

Chapter 1. Purpose and Need

1.1 What's in Chapter 1?

Chapter 1 describes the transportation problems that exist in the Interstate 70 (I-70) Mountain Corridor (the Corridor) today and are forecast to occur in the future. These problems lead to the definition of the project purpose and need. **Chapter 1** documents the transportation problems and the need for a solution to these problems. The purpose and need provides the basis for defining reasonable alternatives and the foundation for eliminating alternatives in **Chapter 2, Summary and Comparison of Alternatives**. **Chapter 1** also describes the study limits, briefly describes the Corridor, and summarizes background information from other studies that contribute to an understanding of the Corridor and its transportation problems. Other related project information presented in **Chapter 1** includes a description of the 2035 and 2050 forecast years used to examine potential future growth and the associated travel demand, including the various types of trips that are likely to occur. For more detailed information on the travel demand forecasts, see the *I-70 Mountain Corridor PEIS Travel Demand Technical Report* (Colorado Department of Transportation [CDOT], March 2011).

1.2 Why was this Corridor study initiated?

Interstate 70 is the only east-west interstate to cross Colorado and the only continuous east-west highway in the study area. It is the major corridor for access to established communities and recreational areas that are important contributors to the quality of life and the economic base in the state. This Corridor provides access to the White River National Forest and the Arapaho and Roosevelt National Forests, the two most visited National Forests in the United States. Destinations along the Corridor include a number of major ski resorts that attract local, national, and international visitors. Recreational travel is the most predominant contributor to peak I-70 highway traffic, especially during summer and winter weekends and holidays. Existing traffic during peak travel times is characterized by congestion that noticeably affects local travel, suppresses the number of skier and other recreational visits, and affects the tourism economy.

In addition to recreational travel, the Corridor is important to freight movement in Colorado. Heavy vehicles—trucks, buses, and recreational vehicles—represent about 10 percent of traffic along the Corridor. The variation in speeds between these vehicles and faster moving automobiles, particularly on the steep grades, contributes to safety, mobility, and congestion in the Corridor. **Figure 1-1** displays Colorado and the I-70 Mountain Corridor.

Growth in the Corridor and the Denver metropolitan region has resulted in an increase in the number of trips along the Corridor. Travelers currently experience congestion, and in the future will experience substantial travel time delays, which restrict mobility and accessibility along the Corridor. Projected travel demands in this Corridor exceed the design capacity of the facility and will result in severe congestion for extended periods of time.

The Corridor traverses the Rocky Mountains of Colorado. The portion of the I-70 highway examined in this document extends for 144 miles and traverses the rugged terrain and outstanding scenery of central Colorado, including the steep grades leading up to the Continental Divide and Vail Pass, and the narrow, steep walled Clear Creek and Glenwood Canyons. Tight curves, steep grades, deficient interchanges, and the lack of climbing and passing lanes contribute to capacity limitations throughout the Corridor's 144 miles.

The lead agencies prepared this document to identify transportation solutions at the Corridor level and to provide a foundation for future project-level analysis of specific improvements. This document recommends the general location, mode types, and capacity for future transportation improvements in the Corridor.

The I-70 Mountain Corridor (referred to as the Corridor) extends 144 miles from Glenwood Springs in western Colorado to C-470/Jeffco Government Center light rail on the western edge of the Denver metropolitan area (**Figure 1-1**). The Corridor includes both the I-70 highway and the associated infrastructure.

Figure 1-1. I-70 Mountain Corridor in Colorado



1.3 What other studies have been completed or are related to this Corridor?

Several related previous and ongoing studies provide background and ongoing information for this document. These include:

- *I-70 Feasibility Study*, 1989 – In this I-70 feasibility study, CDOT identified the need for additional capacity in Clear Creek County, primarily between Floyd Hill and Idaho Springs (CDOT, 1989).
- *I-70 Major Investment Study*, 1998 – This *I-70 Major Investment Study* (MIS) resulted in a 50-year “Vision for the Corridor,” between Glenwood Springs and C-470. The MIS Vision included a desire to change Corridor users’ travel behavior through the introduction of high-speed transit and limited changes to the highway’s capacity. The MIS recommended the preparation of a Programmatic Environmental Impact Statement (PEIS) to examine elements of the vision and potential impacts (CDOT, 1998).
- *I-70 Mountain Corridor Incident Management Plan*, 2000 – The Incident Management Plan addresses procedural and coordination aspects of managing unplanned incidents on the highway affecting the flow of traffic. It includes an incident response manual providing response personnel with a quick, in-the-field reference (CDOT, 2000).
- *Urban Maglev Technology Development Program*, 2004 – The Colorado Department of Transportation and Federal Transit Administration (FTA) sponsored this research effort. This research effort involved the Maglev Transit Group, Sandia National Laboratories, CDOT, and the former Colorado Intermountain Fixed Guideway Authority. The study assessed the potential introduction of magnetic levitation (maglev) high-speed transit in the Corridor. The 2004 final report proposed a high-speed surface transport CM200 design for the Corridor (Federal Transit Administration, 2004).
- *Colorado Tolling Enterprise Preliminary Traffic and Revenue Study*, 2004 – The Colorado General Assembly created the Colorado Tolling Enterprise to finance, build, operate, and maintain toll highways. The Colorado Tolling Enterprise conducted a toll system traffic and revenue feasibility analysis, which found that tolling is feasible on a widened I-70 highway between the Eisenhower-Johnson Memorial Tunnels and Floyd Hill (Colorado Tolling Enterprise, 2004). In 2010, the Colorado Tolling Enterprise was reorganized as the High Performance Transportation Enterprise.
- *State Highway 9 Frisco to Breckenridge Final Environmental Impact Statement (EIS)*, 2004 – The State Highway (SH) 9 project proposed widening a nine-mile segment of SH 9 between Frisco and Breckenridge from two to four lanes to increase the safety and mobility of drivers, transit, pedestrians, and bicyclists. Construction was completed for a 1.2-mile section in Breckenridge and continues on a 1.3-mile section just north of Breckenridge (CDOT, 2004).
- *Colorado Climate Action Plan: A Strategy to Address Global Warming*, 2007 – To face the challenge of climate change, the State of Colorado initiated a plan that sets goals to reduce greenhouse gas emissions by 20 percent below 2005 levels by 2020, and makes a shared commitment with other states and nations to cut emissions even more by 2050 (Ritter, 2007).
- *I-70 Mountain Corridor Context Sensitive Solutions*, 2009 – The I-70 Mountain Context Sensitive Solutions process brought together a multidisciplinary, multi-interest stakeholder group to discuss, debate, and capture what the stakeholders value and who will work together to preserve the Corridor. Processes were developed for use on future Corridor studies, designs, and construction projects to ensure incorporation of these values into the decision making at each phase of project development (CDOT, 2009).

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- *I-70 Coalition: Land Use Planning Study for Rail Transit Alignment throughout the I-70 Corridor*, 2009 – This study focused on how transit integrates with land uses in different communities in the Corridor at potential station locations for transit. It also addressed questions about land use and zoning amendments needed to better accommodate future transit (I-70 Coalition, 2009).
- *Gaming Area Access Draft Environmental Impact Statement (EIS)* – This EIS began in 2000 and considered access improvements along SH 119, United States Highway (US) 6, and the I-70 highway. The Notice of Intent was rescinded in 2010, and the study was never published or completed (CDOT, 2003).
- *InterMountain Connection Feasibility Study* – Two phases of this feasibility study were completed, one in 1998 and a second in 2001 (CDOT, 1998 and CDOT, 2001). This study evaluated feasibility of rail service in the western portion of the Corridor. The recommendations from this study were incorporated into the Intermountain Connection alternative element.
- *Rocky Mountain Rail Authority High-Speed Rail Feasibility Study Business Plan*, 2010 – This study focused on the feasibility of high-speed passenger rail in Colorado and addressed specific criteria established by the Federal Railroad Administration (FRA). The study considered a range of technology options and operating speeds to evaluate for feasibility. The results indicated that a high-speed passenger rail system is conceptually feasible along the I-25 Corridor and I-70 Corridor from Pueblo to Fort Collins and from Denver International Airport to Eagle County Airport. The Rocky Mountain Rail Authority study used a market-based approach to evaluate potential route and station locations based on their ability to produce ridership. It used representative route options and per mile cost estimates for comparison purposes. The Rocky Mountain Rail Authority study is a separate study from this document and does not include a decision about specific technology or alignment location (Rocky Mountain Rail Authority, 2010).

Other studies planned and related to this Corridor include:

- *Colorado State Passenger and Freight Rail Plan* – The Colorado Department of Transportation received funding from the FRA to complete a State Passenger and Freight Rail Plan. Completing this plan is a pre-requisite for applying for FRA high-speed rail funding under the Passenger Rail Investment and Improvement Act (PRIIA) of 2008.
- *Colorado Interregional Connectivity Study* – The Colorado Department of Transportation received funding from FRA for a Denver metropolitan area connectivity study in cooperation with the Regional Transportation District to examine how high-speed rail could interface with the Regional Transportation District FasTracks system. The Regional Transportation District FasTracks Program is a multibillion dollar comprehensive transit expansion plan to build 122 miles of new commuter rail and light rail, 18 miles of Bus Rapid Transit, and enhance bus service across the eight-county Denver metropolitan area district. The connectivity study will address interoperability opportunities and potential ridership synergies between FasTracks and potential future high-speed passenger rail serving the I-70 Corridor and I-25 Corridor.

1.4 What are the horizon years of analysis for the study?

In recognition of the need for a long-term sustainable transportation vision, the project analysis uses both a 2035 planning horizon and a longer 2050 planning horizon. Data for the year 2035 are based on available projections from a variety of sources and provide the foundation for developing and evaluating alternatives. The 2035 planning horizon also provides a milestone allowing projections to 2050. The year 2050 provides a long-term horizon for developing solutions for the Corridor. The alternatives are developed and evaluated on a variety of performance measures that can be reliably established for 2035 and for their ability to meet travel demand in 2050. To account for the increasing variability of projecting

into the future, the 2050 travel demand is estimated with high and low estimates based on more or less aggressive growth projections.

This project began in 2000, and the travel demand model relies on travel and socioeconomic data from the year 2000 (including data from the 2000 United States Census as well as the I-70 User Survey). The year 2000 data set characterizes Corridor conditions and provides a base year to compare future year projections.

The year 2000 remains valid as a base year for the Tier 1 analysis presented in this document because during the development of the PEIS, no major changes have taken place in the 144-mile Corridor that notably alter the snapshot of Corridor conditions provided by the year 2000. No major infrastructure improvements have been implemented in the Corridor since 2000, and travel patterns and needs of Corridor users have not changed substantially. Confirmation of the travel demand model performance is provided by a comparison of the future trendline projected by the model with actual counts for 2008. The actual counts are approximately 17 percent below the model's projection for 2008. This is a reasonable discrepancy, however, because the economic conditions in the nation and the State of Colorado coupled with abnormally high petroleum prices during the year of 2008 likely depressed travel. As the economy rebounds, it is expected the demand for travel in the Corridor will again follow the long-term trendline projected by the model.

1.5 What are the study limits and why were they selected?

The Federal Highway Administration regulations implementing the National Environmental Policy Act (NEPA) require a meaningful evaluation of alternatives. In accordance with 23 CFR 771.111(f), the actions evaluated in this PEIS (1) connect logical termini and are of sufficient length to address environmental matters on a broad scope; (2) have independent utility or independent significance, i.e., be usable and be a reasonable expenditure even if no additional transportation improvements in the area are made; and (3) do not restrict consideration of alternatives for other reasonably foreseeable transportation improvements. The termini used for the I-70 Mountain Corridor PEIS meet these requirements. They are of sufficient length (144 miles) to address environmental matters on a broad scope, can operate independently without other improvements, and do not restrict consideration of alternatives for other reasonably foreseeable future transportation improvements. Being able to operate independently means that a project is usable and a reasonable expenditure even if no additional transportation improvement in the area is made. This concept is at the heart of the discussion of termini for the I-70 Mountain Corridor PEIS. All transportation systems are linked to a surrounding network and travel needs that influence travel patterns and volumes. Improvements to transportation systems must be defined to solve particular problems and prioritize expenditures, which is why project termini are based on the purpose and need for the project. In this case, the purpose and need focuses on mobility and accessibility, congestion, and capacity in the I-70 Mountain Corridor, which has distinct needs, travel patterns, and trip purposes from the Denver metropolitan area and other areas in Colorado.

