I-70 MOUNTAIN CORRIDOR REASSESSMENT
Step 5: Documentation of the 2020 Reassessment

ATTACHMENT 3
Technical Narratives

Supporting Narrative

Step 1A: Evaluation of Context

Step 1B Evaluate Current Components of Purpose and Need

Step 2 Assess Effectiveness of Implementation of Preferred Alternative Components

I-70 MOUNTAIN CORRIDOR REASSESSMENT

NARRATIVE

Step 1A Evaluation of Context

July 6, 2020

WORK PLAN STEP 1A EVALUATION OF CONTEXT

From the Collaborative Effort Record of Decision 2020 Reassessment Work Plan, Step 1 is to Reassess the Purpose and Need. Step 1A is described as follows:

Step 1A: Evaluation of context. Determine if the context in which the Purpose and Need statements were developed have changed. Information that may be needed to evaluate the context includes:

1. Population
2. Land use and land use pressures (including demand)
3. Technology
4. Climate change
5. Others

POPULATION

Methodology

Current forecasts of population are compared to the population forecast used during development of the 2011 I-70 Mountain Corridor Programmatic Environmental Impact Statement (PEIS). The 2011 PEIS included socioeconomic forecasts of population and employment. The base year was 2000 and the original 2025 forecasts were extended to the horizon year of 2035. The forecasts are a primary input to the travel demand model, which produces forecasts of vehicular highway volumes and future transit ridership.

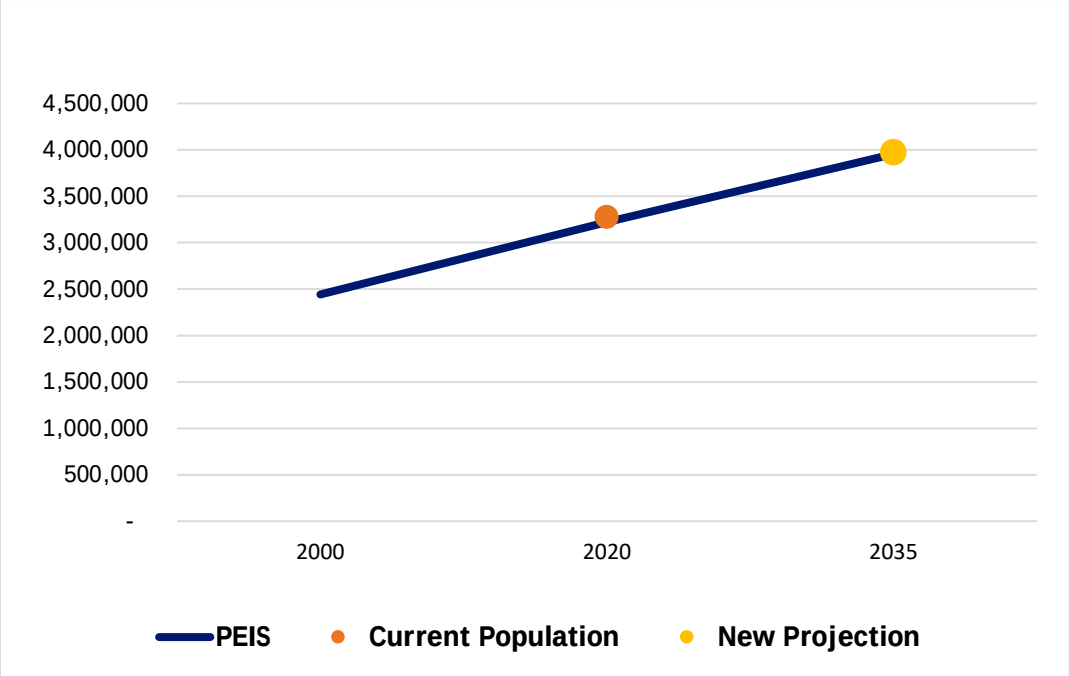
Updated socioeconomic forecasts are available from the statewide travel demand model, *StateFocus*. The model, recently developed by CDOT, has a base year of 2015 and a horizon year of 2045.

The primary source for the forecasts, both in 2011 as well as today, is the Colorado State Demography Office in the Colorado Department of Local Affairs (DOLA).

The current forecasts are compared to the prior population forecast. For a consistent basis of comparison, the forecasts are compared for the year 2035. Current year 2020 estimates of population and employment are presented in Figure 1 through Figure 4. The socioeconomic data are shown for the both the Front Range metro area, where the vast majority of recreation trips are generated, and for the corridor area.

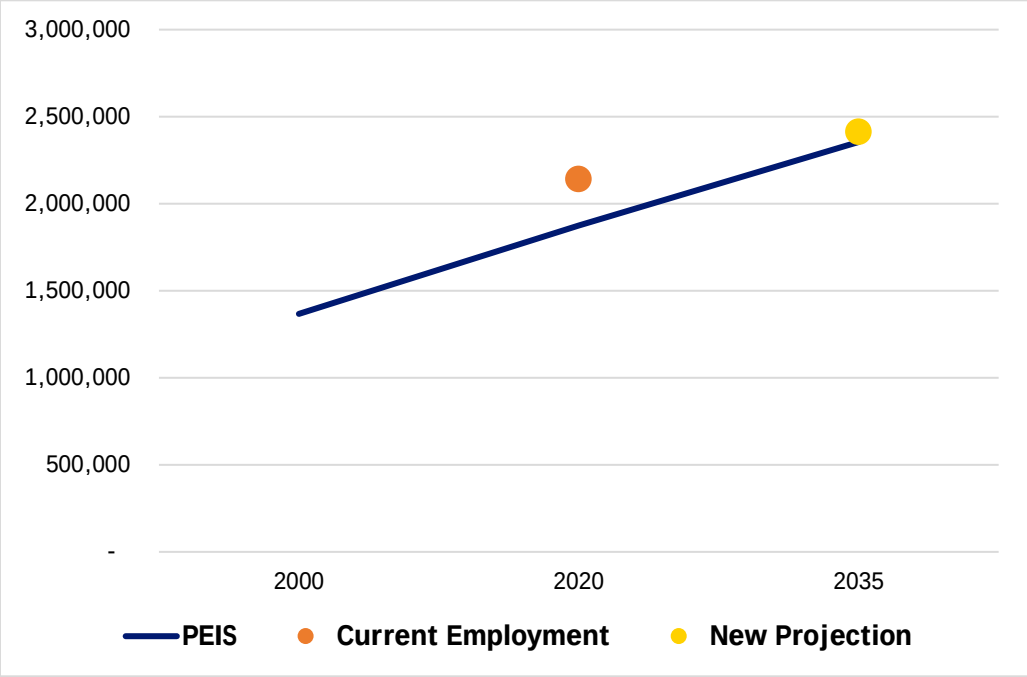
Summary of Findings

Figure 1. Denver Metropolitan Area Population



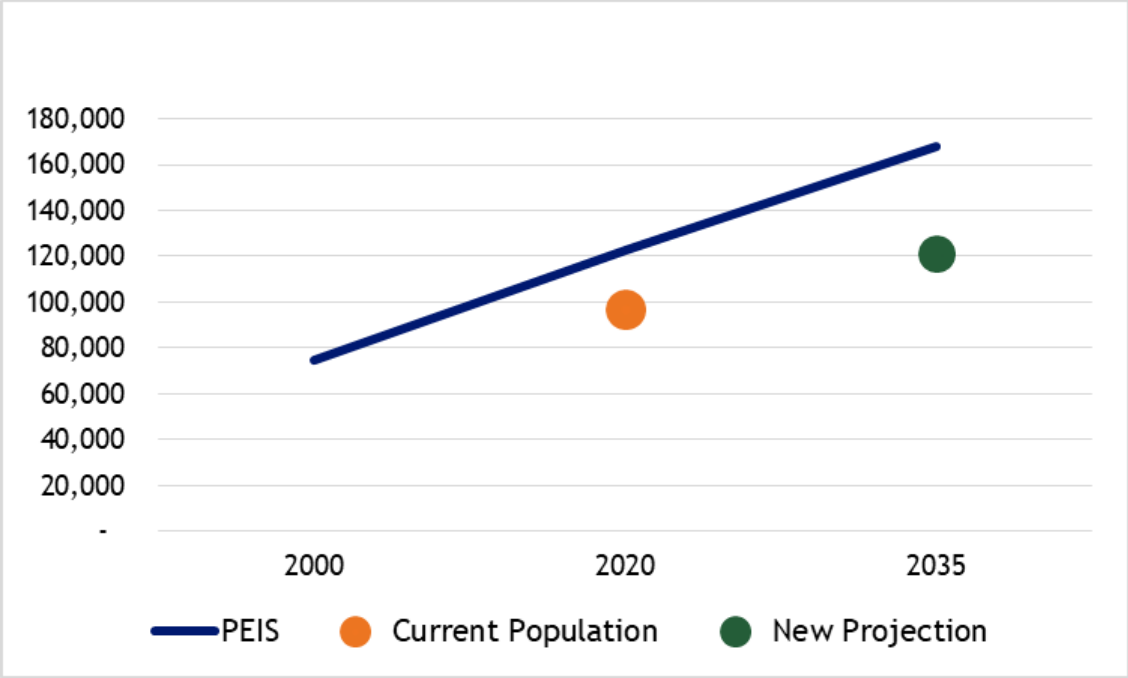
Source: I-70 Mountain Corridor PEIS 2011, 2020 DOLA, and 2035 CDOT Statewide model.
Area: Counties of Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, Jefferson

Figure 2. Denver Metropolitan Area Employment



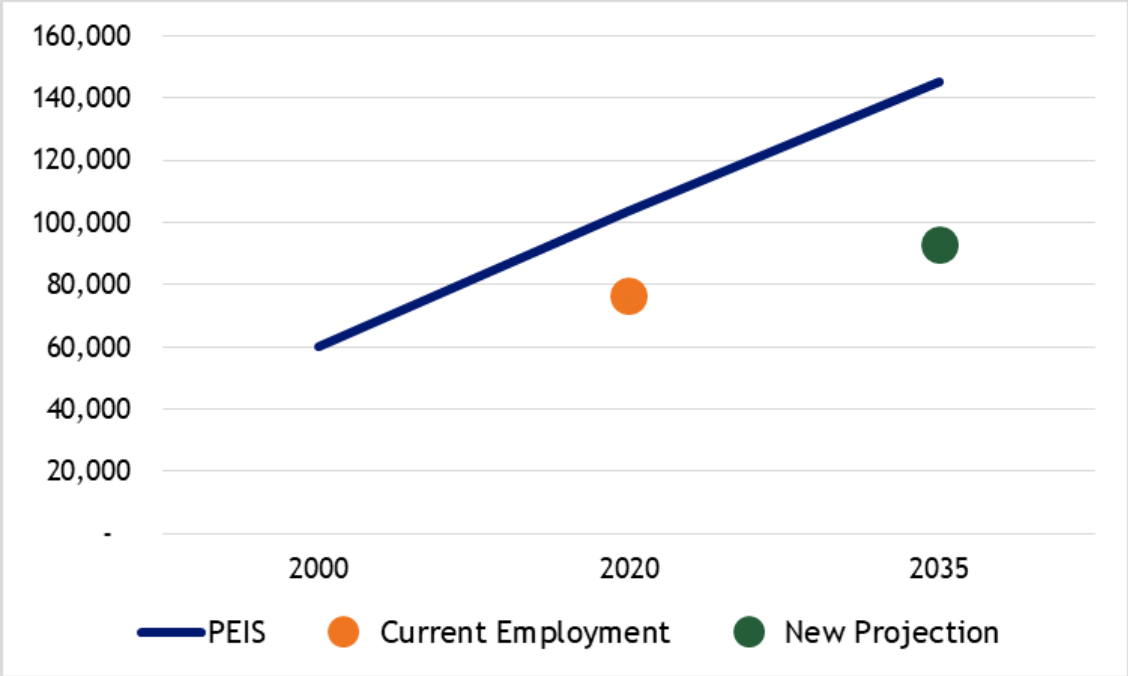
Source: I-70 Mountain Corridor PEIS 2011, 2020 DOLA, and 2035 CDOT Statewide model.
Area: Counties of Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, Jefferson

Figure 3. Corridor Area Population



Source: I-70 Mountain Corridor PEIS 2011, 2020 DOLA, and 2035 CDOT Statewide model.
Area: Counties of Clear Creek, Summit, Eagle

Figure 4. Corridor Area Employment



Source: I-70 Mountain Corridor PEIS 2011, 2020 DOLA, and 2035 CDOT Statewide model.
Area: Counties of Clear Creek, Summit, Eagle

Summary of Findings

In the Denver metropolitan area, the 2011 PEIS 2035 forecasts for both population and employment are very close to the current forecasts for that horizon year. The current estimate of population 2020 is on track with the 2035 projection for the Denver metropolitan area. Current employment in 2020 is slightly higher than the interpolated forecast, perhaps partially because of the unusually low level of unemployment that occurred in early 2020.

In contrast, the 2011 PEIS forecasts for population and employment are notably higher than the current forecasts for the corridor counties of Clear Creek, Summit, and Eagle. This is corroborated by the current estimates for population and employment in those counties in 2020, which are less than the line of forecast. The change in forecast for development in the mountain counties by DOLA could be because of a variety of reasons, including slower observed rates of growth, less interest in the communities for continuing high rates of growth, or other.

LAND USE AND LAND USE PRESSURES

Introduction

The 2011 PEIS recognized the relationship between transportation and predicted changes in land uses in the corridor, depending on the types of transportation alternatives implemented. Highway improvements were expected to distribute growth based on existing trends of dispersed growth in rural areas, while transit alternatives were expected to concentrate growth in populated areas (around stations). The Preferred Alternative, as a mix of both highway and transit improvements, was expected to balance the growth and put pressures both on urban and rural areas to manage growth. For recreation-based land uses, the 2011 PEIS noted that recreational land uses in the I-70 Mountain Corridor heavily influence economic development and travel demand trends. Recreation and tourism account for a higher percentage of jobs along the corridor compared to the rest of the state, and the I-70 Mountain Corridor contains hundreds of recreational destinations. The 2011 PEIS projected that transportation improvements associated with the Preferred Alternative would induce more recreational travel to the I-70 Mountain Corridor as suppressed trips were induced because of improved access and travel conditions.

Methodology

An updated review of land use, recreational activities, and recreational trip indicators used by the travel demand model were assembled through Internet research, as well as review of some research papers and public informational documents.

Summary of Findings

Colorado saw a doubling of economic revenue since 2012 (SCORP, 2019). The outdoor recreation economy in Colorado in 2020 accounts for:

- 229,000 direct jobs
- $28.0 billion in consumer spending

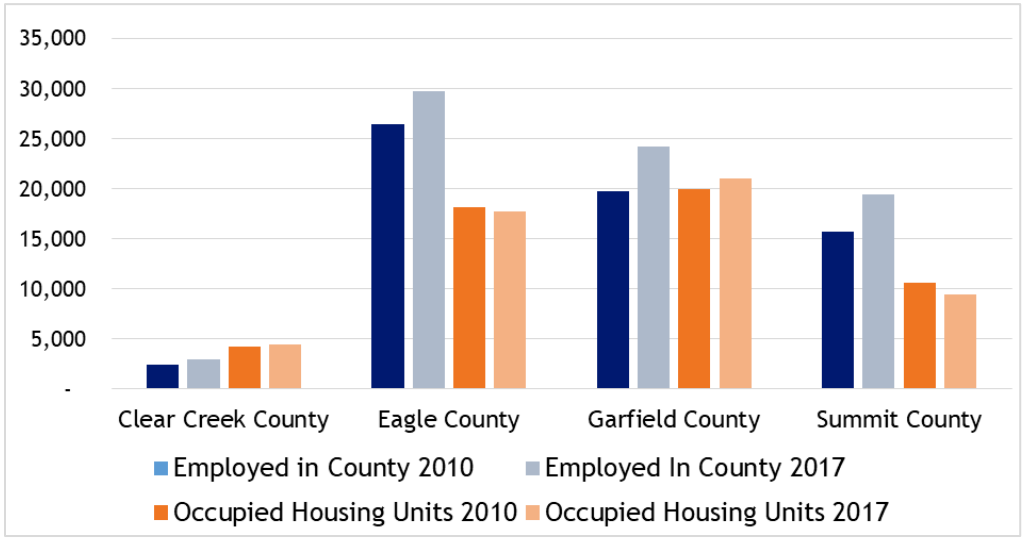
- $9.7 billion in wages and salaries
- $2 billion in state and local tax revenue[1]

Colorado Parks and Wildlife (CPW) recognizes that the increase this revenue brings puts pressure on recreation sites and activities. Because increased pressure on recreational resources, CPW has several strategies and objectives to balance recreation opportunities and stewardship for future generations:

1. **Sustainable Access and Opportunity.** This includes using technology to disperse people to recreation areas that can accommodate them as well as providing off-peak use incentives.
2. **Coloradans and visitors enjoy and care for natural and cultural resources and commit to stewarding them for future generations.** Recently, the CPW put into place a permitting system for Hanging Lake recreation because of overuse in the area.
3. **Land, Water, and Wildlife Conservation Goals.** This includes an ever-evolving use of land management and mitigation strategies, including funding partnerships for forest management, as well as support for sustainable outdoor recreation.

2010 and 2017 census data were analyzed to determine recent housing and employment trends in Clear Creek, Summit, Eagle, and Garfield counties. As Figure 5 shows, there was growth in the number of employed in each county between 2010 and 2017 but minimal growth (or even small decreases) in the number of occupied housing units.

Figure 5. Comparison of Housing and Employment between 2010 and 2017

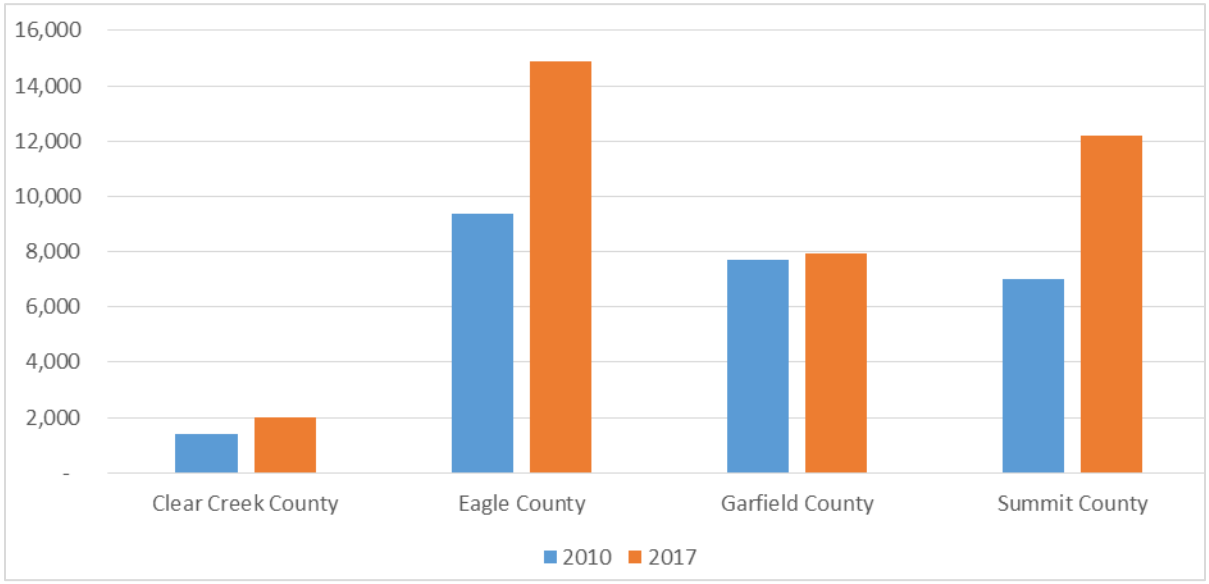


Source: U.S. Census, American Community Survey, 5-Year Estimates, 2010 and 2017 and Longitudinal Employer–Household Dynamics (LEHD) On the Map 2010 and 2017.

[1] Existing year data downloaded April 2020 https://outdoorindustry.org/state/colorado/

Figure 6 presents the number of workers who work in each county but reside in other counties. Figure 6 shows more workers are commuting into Eagle and Summit counties in 2010 compared to 2017.

Figure 6. Comparison of Number of Workers Living Outside County of Employment



Source: U.S. Census, Longitudinal Employer–Household Dynamics (LEHD) On the Map 2010 and 2017.

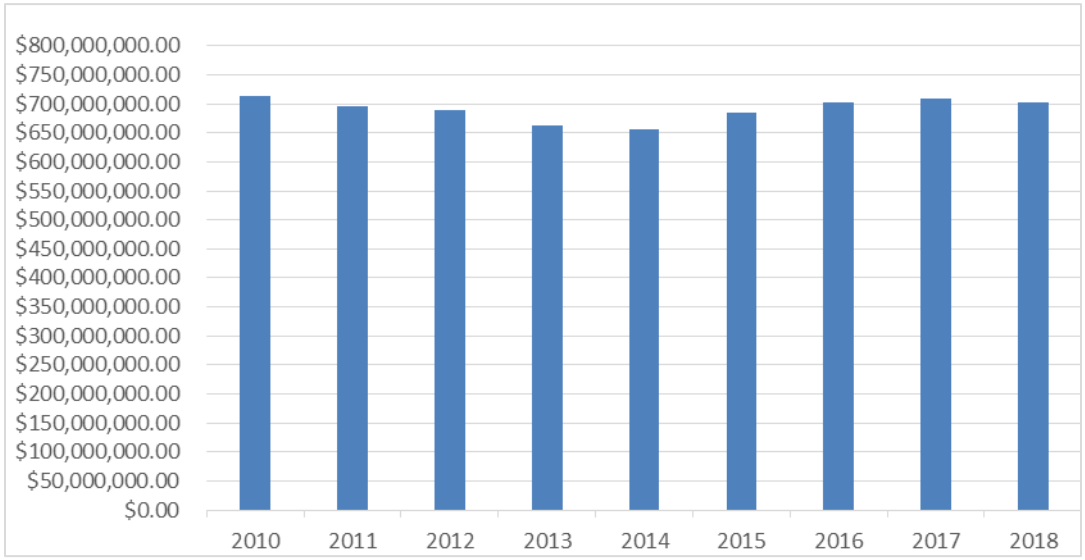
RECREATIONAL TRIP INDICATORS

Recreational trips make up a large portion of the peak period travel that occurs in the corridor. The travel demand model accounts for recreational travel by enumerating indicators for several recreational trip types. Readily available information was gathered to update these statistics for the current year.

Gaming devices

The model uses the estimated number of gaming devices to generate recreational gaming trips. Data from the Colorado Department of Revenue was summarized for casinos in Black Hawk and Central City from 2010 to 2018 (Figure 7). The adjusted gross proceeds (AGP) data revealed that this indicator has fluctuated but remained consistent between $600 million and $700 million. AGP is the total amount of all wagers made by players less all payments to players.

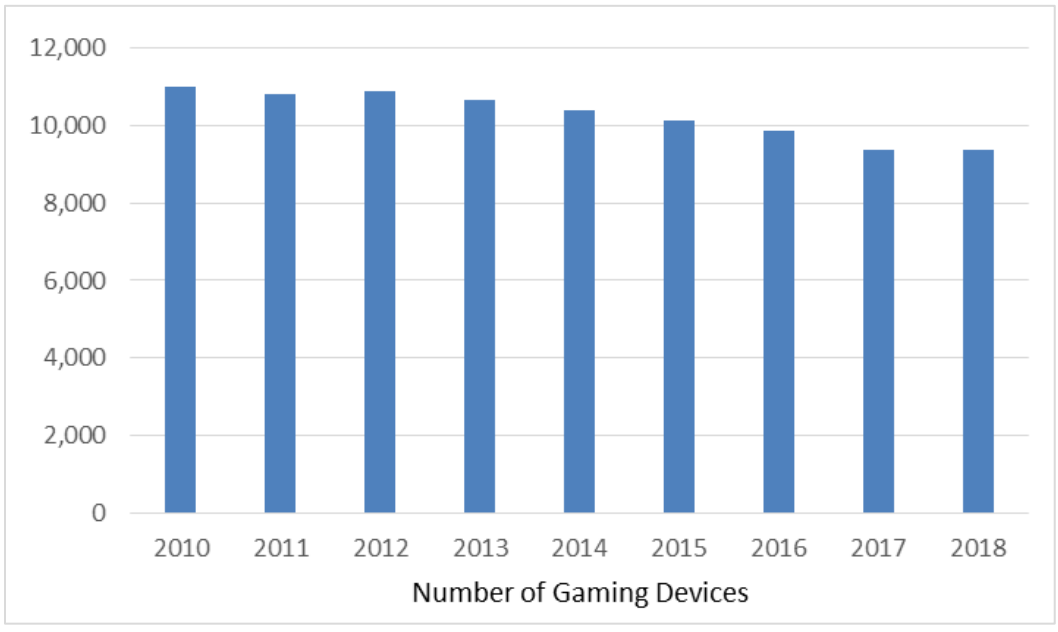
Figure 7. AGP for Black Hawk and Central City adjusted for 2018 Dollars



Source: Colorado Department of Revenue, Statistical Summaries, https://www.colorado.gov/pacific/enforcement/industry-statistics-gaming, accessed February 20, 2020

The number of gaming devices has declined slightly from 2010 to present (Figure 8).

Figure 8. Number of Gaming Devices at Casinos in Black Hawk and Central City by Year



Source: Colorado Department of Revenue, Statistical Summaries, https://www.colorado.gov/pacific/enforcement/industry-statistics-gaming, accessed February 20, 2020

Hotel Beds

The model uses the estimated number of hotel beds to generate some of the visitor recreational trips. A comprehensive list of hotels in Colorado was collected, including the number of rooms

and the hotel date of opening from the Colorado Hotel and Lodging Association (A. Mayhew, personal communication, January 30, 2020). Industry standards were used to convert rooms to the number of beds (deRoos, 2011). Overall, for the four counties along I-70 (Clear Creek, Summit, Eagle, Garfield), there was an increase of 1,400 hotel beds between 2010 and 2020, which is a 7 percent increase.

Second Homes

The model uses the estimated number of second homes to generate some of the visitor recreational trips. There were an estimated 67,000 second homes in 2000, growing to an estimated 125,000 in 2035 in the model area. These are estimated by extrapolating from data developed for the original PEIS travel demand model.

A recent phenomenon is vacation homes available to rent online. In the model, trips to these home rentals are covered by the second homes. For a general reference, in March 2020 a search was conducted of vacation home rentals available through the websites Airbnb.com and VRBO.com. The results for VRBO include all available properties, and the Airbnb results include a snapshot in time, properties available to book between August 21 and 24, 2020.

Table 1. Airbnb and VRBO Vacation Home Rentals in March 2020

County	VRBO—all properties	Airbnb—properties available to book August 21-24, 2020
Clear Creek County	3,036	190
Summit County	9,154	300+
Eagle County	5,682	300+
Garfield County	317	284

Camping sites

The model uses an estimated number of camping sites to generate some of the visitor recreational trips.

From a variety of state and federal sources, the number of public campgrounds in Clear Creek, Summit, Eagle, and Garfield counties is approximately 40, with around 1,000 campsites in 2020.[2] Data for prior years is not available.

Skier visits

The model uses an estimated number of skier visits to resorts to generate some of the visitor recreational trips. Skier visits to the overall Rocky Mountain Area (including Colorado, Utah,

[2] https://www.recreation.gov/.
United States Department of Agriculture, National Forest, Recreational Facilities Data: https://data.fs.usda.gov/geodata/edw/datasets.php?xmlKeyword=camp
Bureau of Land Management, Colorado Recreation Data: https://www.blm.gov/site-page/services-geospatial-gis-data-colorado
US National Park Service, Campsites Data: https://public-nps.opendata.arcgis.com/
Colorado Parks and Wildlife, Campsites Data: http://www.arcgis.com/home/search.html?q=Colorado%20Parks%20and%20Wildlife&t=groups

New Mexico, and Wyoming) totaled 18.1 million in 1999/2000, and 24.4 million in 2018/2019, based on data from the National Ski Areas Association.

