Colorado Express Lane Master Plan

FINAL REPORT - FEBRUARY 2020

COLORADO HPTE
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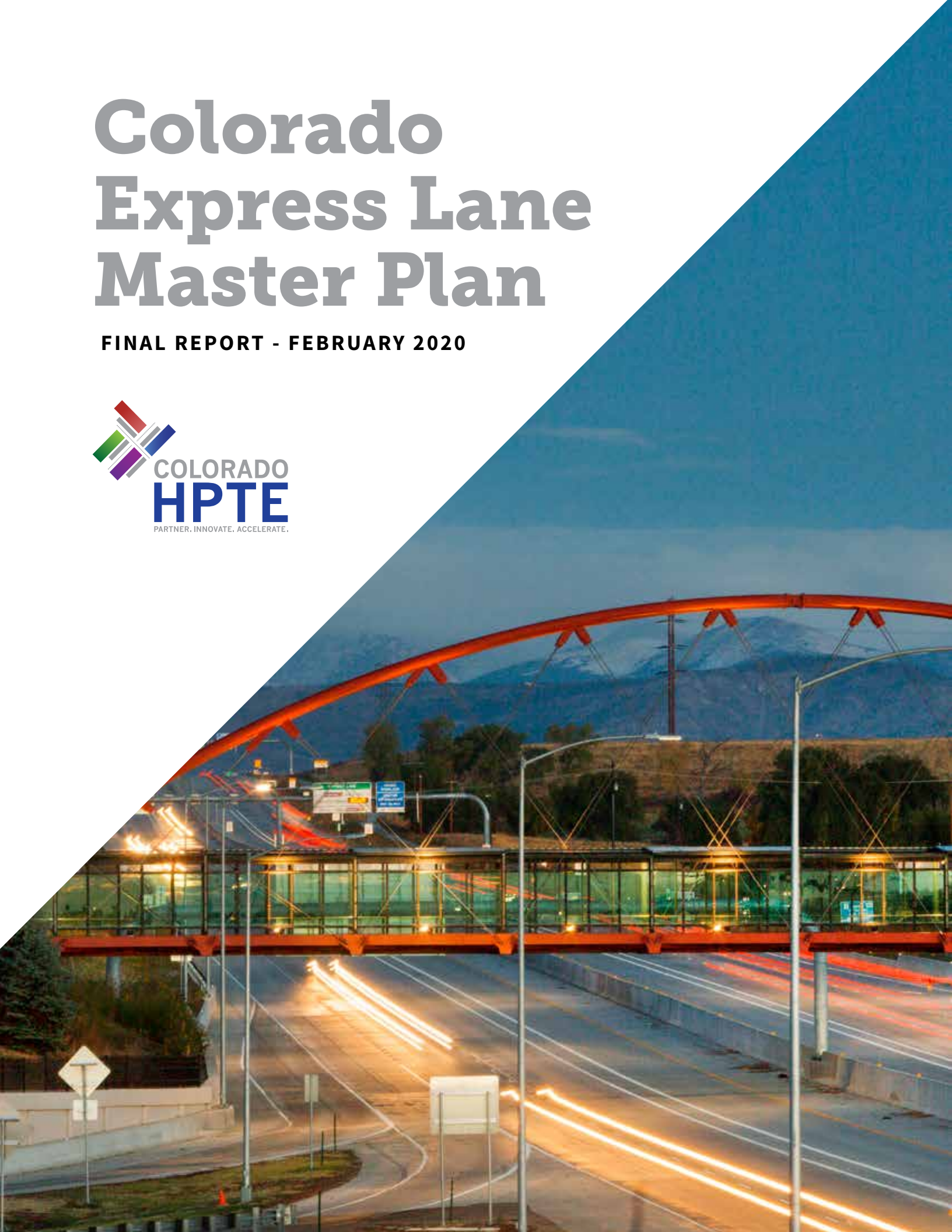

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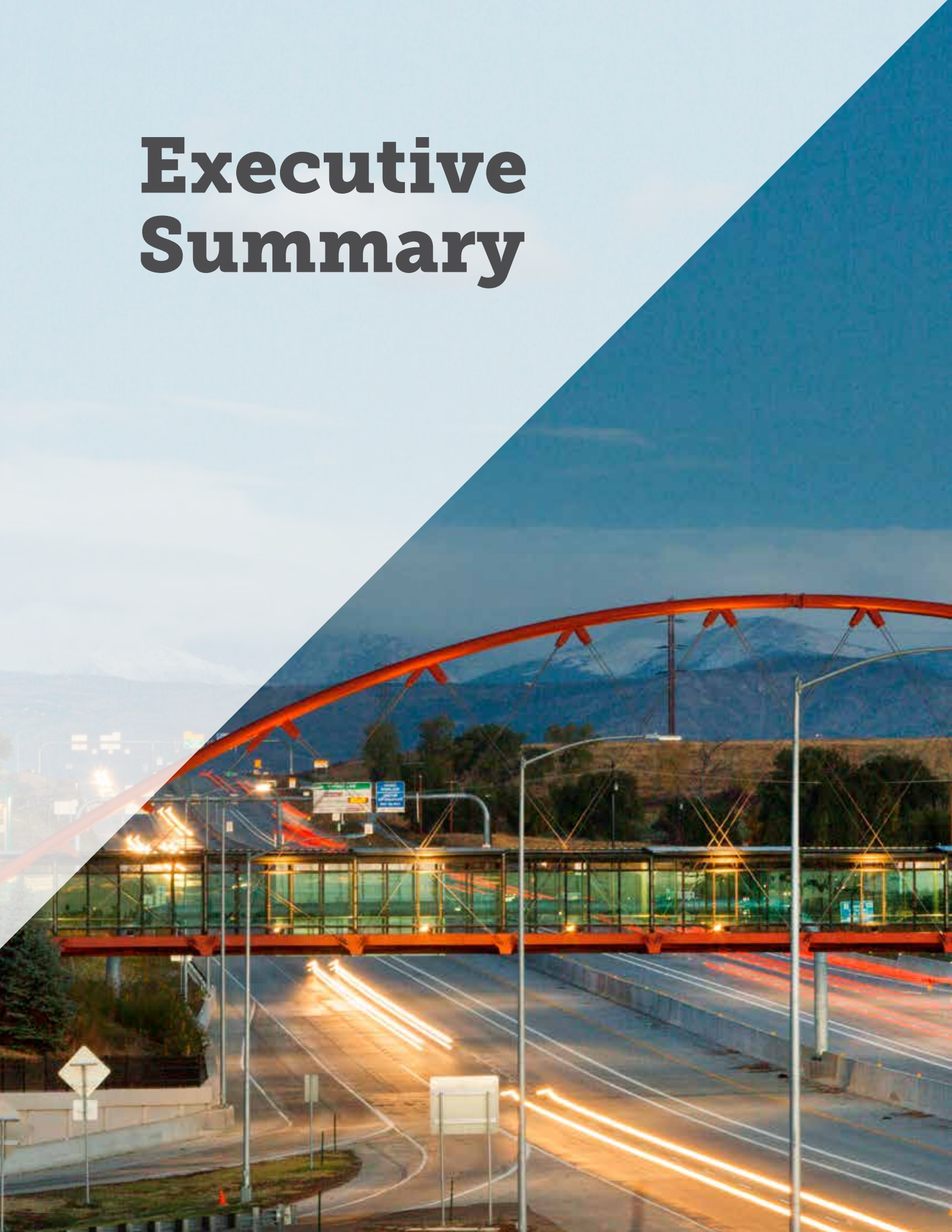


SECTION

E

Between 2018 and 2020, the Colorado High Performance Transportation Enterprise (HPTE) conducted a statewide Express Lane Master Plan (ELMP) in coordination with the Colorado Department of Transportation (CDOT) and other regional partners. The ELMP process identified and produced technical and financial information about potential Express Lane projects throughout the State, so that these projects could be prioritized for future study and development. An important element of the ELMP was a stakeholder and public outreach effort that included a series of interactive workshopswhere perspectives from stakeholders were collected and discussed with HPTE and CDOT staff to fully explore the costs and benefits of potential Express Lane concepts in the prioritized corridors.

One critical output of early engagement was the identification of stakeholder goals for future Express Lanes, that were then used to create measurable evaluation metrics as shown in **Figure E-1**. This framework was used to undertake a 'Phase I' initial screening of potential corridors, that eliminated segments with major flaws and allowed the project team to focus on corridors with the most desirable characteristics for future Express Lanes. These priority corridors were subject to more detailed mobility and financial analysis as part of the Phase II corridor evaluation.

1. The corridors that advanced to the more detailed Phase II analysis exhibited the following characteristics:

2. Potential for improvement in travel speeds and throughput with the application of Express Lane concepts, due to significant level of existing congestion,

3. Potential to support Express Lane system development by connecting to existing or planned Express Lane projects,

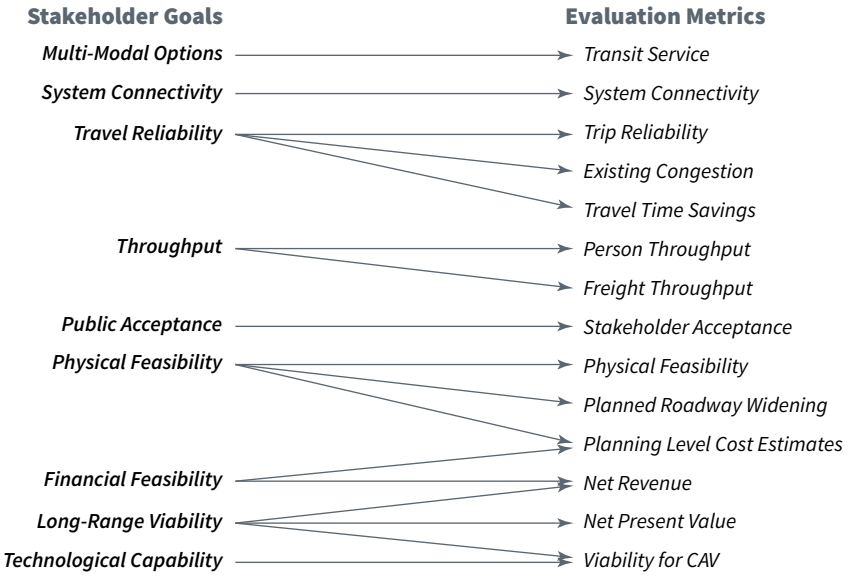
4. Potential to support existing transit service based on the presence of express bus service in or immediately parallel to the corridor,

5. A location where the Express Lanes concepts were more likely to be accepted as a solution to highway congestion problems based on public familiarity with existing Express Lanes,

6. Highway widening or capacity enhancements having already been planned in the corridor, based on the Statewide Transportation Improvement Plan, Long Range Transportation Plan or other CDOT planning documents,

7. Minimal physical constraints to construction, primarily availability of CDOT right-of-way (ROW).

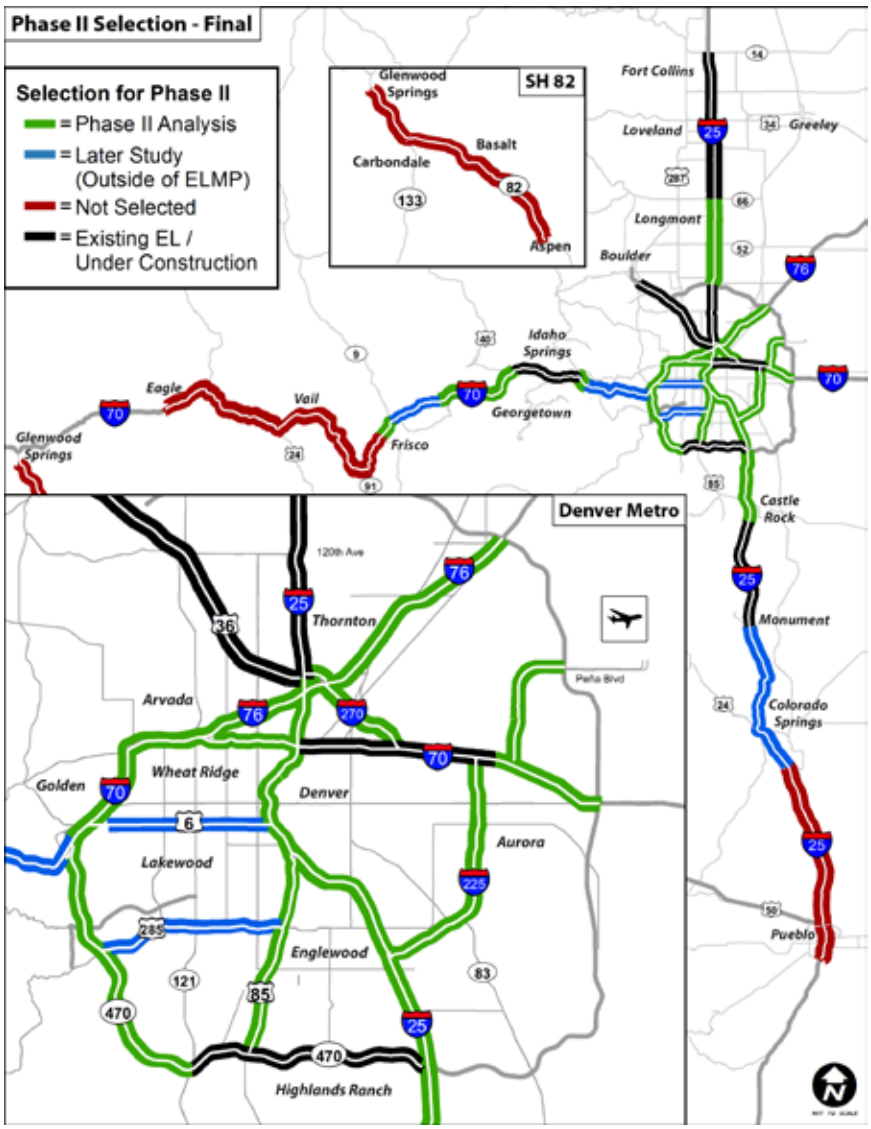
Figure E-1 // Stakeholder Goals and Associated Evaluation Metrics



The selection of corridors for the Phase II analysis was made using a combination of technical initial screening results, along with stakeholder input. The results of this Phase II selection process are shown in **Figure E-2.**

The Phase II analysis was also informed by the previously identified stakeholder goals, but included more rigorous technical mobility and financial analysis to refine the scoring of respective potential Express Lane corridors in a more quantitative framework. This analysis included development of capital and operating costs, traffic impact analysis, and the estimation of toll revenue generating potential.

Figure E-2 // **Initial Screening Results**



- **Capital Costs:** A collection of highway cross-sections "Typical Section Scenarios" were developed and applied to the Phase II corridors based on their traffic volumes, available ROW, and other geometric factors. These standard cross-sections, such as "Inside Widening Only," "Striping Change Only," or "Constrained Urban Setting with Retaining and Noise Walls," had associated unit costs that were used to estimate high-level capital costs for each Phase II corridor segment. Standard CDOT cost estimating procedures and calculation sheets were used for all cost estimates. The Typical Section Scenarios were also used to illustrate the Express Lane concepts to stakeholders and demonstrate why some corridors were more expensive than others, lacked expected functionality, or had potential safety issues to rectify. The facility type, size (number of lane miles), and tolling configuration all fed into the calculation of annual operations and maintenance cost.