The I-70 travel demand model used to analyze traffic volumes in the Corridor covers a study area that includes Corridor communities, the Denver metropolitan area, the North Front Range, the Colorado Springs and Pueblo metropolitan areas, and the Western Slope. It therefore quantifies the travel demand characteristics of Corridor users from all of these areas, including the Denver metropolitan area. Front Range users account for a large portion of trips in the Corridor and contribute to the travel demand and causes of congestion in the Corridor. The I-70 User Study conducted by CDOT in 2000 found that travelers from the Front Range account for 59 percent of Corridor travelers at Idaho Springs, 46 percent at Frisco, and 26 percent at Vail. These Front Range travelers, along with those from other areas of Colorado, are included in the travel demand model (described in detail in the *I-70 Mountain Corridor PEIS Travel Demand Technical Report* [CDOT, March 2011]).

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The western terminus for highway improvements at Glenwood Springs was chosen due to the change in travel patterns, including a drop in the number of recreation trips and overall traffic volumes west of Glenwood Springs. Transit improvements terminate at Eagle County Regional Airport. This facility provides an intermodal connection between aviation and transit service in the region and a focus for transit service in western Eagle County, somewhat analogous to Vail Transportation Center in the eastern part of Eagle County.

The eastern terminus at C-470/Jeffco Government Center light rail station was chosen because it marks a change in travel patterns where the Corridor connects to the Denver metropolitan area and higher traffic volumes associated with the metropolitan region. This location also represents a transition to Denver metropolitan area transportation systems, including urban highways and transit systems, such as the Regional Transportation District FasTracks rail system. The pattern of travel (and carpooling) is well established at the east end of the Corridor, and while trips bound for the Corridor may come from many locations, nearly all that originate in the Denver metropolitan area pass through the I-70/C-470 system interchange.

Although stakeholders have advocated strongly for extending the eastern terminus to the Denver International Airport and/or Denver Union Station, these connections are not necessary to meet the purpose and need for the I-70 Mountain Corridor nor would they contribute substantially to meeting purpose and need. Based on the travel demand model, a direct connection from the Corridor to Denver International Airport would increase ridership in 2035 by approximately 10 percent. Capturing this small volume of transit riders (and diverted traffic) does not warrant the expense or impacts of extending the termini to Denver International Airport. Comparatively speaking, the number of recreational visitors using the Corridor arriving at Denver International Airport is very small in comparison to the number of Corridor users that originate in the Denver metropolitan area and Corridor communities. While Denver Union Station is a planned transit transfer station for the Denver metropolitan area, it is not an origination station and serves only a small fraction of Denver's population directly (without transfers). Travelers transferring from car or transit to the Advanced Guideway System can do so as conveniently at the Jeffco Government Center light rail station as Denver Union Station.

Transfers between the Jeffco Government Center light rail line and the Advanced Guideway System would generate some of the additional ridership that could otherwise occur through direct connection between the Corridor and Denver International Airport or other modal hubs such as Denver Union Station. The additional ridership generated by the light rail connection would not be as high as through direct connection, because of the transfer required. However, as noted previously, the additional ridership generated through a direct connection is not required to meet the purpose and need for the Corridor.

Study and implementation of an Advanced Guideway System between the Eagle County Regional Airport and the Jeffco Government Center light rail station does not preclude other transportation improvement studies outside the Corridor. The Colorado Department of Transportation Division of Transit and Rail is conducting two studies, the Colorado State Passenger and Freight Rail Plan and the Colorado Interregional Connectivity Study, to evaluate transit connections throughout the state, including connections between the I-70 Mountain Corridor Advanced Guideway System and the RTD FasTracks system in the Denver metropolitan area.

1.6 What is the purpose and need for transportation improvements in the Corridor?

The purpose for transportation improvements is to increase capacity, improve accessibility and mobility, and decrease congestion for travel demand (projected to occur in 2050) to destinations along the Corridor as well as for interstate travel, while providing for and accommodating environmental sensitivity, community values, transportation safety, and ability to implement the proposed solutions for the Corridor.

There is a need to address the transportation problems in the Corridor. The three interrelated need statements below specifically describe the need:

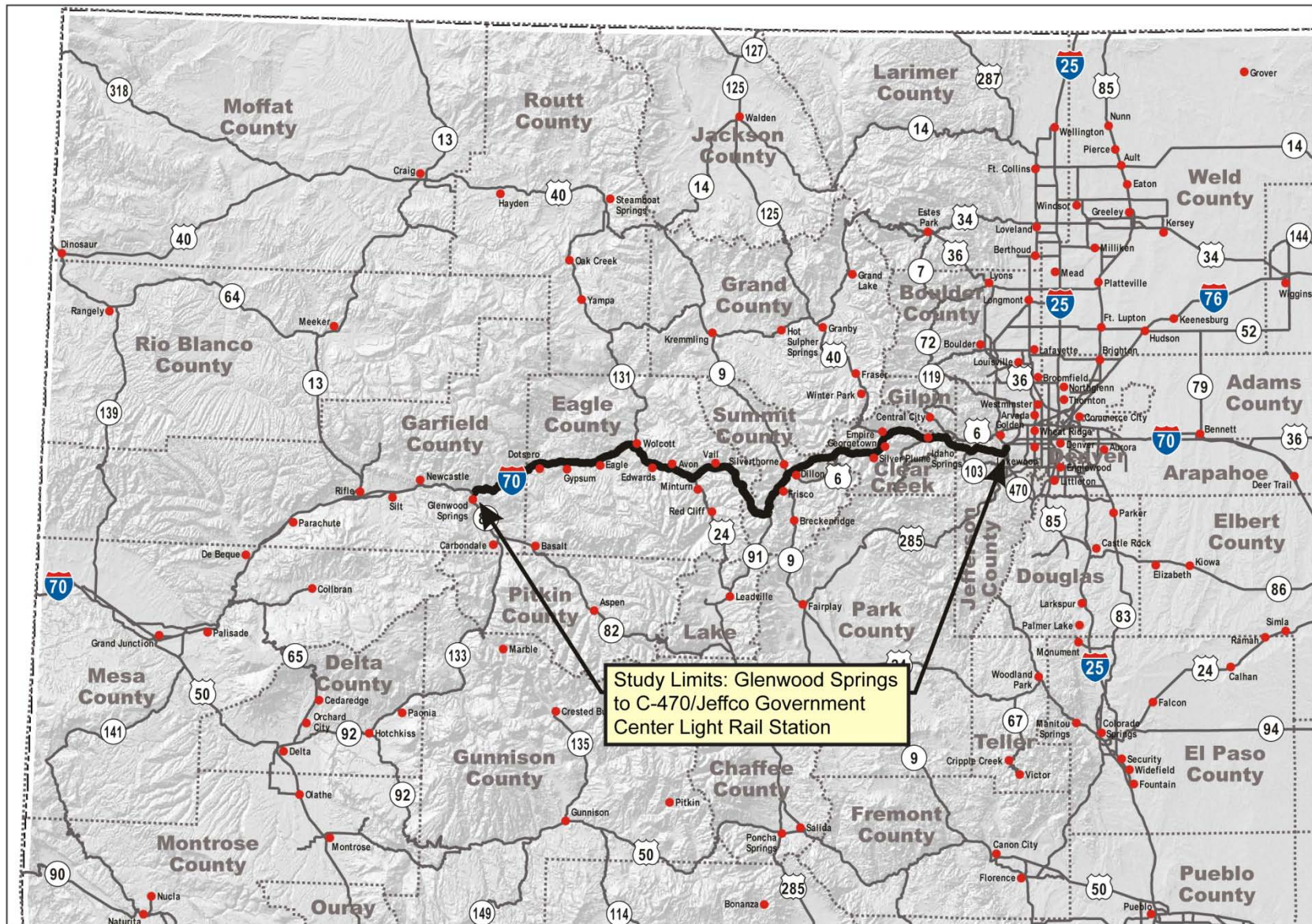
- **Increase capacity** – There is insufficient capacity to accommodate the current and projected demand for person trips in the Corridor. Person trips are used to portray the future demand, rather than vehicle trips, so that all potential modes of travel are examined similarly. Lack of capacity leads to slower travel times and congested conditions, as discussed in the two need statements that follow. It also means that person trip travel demand cannot be adequately accommodated. The inability to adequately accommodate person trip demand results in a need to increase person trip capacity.
- **Improve mobility and accessibility** – Mobility along the I-70 Mountain Corridor is defined as the ability to travel along the Corridor safely and efficiently in a reasonable amount of time. The mix of vehicle types, particularly slow-moving vehicles, directly affects mobility in this Corridor. Slow moving vehicles (trucks, buses, and recreational vehicles) make up about 10 percent of weekday traffic.

Accessibility is related to mobility and is defined as the ability to access destinations served by the Corridor safely, conveniently, and in a reasonable amount of time.

Currently, there are long travel times to traverse the Corridor or reach Corridor destinations during peak weekend conditions. Future increases in person trip demand will result in more congestion, more delay, and increased travel times for weekends and weekdays. Long travel times affect all types of Corridor users, and result in a need to improve mobility and accessibility in the Corridor.

The relationship of capacity and congestion is not direct. Lack of capacity may lead to congested conditions but increased capacity will not necessarily reduce congestion as the additional capacity can also result in more people traveling. As a result, both increased capacity and decreased congestion are addressed as needs for the Corridor.

Figure 1-2. Study Limits



- **Decrease congestion.** Severe congestion occurs on the Corridor during typical peak weekend conditions and is projected to worsen on weekends and to occur on weekdays in the future. Congestion is defined by a poor Level of Service and is measured over the course of a day at a specific location by the number of hours at the worst level of service (Level of Service F – see box).

Many factors can cause congestion, including, but not limited to:

- High volumes of traffic,
- Deficient roadway geometrics,
- Inadequate interchanges,
- Slower-moving vehicles in areas of steep grades,
- Unsafe conditions or actual crashes, and
- Poor road conditions.

Existing and future travel delay results in a need to decrease congestion along the Corridor. Delays are forecast to increase with higher person trip demand.

Safety plays a strong role in mobility, accessibility, and congestion. As such, in areas where safety problems currently exist, improving safety is inherent in the project needs.

Levels of Service are measurements that characterize the quality of operational conditions within a traffic stream and their perception by motorists and passengers. The six levels of service are designated by the letters A through F, with A representing the best operating conditions (light, free-flow traffic) and F the worst (stop-and-go traffic). Roadways operating at Level of Service E are generally considered to be at or near capacity, at which point traffic flow is interrupted by minor disturbances.