TRANSPORTATION TECHNOLOGY

Introduction

Around the time the 2011 PEIS was written, groundbreaking research was occurring in the realm of new automobile and transit vehicle technology: Other technologies affecting mobility and travel behavior that have also evolved rapidly in the last decade include social media, transportation network companies, and smart phone applications for navigation and other travel information.

Methodology

A snapshot of the current state of new transportation technology was assembled largely through Internet research, as well as review of some research papers. A definition of terms of new transportation technologies is provided below:

- Automated vehicles have automated driver assistance features, up to and including driverless vehicles. Autonomous vehicles can be personal or fleet-owned automobiles, or small transit vehicles (HDR, 2019).
- Microtransit refers to public or private transit systems designed to serve relatively small number of persons (3 to 10) at the same time with dynamically dispatched or “ad-hoc” transit services. Microtransit typically is used for first and last mile applications near major transit stations or in campus like settings. (HDR, 2019).
- Connected vehicles are vehicles with the capacity to communicate with other vehicles and roadside infrastructure through interoperable networked wireless communications (HDR, 2019).
- Connected and autonomous vehicles are often together referred to as CAVS. Autonomous vehicles need not be connected vehicles, and connected vehicles need not be automated.
- Maglev trains are suspended and propelled by magnets, using magnetic levitation.[3]
- High-speed transit: 250 kilometers per hour or faster (155 miles per hour).[4]
- Transportation Network Companies refer to hired rides for personal trips that are accessed through a mobile application. Uber and Lyft are the dominant players in this market (HDR, 2019).

Summary of Findings—High Speed Transit Technology

Technology of high speed trains has continued to evolve over the past decade. This provides a brief overview of the current status of technology related to high speed transit.

[3] https://www.energy.gov/articles/how-maglev-works
[4] https://reason.org/wp-content/uploads/files/high_speed_rail_lessons.pdf

ADVANCED GUIDEWAY SYSTEM STUDY TRANSIT TECHNOLOGY VENDORS

In 2014 the Advanced Guideway System (AGS) Feasibility Study conducted by CDOT identified several transit vendors with viable technologies that could potentially serve the I-70 Mountain Corridor. These eight transit technology vendors were researched to ascertain their current status in 2020 regarding implemented projects and/or demonstration pilot projects. Table 2 contains the results of the research. Some of the vendors identified in the 2014 AGS report have conducted tests or pilot projects (CDOT, 2014).

Table 2. Status of Technology Vendors Identified in AGS Study

Provider Name	Provider Status	Technology Type	Technology Status
American Maglev	Open	Maglev	Maglev trains have been tested on full-scale test track in Georgia.
FlightRail	Open	Elevated high-speed rail system	Tested a 1/6 scale working prototype.
General Atomics	Open	Maglev	Tested a full scale working maglev system in California.
MagneMotion	Acquired by Rockwell Automation	Maglev	No updates on Rockwell Automation's website.
Owen Transit Group	Open	High speed rail	Patented new HSR technology.
PPRTC	Open	Public Personal Rapid Transit	Website mentions advocacy, not implementation.
skyTran	Open	Maglev	Began construction on second full-scale test platform and will soon launch first commercial pilot.
Swift Tram	Open	Small scale, automated guideway transit system	Completed conceptual designs.
Talgo	Open	High speed rail	Implemented several HSR projects worldwide, including Spain and Uzbekistan.
Transrapid	Possibly Closed	N/A	No website found.

Source: Online research (each provider's website), accessed February 2020.

MAGLEV

Many of the AGS technology vendors use maglev technology in one form or another.

The fastest train technology available—maglev trains—are advancing across the globe. Compared to traditional steel wheel technologies, maglev trains can travel at higher speeds and have reduced maintenance because they only touch the guideways briefly. Maglev vehicles are quiet and smooth because there is no metal-on-metal contact. In addition, this technology does not include an engine and the concrete guideways are largely unaffected by weather. [5]

[5] https://now.northropgrumman.com/maglev-technology-the-force-is-very-strong-with-this-one/

There are also clear challenges. The cost of maglev technologies, evidenced by past, existing, and planned projects, is a barrier. For example, the Tokaido Shinkansne Bypass (expected to open in 2047) will cost $83 billion to build.[6]

During the last decade, several maglev train lines have opened in other countries (Table 3). While not all are high-speed lines, the viability of maglev technology is clearly demonstrated by these implemented projects. China has unveiled a prototype of a new maglev train designed to reach speeds of up to 600 kilometers per hour or 370 miles per hour.

Table 3. Maglev Train Lines in Other Countries

Country	Train Line	Speed	Status
South Korea	Incheon Airport Maglev	68 mph	Opened 2016
China	Changsha Maglev Express	62 mph	Opened 2016
China	Beijing Metro Line	62 mph	Opened 2017
Japan	Chūō Shinkansen, Tokyo-Nagoya	314 mph	Construction began in 2014, expected to open in 2027
China	Qingyuan Maglev	75 mph	Under construction, opening in 2020
China	Fenghuang Ancient Town Maglev	62 mph	Construction began in 2019, expected opening 2021

Source: https://www.maglev.net/all-existing-and-under-construction-maglev-lines.

In the United States, maglev has also advanced since 2011. The three projects listed below were eligible for the $24 million in Federal Railroad Administration Magnetic Levitation Deployment Grants Program (FY 2019).

- The Baltimore-Washington Maglev Project
  - Currently in planning phase and the National Environmental Policy Act (NEPA) process is on hold; project completion set for 2028.
  - First segment of the Northwest Rail Maglev Project which is planned to extend from Washington to New York City.[7]
  - This project is the NEPA process and completed an alternatives report in 2018. NEPA is on hold to allow Northeast Maglev, the company proposing the train, time to provide more details on the project for regulatory agencies and the public.[8]

[6] https://www.railjournal.com/passenger/high-speed/jr-centrals-chuo-maglev-project-approved/ and https://www.railway-technology.com/projects/chuo-shinkansen-maglev-line/
[7] https://www.bwmaglev.info/
[8] https://www.baltimoresun.com/news/investigations/bs-bz-maglev-paused-20191217-bpgoughwaze27fqbger67vamnq-story.html

- Atlanta-Chattanooga high-speed-rail corridor
  - 2016 Study released with possible routes for maglev or steel wheel.
  - The NEPA process is underway and the Tier 1 Final EIS and Record of Decision have been released.[9]
- Pennsylvania High Speed Rail
  - The proposed Pennsylvania High-Speed Maglev project is an approximately 54-mile line connecting Pittsburgh International Airport, Downtown Pittsburgh, Monroeville, and Greensburg.
  - The Final EIS was completed in 2010. In 2011 the company running Pittsburgh's maglev went bankrupt. While this project was eligible for the Federal Railroad Administration Magnetic Levitation Deployment Grant in 2019, research did not find any indication that funds were sought or the project is still underway.[10]

HYPERLOOP

Hyperloop systems are a new advancement in high-speed transit. Hyperloop systems employ maglev vehicles that are accelerated in vacuum pipelines.[11] There currently are three prominent vendors in the Hyperloop market: Virgin Hyperloop One, TransPod, and Hyperloop Transportation Technologies. There are planned Hyperloop test tracks and studies in Saudi Arabia, India, Canada, France, Abu Dhabi, France, and China.[12]

In the United States, a short test track has been built near Las Vegas, Nevada.[13] Missouri completed an I-70 feasibility study in October 2019.[14] Also, $5 million in initial funding was allocated for a route connecting Cleveland and Chicago in June 2019.[15] In Colorado, a Hyperloop feasibility study was completed by engineering firm AECOM and CDOT. The I-70 Mountain Corridor was included as part of this study. However, Hyperloop is no longer being pursued by CDOT.

Summary of Findings—Vehicle Technology

AUTONOMOUS VEHICLES

Autonomous vehicle features are offered on many new models offered by automobile manufacturers. These include forward collision warnings, automated braking, blind spot

[9] http://www.dot.ga.gov/IS/Rail/AtlantatoChattanooga
[10] https://www.pghcitypaper.com/pittsburgh/is-the-proposed-hyperloop-taking-the-focus-advancing-feasible-transit-solutions-in-pittsburgh/Content?oid=7281728
[11] https://builtin.com/transportation-tech/what-is-hyperloop
[12] https://www.nytimes.com/2019/02/18/technology/hyperloop-virgin-vacuum-tubes.html
[13] https://www.theverge.com/2017/3/7/14840322/hyperloop-one-test-track-nevada-desert
[14] https://hyperloop-one.com/black-veatch-announces-results-first-ever-feasibility-study-hyperloop-united-states-confirms-commercial-viability-virgin-hyperloop-one-technology
[15] https://www.crainscleveland.com/government/initial-funding-cleveland-chicago-hyperloop-passes-house-moves-senate

detection, lane keeping assistance, adaptive cruise control, and a myriad of other elements. These features greatly enhance safety.[16]

Fully functioning completely driverless vehicles are not yet driving the roads and streets. However, many pilot tests of fully driverless vehicles have occurred and are ongoing. These include tests by Tesla, as well as all the major automobile manufacturers. Transportation Network Companies also continue to conduct demonstration projects of driverless automobile vehicles.[17]

In Denver, the Regional Transportation District recently conducted a pilot of a driverless microtransit vehicle. This was staged at Peña Station NEXT on the A-Line Commuter Rail, which occurred for 6 months in 2019. Challenges of the project included disruptions in service because of snow on the road and other severe weather (shuttle was not equipped with temperature regulation). It was very quick to respond to obstacles, was very safe, and there were no accidents.[18]

CONNECTED VEHICLES

Vehicle manufacturers are moving towards producing 100 percent of cars with an embedded data modem.[19] Development of communication protocols, and the type of wireless technology, is continuing. Roadside communication infrastructure is also advancing on most major roadways. Connected vehicle technology has the potential improve safety. Connected vehicles can avoid accidents by communicating with nearby vehicles and be informed of road conditions.[20]

CDOT and Panasonic successfully installed and tested five roadside units and six vehicle onboard units, and established a Network Operations Center to manage the overall system during a pilot deployment in 2018[21]. Additional roadside units were installed along the I-70 Mountain Corridor from Golden to Vail. CDOT is currently operating and maintain the units along I-70, and testing backend software that will support CAV messaging, infrastructure, and traffic management centers.

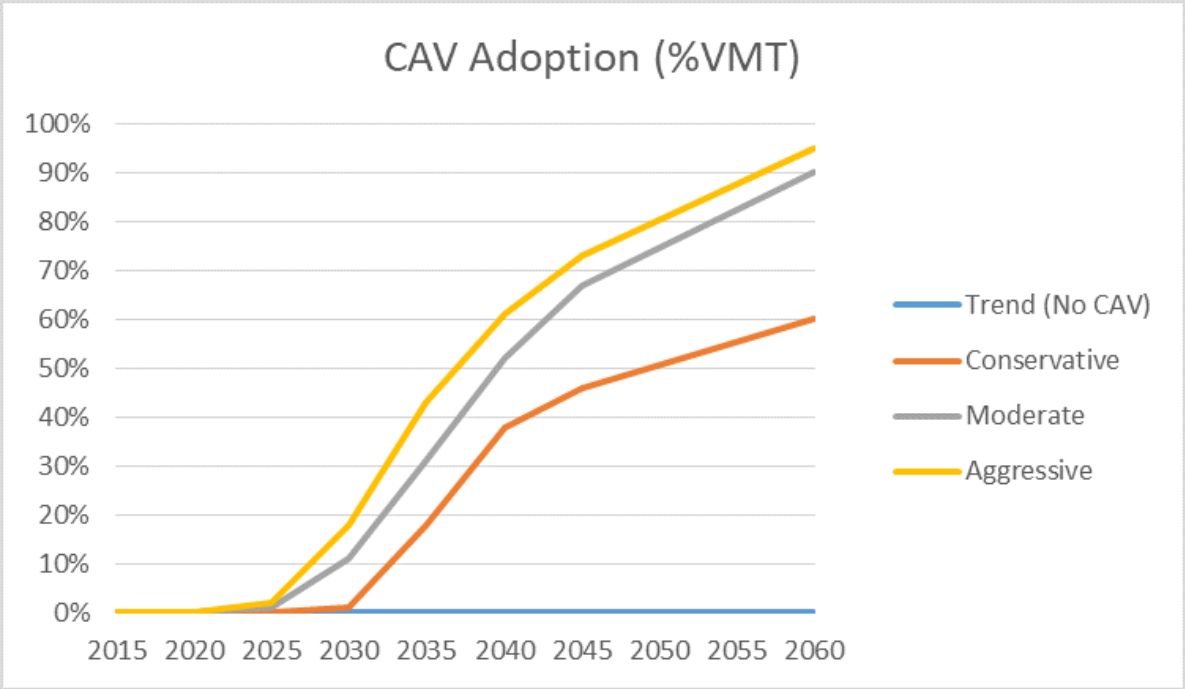
UNCERTAINTIES

As with any new technologies, uncertainties exist. The potential of this vehicle technology to have an impact on congestion is uncertain. In theory, CAVs can travel with very short separation in time and space; therefore, greatly increasing the throughput of a roadway. However, traffic modeling has shown that very high CAV saturation levels are likely required before CAVs will reduce congestion (HDR, 2020). It is also possible that fully autonomous vehicles will induce people to take more trips, and therefore increase the congestion on roads. Other uncertainties include the rate of deployment of technologies, the technology's ability to overcome the

[16] (https://www.wired.com/brandlab/2016/03/a-brief-history-of-autonomous-vehicle-technology/)
[17] https://www.wired.com/brandlab/2016/03/a-brief-history-of-autonomous-vehicle-technology/
[18] https://www.rtd-denver.com/
[19] https://www.aptiv.com/newsroom/article/top-three-trends-driving-the-future-of-connected-vehicles
[20] https://interestingengineering.com/connected-vehicles-in-smart-cities-the-future-of-transportation
[21] https://www.codot.gov/news/2018/july/cdot-and-panasonic-take-first-steps-to-turn-i-70-into-connected-roadway

challenge of weather, and the viability of fully autonomous vehicles. Figure 9 presents the range of potential CAV adoption scenarios in terms of their portion of vehicle miles traveled.

Figure 9. Potential Rates of Connected and Autonomous Vehicle Adoption in Terms of Vehicle Miles Traveled



Source HDR Advanced Mobility Team, 2019.

As Figure 9 shows, an adoption rate of 75 percent—the approximate rate where vehicle throughput will increase—is at year 2045 or beyond, even under the most aggressive scenario. The effect of vehicle technology on congestion in the I-70 Mountain Corridor is most likely decades out.

Further details and information on new technology of high speed transit, autonomous vehicles, and connected vehicles is contained in the draft technical paper *I-70 PEIS Reassessment 2020: Innovations and Advances in Technology* (HDR, 2020).

CLIMATE CHANGE

Introduction

Climate change was considered in the 2011 PEIS, and there was a level of awareness in 2011. Primarily cited in the 2011 PEIS was the Governor's Climate Action Plan, adopted in 2007, which included measures to reduce vehicle carbon dioxide emissions standards and to reduce

vehicle travel through transit, flex time, telecommuting, ride-sharing, and broadband communications.[22]

Awareness and concern over climate issues have grown in the past 9 years. There have been political advancements in the Governor's office and at CDOT with risk and resiliency regarding climate change that add to the context. The Colorado Energy Office has been active in addressing climate change as well with a study called the Greenhouse Gas Road Map.[23]

Methodology

A review of relevant local, national, and worldwide research papers that have been published since the 2011 PIES was completed. These documents included:

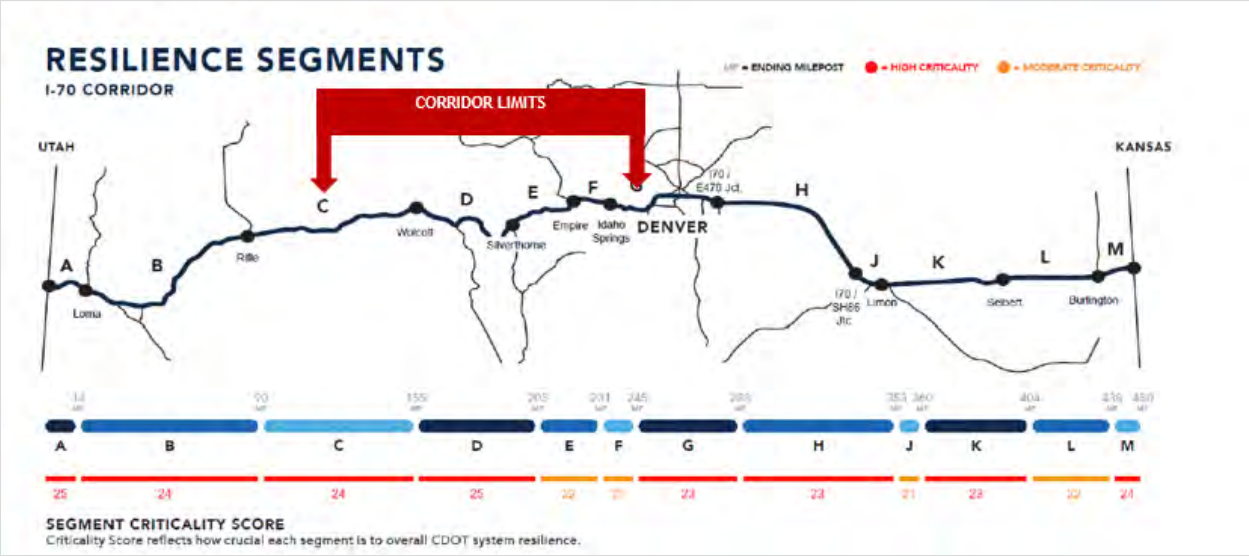
- I-70 Corridor Risk and Resilience Pilot (CDOT, 2017).
- Polis Administration's: Roadmap to 100% Renewable Energy by 2040 and Bold Climate Action (Colorado Energy Office, 2019).
- The United Nation Intergovernmental Panel on Climate Change (IPCC), updated 2013 (IPCC, 2020).
- Transportation System Resilience, Extreme Weather and Climate Change (USDOT, 2015).
- National Climate Assessment (NCA, 2014).
- Paris Agreement (United Nations Climate Change, 2016).

Summary of Findings

Colorado has seen an increase in severe weather events since the 2011 PEIS was completed. In 2013 Colorado experienced a historic flooding event across the state that had a significant impact on the transportation infrastructure, in some cases taking years to repair and replace. Based on an uptick in severe weather events and an increased awareness and scientific research surrounding climate change, a specific emphasis on building "climate resilient transportation infrastructure" has become a top priority for local decision-makers to ensure that the risk and resiliency of the statewide transportation system are in a place that can help withstand national, economic or other disasters. Figure 10 shows the segment criticality score for the entire I-70 Mountain Corridor. The study area for the I-70 Mountain Corridor Reassessment is primarily considered high criticality. CDOT is taking a proactive approach by acknowledging that there are real threats to the complex infrastructure system, identifying where the system might be vulnerable to a natural or human made event. The current administration has not provided direction to the Federal Highway Administration to formally consider climate change implications in administering NEPA.

[22] (2007) Colorado Climate Action Plan: A Strategy to Address Global Warming
[23] Colorado Energy Office: GHG Pollution Reduction Roadmap

Figure 10. Segment Criticality Score for the Entire I-70 Mountain Corridor



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I-70 MOUNTAIN CORRIDOR REASSESSMENT
NARRATIVE
Step 1B Evaluate Current Components of Purpose and Need

July 6, 2020

WORK PLAN STEP 1B EVALUATE CURRENT COMPONENTS OF PURPOSE AND NEED

From the Collaborative Effort Record of Decision 2020 Reassessment Work Plan, Step 1 is to reassess the Purpose and Need. Step 1B is described as follows:

Step 1B: Evaluate current components of Purpose and Need. Determine if the components are still valid using Step 1A context evaluation. The same data sets (listed under each component) must be used as were used in the 2011 Programmatic Environmental Impact Statement (PEIS) to provide a true comparison.

Component 1: Increase capacity. Information that may be needed to evaluate this component includes:

1. Existing traffic data
2. Person trips
3. Updated traffic projections/Travel Demand Model information
4. Transit ridership
5. Others

Component 2: Improve mobility and accessibility. Information that may be needed to evaluate this component includes:

1. Travel time/reliability
2. Safety data
3. Incident response times
4. Travel Demand Model information
5. Others

Component 3: Decrease congestion. Information that may be needed to evaluate this component includes:

1. Level of Service
2. Crash data, Weighted Hazard Index (WHI) information
3. Travel time/reliability
4. Travel Demand Model information
5. Others

COMPONENT 1—INCREASE CAPACITY

Existing Traffic Data

METHODOLOGY

Traffic count data were assembled from the CDOT Online Transportation Information System (OTIS). Average traffic counts for 2010, 2015, and 2019 followed the same methodology of the 2011 PEIS as outlined below. In the 2011 PEIS, the year 2000 Automatic Traffic Recorder (ATR) counts were used to determine the model day hourly and total vehicle trips. The following calendar days were assumed to be representative of the model days:

- **Winter Saturday**: Average of the first two Saturdays in February
- **Summer Thursday:** Average of the first two Thursdays in August
- **Summer Friday:** Average of the first two Fridays in August
- **Summer Saturday:** Average of the first two Saturdays in August
- **Summer Sunday:** Average of the first two Sundays in August

Seven representative locations on the corridor were tabulated, similar to the PEIS (Table 1 through Table 3 and Figure 1 through Figure 3). Because of data collection limitations, such as ATRs that were malfunctioning, some assumptions were necessary as described below:

- 2010
  - Data are unavailable at the Eisenhower-Johnson Memorial Tunnels (EJMT) for the second Saturday in February. Therefore, the average of the first and third Saturdays is used.
  - Data are unavailable at EJMT for the full first weekend in August. Therefore, the average of the second and third weekends is used.
- 2015
  - Data are unavailable for the first two Saturdays of the month for Wolcott. Therefore, averages included for the Winter Saturday for Wolcott are for the last two Saturdays of the month.
  - Data are unavailable at the No Name Tunnels for July and August. Therefore, the averages included for the Summer Sunday at the No Name Tunnels are for the middle weeks of June.
- 2019
  - 2019 traffic counts were unavailable at Station ID 000126-Dowd Junction for sampling dates in 2019. The counts for Station ID 000126-Dowd Junction represent interpolated averages from previous years and adjusted to year-to-year growth at other sampled stations.

For truck counts, more detailed traffic information was obtained from CDOT's Transportation Data Management System. The selected location for this detailed information was at the Veterans Memorial Tunnels, because of the high proportion of recreational demand at this point of the corridor. Comparisons were made for the number of trucks on peak days (defined as

Sundays) and off-peak days (an average of Wednesdays and Thursdays) during two target months—February and August—during the year 2018.

SUMMARY OF FINDINGS

Table 1. 2010 Traffic Volumes on the I-70 Mountain Corridor

Station ID	Name	Winter Saturday ADT	Summer Thursday ADT	Summer Friday ADT	Summer Saturday ADT	Summer Sunday ADT
000107	East of Genesee	70,789	69,244	85,994	86,083	79,113
000120	Veterans Memorial Tunnels	57,050	48,360	64,174	67,235	66,242
000106	EJMT	36,576	32,419	42,660	41,841	44,098
000119	Copper Mountain	17,981	23,687	28,602	26,439	28,591
000126	Dowd Junction	29,699	40,775	44,020	37,009	37,346
000011	Wolcott	17,915	29,605	32,098	26,139	27,564
000105	No Name Tunnels	13,438	21,144	24,063	21,184	23,581

Source: CDOT Online Transportation Information System (OTIS)

ADT = average daily traffic; EJMT = Eisenhower-Johnson Memorial Tunnels

Table 2. 2015 Traffic Volumes on the I-70 Mountain Corridor

Station ID	Location	Winter Saturday ADT	Summer Thursday ADT	Summer Friday ADT	Summer Saturday ADT	Summer Sunday ADT
000107	East of Genesee	78,213	76,367	88,594	90,279	89,781
000120	Veterans Memorial Tunnels	57,757	52,604	67,324	70,109	71,067
000106	EJMT	40,586	36,950	47,655	46,713	47,395
000119	Copper Mountain	22,505	25,521	31,455	28,670	30,184
000126	Dowd Junction	42,664	44,624	49,193	41,684	41,938
000011	Wolcott	17,041	33,188	31,076	24,883	30,667
000105	No Name Tunnels	14,523	16,659	24,543	21,343	24,394

Source: CDOT Online Transportation Information System (OTIS)

ADT = average daily traffic; EJMT = Eisenhower-Johnson Memorial Tunnels

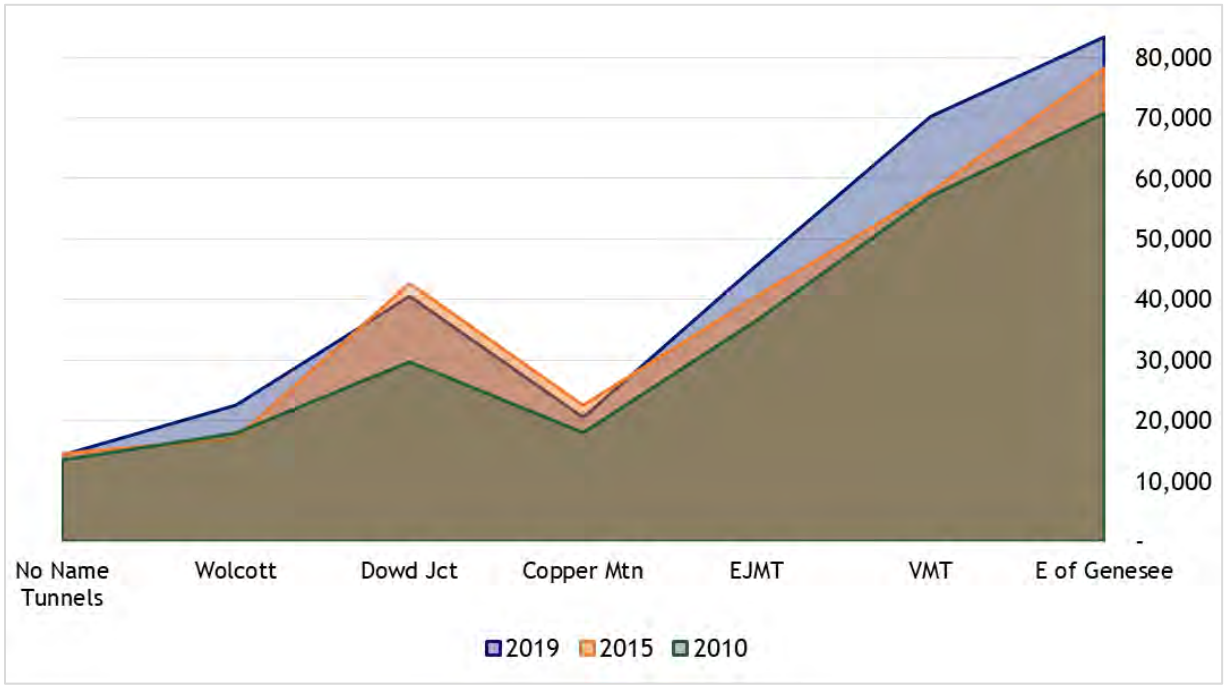
Table 3. 2019 Traffic Volumes on the I-70 Mountain Corridor

Station ID	Location	Winter Saturday ADT	Summer Thursday ADT	Summer Friday ADT	Summer Saturday ADT	Summer Sunday ADT
000107	East of Genesee	83,393	76,965	89,982	90,937	85,856
000120	Veterans Memorial Tunnels	70,236	58,860	75,442	79,730	81,147
000106	EJMT	45,702	41,276	52,157	51,342	50,928
000119	Copper Mountain	20,489	27,457	33,041	30,767	33,174
000126	Dowd Junction	40,529	49,086	54,112	45,852	46,131
000011	Wolcott	22,529	36,606	39,583	32,588	34,140
000105	No Name Tunnels	14,272	24,397	27,467	25,097	27,334

Source: CDOT Online Transportation Information System (OTIS)

ADT = average daily traffic; EJMT = Eisenhower-Johnson Memorial Tunnels

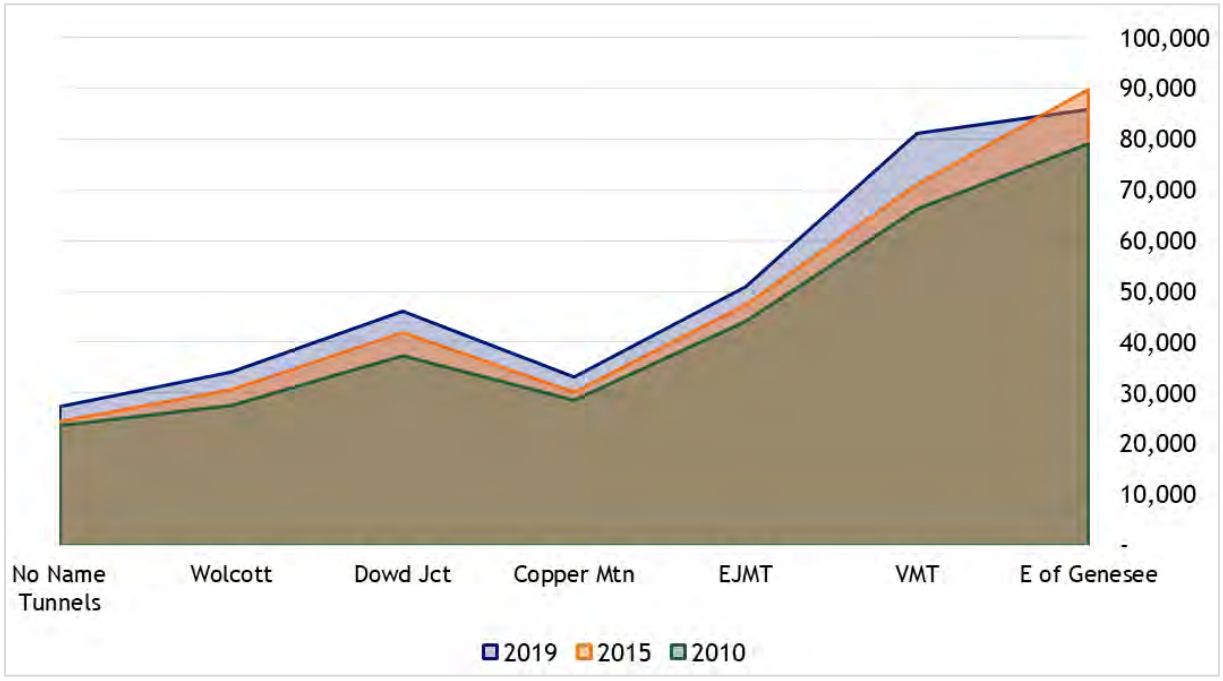
Figure 1. Traffic Data—Trends 2010, 2015, 2019
Winter Saturday Average Daily Traffic



Source: CDOT Online Transportation Information System (OTIS).

