	The AGS alternative under study would require a 24-foot-wide elevated guideway from Eagle County Airport to C-470. The total transportation width including I-70 would be approximately 93 feet where AGS is located on either side of I-70. Where AGS would be located in an open median, the overall width of I-70 would not change.
Ability to meet project need	The AGS and Rail with IMC alternatives (see previous profile) would have similar demand characteristics because they would have similar station locations and feeder bus requirements. Both alternatives would depend on bus service connecting from stations to the respective resort communities and destinations along I-70. AGS ridership is expected to be approximately 5 percent more than rail ridership due to its system attractiveness and because AGS would offer the fastest transit travel times. Because growth in auto use is expected with these alternatives, congestion even with the alternative would be somewhat worse than it is today. If local governments encourage additional pedestrian-oriented developments, transit-oriented attractions and use Travel Demand Management methods to manage auto use during peak travel times, this congestion could be reduced. Between Vail and Avon, these alternatives should substantially reduce congestion at Dowd Canyon. West of Edwards to Glenwood Springs, I-70 is expected to operate at an acceptable level of service in 2025 and these alternatives would have little effect on overall travel in this area. Beyond 2025, with additional travel behavior changes, these would continue to accommodate additional travel on I-70. The AGS alternative would accommodate baseline travel demand (+4 percent), and would reach the ultimate network capacity by 2030 under trend assumptions, or 2065 under the optimistic assumptions (see section 2.3 for description of trend and optimistic assumptions).
Implementation	Total estimated capital costs = $6.15 billion (of which $0.53 billion = Minimal Action components included in capital cost). Intermediate cost-effectiveness (annualized capital cost plus annual O&M cost less annual farebox receipts per annual person mile of travel beyond that of No Action) = $1.21 per person mile. Of the four Transit alternatives, AGS would be the least cost-effective. Construction difficulty (construction duration and impact) = intermediate impact. Construction of the AGS would be accomplished primarily away from I-70 travel lanes, which would minimize traffic disruption, and the alignment for the AGS would be located to minimize community disruption. Summary = high ultimate capacity and fastest Transit alternative; however, the practicality of the technology under adverse weather conditions in the Corridor may require further study. Potential induced traffic may lead to undesired growth.
Safety	Number of high accident areas addressed = intermediate number (same as Rail with IMC). Lowest overall fatality rating of Transit alternatives, in part because of stringent AGS safety standards.



Notes:
1) Placement of colored bars indicates whether that portion of the alternative would be on the north or south side or in the median of existing I-70.
2) Selected localized safety and capacity improvement components of Minimal Action are assumed to be included in each of the action alternatives (interchange modifications, auxiliary lanes, curve safety modifications).

Advanced Guideway System - Cross Sections

The AGS alternative would be a completely elevated system (for 118 miles) and would vary in alignment between the north, south, and median of I-70. The AGS studied in the PEIS is based on an urban maglev system under research by the FTA. This system would include a tubular steel space-truss design supported by piers spaced every 80 to 100 feet along the entire length of the alternative.

A photorealistic visual simulation of AGS is provided on the following page. Additional visual simulations illustrating AGS are provided in Appendix L.

The AGS alternative would require third tunnel bores at the existing two EJMT and Twin Tunnels locations. Specific details are provided below.

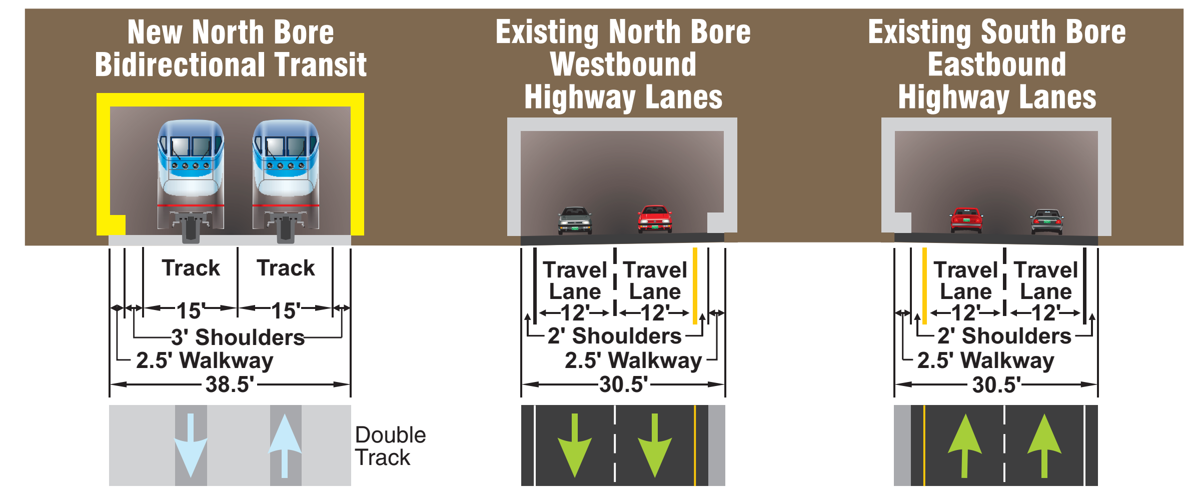
EJMT

- The proposed third tunnel bore would be located to the north of the existing tunnel bores and would accommodate bidirectional AGS. The proposed length of the tunnel would be 14,500 feet.
- The existing north bore would carry two lanes of westbound highway traffic.
- The existing south bore would carry two lanes of eastbound highway traffic.
- On the west side of the Continental Divide the new tunnel bore would require a cut-and-cover section to carry the AGS under the current highway configuration.
- Competent rock exists on the west side of the Continental Divide and should require little if any tunnel support during excavation. On the east side, however, faulted and fractured bedrock has contributed to slope instability that caused a landslide during construction of the original tunnel. Additional geologic challenges on the east side would include the Loveland Fault and a section of clay fault gouge, creating very difficult tunneling conditions.
- The cut-and-cover on the east side of the Continental Divide would result in a relatively large excavation, with cut heights reaching 125 feet. Extensive stabilization would likely be required due to the height of the cuts and relatively poor condition of the subsurface material. All alternative alignments would have to be designed to avoid the existing landslide that was activated during the original north bore construction.

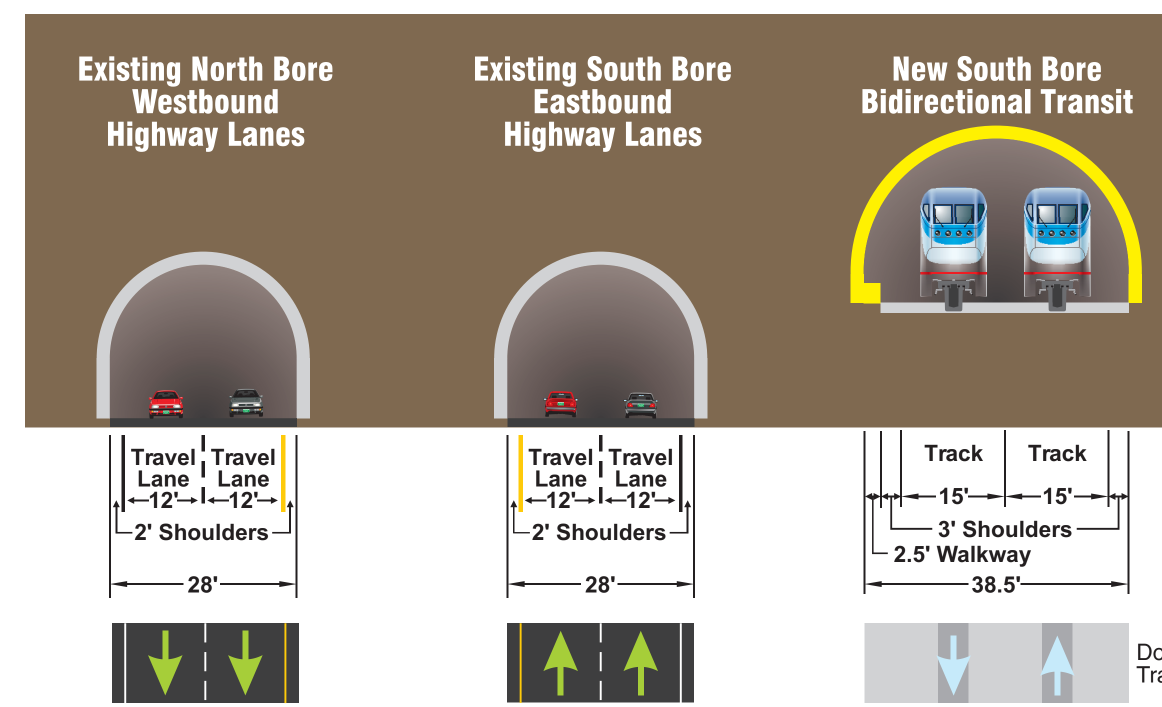
Twin Tunnels

- The proposed third tunnel bore would be located to the south of the existing tunnel bores and would accommodate bidirectional AGS.
- The existing north bore would carry two lanes of westbound traffic.
- The existing south bore would carry two lanes of eastbound traffic.
- Based on the relatively good condition of the subsurface material, conventional stabilization methods would likely be required for the proposed tunnel with a finished concrete lining. The proposed length of the tunnel would be approximately 740 feet and should not require an active ventilation system.
- Due to the difficult narrow terrain in the area and proximity to the existing I-70 alignment, construction staging may be difficult. The approach to the tunnel bore would need to be elevated to avoid impacts to the Scott Lancaster Memorial Bike Path bridge over Clear Creek. In the Tier 2 level of study, options for this tunnel approach could consider relocating the trail and keeping the eastbound tunnel approach on grade, which would reduce tunnel costs.

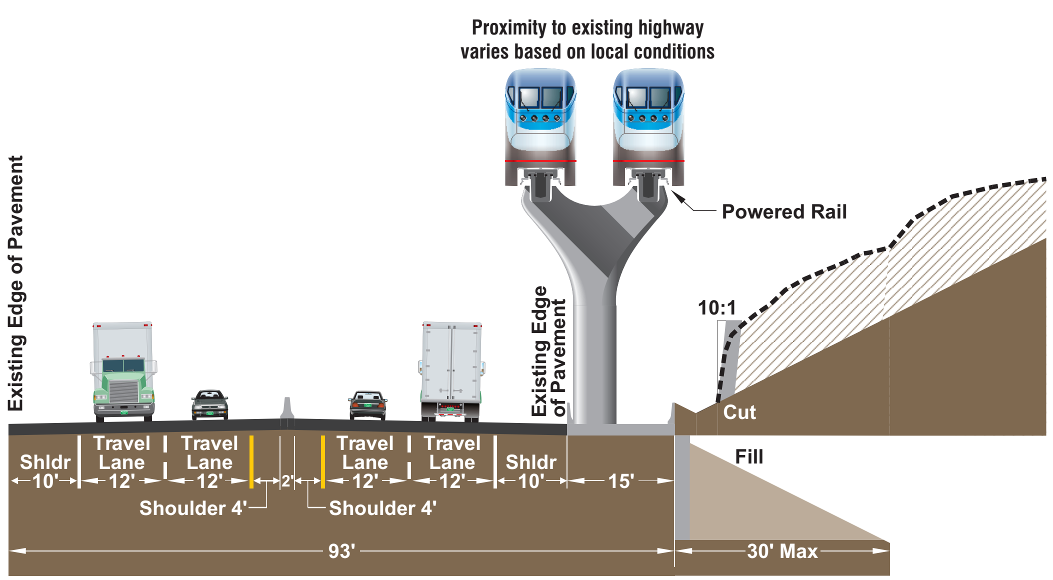
Eisenhower-Johnson Memorial Tunnels (EJMT)

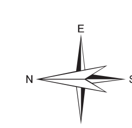


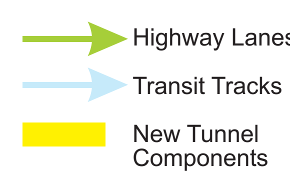
Twin Tunnels



Typical Configuration







Note: All illustrations view from west to east.

Advanced Guideway System

Advanced Guideway System - Operations Description

Characteristics:

Operating characteristics of the AGS would be based on a set of performance standards and would draw heavily from the work done by the teams of Maglev Transit Group, Sandia National Laboratories, CDOT, and CIFGA.

The vehicles assumed for development of passenger loading standards would be modified from the Japanese High-Speed Surface Transportation (HSST) maglev.

A linear induction motor would provide levitation and propulsion.

Like rail, the AGS also would use skip-stop operations. All trains would stop at Frisco, Silverthorne, US 6/Gaming, and Jefferson stations. Local trains making all stops would run at night and other periods of lower demand.

The AGS would use two tracks throughout the length of the Corridor. Because the AGS would offer direct service to Eagle County Airport, the IMC is not included with this alternative.

To reach off-Corridor destinations, passengers would transfer to:

- Summit Stage at Frisco or Silverthorne
- ECO Transit at Vail
- Shuttle buses between Empire Station and Winter Park Resort are assumed to be provided by the AGS operator
- Shuttle routes from the station at the junction of I-70 and US 6 near the base of Floyd Hill, to casinos in Black Hawk and Central City. These shuttles are assumed to be private contractors to casinos in much the same way that private bus operators currently provide service from the Denver metropolitan area.

Plan:

- As with the Rail with IMC alternative, the shortest AGS headways would be generally on winter weekends, while the longest headways would occur on weekdays.
- On weekdays, the K train would have as long or longer headways than the J and L trains. Loveland, Empire Junction, and El Rancho are the stops that would be served only by the K train. Because Loveland and Empire are primarily recreational destinations, it is not surprising to see little weekday demand for the K train.
- During peak periods, the AGS alternative would offer shorter composite headways than the Rail with IMC alternative.
- Because of the AGS, Summit Stage would need to dramatically increase frequencies, particularly to Breckenridge and Keystone.
- ECO Transit would see a smaller increase in ridership from transferring AGS passengers.
- Existing operators in the Corridor (ECO, A/BCT, Town of Vail, and Summit Stage) are assumed to adjust their schedules to accommodate increased demand from AGS.

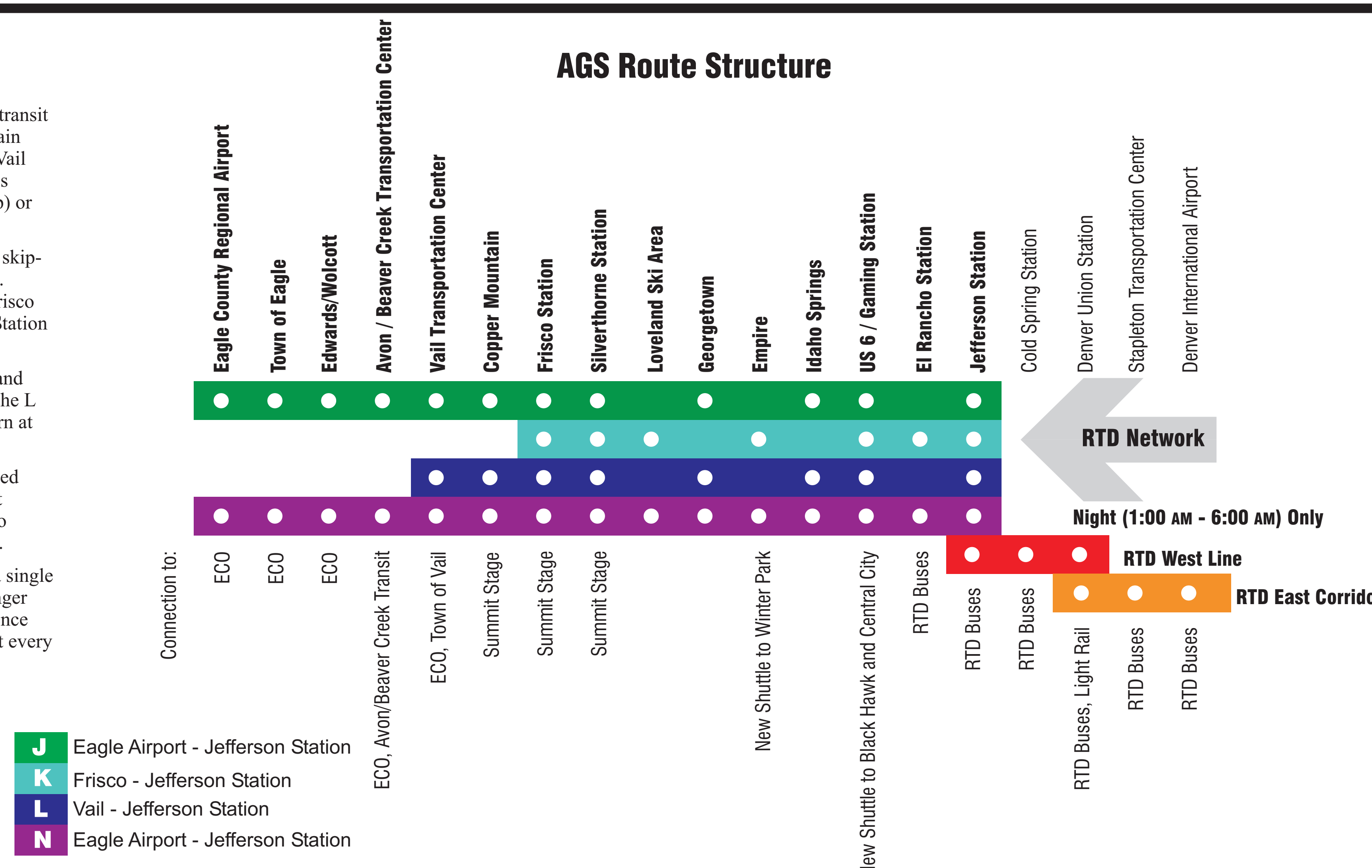
The route structure map follows a convention used by many transit operators, including Breckenridge Free Ride, Copper Mountain Resort, Keystone Resort, RTD, Summit Stage, and Town of Vail Transit. Each route is shown by a uniquely colored line. Stops served by a route are indicated by a white circle (for this map) or other symbol.

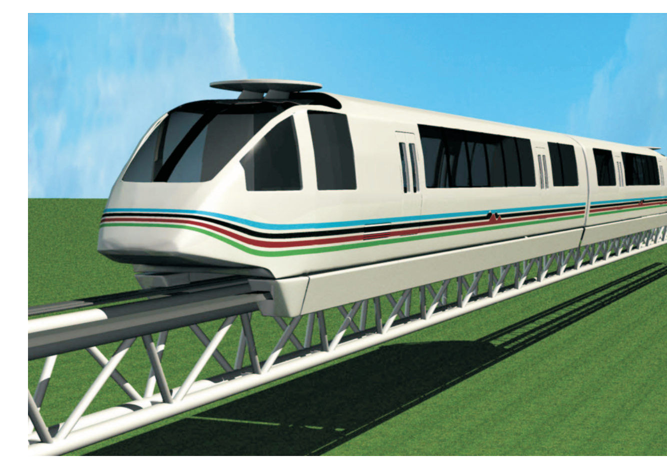
Like the Rail with IMC alternative, the AGS alternative uses skip-stop routes with short turns to better serve Corridor demands. During most of the day, the J, K, and L routes are running. Frisco Station, Silverthorne Station, US 6 / Gaming, and Jefferson Station are served by all three routes.

Vail Transportation Center, Copper Mountain, Georgetown, and Idaho Springs are served by both the J and L routes. In fact, the L route has the same stop pattern as the J route, with a short-turn at Vail.

Loveland Ski Area, Empire Junction, and El Rancho are served only by the K train (during the day). If an El Rancho resident wanted to ski at Beaver Creek, for example, he would have to transfer to a J train at US 6 / Gaming, Silverthorne, or Frisco.

At night (1 AM to 6 AM), the three routes are combined into a single local route, the N train. The El Rancho resident would no longer have to transfer to get to Beaver Creek, but he would experience more time in the train because it would decelerate and stop at every station.





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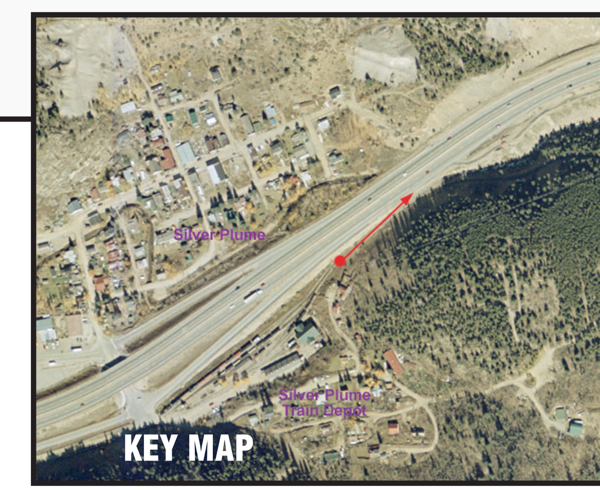
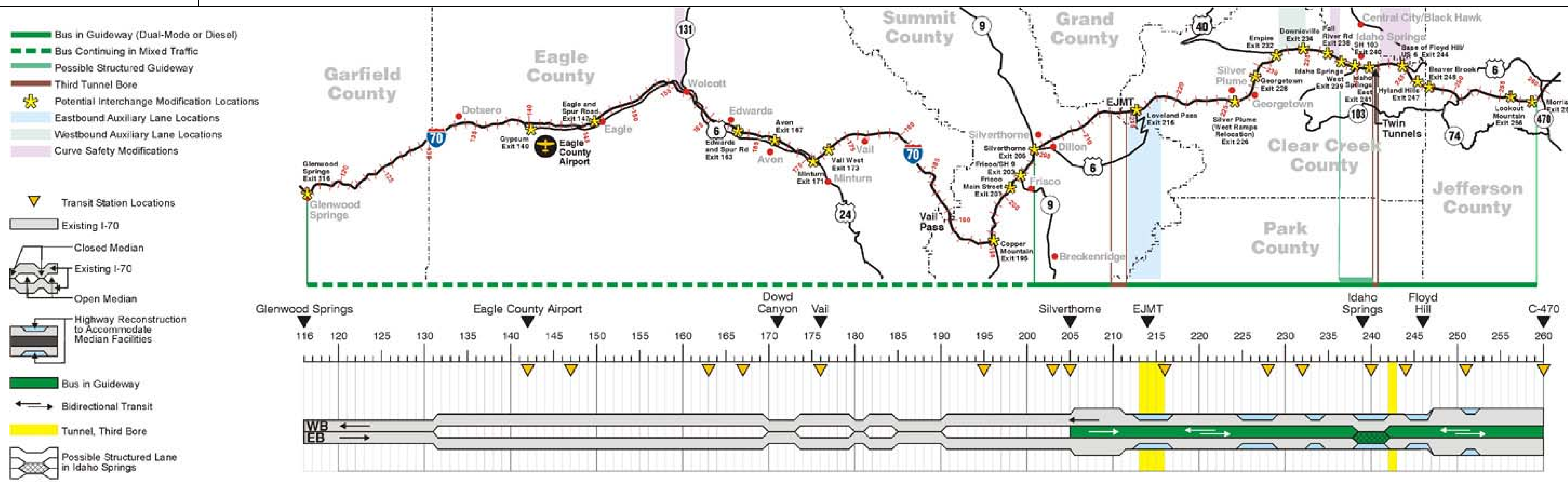
Advanced Guideway System



Advanced Guideway System Alternative Visual Simulation
View Looking East near Silver Plume Train Depot

Dual-Mode Bus and Diesel Bus in Guideway Alternative Overview

Physical Description	The guideway for the Dual-Mode and Diesel Bus alternatives would be located in the I-70 median. The guideway bus system would consist of a single 14-foot-wide guideway (including guiding barriers) eastbound from Silverthorne to the west portal of the EJMT, and a bidirectional guideway 24 feet wide (including guiding barriers) from the EJMT to C-470. These systems would use guidewheels to provide steering control, thus permitting a narrow guideway and improving operations. The dual-mode buses would use electric power in the guideway and diesel power outside the guideway. The diesel buses would use diesel power at all times. Also, the emerging technology of the fuel cell may reach the stage of practical application in the near future, which could be considered as another power source for this alternative. Likewise, compressed natural gas-powered buses with sufficient acceleration for the grades in the Corridor may also become available. New tunnel bores would be required at the Twin Tunnels and the EJMT.
Footprint	Existing I-70 would need to be shifted to the outside where the median would be inadequate. The total transportation corridor width, including I-70, would range from 82 to 100 feet.
Ability to meet project need	The Diesel Bus in Guideway and the Dual-Mode Bus in Guideway alternatives should have similar demand characteristics. Congestion on I-70 would be similar to Rail with IMC and AGS alternatives. Demand levels in Dowd Canyon would approach noticeable levels of congestion on summer weekends, and particularly on summer Friday and Saturday evenings westbound and summer Sunday evenings eastbound. West of Edwards to Glenwood Springs, I-70 is not expected to be congested and these alternatives would have little effect on overall travel in this area. About 2050, additional travel behavior changes would have to occur for these systems to continue to accommodate additional travel on I-70. Ridership on the Dual-Mode Bus in Guideway alternative is expected to be higher than that on the Diesel Bus in Guideway alternative. The Bus in Guideway alternatives would accommodate baseline travel demand (+4 percent for Dual Mode, and +3 percent Diesel), and would reach the ultimate network capacity by 2030 under trend assumptions, or 2055 under the optimistic assumptions (see section 2.3 for description of trend and optimistic assumptions).
Implementation	Total estimated capital costs = \$3.46 billion and \$3.26 billion (of which \$0.53 billion = Minimal Action components included in capital cost). Among the most cost-effective (annualized capital cost plus annual O&M cost less annual farebox receipts per annual person mile of travel beyond that of No Action) = \$0.74 per person mile (dual-mode) to \$0.73 per person mile (diesel). Out of all Transit alternatives, the percent of O&M costs requiring subsidy would be the lowest for the Dual-Mode Bus in Guideway alternative (about 20 percent). Construction difficulty (construction duration and impact) = greatest impact. The location of the bus guideway in the median of I-70 would require adding width to the outside eastbound and westbound lanes of I-70 where the existing median would be insufficient for the guideway. This would result in disruption of travelers and adjacent communities (Idaho Springs, Lawson, Downieville, and Dumont). Summary = intermediate cost. Alternative could leave guideway, connect directly to destinations, and achieve higher speeds in the guideway. The diesel bus would be lighter than the dual-mode bus, and could travel faster out of the guideway; however, on up grades the diesel bus would be slower than the dual-mode bus while in the guideway. Snow accumulation and removal inside the guideway would be a concern and would require further study.
Safety	Number of high accident areas addressed = intermediate number (same as Rail with IMC). Lower overall fatality rating than that of the Six-Lane Highway 65 mph alternative.



Notes:
1) Placement of colored bars indicates whether that portion of the alternative would be on the north or south side or in the median of existing I-70.
2) Selected localized safety and capacity improvement components of Minimal Action are assumed to be included in each of the action alternatives (interchange modifications, auxiliary lanes, curve safety modifications).

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Dual-Mode and Diesel Bus in Guideway - Cross Sections

The alignment of the Dual-Mode and Diesel Bus in Guideway alternatives would primarily be located within the median of I-70. However, as illustrated in the cross sections below, a structured configuration is being considered in Idaho Springs to minimize impacts to the community. A structured configuration would include eastbound traffic lanes stacked above the bidirectional bus. At all other locations along this alignment, Bus in Guideway alternatives would consist of a horizontal configuration (see typical configuration below), and where the median is not wide enough to accommodate the 24-foot-wide guideway, the existing highway would be widened.

Bus in Guideway alternatives would include barriers approximately 3 feet in height that direct the movement of the bus and separate the guideway from general-purpose traffic lanes. Between Silverthorne and the EJMT, only a single bus lane accommodating eastbound buses would be required. From the EJMT to C-470, bidirectional bus lanes would be required, accommodating eastbound and westbound buses.

A photorealistic visual simulation of Bus in Guideway alternatives is provided on the following page. The Bus in Guideway alternatives would require third tunnel bores at the existing EJMT and Twin Tunnels locations. Specific details are provided below.

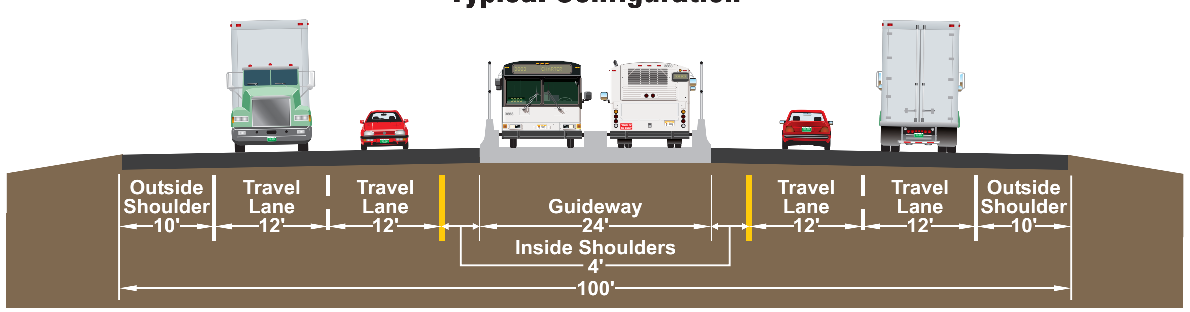
EJMT

- The proposed third tunnel bore would be located to the north of the existing tunnel bores and would accommodate two lanes of westbound traffic. The proposed length of the tunnel would be 13,700 feet.
- The existing north bore would accommodate bidirectional Bus in Guideway.
- The existing south bore would accommodate two lanes of eastbound traffic.
- Competent rock exists on the west side of the Continental Divide and should require little if any tunnel support during excavation. On the east side, however, faulted and fractured bedrock has contributed to slope instability that caused a landslide during construction of the original tunnel. Additional geologic challenges on the east side would include the Loveland Fault and a section of clay fault gouge, creating very difficult tunneling conditions.
- The cut-and-cover on the east side of the Continental Divide would result in relatively large excavation, with cut heights reaching 125 feet. Extensive stabilization would likely be required due to the height of the cuts and relatively poor condition of the subsurface material. All alternative alignments would have to be designed to avoid the existing landslide that was activated during the original north bore construction.

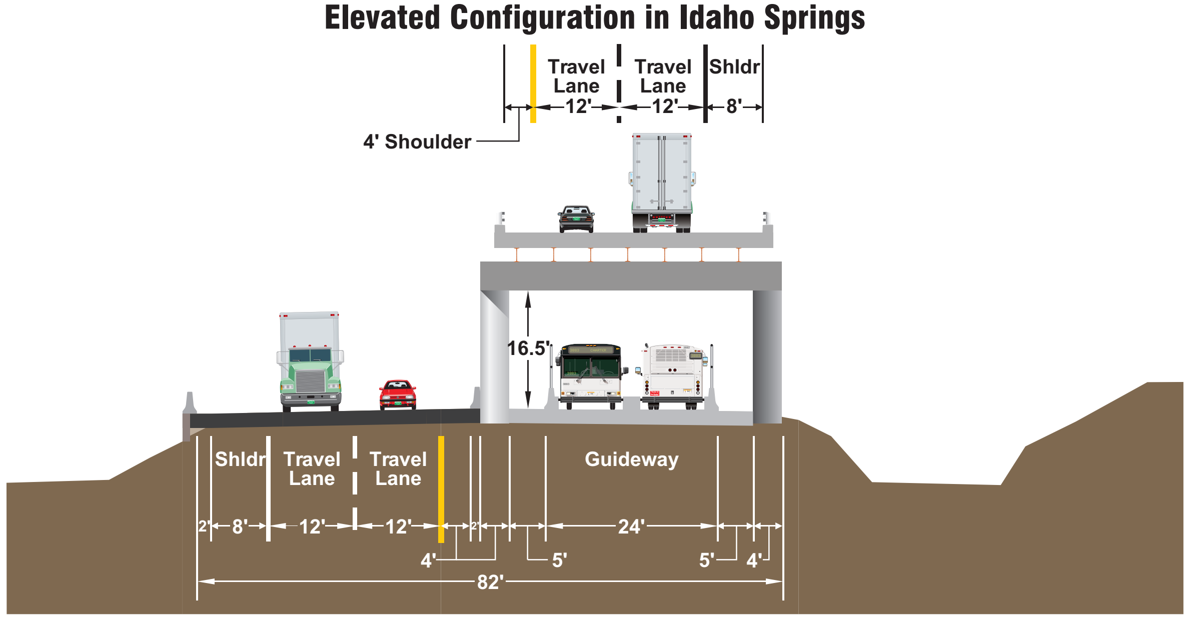
Twin Tunnels

- The existing north bore would accommodate two lanes of westbound traffic.
- The existing south bore would accommodate bidirectional Bus in Guideway.
- The proposed third tunnel bore would be located to the south of the existing tunnel bores and would accommodate two lanes of eastbound traffic.
- Based on the relatively good condition of the subsurface material, conventional stabilization methods would likely be required for the proposed tunnel with a finished concrete lining. The proposed length of the tunnel would be approximately 740 feet and should not require an active ventilation system.
- Due to the difficult narrow terrain in the area and proximity to the existing I-70 alignment, construction staging may be difficult. The approach to the tunnel bore would need to be elevated to avoid impacts to the Scott Lancaster Memorial Bike Path bridge over Clear Creek. In the Tier 2 level of study, options for this tunnel approach could consider relocating the trail and keeping the eastbound tunnel approach on grade, which would reduce tunnel costs.

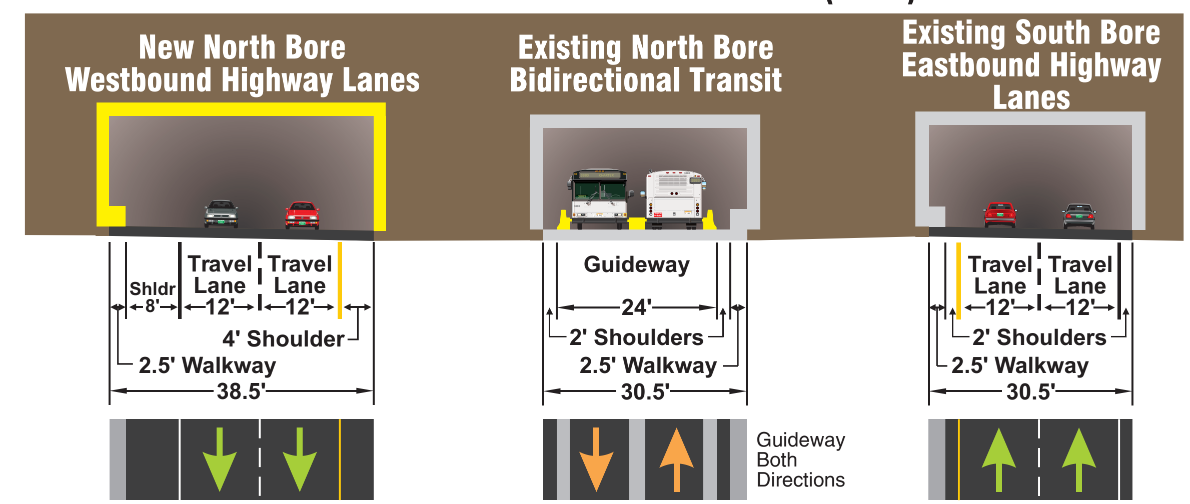
Typical Configuration



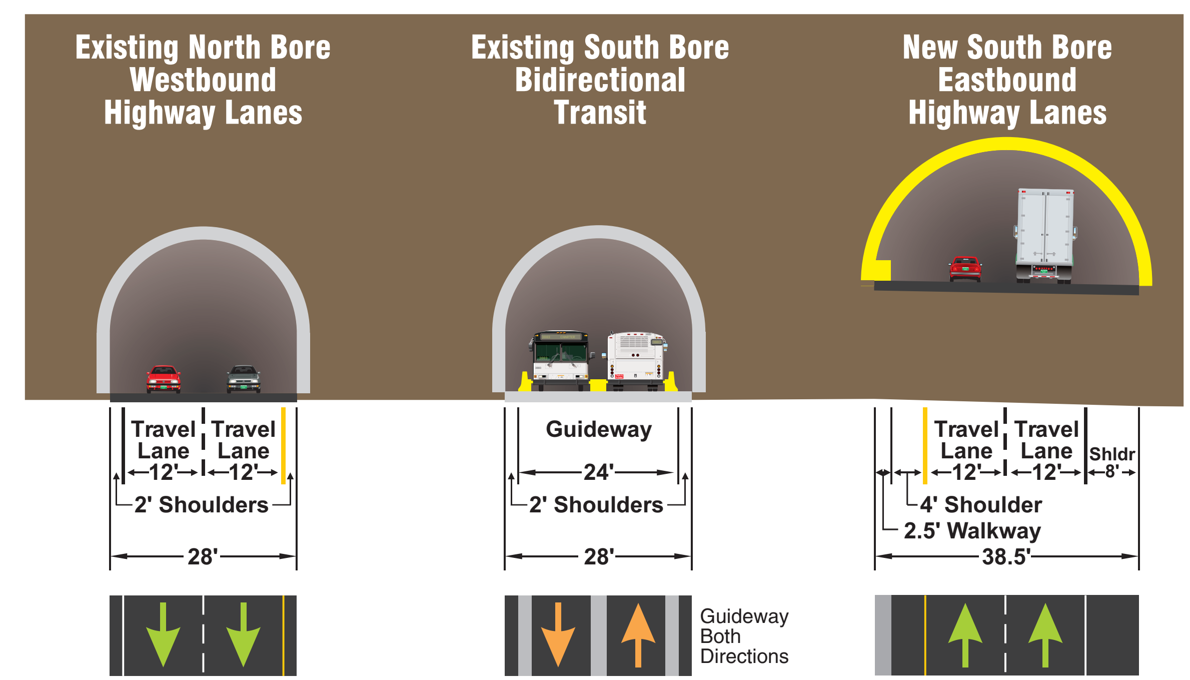
Elevated Configuration in Idaho Springs



Eisenhower-Johnson Memorial Tunnels (EJMT)



Twin Tunnels



Highway Lanes

Bus in Guideway

New Tunnel Components

Note: All illustrations view from west to east.

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Dual-Mode or Diesel Bus in Guideway - Operations Description

Characteristics:

Dual-mode bus would seat 60, powered by "third rail" in guideway.

Diesel bus would seat 40, more powerful on grades outside guideway.

Single eastbound guideway from Silverthorne to West Portal of EJMT.

Two-lane guideway from West Portal of EJMT to Jefferson Station.

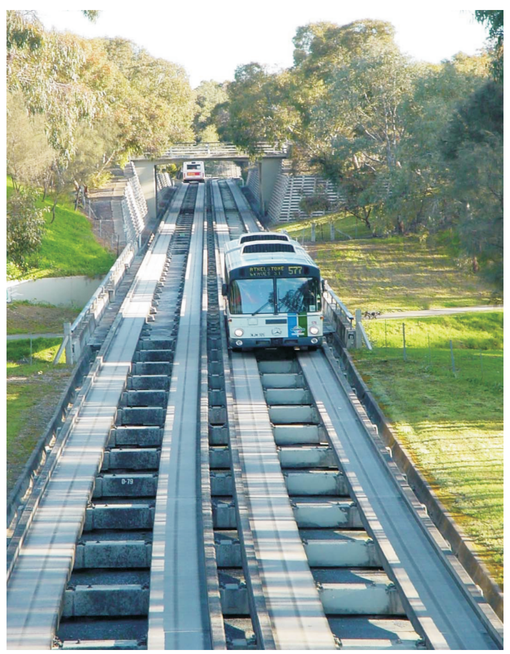
Could continue off I-70, offering a "one-seat ride"; no transfer stations necessary.

Off-line stations.

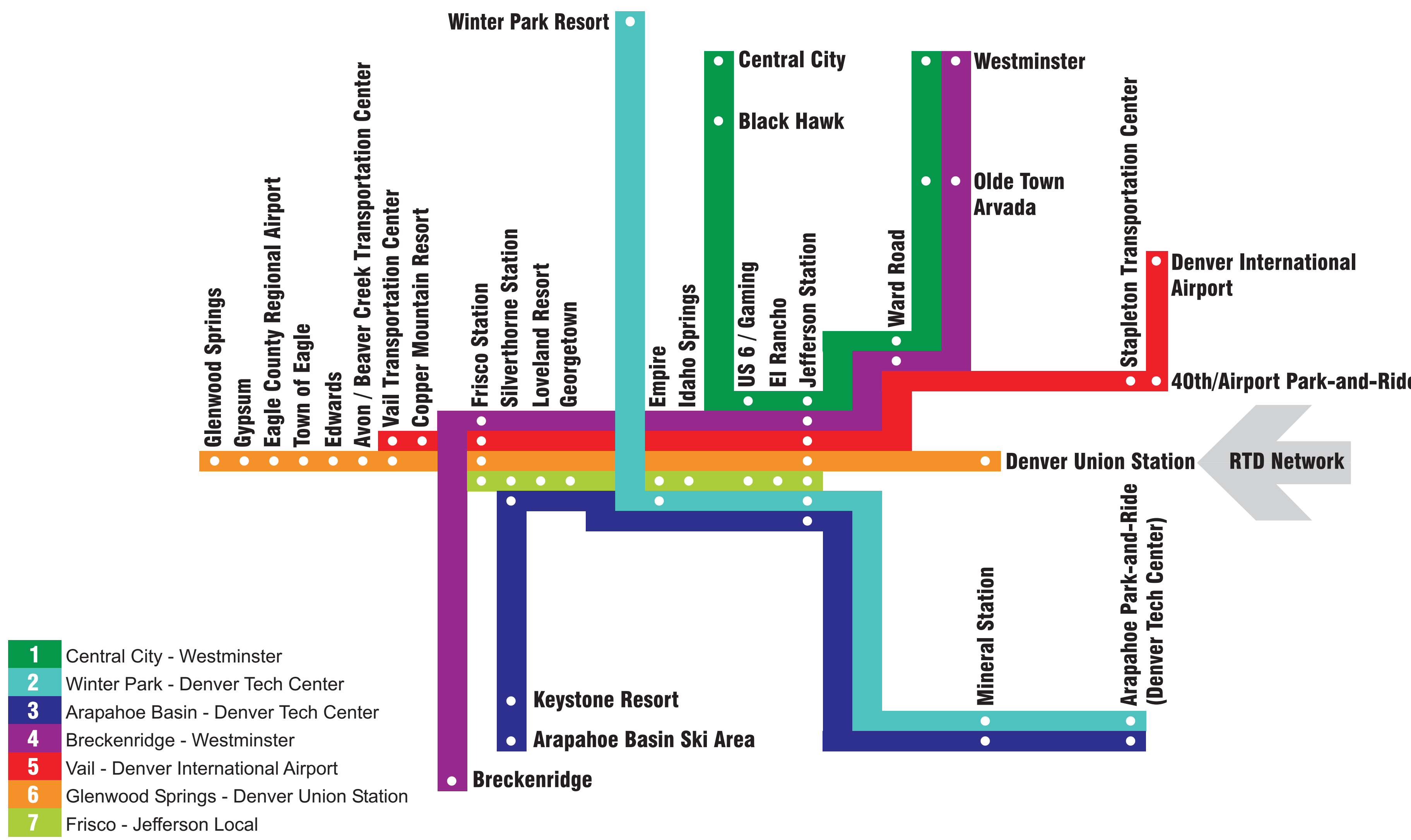
Gap in guideway would allow buses to reach stations and avoid obstructions.

Plan:

- Because diesel buses would be smaller, they always would require more frequent headways.
- The most frequent weekday route would serve the Gaming Area.
- On winter weekends, buses to Arapahoe Basin, Breckenridge, and Vail would be most popular.
- On summer weekends, routes would have more or less similar headways.
- Buses to the Gaming Area would have more frequent service on summer weekends than on weekdays.
- On Winter Park and Vail routes, summer weekend headways would be similar to winter weekends and more frequent than on weekdays.
- On Arapahoe Basin and Breckenridge routes, winter weekend headways would be shortest, and summer weekend headways would be shorter than on weekdays.
- The Frisco local bus would have its most ridership (and, therefore, the shortest headways) on winter weekends, while weekdays and summer weekends would have similar headways.
- The Glenwood Springs bus would have its shortest headways on summer weekends, and similar headways for weekdays and winter weekends.



Dual-Mode or Diesel Bus in Guideway Route Structure

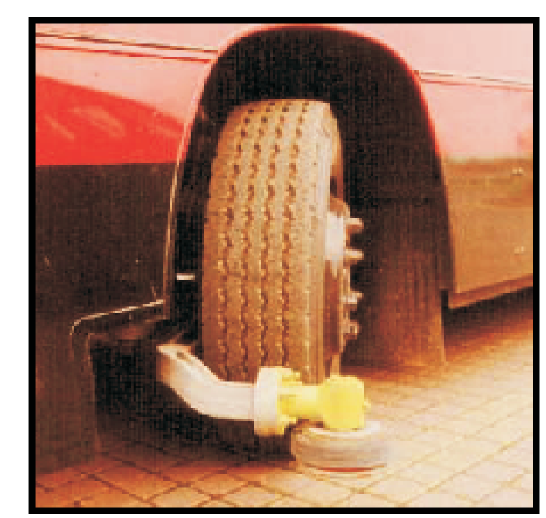


The route structure map follows a convention used by many transit operators, including Breckenridge Free Ride, Copper Mountain Resort, Keystone Resort, RTD, Summit Stage, and Town of Vail Transit. Each route is shown by a uniquely colored line. Stops served by a route are indicated here by a white circle.

Jefferson Station would be the hub of the Bus in Guideway system and would be served by all seven routes. Frisco Station would be a minor hub served by four routes.

The Bus in Guideway system would use what may be thought of as a zoned-express system. Most routes would provide some local distribution within the Denver metropolitan area, meet at Jefferson Station, then run express until they leave the I-70 alignment, when they begin local service again. Routes 5 and 6 would not go far from I-70; instead, each would serve a different group of destinations west of the Continental Divide/EJMT.

As an example trip, a Littleton resident traveling to Glenwood Springs would board route 2 or 3 at the Mineral Station, and change to route 6 at Jefferson Station. Someone traveling from Copper Mountain to Winter Park would start on route 5, change to route 7 at Frisco, and then change to route 2 at Empire Junction. An El Rancho resident traveling to a second home in Avon would likely take route 7 to Jefferson Station, and then board route 6.



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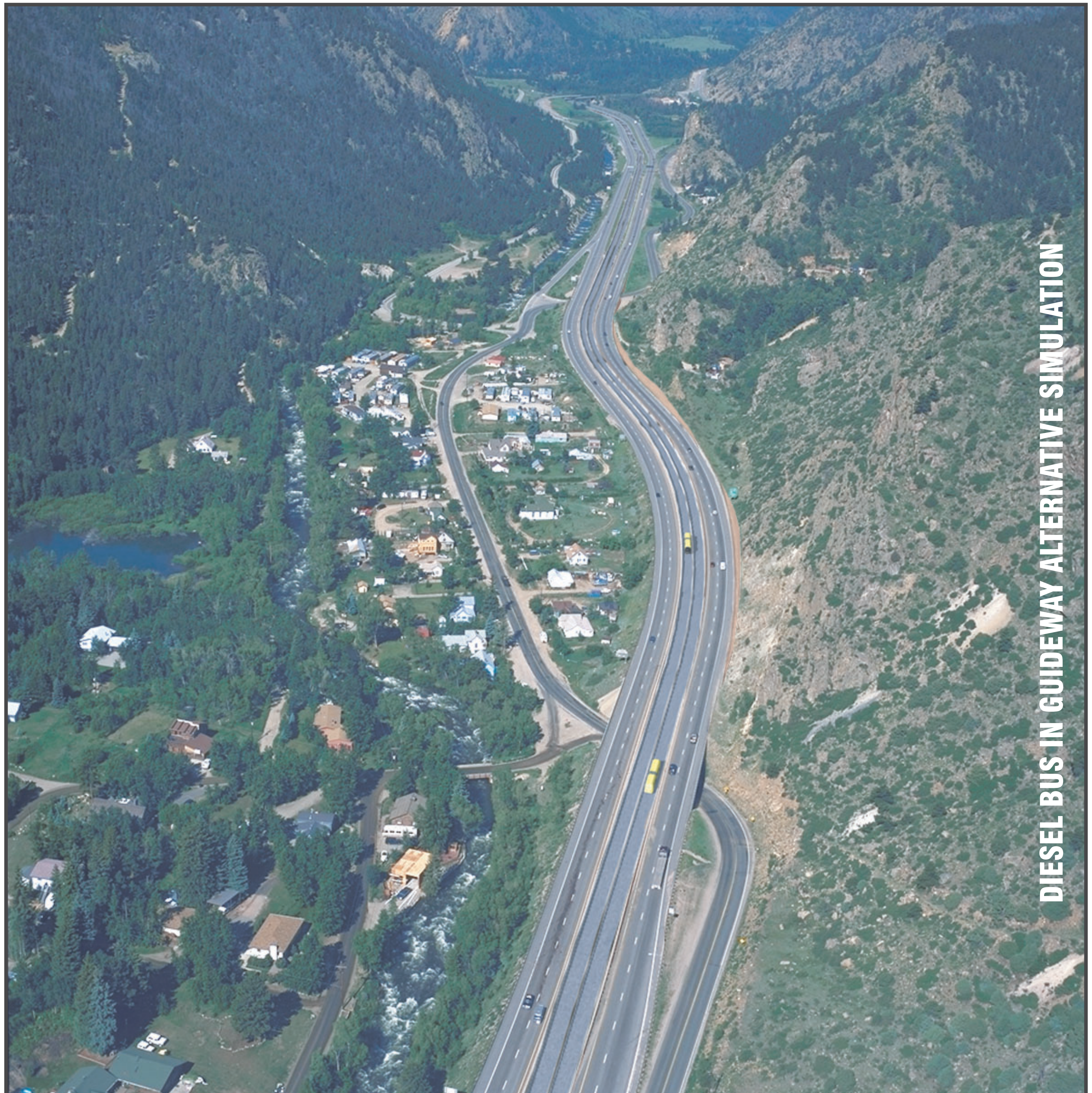

Diesel Bus in Guideway Alternative Visual Simulation
View Looking West near Lawson Toward Empire Junction

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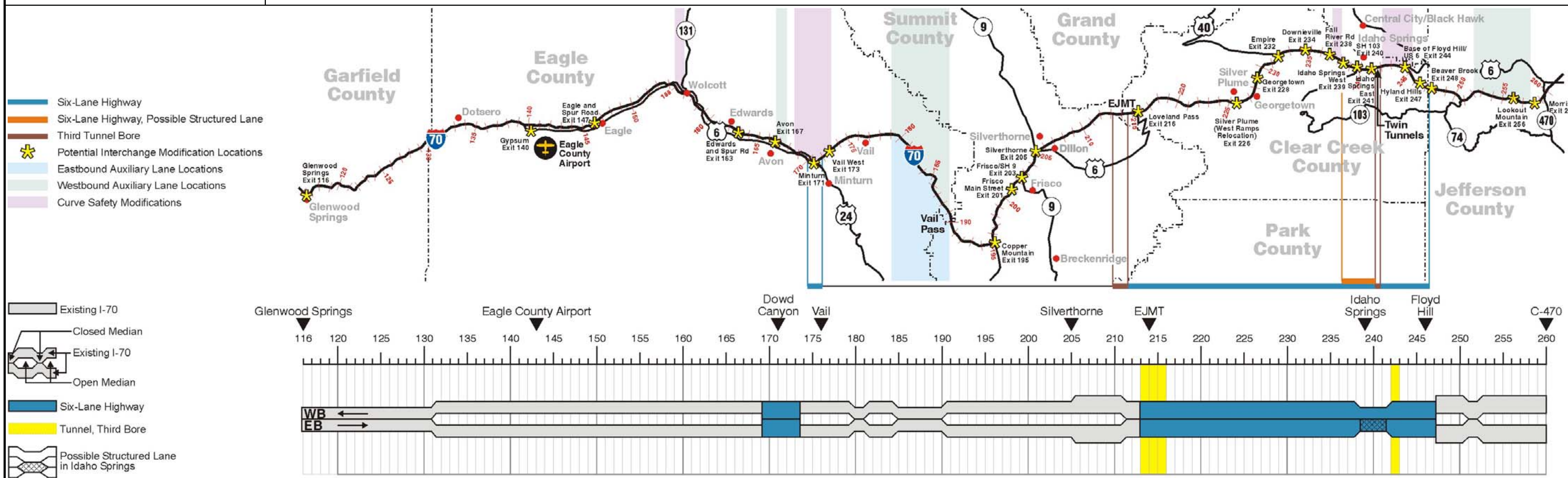
Six-Lane Highway 55 mph Alternative Overview

Physical Description	The Six-Lane Highway 55 mph alternative would include additional traffic lanes in select locations within the Corridor, as follows: **Dowd Canyon (Eagle-Vail to Vail West):** two additional lanes between mileposts 169 and 173, one eastbound and one westbound. **Continental Divide to Floyd Hill:** two additional lanes between milepost 213.5 (EJMT) and milepost 247 (Floyd Hill), one eastbound and one westbound. Structured eastbound lanes may be used in the Idaho Springs area (mileposts 238.9 to 241.4). A paved ditch would be provided on each side of the highway for snow storage with widths as follows: 11 feet from EJMT to Herman Gulch (mileposts 213.5 to 218), 9 feet from Herman Gulch to Silver Plume (mileposts 218 to 226), and 2 feet for all other areas of widening.
Footprint	The total transportation corridor width would range from 94 to 111 feet.
Ability to meet project need	The Six-Lane Highway 55 mph alternative is expected to have sufficient capacity to meet the overall demands in Eagle, Summit, and Clear Creek counties. The mix of gaming traffic from Black Hawk and Central City on Sunday evenings eastbound when weekend traffic from the mountains would still be high is expected to create congestion on Floyd Hill (milepost 247) and extend eastbound through the Jefferson County area. However, this phenomenon would exist among all action alternatives. The expansion in Dowd Canyon would relieve congestion, primarily on weekdays and particularly on summer Fridays westbound. Beyond 2025, congestion would result between EJMT and C-470 on summer Sundays, as population growth continues to seek mountain recreational activities and second home use. The Six-Lane Highway 55 mph alternative would accommodate baseline travel demand (+1 percent), and would reach the ultimate network capacity by 2030 under trend assumptions, or 2050 under the optimistic assumptions (see section 2.3 for description of trend and optimistic assumptions).
Implementation	Total estimated capital costs = $2.41 billion (of which $0.67 billion = Minimal Action components included in capital cost). Among the most cost-effective (annualized capital cost plus annual O&M cost less annual farebox receipts per annual person mile of travel beyond that of No Action) = $0.94 per person mile. Construction difficulty (construction duration and impact) = slightly lower impact than Bus in Guideway, Reversible/HOV/HOT Lanes, or Combination alternatives. Construction of the Six-Lane Highway 55 mph alternative in Clear Creek County would require a traffic management program to mitigate construction-related traffic disruption and community impacts associated with noise, dust, and runoff, as well as housing and services for construction personnel. Summary = relatively low cost and high highway speeds. Less ultimate capacity than that of Transit alternatives and more construction-related traffic congestion.
Safety	Number of high accident areas addressed = greatest number (Wolcott curve, Dowd Canyon, Vail Pass, Silverthorne interchange, east of the EJMT, plus partial improvement at the base of Floyd Hill). Among the highest overall fatality rating among all action alternatives.



Notes:
1) Placement of colored bars indicates whether that portion of the alternative would be on the north or south side or in the median of existing I-70.
2) Selected localized safety and capacity improvement components of Minimal Action are assumed to be included in each of the action alternatives (interchange modifications, auxiliary lanes, curve safety modifications).

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Six-Lane Highway 55 mph - Cross Sections

The Six-Lane Highway 55 mph alternative would include construction of two additional general-purpose traffic lanes, one eastbound and one westbound. Six-Lane Highway 55 mph alternative would be primarily proposed to be on grade; however, in Idaho Springs, a structured configuration is being considered to minimize impacts to the community. As illustrated in the template configuration below, a structured configuration would include eastbound traffic lanes elevated and overhanging the westbound inside shoulder.

A photorealistic visual simulation of Six-Lane Highway 55 mph is provided on the following page. Additional visual simulations illustrating the Six-Lane Highway 55 mph alternative are provided in Appendix L.

Six-Lane Highway 55 mph alternative would require third tunnel bores at the existing EJMT and Twin Tunnels locations. Specific details are provided below.

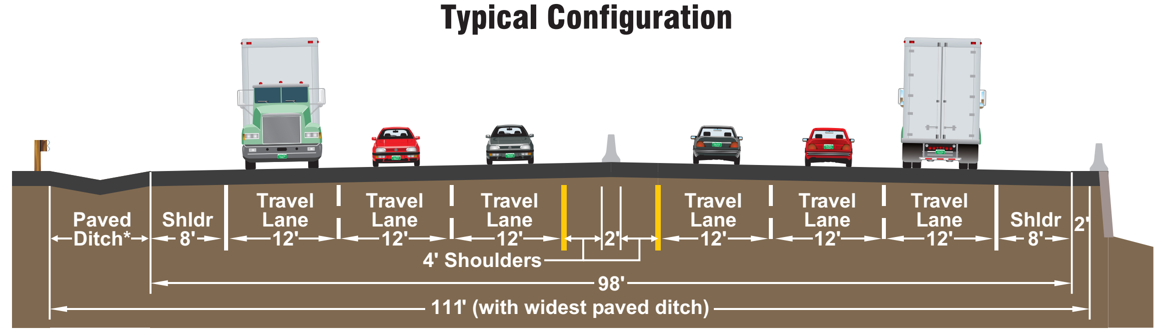
EJMT

- The proposed third tunnel bore would be located to the north of the existing tunnel bores and would accommodate two lanes of westbound traffic. The proposed length of the tunnel would be 13,700 feet.
- The existing north bore would accommodate bidirectional traffic.
- The existing south bore would accommodate two lanes of eastbound traffic.
- Competent rock exists on the west side of the Continental Divide and should require little if any tunnel support during excavation. On the east side, however, faulted and fractured bedrock has contributed to slope instability that caused a landslide during construction of the original tunnel. Additional geologic challenges on the east side would include the Loveland Fault and a section of clay fault gouge, creating very difficult tunneling conditions.
- The cut-and-cover on the east side of the Continental Divide would result in a relatively large excavation, with cut heights reaching 125 feet. Extensive stabilization would likely be required due the height of the cuts and relatively poor condition of the subsurface material. All alternative alignments would have to be designed to avoid the existing landslide that was activated during the original north bore construction.

Twin Tunnels

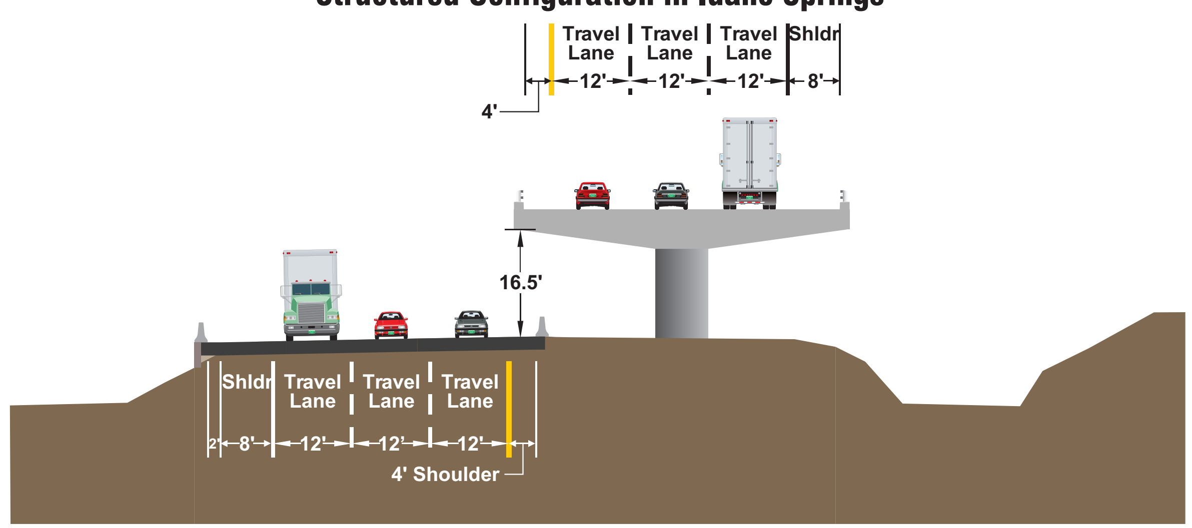
- The existing north bore would accommodate two lanes of westbound traffic.
- The existing south bore would accommodate one lane of westbound traffic.
- The proposed third tunnel bore would be located to the south of the existing tunnel bores and would accommodate three lanes of eastbound traffic.
- Based on the relatively good condition of the subsurface material, conventional stabilization methods would likely be required for the proposed tunnel with a finished concrete lining. The proposed length of the tunnel would be approximately 740 feet and should not require an active ventilation system.
- Due to the difficult narrow terrain in the area and proximity to the existing I-70 alignment, construction staging may be difficult. The approach to the tunnel bore would need to be elevated to avoid impacts to the Scott Lancaster Memorial Bike Path bridge over Clear Creek. In the Tier 2 level of study, options for this tunnel approach could consider relocating the trail and keeping the eastbound tunnel approach on grade, which would reduce tunnel costs.

Typical Configuration



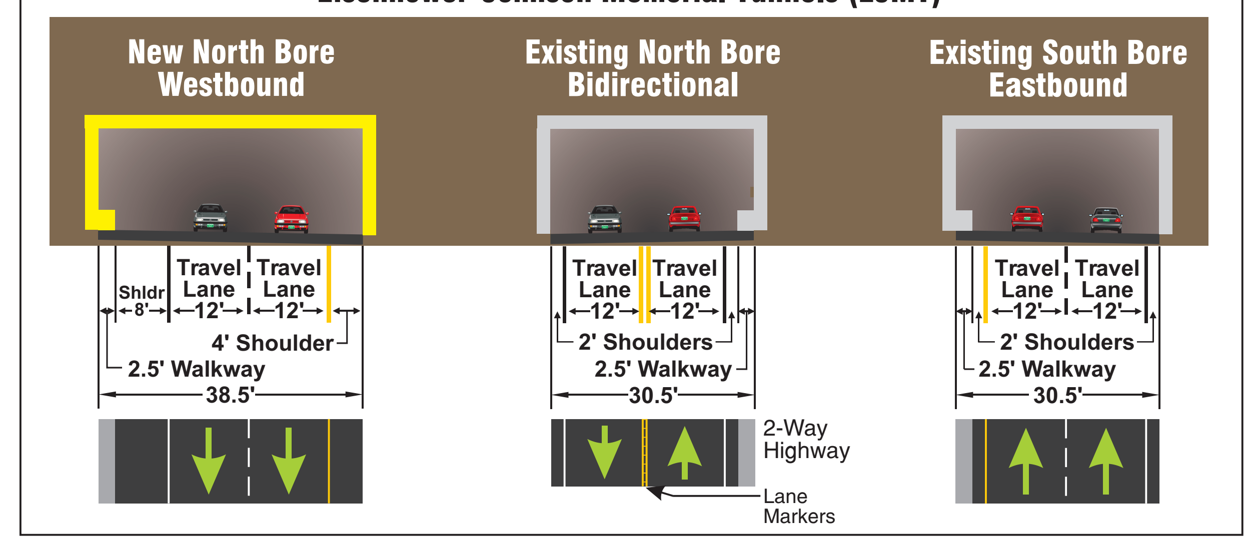
*Variable Paved Ditch Widths:
- 11' from EJMT to Herman Gulch (occurs on north side only)
- 9' from Herman Gulch to Silver Plume (occurs on north side only)
- 2' all areas other than listed above (occurs on north and south side)

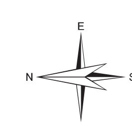
Structured Configuration in Idaho Springs



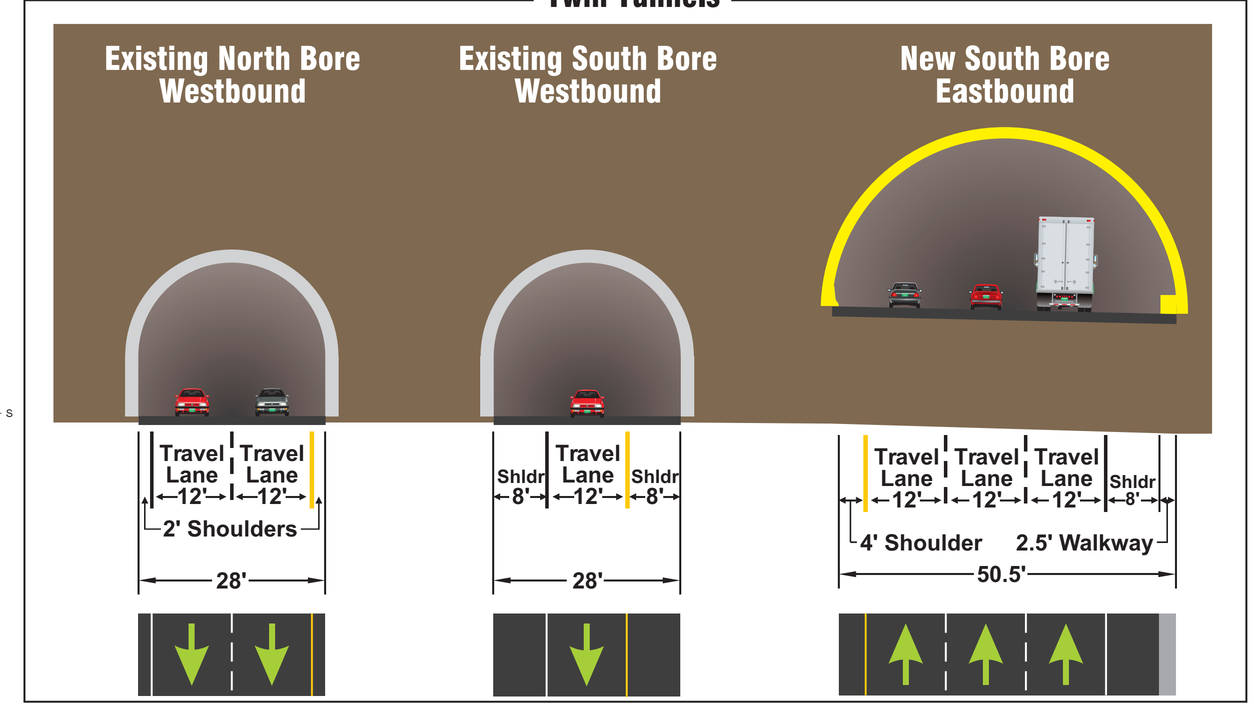
Note: All illustrations view from west to east.

Eisenhower-Johnson Memorial Tunnels (EJMT)





Twin Tunnels



Six-Lane Highway 55 mph

Six-Lane Highway 55 mph

Six-Lane Highway 55 mph - Operations Description

Characteristics:

The Six-Lane Highway 55 mph alternative being considered in the PEIS would incorporate snow storage ditches designed as part of the paved shoulders. The width of the snow storage ditches would be determined by the snow accumulation normally seen above 8,000 to 9,000 feet and the need to have a large enough place to clear it and let it melt.

At 10:1 to 12:1 slopes, the ditches would be considered traversable and, therefore, part of the overall shoulder.

Snow storage ditches would be designed to collect snowmelt and control runoff into sediment basins. The presence of sediment basins along the highway in certain areas where they are necessary would reduce the amount of sand getting to Clear Creek and Straight Creek. These sediment basins would require regular maintenance for proper operation.

As with the No Action alternative, no new transit operators are assumed for the Highway alternatives.

Plan:

- Existing operators are assumed to make incremental frequency adjustments, route extensions, and fleet expansion.
- The operating plans of current transit providers under the Highway alternatives would be very similar to their operating plans under the No Action alternative.
- Reduced congestion associated with increased highway capacity could be expected to lead to greater schedule reliability for existing operators.