- **Traffic Impact Analysis:** The Phase II Express Lane corridors described above were coded into CDOT's new Statewide Travel Forecasting Model, which produced basic tolled travel demand data. The outputs of this model were input to a specialized toll optimization model (Rapid-TOM©) to spread traffic over time periods based on specific toll rate policies, and to produce forecasts of traffic and revenue for each potential Express Lane corridor. Traffic and toll revenue forecasts were then used in the financial and mobility analyses that rendered the prioritized list of Express Lane corridors. Forecast revenue and transactions from the Express Lane corridors for years 2025 and 2045 area provided in **Table E-1**.

Table E-1 // Forecast Revenue and Transactions

	Revenue			Transactions		
	2025	2045	CAGR	2025	2045	CAGR
Denver Metro Segments						
I-225: I-25 to I-70	$5,182,448	30,730,777	9%	1,064,207	13,636,731	1%
I-25: C-470 to Castle Rock	$3,350,586	26,497,051	11%	6,548,513	8,529,764	1%
I-25: US-36 to C-470	11,696,501	93,452,556	11%	41,166,053	52,846,946	1%
I-25: Longmont to E-470	$1,368,643	$15,307,766	13%	6,524,848	8,823,183	2%
I-70 E: Pena to E-470	$250,320	$4,259,775	15%	8,124,470	11,730,077	2%
I-70 W: C-470 to I-25	$3,987,671	20,369,601	8%	2,742,918	16,030,191	1%
C-470: I-70 to Wads	$1,703,395	14,855,691	11%	16,576,295	22,273,675	1%
I-76: I-70 to E-470	$1,230,030	12,884,785	12%	1,611,171	6,060,483	2%
I-270: I-25 to I-70	11,099,761	66,537,528	9%	1,166,270	13,632,434	1%
Pena: I-70 to E-470	$20,930	$524,159	17%	2,850,993	4,890,285	3%
US 85: C-470 to I-25	$7,733,432	43,706,749	9%	7,599,223	9,504,574	1%
I-70 Mountain Corridors						
Frisco-Silverthorne	$34,222	$187,366	9%	1,563,651	1,997,307	1%
Georgetown-EJMT	$138,502	$462,409	6%	1,571,092	1,966,026	1%
Empire-Georgetown	$64,007	$212,512	6%	1,806,740	2,248,791	1%
Floyd Hill	$91,880	$299,402	6%	1,838,693	2,295,125	1%

Forecasts of operating and maintenance costs were generated for each Express Lane corridor using unit costs derived from HPTE experience on existing facilities and similar projects elsewhere in the US. These annual costs were subtracted from annual revenues to arrive at a forecast of net revenues, which were used in the financial prioritization framework. The net revenue metric was selected for the analysis because it takes into account the total cost of the Express Lane corridors, which varies significantly depending on the type of facility and location. For instance, the I-70 Mountain Corridor segments exhibit much higher maintenance costs than the urban corridors due to the more extreme weather conditions. Similarly, urban corridors have much higher operational costs due to the greater volumes of traffic.

The present value (PV) of the net revenue projection for each Express Lane Corridor was calculated and divided by the associated capital cost to develop a ratio which became the basis for financial prioritization scoring. A scale from zero to five was used. Corridors whose PV of net revenues was significantly higher than its capital cost scored a 5, while corridors whose PV of net revenues was lower than the capital cost scored a 2 or less. **Table E-2** presents the financial score and ranking for each of the Express Lane corridors and shows that only five corridors had a PV of net revenues that exceeded capital costs. This result was not surprising, as very few Express Lane projects in the US generate strong revenue streams relative to their costs, due to the option of the free adjacent general-purpose lanes.

Table E-2 // Financial Score and Ranking

CORRIDOR / SEGMENT	PV OF NET REVENUES	CAPITAL COST	PV OF NET REVENUES / CAPITAL COST	FINANCIAL SCORE
I-25 Central (Santa Fe to I-225) (LC)	$299.7	$14.3	20.95	5.00
I-25 Central (I-225 to C-470) (LC)	$112.2	$9.1	12.28	5.00
I-25 Central (US-36 to 20th St.) (LC)	$392.5	$185.1	2.12	4.00
I-270 (I-25 to I-70)	$808.9	$613.3	1.32	3.00
I-25 North (Longmont to E-470)	$159.8	$142.3	1.12	3.00
I-225 (I-70 to I-25)	$360.2	$725.5	0.50	2.00
I-25 Central (US-36 to 20th St.) (A1)	$384.3	$814.8	0.47	1.00
I-70 (Wadsworth to I-25)	$135.4	$320.0	0.42	1.00
I-25 Central (Santa Fe to I-225) (A1)	$379.2	$957.3	0.40	1.00
I-25 South (C-470 to Castle Rock)	$298.5	$1,063.1	0.28	1.00
I-25 Central (I-225 to C-470) (A1)	$159.4	$672.0	0.24	1.00
C-470 (I-70 to Wadsworth)	$154.7	$709.2	0.22	1.00
I-70 (C-470 to Wadsworth)	$99.8	$547.6	0.18	0.00
I-70 East (Chambers to E-470)	$39.0	$228.4	0.17	0.00
I-76 (I-70 to I-270)	$97.3	$649.8	0.15	0.00
I-25 Central (20th St. to Santa Fe) (A1)	$150.8	$1,134.2	0.13	0.00
I-76 (I-270 to E-470)	$27.5	$439.1	0.06	0.00
I-70 Silverthorne to Frisco	$-	$77.6	-	0.00
I-70 Floyd Hill	$(6.7)	$615.5	(0.01)	0.00
Pena Blvd. (CCD - I-70 to E-470)	$(14.6)	$209.5	(0.07)	0.00
I-70 Empire to Georgetown	$(6.2)	$43.6	(0.14)	0.00
I-70 Georgetown to EJMT	$(19.3)	$130.3	(0.15)	0.00

The mobility analysis, again relying on forecasted tolled traffic data, compared the build and no-build scenarios for 2045 to score each of the corridors based on five categories of scoring criteria. Each corridor received a score from one to five in each category, and scores were averaged to provide an overall mobility score and ranking. The scoring criteria included:

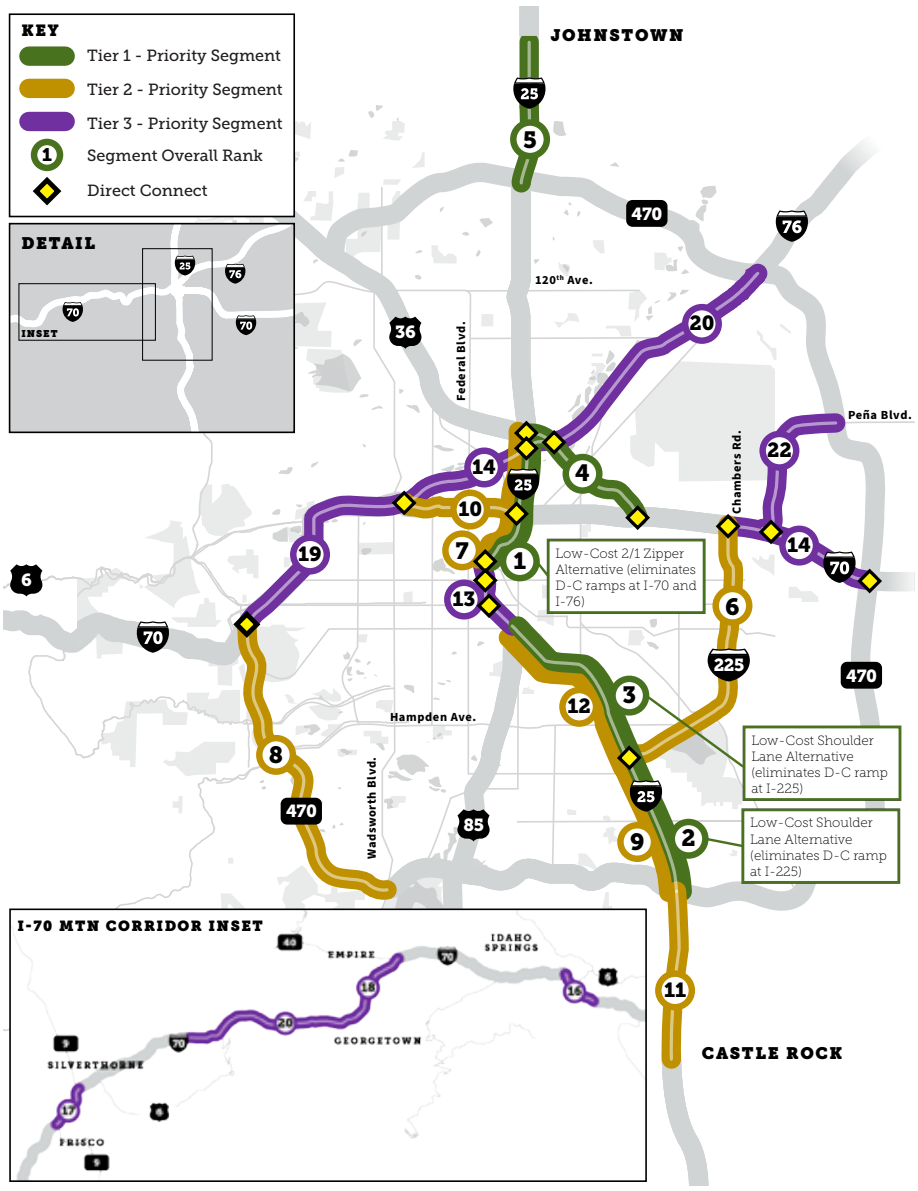
- Travel time savings relative to adjacent general-purpose lanes,
- Express Lane trip reliability based on the 85th percentile travel time compared to the average travel time in the Express Lane,
- Total corridor person throughput improvement (including Express Lane and general-purpose lane traffic),
- Hours of congestion, measured by the number of hours per day that general-purpose lane volume to capacity ratio exceeds the 0.85 threshold, and
- Transit connectivity based on the presence of existing express bus service in the corridor.
- As noted above, the category scores were averaged and resulted in the overall mobility scores contained in **Table E-3**. Table E-3 also shows the combined average using both the mobility and financial scores, which was used to organize Phase II corridors into priority tiers based on overall ranking.

Table E-3 // Overall Segment Prioritization & Ranking

CORRIDOR / SEGMENT	MOBILITY SCORE	FINANCIAL SCORE	OVERALL SCORE	OVERALL RANK
TIER 1 - PRIORITY				
I-25 Central (US 36 to 20th St) [LC]	4.64	4.00	4.32	1
I-25 Central (I-225 to C-470) [LC]	3.27	5.00	4.14	2
I-25 Central (Santa Fe to I-225) [LC]	3.00	5.00	4.00	3
I-270 (I-25 to I-70)	4.27	3.00	3.64	4
I-25 North (E-470 to SH 66)	3.91	3.00	3.45	5
TIER 2 – PRIORITY				
I-225 (I-70 to I-25)	3.45	2.00	2.73	6
I-25 Central (US 36 to 20th St) [A1]	4.45	1.00	2.73	7
C-470 (I-70 to Wadsworth)	4.18	1.00	2.59	8
I-25 Central (I-225 to C-470) [A1]	4.09	1.00	2.55	9
I-70 (Wadsworth to I-25)	4.00	1.00	2.50	10
I-25 South (C-470 to Castle Rock)	3.91	1.00	2.45	11
I-25 Central (Santa Fe to I-225) [A1]	3.27	1.00	2.14	12
TIER 3 – PRIORITY				
I-25 Central (20th St to Santa Fe)	3.91	0.00	1.95	13
I-76 (Wadsworth to I-270)	3.27	0.00	1.64	14
I-70 East (Chambers to E-470)	3.27	0.00	1.64	14
I-70 MTN (Floyd Hill)	3.09	0.00	1.55	16
I-70 MTN (Frisco to Silverthorne)	2.55	0.00	1.27	17
I-70 MTN (Georgetown to Empire)	2.45	0.00	1.23	18
I-70 (C-470 to Wadsworth)	2.00	0.00	1.00	19
I-76 (I-270 to E-470)	1.82	0.00	0.91	20
I-70 MTN (Georgetown to EJMT)	1.82	0.00	0.91	20
Pena Blvd (I-70 to E-470)	1.45	0.00	0.73	22

It is clear from this table, and the map shown in **Figure E-3**, that the urban corridors provided more mobility benefits, primarily due to the larger volumes of traffic impacted and that these corridors experience five days of weekday congestion rather than only two days of weekend congestion in the mountain corridor. The mobility scores are somewhat uniformly distributed due to the lowest performing corridors having at least some benefits, while the higher performers scored well in three or four categories. Because the financial score was only based on one comprehensive measure, there were very few high scores and many corridors that scored only one or zero points. The result is that projects with high financial scores also netted the highest overall scores.

Figure E-3 // Overall Segment Prioritization & Ranking



Detailed data on the scoring and prioritization of all Express Lane elements is provided in the body of this report. The Low Cost (LC) alternatives for I-25 represent the highest ranking three segments. Although these corridors may offer greater combined financial and mobility performance relative to other corridors, it is important to emphasize the sketch-level nature of the ELMP prioritization. In particular, the Low-Cost shoulder lane alternatives for the I-25 TREX section between Santa Fe and C-470 require additional analysis into safety and enforcement considerations in order to confirm their viability from a technical perspective and among stakeholders.

The ELMP also considered financing and alternative delivery options that could be used to package toll revenues to help pay for the costs of construction. HPTE has considerable experience in these tools from the portfolio of projects it currently operates or oversees. Like other parts of the ELMP, the financial analysis applied a uniform transaction structure to all Express Lane corridors to estimate the amount of funding that a toll revenue bond issue could generate. None of the potential Express Lane corridors had revenues that could pay for its entire capital cost under this structure. This said, there are many ways that the financing could be optimized, and with more detailed traffic and revenue study, the portion of costs that could be covered by revenue bonds would likely increase.

The primary conclusions from the ELMP were that there are many potential Express Lane projects that could be implemented to increase the capacity and reliability of the most traveled highway corridors in Colorado. Some of these corridors appear to have revenue generating potential that could offset some of the capital or operating costs, but the real value of Express Lane projects is the reliability and mobility benefits that tolling provides – not necessarily the revenue generating potential.

Express Lane projects on the urban corridors in Denver can provide substantial mobility benefits due to the volumes of commuters and severe congestion during peak periods. However, these projects are costly due to the constrained envelopes in which to build, requiring elevated structures in some areas and direct connect ramps that are challenging to fit within existing vertical and horizontal envelopes. While costly, direct connect ramps will help users realize significant time savings by linking the Express Lanes together into a network. Direct connect ramps also eliminate the impacts of Express Lane users merging in and out of the Express Lanes on general purpose lane flows.

Express Lanes are one of many important tools CDOT can use to improve congested conditions on its highways. With advanced Intelligent Traffic Systems, planning for connected and autonomous vehicles, and coordination with transit and third-party transportation providers, it can build a system that provides appropriate options and satisfies the needs of Colorado's growing population and employment base.