Jct = Junction; Mtn = mountain; EJMT = Eisenhower-Johnson Memorial Tunnels; VMT = Veterans Memorial Tunnels; E = east

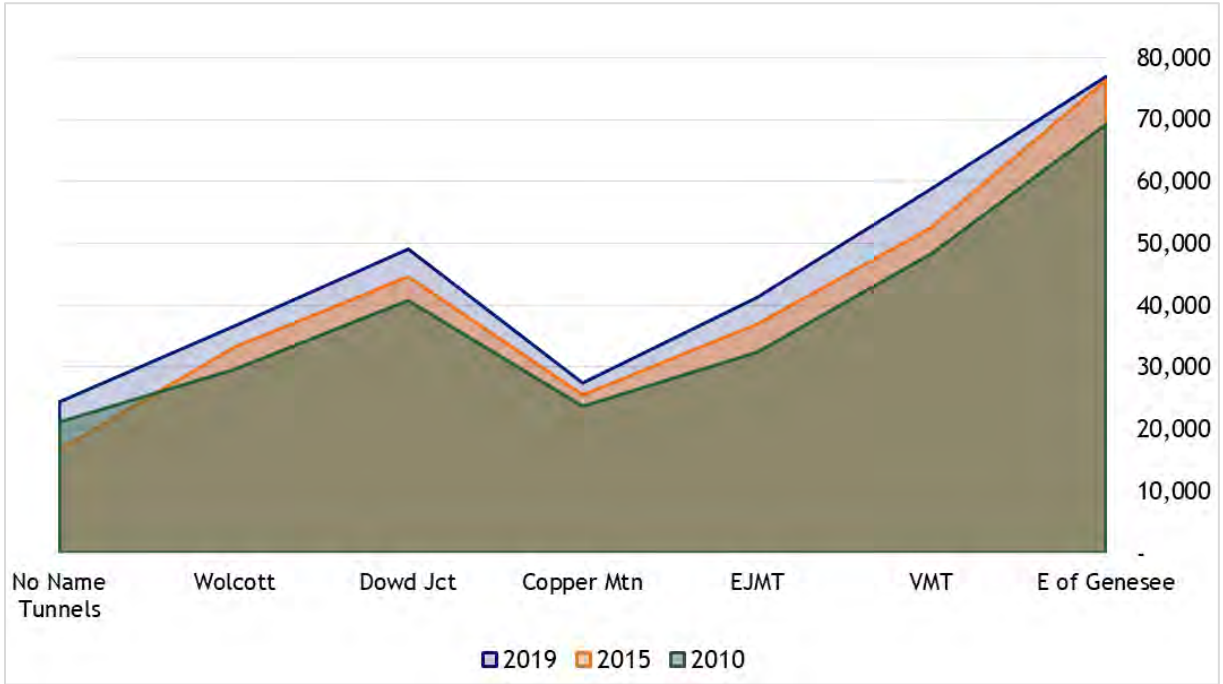
Figure 2. Traffic Data—Trends 2010, 2015, 2019 Summer Sunday Average Daily Traffic



Source: CDOT Online Transportation Information System (OTIS).

Jct = Junction; Mtn = mountain; EJMT = Eisenhower-Johnson Memorial Tunnels; VMT = Veterans Memorial Tunnels; E = east

Figure 3. Traffic Data—Trends 2010, 2015, 2019 Summer Thursday Average Daily Traffic



Source: CDOT Online Transportation Information System (OTIS).

Jct = Junction; Mtn = mountain; EJMT = Eisenhower-Johnson Memorial Tunnels; VMT = Veterans Memorial Tunnels; E = east

Table 4. Peak Day vs Off Peak Day Truck Traffic August

Veterans Memorial Tunnels—August				
Off Peak Day PM Period		**% of PM Peak**	**Off Peak Day Totals**	**% of Off Peak Day Total**
Automobiles	13,990	96.3%	51,024	94.26%
Truck	527	3.63%	3,058	5.65%
Bus	11	0.08%	51	0.09%
Subtotal	538	3.70%	3,109	5.74%
Total Vehicles	**14,528**	**100%**	**54,133**	**100%**
Peak Day PM Period		**% of PM Peak**	**Peak Day Total**	**% of Peak Day Total**
Automobiles	22,161	98.02%	76,229	97.49%
Truck	436	1.93%	1,907	2.44%
Bus	11	0.05%	55	0.07%
Subtotal	447	1.98%	1,962	2.51%
Total Vehicles	**22,608**	**100%**	**78,191**	**100%**

Source: CDOT Transportation Data Management System.

PM = post meridiem (evening)

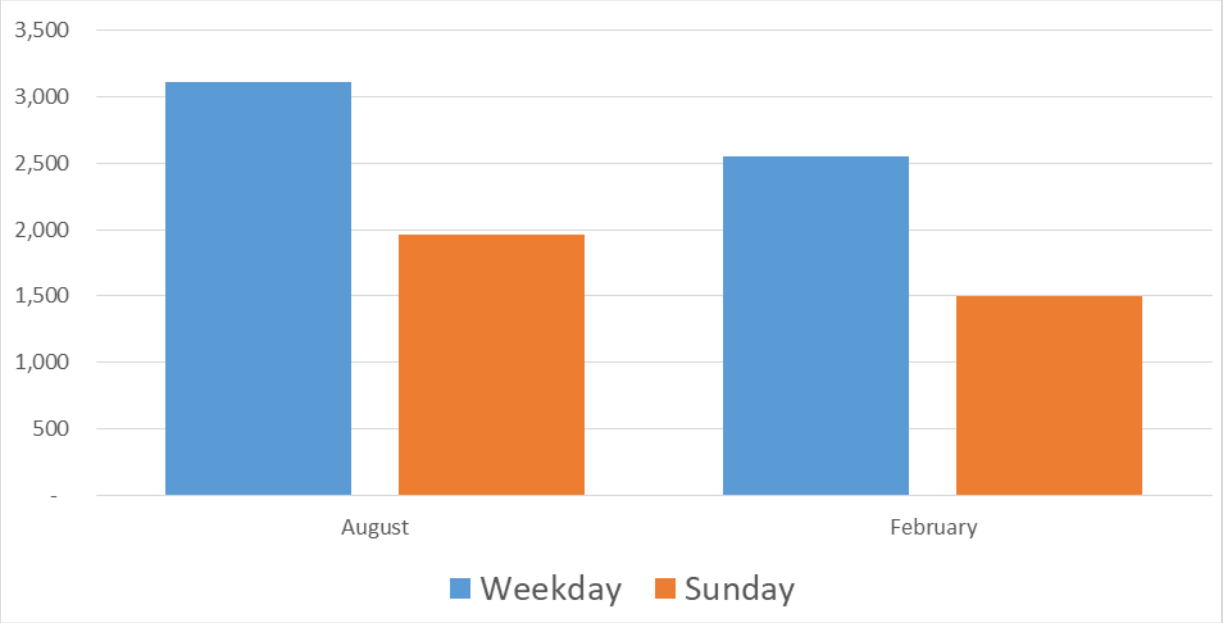
Table 5. Peak Day vs Off Peak Day Truck Traffic August

Veterans Memorial Tunnels—February				
Off Peak Day PM Period		**% of PM Peak**	**Off Peak Day Totals**	**% of Off Peak Day Total**
Automobiles	10,331	95.36%	35,736	93.34%
Truck	485	4.48%	2,486	6.49%
Bus	18	0.17%	63	0.16%
Subtotal	503	4.64%	2,548	6.66%
Total Vehicles	**10,834**	**100%**	**38,284**	**100%**
Peak Day PM Period		**% of PM Peak**	**Peak Day Total**	**% of Peak Day Total**
Automobiles	16,757	98.02%	62,774	97.67%
Truck	325	1.90%	1,422	2.21%
Bus	13	0.08%	74	0.12%
Subtotal	338	1.98%	1,496	2.33%
Total Vehicles	**17,095**	**100%**	**64,270**	**100%**

Source: CDOT Transportation Data Management System.

PM = post meridiem (evening)

Figure 4. Number of Daily Trucks by Type of Day at VMT



Source: CDOT Transportation Data Management System.

OBSERVATIONS

As Table 1 through Table 3 and Figure 1 through Figure 3 show, the corridor has experienced a steady growth in traffic over the last decade. Some anomalies exist, such as east of Genesee on a summer Sunday. These are most likely because of data collection irregularities of the ATRs, which are not uncommon for this equipment.

The number of trucks at the Veterans Memorial Tunnels during 2018 is higher on off-peak days compared to peak travel days, as presented in Table 4, Table 5 and Figure 4. This corroborates the anecdotal information that truckers make an effort to avoid I-70 during the heavy traffic that occurs on Sundays and other peak days.

Person trips

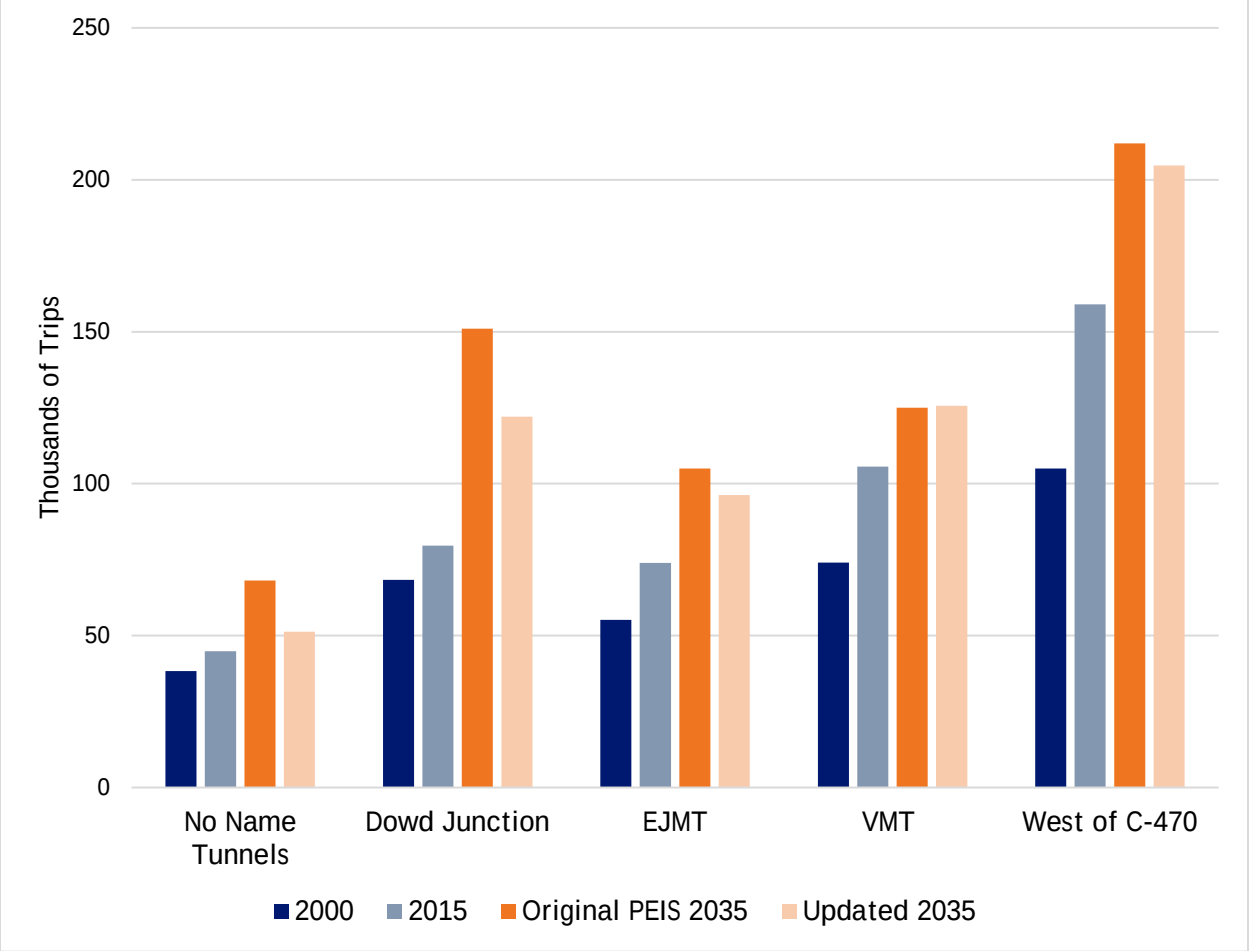
METHODOLOGY

Estimates of person trips were estimated by the 2011 PEIS travel demand model. The person trips are two-way totals. This model was updated with new socio-economic forecasts for 2035 from the Colorado State Demography office. More information on the model is available in the 2020 *Update of the I-70 Mountain Corridor Travel Demand Model*[1] .

[1] Draft technical report in progress (not yet available).

SUMMARY OF FINDINGS

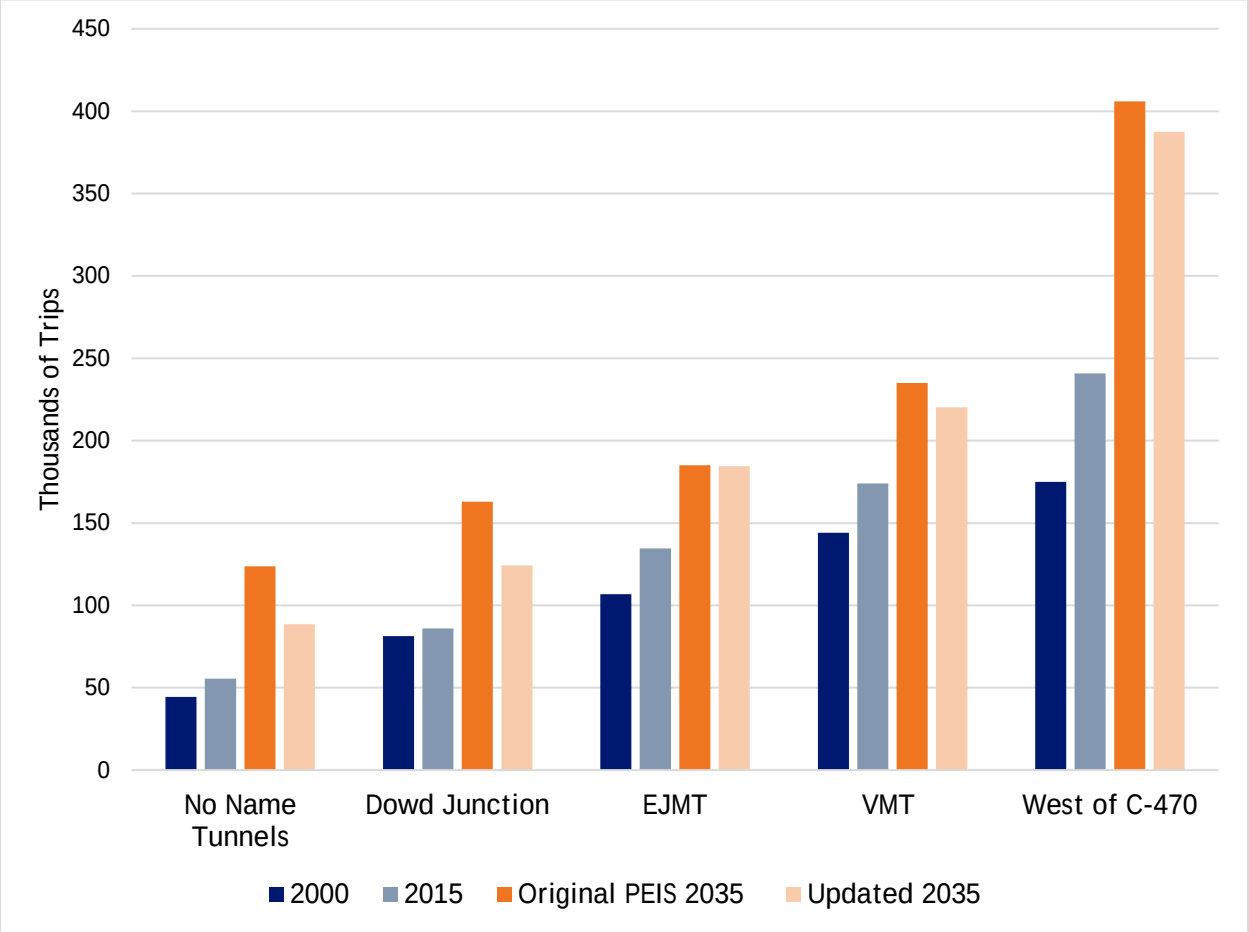
Figure 5. Daily Person Weekday Trip Demand



Sources: I-70 Mountain Corridor PEIS 2035 Transportation Analysis Technical Report (Reissued March 2011); Updated I-70 Mountain Corridor Travel Demand Model (2020).

EJMT = Eisenhower-Johnson Memorial Tunnels; VMT = Veterans Memorial Tunnels

Figure 6. Daily Person Weekend Trip Demand



Sources: I-70 Mountain Corridor PEIS 2035 Transportation Analysis Technical Report Reissued March 2011; Updated I-70 Mountain Corridor Travel Demand Model 2020.

EJMT = Eisenhower-Johnson Memorial Tunnels; VMT = Veterans Memorial Tunnels

OBSERVATIONS

As Figure 5 and Figure 6 show, person trips at the representative locations along the corridor have increased from 2000 through 2015, and are projected to further increase by 2035. The updated 2035 projections are slightly less than the 2035 projections of the 2011 PEIS because of the lower population and employment projections for 2035 from the Colorado State Demography Office. This change is more pronounced on the western portion of the corridor compared to the eastern section, because the 2035 socioeconomic forecasts in the Denver metropolitan area are about the same. Weekend trips are higher than weekday trips on the eastern portion of the corridor because of recreational trips to and from the Denver metropolitan area.

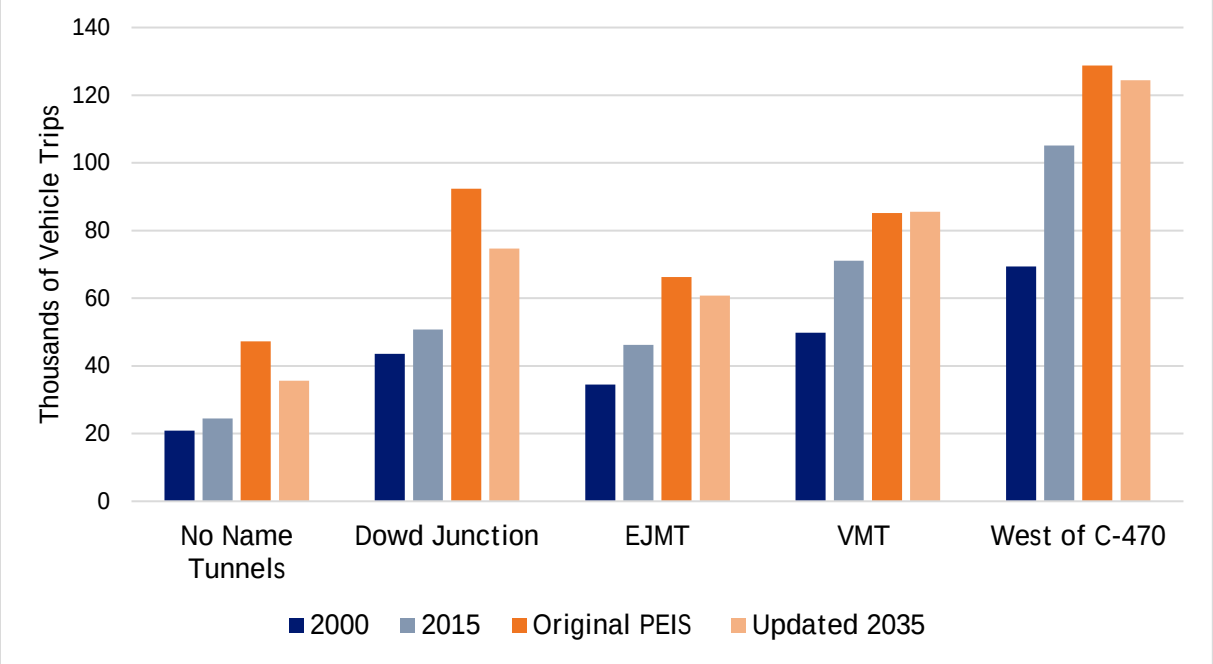
Traffic Projections

METHODOLOGY

Estimates of vehicle trips (two-way totals) were estimated by the 2011 PEIS travel demand model. This model was updated with new socio-economic forecasts for 2035 from the Colorado State Demography office. More information on the model is available in the 2020 *Update of the I-70 Mountain Corridor Travel Demand Model*[2].

SUMMARY OF FINDINGS

Figure 7. Daily Weekday Vehicle Trips

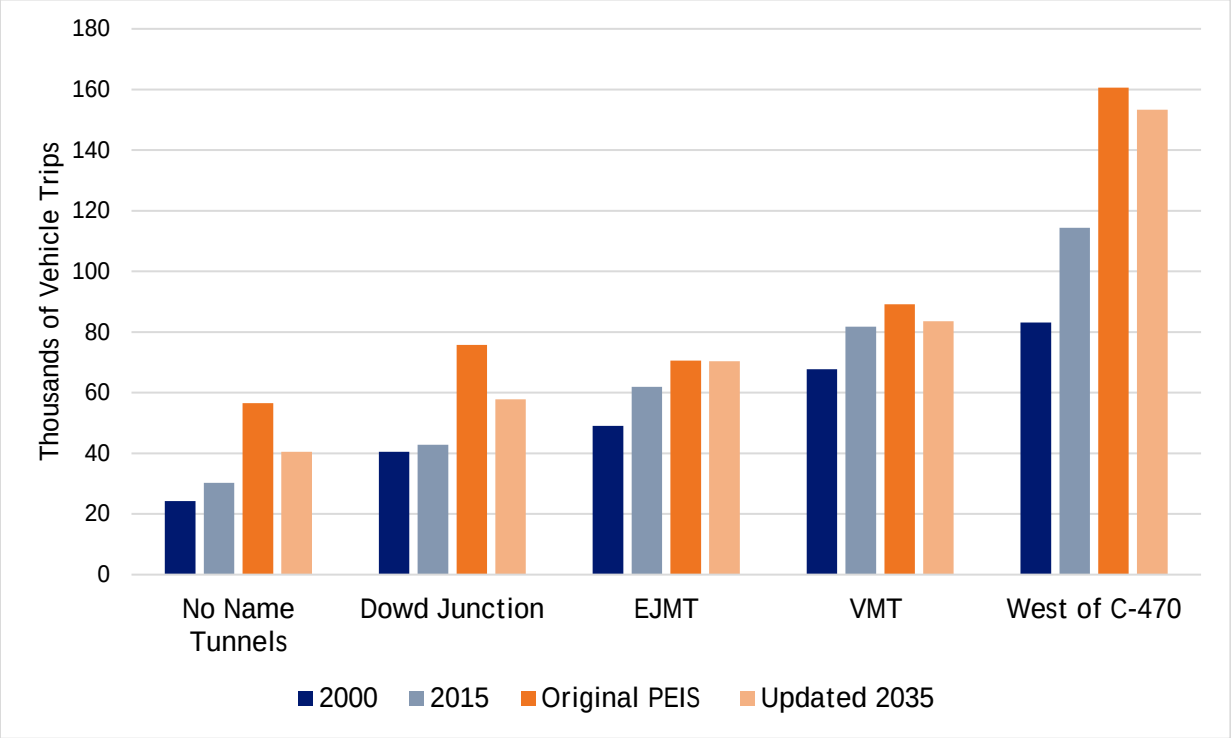


Sources: I-70 Mountain Corridor PEIS 2035 Transportation Analysis Technical Report Reissued March 2011; Updated I-70 Mountain Corridor Travel Demand Model 2020.

EJMT = Eisenhower-Johnson Memorial Tunnels; VMT = Veterans Memorial Tunnels

[2] Draft technical report in progress (not yet available).

Figure 8. Daily Weekend Vehicle Trips



Sources: I-70 Mountain Corridor PEIS 2035 Transportation Analysis Technical Report Reissued March 2011; Updated I-70 Mountain Corridor Travel Demand Model 2020.