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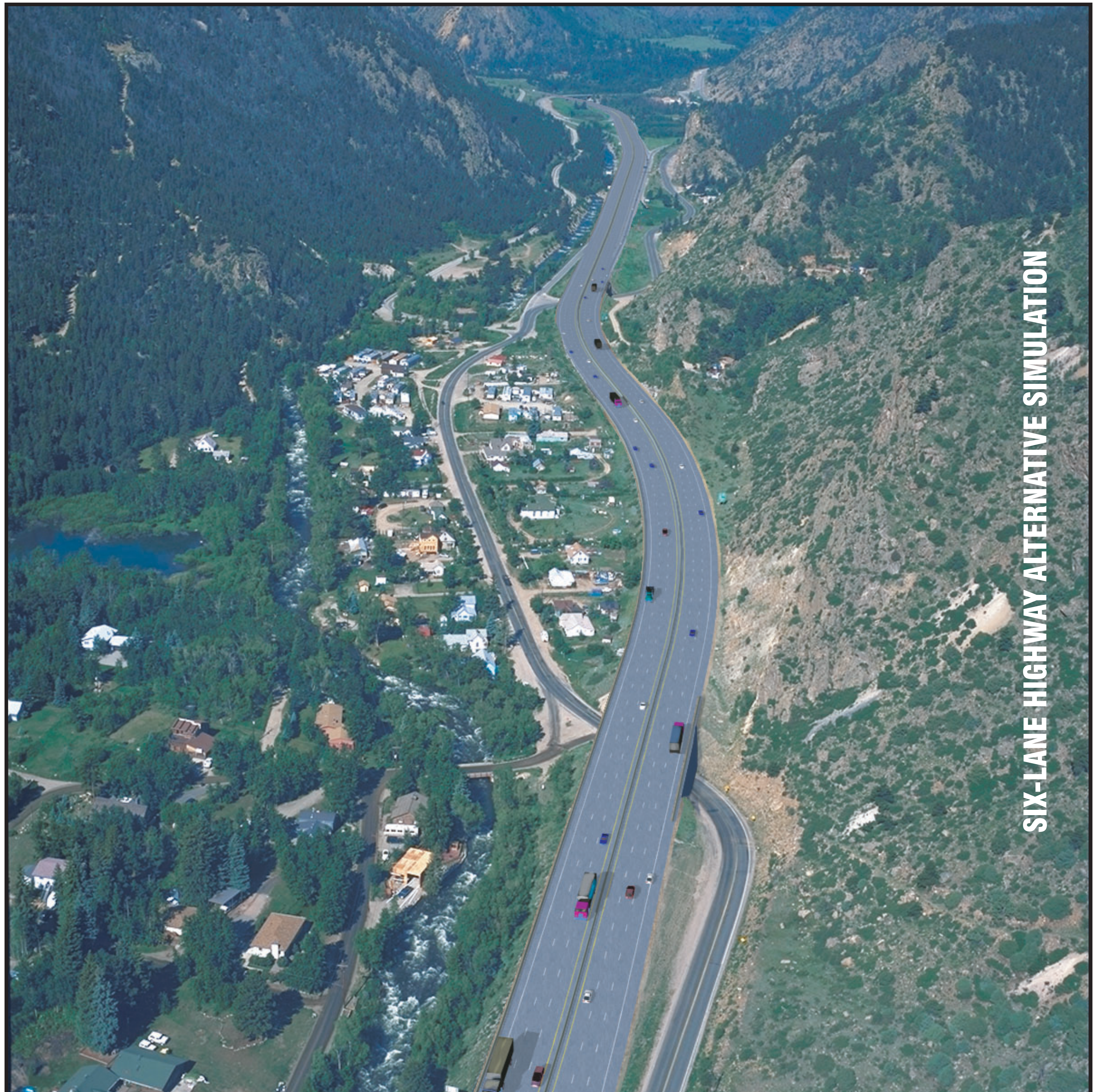
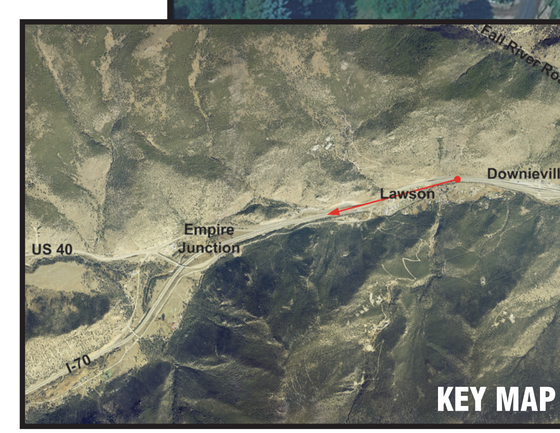


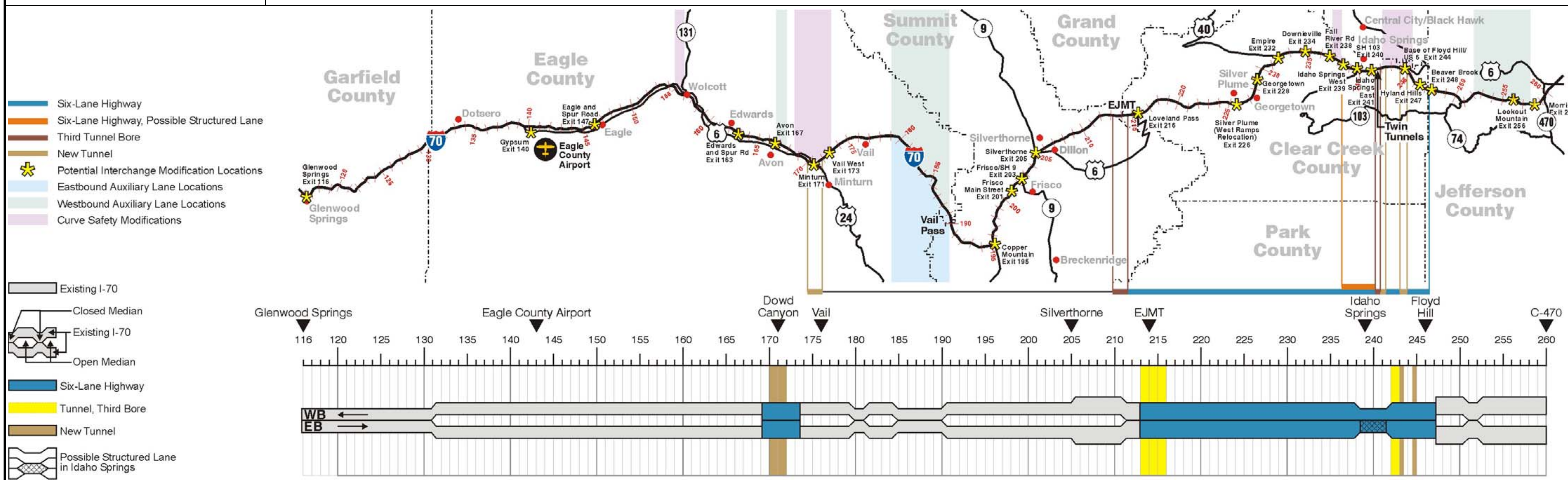
Six-Lane Highway 55 mph



Six-Lane Highway Alternative Visual Simulation
View Looking West near Lawson Toward Empire Junction

Six-Lane Highway 65 mph Alternative Overview

Physical Description	The Six-Lane Highway 65 mph alternative would be similar to the Six-Lane Highway 55 mph alternative but with two new tunnel bores at Dowd Canyon, a new westbound tunnel bore from Hidden Valley to Twin Tunnels (mileposts 242 to 243), a new eastbound tunnel bore at Floyd Hill (mileposts 244 to 247), and highway curve safety modifications near the new tunnels and at Fall River Road. A paved ditch would be provided on each side of the highway for snow storage with widths as follows: 11 feet from EJMT to Herman Gulch (mileposts 213.5 to 218), 9 feet from Herman Gulch to Silver Plume (mileposts 218 to 226), and 2 feet for all other areas of widening.
Footprint	The total transportation corridor width would range from 94 to 111 feet.
Ability to meet project need	The ability to meet project need would be the same as for the Six-Lane Highway 55 mph alternative.
Implementation	Total estimated capital costs = $2.65 billion (of which $0.67 billion = Minimal Action components included in capital cost). Intermediate cost-effectiveness (annualized capital cost plus annual O&M cost less annual farebox receipts per annual person mile of travel beyond that of No Action) = $1.06 per person mile. Construction difficulty (construction duration and impact) = Among the greatest impacts Summary = relatively low cost and high highway speeds. Less ultimate capacity than Transit alternatives and more construction-related traffic congestion. Negligible improvements in congestion relief compared to Six-Lane Highway 55 mph alternative. Benefit over Six-Lane Highway 55 mph alternative would include mitigation of the "S" curves, which are prone to accidents, so accident rates should be reduced slightly.
Safety	Number of high accident areas addressed = greatest number (Wolcott curve, Dowd Canyon, Vail Pass, Silverthorne interchange, east of the EJMT, and at base of Floyd Hill). Among the highest overall fatality rating among all action alternatives. Lowest overall fatality rating among the three Highway alternatives.



Notes:
1) Placement of colored bars indicates whether that portion of the alternative would be on the north or south side or in the median of existing I-70.
2) Selected localized safety and capacity improvement components of Minimal Action are assumed to be included in each of the action alternatives (interchange modifications, auxiliary lanes, curve safety modifications).

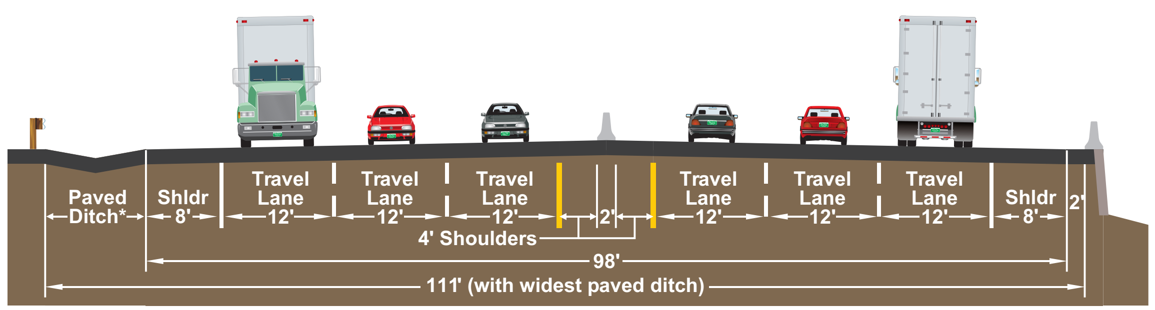
Six-Lane Highway 65 mph - Cross Sections

The Six-Lane Highway 65 mph alternative would include construction of two additional general-purpose traffic lanes, one eastbound and one westbound. Six-Lane Highway 65 mph alternative would be primarily proposed to be on grade; however, in Idaho Springs, a structured configuration is being considered to minimize impacts to the community. As illustrated in the template configuration below, a structured configuration would include eastbound traffic lanes elevated and overhanging the westbound inside shoulder.

Cross sections of tunnels unique to Six-Lane Highway 65 mph alternative are provided on the following page. Additional visual simulations illustrating the Six-Lane Highway 65 mph alternative are provided in Appendix L.

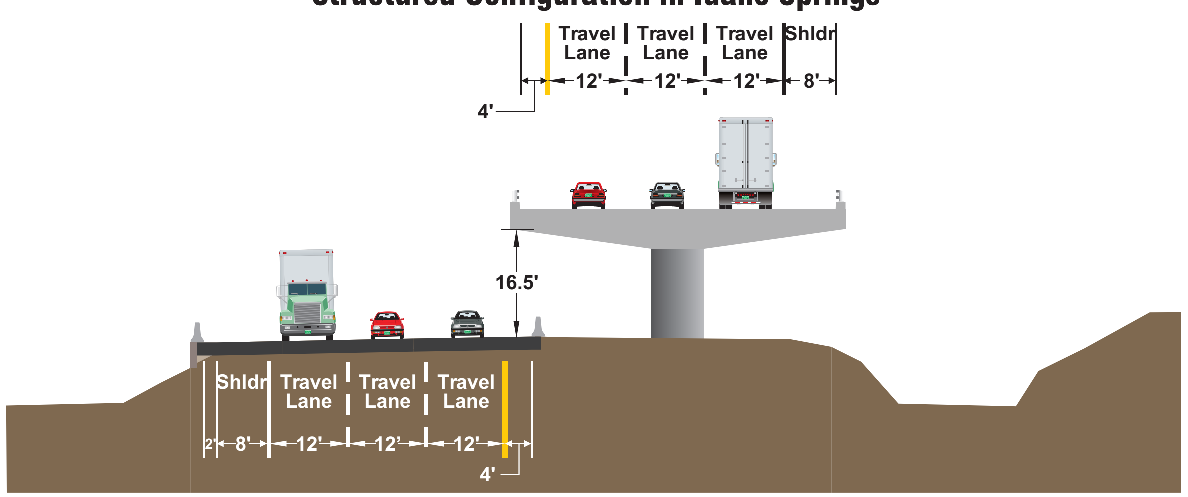
The Six-Lane Highway 65 mph alternative would require third tunnel bores at the existing EJMT and Twin Tunnel locations. Additionally, this alternative would include new tunnel bores in select areas to achieve a higher design speed. Specific details are provided below.

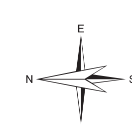
Typical Configuration



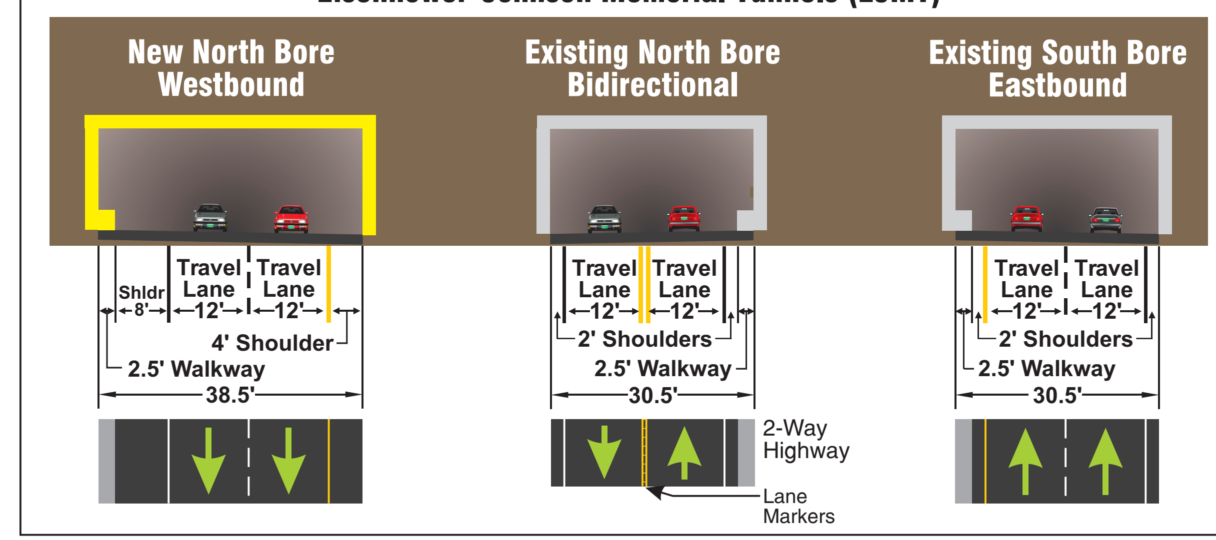
*Variable Paved Ditch Widths:
- 11' from EJMT to Herman Gulch (occurs on north side only)
- 9' from Herman Gulch to Silver Plume (occurs on north side only)
- 2' all areas other than listed above (occurs on north and south side

Structured Configuration in Idaho Springs

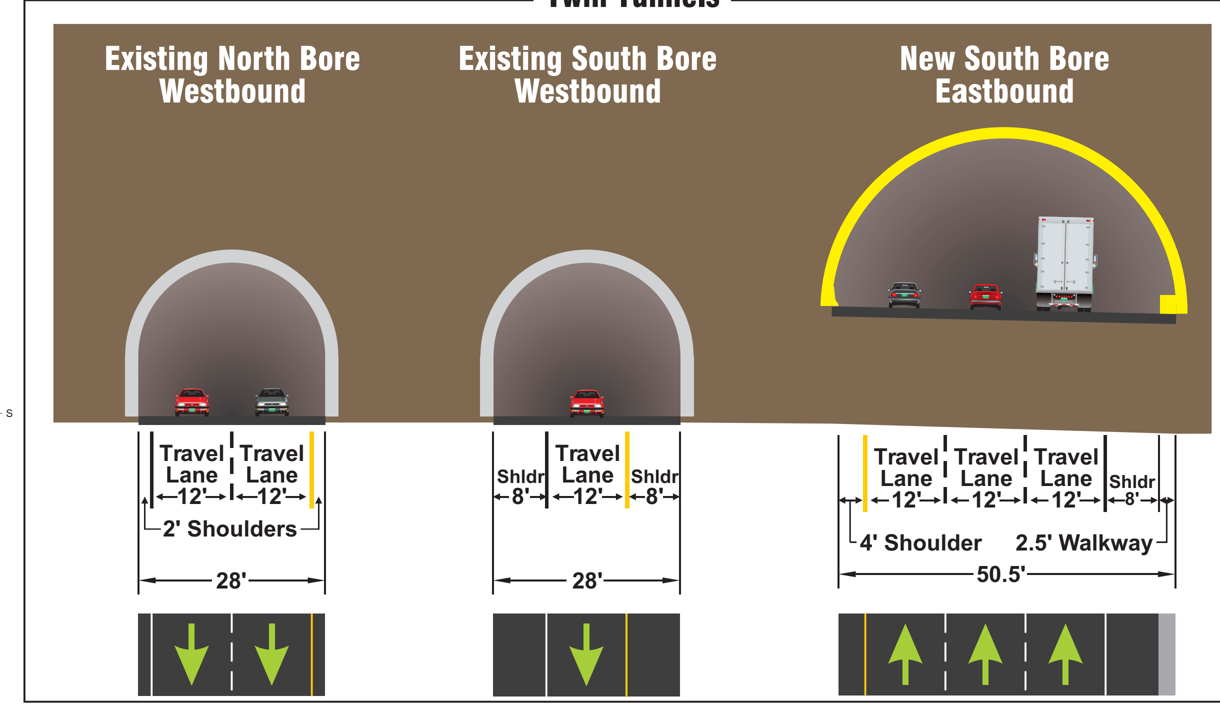




Eisenhower-Johnson Memorial Tunnels (EJMT)



Twin Tunnels



Note: All illustrations view from west to east.

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Six-Lane Highway 65 mph - Cross Sections

THIRD TUNNEL BORES AT EXISTING TUNNEL LOCATIONS (see previous page for cross sections)

EJMT

- The proposed third tunnel bore would be located to the north of the existing tunnel bores and would accommodate two lanes of westbound traffic. The proposed length of the tunnel would be 13,700 feet.
- The existing north bore would accommodate bidirectional traffic.
- The existing south bore would accommodate two lanes of eastbound traffic.
- Competent rock exists on the west side of the Continental Divide and should require little if any tunnel support during excavation. On the east side, however, faulted and fractured bedrock has contributed to slope instability that caused a landslide during construction of the original tunnel. Additional geologic challenges on the east side would include the Loveland Fault and a section of clay fault gouge, creating very difficult tunneling conditions.
- The cut-and-cover on the east side of the Continental Divide would result in a relatively large excavation, with cut heights reaching 125 feet. Extensive stabilization would likely be required due to the height of the cuts and relatively poor condition of the subsurface material. All alternative alignments would have to be designed to avoid the existing landslide that was activated during the original north bore construction.

Twin Tunnels

- The existing north bore would accommodate two lanes of westbound traffic.
- The existing south bore would accommodate one lane of westbound traffic.
- The proposed third tunnel bore would be located to the south of the existing tunnel bores and would accommodate three lanes of eastbound traffic.
- Based on the relatively good condition of the subsurface material, conventional stabilization methods would likely be required for the proposed tunnel with a finished concrete lining. The proposed length of the tunnel would be approximately 740 feet and should not require an active ventilation system.
- Due to the difficult narrow terrain in the area and proximity to the existing I-70 alignment, construction staging may be difficult. The approach to the tunnel bore would need to be elevated to avoid impacts to the Scott Lancaster Memorial Bike Path bridge over Clear Creek. In the Tier 2 level of study, options for this tunnel approach could consider relocating the trail and keeping the eastbound tunnel approach on grade, which would reduce tunnel costs.

NEW TUNNELS

To maintain a 65 mph design speed through Dowd Canyon and Clear Creek Canyon, three new tunnel locations would be required.

Dowd Canyon

- The new tunnels in this location would consist of two new three-lane tunnels, one to accommodate westbound traffic, the other for eastbound traffic. These tunnels are anticipated to be approximately 7,200 feet long.

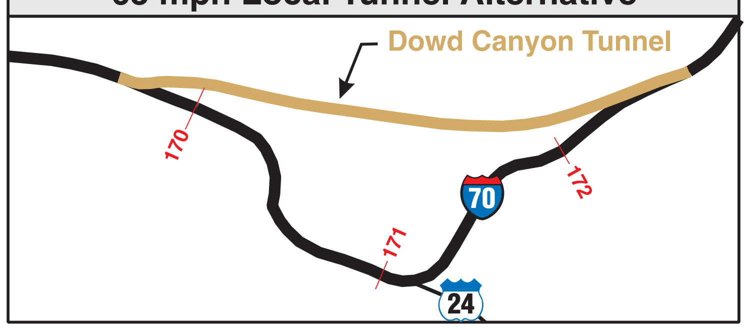
Twin Tunnels to Hidden Valley

- The new tunnel in this location would consist of one new three-lane tunnel that would accommodate westbound traffic only. This tunnel is anticipated to be approximately 1,400 feet long.
- Eastbound would roughly follow the existing alignment but would require curve safety modifications in select locations to maintain the 65 mph design speed.

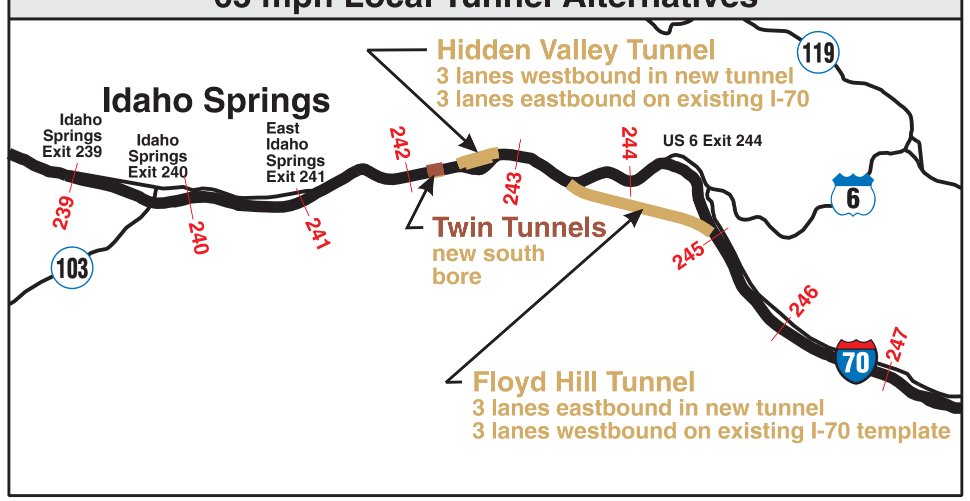
Hidden Valley to Floyd Hill

- The new tunnel in this location would consist of one new three-lane tunnel that would accommodate eastbound traffic only. This tunnel is anticipated to be approximately 5,500 feet long.
- Due to the length of this tunnel, an active ventilation system would be required.

65 mph Local Tunnel Alternative

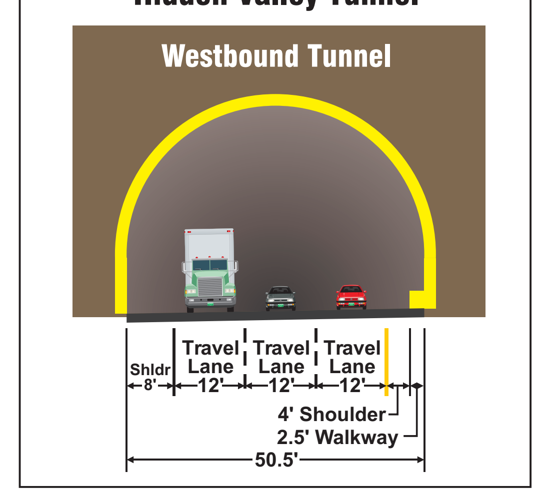


65 mph Local Tunnel Alternatives

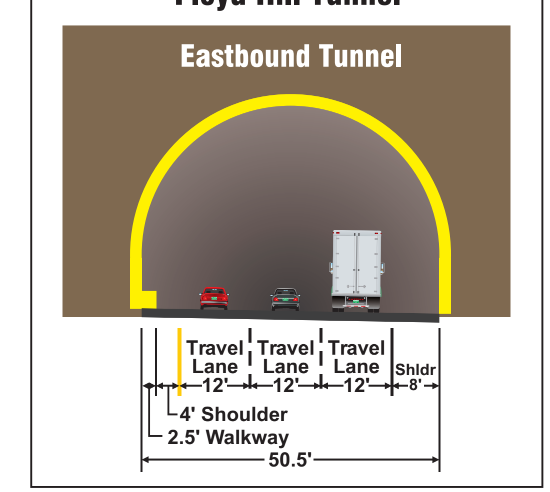


Dowd Canyon Tunnel

Hidden Valley Tunnel



Floyd Hill Tunnel



Notes: All illustrations view from west to east.

Six-Lane Highway 65 mph

Six-Lane Highway 65 mph - Operations Description

Characteristics:

The Six-Lane Highway 65 mph alternative being considered in the PEIS would incorporate snow storage ditches designed as part of the paved shoulders. The width of the snow storage ditches would be determined by the snow accumulation normally seen above 8,000 to 9,000 feet and the need to have a large enough place to clear it to and let it melt.

At 10:1 to 12:1 slopes, the ditches would be considered traversable and, therefore, part of the overall shoulder.

Roadside ditches would be designed to collect snowmelt and control runoff into sediment basins. The presence of sediment basins along the highway in certain areas where they are necessary would reduce the amount of sand getting to Clear Creek and Straight Creek. These sediment basins would require regular maintenance for proper operation.

The Six-Lane Highway 65 mph alternative would require the most extensive tunneling. Due to the size and complexity of the proposed tunnel alternatives, continual monitoring of the tunnel systems would be required. The systems would include lighting, power, surveillance, and control systems. These systems would monitor and control traffic and ventilation in both normal and emergency situations.

Lighting requirements would differ depending on the length of each of the proposed tunnel locations.

With the exception of the proposed new third bore at the Twin Tunnels near Idaho Springs, all of the proposed tunnels would require the installation of a ventilation system to regulate air quality and for fire suppression.

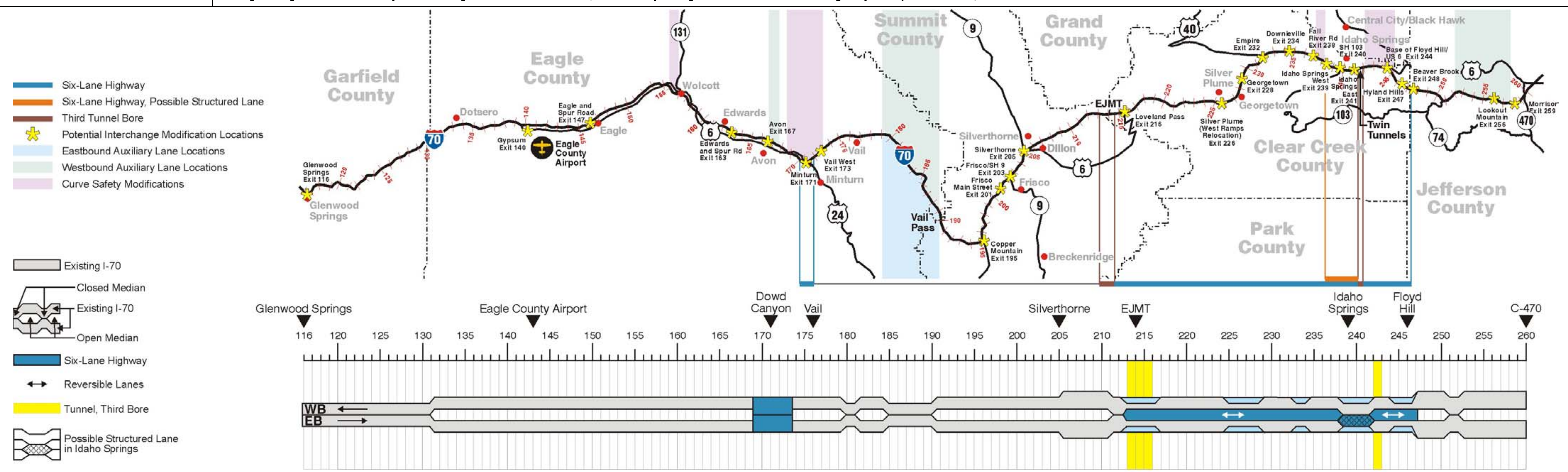
As with the No Action alternative, no new transit operators are assumed for the Highway alternatives.

Plan:

- Existing operators are assumed to make incremental frequency adjustments, route extensions, and fleet expansion.
- The operating plans of current transit providers under the Highway alternatives would be very similar to their operating plans under the No Action alternative.
- Reduced congestion associated with increased highway capacity could be expected to lead to greater schedule reliability for existing operators.

Reversible/HOV/HOT Lanes Alternative Overview

Physical Description	A reversible lane facility would change traffic flow directions as needed to accommodate peak direction demand. Reversible lanes would be built from the west side of the EJMT to just east of Hyland Hills. From the EJMT to just east of the US 6/ base of Floyd Hill interchange, two additional lanes would be provided in the center between the two eastbound and two westbound lanes, separated by a barrier. One lane would provide access to/from US 6/Clear Creek Canyon and the other would continue east along I-70, ending between Hyland Hills and Beaver Brook. The only entrance and exit from the reversible lanes would be at the termini, at US 6, and at the Empire Junction interchange. Tunnel requirements would be the same as those for Six-Lane Highway 55 mph. The alternative would include two additional general-purpose lanes in Dowd Canyon (mileposts 170 to 173), but not barrier separated or reversible. A paved ditch would be provided on each side of the highway for snow storage with widths as follows: 11 feet from EJMT to Herman Gulch (mileposts 213.5 to 218), 9 feet from Herman Gulch to Silver Plume (mileposts 218 to 226), and 2 feet for all other areas of widening. The primary difference in the roadway platform between the Six-Lane Highway (55 or 65 mph) alternatives and this alternative (2 reversible lanes and 4 general purpose lanes) would be the presence of an additional set of barriers for the reversible lanes and an extra set of 4-foot and 8-foot shoulders for these lanes.
Footprint	The total transportation corridor width would range from 82 to 125 feet.
Ability to meet project need	The existing lanes would operate as general-purpose lanes with full access to all interchanges, which all vehicles may use. For this report, it is assumed that the reversible lanes would be operated using free route selection, with drivers choosing their facility based on their destination and travel time assumptions, with the exception being that semitrailers and single-unit trucks would not be eligible to use the reversible lanes. Travel conditions in both the peak (with the reversible lanes) and off-peak configurations would be assessed. It is assumed that the facility would switch directions during daylight hours on peak weekends but would stay in a single direction on weekdays. For some daily directions, the longest travel time would occur when the extra lanes are in that direction and for others it would occur when they are not. The key differences from the Six-Lane Highway (55 or 65 mph) alternatives would occur in the westbound direction. This alternative would provide additional capacity in area west of the Beaver Brook interchange, which would reduce westbound travel times in the segment from C-470 to Beaver Brook and substantially reduce the annual hours of congestion at the Floyd Hill focal point. It is expected that, just as with the Six-Lane Highway (55 or 65 mph) alternatives, the highway would be overloaded in the eastbound direction on peak-days east of Hyland Hills, where the extra lanes end. The Reversible/HOV/HOT Lanes alternative would accommodate baseline travel demand (+1 percent), and would reach the ultimate network capacity by 2030 under trend assumptions, or 2050 under the optimistic assumptions (see section 2.3 for description of trend and optimistic assumptions).
Implementation	Total estimated capital costs = \$2.52 billion (of which \$0.67 billion = Minimal Action components included in capital cost). Among the most cost-effective (annualized capital cost plus annual O&M cost less annual farebox receipts per annual person mile of travel beyond that of No Action) = \$0.87 per person mile. This alternative would be the most cost-effective of the three Highway alternatives. Construction difficulty (construction duration and impact) = Among the greatest impacts. Summary = Relatively low cost and high highway speeds. Less ultimate capacity than Transit alternatives and more construction-related traffic congestion. A higher peak direction capacity and the ability to more easily implement toll, HOV, and HOT scenarios would be the additional benefits over the Six-Lane Highway (55 mph and 65 mph) alternatives.
Safety	Number of high accident areas addressed = greatest number (Wolcott curve, Dowd Canyon, Vail Pass, Silverthorne interchange, and east of the EJMT, plus partial improvement at the base of Floyd Hill). Among the highest overall fatality rates among all action alternatives (same fatality rating as that of the Six-Lane Highway 55 mph alternative).



Notes:
1) Placement of colored bars indicates whether that portion of the alternative would be on the north or south side or in the median of existing I-70.
2) Selected localized safety and capacity improvement components of Minimal Action are assumed to be included in each of the action alternatives (interchange modifications, auxiliary lanes, curve safety modifications).

Reversible/HOV/HOT Lanes - Cross Sections

The Reversible/HOV/HOT Lanes alternative would include construction of two additional reversible traffic lanes. The Reversible/HOV/HOT Lanes alternative is proposed to be primarily on grade; however, in Idaho Springs, a structured configuration is being considered to minimize impacts to the community. As illustrated in the template configuration below, a structured configuration would include eastbound traffic lanes stacked above the two reversible lanes.

Reversible/HOV/HOT Lanes alternative would require third tunnel bores at the existing EJMT and Twin Tunnels locations. Specific details are provided below.

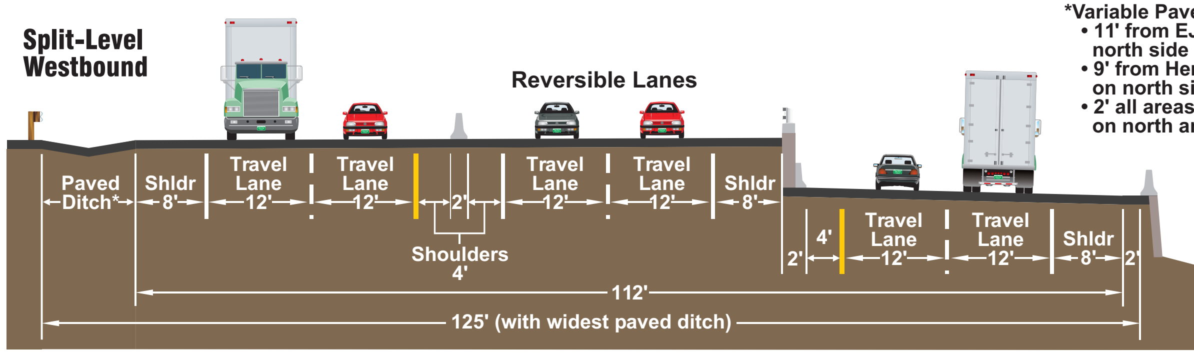
EJMT

- The proposed third tunnel bore would be located to the north of the existing tunnel bores and would accommodate two lanes of westbound traffic. The proposed length of the tunnel would be 13,700 feet.
- The existing north bore would accommodate two reversible lanes of traffic.
- The existing south bore would accommodate two lanes of eastbound traffic.
- Competent rock exists on the west side of the Continental Divide and should require little if any tunnel support during excavation. On the east side, however, faulted and fractured bedrock has contributed to slope instability that caused a landslide during construction of the original tunnel. Additional geologic challenges on the east side would include the Loveland Fault and a section of clay fault gouge, creating very difficult tunneling conditions.
- The cut-and-cover on the east side of the Continental Divide would result in a relatively large excavation, with cut heights reaching 125 feet. Extensive stabilization would likely be required due to the height of the cuts and relatively poor condition of the subsurface material. All alternative alignments would have to be designed to avoid the existing landslide that was activated during the original north bore construction.

Twin Tunnels

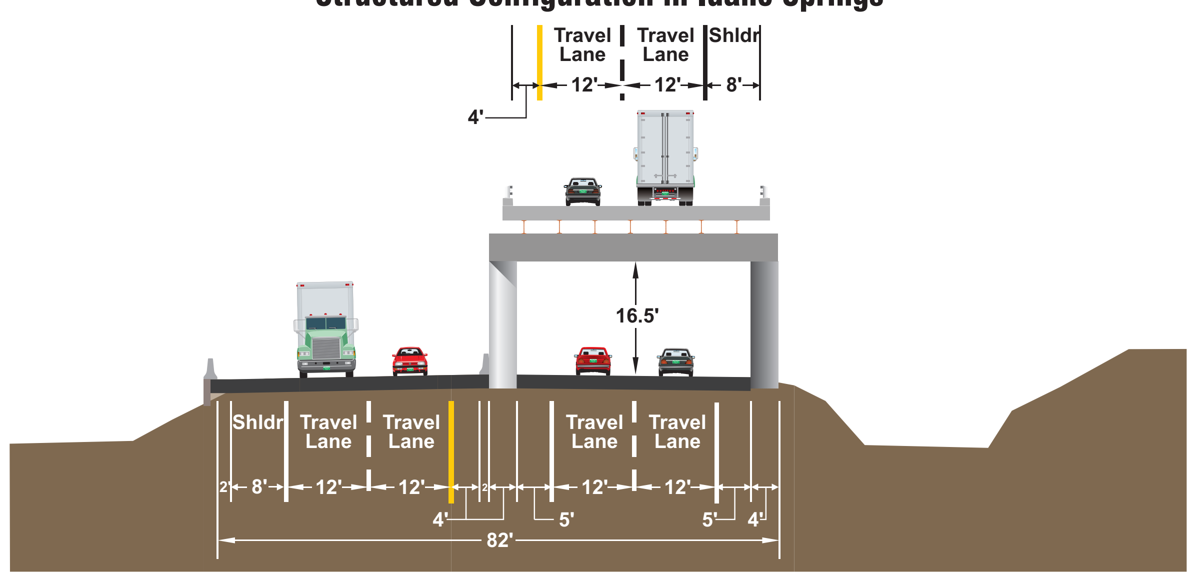
- The existing north bore would accommodate two lanes of westbound traffic.
- The existing south bore would accommodate two reversible lanes of traffic.
- The proposed third tunnel bore would be located to the south of the existing tunnel bores and would accommodate two lanes of eastbound traffic.
- Based on the relatively good condition of the subsurface material, conventional stabilization methods would likely be required for the proposed tunnel with a finished concrete lining. The proposed length of the tunnel would be approximately 740 feet and should not require an active ventilation system.
- Due to the difficult narrow terrain in the area and proximity to the existing I-70 alignment, construction staging may be difficult. The approach to the tunnel bore would need to be elevated to avoid impacts to the Scott Lancaster Memorial Bike Path bridge over Clear Creek. In the Tier 2 level of study, options for this tunnel approach could consider relocating the trail and keeping the eastbound tunnel approach on grade, which would reduce tunnel costs.

Typical Configuration

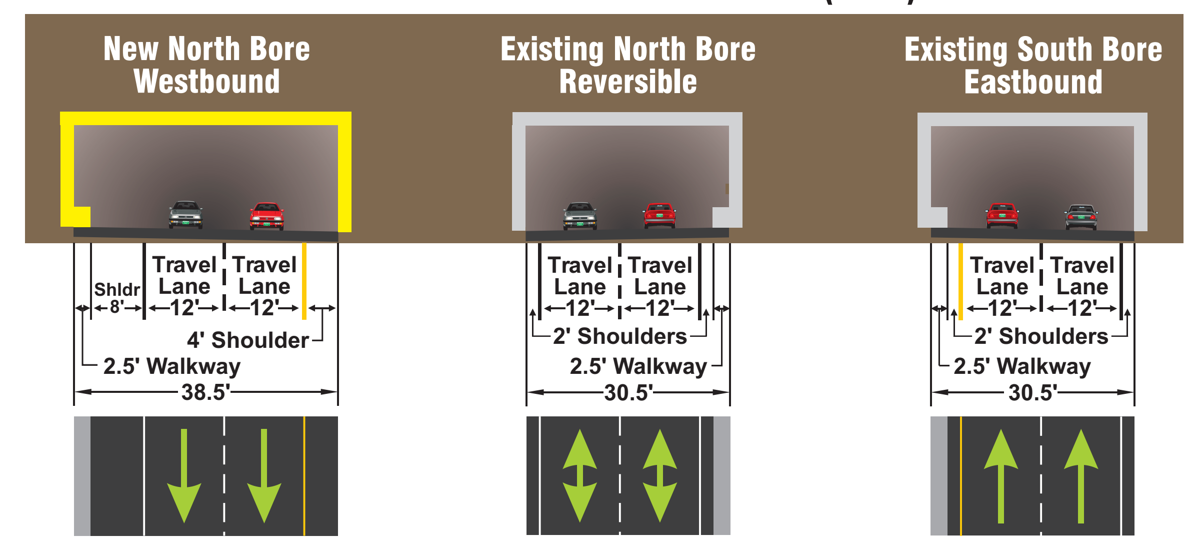


*Variable Paved Ditch Widths:
- 11' from EJMT to Herman Gulch (occurs on north side only)
- 9' from Herman Gulch to Silver Plume (occurs on north side only)
- 2' all areas other than listed above (occurs on north and south side)

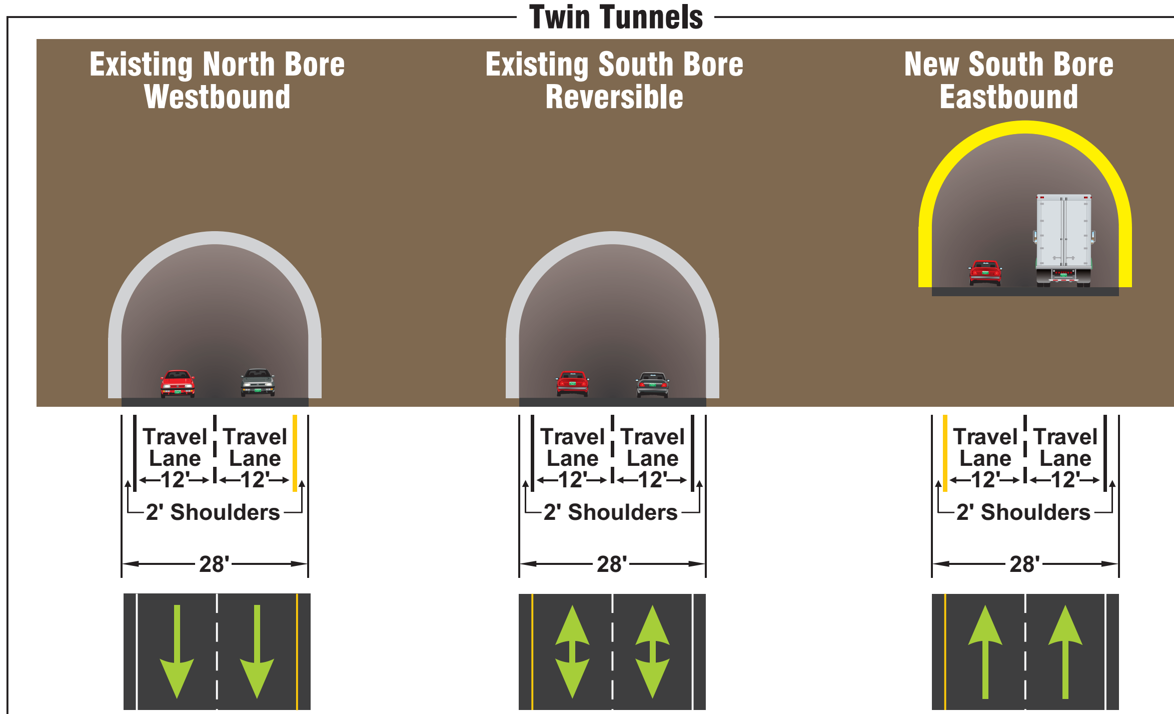
Structured Configuration in Idaho Springs

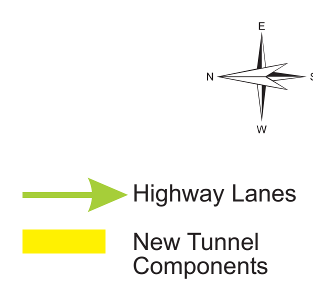


Eisenhower-Johnson Memorial Tunnels (EJMT)



Twin Tunnels





Note: All illustrations view from west to east.

Reversible/HOV/HOT Lanes

Reversible/HOV/HOT Lanes - Operations Description

Characteristics:

Under the Reversible/HOV/HOT Lanes alternative, the I-70 template from the West Portal at the EJMT to Floyd Hill would consist of three barrier-separated sets of two lanes each. The center two reversible lanes would operate in the direction of the peak volume for particular hours of the day. The direction of the center lanes would be controlled through access gates and signing. Two variations of this alternative would include High Occupancy Vehicle (HOV) lanes and High Occupancy / Toll (HOT) lanes.

- HOV lanes could be designated as available for vehicles with two or more people, or another occupancy determined to be appropriate.
- HOT lanes would also allow HOVs; however, vehicles not meeting the occupancy requirement would still be able to use the reversible lanes by paying a toll or fee. Toll collection may use automatic vehicle identification (AVI) tags, such as the ExpressToll transponders currently in use on the E-470 and Northwest Parkway toll roads around the Denver metropolitan area.

The Reversible/HOV/HOT Lanes alternative being considered in the PEIS would incorporate snow storage ditches designed as part of the paved shoulders. The width of the snow storage ditches would be determined by the snow accumulation seen above 8,000 to 9,000 feet and the need to have a large enough place to clear it to and let it melt.

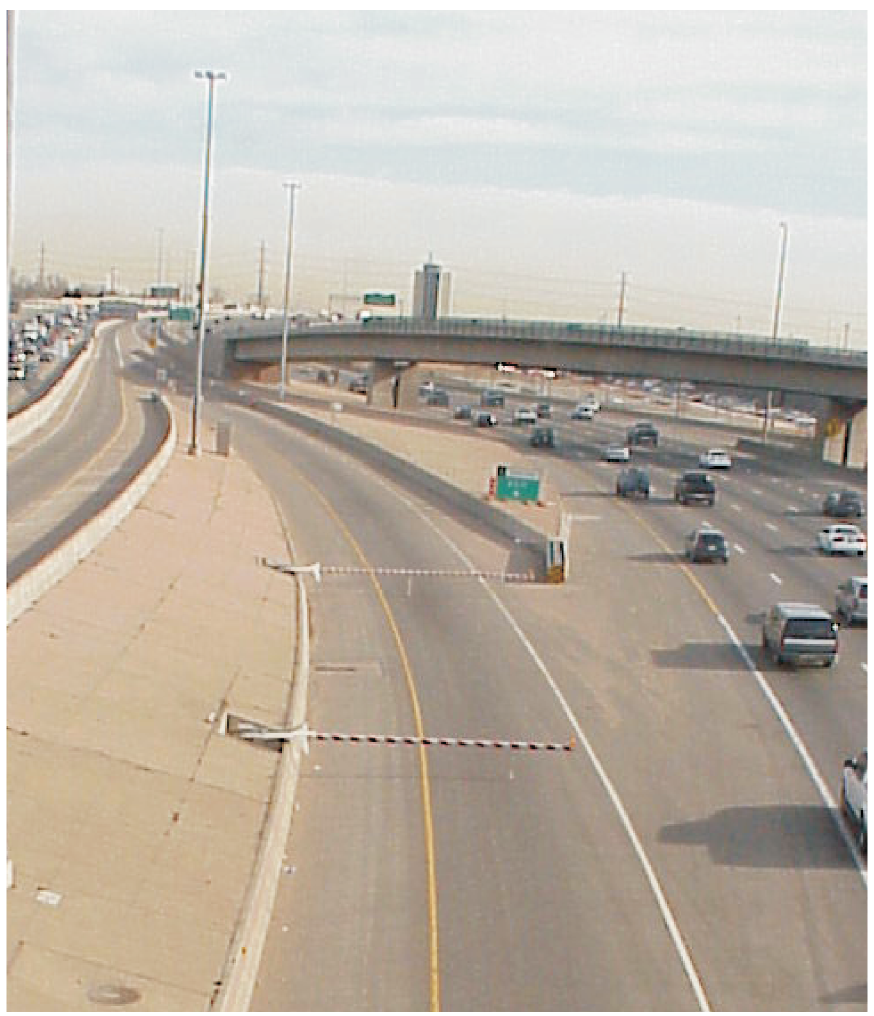
At 10:1 to 12:1 slopes, the ditches would be considered traversable and, therefore, part of the overall shoulder.

Roadside ditches would be designed to collect snowmelt and control runoff into sediment basins. The presence of sediment basins along the highway in certain areas where they are necessary would reduce the amount of sand getting to Clear Creek and Straight Creek. These sediment basins would require regular maintenance for proper operation.

As with the No Action alternative, no new transit operators are assumed for the Highway alternatives.

Plan:

- The reversible lanes could be reversed (from eastbound to westbound or vice versa) through use of gates to control access.
- To ensure that lanes are free of traffic and ready for reversal, a maintenance trail vehicle would follow the last vehicle past the gate or cameras could watch for the last vehicle.
- Once clear, gates at the other end of the facility would be opened, and traffic would be free to enter the lanes going the other way.
- Variable message signs (VMS) would likely be used to inform drivers of the direction and travel time of the reversible lanes. VMS could also display any tolls, should this option be preferred.
- Existing transit operators are assumed to make incremental frequency adjustments, route extensions, and fleet expansion.
- The operating plans of current transit providers under the Highway alternatives would be very similar to their operating plans under the No Action alternative.
- Reduced congestion associated with increased highway capacity could be expected to lead to greater schedule reliability for existing operators.
- Existing transit operators are expected to use the reversible lanes heavily.



Urban example: Reversible Lanes on I-25 in Denver with gates to prevent entry during reverse direction operation.

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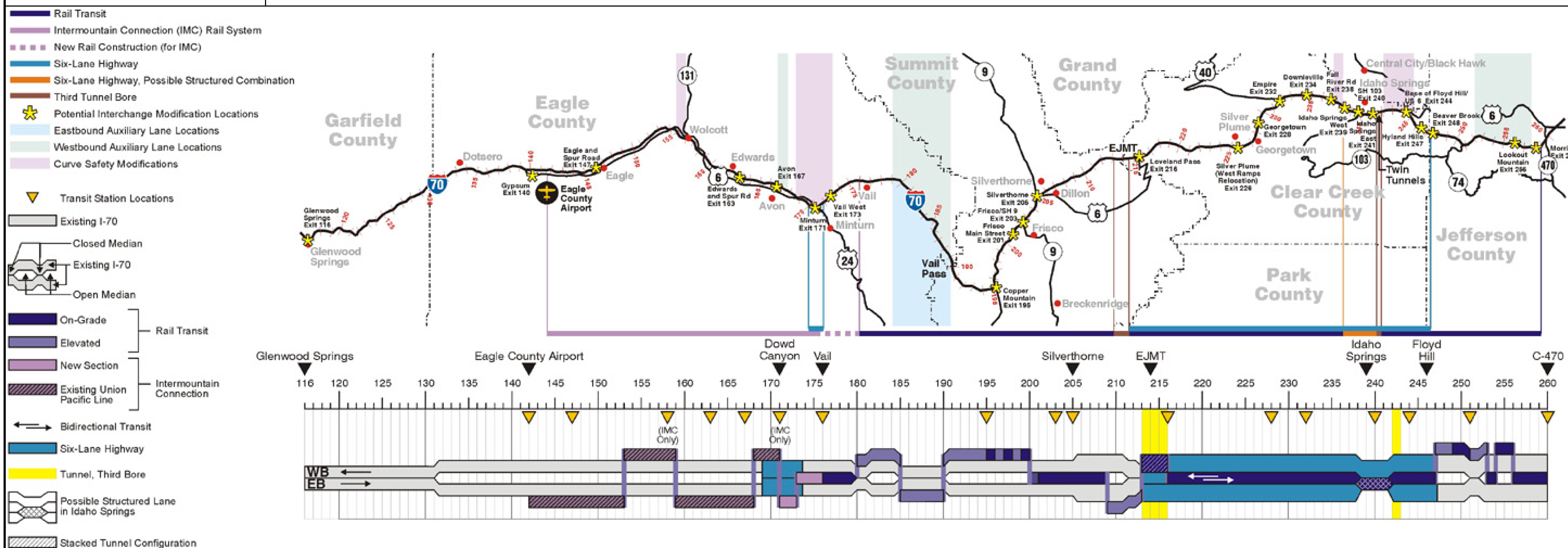
Combination Alternatives

Note: For operations descriptions on the Combination alternatives, refer to the appropriate Highway or Transit alternative discussion.

Combination Six-Lane Highway with Rail and IMC Alternative Overview

Physical Description	The Combination Six-Lane Highway with Rail and IMC alternative would provide rail service and the highway widening described in the overview of the Six-Lane Highway 55 mph alternative in select locations within the Corridor. The six-lane highway would accommodate rail in the median. The rail portion of this alternative would provide transit service from C-470 to the Eagle County Airport. **Dowd Canyon:** Requires two additional lanes for the six-lane highway (mileposts 169 to 173). **Continental Divide to Floyd Hill:** Requires two additional lanes for the six-lane highway from the EJMT (milepost 213.5) to Floyd Hill (milepost 247). Structured eastbound lanes may be required in the Idaho Springs area (mileposts 238.9 to 241.4). A paved ditch would be provided on each side of the highway for snow storage with widths as follows: 11 feet from EJMT to Herman Gulch (mileposts 213.5 to 218), 9 feet from Herman Gulch to Silver Plume (mileposts 218 to 226), and 2 feet for all other areas of widening. New tunnel bores would be required at the Twin Tunnels and EJMT.
Footprint	The total transportation corridor width would range from 94 to 143 feet.
Ability to meet project need	All of the Combination alternatives would provide adequate capacity and result in acceptable levels of service through 2025 and beyond. The Combination Six-Lane Highway with Rail and IMC alternative would accommodate baseline travel demand (+11 percent), and would reach the ultimate network capacity by 2045 under trend assumptions, or 2090 under the optimistic assumptions (see section 2.3 for description of trend and optimistic assumptions).
Implementation	Total capital cost = \$6.5 billion (of which \$0.67 billion = Minimal Action components included in capital cost). Intermediate cost-effectiveness (annualized capital cost plus annual O&M cost less annual farebox receipts per annual person mile of travel beyond that of No Action) = \$0.99 per person mile. Construction difficulty (construction duration and impact) = greatest impact. Construction would occur in the median, outside the existing I-70 template, and away from I-70. Summary = would result in the maximum capacity (2025 and beyond) and the highest future highway speeds. Also high in cost with maximum construction-related traffic congestion.
Safety	Number of high accident areas addressed = greatest number (same as the Six-Lane Highway 55 mph alternative). Overall fatality rating would be lower than that of the Rail with IMC alternative but higher than that of the AGS alternative.



Notes:
1) Placement of colored bars indicates whether that portion of the alternative would be on the north or south side or in the median of existing I-70.
2) Selected localized safety and capacity improvement components of Minimal Action are assumed to be included in each of the action alternatives (interchange modifications, auxiliary lanes, curve safety modifications).

Combination Six-Lane Highway with Rail and IMC - Cross Sections

The Combination Six-Lane Highway with Rail and IMC alternative would include construction of two additional general-purpose traffic lanes and bidirectional rail. Where highway widening would occur (throughout Clear Creek County), rail would be located primarily within the median.

Combination Six-Lane Highway with Rail and IMC is proposed to be primarily on grade; however, in Idaho Springs, a structured configuration is being considered to minimize impacts to the community. As illustrated in the template configuration below, a structured configuration would include eastbound traffic lanes elevated over bidirectional rail.

Combination Six-Lane Highway with Rail and IMC alternative would require third tunnel bores at the existing EJMT and Twin Tunnels locations. Specific details are provided below.

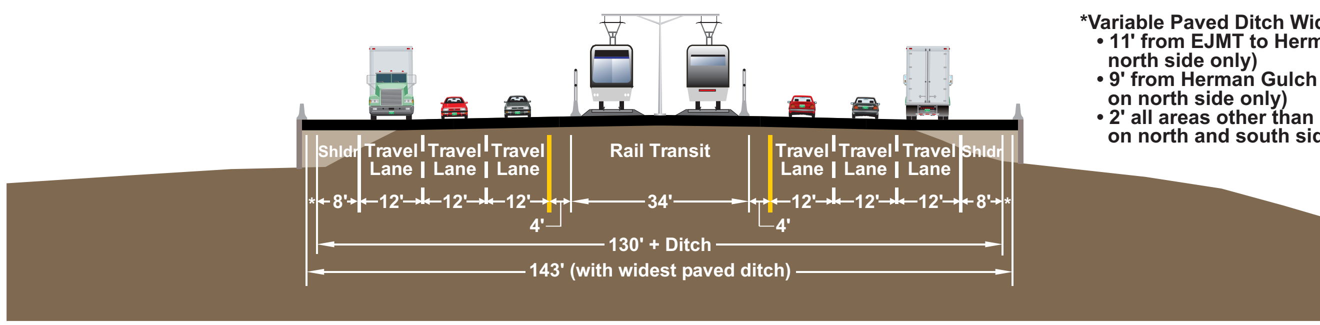
EJMT

- The proposed third tunnel bore would be located to the north of the existing tunnel bores and would accommodate westbound highway traffic and bidirectional rail. As illustrated in the tunnel configurations below, the third bore would consist of two tiers, with westbound highway lanes above rail. The proposed length of the tunnel would be 14,500 feet.
- The existing north bore would accommodate two lanes of bidirectional highway traffic.
- The existing south bore would accommodate two lanes of eastbound traffic.
- Competent rock exists on the west side of the Continental Divide and should require little if any tunnel support during excavation. On the east side, however, faulted and fractured bedrock has contributed to slope instability that caused a landslide during construction of the original tunnel. Additional geologic challenges on the east side would include the Loveland Fault and a section of clay fault gouge, creating very difficult tunneling conditions.
- The cut-and-cover on the east side of the Continental Divide would result in a relatively large excavation, with cut heights reaching 125 feet. Extensive stabilization would likely be required due to the height of the cuts and relatively poor condition of the subsurface material. All alternative alignments would have to be designed to avoid the existing landslide that was activated during the original north bore construction.

Twin Tunnels

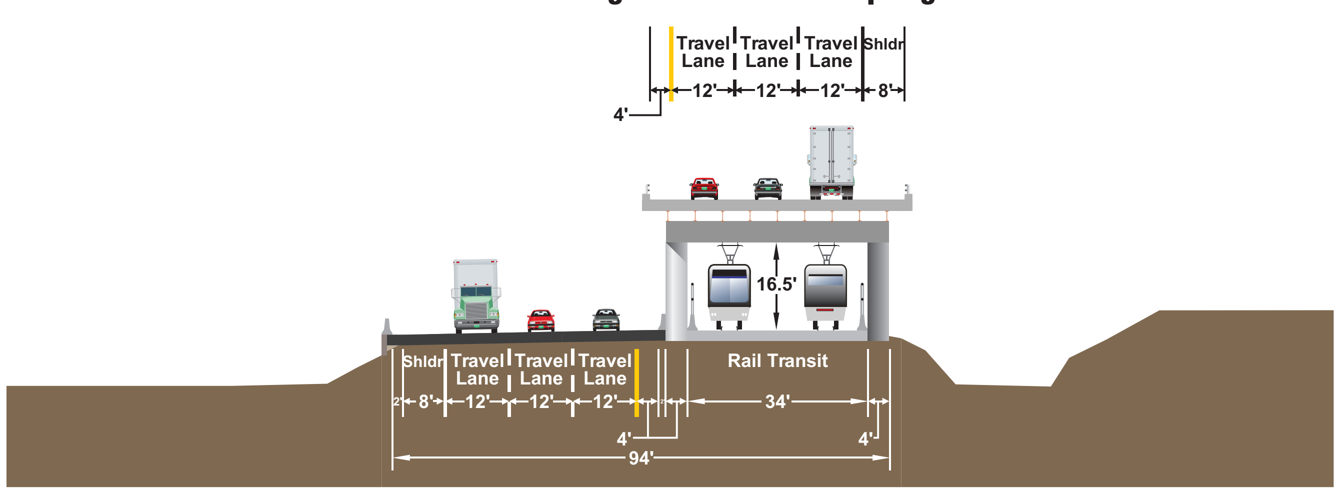
- The existing north bore would be reconstructed from its current width of 28 feet to accommodate three lanes of westbound highway traffic. The tunnel is anticipated to be approximately 740 feet long.
- The existing south bore would accommodate bidirectional rail.
- The proposed third tunnel bore would be located to the south of the existing tunnel bores and would accommodate three lanes of eastbound traffic.
- Based on the relatively good condition of the subsurface material, conventional stabilization methods would likely be required for the proposed tunnel with a finished concrete lining. The proposed length of the tunnel would be approximately 740 feet and should not require an active ventilation system.
- Due to the difficult narrow terrain in the area and proximity to the existing I-70 alignment, construction staging may be difficult. The approach to the tunnel bore would need to be elevated to avoid impacts to the Scott Lancaster Memorial Bike Path bridge over Clear Creek. In the Tier 2 level of study, options for this tunnel approach could consider relocating the trail and keeping the eastbound tunnel approach on grade, which would reduce tunnel costs.

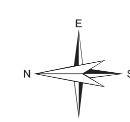
Typical Configuration

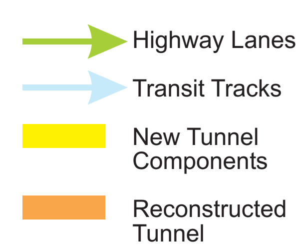


*Variable Paved Ditch Widths:
- 11' from EJMT to Herman Gulch (occurs on north side only)
- 9' from Herman Gulch to Silver Plume (occurs on north side only)
- 2' all areas other than listed above (occurs on north and south side)

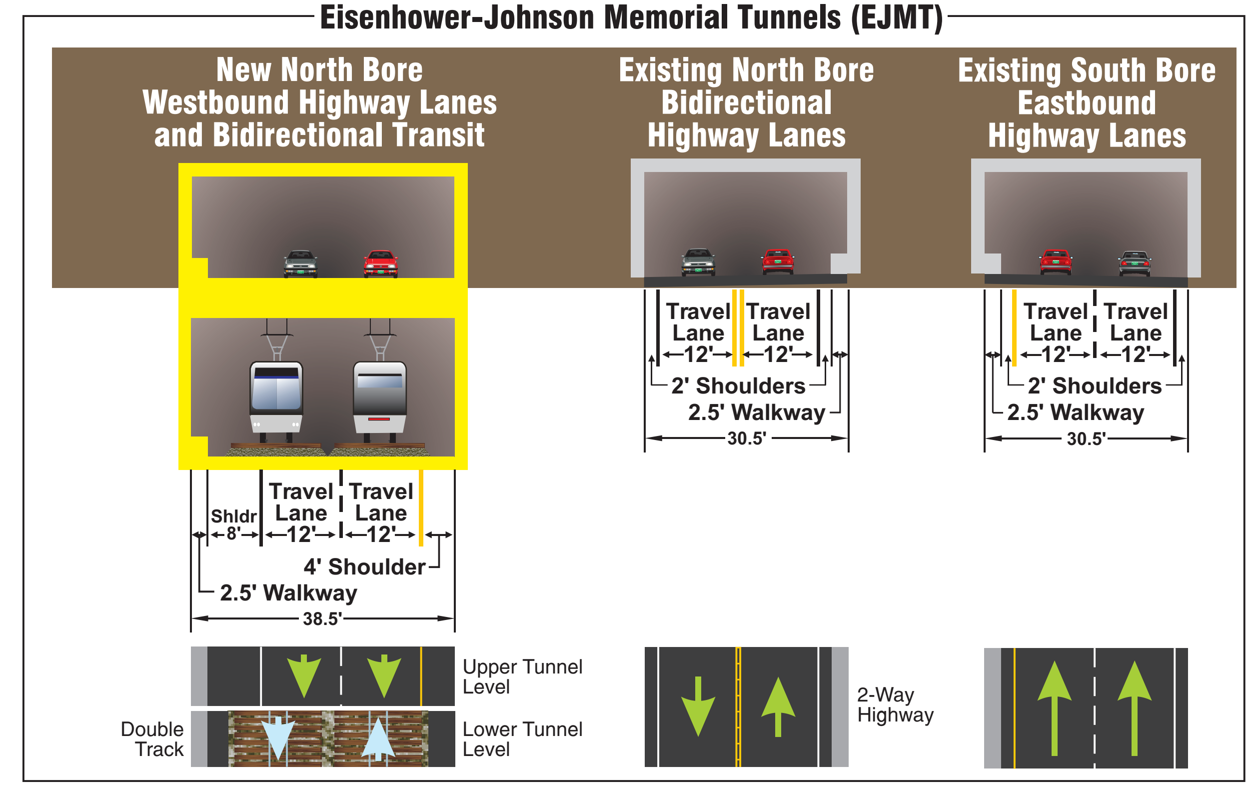
Structured Configuration in Idaho Springs



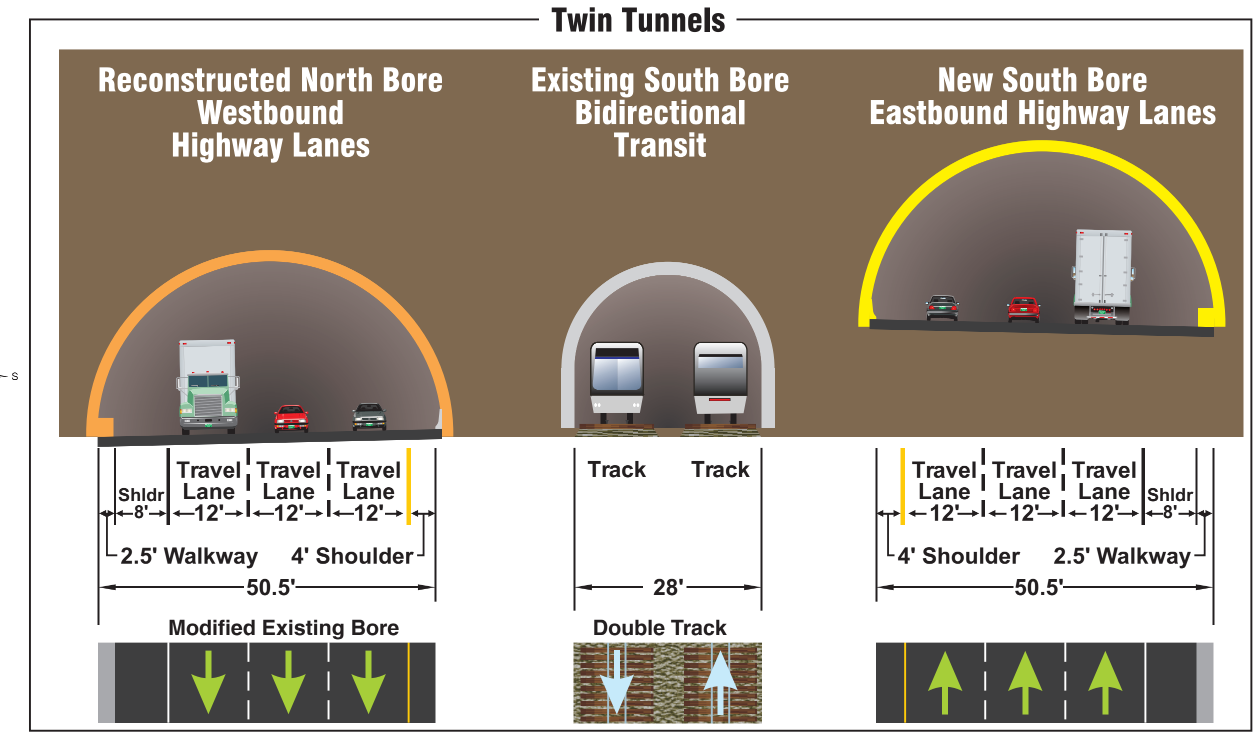




Eisenhower-Johnson Memorial Tunnels (EJMT)



Twin Tunnels



Note: All illustrations view from west to east.