The project purpose and specific needs form the basis for developing and evaluating alternative transportation solutions for the Corridor, as they are measurable and apply throughout the Corridor. However, addressing transportation needs in the Corridor requires careful consideration of the physical, environmental and community constraints and requirements created by the mountain and valley terrains of the Corridor. The protection of the narrow mountain valleys, existing historic communities, and extensive natural resources is critical to the State of Colorado and the communities in the Corridor, and these resources (along with natural hazards) define critical constraints for transportation solutions in the Corridor. Alternatives must meet the transportation needs and be developed in a manner that provides for and accommodates the following:

- **Environmental Sensitivity** – Avoid and minimize adverse impacts on and, where possible, enhance environmental resources, including, but not limited to, stream sedimentation, water quality, wildlife crossings, and impacts on wetlands.
- **Respect for Community Values** – Avoid and minimize adverse impacts on and, where possible, enhance air quality, historic resources, noise levels, visual resources, and social and economic values, as well as minimize the transportation system’s footprint on the mountain communities. Consider the possible growth changes and economic effects that might occur, depending on the ease or difficulty of access.
- **Safety** – Improve where possible problematic roadway geometric conditions, such as tight curves and lane drops, and consider the safety characteristics of the modes of travel. Undesirable safety conditions along the Corridor directly affect the project need, specifically the mobility, accessibility, and congestion elements.
- **Ability to Implement** – Consider technical feasibility (that is, overall use of a mode and the feasibility of the technology), as well as affordability of alternatives in terms of capital costs, maintenance and operational costs, user costs, and environmental mitigation costs. Understanding the construction impacts on existing mobility and to the communities along the Corridor is important to evaluating implementation of alternatives.

1.7 What are the Corridor's features?

The I-70 highway is the only east-west interstate crossing Colorado and serves as the major transportation facility for east-west intra- and interstate movement of people and goods in Colorado. This 144-mile stretch of the interstate passes through five counties (Garfield, Eagle, Summit, Clear Creek, and Jefferson) and directly serves more than 20 communities. In addition, the Corridor connects to several north-south highways (SH 82, SH 131, US 24, SH 9, US 40, SH 103, US 6, SH 119, and C-470) that provide primary access to outlying communities and counties. **Figure 1-2** displays these highways and communities served by the Corridor.

The Corridor traverses the Continental Divide as it passes through the Rocky Mountains. The mountainous topography is a major constraint of the Corridor. **Figure 1-3** displays the vertical and horizontal profile of the Corridor and denotes areas of steep grades. The mountainous topography results in numerous sharp curves on the Corridor.

The Corridor has several nationally and exceptionally significant historic highway features including:

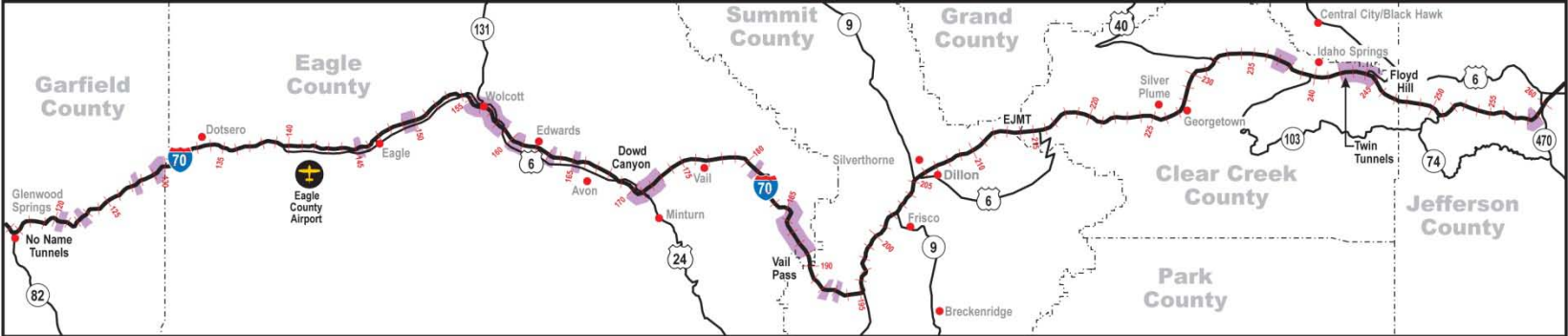
- Glenwood Canyon
- Vail Pass
- Eisenhower-Johnson Memorial Tunnels
- Twin Tunnels
- Genesee Park interchange

After the I-70 highway's inclusion in the national interstate system plan in 1957, construction of initial segments of the interstate occurred in the 1960s. After this time, major construction milestones included:

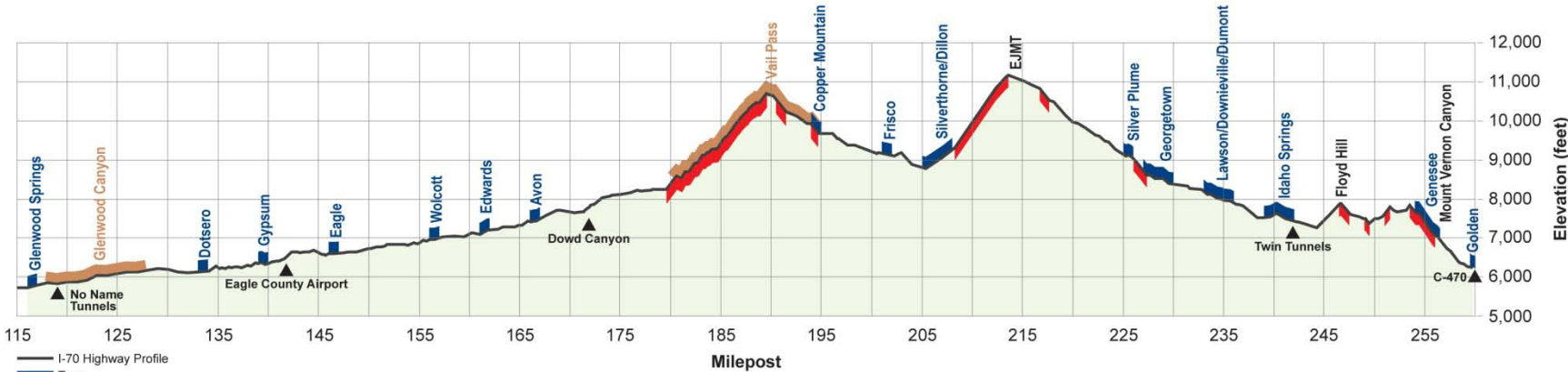
- The Eisenhower Memorial Tunnel at the Continental Divide in 1973, as a single two-lane bore serving both directions of travel;
- Vail Pass, as a four-lane facility in 1978;
- The Johnson Memorial Tunnel in 1979, as a second two-lane bore adjacent to the Eisenhower Tunnel allowing a two-lane tunnel for each direction of traffic, and
- Glenwood Canyon, as a four-lane facility in 1992.

Limited public transit serves the Corridor. Local public agencies operating transit service in or near the Corridor include the Roaring Fork Transportation Authority in Garfield County, Eagle County's ECO Transit, and Summit Stage in Summit County. These agencies provide local and limited intercounty service for local commuters and other travelers. Other available transit services include private shuttle vans to mountain resorts, charter buses, casino buses to the gaming area from the Denver metropolitan area and Denver International Airport, and limited Greyhound intercity bus service. Amtrak offers limited rail service between Denver and Glenwood Springs (via Moffat Tunnel and the Fraser/Winter Park area).

Figure 1-3. Vertical and Horizontal Profile of the I-70 Mountain Corridor



Sharp Curves



Legend:
 — I-70 Highway Profile
 ■ Town
 ▲ Steep Grade
 ■ Exceptional Corridor Award Winning Design

Note: EJMT = Eisenhower-Johnson Memorial Tunnels

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Air travel serving the Corridor accounts for about 6 percent to 8 percent of all person trips within the Corridor. The primary airports serving the Corridor are Eagle County Airport and Aspen/Pitkin County Airport. Many flights to the Corridor airports originate from Denver International Airport.

The travel demand analysis focused on key Corridor locations, which are shown on **Figure 1-4**, and include:

- No Name Tunnels in Glenwood Canyon
- Dowd Canyon west of Vail
- Eisenhower-Johnson Memorial Tunnels at the Continental Divide
- Twin Tunnels east of Idaho Springs
- Floyd Hill east of the junction with US 6

1.8 Who uses this Corridor and for what reasons?

The Corridor currently serves a variety of transportation users. Travelers include commuters, recreationalists, local Corridor residents, intra- and interstate freight truckers, and others. The mix of users varies for weekdays and weekends along the Corridor, as shown in **Figure 1-4**. For a typical weekday, commute trips, local non-work trips, and recreational trips represent the majority of travelers, with some variations by location. Traffic to and from the gaming establishments in Black Hawk and Central City is present east of the US 6 junction at milepost 244. Heavy vehicles (trucks and recreational vehicles) represent about 10 percent of the vehicle mix. In contrast, for a typical weekend day, recreationalists dominate the Corridor traffic. On weekends, commuters, local non-work travelers, and heavy vehicles form only a small portion of the traffic stream. The overall mix of users is relatively consistent between summer and winter although overall volumes are different.

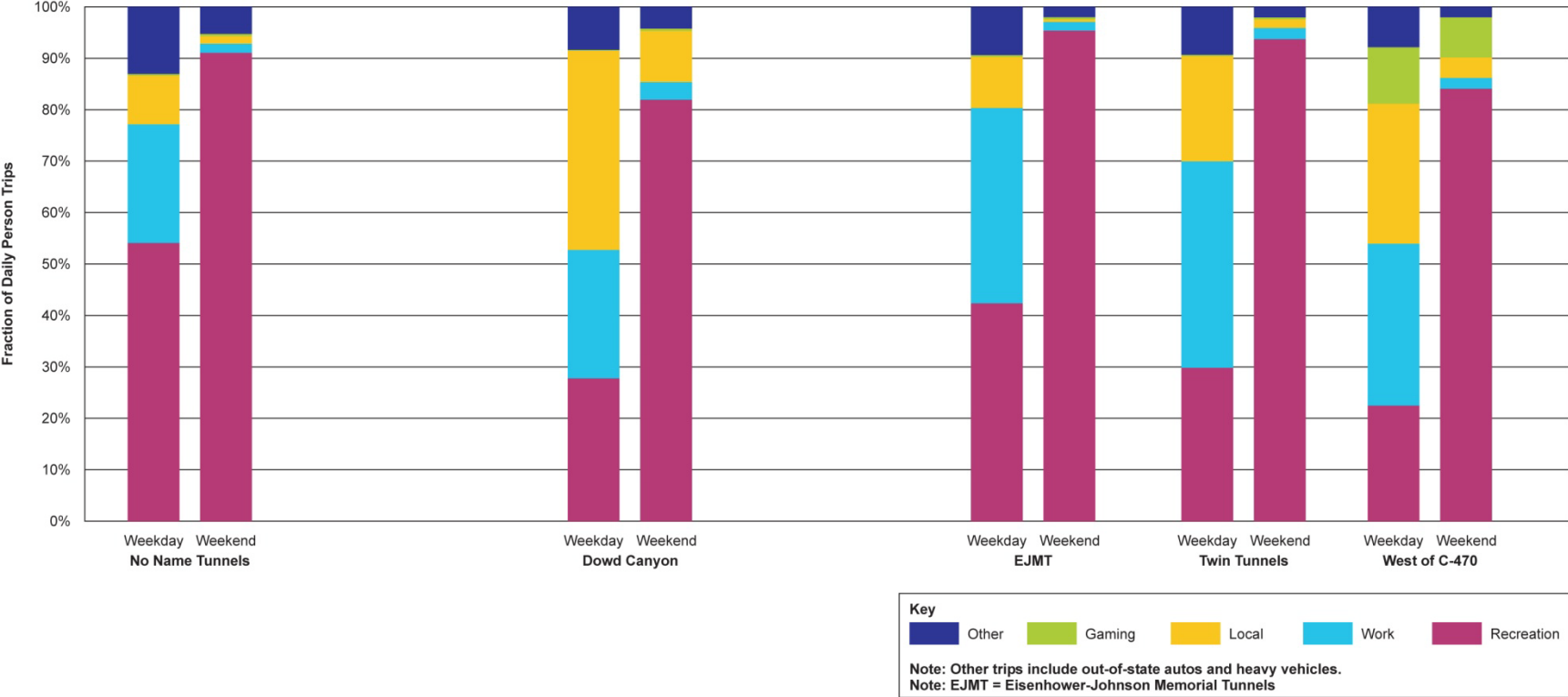
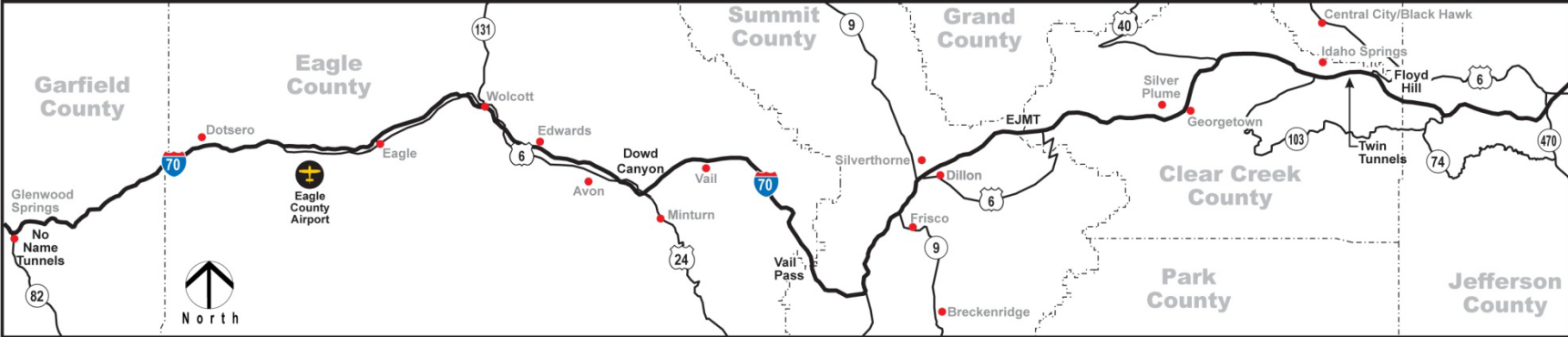
1.8.1 How does the mix of vehicle types affect operations?