EJMT = Eisenhower-Johnson Memorial Tunnels; VMT = Veterans Memorial Tunnels

OBSERVATIONS

As Figure 7 and Figure 8 show, vehicle trips at the representative locations along the corridor have increased from 2000 through 2015, and are projected to further increase by 2035. The updated 2035 projections are slightly less than the 2035 projections of the 2011 PEIS because of the lower population and employment projections for 2035 from the Colorado State Demography Office. This change is more pronounced on the western side of the corridor compared to the eastern section, because the 2035 socioeconomic forecasts in the Denver metropolitan area are about the same. Weekend vehicle trips are higher than weekday trips on the eastern portion of the corridor because of recreational trips to and from the Denver metropolitan area.

Transit Ridership

METHODOLOGY

Data were collected from a variety of sources regarding transit in the I-70 Mountain Corridor. The sources included CDOT Division of Transit and Rail, review of final study reports, the National Transit Database, and Internet research on services provided by a variety of agencies and operators. A summary of findings and references for this research are documented below.

SUMMARY OF FINDINGS

Transit studies and services have advanced in many ways in the I-70 Mountain Corridor since the 2011 PEIS was published.

Technology for high-speed transit has also evolved since 2011; the summary of findings on this topic are found in *Step 1A Evaluation of Context Narrative*.

Bustang

CDOT launched a new transit route, Bustang, serving the I-70 corridor with daily bus routes between Grand Junction and Denver, with additional daily routes between Denver and both Glenwood Springs and Vail. However, it does not serve peak direction recreational trips at peak demand. Ridership has grown dramatically since the Bustang service was launched in 2015. In 2019, ridership was over 70,000 passengers compared to just over 26,000 in 2016, representing a 170 percent increase (V. Henderson, personal communication, January 24, 2020).

Snowstang

CDOT piloted a bus route called Snowstang in 2017 to six ski resorts on two weekends that year (Colorado Ski Country USA, 2017). Based on the success of the pilot and other Bustang routes, Snowstang launched in 2019 with service to three resorts (Loveland, Arapahoe Basin, and Steamboat) (CDOT, 2019). Early reports indicate the ridership is exceeding expectations; however, the 2019-2020 ski season terminated early because of coronavirus (Go I-70, 2020).

Amtrak Winter Park Express Ski Train

Another new service in the corridor is the Amtrak Winter Park Express Ski Train. The original ski train operated from 1940 to 2009. The Winter Park Express returned in 2017 with regular weekend service from Denver Union Station to Winter Park Ski Resort (CPR News, 2016). In 2020, Friday service was added (Winter Park Resort, 2020). Ridership has been growing steadily since it came back into operation. In April 2019, Amtrak reported an increase in ridership of about 7 percent from the 2018 season and 8 percent from the inaugural season in 2017 (Colorado Ski Country USA, 2019).

Ski Shuttles

Ski shuttles provide private transit service from the Denver Front Range (often Denver International Airport [DEN]). Three ski shuttle companies that currently operate were operating in 2011, including Epic Mountain Express, Home James, and Intermountain Express (CDOT, 2011). Epic Mountain Express (formerly known as Colorado Mountain Express) facilitates several transportation options, including ride sharing from airports and to the ski resorts in the Epic group and surrounding communities (Epic Mountain Express, 2020). The Home James shuttle service serves DEN to Winter Park.[3] Intermountain Express had service from Eagle Airport to Vail in 2011, and has since expanded to DEN Airport, Summit County resorts, and Vail Valley Resorts (Intermountain Express, 2020). Several new ski shuttles have begun

[3] https://www.ridehj.com/

service, including Fresh Tracks Transportation[4], Peak 1 Express Shuttle[5], and Summit Express.[6] Table 6 provides additional information on several of the ski shuttles.

Table 6. Ski Shuttles

Ski Shuttle Name	Service Areas	Cost
Summit Express[7]	DEN Airport to Breckenridge, Keystone, Copper, Frisco, Dillon and Silverthorne	Approximately $59 per person
Peak 1[8]	DEN Airport to Summit County (Breckenridge, Keystone, Copper, Frisco, Silverthorne, Dillon) and Vail/Beaver Creek (Vail, Beaver Creek, Avon, Edwards).	The cost for the Summit County shuttle is approximately $44 and Vail is $54 (Mountain Shuttle, 2020).
Fresh Tracks[9]	DEN Airport to several towns in Summit County including Breckenridge, Keystone, Copper, Frisco, Dillon and Silverthorne. They also offer a resort to resort ski shuttle for resorts including Vail, Keystone, Beaver Creek, Copper Mountain, Breckenridge, and Arapahoe Basin.	Approximately $52 - $75 per person
Epic Mountain Express[10]	DEN Airport to Vail/Beaver Creek, DEN Airport to Summit County (Breckenridge, Keystone, Frisco, Copper), DEN Airport to Eagle, Glenwood, Aspen, Eagle-Vail Airport, Vail/Beaver Creek.	The cost is approximately $39 per person, each way.
Home James[11]	DEN Airport to Winter Park	The cost is $63-$78 for adults and $39 for children.
Intermountain Express[12]	Rates provided for service to Eagle Airport and DEN Airport to Vail/Beaver Creek, Breckenridge, Aspen/Snowmass, Steamboat Springs. Additional service may be available.	Rates provided per vehicle, rates $100 - $800. Ridesharing does not appear to be available.

Casino Buses

A variety of buses and shuttles provide transit service to and within Black Hawk and Central City. These include Ace Express Coaches[13], Casino Shuttle by Ramblin Express[14], and Black Hawk & Central City Tramway.[15]

Transit Agencies

Colorado outpaces every other state in terms of rural transit ridership, and many of the transit agencies are located along the I-70 Mountain Corridor. These include Roaring Fork

[4] https://www.freshtrackstransportation.com/
[5] https://www.mountainshuttle.com/
[6] https://www.summitexpress.com/
[7] https://www.summitexpress.com/
[8] https://www.mountainshuttle.com/
[9] https://www.freshtrackstransportation.com/
[10] https://www.epicmountainexpress.com/
[11] https://www.ridehj.com/rates
[12] https://imedenver.com/our-rates/
[13] https://www.aceexpresscoaches.com/
[14] https://ramblinexpress.com/casino-shuttles/
[15] http://site.cityofblackhawk.org/visit-black-hawk/shuttle-service/

Transportation Authority (RFTA), Eagle County Transportation Authority (ECO), Vail Transit, Summit Stage, and Avon Transit. Clear Creek County also operates a route.

RFTA has seen an increase in ridership of 8 percent between 2014 and 2018 and in 2018 reported 4.9 million rides (FTA, 2020). ECO has seen an increase in ridership of 19 percent between 2014 and 2018 and in 2018 reported 1 million rides (FTA, 2020). Vail has been expanding its transit routes and residents and guests have responded favorably. Residents have requested that the City expand the summer bus service. In 2017, Vail saw a 37 percent increase in ridership on routes that had expanded service (Town of Vail, 2017). With current ridership reaching nearly 2 million, Summit Stage has seen a significant increase in rides since it reported 432,000 passenger trips in 1992 (Summit County, 2020). However, in the period between 2014 and 2018, ridership declined by 9 percent (FTA, 2020). In 2018, Summit Stage reported 1.7 million passenger trips. Avon Transit reported 424,696 trips to the National Transit Database for 2018 (FTA, 2020). Avon Transit ridership is lower than recorded in 2008. At that time, the “Town Routes” (including the Blue Line, Red Line, and evening Black Line) and the Gondola Express Route carried a total of 520,000 (Town of Avon, 2017).

Mobility Hubs

Stations along the corridor for existing and future transit have long been identified; for example, in the *I-70 Coalition Land Use Planning Study For Rail Transit Alignment Throughout the I-70 Corridor* (I-70 Coalition, 2009). CDOT is in early planning stages to identify designated mobility hubs across the state. Those along the I-70 Mountain Corridor include Idaho Springs, Frisco, Vail, Eagle, and Glenwood Springs. Providing parking at transit stations is no longer sufficient; there is a need for people to connect to transit through other modes. The services at mobility hubs are also planned to include charging stations for electric vehicles. The goal of mobility hubs in Colorado is to increase transit ridership, multimodal options, safety, trip reliability, economic vitality, and air quality while decreasing vehicle miles traveled, congestion, travel time, and greenhouse gas emissions.

Rail Studies

The Advanced Guideway System (AGS) feasibility study was conducted by CDOT in 2014 with the goal of determining the technical and financial feasibility of a fixed guideway on I-70 from Jefferson County to Eagle County Airport (CDOT, 2014). It concluded that the fixed guideway is technically feasible, but was not financially feasible as of 2014 when the report was completed. The AGS study states that state/local financial commitment, private-sector involvement, and federal government funding/financing would be required. Cost was projected to be $13.3 billion to $32.4 billion (2013 dollars), depending on the pairing of alignment and technology. Ridership was predicted to be 4.6 million to 6.2 million annual riders, assuming a Hybrid Alignment with High Speed Maglev from Eagle County Regional Airport to I-70/C-470 with the Interregional Connectivity Study System in place through Denver including DIA and along I-25 from Pueblo to Fort Collins.

In 2014, CDOT and the Regional Transportation District (RTD) conducted the Interregional Connectivity Study (CDOT, 2014). It concluded that a high-speed transit system is feasible for Colorado, for the Front Range between Pueblo, DEN, and Fort Collins, plus the I-70 Mountain

Corridor AGS. The segments that serve the Front Range perform the best because they connect the highest-density populations and should be phased first.

COMPONENT 2—IMPROVE MOBILITY AND ACCESSIBILITY

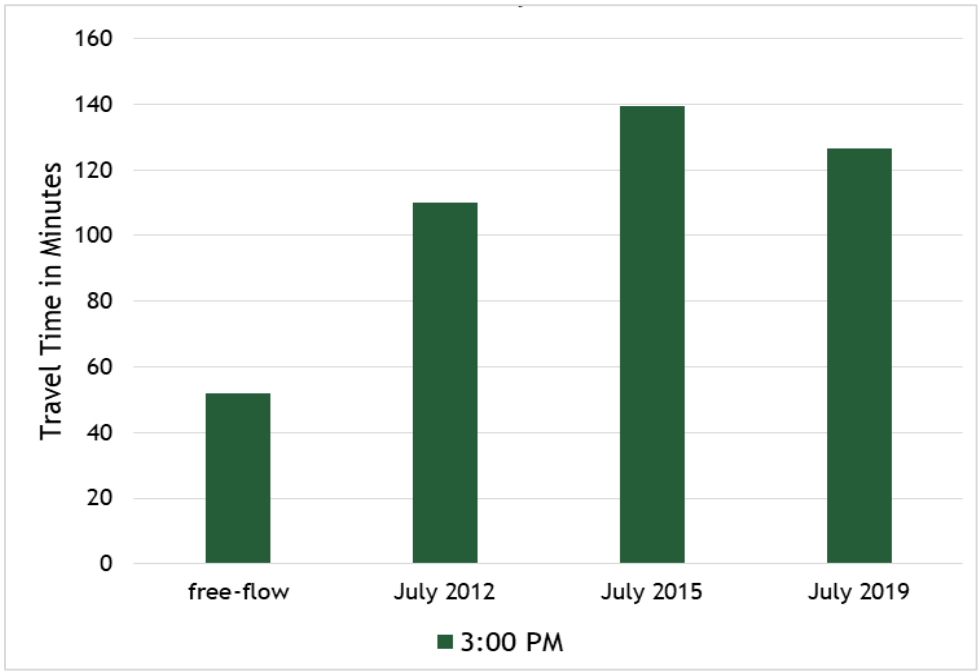
Travel Time/Reliability

METHODOLOGY

Historic and existing travel time information was obtained from INRIX, a traffic speed and travel time collection service. The analyses presented in Figure 9 and Figure 10 average travel times for 2012, 2015, and 2019, as well as free flow time. For the eastern section of the corridor (Silverthorne to C-470), average westbound travel times were presented for winter Saturdays at 7:30 AM (morning) while average eastbound travel times were gathered for summer Sundays at 3:00 PM (evening) to capture the peak travel conditions. For the western section of the corridor (Silverthorne to Glenwood Springs), average travel time (as presented in Figure 11 and Figure 12 for summer Fridays for both eastbound [1:00 PM] and westbound [5:00PM] represents peak travel conditions at this location even though this section does not have such dramatic peak direction travel characteristics. Winter was defined as an average of Saturdays or Sundays in February, while summer was defined as an average of Fridays or Sundays in July.

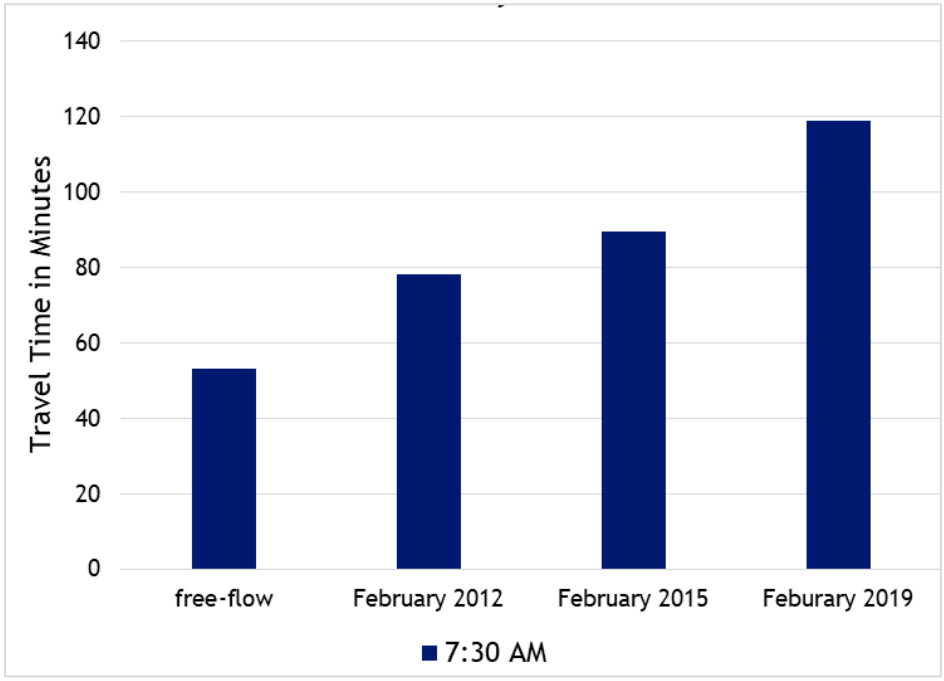
SUMMARY OF FINDINGS

Figure 9. Travel Time Silverthorne to C-470
Summer Sunday Eastbound



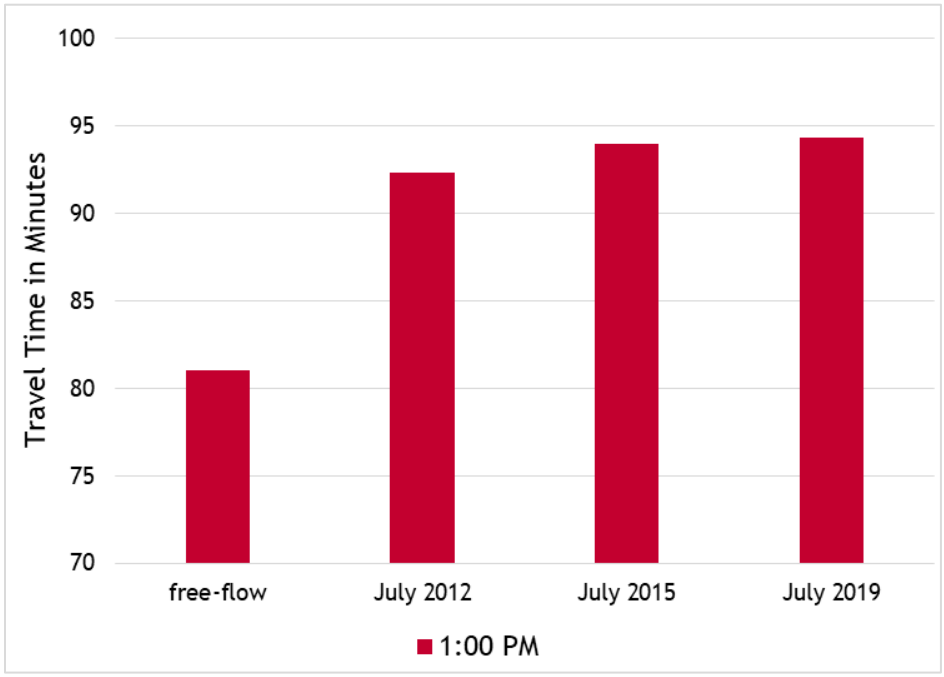
Source: INRIX.

Figure 10. Travel Time Silverthorne to C-470
Winter Saturday Eastbound



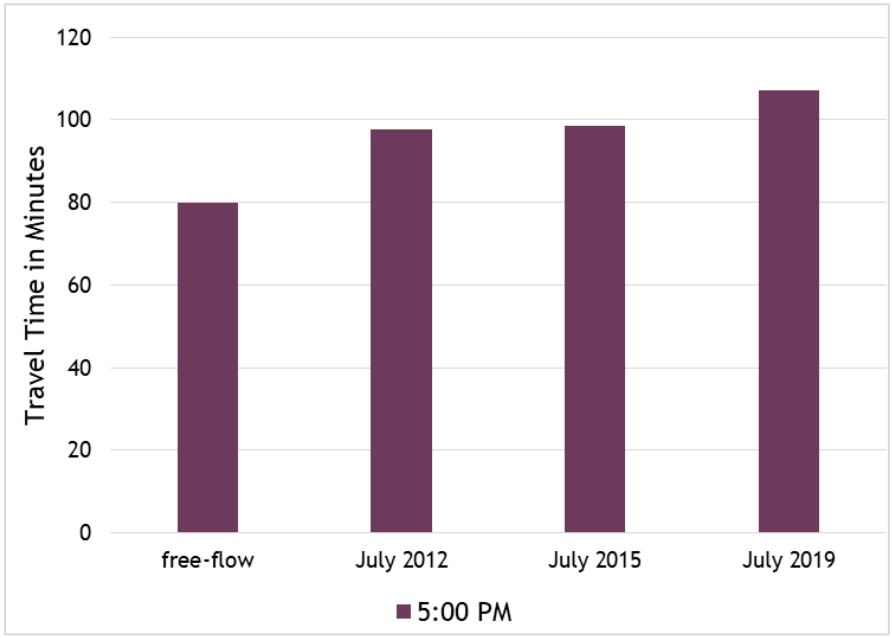
Source: INRIX.

Figure 11. Travel Time Glenwood Springs to Silverthorne
Summer Friday Eastbound



Source: INRIX.

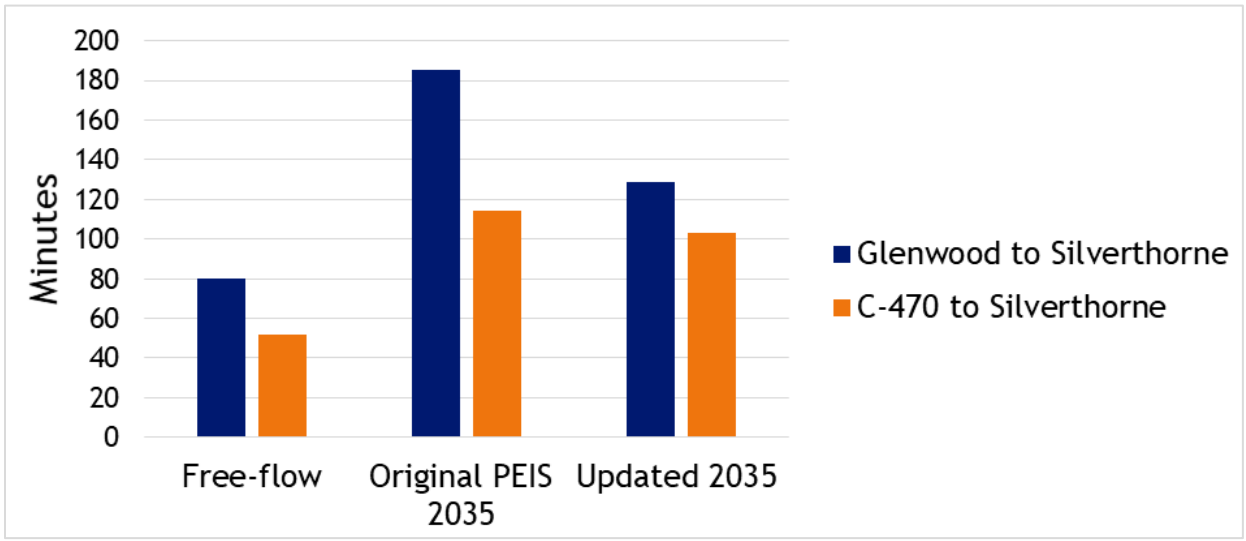
Figure 12. Travel Time Silverthorne Glenwood Springs Summer Friday Westbound



Source: INRIX.

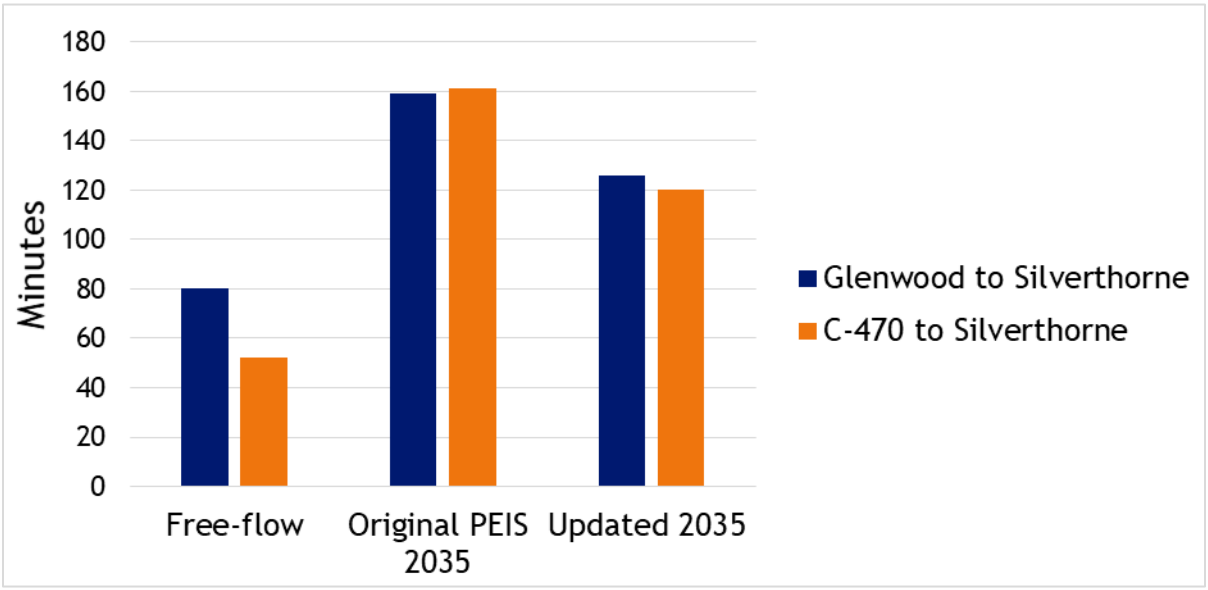
Estimates of future travel time in 2035 were produced by the updated I-70 Mountain Corridor Travel Demand Model. The estimates for travel times were for both typical weekdays (Figure 13) and weekend days (Figure 14) in the peak direction. The travel times are tabulated separately for the western portion of the corridor between Glenwood Springs and Silverthorne and the eastern portion between Silverthorne and C-470.

Figure 13. Weekday Travel Time—Peak Period Direction 2035



Sources: I-70 Mountain Corridor PEIS 2035 Transportation Analysis Technical Report Reissued March 2011; Updated I-70 Mountain Corridor Travel Demand Model 2020.

Figure 14. Weekend Travel Time—Peak Period Direction 2035



Sources: I-70 Mountain Corridor PEIS 2035 Transportation Analysis Technical Report Reissued March 2011; Updated I-70 Mountain Corridor Travel Demand Model 2020.

OBSERVATIONS

During the peak period conditions as presented, travel times for both the eastern and western sections of the corridor are markedly higher than free flow conditions. Travel times have steadily increased on the corridor, between 2012 and 2019. The one exception is eastbound on a Sunday, in the eastern section between Vail and Silverthorne. In this section, the travel times improve in 2019 compared to 2015. This is most likely because of the implementation of the eastbound peak period shoulder lane, from the US 40/Empire Junction interchange to the base of Floyd Hill.

Travel times in 2035 are projected to be significantly higher than free-flow times. The updated travel time estimates for 2035 are slightly less than the prior estimates of the 2011 PEIS because of the lower socioeconomic 2035 forecasts for the mountain corridor counties from the Colorado State Demography office.

Safety

METHODOLOGY

Safety conditions were assessed for the 2011 PEIS. These are documented in the August 2010 (Reissued March 2011) *I-70 Mountain Corridor PEIS Safety Technical Report*. Safety concerns were identified for six segments of I-70, 25 interchanges were identified as needing safety improvements, 4 curves were recognized with safety issues, and locations for 12 auxiliary lanes were identified for safety and other needs.

The focus of the updated analysis for the Reassessment is on the six I-70 segment locations with safety concerns. In the 2011 PEIS, these were identified quantitatively based on the

Weighted Hazard Index (WHI) methodology that identifies safety deficiencies based on crash rates and how those rates compare to statewide average crash rates for similar facility types. Locations where the WHI is higher than 0.0 indicate notable or significant safety deficiencies. Those locations with a WHI greater than 2.0 were identified and mitigation measures suggested that could bring the WHI down to below zero. In the 2011 PEIS, the six locations identified with a WHI greater than 2.0, based on an analysis of 2001 to 2005 crash data, are:

- West of Wolcott Curve
- Westbound, west side of Vail Pass
- Eastbound, EJMT to Herman Gulch
- Westbound, Morrison to Chief Hosa
- Loveland Pass interchange
- Base of Floyd Hill

These locations were reassessed to determine if crash conditions have changed since publication of the 2011 PEIS. Crash data were provided for the project corridor from CDOT for 2011 through 2018 (Table 7.). CDOT has advanced its crash analysis methodology and now uses the Level of Service of Safety (LOSS) methodology to evaluate safety along its highway system. LOSS considers crash frequency and severity and traffic volumes in a graphical comparison with crash rates of other, similar highways. LOSS 1 indicates a low potential for crash reduction and LOSS 4 indicates a high level of potential for crash reduction. A LOSS number was calculated for the six identified high-crash locations listed above, with LOSS 3 or LOSS 4 being comparable to a WHI of 2.0 or higher.

SUMMARY OF FINDINGS

Table 7. Comparison of Crash Trends at I-70 Segment Locations of Concern

Location	(2011 PEIS) 2001-2005 Weighted Hazard Index (WHI)	2011-2018 Level of Service of Safety (LOSS)	Observation
West of Wolcott Curve	WHI 2.01	LOSS II	Curve correction project appears to have alleviated safety issues
WB, west side of Vail Pass	WHI 4.78	LOSS IV	Still a high crash location
EB, EJMT to Herman Gulch	WHI 2.56	LOSS II/ LOSS III	EB auxiliary lane project together with ramp metering appear to have alleviated safety issues
WB, Morrison to Chief Hosa	WHI 3.01	LOSS IV	Still a high crash location
Loveland Pass interchange	WHI 4.53	LOSS IV	Still a high crash location
Base of Floyd Hill	WHI 2.74	LOSS IV	Still a high crash location

Sources: I-70 Mountain Corridor PEIS Safety Technical Report, August 2010 (Reissued March 2011), 2020 *Updated Safety Analysis I-70 Mountain Corridor PEIS*

Further information is available in the accompanying technical report, 2020 *Updated Safety Analysis I-70 Mountain Corridor PEIS*[16].

OBSERVATIONS

At the two locations where safety improvement projects have been implemented, crash patterns appear to have been improved. Safety concerns remain at the other four locations.