Combination Six-Lane Highway with Rail and IMC

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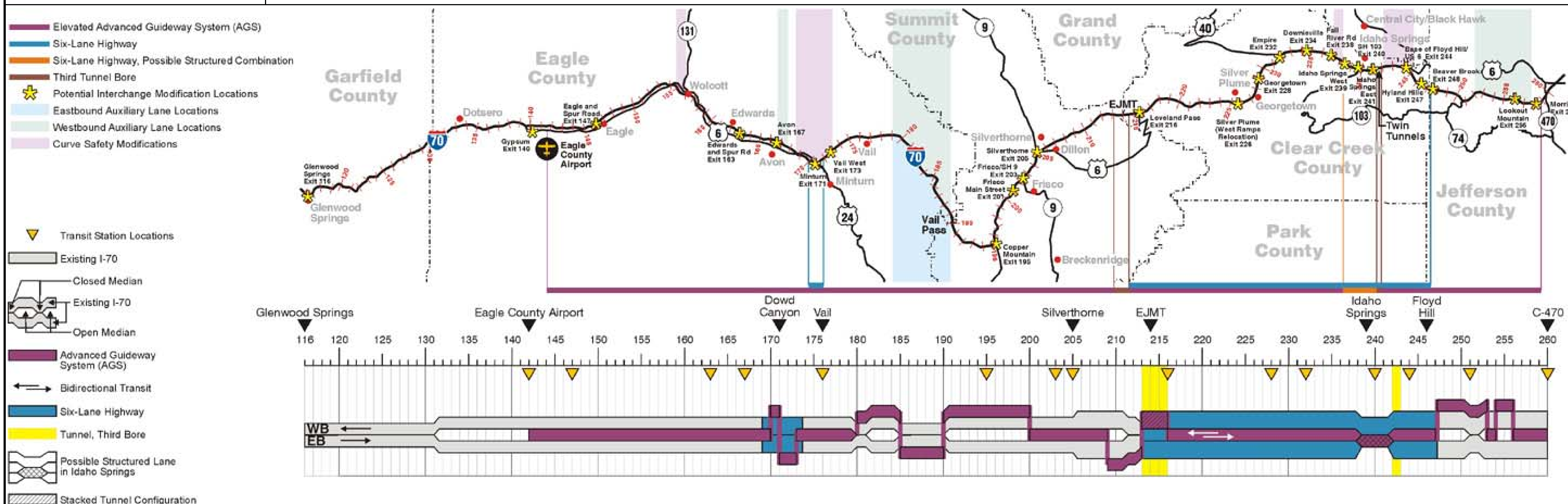
Combination Six-Lane Highway with AGS Alternative Overview

Physical Description	The Combination Six-Lane Highway with AGS alternative would provide transit service and the highway widening described in the overview of the Six-Lane Highway 55 mph alternative in select locations within the Corridor. Transit service would be provided from the Eagle County Airport to C-470, with a fully elevated system that would use new technologies providing higher speeds and climbing capability than rail technology. The AGS under evaluation in the I-70 PEIS is the urban magnetic levitation (maglev) system in research by the Federal Transit Administration (FTA). Tunnel requirements would be the same as those for the Combination Six-Lane Highway with Rail and IMC. **Dowd Canyon:** This alternative requires two additional lanes for the six-lane highway (mileposts 169 to 173). **Continental Divide to Floyd Hill:** Requires two additional lanes for the six-lane highway from the EJMT (milepost 213.5) to Floyd Hill (milepost 247). Structured eastbound lanes may be required in the Idaho Springs area (mileposts 238.9 to 241.4). A paved ditch would be provided on each side of the highway for snow storage with widths as follows: 11 feet from EJMT to Herman Gulch (mileposts 213.5 to 218), 9 feet from Herman Gulch to Silver Plume (mileposts 218 to 226), and 2 feet for all other areas of widening.
Footprint	The total transportation corridor width would range from 94 to 135 feet.
Ability to meet project need	The Combination Six-Lane Highway with AGS alternative would provide adequate levels of service through 2025 and beyond. The Combination Six-Lane Highway with AGS alternative would accommodate baseline travel demand (+11 percent), and would reach the ultimate network capacity by 2050 under trend assumptions, or 2090 under the optimistic assumptions (see section 2.3 for description of trend and optimistic assumptions).
Implementation	Total estimated capital costs = $8.64 billion (of which $0.67 = Minimal Action components included in capital cost). Among the least cost-effective (annualized capital cost plus annual O&M cost less annual farebox receipts per annual person mile of travel beyond that of No Action) alternatives = $1.44 per person mile. Least cost-effective of the four Build Combination Simultaneously alternatives. Build AGS and Preserve for Six-Lane Highway is the least cost-effective of all alternatives. Construction difficulty (construction duration and impact) = greatest impact.
Safety	Number of high accident areas addressed = greatest number (same as the Six-Lane Highway 55 mph alternative). The least overall fatality rating of all alternatives, because of combined safety of AGS and mitigation of high accident areas.



Notes:
1) Placement of colored bars indicates whether that portion of the alternative would be on the north or south side or in the median of existing I-70.
2) Selected localized safety and capacity improvement components of Minimal Action are assumed to be included in each of the action alternatives (interchange modifications, auxiliary lanes, curve safety modifications).

Combination Six-Lane Highway with AGS - Cross Sections

The Combination Six-Lane Highway with AGS alternative would include construction of two additional general-purpose traffic lanes and bidirectional AGS. Where highway widening would occur (throughout Clear Creek County), AGS would be located within the median. Throughout the remainder of the Corridor, the AGS alignment would vary between the north, south, or median of I-70.

Combination Six-Lane Highway with AGS alternative would consist of primarily elevated AGS; however, in Idaho Springs, a structured configuration is being considered to minimize impacts to the community. As illustrated in the template configuration below, a structured configuration would include eastbound traffic lanes elevated over bidirectional AGS.

The Combination Six-Lane Highway with AGS alternative would require third tunnel bores at the existing EJMT and Twin Tunnel locations. Specific details are provided below.

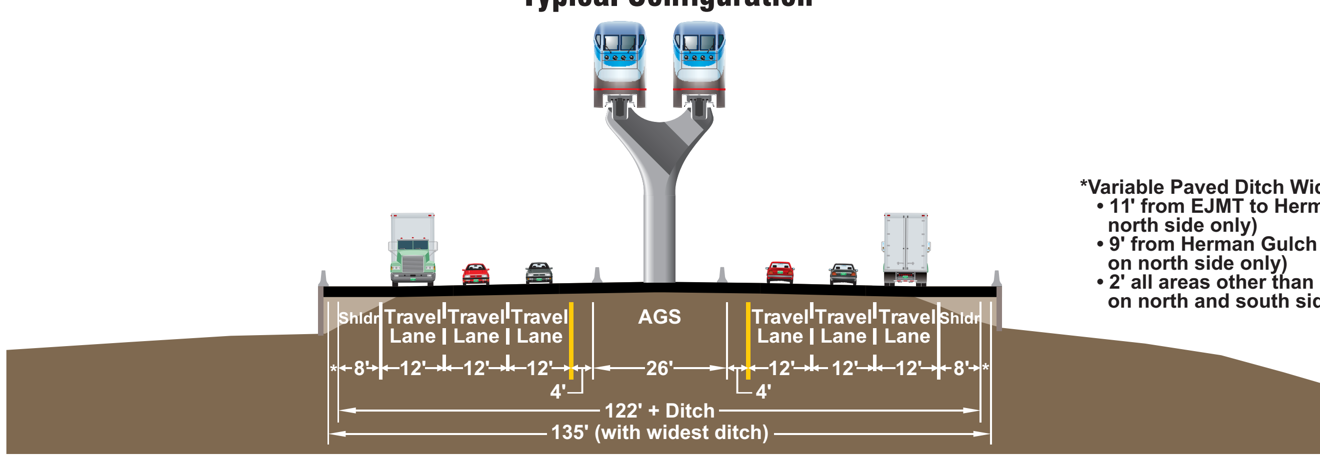
EJMT

- The proposed third tunnel bore would be located to the north of the existing tunnel bores and would accommodate westbound highway traffic and bidirectional AGS. As illustrated in the tunnel configurations below, the third bore would consist of two tiers, with westbound highway lanes above AGS. The proposed length of the tunnel would be 14,500 feet.
- The existing north bore would accommodate two lanes of bidirectional highway traffic.
- The existing south bore would accommodate two lanes of eastbound traffic.
- Competent rock exists on the west side of the Continental Divide and should require little if any tunnel support during excavation. On the east side, however, faulted and fractured bedrock has contributed to slope instability that caused a landslide during construction of the original tunnel. Additional geologic challenges on the east side would include the Loveland Fault and a section of clay fault gouge, creating very difficult tunneling conditions.
- The cut-and-cover on the east side of the Continental Divide would result in a relatively large excavation, with cut heights reaching 125 feet. Extensive stabilization would likely be required due to the height of the cuts and relatively poor condition of the subsurface material. All alternative alignments would have to be designed to avoid the existing landslide that was activated during the original north bore construction.

Twin Tunnels

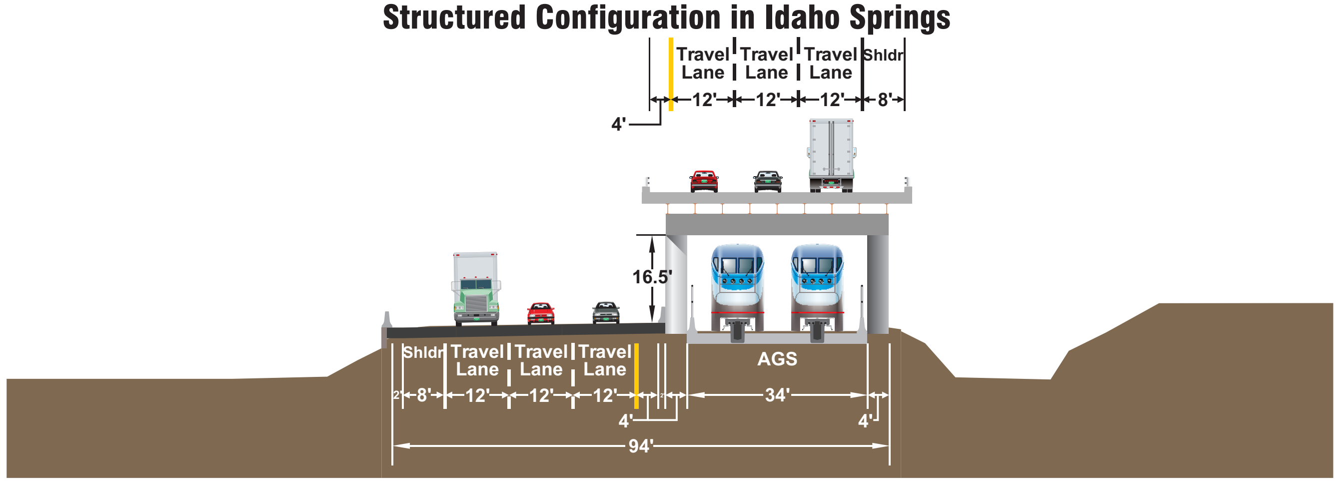
- The existing north bore would be reconstructed from its current width of 28 feet to accommodate three lanes of westbound highway traffic. The tunnel is anticipated to be approximately 740 feet long.
- The existing south bore would accommodate bidirectional AGS.
- The proposed third tunnel bore would be located to the south of the existing tunnel bores and would accommodate three lanes of eastbound traffic.
- Based on the relatively good condition of the subsurface material, conventional stabilization methods would likely be required for the proposed tunnel with a finished concrete lining. The proposed length of the tunnel would be approximately 740 feet and should not require an active ventilation system.
- Due to the difficult narrow terrain in the area and proximity to the existing I-70 alignment, construction staging may be difficult. The approach to the tunnel bore would need to be elevated to avoid impacts to the Scott Lancaster Memorial Bike Path bridge over Clear Creek. In the Tier 2 level of study, options for this tunnel approach could consider relocating the trail and keeping the eastbound tunnel approach on grade, which would reduce tunnel costs.

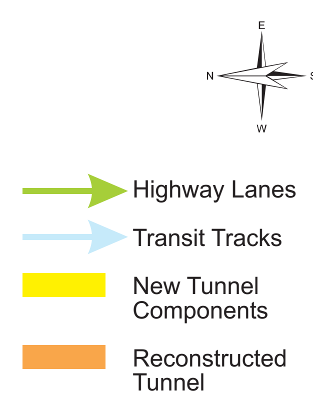
Typical Configuration



*Variable Paved Ditch Widths:
- 11' from EJMT to Herman Gulch (occurs on north side only)
- 9' from Herman Gulch to Silver Plume (occurs on north side only)
- 2' all areas other than listed above (occurs on north and south side)

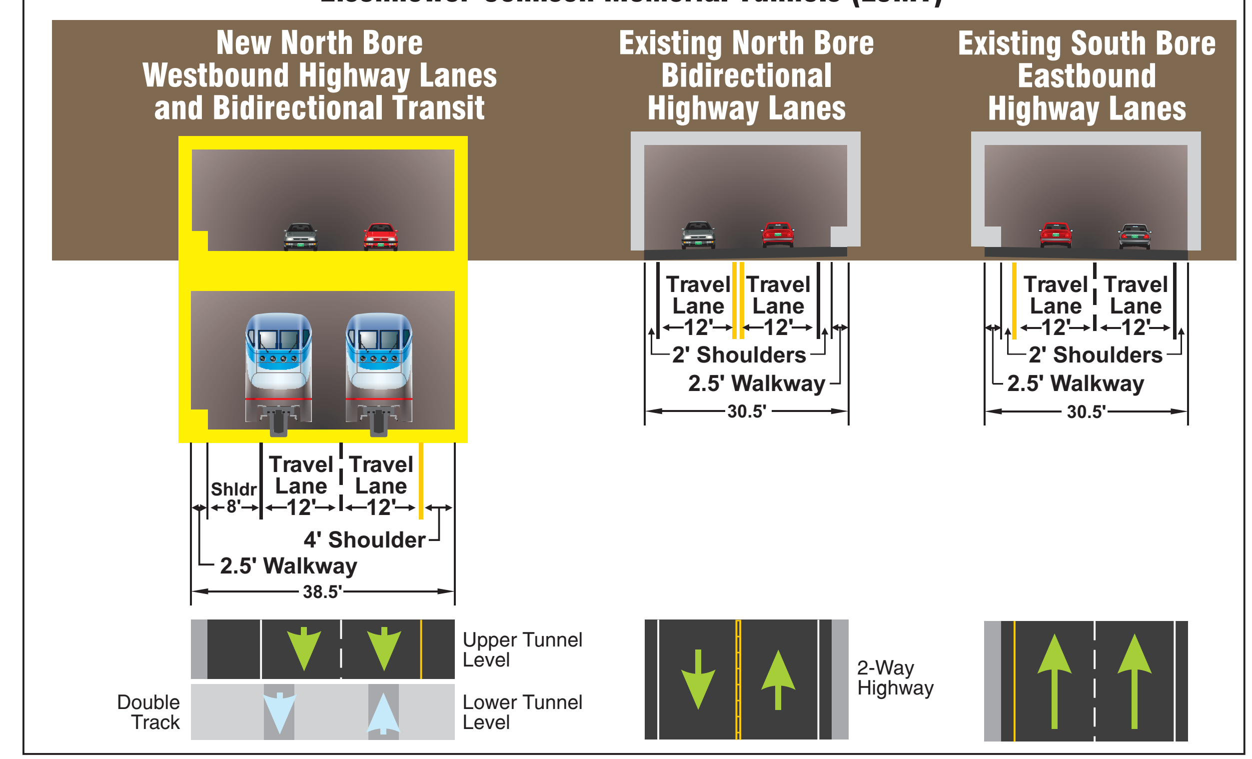
Structured Configuration in Idaho Springs



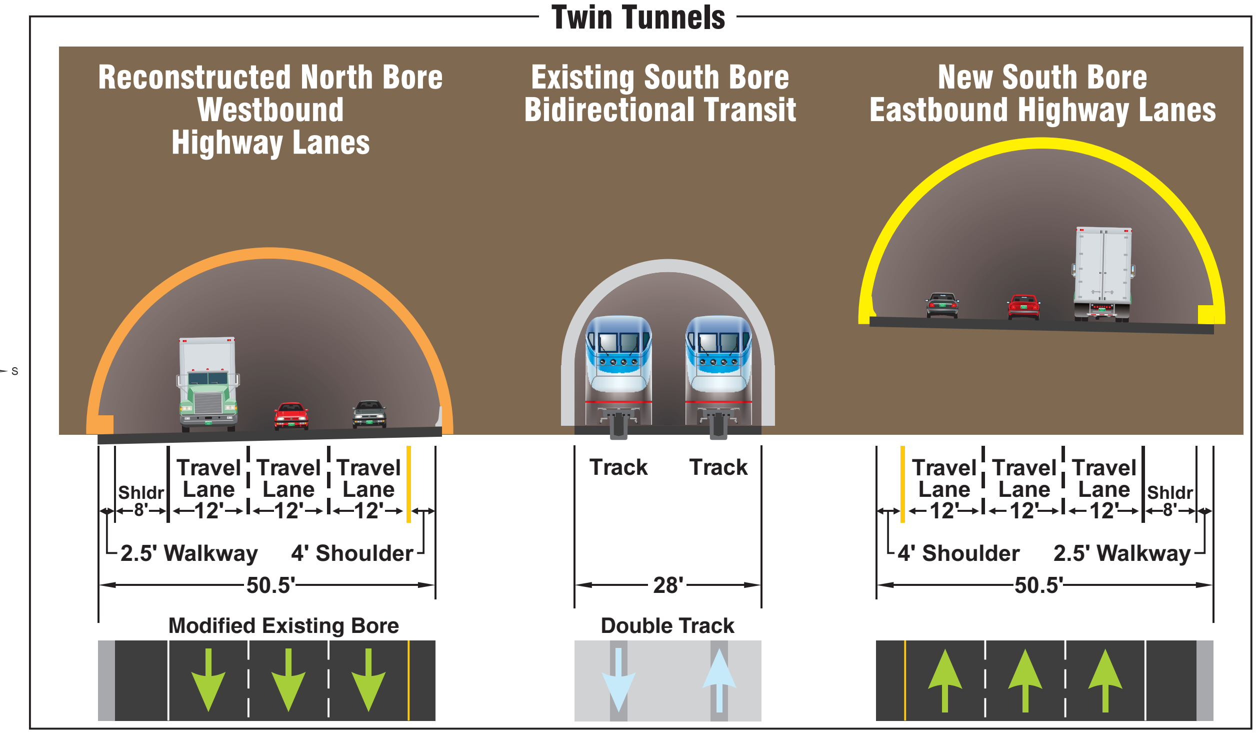


Note: All illustrations view from west to east.

Eisenhower-Johnson Memorial Tunnels (EJMT)



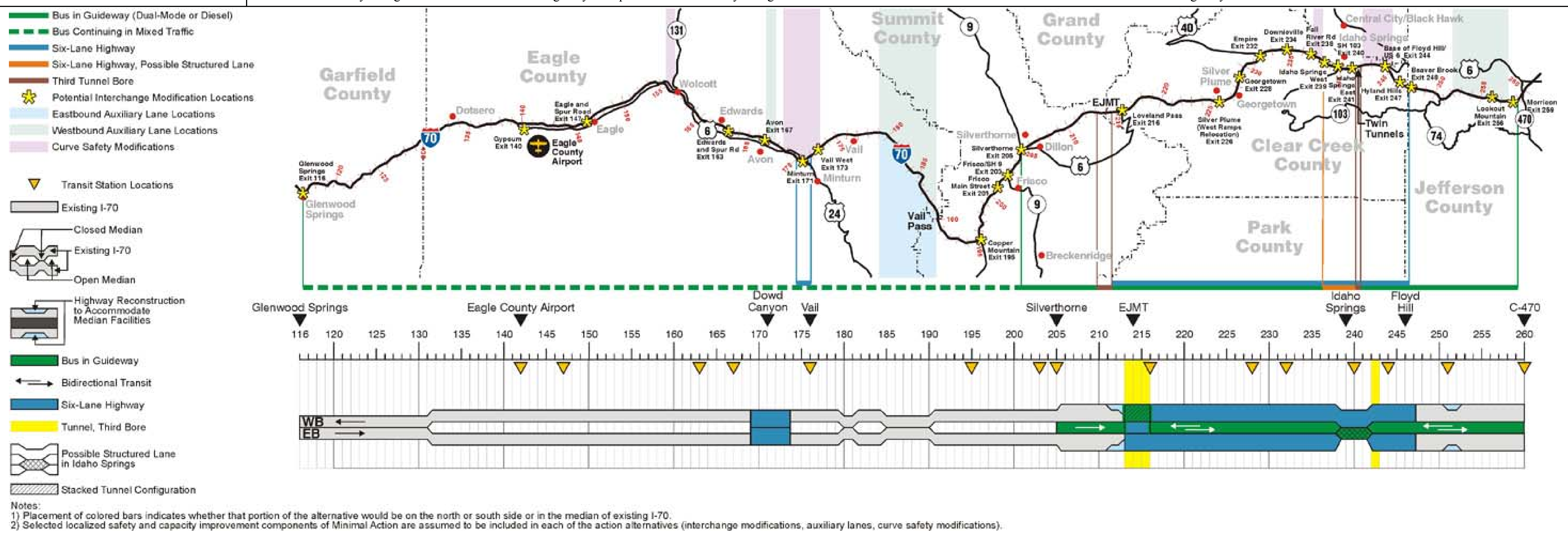
Twin Tunnels



Combination Six-Lane Highway with AGS

Combination Six-Lane Highway with Dual-Mode or Diesel Bus in Guideway Alternative Overview

Physical Description	The Combination Six-Lane Highway with Dual-Mode or Diesel Bus in Guideway alternatives would provide transit service and the highway widening described in the overview of the Six-Lane Highway 55 mph alternative in select locations within the Corridor. The guideway would be located in the median. The guideway bus system would consist of a single 14-foot wide guideway (including guiding rails) eastbound from Silverthorne to the west portal of the EJMT, and a bidirectional guideway 24 feet wide (including guiding barriers) from the EJMT to C-470. These systems would use guidewheels to provide steering control, thus permitting a narrow guideway and improving operations. The dual-mode buses would use electric power in the guideway and diesel power outside the guideway. The diesel buses would use diesel power at all times. New tunnel bores would be required at the Twin Tunnels and the EJMT. **Dowd Canyon:** Requires two additional lanes for the six-lane highway (mileposts 169 to 173). **Continental Divide to Floyd Hill:** Requires two additional lanes for the six-lane highway from the EJMT (milepost 213.5) to Floyd Hill (milepost 247). Structured eastbound lanes may be required in the Idaho Springs area (mileposts 238.9 to 241.4). A paved ditch would be provided on each side of the highway for snow storage with widths as follows: 11 feet from EJMT to Herman Gulch (mileposts 213.5 to 218), 9 feet from Herman Gulch to Silver Plume (mileposts 218 to 226), and 2 feet for all other areas of widening.
Footprint	The total transportation corridor width would range from 94 to 134 feet.
Ability to meet project need	The Combination Six-Lane Highway with Dual-Mode or Diesel Bus in Guideway alternative would provide adequate levels of service through 2025 and beyond. The Combination Six-Lane Highway with Bus in Guideway alternatives would accommodate baseline travel demand (+11 percent for Dual Mode, and +10 percent for Diesel), and would reach the ultimate network capacity by 2045 under trend assumptions, or 2080 under the optimistic assumptions (see section 2.3 for description of trend and optimistic assumptions).
Implementation	Total estimated capital costs = \$4.37 and \$4.17 billion (of which \$0.67 billion = Minimal Action components included in capital cost). Among the most cost-effective (annualized capital cost plus annual O&M cost less annual farebox receipts per annual person mile of travel beyond that of No Action) = \$0.63 per person mile to \$0.65 per person mile. The Combination Six-Lane Highway with Dual-Mode Bus in Guideway alternative would be the most cost-effective of all alternatives. Construction difficulty (construction duration and impact) = greatest impact.
Safety	Number of high accident areas addressed = greatest number (same as the Six-Lane Highway 55 mph alternative). Lower overall fatality rating than that of the Six-Lane Highway 65 mph alternative. Fatality rating of these alternatives would be similar to that of the Combination Six-Lane Highway with Rail and IMC alternative or the four Transit alternatives.



Combination Six-Lane Highway with Dual-Mode or Diesel Bus in Guideway - Cross Sections

The Combination Six-Lane Highway with Bus in Guideway alternatives would include construction of two additional general-purpose traffic lanes and two bidirectional bus guideways. Where highway widening would occur (throughout Clear Creek County), bus in guideway would be located primarily within the median.

Combination Six-Lane Highway with Bus in Guideway alternatives are proposed to be primarily on grade; however, in Idaho Springs, a structured configuration is being considered to minimize impacts to the community. As illustrated in the template configuration below, a structured configuration would include eastbound traffic lanes elevated over the bidirectional Bus in Guideway.

The Combination Six-Lane Highway with Bus in Guideway alternatives would require third tunnel bores at the existing EJMT and Twin Tunnel locations. Specific details are provided below.

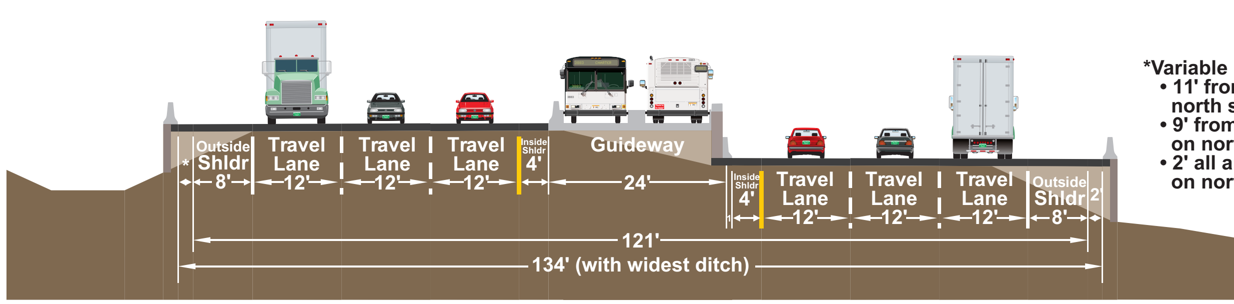
EJMT

- The proposed third tunnel bore would be located to the north of the existing tunnel bores and would accommodate two lanes of westbound highway traffic and the bidirectional bus guideways. As illustrated in the tunnel configurations below, the third bore would consist of two tiers, with westbound highway lanes above the bus guideways. The proposed length of the tunnel would be 13,700 feet.
- The existing north bore would accommodate two lanes of bidirectional highway traffic.
- The existing south bore would accommodate two lanes of eastbound traffic.
- Competent rock exists on the west side of the Continental Divide and should require little if any tunnel support during excavation. On the east side, however, faulted and fractured bedrock has contributed to slope instability that caused a landslide during construction of the original tunnel. Additional geologic challenges on the east side would include the Loveland Fault and a section of clay fault gouge, creating very difficult tunneling conditions.
- The cut-and-cover on the east side of the Continental Divide would result in a relatively large excavation, with cut heights reaching 125 feet. Extensive stabilization would likely be required due to the height of the cuts and relatively poor condition of the subsurface material. All alternative alignments would have to be designed to avoid the existing landslide that was activated during the original north bore construction.

Twin Tunnels

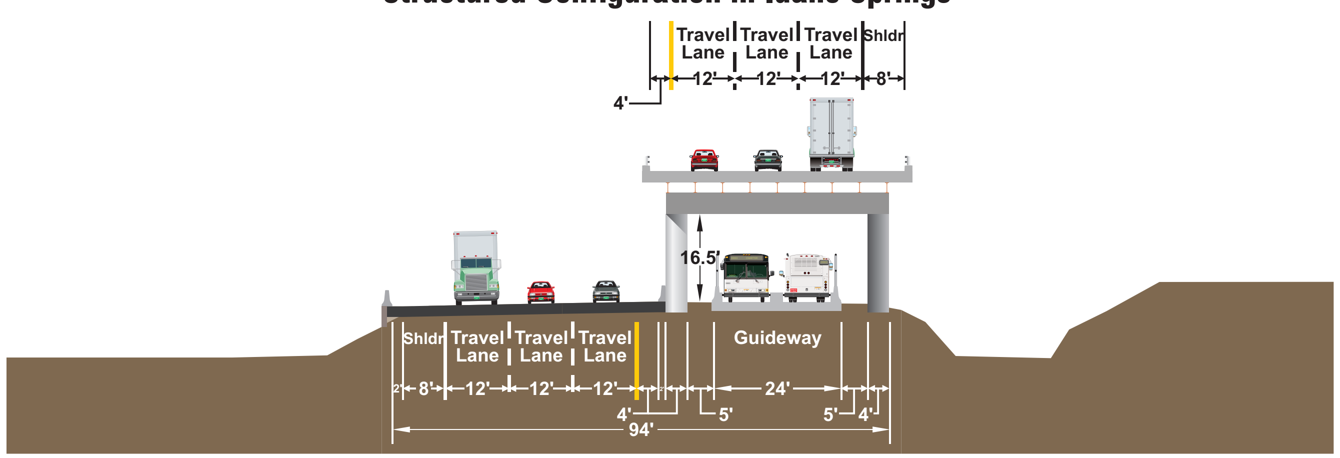
- The existing north bore would be reconstructed from its current width of 28 feet to accommodate three lanes of westbound highway traffic. The tunnel is anticipated to be approximately 740 feet long.
- The existing south bore would accommodate the bidirectional bus guideways.
- The proposed third tunnel bore would be located to the south of the existing tunnel bores and would accommodate three lanes of eastbound traffic.
- Based on the relatively good condition of the subsurface material, conventional stabilization methods would likely be required for the proposed tunnel with a finished concrete lining. The proposed length of the tunnel would be approximately 740 feet and should not require an active ventilation system.
- Due to the difficult narrow terrain in the area and proximity to the existing I-70 alignment, construction staging may be difficult. The approach to the tunnel bore would need to be elevated to avoid impacts to the Scott Lancaster Memorial Bike Path bridge over Clear Creek. In the Tier 2 level of study, options for this tunnel approach could consider relocating the trail and keeping the eastbound tunnel approach on grade, which would reduce tunnel costs.

Typical Configuration



*Variable Paved Ditch Widths:
- 11' from EJMT to Herman Gulch (occurs on north side only)
- 9' from Herman Gulch to Silver Plume (occurs on north side only)
- 2' all areas other than listed above (occurs on north and south side)

Structured Configuration in Idaho Springs



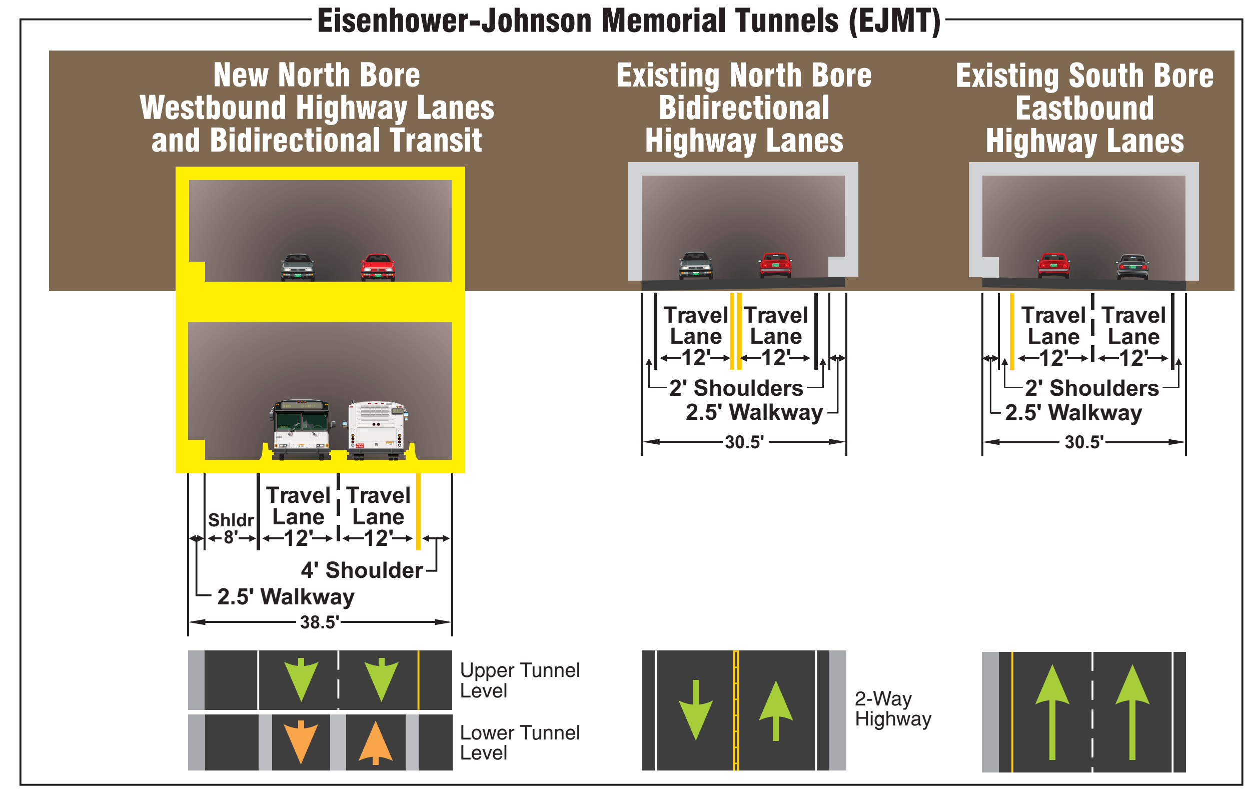
Highway Lanes

Bus in Guideway

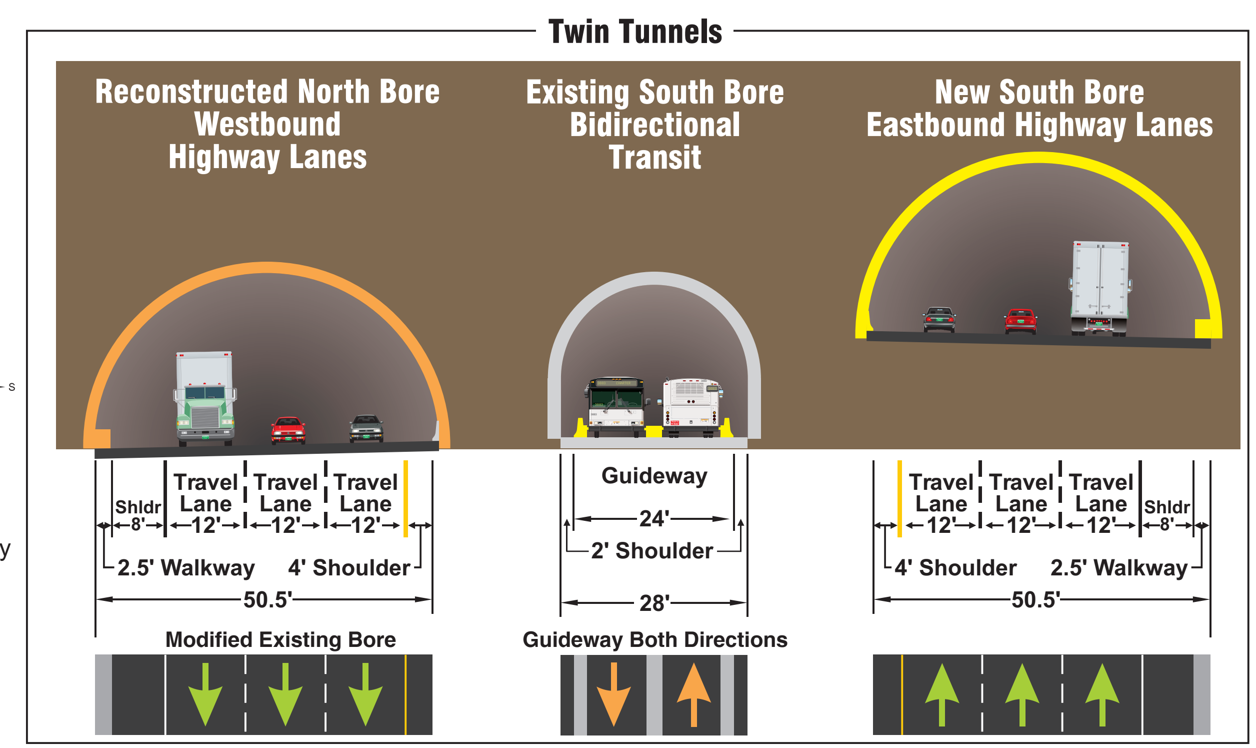
New Tunnel Components

Reconstructed Tunnel

Eisenhower-Johnson Memorial Tunnels (EJMT)



Twin Tunnels



Note: All illustrations view from west to east.

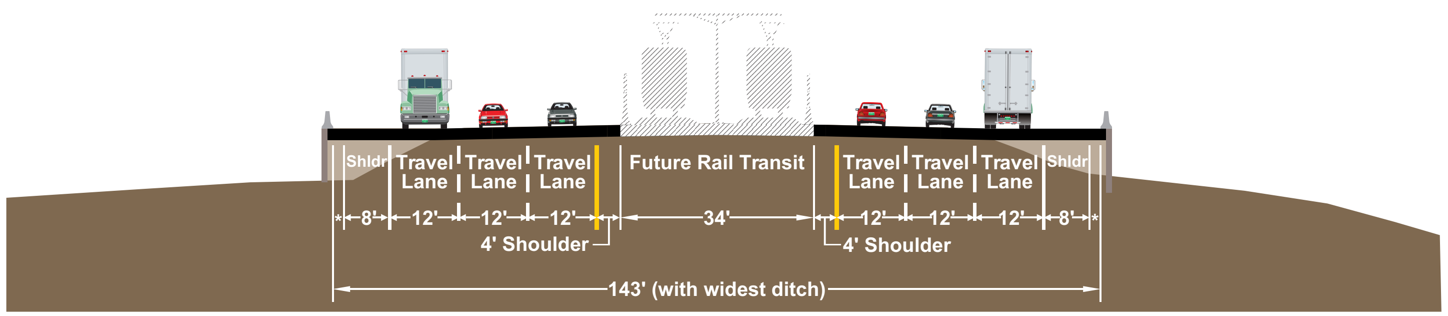
Combination Six-Lane Highway with Dual-Mode or Diesel Bus in Guideway

Combination Alternatives - Preservation Options Alternative Overview

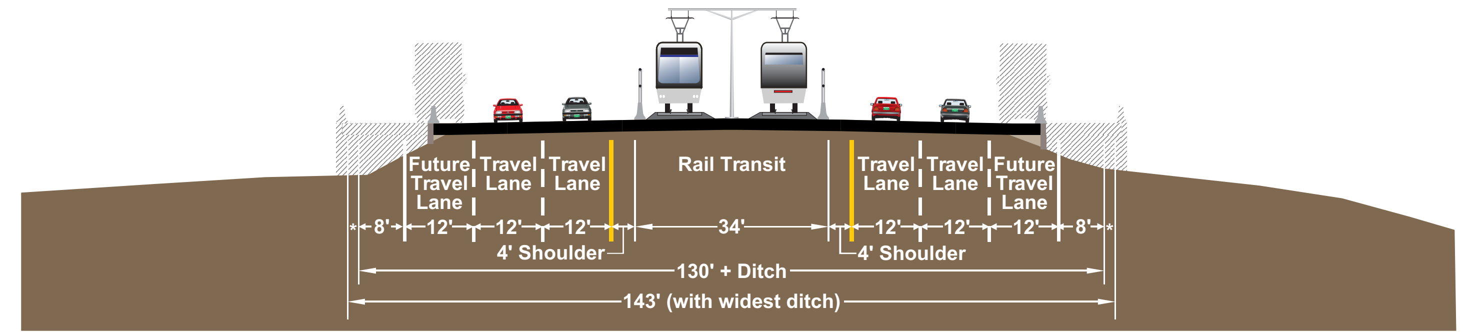
Physical Description	Eight Preservation Combination alternatives are being considered in the I-70 PEIS. Preservation Combination alternatives have been developed for the PEIS to assess future multimodal transportation systems for the Corridor. Unlike the "build" Combination alternatives that combine Six-Lane Highway with Transit (Rail, AGS, or Bus in Guideway systems), the intent of the Preservation Combination alternatives is to include or not preclude space for future modes in the Corridor. The following are alternatives evaluated for preserving or not precluding a future mode in the Corridor. • Rail with IMC with Highway Preservation • Highway with Rail and IMC Preservation • AGS with Highway Preservation • Highway with AGS Preservation • Dual-Mode Bus with Highway Preservation • Highway with Dual-Mode Bus Preservation • Diesel Bus with Highway Preservation • Highway with Diesel Bus Preservation **Preservation of Transit in Combination Alternatives – Tier 1:** At the Tier 1 level of the NEPA process, CDOT is assuming the following concepts for accommodating or not precluding future transit in the Corridor PEIS: **Preservation-Inclusion Option:** • The Inclusion Option would involve planning and designing the initial transportation mode, while "preserving" the three-dimensional space for the future mode. • The "space" for the future transportation mode would be developed at the time that the selected alternative would be implemented. This could require acquiring right-of-way, making interchange modifications, or installing walls that would be sized and located to be compatible with the ultimate multimodal transportation template. • Most environmental effects would be based on the total footprint of the combined alternative although there are exceptions, which are noted below. • The "need" (mobility) analyses would account for only the build portion. • Cost estimates would be modified to reflect only the build portion and the cost to preserve the three-dimensional space for the future action. • Intergovernmental transportation coordination strategies would be key to the development of a future multimodal Corridor. **Preservation-Nonpreclusion Option:** • The Nonpreclusion Option for the preservation of transit would be to plan and design the initial transportation mode in such a manner as to "not preclude" a future mode. • With this approach, a six-lane highway would be developed as a part of the 20-year plan, in a manner that would *not* involve interchange modifications or developing the space for a future transit system as with the Inclusion Option. • To place a future transit into the median of a six-lane highway under the Nonpreclusion Option, the highway would have to be rebuilt by widening to the outside for the highway lanes to make space for the transit system in the median. • Interchange modifications, walls, and other earthwork would be done at the time when the future transit mode would be implemented. • This approach would minimize the investment in the future mode until such time when it would be implemented. • Coordinated transportation strategies with appropriate jurisdictions and land management agencies would be required. **Tier 2 Decisions Implementing Future Transit into the Corridor:** Approaches for integrating future transit in the Corridor could be reviewed at the Tier 2 level of the NEPA process. Decisions could be made at that time as to Inclusion versus Nonpreclusion options. Refinements could modify the Tier 1 template if financially or environmentally beneficial, if not to the detriment of the preservation commitment. Any purchase of right-of-way for preservation would be further evaluated during Tier 2 analysis.
Footprint	The preservation footprint would be highly variable depending on construction phasing and approach. For example, some infrastructure components, such as retaining walls or the bus guideway, may be built to their final configuration. Other components, such a highway lanes, may be converted to another mode later. See the descriptions of the Combination alternatives for the maximum or ultimate footprint of the Transit alternatives with Highway Preservation. Similarly, see the Highway alternatives for the maximum footprint of the Highway with Transit Preservation alternatives. The preservation footprints assumed for analysis would depend on the resource being analyzed. For some resources, the total of the Combination alternative would be analyzed. For other resources, delaying full construction would delay the impact on the resources and the benefit from transportation expansion.
Ability to meet project need	Total estimated capital costs = ranges from $2.41 to $8.64 billion (of which $0.53 billion to $0.67 billion = Minimal Action components included in capital cost). For Transit with Highway Preservation, see Transit alternatives' descriptions of ability to meet need. For Highway with Transit Preservation, see Highway alternatives' descriptions of ability to meet need.
Implementation	Total estimated capital costs for Highway with Transit Preservation alternatives would be more than those of the Six-Lane Highway 55 mph alternative and considerably less than the corresponding Combination alternative. Capital costs of Transit alternatives with Highway Preservation would be almost as much as the full-build Combination alternatives. Highway with Transit Preservation alternatives would be less cost-effective than the Six-Lane Highway 55 mph alternative (because no transit travel is yet realized). Transit alternatives with Highway Preservation would be less cost-effective than the corresponding Transit alternative or Combination alternative, due to the requirement to establish a bus guideway in the median of I-70.
Safety	See Transit alternatives for Transit with Highway Preservation. See Highway alternatives for Highway with Transit Preservation.

Combination Alternatives - Preservation - Inclusion Option - Cross Sections

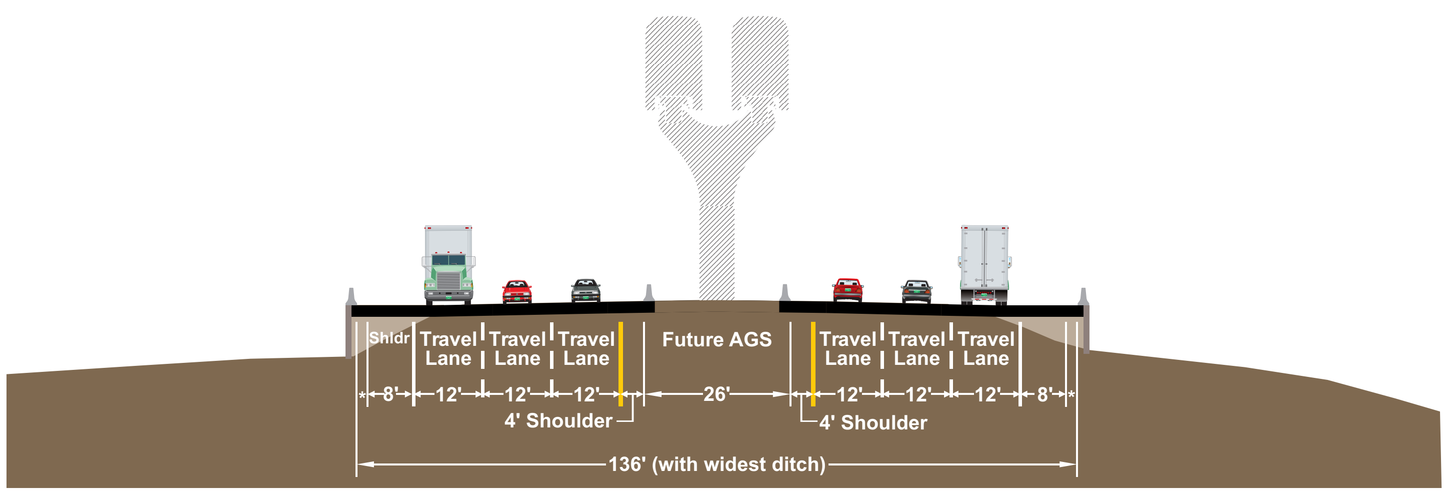
Highway with Rail Preservation



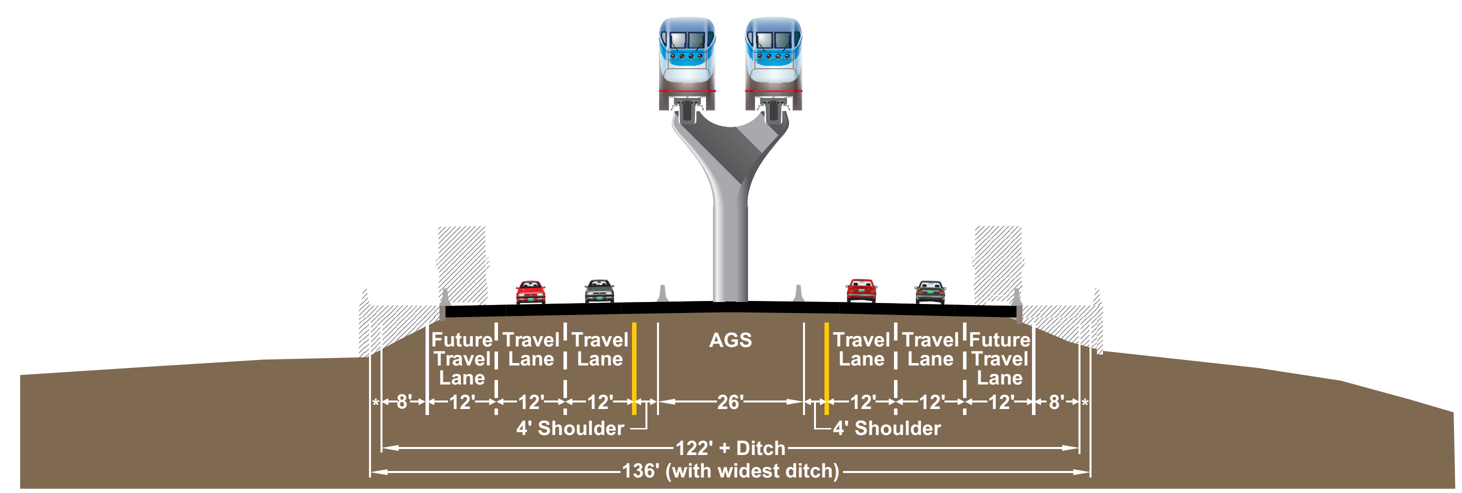
Rail with Highway Preservation



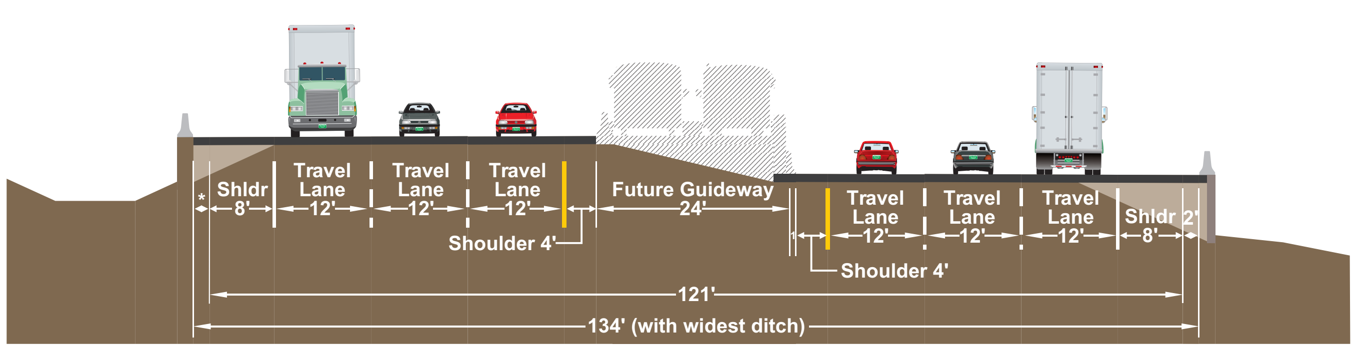
Highway with AGS Preservation



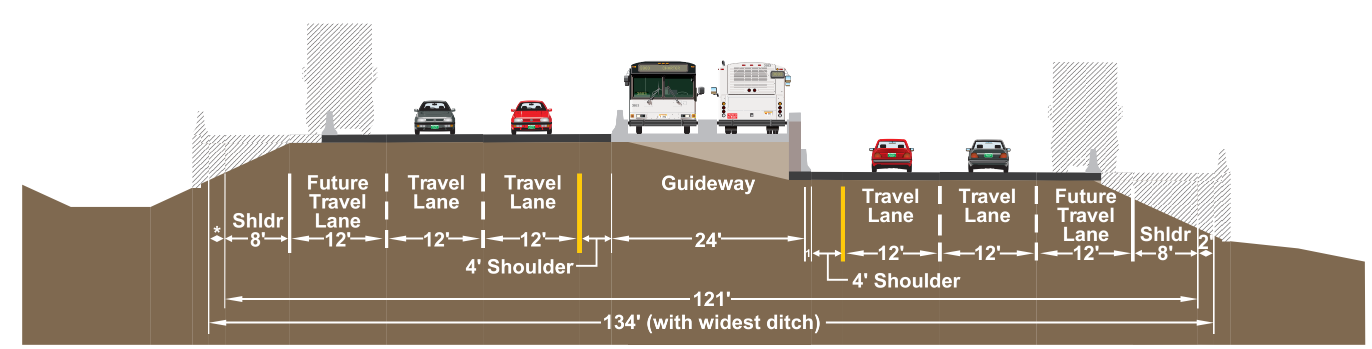
AGS with Highway Preservation



Highway with Bus in Guideway Preservation



Bus in Guideway with Highway Preservation

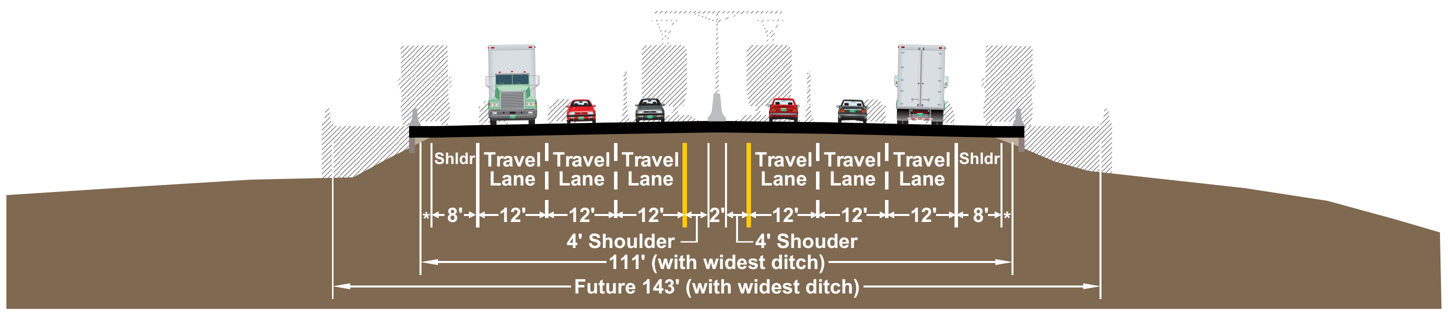


*Variable Paved Ditch Widths:
- 11' from EJMT to Herman Gulch (occurs on north side only)
- 9' from Herman Gulch to Silver Plume (occurs on north side only)
- 2' all areas other than listed above (occurs on north and south side)

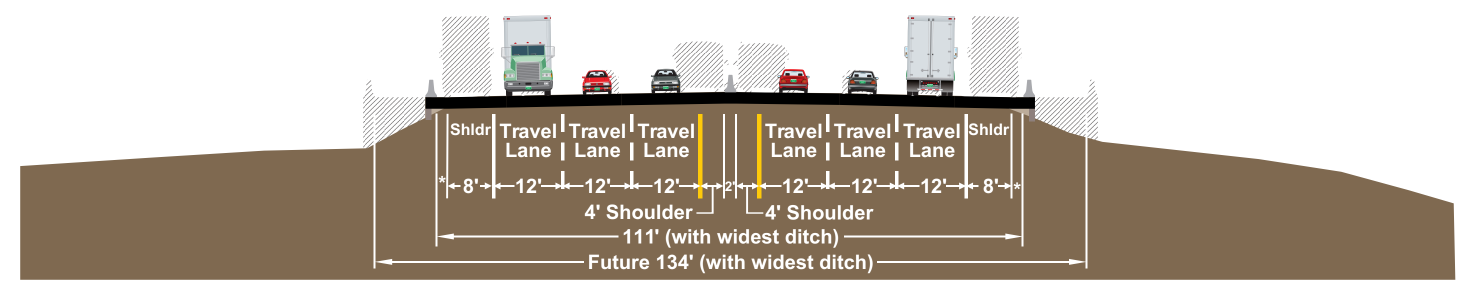
Note: All illustrations view from west to east.

Combination Alternatives - Preservation - Nonpreclusion Option - Cross Sections

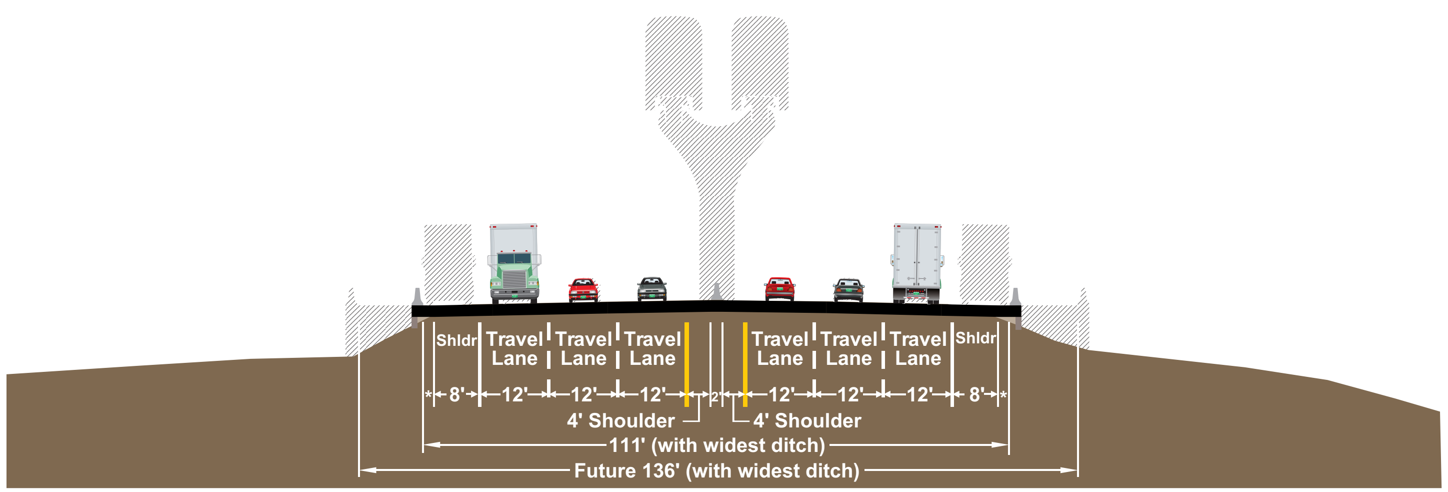
Highway with Rail Nonpreclusion Option



Highway with Dual-Mode or Diesel Bus in Guideway Nonpreclusion Option

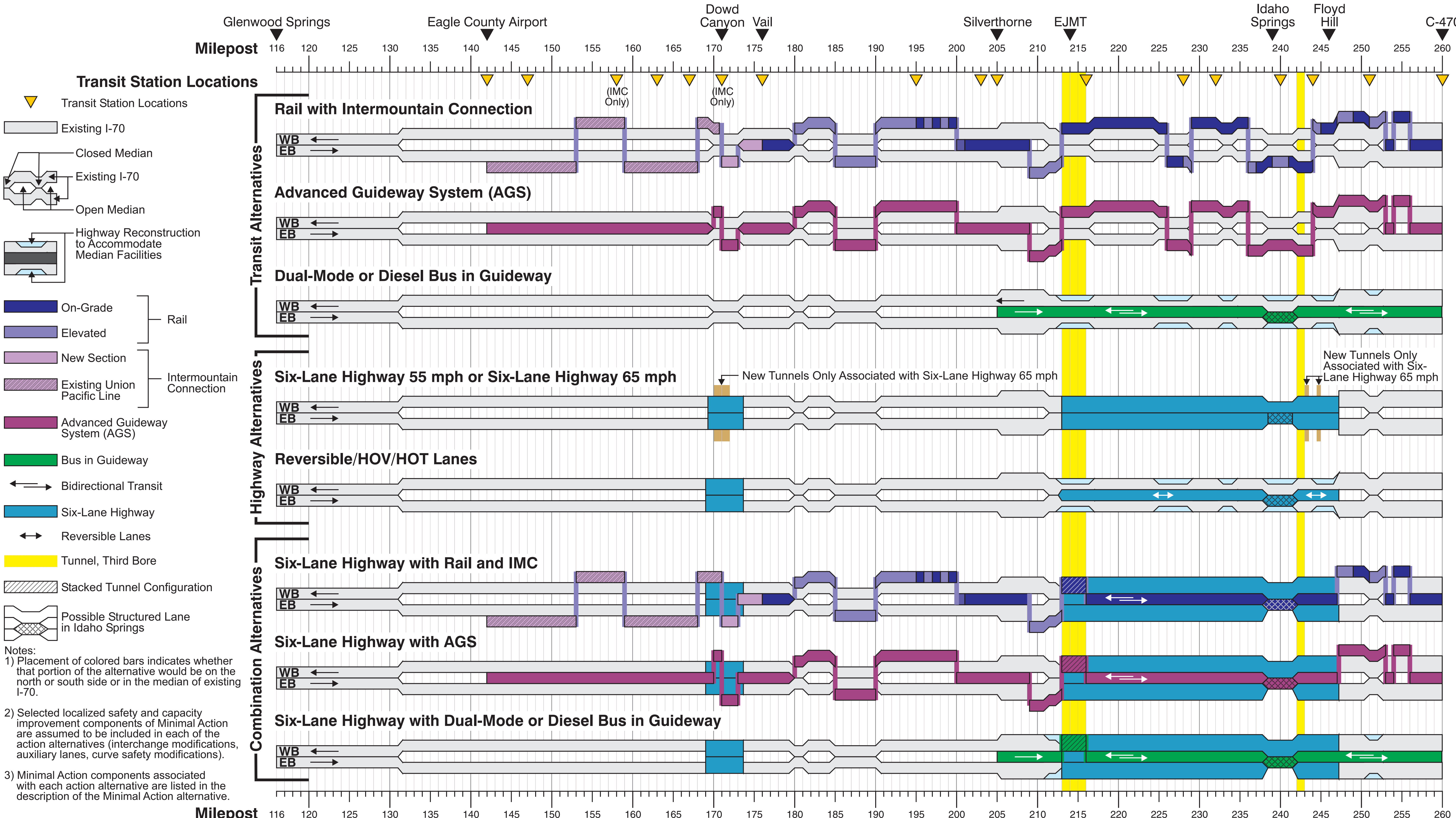


Highway with AGS Nonpreclusion Option



*Variable Paved Ditch Widths:
- 11' from EJMT to Herman Gulch (occurs on north side only)
- 9' from Herman Gulch to Silver Plume (occurs on north side only)
- 2' all areas other than listed above (occurs on north and south side)

Note: All illustrations view from west to east.



Notes:
1) Placement of colored bars indicates whether that portion of the alternative would be on the north or south side or in the median of existing I-70.

2) Selected localized safety and capacity improvement components of Minimal Action are assumed to be included in each of the action alternatives (interchange modifications, auxiliary lanes, curve safety modifications).

3) Minimal Action components associated with each action alternative are listed in the description of the Minimal Action alternative.

Figure 2-3. Alternative Alignment Features

Table 2-6. Alternative Dimensions

		Transit Alternatives				Highway Alternatives			Combination Highway/Transit Alternatives			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
	Minimal Action Alternative	**Rail with IMC**	**Advanced Guideway System**	**Dual-Mode Bus in Guideway**	**Diesel Bus in Guideway**	**6-Lane Highway 55 mph**	**6-Lane Highway 65 mph**	**Reversible/HOV/ HOT Lanes**	**6-Lane Highway with Rail and IMC** *9 – Build Combination Simultaneously* *9a – Build Transit and Preserve for Highway* *9b – Build Highway and Preserve for Transit*	**6-Lane Highway with AGS** *10 – Build Combination Simultaneously* *10a – Build Transit and Preserve for Highway* *10b – Build Highway and Preserve for Transit*	**6-Lane Highway with Dual-Mode Bus in Guideway** *11 – Build Combination Simultaneously* *11a – Build Transit and Preserve for Highway* *11b – Build Highway and Preserve for Transit*	**6-Lane Highway with Diesel Bus in Guideway** *12 – Build Combination Simultaneously* *12a – Build Transit and Preserve for Highway* *12b – Build Highway and Preserve for Transit*
Total transportation Corridor width*	Varies by Minimal Action component	93 to 112 feet	93 to 104 feet	100 to 104 feet	100 to 104 feet	94 to 111 feet	94 to 111 feet	82 to 125 feet	94 to 143 feet	94 to 135 feet	94 to 134 feet	94 to 134 feet
New template description for direct impact assessment	Varies by Minimal Action component	• New rail alignment between Eagle County Airport and Eagle (IMC) • Existing rail alignment between Eagle and Dowd Canyon (IMC) • New rail alignment between Dowd Canyon and Vail (IMC) • 20-foot single track, Vail to Frisco with passing sidings • 34-foot double track, Frisco to C-470	• 20.5-foot guideway structure, double track • 25-foot total associated with guideway and train set • 20- to 25-foot temporary construction disturbance under elevated guideway	• 14-foot eastbound single-lane guideway, Silverthorne to EJMT • 24-foot two-lane guideway, EJMT to C-470		• Two additional 12-foot-wide lanes at Dowd Canyon and between EJMT and Floyd Hill • Variable paved ditches 2 to 11 feet wide to be utilized for snow storage • Variable shoulder widths 10 to 19 feet wide (consisting of 8-foot typical shoulder plus 2- to 11-foot traversable/driveable snow storage area)	• Two additional 12-foot-wide lanes at Dowd Canyon in a tunnel • Two additional 12-foot-wide lanes between EJMT and Floyd Hill • Variable paved ditches 2 to 11 feet wide to be utilized for snow storage • Variable shoulder widths 10 to 19 feet wide (consisting of 8-foot typical shoulder plus 2- to 11-foot traversable/ driveable snow storage area)	• Two additional general-purpose 12-foot-wide lanes at Dowd Canyon and two barrier separated reversible lanes between EJMT and Floyd Hill • Variable paved ditches 2 to 11 feet wide to be utilized for snow storage • Variable shoulder widths 10 to 19 feet wide (consisting of 8-foot typical shoulder plus 2 to 11 feet traversable/ driveable snow storage area)	• New rail for IMC between Eagle County Airport and Eagle • Existing rail for IMC between Eagle and Dowd Canyon • New rail for IMC between Dowd Canyon and Vail • 20-foot single track, Vail to Frisco with passing sidings • 34-foot double track, Frisco to C-470 • Two additional 12-foot-wide lanes at Dowd Canyon and between EJMT and Floyd Hill • Variable paved ditches 2 to 11 feet wide	• 20.5-foot guideway structure, double track • 25-foot total associated with guideway and train set • Two additional 12-foot-wide lanes at Dowd Canyon and between EJMT and Floyd Hill • Variable paved ditches 2 to 11 feet wide	• 14-foot eastbound single-lane guideway, Silverthorne to EJMT • 24-foot two-lane guideway, EJMT to C-470 • Two additional 12-foot lanes at Dowd Canyon and between EJMT and Floyd Hill • Variable paved ditches 2 to 11 feet wide between EJMT and Floyd Hill	
Additional construction disturbance width	30 feet (15 feet to each side of template)		No additional construction disturbance width beyond footprint	30 feet (15 feet to each side of template, where no median space available)								
Additional sensitivity zone width	30 feet (15 feet to each side of construction disturbance zone)											
Vertical profile	N/A	70 percent on grade 30 percent elevated (minimum 16.5 feet high)	Elevated (minimum 16.5 feet high)	• Primarily on grade • Possible structured configuration through Idaho Springs • Located within median		• Primarily on grade • Possible structured configuration through Idaho Springs			• Primarily on grade • Possible structured configuration through Idaho Springs • Rail on grade within median where highway expanded	• AGS elevated in median where highway expanded (minimum 16.5 feet high) • Highway primarily on grade • Possible structured configuration through Idaho Springs	• Primarily on grade within median • Possible structured configuration through Idaho Springs	

**Represents typical transportation corridor width for alternative, not including Minimal Action components packaged with alternative.*

				Transit Alternatives				Highway Alternatives			Combination Highway/Transit Alternatives			
			1	2	3	4	5	6	7	8	9	10	11	12
			Minimal Action Alternative	**Rail with IMC**	**Advanced Guideway System**	**Dual-Mode Bus in Guideway**	**Diesel Bus in Guideway**	**6-Lane Highway 55 mph**	**6-Lane Highway 65 mph**	**Reversible/HOV/ HOT Lanes**	**6-Lane Highway with Rail and IMC** *9 – Build Combination Simultaneously* *9a – Build Transit and Preserve for Highway* *9b – Build Highway and Preserve for Transit*	**6-Lane Highway with AGS** *10 – Build Combination Simultaneously* *10a – Build Transit and Preserve for Highway* *10b – Build Highway and Preserve for Transit*	**6-Lane Highway with Dual-Mode Bus in Guideway** *11 – Build Combination Simultaneously* *11a – Build Transit and Preserve for Highway* *11b – Build Highway and Preserve for Transit*	**6-Lane Highway with Diesel Bus in Guideway** *12 – Build Combination Simultaneously* *12a – Build Transit and Preserve for Highway* *12b – Build Highway and Preserve for Transit*
Tunnel Components	New Tunnel	Dowd Canyon	N/A	N/A	N/A	N/A	N/A	N/A	Two new 3-lane tunnels 50.5 feet wide and 7,200 feet long for eastbound and westbound traffic	N/A	N/A	N/A	N/A	N/A
	Third Bore	EJMT/ Continental Divide	N/A	One new 2-track tunnel 38.5 feet wide and 14,500 feet long		One new 2-lane tunnel 38.5 feet wide and 13,700 feet long (existing north bore becomes bi-directional guideway)		One new 2-lane tunnel 38.5 feet wide and 13,700 feet long for westbound traffic			One new tunnel, double-deck configuration (2-lane highway above and double-track rail below) 38.5 feet wide and 14,500 feet long		One new tunnel, double-deck configuration (2-lane highway above and bidirectional guideway below) 38.5 feet wide and 13,700 feet long	
	Third Bore	Twin Tunnels	N/A	One new 2-track tunnel 38.5 feet wide and 740 feet long		One new 2-lane tunnel 38.5 feet wide and 740 feet long (existing south bore becomes bidirectional guideway)		One new 3-lane tunnel 50.5 feet wide and 740 feet long for eastbound traffic		One new 2-lane tunnel 38.5 feet wide and 740 feet long for eastbound traffic	One new 3-lane tunnel 50.5 feet wide and 740 feet long; reconstruct existing north bore to 50.5 feet			
	New Tunnel	Twin Tunnels to Hidden Valley	N/A	N/A	N/A	N/A	N/A	N/A	One new 3-lane tunnel 50.5 feet wide and 1,400 feet long for westbound traffic	N/A	N/A	N/A	N/A	N/A
	New Tunnel	Hidden Valley to Floyd Hill	N/A	N/A	N/A	N/A	N/A	N/A	One new 3-lane tunnel 50.5 feet wide and 5,500 feet long for eastbound traffic	N/A	N/A	N/A	N/A	N/A
Ancillary facilities			N/A	• 3-foot-tall barrier to separate rail from traffic lanes • 5-foot fence above barrier for on-grade sections • 24-foot-tall overhead catenary	• 3-foot-tall barrier to protect traffic from AGS piers	• Three 3-foot-tall barriers to guide buses and separate buses from traffic lanes		Paved ditch • 11 feet, Herman Gulch to Continental Divide • 9 feet, Silver Plume to Herman Gulch • 2 feet, all other areas		• Paved ditch (see 6-Lane Highway) • Two 3-foot-tall barriers to separate reversible lanes from general purpose lanes	• 3-foot-tall barrier to protect traffic from rail • 5-foot fence above barrier for on-grade sections • 24-foot-tall overhead catenary	• 3-foot tall barrier to protect traffic from AGS piers	• Three 3-foot-tall barriers to guide buses and separate buses from traffic lanes	

Note: The existing total transportation Corridor width ranges from 78 to 104 feet.