Even though trucks, buses, and recreational vehicles together make up only about 10 percent of the weekday traffic, these heavy vehicles affect traffic conditions disproportionately. Most heavy vehicles cannot travel up or down steep grades as fast as most passenger cars. Several extended steep grade sections of up to 7 percent exist along the Corridor as the I-70 highway traverses the mountainous terrain. **Figure 1-3** illustrates the grades along the Corridor. The resulting variation of vehicle speeds on steep grades creates safety problems, decreases capacity, and increases congestion. On steep two-lane segments, a truck, bus, or recreational vehicle passing a slower vehicle causes congestion in both lanes. These issues are exacerbated during winter weather conditions of snow and ice.

Slow moving vehicles prominently influence mobility along the Corridor because of:

- Many areas of extended steep grades along the Corridor;
- Lack of reasonable alternatives to trucks making deliveries along the Corridor; and
- Many areas of steep grades with only two lanes, where a truck passing a slower vehicle will block all faster vehicles causing congestion in both lanes.

Figure 1-4. 2000 Travel by Trip Purpose at Key Corridor Locations



1.9 What future growth is expected to occur in the Corridor?

The area served by the I-70 highway—the Corridor communities, the Denver metropolitan area, and Colorado as a whole—has experienced tremendous growth, with additional growth projected to occur in the future. Estimates of future growth are based on projections of population and employment. The Colorado Department of Local Affairs prepares the employment projections in coordination with national economic projections. The agency also projects employment growth and allocation for each Colorado county based on historical patterns and assumptions of future economic activity by job sector. The projections for population estimates are based on the employment estimates and on assumptions of fertility, survival, and migration rates. Projections from the Department of Local Affairs are available for the planning horizon year of 2035. The Department of Local Affairs 2035 population and employment estimates provide an established and well-recognized source for growth projections.

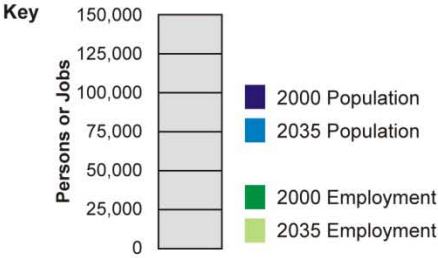
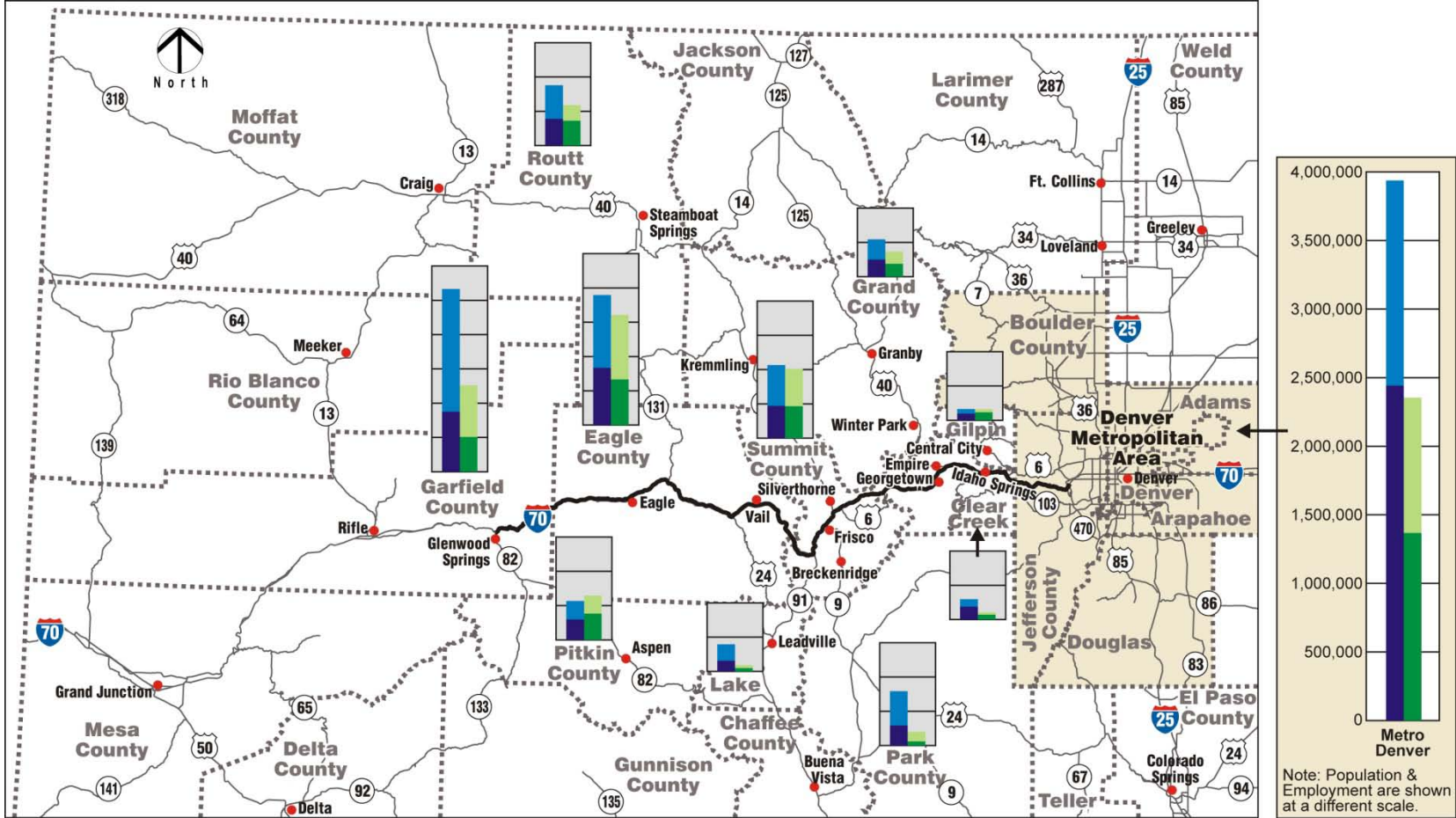
Figure 1-5 illustrates the population and employment growth between 2000 and 2035 in the areas served by the Corridor. In 2035, in the central counties along the Corridor (Eagle, Summit, and Clear Creek counties), total population is expected to reach over 160,000 and total employment over 135,000. This more than doubles the 2000 amount of socioeconomic activity in these counties. Outlying areas served by the Corridor also are projected to experience large increases in population and employment. West of the Corridor, Garfield County population will grow to about 130,000 in 2035, a tripling of the 2000 level. For Grand and Routt counties to the north, 2035 population and employment will be about twice the levels of 2000. Pitkin, Lake, and Park counties, which also are served by the Corridor, will almost double in population, reaching in combination over 85,000 people in 2035. Growth in the Denver metropolitan area is examined due to its generation of recreational trips to the Colorado mountains using the Corridor. The metropolitan Denver population is projected to reach almost 4 million by 2035, compared to about 2.5 million in 2000.

1.9.1 Are population and employment projections available for 2050?

Projections from the Colorado Department of Local Affairs are available only to the horizon year of 2035. Beyond 2035, several local communities along the Corridor are examining desired growth patterns and limits. Future decisions about land use could affect travel patterns and trip generation. While this long-term growth is under discussion, estimates of population and employment for 2050 are not available. Therefore, for the 2050 analysis, only travel demand has been projected. A high and low estimate of 2050 travel demand was created using the 2035 forecasts as a foundation; 2035 travel demand is based on travel demand modeling, while 2050 forecasts are based on trend analysis. Accounting for the potential variation by using high and low estimates provides confidence in the 2050 travel demand forecasts.

Section 1.10.6 discusses the travel demand extensions to 2050 and the assumptions associated with this long-range forecast.

Figure 1-5. 2000 to 2035 Population and Employment Growth



1.10 What is the current and projected travel demand?

Travel demand in the Corridor is directly related to the amount and location of population and employment activity in the Corridor communities, in the Denver metropolitan area, and in Colorado as a whole. Population growth results in increased demand for commute, shopping, recreation, and other trip purposes. Employment increases are reflected in a higher number of commute, retail, construction, and other trips. Land use patterns surrounding the Corridor affect trip origin and destination patterns. For example, both the imbalance of jobs and residents within counties and the desire of residents to recreate in the mountains of Colorado affect travel demand in the Corridor. On the Corridor, travel demand varies substantially by trip purpose, by location, by weekdays and weekends, and by season. For more detailed information on the travel demand forecasts, see the *I-70 Mountain Corridor PEIS Travel Demand Technical Report* (CDOT, March 2011).

1.10.1 How is demand defined?

Travel demand is defined in terms of person trips. Person trips, in contrast to vehicle trips, take into account the effectiveness of vehicle occupancy, alternative mode, and travel demand strategies. Travel demand for 2035 and for 2050 is presented for both typical weekday and weekend conditions. Typical conditions are defined by analyzing several representative days throughout the year establishing typical weekday and weekend travel demand volumes. Travel demand on various days throughout the year is higher than typical conditions and lower on other days. For purposes of analysis, typical conditions are assumed. **Chapter 2, Summary and Comparison of Alternatives** discusses the method and measures used to analyze the ability of alternatives to meet 2035 and 2050 travel demand.

1.10.2 How are the travel demand forecasts prepared?

A travel demand model is a planning tool that provides future estimates of roadway and transit person trip volumes for defining the purpose and need, as well as comparing alternative scenarios that address the needs. Although travel demand models are typically used in urban areas, the lead agencies developed a travel demand model for this project's 144-mile rural Corridor because one did not exist for the entire study area.

To capture the Corridor's unique combination of recreation, long-distance commute, interstate, and other trips, CDOT conducted travel surveys in 2000 and 2001. These travel surveys, which recorded travelers' current travel behaviors, also asked for mode preference responses related to future potential transit choices in the Corridor.