1

Introduction

SECTION

1

The Colorado High Performance Transportation Enterprise (HPTE), the Colorado Department of Transportation (CDOT), and other regional partners began an investigation into the potential expansion of Express Lanes throughout Colorado in 2018. The Colorado Express Lane Master Plan (ELMP) seeks to build on the success of the existing US 36, I-25, and I-70 Mountain Express Lanes by establishing a vision for HPTE to deliver a statewide system of Express Lanes in Colorado to maximize regional benefits.

A statewide Express Lanes network will provide a more reliable, faster travel option that improves the efficiency of corridors experiencing congestion. The ELMP intends to serve as a comprehensive, long-term, strategic road map for the prioritization, planning, and development of future Express Lane projects to deliver a statewide network, based on both technical analysis and stakeholder input. The goal of the ELMP is to:

- Identify and prioritize which corridors have the potential to benefit from Express Lanes in the future;
- Identify the potential revenue-generating capacity of those corridors;
- Estimate the potential cost and level of construction impact of various Express Lane design alternatives; and
- Engage with Stakeholders to inform technical analysis, project approach, and ultimate recommendations.

The purpose of this document is to detail the approach undertaken by HPTE to meet the goals listed above convey the prioritized list of future Express Lane project concepts recommended as a result of the ELMP process. The sections contained within this report detail the technical and stakeholder engagement elements of the ELMP process.

1.1 Background

HPTE Organization

In 2009, SB 09-108 — the Funding Advancement for Surface Transportation and Economic Recovery (FASTER) Act — created the High Performance Transportation Enterprise (HPTE). The HPTE is the successor to the Colorado Toll Enterprise (CTE) that was established in 2002 when the Colorado General Assembly passed House Bill (HB) 02-1310. The goal of HPTE, pursuant to C.R.S.§ 43-4-806, is to:

- Aggressively pursue innovative means of more efficiently financing important surface transportation infrastructure projects that will improve the safety, capacity, and accessibility of the surface transportation system;
- That can be feasibly commenced in a reasonable amount of time; and
- That will allow for more efficient movement of people, goods, and information throughout the state.

The statute specifically states that HPTE may use public-private partnerships (P3), issue revenue bonds, enter into operating concession agreements, use design build contracting, and implement user-fee based project financing — also known as tolls.

Express Lanes Defined

Express Lanes, also commonly referred to as high-occupancy toll (HOT) lanes, are dedicated lanes on the freeway where demand is managed by restricting access to certain vehicle types and allowing vehicles not meeting the eligibility requirements to pay a toll to travel in the lanes. Express Lanes can maintain toll-free or discounted travel for buses, high-occupancy vehicles (HOVs) and other vehicles designated as being eligible to use the lanes, and charge a toll for other passenger vehicles that choose to use the lane. Express Lane tolls are collected via electronic toll collection (ETC) systems and typically vary based on the level of congestion to ensure that a high level of service is maintained in the Express Lane. As traffic in the Express Lanes increases, the toll rates can also increase as a disincentive to limit the number of people entering the lanes. Toll rates decrease when traffic in the lanes decreases to incentivize more vehicles to use the existing capacity in the lane. Shifting vehicles from congested general-purpose lanes to utilize excess capacity in the Express Lanes benefits general-purpose (gp) lanes flow while maintaining free-flow operations in the Express Lanes.

HPTE's Mission

Partner with CDOT, private industry, and local communities

Aggressively pursue innovative financing alternatives not otherwise available to the state

Quickly deliver transportation infrastructure options that improve mobility and

Communicate openly with all stakeholders

Tolling Context

Express Lanes may be among the newest variant of tolling, but the overall concept is hardly new. Since the gold rush of 1858, toll roads have operated within Colorado. Colorado's contemporary history with tolling and Managed Lanes began in 1988. At this time, two events occurred:

- The creation of the E-470 Public Highway Authority (PHA), which authorized the state's first toll road (still in operation); and
- The investment by the Colorado Department of Transportation (CDOT), Regional Transportation District (RTD), City and County of Denver (CCD), U.S. Federal Highway Administration (FHWA), and Federal Transit Administration (FTA) in a reversible bus/HOV facility on I-25.

Although the I-25 HOV lanes were successful upon opening and met the project's purpose, they provided excess unused capacity. In 1999, Colorado enacted SB 99-088 (the HOT Lane Act), which required CDOT to convert and operate the I-25 HOV lanes as tolled Managed Lanes. Since the first tolled Managed Lanes were opened in 2006 by the CTE on I-25, the E-470 PHA has provided toll system integration and collection services for all Colorado Express Lanes.

Today, HPTE operates and maintains the existing I-70 Mountain Express Lane (eastbound) and the I-25 North Express Lanes from US 36 to 120th Avenue. Plenary Roads Denver (PRD), a P3 partner to HPTE, operates and maintains the US 36 and I-25 Central reversible Express Lanes with HPTE overight of all activities. HPTE is overseeing the development of an additonal 155 miles of Express Lanes slated to begin operations by 2023.

2

Stakeholder Engagement

SECTION

2

Stakeholder engagement was a key facet in developing recommendations for a future network of Express Lanes as part of the Express Lane Master Plan process. The project team identified three main communication goals for the ELMP:

- Educate and engage stakeholders and the public on the purpose, benefits and results from the use of Express Lanes in Colorado
- Educate and engage stakeholders on how the development of and results from the ELMP may benefit their local communities
- Enable HPTE to establish a network of informed decision-makers that can help support the development of the ELMP and future corridor projects as they move into project development

To achieve these overall goals, communication efforts focused on the following three key target audiences: **1)** Agency partners, **2)** General public (statewide), and **3)** Project-specific stakeholders.

As discussed further in this section and throughout this document, each of these target audiences played a role in the successful development of the ELMP. Agency stakeholders partnered with HPTE to inform technical analysis and to assist in developing the plan itself. The focus for the statewide general public was on education and concurrence on the need and benefits for Express Lanes overall, and outreach to project-specific stakeholders was used to gather information and insights that will help HPTE move quickly and efficiently into future project development.

Given the unique focus of the engagement with each of these audiences, specific objectives were established for each outreach component, as listed below.

Agency Partnership:

1. Establish a network of informed stakeholders for Express Lanes overall that can support future corridor projects as they move into project development
2. Obtain feedback on plan development, including evaluation criteria, performance measures, data collection, evaluation methodology and requirements that will ultimately form the foundation for corridor recommendations at the conclusion of the study
3. Gain concurrence on the eventual tiered list of future potential Express Lanes corridors based on established mobility and financial criteria.

Statewide Outreach:

1. Support HPTE's ongoing statewide education outreach efforts to increase the understanding of the benefits of Express Lanes

2. Communicate the results of the ELMP, including a tiered list of future potential Express Lanes corridors and the value of developing an overall Express Lanes network

Project Specific Outreach:

1. Provide as much information as possible to HPTE to support efficient future project development

2. Identify key project-specific stakeholders, decision-makers and influencers, and any potential project-specific concerns and challenges

3. Share issues/concerns and best practices from existing project teams that can assist HPTE in developing future projects

2.1 Agency Partner Outreach

The ELMP team held a series of three half-day workshops to educate a broad, statewide group of stakeholders and engage them directly in the ELMP process. A list of stakeholder workshop participants is included in Appendix A. These workshops acted as the cornerstone of the ELMP process by allowing agency stakeholders to provide input on the evaluation criteria, performance measures, data collection, evaluation methodology and requirements that resulted in specific corridor recommendations. A brief summary of each workshop is listed below, and are detailed further throughout this document. In addition, a more detailed description of each workshop is included in Appendix A.

- **Workshop 1:** The first workshop was held in August 2018 at the beginning of the ELMP process. The workshop included an introduction to Express Lanes and the ELMP, interactive activities that defined the goals and objectives of the study, and it outlined the corridors indentified for future analysis. Both the goals and objectives, and corridor focus areas were essential in informing technical analysis, as explained in section 3.0.

- **Workshop 2:** The second workshop was held in December 2018 at the conclusion of the initial corridor screening task. This workshop included an overview of the evaluation criteria used as part of the initial screening and the initial selection of Phase II corridors for more detailed analysis. The workshop also included an interactive activity where stakeholders were encouraged to comment and critique technical analysis, as well as to help confirm Phase II corridors for further study.

- **Workshop 3:** The third, and final, ELMP stakeholder workshop occurred in November 2019. This workshop included a detailed review of initial Financial and Mobility Analysis findings, as described in section 7.0 and 8.0. After the review of technical contentment, stakeholders were divided into breakout groups, and facilitated through an activity to inform criteria weighting, additional scoring considerations, and corridor prioritization (section 9.0).

2.2 Statewide Outreach

As part of the ELMP, the project team worked with HPTE to educate the general public about Express Lanes and benefits of an overall Express Lanes network. Outreach was structured in this manner based on previous research, which indicated that many areas of the state were not familiar with Express Lanes, while others were well informed about Express Lanes and how to use them, and had strong feelings of support or concern.

This phase of statewide outreach included presentations to stakeholder organizations, telephone town halls, and social media outreach, as summarized below. In addition, all facets of statewide outreach were centered around a set of key messages, which sought to educate the public on what an Express Lane is, the benefits of using them, the benefits of an integrated Express Lane network, why HPTE is looking to expand their Express Lane network, as well as Express Lane performance and equity considerations. These key messages identified for statewide outreach are included in Appendix A.

Stakeholder Group Presentations

The project team worked with agency partners to identify key organizations across the state, and scheduled presentations to educate them on the benefits of an overall Express Lanes network, the ELMP process and initial technical findings, and to identify and discuss any specific concerns.

The team presented to the following eight, geographically diverse organizations. Individual presentations and summaries of each of these meetings is included in Appendix A.

- Commerce City Chamber of Commerce
- Denver Chamber of Commerce
- Denver South Economic Development Partnership
- Fort Collins Chamber of Commerce
- MOVE Colorado
- DRCOG Technical Advisory Committee (TAC)
- I-70 Mountain Corridor Coalition
- Berthoud Chamber of Commerce

Telephone Town Halls (TTHs)

The ELMP project team conducted four TTHs in July 2019 to focus on educating participants on the purpose and initial results of the ELMP project, the benefits of Express Lanes and next steps for HPTE. The TTHs were held in each CDOT region, except Region 5, where HPTE is not currently evaluating potential Express Lanes. In addition, two separate town halls were held in Region 1 due to the large population of the Denver Metro area. The number of total attendees for all four TTHs reached 5,081, with 38 questions asked.

Customized TTH content was developed for different areas of the state to keep all information relevant and the audience engaged, including specific polling questions for each TTH to boost the engagement and gather additional information regarding Express Lanes. Each TTH is summarized below. Appendix A provides more detailed information, including results for each of the polling questions.

- **Southeast Metro Denver TTH** - The number of attendees for the southeast metro Denver TTH reached 1,498 people and nine participants asked questions during the call. The geographic area of this TTH included people living south of I-70 and east of I-25 (Arapahoe, Elbert, El Paso, Lincoln, Denver, and Adams counties).

- **Southwest Metro Denver TTH** - The southwest metro Denver TTH reached 1,784 people and 13 participants asked questions during the call. The geographic area of this TTH included people living mainly south of I-70, and west of I-25 (Jefferson, Douglas, Park, Fremont, Teller, Denver, Adams, and Broomfield counties).

- **North Denver TTH** - 1,573 people participated in the North Denver TTH, and 13 participants asked questions during the call. The geographic area of this TTH included people living north of I-70 (Boulder, Larimer, Weld, Broomfield, Morgan, Adams, and Denver counties).

- **I-70 Mountain Area TTH** - The number of attendees for the I-70 Mountain TTH reached 226 people and three participants asked questions during the call. The geographic area of this TTH included people living along the I-70 mountain corridor, west of Denver to Frisco (Gilpin, Summit, Clear Creek, Grand, and Summit counties).

The ELMP project team worked with CDOT and HPTE to post on Facebook and Twitter to inform the public and key stakeholders about the outreach efforts, including upcoming TTHs. Information about the final report will also be shared on social media.

2.3 Project Specific Outreach

Project-specific outreach was focused on identifying best practices and points-of-contact for each Express Lanes project currently under construction, and identifying key information for potential future projects that will assist in future outreach once these projects move further into individual project development. Summary information for all projects currently in construction, and those for potential future Express Lanes are included in Appendix A.

3

Goals & Objectives
Phase I

SECTION

3

Defining statewide goals and objectives for Express Lanes represents a critical first step in the process of identifying Colorado highway corridors that could be viable for Express Lane solutions. A defined set of goals and objectives helped to inform the technical evaluation of highway corridors, and decisions regarding how potential corridors should be prioritized for future implementation. This section describes the formation of ELMP goals, and how those goals were used to define evaluation criteria and shape subsequent evaluation as part of the ELMP.

3.1 Goal Formation

Goals for future Colorado Express Lanes were defined by stakeholders as part of Workshop 1, as described in section 2.0. The workshop included an interactive activity where, working together in small teams, stakeholder attendees brainstormed potential goals and objectives, and then worked to prioritize and vote for those that the group considered to be most important. Among dozens of goals and objectives discussed, **Table 3-1** identifies those put forth as the top priorities, along with the total votes each goal received from stakeholders. As shown in the table, identified goals ranged from items related to financial feasibility and long-term viability, to traffic impact, transit accommodation, and future technologies.

Table 3-4 // Stakeholder Goal Formation Activity Results

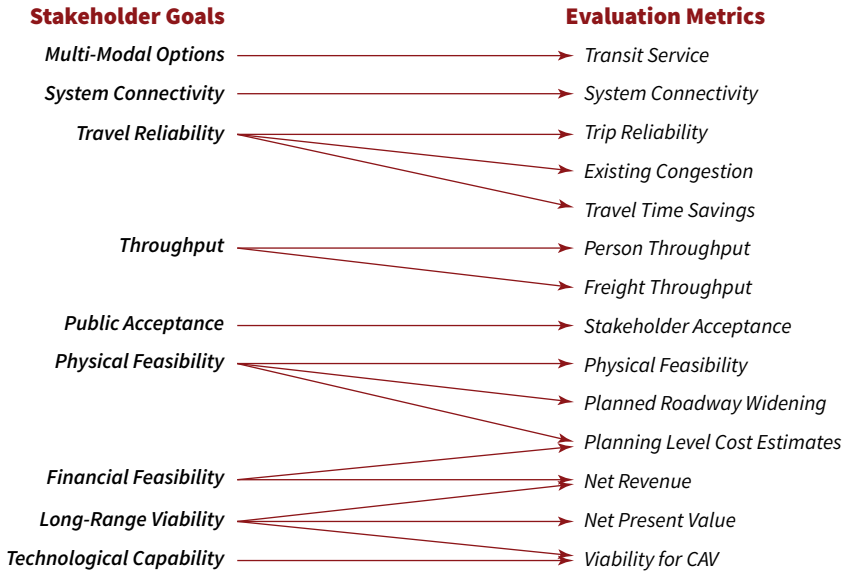
EXPRESS LANE GOALS	STAKEHOLDER VOTES
Multi-Modal Options - support shift away from SOV travel and toward more multi-modal options	28
Public Acceptance - strive to achieve greater public acceptance of Express Lanes	26
Reliability - enhance travel reliability along corridors	24
Technological Capability - enable test beds for connective vehicle technology and other emerging vehicle technologies	18
Financial Feasibility - ensure that Express Lanes are financially feasible solutions for a given corridor	15
Person Throughput - move more people along key highway corridors	13
System-wide - ensure that new Express Lanes contribute to an integrated network	9
Long-range - ensure that Express Lane benefits extend into the long-term	9
Connectivity – create an integrated network of Express Lanes	8
Physical Feasibility – prioritize corridors where construction would be feasible	8

3.2 Evaluation Criteria

The goals and objectives discussed in section 3.1 were essential in shaping the subsequent technical evaluation of potential Express Lane corridors. Following their identification by stakeholders, the goals and objectives were used by the project technical team to inform metrics that would be used to evaluate potential Express Lane corridors and prioritize them based on their relative performance.