Incident Response Times

METHODOLOGY

Data are not available on the number of minutes that emergency responders needed to respond to individual incidents. However, there are several programs that CDOT has initiated that mitigate incident response times; these are listed and described below in the Summary of SUMMARY OF Findings section.

There is limited data on clearance times, which is defined for this analysis as the duration of time that a lane or lanes are closed due to vehicle-related incidents, such as disabled vehicles, stalled cars, crashes, etc. This is logged by CDOT personnel into a database called COGNOS. There are full incident reports from Fiscal Year (FY) 2014-2015, FY 2015-2016, FY 2016-2017, and FY 2017-2018. Other years were not available. The incident reports included data pertaining to events along I-70 between mile markers 133 and 259, which caused full or partial closure. The data logs do not appear to be particularly robust nor necessarily well-defined; but provide some information nonetheless. Clearance time for lane closure events such as roadway maintenance, avalanche control, debris clearance, rock fall, etc. are not included in this analysis.

SUMMARY OF FINDINGS

CDOT has taken several actions that support improved incident response times, among other safety and mobility benefits. These include the following:

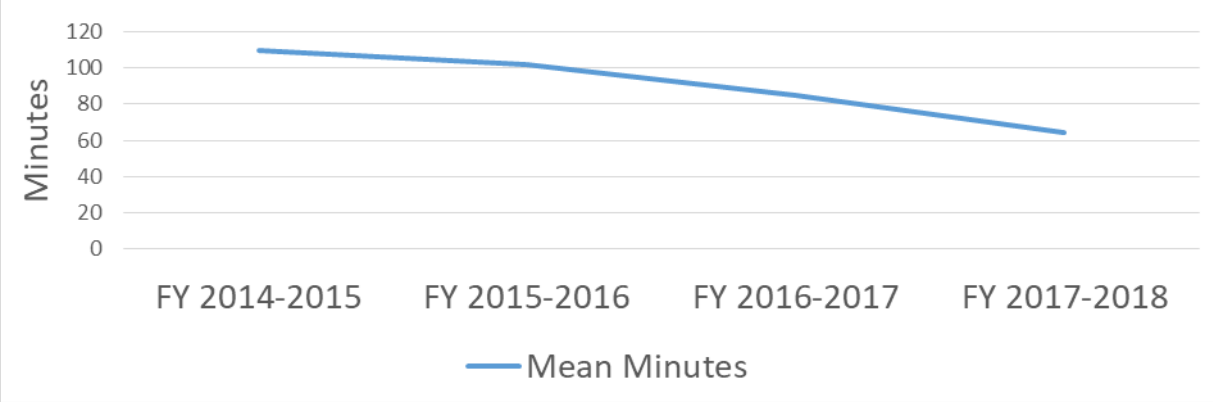
- CDOT has updated Traffic Incident Management Plans for the corridor counties. These plans direct emergency responders regarding procedures, communication protocols, and other guidance for coordination, for a hierarchy of incident types. These include Clear Creek County August 2018, Eagle County July 2019, and Summit County July 2019.
- CDOT created a position of a full-time corridor operations manager for the I-70 Mountain Corridor. The manager oversees all policies, procedures, and activities that impact the safety and mobility of the I-70 Mountain Corridor. The manager evaluates corridor conditions, determines appropriate operational and safety strategies, evaluates projects, and coordinates with a variety of CDOT, law enforcement, and community stakeholders.
- CDOT has prepared an I-70 Mountain Corridor Winter Operations Plan in 2016. The Winter Operations Plan specifies cost-effective strategies, procedures, and projects to maximize corridor safety and mobility during the winter travel season.

[16] Draft technical report in progress (not yet available)

- The eastbound Mountain Express Lane (MEXL) or peak period shoulder lane, improves the ability of emergency response providers to get to incidents during peak period times of severe congestion. The addition of a westbound MEXL (currently under construction) will further improve these conditions between Floyd Hill and Empire Junction.

While different than incident response times, there is information on clearance times. Clearance times as defined for this analysis as the duration of time that a lane or lanes are closed because of vehicle-related incidents, such as disabled vehicles, stalled cars, crashes, etc. As Figure 15 shows, the average amount of time to clear vehicle incidents has a clear downward trend since FY 2014-2015.

Figure 15. I-70 Closure Duration from Vehicle Incidents



Sources: CDOT Incident Reports FY 2014-2015, FY 2015-2016, FY 2016-2017, FY 2017-2018.

COMPONENT 3—DECREASE CONGESTION

Level of Service

METHODOLOGY

Level of service is measured with hours of severe congestion, as it was in the 2011 PEIS.

INRIX data were analyzed for the locations presented in the 2011 PEIS. Four time periods were analyzed, where each of these days in the month was averaged:

- August 2012 Thursdays
- August 2019 Thursdays
- August 2012 Sundays
- August 2019 Sundays

For each time period, speeds were analyzed in the eastbound direction for each weekday (Figure 16) or weekend day (Figure 17) in the month. Where average speeds drop below 75 percent of an approximate average of free-flow in the segment in question during a 15-minute period, these segments are flagged as congested. For example, approaching EJMT from Silverthorne, free flow speeds are approximately 65 miles per hour during the majority of the

day; therefore, speeds below 48.75 miles per hour during a 15-minute period are considered congested. Note that some segments have different free-flow speeds during different times of day because of varying vehicle types throughout the day and topography.

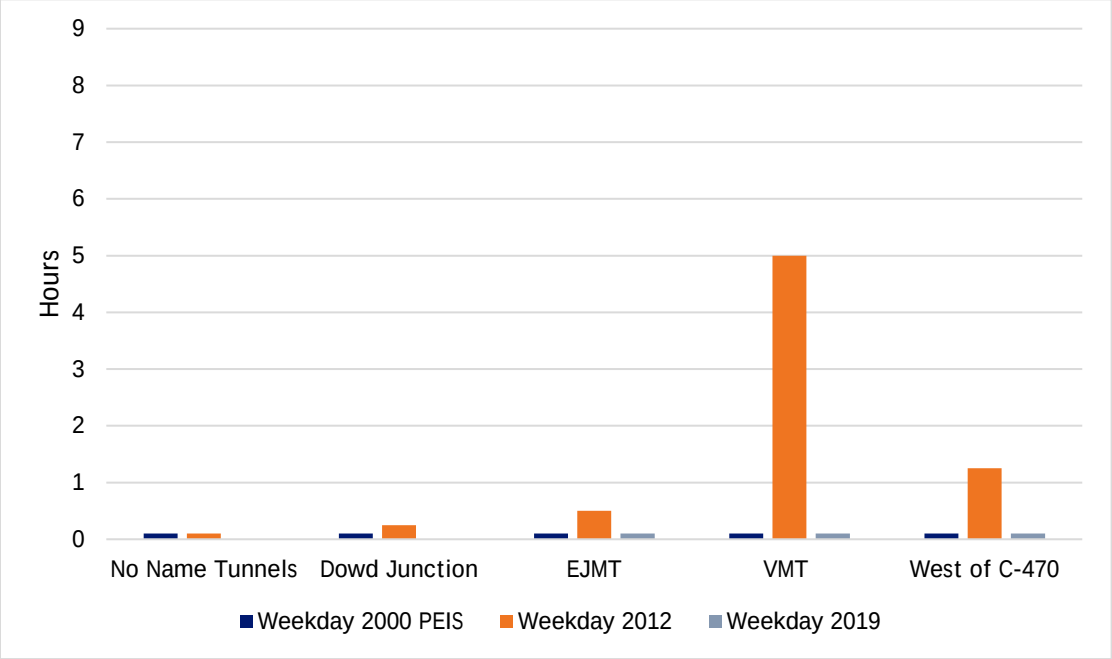
Results were reasonable but two potential exceptions were noted in the data:

- **No Name Tunnels**. The results for 2019 weekdays appear to be skewed for unknown reasons.
- **Dowd Junction.** The results for the 2019 weekdays appear to be skewed. Congestion occurs between 6:00 PM and 10:00 PM which seems unlikely.

These un-intuitive data points were omitted from the summary of findings.

SUMMARY OF FINDINGS

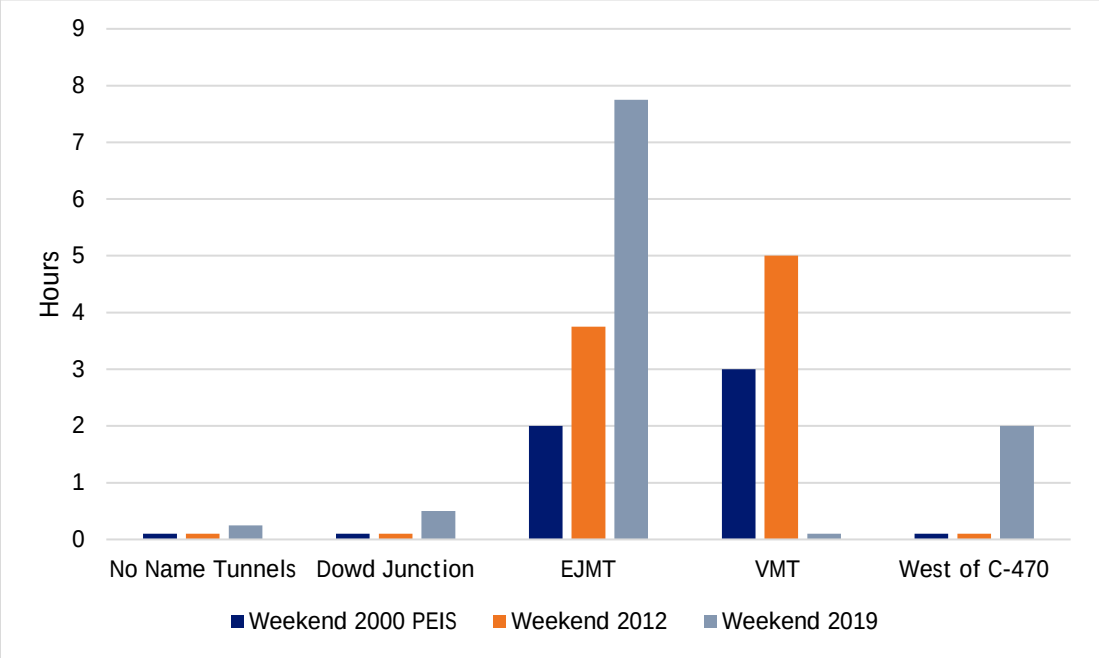
Figure 16. Daily Hours of Congestion: Weekday



Source: INRIX.

EJMT = Eisenhower-Johnson Memorial Tunnels; VMT = Veterans Memorial Tunnels

Figure 17. Daily Hours of Congestion: Weekend



Source: INRIX.

EJMT = Eisenhower-Johnson Memorial Tunnels; VMT = Veterans Memorial Tunnels

OBSERVATIONS

On a typical weekday, the hours of congestion are relatively low at the representative locations in the corridor. An exception is in 2012 where the data indicate the hours of congestion peaked at Veteran Memorial Tunnels, and also on C-470. In 2019, after the tunnels were widened to three lanes (and three lanes were continued eastbound to the base of Floyd Hill), the hours of congestion drop to a nominal amount at these two locations.

On a typical weekend day, the hours of congestion are relatively low at the western representative locations at No Name Tunnels and Dowd Junction. However, at EJMT the hours of severe congestion, already notable in 2000, continue to rise through 2012 and 2019. This is also the case at Veteran Memorial Tunnels. However, in 2019, after the tunnels were widened to three lanes (and three lanes were continued eastbound to the base of Floyd Hill), the hours of congestion drop back to a nominal number.

Crash Data

Safety data is presented in Component 2—Improve Mobility and Accessibility section above.

Travel Time/Reliability

Travel time data is presented in the Component 2—Improve Mobility and Accessibility section above.

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I-70 MOUNTAIN CORRIDOR REASSESSMENT NARRATIVE

Step 2 Effectiveness of Implementation of Preferred Alternative Components

July 6, 2020

WORK PLAN STEP 2 ASSESS EFFECTIVENESS

From the Collaborative Effort Record of Decision (ROD) 2020 Reassessment Work Plan, Step 2 is to assess the effectiveness of the implementation of components of the Preferred Alternative. Step 2A and Step 2B are described as follows:

Step 2A: Determine how to measure/assess effectiveness. This will include an evaluation against the Purpose and Need and may include other factors as recommended by the subcommittee. Data collection will be needed such as:

- Travel time before and after implementation of an improvement
- Incident response times before and after implementation of an improvement
- Transit ridership before and after implementation of an improvement
- Person/vehicle capacity of surrounding area before and after implementation of an improvement
- How well have we been providing for and accommodating community values and environmental sensitivity (qualitative)
- Others

Step 2B: Assess the effectiveness of the implementation of the Preferred Alternative to date along with the remaining elements of the Minimum and Maximum Programs of Improvements/Preferred Alternative, timing, and anticipated effects. This analysis of components (Non-Infrastructure Related Components, Advanced Guideway System [AGS], and Highway Improvements) is taken directly from the ROD to show the details under each component as listed.

ASSESS EFFECTIVENESS OF OTHER COMPONENTS

The effectiveness of the Purpose and Need includes other components for consideration. The Context Sensitive Solution (CSS) process decision making principles must be applied to each life cycle of all I-70 Mountain Corridor Tier 2 projects. The CSS decision making process identifies core values that must be included for consideration in the project development process. These core values include but are not limited to, maintaining a healthy environment which preserves restores and enhances natural resources in the Tier 2 project areas and respecting community values that promote community character and their viability.

Consideration of environmental sensitivity and community values is paramount to assessing effectiveness of the of Tier 2 projects in meeting the overall corridor Purpose and Need.

The Final 2011 I-70 Mountain Corridor Programmatic Environmental Impact Statement (PEIS) Purpose and Need included language that transportation solutions *must* provide for and accommodate environmental sensitivity and community values.

Environmental Sensitivity

Acknowledging Environmental Sensitivity from project development through operations and maintenance directs stakeholders to 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. CSS guidance includes many tools to meet this objective to protect and enhance these natural and biological resources.

- Stream and Wetland Ecological Enhancement Program (SWEEP): The PEIS includes a Memorandum of Understanding to convene a SWEEP Issue Task Force for each Tier 2 project in order to integrate and address water resource needs with design elements during construction and long term maintenance and operations. The SWEEP identifies opportunities to enhance water quality, address sediment control, consider wetlands—fisheries, riparian areas and protection of necessary aquatic biota.

- A Landscape Level Inventory of Valued Ecosystem Components (ALIVE): The PEIS includes a Memorandum of Understanding for interagency collaboration to provide an opportunity to address issues related to wildlife connectivity and habitat fragmentation. An ALIVE Issue Task Force has been convened for Tier 2 projects to look at project specific opportunities to identify and mitigate wildlife permeability issues.

Community Values

Similarly, acknowledging community values in Tier 2 projects includes the objective to avoid and minimize adverse impacts on community values that define and retain community character. Tier 2 projects where possible, should consider and enhance air quality and historic resources, address impacts to noise levels, visual resources, and social and economic values, as well as minimize the transportation system's footprint on the mountain communities. Several agreements are in place to consider these resources during project planning and subsequent life cycles of Tier 2 projects. The following agreements are in place to retain community values.

- I-70 Mountain Corridor Section 106 Programmatic Agreement. Historic context, including historic features and landmarks, are critical to defining and retaining community character. A Programmatic Agreement was developed specifically to honor and retain the historic context in the corridor. A Section 106 Issue Task Force is convened to ensure the preservation of historic resources is taken into consideration when planning and constructing Tier 2 projects.

- I-70 Mountain Corridor Aesthetics Guidance. The I-70 Mountain Corridor Aesthetic Guidance provides an aesthetic vision for the entire corridor that will guide the design of future projects and improvements. The guidance defines the corridor as a whole rather than defining it in construction phases or funding increments. This ensures that future projects do not become separate and disconnected from the entire corridor. The guidance is intended to be used in all future design efforts for Tier 2 projects. Location specific considerations are included in the guidance for earthwork, rock cuts, vegetation clearing, revegetation practices, retaining wall design, bridges, sound attenuation, trails, and bike paths.
- I-70 Mountain Corridor Design Criteria and Design Criteria Exceptions process. Design guidelines have been developed for the I-70 Mountain Corridor. During project development for Tier 2 projects, the team uses the guidelines to inform the design. The design is also informed by partnerships with the local community, agencies and stakeholders with a vested interest. The I-70 Mountain Corridor CSS process allows deviations from the Design Criteria if it's not feasible. Design Exceptions must be vetted through work with the Project Leadership Team, Technical Team and Issue Task Forces. The Design Exceptions process requires measuring each request against nine justification criteria – including complementing the surrounding physical characteristics, enhancing safety, increasing capacity, protecting the environment, utilizing new technology and others.

METHODOLOGY

Several Tier 2 projects along the corridor have been constructed as part of the Minimum Program of the Preferred Alternative. Both infrastructure and non-infrastructure projects have been constructed such as the Eastbound Mountain Express Lane, the Fall River Road bridge, Veterans Memorial Tunnels, and improvements to the Eagle Spur Road. For the Reassessment, a review of these projects was conducted to determine if project mitigation developed as part of the working groups and task forces was included in design documents and if project specific mitigation was included in final design and construction documents.

SUMMARY OF FINDINGS

The Project Leadership Teams, Technical Teams, and Issue Task Forces on the Tier 2 projects to date have used the CSS guidance to identify areas where impacts can be avoided or minimized and resources that can be enhanced to accommodate Environmental Sensitivity and Community Values. Using the CSS guidance, the Aesthetics Guidance, Design Criteria, and ALIVE, SWEEP, and Section 106 Issue Task Forces have been instrumental in the application of processes to retain and enhance values specific to project locations along the corridor in order to successfully address impacts to community resources and provide mitigation for a majority of the impacts. Opportunities for enhancement are sometimes limited, but implemented when feasible.

While all projects along the corridor have followed the PEIS agreements and processes to avoid and minimize impacts to communities and the environment, several have gone above and

beyond to enhance these values. Some successful examples of application of the CSS process and aesthetic guidelines and design criteria, SWEEP and ALIVE Memoranda of Understanding, and the Section 106 Programmatic Agreement include the following:

- The Veterans Memorial Tunnels (Twin Tunnels) project was the first Tier 2 process conducted after the PEIS, and it was developed on a very accelerated timeline that was born out of a visioning exercise with stakeholders and industry experts to identify possibilities for constructing the Veterans Memorial Tunnels expansion on an accelerated timeline. Stakeholder involvement in developing the project's goals, core values, criteria, and desired outcomes through the CSS process allowed CDOT to accelerate the project schedule, avoid backtracking, and develop a quality project. The Veterans Memorial Tunnels' collaborative approach demonstrates that building trust with stakeholders at all levels is an integral part of expedited project delivery, and FHWA formally recognized CDOT's achievements with a 2013 Environmental Excellence Award for Environmental Streamlining. Specific design elements that supported environmental sensitivity included:
  - A partnership with Colorado Parks and Wildlife (CPW), Trout Unlimited, Clear Creek Watershed, and others to restore aquatic habitat and water quality through a portion of Clear Creek downstream of the Game Check Area Park. Since implementation of the mitigation, trout biomass has increased, and recreational access to the creek has been enhanced.
  - An adaptive mitigation approach that incentivized the Construction Manager/General Contractor (CM/GC) to avoid or minimize environmental impacts during construction to reduce mitigation requirements (if impacts were avoided, compensatory mitigation was not required).
  - Use of visual simulations to support decisions regarding tradeoffs between impacts to the median and Clear Creek. CDOT and FHWA sought and honored public input during the NEPA process (both options were carried forward and analyzed) to minimize impacts to the creek and shift into the median.
- The Eastbound Peak Period Shoulder Lane (PPSL) project (now known as the Eastbound Mountain Express Lane, or MEXL) was developed out of the adaptive management approach of the PEIS to provide significant congestion relief with a much smaller impact to the environment and community than would be required to add a permanent travel lane. This concept of utilizing existing infrastructure is one of the non-infrastructure components in the PEIS, and the CSS process helped FHWA, CDOT, and stakeholders come to agreements about how the project should operate. The innovative project was the nation's first project to use a highway shoulder as a part-time lane based on recreational traffic. Working through the CSS process, the project was able to be designed to avoid acquiring new right-of-way; avoid adverse effects to historic properties; and minimize wetland impacts, including placing fill and removing valuable riparian vegetation along Clear Creek. The design changes supported environmental sensitivity and allowed the project to be processed as a Categorical

Exclusion. The project resulted in a noticeable increase in economic activity in Idaho Springs; enhanced reliability of travel for recreational travelers, community residents, and emergency vehicles; reduced air pollution associated with congestion; improved wildlife connectivity; and enhanced the historic Water Wheel Park in Idaho Springs.

- During the Westbound PPSL project, the ALIVE Issue Task Force met three times during the design (life cycle phase 3) to evaluate opportunities to reduce big horn sheep mortality near Empire Junction (US 40). The group used information from stakeholders, including CPW, to identify areas where mitigation measures could be applied to reduce mortality and wildlife vehicle collisions; examples include limiting and removing vegetation in roadside areas, adding targeted signage in two locations to warn motorists of seasonal migration, the addition of guardrail to redirect wildlife, and providing median barrier gaps for small animal migration. This project also raised awareness of bighorn sheep conflicts, which were identified in the ALIVE MOU as one of the Linkage Interference Zones.
- During the Eastbound Auxiliary Lane from EJMT to Herman Gulch project, the SWEEP MOU was followed, and the project was redesigned (shortened) to avoid impacts to fen wetlands. Fens are ancient wetlands (thousands of years old) that are recognized as irreplaceable resources in the Southern Rocky Mountain Region due to the functional and biological values they provide. They are afforded special protection because of their rarity and the difficulty of mitigation and restoration. Several fen wetland complexes were identified in the project area during the NEPA phase, and the project was modified to avoid impacting these irreplaceable resources. The construction phase carefully monitored the identified fens to avoid direct or indirect impacts. The Technical Team, Project Leadership Team, and CE agreed that shortening this project to avoid fen impacts was the right approach.

SUMMARY OF FINDINGS

Implementation of the agreements along the corridor provides a successful framework in which to accommodate objectives specified in the Purpose and Need. Environmental Sensitivity and Community values were considered, accommodated and included in developing the Purpose and Need for the PEIS. Project-specific mitigation to protect resources is included in planning, design and construction of Tier 2 projects.

There are five life cycle phases for each Tier 2 project; implementation of these agreements have protected invaluable resources along the corridor when viable. Often working groups are convened and included during the first three life cycles of planning, project development and design and these agreements are successfully applied and included in planning, project development and design. Stakeholder feedback indicates that working group and issue task force objectives have not been applied as successfully during the last 2 life cycle phases (project construction and operations, maintenance and monitoring).

There was general agreement among the group that some projects more effectively used the CSS process and implementation of agreements.

In summary, the most effective projects in providing for and accommodating environmental sensitivity and respect for community values were those that carried CSS through all the life cycles, included tracking of environmental and community values through those phases, and those that incorporated best practices and lessons learned from previous projects.

IMPLEMENTATION STATUS: REVIEW OF TRANSPORTATION FUNDING INITIATIVES

Statewide Transportation Funding Proposals from 1999 through 2020

METHODOLOGY

There have been multiple efforts over the last 20 years proposing to increase funding for transportation. Information is available online concerning transportation funding proposals, bills and initiatives 1999-2020. Some of those proposals came in the form of introduced legislation, legislatively referred measures, and citizen ballot initiatives. Some proposals focused solely on funding for the state transportation system; others proposed to increase funding for the state, counties, and municipalities. Some proposals called for allocating funding for transportation from the state's general fund and other proposed raising new taxes or fees. Additional information on the amount of historical amount of transportation funding is available in https://leg.colorado.gov/publications/2019-colorados-transportation-system.

SUMMARY OF FINDINGS

The summary of findings is shown below in Table 1.

Table 1. Outcomes of Colorado Transportation Funding Measures (1999-2020)

Year	Proposal (Title Or Bill #)	Description	Proposal Outcome
1999	Referendum A	TRANS bonds—Referred measure enabling the state to bond against anticipated federal HTF to funding specific list of projects including I70 West	Passed at ballot
2001	Amendment 26—Surplus Revenue to Test I-70 Fixed Guideway	The amendment proposed to expend $50 million of surplus state revenue to plan and test a fixed guideway transportation system for the I-70 corridor linking Denver International Airport and Eagle County Airport; and exempts the Colorado Intermountain Fixed Guideway Authority from state constitutional revenue and spending limitations.	Failed at ballot
2002	HB02-1310	HB 02-1310 transferred two thirds of the excess General Fund reserve remaining after TABOR refunds, the statutory reserve, a 6 percent increase in General Fund appropriations, and the SB 97-1 diversion to the HUTF.	Passed in legislature
2008	Amendment 52—Severance Tax for Transportation	Amendment 52 proposed amending the Colorado Constitution to require the state legislature to spend a portion of state severance tax collections on highway projects.	Failed at ballot
2008	Amendment 58—Severance Taxes on the Oil and Natural Gas Industry	Amendment 58 proposed changing the Colorado statutes to: ▪ increase the amount of state severance taxes paid by oil and natural gas companies, primarily by eliminating an existing state tax credit; ▪ Allocate the increased severance tax revenue to college scholarships for state residents, wildlife habitat, renewable energy projects, transportation projects in energy-impacted areas, and water treatment grants; and ▪ Exempt all oil and gas severance tax revenue from state and local spending limits.	Failed at ballot
2009	SB08-108 -FASTER	Increased various fees (vehicle registration, late fees, rental cars) allocated to State/counties/cities for investment in transportation infrastructure. Created HPTE and Bridge Enterprise.	Passed
2009	SB09-228	SB 09-228 altered the limit on General Fund (GF) appropriations, repealed the SB 97-1 diversion and HB 02-1310 transfers, and required alternative transfers (subject to triggers) to transportation, capital construction, and the General Fund statutory reserve.	Passed
2010	Proposition 101—Income, Motor Vehicle and	Proposition 101 proposed amending the Colorado statutes to: ▪ reduce the state income tax rate from 4.63 percent to 4.5 percent in 2011, and to 3.5 percent gradually over time;	Failed at ballot

Table 1. Outcomes of Colorado Transportation Funding Measures (1999-2020)

Year	Proposal (Title Or Bill #)	Description	Proposal Outcome
	Telecommunications Taxes and Fees	▪ Reduce or eliminate taxes and fees on vehicle purchases, registrations, leases, and rentals over the next four years; ▪ Eliminate all state and local taxes and fees on telecommunication services, except 911 fees; and ▪ Require voter approval to create or increase fees on vehicles and telecommunication services.	
2016	SB16-210	Fix Colorado Roads Act. Proposed to require the Transportation Commission to place a measure on the ballot authorized Transportation Revenue Anticipation Notes (TRANs bonds) and dedicating five percent sales and use tax revenue from the general fund without raising taxes	Failed in legislature
2017	HB17-1171	Proposal for a referred ballot measure to authorize CDOT to issue new Transportation Revenue Anticipation Notes	Failed in legislature
2017	HB17-1242	Proposal for New Transportation Infrastructure Funding Revenue, refer ballot measure to increase sales and use taxes by 0.5 percent and authorize bonding up to $3.5b	Failed in legislature
2017	SB17-205	Proposal to all the Transportation Commission to submit a ballot question to the voters at either the November 2017, 2018, or 2019 election, which, if approved, would have increased the state sales and use tax from 2.9% to 3.15%, also allowed for bonding against tax revenue	Failed in legislature
2017	SB17-267	SB 17-267 authorized executions of lease-purchase agreements to fund transportation in FY 2018-19 ($424 million for transportation), FY 2019-20, FY 2020-21, and FY 2021-22 ($500 million for transportation each year). The bill requires General Fund obligations for lease payments each year; the obligation grows as agreements are executed and will total $91 million annually beginning in FY 2021-22	Passed
2018	Proposition 110—Transportation Bond Issue and Sales Tax Increase	Statewide ballot proposal to increase sales tax by 0.62 percent for 20 years to support state and local roadway and transit investments.	Failed at ballot
2018	Proposition 109—Transportation Bond Issue and Reallocation of Existing Revenue	Statewide ballot proposal to issue $3.5b in bonds for transportation utilizing general fund revenues to pay debt service	Failed at ballot

Table 1. Outcomes of Colorado Transportation Funding Measures (1999-2020)

Year	Proposal (Title Or Bill #)	Description	Proposal Outcome
2018	SB18-001	SB 18-001 transferred of $495 million in FY 2018-19 and $200 million in FY 2019-20 from the General Fund to a combination of the State Highway Fund, the HUTF, and the Multimodal Transportation Options Fund. For FY 2020-21 through FY 2039-40, the bill transfers $50 million annually from the General Fund to the State Highway Fund.	Passed
2019	HB19-1157	Proposed to modify and increase Specific Ownership Tax Rates and allocate to HUTF	Failed
2019	SB19-051	Proposal to increase the SB18-001 general fund allocation to transportation from $150M to $340m	Failed
2019	SB19-239	Proposed for CDOT to conduct an analysis of impact of emerging technologies on the state transportation system and make recommendations (including tax and fee proposals)	Passed
2019	SB19-262	General Fund transfer of $100m to transportation, one time only	Passed
2019	Proposition CC	Statewide ballot proposal referred by the legislature to retain TABOR Surplus funds for education and transportation.	Failed at ballot
2020	HB20-1151	Expand authority of transportation planning regions—bill proposed to give regional planning entities (MPOs and TRP) a streamlined approach to creating regional transportation authorities to fund transportation.	Introduced
2020	SB20-44	Bill proposed to allocate sales and use tax revenue attributable to the sales or use of vehicles and related items to transportation funding.	Failed

Sources:

"2019 Transportation Handbook." Colorado Legislative Council, Colorado General Assembly, Nov. 2019, leg.colorado.gov.