The travel demand model was calibrated and validated using observed traffic conditions in 2000, along with United States Census data and the travel survey data. The 2000 data remains valid for model calibration as no major changes in transportation infrastructure have occurred since 2000. The Corridor serves the same market of users with the same I-70 highway infrastructure as was in place in 2000. The validity of the travel demand model was shown to be within industry standards (modeled vehicle volumes are within a half-lane of capacity of observed vehicle volumes). Sensitivity tests demonstrated that the model responds as expected given different input data sets.

In 2008, a comparison of observed Corridor traffic volumes with the future travel model volume trendline illustrates that actual volumes are less than predicted by the travel model, but still within a reasonable margin of error. The variation is expected given the changes in economic conditions of the nation, state, and the Corridor as well as high petroleum prices in 2008. It is expected that upon a rebound of the economy, the demand for travel in the Corridor will again reflect the future travel demand projections. During Tier 2 processes, more specific location modeling will be performed and inputs updated as they are available.

Detailed analysis prepared originally for 2025 was updated for 2035 using the 2035 socioeconomics and determining the growth rate for each trip purpose at specific locations along the Corridor. The 2025 and 2035 forecasts provide a foundation for the 2050 travel demand estimates, which are presented in a range to account for the increasing variability of projecting that far into the future.

As a simulation model, confidence in its output depends upon the assumptions of its major inputs of future population and employment and travel behavior parameters (trip generation rates, trip length preferences, mode choice factors), which are influenced by available technology, cost of travel, the availability and price of petroleum or other fuels, and other conditions influencing travel. Any model will have uncertainties inherent in trying to predict what travelers will do in the future. The methods used for the travel demand forecasting for this project use the most up-to-date technology and widely accepted standards for transportation planning.

The travel demand model future background network assumed a new tunnel between the I-70 highway and SH 119 toward Black Hawk, proposed under the now withdrawn *Gaming Area Access Environmental Impact Statement*. Without the tunnels, more traffic will use US 6 and the Central City Parkway. The overall effect on the I-70 highway is less traffic east of US 6 but more traffic on the I-70 highway between US 6 and Central City Parkway. This change in traffic pattern is at a localized level over a distance of about 3 to 4 miles and does not affect the Tier 1 recommendations for the general location, mode types, and capacity for future transportation improvements at the corridorwide level. Specific analysis of this travel demand effect will be conducted during Tier 2 processes at this location to define the appropriate project level design.

Further information about the travel demand model, including its major assumptions, validation, and results is in the *I-70 Mountain Corridor PEIS Travel Demand Technical Report* (CDOT, March 2011) and its appendices.

1.10.3 How do traffic patterns differ between summer and winter?

Traffic volumes are generally higher in the summer than winter months. This is the case for both weekends and weekdays. For example, traffic on a typical summer weekend day at the Eisenhower-Johnson Memorial Tunnels is about 45 percent higher than in the winter. At this location, typical summer weekday traffic is about 15 percent greater than in the winter. These seasonal differences vary along the Corridor. However, during the busiest hours, winter volumes are sometimes higher than summer volumes at specific locations due to most ski area traffic departing at the same time.

1.10.4 How does the location of population and employment affect travel?

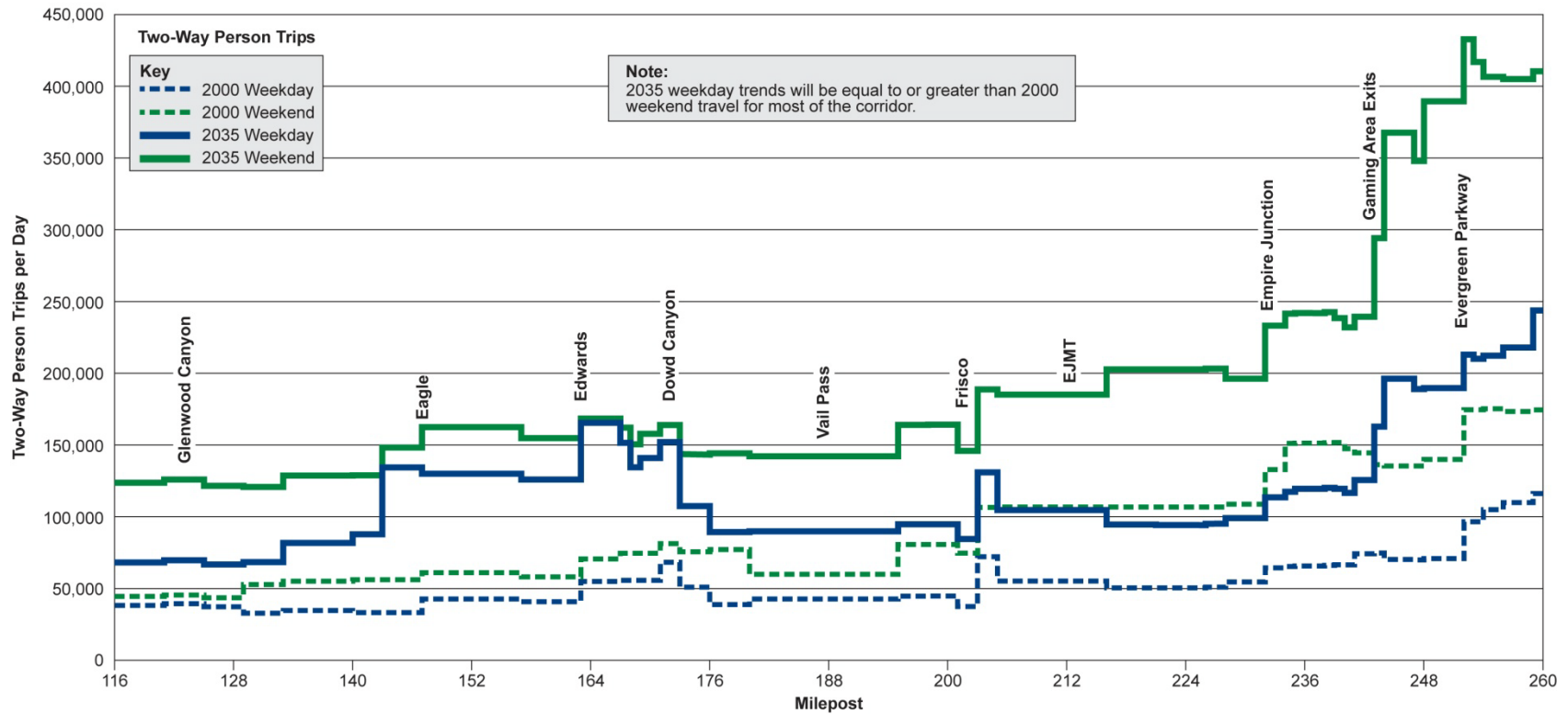
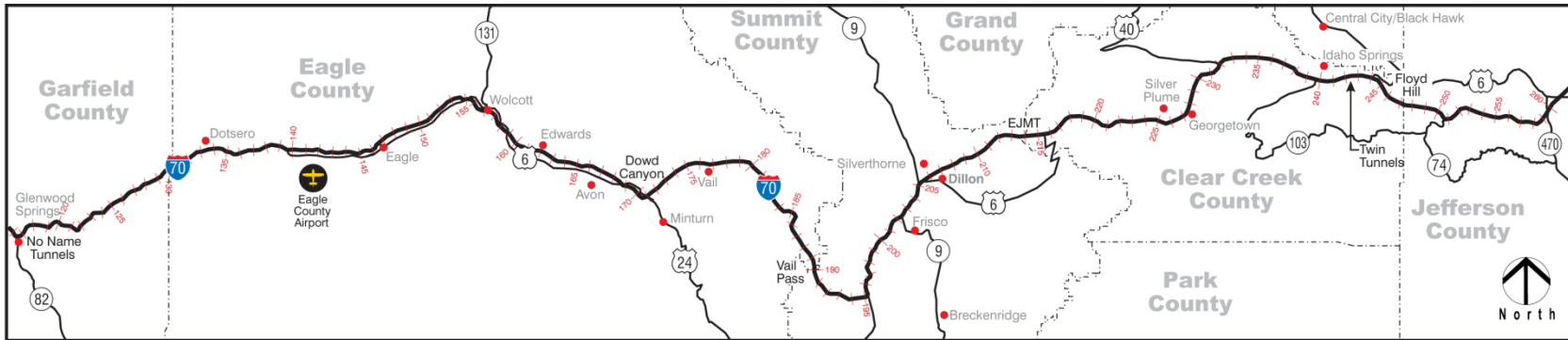
The balance of population and employment varies in the Corridor counties, as shown in **Figure 1-5**. Those counties with population substantially higher than employment have residents who commute out of the county for jobs using the I-70 highway. For example, residents from Lake, Park, and Grand counties typically commute to employment sites in Summit and Eagle counties. Many Corridor residents commute to jobs in the gaming district in Gilpin County and to the Aspen area of Pitkin County. Similarly, many commuters travel on the I-70 highway to jobs in the Denver metropolitan area.

1.10.5 What is the travel demand in 2035?

As the Corridor communities and Colorado have grown, travel demand on the Corridor has grown correspondingly. **Figure 1-6** presents travel demand for the Corridor for a typical weekday and a typical weekend day. The Corridor travel demand is displayed in terms of person trips, for 2000 and 2035 conditions. In general, demand is higher along the Corridor toward the Denver metropolitan area in the east. On weekends, the amount of travel demand to and from the Denver metropolitan area increases dramatically due to recreational trips. A rise in travel demand in the Eagle County area is due to commute and local trips using the Corridor.

Chapter 1. Purpose and Need

Figure 1-6. 2000 and 2035 Travel Demand



Note: EJMT = Eisenhower-Johnson Memorial Tunnels

Between 2000 and 2035, travel demand is expected to grow. For example, at the Eisenhower-Johnson Memorial Tunnels, the amount of person trip demand on a typical summer weekend day is expected to be more than 185,000 compared to 107,000 in 2000, an increase of about 75 percent. For a typical weekday, the future person trip demand at the Eisenhower-Johnson Memorial Tunnels is expected to be about 105,000 compared to 55,000 in 2000, or a 90 percent increase. Overall, growth in person trip demand along the Corridor ranges from 65 percent to 175 percent between 2000 and 2035. For most of the Corridor, the 2035 weekday travel demand is equal to or greater than 2000 weekend demand.

1.10.6 What is the travel demand in 2050?

The 2050 travel demand forecasts are presented in a range to account for the increasing variability of projecting into the future. The range of low and high estimates of 2050 travel demand are based on projections from the 2035 data because supporting population and employment forecast data are not available for the long-term year of 2050. The 2035 travel forecasts, using the available 2035 population and employment data estimates, provide a foundation for the 2050 forecasts. To extend travel demand to 2050, varied assumptions about travel growth rate provide for the low and high 2050 estimates. The assumptions are based on the projected travel growth pattern between 2025 and 2035, as it varies along the Corridor. The low estimate assumes, at each location, the average annual amount of absolute travel growth between 2025 and 2035 continues to 2050 (a simple linear growth trend). For the high estimate, the average percentage travel growth rate during the 10-year period between 2025 and 2035 was applied for each location (compounded growth). The annual growth rate for the high travel estimate varies from about 1 percent in the eastern portion of the Corridor to over 3 percent in the western portion of the Corridor. While the 2050 travel demand estimates have an inherent uncertainty due to these assumptions for the growth rates between 2035 and 2050, the high-low range accounts for the variability of projecting out to 2050 and provides a reasonable range for the long-term horizon.

Using this method, the 2050 total daily two-way person trip demand increases between about 10 percent and 65 percent above 2035, as seen in **Figure 1-7**. In 2050, weekday demand will exceed 200,000 person trips at Dowd Canyon and west of C-470. Weekend demand in 2050 will exceed 200,000 person trips at all five representative locations; demand is expected to approach 300,000 and 500,000 person trips at Twin Tunnels and west of C-470, respectively. The variation due to the high-low range makes up about 1 percent to 15 percent of the total 2050 demand, depending on location.