Figure 3-1 shows how individual goals were used to define measurable performance measures for analysis. As one example shown in the figure, the goal of Travel Reliability was translated into the quantifiable metrics of trip reliability, existing congestion, and travel time savings.

Figure 3-1 // Stakeholder Goals & Evaluation Metrics



Following the initial selection of evaluation criteria based on goals and objectives, the project technical team worked with HPTE staff to further define measurable evaluation metrics. **Table 3-2** shows the evaluation metrics that were identified for technical evaluation. Selected metrics were determined in large part by the goals and objectives identified earlier in this section, industry best practices, and the policy priorities of HPTE and CDOT. Table 3-2 also outlines where individual criteria are applied within the two-phase Express Lane corridor evaluation. Specifically, which were used as part of the initial screening to eliminate corridors that showed little to no viability of future Express Lanes, and which were used to prioritize potential corridors as part the more detailed Phase II evaluation.

Table 3-5 // Phase I & Phase II Evaluation Metrics

PHASE I – INITIAL SCREENING	PHASE II – DETAILED EVALUATION
Existing Congestion — Speed — Travel Time Index (TTI) — Planning Time Index (PTI)	**Traffic Performance** — Peak-period Person Throughput — Peak-period Freight Throughput — Trip Reliability
Acceptance — Public & Jurisdictional Acceptance — Planned Roadway Widening	**Acceptance** — Public & Jurisdictional Acceptance
Transit & Connectivity — Transit Service — System Connectivity	**Transit & Connectivity** — Transit Service — System Connectivity
Physical Feasibility — High-Level Constructability	**Physical Feasibility** — Planning Level Cost Estimates
	Financial Feasibility — Net Revenue — Net Present Value
	Viability for Connected & Automated Vehicles

4

Initial Screening
Phase I

SECTION

4

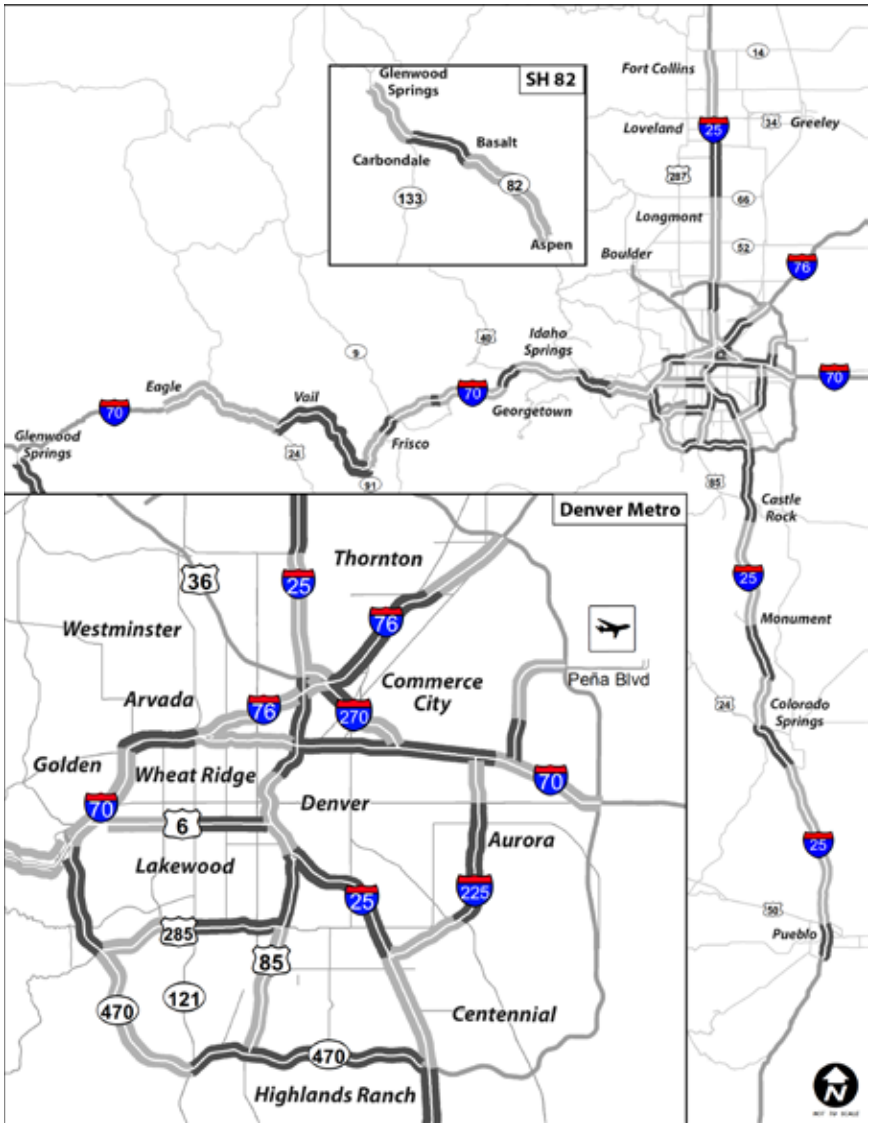
This section describes the initial screening of potential Colorado Express Lane corridors, which represents the first of a two-phase Express Lane evaluation process as part of the ELMP. The purpose of the initial screening is to eliminate corridors that showed little to no viability for a future Express Lane. This also allowed for project resources to be focused on the more detailed evaluation of potential Express Lane corridors in Phase II (as described in sections 5-9).

4.1 Initial Screening Methodology

The initial screening was carried out by applying the Phase I evaluation metrics shown in Table 3-2 to highways throughout Colorado. The highway corridors that were analyzed as part of the initial screening were defined as part of an interactive session during Workshop 1, where stakeholders were asked to inform the corridor limits for ELMP technical analysis. **Figure 4-1** shows the corridors that were confirmed by stakeholders as the starting point of technical evaluation, divided into measurable segments based on logical termini, and expressed by the intermittant light and dark gray segments. As shown in the figure, the initial screening included all limited access freeways in the Denver metro area, I-25 from Loveland to Pueblo, and the I-70 mountain corridor from Eagle to Golden. In addition, the initial screening included the two signalized corridors of State Highway (SH) 82 between Glenwood Springs and Aspen, and US 85 / Santa Fe Drive south of downtown Denver HOV lanes.

The analysis was conducted using individual evaluation metrics calculated and arrayed in a spreadsheet database. Phase I screening segments were scored for each evaluation criteria on a five-point scale, based on relative performance among all corridor segments. Individual scoring thresholds are described in section 4.2, along with a results map for each evaluation metric. All maps utilize a similar color gradation described below, where blue represents the highest scoring segments and red represents the lowest scoring segments, indicating the most viable Express Lane segments relative to each metric.

Figure 4-1 // Phase I Screening Segments



Scoring - Viability of Express Lanes:

4.2 Initial Screening Evaluation

Section 4.2.1 to 4.2.7 describe the scoring and segment results of each initial screening metric in greater detail.

4.2.1 Existing Congestion

The presence of existing congestion within a corridor segment was treated as the most important consideration of the Phase I initial screening process. Existing congestion was considered significant, since existing GP lane congestion is a vital component in an Express Lane's ability to offer a travel time and reliability benefit to drivers within a corridor. The calculation for existing congestion relied on 2018 average speed and travel time data obtained from INRIX. The project team utilized this data to compare Peak-Hour (most congested) conditions to free-flow traffic conditions using the three sub-metrics of:

- Speed: Speed differential was measured in miles per hour (mph).
- Travel Time Index (TTI): TTI is a comparison of average travel times between peak-hour and free-flow periods, where "1.0" indicates no difference in travel times, and a larger number indicates a longer, slower, travel time during the peak-hour.
- Planning Time Index (PTI): PTI represents the 95th percentile travel time compared to free-flow conditions. PTI is used to represent the extra time that a driver might plan for in advance of a high value trip, such as driving to the airport for an important flight. The larger the PTI value, the larger the differential between the 95th percentile travel time and non-congested free flow travel times.

Scoring Guidelines:

SPEED

5	> 25 mph
3	10 to 25 mph
0	< 10 mph

TRAVEL TIME INDEX (TTI)

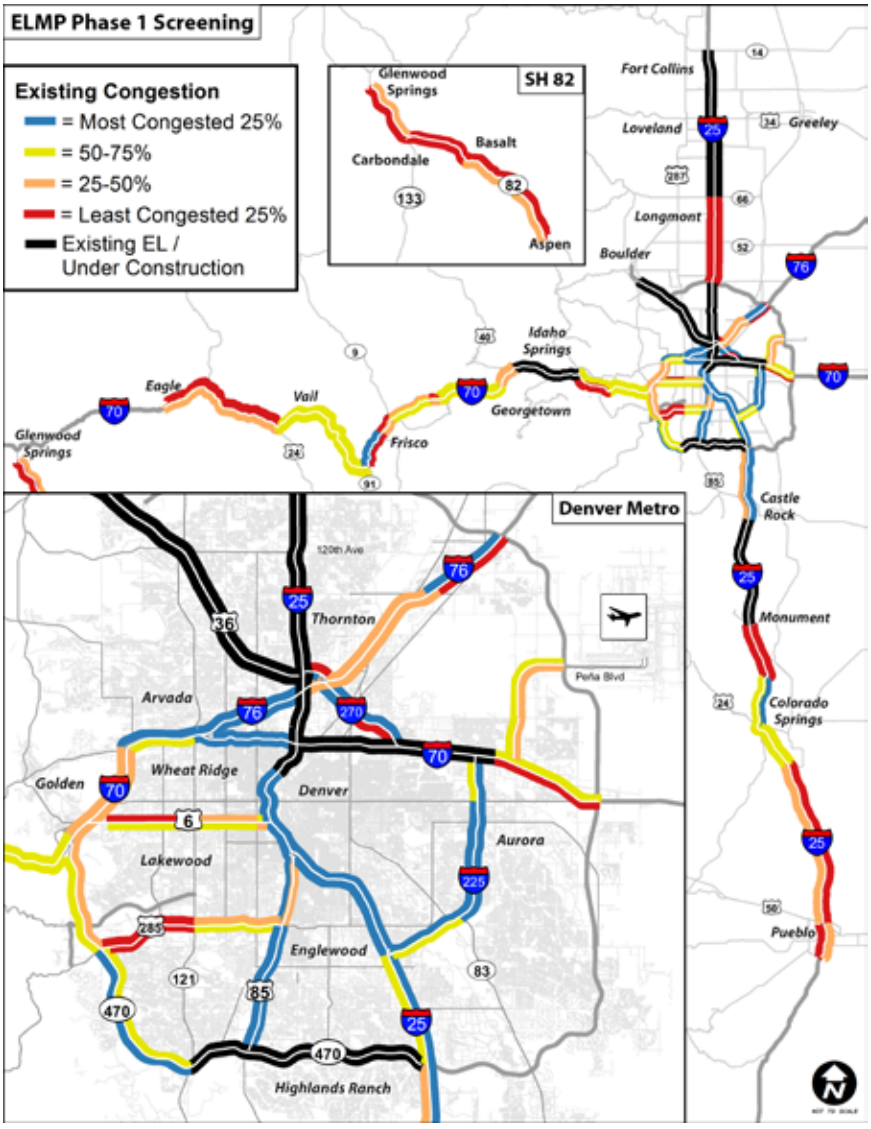
5	> 1.9
3	> 3.5
0	< 1.3

PLANNING TIME INDEX (PTI)

5	> 3.5
3	> 3.5
0	< 2

The scoring thresholds for each existing congestion sub-metric are shown below. Each of these individual scores were then averaged to calculate an existing congestion score for each corridor segment. Figure 4-2 shows the relative results for existing congestion for each corridor segment. Not surprisingly, the most congested corridor segments (those in blue) are concentrated in the central Denver metro area on I-25, I-70, I-225, I-270, and I-76. There are also congested segments shown near downtown Colorado Springs, and throughout the I-70 Mountain Corridor. The least congested segments include US 6 and US 285 in the Denver area, along with the more rural sections of I-25 near Longmont and Pueblo, I-70 west of Vail, and SH 82 south of Glenwood Springs.

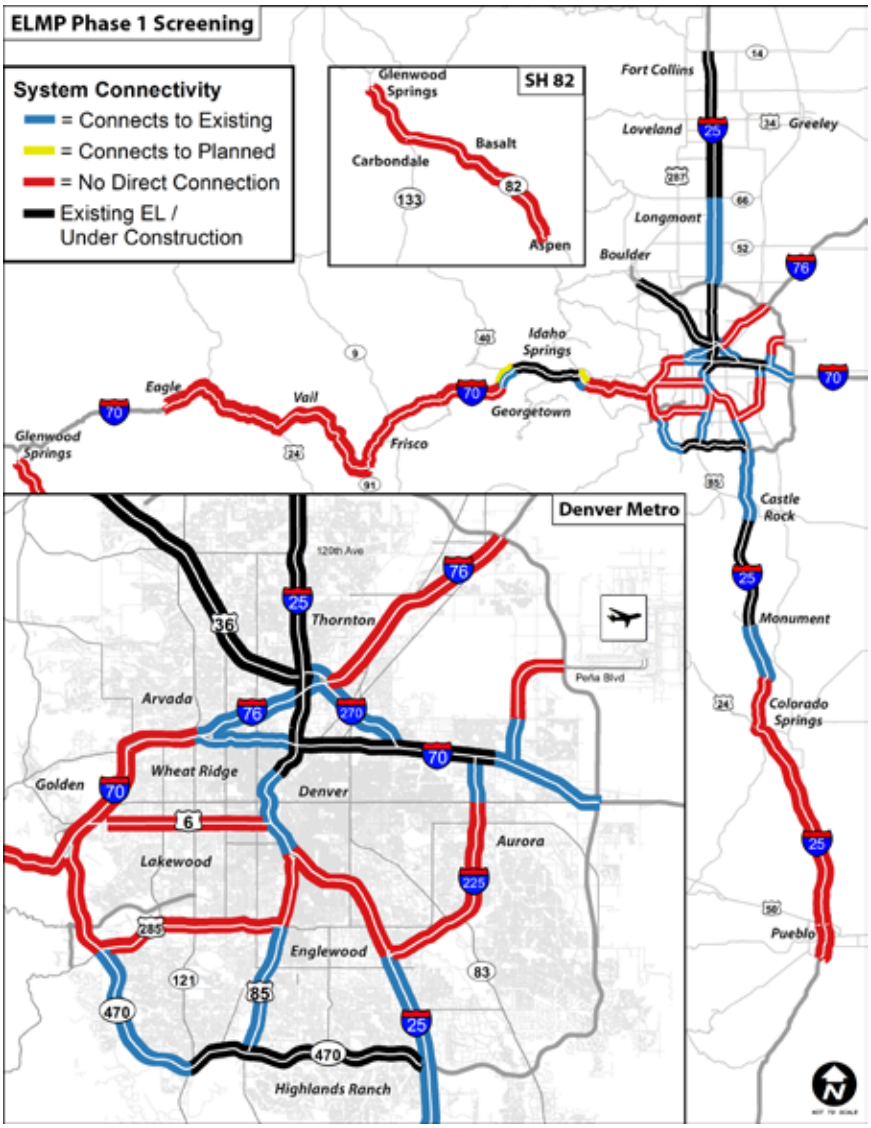
Figure 4-2 // Existing Congestion – Initial Screening



4.2.2 System Connectivity

System connectivity was measured as part of the initial screening by identifying whether a new Express Lane within a corridor segment would connect to an existing Express Lane, a planned Express Lane, or one currently under construction at the time of the initial screening exercise in Fall 2018. Scoring guidelines for the system connectivity metric are shown below, with scoring results for individual corridor metrics shown in **Figure 4-3**. It should be noted that the only corridor segments that scored a "3," were those immediately adjacent to the I-70 Westbound Peak-Period Shoulder Lane (PPSL), which was still in in early project development in November 2018.