2.2.1 Tier 1 Construction Assumptions and Future Considerations

2.2.1.1 Tier 1 Assumptions

Introduction

At this Tier 1 level of analysis, only broad assumptions regarding the construction of alternatives have been developed. This section provides assumptions on timing for construction, construction phasing and traffic management, and potential construction impacts. Environmental impacts associated with construction activities are described in Chapter 3.

Key Assumptions for Construction Timing, Phasing and Traffic Management

The PEIS has established the following interrelated assumptions at the Tier 1 level:

- Construction of any alternative retained for full evaluation in the PEIS would be accomplished between the years 2010 and 2025. Implementing this assumption would necessitate completing Tier 1 and Tier 2 NEPA requirements and a meaningful amount of design work before 2010, so that some construction of a selected alternative from the ROD could start by 2010.
- Construction of any alternative would be phased in such a manner that the operation of the existing highway would be maintained throughout construction, although some limited interruptions to traffic could be expected during off-peak hours of operation. It is essential that traffic be managed through peak travel periods and seasonal conditions to meet the 15-year construction timeframe.
- Construction would be phased in a manner that prioritizes those areas of the Corridor that have the greatest need or add utility to the transportation system.

Estimated Construction Impacts

For this study, a construction disturbance zone is assumed to require an additional 15 feet beyond the proposed permanent footprint for most alternatives. However, AGS, which is completely elevated, is anticipated to be constructed within the footprint of that alternative, not requiring an additional construction zone beyond its permanent footprint. An additional 15-foot sensitivity zone beyond the construction disturbance zone has been identified for all alternatives, where additional impacts to some resources may occur. Preliminary studies have demonstrated that most proposed construction can be contained within these limits. However, exceptions are anticipated in areas requiring tall rock cuts. Tall rock cuts are likely to be necessary for some alternatives in various locations between Fall River Road and the base of Floyd Hill (milepost 237 to 244). The extent of these additional encroachments has not been analyzed in this Tier 1 level of study.

Impacts would be associated with an alternative's permanent footprint, its construction disturbance zone, and if relevant, its sensitivity zone. Impacts associated with the construction disturbance zone, which would extend 15 feet from the edge of the permanent footprint, would be mitigated based on the resource affected.

The sensitivity zone, which would extend 15 feet from the edge of the construction disturbance zone, was established to account for other possible construction-related impacts affecting habitat and water resources from the implementation of alternatives. The sensitivity zone was also established to account for those resources that may be affected by roadway operations, including runoff from the road that includes winter maintenance material, and other contaminants such as heavy metals, and fuel-based organic compounds. The sensitivity zone would provide a measure of possible effects on the functions of these adjacent resources.

2.2.1.2 Construction Considerations

Introduction

Several factors could influence the timing and, therefore, the sequencing of construction, as well as the ability to get all components of a given alternative constructed in 15 years. These would include:

- Revenue stream – annual availability of project funds
- Necessity to maintain existing traffic operations
- Seasonal factors, such as weather and temperature constraints, and the accommodation of recreational events
- Phasing
- Compliance with environmental mitigation requirements

Future studies will include analysis of these issues.

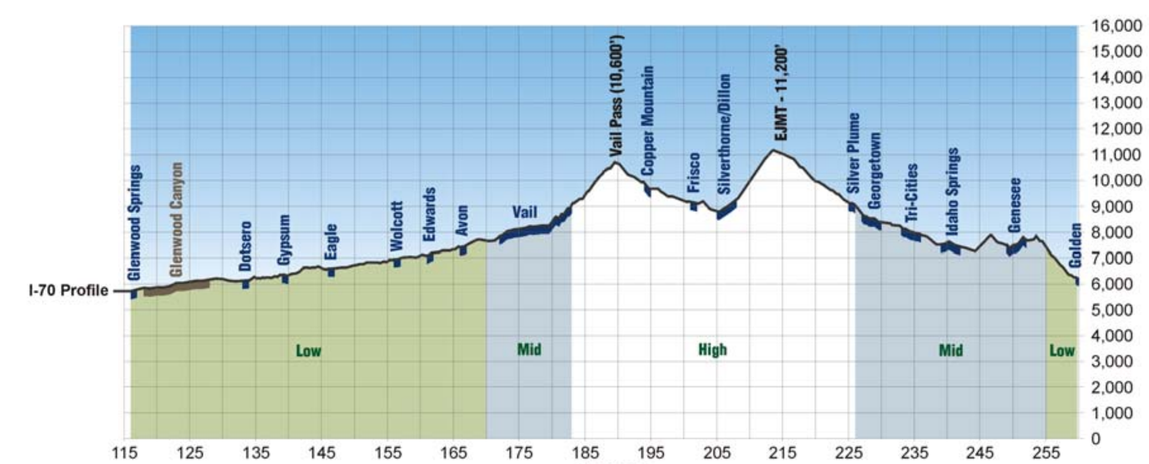
See the following sections for additional discussions of construction-related impacts:

- Section 3.9.3.3 for an analysis of construction impacts in Clear Creek County
- Section 3.12.5 for a discussion of construction noise
- Section 3.4.4.2 for construction and stream disturbance
- Section 3.18.3.1 for energy-related construction impacts

Construction Timing

The Corridor presents both physical and seasonal constraints to construction activities. The 144-mile Corridor between Glenwood Springs and C-470 generally consists of three elevation ranges relating to construction activities: low-, mid-, and high-elevation area, as illustrated in Figure 2-4. While the ideal construction periods throughout the Corridor would be the summer and transition seasons, lower elevation areas (8,000 feet or less) could be candidates for construction throughout the winter, depending on individual years. Likewise, but to a lesser extent, in areas of mid-elevation around the town of Vail and between Dumont and Genesee, it would be possible that extended seasonal work could be permitted by climatic conditions. However, in higher elevations of the Corridor, between east Vail and Georgetown, winter construction would typically not be feasible.

Figure 2-4. Elevation Ranges Related to Construction Activities



It should be assumed that the bulk of the construction activity would be carried out during the traditional spring, summer, and fall periods. Some activities, such as paving operations, would depend on air temperature and clearly could not be done in the winter or under severe weather conditions. Specifications would be developed at Tier 2 to identify for the contractors construction operation constraints like the maintenance of existing traffic limitations on detours and community specific-issues, such as nighttime noise levels. Construction in proximity to communities would occur in consultation with the affected communities.

Available Housing and Transportation for Construction Workers

Construction will involve all counties along the Corridor. The focus of this discussion is on Clear Creek County because this county will experience the greatest concentration of construction activity due to a number of factors, including constrained topography.

The effects of construction workers on the Clear Creek County economy are primarily dependent on worker commuting and residence conditions. For construction occurring in Clear Creek County, it is expected that most of the construction workers would commute from the Denver metropolitan area (the principal labor market for such workers) and would not reside in the county. Most workers would commute daily to project job sites in the county (assuming commute times of about one hour), preventing the need for most temporary workweek accommodations in the county. Construction workers are expected to generate some local spending in communities along the route, but the amount would be considerably less than their total earnings. Workers commuting to job sites daily generally spend relatively little on the job for products and services such as gasoline, lunches, and snacks, or other casual and brief recreation.

Construction Phasing

The construction phasing approach will be developed during the design phase. Construction phasing will depend on a number of factors, including anticipated revenue stream, logical roadway and/or transit segments, traffic management strategies, and identification of priority of areas. Key considerations for construction phasing are described below.

Priorities. Establishing priorities for areas of construction is important because there are areas along the Corridor that would have greater need than others based on safety and mobility issues.

Construction methods. If practical, construction should be phased such that material that is excavated in one area could then be used as fill in another without having to provide for interim storage or disposal. This approach could reduce the “double handling” of materials. For example, alternatives involving tunnel construction would be developed such that the excavated tunnel spoils could be used elsewhere on the project as it is removed from the excavation site. This could be in the form of fill material behind retaining walls, for example, or for use as aggregates if the material is suitable for that purpose.

Materials and equipment storage. Storage areas are often limited when improving existing transportation facilities, especially within the tight constraints of the I-70 Corridor. One approach for limiting the amount of required storage area is the use of prefabricated elements on the project. By fabricating major concrete components such as bridge girders, retaining wall segments, and even bridge pier and deck segments at remote casting yards, it is possible to preserve more space for traffic and for those major pieces of equipment necessary to construct the alternative or project.

Traffic Management

As discussed above, the phasing of construction will be heavily driven by the requirement to maintain traffic mobility and safety. Traffic volumes along the Corridor are continuing to grow and the mobility problems that have developed can be expected to worsen by the time construction is anticipated to start (2010). Therefore, the phasing of construction with traffic movement will be a critical element. There are certain periods of high traffic when interference with traffic cannot be tolerated.

The summer months could present the greatest timing challenges due to the spread of travel times as compared to winter. Nighttime would have its own constraints in terms of potential truck traffic attempting to avoid peak travel times, and concerns for construction noise affecting Corridor communities.

2.2.1.3 Summary Comparison of Potential Traffic Disruption during Construction

Overview

There would be a wide range of impacts in terms of potential traffic disruption and overall mobility along the corridor as a result of the construction of alternatives. These impacts would typically be directly correlated with the overall width of the construction footprint, although there will be exceptions to this premise. For example, construction of certain Minimal Action components such as local curve safety modifications, auxiliary lanes, or interchange improvements could cause short-term, site-specific traffic disruption.

The following discussion is qualitative and focuses on the key factors that could contribute to traffic disruption during construction. Specific construction techniques and traffic management schemes would be developed during Tier 2 NEPA studies, project design, and construction planning. Other factors not taken into consideration at Tier 1 include availability of labor and materials resources. This discussion focuses on the broader implications of alignment, construction footprint, major structures (long bridges, tall retaining walls), and construction traffic control strategies associated with alternatives.

As indicated in the assumptions above (section 2.2.1.1), a premise of this study is that the highway would remain operational throughout the anticipated construction timeframe. This would require avoiding lane closures or reductions in the normal number of through lanes during peak travel times. During off-peak travel periods, reductions in the number of lanes, or even temporary total closures of the highway, would be inevitable due to construction activities that cannot reasonably and safely be accomplished any other way. Managing traffic during all stages of construction would be subject to detailed planning, including community involvement.

Descriptions of potential traffic disruption associated with alternatives are provided in the following sections. Comparative rankings of construction duration and potential traffic disruption are provided in Table **2-7**.

Ranks are a general indication of construction impacts which are quantified by the length or number of facilities associated with each alternative.

No Action Alternative

The No Action alternative would have the least construction impact on traffic. Construction related impacts of the No Action alternative to I-70 would be primarily associated with the use of I-70 to access the specific project areas. There would be no changes in the footprint of the corridor and the alignment I-70 would remain as it is presently. Isolated locations, such as the assumed new access to the gaming areas or the new Eagle County Airport interchange, will require short-term traffic management strategies

Minimal Action, Rail with IMC, and AGS Alternatives

Minimal Action alternative. This alternative would be among the intermediate range of construction impacts among alternatives, as a result of potential local traffic disruption due to the construction of:

- 24 interchanges
- 39 total miles (eastbound and westbound) of auxiliary lanes
- Four curve safety modifications locations

The curve-smoothing components of this alternative would most likely result in greatest impacts in the location of Dowd Canyon, Fall River Road and east of the Twin Tunnels. These would involve tall rock cuts (100 to 150 ft), especially east of the Twin Tunnels. Implementation of excavation techniques for tall rock has been developed in Colorado to minimize traffic disruption to ten to twenty minutes at those times when a blast would be required.

Other potential traffic disruption stemming from the construction of the Minimal Action alternative would be associated with auxiliary lanes. Construction would for the most part be carried out adjacent to and outside the traveled lanes of I-70. Disruption to traffic would be most likely be limited to the closure of shoulders in order to provide a safety buffer, and to locations where access and egress points would be required for purposes of delivery and removal of materials and equipment.

Rail with IMC and AGS alternatives. These alternatives would be in the intermediate range of traffic disruption, relative to other alternatives, due to the following construction requirements:

- Construction requirements for approximately 92 miles of a new (partially elevated) rail system from mp 168 to mp 260
- Construction requirements for approximately 115 miles of an elevated AGS from mp 145 to 260
- New tunnel bores at the EJMT and Twin Tunnels (see section on tunnel waste disposal below)
- Associated Minimal Action components of these alternatives

The Rail with IMC and AGS alternatives would be constructed adjacent to the existing travel lanes of I-70, or in the median, where adequate space would be available. The alignment of these alternatives would require an estimated 15 elevated Rail and 16 elevated AGS crossings of I-70.

The IMC portion of the Rail alternative would utilize the existing Union Pacific railroad right-of-way, and not result in new construction impacts.

Where construction of the Rail and AGS systems would be adjacent to the existing travel lanes of I-70, encroachment onto the immediate edge of I-70 could result that would require shoulder closures in order to provide a safety buffer. Construction up to the edge of the shoulder would not be accomplished unless all vehicular access to the shoulder is restricted. This could also require placement of continuous barriers along the edge of the traveled lanes, and also require a reduction in lane width (although not in lane numbers). Both of these requirements could result in adverse effects on traffic flow, and overall capacity. The construction of the overpass superstructures of the rail and AGS systems would require temporary closure of traffic along I-70.

Construction of these alternatives in such close proximity would potentially result in additional impacts on traffic to satisfy requirements for materials and equipment access and egress needs. There are very few locations along the Corridor where such access and egress is provided via adjacent frontage roads. Therefore, such equipment maneuvers would require the use of existing I-70 traffic lanes, where adjacent interchanges are not available. The rather large turning requirements of material supply and equipment vehicles, combined with the narrow space available beside I-70, would affect free-flowing traffic movement during construction. The only way for them to access the area available for construction would be through openings in the continuous barrier, which could require frequent, but very short duration, stoppages of all traffic. This could be very disruptive to upstream traffic, potentially resulting in extended traffic constraints, especially in locations such as Mt. Vernon Canyon, Floyd Hill to Empire Junction, Georgetown Hill, the Vail Valley and Dowd Canyon. Impacts would only disrupt one direction of travel, except in those locations where construction would be in the median.

Construction sequencing and phasing would be key to the success of the mitigation of the potential traffic disruption during the construction of these transit systems. It is assumed that traffic would be able to continue using the existing travel lanes for the duration of construction of these transit systems, except during the construction of transit structures over I-70 at crossing locations.

Bus in Guideway, Highway, and Combination Alternatives

Bus in Guideway, Highway, and Combination alternatives. These alternatives would be in the greatest range of traffic disruption relative to the other alternatives, as a result of the following construction requirements:

- Reconstruction of 16 miles of I-70 to accommodate the bus guideway in a barrier-separated system within the median of I-70
- Reconstruction of 37 miles of I-70 to accommodate additional lanes for Six-Lane Highway (55 or 65 mph), and Reversible/HOV/HOT Lanes
- The associated Minimal Action components of each alternative.
- New tunnel bores (see section on tunnel construction waste disposal below):
    - Bus in Guideway – new tunnel bores at the EJMT and Twin Tunnels
    - Six-Lane Highway 55mph, Reversible/HOV/HOT Lanes, and Combination alternatives - new bores at the EJMT and Twin Tunnels
    - Six-Lane Highway 65mph – new tunnel bores at the EJMT and Twin Tunnels, and at Dowd Canyon. In addition, a new bore would be required westbound through “s” curves east of the Twin Tunnels, and eastbound from Hidden Valley to Floyd Hill (see section on tunnel construction waste disposal below).

- Potential structured lanes through the Idaho Springs area

Long bridges and tall retaining walls that are associated with these alternatives would require the greatest amount of earth moving and foundation construction. These activities would be time-consuming and require large equipment. Construction during off-peak hours would also require special consideration for noise and lights adjacent to communities. Efficiency would be reduced unless some of this equipment is permitted to operate continuously, such as foundation drilling equipment that is not easily moved out of the way when a declared off-peak period ends.

These alternatives will require considerably more rock excavation – both for making the tall cuts as well as portal cuts for tunnels. Because these activities are not typically carried out at night, construction during off-peak daytime hours could require stopping traffic for certain durations.

The construction of the structured lanes sections through Idaho Springs would be time-consuming, and involve activities in close proximity to I-70 traffic. While it is assumed that maintaining two through lanes in each direction would be possible, these lanes may require narrowing to less than the standard 12 feet, and shoulders are likely to be barricaded from traffic in order to allow work to proceed at their edges.

In order to build any of these alternatives, there would be requirements for several transitions and detours from old pavement to new, to accommodate a particular piece of equipment that may have to stay in one position for days at a time. These detours would typically be constructed with reduced standards and speeds. The use of traffic control devices would be extensive, which would also affect the speed of traffic in construction areas.

The nature of these construction requirements and constraints in such close proximity to traffic could result in extended traffic interference for each of these alternatives.

Table 2-7. Comparison of Construction Duration and Potential Traffic Disruption

			Transit Alternatives				Highway Alternatives			Combination Highway/Transit Alternatives			
		1	2	3	4	5	6	7	8	9	10	11	12
	No Action Alternative	Minimal Action Alternative	Rail with IMC	Advanced Guideway System	Dual-Mode Bus in Guideway	Diesel Bus in Guideway	6-Lane Highway 55 mph	6-Lane Highway 65 mph	Reversible/ HOV/HOT Lanes	6-Lane Highway with Rail and IMC *9 – Build Combination simultaneously* *9a – Transit Built First* *9b – Highway Built First*	6-Lane Highway with AGS *10 – Build Combination simultaneously* *10a – Transit Built First* *10b – Highway Built First*	6-Lane Highway with Dual-Mode Bus in Guideway *11 – Build Combination simultaneously* *11a – Transit Built First* *11b – Highway Built First*	6-Lane Highway with Diesel Bus in Guideway *12 – Build Combination simultaneously* *12a – Transit Built First* *12b – Highway Built First*
Construction Duration and Impact	1	1	2	2	3	3	3	3	3	3 2 3	3 2 3	3 3 3	3 3 3

Legend

Least construction impacts
Intermediate construction impacts
Greatest construction impacts

Tunnel Construction Waste Disposal

Construction of tunnels would create large quantities of waste rock. CDOT would use waste materials onsite wherever possible. Onsite uses of rock and clayey materials would minimize truck traffic. Onsite uses might include having onsite crushers and concrete or asphalt plants for the creation of aggregate and riprap. These materials might be used for drainage channels, avalanche chutes, rockslide stabilization, berms, and road base. If onsite use is not possible or feasible, numerous disposal options have been identified. Details of the disposal of tunnel waste are provided in Section 3.7, Geologic Hazards. Table 2-8 provides a summary of tunnel locations and waste quantities and potential truck requirements.

Table 2-8 Tunnel Construction Waste

Waste Source	Location (mp on I-70)	Amount of Waste (cubic yard)	Number of Truckloads[a]	Rock Type
Dowd Canyon	169–173	973,520	74,887	Sand/shale
Continental Divide – north[b]	213.5–215	1,221,810	93,986	¾ hard granite/gneiss, ¼ clay or crumbly material
Continental Divide – south[b]	213.5–215	1,054,450	81,112	¾ hard granite/gneiss, ¼ clay or crumbly material
Twin Tunnels	242.1–242.3[a]	95,450	7,343	Hard granite/gneiss
65 mph curves – eastbound	242–242.8[a]	204,540	15,726	Hard granite/gneiss
– westbound	242–242.8[a]	470,430	36,187	Hard granite/gneiss
Floyd Hill Tunnel	243.2–245.2	756,770	58,214	Hard granite/gneiss

[a] *For Six-Lane Highway (55 or 65 mph) or Rail with IMC alternatives, options would include either increasing the bores at the Twin Tunnels or creating 65 mph curve tunnels that would pass around the existing Twin Tunnels.*
[b] *The total for the Continental Divide borings would be 2,276,260 cubic yards. Since one-fourth of this material is estimated to be crumbly or clayey, the amount of material unlikely to be resold would be about 569,070 cubic yards.*
[c] *Assumes 13 cubic yards per truckload, rounded to next truckload.*

2.3 Comparison of Alternatives

This section further explores the alternatives, with a comparison based on the following criteria: **mobility, safety, cost,** and **environmental and community values**. The comparative analyses of alternatives in this section will be used in the process of identifying the preferred alternative in the Final PEIS.

For the mobility comparison only, discussion of Combination alternatives typically refers to the option to *build highway and transit simultaneously*. Preservation alternatives are considered to be the same as their single-mode counterpart and therefore this section focuses on the alternatives listed in the box at right.

Alternatives Evaluated in the Mobility Comparison

- No Action
- Minimal Action
- Rail with IMC
- AGS
- Diesel Bus in Guideway
- Dual-Mode Bus in Guideway
- Six-Lane Highway 55 mph
- Six-Lane Highway 65 mph
- Reversible/HOV/HOT Lanes
- Combination Six-Lane Highway with Rail and IMC
- Combination Six-Lane Highway with AGS
- Combination Six-Lane Highway with Dual-Mode Bus in Guideway
- Combination Six-Lane Highway with Diesel Bus in Guideway

2.3.1 Overview of Mobility Evaluations

The differences in mobility among alternatives, including the No Action alternative, are described and quantified in this section. A focus of the comparison among alternatives is how each alternative may accommodate the 2025 Baseline level of demand, described in Chapter 1, Purpose of and Need for Action. The comparisons of each alternative are made with respect to the following factors:

- Accommodation of 2025 Baseline travel demand and accommodation of travel growth beyond 2025
- Travel time
- Hours of congestion

The mobility comparisons focus on distinguishing the differences among alternatives. For a broader discussion of travel characteristics and additional data on mobility comparisons, see Appendix B, Transportation Analysis and Data. The termini of each alternative are illustrated in section 2.2. The following sections summarize the travel demand model, and the mobility criteria and comparison process, followed by comparisons among alternatives.

2.3.1.1 Travel Demand Model

All mobility data for travel performance analysis are derived from the I-70 PEIS travel demand model. For a comprehensive discussion of the model, see Appendix C, Description of the Travel Model. The travel demand model encompasses the transportation network of western Colorado that includes I-70. The area is defined by Wyoming to the north, Pueblo to the south, Denver International Airport (DIA) to the east, and Utah to the west. The model forecasts a set of days in 2000 (calibration days) for the current conditions, and in a set of days in 2025 (forecast days) for the Baseline scenario and the project alternatives. Model days can then be extrapolated to an entire year to provide annualized forecasts.

The PEIS travel demand model includes a four-step model similar to those used for metropolitan transportation planning. Briefly, the four steps are:

1. **Trip generation.** This step establishes the total numbers of trips.
2. **Trip distribution.** This step links origins to destinations based on the relative distances of their locations.
3. **Mode choice.** This step determines the choices between auto and transit based on relative times and costs, and traveler preferences.
4. **Trip assignment.** The purpose of this is to determine the route location for the highway and also the boarding for the transit facility.

The following **selected model days and seasons** represent typical summer and winter weekend and weekdays in the comparative analyses:

- **Summer Thursday** represents a typical work day in the Corridor.
- **Summer Friday** represents a mixture of weekday travel and recreation-related trips made at the beginning of the weekend. Friday trips were examined only for the western part of the Corridor, west of Vail.
- **Winter Saturday** represents primarily recreation travel, and contains a large proportion of day winter recreation use.
- **Summer Sunday** represents both single-day recreational travel and overnight recreation trips, and the time when the highest daily volumes generally occur in the Corridor. Volumes are particularly high on summer Sunday evenings, when both day recreation and overnight recreation participants return home.

Descriptions and data for all of the model days evaluated in the travel model are provided in Appendix B.

Model Distinctions between 2025 Baseline Scenario and No Action Alternative

There is a distinction between the Baseline scenario – which is the theoretical 2025 travel demand used for comparison – and the No Action alternative – which consists of the implementation of only currently planned projects on the existing network. The difference between the Baseline and No Action is described below.

Specific Applications of the Modeling Process

- The model is based primarily on two software applications – TransCAD and VISSIM. TransCAD uses a four-step model to assess a broad study area for demand and transit share by analyzing socioeconomic and recreation use data, transportation networks, and travel costs. The resulting interchange-to-interchange vehicle demand matrix relationships produced by the TransCAD model is utilized by the traffic simulator VISSIM to produce travel times, LOS, and congestion data.
- The PEIS travel model goes beyond typical metropolitan models by including a traffic simulation component, VISSIM. The traffic simulator provides more reliable estimates of congestion and queuing than the TransCAD model. It is based on more rigorous assumptions regarding driver behavior and the performance of various types of vehicles. All alternatives are evaluated with the traffic simulator to compare the vehicle performance within the Corridor. For example, the VISSIM model accounts for steep grades in the Corridor and the restrictions on the speeds of loaded freight vehicles, which may then interfere with the free movement of passenger vehicles. To the extent that congestion remains after the introduction of an alternative, the traffic simulator provides an estimate of the discrete measure of performance, by which to compare alternatives on a relative basis.
- At the high levels of demand and congestion that are typical of the I-70 Corridor, differences in travel performance of an alternative forecasted by the traffic simulator are often quite pronounced. This allows for better differentiation among alternatives within common modes, and between the different modes of alternatives (see section 2.2 for a description of all 21 alternatives).
- The PEIS travel demand model explicitly considers trip purposes included in most metropolitan models – home-based work trips stratified by income, other home-based trips, non-home based trips, commercial vehicle trips, internal-external trips, and external-external trips. The model also includes numerous distinct recreational trip purposes, as a basis for determining the effect of each alternative on Corridor travel patterns.

2025 Baseline

The **2025 Baseline demand** defines the project need described in Chapter 1. The Baseline is a scenario, not an alternative, and represents a theoretical travel demand that may or may not occur. The modeling process and assumptions to produce the 2025 Baseline demand combines the 2025 socioeconomics and current travel propensities listed below:

1. Population and employment forecasts from the Colorado Department of Local Affairs (DOLA) and Corridor counties (see Appendix C, Description of the Travel Model)
2. Recreation visitation forecasts from the USFS and Colorado Ski Country USA
3. Current (year 2000) propensities to travel, including trip-making rates, regardless of the traveler's tolerance to congestion
4. The existing transportation network, plus those projects approved and planned for implementation before 2025, as described in the No Action Alternative Overview in section 2.2

5. The Baseline scenario does not assume any adjustment in travel choice. Therefore, it does not represent equilibrium between supply and demand, or consider choices that travelers may make in their travel plans in response to the adequacy or limitations on capacity.

The Baseline scenario is based on a theoretical assumption that travel demand in the Corridor would grow in line with socioeconomic projections without consideration for any travel limitations on I-70. In addition, the Baseline scenario assumes that the projected growth in traffic on I-70 would not influence the population and employment projections, or result in the suppression of trips.

Consideration of the effect of the Baseline demand on the No Action transportation network produces **Baseline travel performance**. Essentially, the Baseline travel performance provides an indication of the demand for future travel, as well as a worst-case benchmark of future congestion, if that demand would not be satisfied by the future transportation system. This benchmark is used to measure the mobility benefits resulting from the changes to capacity inherent in each alternative.

The Baseline scenario was used to group alternatives according to whether they would be able to meet the need for mobility forecast to the year 2025, and therefore accommodate Baseline demand. The grouping of alternatives is discussed in section 2.4.

No Action Alternative

The No Action alternative described in section 2.2 would consist of short-term projects on the existing network. As described above, the Baseline scenario and the No Action alternative are based on the same highway network. However, the No Action alternative represents equilibrium between traveler's trip-making propensities and the resulting levels of congestion. It also assumes current capacities along I-70. The Corridor is currently congested on many peak recreational season weekends, and trip suppression is assumed to be occurring. To produce the No Action forecast, the travel demand model – using the assumption that trip suppression will continue due to travelers' intolerance to high levels of congestion – reduces trip generation rates from their year 2000 level until a tolerable level of congestion is reached. However, even with a reduction in trip generation rates from 2025 Baseline projections, person trips on I-70 with the No Action alternative are still projected to increase by approximately 30 percent (at locations already heavily congested) to 150 percent during the peak days between 2000 and 2025. The 150 percent increases are realized on winter Saturday at the Floyd Hill (due to diversion of gaming traffic from US 6), East of Eagle, and No Name Tunnels focal points.

Induced and Suppressed Travel Demand and Development

Suppression and inducement of travel is a central factor in the analysis of travel performance by alternatives in the Corridor. Improved travel times associated with alternatives could encourage Corridor travelers to make trips they might otherwise forgo, resulting in additional trips beyond Baseline forecasts – that is, to induce travel – and possibly induce land use growth in the Corridor. Conversely, with no changes made to I-70 (other than the projects included in the No Action alternative), increased congestion is expected to result, as population and travel demand increase. This could cause some travelers to forgo trips, resulting in trip suppression.

Approach

Induced travel is estimated on an origin-to-destination basis using relationships determined from the I-70 Ridership Survey (see Appendix D, Documentation of the I-70 Ridership Survey). The survey described a hypothetical new transit system for the I-70 Corridor, asked respondents how many trips they currently make in the Corridor, and asked how many additional trips (if any) they would make if the hypothetical transit system or additional travel lanes did exist.

Suppressed travel is estimated by gradually reducing the number of trips until a tolerable travel time results. An expert panel of traffic engineers familiar with the Corridor provided their insights into how much congestion travelers might tolerate to characterize a reasonable suppressed travel time.

Existing travel demand is most easily measured by counting the number of vehicles passing a point. To describe the Corridor-wide effect of an alternative on travel demand levels, a measure that combines many points is needed. The measure of induced travel shown in Table 2-9, and in Appendix B, Transportation Analysis and Data, in Table B-3, is based on averaging the annual person trips at each of the 10 focal points described in Chapter 1, Purpose of and Need for Action, and comparing this average against the corresponding average for the Baseline scenario. Details of induced or suppressed travel demand were calculated for each single focal point and/or each single model day. Results of such calculations are shown in the demand comparisons in Appendix B.

Evaluation of Demand

Comparisons of alternatives are complicated by the phenomena of variable amounts, times, and reasons for travel that could result in inducing or suppressing travel from the Baseline scenario. A more traditional approach using a fixed level of demand would show that the alternative with the greatest capacity would produce the fastest travel times. In the model used for this study, because demand is allowed to vary in response to seasonal demand and to congestion levels, each alternative is forecast to have a unique amount of demand.

As the capacity of alternatives increases from No Action, so would the demand. As a result, demand would vary among the alternatives, and an assumption that better travel times or fewer hours of congestion would be realized with the higher capacity alternatives would not necessarily be achieved, since the additional demand (inducement) would also have the potential to consume part of the additional capacity. A worst-case approach was taken to convey the changes in travel time and congested hours and address the long-term I-70 travel demand.

Changes in travel demand in response to the increased capacity offered by each alternative (induced or suppressed) would also influence resulting levels of congestion and travel time in the Corridor. For example, induced travel would negate part of an alternative's travel time savings over the No Action alternative. In addition, with an increased number of vehicles on the road due to changes to socioeconomic condition, travel times would not be improved as much as they would be if travel demand remained constant at the No Action level. For this reason, the differences in travel times and other mobility measures for alternatives would not be as great as if the same alternatives were tested with a single, fixed demand. In effect, people's propensity to take additional trips (induced travel) would result in an increased burden relative to each alternative's ability to accommodate travel demand.

Induced travel and induced development could also have indirect and cumulative impacts on the community values and environmental sensitivity of the Corridor, as described in Chapter 4, Cumulative Impacts Analysis.

2.3.2 Mobility Criteria and Comparison Process

The following mobility criteria are applied for comparisons among alternatives:

- **Travel Demand**
  - **Ability to Accommodate 2025 Baseline Travel Demand**. This section compares the ability of alternatives to accommodate 2025 Baseline travel demands on an annual basis and for selected model days. Total person trips at selected focal points are examined, to describe how alternatives with induced travel would be capable of accommodating the Baseline demand, while those with suppressed travel would not.
  - **Ability to Accommodate Travel Demand Beyond 2025**. The final mobility comparisons address the ability of each alternative to accommodate the forecasted Baseline demand and the year in which an alternative might reach its ultimate capacity.
- **Travel Time.** Travel time comparisons are based on (1) the selected model days, and (2) annual average peak-hour travel time (representing an average of all 365 days of the year). Highway travel time is a common indicator of the performance of each alternative. Comparisons are presented for each alternative for the entire Corridor, as well as for key segments within the Corridor. Transit travel times are provided as an indication of the performance of the transit systems. In addition, an example of complete trip from specific origins and destinations is provided, in order to compare total travel times among alternatives.
- **Hours of Congestion (LOS F).** A comparison of the duration of congestion at focal points is made among the alternatives on an annual and peak day basis.

Within discussions for each criterion, alternatives are first summarized for the Corridor, and then examined within specific geographic segments or focal points within the Corridor. Bar charts summarize data on a Corridor-wide basis, and comparative tables provide the related thresholds for travel demand performance and data for each alternative.

2.3.3 Travel Demand Comparisons

Travel demand comparisons provide the basis to measure the ability of alternatives to meet the underlying need of the project (as described in Chapter 1), as follows:

Alternatives that meet the need would:

- Accommodate the projected 2025 travel demand for the Corridor, and
- Could also address the continued growth beyond 2025.

The ability of alternatives to accommodate 2025 travel demand is based on annual average travel demand. An alternative resulting in suppressed demand would not accommodate travel growth through 2025 and therefore would not meet the project need. A comparison of alternatives based on daily travel demand on selected model days and locations is also included in this section. Table 2-9 shows the annual amount of inducement and suppression, which is determined by the difference between the projected annual travel demand for each alternative and the 2025 Baseline travel demand. To present a Corridor-wide view, an average of total travel demand in person trips of all 10 focal points, for both eastbound and westbound, is used. If the average travel demand for an alternative is greater than the Baseline demand, the alternative is considered to be inducing the travel demand, resulting in induced trips. If the alternative has an average travel demand less than the Baseline demand, it is considered to be suppressing the travel demand, resulting in suppressed trips.

The ability of alternatives to accommodate travel growth beyond 2025 is also described in this section.

2.3.3.1 Ability to Accommodate the Projected 2025 Travel Demand

This section provides comparison of alternatives based on:

- Annual travel demand
- Selected model day travel demand

Comparisons of Annual and Selected Model Day Travel Demand

Chart 2-1 and Table 2-9 present the ability of alternatives to accommodate average annual travel demand. This analysis identifies the expected amount of trip suppression or inducement, by each alternative, in comparison to the Baseline.

Thresholds. The thresholds for the ability to accommodate average annual travel demands are:

- Baseline demand or greater – more than 0 percent (induced trips)
- Less than Baseline demand – less than 0 percent (suppressed trips)

Only two categories are shown for this comparative analysis, because an alternative that accommodates the Baseline demand (and no more) would meet this need criterion, just as an alternative with excess capacity to induce demand does.

All of the action alternatives (Transit, Highway, and Combination alternatives) are shown to accommodate Baseline demand on an annual basis and fall into the “meets Baseline demand or greater” category, while the Minimal Action and No Action alternatives do not accommodate Baseline demand and fall in the “less than Baseline” category.

Alternatives would rank in the following order, from worst-performing to best-performing for their ability to accommodate 2025 Baseline demand (measured in terms of annual person trips averaged over the 10 focal points):

- The No Action and Minimal Action alternatives would suppress trips at a rate of 4 percent and 2 percent, respectively, and would not meet the underlying need to accommodate 2025 Baseline demand.
- Each Highway alternative would induce trips over Baseline demand by about 1 percent more person trips.
- The Transit alternatives would induce the next most travel; AGS would induce slightly more travel than the other Transit alternatives (5 percent versus 4 percent).
- The Combination alternatives would induce the greatest increase in trip making (11 to 12 percent).

Chart 2-1. Ability of Alternatives to Accommodate Annual Travel Demand

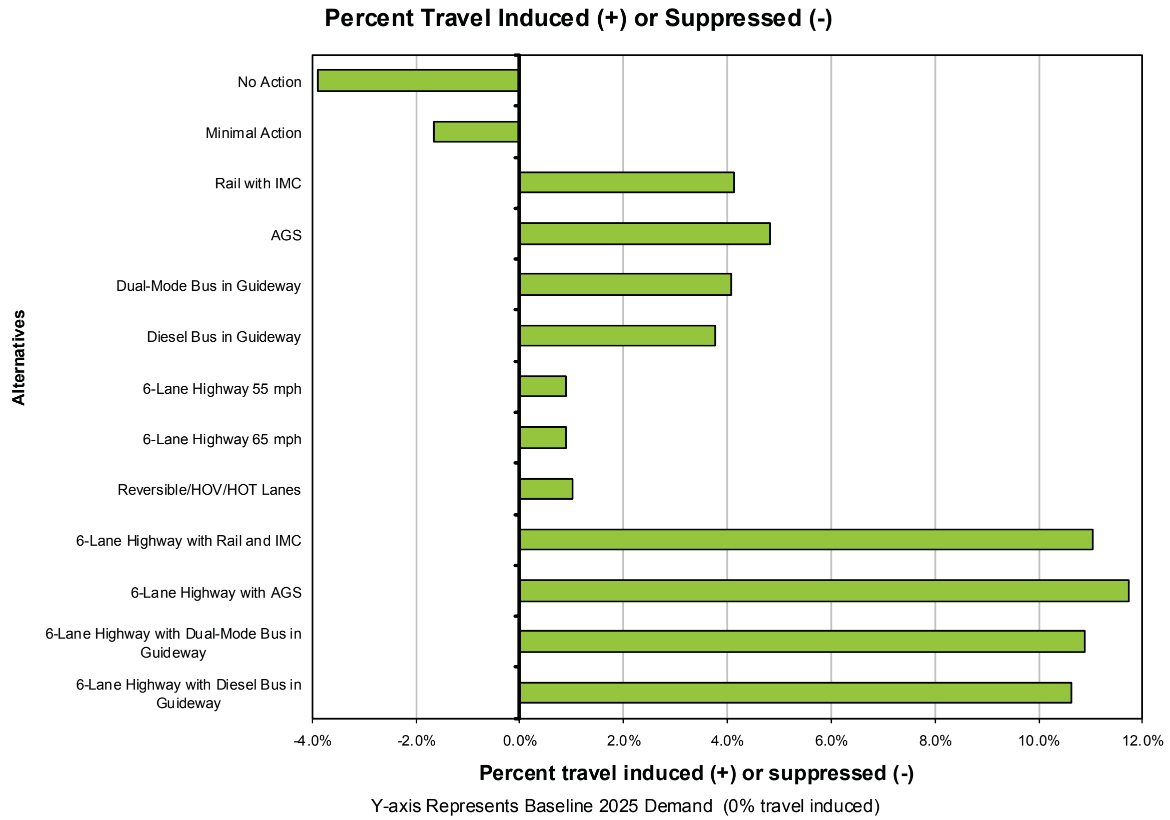


Table 2-10 shows the level of suppressed or induced demand for selected peak days at selected focal points.

- **Winter Saturday.** Winter Saturday westbound at Twin Tunnels represents relatively high need for capacity improvement. This location and direction has the strongest contrast from the measure of annual travel for No Action and Minimal Action, where travel demand would be suppressed at levels greater than 20 percent. Transit alternatives would accommodate less demand than measured for annual travel – with percentages at or below Baseline – whereas Highway alternatives would accommodate a higher demand on this model day than that projected for annual travel. The Combination alternatives would accommodate more than twice the demand on winter Saturday than it is projected to for the annual travel demand.
- **Summer Friday.** The No Action, Minimal Action, Transit, and Highway alternatives would all be similar to Baseline travel demand on a summer Friday at Dowd Canyon. The Combination alternatives would accommodate about half of the demand shown on an annual Corridor-wide basis.
- **Summer Sunday.** The highest demand for improvement is represented by summer Sunday eastbound at the West of Silverthorne focal point. The Transit, Highway, and Combination alternatives would all be above the annual average in their ability to accommodate annual demand on this model day.
- **Summer Thursday.** Summer Thursday represents off-peak travel, and at the West of Silverthorne and Twin Tunnels focal points the No Action alternative on a daily basis would be suppressed more than it would under the annual Corridor-wide demand. This model day is projected to see growth of approximately 20,000 person trips, which would result in a suppression in travel demand below the annual average, illustrating the potential need for improved capacity on a weekday basis.

Table 2-9. Inducement or Suppression Effect on Average Annual Travel Demand

Element of Purpose and Need	No Action Alternative	1 Minimal Action Alternative	2 Rail with IMC	3 Advanced Guideway System (AGS)	4 Dual-Mode Bus in Guideway	5 Diesel Bus in Guideway	6 6-Lane Highway 55 mph	7 6-Lane Highway 65 mph	8 Reversible/ HOV/HOT Lanes	9 6-Lane Highway with Rail and IMC (9 - Build Combination simultaneously; 9a - Build Transit First; 9b - Build Highway First)	10 6-Lane Highway with AGS (10 - Build Combination simultaneously; 10a - Build Transit First; 10b - Build Highway First)	11 6-Lane Highway with Dual-Mode Bus in Guideway (11 - Build Combination simultaneously; 11a - Build Transit First; 11b - Build Highway First)	12 6-Lane Highway with Diesel Bus in Guideway (12 - Build Combination simultaneously; 12a - Build Transit First; 12b - Build Highway First)
			Transit Alternatives				Highway Alternatives			Combination Highway/Transit Alternatives			
Effect on Annual Travel (average of all focal points combined)	–4%	–2%	+4%	+5%	+4%	+4%	+1%	+1%	+1%	9 +11% 9a +4% 9b +1%	10 +12% 10a +5% 10b +1%	11 +11% 11a +4% 11b +1%	12 +11% 12a +4% 12b +1%

Legend	Ability to Accommodate 2025 Baseline Demand
(green)	Baseline Demand or Greater - more than 0 percent (Induced Trips)
(yellow)	
(red)	Less than Baseline Demand - less than 0 percent (Suppressed Trips)

Table 2-10. Inducement or Suppression Effect on Selected Model Day Travel Demand

		No Action Alternative	1 Minimal Action Alternative	2 Rail with IMC	3 Advanced Guideway System (AGS)	4 Dual-Mode Bus in Guideway	5 Diesel Bus in Guideway	6 6-Lane Highway 55 mph	7 6-Lane Highway 65 mph	8 Reversible/ HOV/HOT Lanes	9 6-Lane Highway with Rail and IMC (9 - Build Combination simultaneously; 9a - Build Transit First; 9b - Build Highway First)	10 6-Lane Highway with AGS (10 - Build Combination simultaneously; 10a - Build Transit First; 10b - Build Highway First)	11 6-Lane Highway with Dual-Mode Bus in Guideway (11 - Build Combination simultaneously; 11a - Build Transit First; 11b - Build Highway First)	12 6-Lane Highway with Diesel Bus in Guideway (12 - Build Combination simultaneously; 12a - Build Transit First; 12b - Build Highway First)
				Transit Alternatives				Highway Alternatives			Combination Highway/Transit Alternatives			
Winter Saturday	2025 Person Trips WB at Twin Tunnels	–27%	–21%	–4%	+1%	–0%	–1%	+5%	+5%	+6%	9 +23% 9a –4% 9b +5%	10 +25% 10a +1% 10b +5%	11 +24% 11a –0% 11b +5%	12 +24% 12a –1% 12b +5%
Winter Saturday	2025 Person Trips WB West of Silverthorne	–18%	–12%	+7%	+6%	+5%	+5%	+1%	+1%	+4%	9 +28% 9a +7% 9b +1%	10 +29% 10a +6% 10b +1%	11 +28% 11a +5% 11b +1%	12 +27% 12a +5% 12b +1%
Summer Friday	2025 Person Trips WB at Dowd Canyon	0%	+0%	+1%	+1%	+1%	+1%	+1%	+1%	+0%	9 +5% 9a +1% 9b +1%	10 +5% 10a +2% 10b +1%	11 +5% 11a +1% 11b +1%	12 +5% 12a +1% 12b +1%
Summer Friday	2025 Person Trips EB at Dowd Canyon	0%	–0%	+0%	+1%	–1%	–1%	+1%	+1%	+0%	9 +4% 9a +0% 9b +1%	10 +4% 10a +1% 10b +1%	11 +3% 11a –1% 11b +1%	12 +3% 12a –1% 12b +1%
Summer Sunday	2025 Person Trips EB West of Silverthorne	–14%	–9%	+2%	+2%	+1%	+1%	+6%	+6%	+6%	9 +20% 9a +2% 9b +6%	10 +21% 10a +2% 10b +6%	11 +18% 11a +1% 11b +6%	12 +18% 12a +1% 12b +6%
Summer Sunday	2025 Person Trips EB at Twin Tunnels	–10%	–5%	+11%	+16%	+9%	+8%	+7%	+7%	+6%	9 +23% 9a +11% 9b +7%	10 +26% 10a +16% 10b +7%	11 +21% 11a +9% 11b +7%	12 +20% 12a +8% 12b +7%
Summer Thursday	2025 Person Trips WB at Twin Tunnels	–6%	+1%	+2%	+2%	+2%	+2%	+2%	+2%	+2%	9 +8% 9a +2% 9b +2%	10 +8% 10a +2% 10b +2%	11 +8% 11a +2% 11b +2%	12 +8% 12a +2% 12b +2%
Summer Thursday	2025 Person Trips WB at West of Silverthorne	–8%	–1%	0%	+1%	0%	0%	0%	0%	0%	9 +7% 9a +0% 9b 0%	10 +8% 10a +1% 10b 0%	11 +6% 11a 0% 11b 0%	12 +6% 12a 0% 12b 0%

Notes: Inducement or suppression of less than half a percent is shown by +0% or –0%, respectively.

Comparisons of Selected Model Day Peak-Hour Travel Demand

A comparison of alternatives based on daily travel demand on selected model days and locations is provided in this section and illustrated on Table 2-11. Selected model day peak-hour person trips are shown at three key focal points:

- **Dowd Canyon –** summer Friday (reflecting activity in Eagle County),
- **West of Silverthorne –** summer Sunday, and winter Saturday (reflecting activity in Summit County)
- **Twin Tunnels –** summer Sunday, and winter Saturday (reflecting activity in Clear Creek County, Grand County, and the Denver metropolitan area)

In addition, a discussion of weekday (summer Thursday) peak-hour demand follows the focal point discussions.

Dowd Canyon (milepost 172) Peak-Hour Travel Demand

Summer Friday is the peak day for either direction of I-70 at Dowd Canyon. Under the 2025 Baseline scenario, about 73,300 person trips would be made eastbound and 75,300 person trips westbound here on summer Friday. The No Action alternative would accommodate the same number of person trips; that is, no suppression would occur with the No Action alternative on summer Friday.

As expected, the greatest peak day inducement at Dowd Canyon would occur with the Combination Six-Lane Highway with Rail and IMC “build simultaneously” alternative and the Combination Six-Lane Highway with AGS “build simultaneously” alternative. These two Combination alternatives would result in 5 percent more person trips than Baseline westbound (the weekend overnight recreation direction) and 4 percent more person trips eastbound. The Combination “build simultaneously” alternatives involving Bus in Guideway would have almost as much inducement, at 5 percent westbound and 3 percent eastbound.

After the Combination alternatives, the AGS alternative (alone or with Highway Preservation) and the Six-Lane Highway alternatives (either the 55 mph or 65 mph design speed, alone or with Transit Preservation) would have the next highest level of inducement, about 1 percent more person trips than the 2025 Baseline in each direction. The Rail with IMC alternative (alone or with Highway Preservation) would accommodate 400 fewer westbound transit person trips, 200 fewer eastbound transit person trips, and 100 fewer highway person trips in either direction than the AGS alternative. The Reversible/ HOV/HOT Lanes alternative would accommodate 300 to 400 fewer highway person trips in either direction than the Six-Lane Highway alternatives. (It should be noted that the Reversible/HOT/HOV Lane alternative includes reversible lanes only east of the EJMT, and that in the Dowd Canyon area, two additional general purpose lanes are proposed.)

Westbound, the two Bus in Guideway alternatives (where bus trips have left the guideway and are traveling in mixed traffic) would accommodate about the same number of trips as the Six-Lane Highway alternatives, while eastbound, the Bus in Guideway alternatives would experience slight person trip suppression from the 2025 Baseline. The Minimal Action alternative would accommodate 100 more westbound person trips than No Action, and about the same number of eastbound person trips as No Action.

West of Silverthorne (milepost 204) Peak-Hour Travel Demand

Under the 2025 Baseline, there would be 96,500 summer Sunday (the peak day) person trips eastbound West of Silverthorne, and 64,900 person trips westbound on winter Saturday (summer Saturday would be the peak westbound day with 75,100 person trips). The greatest peak day inducement here would occur with the Combination Six-Lane Highway with AGS “build simultaneously” alternative – which was also the case with Dowd Canyon – but more person trips would be induced here than in Dowd Canyon. The Combination Six-Lane Highway with AGS alternative would result in 29 percent more westbound person trips than Baseline, and 21 percent more eastbound person trips.

The ranking of the remaining Combination “build simultaneously” alternatives would follow the expected mode order: The Combination Six-Lane Highway with Rail and IMC would have the next highest inducement with 28 percent more person trips than Baseline westbound, and 20 percent more eastbound. Next would be the Combination Six-Lane Highway with Dual-Mode Bus in Guideway alternative (18 percent eastbound and 28 percent westbound), and then the Combination Six-Lane Highway with Diesel Bus in Guideway alternative (18 percent eastbound and 27 percent westbound).

The ordering of single-mode alternatives varies by direction. Westbound, the Rail with IMC alternative (alone or with Highway Preservation) would induce about 500 more person trips than the AGS alternative (7 percent versus 6 percent). These alternatives would be followed by the Bus in Guideway alternatives (either power source, alone or with Highway Preservation) at 5 percent inducement, the Reversible/HOV/HOT Lanes alternative (4 percent), and the Six-Lane Highway alternatives of either design speed (1 percent).

Eastbound, the descending order of inducement would be the Six-Lane Highway alternatives (either speed, alone or with Transit Preservation, 6 percent inducement), the Reversible/HOV/HOT Lanes alternative (also 6 percent), the AGS alternatives (alone or with Highway preservation; 2 percent), the Rail with IMC alternatives (also 2 percent), the Dual-Mode Bus in Guideway alternatives (1 percent), and the Diesel Bus in Guideway alternatives (also 1 percent).

The Minimal Action alternative would accommodate fewer person trips than the 2025 Baseline here (12 percent suppression westbound and 9 percent eastbound), and the No Action alternative would result in even more suppression (18 percent westbound and 14 percent eastbound).

Twin Tunnels (milepost 242) Peak-Hour Travel Demand

As at Dowd Canyon and West of Silverthorne, the greatest trip inducement at the Twin Tunnels would occur with the Combination Six-Lane Highway with AGS “build simultaneously” alternative. On the peak eastbound day, summer Sunday, about 124,600 person trips are forecast for the 2025 Baseline scenario, and 156,800 person trips for the Combination involving AGS, which is a 26 percent inducement. The westbound inducement for this Combination alternative is almost as large: the forecast 128,700 person trips would be 25 percent more than the 103,000 winter Saturday person trips for the 2025 Baseline.

Eastbound, the second greatest inducement would occur with the Combination Six-Lane Highway with Rail and IMC “build simultaneously” alternative (23 percent more person trips than Baseline), followed by the Combination Six-Lane Highway with Dual-Mode Bus in Guideway “build simultaneously” alternative (21 percent), the Combination Six-Lane Highway with Diesel Bus “build simultaneously” alternative (20 percent), the AGS alternatives (alone or with Highway Preservation, 16 percent), the Rail with IMC alternatives (11 percent), the Dual-Mode Bus in Guideway alternatives (9 percent), the Diesel Bus in Guideway alternatives (8 percent), the Six-Lane Highway alternatives (both speeds, alone or with Transit Preservation; 7 percent), and the

Reversible/HOV/HOT Lanes alternative (6 percent). Minimal Action and No Action would result in successively more trip suppression eastbound, 5 percent and 10 percent, respectively.

Westbound, the Combination Six-Lane Highway with Dual-Mode Bus in Guideway “build simultaneously” alternative and the Combination Six-Lane Highway with Diesel Bus in Guideway “build simultaneously” alternative (each about 24 percent) would have more induced winter Saturday person trips than the Combination involving Rail and IMC (23 percent).

Each of the Highway alternatives would have more induced westbound winter Saturday person trips than any of the Transit alternatives alone or with Highway Preservation. The Reversible/HOV/HOT Lanes alternative (6 percent) would accommodate 700 more person trips (composed of 800 additional highway person trips but 100 fewer transit person trips) than any of the Six-Lane Highway alternatives (either speed, alone or with Transit Preservation), which would be 5 percent. As expected, AGS would be the Transit alternative with the greatest person trips, 103,700 or about 1 percent more than Baseline. The alternatives involving Bus in Guideway would have slightly fewer person trips than Baseline – no more than 1 percent.

Unlike West of Silverthorne, a greater percentage of westbound peak day person trips would be suppressed at the Twin Tunnels under No Action and Minimal Action than would be suppressed eastbound. Westbound winter Saturday Minimal Action travel at the Twin Tunnels is projected to be about 81,200 person trips (76,300 highway and 4,900 transit), or about 21 percent less than the 2025 Baseline. No Action is forecast to accommodate 74,900 (73,300 highway and 1,600 person trips on existing shuttle van services) person trips, for 27 percent suppression.

Weekday Peak-Hour Travel Demand

While examining weekend travel demand gives an overview of how I-70 might behave under heavy volumes, summer Thursday demand forecasts provide an indication of more everyday travel patterns – when Work and Local Non-Work trips make up most of the traffic, rather than recreational trips. Weekday travel has a greater percentage of local trips. Between 2000 and 2025, the population of both Clear Creek and Summit counties is projected to increase by about 85 percent. Clear Creek County employment is projected to increase by about 58 percent during the 25 years, and Summit County employment is forecast to increase by about 90 percent.

The Highway alternatives highlight the difference in trip composition on weekdays versus weekends. On winter Saturday, westbound person trips under the Reversible/HOV/HOT Lanes alternative would be about 1 to 3 percent higher than those of the Six-Lane Highway alternatives at these two focal points. On summer Thursday, the westbound person trips would be essentially equal under all three Highway alternatives, suggesting a much lower fraction of overnight trips.

As shown on Table 2-10, westbound summer Thursday travel at the Twin Tunnels would grow at about the same rate as Clear Creek County employment – the 2025 Baseline demand of about 60,500 person trips is projected to be about 55 percent more than the 2000 level (about 39,000 person trips). Under different alternatives, the growth in westbound summer Thursday person trips at the Twin Tunnels would range from about 46 percent with No Action to about 68 percent under the Combination Six-Lane Highway with AGS “build simultaneously” alternative. By comparison, the growth in westbound winter Saturday person trips from 2000 to the 2025 Baseline would be about 72 percent here – more than the growth of summer Thursday person trips seen under any alternative.

The summer Thursday growth in westbound person trips at West of Silverthorne would be slightly greater than that at the Twin Tunnels, but well below the growth in Summit County population or employment. In 2000, about 38,000 people traveled westbound at West of Silverthorne on a summer Thursday. The 2025 Baseline demand of about 60,700 person trips westbound would be about 59 percent greater than the 2000 volume. Growth here under various alternatives would ranges from 47 percent (No Action) to 72 percent (Combination Six-Lane Highway with AGS “build simultaneously”). The Transit alternatives and the Highway alternatives would accommodate roughly the same amount of westbound person trips here as the 2025 Baseline.

Although trip suppression would occur westbound on summer Thursday for these two focal points under No Action, there would be no trip suppression eastbound. This result suggests that the suppressed trips would likely be some of the few recreational trips heading from the Front Range to Corridor communities to get an early start on the weekend. Summer Thursday travel time under No Action westbound from Downieville to Loveland Pass is projected to be 34 to 48 minutes, which is more than the 2000 winter Saturday travel time for the same westbound segment.

Role of Transit in the Corridor

While Table 2-11 provides the number of highway and transit person trips in the Corridor for each alternative, Chart 2-2 gives a more graphic comparison of the role that transit would play in the Corridor under each of the alternatives. It illustrates the transit share of daily person trips in the Corridor that is projected for each alternative, based on travel demand for selected model days. As shown with lighter colors and dotted lines on the chart, for Combination alternatives where the Highway would be built first with preservation for Transit, the potential transit share would be the same percentage for the Transit portion when it would be eventually built as it would be for the Transit portion if both portions were built simultaneously. Similarly, Chart 2-2 shows the potential transit share that the Transit portion would have when the Six-Lane Highway portion would be eventually built, which would be the same percentage as for the Transit portion if both portions were built simultaneously. Until the Highway portion is built, the Transit with Highway Preservation alternatives would have transit shares that are the same as the Transit-only alternatives.

For **winter Saturday westbound** at the Twin Tunnels, illustrating the weekend winter recreation traffic heading to the mountains from the Front Range, the greatest transit share is projected for the Dual-Mode Bus in Guideway, followed closely by the AGS and the Diesel Bus in Guideway, each at about a 28 percent share. The Rail with IMC alternative would carry about a 25 percent transit share, and the Combination alternatives are projected to have a 21 to 23 percent transit share. Transit share under the Highway alternatives would be even less – about 1 percent – than that projected for Minimal Action (6 percent) or No Action (2 percent).

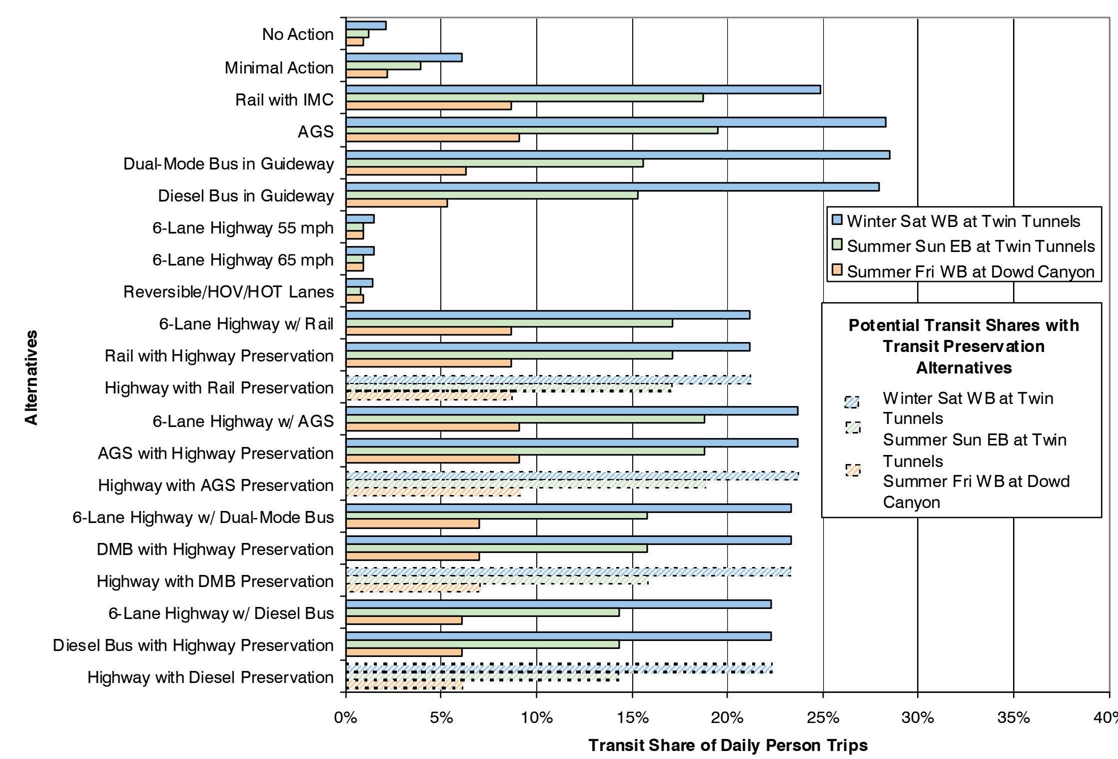
Compared to the Twin Tunnels, the winter Saturday westbound transit shares at West of Silverthorne would be slightly higher, with different alternatives having the greatest transit share. Here, the AGS alternative would have the greatest share – about 32 percent of westbound person trips. The Dual-Mode Bus in Guideway alternative would carries about 31 percent of westbound person trips at West of Silverthorne on transit. The Rail with IMC alternative would have a 30 percent transit share, followed by the Combination Six-Lane Highway with AGS alternative (29 percent), the Combination Six-Lane Highway with Dual-Mode Bus in Guideway alternative (28 percent), the Diesel Bus in Guideway alternative (28 percent), and the Combination Six-Lane Highway with Diesel Bus in Guideway alternative (26 percent). The Minimal Action alternative would result in about 7 percent of person trips on transit here. Summit Stage and other existing services would get a mode share of just over 2 percent under No Action, and just under 2 percent with the Highway alternatives.

For **summer Sunday eastbound** at the Twin Tunnels, the greatest transit share – almost 20 percent – is projected for the AGS alternative. The Combination Six-Lane Highway with AGS alternative would have about a 19 percent transit share, as would the Rail with IMC alternative. Combination Six-Lane Highway with Rail and IMC would have about a 17 percent share. Dual-Mode or Diesel Bus in Guideway, as well as the Combination alternatives involving Bus in Guideway, would have about a 14 to 16 percent share. Minimal Action, with its bus in mixed traffic component, would have almost a 4 percent share. Transit shares for the Highway alternatives and No Action would be 1 percent or less.

West of Silverthorne, the AGS alternative would have the greatest transit share among summer Sunday eastbound person trips. The AGS's 19 percent transit share here would be just slightly less than its 20 percent share at the Twin Tunnels. The Rail with IMC alternative also would have a transit share of about 19 percent, though slightly less than the AGS transit share. The Combination Six-Lane Highway with AGS alternative would result in a 17 percent transit share here, followed by the two Bus in Guideway alternatives and the Combination Six-Lane Highway with Rail and IMC alternative – each of which would have a 16 percent transit share. The Combinations involving Bus in Guideway would have transit shares of 14 or 15 percent. Finally, the Minimal Action alternative would result in a 4 percent transit share, while No Action and the three Highway alternatives each would attract just under 1 percent of person trips to transit.

For **summer Friday westbound** travel at Dowd Canyon, reflecting the peak travel times on the western side of the Corridor, the AGS, Rail with IMC and Combination alternatives involving AGS and Rail with IMC would each have about a 9 percent transit share. Combination Six-Lane Highway with Dual-Mode Bus would have the next highest transit share at 7 percent. The standalone Bus in Guideway alternatives and the Combination Six-Lane Highway with Diesel Bus in Guideway alternative would have about a 5 to 6 percent transit share. Minimal Action would have about a 2 percent transit share, and the Highway alternatives and No Action would have the same amount: just under 1 percent.

Chart 2-2. Percent Transit Share



Note: Transit shares shown for Transit alternatives with Highway Preservation reflect the potential transit share when the Six-Lane Highway is eventually built. Until this time, these Preservation alternatives would have transit shares similar to the corresponding single-mode alternatives.