Potyondy, Patrick. Statewide Ballot Measures Database, National Conference of State Legislatures, 2020, www.ncsl.org/research/elections-and-campaigns/ballot-measures-database.aspx.

"Prior Session Information 2016-2020." Prior Session Information | Colorado General Assembly, leg.colorado.gov/prior-session-information.

"Prior Session Information 1999-2015." Prior Session Information | Colorado General Assembly, leg.colorado.gov/prior-session-information.

"Colorado Transportation Commission." January TC Packet, Jan. 2020, www.codot.gov/about/transportation-commission/documents/2020-supporting-documents/tc-january-2020-packet.pdf.

SUMMARY OF FINDINGS

As presented in Table 1, there have been multiple attempts over the years to increase state investment in transportation. The efforts have resulted in more failures than successes.

ASSESS THE EFFECTIVENESS OF THE IMPLEMENTATION OF THE PREFERRED ALTERNATIVE

METHODOLOGY

An effectiveness rating was given to those Preferred Alternative components that are ongoing or completed projects. These were each rated with a Low, Medium, or High Effectiveness in regards to mobility and safety. As an initial broad-brush sketch analysis for the planning discussion, a quantitative benefit was calculated and presented alongside the project cost. This was only calculated for those projects that had before and after empirical data available. Further data and detailed technical analysis is needed, as assumptions were needed to complete the sketch calculations. These calculations are in Attachment A through Attachment F.

SUMMARY OF FINDINGS

Information on the status and effectiveness of each of the components of the Preferred Alternative is presented in Table 2. It is recognized that each of the components incrementally contributes towards the realization of the I-70 Mountain Corridor's Purpose and Need and Preferred Alternative. As individual components are implemented during Tier 2 processes, progress will continue towards the implementation of the Preferred Alternative and fulfillment of the Purpose and Need. The effectiveness of each individual component is assessed accordingly.

Additional Travel Time Information, to supplement Attachment A, is available for the Eastbound MEXL, which is part of the Non-Infrastructure Improvements: Expanded use of existing transportation infrastructure category of the Preferred Alternative.

Table 2. Preferred Alternative Minimum Program of Improvements—Status of Implementation

***Completed refers to a project that has been finished with a completion date**

****In progress refers to a project that is in planning or construction**

Purpose and Need Components:
1. Increase capacity
2. Improve mobility and accessibility
3. Decrease congestion

Line #	Preferred Alternative Item	*Completed	Completion Date	Completed Actions *	**In Progress/ Ongoing	Work in Progress/Ongoing**	Effectiveness Observation (if available)	Purpose and Need Component (measures)	Effectiveness Rating		Recommended Level of Effort (Step 4 Activity)
											High Effectiveness: Needs to be Initiated
											Medium Effectiveness: Continue with Current Level of Effort
											Low Effectiveness: More Effort Needed
											Reduce Effort
									Mobility	Safety	
	Non-Infrastructure Related Components										
1	Increased Enforcement				✓	"For the MEXL, the Colorado State Patrol (CSP) increased safety enforcement in 2019 with troopers on overtime along the eastbound mountain express lane from Empire to Idaho Springs to help decrease unsafe driving behavior and increase efficiency. Overall, each CSP troop defines goals and objectives to reduce crashes and save lives. Troop 1A picked the lower end of I-70 as a primary targeted roadway. The troop is using a targeted saturation methodology with team operations, using multiple troopers."	"For the MEXL effort, the CSP reports the number of crashes did not appreciably decrease with increased enforcement, so the benefits did not justify the costs of overtime for troopers. With the targeted saturation strategy, the number of contacts with passenger vehicles and commercial vehicles have gone up significantly. Crashes are way down. Impossible to say if the effect is from COVID-19 or the targeted enforcement; probably some of both. "	2: Improved mobility and accessibility (travel time/reliability)	Unknown	Unknown	
2	Bus, van, or shuttle service in mixed traffic				✓	Ski shuttles continue to serve the corridor. Bustang service, which began in 2015, provides daily trips to and from corridor communities and Denver, but does not serve peak direction recreational trips at peak demand. Snowstang service, initially piloted in 2017, was launched in 2019 to three resorts.	In 2019, Bustang ridership was over 70,000 passengers compared to just over 26,000 in 2016, representing a 170% increase. In 2018, Bustang averaged 3,050 riders a month throughout the Corridor. Preliminary Snowstang ridership found that buses to Loveland and A-Basin were running 49% full; Steamboat buses were running 30% full. These both exceed CDOT's initial expectations. 40% of the riders are out-of-state or international tourists. In the inaugural 2019-2021 seasons, sold more than 2,000 tickets over 14 weekends.	1: Increased capacity (person trips, transit ridership)	See separate table	Unknown	
3	Programs for improving truck movements				✓	Revisions to the traction and chain laws to improve safety and operations; Off-corridor staging areas for trucks during adverse weather events; Variable speed limits in Glenwood	Remote tunnel metering reduces heavy tow incidents during adverse weather events. Truck parking program has facilitated off-mainline parking during closures for a safer mainline and truck operations.	2: Improved mobility and accessibility (travel time/reliability, safety data); 3: Decreased	(Based on limited data and group discussion)	(Based on limited data and group discussion)	

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									High Effectiveness		Needs to be Initiated
									Medium Effectiveness		Continue with Current Level of Effort
									Low Effectiveness		More Effort Needed
									Mobility	**Safety**	Reduce Effort
						Canyon; Remote continuous flow metering at Silverthorne to improve truck traction approaching the tunnel eastbound; Active Corridor Management. Colorado Motor Carriers Association (CMCA) programs include public service announcements (PSAs) on chain awareness, providing a best practices document, and working with trucking firms that are repeat offenders.		congestion (travel time/reliability, level of service)			
4	Driver education				✓	GoI-70.com shares news and other articles that help educate drivers on traveling through the I-70 Mountain Corridor. Topics include: Available transit and carpool services, real-time information sources, Colorado Traction Laws, Tire Checks, Move it Law, Move Over Law, Left Lane Law and Avalanche Activity. Additional outreach to travelers is done through the blog, social media, eBlasts and extensive partner outreach. CMCA has produced an audio guide for truckers to safely drive the I-70 Mountain Corridor, by milepost	Analytics show GoI-70.com site visitation has grown consistently since 2009. Last winter, the website received over 15,000 hits in a single day. Traction law compliance will be evaluated in 2020.	2: Improved mobility and accessibility (travel time/reliability, safety data)	(Based on limited data and group discussion)	(Based on limited data and group discussion)	
5	Expanded use of existing transportation infrastructure in and adjacent to the corridor	✓	Dec. 2015	Eastbound Mountain Express Lane (MEXL) opened in December 2015. Updated each county's Traffic Incident Management Plans Active corridor management has been implemented, including creation of a full-time corridor operations manager	✓	Westbound MEXL project under construction, opening projected for 2021.	" ▪ The EB MEXL diverts 750 to 900 cars from the free general-purpose lanes. This alleviates traffic congestion in the Express Lane, and decreases congestion in general-purpose lanes and frontage roads travel time savings. ▪ Travel times have improved. For example, on July Sundays 2012-2014, eastbound travel time averaged 42 to 51 minutes. On July Sundays 2016-	2: Improved mobility and accessibility (travel time/reliability, incident response times); 3: Decreased congestion (level of service, travel time/reliability)	See separate table	(Based on limited data and group discussion)	

Table 2. Preferred Alternative Minimum Program of Improvements—Status of Implementation

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											Low Effectiveness: More Effort Needed
											Reduce Effort
									Mobility	Safety	
				Ramp meters have been installed throughout much of the corridor.			2018, travel time averaged 21 to 24 minutes. ▪ Over the entire 12-mile MEXL corridor as a whole, crashes have increased slightly more than would have been expected without changes to the roadway over the time period. ▪ Crashes have increased significantly in the western 5 miles of the corridor and this increase may be a product of substandard cross section elements and weaving associated with the US 40 entrance and express lane access combination. ▪ Crashes have decreased significantly in the eastern 2 miles and this decrease may be a product of the major geometric and cross section improvements that resulted from the Veterans Memorial Tunnel expansion project. ▪ Crashes in the middle 5 miles increased slightly. This segment has substandard cross section elements but does not have any high-volume exit or entrance ramps or any legal access to the managed lane.				
6	Use of technology advancements and improvements to increase mobility without additional infrastructure				✓	Technological advancements without the addition of infrastructure include: Electronic Signage, Intelligent Transportation System and Vehicle to Infrastructure (V2X) Data Ecosystem. CDOT is currently testing V2X throughout the corridor. CoTrip.org and GovDelivery/Travel Alerts have been improved in recent years.	As this technology matures and is installed along the corridor, effectiveness evaluations will be conducted	2: Improved mobility and accessibility (travel time/reliability, safety data)	(Based on limited data and group discussion)	(Based on limited data and group discussion)	
7	Traveler information and other information technology systems				✓	Traveler information is shared via Intelligent Transportation System; CoTrip; Variable Message Signs		2: Improved mobility and accessibility (travel	(Based on limited data	(Based on limited data	

Table 2. Preferred Alternative Minimum Program of Improvements—Status of Implementation

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									High Effectiveness		Needs to be Initiated
									Medium Effectiveness		Continue with Current Level of Effort
									Low Effectiveness		More Effort Needed
									Mobility	**Safety**	Reduce Effort
						(VMS);CDOT Alert Texts; CDOT email alerts		time/reliability, safety data)	and group discussion)	and group discussion)	
8	Shift passenger and freight travel demand by time of day and day of week				✔	The most popular feature of GoI70.com is the weekend travel forecast which is intended to shift passenger travel demand by time of day and day of week. Over 150 dining and lodging businesses along the I-70 Mountain Corridor offer deals to encourage drivers to avoid peak travel times. Examples include: $2 tacos from 4-6pm on Saturdays and Sundays at Twist; 20% off activities at Lawson Adventure Park Saturday & Sunday 4pm-close.	The GoI-70.com weekend travel forecast received over 130,000 views during the 2019-2020 winter season. Analysis of data in 2011 indicated that peak traffic had noticeably shifted since the promotion of off peak travel began 2009.	2: Improved mobility and accessibility (travel time/reliability); 3: Decreased congestion (level of service, travel time/reliability)	(Based on limited data and group discussion)	(Based on limited data and group discussion)	
9	Convert day trips to overnight stays				✔	GoI70.com Peak Time Deals worked with the lodging community to create Sunday Night Stay promotions. These are posted on the Peak Time Deals and promoted frequently through GoI70 blogs, eBlasts, social posts and stakeholder outreach. Examples include: $125 Sunday night at the Sitzmark Lodge in Vail; 20% off a Sunday night stay at the Wedgewood Lodge in Breckenridge		2: Improved mobility and accessibility (travel time/reliability); 3: Decreased congestion (level of service, travel time/reliability)	(Based on limited data and group discussion)	(Based on limited data and group discussion)	
10	Convert single occupancy vehicle commuters to high occupancy travel and/or public transportation				✔	Transit promotion incentives include traveling in groups to receive discounted fares. Resorts are offering incentives to carpool by promoting reduced or free parking as well as discounted lift tickets for groups that travel together. For example, Keystone, Breckenridge, Copper Mountain and Arapahoe Basin have carpool parking incentive programs, offering discounted parking, close-in parking or discounted lift tickets. Summit express airport shuttle offers a savings of $12 per person when traveling with 3 or more passengers.	These programs are most likely contributing to the success of the Bustang ridership	1: Increased capacity (person trips, transit ridership)	(Based on limited data and group discussion)	(Based on limited data and group discussion)	

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									High Effectiveness		Needs to be Initiated
									Medium Effectiveness		Continue with Current Level of Effort
									Low Effectiveness		More Effort Needed
									Mobility	**Safety**	Reduce Effort
11	Implement transit promotion incentives				✓	Transit promotion incentives include traveling in groups to receive discounted fares. Resorts are incentivizing carpooling by offering reduced or free parking as well as discounted lift tickets. Summit Express airport shuttle offers a savings of $12 per person when traveling with 3 or more passengers. For example, Loveland Ski Area and Arapahoe Basin offered lift ticket discounts for Front Range Ski Bus riders. Arapahoe Basin offered food and beverage vouchers for Snowstang riders. Some airport shuttles offer discounts through GoI70 Peak Time Deals.	These programs are most likely contributing to the success of the Bustang ridership	1: Increased capacity (person trips, transit ridership)	(Based on limited data and group discussion)	(Based on limited data and group discussion)	
12	Other transportation demand management measures to be determined				✓	I-70 Coalition frequently communicates transportation demand management messages and strategies with partners who are encouraged to 'share' with their network and customers. Partners include resorts, local government public information officers (PIOs), Information/Welcome Centers, resort associations, property managers, lodging sector, destination marketing organizations and chambers of commerce. I-70 Coalition created and piloted the Why Drive? Campaign in coordination with the lodging sector to promote transportation alternatives to mountain visitors. Since 2012, I-70 Coalition has undertaken a bi-annual research study program. These surveys inform how existing travel resources and programs are being received and utilized by the traveling public and how they might be improved.		2: Improved mobility and accessibility (travel time/reliability)	(Based on limited data and group discussion)	(Based on limited data and group discussion)	

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									High Effectiveness		Needs to be Initiated
									Medium Effectiveness		Continue with Current Level of Effort
									Low Effectiveness		More Effort Needed
									Mobility	**Safety**	Reduce Effort
	Advanced Guideway System										
13	Feasibility of high speed rail passenger service				✓	AGS Feasibility Study (August 2014)			Incomplete	Incomplete	
a	Potential station locations and local land use considerations				✓	AGS Feasibility Study (August 2014)			Incomplete	Incomplete	
b	Transit governance authority				✓	AGS Feasibility Study (August 2014)			Incomplete	Incomplete	
c	Alignment				✓	AGS Feasibility Study (August 2014)	Several alignments are viable, but Hybrid Alignment is preferred		Incomplete	Incomplete	
d	Technology				✓	AGS Feasibility Study (August 2014)	Study finding: Fixed guideway options are technically feasible but not financially feasible as of 2014 (no funding identified as of 2020)		Incomplete	Incomplete	
e	Termini				✓	AGS Feasibility Study (August 2014)			Incomplete	Incomplete	
f	Funding requirements and sources				✓	AGS Feasibility Study (August 2014)	Study finding: Fixed guideway options are technically feasible but not financially feasible as of 2014 (no funding identified as of 2020)		Incomplete	Incomplete	
g	Transit ridership				✓	AGS Feasibility Study (August 2014), Interregional Connectivity Study (January 2014), & Economic Impact of High-Speed Transit in the Mountain Corridor (July 2019)	Study finding: Annual ridership estimated at 4.6 to 6.2 million as of 2014, assuming a connection to a front range high speed transit system including DIA (no funding identified as of 2020)		Incomplete	Incomplete	
h	Potential system owner/operator				✓				Incomplete	Incomplete	
i	Interface with existing and future transit systems				✓	AGS Feasibility Study (August 2014) & Interregional Connectivity Study (January 2014)			Incomplete	Incomplete	
j	Role of an Advanced Guideway System in freight delivery both in and through the corridor								Incomplete	Incomplete	
14	Functioning AGS								Incomplete	Incomplete	
	Highway Improvements										
	Specific Highway improvements										

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									Medium Effectiveness		Continue with Current Level of Effort
									Low Effectiveness		More Effort Needed
											Reduce Effort
									Mobility	**Safety**	
15	6 lane component from Floyd Hill through the Veterans Memorial Tunnels (MP 243 to MP247) including a bike trail and frontage roads from Idaho Springs to Hidden Valley and Hidden Valley to US 6	✔	Dec. 2014, Sept 2015, and TBD	Eastbound tunnel widened to 3 lanes; Westbound tunnel was widened to accommodate three lanes in the future; Frontage road and bike trail between Game Check area and Hidden Valley.	✔	Environmental Assessment and preliminary engineering is underway for I-70 from east of the Floyd Hill/Beaver Brook Exit (248) to Idaho Springs Exit (241). A Categorical Exclusion is underway for improvements to CR 314 between the Game Check trailhead and the City of Idaho Springs baseball fields.	The 3-lane project completed to date has improved safety: an average of 51 crashes per year from 2009 to 2011, eastbound from Twin Tunnels to base of Floyd Hill. After the major geometric and cross section improvements, an average of 22 crashes per year, from 2016 to 2018. Similar safety improvements are expected upon completion of the EA and Cat Ex projects	1: Increased capacity (person trips) 2: Improved mobility and accessibility (travel time/reliability, safety data, incident response time) 3: Decreased congestion (level-of-service, travel time/reliability)	See separate table	See separate table	
16	Empire Junction (US 40 and I-70) interchange improvements (MP 232)								Incomplete	Incomplete	
17	Eastbound auxiliary lane from Eisenhower-Johnson Memorial Tunnels to Herman Gulch (MP 215 - MP 218)	✔	2016	The auxiliary lane ends at approximately 217.5, a half mile west of the Herman Gulch Interchange. The Project did not extend entirely to Herman Gulch to limit environmental impacts. CE agreement on project limits.			2011-2018 data indicates an improvement in crash history. The extension of the auxiliary lane at US-6 together with implementation of the mainline metering along eastbound I-70, east of the Silverthorne/Dillon interchange, has eased some of the safety concerns in this location. During the CSS process, it was agreed to shorten the project by a 1/2 mile (to limit environmental impacts)	2: Improved mobility and accessibility (travel time/reliability, safety data); 3: Decreased congestion (level-of-service, safety data, travel time/reliability)	Unknown	See separate table	
18	Westbound auxiliary lane from Bakerville to Eisenhower-Johnson Memorial Tunnels (MP 215 to MP 221)								Incomplete	Incomplete	
	Other Highway Improvements										
19	Truck operation improvements, such as	✔	2015, 2016, and In Progress	The completed Eastbound PPSL project constructed two pull outs for emergency	✔	7 new safety pullouts will be constructed as part of the westbound PPSL project. 5 new pullouts will be constructed in the	Pullouts and expanded chain stations improve safety conditions for truck drivers	2: Improved mobility and accessibility (travel	(Based on limited data	(Based on limited data	

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	pullouts, parking, and chain stations			refuge in December 2015. East Vail chain station was expanded in 2016.		westbound direction and 2 new pullouts in the eastbound direction.	on the roadside. Traffic operations are also improved.	time/reliability, safety data)	and group discussion)	and group discussion)	
20	Safety improvements west of Wolcott	✓	2013	Super-elevation curve correction through Wolcott	✓		2011-2018 data indicates an improvement in crash history, compared to 2001-2005. The curve correction may have alleviated safety issues at Wolcott	2: Improved mobility and accessibility (safety data)	Unknown	See separate table	
21	Safety and capacity improvements in Dowd Canyon	✓	2019	Eastbound on-ramp plus taper has been extended by approximately 500' as a safety improvement.	✓	Planning has started; currently on hold pending the results of a Bridge Enterprise inspection project. CDOT Region 3 will reassess the project in early 2020.	Data not yet available on eastbound ramp improvement	2: Improved mobility and accessibility (safety data)	Incomplete	Incomplete	
	Interchange Improvements at:										
22	Glenwood Springs (MP 116)	✓	Dec. 2018	Interchange improvements were constructed as part of the Grand Avenue Bridge (GAB) Project. Interchange improvements include: Lengthened on/off ramps, increased vehicle storage, new signals, new pedestrian underpass, and a new configuration of the interchange for the newly realigned Grand Avenue bridge			The Exit 116 connection from SH82 to I-70 and vice versa is operationally much better than before the GAB project, basically much more efficient operations by having a more direct connection to the corridors and also separating out local traffic from mainline pass through traffic accessing the SH82 and/or I-70 corridors. The new pedestrian underpass under SH82 also provides traffic operational improvements/benefits because a ped phase was eliminated at one of the signals. The pedestrian underpass also provides a considerable safety benefit, separating bikes and peds from motorized vehicles in this active resort community.	2: Improved mobility and accessibility (safety data)	(Based on limited data and group discussion)	Unknown	
23	Gypsum (MP 140)								Incomplete	Incomplete	
24	Eagle County Airport								Incomplete	Incomplete	
25	Wolcott (MP 157)								Incomplete	Incomplete	
26	Eagle and Spur Road (MP 147)	✓	2015	Roundabouts were incorporated into the interchange to remove the traffic lights. Also a pedestrian bridge over I-70 was installed, pedestrian circulation in general was improved, and				2: Improved mobility and accessibility (safety data)	Unknown	Unknown	

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									High Effectiveness		Needs to be Initiated
									Medium Effectiveness		Continue with Current Level of Effort
									Low Effectiveness		More Effort Needed
									Mobility	**Safety**	Reduce Effort
				better access from a park-and-ride to a bus stop which was improved for safety.							
27	Edwards and Spur Road (MP 163)	✓	2011-Phase 1, 2020-Phase 2	Phase 1 of the project—completed in 2011—made improvements to the northern half of the Spur Road, including four new roundabouts and improved connections with the I-70 on- and off-ramps.	✓	Phase 2 is currently underway and includes design improvements to the southern half of the Edwards Spur Road - a distance of approximately 0.4 miles. Phase 2 included improved safety features such as widening roads and bridges, improved sight distances at intersections. The project added refuge islands large enough to accommodate bicycles and trailers at the roundabout. It also added Rectangular Rapid Flashing Beacons for crosswalks at the roundabout. For recreation use, the project added separated pedestrian trails and bridges as well as added bike lanes to the roadway system.		2: Improved mobility and accessibility (safety data)	Unknown	See separate table	
28	Avon (MP 167)								Incomplete	Incomplete	
29	Minturn (MP 171)	✓	Fall 2019	Eastbound on-ramp plus taper has been extended by approximately 500' as a safety improvement.	✓	Planning has started; currently on hold pending the results of a Bridge Enterprise inspection project. CDOT Region 3 will reassess the project in early 2020.	Data not yet available on eastbound ramp improvement	2: Improved mobility and accessibility (safety data)	Unknown	Unknown	
30	Vail West (MP 173)/Simba Run								Incomplete	Incomplete	
31	Vail (MP 176)								Incomplete	Incomplete	
32	Vail East (MP 180)								Incomplete	Incomplete	
33	Vail Pass (East Shrine Pass Road - MP 190)								Incomplete	Incomplete	
34	Copper Mountain (MP 195)								Incomplete	Incomplete	
35	Frisco/Main Street (MP 201)								Incomplete	Incomplete	
36	Frisco/SH9 (MP 203)				✓	Currently working on traffic analysis, operational analysis and design concepts			Incomplete	Incomplete	
37	Silverthorne (MP 205)				✓	I-70 Silverthorne/Dillon Interchange Study has been completed			Incomplete	Incomplete	
38	Loveland Pass (MP 216)								Incomplete	Incomplete	

Table 2. Preferred Alternative Minimum Program of Improvements—Status of Implementation

***Completed refers to a project that has been finished with a completion date** ****In progress refers to a project that is in planning or construction**

Purpose and Need Components:
1. Increase capacity
2. Improve mobility and accessibility
3. Decrease congestion

Line #	Preferred Alternative Item	*Completed	Completion Date	Completed Actions *	**In Progress/ Ongoing	Work in Progress/Ongoing**	Effectiveness Observation (if available)	Purpose and Need Component (measures)	Effectiveness Rating		Recommended Level of Effort (Step 4 Activity)
									High Effectiveness		Needs to be Initiated
									Medium Effectiveness		Continue with Current Level of Effort
									Low Effectiveness		More Effort Needed
											Reduce Effort
									Mobility	Safety	
39	Georgetown (MP 228)	✓	2012	Added roundabout serving interchange access road			*Data collection in progress	2: Improved mobility and accessibility (safety data)	Unknown	Unknown	
40	Downieville (MP 234)								Incomplete	Incomplete	
41	Fall River Road (MP 238)								Incomplete	Incomplete	
42	Base of Floyd Hill/US 6 (MP 244)				✓	Element of the Floyd Hill Project - Environmental Assessment in Progress			Incomplete	Incomplete	
43	Hyland Hills (MP 247)				✓	Element of the Floyd Hill Project - Environmental Assessment in Progress			Incomplete	Incomplete	
44	Beaver Brook (MP 248)				✓	Element of the Floyd Hill Project - Environmental Assessment in Progress			Incomplete	Incomplete	
45	Evergreen Parkway /SH 74 (MP 252)								Incomplete	Incomplete	
46	Lookout Mountain (MP 256)								Incomplete	Incomplete	
47	Morrison (MP 259)								Incomplete	Incomplete	
	Auxiliary lanes										
48	Avon to Post blvd. (Exit 168)								Incomplete	Incomplete	
49	West side of Vail Pass (eastbound and westbound)				✓	Environmental Assessment and conceptual design for safety improvements are underway. Design and construction can follow as funding becomes available.			Incomplete	Incomplete	
50	Frisco to Silverthorne (eastbound)				✓	Currently working on traffic analysis, operational analysis and design concepts. Roadway and feasibility studies are underway as well as environmental research.			Incomplete	Incomplete	
51	Morrison to Chief Hosa (westbound)								Incomplete	Incomplete	

EASTBOUND MEXL ADDITIONAL INFORMATION

METHODOLOGY

The Eastbound MEXL, operating as a peak period shoulder lane, opened to traffic in 2015. It is operated up to 100 times per year, on most Saturday and Sunday afternoons as well as on Monday holidays.

The mobility effectiveness of the Eastbound MEXL can be assessed by comparing average travel times, before and after its implementation. Several representative summer and winter days (averaged across all lanes over the selected month) are presented in Figure 1 through Figure 6—for three years before its opening (2012, 2013, and 2014) and for three representative years after its opening (2016, 2018, and 2020 (2019 was used in place of 2020 for analysis periods that have not occurred yet)). For the January comparison, 2017 was used instead of 2016 because the PPSL was not open every weekend in January in 2016.