Figure 4-3 // System Connectivity – Initial Screening



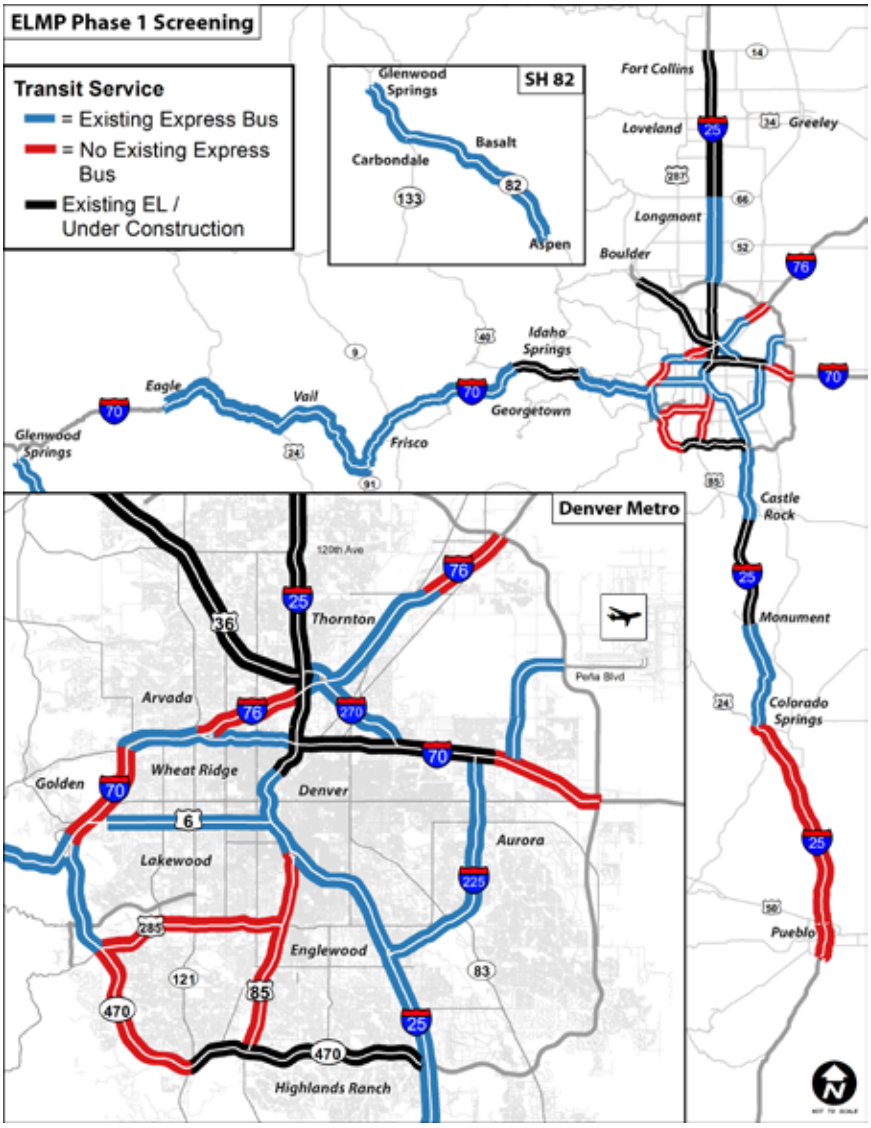
Scoring Guidelines:

5	Segment connects to Existing **EL / Under Construction**
3	Segment connects to **Planned EL**
0	Segment **Does Not** connect to Existing of Planned EL

4.2.3 Transit Service

The initial screening process considered transit service through the presence or absence of Express Bus services (as of December 2018). Specifically, whether there are express bus routes operating along a corridor segment, or nearby parallel route, that would be able to utilize an Express Lane facility. Scores were assigned through a simple yes or no process, as shown below and in Figure 4-4. As shown in the figure, the majority of corridor segments currently service express commuter and intercity bus services.

Figure 4-4 // Transit Service – Initial Screening



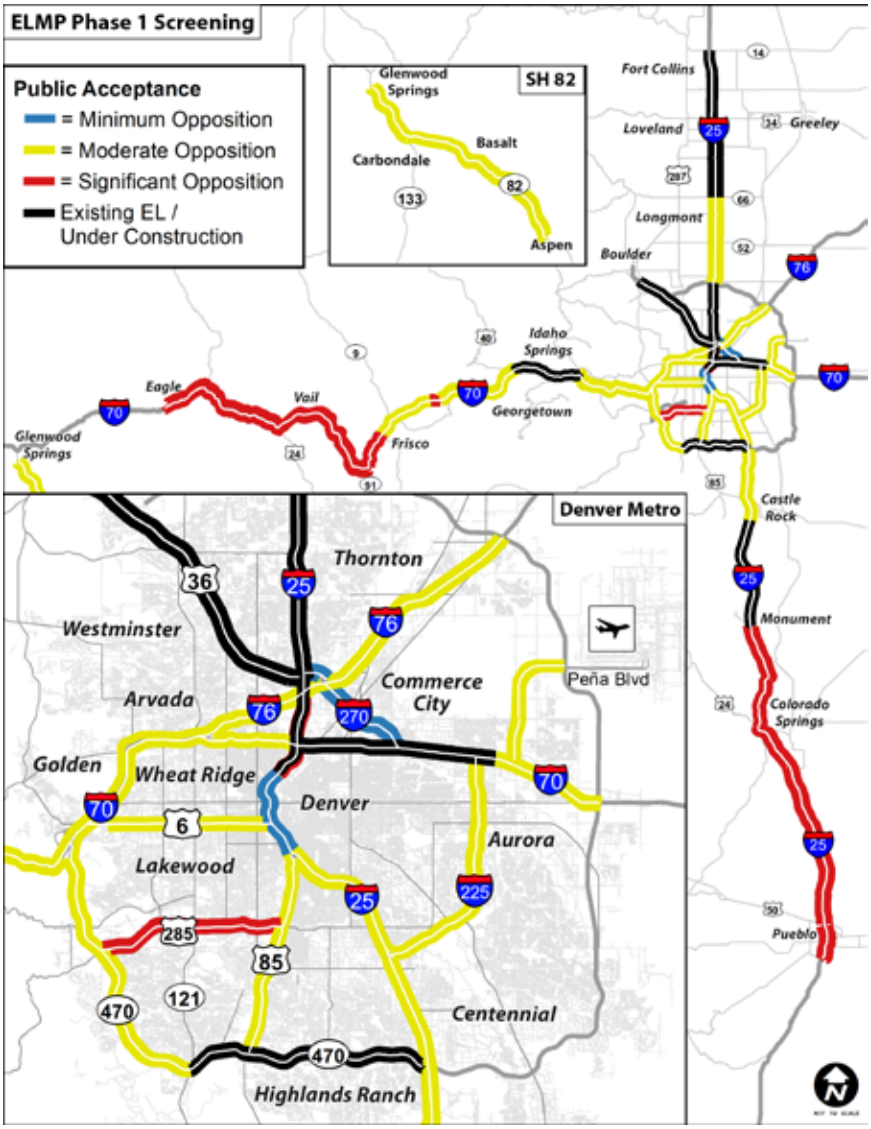
Scoring Guidelines:

5	**Existing Express Bus** along segment or parallel route
0	**No Existing Express Bus** along segment or parallel route

4.2.4 Public Acceptance

The public acceptance measure was the most qualitative of the initial screening metrics. Individual segments were scored based on whether local travel markets adjacent to corridors would be expected to have experience with existing Express Lanes, and therefore a better understanding and acceptance of the facilities. By this reasoning, segments in the south Front Range and western I-70 Mountain Corridor would be expected to face somewhat significant opposition, while specific segments in the Denver metro area would be expected to face minimum opposition. However, most segments in the initial screening scored a "3," based on the moderate level of expected opposition. Additional score adjustments were made based on local knowledge gleaned from other CDOT projects and outreach efforts. Results for this metric are shown in Figure 4-5.

Figure 4-5 // Public Acceptance – Initial Screening



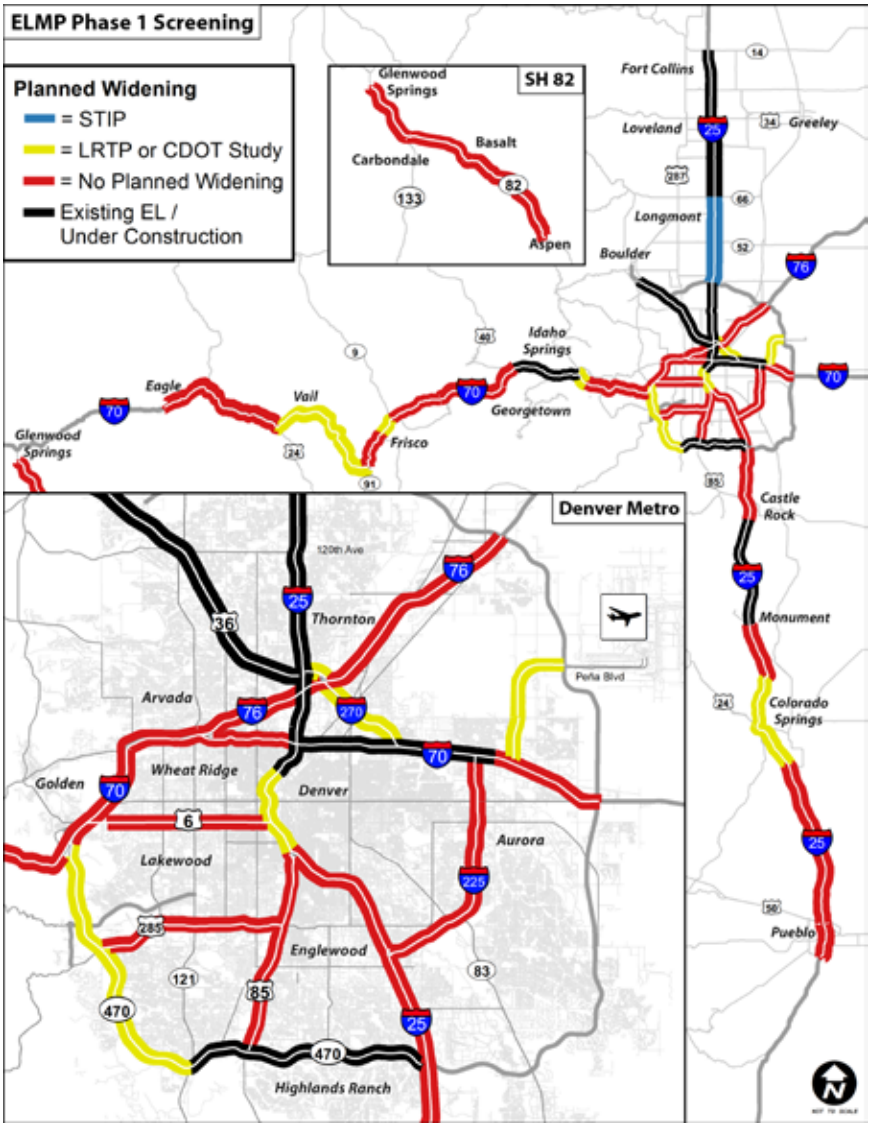
Scoring Guidelines:

5	Potential Express Lane would likely face **Minimum Public Opposition** from adjacent communities
3	Potential Express Lane would likely face **Moderate Public Opposition** from adjacent communities
0	Potential Express Lane would likely face **Significant Public Opposition** from adjacent communities

4.2.5 Planned Widening

Segment scoring for the planned widening metric relied on information from the Statewide Transportation Improvement Plan (STIP), regional Long Range Transportation Plans (LRTP), and previous CDOT studies and planning documents. As shown below, segments scored highly if future corridor widening, specifically the addition of new capacity, was identified in the STIP, and scored a "3" if widening was identified in a regional plan or as the result of a specific corridor study. These determinations were based on the idea that a new Express Lane could be viable if additional capacity was already warranted through previous investigations. As shown in Figure 4-6, several locations have been identified for future widening in regional plans and corridor studies, while only I-25 North between E-470 and SH 66 has been identified for future widening as part of the STIP.