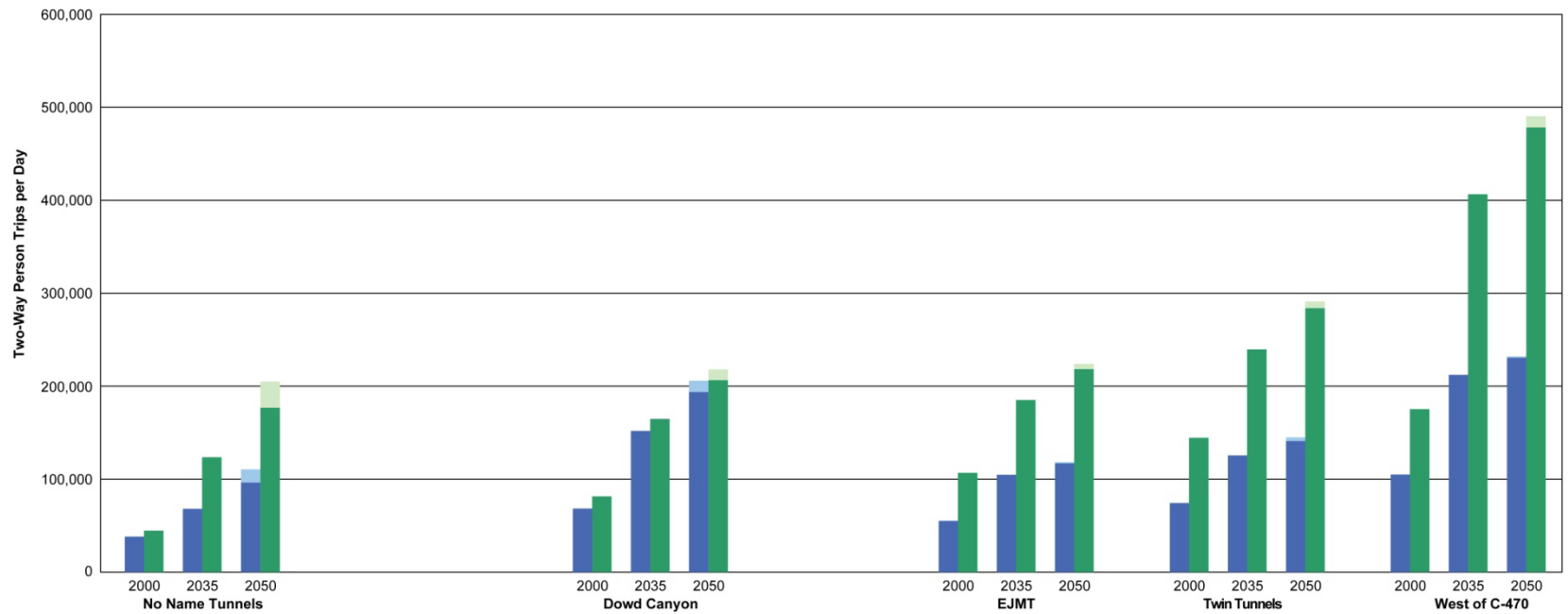
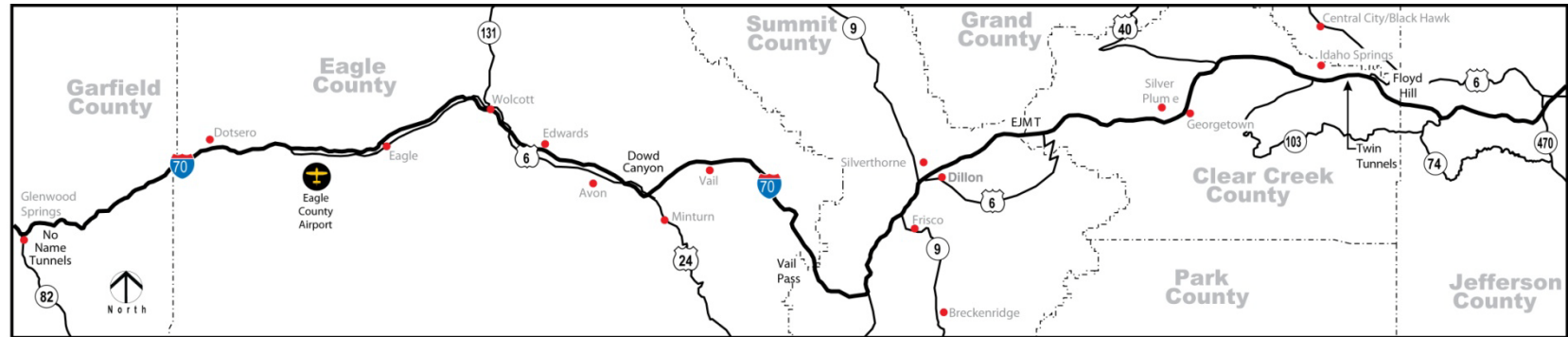
1.10.7 What is unmet demand?

The future projected travel demand exceeds the capacity of the Corridor. The excess demand is partially spread to other times and days, but part of the demand is unmet as some users will cancel their desired trip. Unmet demand occurs when travelers want to make a trip but choose to not to because of severe congestion conditions, long travel times, or other unsatisfactory conditions.

The concept of unmet demand recognizes that the number of trips taken along the Corridor is related to the conditions of travel. The measurement of unmet demand is based on the desire to take a trip using the Corridor based on current travel conditions in good weather. (Although poor weather conditions can suppress trips, the model does not include this variable in the unmet demand projections.) Improvements beyond those travel conditions potentially increase the desire to make a trip. In turn, this potentially results in increased demand and additional Corridor person trips.

Unmet demand is measured in person trips. The need to increase capacity is based on person trips; there are various ways to increase person trip capacity. Increased person trip capacity can be provided by additional roadway capacity, new transit capacity, increased vehicle occupancy rates or improved use of existing facilities. Each of these options may have different effects on the need to improve mobility and accessibility, and the need to reduce congestion.

Figure 1-7. 2000, 2035, and 2050 Travel Demand



- Weekday
- Weekend
- 2050 Weekday High
- 2050 Weekend High

Note: 2050 demand projection with Low-High range.
 Note: EJMT = Eisenhower-Johnson Memorial Tunnels

1.11 How are the needs demonstrated by transportation problems in the Corridor?

1.11.1 The need to increase capacity

The inability to adequately accommodate person trip demand results in a need to increase person trip capacity, as summarized in **Section 1.6**. This need addresses the transportation problems described below.

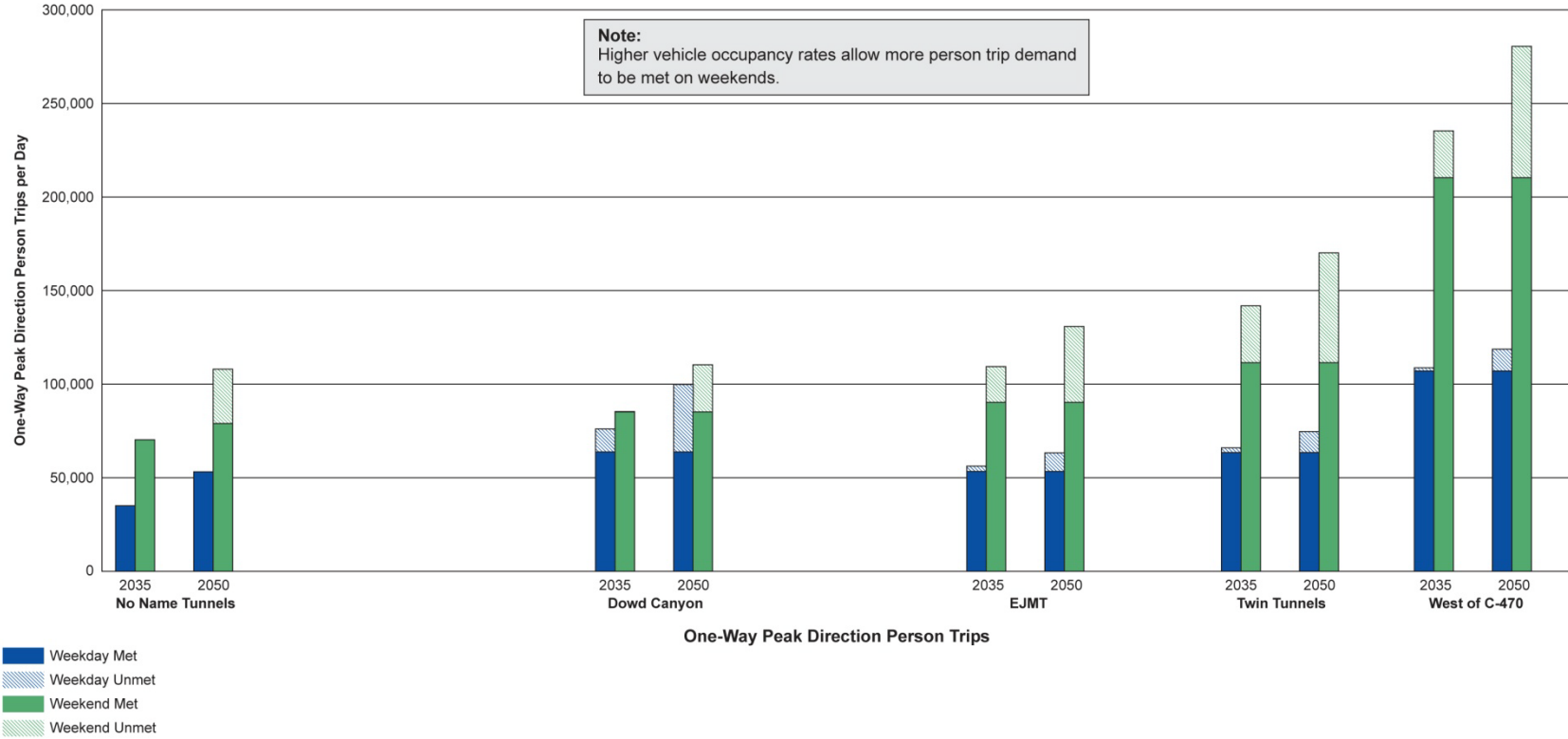
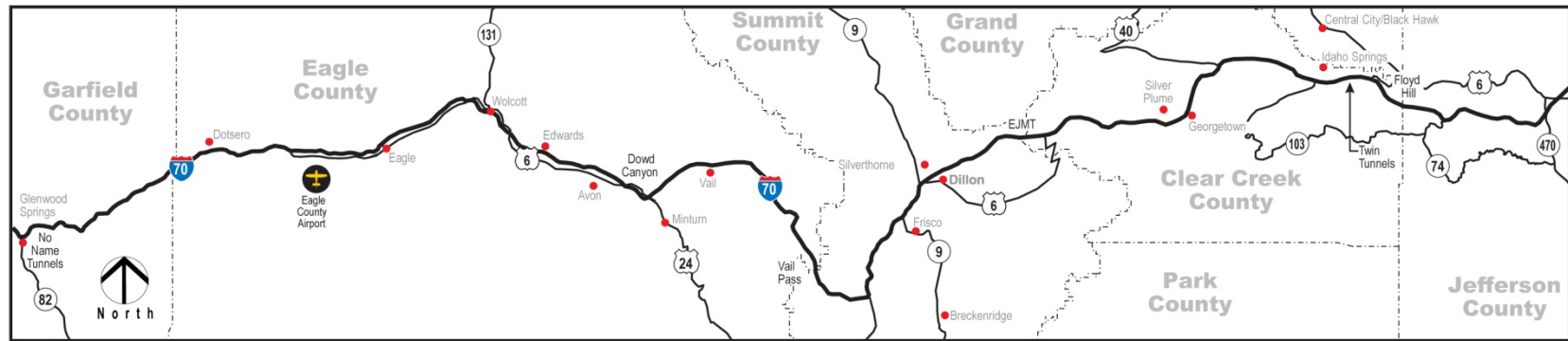
The Corridor serves a wide variety of trips as described in **Section 1.8**. Many of these trips could not occur without the I-70 highway. The ability of the Corridor to accommodate these trips is a major underpinning of all activity—social, work, and recreation—occurring within the Corridor and in areas served by the Corridor. The inability of the Corridor to accommodate demand for person trips now and in the future is an acute transportation problem.