Table 2-11. Travel Demand for Selected Model Days – Highway and Transit Person Trips

						Transit Alternatives				Highway Alternatives		
					1	2	3	4	5	6	7	8
		2000	2025 Baseline	No Action Alternative	Minimal Action Alternative	Rail with IMC	Advanced Guideway System (AGS)	Dual-Mode Bus in Guideway	Diesel Bus in Guideway	6-Lane Highway 55 mph	6-Lane Highway 65 mph	Reversible/ HOV/HOT Lanes
Winter Saturday	WB Person Trips at Twin Tunnels	59,600 H 400 T	101,400 H 1,600 T	73,300 H 1,600 T	76,300 H 4,900 T	74,500 H 24,700 T	74,300 H 29,400 T	73,400 H 29,200 T	73,600 H 28,400 T	106,600 H 1,600 T	106,600 H 1,600 T	107,400 H 1,500 T
Winter Saturday	WB Person Trips at West of Silverthorne	44,800 H 500 T	63,700 H 1,200 T	52,100 H 1,200 T	53,500 H 3,700 T	48,800 H 20,600 T	46,600 H 22,300 T	47,400 H 20,800 T	48,900 H 19,200 T	64,200 H 1,200 T	64,200 H 1,200 T	66,400 H 1,200 T
Summer Friday	WB Person Trips at Dowd Canyon	40,200 H 200 T	74,600 H 700 T	74,600 H 700 T	73,700 H 1,700 T	69,600 H 6,600 T	69,700 H 7,000 T	71,100 H 4,800 T	71,800 H 4,000 T	75,100 H 700 T	75,100 H 700 T	74,700 H 700 T
Summer Friday	EB Person Trips at Dowd Canyon	38,900 H 400 T	72,200 H 1,100 T	72,200 H 1,100 T	71,400 H 1,900 T	67,400 H 6,000 T	67,500 H 6,200 T	68,900 H 3,800 T	69,500 H 3,200 T	72,700 H 1,100 T	72,700 H 1,100 T	72,400 H 1,100 T
Summer Sunday	EB Person Trips West of Silverthorne	61,000 H 200 T	95,800 H 700 T	82,300 H 700 T	84,400 H 3,500 T	80,300 H 18,300 T	79,800 H 18,800 T	81,900 H 16,000 T	81,800 H 16,000 T	101,200 H 700 T	101,200 H 700 T	101,100 H 700 T
Summer Sunday	EB Person Trips at Twin Tunnels	88,000 H 100 T	123,300 H 1,300 T	110,900 H 1,300 T	113,800 H 4,600 T	112,100 H 25,900 T	116,200 H 28,200 T	114,600 H 21,300 T	114,400 H 20,700 T	132,200 H 1,100 T	132,200 H 1,100 T	131,000 H 1,100 T
Summer Thursday	WB Person Trips at Twin Tunnels	39,000 H 10 T	60,400 H 100 T	56,800 H 100 T	59,900 H 1,000 T	55,500 H 6,200 T	55,700 H 6,300 T	57,400 H 4,500 T	57,100 H 4,500 T	61,800 H 100 T	61,800 H 100 T	61,600 H 100 T
Summer Thursday	WB Person Trips at West of Silverthorne	38,000 H 70 T	60,500 H 200 T	55,600 H 200 T	58,600 H 1,100 T	53,800 H 6,800 T	53,100 H 7,900 T	55,800 H 4,900 T	56,000 H 4,700 T	60,500 H 200 T	60,500 H 200 T	60,500 H 200 T

		Combination Highway/Transit Alternatives							
		9		10		11		12	
		6-Lane Highway with Rail and IMC		6-Lane Highway with AGS		6-Lane Highway with Dual-Mode Bus in Guideway		6-Lane Highway with Diesel Bus in Guideway	
		9	- Build Combination simultaneously	10	- Build Combination simultaneously	11	- Build Combination simultaneously	12	- Build Combination simultaneously
		9a	- Build Transit First	10a	- Build Transit First	11a	- Build Transit First	12a	- Build Transit First
		9b	- Build Highway First	10b	- Build Highway First	11b	- Build Highway First	12b	- Build Highway First
Winter Saturday	WB Person Trips at Twin Tunnels	9	99,500 H 26,800T	10	98,200 H 30,500 T	11	98,200 H 29,900 T	12	99,200 H 28,500 T
		9a	74,500 H 24,700 T	10a	74,300 H 29,400 T	11a	73,400 H 29,200 T	12a	73,600 H 28,400 T
		9b	106,600 H 1,600 T	10b	106,600 H 1,600 T	11b	106,600 H 1,600 T	12b	106,600 H 1,600 T
Winter Saturday	WB Person Trips at West of Silverthorne	9	60,500 H 22,700 T	10	59,200 H 24,500 T	11	59,300 H 23,400 T	12	60,700 H 21,600 T
		9a	48,800 H 20,600 T	10a	46,600 H 22,300 T	11a	47,400 H 20,800 T	12a	48,900 H 19,200 T
		9b	64,200 H 1,200 T	10b	64,200 H 1,200 T	11b	64,200 H 1,200 T	12b	64,200 H 1,200 T
Summer Friday	WB Person Trips at Dowd Canyon	9	72,400 H 6,900 T	10	72,100 H 7,200 T	11	73,400 H 5,500 T	12	73,900 H 4,800 T
		9a	69,600 H 6,600 T	10a	69,700 H 7,000 T	11a	71,100 H 4,800 T	12a	71,800 H 4,000 T
		9b	75,100 H 700 T	10b	75,100 H 700 T	11b	75,100 H 700 T	12b	75,100 H 700 T
Summer Friday	EB Person Trips at Dowd Canyon	9	70,100 H 6,200 T	10	69,800 H 6,500 T	11	71,100 H 4,400 T	12	71,600 H 3,800 T
		9a	67,400 H 6,000 T	10a	67,500 H 6,200 T	11a	68,900 H 3,800 T	12a	69,500 H 3,200 T
		9b	72,700 H 1,100 T	10b	72,700 H 1,100 T	11b	72,700 H 1,100 T	12b	72,700 H 1,100 T
Summer Sunday	EB Person Trips West of Silverthorne	9	96,700 H 18,900 T	10	97,100 H 19,900 T	11	97,400 H 16,800 T	12	97,600 H 16,000 T
		9a	80,300 H 18,300 T	10a	79,800 H 18,800 T	11a	81,900 H 16,000 T	12a	81,800 H 16,000 T
		9b	101,200 H 700 T	10b	101,200 H 700 T	11b	101,200 H 700 T	12b	101,200 H 700 T
Summer Sunday	EB Person Trips at Twin Tunnels	9	126,900 H 26,200 T	10	127,300 H 29,500 T	11	127,500 H 23,900 T	12	128,500 H 21,400 T
		9a	112,100 H 25,900 T	10a	116,200 H 28,200 T	11a	114,600 H 21,300 T	12a	114,400 H 20,700 T
		9b	132,200 H 1,100 T	10b	132,200 H 1,100 T	11b	132,200 H 1,100 T	12b	132,200 H 1,100 T
Summer Thursday	WB Person Trips at Twin Tunnels	9	59,100 H 6,400 T	10	58,600 H 7,100 T	11	60,408 H 5,100 T	12	60,900 H 4,600 T
		9a	55,500 H 6,200 T	10a	55,700 H 6,300 T	11a	57,400 H 4,500 T	12a	57,100 H 4,500 T
		9b	61,800 H 100 T	10b	61,800 H 100 T	11b	61,800 H 100 T	12b	61,800 H 100 T
Summer Thursday	WB Person Trips at West of Silverthorne	9	57,700 H 7,200 T	10	57,000 H 8,700 T	11	58,800 H 5,800 T	12	59,600 H 4,800 T
		9a	53,800 H 6,800 T	10a	53,100 H 7,900 T	11a	55,800 H 4,900 T	12a	56,000 H 4,700 T
		9b	60,500 H 200 T	10b	60,500 H 200 T	11b	60,500 H 200 T	12b	60,500 H 200 T

Notes: Person trips followed by an “H” are highway person trips, while those followed by a “T” are on transit.

2.3.3.2 Ability to Accommodate Travel Growth Beyond 2025

The ability of an alternative to address the continued growth in travel demand beyond 2025 is measured based on the year in which network capacity of the proposed transportation system would be reached. Chart 2-3 and Table 2-12 provide the results of the analysis and comparisons of alternatives' ability to accommodate travel growth beyond 2025.

The assessment of amount of demand accommodated by alternatives and the year at which the Corridor would reach its network capacity provides two different measures of the same distribution. The amount of demand accommodated is assessed for all alternatives at a given year: 2025. The year at network capacity is determined at a given level of demand (equal to the alternative's capacity) to find how many years an alternative might accommodate expected travel growth. This analysis measures capacity for the Corridor at the EJMT for an eastbound summer Sunday.

For the comparisons that follow, a range of years at which an alternative would reach its capacity is presented, based on two sets of assumptions. Both calculations, one considered to be **"optimistic"** and the other considered to be following a current **"trend,"** assume that:

- Traffic growth that occurs between 2000 and 2025 would continue into the future
- Summer Sunday movement, from west of the Continental Divide moving east to the Front Range, would put the most pressure on Corridor network capacity.

The "trend" forecast of the year the Corridor would reach capacity under the different alternatives is based on assuming no change in vehicle occupancy, transit share, or tolerance to congestion after 2025. Note that under the "trend" assumptions, any alternative not able to accommodate the Baseline demand – that is, any alternative with trip suppression – would be considered to have reached its network capacity before 2025.

The "optimistic" forecast assumes increases in each of these variables. For this measure, the following assumptions were made:

- Auto occupancies would increase 12 percent (increasing the average auto occupancy from 2.6 persons per vehicle to 2.9 persons per vehicle)
- Travelers would be more tolerant of congestion (only trips with average speeds lower than 22.5 mph, rather than 30 mph, would be suppressed)
- More travelers would use transit to the extent that seats were available

Thresholds. On Table 2-12, for the network capacity analysis, alternatives that would accommodate expected demand beyond 2050 are shown in green. Alternatives that would have insufficient capacity to accommodate demands beyond 2030 are shown in red, because construction of major action alternatives is not expected to be completed before 2025, and any action alternative should have a reasonable "life" before further improvements are needed.

Network capacity thresholds are as follows:

- Short-term capacity (meets capacity in 2030)
- Intermediate-term capacity (meets capacity between 2031 and 2050)
- Long-term capacity (meets capacity beyond 2051)

Comparisons Based on Trend Assumptions

The following is the ranking of alternatives, using the "trend" assumptions to calculate the year in which Corridor demands would reach I-70's network capacity, in the following order, from worst-performing to best-performing:

- With no improvements to I-70, under the "trend" assumptions, the Corridor would reach capacity in 2010 under the No Action alternative. The Minimal Action alternative would reach capacity in 2015.
- The Highway and Transit alternatives would accommodate travel demand to about 2030, resulting in short-term capacity for the Corridor under "trend" assumptions.
- The Combination "build simultaneously" alternatives would accommodate the expected travel growth between 2045 and 2050, providing intermediate-term capacity.

Comparisons Based on Optimistic Assumptions

The following is the ranking of alternatives, using the "optimistic" assumptions to calculate the year in which Corridor demands would reach I-70's network capacity, in the following order, from worst-performing to best-performing:

- Under the "optimistic" assumptions, the No Action alternative would have capacity available until 2020 if vehicle occupancies and tolerances to congestion increased. The Minimal Action alternative would be able to accommodate the 2025 travel demand, but no more.
- The Highway alternatives would reach network capacity at 2050 under the "optimistic" assumptions, providing intermediate-term capacity for the Corridor.
- The Transit alternatives would reach network capacity in 2055 (Bus in Guideway alternatives) or 2065 (Rail with IMC and AGS alternatives) under "optimistic" assumptions, providing long-term capacity for the Corridor.
- The Combination "build simultaneously" alternatives would also provide long-term capacity for the Corridor under the "optimistic" assumptions.

Chart 2-3. Year that the Corridor Would Reach Network Capacity Under Each Alternative

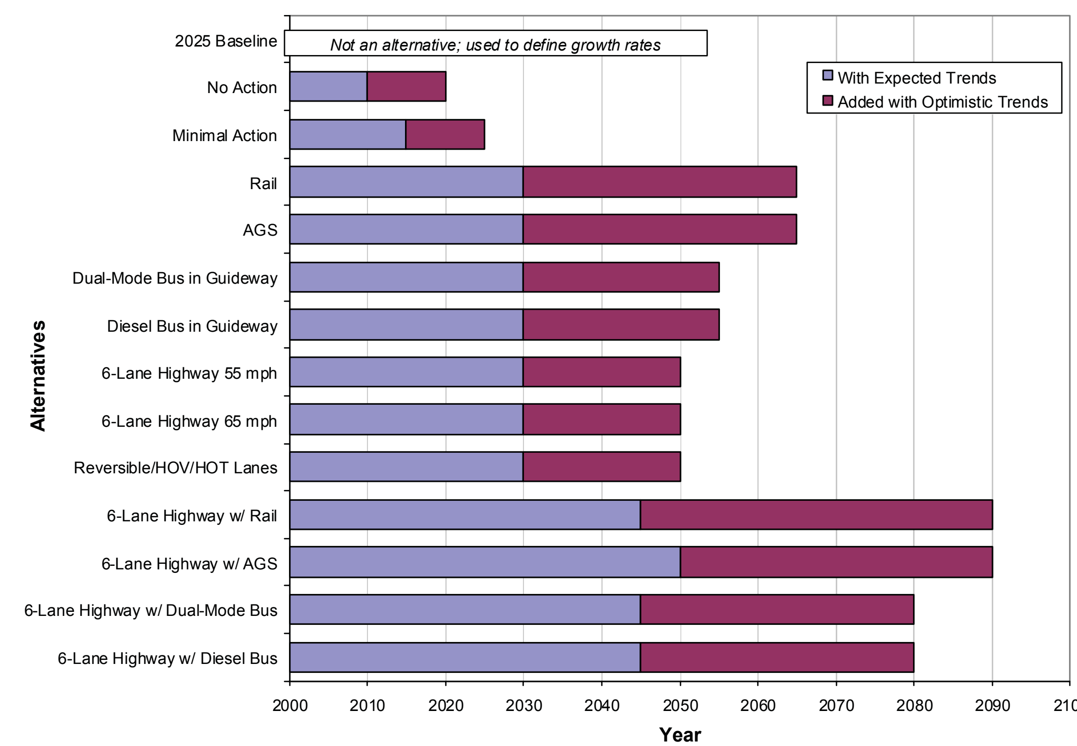


Table 2-12. Network Capacity beyond 2025

Element of Purpose and Need	No Action Alternative	1 Minimal Action Alternative	2 Rail with IMC	3 Advanced Guideway System (AGS)	4 Dual-Mode Bus in Guideway	5 Diesel Bus in Guideway	6 6-Lane Highway 55 mph	7 6-Lane Highway 65 mph	8 Reversible/ HOV/HOT Lanes	9 6-Lane Highway with Rail and IMC	10 6-Lane Highway with AGS	11 6-Lane Highway with Dual-Mode Bus in Guideway	12 6-Lane Highway with Diesel Bus in Guideway
			Transit Alternatives				Highway Alternatives			Combination Highway/Transit Alternatives			
										9 - Build Combination simultaneously 9a - Build Transit First 9b - Build Highway First	10 - Build Combination simultaneously 10a - Build Transit First 10b - Build Highway First	11 - Build Combination simultaneously 11a - Build Transit First 11b - Build Highway First	12 - Build Combination simultaneously 12a - Build Transit First 12b - Build Highway First
Network Capacity (Trend)	2010	2015	2030	2030	2030	2030	2030	2030	2030	9: 2045 9a: 2030 9b: 2030	10: 2050 10a: 2030 10b: 2030	11: 2045 11a: 2030 11b: 2030	12: 2045 12a: 2030 12b: 2030
Network Capacity (Optimistic)	2020	2025	2065	2065	2055	2055	2050	2050	2050	9: 2090 9a: 2065 9b: 2050	10: 2090 10a: 2065 10b: 2050	11: 2080 11a: 2055 11b: 2050	12: 2080 12a: 2055 12b: 2050

Legend

Network Capacity
Long-term capacity (2051 or beyond)
Intermediate-term capacity (2031 to 2050)
Short-term capacity (2030 or earlier)

Notes:

"Trend" assumptions for calculating the year when the network capacity is reached involve no change in average auto occupancy, tolerance to congestion, or transit share from 2025 forecasts.

"Optimistic" assumptions involve a 12 percent increase in occupancy, increased tolerance to congestion (only trips with average speeds lower than 22.5 mph, rather than 30 mph, will be suppressed), and all transit seats will be filled.

2.3.4 Travel Time Comparisons

The highway travel times provide a common measure for comparing the performance of all alternatives. Two types of comparisons are evaluated for highway travel time for all alternatives: (1) annual average peak-hour travel time and (2) peak-hour travel time for selected model days. Transit travel times are also provided by alternative. In order to compare travel times between transit system trips and highway trips, an evaluation of complete multi-modal trips from selected origins in the Denver metropolitan area to selected destinations in the Corridor is provided.

For Transit alternatives (Rail with IMC, AGS, Dual-Mode and Diesel Bus in Guideway, and the Combination Six-Lane Highway with Transit alternatives) the highway travel times demonstrate the positives and negatives that would result from overall growth in traffic, but fewer trips on the existing and in some cases widened highway due to the introduction of transit into the Corridor. Travel time by transit is also provided as an indicator of changes to Corridor travel time in this mode.

The following model days were selected to provide continuity in the comparison of peak-hour travel times for alternatives:

- In the eastern part of the Corridor, from Copper Mountain to C-470:
  - Winter Saturday – westbound
  - Summer Sunday – eastbound
- For the western part of the Corridor, from Glenwood Springs to Copper Mountain:
  - Summer Friday – eastbound and westbound

The winter Saturday and summer Sunday model days were selected to evaluate the performance of alternatives from Copper Mountain (milepost 195) to C-470 (milepost 260), where weekend recreation trips dominate the travel demand. The summer Friday model day was selected to evaluate the performance of alternatives west of Copper Mountain, where Work trips and Local Non-Work trips dominate the travel demand.

The following sections include descriptions of the development of criteria, thresholds for the travel time comparisons, highway and transit travel time comparisons, and multimodal travel time comparisons.

Highway versus Transit Travel Time

Highway travel times are a major input factor to the mode choice module in the I-70 travel demand model, which determines the mode choice in a multimodal transportation system. If the highway travel time for a total trip would be greater than the transit travel time for the same origin and destination, then the propensity for taking the transit would increase. Otherwise, the opposite would take place. The model is capable of reaching a balance between various modes of transportation. Therefore, highway travel time comparisons provide a complete travel time performance for a multimodal environment.

- **Corridor-wide Highway travel time** is calculated for travel between two points on I-70, given the improvements of the specific alternative, whether it is a Highway, Transit, or Combination alternative. (Note that for the Transit alternatives, about 70 percent or more people – depending on day and location – are forecast to travel by auto.)
- **Corridor-wide Transit travel time** is the amount of time expected for travel on the transit system in the case of Transit and Combination alternatives. A number of factors that can affect travel times, including the demand on a particular day or the grade of the terrain in a particular direction, have been included in the calculations.
- **Complete trip between Denver metropolitan area and Corridor travel time.** Access times, egress times, and transit station wait times can also effect one's selection for mode of travel, for trips between Denver metropolitan area and Corridor transportation centers for different modes.

Development of Criteria

The initial step in the travel time analysis was to divide the Corridor into the following five study segments. Also included are the focal points selected to represent congestion in the Corridor:

1. **Glenwood Springs to Edwards –** This segment contains the more rural parts of Eagle and Garfield counties.
2. **Edwards to Copper Mountain –** This segment contains the more urban core of Eagle County plus Vail Pass. The focal point selected to represent this section is at **Dowd Canyon** (milepost 172).
3. **Copper Mountain to Downieville –** This segment connects much of Summit County with the western portion of Clear Creek County, and includes the Continental Divide crossing through the EJMT. The focal points selected to represent this section include **West of Silverthorne** (milepost 204), and **EJMT** (milepost 214).
4. **Downieville to Beaver Brook –** This segment includes travel to Berthoud Pass (US 40) and Floyd Hill and travel to the Central City and Black Hawk Gaming Areas via the Central City Parkway and the assumed Gaming Area Access through the Black Hawk tunnel. The focal points selected to represent this section include **East of Empire Junction** (milepost 123), **Twin Tunnels** (milepost 242), and **Top of Floyd Hill** (milepost 246).
5. **Beaver Brook to C-470 (or Jefferson Station) –** This segment includes travel within the western portion of Jefferson County, which is at the fringe of the Denver metropolitan area. The focal points selected to represent this section is at **Genesee** (milepost 254).

These five segments represent combinations of the 10 study segments described in Chapter 1, Purpose of and Need for Action, and Appendix B, Transportation Analysis and Data.

The second step was to calculate travel times for highway and transit travel within the five study segments and across the Corridor. Adding the travel times from among the corresponding 10 segments in Appendix B derived travel times for the five segments that are evaluated in this section.

Thresholds. Travel time is reported in minutes in the comparisons of alternatives; however, thresholds for travel time were defined based on the average speed of travel through the length of each of the five segments. Average speed was established as the measure for travel time, because it is a common performance measure for any alternative, regardless of length or mode of transportation. A minimum speed of 50 mph was adopted for the "shortest" travel time threshold, which is coded by green on the charts and tables in this section. This 50 mph speed threshold was selected because is the lowest current speed limit within the Corridor, occurring at Glenwood Canyon. The threshold between intermediate travel time (yellow) and longest travel time (red) was set at 30 mph, because this average speed would reflect considerable queuing within a segment. The same thresholds are used for highway and transit travel times to facilitate comparison of different modes on an equal basis.

Calculation of Travel Time Measures

- **Selected model day peak-hour travel time (includes peak direction)** indicates the changes to travel time for a particular alternative on the model days examined. This measure of travel time represents the time projected in either the eastbound or westbound direction, and for model days with typically heavy demand. Note that travel times in each direction are provided in Appendix B. Selected model day peak-hour travel time represents only one of 8,760 hours in a year. Note that the selected model day peak-hour travel time is representative of typical peak travel conditions. Unusual events, such as additional holiday demand or reductions in roadway capacity caused by incidents or severe weather (although these are factors), are not reflected in the computations. Note also that the peak day for one segment may not be the same as the peak day for another segment in the Corridor, nor will it be the same as the selected model day for Corridor-wide results. As such, the peak-day travel times for each segment are not additive. The peak day for the Corridor as a whole will not be the peak day for every segment within it.
- **Annual average peak-hour travel time** represents the average of peak-hour travel times for all 365 days in the year, which provides a broader picture of alternative performance. Note that the annual average peak-hour travel time will reflect a large number of weekdays, when congestion in the Corridor is less severe than weekends (which include Friday evenings).

In summary, travel time thresholds for both highway and transit travel are based on the following speeds:

- Longest travel time (represented by speeds at less than 30 mph)
- Intermediate travel time (represented by speeds at 30 mph to 50 mph)
- Shortest travel time (represented by speeds at greater than 50 mph)

2.3.4.1 Highway Travel Time Comparisons

The following discussions provide a comparison of highway travel times for: (1) annual average peak-hour travel times; and (2) selected model day peak-hour travel times.

Corridor Summary: Annual Average Peak-Hour Travel Time

As shown on Chart 2-4, and Table 2-13, on a Corridor-wide basis, the annual average peak-hour travel times of all of the alternatives would be lower than Baseline, under the best to intermediate travel time thresholds. However, the improvement in travel time over the Baseline by the No Action and Minimal Action alternative would result from suppressed trips and lower vehicle volumes than Baseline demand. With lower volumes of traffic than under the Baseline projections, the travel performance of the No Action and Minimal Action alternatives would not accommodate the future Baseline projections. The No Action travel time would be helped by the contribution of a continuous climbing lane from the assumed Black Hawk Tunnel at US 6 in Clear Creek County to the top of Floyd Hill. The Highway travel times of the 18 Transit, Highway and Combination alternatives shown on Table 2-13 are attributable to increased capacity, despite the influence of induced trips that would offset some expected travel time savings.

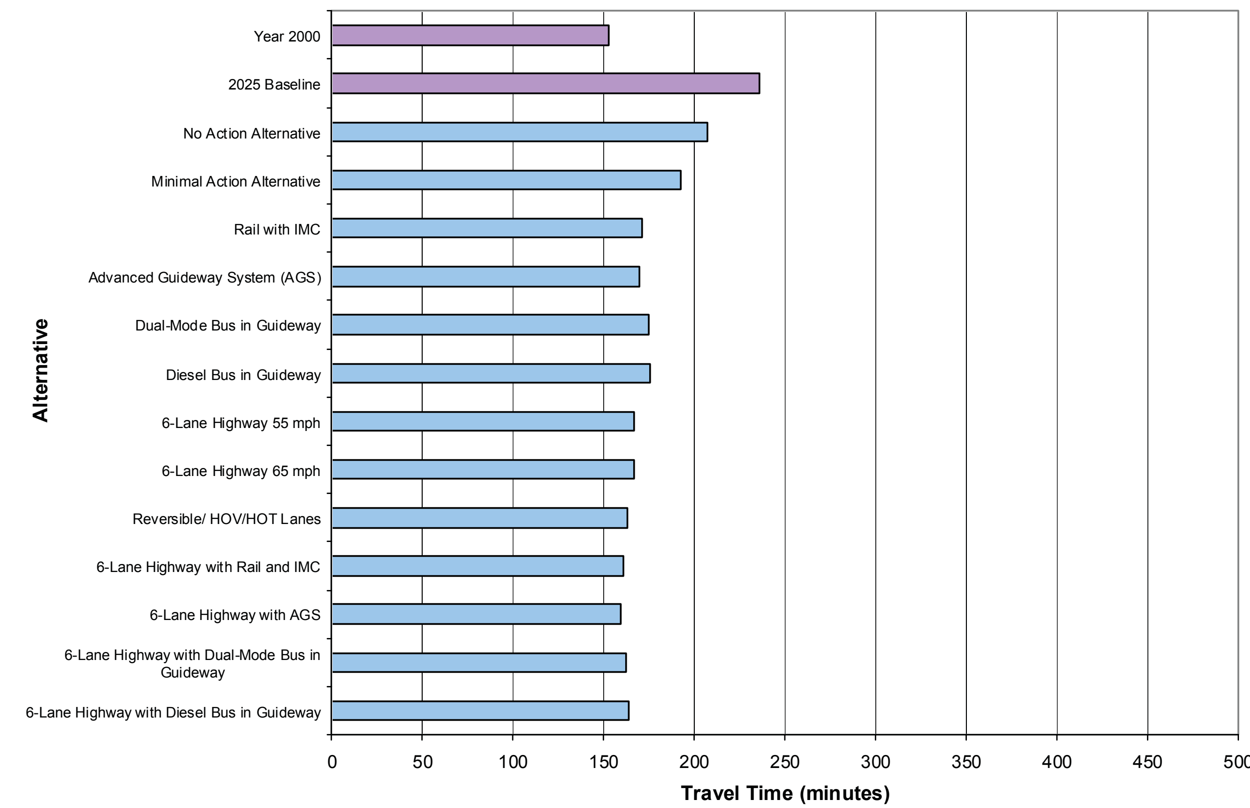
As shown on Table 2-13, Highway travel times from Glenwood Springs to C-470 for the No Action, Minimal Action, and Bus in Guideway alternatives fall within the intermediate range of annual average highway travel time. The Rail, AGS, Highway, and Combination "build simultaneously" alternatives fall in the best range. While the bar chart shows similar annual average peak-hour travel times, alternatives would be carrying different levels of demand, and some alternatives would therefore be offering a higher level of mobility (see section 2.3.3 on the resulting person trips accommodated as compared to the 2025 Baseline level of demand).

The alternatives would rank in the following order, from worst-performing to best-performing:

- The alternative with the slowest highway travel time through the Corridor would be the No Action alternative, taking 207 minutes (about 3.5 hours). The Minimal Action highway travel time (193 minutes) would be roughly halfway between that of No Action and the slowest Transit alternative, Diesel Bus in Guideway (176 minutes).
- The highway travel times of the Transit alternatives would be somewhat faster than those of the Minimal Action alternative. Among these, for travel on the unimproved highway, Diesel Bus in Guideway would be the slowest, followed closely Dual-Mode Bus in Guideway. AGS would be fastest, followed by Rail with IMC; these would be in the best range for annual average highway travel time.
- Among the Highway alternatives, the Six-Lane Highway (55 or 65 mph) alternatives would be slightly faster than the Reversible/HOV/HOT Lanes alternative.
- Driving the 144-mile length of the Corridor, between Glenwood Springs and C-470, would be fastest under the Combination Six-Lane Highway with AGS alternative – 161 minutes, or 2 hours and 41 minutes. The remaining Combination alternatives would have slightly longer but similar highway travel times.

As noted above, the No Action and Minimal Action alternatives would carry lower volumes of traffic than under the Baseline projections. Therefore, the travel performance of the No Action and Minimal Action alternatives would not be as favorable as it appears in Chart 2-4 in comparison to other alternatives that would be able to accommodate the future Baseline projections. Travel time of major action alternatives is attributable to increased capacity, despite some induced trip making.

Chart 2-4. Annual Average Peak-Hour Highway Travel Time (Glenwood Springs to C-470)



Corridor Summary: Selected Model Day Peak-Hour Travel Time

Corridor-wide highway travel times for the peak hour of travel for the selected peak model days are calculated by adding the travel time of a selected day (**summer Friday**) between Glenwood Springs and Copper Mountain to the travel time of a peak day for the eastern part of the Corridor between Copper Mountain and C-470. Different model days are selected for the eastern part of the Corridor, to reflect peak recreational travel and seasonal differences. Westbound, **winter Saturday** experiences a spike of travel demand in the morning as Front Range residents head to the Corridor for recreation. Eastbound volumes are highest on **summer Sunday,** when several adjacent afternoon and evening hours see heavy volumes composed of day recreation and overnight recreation travelers returning to homes in the Front Range.

Since travel times from different model days are added together for two halves of the Corridor, these selected model day peak-hour travel times would not reflect the experience of someone traveling the length of the Corridor at once. However, these composite measures are still useful, as they give a worst-case estimate of travel in the Corridor, and allow consistent comparison of alternatives under the most critical conditions.

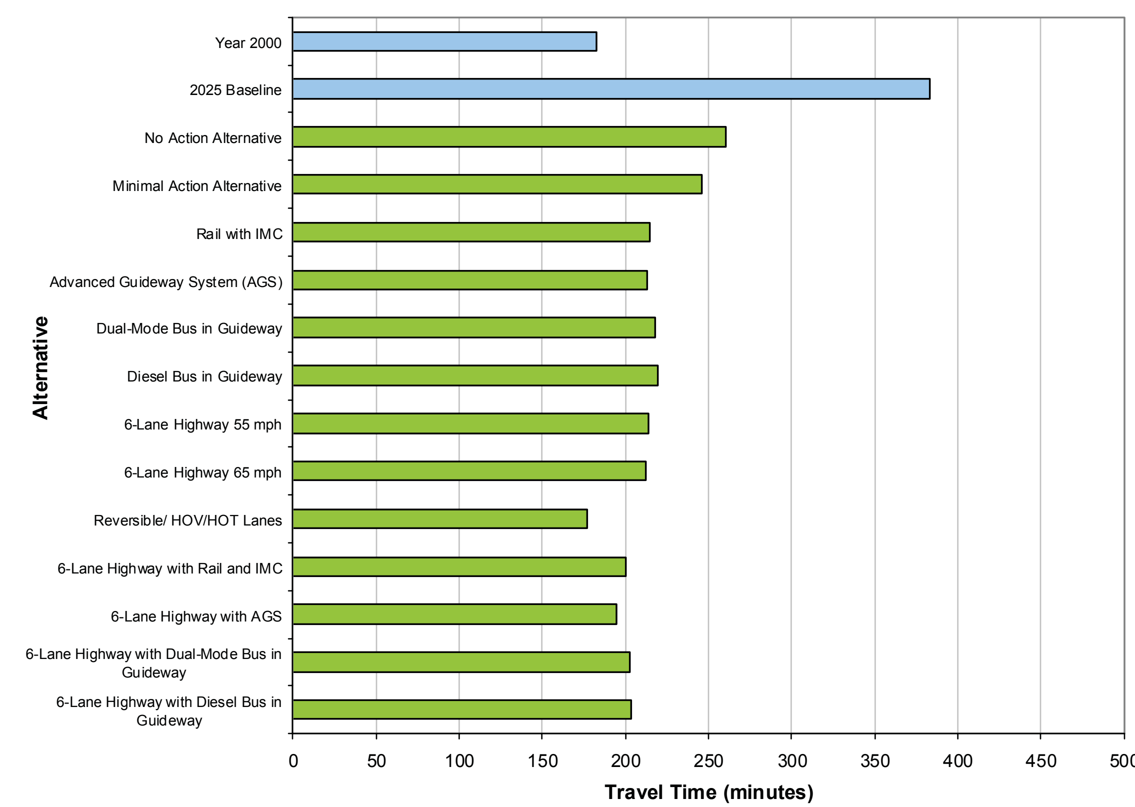
Chart 2-6 (eastbound) and Chart 2-5 (westbound) illustrate the differences in the Corridor-wide highway travel time performance of the alternatives under these peak demand conditions for the selected model days. Table 2-14 provides the peak-hour travel times within the three thresholds for the selected model days within each of the five segments described above. The worst selected model day peak-hour travel times for each alternative for each of the 10 segments are provided in Appendix B.

Selected Model Day Travel Times – Westbound

For **westbound** travel on winter Saturday (from C-470 to Copper Mountain) and summer Friday (from Copper Mountain to Glenwood Springs), the alternatives would have a similar ranking as they have for eastbound highway travel time, with the exception of the Reversible/HOV/HOT Lanes alternative and the AGS alternative, which would offer shorter relative travel times. Highway travel times on a winter Saturday westbound in 2025 would be similar to or greater than current times for all alternatives except the Reversible/HOV/HOT Lanes alternative, as shown on Chart 2-5 and Table 2-13. Westbound winter Saturday travel times are shown below:

- The No Action alternative would takes 251 minutes on a winter Saturday westbound, which is about 66 percent as long as projected for the 2025 Baseline condition (383 minutes), reflecting the suppression of trips projected for No Action. The No Action alternative and Baseline scenario would benefit from the addition of a continuous westbound lane from the top of Floyd Hill to the US 6 interchange near the base of Floyd Hill, in association with the assumed improvements to the Gaming Area.
- The Minimal Action alternative would result in 246 minutes of highway travel time from C-470 to Glenwood Springs, about 35 percent longer than 2000 travel times. Depending on the location within the Corridor, the Minimal Action alternative would accommodate around 25 to 125 percent more vehicle trips than are accommodated in 2000, and up to 8 percent more person trips than No Action.
- The Combination alternatives would offer highway travel times about 10 to 20 minutes longer than in 2000. The Combination Six-Lane Highway with AGS “build simultaneously” alternative (195 minutes) would be the fastest of the four Combination “build simultaneously” alternatives, followed by the Combination Six-Lane Highway with Rail and IMC “build simultaneously” alternative (200 minutes). The two Combination Six-Lane Highway with Bus in Guideway “build simultaneously” alternatives each have 203-minute highway travel times.
- The AGS alternative (213 minutes) with an unimproved highway would result in the same westbound highway travel time as the Six-Lane Highway 65 mph alternative. The Six-Lane Highway 55 mph alternative would take 1 minute longer and the Rail with IMC alternative would take 2 minutes longer than the AGS alternative. The Dual-Mode and Diesel Bus in Guideway alternatives with an unimproved highway would result in highway travel times (218 and 220 minutes respectively) within 5 minutes of the Rail with IMC alternative.
- By offering four westbound lanes from Floyd Hill to past the Continental Divide, the Reversible/HOV/HOT Lanes alternative would result in a Corridor-wide travel time 5 minutes shorter than in 2000, even with the alternative accommodating about twice as many person trips East of Empire Junction as in 2000.

Chart 2-5 Selected Model-Day, Peak-Hour Highway Travel Time (Westbound: C-470 to Glenwood Springs)



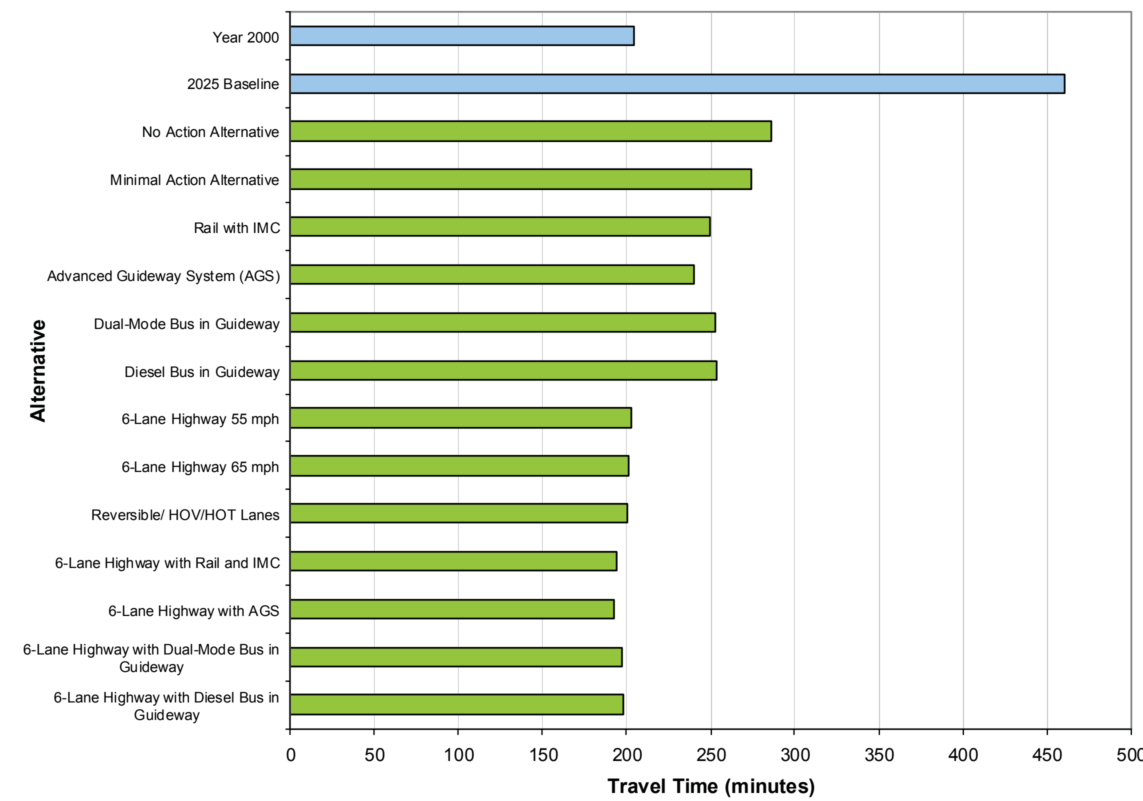
Selected Model Day Travel Times – Eastbound

Alternative **eastbound** travel times for the length of the Corridor (Glenwood Springs to C-470) would range from 192 minutes with the Combination Six-Lane Highway with AGS "build simultaneously" alternative to 286 minutes with the No Action alternative. Chart 2-6 shows the travel times under each alternative compared to the Baseline benchmark time of 460 minutes, or just over 7.5 hours. The Baseline travel time would fall in the longest travel time range for peak-hour travel time for summer Friday (Glenwood Springs to Copper Mountain) and summer Sunday (Copper Mountain to C-470). The Baseline eastbound travel time (460 minutes) would be about 20 percent more than the Baseline westbound travel time (383 minutes).

As shown on Table 2-13, for travel from Glenwood Springs to C-470, all of the alternatives would fall within the intermediate range of eastbound travel time and rank in the following order, from worst-performing to best-performing:

- The No Action and Minimal Action alternatives would offer the slowest travel times across the Corridor. Their travel times would be about 60 percent of Baseline travel time, reflecting the suppression of travel resulting in lower vehicle volumes than Baseline demand.
- The highway travel times for the Transit alternatives would be somewhat better, with the Dual-Mode and Diesel Bus in Guideway alternatives being the slowest of these (253 and 254 minutes respectively), followed by Rail with IMC at 249 minutes and AGS at 240 minutes.
- The Highway alternatives would offer highway travel times at less than half that of the Baseline scenario. The travel time for Six-Lane Highway 55 mph and 65 mph alternatives would be similar because they would accommodate the same travel demand, and provide the same eastbound and westbound capacity. (Also note that the Six-Lane Highway 65 mph alternative would improve the design speed in just a few miles of the 144-mile Corridor.) Eastbound highway travel times are projected to be a few minutes faster than in 2000.
- The Combination "build simultaneously" alternatives would have the fastest Corridor-wide travel times, with Combination Six-Lane Highway with AGS (192 minutes) followed closely by Combination Six-Lane Highway with Rail and IMC (194 minutes) and the Combination Six-Lane Highway with Bus in Guideway alternatives (197 and 198 minutes).
- Travel times in the Downieville to Beaver Brook segment would be longer in 2025 than current travel times for all alternatives (except for the Combination Six-Lane Highway with AGS, which would be the same). An increase of over 50 percent in weekend person trips at East of Empire Junction from 2000 to 2025 is projected for the No Action alternative. Under the Six-Lane Highway alternatives, a 95 percent increase is projected for winter Saturday westbound person trips at East of Empire Junction, and a 64 percent increase is projected for summer Sunday eastbound. (See the tables in Appendix B.)

Chart 2-6. Selected Model Day, Peak-Hour Highway Travel Time (Eastbound: Glenwood Springs to C-470)



Segment Summaries: Highway Travel Times

The following discussion discloses more discrete travel times for each alternative within each of five segments in the Corridor. As noted above, peak-hour travel times on selected model days reveal the performance of an alternative under conditions of highest demand for travel. The comparison shows how well an alternative will perform under the worst conditions, on whatever day those conditions may fall.

As discussed previously, Table 2-14 provides a comparison of alternatives for peak-hour highway travel time on selected model days. Chart 2-7 illustrates the westbound highway travel time performance of the alternatives on the selected model days (winter Saturday and summer Friday) in each segment, with Baseline provided as a benchmark for comparison. Chart 2-8 presents similar information for eastbound travel on summer Friday (in Garfield and Eagle Counties) and summer Sunday. Annual average travel times are also discussed for each segment to provide a broader picture of the performance of alternatives.

Chart 2-7. Selected Model Day, Peak-Hour Westbound Highway Travel Time

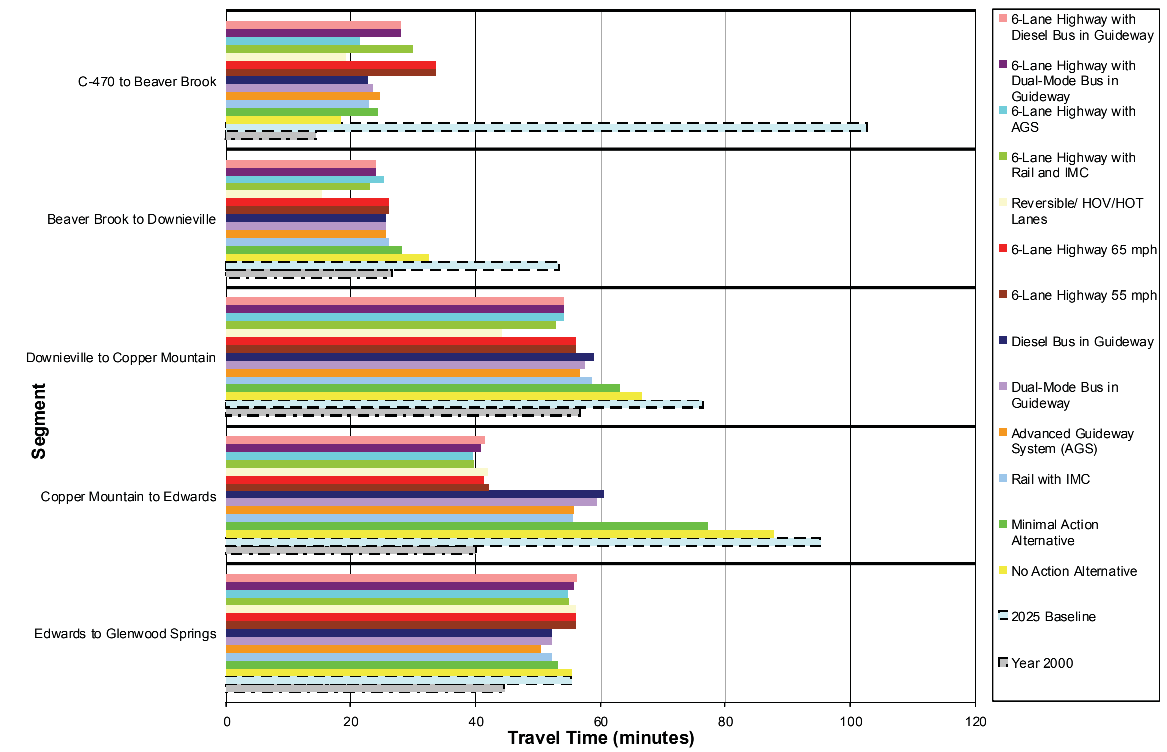


Chart 2-8. Selected Model Day, Peak-Hour Eastbound Highway Travel Time

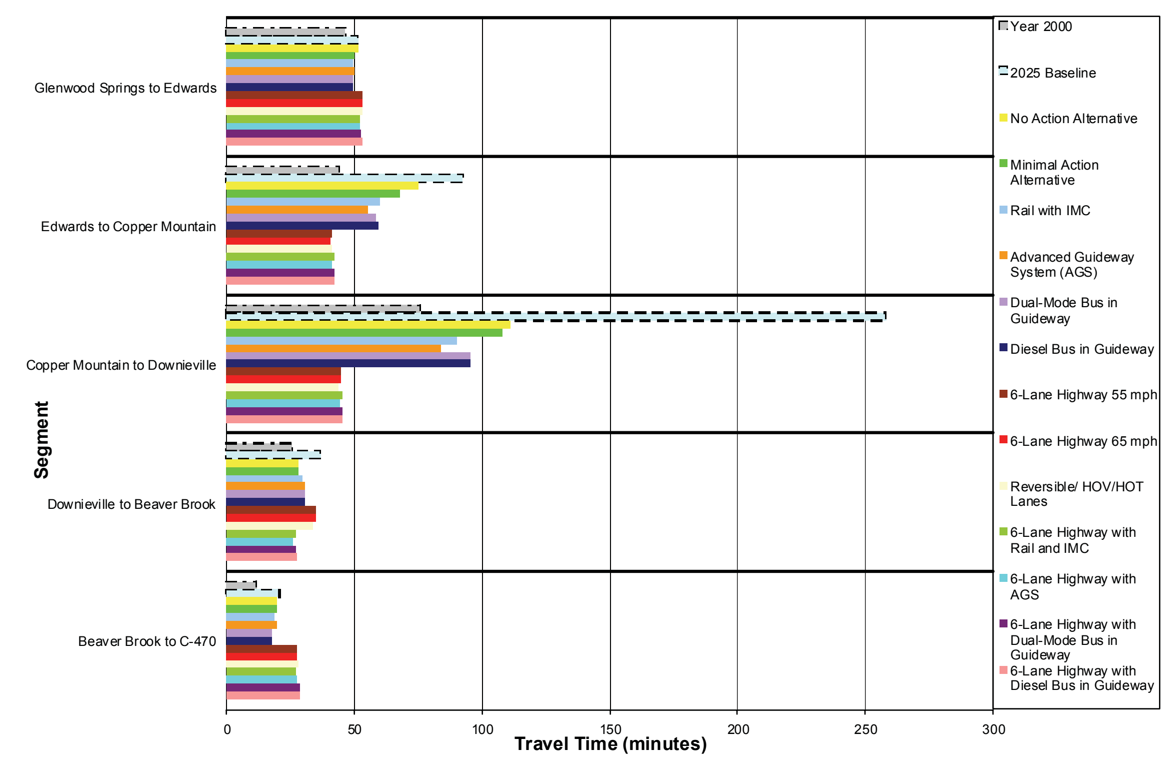


Table 2-13. Annual Average Peak-Hour Highway Travel Time

Element of Purpose and Need	Corridor Segment	Year 2000	2025 Baseline	No Action Alternative	Minimal Action Alternative	Rail with IMC	Advanced Guideway System (AGS)	Dual-Mode Bus in Guideway	Diesel Bus in Guideway	6-Lane Highway 55 mph	6-Lane Highway 65 mph	Reversible/ HOV/HOT Lanes	6-Lane Highway with Rail and IMC	6-Lane Highway with AGS	6-Lane Highway with Dual-Mode Bus in Guideway	6-Lane Highway with Diesel Bus in Guideway
						Transit Alternatives				Highway Alternatives			Combination Highway/Transit Alternatives			
					1	2	3	4	5	6	7	8	9	10	11	12
													9 - Build Combination Simultaneously	10 - Build Combination Simultaneously	11 - Build Combination Simultaneously	12 - Build Combination Simultaneously
													9a - Build Transit and Preserve for Highway	10a - Build Transit and Preserve for Highway	11a - Build Transit and Preserve for Highway	12a - Build Transit and Preserve for Highway
													9b - Build Highway and Preserve for Transit	10b - Build Highway and Preserve for Transit	11b - Build Highway and Preserve for Transit	12b - Build Highway and Preserve for Transit
Mobility: Annual Average Peak-Hour **Highway Travel Time** (minutes)	Glenwood Springs to Edwards (47 miles)	44	52	52	50	49	49	49	50	53	53	53	9: 51	10: 50	11: 51	12: 51
													9a: 49	10a: 49	11a: 49	12a: 50
													9b: 53	10b: 53	11b: 53	12b: 53
	Edwards to Copper Mountain (32 miles)	35	54	53	47	41	41	43	44	35	35	35	9: 34	10: 34	11: 34	12: 35
													9a: 41	10a: 41	11a: 43	12a: 44
													9b: 35	10b: 35	11b: 35	12b: 35
	Copper Mountain to Downieville (39 miles)	44	75	61	60	47	46	48	49	41	41	43	9: 41	10: 41	11: 42	12: 42
													9a: 47	10a: 46	11a: 48	12a: 49
													9b: 41	10b: 41	11b: 41	12b: 41
	Downieville to Beaver Brook (14 miles)	15	30	25	21	18	17	18	18	17	17	15	9: 15	10: 15	11: 15	12: 15
													9a: 18	10a: 17	11a: 18	12a: 18
													9b: 17	10b: 17	11b: 17	12b: 17
	Beaver Brook to C-470 (12 miles)	14	25	16	15	16	16	16	16	21	21	18	9: 20	10: 20	11: 20	12: 21
													9a: 16	10a: 16	11a: 16	12a: 16
													9b: 21	10b: 21	11b: 21	12b: 21
	Glenwood Springs to C-470[1] (144 miles)	153	236	207	193	171	170	175	176	167	167	164	9: 161	10: 160	11: 163	12: 164
													9a: 171	10a: 170	11a: 175	12a: 176
													9b: 167	10b: 167	11b: 167	12b: 167

Legend

- Shortest travel time (average 50 mph or greater)[2]
- Intermediate travel time (average 30 to 50 mph)[2]
- Longest travel time (average 30 mph or lower)[2]

Notes:

[1] *This represents the annual average travel time for the entire Corridor (Glenwood Springs to C-470, milepost 116 to 260) and is the sum of the annual average travel times of each study segment above.*

[2] *Thresholds are defined on the basis of the average speed of travel through an entire segment to make segments comparable. Actual travel times are listed in the table cells.*

[3] *No new transit service is introduced west of the Vail Transportation Center under the Minimal Action alternative.*

2.3 Comparison of Alternatives

Table 2-14. Selected Model Day, Peak-Hour Highway Travel Time

Element of Purpose and Need	Corridor Segment and Selected Model Day	Year 2000	2025 Baseline	No Action Alternative	1 Minimal Action Alternative	Transit Alternatives 2 Rail with IMC	Transit Alternatives 3 Advanced Guideway System (AGS)	Transit Alternatives 4 Dual-Mode Bus in Guideway	Transit Alternatives 5 Diesel Bus in Guideway	Highway Alternatives 6 6-Lane Highway 55 mph	Highway Alternatives 7 6-Lane Highway 65 mph	Highway Alternatives 8 Reversible/ HOV/HOT Lanes	Combination Highway/Transit Alternatives 9 6-Lane Highway with Rail and IMC	Combination Highway/Transit Alternatives 10 6-Lane Highway with AGS	Combination Highway/Transit Alternatives 11 6-Lane Highway with Dual-Mode Bus in Guideway	Combination Highway/Transit Alternatives 12 6-Lane Highway with Diesel Bus in Guideway
													9 - Build Combination Simultaneously 9a - Build Transit and Preserve for Highway 9b - Build Highway and Preserve for Transit	10 - Build Combination Simultaneously 10a - Build Transit and Preserve for Highway 10b - Build Highway and Preserve for Transit	11 - Build Combination Simultaneously 11a - Build Transit and Preserve for Highway 11b - Build Highway and Preserve for Transit	12 - Build Combination Simultaneously 12a - Build Transit and Preserve for Highway 12b - Build Highway and Preserve for Transit
Mobility: Peak Hour of Selected Model Day **Westbound Highway Travel Time** (minutes)	**Glenwood Springs to Edwards** (47 miles) Summer Friday	45	55	55	53	52	50	52	52	56	56	56	9: 55 9a: 52 9b: 56	10: 55 10a: 50 10b: 56	11: 56 11a: 52 11b: 56	12: 56 12a: 52 12b: 56
	Edwards to Copper Mountain (32 miles) Summer Friday	40	95	88	77	56	56	59	60	42	41	42	9: 40 9a: 56 9b: 42	10: 39 10a: 56 10b: 42	11: 41 11a: 59 11b: 42	12: 41 12a: 60 12b: 42
	Copper Mountain to Downieville (39 miles) Winter Saturday	57	76	67	63	59	57	58	59	56	56	44	9: 53 9a: 59 9b: 56	10: 54 10a: 57 10b: 56	11: 54 11a: 58 11b: 56	12: 54 12a: 59 12b: 56
	Downieville to Beaver Brook (14 miles) Winter Saturday	27	53	33	28	26	26	26	26	26	26	15	9: 23 9a: 26 9b: 26	10: 25 10a: 26 10b: 26	11: 24 11a: 26 11b: 26	12: 24 12a: 26 12b: 26
	Beaver Brook to C-470 (12 miles) Winter Saturday	14	103	18	24	23	25	23	23	34	34	19	9: 30 9a: 23 9b: 34	10: 21 10a: 23 10b: 34	11: 28 11a: 23 11b: 34	12: 28 12a: 23 12b: 34
	Glenwood Springs to C-470 [1] (144 miles)	182	383	261	246	215	213	218	220	214	213	177	9: 200 9a: 215 9b: 214	10: 195 10a: 213 10b: 214	11: 203 11a: 218 11b: 214	12: 203 12a: 220 12b: 214
Mobility: Peak Hour of Selected Model Day **Eastbound Highway Travel Time** (minutes)	**Glenwood Springs to Edwards** (47 miles) Summer Friday	47	52	52	50	50	50	50	50	53	53	53	9: 52 9a: 50 9b: 53	10: 52 10a: 50 10b: 53	11: 53 11a: 50 11b: 53	12: 53 12a: 50 12b: 53
	Edwards to Copper Mountain (32 miles) Summer Friday	44	92	75	68	60	55	59	59	42	41	41	9: 42 9a: 60 9b: 42	10: 41 10a: 55 10b: 42	11: 42 11a: 59 11b: 42	12: 43 12a: 59 12b: 42
	Copper Mountain to Downieville (39 miles) Summer Sunday	76	258	111	108	90	84	95	95	45	45	44	9: 45 9a: 90 9b: 45	10: 44 10a: 84 10b: 45	11: 46 11a: 95 11b: 45	12: 46 12a: 95 12b: 45
	Downieville to Beaver Brook (14 miles) Summer Sunday	26	37	28	29	30	31	31	31	35	35	34	9: 27 9a: 30 9b: 35	10: 26 10a: 31 10b: 35	11: 27 11a: 31 11b: 35	12: 28 12a: 31 12b: 35
	Beaver Brook to C-470 (12 miles) Summer Sunday	12	21	20	20	19	20	18	18	28	28	28	9: 27 9a: 19 9b: 28	10: 28 10a: 20 10b: 28	11: 29 11a: 18 11b: 28	12: 29 12a: 18 12b: 28
	Glenwood Springs to C-470 [1] (144 miles)	205	460	286	275	249	240	253	254	203	202	200	9: 194 9a: 249 9b: 203	10: 192 10a: 240 10b: 203	11: 197 11a: 253 11b: 203	12: 198 12a: 254 12b: 203

Legend

Shortest travel time (average 50 mph or greater)
Intermediate travel time (average 30 to 50 mph)
Longest travel time (average 30 mph or lower)

Notes:

Thresholds are defined on the basis of the average speed of travel through an entire segment to make segments comparable. Actual travel times are listed in the table cells.

[1] This represents the travel time for the entire Corridor (Glenwood Springs to C-470, milepost 116 to 260) and is the sum of the worst travel times of each study segment above.

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Glenwood Springs to Edwards (mileposts 116 to 163)

Annual Average Peak-Hour Travel Time. As shown on Table 2-13, the Baseline and all alternatives would be in the best range through this 47-mile segment, indicating speeds of 50 mph or better. The travel time for these alternatives would be similar to those for Baseline, indicating no suppression of trips in this segment.

Selected Model Day Peak-Hour Travel Time. As shown on Table 2-14, the Baseline highway summer Friday, peak-hour travel time of 52 minutes eastbound and 55 minutes westbound through this 47-mile segment through portions of Garfield and Eagle counties would represent uncongested travel. All of the alternatives would fall within the intermediate to best range of travel time, and would rank in the following order, from worst-performing to best-performing:

- The Highway alternatives and the Combination Six-Lane Highway with Bus in Guideway alternatives would be ranked in the intermediate travel time range westbound, and would take slightly longer than Baseline in either direction for this segment.
- The No Action alternative, the Combination Six-Lane Highway with AGS "build simultaneously" alternative, and the Combination Six-Lane Highway with Rail and IMC "build simultaneously" alternative would offer similar travel time as Baseline in either direction, and would be in the best range for highway travel time.
- The Minimal Action alternative and the Transit alternatives are all within the best travel time and are the same as or below the Baseline scenario. The AGS alternative results in 50-minute travel times both eastbound and westbound for this segment, and is the fastest alternative westbound here.

Edwards to Copper Mountain (mileposts 163 to 195)

Annual Average Peak-Hour Travel Time. As shown on Table 2-13, the Baseline annual average peak-hour highway travel time of 54 minutes through this 32-mile segment represents congestion at a low end of the intermediate range, with average speeds of about 35 mph. Alternatives would rank in the following order, from worst-performing to best-performing:

- The No Action alternative would produce the slowest annual average peak-hour travel time of 53 minutes, which is similar to Baseline. The Minimal Action alternative travel time would be 7 minutes faster than Baseline at 47 minutes. Both would result in trip suppression during peak-day, peak-hour travel.
- All Transit alternatives would be in the intermediate range with similar annual average peak-hour highway travel times, producing speeds averaging between 30 mph and 50 mph between Edwards and Copper Mountain.

The Highway alternatives, and the Combination "build simultaneously" and "build Highway first" alternatives would be in the best travel time range for highway travel. These six alternatives would include six traffic lanes on I-70 in Dowd Canyon.

Selected Model Day Peak-Hour Travel Time. As shown on Table 2-14, the Baseline selected model day peak-hour highway travel time of 92 minutes eastbound and 95 minutes westbound through this 32-mile segment through portions of Eagle and Summit counties represents congested summer Friday, peak-hour travel at speeds of approximately 20 mph. Alternatives would rank in the following order, from longest travel time to shortest travel time:

- The No Action and Minimal Action alternatives would be in the longest travel time range westbound, with peak-hour speeds of 21 mph and 25 mph, respectively. The No Action alternative would be 7 minutes faster than the Baseline westbound in this segment and 17 minutes faster than Baseline eastbound, and the Minimal Action alternative would be 18 minutes faster than Baseline westbound and 14 minutes faster than Baseline eastbound. Both would result in highway trip suppression during summer Friday peak-hour travel, as travelers would adjust their departure times, or take transit if available (such as the bus in mixed traffic provided as part of Minimal Action). The Minimal Action alternative benefits from the addition of climbing lanes on the west side of Vail Pass.
- All other Transit, Highway, and Combination alternatives would be in the intermediate range for travel times in this segment, indicating summer Friday peak-hour speeds of between 30 and 50 mph, except Reversible/HOV/HOT Lanes, which would fall in the shortest category.
- The Transit alternatives (which do not including climbing lanes on Vail Pass) would have highway travel times that are longer than those of the Highway alternatives or the Combination alternatives (all of which include climbing lanes on the west side of Vail Pass).
- The Transit alternatives would have highway travel times within 5 minutes of each other. AGS would be the fastest Transit alternative in either direction. Westbound, the Rail with IMC alternative would have the same highway travel time as the AGS alternative, while eastbound, it would be the slowest of the Transit alternatives, because the electric multiple-unit (EMU) cars would slow as they ascend the steep Vail Pass grades. Slower transit service would encourage more travelers to use the highway, which would result in slower highway travel times as well.
- The Highway and Combination "build simultaneously" alternatives would have highway travel times within 3 minutes of each other.

Copper Mountain to Downieville (mileposts 195 to 234)

Annual Average Peak-Hour Travel Time. As shown on Table 2-13, the Baseline annual average peak-hour highway travel time of 75 minutes through this 39-mile segment would represent congestion at the low end of the intermediate range, with average speeds of about 31 mph. Alternatives would rank in the following order, from worst-performing to best-performing:

- Travel times for the No Action and Minimal Action alternatives would be similar at about 15 minutes less than Baseline. Trip suppression for the No Action and Minimal Action alternatives would be more noticeable in this section than between Edwards and Copper Mountain.
- The Rail with IMC alternative and the Bus in Guideway alternatives would result in intermediate range travel times.
- The AGS alternative, Highway alternatives, and Combination "build simultaneously" alternatives would offer similar travel times (on an annual average basis) between Copper Mountain and Downieville, a segment of I-70 that would be improved by these alternatives. All would be in the best travel time range, indicating annual average peak-hour speeds of 50 mph or greater.

Selected Model Day Peak-Hour Travel Time. As shown on Table 2-14, the Baseline summer Sunday peak-hour eastbound highway travel time of 258 minutes through this 39-mile segment through portions of Summit and Clear Creek counties would represent congested peak-hour travel at speeds below 10 mph. These would be the second-lowest Baseline speeds during peak-hour travel time within the Corridor, after the Beaver Brook to C-470 segment, representing the second highest level of peak congestion in the Corridor. Eastbound in this segment, the Baseline scenario, No Action, Minimal Action, and the Transit alternatives would all fall in the longest travel time category. The Highway alternatives and the Combination "build simultaneously" alternatives would fall in the shortest travel time category.

The westbound Baseline winter Saturday highway travel time of 76 minutes would correspond to a speed of just over 30 mph, in the intermediate travel time category. All alternatives also would fall into the intermediate travel time category, except for the Reversible/HOV/HOT Lanes alternative, which would fall in the shortest travel time category.

Westbound, the winter Saturday highway travel times under various alternatives in the Copper Mountain to Downieville segment would range from 44 minutes – also under the Reversible/ HOV/HOT Lanes alternative – to 67 minutes, about 90 percent of the Baseline travel time. The alternatives ordered from longest to shortest travel times would be as follows:

- The No Action alternative would result in the longest travel time and winter Saturday person trip suppression of about 10 to 20 percent in this segment.
- The Minimal Action alternative would be next with a highway travel time of 63 minutes, or a speed of about 37 mph. Person trips suppression under Minimal Action would range from 5 to 13 percent from Downieville to Copper Mountain, with greater suppression occuring in the eastern parts of this segment.
- The Transit alternatives, the two Six-Lane Highway alternatives, and the Combination "build simultaneously" alternatives would offer similar travel times, ranging from 53 to 59 minutes. The Rail with IMC alternative and the Diesel Bus in Guideway alternative would result in the longest travel times of these alternatives, while the Combination Six-Lane Highway with Rail and IMC "build simultaneously" alternative would result in the shortest highway travel time of these intermediate alternatives.
- The Reversible/HOV/HOT Lanes alternative would offer the shortest winter Saturday travel time from Downieville to Copper Mountain, and would accommodate about 4 percent more person trips than the 2025 Baseline at the three focal points in this section (West of Silverthorne, EJMT, and East of Empire Junction).

For **eastbound** summer Sunday in the Copper Mountain to Downieville segment, alternatives ranked from longest travel time to shortest travel time would be in the following order:

- The No Action (111 minutes) and Minimal Action (108 minutes) alternatives would have the longest eastbound highway travel times from Copper Mountain to Downieville. However, these travel times would be less than half of the Baseline travel time because summer Sunday person trips would be suppressed from 3 to 8 percent in this section. Peak-hour speeds would be approximately 20 mph.
- The Transit alternatives would result in highway travel times that are about 15 to 25 minutes faster than Minimal Action and No Action, yet would still fall within the longest travel time category. Of the four Transit alternatives, the Bus in Guideway alternatives would result in the longest travel time: 95 minutes. By attracting a greater percentage of travelers from the highway, the AGS alternative would result in a travel time of 84 minutes from Copper Mountain to Downieville.
- Highway and Combination alternatives would result in travel times of 44 to 46 minutes, and summer Sunday peak-hour speeds of about 52 mph, in the shortest travel time category. The Reversible/HOV/HOT Lanes alternative and the Combination Six-Lane Highway with AGS "build simultaneously" alternative would offer the shortest highway travel times.

Downieville to Beaver Brook (mileposts 234 to 248)

Annual Average Peak-Hour Travel Time – As shown on Table 2-13, the Baseline annual average peak-hour highway travel time of 30 minutes through this 14-mile segment represents congestion in the greatest range, with an average speed of about 28 mph. Alternatives would rank in the following order, from worst-performing to best-performing:

- The No Action alternative travel time of 25 minutes and Minimal Action alternative travel time of 21 minutes would be faster than the Baseline travel time in this segment due to trip suppression. These alternatives would be within the intermediate travel time range, although slower than the other alternatives.
- All Transit and Highway alternatives would be in the intermediate range for highway travel time, except Reversible/HOV/HOT Lanes, which would be in the best range (equal to year 2000 travel time).
- From Downieville to Beaver Brook, all of the Combination "build simultaneously" alternatives would have the fastest annual average driving times, and would be in the best annual average peak-hour travel time range, with speeds of 50 mph or faster.

Selected Model Day Peak-Hour Travel Time. As shown on Table 2-14, the Baseline winter Saturday, peak-hour **westbound** highway travel time of 53 minutes through this 14-mile segment in Clear Creek County represents congested peak-hour travel at speeds around 15 mph. This Baseline travel time would be about twice the year 2000 travel time, and would represent the third lowest Baseline speed during peak-hour travel time within the Corridor, after the Copper Mountain to Downieville and Beaver Brook to C-470 segments. Furthermore, the westbound highway travel times for the Baseline scenario and all alternatives would reflect the addition of a continuous lane from the top of Floyd Hill to the interchange with US 6 at the bottom of Floyd Hill. Considering **westbound** winter Saturday highway travel times, alternatives would rank in the following order, from longest to shortest:

- The No Action and Minimal Action alternatives would be in the longest travel time range with similar travel times that would be approximately 40 percent less or 20 to 25 minutes lower than of the Baseline travel, with winter Saturday peak-hour speeds of approximately 25 to 30 mph. These alternatives would result in trip suppression occurring more noticeably at peak travel times in this section (and about 10 to 20 percent suppression of daily person trips) than between Edwards and Copper Mountain (where daily person trip suppression is no more than 1 to 2 percent).
- In this Beaver Brook to Downieville segment, the Transit alternatives, the Six-Lane Highway (55 or 65 mph) alternatives, and the Combination "build simultaneously" alternatives would result in winter Saturday peak hour travel times of 23 to 26 minutes, which would put them into the intermediate travel time category, and be slightly faster than year 2000 travel times. The single-mode alternatives would result in highway travel times at the upper end of this range (26 minutes).
- The Reversible/HOV/HOT Lanes alternative would offer what is clearly the shortest highway travel time from Beaver Brook to Downieville – 15 minutes, corresponding to a speed of about 55 mph, in the shortest travel time category.