Figure 4-6 // Planned Widening – Initial Screening



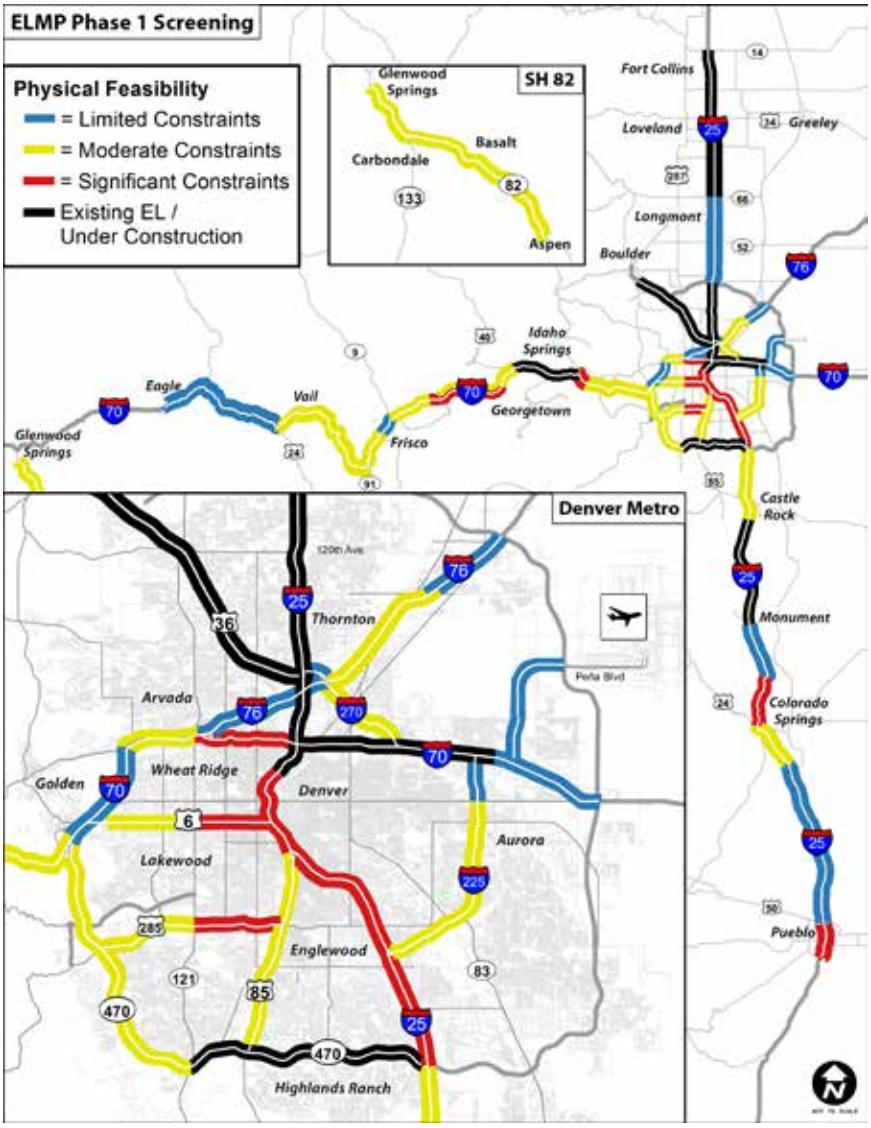
Scoring Guidelines:

5	Portion of segment identified for **Future Widening in STIP**
3	Portion of segment identified for **Future Widening in LRTP or CDOT Study**
0	**No Future Widening** identified in STIP or LRTP

4.2.6 Physical Feasibility

Each initial screening corridor segment was assessed in terms of the physical feasibility of Express Lanes through a planning level analysis of available shoulder widths, existing median configurations, and the presence and absence of constraining bridges, interchanges, and rights-of-way (ROW). Using these considerations, each segment was determined to be either significantly, moderately, or minimally constrained, as shown below. Physical feasibility was considered a vital measure as part of the initial screening, since it can be used as a high-level indicator of eventual Express Lane capital costs. Results for the physical feasibility assessment are shown in Figure 4-7. Most high-scoring segments are located in more rural or suburban areas with available ROW and limited constraints, while low scoring segments are concentrated in more urban areas of Denver and Colorado Springs, along with the I-70 Mountain Corridor.

Figure 4-7 // Physical Feasibility – Initial Screening



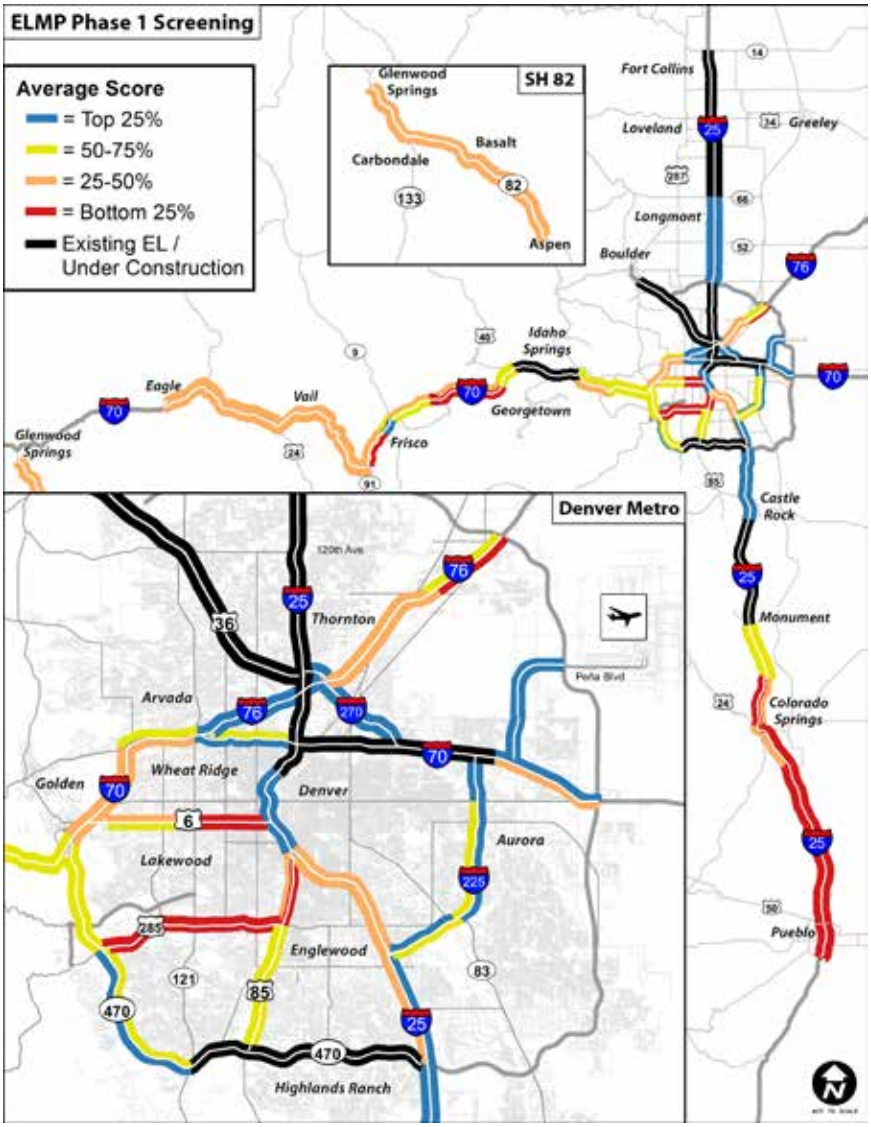
Scoring Guidelines:

5	Segment has available median or shoulder space with **Limited Constraints**
3	Segment has available median or shoulder space, but with some Moderate Constraints (Interchanges, widening)
0	Segment has limited space with **Significant Constraints** (ROW, Walls, below/above grade construction)

4.2.7 Average Score

The individual metric results described throughout section 4.2 were used to determine an average overall score for each individual corridor segment. Evaluation measures were grouped into categories and averaged together—effectively creating a weighted average score for each segment. Corridor segments were then ranked and divided into quartiles based on their relative performance, as shown in Figure 4-8. The highest scoring 25 percent of segments are located mostly in the Denver metro area along I-25, I-270, I-76, I-70, C-470, and I-225. These segments scored highly due to existing congestion, proximity to existing Express Lanes which provide public familiarity and system connectivity, and existing express bus services. The lowest scoring segments are located on I-25 south of Monument, along the I-70 Mountain Corridor, and in the western Denver metro area. Low scoring segments were a result of limited congestion and challenging physical feasibility. Phase I Initial Screening Matrix with individual segment scores is included in Appendix C.

Figure 4-8 // Average Score – Initial Screening



Scoring Guidelines:

5	Highest Scoring Segments (Top 25%)
3	50 to 75%
1	25 to 50%
0	Lowest Scoring Segments (Bottom 25%)

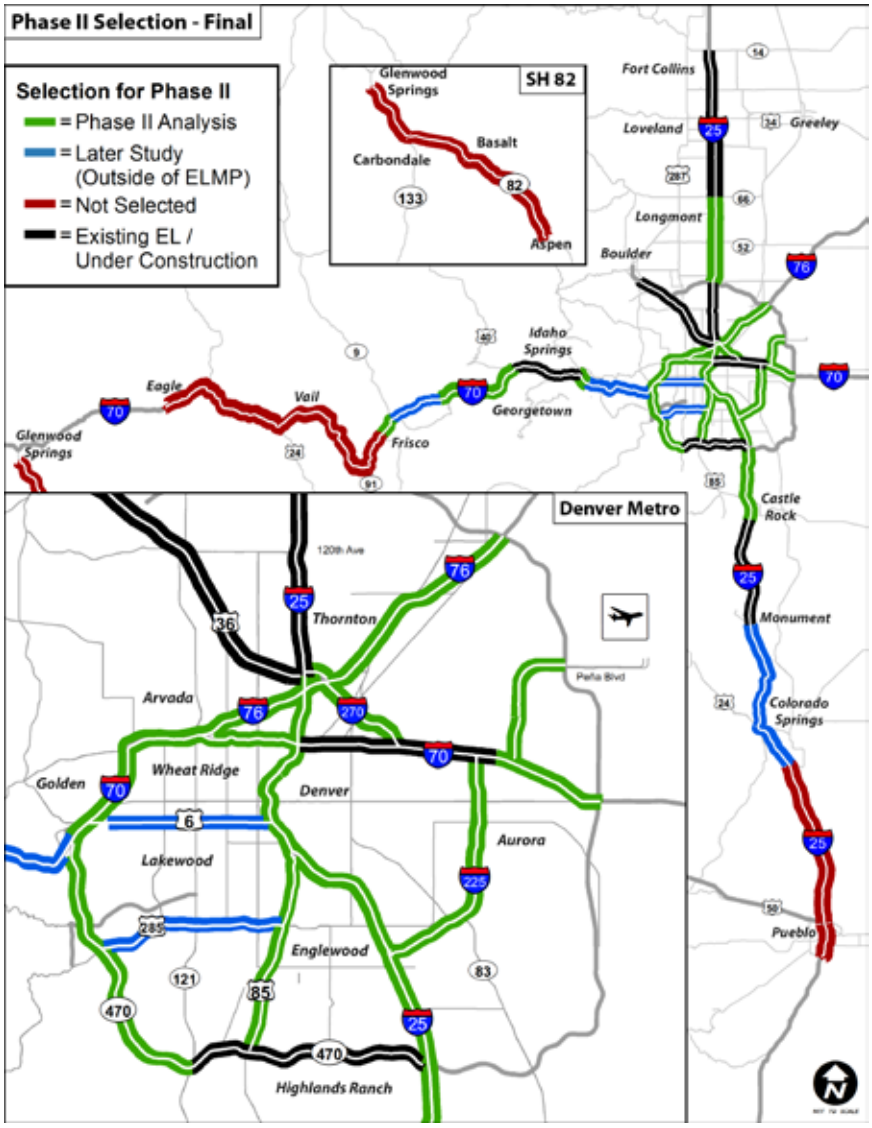
4.3 Phase II Corridor Selection

Although important, the overall average score discussed in the previous section was used as only one consideration in the section of corridors for further study. In order to select Phase II corridors for more detailed analysis, the project team developed a set of selection rules in coordination with HPTE. These considerations are explained below:

- Using the existing congestion scores described in section 4.2.1, the most congested (top 25%) of corridors were selected for Phase II analysis, regardless of other category scores. This decision was centered around the reality that existing corridor congestion, and an Express Lane's ability to provide some relief to this congestion, is the most important indicator of the potential success of an Express Lane facility. As such, no highly congested segments were eliminated from consideration prior to more detailed analysis.
- Utilizing the same congestion data and logic described above, the least congested corridors (bottom 25%) were not selected to move forward for Phase II analysis.
- The remaining segments were selected for Phase II analysis if the following conditions were met:
  - *An average overall initial screening score that fell within the top 50% of segments.*
  - *A portion of the segment was identified for additional capacity expansion by a previous CDOT study.*
  - *The segment would increase Express Lane system continuity by closing a gap between Existing Express Lanes and other high-scoring segments.*
  - *There were no indications of significant public opposition to a future Express Lane voiced by stakeholders as part of Workshop 2.*
  - *Other unique considerations for the I-70 Mountain Corridor, such as known operational practices and local conditions shared by CDOT and I-70 Corridor Coalition stakeholders.*

Corridors selected for Phase II analysis are shown in Figure 4-9. Selected corridors include the majority of freeway corridors in the Denver metro area, I-25 from Longmont to Castle Rock, and sections of the I-70 Mountain Corridor that expand on the existing I-70 PPSL. Other more unique corridors selected for Phase II include the existing I-25 Central Bi-Directional Express Lanes, as well as the existing HOV lane on US 85.

Figure 4-9 // Phase II Corridor Selection



5

Alternative Development Phase II

SECTION

5

Alternatives for Express Lane implementation were developed for corridors and direct connect ramps that advanced to Phase II. Planning level concept designs were developed to determine geometric feasibility of implementing Express Lanes in identified corridors and at potential direct connect ramps. The concept designs consisted of typical section analysis, line diagram development, and in certain corridors and direct connect ramps, high level concept designs. These concept designs confirmed feasibility and provided a design for the development of capital cost estimates.

5.1 Conceptual Design Approach

The concept designs developed for this master plan are planning level only for an Express Lane implementation and should not be considered final configurations. Future project development including preliminary design and environmental clearances will ultimately define individual proposed build alternatives.

5.1.1 Typical Sections

For this ELMP, the basic Express Lane implementation was assumed as an inside buffer separated lane with a standard 10-12 foot inside shoulder, 12-foot lane and 4-foot painted buffer between the Express and general-purpose lanes. It was assumed all ingress and egress zones would be accommodated with a parallel approach, and no additional acceleration/deceleration lanes would be needed. For planning purposes initial ingress/egress and tolling point locations were identified for traffic modeling and cost estimation purposes.

Concept designs consisted of analyzing how the basic Express Lane fit within the existing general-purpose lanes and available median widths. Data obtained during Phase I for the geometric feasibility analysis of each corridor was analyzed in more detail to develop typical section scenarios for Express Lane implementation. The proposed median Express Lane typical section requires 58 feet of width between existing travel lanes to accommodate an Express Lane in each direction without shifting existing general-purpose traffic. Where 58 feet is not available additional widening to the outside and general-

purpose lane shifts are required to accommodate the additional lanes.

Horizontal geometry measurements were used to verify and supplement design screening data. More specifically, locations at which changes in horizontal geometry occur were reviewed to determine the need for additional typical sections.

For clarity, typical sections were divided into six basic scenarios that summarize the geometry of most of the segments analyzed. Five additional typical section scenarios were considered for the I-70 Mountain Corridor, three of which reflect improvements to provide Peak-Period Shoulder Express Lanes (PPSEL). Each scenario reflects a different level of constructive effort and capital investment as seen in **Table 5-1** below. Typical sections are shown in Appendix B: Typical Sections for ELMP Phase II Corridors.

Table 5-1 // Phase 2 Typical Section Scenarios

SCENARIO	DESCRIPTION OF WORK TO IMPLEMENT EXPRESS LANES	EXPECTED REQUIRED INVESTMENT
Scenario 1	Inside widening only	Mid-level investment, variable cost dependent on existing median configuration and width of widening required
Scenario 2	Inside & outside widening with general-purpose lane shift	Mid to high-level investment; requires increased widening, right-of-way acquisition possible
Scenario 3	Outside widening only with general-purpose lane shift	Mid to high-level investment; walls possible for outside widening, right-of-way acquisition possible
Scenario 4	Inside widening only with wide depressed median	Mid-level investment depending on width of widening and existing median configuration
Scenario 5	Striping change only	Minimal investment
Scenario 6	Constrained urban segment with retaining & noise walls	High-level investment; retaining and noise walls required, ROW acquisition probable
I-70 Mountain PPSEL Scenario 10	Median PPSEL	Variable; depending on existing median configuration and the width of widening required
I-70 Mountain PPSEL Scenario 11	Median PPSEL with median retaining wall	Mid to high-level investment; cost variation dependent on retaining wall design
I-70 PPSEL Scenario 12	Median reversible PPSEL with Zipper Barrier	High-level investment expected for installation and operation of zipper system
I-70 Mountain EL Scenario 20	Median Express Lane with wide sloped median	Mid-level investment; cost variation dependent on existing median configuration and width of widening required
I-70 Mountain EL Scenario 21	Median Express Lane (one direction)	Min to mid- level investment; cost variation dependent on existing median configuration and width of widening required

5.1.2 Concept Line Diagrams

For each of the corridors analyzed, line diagrams were developed to illustrate the horizontal constraints of the existing corridors and the locations at which each typical section scenario will be implemented. High-level details such as existing horizontal width, number of lanes, safety features, and crossroads are considered for each corridor. Shaded shapes indicate required widening for each segment and are included on each diagram. Each shape is color coded to indicate the typical section scenarios required to implement the Express lane. Descriptions of each corridor are provided below. The corresponding line diagram sheets can be found in Appendix B: Line Diagrams for ELMP Phase II Corridors.