The safety effectiveness of the Eastbound MEXL can be assessed by comparing crash statistics for the three year periods before and after it implementation, 2009 – 2011 and 2016-2018 respectively. Crashes are considered statistical "rare events." As a result, a very large number of "trials" (vehicles passing through a given segment and either not crashing or crashing) are needed to draw accurate conclusions on whether or not crash frequency on a given piece of highway is changing over time. Using too small of a time or distance interval, too large of a segment, and not properly taking into account changes in traffic volume can cause an observer to overlook changes that would be observed over longer time frames, conversely, attribute a change that actually turns out to be within the normal range of general random occurrence of these events. This safety analysis accounts for and corrects that random influence to give an accurate answer by analyzing homogeneous segments of the roadway and excluding the influence of temporary construction impacts on crashes.

SUMMARY OF FINDINGS

Figure 1. Travel Time for Eastbound I-70 from Empire Junction to Idaho Springs on July Saturday

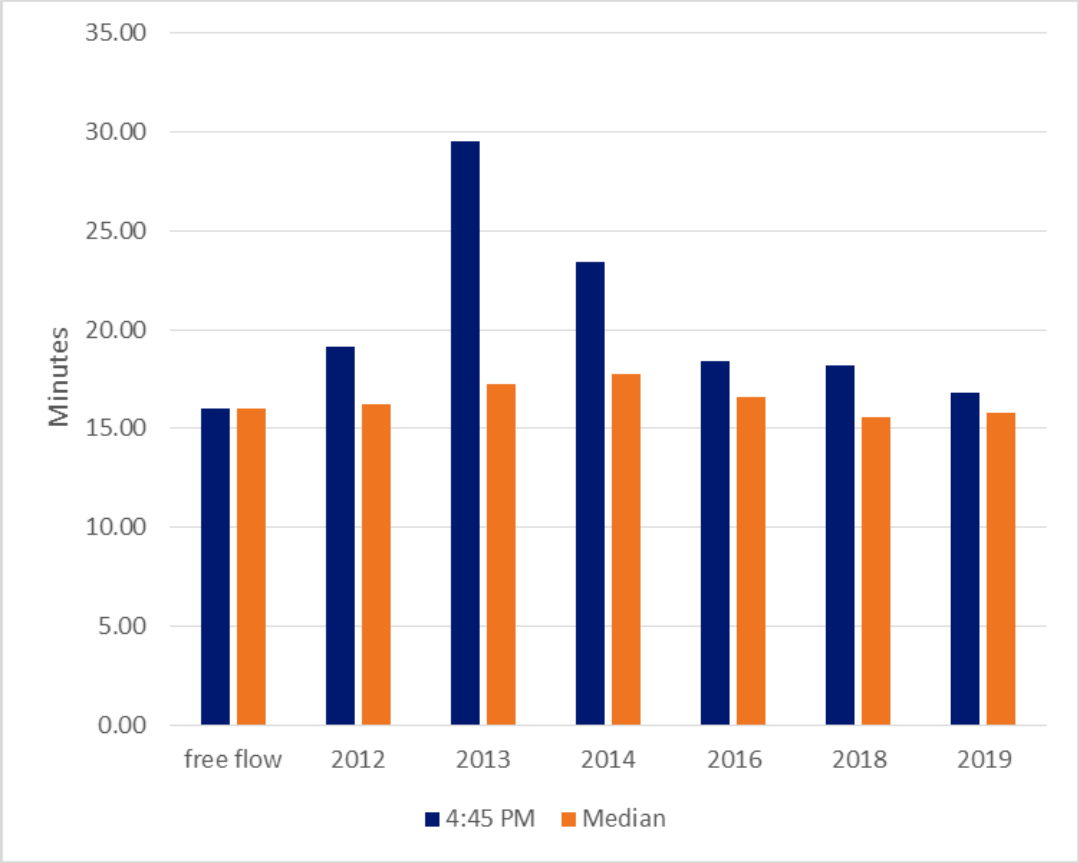

Figure 2. Travel Time for Eastbound I-70 from Empire Junction to Idaho Springs for July Sunday

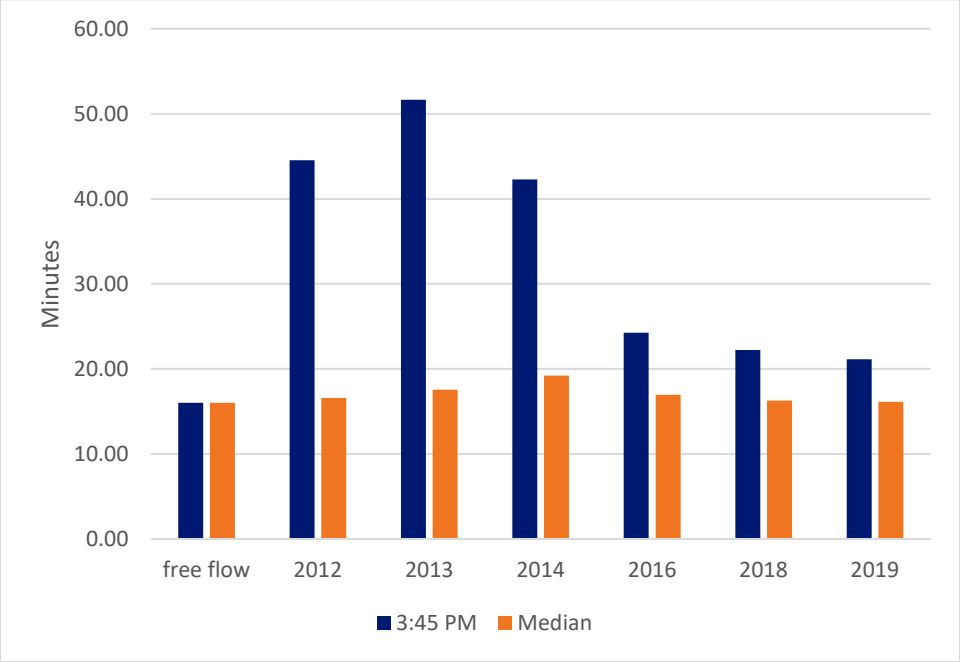

Figure 3. Travel Time for Eastbound I-70 from Empire Junction to Idaho Springs for January Saturday

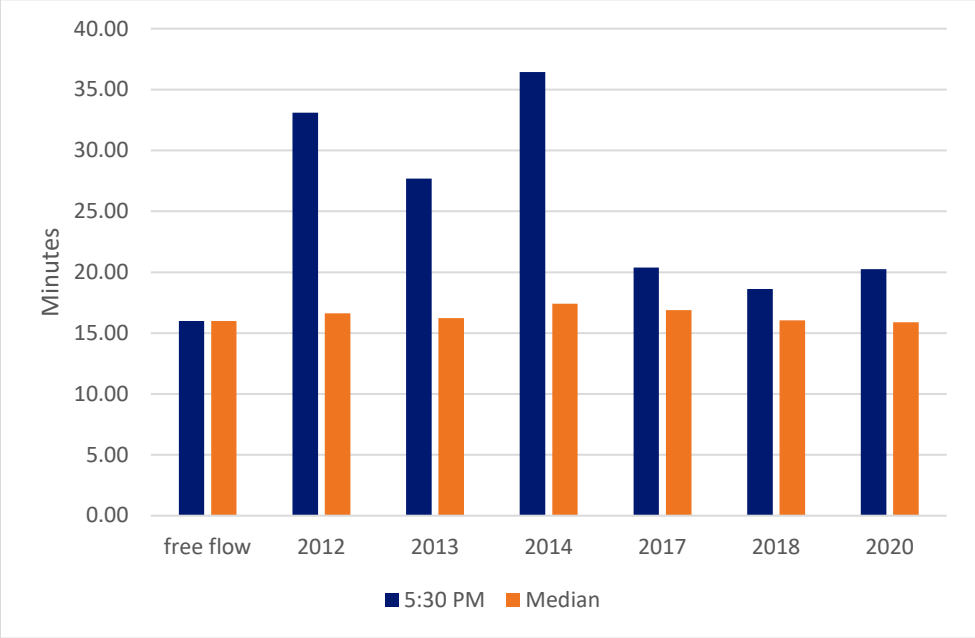

Figure 4. Travel Time for Eastbound I-70 from Empire Junction to Idaho Springs for January Sunday

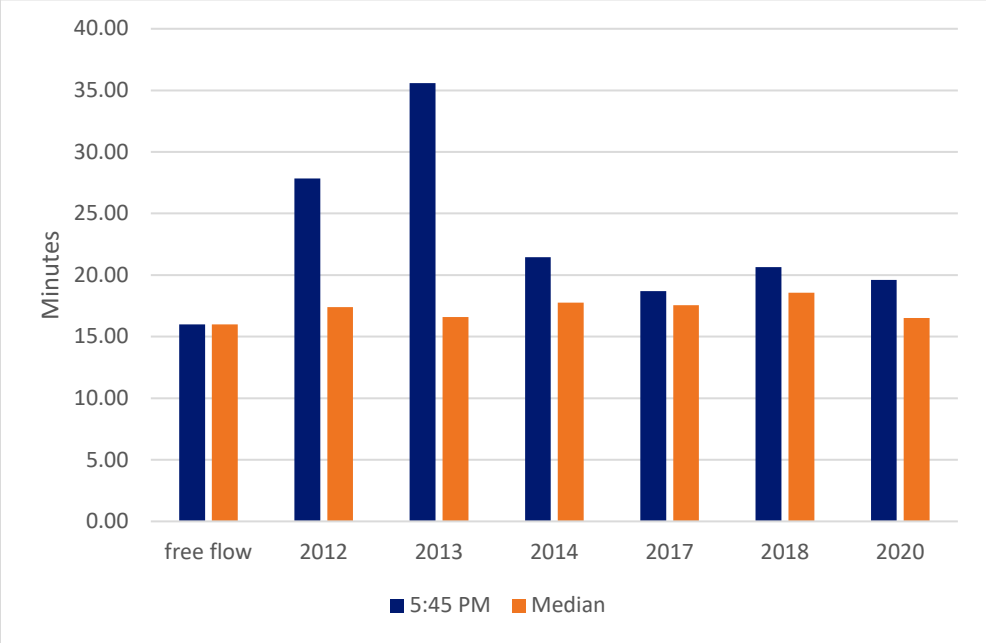

Figure 5. Travel Time for Eastbound I-70 from Empire Junction to Idaho Springs for February Saturday

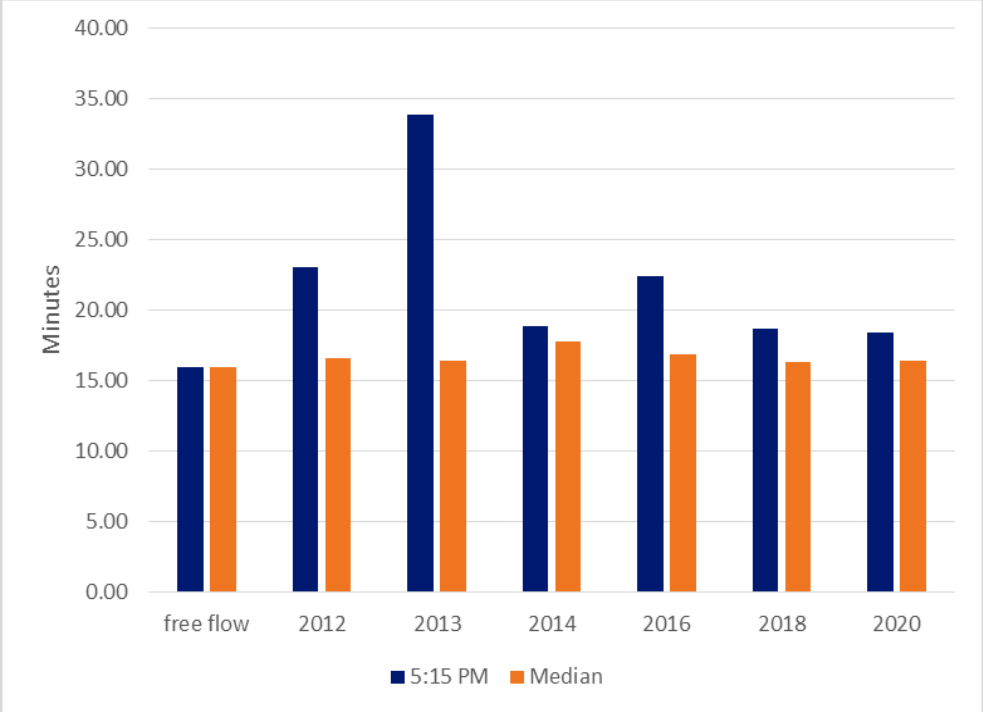

Figure 6. Travel Time for Eastbound I-70 from Empire to Idaho Springs for February Sunday

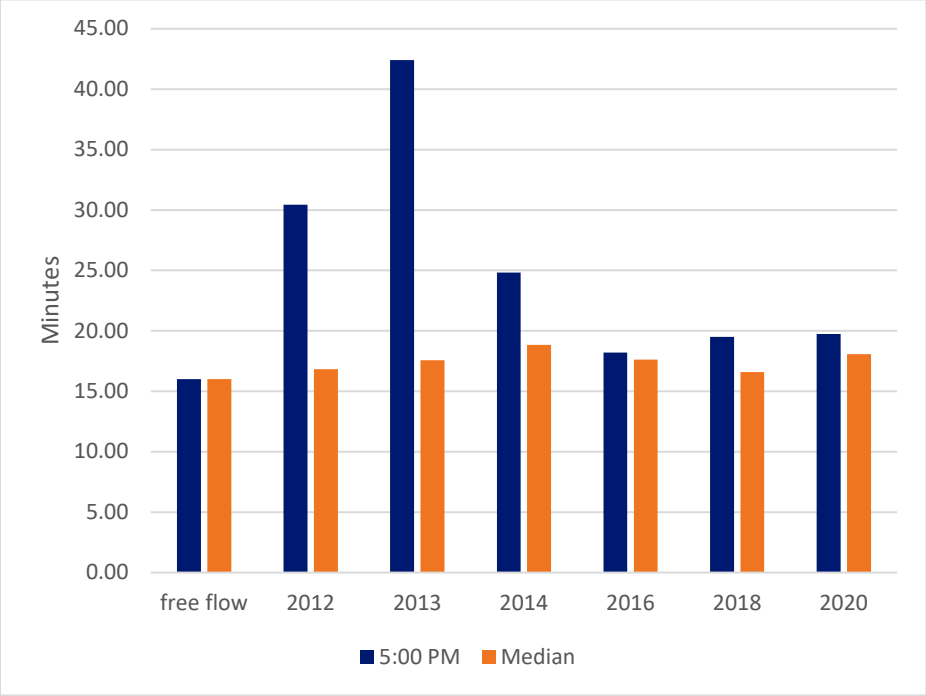

Figure 7. Travel Time for Eastbound I-70 from Empire Junction to Idaho Springs on Martin Luther King Day

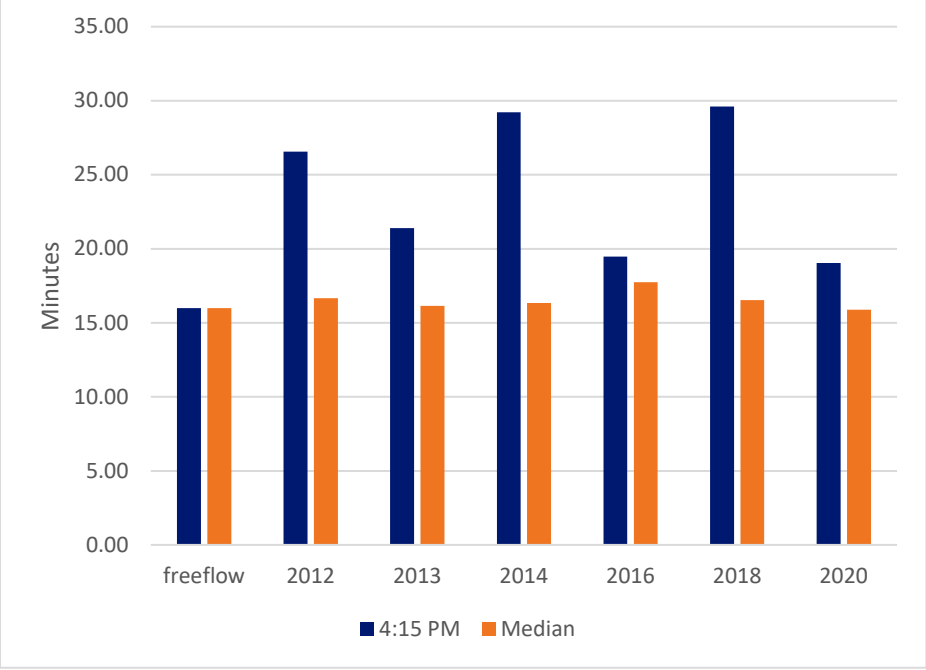

Figure 8. Travel Time for Eastbound I-70 from Empire Junction to Idaho Springs on Memorial Day

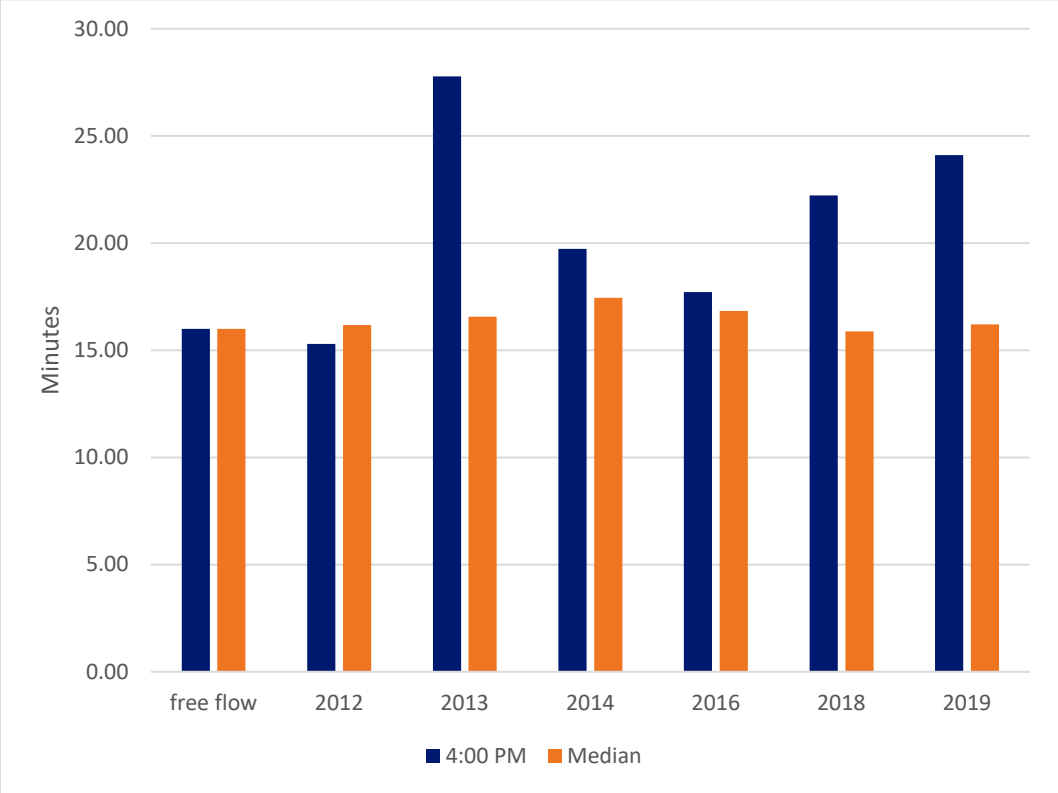

Table 3 shows the before and after crash statistics of the Eastbound MEXL. The key findings are that over the entire 12-mile MEXL corridor as a whole, crashes have increased slightly more than would have been expected without changes to the roadway over the time period.

However there is significant variation depending on the subsection of the MEXL corridor. Crashes have increased significantly in the western 5 miles of the corridor and this increase may be a product of substandard cross section elements and weaving associated with the US 40 entrance and express lane access combination. In the easternmost 2 mile subsection, crashes have decreased significantly and this decrease may be a product of the major geometric and cross section improvements that resulted from the Veterans Memorial Tunnel expansion project. Crashes in the middle 5-mile subsection increased slightly. This segment has substandard cross section elements but does not have any high-volume exit or entrance ramps or any legal access to the managed lane.

Table 3. Number of Crashes Before and After MEXL

Corridor Segment	Milepost Endpoints	Crash Type	Before 1/1/2009 - 12/31/2011	After 1/1/2016 - 12/31/2018
Entire MEXL Corridor	MP 231.75 – 243.57	PDO	276	258
		Injury	75	81
		Fatality	0	0
		TOTAL	**351**	**339**
Western Subsection	MP 231.75 – 236.62	PDO	70	123
		Injury	32	56
		Fatality	0	0
		TOTAL	**102**	**179**
Middle Subsection	MP 236.63 – 241.49	PDO	82	77
		Injury	14	18
		Fatality	0	0
		TOTAL	**96**	**93**
Eastern Subsection	MP 241.50 – 243.57	PDO	124	58
		Injury	29	9
		Fatality	0	0
		TOTAL	**153**	**67**

PDO = Property Damage Only
Source: CDOT R1 June 2020

SUMMARY OF FINDINGS

The representative data in Figure 1 through Figure 8 show the median travel time is typically slightly longer than or about the same as free flow time to travel between Empire Junction and Idaho Springs. The median time means that over the course of the day, half of the trips are longer than the median time, and half are shorter than the median time.

The mobility effectiveness of the Eastbound MEXL is evident by the data shown in Figure 1 through Figure 8 for the highest travel time, during the peak demand to travel to the Denver metropolitan area in the late afternoon. In general, before the MEXL was implemented, the travel time between Empire Junction and Idaho Springs ranged up to 35 or 40 minutes. After 2015, the average travel times during the peak demand dropped markedly, closer to 20 minutes. Some natural variations can be seen in the recorded data of the average daily patterns. This is particularly the case for the holidays of Martin Luther King Day (Figure 7) and

Memorial Day (Figure 8), which are one time slot snapshots for one day each year, instead of monthly averages as shown in Figure 1 through Figure 6.

The safety effectiveness of the Eastbound MEXL is ambiguous. For the whole 12 miles corridor, crashes have increased slightly more than would have been expected. The crash statistics differ by subsection. Crashes have notably risen in the westernmost 5-mile subsection, and risen slightly for the middle 5-mile subsection. However for the easternmost 2-mile subsection, crashes have significantly decreased, due to the geometric and cross-section improvements of adding a third eastbound lane between the Veterans Memorial Tunnels and the bottom of Floyd Hill.

ATTACHMENT A.

Non-Infrastructure Component: Bus, van, or shuttle service in mixed traffic—Bustang Transit Service

DRAFT - EFFECTIVENESS RATING OBSERVATIONS AND CALCULATIONS

Line #	Implemented Component	Effectiveness Observation (if available)	Annual Operating Cost (millions)	Calculated Quantitative Benefit							Qualitative Benefits
				Annual Bustang riders	Riders who would have been a driver	Time benefit as rider (hours)	Time saved per year not driving (hours)	Value of time ($/hour)	Dollar benefit per year	Effectiveness Rating	
2	Bus, van, or shuttle service in mixed traffic: Bustang	In 2019, Bustang ridership was over 70,000 passengers compared to just over 26,000 in 2016, representing a 170% increase. In 2018, Bustang averaged 3,050 riders a month throughout the Corridor.	$ 2.4	70,000	35,000	1	35,000	$ 22	$ 770,000		+ Serve riders who are unable to drive, or do not have access to a vehicle + Serve riders who do not desire to drive + Provide a mobility choice + Demonstrates need and demand for corridor transit service + Improved Air Quality

Effectiveness Rating:

High Effectiveness
Medium Effectiveness
Low Effectiveness

Sources and Assumptions

This is an initial broadbrush sketch analysis for planning discussion only. Further data and detailed technical analysis is needed

Bustang ridership: CDOT Division of Transit and Rail, 2020

Annual west line Operating cost FY2018-19 was $2.1M: CDOT Division of Transit and Rail, 2020

Startup capital costs for 5 motorcoaches, fareboxes, radios, routers, etc = $3.1M: CDOT Division of Transit and Rail, 2020 0.25833333

Assume bus life cycle of 12 years; annualized startup costs of $0.3m

Assume Bustang rider otherwise would have ridden in vehicles with an auto occupancy of 2

Assume average west line Bustang ride time of 2 hours; assume 1 hour is recovered by peronal vehicle driver who is now a passenger as benefit

Assume an average value of time - source I-70 Travel Demand Model, inflated to 2020 dollars. (weighted average of $22 work, $22 recreation, $13 non-work. Excludes truck)

Calculated Benefit excludes cost of fare

https://www.vtpi.org/tranben.pdf :

Table 38 **Transit Benefits** (Litman 2004)

Benefits	Description
User benefits	Increased convenience, speed and comfort to users from transit service improvements.
Congestion Reduction	Reduced traffic congestion.
Facility cost savings	Reduced road and parking facility costs.
Consumer savings	Reduced consumer transportation costs, including reduced vehicle operating and ownership costs.
Transport diversity	Improved transport options, particularly for non-drives.
Road safety	Reduced per capita traffic crash rates.
Environmental quality	Reduced pollution emissions and habitat degradation.
Efficient land use	More compact development, reduced sprawl.
Economic development	Increased productivity and agglomeration efficiencies.
Community cohesion	Positive interactions among people in a community.
Public health	Increased physical activity (particularly walking).

Evaluating Public Transit Benefits and Costs Best Practices Guidebook 6 April 2020 Todd Litman Victoria Transport Policy Institute

ATTACHMENT B.
Non-Infrastructure Component: Expanded Use of Existing Infrastructure—Eastbound Mountain Express Lane (MEXL)

DRAFT - EFFECTIVENESS RATING OBSERVATIONS AND CALCULATIONS

Line #	Implemented Component	Effectiveness Observation (if available)	Cost (millions)	Calculated Quantitative Benefit									Effectiveness Rating	Qualitative Benefits
				Weekend Daily EB Volume at VMT	Weekend Daily EB Person Trips at VMT	Weekend Peak Period EB Person Trips	Median travel time decrease (minutes)	Peak Period travel time decrease (minutes)	Days per year	Time saved per year (hours)	Assumed Value of time ($/hour)	Dollar savings per year (millions)		
5	Expanded Use of Existing Infrastructure: Eastbound Mountain Express Lane (MEXL)	The EB MEXL diverts 750 to 900 cars from the free general-purpose lanes. This alleviates traffic congestion in the Express Lane, and decreases congestion in general-purpose lanes and frontage roads travel time savings. Travel times have improved. For example, on July Sundays 2012-2014, eastbound travel time averaged 42 to 51 minutes. On July Sundays 2016-2018, travel time averaged 21 to 24 minutes.	$ 68	35,000	77,000	7,700	0.75	10	88	214,958	$ 24	$ 5.2		+ Improved Travel Time + Improved Quality of Life + Increased Economic Activity + Improved Emergency Response Access + Improved Air Quality

Effectiveness Rating:
- High Effectiveness
- Medium Effectiveness
- Low Effectiveness

Sources and Assumptions:
This is an initial broadbrush sketch analysis for planning discussion only. Further data and detailed technical analysis is needed.