The **eastbound** Baseline summer Sunday travel time from Downieville to Beaver Brook would be 37 minutes, or just over 40 percent more than the 2000 highway travel time. Peak-hour travel times under the various alternatives would range from 27 minutes (nearly matching the 2000 highway travel time), to 35 minutes under the two Six-Lane Highway alternatives. From longest to shortest eastbound travel time, the alternatives would be ordered as follows:

- Peak-hour highway travel time under the Reversible/HOV/HOT Lanes alternative would be 1 minute faster than the other two Highway alternatives. The Highway alternatives' peak hour speed would be just under 25 mph.

- The AGS alternative and the two Bus in Guideway alternatives (31 minutes) would result in highway travel times 1 minute longer than the Rail with IMC alternative
- The highway travel time from Downieville to Beaver Brook under Minimal Action (29 minutes) would be 1 minute faster than that of the Rail with IMC alternative, and 1 minute slower than No Action.
- The Combination alternatives would offer highway travel times of 26 to 28 minutes, with the Combination involving Diesel Bus in Guideway taking the longest (and the same as No Action), and the Combination involving AGS the shortest (and the same as 2000). All alternatives would fall in the longest travel time category eastbound, except for the Combination Six-Lane Highway with AGS "build simultaneously" alternative, which would fall in the intermediate category.

Beaver Brook to C-470 (mileposts 248 to 260)

Annual Average Peak-Hour Travel Time – As shown on Table 2-13, the Baseline annual average peak-hour highway travel time of 25 minutes through this 12-mile segment would represent congestion in the worst travel time range, with average speeds below 30 mph. Alternatives would rank in the following order, from worst-performing to best-performing:

- Unlike travel times for the selected model day peak hour, all alternatives would be in the intermediate range for annual average peak-hour travel time in this segment. While the alternative travel times would range from 16 to 21 minutes, each alternative would improve on the average Baseline travel time in this segment.
- The No Action and Minimal Action alternatives would result in shorter travel times due to trip suppression.
- The Highway alternatives and the Combination alternatives would offer similar travel times, with the longest average travel times among the alternatives (20 to 21 minutes). Capacity improvements in this segment would be limited to the Minimal Action capacity element involving a westbound auxiliary lane.
- Few highway capacity improvements are proposed for this segment; improvements elsewhere may induce traffic demand; and the eastbound three lanes from the Continental Divide through Clear Creek County would allow demand to reach the unimproved Jefferson County roadway faster than under the existing network.
- Transit alternatives would have shorter travel times than the Highway and Combination alternatives.

Selected Model Day Peak-Hour Travel Time – As shown on Table 2-14, the westbound winter Saturday, peak-hour Baseline travel time of 103 minutes for this 12-mile segment through portions of Clear Creek and Jefferson counties represents congested peak-day, peak-hour travel at speeds below 10 mph. These would be the lowest Baseline speeds during peak-hour travel time within the Corridor, representing the highest level of peak congestion. The westbound winter Saturday peak-hour Baseline highway travel time would be more than seven times the corresponding year 2000 travel time, while the daily vehicle trips accommodated at Genesee under the Baseline would be only slightly more than double the year 2000 level. The 103-minute (or 1 hour 43 minute) travel time corresponds to stop-and-go travel for essentially the whole distance from C-470 to Beaver Brook.

Alternatives ranked from longest to shortest **westbound** winter Saturday peak-hour highway travel time would be ordered as follows:

- While the Six-Lane Highway (55 or 65 mph) alternatives would offer a considerable improvement over the Baseline travel time, these alternatives would have the longest travel time, at 34 minutes or about 2.5 times the year 2000 travel time.
- The Combination Six-Lane Highway with Rail and IMC "build simultaneously" alternative would result in a travel time of 30 minutes, also in the longest travel time category.
- The Combination alternatives involving Bus in Guideway would each result in a highway travel time of 28 minutes from C-470 to Beaver Brook, or about twice the year 2000 travel time, and would also fall within the longest travel time category.
- The AGS alternative would result in a winter Saturday peak-hour highway travel time of 25 minutes, putting it into the longest travel time category.
- The Minimal Action alternative is projected to have peak-hour highway travel times of 24 minutes, in the longest travel time category.
- Three Transit alternatives – Rail with IMC, Dual-Mode Bus in Guideway, and Diesel Bus in Guideway – would result in a 23-minute peak-hour highway travel time, falling within the intermediate travel time category.
- The Combination Six-Lane Highway with AGS "build simultaneously" alternative would result in highway travel times of up to 21 minutes on winter Saturday. Peak-hour travel times with the Reversible/HOV/HOT Lanes alternative would be 19 minutes. These would both be intermediate travel times.
- The No Action alternative is projected to have the shortest winter Saturday westbound highway travel time – 18 minutes, or an average speed of about 40 mph – of all alternatives in this segment. This surprising result occurs for two reasons: (1) winter Saturday vehicle trips at Genesee would be suppressed under No Action about 14 percent below the Baseline level because of congestion further west in the Corridor, and (2) a continuous lane from the top of Floyd Hill (just west of the Hyland Hills on-ramp) to the US 6 interchange at the base of Floyd Hill – constructed in association with the assumed improvements to the Gaming Area – eliminates an existing westbound bottleneck at this location.

Eastbound summer Sunday peak-hour travel times reflect a quite different travel pattern than westbound winter Saturday. The Baseline peak-hour travel time of 21 minutes would be only 75 percent longer than the year 2000 highway travel time. While this Baseline travel time would fall within the intermediate category, the eastbound highway travel time under each of the Highway alternatives and the Combination "build simultaneously" alternatives would fall in the longest travel time category. For summer Sunday peak-hour travel, the alternatives sorted from longest highway travel times to shortest would be:

- The two Combination alternatives involving Bus in Guideway would have the longest highway travel time of 29 minutes. Travel times under the Highway alternatives (28 minutes), the Combination Six-Lane Highway with AGS alternative (also 28 minutes), and the Combination Six-Lane Highway with Rail and IMC alternative (27 minutes) would be similar.
- The eastbound highway travel time under the No Action, Minimal Action, or AGS alternatives would be 20 minutes, or 1 minute less than Baseline. (These alternatives thus would fall in the intermediate travel time category.)
- Highway travel from Beaver Brook to C-470 is projected to take 19 minutes during summer Sunday peak hours under the Rail with IMC alternative. The two Bus in Guideway alternatives are expected to result in the shortest eastbound travel times for this segment – 18 minutes. However, this travel time would be 50 percent greater than the 2000 eastbound summer Sunday peak-hour travel time.

The variability of auto driving time would be apparent from the difference between the summer Sunday eastbound highway travel time and the annual average highway travel time. For the fastest alternatives on summer Sunday between Beaver Brook and C-470 – the two Bus in Guideway alternatives – this difference is 2 minutes (18 minutes on summer Sunday versus 16 minutes average). For the slowest summer Sunday alternative, the Combination alternatives involving Bus in Guideway, the difference is 8 or 9 minutes, or about 40 percent of the annual average travel times for these alternatives (20 or 21 minutes).

2.3.4.2 Transit Travel Time Comparison

Corridor Summary: Transit Travel Time

Table 2-15 provides annual averages of peak-hour transit travel times. Table 2-16 provides the transit travel time during peak hours of selected model days (winter Saturday westbound and summer Sunday eastbound between C-470 and Copper Mountain, and summer Friday for either direction west of Copper Mountain), which represent the heaviest travel periods.

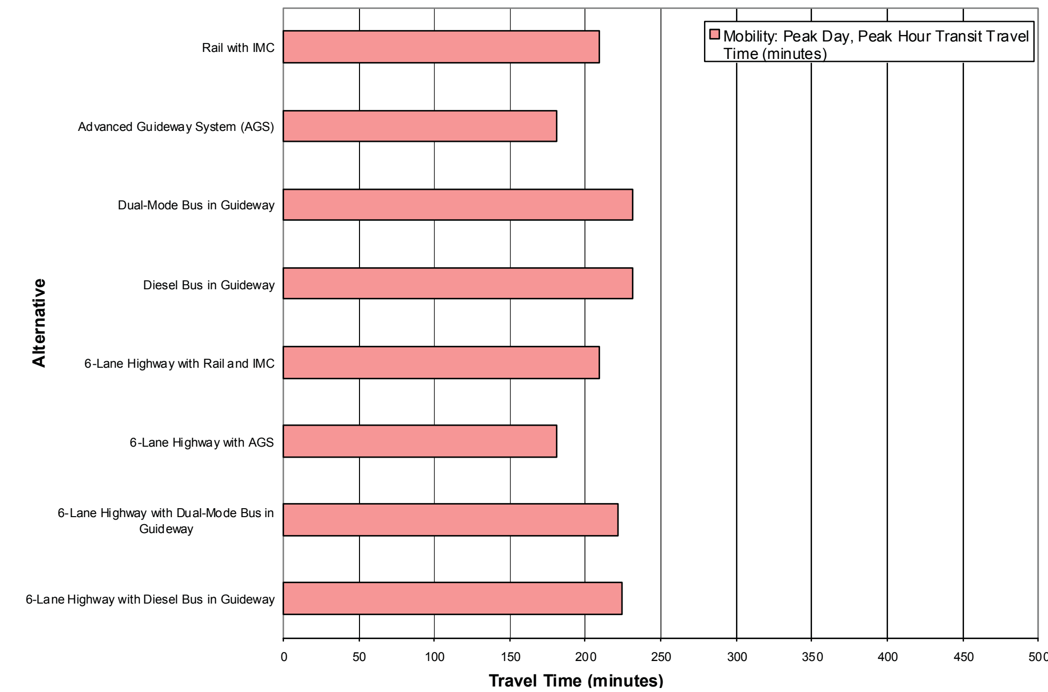
Chart 2-9 shows the annual average peak-hour transit travel time in either direction. Chart 2-11 and Chart 2-10 illustrate the performance of the alternatives offering transit systems on a Corridor-wide basis. Chart 2-11 indicates the eastbound summer Sunday peak-hour transit travel time for each alternative. Chart 2-10 provides the peak-hour travel time for westbound transit travel on winter Saturday.

Annual Average Peak-Hour Transit Travel Time

Annual average peak-hour transit times for the Corridor from Glenwood Springs to C-470 would fall into the intermediate range for all alternatives. Alternatives would rank in the same order as they do for selected model day peak-hour on a Corridor-wide basis. From worst-performing to best-performing, they would rank as follows:

- The Bus in Guideway alternatives would offer the slowest transit travel time, with some improvement made by the Combination Six-Lane Highway with Bus in Guideway alternatives.
- Transit travel times for the Rail and IMC and Combination Six-Lane Highway with Rail and IMC alternatives would be the same, and somewhat faster than the Bus in Guideway alternatives.
- The AGS and Combination Six-Lane Highway with AGS alternatives would also be the same, and offer the fastest transit travel through the entire Corridor from Glenwood Springs to Jefferson Station on an annual average basis, at 181 minutes.

Chart 2-9. Annual Average Peak-Hour Transit Travel Time (Glenwood Springs to C-470)



Note: No Corridor-wide transit service is available in 2000, under the 2025 Baseline scenario, or under the No Action alternative, and no new transit service is introduced west of the Vail Transportation Center under the Minimal Action alternative. Therefore, these are not included on this chart.

Selected Model Day Peak-Hour Transit Travel Time

From Glenwood Springs to C-470 (called Jefferson Station for transit comparison), selected model day peak-hour travel times for all alternatives would fall into the intermediate range. Alternatives would rank in the following order, from worst-performing to best-performing:

- The Bus in Guideway alternatives would have the slowest transit travel times Corridor-wide. The Combination Six-Lane Highway with Bus in Guideway alternatives would offer some improvement (about 10 to 30 minutes) in this travel time on the peak day.
- Rail with IMC alternative and Combination Six-Lane Highway with Rail and IMC alternative would have the same transit travel times of 204 minutes westbound and 212 minutes eastbound. Most of the 8-minute travel time difference would be associated with the decreased performance experienced as the electric multiple-unit (EMU) cars ascend the steep grades from Vail East Entrance to the summit of Vail Pass. Details of travel times within the same five segments considered above for highway travel times (Glenwood Springs to Edwards, Edwards to Copper Mountain, Copper Mountain to Downieville, Downieville to Beaver Brook, and Beaver Brook to Jefferson Station) are shown in Table 2-16.
- Transit travel times for AGS and Combination Six-Lane Highway with AGS would also be the same – 3 hours (180 minutes) in either direction. These alternatives offer the fastest travel from Glenwood Springs to Jefferson Station.

Chart 2-10 provides the peak-hour travel time for westbound transit travel on winter Saturday. Chart 2-11 indicates the eastbound summer Sunday peak-hour transit travel time for each alternative.

Chart 2-10. Selected Model-Day, Peak-Hour Transit Travel Time (Westbound: C-470 to Glenwood Springs)

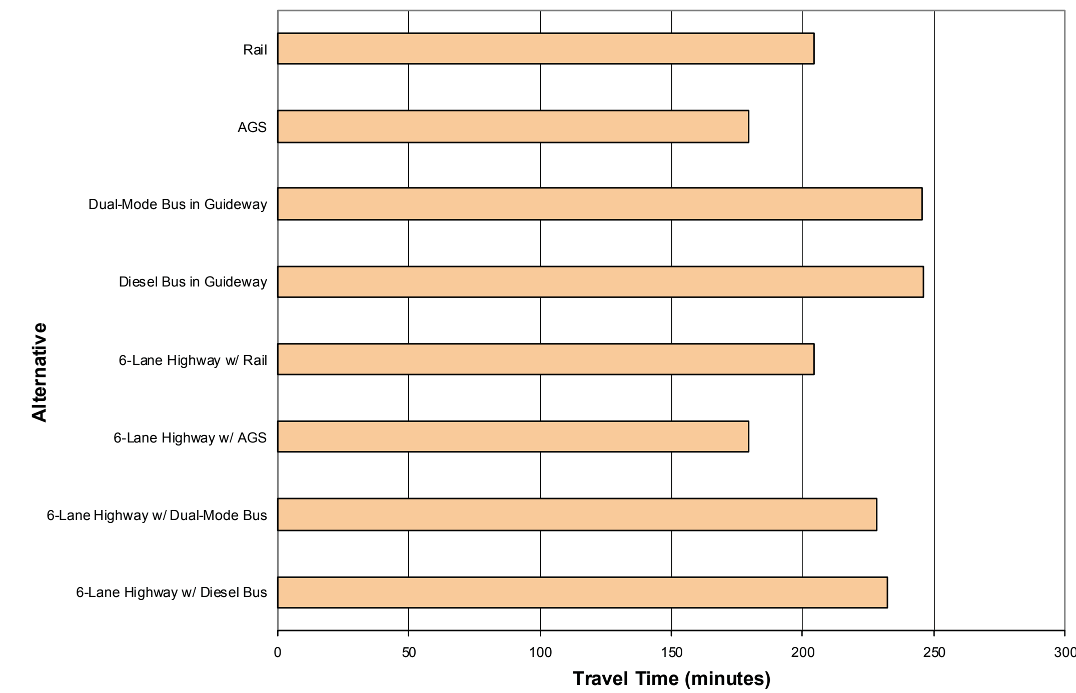


Chart 2-11. Selected Model Day, Peak-Hour Transit Travel Time (Eastbound: Glenwood Springs to C-470)

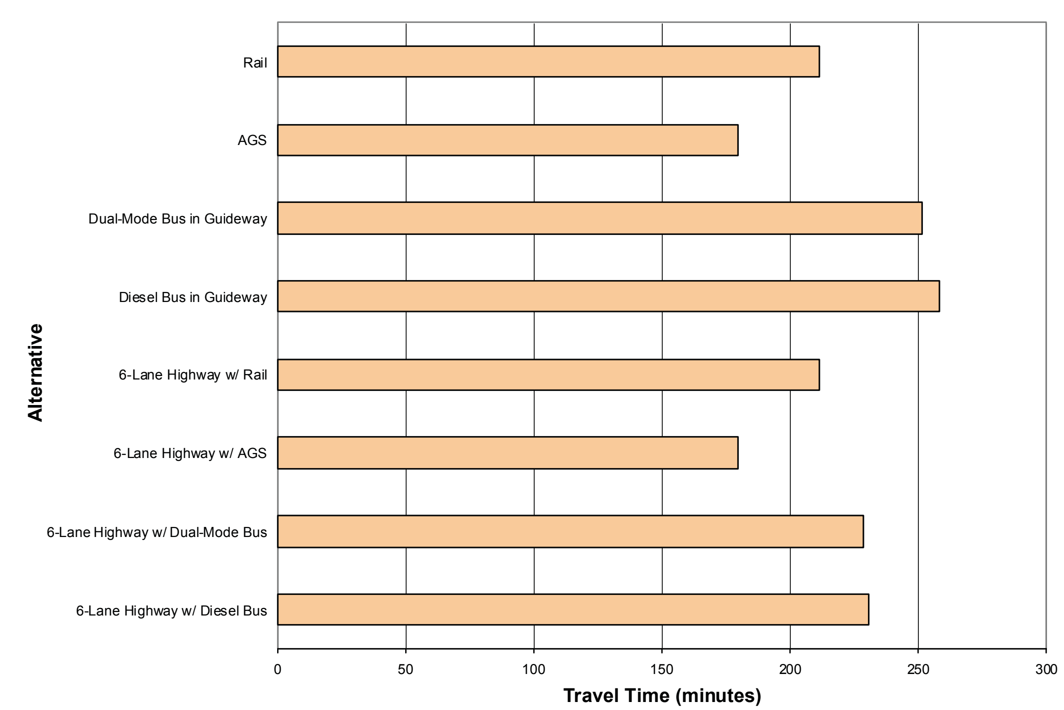


Table 2-15. Annual Average Peak-Hour Transit Travel Time

Element of Purpose and Need	Segment	Year 2000	2025 Baseline	No Action Alternative	1 Minimal Action Alternative	Transit Alternatives: 2 Rail with IMC	3 Advanced Guideway System (AGS)	4 Dual-Mode Bus in Guideway	5 Diesel Bus in Guideway	Highway Alternatives: 6 6-Lane Highway 55 mph	7 6-Lane Highway 65 mph	8 Reversible/ HOV/HOT Lanes	Combination Highway/Transit Alternatives: Sub-alternative	9 6-Lane Highway with Rail and IMC	10 6-Lane Highway with AGS	11 6-Lane Highway with Dual-Mode Bus in Guideway	12 6-Lane Highway with Diesel Bus in Guideway
													9 / 10 / 11 / 12 - Build Combination Simultaneously				
													9a / 10a / 11a / 12a - Build Transit and Preserve for Highway				
													9b / 10b / 11b / 12b - Build Highway and Preserve for Transit				
Mobility: Annual Average Peak-Hour **Transit Travel Time** (minutes)	Glenwood Springs to Edwards	No Corridor-wide transit service is available in 2000, under the 2025 Baseline scenario, or under the No Action alternative.			N/A [3]	69	63	66	66	No Corridor-wide transit service is available under the Highway alternatives.			9 / 10 / 11 / 12	69	63	68	68
													9a / 10a / 11a / 12a	69	63	66	66
													9b-12b	No Corridor-wide transit service is available under the Highway with Transit Preservation alternatives.			
	Edwards to Copper Mountain				N/A [3]	46	36	63	59				9 / 10 / 11 / 12	46	36	53	50
													9a / 10a / 11a / 12a	46	36	63	59
													9b-12b	No Corridor-wide transit service is available under the Highway with Transit Preservation alternatives.			
	Copper Mountain to Downieville				81	57	50	64	65				9 / 10 / 11 / 12	57	50	63	65
													9a / 10a / 11a / 12a	57	50	64	65
													9b-12b	No Corridor-wide transit service is available under the Highway with Transit Preservation alternatives.			
	Downieville to Beaver Brook				27	21	18	22	21				9 / 10 / 11 / 12	21	18	22	21
													9a / 10a / 11a / 12a	21	18	22	21
													9b-12b	No Corridor-wide transit service is available under the Highway with Transit Preservation alternatives.			
	Beaver Brook to C-470				21	16	14	16	20				9 / 10 / 11 / 12	16	14	16	20
													9a / 10a / 11a / 12a	16	14	16	20
													9b-12b	No Corridor-wide transit service is available under the Highway with Transit Preservation alternatives.			
	Glenwood Springs to C-470[1]				N/A [3]	209	181	231	231				9 / 10 / 11 / 12	209	181	222	224
													9a / 10a / 11a / 12a	209	181	231	231
													9b-12b	No Corridor-wide transit service is available under the Highway with Transit Preservation alternatives.			

Legend

- Shortest travel time (50 mph or greater)[2]
- Intermediate travel time (30 to 50 mph)[2]
- Longest travel time (30 mph or lower)[2]

Notes:

[1] *This represents the annual average travel time for the entire Corridor (Glenwood Springs to C-470, milepost 116 to 260) and is the sum of the annual average travel times of each study segment above.*

[2] *Thresholds are defined on the basis of the average speed of travel through an entire segment to make segments comparable. Actual travel times are listed in the table cells.*

[3] *No new transit service is introduced west of the Vail Transportation Center under the Minimal Action alternative.*

Table 2-16. Selected Model Day, Peak-Hour Transit Travel Time

Element of Purpose and Need	Corridor Segment and Selected Model Day	Year 2000	2025 Baseline	No Action Alternative	1 Minimal Action Alternative	2 Rail with IMC	3 Advanced Guideway System (AGS)	4 Dual-Mode Bus in Guideway	5 Diesel Bus in Guideway	6 6-Lane Highway 55 mph	7 6-Lane Highway 65 mph	8 Reversible/ HOV/HOT Lanes	Sub-alternative	9 6-Lane Highway with Rail and IMC	10 6-Lane Highway with AGS	11 6-Lane Highway with Dual-Mode Bus in Guideway	12 6-Lane Highway with Diesel Bus in Guideway
													9 / 10 / 11 / 12	- Build Combination Simultaneously	- Build Combination Simultaneously	- Build Combination Simultaneously	- Build Combination Simultaneously
													9a / 10a / 11a / 12a	- Build Transit and Preserve for Highway	- Build Transit and Preserve for Highway	- Build Transit and Preserve for Highway	- Build Transit and Preserve for Highway
													9b / 10b / 11b / 12b	- Build Highway and Preserve for Transit	- Build Highway and Preserve for Transit	- Build Highway and Preserve for Transit	- Build Highway and Preserve for Transit
Mobility: Peak Hour of Selected Model Day **Westbound Transit Travel Time** (minutes)	Glenwood Springs to Edwards	No Corridor-wide transit service is available in 2000, under the 2025 Baseline scenario, or under the No Action alternative.			N/A [3]	68	62	69	69	No Corridor-wide transit service is available under the Highway alternatives.			9 / 10 / 11 / 12	68	62	69	69
													9a / 10a / 11a / 12a	68	62	69	69
													9b-12b	No Corridor-wide transit service is available under the Highway with Transit Preservation alternatives.			
	Edwards to Copper Mountain				N/A [3]	42	36	76	73				9 / 10 / 11 / 12	42	36	56	54
													9a / 10a / 11a / 12a	42	36	76	73
													9b-12b	No Corridor-wide transit service is available under the Highway with Transit Preservation alternatives.			
	Copper Mountain to Downieville				78	58	51	63	63				9 / 10 / 11 / 12	58	51	65	68
													9a / 10a / 11a / 12a	58	51	63	63
													9b-12b	No Corridor-wide transit service is available under the Highway with Transit Preservation alternatives.			
	Downieville to Beaver Brook				34	21	18	22	21				9 / 10 / 11 / 12	21	18	22	21
													9a / 10a / 11a / 12a	21	18	22	21
													9b-12b	No Corridor-wide transit service is available under the Highway with Transit Preservation alternatives.			
	Beaver Brook to C-470				24	16	14	16	20				9 / 10 / 11 / 12	16	14	16	20
													9a / 10a / 11a / 12a	16	14	16	20
													9b-12b	No Corridor-wide transit service is available under the Highway with Transit Preservation alternatives.			
	Glenwood Springs to C-470 [1]				N/A [3]	204	180	246	246				9 / 10 / 11 / 12	204	180	228	232
													9a / 10a / 11a / 12a	204	180	246	246
													9b-12b	No Corridor-wide transit service is available under the Highway with Transit Preservation alternatives.			
Mobility: Peak Hour of Selected Model Day **Eastbound Transit Travel Time** (minutes)	Glenwood Springs to Edwards	No Corridor-wide transit service is available in 2000, under the 2025 Baseline scenario, or under the No Action alternative.			N/A [3]	70	64	66	66	No Corridor-wide transit service is available under the Highway alternatives.			9 / 10 / 11 / 12	70	64	70	71
													9a / 10a / 11a / 12a	70	64	66	66
													9b-12b	No Corridor-wide transit service is available under the Highway with Transit Preservation alternatives.			
	Edwards to Copper Mountain				N/A [3]	49	36	74	75				9 / 10 / 11 / 12	49	36	60	58
													9a / 10a / 11a / 12a	49	36	74	75
													9b-12b	No Corridor-wide transit service is available under the Highway with Transit Preservation alternatives.			
	Copper Mountain to Downieville				143	56	49	74	76				9 / 10 / 11 / 12	56	49	61	62
													9a / 10a / 11a / 12a	56	49	74	76
													9b-12b	No Corridor-wide transit service is available under the Highway with Transit Preservation alternatives.			
	Downieville to Beaver Brook				35	21	18	22	21				9 / 10 / 11 / 12	21	18	22	21
													9a / 10a / 11a / 12a	21	18	22	21
													9b-12b	No Corridor-wide transit service is available under the Highway with Transit Preservation alternatives.			
	Beaver Brook to C-470				24	16	14	16	20				9 / 10 / 11 / 12	16	14	16	20
													9a / 10a / 11a / 12a	16	14	16	20
													9b-12b	No Corridor-wide transit service is available under the Highway with Transit Preservation alternatives.			
	Glenwood Springs to C-470 [1]				N/A [3]	212	180	252	258				9 / 10 / 11 / 12	212	180	229	231
													9a / 10a / 11a / 12a	212	180	252	258
													9b-12b	No Corridor-wide transit service is available under the Highway with Transit Preservation alternatives.			

Legend

- Shortest travel time (50 mph or greater)[2]
- Intermediate travel time (30 to 50 mph)[2]
- Longest travel time (30 mph or lower)[2]

Notes:

[1] *This represents the travel time for the entire Corridor (Glenwood Springs to C-470, milepost 116 to 260) and is the sum of the worst travel times of each study segment above.*

[2] *Thresholds are defined on the basis of the average speed of travel through an entire segment to make segments comparable. Actual travel times are listed in the table cells.*

[3] *No new transit service is introduced west of the Vail Transportation Center under the Minimal Action alternative.*

Example of Complete Trips: Denver Metropolitan Area to Vail

This analysis considers travel between Vail Transportation center (near Vail Village) and four Denver/Boulder metropolitan area RTD transit centers – downtown Boulder, DIA, the Denver Tech Center (DTC), and downtown Littleton – by three means:

1. Using highways all the way (shown by a blue bar in Chart 2-13 and Chart 2-12)
2. Using auto access within the Denver metropolitan area, parking at a planned transit station in the vicinity of I-70 and C-470 (Jefferson Station), and riding transit in the Corridor (shown by a yellow bar)
3. Using transit all the way (shown by a red bar)

Eastbound travel is considered for a summer Sunday while westbound travel is described for a winter Saturday. Table 2-17 and Table 2-18 give a summary of the total elapsed time between the various combinations of origins, destinations, and model days. More complete details, such as access times, egress times, and waiting times, are shown in Appendix B. The appendix also includes additional examples of winter Saturday and summer Sunday travel between Winter Park and the Denver metropolitan area. This set of origin-destination pairs provides a more complex example, because of the travel off I-70 required to reach Corridor attractions (that is, between Empire Junction and Winter Park). These additional examples illustrate the possible effects of trip inducement, trip suppression, and mode shift on local roadways in the Corridor communities.

The results of Table 2-17 and Table 2-18 are summarized graphically in Chart 2-13 for westbound travel and Chart 2-12 for eastbound travel. Note that for the No Action alternative and the three Highway alternatives, the two means of travel involving transit would not be available; therefore, only one bar is shown for these alternatives.

Summary. The highway travel times for trips from DTC to Vail under the 2025 Baseline scenario would be considerably longer (approximately 300 minutes westbound and 400 minutes eastbound) than those shown for year 2000 (approximately 150 minutes westbound and 170 minutes eastbound). The No Action and Minimal Action alternatives would have travel times up to 190 minutes westbound and up to 270 minutes eastbound, with a considerable suppression of trips, and would not accommodate 2025 travel demand projections. In contrast, travel times for many of the action alternatives would result in travel times approaching those of today, while accommodating the increased travel demand projected for 2025.

Trips using park-and-ride access to Jefferson Station would be faster than those using transit within the Denver metropolitan area, because most of the highway congestion in the Denver metropolitan area occurs during weekdays, not weekends, as are considered in Table 2-17 and Table 2-18. Special events may result in localized weekend congestion in the Denver metropolitan area, but these events are not included in the PEIS model days.

Westbound Highway Travel

Highway travel characteristics for **westbound winter Saturday**, from the **Denver Tech Center (DTC)** to **Vail Transportation Center** include:

- Reversible/HOV/ HOT Lanes alternative would offer the most attractive travel times, which would be about 15 minutes shorter than year 2000 highway travel times.
- The next quickest alternative, the Combination Six-Lane Highway with AGS alternative, would offer highway travel times roughly comparable with those of 2000.
- The Transit alternatives with the three remaining Combination alternatives would form the next fastest group. Travel times to Vail Village under these alternatives would be about 150 minutes from downtown Littleton, 160 minutes from the Denver Tech Center (DTC), 165 minutes from downtown Boulder, and 170 minutes from DIA.
- Driving under the Six-Lane Highway (55 mph or 65 mph) alternatives would take about 10 minutes longer than it would under the Transit alternatives.
- Minimal Action and No Action highway travel times would differ by no more than a minute (although somewhat more person trips would be made under Minimal Action). If travelers are not very tolerant of congestion, causing many trips to be suppressed under these alternatives, Minimal Action and No Action would have highway travel times roughly equal to the highway travel times under the Transit alternatives. Minimal Action and No Action highway travel times with a high tolerance of congestion (little suppression) are projected to be about half an hour longer than driving times for the same alternative with a low tolerance of congestion. Even with a high tolerance of congestion, Minimal Action and No Action would offer highway travel times that are about 60 percent of the Baseline scenario.

In general, the four Transit alternatives as well as the four Combination alternatives are expected to have similar travel times as compared to each other, and 10 minutes faster than the Highway alternatives (except for the Reversible/HOV/HOT Lanes alternative, which has the fastest travel time).

Among the Transit and Combination alternatives, the ones involving AGS, especially Combination Six-Lane Highway with AGS, would have an edge over the others. As mentioned above, the Minimal Action and No Actions travel times would be very similar, but the travel times for these would range from the same as Transit to half an hour more than Transit.

Westbound Transit Travel

Transit travel characteristics for **westbound winter Saturday**, from the **DTC to Vail Transportation Center**:

- The AGS alternative and the Combination Six-Lane Highway with AGS alternative would offer the fastest transit travel times from the Denver metropolitan area to Vail Village. AGS riders who drive to Jefferson Station could complete their trip about 10 minutes faster than they could have driven the same distance in 2000.
- However, those taking transit all the way would spend half an hour to an hour longer than they would have driven in 2000.
- The Rail with IMC alternative and the Combination Six-Lane Highway with Rail and IMC alternative would offer the next fastest transit travel times, about 20 minutes longer than the AGS alternative.
- The two Bus in Guideway alternatives would form the group offering the third-fastest transit travel times to Vail Village on a winter Saturday. Transit travel under these alternatives would take about 10 minutes longer than under the Rail with IMC alternative, and thus about a half hour longer than under the AGS alternative.
- The two Combination alternatives involving Bus in Guideway would have transit travel times 5 to 10 minutes longer than their single-mode counterparts.
- As expected, transit travel times would be the greatest under the Minimal Action alternative, taking about 20 to 45 minutes longer than the Combination Six-Lane Highway with Diesel Bus in

Guideway alternative, and about 1 to 1.5 hours longer than transit travel under the AGS alternative.

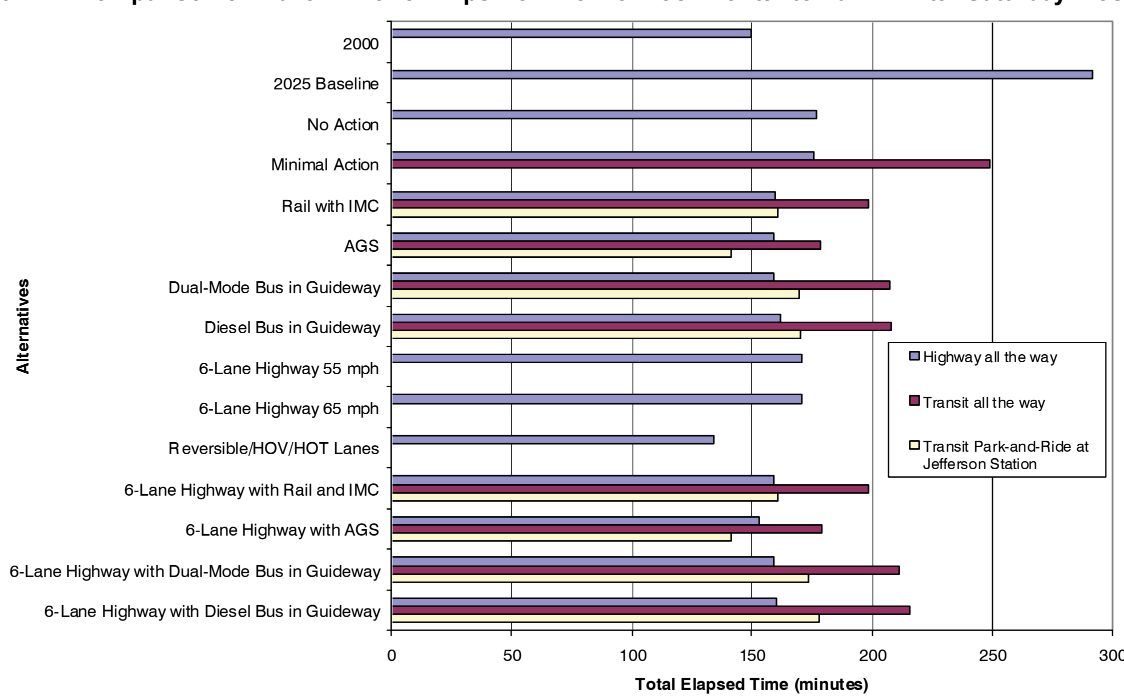
- The Baseline highway travel time from Boulder to Vail Village would be about equal to the Minimal Action transit-all-the-way time, assuming that travelers have a high tolerance of congestion (low trip suppression). The Minimal Action transit travel times for other Denver metropolitan area origins would be less than the Baseline highway travel time.

A general trend observed is that the AGS and Combination Six-Lane Highway with AGS would have the best travel times for both transit-all-the-way and for those driving to Jefferson Station, although the ones driving to the park-and-ride would have shorter travel times (as explained in the beginning of this example).

Rail with IMC and Combination Six-Lane Highway with Rail and IMC would also have similar travel times that would be about 20 minutes longer than the AGS and Combination Six-Lane Highway with AGS alternatives.

The Bus in Guideway alternatives and the Combination alternatives involving Bus in Guideway would have similar travel times as well, which would be almost 30 minutes longer than those for AGS. The Minimal Action alternative would have by far the longest transit travel time. This can be attributed to its “bus in mixed traffic” nature in Clear Creek County causing it to be affected by the congestion on the highway, in conjunction with the limited performance of the buses over steep grades such as those leading up to Vail Pass (where congestion would not be severe enough to limit the buses’ speeds).

Chart 2-12. Comparison of Travel Time for Trips from Denver Tech Center to Vail - Winter Saturday Westbound



Eastbound Highway Travel

Highway travel characteristics for **eastbound summer Sunday**, from **Vail Transportation Center to Denver Tech Center:**

- The four Combination alternatives and three Highway alternatives would offer highway travel times that are shorter than driving times in 2000.
- The fastest of these seven alternatives, the Combination involving AGS, would have a highway travel time about 15 minutes faster than 2000.
- Highway travel times under the AGS alternative would be about 30 minutes longer than under the Six-Lane Highway alternatives, or about 20 to 25 minutes longer than 2000.
- The remaining Transit alternatives would offer highway travel times about 10 to 15 minutes longer than under AGS.
- Under Minimal Action, highway travel times would range from about 10 minutes less than under AGS (because far fewer person trips are accommodated), to as much as 75 minutes longer than AGS. (The midpoint of the Minimal Action highway travel time range – for example, 227 minutes for trips from Vail Village to the Tech Center – would be about 20 minutes longer than under the slowest of the Transit alternatives.) The range of No Action highway times would be about 5 minutes longer than the Minimal Action range.

A general trend in the expected highway travel times is that the fastest travel times would be for the four Combination alternatives (with Combination Six-Lane Highway with AGS being the fastest) followed by the three Highway alternatives (with Reversible/HOV/HOT Lanes being about 3 minutes faster).

Eastbound Transit Travel

Transit travel characteristics for eastbound **summer Sunday**, from **Vail Transportation Center to Denver Tech Center:**

- The ordering of alternatives from least to greatest travel time would be:
  - A tie between the AGS alternative and the Combination Six-Lane Highway with AGS
  - The Combination Six-Lane Highway with Rail and IMC alternative
  - The Rail with IMC alternative
  - About a minute difference between the two Combination alternatives involving Bus in Guideway
  - The Dual-Mode Bus in Guideway alternative
  - The Diesel Bus in Guideway alternative
  - Minimal Action.
- Under each of the Combination alternatives, the AGS alternative, and the Rail with IMC alternative, travel times for riders who would leave Jefferson Station by driving would be less than or roughly equal to the 2000 highway travel time.
- The travel time for park-and-ride patrons would be about 15 minutes longer than existing for the Dual-Mode Bus in Guideway alternative, and about 20 minutes longer than existing for the Diesel Bus in Guideway alternative.
- The Minimal Action park-and-ride time would range from about 80 minutes more than the 2000 highway time to about 165 minutes more.

To summarize, AGS and the Combination alternative involving AGS would display the fastest travel times for both transit-all-the-way and those driving to Jefferson Station. The Rail with IMC and Combination Six-Lane Highway with Rail and IMC alternatives also would show similar travel times (though the Combination alternative would take about 5 minutes less), for both transit-all-the-way and those driving to Jefferson Station. This travel time performance would be followed by the Combination alternatives involving Bus in Guideway.

The Dual Mode Bus in Guideway would come next as it would have about a 5-minute advantage over the Diesel Bus. This would be due to the better performance of the Dual Mode Bus, as compared to Diesel Bus, over steep grades while in the guideway. Outside the guideway the Diesel Bus would have better performance but the traffic congestion on the highway would inhibit the Diesel Bus from taking advantage of it. As mentioned above, the Minimal Action alternative would have, by far, the longest transit travel time projected.

For an example trip from Vail Village to the Tech Center, the 2000 highway time is about 170 minutes. The same trip in 2025 is expected to take about 139 minutes for park-and-ride patrons under the AGS alternative, 156 minutes under the Combination alternative involving Rail and IMC, 161 minutes for the Rail with IMC alternative, 188 minutes under the Dual-Mode Bus in Guideway alternative, and from 251 to 337 minutes under Minimal Action.

For passengers using transit all the way from Vail Village, the AGS alternative (and the Combination alternative involving AGS) transit travel time would be 5 minutes more than the 2000 driving time. Other alternatives retain their relative ranking and travel time differences. Under Minimal Action, the transit travel time from Vail Village to the Tech Center would range from 290 to 375 minutes, or about 2 hours to 205 minutes longer than driving today.

Chart 2-13. Comparison of Travel Time for Trips from Vail to Denver Tech Center - Summer Sunday Eastbound

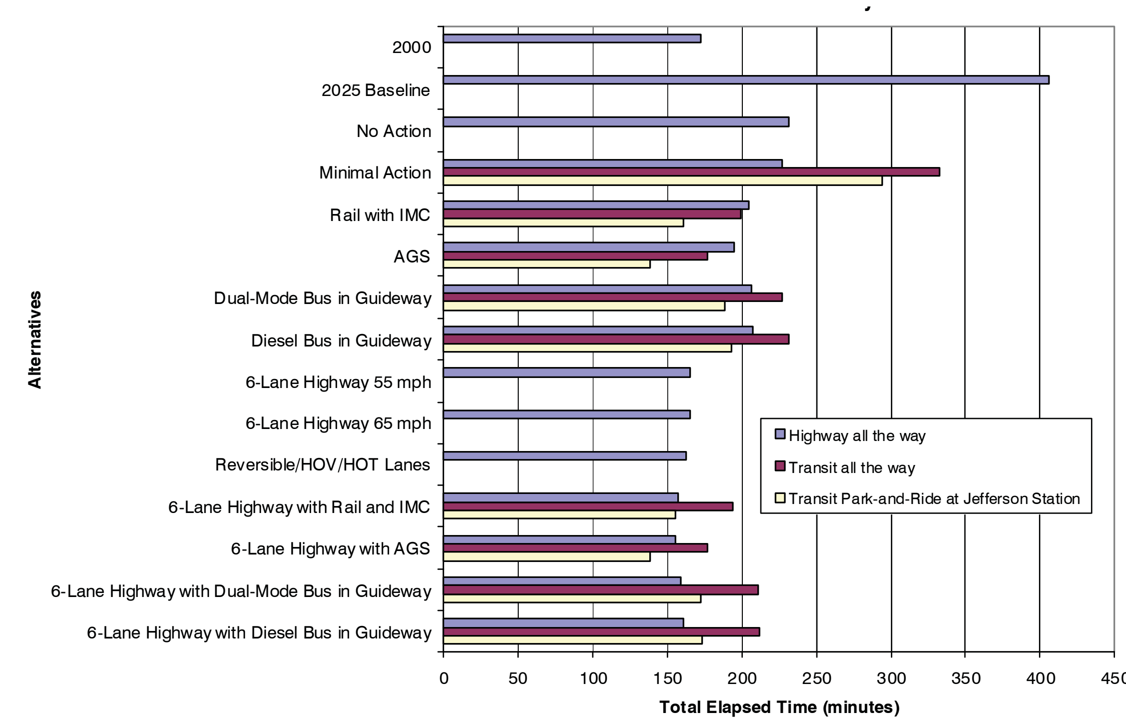


Table 2-17. Westbound Travel Times (Minutes) for Selected Origin-Destination Pairs and Model Days

Element of Purpose and Need			2000	2025 Baseline	No Action Alternative	Transit Alternatives					Highway Alternatives			Combination Highway/Transit Alternatives				
						1	2	3	4	5	6	7	8		9	10	11	12
						Minimal Action Alternative	Rail with IMC	Advanced Guideway System (AGS)	Dual-Mode Bus in Guideway	Diesel Bus in Guideway	6-Lane Highway 55 mph	6-Lane Highway 65 mph	Reversible/ HOV/HOT Lanes		6-Lane Highway with Rail and IMC	6-Lane Highway with AGS	6-Lane Highway with Dual-Mode Bus in Guideway	6-Lane Highway with Diesel Bus in Guideway
														9 / 10 / 11 / 12	9 - Build Combination Simultaneously	10 - Build Combination Simultaneously	11 - Build Combination Simultaneously	12 - Build Combination Simultaneously
														9a / 10a / 11a / 12a	9a - Build Transit and Preserve for Highway	10a - Build Transit and Preserve for Highway	11a - Build Transit and Preserve for Highway	12a - Build Transit and Preserve for Highway
														9b / 10b / 11b / 12b	9b - Build Highway and Preserve for Transit	10b - Build Highway and Preserve for Transit	11b - Build Highway and Preserve for Transit	12b - Build Highway and Preserve for Transit
Denver Metropolitan Area to Vail, Westbound, Winter Saturday	Highway All the Way	From Downtown Boulder	156	298	168 – 199	167 – 196	165	165	165	167	177	177	140	9 / 10 / 11 / 12	165	159	165	166
														9a / 10a / 11a / 12a	165	165	165	167
														9b / 10b / 11b / 12b	177	177	177	177
		From Downtown Littleton	143	283	153 – 184	152 – 181	151	150	150	153	162	162	125	9 / 10 / 11 / 12	150	144	150	152
														9a / 10a / 11a / 12a	151	150	150	153
														9b / 10b / 11b / 12b	162	162	162	162
		From Denver Tech Center	150	292	162 – 193	161 – 191	160	159	159	162	171	171	134	9 / 10 / 11 / 12	159	153	159	160
														9a / 10a / 11a / 12a	160	159	159	162
														9b / 10b / 11b / 12b	171	171	171	171
		From DIA	160	302	172 – 203	171 – 200	169	169	169	171	181	181	144	9 / 10 / 11 / 12	169	163	169	170
														9a / 10a / 11a / 12a	169	169	169	171
														9b / 10b / 11b / 12b	181	181	181	181
	Transit Park-and-Ride	From Downtown Boulder	**Assumptions:** • Travel Times calculated between Denver metropolitan area transportation centers and Vail Village transit center. • Existing RTD services and DRCOG 2025 financially constrained plan • I-70 Routes as described in section 2.2 • Operating Plan as described in Appendix E • For Rail and AGS traveler uses first train serving that destination • Wait time is ½ headway at stations **Note:** No Corridor-wide transit service is assumed in 2000, under the 2025 Baseline scenario, or under the No Action alternative.			205 – 230	167	147	175	176	No Corridor-wide transit service is assumed under the Highway alternatives.			9 / 10 / 11 / 12	167	147	180	184
														9a / 10a / 11a / 12a	167	147	175	176
														9b-12b	No Corridor-wide transit service is available under the Highway with Transit Preservation alternatives.			
		From Downtown Littleton				190 – 215	152	132	161	162				9 / 10 / 11 / 12	152	133	165	169
														9a / 10a / 11a / 12a	152	132	161	162
														9b-12b	No Corridor-wide transit service is available under the Highway with Transit Preservation alternatives.			
		From Denver Tech Center				199 – 225	161	141	170	170				9 / 10 / 11 / 12	161	142	174	178
														9a / 10a / 11a / 12a	161	141	170	170
														9b-12b	No Corridor-wide transit service is available under the Highway with Transit Preservation alternatives.			
		From DIA				209 – 234	171	151	179	180				9 / 10 / 11 / 12	171	152	184	188
														9a / 10a / 11a / 12a	171	151	179	180
														9b-12b	No Corridor-wide transit service is available under the Highway with Transit Preservation alternatives.			
	Transit All the Way	From Downtown Boulder				273 – 297	235	215	244	244				9 / 10 / 11 / 12	235	216	248	252
														9a / 10a / 11a / 12a	235	215	244	244
														9b-12b	No Corridor-wide transit service is available under the Highway with Transit Preservation alternatives.			
		From Downtown Littleton				235 – 259	196	177	205	206				9 / 10 / 11 / 12	196	177	209	213
														9a / 10a / 11a / 12a	196	177	205	206
														9b-12b	No Corridor-wide transit service is available under the Highway with Transit Preservation alternatives.			
		From Denver Tech Center				237 – 261	199	179	207	208				9 / 10 / 11 / 12	199	179	211	216
														9a / 10a / 11a / 12a	199	179	207	208
														9b-12b	No Corridor-wide transit service is available under the Highway with Transit Preservation alternatives.			
		From DIA				244 – 268	205	186	214	215				9 / 10 / 11 / 12	205	186	218	222
														9a / 10a / 11a / 12a	205	186	214	215
														9b-12b	No Corridor-wide transit service is available under the Highway with Transit Preservation alternatives.			

Note: N/A = Not applicable or not available, for example, in the case of a scenario or alternative with no Corridor-wide transit system.

Table 2-18.Travel Times (Minutes) for Selected Origin-Destination Pairs and Model Days

Element of Purpose and Need			2000	2025 Baseline	No Action Alternative	Transit Alternatives: 1 Minimal Action Alternative	2 Rail with IMC	3 Advanced Guideway System (AGS)	4 Dual-Mode Bus in Guideway	5 Diesel Bus in Guideway	Highway Alternatives: 6 6-Lane Highway 55 mph	7 6-Lane Highway 65 mph	8 Reversible/ HOV/HOT Lanes	Sub-alternative	Combination Highway/Transit Alternatives: 9 6-Lane Highway with Rail and IMC	10 6-Lane Highway with AGS	11 6-Lane Highway with Dual-Mode Bus in Guideway	12 6-Lane Highway with Diesel Bus in Guideway
														9, 10, 11, 12 - Build Combination Simultaneously 9a, 10a, 11a, 12a - Build Transit and Preserve for Highway 9b, 10b, 11b, 12b - Build Highway and Preserve for Transit				
Vail to Denver Metropolitan Area, Eastbound, Summer Sunday	Highway All the Way	To Downtown Boulder	195	429	214 – 295	209 – 290	227	218	230	230	188	188	185	9 / 10 / 11 / 12	180	179	182	183
														9a / 10a / 11a / 12a	227	218	230	230
														9b / 10b / 11b / 12b	175	175	175	175
		To Downtown Littleton	169	403	188 – 269	183 – 264	202	192	204	204	162	162	159	9 / 10 / 11 / 12	154	153	156	157
														9a / 10a / 11a / 12a	202	192	204	204
														9b / 10b / 11b / 12b	155	155	155	155
		To Denver Tech Center	172	406	192 – 272	186 – 268	205	195	207	207	165	165	162	9 / 10 / 11 / 12	157	156	160	161
														9a / 10a / 11a / 12a	205	195	207	207
														9b / 10b / 11b / 12b	163	163	163	163
		To DIA	190	423	209 – 289	203 – 284	222	212	224	225	182	182	180	9 / 10 / 11 / 12	175	173	177	178
														9a / 10a / 11a / 12a	222	212	224	225
														9b / 10b / 11b / 12b	175	175	175	175
	Transit Park-and-Ride	To Downtown Boulder				274 – 359	183	162	211	216				9 / 10 / 11 / 12	179	162	195	196
														9a / 10a / 11a / 12a	183	162	211	216
														9b-12b	No Corridor-wide transit service is available under the Highway with Transit Preservation alternatives.			
		To Downtown Littleton				248 – 333	158	136	185	190				9 / 10 / 11 / 12	153	136	169	170
														9a / 10a / 11a / 12a	158	136	185	190
														9b-12b	No Corridor-wide transit service is available under the Highway with Transit Preservation alternatives.			
		To Denver Tech Center				251 – 337	161	139	188	193				9 / 10 / 11 / 12	156	139	173	174
														9a / 10a / 11a / 12a	161	139	188	193
														9b-12b	No Corridor-wide transit service is available under the Highway with Transit Preservation alternatives.			
		To DIA				268 – 354	178	156	206	210				9 / 10 / 11 / 12	173	156	190	191
														9a / 10a / 11a / 12a	178	156	206	210
														9b-12b	No Corridor-wide transit service is available under the Highway with Transit Preservation alternatives.			
	Transit All the Way	To Downtown Boulder				326 – 411	236	214	263	268				9 / 10 / 11 / 12	231	214	247	248
														9a / 10a / 11a / 12a	236	214	263	268
														9b-12b	No Corridor-wide transit service is available under the Highway with Transit Preservation alternatives.			
		To Downtown Littleton				287 – 373	197	175	225	229				9 / 10 / 11 / 12	192	175	209	210
														9a / 10a / 11a / 12a	197	175	225	229
														9b-12b	No Corridor-wide transit service is available under the Highway with Transit Preservation alternatives.			
		To Denver Tech Center				290 – 375	199	177	227	231				9 / 10 / 11 / 12	194	177	211	212
														9a / 10a / 11a / 12a	199	177	227	231
														9b-12b	No Corridor-wide transit service is available under the Highway with Transit Preservation alternatives.			
		To DIA				296 – 382	206	184	234	238				9 / 10 / 11 / 12	201	184	218	219
														9a / 10a / 11a / 12a	206	184	234	238
														9b-12b	No Corridor-wide transit service is available under the Highway with Transit Preservation alternatives.			

Assumptions:
- Travel Times calculated between Denver metropolitan area transportation centers and Vail Village transit center.
- Existing RTD services and DRCOG 2025 financially constrained plan
- I-70 Routes as described in section 2.2
- Operating Plan as described in Appendix E
- For Rail and AGS traveler uses first train serving that destination
- Wait time is ½ headway at stations

Note: No Corridor-wide transit service is assumed in 2000, under the 2025 Baseline scenario, or under the No Action alternative.

No Corridor-wide transit service is assumed under the Highway alternatives.

Note: N/A = Not applicable or not available, for example, in the case of a scenario or alternative with no Corridor-wide transit system.

2.3.5 Congestion Comparison

This section provides comparisons of alternatives based on both **annual hours of congestion** and **peak-day hours of congestion,** which are calculated at the 10 focal points selected to represent levels of congestion in the Corridor. Each focal point is described in Chapter 1, Purpose of and Need for Action. "Hours of congestion" is a measure of the ability of each alternative to accommodate the levels of travel demand described in section 2.3.3.

The initial step in the analysis of congestion was to select the following focal points for the comparisons of alternatives from among the 10 points that are evaluated in Appendix B:

Key westbound focal points

- Genesee
- Top of Floyd Hill
- Twin Tunnels
- East of Empire Junction
- EJMT
- Dowd Canyon

Key eastbound focal points

- Dowd Canyon
- West of Silverthorne
- EJMT
- East of Empire Junction
- Twin Tunnels
- Top of Floyd Hill
- Genesee

The remaining focal points were not included in the comparisons, because there would be little or no congestion at those locations. For example, both the No Name Tunnels and East of Eagle focal points would be able to accommodate the Baseline travel demand without congestion. Congestion is defined as traffic that operates at a level of service (LOS) of "F," or stop-and-go traffic.

Annual hours of congestion comparisons quantify the peak hours throughout the entire year, while peak-day hours of congestion provide a measure of the ability of alternatives to accommodate travel demand projected for summer and winter recreation trips. Representative model days were also chosen to compare peak-day hours of congestion (LOS F) at the key focal points on a consistent basis. **Winter Saturday** was chosen to examine the westbound key focal points from Genesee to the EJMT, since this day currently experiences noticeable queuing and slowing, such as at the Floyd Hill lane drop and at Georgetown Hill. For the eastbound focal points from West of Silverthorne to Genesee, volumes on **summer Sunday** are heavy for several hours at a time, as Denver metropolitan area residents return from recreation in the Corridor. **Summer Friday** is the peak day in either direction at Dowd Canyon.

How Congestion is Calculated

- Hours of congestion are calculated on a daily directional basis and on an annual basis. Alternatives with a higher number of congestion hours during a year are considered to be functioning worse in traffic operation than alternatives with a lower number of congestion hours. The annual congestion hours and demands were determined from the daily directional level and reported as annual totals. A congested hour is defined as one in which the traffic is expected to operate under stop-and-go conditions – that is, LOS F. Congestion hours and "percent of annual hours under congestion" are reported for 10 focal points per alternative in Appendix B.
- Hours of directional peak-day congestion and annual hours of congestion are given in the Travel Characteristics figures in Appendix B for each segment. This represents the number of hours the traffic flows at LOS F on a peak day for the segment.
- Changes in peak-day level of service (LOS) and travel time (minutes per vehicle trip eastbound or westbound) are determinants of how well an alternative is functioning under the peak-hour demand of that alternative for specific model days. This mobility comparison shows each alternative's travel time and LOS for representative segments of the Corridor.

The third step was to establish congestion criteria for highway travel, and to calculate annual average hours of congestion and peak-day hours of congestion for eastbound and westbound at the 10 focal points, which are described in Chapter 1 and Appendix B.

Thresholds. For the annual hours of congestion at a location, "365 hours per year" was selected as the threshold for the greatest, or red, category since it represents the point at which congestion (LOS F, or stop-and-go traffic) could occur for a substantial period, for example, 6 hours or greater per day during 40 to 60 peak days of the year. The 365-hour threshold was used to define the problematic areas in Chapter 1.

Table 2-19 shows more specific examples of how 365 hours of congestion (LOS F) might be distributed within a year, if certain other days also experienced as much congestion as a particular model day. Keep in mind that the table does *not* show the hours of congestion expected under any particular scenario, but the pattern of hours necessary to exceed the 365-hour threshold.

The longest model day hours of congestion shown in the table is eastbound at West of Silverthorne (under the 2025 Baseline scenario), for about 16 hours and 50 minutes on a summer Sunday. About 22 such similar days at this location would result in 365 annual hours of congestion.

For another example, the shortest duration of congestion shown in Table 2-19 is westbound at Genesee, with about 1 hour and 20 minutes of congestion on a winter Saturday. As many as 258 such days would be required to reach the 365-hour threshold. Of course, some of these congested days would have to occur on weekdays and summer weekends, because there are fewer than 258 winter weekends each year.

Table 2-19. Distribution of Annual Hours of Congestion (LOS F) Under 2000 or 2025 Baseline Travel Patterns

Focal Point	Direction	Peak Day	365 hours of Congestion (LOS F) per year Corresponds to …
Dowd Canyon	EB	Summer Friday	33 days of 11 hours LOS F
	WB	Summer Friday	140 days of 2 hours 40 minutes LOS F
Vail Pass	EB	Summer Sunday	25 days of 14 hours 40 minutes LOS F
West of Silverthorne	EB	Summer Sunday	22 days of 16 hours 50 minutes LOS F
EJMT	EB	Summer Sunday	60 days of 6 hours LOS F, ***or*** 73 days of 5 hours LOS F
	WB	Summer Saturday	90 days of 4 hours LOS F
East of Empire Junction	EB	Summer Sunday	52 days of 7 hours LOS F, ***or*** 49 days of 7 hours 30 minutes LOS F
	WB	Winter Saturday	40 days of 9 hours 10 minutes LOS F, ***or*** 49 days of 7 hours 30 minutes LOS F
Twin Tunnels	EB	Summer Sunday	67 days of 5 hours 30 minutes LOS F
	WB	Winter Saturday	23 days of 15 hours 40 minutes LOS F, ***or*** 77 days of 4 hours 50 minutes LOS F
Floyd Hill	EB	Summer Sunday	75 days of 4 hours 50 minutes LOS F
	WB	Winter Saturday	43 days of 8 hours 30 minutes LOS F, ***or*** 110 days of 3 hours 20 minutes LOS F
Genesee	EB	Summer Sunday	97 days of 3 hours 50 minutes LOS F
	WB	Winter Saturday	258 days of 1 hours 20 minutes LOS F

Source: CDOT, JFSA

Notes: Examples may not compute to exactly 365 hours of congestion due to rounding to whole days and daily hours of congestion to 10 minutes

A lower threshold of 120 hours per year was selected to distinguish intermediate congestion (yellow) from least congestion (green), because that quantity of congestion corresponds to 60 peak days (about the current number of weekends with congestion) having 2 hours of congestion each.

To summarize, congestion thresholds are as follows:

- Least hours of congestion (119 hours or less per year)
- Intermediate hours of congestion (120 to 364 hours per year)
- Greatest hours of congestion (365 or more hours per year)

Westbound Corridor-Wide Annual Hours of Congestion (LOS F) Comparisons

Annual hours of highway congestion are provided for eastbound and westbound directions on Table 2-20. All alternatives would reduce the Corridor-wide annual hours of congestion from the Baseline scenario, which falls within the greatest hours of congestion range in the westbound direction. Alternatives would rank in the following order from worst-performing to best-performing:

- While the No Action and Minimal Action alternatives would result in a reduction in annual hours of congestion, they would not accommodate the Baseline travel demand. However, as described in Section 2.2, interchange improvements and auxiliary lanes in the Minimal Action alternative would improve local capacity in the Corridor, and improve the ability to accommodate Baseline travel demand over the No Action alternative.
- The Transit-only alternatives would reduce congestion from Baseline levels, although congestion at the greatest and intermediate ranges would occur at Genesee, Top of Floyd Hill, Twin Tunnels, and Dowd Canyon focal points.
- The Six-Lane Highway (55 mph or 65 mph) alternatives and Combination alternatives would be similar and would result in uncongested travel conditions at each focal point except at the Top of Floyd Hill, where congestion would remain at the greatest range. Annual hours of congestion for the Highway alternatives would exceed the projected Baseline hours of annual congestion at the Top of Floyd Hill.
- The Reversible/HOV/HOT Lanes alternative would operate in the least hours of congestion range at each of the key focal points except at the Top of Floyd Hill, where it would be in the intermediate range. The Reversible/HOV/HOT Lanes alternative would still result in the lowest annual hours of congestion at the Top of Floyd Hill compared to the Baseline and all other alternatives.

Eastbound Corridor-Wide Annual Hours of Congestion (LOS F) Comparisons

All alternatives would reduce Corridor-wide annual hours of congestion from the Baseline scenario in the eastbound direction except at the Top of Floyd hill and Genesee focal points. Table 2-20 illustrates that the overall eastbound annual hours of congestion for Baseline travel are about one-third of that in the westbound direction. At two focal points, West of Silverthorne and the Top of Floyd Hill, Baseline would fall into the intermediate hours of congestion range. At Dowd Canyon, Baseline would be in the least hours of congestion range. Eastbound Baseline travel would be in the greatest hours of congestion range at four of the focal points: EJMT, East of Empire Junction, Twin Tunnels, and Genesee. Alternatives would rank in the following order from worst-performing to best-performing:

- While the No Action and Minimal Action alternatives would result in a reduction in annual hours of congestion, they would not accommodate the Baseline travel demand.
- Highway and Combination alternatives would result in a considerably higher level of congestion than Baseline at the Top of Floyd Hill and Genesee, where annual person trips would more that double between year 2000 and 2025 Baseline. At the Top of Floyd Hill, annual person trips would grow from approximately 25,000,000 to 64,000,000; and at Genesee, annual person trips would grow from approximately 36,000,000 to 73,000,000.
- The Transit-only alternatives would operate in the best and intermediate range of annual hours of congestion at the Top of Floyd Hill and Genesee.

Table 2-20. Annual Hours of Congestion (LOS F)

Element of Purpose and Need		2025 Baseline	No Action Alternative	1 Minimal Action Alternative	2 Rail with IMC	3 Advanced Guideway System (AGS)	4 Dual-Mode Bus in Guideway	5 Diesel Bus in Guideway	6 6-Lane Highway 55 mph	7 6-Lane Highway 65 mph	8 Reversible/ HOV/HOT Lanes	9 6-Lane Highway with Rail and IMC (9 - Build Combination simultaneously; 9a - Build Transit first; 9b - Build Highway first)	10 6-Lane Highway with AGS (10 - Build Combination simultaneously; 10a - Build Transit first; 10b - Build Highway first)	11 6-Lane Highway with Dual-Mode Bus in Guideway (11 - Build Combination simultaneously; 11a - Build Transit first; 11b - Build Highway first)	12 6-Lane Highway with Diesel Bus in Guideway (12 - Build Combination simultaneously; 12a - Build Transit first; 12b - Build Highway first)
				Transit Alternatives					Highway Alternatives			Combination Highway/Transit Alternatives			
Annual Hours of Congestion (LOS F): **Westbound**	Genesee (mp 254)	1,550	1,004	1,019	930	978	1,000	989	47	47	66	9: 45 9a: 930 9b: 47	10: 42 10a: 978 10b: 47	11: 44 11a: 1,000 11b: 47	12: 45 12a: 989 12b: 47
	Top of Floyd Hill (mp 246)	1,100	617	578	484	500	542	531	1,123	1,123	131	9: 1,030 9a: 484 9b: 1,123	10: 981 10a: 500 10b: 1,123	11: 1,043 11a: 542 11b: 1,123	12: 1,064 12a: 531 12b: 1,123
	Twin Tunnels (mp 242)	690	214	262	161	157	206	198	67	67	25	9: 46 9a: 161 9b: 67	10: 43 10a: 157 10b: 67	11: 52 11a: 206 11b: 67	12: 55 12a: 198 12b: 67
	East of Empire Junction (mp 233)	590	249	5	2	2	3	3	39	39	52	9: 24 9a: 2 9b: 39	10: 22 10a: 2 10b: 39	11: 28 11a: 3 11b: 39	12: 30 12a: 3 12b: 39
	EJMT (mp 214)	719	316	67	45	41	52	52	23	23	55	9: 13 9a: 45 9b: 23	10: 12 10a: 41 10b: 23	11: 16 11a: 52 11b: 23	12: 18 12a: 52 12b: 23
	Dowd Canyon (mp 172)	560	560	540	362	347	500	516	0	0	0	9: 0 9a: 362 9b: 0	10: 0 10a: 347 10b: 0	11: 0 11a: 500 11b: 0	12: 0 12a: 516 12b: 0
	Total	5,209	2,959	2,471	1,985	2,026	2,304	2,290	1,300	1,300	329	9: 1,158 9a: 1,985 9b: 1,300	10: 1,099 10a: 2,026 10b: 1,300	11: 1,183 11a: 2,304 11b: 1,300	12: 1,212 12a: 2,290 12b: 1,300
Annual Hours of Congestion (LOS F): **Eastbound**	Dowd Canyon (mp 172)	100	100	65	23	21	33	34	0	0	0	9: 0 9a: 23 9b: 0	10: 0 10a: 21 10b: 0	11: 0 11a: 33 11b: 0	12: 0 12a: 34 12b: 0
	West of Silverthorne (mp 204)	174	92	30	17	15	21	21	167	167	170	9: 125 9a: 17 9b: 167	10: 118 10a: 15 10b: 167	11: 140 11a: 21 11b: 167	12: 151 12a: 21 12b: 167
	EJMT (mp 214)	580	499	276	158	145	194	194	27	27	22	9: 17 9a: 158 9b: 27	10: 16 10a: 145 10b: 27	11: 20 11a: 194 11b: 27	12: 22 12a: 194 12b: 27
	East of Empire Junction (mp 233)	490	305	324	206	185	229	227	33	33	23	9: 21 9a: 206 9b: 33	10: 20 10a: 185 10b: 33	11: 24 11a: 229 11b: 33	12: 26 12a: 227 12b: 33
	Twin Tunnels (mp 242)	740	618	435	279	254	310	306	28	28	102	9: 15 9a: 279 9b: 28	10: 13 10a: 254 10b: 28	11: 18 11a: 310 11b: 28	12: 20 12a: 306 12b: 28
	Top of Floyd Hill (mp 246)	300	260	114	68	71	85	83	585	585	549	9: 507 9a: 68 9b: 585	10: 486 10a: 71 10b: 585	11: 549 11a: 85 11b: 585	12: 558 12a: 83 12b: 585
	Genesee (mp 254)	584	525	394	291	308	335	329	1,096	1,096	1,100	9: 947 9a: 291 9b: 1,096	10: 908 10a: 308 10b: 1,096	11: 1,056 11a: 335 11b: 1,096	12: 1,069 12a: 329 12b: 1,096
	Total	3,068	2,430	1,655	1,052	1,009	1,218	1,205	1,936	1,936	1,965	9: 1,632 9a: 1,052 9b: 1,936	10: 1,560 10a: 1,009 10b: 1,936	11: 1,807 11a: 1,218 11b: 1,936	12: 1,846 12a: 1,205 12b: 1,936

Legend

- Least hours of congestion (119 hours or less)
- Intermediate hours of congestion (120 to 364 hours)
- Greatest hours of congestion (365 hours or more)

Note: Focal points not shown have little (less than 120 hours) or no congestion under all alternatives and, therefore, would have green coding for all cells in the omitted rows.

Table 2-21. Daily Hours of Congestion (LOS F)

Combination alternative variants: 9, 10, 11, 12 – Build Combination simultaneously; 9a, 10a, 11a, 12a – Build Transit First; 9b, 10b, 11b, 12b – Build Highway First.