5.1.3 Specialty Corridors (I-25 Central and Santa Fe)

The I-25 Central Corridor between US 36 and C-470 was reviewed in more detail due to the constrained nature of the corridor. The central corridor includes three distinct segments; the existing reversible Express Lanes between US 36 and 20th Street; the ongoing I-25 Central Planning and Environmental Linkage (PEL) study between 20th and Santa Fe (US 85); and the segment from Santa Fe to C-470, formerly known as the Transportation Expansion Project (TREX) segment while in construction in the early 2000's. Several concepts were identified and developed to different levels to confirm geometric feasibility and develop cost estimates. Detail on these various concepts is discussed below within each sub segment of I-25 Central.

The Santa Fe (US 85) Corridor was the only non-freeway corridor to advance to Phase 2. This corridor has an existing HOV lane that could be converted to an Express Lane, but also has many at grade intersections that could cause delay, negating mobility benefits. This corridor was reviewed in more detail than typical section and line diagrams.

5.1.4 CDOT Projects in Progress

Several projects are in various phases of preliminary engineering and environmental clearances. Descriptions of proposed Express Lane implementations and available cost estimates were used. These projects include: North I-25 (SH 7 to SH 66); I-25 South (C-470 to Castle Rock); and I-70 at Floyd Hill.

5.1.5 Direct Connect Ramps

High level concept designs were developed for direct connect ramps at select locations that experience high traffic volumes on existing facilities. These designs included both schematic type line drawings and more detailed concept layouts to define Express Lane direct connect ramps and modifications to existing interchanges required to identify a geometrically feasible direct connect ramp alternative. Details on these ramps are discussed at each location.

5.2 Corridors and Direct Connect Descriptions

5.2.1 Beltway Corridors

COLORADO HIGHWAY 470 (I-70 TO WADSWORTH)

Description: Colorado Highway C-470 in western the Denver metro area from I-70 to Wadsworth Blvd to I-70 is a 14-mile corridor with two and three lanes in each direction. The access controlled highway has both depressed and concrete barrier median sections. The corridor begins at I-70 with a possible direct connection to I-70 east of C-470 and ends with a connection to the soon to open Express Lanes east of Wadsworth Blvd to I-25.

Express Lane Implementation: From I-70 to US 285, with the existing median concrete barrier, the highway would be widened to the outside and the existing general-purpose lanes shifted to implement the Express Lanes in the inside lanes (scenario 3). From US 285 to Wadsworth Blvd the existing narrow depressed median would be paved along with widening to the outside (scenario 2) to accommodate the Express Lanes in the inside and shift existing general-purpose lanes outside. It is possible that noise walls may be warranted in locations along C-470 south of US 285 once a noise analysis is completed during the preliminary design and environmental clearance phase. The existing right of way is sufficient to accommodate the implementation of Express Lanes that meet current design standards.

INTERSTATE 225 (I-70 TO I-25)

Description: I-225 is a 12-mile ring interstate on the east side of Denver connecting I-70 to I-25. I-225 generally has three lanes in each direction with a concrete median barrier in some segments, and a narrow depressed median in other segments. The south end approaching I-25 includes a light rail train in the median. The corridor begins at I-70 with a possible direct connection to I-70 Express lanes east and west of I-225 and ends at I-25 with a possible direct connect to I-25 Express Lanes, depending on the final configuration of potential Express Lanes on I-25.

Express Lane Implementation: From I-70 to just east of Parker, both all outside widening (scenario 3) and inside and outside widening (scenario 2) would be required to accommodate an Express Lane in each direction. The existing general-purpose lanes would be shifted out for the Express Lanes in the median. The existing Parker light rail station in the median and adjacent park and ride and flyover creates a pinch point limiting the ability to fit an Express Lane in the southbound direction through the Parker Road interchange. This requires the southbound Express Lanes to realign to the northbound lanes around the light rail station and then flyover the light rail tracks, via a long bridge, south of the interchange ramps back to the southbound lanes. The interstate would continue to be widened to the outside in both directions from the Parker interchange to I-25 for the additional width needed for the Express Lanes. The existing right of way is mostly sufficient to accommodate the implementation of Express Lanes that meet current design standards, but easements and minor right of way maybe needed to construct the improvements at spot locations.

PENA BOULEVARD (I-70 TO E-470)

Description: Pena Boulevard between I-70 and E-470 is an 8.8 mile controlled access highway that provides access to Denver International Airport from I-70. Pena Boulevard generally has two lanes in each direction with a very wide median. The corridor begins on the south at I-70 with a possible direct connection to and from the I-70 Express lanes, currently under construction as part of the C70 Project, and ends the E-470 interchange.

Express Lane Implementation: The wide divided highway allows for widening to the inside in each direction (Scenario 4) to accommodate a new Express Lane while still maintaining a wide depressed median. The existing right of way is sufficient to accommodate the implementation of Express Lanes that meet current design standards

5.2.2 East / West Corridors

INTERSTATE 70 (C-470 TO I-76 SEGMENT)

Description: Interstate 70 in western Denver metro area from C-470 to I-76 is a 9-mile corridor with three to five lanes in each direction and both depressed and concrete barrier median sections. This sub segment begins just west of C-470 on the west end and continues to the intersection of I-70 and I-76 which would require direct connect Express Lane ramps to continue Express Lanes along both I-70 and I-76.

Express Lane Implementation: From C-470 to Clear Creek there is sufficient median width to pave the median and implement one Express Lane in each direction that meets standard without shifting general-purpose lanes (scenario 1). From Clear Creek to Kipling the existing narrow depressed median would be paved along with widening to the outside (scenario 2) to accommodate the Express Lanes in the inside and shifting existing general-purpose lanes outside. East of Kipling to I-76 requires outside widening with substantial new retaining and noise walls (scenario 6) due to the constrained urban nature of this segment with adjacent neighborhoods and frontage roads. The existing right of way is sufficient to accommodate the implementation of Express Lanes that meet design standards from C-470 to Kipling. East of Kipling minor right of way and easement maybe required to construct the widening.

INTERSTATE 70 (I-76 TO I-25 SEGMENT)

Description: Interstate 70 from I-76 to I-25 is a constrained urban 5-mile corridor with three lanes in each direction and substandard inside shoulders with a concrete barrier median. This sub segment of the I-70 corridor would begin at a potential direct connect ramp of I-70 and I-76 on the west end and continue to I-25 on the east end where Express Lanes would connect to the Central 70 Project currently under construction.

Express Lane Implementation: Due to the constrained urban nature of this segment with adjacent neighborhoods and frontage roads, significant outside widening with substantial new retaining and noise walls (Scenario 6) is required between I-76 and

east of Pecos. This includes major interchange improvements at Harlan, Sheridan, and Federal. East of Pecos to the Central 70 Project connection could be accommodated with changes to the existing pavement markings (scenario 5). The existing wood barrier fences would be replaced with noise walls. The existing right of way would accommodate the implementation of Express Lanes that meet design standards with the use of retaining walls, but minor right of way and easements would be required to construct the widening and interchange improvements.

INTERSTATE 70 EAST (PENA BLVD TO E-470 SEGMENT)

Description: Interstate 70 from Pena Blvd to E-470 is a 5.5 mile interstate segment on the east side of the Denver Metro area with two lanes in each direction and a depressed median. The pavement was reconstructed less than 10 years ago for most of this segment. The west end would connect to the Express Lanes under construction as part of the Central 70 Project and terminate on the east end at E-470.

Express Lane Implementation: From Pena Boulevard to Colfax Avenue there is sufficient median width to pave the median and implement one Express Lane in each direction that meets standard without shifting general-purpose lanes (scenario 1). At the Colfax Avenue interchange with the left hand westbound exit ramp the potential Express Lanes would follow the eastbound alignment before connecting back to the median east of the ramps. The existing right of way is sufficient to accommodate the implementation of Express Lanes that meet design standards.

INTERSTATE 76 (I-70 TO I-25 SEGMENT)

Description: Interstate 76 from I-70 to I-25 is 6 mile interstate segment with two lanes in each direction and a depressed median. This segment has a numerous bridges and is built on a high earth fill. This corridor begins on the west end at I-70 through direct connect ramps and continues to I-25 where it would connect to an additional I-76 Express Lane Segment. There are potential direct connect ramps at I-25 discussed the direct connect ramp section.

Express Lane Implementation: From the potential I-70 and I-76 direct connect ramps the existing depressed median would be paved along with widening to the outside (Scenario 2) to accommodate the Express Lanes in the inside and shift existing general-purpose lanes outside. The existing median is wide enough to accommodate Express Lanes with substandard inside shoulders of 8 foot width. However, for this ELMP, costs were developed assuming inside and outside widening and standard shoulders. It is possible that noise walls are warranted in locations along I-76 once a noise analysis is completed during the preliminary design and environmental clearance phase. The existing right of way is sufficient to accommodate the implementation of Express Lanes that meet current design standards.

INTERSTATE 76 (I-25 TO E-470 SEGMENT)

Description: Interstate 76 from I-25 to E-470 is an 11 mile interstate segment built mostly with two lanes, but with some sections of three lanes. It has both depressed median and concrete barrier median sections. This segment is constrained and narrow between US

6 and US 85. This corridor begins on the west end at I-25 continuing from the previous I-76 segment and extends northeast terminating near E-470. There are potential direct connect ramps at I-25 and I-270 discussed the direct connect ramp section.

Express Lane Implementation: From the I-25 to just east of I-270, the existing median would be paved and minor widening to the outside (Scenario 2) to accommodate the Express Lanes in the inside and shift existing general-purpose lanes outside. From I-270 to north of 74th the existing median is paved and only pavement marking modifications (scenario 5) would be needed to accommodate an Express Lane in each direction. North of 74th to US 85 the interstate would be widened to the outside and the existing general-purpose lanes shifted to implement the Express Lanes in the inside (scenario 3). The US 6 interchange would need to be completely reconstructed for the widening. At the US 85 interchange with the left hand northbound exit ramp the potential Express Lanes would follow the southbound I-76 alignment before connecting back to the median north of the interchange. From US 85 to E-470 the existing median would be paved and minor widening to the outside (Scenario 2) to accommodate the Express Lanes in the inside and shift existing general-purpose lanes outside. It is possible that noise walls may be warranted in locations along I-76 once a noise analysis is completed during the preliminary design and environmental clearance phase. The existing right of way is sufficient to accommodate the implementation of Express Lanes that meet current design standards for most of this segment, however there could be the need for minor right of way and easements between US 6 and US 85.

INTERSTATE 270 (I-70 TO I-25 SEGMENT)

Description: Interstate 270 from I-25 to I-70 is a 6 mile interstate segment with two lanes in each direction with both depressed median and concrete barrier median sections. This segment has numerous bridges and is built on a high earth fill. This corridor begins on the west end at I-25 and US 36 through direct connect ramps and continues to I-70 where it would connect to I-70 through direct connect ramps There are potential direct connect ramps at I-25/US36, I-76 and I-70 discussed the direct connect ramp section.

Express Lane Implementation: From I-25 to I-76 there is sufficient median width to pave the median and implement one Express Lane in each direction that meets standards without shifting general-purpose lanes (scenario 1). From I-76 to west of the Vasquez interchange the existing depressed median would be paved along with widening to the outside (scenario 2) to accommodate the Express Lanes in the inside and shift existing general-purpose lanes outside. The York Street interchange and I-76 ramps would be reconstructed and realigned. Through the Vasquez interchange the existing median would be paved (scenario 1). The last mile and a half approaching I-70 was reconstructed in the early 2000's with a concrete barrier. In this section the interstate would be widened to the outside and the existing general-purpose lanes shifted to implement the Express Lanes in the inside (scenario 3). It is possible that noise walls may be warranted in spot locations along I-270 once a noise analysis is completed during the preliminary design and environmental clearance phase. The existing right of way is sufficient to accommodate the implementation of Express Lanes that meet current design standards.

5.2.3 I-25 Corridors

NORTH I-25 (SH 7 TO SH 66)

Description: Interstate 25 from SH 66 to SH 7 is a 14 mile segment with a wide divided median that was reconstructed in the 2000's and planned for future widening. The North I-25 EIS identified an additional Express Lane in this segment. The northbound and southbound lanes would be widened into the median to provide an Express Lane in each direction that meets design standards (scenario 4). The project is currently in the preliminary design phase.

CENTRAL I-25 (US 36 TO 20TH SEGMENT)

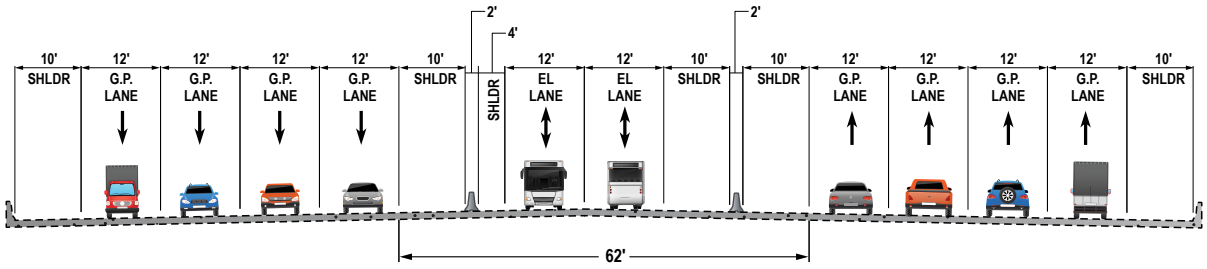
Description: Interstate 25 between US 36 and 20th Street is a six mile, four and five-lane freeway with an existing barrier-separated two lane reversible Express Lane section. This section includes the I-70, I-76, and US36/I-270 interchanges. The existing reversible section begins at 20th Street and ends on US 36 west of I-25. There is an existing direct connect ramp from the reversible section into downtown at 20th Street. Any change to this segment requires relocating the existing reversible lane termini on US 36 and reconfiguring the I-25 to US 36 Express Lane direct connect ramps. Several alternatives were developed and analyzed to understand the benefits and opportunities of continuous Express Lanes in both directions through this segment. Two options were fully developed and modeled with cost estimates. Typical sections for each are shown in **Figure 5-1**.