Assume 35,000 EB ADT (1/2 of 70,000 Weekend ADT)

Assume 10% of weekend traffic during the peak period

Assume 2.2 Auto occupancy at VMT Twin Tunnels (PEIS Transportation Analysis Tech Report)

Assume median travel time savings 0.75 minutes and pk period savings July Sundays 2012-2014, eb travel time averaged 42 to 51 minutes. On July Sundays 2016-2018, travel time averaged 21 to 24 min.46 minus 22 = 24, round down to 20. (source: INRIX analysis)

Note travel time includes travel time effect of widening to three lanes on eastbound I-70 from VMT Twin Tunnels to Floyd Hill. Assume 50% due to MEXL. 20 minutes / 2 = 10 minutes

Assume 88 days of operation (44 weekends)

Assume $24 for average value of time - source I-70 Travel Demand Model, by trip purpose, inflated to 2020 dollars. (weighted average of $22 work, $22 recreation, $13 non-work, and $82 truck trip purpose)

Assume life cycle of 20 years

Project Cost $68 million (CDOT)

	Station ID	Location	Winter Saturday ADT	Summer Thursday ADT	Summer Friday ADT	Summer Saturday ADT	Summer Sunday ADT
2019 ADT	000120	Twin Tunnels	70,236	58,860	75,442	79,730	81,147

ATTACHMENT C.

Highway Improvements (Specific Highway Improvements): 6-lane component from Floyd Hill through the Veterans Memorial Tunnels (MP 243 to MP247) including a bike trail and frontage roads from Idaho Springs to Hidden Valley and Hidden Valley to US 6

DRAFT - EFFECTIVENESS RATING OBSERVATIONS AND CALCULATIONS

Line #	Implemented Component	Effectiveness Observation (if available)	Cost (millions)	Calculated Quantitative Benefit									Effectiveness Rating	Qualitative Benefits
				Weekend Daily EB Volume at VMT	Weekend Daily EB Person Trips at VMT	Weekend Peak Period Person Trips	Median travel time decrease (minutes)	Peak Period travel time decrease (minutes)	Days per year	Time saved per year (hours)	Assumed Value of time ($/hour)	Dollar savings per year (millions)		
15	6 lane component from Floyd Hill through the Twin Tunnels (MP 243 to MP247) including a bike trail and frontage roads from Idaho Springs to Hidden Valley and Hidden Valley to US 6	The 3-lane project completed to date has improved safety: an average of 43 crashes per year from 2006 to 2010 , eastbound from Twin Tunnels to base of Floyd Hill. After eastbound tunnel third lane project, an average of 21 crashes per year , from 2015 to 2016.	$ 73	35,000	77,000	7,700	0.75	10	88	214,958	$ 24	$ 5.2		+ Improved Travel Time + Improved Safety + Improved Quality of Life + Increased Economic Activity + Improved Emergency Response Access + Improved Air Quality

Line #	Implemented Component	Effectiveness Observation (if available)	Cost (millions)	Calculated Quantitative Benefit									Effectiveness Rating	Qualitative Benefits
				Crashes per Year Prior to Project	Crashes per Year Post Project	Reduction in Crashes Attributable to Project	Weighted Average Cost per crash					Dollar savings per year (millions)		
15	6 lane component from Floyd Hill through the Twin Tunnels (MP 243 to MP247) including a bike trail and frontage roads from Idaho Springs to Hidden Valley and Hidden Valley to US 6	The 3-lane project completed to date has improved safety: an average of 43 crashes per year from 2006 to 2010 , eastbound from Twin Tunnels to base of Floyd Hill. After eastbound tunnel third lane project, an average of 21 crashes per year , from 2015 to 2016.	$ 73	43	21	16.5	$8,000					$0.1		+ Improved Travel Time + Improved Safety + Improved Quality of Life + Increased Economic Activity + Improved Emergency Response Access + Improved Air Quality

Effectiveness Rating:

High Effectiveness
Medium Effectiveness
Low Effectiveness

Sources and Assumptions:
This is an initial broadbrush sketch analysis for planning discussion only. Further data and detailed technical analysis is needed.

Assume 35,000 EB ADT (1/2 of 70,000 Weekend ADT)
Assume 10% of weekend traffic during the peak period
Assume 2.2 Auto occupancy at VMT Twin Tunnels (PEIS Transportation Analysis Tech Report)

Assume median travel time savings 0.75 minutes and pk period savings July Sundays 2012-2014, eb travel time averaged 42 to 51 minutes. On July Sundays 2016-2018, travel time averaged 21 to 24 min.46 minus 22 = 24, round down to 20. (source: INRIX analysis)

Note travel time includes travel time effect of MEXL. Assume 50% due to widening to three lanes on eastbound I-70 from VMT Twin Tunnels to Floyd Hill. 20 minutes / 2 = 10 minutes
Assume 88 days of operation (44 weekends)
Assume an average value of time - source I-70 Travel Demand Model, by trip purpose, inflated to 2020 dollars. (weighted average of $22 work, $22 recreation, $13 non-work, and $82 truck trip purpose)
Assume life cycle of 20 years
Project Cost Twin Tunnels = 145 M (EB 55M, WB 54M, Design/Other packages 36M (CDOT)). Assume $55m + 1/2 of $36m = $73m
Assume 75% of reduced crashes are attributable to project. Other factors that can contribute to reducing crash patterns include changes in traffic volume and fleet mix, driver behavior, enforcement, and corridor management (e.g. plowing policies, preemptive closures, law changes, etc.).

Project completed 2014	Crash History			2011-2013		
	2006-2010	2015-2016		Assumed Split	Cost per crash (National Safety Council nsc.org)	
MP 242 to MP 244			Property Damage Only	99	PDO	$4,500
crashes per year	43.0	21	Injury	1	Disabling injury	$96,000
Safety Assessment I-70 Twin Tunnels 2011				15	Evident/possible Inj	$25,000
Safety Assessment I-70 Recon/Widening 2018			Fatality	0	Fatality	$1,660,000
			Total	115		
					wtd average	$ 7,970

ATTACHMENT D.

Highway Improvements (Specific Highway Improvements): Eastbound auxiliary lane from Eisenhower-Johnson Memorial Tunnels to Herman Gulch (MP 215 to MP 218)

DRAFT - EFFECTIVENESS RATING OBSERVATIONS AND CALCULATIONS

Line #	Implemented Component	Effectiveness Observation (if available)	Cost (millions)	Calculated Quantitative Benefit						Qualitative Benefits
				Crashes per Year Prior to Project	Crashes per Year Post Project	Reduction in Crashes Attributable to Project	Weighted Average Cost per crash	Dollar savings per year (millions)	Effectiveness Rating	
17	Eastbound auxiliary lane from Eisenhower-Johnson Memorial Tunnels to Herman Gulch (MP 215 - MP 218)	2011-2018 data indicates an improvement in crash history. The extension of the auxiliary lane at US-6 together with implementation of the mainline metering along EB I-70, east of the Silverthorne/Dillon interchange, has eased some of the safety concerns in this location.	$ 4	26	16	5	$9,800	**$ 0.05**		+ Improved Safety + Improved Travel Time + Improved Emergency Response Access + Improved Air Quality

Effectiveness Rating:

High Effectiveness
Medium Effectiveness
Low Effectiveness

Sources and Assumptions:

This is an initial broadbrush sketch analysis for planning discussion only. Further data and detailed technical analysis is needed.

Project Cost $4 million.

Assume life cycle of 20 years

Assume 50% of reduced crashes are attributable to project. Other factors that can contribute to reducing crash patterns include changes in traffic volume and fleet mix, driver behavior, enforcement, and corridor management (e.g. plowing policies, preemptive closures, law changes, etc.).

Project completed 2016	Crash History					
	2011-2015	2017-2018		Assumed Split	Cost per crash (National Safety Council nsc.org)	
MP 216.5 to MP 218						
Property Damage Only	101	25		101	PDO	$4,500
Injury	31	7		1	Disabling injury	$96,000
				30	Evident/possible Inj	$25,000
Fatality	0			0	Fatality	$1,660,000
Total	132	32		132		
years	5	2			wtd average	$ 9,852
crashes per year	26.4	16				

ATTACHMENT E.

Highway Improvements (Other Highway Improvements): Safety improvements west of Wolcott

DRAFT - EFFECTIVENESS RATING OBSERVATIONS AND CALCULATIONS

Line #	Implemented Component	Effectiveness Observation (if available)	Cost (millions)	Calculated Quantitative Benefit					Effectiveness Rating	Qualitative Benefits
				Crashes per Year Prior to Project	Assumed Crashes per Year Post Project	Reduction in Crashes Attributable to Project	Weighted Average Cost per crash	Dollar savings per year (millions)		
20	Safety improvements west of Wolcott	2011-2018 data indicates an improvement in crash history, compared to 2001-2005. The curve correction may have alleviated safety issues at Wolcott	$ 0.5	11	9	1.0	$ 14,700	**$ 0.01**		+ Improved Safety

Effectiveness Rating:

High Effectiveness
Medium Effectiveness
Low Effectiveness

Sources and Assumptions:
This is an initial broadbrush sketch analysis for planning discussion only. Further data and detailed technical analysis is needed.

Assume life cycle of 20 years
Assume 50% of reduced crashes are attributable to project. Other factors that can contribute to reducing crash patterns include changes in traffic volume and fleet mix, driver behavior, enforcement, and corridor management (e.g. plowing policies, preemptive closures, law changes, etc.).
Cost: included in repaving project. Assume $500,000

Project completed 2013	Crash History					
	2011- 2012	2014-2018		Assumed Split	Cost per crash (National Safety Council nsc.org)	
MP 154.5 to MP 156						
Property Damage Only	14	35		14	PDO	$4,500
Injury	7	11		1	Disabling injury	$96,000
				6	Evident/possible Inj	$25,000
Fatality	1			0	Fatality	$1,660,000
Total	22	46		21		
years	2	5			wtd average	$ 14,714
crashes per year	11	9.2				

ATTACHMENT F.

Highway Improvements (Interchange Improvements): Edwards and Spur Road (MP 163). Phase 1 of the project—completed in 2011—made improvements to the northern half of the Spur Road, including four new roundabouts and improved connections with the I-70 on- and off-ramps.

DRAFT - EFFECTIVENESS RATING OBSERVATIONS AND CALCULATIONS

Line #	Implemented Component	Effectiveness Observation (if available)	Cost (millions)	Calculated Quantitative Benefit					Effectiveness Rating	Qualitative Benefits
				Crashes per Year Prior to Project	Crashes per Year Post Project	Reduction in Crashes Attributable to Project	Weighted Average Cost per crash	Dollar savings per year (millions)		
27	Edwards and Spur Road (MP 163). Phase 1 of the project—completed in 2011—made improvements to the northern half of the Spur Road, including four new roundabouts and improved connections with the I-70 on- and off-ramps.		$ 9.5	4	2	2	$ 22,000	**$ 0.04**		+ Improved Safety + Improved Emergency Response Access

Effectiveness Rating:

High Effectiveness
Medium Effectiveness
Low Effectiveness

Sources and Assumptions:
This is an initial broadbrush sketch analysis for planning discussion only. Further data and detailed technical analysis is needed.

https://safety.fhwa.dot.gov/provencountermeasures/roundabouts/

Safety effectiveness: FHWA's safety website notes that roundabouts reduce crashes that cause severe injuries or death by 82% over two way stop control and 78% over signalized intersections.

Assume life cycle of 20 years

Phase 1 Cost $9.5 million (CDOT)

Project completed 2011	Crash History						
	Calculated back history*	2012-2018		Assumed Split	Cost per crash (National Safety Council nsc.org)		
MP 162.3 - MP 163.3							
Property Damage Only	12.0	12		12.0	PDO		$4,500
Injury	18.2	4		2.0	Disabling injury		$96,000
				16	Evident/possible Inj		$25,000
Fatality					Fatality		$1,660,000
Total	30.2	16		30			
years	7	7				wtd average	$ 21,533
crashes per year	4.3	2.3					

* Crash data not immediately available prior to 2011; calculate prior crashes based on roundabout crash reduction factor of 78% from FHWA
Assume 100% of reduced crashes are attributable to project

ATTACHMENT 4
Preferred Alternative Tracking Sheet

Preferred Alternative Minimum Program of Improvements - Status of Implementation

(The components of the Preferred Alternative Maximum Program have not been implemented and therefore are not listed)

Line #	Preferred Alternative Item	Completion Date	Completed Actions *	Work in Progress / Ongoing**	Effectiveness Rating		Recommended Level of Effort (Step 4 Activity)
					Mobility	Safety	
	Non-Infrastructure Related						
1	Increased Enforcement			For the MEXL, the Colorado State Patrol (CSP) increased safety enforcement in 2019 with troopers on overtime along the eastbound mountain express lane from Empire to Idaho Springs to help decrease unsafe driving behavior and increase efficiency. Overall, each CSP troop defines goals and objectives to reduce crashes and save lives. Troop 1A picked the lower end of I-70 as a primary targeted roadway. The troop is using a targeted saturation methodology with team operations, using multiple troopers.	Unknown	Unknown	Continue with Current Level of Effort
2	Bus, van, or shuttle service in mixed traffic			Ski shuttles continue to serve the corridor. Bustang service, which began in 2015, provides daily trips to and from corridor communities and Denver, but does not serve peak direction recreational trips at peak demand. Snowstang service, initially piloted in 2017, was launched in 2019 to three resorts.	See separate table	Unknown	More Effort Needed

High Effectiveness
Medium Effectiveness
Low Effectiveness

Needs to be Initiated
Continue with Current Level of Effort
More Effort Needed
Reduce Effort
SPLIT: Current Level of Effort and More Effort

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3	Programs for improving truck movements			Revisions to the traction and chain laws to improve safety and operations; Off-corridor staging areas for trucks during adverse weather events; Variable speed limits in Glenwood Canyon; Remote continuous flow metering at Silverthorne to improve truck traction approaching the tunnel eastbound; Active Corridor Management. Colorado Motor Carriers Association (CMCA) programs include public service announcements (PSAs) on chain awareness, providing a best practices document, and working with trucking firms that are repeat offenders.	(Based on limited data and group discussion)	(Based on limited data and group discussion)	More Effort Needed
4	Driver education			GoI-70.com shares news and other articles that help educate drivers on traveling through the I-70 Mountain Corridor. Topics include: Available transit and carpool services, real-time information sources, Colorado Traction Laws, Tire Checks, Move it Law, Move Over Law, Left Lane Law and Avalanche Activity. Additional outreach to travelers is done through the blog, social media, eBlasts and extensive partner outreach. CMCA has produced an audio guide for truckers to safely drive the I-70 Mountain Corridor, by milepost	(Based on limited data and group discussion)	(Based on limited data and group discussion)	More Effort Needed

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5	Expanded use of existing transportation infrastructure in and adjacent to the corridor	Dec. 2015	Eastbound Mountain Express Lane (MEXL) project opened in December 2015. Updated each county's Traffic Incident Management Plans Active corridor management has been implemented, including creation of a full-time corridor operations manager Ramp meters have been installed throughout much of the corridor.	Westbound MEXL project under construction, opening projected for 2021.	See separate table	(Based on limited data and group discussion)	Continue with Current Level of Effort
6	Use of technology advancements and improvements to increase mobility without additional infrastructure			Technological advancements without the addition of infrastructure include: Electronic Signage, Intelligent Transportation System and Vehicle to Infrastructure (V2X) Data Ecosystem. CDOT is currently testing V2X throughout the corridor. CoTrip.org and GovDelivery/Travel Alerts have been improved in recent years.	(Based on limited data and group discussion)	(Based on limited data and group discussion)	More Effort Needed
7	Traveler information and other information technology systems			Traveler information is shared via Intelligent Transportation System; CoTrip; Variable Message Signs (VMS);CDOT Alert Texts; CDOT email alerts	(Based on limited data and group discussion)	(Based on limited data and group discussion)	More Effort Needed

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8	Shift passenger and freight travel demand by time of day and day of week			The most popular feature of GoI70.com is the weekend travel forecast which is intended to shift passenger travel demand by time of day and day of week. Over 150 dining and lodging businesses along the I-70 Mountain Corridor offer deals to encourage drivers to avoid peak travel times. Examples include: $2 tacos from 4-6pm on Saturdays and Sundays at Twist; 20% off activities at Lawson Adventure Park Saturday & Sunday 4pm- close.	(Based on limited data and group discussion)	(Based on limited data and group discussion)	More Effort Needed
9	Convert day trips to overnight stays			GoI70.com Peak Time Deals worked with the lodging community to create Sunday Night Stay promotions. These are posted on the Peak Time Deals and promoted frequently through GoI70 blogs, eBlasts, social posts and stakeholder outreach. Examples include: $125 Sunday night at the Sitzmark Lodge in Vail; 20% off a Sunday night stay at the Wedgewood Lodge in Breckenridge	(Based on limited data and group discussion)	(Based on limited data and group discussion)	Continue with Current Level of Effort

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10	Convert single occupancy vehicle commuters to high occupancy travel and/or public transportation			Transit promotion incentives include traveling in groups to receive discounted fares. Resorts are offering incentives to carpool by promoting reduced or free parking as well as discounted lift tickets for groups that travel together. For example, Keystone, Breckenridge, Copper Mountain and Arapahoe Basin have carpool parking incentive programs, offering discounted parking, close-in parking or discounted lift tickets. Summit express airport shuttle offers a savings of $12 per person Transit promotion incentives include traveling in groups to receive discounted fares. Resorts are offering incentives to carpool by promoting reduced or free parking as well as discounted lift tickets for groups that travel together. For example, Keystone, Breckenridge, Copper Mountain and Arapahoe Basin have carpool parking incentive programs, offering discounted parking, close-in parking or discounted lift tickets. Summit express airport shuttle offers a savings of $12 per person when traveling with 3 or more passengers.	(Based on limited data and group discussion)	(Based on limited data and group discussion)	More Effort Needed
11	Implement transit promotion incentives			Transit promotion incentives include traveling in groups to receive discounted fares. Resorts are incentivizing carpooling by offering reduced or free parking as well as discounted lift tickets. Summit Express airport shuttle offers a savings of $12 per person when traveling with 3 or more passengers. For example, Loveland Ski Area and Arapahoe Basin offered lift ticket discounts for Front Range Ski Bus riders. Arapahoe Basin offered food and beverage vouchers for Snowstang riders. Some airport shuttles offer discounts through GoI70 Peak Time Deals.	(Based on limited data and group discussion)	(Based on limited data and group discussion)	More Effort Needed

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12	Other transportation demand management measures to be determined			I-70 Coalition frequently communicates transportation demand management messages and strategies with partners who are encouraged to 'share' with their network and customers. Partners include resorts, local government public information officers (PIOs), Information/Welcome Centers, resort associations, property managers, lodging sector, destination marketing organizations and chambers of commerce. I-70 Coalition created and piloted the Why Drive? Campaign in coordination with the lodging sector to promote transportation alternatives to mountain visitors. Since 2012, I-70 Coalition has undertaken a bi-annual research study program. These surveys inform how existing travel resources and programs are being received and utilized by the traveling public and how they might be improved.	(Based on limited data and group discussion)	(Based on limited data and group discussion)	More Effort Needed
	Advanced Guideway System						
13	Feasibility of high speed rail passenger service			AGS Feasibility Study (August 2014)	Incomplete	Incomplete	More Effort Needed
a	Potential station locations and local land use considerations			AGS Feasibility Study (August 2014)	Incomplete	Incomplete	More Effort Needed
b	Transit governance authority			AGS Feasibility Study (August 2014)	Incomplete	Incomplete	SPLIT: Current Level of Effort and More Effort Needed
c	Alignment			AGS Feasibility Study (August 2014)	Incomplete	Incomplete	
d	Technology			AGS Feasibility Study (August 2014)	Incomplete	Incomplete	More Effort Needed
e	Termini			AGS Feasibility Study (August 2014)	Incomplete	Incomplete	SPLIT: Current Level of Effort and More Effort Needed
f	Funding requirements and sources			AGS Feasibility Study (August 2014)	Incomplete	Incomplete	

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g	Transit ridership			AGS Feasibility Study (August 2014), Interregional Connectivity Study (January 2014), & Economic Impact of High-Speed Transit in the Mountain Corridor (July 2019)	Incomplete	Incomplete	More Effort Needed
h	Potential system owner/operator				Incomplete	Incomplete	More Effort Needed
i	Interface with existing and future transit systems			AGS Feasibility Study (August 2014) & Interregional Connectivity Study (January 2014)	Incomplete	Incomplete	More Effort Needed
j	Role of an Advanced Guideway System in freight delivery both in and through the corridor				Incomplete	Incomplete	More Effort Needed
14	Functioning AGS				Incomplete	Incomplete	More Effort Needed
	Highway Improvements						
	Specific Highway improvements						
15	6 lane component from Floyd Hill through the Twin Tunnels (MP 243 to MP247) including a bike trail and frontage roads from Idaho Springs to Hidden Valley and Hidden Valley to US 6	Dec. 2014, Sept 2015, and TBD	Eastbound tunnel widened to 3 lanes; Westbound tunnel was widened to accommodate three lanes in the future; Frontage road and bike trail between Game Check area and Hidden Valley.	Environmental Assessment and preliminary engineering is underway for westbound I-70 from east of the Floyd Hill/Beaver Brook Exit (248) to Idaho Springs Exit (241) A Categorical Exclusion is underway for improvements to CR 314 between the Game Check trailhead and the City of Idaho Springs baseball fields.	See separate table	See separate table	More Effort Needed
16	Empire Junction (US 40 and I-70) interchange improvements (MP 232)				Incomplete	Incomplete	Continue with Current Level of Effort

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17	Eastbound auxiliary lane from Eisenhower-Johnson Memorial Tunnels to Herman Gulch (MP 215 - MP 218)	2016	The auxiliary lane ends at approximately 217.5, a half mile west of the Herman Gulch Interchange. The Project did not extend entirely to Herman Gulch to limit environmental impacts. CE agreement on project limits.		Unknown	See separate table	Continue with Current Level of Effort
18	Westbound auxiliary lane from Bakerville to Eisenhower-Johnson Memorial Tunnels (MP 215 to MP 221)				Incomplete	Incomplete	More Effort Needed
	Other Highway Improvements						
19	Truck operation improvements, such as pullouts, parking, and chain stations	2015, 2016, and In Progress	The completed eastbound PPSL project constructed two pull outs for emergency refuge in December 2015. East Vail chain station was expanded in 2016.	7 new safety pullouts will be constructed as part of the westbound PPSL project. 5 new pullouts will be constructed in the westbound direction and 2 new pullouts in the eastbound direction.	(Based on limited data and group discussion)	(Based on limited data and group discussion)	Continue with Current Level of Effort
20	Safety improvements west of Wolcott	2013	Super-elevation curve correction through Wolcott		Unknown	See separate table	Continue with Current Level of Effort
21	Safety and capacity improvements in Dowd Canyon	2019	Eastbound on-ramp plus taper has been extended by approximately 500' as a safety improvement.	Planning has started; currently on hold pending the results of a Bridge Enterprise inspection project. CDOT Region 3 will reassess the project in early 2020.	Incomplete	Incomplete	Continue with Current Level of Effort

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	Interchange Improvements at:						
22	Glenwood Springs (MP 116)	Dec. 2018	Interchange improvements were constructed as part of the Grand Avenue Bridge (GAB) Project. Interchange improvements include: Lengthened on/off ramps, increased vehicle storage, new signals, new pedestrian underpass, and a new configuration of the interchange for the newly realigned Grand Avenue bridge		(Based on limited data and group discussion)	Unknown	Continue with Current Level of Effort
23	Gypsum (MP 140)				Incomplete	Incomplete	Continue with Current Level of Effort
24	Eagle County Airport				Incomplete	Incomplete	Continue with Current Level of Effort
25	Wolcott (MP 157)				Incomplete	Incomplete	Continue with Current Level of Effort
26	Eagle and Spur Road (MP 147)	2015	Roundabouts were incorporated into the interchange to remove the traffic lights. Also a pedestrian bridge over I-70 was installed, pedestrian circulation in general was improved, and better access from a park-and-ride to a bus stop which was improved for safety.		Unknown	Unknown	Continue with Current Level of Effort

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27	Edwards and Spur Road (MP 163)	2011- Phase 1, 2020- Phase 2	Phase 1 of the project—completed in 2011—made improvements to the northern half of the Spur Road, including four new roundabouts and improved connections with the I-70 on- and off-ramps.	Phase 2 is currently underway and includes design improvements to the southern half of the Edwards Spur Road - a distance of approximately 0.4 miles. Phase 2 included improved safety features such as widening roads and bridges, improved sight distances at intersections. The project added refuge islands large enough to accommodate bicycles and trailers at the roundabout. It also added Rectangular Rapid Flashing Beacons for crosswalks at the roundabout. For recreation use, the project added separated pedestrian trails and bridges as well as added bike lanes to the roadway system.	Unknown	See separate table	Continue with Current Level of Effort
28	Avon (MP 167)				Incomplete	Incomplete	Continue with Current Level of Effort
29	Minturn (MP 171)	Fall 2019	Eastbound on-ramp plus taper has been extended by approximately 500' as a safety improvement.	Planning has started; currently on hold pending the results of a Bridge Enterprise inspection project. CDOT Region 3 will reassess the project in early 2020.	Unknown	Unknown	Continue with Current Level of Effort
30	Vail West (MP 173)/Simba Run				Incomplete	Incomplete	Continue with Current Level of Effort
31	Vail (MP 176)				Incomplete	Incomplete	Continue with Current Level of Effort
32	Vail East (MP 180)				Incomplete	Incomplete	Continue with Current Level of Effort
33	Vail Pass (East Shrine Pass Road - MP 190)				Incomplete	Incomplete	Continue with Current Level of Effort
34	Copper Mountain (MP 195)				Incomplete	Incomplete	Continue with Current Level of Effort
35	Frisco / Main Street (MP 201)				Incomplete	Incomplete	Continue with Current Level of Effort
36	Frisco / SH9 (MP 203)			Currently working on traffic analysis, operational analysis and design concepts	Incomplete	Incomplete	Continue with Current Level of Effort

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37	Silverthorne (MP 205)			I-70 Silverthorne/Dillon Interchange Study has been completed	Incomplete	Incomplete	Continue with Current Level of Effort
38	Loveland Pass (MP 216)				Incomplete	Incomplete	Continue with Current Level of Effort
39	Georgetown (MP 228)	2012	Added roundabout serving interchange access road		Unknown	Unknown	Continue with Current Level of Effort
40	Downieville (MP 234)				Incomplete	Incomplete	Continue with Current Level of Effort
41	Fall River Road (MP 238)				Incomplete	Incomplete	Continue with Current Level of Effort
42	Base of Floyd Hill / US 6 (MP 244)			Element of the Floyd Hill Project - Environmental Assessment in Progress	Incomplete	Incomplete	SPLIT: Current Level of Effort and More Effort Needed
43	Hyland Hills (MP 247)			Element of the Floyd Hill Project - Environmental Assessment in Progress	Incomplete	Incomplete	
44	Beaver Brook (MP 248)			Element of the Floyd Hill Project - Environmental Assessment in Progress	Incomplete	Incomplete	Continue with Current Level of Effort
45	Evergreen Parkway / SH 74 (MP 252)				Incomplete	Incomplete	Continue with Current Level of Effort
46	Lookout Mountain (MP 256)				Incomplete	Incomplete	Continue with Current Level of Effort
47	Morrison (MP 259)				Incomplete	Incomplete	Continue with Current Level of Effort
	Auxiliary lanes						
48	Avon to Post blvd. (Exit 168)				Incomplete	Incomplete	Continue with Current Level of Effort
49	West side of Vail Pass (eastbound and westbound)			Environmental Assessment and conceptual design for safety improvements are underway. Design and construction can follow as funding becomes available.	Incomplete	Incomplete	Continue with Current Level of Effort
50	Frisco to Silverthorne (eastbound)			Currently working on traffic analysis, operational analysis and design concepts. Roadway and feasibility studies are underway as well as environmental research.	Incomplete	Incomplete	Continue with Current Level of Effort

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51	Morrison to Chief Hosa (westbound)				Incomplete	Incomplete	SPLIT: Current Level of Effort and More Effort Needed
			***Completed refers to a project that has been finished with a completion date**	****In progress refers to a project that is in planning or construction**			