Element of Purpose and Need		2025 Baseline	No Action Alternative	Minimal Action Alternative	Rail with IMC	Advanced Guideway System (AGS)	Dual-Mode Bus in Guideway	Diesel Bus in Guideway	6-Lane Highway 55 mph	6-Lane Highway 65 mph	Reversible/ HOV/HOT Lanes	6-Lane Highway with Rail and IMC			6-Lane Highway with AGS			6-Lane Highway with Dual-Mode Bus in Guideway			6-Lane Highway with Diesel Bus in Guideway		
					Transit Alternatives				Highway Alternatives			Combination Highway/Transit Alternatives											
				1	2	3	4	5	6	7	8	9	9a	9b	10	10a	10b	11	11a	11b	12	12a	12b
Winter Saturday Hours of Congestion (LOS F): **Westbound**	Genesee (mp 254)	6	0	0	0	0	0	0	4	4	4	4	0	4	4	0	4	4	0	4	4	0	4
	Top of Floyd Hill (mp 246)	10	0	2	2	2	2	2	8	8	3	7	2	8	7	2	8	7	2	8	8	2	8
	Twin Tunnels (mp 242)	9	4	7	4	4	5	5	3	3	0	2	4	3	2	4	3	2	5	3	2	5	3
	East of Empire Junction (mp 233)	12	4	0	0	0	0	0	1	1	0	0	0	1	0	0	1	0	0	1	0	0	1
	EJMT (mp 214)	7	0	2	1	1	1	1	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0
	West of Silverthorne (mp 204)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Summer Thursday Hours of Congestion (LOS F): Dowd Canyon (mp172)	**Westbound**	4	4	4	3	3	4	4	0	0	0	0	3	0	0	3	0	0	4	0	0	4	0
	Eastbound	3	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Summer Sunday Hours of Congestion (LOS F): **Eastbound**	West of Silverthorne (mp 204)	8	3	2	1	1	1	1	8	8	8	6	1	8	6	1	8	7	1	8	7	1	8
	EJMT (mp 214)	8	7	8	4	4	5	5	1	1	1	1	4	1	1	4	1	1	5	1	1	5	1
	East of Empire Junction (mp 233)	10	8	9	6	5	6	6	1	1	1	1	6	1	1	5	1	1	6	1	1	6	1
	Twin Tunnels (mp 242)	11	8	12	8	7	9	8	1	1	1	1	8	1	0	7	1	1	9	1	1	8	1
	Top of Floyd Hill (mp 246)	4	3	5	3	3	4	3	9	9	9	8	3	9	7	3	9	8	4	9	9	3	9
	Genesee (mp 254)	6	5	10	8	8	9	9	11	11	11	10	8	11	9	8	11	11	9	11	11	9	11

Note: Days shown do not necessarily represent the day with the greatest hours of congestion (LOS F) for a particular location and alternative. Rather, Corridor-wide travel patterns were used to determine the days shown above.

Summer Friday · *Summer Sunday* · *Winter Saturday*

Chart 2-14. Annual Hours of Congestion Westbound

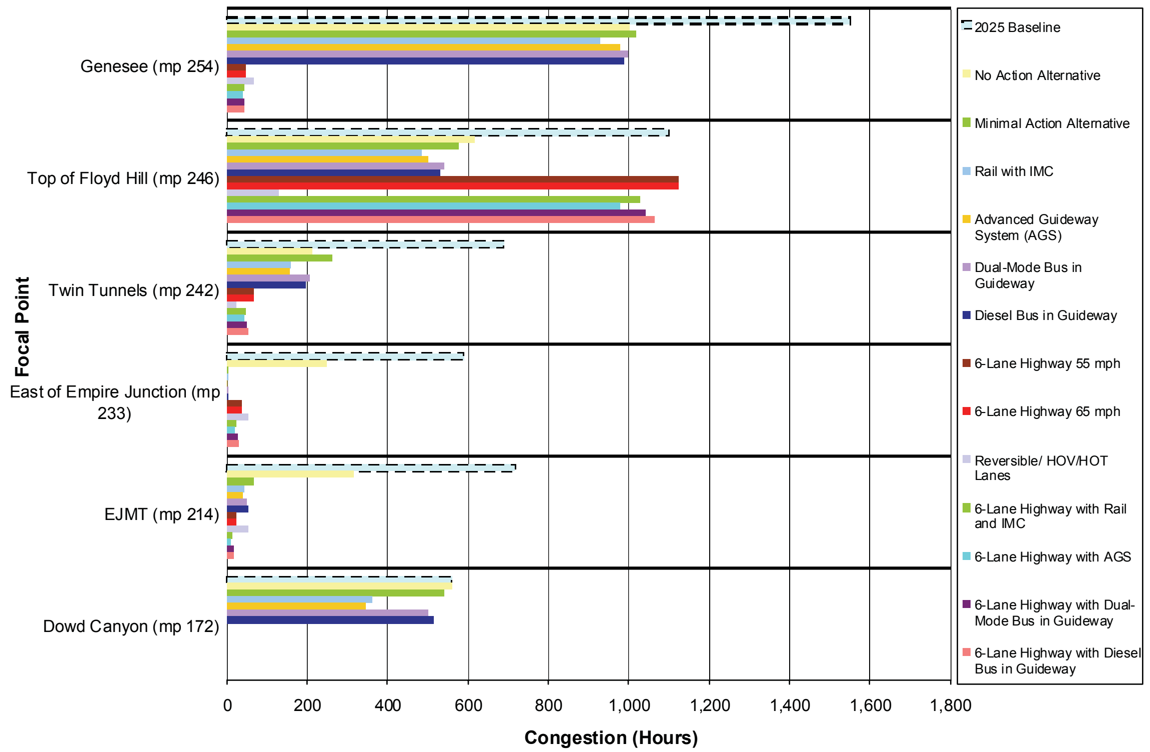


Chart 2-15. Selected Model Day Hours of Congestion: Westbound

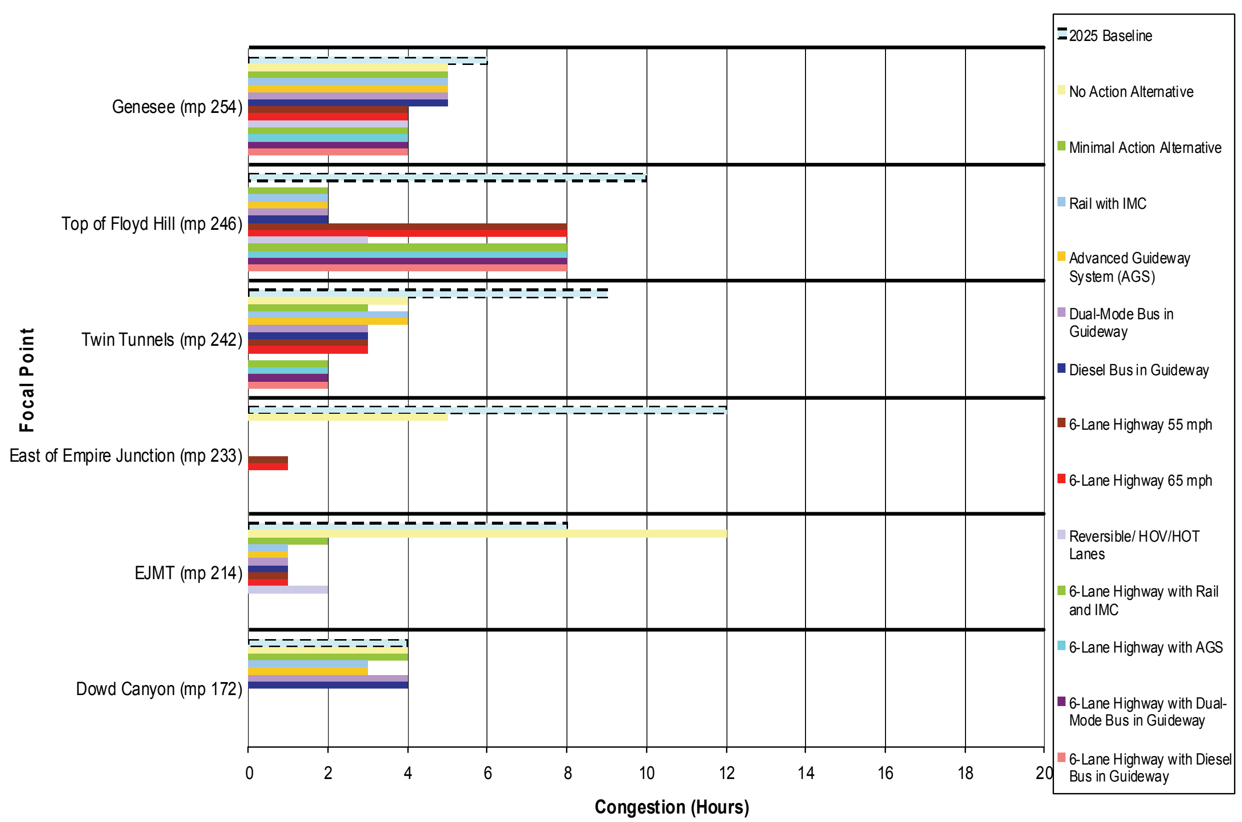


Chart 2-16. Annual Hours of Congestion Eastbound

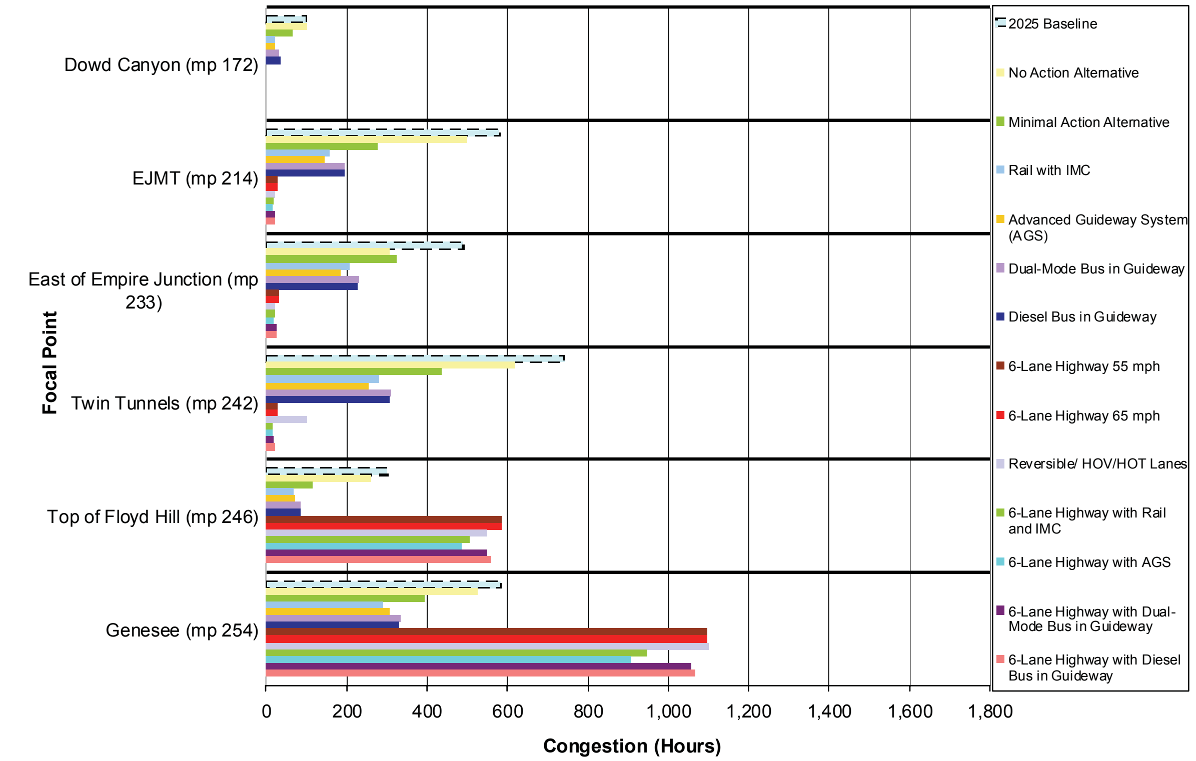
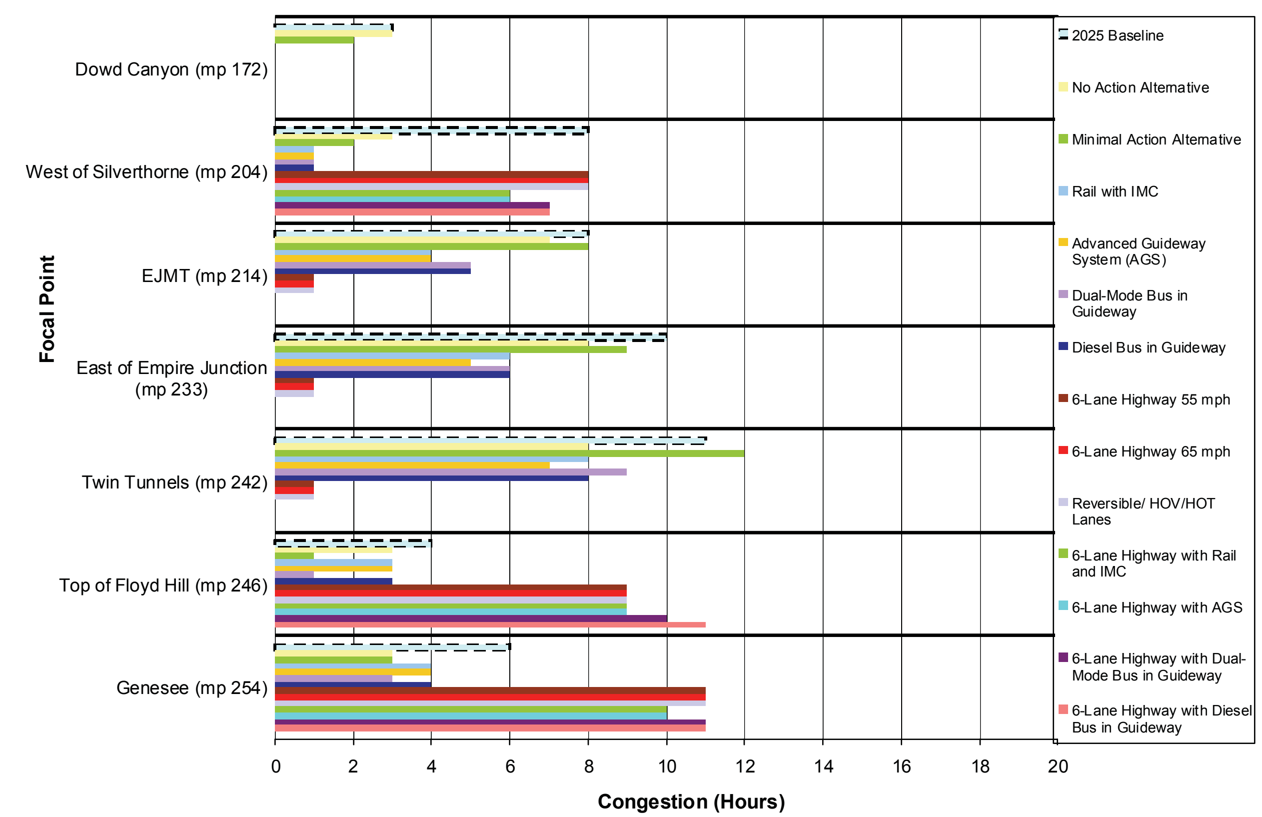


Chart 2-17. Selected Model Day Hours of Congestion: Eastbound



Westbound Annual and Peak-Day Hours of Congestion (LOS F) at Focal Points

This section provides a summary of westbound annual and peak day hours of congestion as illustrated on the following tables and charts:

- Table 2-20. Annual Hours of Congestion (LOS F)
- Table 2-21. Daily Hours of Congestion (LOS F)
- Chart 2-14. Annual Hours of Congestion Westbound
- Chart 2-15. Selected Model Day Hours of Congestion: Westbound

Genesee (milepost 254)

Annual Hours of Congestion

Westbound at Genesee, the Baseline scenario results in 1,550 hours of congestion per year, falling in the greatest hours of congestion range. Alternatives would rank in the following order, from worst-performing to best-performing:

- The No Action, Minimal Action, and Transit alternatives would fall into the greatest range for annual hours of congestion. The No Action and Minimal Action alternatives would result in a trip reduction of approximately 33 percent from Baseline, attributable to trip suppression. However, as described in Section 2.2, interchange improvements and auxiliary lanes in the Minimal Action alternative would improve local capacity in the Corridor, and improve the ability to accommodate Baseline travel demand over the No Action alternative.
- The Six-Lane Highway (55 and 65 mph) and Combination alternatives, which would include an auxiliary climbing lane from the Morrison (Hogback) Interchange (milepost 259) to the Chief Hosa Interchange (milepost 253), each would experience less than 50 hours of congestion annually, therefore falling into the least hours of congestion range. While still among alternatives in the least range, the Reversible/HOV/HOT Lanes would result in the over 60 hours of congestion annually in this segment.

Selected Model Day Hours of Congestion

On winter Saturday, the alternatives fall into two categories at Genesee:

- No Action, Minimal Action, and the Transit alternatives are not projected to experience any hours of congestion, contrary to the annual result.
- Each of the Highway alternatives and Combination alternatives are forecast to experience 4 hours of congestion on winter Saturday. For comparison, 6 hours of congestion are predicted westbound at Genesee under the Baseline scenario.

Top of Floyd Hill (milepost 246)

Annual Hours of Congestion

The Baseline scenario is in the greatest hours of congestion range, at 1,100 annual hours. All alternatives other than Reversible/HOV/HOT Lanes would also fall in the greatest hours of congestion range and rank in the following order, from worst-performing to best-performing:

- The Six-Lane Highway (55 or 65 mph) and Combination alternatives would have greater hours of congestion than Baseline or any of the other alternatives, and twice those of the Transit alternatives.
- The No Action and Minimal Action alternatives have about half the hours of congestion as Baseline, but would fall into the greatest range for annual hours of congestion, and would result in trip suppression.
- The Transit alternatives would result in the next highest level of annual hours of congestion.
- The Reversible/HOV/HOT Lanes alternative would result in considerably fewer hours of congestion in this segment (131) and would be the only alternative falling in the intermediate range of annual hours of congestion.

Selected Model Day Hours of Congestion

On winter Saturday, the Baseline scenario is forecast to have 10 hours of congestion westbound, more than any alternative. The winter Saturday rank of alternatives, from worst-performing to best performing is:

- The Six-Lane Highway (55 or 65 mph) alternatives and the Combination Six-Lane Highway with Diesel Bus in Guideway "build simultaneously" alternative are each projected to experience 8 hours of congestion.
- The three remaining Combination alternatives are forecast to have 7 hours of congestion on winter Saturday. (Each of these Combination alternatives also has fewer annual hours of congestion than the Combination Six-Lane Highway with Diesel Bus in Guideway "build simultaneously" alternative.)
- With 3 hours of congestion westbound, the Reversible/HOV/HOT Lanes alternative ranks among the middle of alternatives for winter Saturday, while having the least annual hours of congestion.
- The Transit alternatives and Minimal Action are forecast to have 2 hours of congestion westbound on winter Saturday.
- Because winter Saturday trips are suppressed, the No Action alternative is not forecast to have any westbound hours of congestion at the Top of Floyd Hill. In contrast, on an annual basis, No Action has more hours of congestion than the Transit alternatives and Minimal Action.

Twin Tunnels (milepost 242)

Annual Hours of Congestion

The Baseline scenario is in the highest range and has congestion that lasts two to three times as long as the most congested alternative in this location. Alternatives would rank in the following order, from worst-performing to best-performing:

- The No Action and Minimal Action alternatives would be in the intermediate range for annual hours of congestion at the Twin Tunnels. The Minimal Action alternative would result in a greater duration of congestion than the No Action alternative, and both alternatives would result in trip suppression.
- The Transit alternatives would be in the intermediate range for annual hours of congestion at the Twin Tunnels.
- At the Twin Tunnels, the Highway and Combination alternatives would be in the least range for annual hours of congestion.

Selected Model Day Hours of Congestion

The Baseline scenario is forecast to have 9 hours of congestion westbound at the Twin Tunnels on winter Saturday, more than any alternative. For this model day, the ranking of alternatives, from worst-performing to best-performing, would be:

- Minimal Action, with 7 hours of congestion is the most congested alternative both on winter Saturday and annually.
- The two Bus in Guideway alternatives are projected to have 5 hours of congestion.

- Four hours of congestion results with the No Action, Rail with IMC, and AGS alternatives. No Action is less congested than the Bus in Guideway alternatives on winter Saturday, but more congested westbound at the Twin Tunnels annually.
- The remaining alternatives have the same ordering on winter Saturday as annually:
  - The two Six-Lane Highway alternatives are forecast to experience 3 hours of congestion westbound at the Twin Tunnels.
  - Each of the four Combination "build simultaneously" alternatives results in 2 hours of congestion.
  - The Reversible/HOV/HOT Lanes alternative is not forecast to experience any congestion westbound on winter Saturday at the Twin Tunnels. This alternative also has the least annual hours of congestion.

East of Empire Junction (milepost 233)

Annual Hours of Congestion

Westbound approaching Empire Junction, trucks leaving the Downieville weigh station ascend a moderate grade to rejoin the I-70 mainline. At the same time, automobiles bound for US 40 are beginning to move to the right-hand lane in anticipation of the Empire Junction off-ramp. These weaving movements involving vehicles of different sizes and speeds result in greater congestion. Weaving movements are an inefficient use of road capacity because vehicles changing lanes require a gap in the desired lane.

Under the Baseline scenario, which is in the highest range for annual hours of congestion, 590 hours of annual congestion would occur at this location. Alternatives would rank in the following order, from worst-performing to best-performing:

- With the trip suppression of the No Action alternative, about 249 hours per year would be expected to be congested. The No Action alternative would fall in the intermediate hours of congestion range in this segment.
- This three-lane section would reduce congestion to about 39 hours per year for each Highway alternative.
- The Minimal Action and Transit alternatives would provide a westbound auxiliary lane from Downieville to Empire Junction, resulting in annual congestion in the least range.

Selected Model Day Hours of Congestion

As with annual hours of congestion, the Baseline scenario has more hours of congestion at East of Empire Junction on winter Saturday – 12 hours – than any alternative. The winter Saturday ranking of alternatives, from worst-performing to best-performing, is:

- The No Action alternative is forecast to have 4 hours of congestion westbound at East of Empire Junction. No Action has the most hours of congestion of any alternative, annually and on winter Saturday at this focal point.
- The two Six-Lane Highway alternatives are projected to experience 1 hour of congestion here on winter Saturday.
- No hours of congestion are anticipated westbound at East of Empire Junction for any of the remaining alternatives – Minimal Action, the Transit alternatives, the Reversible/HOV/HOT Lanes alternative, and the Combination alternatives. Congestion on other model days accounts for the Reversible/HOV/HOT Lanes alternative having more annual hours of congestion than the Six-Lane Highway (55 or 65 mph) alternatives.

EJMT (milepost 214)

Annual Hours of Congestion

Approaching the Eisenhower Tunnel, the Baseline scenario is in the highest range and has congestion that lasts more than twice as long as the most congested alternative in this location. Alternatives would rank in the following order, from worst-performing to best-performing:

- At EJMT, the No Action alternative is the only alternative in the intermediate range for annual hours of congestion and would result in almost five times as much congestion as the Minimal Action alternative. The reduction from Baseline in hours of congestion for both the No Action and Minimal Action alternatives would reflect trip suppression. The reduction for the Minimal Action alternative reflects the addition of the auxiliary lanes on Georgetown Hill and at Bakerville to EJMT.
- The Transit, Highway, and Combination alternatives would also result in congestion in the least range.

Selected Model Day Hours of Congestion

Westbound on winter Saturday, the Baseline scenario is projected to result in 7 hours of congestion at EJMT, more than three times as long as the most congested alternative. For winter Saturday, the alternatives would rank in the following order, from worst-performing to best-performing:

- Two hours of congestion are forecast for Minimal Action.
- Each of the Transit alternatives (alone or with Highway Preservation) is projected to experience 1 hour of congestion on winter Saturday.
- No Action, the three Highway alternatives, the four Combination "build simultaneously" alternatives, and the Combination alternatives where the Six-Lane Highway is built first are all expected to have no congested hours on winter Saturday. (In contrast, No Action has the greatest annual hours of congestion, and the Reversible/HOV/HOT Lanes alternative has fewer annual hours of congestion than only No Action and Minimal Action.)

West of Silverthorne (mp 204)

No hours of congestion are projected to occur westbound at West of Silverthorne under the Baseline scenario or any alternative. Since no hours of congestion westbound are forecast here for any other model day, West of Silverthorne is not a key focal point westbound. It is not shown for westbound travel on Table 2-20, and it is shown as a row of zeros in Table 2-21.

Dowd Canyon (milepost 172)

Annual Hours of Congestion

At Dowd Canyon, annual hours of congestion of Baseline and the No Action, Minimal Action, and Bus in Guideway alternatives would be very similar, within the greatest range of annual hours of congestion. Alternatives would rank in the following order, from worst-performing to best-performing:

- The No Action and Minimal Action alternatives would be in the greatest range of annual hours of congestion.
- Bus in Guideway alternatives with buses traveling in mixed traffic in this area would be in the highest range for annual hours of congestion
- The relatively high congestion associated with the Transit alternatives – compared to the Highway alternatives – would suggest a benefit of widening to a six-lane highway through Dowd Canyon with the Transit alternatives.

- The AGS and Rail with IMC alternatives would be in the intermediate range for annual hours of congestion.
- The Highway and Combination "build simultaneously" alternatives or Combination alternatives where the Highway is built first would avoid congestion.

Selected Model Day Hours of Congestion

The summer Friday ranking of congestion hours westbound at Dowd Canyon is quite similar to the annual ranking. From the worst-performing to best performing alternatives, the summer Friday ranking is:

- No Action, Minimal Action, and the two Bus in Guideway alternatives would be the most congested, with 4 hours of summer Friday projected to operate at LOS F. These alternatives have the same duration of congestion as the Baseline scenario.
- The Rail with IMC and AGS alternatives (alone or with Highway Preservation) are forecast to experience 3 hours of congestion westbound through Dowd Canyon on summer Friday.
- The Highway alternatives and the Combination "build simultaneously" alternatives (or building the Six-Lane Highway first with Transit Preservation) would avoid congestion on all model days.

Eastbound Annual and Peak Day Hours of Congestion (LOS F) at Focal Points

This section provides a summary of eastbound annual and peak day hours of congestion as illustrated on the following tables and charts:

- Table 2-20. Annual Hours of Congestion (LOS F)
- Table 2-21. Daily Hours of Congestion (LOS F)
- Chart 2-16. Annual Hours of Congestion Eastbound
- Chart 2-17. Selected Model Day Hours of Congestion: Eastbound

Dowd Canyon (milepost 172)

Annual Hours of Congestion

All alternatives are anticipated to fall in the least range for annual hours of congestion for eastbound traffic at Dowd Canyon. Baseline, which is identical to the No Action alternative in this segment, is also in the least range. Alternatives would rank in the following order, from worst-performing to best-performing:

- The No Action alternative would have the highest level of congestion at this focal point, at the same level as the Baseline scenario.
- The Minimal Action alternative would result in the second-most congestion, about midway between that of No Action and that of the Transit alternatives. The reduced congestion would reflect trip suppression.
- The Transit alternatives would have similar hours of congestion to each other, although AGS and Rail with IMC would perform better than the Bus in Guideway alternatives.
- The Highway and Combination alternatives would not result in any congestion at either Dowd Canyon or the Vail Pass lane-drop.

Selected Model Day Hours of Congestion

On summer Friday eastbound through Dowd Canyon, both the Baseline scenario and No Action alternative are forecast to experience 3 hours of congestion. Minimal Action would perform slightly better, with 2 hours of congestion on summer Friday. The remaining alternatives – all of which involve major construction – would avoid eastbound congestion through Dowd Canyon on summer Friday.

West of Silverthorne (milepost 204)

Annual Hours of Congestion

The Baseline scenario is in the intermediate hours of congestion range eastbound at West of Silverthorne. Alternatives would rank in the following order, from worst-performing to best-performing:

- The Highway alternatives would have the highest amount of congestion, similar to the Baseline scenario, with the Reversible/HOV/HOT Lanes alternative having slightly more than the Six-Lane Highway (55 or 65 mph) alternatives. The three Highway alternatives would be in the intermediate range for annual hours of congestion at this Summit County focal point.
- Three of the Combination alternatives follow with similar levels of congestion. All Combination alternatives, with the exception of Combination Six-Lane Highway with AGS (which would be on the high end of the least range), would fall in the intermediate range of annual congestion hours at West of Silverthorne relative to other alternatives.
- The No Action, Minimal Action, and Transit alternatives and Combination Six-Lane Highway with AGS would fall in the least range for annual hours of congestion at West of Silverthorne.
- The No Action and Minimal Action alternatives would result in considerably less congestion than the Baseline scenario, resulting from suppression of travel.
- The Transit alternatives would offer further improvement, with similar levels of congestion between them.

Selected Model Day Hours of Congestion

Under the Baseline scenario, 8 hours of congestion are forecast on summer Sunday for eastbound vehicles passing the West of Silverthorne focal point. The summer Sunday ranking of alternatives, from worst-performing to best-performing, is similar to the annual ranking:

- The three Highway alternatives are projected to have the same 8 hours of congestion as under the Baseline scenario.
- The Combination Six-Lane Highway with Bus in Guideway "build simultaneously" alternatives would result in 7 hours of congestion on summer Sunday.
- The Combination Six-Lane Highway with Rail and IMC "build simultaneously" alternative and the Combination Six-Lane Highway with AGS "built simultaneously" alternative would each experience 6 hours of congestion here eastbound.
- Three hours of congestion are forecast for summer Sunday eastbound under No Action.
- The Minimal Action alternative results in 2 hours of congestion.
- Each of the Transit alternatives (alone or with Highway Preservation) is projected to experience 1 hour of congestion eastbound at West of Silverthorne.

EJMT (milepost 214)

Annual Hours of Congestion

The Baseline scenario results in 580 hours of congestion at EJMT and is in the greatest range for annual hours of congestion. Alternatives would rank in the following order, from worst-performing to best-performing:

- The No Action alternative, which would be in the greatest range for annual hours of congestion, would result in the most annual hours of congestion in this segment. Congestion for the No Action alternative would be somewhat lower than Baseline, resulting from trip suppression.
- The Minimal Action alternative would be in the intermediate range, the reduction from Baseline resulting from trip suppression.
- Transit alternatives would be in the intermediate range for annual hours of congestion. The AGS alternative would attract the greatest share of travelers to transit and would result in the least congestion among the Transit alternatives.
- The Highway alternatives would be in the least range for annual congestion.
- The Combination alternatives would also be in the least range for annual hours of congestion at the EJMT focal point.

Selected Model Day Hours of Congestion

Except for a change in ordering between No Action and Minimal Action, the summer Sunday ranking for daily hours of congestion eastbound approaching the Johnson Tunnel would be the same as the annual ranking:

- Eight hours of congestion are forecast for Minimal Action on summer Sunday, the same as for the Baseline scenario, and more than any other alternative.
- No Action is projected to result in 7 hours of congestion eastbound approaching the EJMT.
- The Bus in Guideway alternatives (alone or with Highway Preservation) would experience 5 hours of congestion eastbound on summer Sunday, and the other Transit alternatives – Rail with IMC and AGS (alone or with Highway Preservation) – are expected to encounter 4 hours of congestion on the same day.
- The Highway alternatives (alone or with Transit Preservation) and the Combination "build simultaneously" alternatives are not forecast to have any congestion eastbound on summer Sunday approaching the west portal of the EJMT.

East of Empire Junction (milepost 233)

Annual Hours of Congestion

Under the 2025 Baseline, 490 hours per year are expected to experience LOS F conditions at East of Empire Junction, putting it in the greatest range for annual hours of congestion. Alternatives would rank in the following order, from worst-performing to best-performing:

- The trip suppression associated with the Minimal Action and No Action alternatives would reduce congestion at East of Empire Junction. These alternatives would fall in the intermediate range for annual hours of congestion.
- The Transit alternatives would be in the intermediate range of congestion.
- The Highway and Combination alternatives, which would fall in the least range for annual hours of congestion, are expected to reduce congestion considerably at this focal point, to somewhere in the range of 20 to 33 hours.

Selected Model Day Hours of Congestion

The summer Sunday ranking of alternatives and the Baseline scenario results in the same order as for annual hours of congestion at East of Empire Junction:

- The Baseline scenario has more hours of congestion – 10 on summer Sunday – than any alternative.
- Among alternatives, Minimal Action has the greatest duration of congestion, with 9 hours projected to operate at LOS F.
- No Action results in 8 hours of congestion on summer Sunday eastbound at East of Empire Junction.
- The Transit alternatives are projected to experience 6 hours of congestion on summer Sunday, with the exception of the AGS alternative, which is forecast to have 5 hours of congestion.
- The Six-Lane Highway (55 mph) alternative alone or with Transit Preservation, the Six-Lane Highway (65 mph) alternative, the Reversible/HOV/HOT Lanes alternative, and the Combination "build simultaneously" alternatives are each expected to encounter 1 hour of congestion eastbound at the merge at East of Empire Junction.

Twin Tunnels (milepost 242)

Annual Hours of Congestion

The greatest congestion at the Twin Tunnels, 740 hours, occurs under the Baseline scenario. Alternatives would rank in the following order, from worst-performing to best-performing:

- The No Action and Minimal Action alternatives would be in the greatest range for annual hours of congestion.
- The Transit alternatives would be in the intermediate range for annual hours of congestion at the Twin Tunnels.
- Each of the Highway alternatives would result in substantially less congestion than the Transit alternatives and would fall in the least range. The eastbound Reversible/HOV/HOT Lanes alternative would be less effective than Reversible/HOV/HOT Lanes westbound as well as the Six-Lane Highway (55 or 65 mph) due to the transition required from two reversible lanes plus two general-purpose lanes to three general-purpose lanes east of this location. This would create a bottleneck for eastbound travel.
- The Combination alternatives would offer the least amount of congestion.

Selected Model Day Hours of Congestion

The 12 hours of congestion eastbound at the Twin Tunnels under Minimal Action on summer Sunday is more than the 11 hours of congestion expected under the Baseline scenario. The remaining alternatives, in decreasing order of congestion, rank as follows:

- The Dual-Mode Bus in Guideway alternative (alone or with Highway Preservation) is projected to result in 9 hours of congestion eastbound at the Twin Tunnels. (Annually, this alternative has fewer hours of congestion than No Action.)
- Eight hours of congestion eastbound is forecast for No Action, the Rail with IMC alternative, and the Diesel Bus in Guideway alternative on summer Sunday.
- The AGS alternative (alone or with Highway Preservation) would experience 7 summer Sunday congested hours.
- One hour of congestion on summer Sunday is expected for the Highway alternatives (alone or with Transit Preservation), the Combination Six-Lane Highway with Rail and IMC "build simultaneously" alternative, and the Combination Six-Lane Highway with Bus in Guideway "build simultaneously" alternatives.

- The Combination Six-Lane Highway with AGS "build simultaneously" alternative has the least congestion, with none expected on summer Sunday eastbound at the Twin Tunnels. This result is not surprising, since this alternative has the greatest capital cost and results in the greatest person-moving capacity.

Top of Floyd Hill (milepost 246)

Annual Hours of Congestion

The Baseline scenario at the Top of Floyd Hill results in 300 annual hours of congestion and falls in the intermediate range. Alternatives would rank in the following order, from worst-performing to best-performing:

- The Highway and Combination alternatives would be in the greatest range for annual hours of congestion with hours greater than the No Action or Baseline. Highway alternatives would have a higher level of congestion than the Combination alternatives at this focal point.
- At the Top of Floyd Hill, the No Action alternative would be in the intermediate range for annual hours of congestion, with a reduction from Baseline reflecting trip suppression.
- The Minimal Action and Transit alternatives would fall in the least range for annual hours of congestion.

Selected Model Day Hours of Congestion

Eastbound at the Top of Floyd Hill, six alternatives (not counting the Preservation alternatives, which are considered variants of their corresponding single-mode alternative here) have fewer annual hours of congestion than the Baseline scenario, while on summer Sunday, only four alternatives have fewer hours of congestion than the 4 hours experienced under the Baseline condition. The summer Sunday ranking of alternatives, starting with those with the most congestion, is:

- The Highway alternatives and the Combination Six-Lane Highway with Diesel Bus in Guideway "build simultaneously" alternative are forecast to have the most congestion here, with 9 hours operating at LOS F.
- Eight hours of congestion are projected for both the Combination Six-Lane Highway with Rail and IMC "build simultaneously" alternative and the Combination Six-Lane Highway (55 mph) with Dual-Mode Bus in Guideway "build simultaneously" alternative.
- The Combination Six-Lane Highway with AGS alternative is forecast to experience 7 hours of congestion eastbound on summer Sunday at the Top of Floyd Hill.
- The Minimal Action alternative results in 5 summer Sunday hours operating under LOS F.
- The Dual-Mode Bus in Guideway alternative is projected to experience 4 hours of congestion, the same amount forecast under the Baseline scenario for this model day.
- The No Action alternative, the Rail with IMC alternative, the AGS alternative, and the Diesel Bus in Guideway alternative have the least hours of congestion, with 3 hours during summer Sunday operating at LOS F.

Genesee (milepost 254)

Annual Hours of Congestion

The Baseline scenario is expected to see almost 600 hours of congestion annually eastbound, putting it in the greatest range. Alternatives would rank in the following order, from worst-performing to best-performing:

- Eastbound within Jefferson County, no highway capacity improvements are contemplated. The result would be that the congestion for the Highway and Combination alternatives at this focal point would range from 900 to 1,100 hours annually (falling in the greatest range)– not quite double the Baseline level.
- The No Action and Minimal Action alternatives would be in the greatest range of congestion, with some reduction from Baseline resulting from suppressed travel, and about half that of the Highway and Combination alternatives.
- The Transit alternatives would fall within the intermediate range, with about a third the congested hours of the Highway or Combination alternatives.

Selected Model Day Hours of Congestion

On summer Sunday at Genesee, only one alternative (No Action) has fewer eastbound hours of congestion than the Baseline scenario, which is projected to have 6 hours of congestion. The summer Sunday ranking of alternatives, from worst-performing to best-performing, are as follows:

- As in the annual case, the most congested alternatives on summer Sunday are the Highway alternatives (alone or with Transit Preservation) and the Combination Six-Lane Highway with Bus in Guideway "build simultaneously" alternatives. Each of these alternatives would experience 11 hours of congestion.
- Minimal Action and the Combination Six-Lane Highway with Rail and IMC "build simultaneously" alternative would each result in 10 hours of congestion on summer Sunday eastbound at Genesee.
- The Combination Six-Lane Highway with AGS "build simultaneously" alternative and the Bus in Guideway alternatives (alone or with Highway Preservation) are forecast to have 9 hours of congestion.
- The Rail with IMC alternative and the AGS alternative have the least congestion among the Transit-only alternatives, at 8 hours eastbound on summer Sunday.
- As mentioned above, No Action is the least congested alternative eastbound at Genesee, with only 5 summer Sunday hours operating at LOS F due to trip suppression.

2.3.6 Safety Comparison of Alternatives

2.3.6.1 Development of Criteria

Safety involves avoiding property damage, personal injury, and fatalities while traveling. For highway travel, high-accident locations are often associated with the geometric design and physical constraints of the roadway and inclement weather conditions. For transit, safety is influenced by mode technology and certain operational parameters. Section 2.2 identifies curve safety modifications, auxiliary lanes, and interchange improvements that have been identified to address the areas of Corridor safety concern described in Chapter 1, Purpose of and Need for Action, and summarized below.

Accidents are typically classified in three levels of severity:

- Fatalities
- Injuries to persons
- Other events, typically called "property damage only" in the highway context (for example, colliding with another vehicle or with obstacles on or near the roadway) and "incidents" in the transit context (including collisions, fires, and going off the roadway, track, or guideway)

Current highway accident rates (based on vehicle miles of travel or VMT) for the entire Corridor were calculated from accident data from August 1, 1996, to December 31, 2001. If no major improvements were made to I-70, it was assumed that these accident rates would remain the same in the future. The Corridor was then divided into the following seven sections to examine the effect of improvements on each section:

- C-470 to Hyland Hills
- Hyland Hills to Empire Junction
- Empire Junction to Loveland Pass
- Loveland Pass to Silverthorne
- Silverthorne to Vail Pass
- Vail Pass to Edwards
- Edwards to Glenwood Springs

For each alternative, the potential number of accidents was projected, based on the VMT in each section. Roadway improvements such as curve realignment, additional through lanes, and climbing lanes were identified in each of the seven sections. CDOT has developed Accident Reduction Factors (ARF) for each type of proposed improvement; these factors were applied to obtain a predicted number of accidents in improved sections. If there was more than one type of improvement in a section, then the highest ARF was used. For some types of improvements and severities of accidents, the ARF may be zero. That is, the improvement produces no reduction in accidents of this severity. Finally, the predicted total number of accidents by severity was divided by forecast person miles traveled (PMT) for comparison with the transit component of alternatives.

2.3.6.2 Driver Expectancy

"Driver expectancy" is an important factor that influences highway safety rates. Driving is a mentally demanding task in which people acquire information about the roadway and their surroundings, process that information, and take appropriate action to control and guide their vehicles. Steering and maintaining or adjusting speed are the simplest control actions. Different series of these actions allow drivers to execute maneuvers such as changing lanes, passing, and merging. Drivers must also perform vehicle-trip planning and navigation tasks to reach their destination.

Driver Expectancy – Overview of Safety Issues in the Corridor

The physical design of a roadway can affect driver performance. As *A Policy on Geometric Design of Highways and Streets* (AASHTO, 2001) says:

> *When drivers use a highway designed to be compatible with their capabilities and limitations, their performance is aided. When a design is incompatible with the capabilities of drivers, the chance for driver errors increase, and crashes or inefficient operation may result.*

Driver expectancy refers to the training and—more importantly—experience of driving on particular types of roadways. When drivers have executed successful (that is, safe) maneuvers in response to a particular situation in the past, they can recall and execute that maneuver should a similar situation arise. Certain aspects of driving may become almost "automatic" or "instinctual." Researchers have shown that driver reaction times can be up to 35 percent faster to expected situations, compared to unexpected ones.

Elements of I-70 in the Corridor that may violate driver expectancy include:

- Unexpected and sharp curves, and steep grades associated with mountainous conditions
- Wide variation in the speeds of vehicles on the roadway
- Changes in posted speed limits (regulatory or advisory)
- Disabled vehicles, fallen rocks, animals, or other obstacles on the roadway
- Left-side on- and off-ramps, and other nonstandard geometric features
- Inclement weather conditions, including icy roads and bridges, and particularly, the ability of out-of-state residents who are not familiar with the I-70 mountainous roadway to respond to these
- The presence of large, fast-moving vehicles

Mountain topography places considerable constraints on the I-70 alignment and profile. The highway has many curves and grades to conform to the surrounding terrain and geology, thus avoiding potentially expensive and environmentally intrusive construction. As a result, the alignment and grades make I-70 a difficult highway to drive. Because many of the vehicles on I-70 are driven by visitors during peak recreation use, these drivers are often unfamiliar with curves and driving conditions, and thus rely on signage, sufficient sight distances, and other treatments. If these drivers cannot anticipate upcoming curves, they will slow down and drive more conservatively. However, other I-70 users may travel the same portion of roadway daily, developing a memory of the highway layout and may take familiar curves faster to arrive at the destination sooner. The experienced drivers may travel at speeds that are incompatible with the inexperienced drivers and may be required to take evasive actions to avoid collision with an unexpected slower vehicle ahead.

Other aspects of I-70 in the Corridor can also result in large differences in speeds among vehicles. For example, steep grades make differences in engine power readily apparent. Loaded freight vehicles and recreational vehicles with trailers are two examples of vehicles that may be slower than average on grades. The potential for crashes increases, for example, when an RV traveling 35 mph passes a 30 mph truck on a two-lane portion of I-70. The crash potential is particularly great if a fast-moving vehicle from behind does not notice this situation, either through inattention or distraction, or because of limited sight distances from curves and geologic features.

Another consequence of the curves in I-70 is the fact that speed limits frequently vary in the Corridor. Certain curves may have advisory speeds lower than the regulatory speed limit on surrounding portions of I-70. These changes in speed may not be expected and, therefore, result in driver errors, or sudden movements that may not be anticipated by other drivers.

The constrained geography of the Corridor means that at some locations, the I-70 roadway is adjacent to a rock cut that may expose loose material. In other locations, constraints may necessitate the use of narrower-than-standard shoulders. If a breakdown occurs at such a location, it may not be possible to fully remove a disabled vehicle from the active travel way. Wildlife may enter the roadway or objects may fall off of other vehicles. Each of these items forms an obstruction in the roadway, forcing drivers to react and change their travel path.

For example, at most interstate highway interchanges, on- and off-ramps adjoin the right-hand lane, where travel speeds are slower (indeed, design standards encourage such practices), so drivers come to expect entrance and exit ramps on the right. The left-hand-side ramps at the US 6 interchange at the bottom of Floyd Hill violate driver expectations and, consequently, result in higher accident rates. Drivers may also be more familiar with diamond interchanges; therefore, partial cloverleaf interchanges with tight ramps (such as at Minturn interchange, Copper Mountain, Empire Junction, and East Idaho Springs) can also be safety hazards.

The mountain climate means that I-70 drivers may experience extreme weather conditions that may occur suddenly. Snow squalls can reduce visibility to white-out conditions, resulting in hazardous conditions, especially for inexperienced drivers.

Even the mix of traffic may be unfamiliar to some I-70 drivers. Some people may not be used to the high percentage of trucks in the traffic stream, particularly on weekdays and at the mountain passes. Many report that driving next to a fast-moving truck (whether passing or being passed) can be intimidating. Steep canyon walls and narrow roadway widths may further contribute to a sense of claustrophobia.

Driver expectancy is the rationale for adopting a safety criterion of "number of high accident locations addressed." Higher-profile accident locations in the Corridor include:

- Wolcott curve
- Dowd Canyon
- Silverthorne interchange
- East of the EJMT
- Base of Floyd Hill (Twin Tunnels to the US 6 interchange near the gaming area)

2.3.6.3 Calculation of Transit Accident Rates

Transit accident rates were calculated from the 2001 National Transit Database (NTD), from the average of systems with similar modes and fleet sizes. (The size of the I-70 fleet was determined from the operating plan.) Because there is no AGS currently in operation in the US, the safety goals in the Colorado Maglev Project "Task 3: Transit System Performance Requirements" were assumed as the accident rates for the AGS. Total accidents by severity were calculated for each Corridor operator by multiplying by the relevant PMT.

The high accident and injury rates predicted for bus systems suggested that reporting requirements may have confounded cross-mode comparisons. Bus accident calculations are based on the 2001 NTD, the latest year such statistics are available. Reporting requirements were changed in 2002 to make NTD accident statistics more comparable to those of other modes. For example, in 2001, any incident involving transit property damage exceeding $1,000 was required to be reported in the NTD. Beginning in 2002, incidents involving property damage of $25,000 or more are reported as "major incidents," and those involving damage of $7,500 to $25,000 as "minor accidents." Incidents involving property damage of $1,000 to $7,500 would no longer be reported. Furthermore, commuter railroads are required to report safety incidents (that is, accidents) to the Federal Railroad Administration, rather than to the Federal Transit Administration, which collects and disseminates the NTD.

Similarly, accident reporting requirements changed in 2002. Previously, an injury was defined as

> *Any physical damage or harm to a person requiring medical treatment, or any physical damage or harm to a person reported at the time and place of occurrence. For employees, an injury includes incidents resulting in time lost from duty or any definition consistent with a transit agency's current employee injury reporting practice.*

Beginning in 2002, an injury was defined more narrowly as "Any physical damage or harm to persons as a result of an incident that requires immediate medical attention away from the scene." For example, patrons receiving minor first aid on the scene of an incident would no longer count towards injuries under the new reporting guidelines.

Table 2-22 compares the accident rates for each of the alternatives. Because bus accident and injury data calculated from the 2001 NTD are not directly comparable to other modes, these rates are not shown in Table 2-22. However, for full disclosure, these safety details are shown in Appendix B, Transportation Analysis and Data.

2.3.6.4 Safety Comparisons

To compare multimodal alternatives, fatality rates – the number of fatalities predicted per 100 million person miles (both highway and transit) were evaluated for each alternative. The number of fatalities per 100 million person miles predicted for the different alternatives is as follows:

- The No Action alternative, with 0.62 fatalities per 100 million person miles, would not address the existing highway safety issues in the Corridor.
- The Minimal Action alternative, with 0.50 fatalities per 100 million person miles, would provide local highway safety improvements.
- The Six-Lane Highway 55 mph alternative and the Reversible/HOV/HOT Lanes alternative are both expected to experience 0.54 fatalities per 100 million person miles.
- The fatality rate for Six-Lane Highway 65 mph alternative is 0.52 fatalities per 100 million person miles. This is a reduction in fatalities from the Six-Lane Highway 55 mph alternative (0.54 fatalities per 100 million person miles). This alternative provides new alignments of I-70 – often requiring tunnels – to increase the design speed at certain high-accident locations, such as Dowd Canyon and the area near Hidden Valley and Floyd Hill.
- The Transit alternatives are safer than the Six-Lane Highway 65 mph alternative, and have predicted fatality rates in the range of 0.46 to 0.49 fatalities per 100 million person miles. In general, the fatality rates among transit riders (up to 0.11 fatalities per 100 million person miles) are much lower than those who use private vehicles on the current I-70 alignment (0.44 to 0.63 fatalities per 100 million person miles).
- The range of fatality rates among the Combination alternatives, 0.44 to 0.49 fatalities per 100 million person miles, is very similar to the range for the Transit alternatives. The Combination Six-Lane Highway with AGS alternative is the safest of all the alternatives. Whether an alternative involving Dual-Mode Bus in Guideway is safer than one involving Diesel Bus in Guideway seems to be quite sensitive to the transit ridership and trip inducement patterns of the alternative.

Table 2-22. Accident Rates per Million Person Miles

Element of Purpose and Need					Transit Alternatives				Highway Alternatives				Combination Highway/Transit Alternatives			
				1	2	3	4	5	6	7	8		9	10	11	12
		2025 Baseline	No Action Alternative	Minimal Action Alternative	Rail with IMC	Advanced Guideway System (AGS)	Dual-Mode Bus in Guideway	Diesel Bus in Guideway	6-Lane Highway 55 mph	6-Lane Highway 65 mph	Reversible/ HOV/HOT Lanes		6-Lane Highway with Rail and IMC	6-Lane Highway with AGS	6-Lane Highway with Dual-Mode Bus in Guideway	6-Lane Highway with Diesel Bus in Guideway
Overall Safety (Highway and Transit travel)	Accident Rate per million person miles	0.71	0.71	0.60	0.64	0.57	Not Comparable	Not Comparable	0.61	0.59	0.61	9 / 10 / 11 / 12 - Build Combination Simultaneously	0.62	0.54	Not Comparable	Not Comparable
												9a / 10a / 11a / 12a - Build Transit and Preserve for Highway	0.64	0.57	Not Comparable	Not Comparable
												9b / 10b / 11b / 12b - Build Highway and Preserve for Transit	0.61	0.61	0.61	0.61
	Injury Rate per million person miles	0.21	0.21	0.20	0.22	0.18	Not Comparable	Not Comparable	0.18	0.18	0.18	9 / 10 / 11 / 12 - Build Combination Simultaneously	0.22	0.17	Not Comparable	Not Comparable
												9a / 10a / 11a / 12a - Build Transit and Preserve for Highway	0.22	0.18	Not Comparable	Not Comparable
												9b / 10b / 11b / 12b - Build Highway and Preserve for Transit	0.18	0.18	0.18	0.18
	Fatality Rate per 100 million person miles	0.63	0.62	0.50	0.49	0.46	0.49	0.48	0.54	0.52	0.54	9 / 10 / 11 / 12 - Build Combination Simultaneously	0.47	0.44	0.47	0.49
												9a / 10a / 11a / 12a - Build Transit and Preserve for Highway	0.48	0.46	0.49	0.48
												9b / 10b / 11b / 12b - Build Highway and Preserve for Transit	0.54	0.54	0.54	0.54

2.3.7 Cost Comparison of Alternatives

This section provides the results of the cost analyses for alternatives. Included are operations and maintenance cost assumptions, capital cost assumptions, and total cost comparisons. The criteria, thresholds and individual comparisons for transit operating and maintenance costs requiring subsidy, capital costs, and cost-effectiveness operations and maintenance cost assumptions are provided. Cost comparisons are provided on Table 2-24. Supporting cost data are provided in Appendix B.

2.3.7.1 Highway Operations

Annual highway operating and maintenance costs were estimated by first developing a per-lane-mile unit cost from current CDOT maintenance budgets. Unit costs for the major tunnels in the study Corridor—the Hanging Lake Tunnels in Glenwood Canyon and the EJMT at the Continental Divide—were calculated separately. For the portion of the Corridor outside the major tunnels (about 142 miles), the average yearly maintenance cost is about $12,000 per lane-mile. For the major tunnels (about two miles), the cost is about $340,000 per lane-mile.

The cost of the Annual highway O&M costs for each of the 20 PEIS alternatives follows:

- For No Action, Minimal Action, the Transit-only alternatives, and the Build Transit and Preserve for Highway alternatives, highway operating and maintenance costs would be approximately $17 million per year.
- For the Six-Lane Highway 55 mph alternative, the Combination "build simultaneously" alternatives, and the Build Highway and Preserve for Transit alternatives, annual highway operating and maintenance costs would be approximately $20 million.
- For the Reversible/HOV/HOT Lanes alternative, highway operating and maintenance costs would be approximately $22 million.
- For the Six-Lane Highway 65 mph alternative, highway operating and maintenance costs in 2025 would be approximately $25 million

Also note that the unit costs developed above were used as one component to estimate the cost of maintaining the Bus in Guideway alternatives.

2.3.7.2 Transit Operations

Operating plans for alternatives described in section 2.2 and Appendix E, Operational Characteristics of Alternatives, provided the basis to estimate operation and maintenance costs from various unit costs. Operation costs are grouped into one of five categories:

- Energy consumption (diesel fuel or electricity) is determined from simulations of rail and bus operations.
- Per-mile cost reflects those costs generally associated with maintenance and cleaning, which are most strongly correlated with vehicle miles.
- Vehicle crew costs are calculated from the vehicle revenue hours and the number of people needed to operate each bus or train.
- Other labor includes wages and benefits for station staff, dispatch staff, and administrative staff. Station staffing requirements are developed from estimates of boardings and alightings at each station, and taking into account the role of each station within the Corridor transportation network.
- Casualty and liability are estimated with the use of a regression model.

2.3.7.3 Capital Cost Assumptions

Quantities for earthwork and wall areas common to both Highway and Transit alternatives were derived by modeling the proposed typical section and alternative alignment against detailed terrain data. Once these quantities were derived, they were placed in a cost-estimating spreadsheet that adds percentages for other items in lieu of known quantities. The items use percentages including: contingencies, ITS, drainage/utilities, signing and striping, construction signing and traffic control, mobilization, force accounts, right-of-way, construction engineering, and preliminary engineering. The percentages applied varied for the Highway, Transit, or Combination alternative based on difficulty of construction, expected detours, drainage requirements, and ease or difficulty of engineering of a particular component.

Highway Capital Costs

Capital costs for the Highway alternatives were based on nine major construction items:

- Structures
- Walls
- Earthwork
- Pavement
- Base course
- Barrier
- Special structures (such as structured lanes in Idaho Springs)
- Tunnels
- Interchanges

Unit costs for these items were arrived at by a consensus of opinion of experienced construction personnel across the region. Tunnel costs are based on geotechnical reports prepared as part of this study. Specific costs were prepared for the proposed interchange, curve safety modification and auxiliary lane improvements.

Transit Capital Costs

Capital costs for Transit alternatives were based on the following:

- The Dual-Mode and Diesel Bus in Guideway alternatives were developed in a similar fashion to the Highway alternatives, with the exception that the capital cost of the bus fleet was added.
- The AGS alternative was developed by combining many of the same items shown above, such as structures, walls, and earthwork, with information from the Colorado Maglev Project. This information includes rolling stock, electrification, track, and propulsion system costs.
- The Rail with IMC alternative was developed by combining many of the same items shown above, such as structures, walls, and earthwork, with information developed on rolling stock, track, and propulsion system costs.
- Similar methods were used to develop costs for the Combination alternatives, as appropriate.

2.3.7.4 Development of Total Cost Comparison Criteria

Quantification of the two most familiar components of cost – capital cost and operating and maintenance (O&M) cost – are provided in Appendix B, Transportation Analysis and Data. Another component of cost is the cost paid by travelers (users) rather than the entity or entities providing transportation infrastructure and services. Auto user costs are proportional to the mobility provided and are thus compared elsewhere ("Effect on Annual Travel"). For transit, the costs paid by customers are also the fares collected by the operator. The difference between transit operating and maintenance costs and fare receipts must generally be paid through some subsidy mechanism.

While the PEIS alternatives have widely varying costs, they also provide different amounts of mobility. A common comparison technique is to construct a cost-effectiveness index by calculating the cost associated with a particular amount of mobility. More details of this calculation are given below. This PEIS calculates a cost-effectiveness index that include capital and operating and maintenance costs, which are presented in Appendix B. Therefore, to avoid redundancy, no comparisons based solely on annual operating and maintenance costs or auto user costs are shown in Table 2-24. Total capital cost is retained for comparison because of its ease in interpretation and because of its use in grouping alternatives as "preferred" or "not preferred." The remaining cost component – transit subsidies – is also shown separately in the table as a percentage of total operating and maintenance costs.

2.3.7.5 Transit Operating and Maintenance Costs Requiring Subsidy Comparisons

Thresholds

No new Corridor transit system is introduced with the Highway alternatives or the No Action alternative; therefore, these alternatives are not rated. For alternatives establishing new transit service on I-70, the ratio of the annual transit subsidy to annual operations and maintenance costs is presented in Table 2-24. (Annual subsidy is the amount of operating and maintenance costs not covered by farebox receipts.) The percent of operating and maintenance costs requiring subsidy varies from 10 percent (Combination Six-Lane Highway with Dual-Mode Bus in Guideway) to 53 percent (alternatives involving AGS). No natural thresholds exist for the percent of operating costs requiring subsidy; this ratio varies by transit operator, and ratios estimated for project alternatives are below the national average. (Low subsidy ratios may be caused by differences between intercity and urban travel, not assuming discounted fares for frequent riders or other groups, or errors inherent in Stated Preference data supporting the mode choice model.) Thresholds for the ratings in Table 2-24 were, therefore, established by dividing the range of subsidy ratio into thirds as follows:

- Lowest subsidy cost range: less than 24 percent
- Intermediate subsidy cost range: 24 to 39 percent
- Highest subsidy cost range: more than 39 percent

Comparison

- The Combination Six-Lane Highway with Dual-Mode Bus in Guideway alternative (10 percent), the Dual-Mode Bus in Guideway alternative (21 percent), and the Combination Six-Lane Highway with Diesel Bus in Guideway alternative (22 percent), and would fall in the lowest subsidy range.
- The Diesel Bus in Guideway alternative would require a slightly greater share of operating costs to be subsidized (30 percent) and would fall in the intermediate range.
- The alternatives involving Rail with IMC – whether separately or in combination with a Six-Lane Highway – would require a 38 percent subsidy, and fall in the intermediate range.
- Minimal Action buses in mixed traffic (50 percent), and the alternatives involving AGS (53 percent) would be in the highest subsidy range.

Effect of Fare Level on Ridership and Fare Receipts

A sensitivity analysis helped determine the most reasonable fare level to assume for Transit alternatives. The fare levels tested ranged from 5 cents per mile to about 50 cents per mile (which is comparable to the fare level on private shuttle vans operating in the Corridor). Table 2-23 shows the range of transit ridership associated with various fare levels, and what the change in ridership would be if the fare level was changed from 10 cents per mile, which was selected as the fare level for this study. Note that since the fare receipts number is the product of the number of riders and the fares charged, and since higher fares results in less ridership, the net result to fare receipts depends on how sensitive riders are to fares. Therefore, Table 2-23 also shows the change in fare receipts associated with a change from the 10-cent-per-mile fare level.

Table 2-23. Change From 10-Cent per Mile Fare Level (5 to 15% Transit Share Depending on Purpose)

New Fare Level	Transit Share	Change in Ridership	Change in Fare Receipts
4 cents per mile	5 to 20%	+10 to +45%	–40 to –55%
8 cents per mile	5 to 15%	+5 to +15%	–10 to –15%
10 cents per mile	5 to 15%	N/A	N/A
15 cents per mile	0 to 15%	–10 to –45%	–15 to +35%
25 cents per mile	0 to 10%	–35 to –90%	–80 to +60%
50 cents per mile	0 to 5%	–70 to –100%	–100 to +40%

Notes: Bus in Guideway, Summer Saturday, selected trip purposes

At 8 cents per mile, ridership increases by 5 to 15 percent (depending on the mix of trip purposes, the model day considered, and the transit technology associated with an alternative), but fare receipts drop by 10 to 15 percent. This result indicates that the fare receipt-maximizing fare level is greater than 8 cents per mile. The 4-cent-per-mile fare level further illustrates this conclusion, since ridership increases by 10 to 45 percent, but fare receipts decrease by about 40 to 55 percent.

Raising fares to 15 cents per mile decreases ridership by 10 to 45 percent, and has an uncertain result on fare receipts. Depending on the mix of passengers, fare receipts might increase 35 percent, or decrease up to 15 percent. At 25 cents per mile, fare revenues are more likely to decrease (by as much as 80 percent) than increase from the 10-cent-per-mile level. At 50 cents per mile, the transit operator stands to lose 70 percent to all of its ridership.

However, maximizing fare receipts was not the only consideration in selecting a fare level. The goal of the Transit alternatives is to reduce vehicular congestion on I-70, which can be accomplished with a lower fare. In balancing the concerns of reducing congestion and reducing the necessary transit subsidy, the 10-cent-per-mile fare level was chosen as a reasonable compromise. This fare level allows for simpler calculation of one-way or round-trip fares, and is comparable to the level of auto operating costs assumed (36.5 cents per mile, consistent with IRS deduction policies) when divided by typical vehicle occupancies for recreational trips (2.6 passengers per vehicle on average).

2.3.7.6 Capital Cost Comparisons

Thresholds

Capital cost comparisons were based on the likelihood of funding availability, as follows:

- Committed funds - The Transportation Commission has committed approximately $1.6 billion of the Strategic Corridor Investment Program to the Corridor. This amount represents the funding that may be available over the next 20 years.
- Uncommitted funds – Additional funds necessary for implementation of project alternatives remain uncommitted. Depending on the decision on the preferred alternative for I-70, some of the

uncommitted funds may be allocated to this Corridor, although the likelihood exists that a number of other strategic corridors may have a higher priority for allocation of these funds. A $4 billion amount has been set as a cost threshold for evaluating alternatives in terms of "reasonableness" from an economic affordability point of view. This threshold was set to not preclude alternatives that may be affordable if funding sources over and above the $1.6 billion were to be secured.

As a result of the ranges of likely funding, the following thresholds were established for capital costs:

- Lowest cost range - $1.6 billion or less
- Intermediate cost range - $1.6 to $4.0 billion
- Highest cost range - $4.0 billion or more

Comparison

Alternatives would be ranked as follows from the lowest capital cost to highest capital cost:

Lowest cost range alternative

- Minimal Action ($1.30 billion)

Intermediate cost range alternatives

- Six-Lane Highway 55 mph ($2.40 billion)
- Reversible/HOV/HOT Lanes ($2.52 billion)
- Six-Lane Highway 65 mph ($2.65 billion)
- Combination Six-Lane Highway with AGS Preservation ($2.87 billion)
- Combination Six-Lane Highway with Bus (both Dual-Mode and Diesel) in Guideway Preservation ($2.91 billion)
- Combination Six-Lane Highway with Rail and IMC Preservation ($3.03 billion)
- Diesel Bus in Guideway ($3.26 billion)
- Dual-Mode Bus in Guideway ($3.46 billion)
- Diesel Bus in Guideway with Highway Preservation ($3.80 billion)

Highest cost range alternatives

- Dual-Mode Bus in Guideway with Highway Preservation (just over $4.0 billion)
- Combination Six-Lane Highway and Diesel Bus in Guideway "build simultaneously" ($4.17) billion)
- Combination Six-Lane Highway and Dual-Mode Bus in Guideway "build simultaneously" ($4.37 billion)
- Rail with IMC ($4.91 billion)
- Rail and IMC with Highway Preservation ($6.14 billion)
- Combination Six-Lane Highway with Rail and IMC "build simultaneously" ($6.50 billion)
- AGS with Highway Preservation ($8.32 billion)
- Combination Six-Lane Highway with AGS "build simultaneously" ($8.64 billion)

2.3.7.7 Cost-Effectiveness Comparisons

Thresholds

Criteria for the cost-effectiveness analysis considers capital costs (annualized at 7 percent of the total capital cost, based on CDOT policy), and operating and maintenance costs, less transit farebox receipts. Increased transportation capacity could result in more trips being made in the Corridor and also in longer trips to a greater number of potential destinations. Therefore, person miles of travel (PMT) provides the multimodal denominator for PEIS cost-effectiveness indices.

The cost-effectiveness index is based on the ratio of the difference in costs between an alternative and the No Action alternative, divided by the corresponding difference in PMT. Mathematically, this cost-effectiveness index is defined as:

$$Cost\ Effectiveness\ Index_{Alternative} = \frac{Cost_{Alternative} - Cost_{\text{No Action}}}{PMT_{Alternative} - PMT_{\text{No Action}}}$$

Because the Preservation alternatives involve different costs but the same mobility as the corresponding Highway or Transit alternative, each of the 20 action alternatives would have a different cost-effectiveness value. With this cost-effectiveness definition, no cost-effectiveness value has been calculated for the No Action alternative.

The 20 action alternatives range in cost-effectiveness from $0.63 per person mile (Combination Six-Lane Highway with Dual-Mode Bus in Guideway "build simultaneously") to $1.56 per person mile (Build AGS and Preserve for Highway). Dividing the range of cost effectiveness into thirds produces the following cost-effectiveness categories:

- Most cost-effective - less than $0.94 per person mile
- Intermediate cost-effective - $0.94 to $1.25 per person mile
- Least cost-effective - more than $1.25 per person mile

With this set of thresholds, eight alternatives belong to the most cost-effective group, eight belong to the intermediate cost effectiveness category, and four belong to the least cost-effective group.

Comparison

The comparisons of alternatives by cost-effectiveness are shown in Table 2-24 and summarized below in rank order of least cost per incremental person mile over No Action (that is, the most cost-effective) to greatest cost per person mile:

- The Combination Six-Lane Highway with Dual-Mode or Diesel Bus in Guideway "build simultaneously" alternatives would be the most cost-effective at estimated costs of $0.63 and $0.65 per person mile, respectively.
- The Diesel and Dual-Mode Bus in Guideway alternatives are the next most cost-effective, at $0.73 and $0.74 per person mile, respectively.
- The Build Diesel or Dual-Mode Bus in Guideway and Preserve for Highway alternatives are the next most cost-effective, at $0.84 and $0.85 per person mile, respectively. It is interesting to note that the six most cost-effective alternatives involve bus in guideway service.
- The Reversible/HOV/HOT Lanes alternative ($0.87 per person mile) is almost as cost-effective as the Build Dual-Mode Bus in Guideway and Preserve for Highway alternative.