The travel demand model information presented in **Section 1.10** forecasts the amount of unmet demand as a result of severe congestion, long travel times, and other unsatisfactory travel conditions in the future. While it is recognized that there is already some unmet demand along the Corridor, particularly during weekends when congestion is the worst, the model forecasts the additional unmet demand for 2035 and 2050 relative to 2000 trip-making. **Figure 1-8** shows the unmet demand of person trips for representative locations along the Corridor. By 2035, unmet demand occurs during weekdays and weekends for locations east of and including the Eisenhower-Johnson Memorial Tunnels. Weekday unmet demand also occurs at Dowd Canyon representing the Vail Valley area. By 2050, unmet demand increases substantially in all parts of the Corridor. Unmet weekday demand at Dowd Canyon is forecast to be around 35,000 person trips per day in the peak direction. During weekends unmet demand west of C-470 is forecast to be around 70,000 person trips per day in the peak direction. These trips represent activities, such as social, work, and recreation that are desired along the Corridor but not occurring due to poor future travel conditions.

Because of poor travel conditions in the Corridor in 2050, around 9 million people annually who would use the Corridor to reach destinations will instead choose not to travel in the Corridor. These suppressed trips directly affect overall Corridor mobility, accessibility to Corridor destinations, recreational opportunities, and economic activity.

The amount of demand accommodated is different for weekdays and weekends due to automobile occupancy. On weekends, higher average vehicle occupancy ranging from 1.65 to 2.35 allows for more accommodation of person trips than weekdays, where an average rate between 1.45 and 1.65 is expected.

Figure 1-8. 2035 and 2050 Unmet Person Trip Demand



Note: EJMT = Eisenhower-Johnson Memorial Tunnels

1.11.2 The need to improve mobility and accessibility

Long travel times within the Corridor result in a need to safely, effectively, and efficiently improve mobility and accessibility in the Corridor. Long travel times result in less ability by travelers to engage in activities served by the Corridor, such as work, recreation, shopping, and social activities. Long travel times also result in increased traveler frustration and unmet demand as discussed in the previous section.

Travel time calculations for the Corridor analyzing transportation operations determined average speeds by segment, with consideration of steep grades, sharp curves, roadway design, and traffic conditions. **Figure 1-9** displays 2035 travel time conditions in comparison to free-flow. The year 2035 peak period travel times are around two to three times longer than free flow conditions. For the western part of the Corridor between Glenwood Springs and Silverthorne, weekday peak period travel times are around 185 minutes compared to around 80 minutes for free flow. Weekend peak period travel time for this part of the Corridor is about 160 minutes, twice as long as free flow. For the eastern part of the Corridor between Silverthorne and C-470, free flow travel time is between 50 minutes and 55 minutes. By 2035, peak period weekday and weekend travel times are about 115 minutes and 160 minutes, respectively.

The much longer travel times in the future will result in people changing travel patterns, either avoiding trips entirely (unmet trips) or shifting when they travel during time of day or day of week. Congestion will occur for longer periods during the day and more days of the week.

Long travel times greatly affect mobility in the Corridor for residents, workers, and visitors alike. Accessibility to locations served by the I-70 highway is greatly reduced given these long travel times.

For the need to improve mobility and accessibility, travel times in 2035 are used to display the extent of the problem because the amount of detailed information about travel in 2050 is limited. **Section 1.10.6** provides a comparison of the 2050 travel with the 2035 travel demand. The higher levels of demand in 2050 strongly indicate that travel times deteriorate from 2035 conditions.

Slow-moving vehicles along the steep grades of the Corridor contribute to congestion and limit mobility in the Corridor. In locations where steep grades occur and the ability to pass slow-moving vehicles is limited, mobility can be greatly reduced, particularly in times of heavy traffic conditions and/or poor weather. **Figure 1-10** displays the problem locations mobility, congestion, and safety, many of which are in areas of steep grades and limited passing lanes. For example, Vail Pass has grades of up to 7 percent, and between 9 percent and 12 percent of all vehicles are trucks, buses, or recreational vehicles, depending on the time of year and day. With only two lanes of roadway in each direction, these slow-moving vehicles greatly hamper the ability of faster vehicles to pass. When slow-moving vehicles pass other slow-moving vehicles, speeds are reduced and congestion results.

Figure 1-9. 2035 Peak Period Peak Direction Travel Time

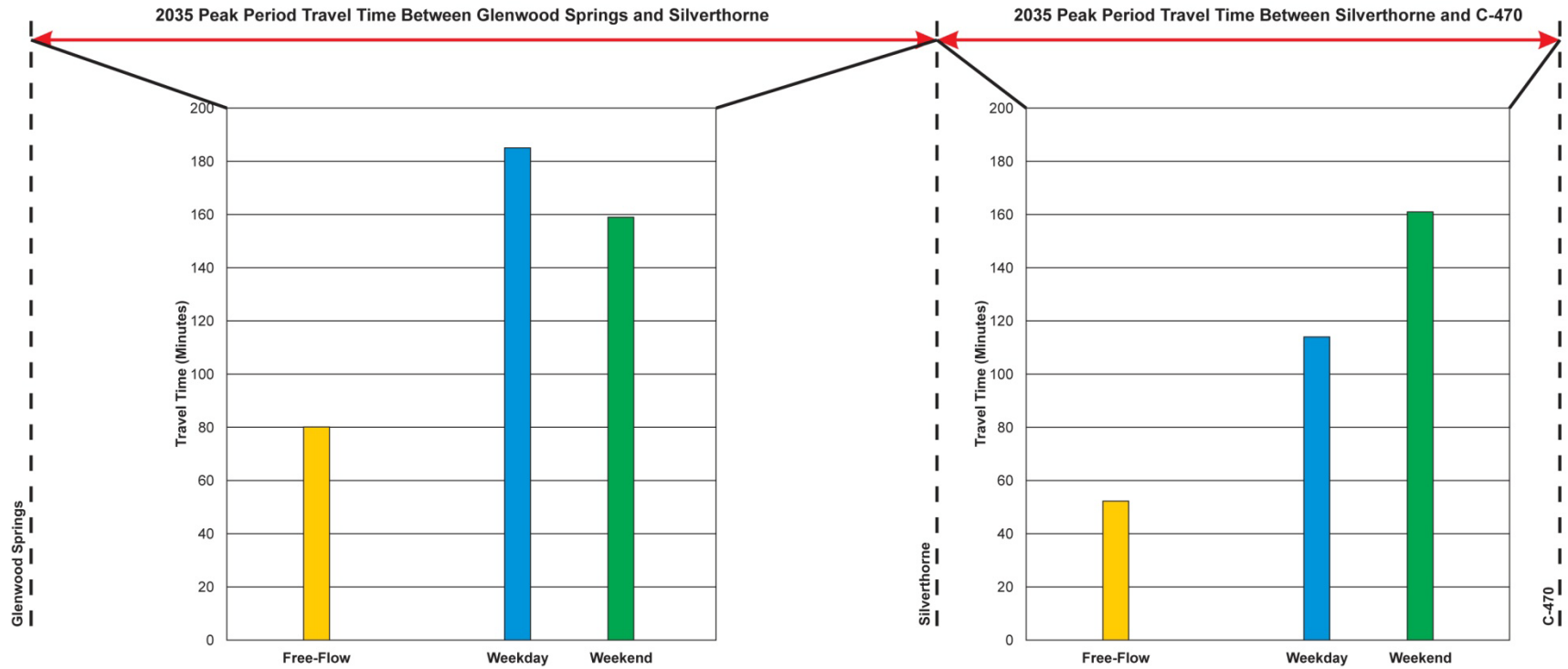
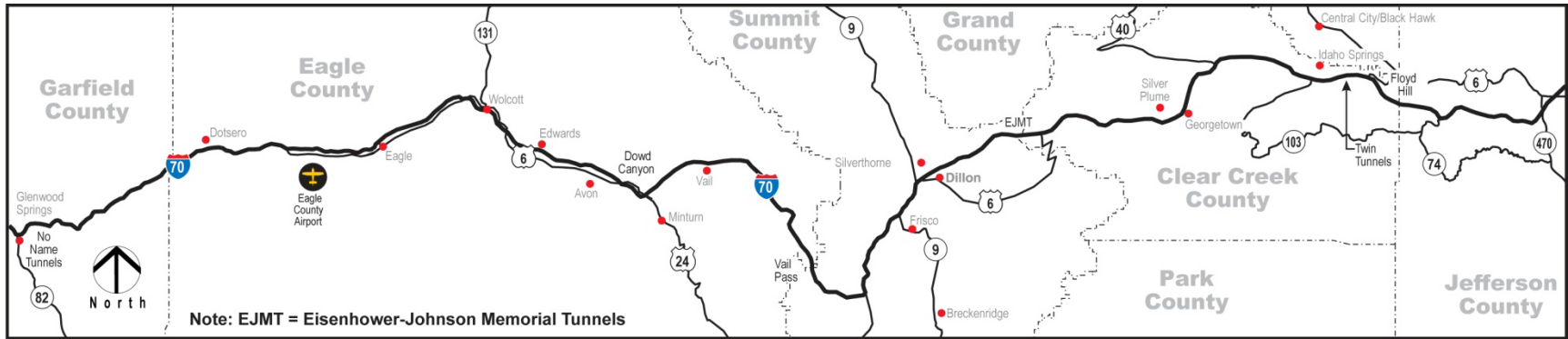
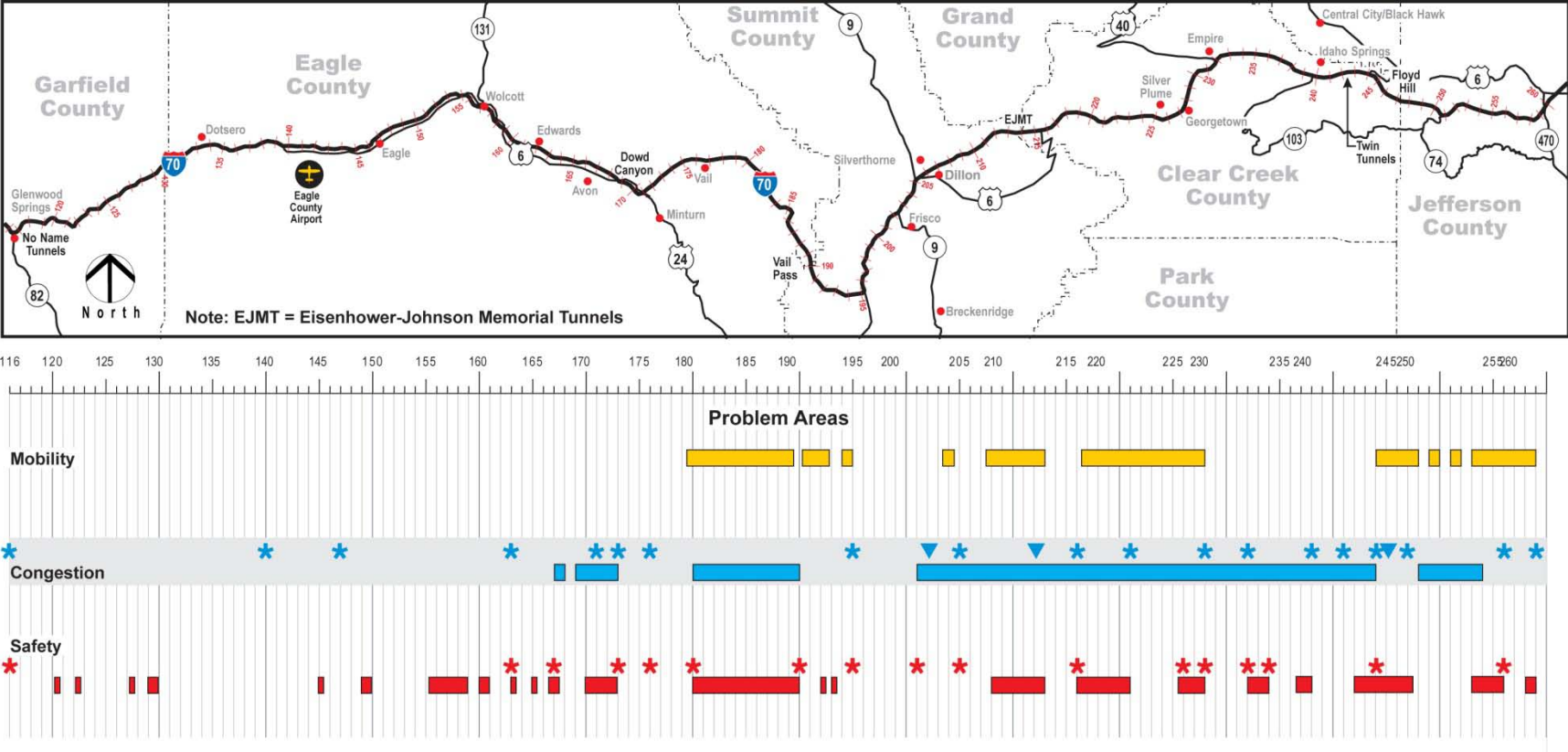