- The Six-Lane Highway 55 mph alternative has an estimated cost-effectiveness of $0.94 per person mile, and is the least cost-effective alternative of the eight alternatives in the least cost per incremental person mile group.
- The Combination Six-Lane Highway with Rail and IMC "build simultaneously" alternative has an estimated cost-effectiveness of $0.99 per person mile, and is the most cost-effective of the eight alternatives in the intermediate cost per person mile group.
- With a cost-effectiveness of $1.01 per person mile, the Build Highway and Preserve for AGS alternative is almost as cost-effective as the Combination Six-Lane Highway with Rail and IMC "build simultaneously" alternative.
- The Build Highway and Preserve for Dual-Mode or Diesel Bus in Guideway alternatives are almost as cost-effective ($1.03 per person mile) as the Build Highway and Preserve for AGS alternative.
- The Six-Lane Highway 65 mph alternative is less cost-effective ($1.06 per person mile) than the Six-Lane Highway 55 mph alternative because much of the incremental cost of the 65 mph alternative is for improvements designed to make I-70 safer, rather than to provide additional mobility.
- The Build Highway and Preserve for Rail with IMC alternative is just slightly less cost-effective ($1.07 per person mile) than the Six-Lane Highway 65 mph alternative.
- The Rail with IMC alternative ($1.14 per person mile) and the AGS alternative ($1.21) are the next most cost-effective.
- The four alternatives in the greatest cost per incremental person mile category – Minimal Action and three Combination or Preservation alternatives – are clustered with cost-effectiveness indices within $0.20 per person mile of each other:
- The Minimal Action alternative has a cost-effectiveness index estimated at $1.45 per person mile. This alternative is not as cost-effective as others because several Minimal Action components involve safety improvements or Travel Demand Management initiatives. Safety improvements are not expected to affect PMT, while TDM may cause PMT to decrease, rather than increase.
- Three remaining Combination and Preservation alternatives have similar cost-effectiveness: The Build Rail with IMC and Preserve for Highway alternative requires an expenditure of $1.39 for each person mile above No Action accommodated. The Combination Six-Lane Highway and AGS "build simultaneously" alternative has a cost-effectiveness of $1.44 per person mile. At $1.56 per person mile, the Build AGS and Preserve for Highway alternative is the least cost-effective alternative.

Table 2-24. Capital Costs, Operations and Maintenance Costs, and Cost-Effectiveness

Element of Purpose and Need		No Action Alternative	1 Minimal Action Alternative	2 Rail with IMC	3 Advanced Guideway System (AGS)	4 Dual-Mode Bus in Guideway	5 Diesel Bus in Guideway	6 6-Lane Highway 55 mph	7 6-Lane Highway 65 mph	8 Reversible/ HOV/HOT Lanes
				Transit Alternatives				Highway Alternatives		
Cost	% Transit O&M Costs Requiring Subsidy ($ Annual Transit Subsidy/ / $ Annual Transit O&M)	N/A	50% ($16 / $31)	38% ($52 / $135)	53% ($95/ $180)	21% ($20 / $94)	30% ($30 / $99)	N/A	N/A	N/A
Cost	Capital Cost ($ million)	$0*	$1,308	$4,915	$6,149	$3,468	$3,264	$2,405	$2,648	$2,520
Cost	Overall Cost-Effectiveness ($/person-mi)	N/A	$1.45	$1.14	$1.21	$0.74	$0.73	$0.94	$1.06	$0.87

Combination Highway/Transit Alternatives

Element of Purpose and Need			9 6-Lane Highway with Rail and IMC	10 6-Lane Highway with AGS	11 6-Lane Highway with Dual-Mode Bus in Guideway	12 6-Lane Highway with Diesel Bus in Guideway
Cost	% Transit O&M Costs Requiring Subsidy ($ Annual Transit Subsidy/ / $ Annual Transit O&M)	9 / 10 / 11 / 12 - Build Combination Simultaneously	38% ($54 / $142)	53% ($105 / $200)	10% ($9 / $83)	22% ($21 / $93)
		9a / 10a / 11a / 12a - Build Transit and Preserve for Highway	38% ($52 / $135)	53% ($95 / $180)	21% ($20 / $94)	30% ($30 / $99)
		9b / 10b / 11b / 12b - Build Highway and Preserve for Transit	N/A	N/A	N/A	N/A
Cost	Capital Cost ($ million)	9 / 10 / 11 / 12	$6,400	$8,540	$4,275	$4,071
		9a / 10a / 11a / 12a	$6,147	$8,321	$4,008	$3,803
		9b / 10b / 11b / 12b	$2,759	$2,601	$2,640	$2,640
Cost	Overall Cost-Effectiveness ($/person-mi)	9 / 10 / 11 / 12	$0.99	$1.44	$0.63	$0.65
		9a / 10a / 11a / 12a	$1.39	$1.56	$0.85	$0.84
		9b / 10b / 11b / 12b	$1.07	$1.01	$1.03	$1.03

Legend	Transit O & M Costs Requiring Subsidy	Capital Cost	Overall Cost-Effectiveness
(green)	lowest third: less than 24 percent	$1.6 billion or less	least cost per incremental person mile: less than $0.94 per person mile
(yellow)	middle third: 24 to 39 percent	$1.6 to 4.0 billion	intermediate cost per incremental person mile: $0.94 to $1.25 per person mile
(red)	highest third: more than 39 percent	$4.0 billion or more	greatest cost per incremental person mile: more than $1.25 per person mile

Note: N/A = Not applicable.
Overall cost-effectiveness is defined as the ratio of the difference in net cost between the alternative and the No Action alternative, to the difference in person miles of travel between the alternative and the No Action alternative. Net cost is the capital cost annualized at 7 percent, plus operating and maintenance costs, less fare receipts.

Note: * *$0 represents new capital projects in the I-70 corridor. This does not reflect the operating and maintenance or capital projects independently planned.*

2.3.8 Environmental and Community Values Impact Comparison

2.3.8.1 Methodologies

Developing an environmental process and criteria to be applied for assessing impacts and comparing alternatives at the Tier 1 stage of the NEPA process has involved extensive involvement of the MCAC/TAC and federal interdisciplinary team, and collaboration with CDOT and FHWA. The resources shown in Table 2-25 and Table 2-26 located at the end of section 2.3.8 are considered responsive to issues and strategic in the grouping of alternatives into those that are preferred and those that are not preferred, as discussed in section 2.4.

Full disclosure of direct, indirect, and cumulative impacts for all resources studied appears in Chapter 3, Affected Environment and Environmental Impacts, and Chapter 4, Cumulative Impacts Analysis. Table 2-25 and Table 2-26 provide the relative impact each alternative would have on environmental and community value resources in three levels, from least to greatest, as well as numeric rankings. Methods for inventory and assessment and data tables quantifying impacts are provided in Appendix A, Environmental Analysis and Data.

The following sections provide an overview of the methodologies used to compare alternatives described in section 2.2. The purpose of the following summary of methods is to focus on the development of the comparative analysis of environmental impacts.

Comparison and Ranking of Alternatives

The following is a summary of the techniques applied to compare and rank alternatives.

Overlay Analysis

Environmental impacts resulting from the implementation of alternatives are ranked on the basis of area of disturbance. For each alternative, a GIS overlay process was used to identify resource encroachment and proximity. Each alternative template was discretely compared to each resource type. For analysis, this template is composed of three zones: the **alternative footprint,** area of **construction disturbance,** and adjacent **sensitivity zone.**

- **Alternative footprint.** Impacts associated with the footprint are considered permanent because the given resource will be covered by the transportation facility (such as additional traffic lanes, rail, or guideway).
- **Construction disturbance.** Impacts associated with construction disturbance were considered temporary because this area will later be reclaimed. Mitigation would vary in timeframe depending on the resource affected. For example, the duration required to reestablish forest vegetation is much longer than that required for grassland or shrublands vegetation.
- **Sensitivity zone.** The sensitivity zone applies only to habitat and aquatic resources. This zone extends 15 feet from the edge of the construction disturbance zone, and was established to identify additional construction-related and operational impacts affecting environmental resources from the alternatives. While it is acknowledged that impacts may also extend beyond the sensitivity zone into adjacent and downstream locations, this area provides a measure of possible effects on functions of adjacent areas.

For each resource, alternatives were ranked in order (from least to greatest) based on the area affected, by the combination of the alternative footprint, construction disturbance, and sensitivity zone. Alternatives disturbing the same amount of area (to within 5 percent difference) were given the same rank.

Alternative Design Interpretation

An interpretation of the conceptual designs and alignments for alternatives included barrier effects on wildlife movement, and visual impacts based on the level of contrast with elements of each alternative. Design features were related to median treatment, height and length of walls on cut-and-fill slopes, and alternative structures (such as elevated guideways, protective barriers, or catenary wires). Simulations and three-dimensional animations were used in the analysis of transit and highway features.

Model Applications

Noise and air quality impacts are related to changes in traffic volume. Changes in peak-hour noise levels were calculated based on existing and projected traffic data and the Stamina II model. Changes in carbon monoxide (CO) and particulate matter (PM_{10}) were evaluated by application of the EPA MOBILE 6 model to identify emissions for a 24-hour period.

The increased area in impervious surface was used to calculate the effects of stormwater runoff for each alternative. The FHWA stormwater runoff model was used to evaluate the change in sediment loading from winter maintenance activities, and relative increase in highway-related pollutants such as phosphorus, copper, and zinc.

Levels of Impacts

An impact criterion from greatest to least impact was identified for each resource issue in order to facilitate a relative comparison of alternatives. Impact thresholds were based on units of measure for a resource impact such as area of disturbance (acres, linear feet), increase in concentration (air and water quality), or number of units affected (land and growth effects, wildlife linkage zones). Color-coding was used in Table 2-25 and Table 2-26 for easy recognition: red for greatest, yellow for intermediate, and green for least impact. Thresholds are based on the sum of the footprint, construction disturbance, and sensitivity zone impacts. For an explanation of impact thresholds see Appendix A.

Ranking of Impacts

It is important to note that each set of rankings in Table 2-25 and Table 2-26 is specific to a resource. For example, Dual-Mode Bus in Guideway has been assigned a ranking of 2 with respect to vegetation; this means that among the alternatives under consideration, Dual-Mode Bus in Guideway would affect the smallest area of vegetation, other than the No Action alternative. The Six-Lane Highway 65 mph and the Minimal Action alternative have both been assigned a ranking of 4, with respect to vegetation, and therefore would affect areas of vegetation to the same extent in terms of numbers of acres affected. While the rankings are the same, the alternatives could differ in terms of the specific acres of impact or location at which the vegetation occur, or the species affected. These differences are addressed in Chapter 3 of this Draft PEIS.

It is also important to note that the ranking of impacts is specific to each environmental receptor. For example, a ranking of 1 with respect to songbird habitats cannot be compared to a ranking of 1 for wetlands, except to say that the ranking of 1 in each case means that the particular alternative would affect the fewest acres containing the resource.

A ranking of 1 does not necessarily mean that the impact on the environment is minimal. It simply means that the relative impact of the alternative ranked 1 is lower than that of any other alternative. Conversely, being ranked as the highest impacting alternative means that the alternative affects the resource more than other alternatives, not necessarily that the impact is large. The rank does not indicate the magnitude of the consequence.

Finally, it is also not possible to combine the rankings for each resource into a total number which can then be compared across alternatives. To add these rankings would not be meaningful, because while rankings take into account the extent of impact, they do not indicate the quality or context for any particular resource in particular areas. Although the resources identified and ranked are considered pertinent and important, the rank does not fully disclose the implications of the impact. These implications are disclosed in detail in Chapter 3, Affected Environment and Environmental Impacts.

Indirect and Cumulative Impacts

Indirect and cumulative impacts are shown in Table 2-27. They are given a generalized characterization in three color categories, from green (representing the least potential for impact) to red (representing the greatest potential for impact).

Indirect impacts are associated with the growth effects of alternatives. Improving accessibility and mobility for users of I-70 may have impacts on population growth, the economy, and land use patterns. These changes could, in turn, affect natural resources.

A forecast was developed for the effects of induced or suppressed growth of the alternatives and associated projection of spending. These spending projections were input into a regional economic input-output model (REMI) of the nine-county region, which generated projected changes in economic indicators such as gross regional product and regional employment.

The assessment of cumulative impacts included the application of model data (REMI, MOBILE 6, and I-70 TransCAD travel demand model), GIS overlay data, historical and current aerial photographs, trend analysis in population growth and land use development patterns, and travel demand forecasting. The BASINS model was used to show cumulative impacts on water quality from planned development in the Corridor.

2.3.8.2 Comparison of Alternatives for Key Federally Protected Resources

The Tier1 level of NEPA evaluation that has been conducted for the PEIS provides a preliminary determination of impacts on environmental resources, including those that have specific regulatory protection. This section provides a comparison of alternatives for following federally protected resources:

- Aquatic ecosystem - Clean Water Act, Section 404(b)(1) Guidelines
- 4(f) resources - Section 4(f) of the U.S. Department of Transportation Act of 1966, 49 USC 303(c)
- Historic properties - Section 106 of the National Historic Preservation Act (NHPA)
- Threatened and Endangered Species - Section 7 of the Endangered Species Act

Consistent with the intent of these regulations, the development of PEIS alternatives has been planned to avoid or minimize impacts on these protected resources to the extent that the level of detail available at the Tier 1 stage allows. The following comparison of impacts on these resources is provided to be in compliance with federal guidelines. The comparison process is intended to ensure that opportunities to avoid or minimize harm to these resources at subsequent Tier 2 stages are not precluded by decisions on alternatives at the Tier 1 stage.

The screening of alternatives, described in section 2.1, was the first step in avoiding or minimizing harm to environmental resources. Screening studies were conducted through a coordinated effort with the public and agency involvement programs identified in Chapter 6, Public and Agency Involvement, and Appendix P, Public and Agency Involvement. The following committees were formed to address these:

- Aquatic ecosystems – SWEEP Committee (Stream and Wetland Ecological Enhancement Program)
- Threatened, Endangered, and Special Status Species – ALIVE Committee (A Landscape Level of Inventory of Valued Ecosystem components)
- 4(f) and 6(f) resources – 4(f) 6(f) Ad Hoc Committee

The following sections provide a comparative analysis of federally protected resources.

Clean Water Act, Section 404(b)(1) Guidelines

Before issuing a Section 404 permit authorizing the placement of dredged or fill material into waters of the US, a proposed project must be evaluated by the Corps of Engineers (COE) to determine its compliance with Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material (40 CFR Part 230). These 404(b)(1) guidelines state that "no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other substantial adverse environmental consequences."

While the guidelines for implementing NEPA provided by the Council on Environmental Quality require that "reasonable" alternatives be considered (which include "those that are practical or feasible from the technical and economic standpoint"), the Clean Water Act Section 404(b)(1) guidelines are more restrictive and require that only "practicable" alternatives be considered. The Clean Water Act's definition of "practicable" is "available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes."

The 404(b)(1) guidelines require that the least environmentally damaging practicable alternative must also:

- Not violate any other applicable state or federal regulations
- Not cause or contribute to the substantial degradation of waters of the US
- Appropriately and practicably minimize impacts

The 404(b)(1) guidelines define the aquatic ecosystem as "waters of the United States, including wetlands, that serve as habitat for interrelated and interacting communities and populations of plants and animals." For the PEIS, the aquatic ecosystem within the project area has been separated into wetlands, other waters of the US, springs and fens, riparian areas, and streams. Table 2-26 provides a summary ranking of the impacts on the aquatic ecosystem, and a quantification of impacts is presented in section 3.6, Wetlands, Other Waters of the US, and Riparian Areas. Cumulative impacts on these resources are described in Chapter 4, Cumulative Impacts Analysis. The quantification and ranking by alternative provides the basis to identify the least environmentally damaging alternative to these aquatic ecosystem resources. The SWEEP committee has involved the COE, EPA, USFS, watershed associations, and special interest groups in the identification of water resource issues in the Corridor.

Although wetlands and other waters of the US along the Corridor may appear to be similar, species composition varies substantially with elevation changes. Impacts on wetlands and other waters of the US from project alternatives include loss of wetland areas from the footprint of each alternative, construction disturbance, as well as the sensitivity zone. It was established to identify the likelihood of additional construction-related impacts affecting wetlands, springs/fens, other waters of the US, and riparian areas from the alternatives. Impacts may also extend beyond the sensitivity zone into adjacent and downstream locations. Such impacts include erosion and sedimentation that is not controlled by erosion control measures, inadvertent encroachment into these areas by construction activities (personnel and equipment), and the installation of exclusion fencing and silt fencing and other erosion control material in the edge of the work areas.

The following sections describe the comparison of the impacts of alternatives to aquatic ecosystem resources. It should be noted that while the Minimal Action alternative has been included for disclosure in the PEIS, it does not meet the need for the project and, therefore is not considered a "reasonable alternative" by NEPA criteria. As such, while the components of the Minimal Action alternative as a single mode may collectively result in the least damage to aquatic resources, it should not be considered in the determination of the least damaging alternative to aquatic resources.

Aquatic Resources

The least direct impact on wetlands, springs/fens, other waters of the US, and riparian areas (outside the No Action and Minimal Action alternatives) would be shared by two alternatives: Dual-Mode Bus in Guideway and Diesel Bus in Guideway.

The four Transit alternatives would have the least indirect and cumulative impacts on wetlands, springs/fens, other waters of the US, and riparian areas.

Wetlands. The Bus in Guideway alternatives would permanently affect 0.8 acre of wetlands. Temporary impacts would affect 1.6 acres of wetlands within the construction disturbance zone and may also affect 2.4 acres within the sensitivity zone.

Springs/fens. Specially protected wetlands (fens) are most abundant or likely to occur at the higher elevations of the Corridor, especially near the summit of Vail Pass. Possible impacts on fens would be the loss of wetlands and changes in function and value from changes in input of material (winter maintenance containments) and changes in hydrology. Fens are a COE specially protected resource. The USFWS considers fens irreplaceable in this Region, and furthermore consider that there is no acceptable mitigation of impacts to this resource. Springs/fens would have the most potential to be affected in the Vail Pass area. Preliminary field inspections were conducted along Vail Pass to identify fens within the spring/fen map unit that are near I-70. The Minimal Action, Bus in Guideway, Highway, and Combination Six-Lane Highway with Bus in Guideway alternatives would all avoid fens. While all other alternatives were calculated to result in impacts associated with these alternatives' footprint, construction disturbance, and sensitivity zones, these impacts would be avoidable based on the assumptions described in section 3.6, Wetlands, Other Waters of the US, and Riparian Areas. Design and mitigation details to avoid fens will be considered in detail at the Tier 2 level of study.

Other waters of the US. The Bus in Guideway alternatives would permanently affect 0.8 acre of other waters of the US. These alternatives' temporary impacts would affect 2.4 acres of other waters of the US within the construction disturbance zone and may also affect 5.1 acres within the sensitivity zone.

Riparian areas. Riparian areas are located next to streams and often comprise much of the associated floodplain and provide important and unique wildlife habitat areas. Possible impacts on riparian areas would be loss or fragmentation of riparian corridors along streams, and changes in the floodplain. The Bus in Guideway alternatives would permanently affect 4.1 acres of riparian areas; temporary impacts would affect 4.1 acres of riparian areas within the construction disturbance zone and may also affect 4.9 acres within the sensitivity zone.

Section 4(f)

Under Section 4(f), FHWA may not approve the use of land from a significant publicly owned public park, recreation area, or wildlife and waterfowl refuge, or any significant historic site unless a determination is made that:

- There is no feasible and prudent alternative to the use of land from the property; and
- The action includes all possible planning to minimize harm to the property resulting from such use.

A key role of the PEIS has been to establish the opportunity to avoid the use of 4(f) properties at the Tier 1 level.

Other than the No Action alternative, all alternatives would result in use of 4(f) properties. The use of Section 4(f) properties is similar among all action alternatives and is addressed in greater detail in section 3.16.

Section 106 Regulations

Under Section 106 of the NHPA, agencies are required to account for the effects of their undertakings on historic properties, and afford the Advisory Council on Historic Places (ACHP) the opportunity to comment on such undertakings at the early stages of project planning to assess their effects and seek ways to avoid, minimize, or mitigate any adverse effects on historic properties. A key role of the PEIS has been to establish the opportunity to avoid impacts on historic properties at the Tier 1 level. The role of the 4(f)/6(f) Ad Hoc Committee has been to initiate consultation with the ACHP and the State Historic Preservation Officer at the Tier 1 level. The committee has provided direction on the strategy for identifying historic properties, an area of potential effect, and criteria to assess impacts on historic properties at the Tier 1 level. The following comparison shows the potential of alternatives to avoid impacts on historic properties.

The Minimal Action alternative would result in the least impact on historic properties, followed by the Bus in Guideway alternatives and the Six-Lane Highway (55 and 65 mph) alternatives. Historic properties are addressed in section 3.15.

Threatened, Endangered, and Special Status Species

Section 7 of the Endangered Species Act requires that a federal agency, in consultation with the Secretary of the Interior, avoid any action they authorize, fund, or carry out that is likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. In fulfilling these requirements, each agency must use the best scientific and commercial data available. The role of the ALIVE committee has been to initiate the process of complying with Section 7 by engaging the involvement of the US Fish and Wildlife Service, the US Forest Service, the Bureau of Land Management, and the Colorado Division of Wildlife to identify critical habitats, and plan wildlife crossings for the Corridor, to reduce the effects of I-70 on wildlife. The following is a summary of the comparison of alternatives and their ability to avoid the habitats of threatened, endangered, and special status species.

Federally threatened, endangered, and special status (TES) species known to occur within the Corridor include lynx, boreal toads, and Colorado River and greenback cutthroat trout. Possible impacts on TES species are the loss or fragmentation of habitat and barrier effect of the highway that restricts movement or reduces access to habitat.

Other than the No Action alternative, the Minimal Action alternative would have the least impact on TES species habitat, affecting approximately 119 acres (including the footprint, construction disturbance, and sensitivity zone). The Bus in Guideway alternatives (in addition to the No Action and Minimal Action alternatives) would result in the lowest indirect and cumulative impacts on TES species habitat.

2.3.8.3 Comparison of Environmental and Community Impacts by Alternative

The following is a comparative summary of the impacts of alternatives on environmental resources (footprint, construction zone, and sensitivity zone), and community values, as well as cumulative impacts. This summarizes the comparative matrices for environmental sensitivity (Table 2-25), community values (Table 2-26), and cumulative impacts (Table 2-27). While the tables are comprehensive, the following discussion is focused on the key differences among alternatives and does not address all impacts. Indirect impacts on community values are not shown in tables, but are addressed in section 3.9.

No Action

Direct Impacts

It is important to note that the No Action alternative does not equate with "no impact." Not only does the existing I-70 have some impact on the environment, the No Action alternative represents projects already approved and planned for construction within the next 20 years.

While it is generally the case that the No Action alternative has less impact on resources than the build alternatives, some alternatives would have lower impacts than No Action on certain resources. The Transit alternatives, for example, would have the effect of lowering emissions in the air relative to the No Action alternative.

That said, the No Action alternative would consistently rank among the least for impacts on all environmental resources.

The No Action alternative would also rank among the least for impacts on community values resources, including currently developed lands and right-of-way, visual resources, 4(f) properties, noise, and air quality.

Indirect and Cumulative Impacts

Relatively high indirect and cumulative impacts on social and economic values associated with the No Action alternative could result from suppressed economic conditions.

Minimal Action

Direct Impacts

The Minimal Action alternative would be ranked moderate among alternatives for its impacts on vegetation (188 acres disturbed), fisheries (29 acres disturbed), and winter maintenance (23 percent increase in sand use and 19 percent increase in the use of liquid deicers). For all other environmental resources, the Minimal Action alternative ranks among the least compared with other alternatives.

The Minimal Action alternative would be ranked among the greatest for its impacts on currently developed lands (70 parcels affected) and would be ranked moderate among alternatives for right-of-way requirements (27.8 acres required). The Minimal Action alternative would be ranked least among alternatives for its impacts on all other community values resources.

Indirect and Cumulative Impacts

Relatively high indirect and cumulative impacts on social and economic values associated with the Minimal Action alternative may occur due to suppressed economic conditions.

Rail with IMC

Direct Impacts

The Rail with IMC alternative ranks among the highest compared with other alternatives for impacts on other waters of the US (16 acres disturbed), fisheries (41 acres disturbed), and recreation (12 properties disturbed). It would also be one of the highest ranking alternatives for impacts on water quality from stormwater runoff, with between 26 percent and 28 percent increase in stream load (3-year storm event) of phosphorus, copper, zinc, chloride, and TSS.

The Rail with IMC alternative would be ranked moderate among alternatives for impacts on key wildlife habitat (244 acres), although the alternative's impacts on high-quality songbird habitat would be ranked among the highest. Impacts on the following resources would also be ranked as moderate: TES species habitat (311 acres of disturbance), vegetation (215 acres disturbed), wetlands (13 acres disturbed), riparian areas (19.5 acres disturbed), and streams (32,434 linear feet disturbed).

The Rail with IMC alternative would rank moderate for impacts to currently developed lands (77 parcels affected) and right-of-way requirements (34 acres). This alternative would rank moderate for its impacts on visual resources and noise levels. The Rail with IMC alternative ranks among the least for impact on air quality.

Indirect and Cumulative Impacts

Cumulative impacts on wildlife habitat and wetlands due to possible induced growth in urban areas are expected to be relatively low for the Rail with IMC alternative. Cumulative impacts on water resources, land use, recreation resources, visual resources, and historic properties would rank as moderate for the Rail with IMC alternative. Indirect and cumulative impacts to economic values would be among the least; and indirect impacts associated with possible induced growth would be moderate.

Advanced Guideway System

Direct Impacts

The AGS alternative would be ranked among the moderate or least impacting alternatives on environmental resources with the following exceptions: deer habitat, for which it would be ranked among the highest (45 acres disturbed). Overall, the impact on key wildlife habitat would be among the least, and impact on TES species would be moderate among alternatives. Impacts on fisheries would be moderate among alternatives. Impacts on vegetation would be among the least with 170 acres disturbed. Impacts on wetlands, other waters of the US, riparian areas, and streams also are ranked as among the least.

The AGS alternative would rank among the highest of alternatives for impacts on visual resources and recreation (12 properties disturbed). Right-of-way requirements would rank as moderate (32.6 acres). The AGS alternative would be among the least for impact on noise levels and air quality.

Indirect and Cumulative Impacts

Cumulative impacts on wildlife habitat and wetlands due to possible induced growth in urban areas are expected to be relatively low for the AGS alternative. Cumulative impacts on water resources, land use, recreation resources, visual resources, and historic properties would rank as moderate for the

AGS alternative. Indirect and cumulative impacts to economic values would be among the least; and indirect impacts associated with possible induced growth would be moderate.

Dual-Mode Bus in Guideway and Diesel Bus in Guideway

Direct Impacts

Neither Dual-Mode Bus in Guideway nor Diesel Bus in Guideway would be ranked among the highest impacting alternatives on any environmental resource with the exception of winter maintenance. The use of liquid deicers is predicted to increase by 39 percent. This is because more intensive usage of deicers would be expected for the guideway since sand would not be used. The Bus in Guideway alternative impacts would be ranked among the least compared with other alternatives in every environmental resource except key wildlife habitat, for which they would be ranked moderate due to 185 acres of impacts to bighorn sheep habitat. These two alternatives would have rankings identical to each other for all environmental resources.

The Bus in Guideway alternatives would rank among the least for impacts on currently developed lands (75 parcels affected). These alternatives would have among the least impacts on visual resources, noise levels, and right-of-way requirements (24.8 acres).

Indirect and Cumulative Impacts

Cumulative impacts on wildlife habitat and wetlands due to possible induced growth in urban areas are expected to be relatively low for the Bus in Guideway alternatives. Cumulative impacts on water resources, land use, recreation resources, visual resources, and historic properties would rank as moderate for the Bus in Guideway alternatives. Indirect and cumulative impacts to economic values would be among the least, and indirect impacts associated with possible induced growth would be moderate.

Six-Lane Highway 55 and 65 mph

Direct Impacts

Six-Lane Highway 55 mph impacts would be ranked among the least or moderate compared with other alternatives. Moderate impacts would be expected on key wildlife habitat, vegetation, riparian areas, fisheries, and streams. For TES species, wetlands, and other waters of the US, impacts of Six-Lane Highway 55 mph would be ranked among the least.

Six-Lane Highway 65 mph would be ranked among the highest impacting alternatives for its impact on bighorn sheep habitat (of which 220 acres would be disturbed). The overall ranking for impact on key wildlife habitat would be moderate (though impact rankings for deer and songbird habitats would be among the least), and for TES species habitat, it would be ranked among the least compared with other alternatives. Impacts on vegetation, other waters of the US, fisheries, and streams would be ranked moderate. Six-Lane Highway 65 mph would be ranked among the least compared with other alternatives for impacts on wetlands.

For both Six-Lane Highway alternatives, impacts on winter maintenance and water quality from stormwater runoff would be rated moderate.

The impacts of these alternatives would be similar for all community values resources. The Six-Lane Highway alternatives would rank among the highest for their impacts on noise levels, with an anticipated increase of 2 to 3 dB, and among the highest for impacts on air quality (re-entrained dust and visibility). The Six-Lane Highway 55 mph alternative would also be ranked among the least for impacts on currently developed lands (71 parcels affected). The Six-Lane Highway 65 mph alternative would rank moderate for currently developed lands (76 parcels). The Six-Lane Highway alternatives would be ranked as having among the lowest impact on visual resources.

Indirect and Cumulative Impacts

Cumulative impacts on wildlife habitat, wetlands, and water resources, due to possible induced growth in urban and rural areas, are expected to be moderate among alternatives for the Six-Lane Highway alternatives. Cumulative impacts on social and economic values, recreation resources, and visual resources would rank as low among alternatives. Indirect and cumulative impacts to economic values would be among the least. Cumulative impacts on historic properties would rank as moderate for the Six-Lane Highway alternatives.

Reversible/HOV/HOT Lanes

Direct Impacts

Impacts of the Reversible/HOV/HOT Lanes alternative on key wildlife habitat would be ranked among the greatest compared with other alternatives, due to 236 acres of impacts to bighorn sheep habitat. Impacts would be ranked as moderate for vegetation, wetlands, other waters of the US, riparian areas, fisheries, and streams. Impacts on TES species habitat would be among the least compared with other alternatives. This alternative would rank moderate for increase in stream loads (3-year storm event) of zinc, TSS, phosphorus and copper; and would rank among the greatest for increase in sand and deicer usage.

Similar to the other Highway alternatives, the Reversible/HOV/HOT Lanes alternative would be ranked among the highest for its impact on noise levels, with an anticipated increase of 2 to 3 dB, and all air quality indicators. The Reversible/HOV/HOT Lanes alternative is also anticipated to rank moderate for impacts on currently developed lands (80 parcels affected). The Reversible/HOV/HOT Lanes alternative would rank among the least for right-of-way requirements (28.6 acres) and would be ranked as having among the lowest impact on visual resources. This alternative would rank among the greatest for disturbance of historic properties (12 properties).

Indirect and Cumulative Impacts

Cumulative impacts on wildlife habitat, wetlands, and water resources, due to possible induced growth in urban and rural areas, are expected to be moderate among alternatives for the Reversible/HOV/ HOT Lanes alternative. Cumulative impacts on social and economic values, recreation resources, and visual resources would rank as low among alternatives. Indirect and cumulative impacts to economic values would be among the least, and indirect impacts associated with possible inducted growth would be moderate. Cumulative impacts on historic properties would rank as moderate for the Reversible/HOV/HOT Lanes alternative.

Combination Six-Lane Highway with Rail and IMC

Direct Impacts

The Combination Six-Lane Highway with Rail and IMC alternative would rank among the highest impacting alternatives on every environmental resource under consideration with the exception of winter maintenance. Approximate impacts include key wildlife habitat (total of 323 acres disturbed), TES species (429 acres), vegetation (300 acres), wetlands (18.7 acres), other waters of the US (19.6 acres), riparian areas (30.8 acres), fisheries (53.3 acres), and streams (43,758 linear feet disturbed). Impacts on the water quality of stormwater runoff are expected to be among the greatest; however, these impacts would be reduced to moderate among alternatives if the highway is built with transit preservation.

The Combination Six-Lane Highway with Rail and IMC alternative would rank among the greatest for impacts on currently developed lands (87 parcels affected), right-of-way requirements (37 acres), and noise (anticipated increase of 5 dB). The impacts of this alternative on visual resources and air quality would rank moderate.

Indirect and Cumulative Impacts

Cumulative impacts (due to possible induced growth in urban and rural areas) to wildlife habitat, wetlands, water resources, land use, recreation resources, and visual resources would be ranked among the greatest for the Combination alternatives. Indirect and cumulative impacts to economic values would be among the least, and indirect impacts from possible induced growth would be among the greatest. Cumulative impacts on historic properties would rank as moderate for the Combination alternatives.

Combination Six-Lane Highway with AGS

Direct Impacts

Combination Six-Lane Highway with AGS ranks among the greatest of alternatives for impacts on all of the following environmental resources: key wildlife habitat (total of 318 acres disturbed), TES species (394 acres), vegetation (285 acres), wetlands (18.3 acres), other waters of the US (18.1 acres), riparian areas (28.1 acres), fisheries (51 acres), and streams (41,319 linear feet disturbed). The moderate ranked impacts from stormwater runoff and winter maintenance would be reduced to among the least where the transit would be built with a highway preservation.

The Combination Six-Lane Highway with AGS alternative would rank among the greatest for direct impacts on all community values resources.

Indirect and Cumulative Impacts

Cumulative impacts (due to possible induced growth in urban and rural areas) to wildlife habitat, wetlands, water resources, land use and social values, recreation resources, and visual resources would be ranked among the greatest of the Combination alternatives. Indirect and cumulative impacts to economic values would be among the least, and indirect impacts from possible induced growth would be among the greatest. Cumulative impacts on historic properties would rank as moderate for the Combination alternatives.

Combination Six-Lane Highway with Dual-Mode or Diesel Bus in Guideway

Direct Impacts

The Combination Six-Lane Highway with Dual-Mode Bus in Guideway and Combination Six-Lane Highway with Diesel Bus in Guideway alternatives would have identical rankings for impacts on all environmental resources.

These Combination Six-Lane Highway with Dual-Mode or Diesel Bus alternatives rank among the highest compared with other alternatives for their impact on key wildlife habitat, with the habitats of elk (7 acres disturbed) and bighorn sheep (244 acres disturbed) having impacts ranked among the highest for alternatives. (However, impacts on deer habitats and songbird habitat would be ranked among the least compared with other alternatives.) Combination Six-Lane Highway with Dual-Mode or Diesel Bus in Guideway alternatives would also be ranked among the highest for impacts on streams (37,173 linear feet).

The alternatives' impacts on TES species habitat, vegetation, wetlands, riparian areas, and fisheries would be ranked moderate.

These alternatives would rank among the greatest for their impacts on winter maintenance due to intensive deicer usage in the guideway. Impacts from stormwater runoff (3-year event) would remain moderate among alternatives for TSS, phosphorous, zinc, chloride, and copper loads; and impacts from stormwater runoff would also be moderate if transit is built with a highway preservation, or highway is built with a transit preservation.

The Combination Six-Lane Highway with Dual-Mode or Diesel Bus in Guideway alternatives would rank among the greatest for impacts on currently developed lands (85 parcels affected), recreation (11 properties disturbed), historic (12 properties disturbed), air quality (re-entrained dust and visibility), and noise levels (anticipated increase in a range from 3 to 4 dB). Impacts from right-of-way requirements (32.1 acres) would be moderate. Impacts on visual resources would be ranked moderate.

Indirect and Cumulative Impacts

Cumulative impacts (due to possible induced growth in urban and rural areas) to wildlife habitat, wetlands, water resources, land use, recreation resources, and visual resources would be ranked among the greatest for the Combination alternatives. Indirect and cumulative impacts to economic values would be among the least, and indirect impacts from possible induced growth would be among the greatest. Cumulative impacts on historic properties would rank as moderate for the Combination alternatives.

Table 2-25. Environmental Sensitivity – Ranks and Levels of Impact of Alternatives

			Transit Alternatives				Highway Alternatives			Combination Highway/Transit Alternatives			
		1	2	3	4	5	6	7	8	9	10	11	12
	No Action Alternative	Minimal Action Alternative	Rail with IMC	Advanced Guideway System	Dual-Mode Bus in Guideway	Diesel Bus in Guideway	6-Lane Highway 55 mph	6-Lane Highway 65 mph	Reversible/ HOV/HOT Lanes	6-Lane Highway with Rail and IMC *9 – Build Combination simultaneously* *9a – Build Transit First* *9b – Build Highway First*	6-Lane Highway with AGS *10 – Build Combination simultaneously* *10a – Build Transit First* *10b – Build Highway First*	6-Lane Highway with Dual-Mode Bus in Guideway *11 – Build Combination simultaneously* *11a – Build Transit First* *11b – Build Highway First*	6-Lane Highway with Diesel Bus in Guideway *12 – Build Combination simultaneously* *12a – Build Transit First* *12b – Build Highway First*
Key Deer Habitat	1	2	2	3	2	2	2	2	2	2	4	2	2
Key Elk Habitat	1	1	3	1	2	2	3	3	4	7	6	5	5
Key Bighorn Sheep Habitat	1	2	5	3	4	4	6	6	7	8	7	7	7
Quality Songbird Habitat	1	3	6	4	3	3	3	2	3	7	5	3	3
Summary	**1**	**2**	**5**	**3**	**4**	**4**	**5**	**5**	**6**	**7**	**7**	**6**	**6**
Threatened, Endangered, and Special Status Species	1	2	8	6	3	3	5	4	5	10	9	7	7
Vegetation	1	4	5	3	2	2	5	4	6	8	7	6	6
Wetlands	1	3	7	4	2	2	5	5	6	8	8	7	7
Springs/Fens	1	1	3	2	1	1	1	1	1	4	3	1	1
Other Waters of the US	1	3	7	4	2	2	4	5	6	9	8	7	7
Riparian Areas	1	3	4	3	2	2	5	6	6	9	8	7	7
Summary	1	3	6	4	2	2	5	6	6	9	8	7	7
Fisheries	1	3	6	4	2	2	4	3	4	7	7	5	5
Streams	1	2	6	4	3	3	5	6	6	9	8	7	7
Winter Maintenance	1	2	1	1	5	5	3	4	5	3 1 3	3 1 3	6 5 3	6 5 3
Stormwater	1	2	4	1	3	3	3	3	3	5 4 3	3 1 3	3 3 3	3 3 3

Legend:

Least Impact
Intermediate Impact
Greatest Impact

Each set of rankings and color-coding is specific to a resource; ranks and colors cannot be compared across resources. For each resource, alternatives were ranked in order (from least to greatest) based on the area affected, by the combination of the alternative footprint, construction disturbance, and sensitivity zone. Alternatives disturbing the same amount of area (to within 5 percent difference) were given the same rank. Color-coding shows the greatest, intermediate, and least impacts, based on each resource's specific units of measure and range of impacts.

Table 2-26. Community Values – Ranks and Levels of Impact of Alternatives

			Transit Alternatives					Highway Alternatives			Combination Highway/Transit Alternatives			
			1	2	3	4	5	6	7	8	9	10	11	12
		No Action Alternative	**Minimal Action Alternative**	**Rail with IMC**	**Advanced Guideway System**	**Dual-Mode Bus in Guideway**	**Diesel Bus in Guideway**	**6-Lane Highway 55 mph**	**6-Lane Highway 65 mph**	**Reversible/ HOV/HOT Lanes**	**6-Lane Highway with Rail and IMC** *9 – Build Combination simultaneously* *9a – Build Transit First* *9b – Build Highway First*	**6-Lane Highway with AGS** *10 – Build Combination simultaneously* *10a – Build Transit First* *10b – Build Highway First*	**6-Lane Highway with Dual-Mode Bus in Guideway** *11 – Build Combination simultaneously* *11a – Build Transit First* *11b – Build Highway First*	**6-Lane Highway with Diesel Bus in Guideway** *12 – Build Combination simultaneously* *12a – Build Transit First* *12b – Build Highway First*
Land Use	Parcels	1	2	2	2	2	2	2	2	2	3	3	3	3
	ROW	1	3	4	4	2	2	3	3	3	5	6	4	4
Visual Resources		1	2	5	7	3	3	3	3	3	6	7	4	4
Recreation		1	3	6	6	2	2	4	3	4	6	6	5	5
Historic		1	2	2	2	2	2	2	2	3	3	3	3	3
4(f)		N/A	Similar											
Noise (Ranks not provided*)	Dowd Canyon	*	*	*	*	*	*	*	*	*	*	*	*	*
	Vail	*	*	*	*	*	*	*	*	*	*	*	*	*
	Dillon Valley	*	*	*	*	*	*	*	*	*	*	*	*	*
	Silver Plume	*	*	*	*	*	*	*	*	*	*	*	*	*
	Georgetown	*	*	*	*	*	*	*	*	*	*	*	*	*
	Lawson, Downieville, Dumont	*	*	*	*	*	*	*	*	*	*	*	*	*
	Idaho Sprints	*	*	*	*	*	*	*	*	*	*	*	*	*
Air Quality	CO	2	1	1	1	1	1	3	3	4	3 1 3	3 1 3	3 1 3	3 1 3
	Entrained Dust	2	1	1	1	1	1	3	3	3	3 1 3	3 1 3	3 1 3	3 1 3
	Visibility	2	2	1	1	1	1	3	3	3	3 1 3	3 1 3	3 1 3	3 1 3

Legend:

Least Impact
Intermediate Impact
Greatest Impact

Each set of rankings and color-coding is specific to a resource; ranks and colors cannot be compared across resources. For each resource, alternatives were ranked in order (from least to greatest) based on the area affected, by the combination of the alternative footprint, construction disturbance, and sensitivity zone. Alternatives disturbing the same amount of area (to within 5 percent difference) were given the same rank. Color-coding shows the greatest, intermediate, and least impacts, based on each resource's specific units of measure and range of impacts.

* While noise thresholds provide relative comparison of increases in noise at seven locations across the Corridor, more discrete rankings are not appropriate because noise levels are variable and highly dependent on location-specific terrain and development features. See section 3.12 for terrain-specific issues in analyzed areas and predicted noise levels.

Table 2-27. Summary of Cumulative Impacts

Resource	No Action	Minimal Action	Transit Alternatives	Highway Alternatives	Highway/Transit Combination Alternatives
Wildlife Habitat	No Cumulative Impact	No Cumulative Impact	**Foreseeable Future:** Existing and planned development acreage comprises ~ 47%, 35%, 9%, and 23% of deer, elk, bighorn sheep, and songbird habitat, respectively. **Cumulative Impacts:** Transit alternatives would increase Corridor impacts slightly (additional increase of <5% from expected habitat changes) due to possible induced growth (centered in urban areas) in the Eagle River watershed.	**Foreseeable Future:** Existing and planned development acreage comprises ~ 47%, 35%, 9%, and 23% of deer, elk, bighorn sheep, and songbird habitat, respectively. **Cumulative Impacts:** Highway alternatives would increase Corridor impacts moderately (additional increase of 1% to 22% from expected habitat changes) due to possible induced growth (in both urban and rural areas) in the Eagle River watershed.	**Foreseeable Future:** Existing and planned development acreage comprises ~ 47%, 35%, 9%, and 23% of deer, elk, bighorn sheep, and songbird habitat, respectively. **Cumulative Impacts:** Combination alternatives would have the greatest increase in Corridor impacts (additional increase of 3% to 39% from expected habitat changes) due to possible induced growth (in both urban and rural areas) in the Eagle River and Blue River watersheds.
Wetlands	No Cumulative Impact	No Cumulative Impact	**Foreseeable Future:** Existing and planned development acreage comprises ~37% of water resources/wetlands (200' buffer zone) areas. **Cumulative Impacts:** Transit alternatives would increase Corridor impacts slightly (additional increase of ~2% from expected growth) due to possible induced growth (centered in urban areas) in the Eagle River watershed. Direct impacts (primarily the Rail with IMC alternative) would have cumulative effects (additive to historic impacts) in the Clear Creek watershed.	**Foreseeable Future:** Existing and planned development acreage comprises ~37% of water resources/wetlands (200' buffer zone) areas. **Cumulative Impacts:** Highway alternatives would increase Corridor impacts moderately (additional increase of ~13% from expected change) due to possible induced growth (in both urban and rural areas) in the Eagle River watershed. Direct impacts would have cumulative effects (additive to historic impacts) in the Clear Creek watershed.	**Foreseeable Future:** Existing and planned development acreage comprises ~37% of water resources/wetlands (200' buffer zone) areas. **Cumulative Impacts:** Combination alternatives would have the greatest Corridor impacts (additional increase of ~28% from expected change) due to possible induced growth (in both urban and rural areas) in the Eagle River and Blue River watersheds. Direct impacts (primarily the Rail with IMC Combination alternative) would have cumulative effects (additive to historic impacts) in the Clear Creek watershed.
Water Resources	No Cumulative Impact	No Cumulative Impact	**Foreseeable Future:** Existing I-70 contributes 6% of the phosphorus load in the Corridor. Planned development will increase phosphorus loads by ~23%. **Cumulative Impacts:** Transit alternatives would increase Corridor impacts slightly (<7%) due to possible induced growth (centered in urban areas) in the Eagle River watershed.	**Foreseeable Future:** Existing I-70 contributes 6% of the phosphorus load in the Corridor. Planned development would increase phosphorus loads by ~23%. **Cumulative Impacts:** Highway alternatives would increase Corridor impacts slightly (~10%) due to possible induced growth (in both urban and rural areas) in the Eagle River watershed.	**Foreseeable Future:** Existing I-70 contributes 6% of the phosphorus load in the Corridor. Planned development would increase phosphorus loads by ~23%. **Cumulative Impacts:** Combination alternatives would have the greatest Corridor impacts (~24% increase) due to possible induced growth (in both urban and rural areas) in the Eagle River and Blue River watersheds.
Social and Economic Values	**Foreseeable Future:** Regional GRP is expected to grow 215% by 2035. **Cumulative Impacts:** Possible suppressed economic conditions could decrease expected growth in GRP by ~ 22%		**Foreseeable Future:** Regional GRP is expected to grow 215% by 2035. Corridor population is expected to grow 100% by 2025. **Cumulative Impacts:** Transit alternatives are expected to support growth in GRP. Transit alternatives will have moderate Corridor impacts caused by possible induced growth in Eagle County (additional increase of 22% from expected growth). Induced growth in Eagle County might also increase commuting and cause induced growth impacts on adjacent counties.	**Foreseeable Future:** Regional GRP is expected to grow 215% by 2035. Corridor population is expected to grow 100% by 2025. **Cumulative Impacts:** Highway alternatives are expected to support growth in GRP. Highway alternatives would have slight Corridor impacts (additional increase of ~22% in Eagle County from expected growth change) caused by possible induced growth. Highway alternatives are expected to allow greater dispersed growth in rural areas of Eagle County. Induced growth in Eagle County might also increase commuting and cause induced growth impacts on adjacent counties.	**Foreseeable Future:** Regional GRP is expected to grow 215% by 2035. Corridor population is expected to grow 100% by 2025. **Cumulative Impacts:** Combination alternatives are expected to support or exceed growth in GRP. Combination alternatives would have the greatest impacts (additional increase of ~100% in Eagle County and ~40% in Summit County from expected growth changes) caused by possible induced growth. Induced growth in Eagle and Summit counties might also increase commuting and cause induced growth impacts on adjacent counties.
Recreational Resources	No Cumulative Impact	No Cumulative Impact	**Foreseeable Future:** 2025 projections indicate that ARNF (Corridor districts) skier visits and winter and summer RVDs are expected to increase by 0.6 million, 0.9 million, and 2.6 million, respectively, from 2000 levels. 2025 projections indicate that WRNF (Corridor districts) skier visits and winter and summer RVDs are expected to increase by 1 million, 0.8 million, and 3 million, respectively, from 2000 levels. **Cumulative Impacts:** Transit alternatives could increase ARNF/WRNF visitation levels by 0.2/0.5 million winter forest destination trips and 0.2/0.5 million summer forest destination trips in 2025.	**Foreseeable Future:** 2025 projections indicate that ARNF (Corridor districts) skier visits and winter and summer RVDs are expected to increase by 0.6 million, 0.9 million, and 2.6 million, respectively, from 2000 levels. 2025 projections indicate that WRNF (Corridor districts) skier visits and winter and summer RVDs are expected to increase by 1 million, 0.8 million, and 3 million, respectively, from 2000 levels. **Cumulative Impacts:** Highway alternatives could increase ARNF/WRNF visitation levels slightly by 0.04/0.15 million winter forest destination trips and 0.04/0.12 million summer forest destination trips in 2025.	**Foreseeable Future:** 2025 projections indicate that ARNF (Corridor districts) skier visits and winter and summer RVDs are expected to increase by 0.6 million, 0.9 million, and 2.6 million, respectively, from 2000 levels. 2025 projections indicate that WRNF (Corridor districts) skier visits and winter and summer RVDs are expected to increase by 1 million, 0.8 million, and 3 million, respectively, from 2000 levels. **Cumulative Impacts:** Combination alternatives could produce the greatest increase in ARNF/WRNF visitation levels by 0.4/1.3 million winter forest destination trips and 0.4/1.0 million summer forest destination trips in 2025.
Visual Resources	No Cumulative Impact	No Cumulative Impact	**Foreseeable Future:** Existing and planned development acreage comprises ~32% of the area visible from I-70. **Cumulative Impacts:** The Transit alternatives would have moderate cumulative impacts (an additional ~9% of the area visible from I-70 would be developed) to visual resources from possible induced growth in the Eagle River watershed.	**Foreseeable Future:** Existing and planned development acreage comprises ~32% of the area visible from I-70. **Cumulative Impacts:** The Highway alternatives would have moderate cumulative impacts (additional increase of ~10% in development of the area visible from I-70) to visual resources from possible induced growth in the Eagle River watershed.	**Foreseeable Future:** Existing and planned development acreage comprises ~32% of the area visible from I-70. **Cumulative Impacts:** The Combination alternatives would have the greatest cumulative impacts (additional increase of ~45% in development of the area visible from I-70)) to visual resources from possible induced growth in the Eagle River and Blue River watersheds.
Historic Properties	No Cumulative Impact	No Cumulative Impact	**Foreseeable Future:** Planned development in Clear Creek County is expected to increase developed acreage by more than 200 percent. Impacts from indirect disturbance (noise and visual impacts) to historic districts and landmark areas (mining related) to areas previously displaced/disturbed by original I-70 construction would cause cumulative effects. **Cumulative Impacts:** Planned development and possible development from induced growth in Eagle County might cause limited cumulative effects (indirect visual and noise impacts) to historic landmarks and properties.		
Air Quality	Cumulative Impacts for CO and PM_{10} are not indicated on a regional basis in the Corridor, and cumulative impacts from entrained dust are considered minimal. Emissions from mobile sources have decreased since 1970 due to reformulated gasoline and modern emission controls, and are expected to decrease in the future. Highway maintenance and woodburning controls are expected to control entrained particulate matter.				

Legend:

Least Impact	Intermediate Impact	Greatest Impact

2.4 Grouping of Alternatives

Twenty-one alternatives are presented in the Draft PEIS for full disclosure of impacts, cost, and consistency with the purpose and need of the project. NEPA requires that reasonable alternatives be offered and addressed and that preferred alternatives be disclosed when known. To comply with this, the 21 alternatives have been grouped into those that are "preferred" and those that are not (the "other" grouping).

Preferred alternatives are defined as those that:

- Best meet the underlying need while achieving purposes to varying degrees

Other alternatives are defined as those that:

- Do not meet the underlying need as well while achieving purposes to varying degrees

Or

- Are not reasonable due to technical and/or economical infeasibility

Alternatives determined not to be preferred could move into the preferred category with new information or with modification for the Final PEIS.

Objectives for grouping of alternatives include:

- A comprehensive and systematic process, to meet NEPA requirements
- A framework for decision making provided by the process
- Identification of a preferred group of alternatives (using data included in the *Summary of Preliminary Findings,* September 2003)
- Identification of an interdisciplinary process for preferred group decision making

The benefits of identifying a group of preferred alternatives in the Draft include the fact that the public learns sooner in the PEIS process rather than later which alternatives seem most viable. In addition, grouping alternatives during the Draft PEIS process will allow an earlier and more focused discussion on how to shape I-70.

The group of preferred alternatives will be narrowed to a preferred alternative between the Draft PEIS and the Final PEIS for identification in the Final PEIS.

2.4.1 Grouping Process

CDOT completed a *I-70 PEIS Summary of Preliminary Findings* report to provide interested parties and stakeholders with information pertinent to decision making, and data that had been collected and evaluated in the completion of the Draft PEIS. The package was intended to provide the necessary Tier 1 information so that the differing impacts associated with each alternative could be discerned. This *I-70 PEIS Summary of Preliminary Findings* report was distributed to Advisory Committee members in a meeting on September 4, 2003, to orient members to the information provided and to answer questions. On September 23, 2003, CDOT held a listening forum of key stakeholders represented by the MCAC / TAC members. The listening forum focused on the following key questions:

1. The alternatives vary in their ability to meet the project "need"—to increase capacity, improve accessibility and mobility, and decrease congestion—as measured by the ability to accommodate projected 2025 baseline travel demand:
   a. What is your view on meeting the need relative to the tradeoffs to be made (that is, positive and negative environmental effects and consequences)?
   b. What are the gains and losses of pursuing those alternatives that may not accommodate future potential growth as well?
   c. What are the gains and losses of pursuing those alternatives that may induce demand beyond planned growth?

1) Given that alternatives that are economically feasible are defined as those that meet the NEPA test of reasonableness, what is your view of "affordability"?

2) From the perspective of your constituents, which alternatives would you put in the "preferred" grouping and why?

3) From the perspective of your constituents, which alternatives would you put in the "other" grouping and why?

4) From the perspective of your constituents, what else would you want the decision-makers to know as they contemplate the decision before them?

In addition to the MCAC/TAC members, the listening forum was attended by CDOT and FHWA executives charged with the responsibility for the decision on I-70, most of the cooperating agencies, and the federal interdisciplinary team members. Following the listening forum, a meeting was held with the federal interdisciplinary team to gain their perspective on the questions asked at the listening forum and to receive technical feedback on the data provided in the *I-70 PEIS Summary of Preliminary Findings* report.

What CDOT and FHWA heard at the Listening Forum and as a result of the discussions with the federal interdisciplinary team was quite varied; most acknowledged the need to do something, many wanted quick action, and some did not want a solution that would result in future congestion as is experienced today. Some highly favored a new mode of transportation and others believed that rail transit would not be suited for this Corridor. All were sincere about the environmental and community values to be respected. Little opinion was offered on what might constitute an affordable alternative.

The preliminary grouping of alternatives was announced to the public and presented to the Advisory Committee members on November 18, 2003. In addition, newsletters were mailed to more than 10,000 stakeholders to inform them of the grouping decision to be part of the Draft PEIS. The project website was also updated with this information.

The consideration of the environmental sensitivity and community values purposes have shaped many of the alternatives evaluated. See Chapter 3 for discussions of how this has occurred for each resource. Preliminary findings of the environmental and community value impacts were disclosed to the Corridor stakeholders during September and November 2003, when the discussion involving the grouping of preferred alternatives occurred. This information was disclosed so that the CDOT and FHWA decision makers would be fully informed about the public concerns (as represented by the MCAC / TAC members and the federal interdisciplinary team), issues, and consequences of the alternatives considered, before deciding which alternatives would be in the "preferred" group and which would be in the "other" (not preferred) group.

All of the listening forum questions were specific to the issue of grouping. Therefore, the definition of grouping is as follows:

- **Preferred Alternatives.** These alternatives best meet the underlying need (as measured by the ability to accommodate projected 2025 baseline travel demand) and achieve the project purposes (that is, Community Values, Environmental Sensitivity, Safety, Implementation) to varying degrees.
- **Other Alternatives.** These alternatives do not meet the underlying need as well and achieve the purposes to varying degrees **or** are not reasonable due to technical and/or economical feasibility.

An interdisciplinary process of alternatives comparison was conducted based on need and purpose criteria (implementation, safety, environmental sensitivity, community values). Steps involved in grouping included:

- Identification of thresholds to achieve objectives stated above
- Placement of alternatives that do not meet reasonableness and need thresholds into "other" group
- Identification of environmental preferences among alternatives

2.4.1.1 Reasonableness and Need

The criteria for grouping alternatives are based on the requirement that an alternative must be economically reasonable and meet the project need. The rationale for grouping the alternatives is provided below. Environmental criteria were a key component of developing, screening, and refining alternative footprints and alignments to minimize or avoid impacts on environmental and community resources. Direct and indirect environmental impacts of alternatives are disclosed in Chapter 3, and Cumulative Impacts are disclosed in Chapter 4.

Reasonableness. The measure for economic reasonableness is defined as any alternative less than or equal to $4 billion in capital cost. Section 2.4.2, Grouping Results, provides the capital cost of each alternative and indicates the preferred group alternatives that are economically reasonable.

The Transportation Commission has committed approximately $1.6 billion of the Strategic Corridor Investment Program to the Corridor. Additional funds necessary for implementation of project alternatives remain uncommitted. Depending on the decision on the preferred alternative for I-70, some of the uncommitted funds may be allocated to this Corridor, although the likelihood exists that a number of other strategic corridors may have a higher priority for allocation of the funds from the CDOT's available monies. The $1.6 billion amount represents the funding that may be available over the next 20 years. A $4 billion amount has been set as a cost threshold for evaluating alternatives in terms of "reasonableness" from an economic affordability point of view. This threshold was set to not preclude alternatives that may be affordable if funding sources over and above the $1.6 billion were to be secured.

Need. The measure for meeting "need" is 2025 Baseline travel demand. An alternative must have the capacity to accommodate the 2025 Baseline travel demand. Section 2.4.2, Grouping Results, indicates the percent that alternatives are either above or below the annual average Baseline travel demand.

The "Baseline" is a projection of what the travel demand would be if all various trip purposes on a peak model day in 2025 were to be satisfied on the existing highway network without any future changes to the capacity of I-70 (except those noted under the No Action alternative), as defined in Chapter 1, Purpose of and Need for Action. Baseline travel demand varies by location in the Corridor, season (summer or winter), model day, hour, and direction of travel. A quantification of the Baseline travel demand is summarized in Chapter 1, provided in more detail in Appendix B, Transportation Analysis and Data.

For purposes of the need threshold for determining the preferred group of alternatives, the annual average baseline travel demand has been applied, where 0% = Baseline. Alternatives would meet the need at or above 0%, as opposed to alternatives below 0% that would not meet the need.

2.4.2 Grouping Results of Action Alternatives

Table 2-28. Grouping Results of Action Alternatives

	Minimal Action	Transit Alternatives				Highway Alternatives			Combination Alternatives											
									6-Lane Highway with Rail and IMC			6-Lane Highway with AGS			6-Lane Highway with Dual-Mode Bus			6-Lane Highway with Diesel Bus		
	1	2	3	4	5	6	7	8	9	9a	9b	10	10a	10b	11	11a	11b	12	12a	12b
Reasonableness: Total capital cost including Minimal Action components ($ million) (threshold for determining reasonable alternatives less than or equal to $4 billion)	1.30	4.91	6.15	3.46	3.26	2.40	2.65	2.52	6.50	6.14	3.03	8.64	8.32	2.87	4.37	4.01	2.91	4.17	3.80	2.91
Need: Ability to accommodate Baseline travel demand (threshold is at [0%], or above annual average Baseline travel demand)	-2%	+4%	+5%	+4%	+4%	+1%	+1%	+1%	+11%	+4%	+1%	+12%	+5%	+1%	+11%	+4%	+1%	+11%	+4%	+1%

- Alternatives with a capital cost less than or equal to $4 billion
- Alternatives that are at (0%), or above annual average Baseline travel demand

Alternatives with a capital cost above $4 billion

Alternatives that are below the average annual Baseline travel demand (below 0%)

Preferred Group of Alternatives

NO ACTION
Although the No Action Alternative does not meet the baseline travel demand, it has been retained for evaluation in the PEIS to conform with NEPA requirements.

TRANSIT ALTERNATIVES
4. Dual-Mode Bus in Guideway
5. Diesel Bus in Guideway

HIGHWAY ALTERNATIVES
6. Six-Lane Highway 55 mph
7. Six-Lane Highway 65 mph
8. Reversible/HOV/HOT Lanes

PRESERVATION ALTERNATIVES
9b.Build Six-Lane Highway and Preserve for Rail with IMC
10b. Build Six-Lane Highway and Preserve for AGS
11b. Build Six-Lane Highway and Preserve for Dual-Mode Bus in Guideway
12b. Build Six-Lane Highway and Preserve for Diesel Bus in Guideway

Other Group of Alternatives

1. MINIMAL ACTION (as a single-mode alternative)

TRANSIT ALTERNATIVES
2. Rail with IMC
3. AGS

COMBINATION ALTERNATIVES - BUILD SIMULTANEOUSLY
9. Six-Lane Highway with Rail and IMC
10. Six-Lane Highway with AGS
11. Six-Lane Highway with Dual-Mode Bus in Guideway
12. Six-Lane Highway with Diesel Bus in Guideway

PRESERVATION ALTERNATIVES
9a. Build Rail with IMC and Preserve for Highway
10a. Build AGS and Preserve for Highway
11a. Build Dual-Mode Bus in Guideway and Preserve for Highway
12a. Build Diesel Bus in Guideway and Preserve for Highway

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2.5 Permit Requirements

The following table provides possible federal and state permit requirements necessary for the implementation of any of the project alternatives. It is important to note that the necessity for any given permit requirement would be determined at the Tier 2 level of study.

Permit or Requirement for Agency Approval	Applicability	Coordinating Agency
FEDERAL		
Discharge of pollutants to water of the US. Section 402 Permit, Clean Water Act. (33 USC 1251)	The National Pollutant Discharge Elimination System (NPDES) program issues, monitors, and enforces permit for direct discharge of pollutants to the nation's waters. Permit program implements the regulations, limitations, and standards promulgated pursuant to §301, 304, 306, 307, and 308 of the CWA for point source discharge.	US Environmental Protection Agency Colorado Department of Public Health and Environment, Water Quality Division
Management and protection of wetlands. Section 404 Permit, Clean Water Act (40 CFR Parts 230, 33 CFR Parts 320-330 and 40 CFR Part 6, Appendix A)	A section 404 Permit is required when waters of the US including wetlands are affected by the discharge of dredged or fill material into a water of the US.	US Army Corps of Engineers. Omaha District, Denver Regulatory Office Sacramento District
Effects on the aquatic environment Section 404(b)(1), Clean Water Act, (40 CFR Parts 230)	Requirement to identify the least damaging alternative to the aquatic environment. Any discharge permitted must also be within the public interest.	US Army Corps of Engineers. Omaha District, Denver Regulatory Office Sacramento District, Frisco Regulatory Office
Threatened and Endangered Species and their habitat. Section 7 Consultation Endangered Species Act (16 USC 1531 et seq); 50 CFR Part 200, 50 CFR Part 402 Fish and Wildlife Coordination Act (16 USC 661 et seq) 33 CFR Parts 320-330 Migratory Bird Treaty Act of 1918 (16 USC 703-712).	Section 7 consultation in conjunction with Section 404 or 10 permitting is required to assure protection of endangered or threatened species and their critical habitat. The lead agency should request a determination from the USFWS whether there are listed or proposed species or critical habitats present in the study area. A Biological Assessment (BA) will be prepared to examine any possible impacts of a proposed action upon the affected species or critical habitats in the project area. The Migratory Bird Treaty Act implements various treaties and conventions between the U.S. and Canada, Japan, Mexico and the former Soviet Union for the protection of migratory birds. Under the Act, taking, killing or possessing migratory birds is unlawful.	US Fish and Wildlife Service, Colorado Field Office
Actions to protect fish or wildlife. Section 661 Fish and Wildlife Coordination Act (16 USC 661 et seq), 40 CFR 6.302	Consultation is required if alteration of the water resource would occur as a result of the proposed project that would result in impacts on fish and wildlife.	US Fish and Wildlife Service, Colorado Field Office Colorado Division of Wildlife
Disturbance of mine waste within CERCLA operable unit. Section 121 Comprehensive Environmental Response, and Liability Act (42 USC 9601-9657), 40 CFR 300	A MOA between CDOT, EPA CERCLA staff, and CDPHE Solid Waste and CERCLA staff would be prepared to ensure mine waste management is consistent with CERCLA cleanup programs that have taken place in the area.	US Environmental Protection Agency Colorado Department of Public Health and Environment, Solid Waste Unit
Safe use of air space. Federal Aviation Administration, Northwest Mountain Region Planning Guidance 98-19. "Roads in runway protection zone"	A notice to the FAA for the review and approval of activities near the Eagle County Airport will be required to address concerns and effects of the proposed project on the safe and efficient use of navigable air space. Administration Notice of Proposed Construction or Alteration and Hazard Determination (FAA Form 7460-1)	Federal Aviation Administration
Special use permits. US Forest Service	Letter of Consent (LOC) from the USFS for additional easement would be required for obtaining right-of-way on national forest land.	US Forest Service
Protection of archaeological resources. Archeological and Historic Preservation Act. (16 USC 469a-1)	Actions taken to recover and preserve artifacts and archaeological data.	Advisory Council on Historic Properties State Historic Preservation Office
Effects to historic properties. Section 106 Coordination National Historic Preservation Act. (16 USC 470 et seq), 36 CFR Part 800	Section 106 requires that federal agencies take into account the effect of an action or undertaking on historic properties.	Advisory Council on Historic Properties State Historic Preservation Office USFS, Rocky Mountain Region Bureau of Land Management
Section 4(f) Evaluation. US Department of Transportation Act. (23 USC Section 138) 23 CFR 771.135	A Section 4(f) determination will be made when a project encroaches onto public park and recreation lands, wildlife and waterfowl refuges, and historic sites and there is no feasible and prudent alternative to such use.	The Section 4(f) evaluation shall be provided for coordination and comment to the officials having jurisdiction over the Section 4(f) property and to the Department of Interior, and as appropriate to the Department of Agriculture and the Department of Housing and Urban Development. The final decision on applicability of Section 4(f) to a particular property is made by FHWA.

Permit or Requirement for Agency Approval	Applicability	Coordinating Agency
STATE OF COLORADO		
Disturbance of Mine Waste *Colorado recycling guidance.*	Historical mine waste material is considered as a solid waste in Colorado if it is disturbed and not reused. CDOT plans to manage this material onsite to the extent possible. CDOT will submit a materials reuse plan to EPA and CDPHE for approval and onsite management.	US Environmental Protection Agency Colorado Department of Public Health and Environment
Division of Wildlife SB40	Aquatic resources, streams, and fishing waters potentially affected by state-funded highway projects are protected under Colorado SB 40 (33-5-101-107, CRS 1973 as amended). The term "fishing waters" is defined as all aquatic and associated riparian ecosystems that support or are capable of supporting viable fish populations (native, introduced, sport, and nongame fish). The application must be completed at least 60 days before the start of construction, is based on final design, and is coordinated with, submitted to, and approved by CDOW's Wildlife Commission. The Wildlife Commission can recommend that project plans be modified to avoid negatively affecting riparian and fishery resources. Recommended avoidance and mitigation measures are based on permanent and temporary impacts on wetlands, stream banks, sensitive species, and Gold Medal fishing waters.	Colorado Division of Wildlife
Point source discharge of water. Colorado Discharge Permit System. Colorado Water Quality Control Act 25-8-101	Any applicant for a federal permit to conduct an operation that may result in any discharge to navigable waters shall provide to the licensing/permitting agency a certificate from the state that the discharge will comply with applicable provisions of CWA §301, 302, 303, 304, 306, and 307.	Colorado Department of Public Health and Environment
NPDES Construction Storm Water Discharge Permit	Construction stormwater permit is required if more than 1 acre of land is disturbed.	Colorado Department of Public Health and Environment, Water Quality Division
Air Quality. Colorado Revised Statute 25-7-112, 1973. 5 Code of Regulations 1001-5, NO 3	Notice of fugitive dust must be given and application made for a fugitive dust permit.	Colorado Department of Public Health and Environment, Air Pollution Control Division
Colorado Revised Statute 34-32-100 et seq. 2 Code of Regulations 4071 Rules 2, 3, and 4.	Limited impact, regular or special mining and reclamation permit for riprap, sand, and gravel for projects.	Colorado Department of Natural Resources, Mine Land Reclamation Division
Permit for explosive material. Colorado Revised Statute, 9-7-101 et seq. 7 Code of Regulations 1101-9	Permit for explosive material.	Colorado Division of Labor, Public Safety Section

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