Figure 1-10. Problem Areas for Mobility, Congestion, and Safety



- Key**
- * * Interchange
 - ▼ Lane Drop
 - Yellow bar Mobility Problem Areas
 - Blue bar Congestion Problem Areas
 - Red bar Safety Problem Areas

1.11.3 The need to decrease congestion

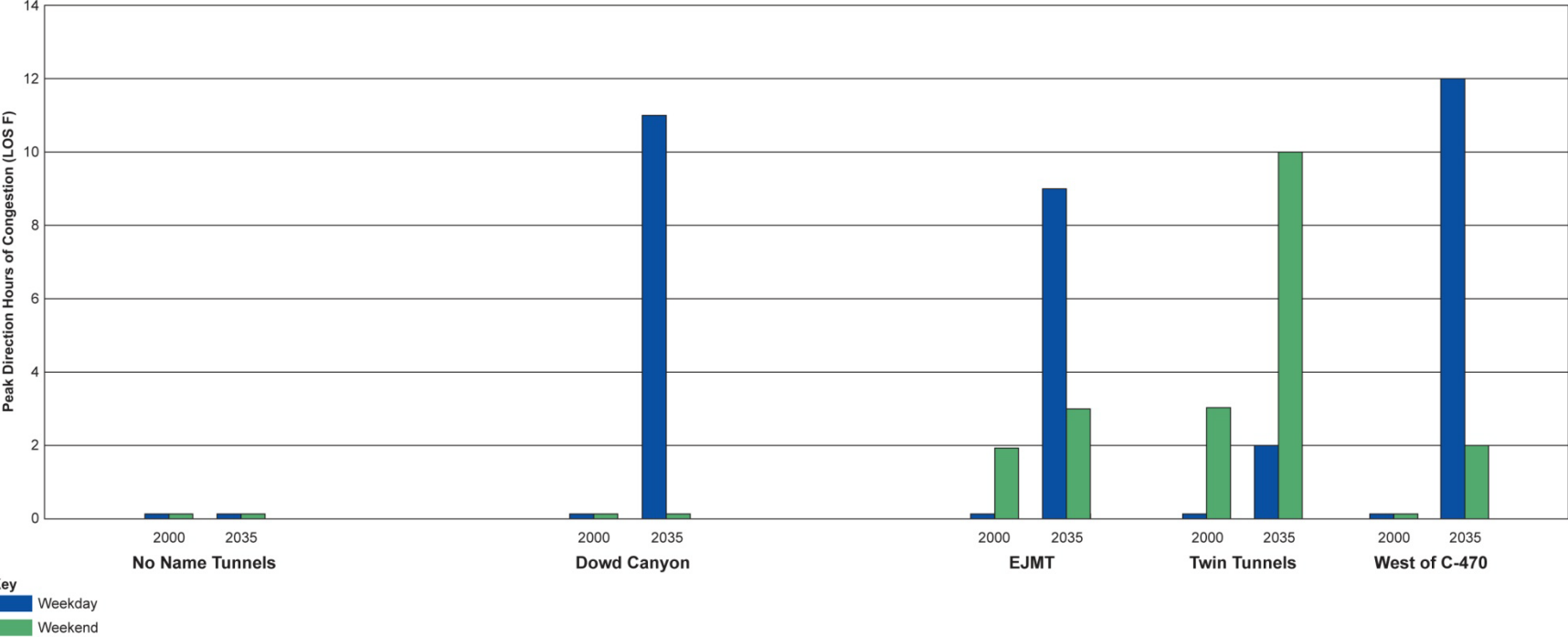
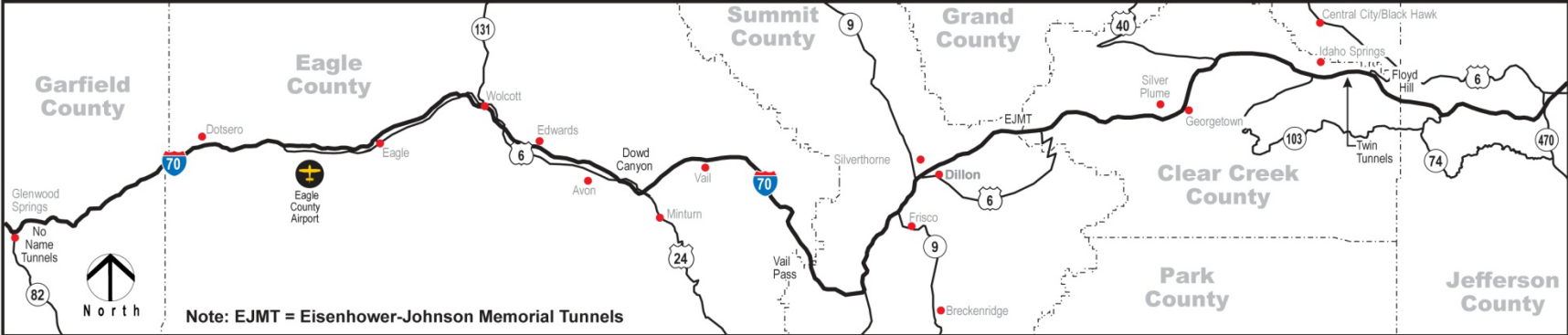
Existing and future periods of poor levels of service result in the need to decrease congestion along the Corridor, as summarized in **Section 1.6**. Severe congestion, defined as Level of Service F (stop-and-go traffic), is occurring at certain locations along the Corridor now and is projected to worsen in the future (with more congested locations and longer hours of congestion). **Figure 1-11** displays the hours of severe congestion for representative locations along the Corridor for 2000 and 2035. For example, **Figure 1-11** shows that at the Eisenhower-Johnson Memorial Tunnels, an average of two hours of severe congestion occurred in the peak direction during the typical weekend in 2000. Three hours of peak direction severe congestion occurred at the Twin Tunnels on weekends. By 2035, noticeably worse levels of congestion at more locations along the Corridor is projected. For example, during the typical weekday peak direction, congestion occurs for about 11 hours at Dowd Canyon (representing the Vail Valley) and for about 12 hours in the segment west of C-470 (near the Denver metropolitan area). This condition represents about half a weekday where traffic is in stop-and-go conditions. Similarly, during the 2035 typical weekend peak direction, severe congestion at the Twin Tunnels occurs for about 10 hours. At some locations along the Corridor in the future, weekday congestion is more prevalent than weekend congestion. This is due to the high proportion of peak period work trips on the I-70 highway west of C-470 (for commuters to and from the Denver metropolitan area) and in the Dowd Canyon area. At the Eisenhower-Johnson Memorial Tunnels, future weekday congestion is worse than weekend congestion because a higher portion of heavy trucks travel the Corridor on weekdays compared to weekends and severely limits the highway capacity on the steep approach grades to the tunnels. In contrast, at the Twin Tunnels, weekend congestion is higher than weekday congestion due to higher peak period volumes at this location on weekends compared to weekdays, and heavy trucks do not limit capacity as much due to the relatively flat grades at this location. Although **Figure 1-11** shows congestion at representative locations, congested conditions could back up for many miles around these locations, and congestion of the I-70 highway occurs in long sections.

Areas of widespread congestion occur by 2035 for extended periods throughout the week and on weekends. These high levels of congestion contribute to long travel times and result in suppressed trips (desired trips to destinations along the Corridor that are not taken). By 2035 the extent of the travel problems along the Corridor are severe and extensive resulting in poor mobility and restricted accessibility throughout the Corridor.

Further, while transportation analyses were conducted for 2035 and projected to 2050, the need for this project is to meet the long-term 2050 demand. The 2050 travel demand, while not as well defined and subject to more variability, is described in **Section 1.10.6**. The higher levels of demand compared to 2035 strongly indicate congestion problems will worsen.

Travel delay is also directly attributable to other conditions, including deficient roadway geometrics, inadequate interchanges, unsafe conditions, actual crashes, poor road conditions, and slower moving vehicles in areas of steep grades. Locations along the Corridor that exhibit these conditions are categorized by safety and congestion problem areas. Safety problem areas are identified by a weighted hazard index (WHI) greater than zero, indicating an area with a higher weighted crash rate than the statewide average (measured by the number and severity observed crashes). Crashes reduce the flow of traffic and, therefore, increase delay within the Corridor. Areas where existing roadway facilities result in congestion are typically located at sharp geometric curves, interchanges that have the potential to back traffic onto the I-70 highway, and steep grades that present conflicts with slow-moving vehicles. These congestion problem locations reduce the flow of traffic and increase congestion. **Figure 1-10** shows the problem areas of mobility, safety, and congestion. The large number of areas identified in the figure indicates the widespread problems in the Corridor. These problems directly affect overall congestion, as well as general mobility and accessibility to destinations served by the Corridor.

Figure 1-11. 2000 and 2035 Hours of Congestion



1.12 How is the project purpose and need used to evaluate potential solutions?

The purpose and need is the basis for developing and evaluating alternatives to address the projected transportation problems. Addressing the long-term (2050) needs of the project is an integral outcome of the alternatives evaluation process. Specific factors to illustrate the extent of the transportation problems that need to be addressed are used to measure how well alternatives meet these needs in the future.

Chapter 2, Summary and Comparison of Alternatives discusses the analysis of the alternatives and the methods used to measure their performance.

Addressing transportation needs in the Corridor requires careful consideration of the physical, environmental and community constraints and requirements created by the mountain and valley terrain of the Corridor. The protection of the narrow mountain valleys, existing historic communities, and extensive natural resources is critical to the State and the communities in the Corridor and these resources —along with natural hazards—define critical constraints for transportation solutions in the Corridor. Alternatives must meet the transportation needs and be developed in a manner that provides for and accommodates the following:

- Environmental sensitivity,
- Community values,
- Transportation safety, and
- The ability to implement the proposed solution.

Chapter 2, Summary and Comparison of Alternatives provides a more detailed description of how the purpose and need and the Corridor context-specific considerations have been used in developing, evaluating, and comparing alternatives to identify the Preferred Alternative.