Express Lanes Implementation: Alternative 1-Bifurcated Aerial – Due to the tightly constrained urban environment of this corridor and the impacts of widening the existing highway, a bifurcated aerial concept was developed to provide additional Express Lanes in this corridor. This would leave the existing two reversible Express Lanes in their current condition, and they would always be southbound Express Lanes. A new aerial bridge structure, with two Express Lanes in the northbound direction, would begin near 20th street and run on the east edge of the existing roadway through the I-70 interchange just south of I-76 where the aerial structure would tie back into the median area on grade. The two lane aerial bridge would be 41 feet in total width and meet design standards with a 4 foot inside shoulder, two 12-foot Express Lanes and a 10 foot outside shoulder. Benefits of the bifurcated aerial structure include facilitating direct connections to the 20th street direct connect ramp and the I-70 corridor. This aerial structure would require pockets of right of way and easements for bridge piers.

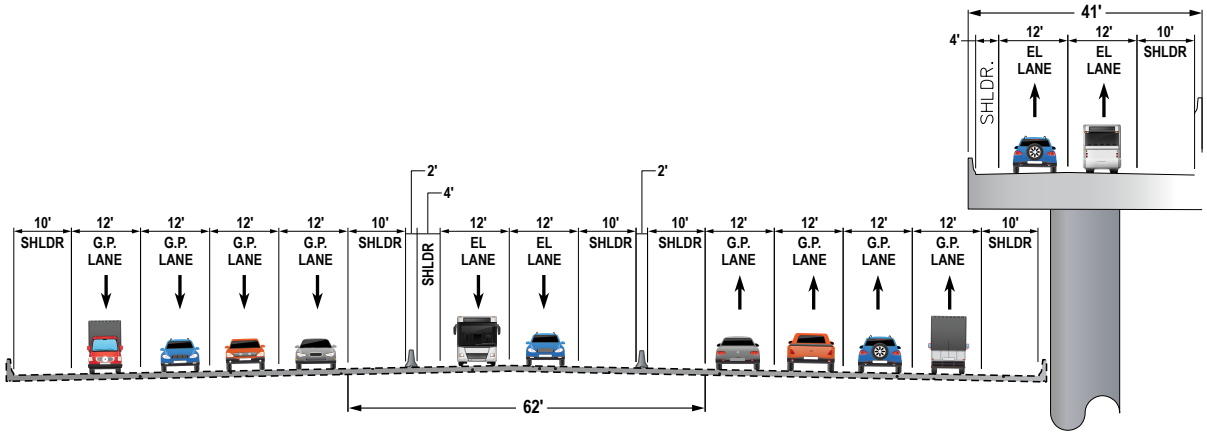
Express Lanes Implementation: Low Cost Alternative Reversible Zipper – A lower cost alternative would be to reconfigure the existing barrier separated reversible lanes to maximize the use of the pavement width. The existing barrier-separated cross section is approximately 62 feet wide between northbound and southbound general-purpose lanes, but only carries two lanes of traffic due to the shoulder requirements along barriers and lanes. Reconfiguring this segment to include a moveable zipper barrier would allow for one Express Lane in each direction and an additional Express Lane in the peak-period controlled by the zipper barrier. This barrier would be a continuous string of short barrier segments that can be moved with a special barrier moving machine. For this alternative during the AM peak-periods, two southbound and one northbound

Express Lanes would be provided. The zipper barrier would be moved during the mid-day and provide one southbound and two northbound Express Lanes during the PM peak-period. The existing Park Avenue flyover provides a pinch point on the south requiring widening and slight realignment of all the northbound lanes to avoid reconstructing this flyover bridge. The south end termini would be at the 20th Street direct connect bridge, and the north end termini would be just south of I-76. From I-76 north, two Express Lanes in each direction would proceed through the I-25 and US 36/I-270 interchange. Utilizing the available width between the northbound and southbound general-purpose lanes for most of this segment would enable a typical section with 4 foot painted buffers in both directions, 12 foot Express Lanes, and an inside shoulder of 8 feet against the moveable barrier. This shoulder would be a couple feet short of design standards but would allow the implementation of this system with in the footprint of the existing interstate roadway without additional right of way.

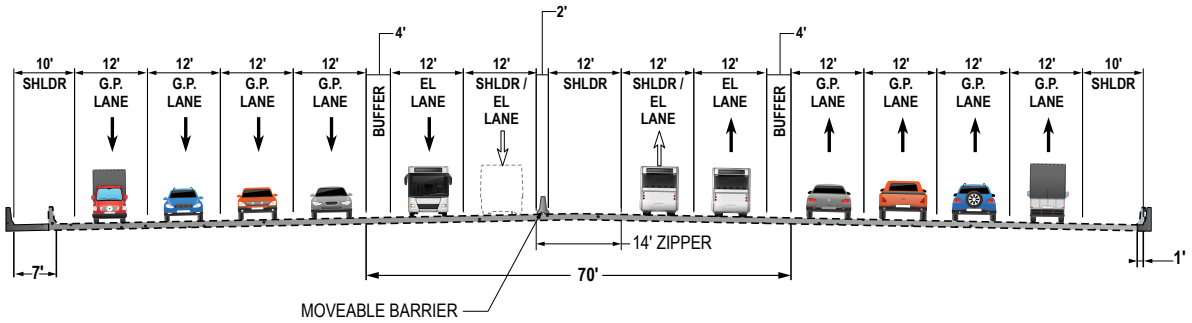
Figure 5-1 // Central I-25 (US 36 to I-25) Options



EXISTING CONDITION



ELEVATED NB
(Always 2EL / 2EL)



REVERSIBLE ZIPPER LANE
(2EL (SB)/1EL (SB)

CENTRAL I-25 (20TH TO SANTA FE SEGMENT)

Description: Interstate 25 in the central part of Denver from 20th Street to Santa Fe (US 85), is 4 mile interstate segment with four and five lanes in each diection, and a concrete barrier median in a highly constrained urban environment that includes a curvy alignment and several closely spaced interchanges. CDOT is currently completing a PEL study for this segment. When this ELMP began alternative development, the PEL was not to a point that it could provide alternatives and cost estimates, therefore alternatives were developed to implement an Express Lane through this segment of I-25.

Express Lanes Implementation: To accommodate an Express Lane in each direction in this segment significant widening and reconstruction is required that then impacts existing substandard interchanges. Available existing condition information from the PEL including traffic and right of way information was reviewed to understand constraints and interchange improvement needs. The numerous pinch points created by existing development and topography and additional operation and capacity needs influenced the decision to develop an Express Lane alternative with a non-standard four foot inside shoulder through this section. The 4 foot buffer and 12 foot Express Lane would still be utilized. Additionally, the ELMP identified opportunities for direct connect ramps to and from the potential Express Lanes to Speer Boulevard, Auraria Parkway, and from US 6 to northbound I-25.

A planning level design was developed from 20th to Santa Fe to implement a continuous Express Lane in each direction along with widening and realignment of the interstate to minimize impacts to adjacent development and environment. This alternative includes reconstructing the Speer and 23rd Street interchanges and realigning and reconnecting existing ramps. The Valley Highway EIS alternative alignment from Santa Fe to US 6 was included which requires realigning the adjacent railroad tracks to the east. The alternative design includes several direct connect ramps as detailed in the direct connect section. Without direct connect ramps it is recommended that no access points would be provided along this section of I-25 due to the curved alignment and high number of interchanges. The weave movements required into and out of the Express Lanes would impact operations and safety. This alternative requires significant right of way and relocations, and it is anticipated that several long stretches of noise walls would be required. As noted this concept requires a design exception for the substandard inside shoulder.

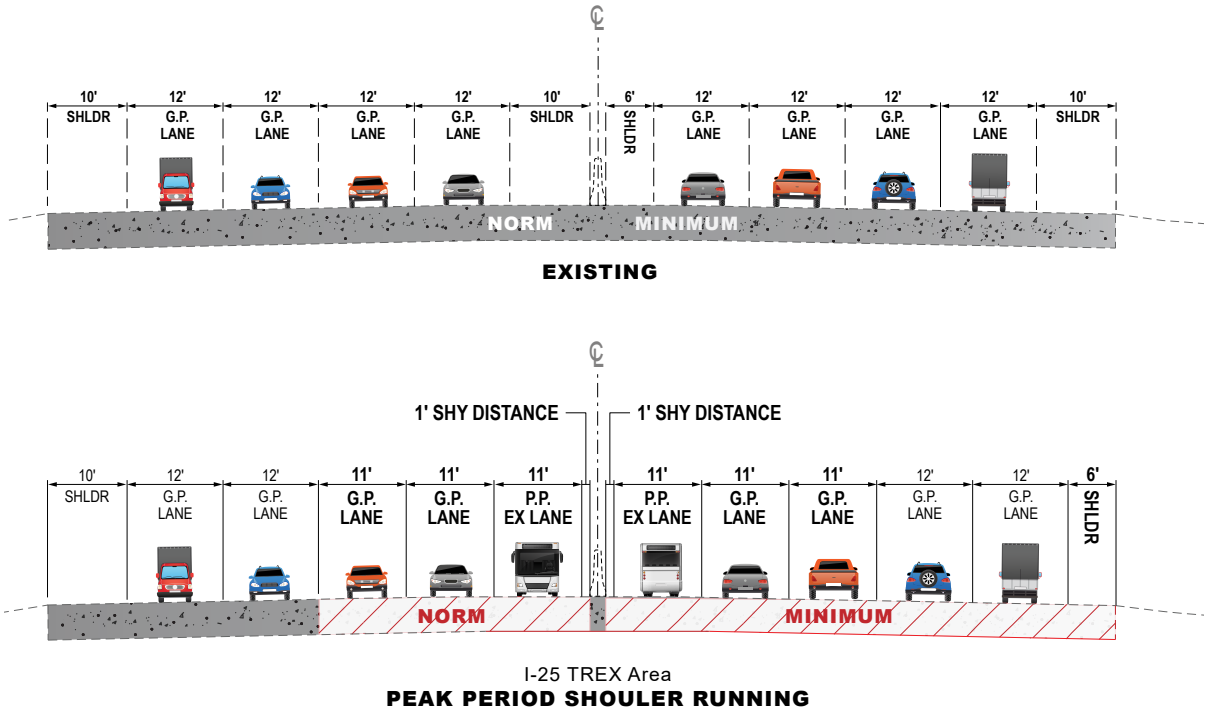
CENTRAL I-25 (SANTA FE TO C-470 SEGMENT)

Description: Interstate 25 from Santa Fe (US 85) to C-470 is a 13.5 mile four and five lane interstate segment with a concrete barrier median in a highly constrained urban environment with a parallel light rail line on the west side. The entire corridor was reconstructed in the mid-2000's as part of the TREX and I-25 Broadway Bridge replacement projects. This segment would connect to any Express Lane options in the Central I-25 segment to the north, and tie into the South I-25 Express Lanes and the C-470 direct connect ramps on the southern end.

Express Lanes Implementation: Alternative 1 Aerial – Due to the tightly constrained corridor the only option to add a new Express Lanes that meets standards while maintaining the existing number of highway lanes is to elevate above the existing corridor. Option 1 for this segment includes a complete aerial Express Lane concept with one Express Lane in each direction on a viaduct bridge. This would require a bridge 55 feet in width to meet standards (4 foot inside shoulder, 15 foot lane, 6 foot outside shoulder) for single lane barrier separated lanes. These widths are required for breakdown and emergency response. The bridge would mostly be located above the existing centerline of I-25 with bridge piers within the existing concrete barrier. However, at the I-25/I-225 interchange, the alignment would shift to the west side of I-25 to provide direct connect options to I-225 and an access connection to Union Avenue. The aerial bridge would begin north of C-470 and end north of Santa Fe. Access to the aerial bridge system would be limited to four intermediate locations: Arapahoe Road area, Belleview area (Union Ave), Colorado Blvd area, and Broadway area. The aerial bridge would need to rise to pass over the numerous existing highway overpasses and pedestrian bridges. The costs for this option are extremely high and have impacts associated with an aerial bridge system 20 to 50 feet high through residential areas.

Express Lanes Implementation: Low Cost Shoulder Express Lane – Due to the costs and impacts of the aerial option, a lower cost option was investigated. Option 2 includes a shoulder running Express Lane option on the existing inside shoulder. Most of this segment has 10 to 12 foot inside shoulders. The shoulder running option would include a 1 to 2 foot separation between the existing concrete median barrier and the proposed Express Lane. The Express Lane would be 11 feet in width, with an 8-12 inch painted stripe between the Express Lane and general-purpose lane. To accommodate this implementation the inside general-purpose lane would be reduced to 11 feet in width, and in some locations the second inside general-purpose lane would be narrowed as well. There are a few pinch points that will require additional lane or shoulder narrowing or some reconstruction and widening. Between Orchard Road and Arapahoe Road the existing Yosemite Street bridge constrains the interstate. This will need to be rebuilt to allow the interstate to be widened to accommodate the shoulder running Express Lane option. The reduced lanes and shoulder widths will require a design exception. This shoulder running Express Lane option could require variable speed limit control in the Express Lane during peak-periods to minimize potential speed differential. Additionally, lane restrictions outside of peak-hours would need to be investigated during project development.

Figure 5-2 // Central I-25 (Santa Fe to C-470) Shoulder Running Typical Section



SOUTH I-25 (C-470 TO CASTLE ROCK)

Description: Interstate 25 from C-470 to the south end of Castle Rock is a 13 mile three and four lane interstate segment with a median concrete barrier. This section was reconstructed through multiple projects over the last two decades. Over the last three years CDOT has been studying this segment in the I-25 PEL South Colorado Springs Denver South Connection.

Express Lanes Implementation: The PEL has identified an ultimate configuration that includes adding an Express Lane in each direction. This will require widening to the outside and shifting the general-purpose lanes to accommodate Express Lanes in the inside in both directions. The project would connect to the currently under construction Express Lanes in the I-25 South Gap project and could connect to the C-470 Express Lanes via direct connect ramps.

5.2.4 Santa Fe (US 85) Corridor

SANTA FE (I-25 TO C-470)

Description: The Santa Fe (US 85) Corridor from I-25 to C-470 is a 9.4 mile north-south arterial highway with at-grade intersections and grade separated interchanges. There is an existing 4-mile section with an underutilized peak-period HOV lane in each direction. The corridor is constrained by railroad tracks on the east and commercial and residential development on the west. The corridor advanced into Phase II analysis because of the underutilized HOV lane and the opportunity to convert to an Express Lane. The south end would begin at C-470 with a potential direct connect to the soon-to-open C-470 Express Lanes, and end on the north end at I-25 with potential direct connect ramps.

Express Lane Implementation: The Santa Fe corridor was developed in three segments:

- **North** - I-25 to Florida (split alignment);
- **Central** - Florida to Belleview (existing HOV); and
- **South** - Belleview to C-470.

A concept design was developed for the North segment that would align a northbound and southbound barrier separated Express Lane along the northbound Santa Fe lanes adjacent to the Platte River. These lanes would grade separate over existing intersections at Mississippi, Florida and Iowa before connecting to the existing HOV lanes. This would include potential direct connect ramps to and from I-25 to relieve congestion at the existing I-25 and Santa Fe ramps. These direct connect ramps are dependent on the final alignment and widening of I-25 north of Alameda where the flyover ramps would tie into I-25.

In the Central section the existing HOV lane would be converted to an Express Lane. Express Lanes would be grade separated at most of the existing at grade intersections. This requires flyover bridges with lengths approaching 1000 feet.

The South section would be widened to accommodate a new Express Lane in each direction. The Express Lanes would need to be grade separated through the downtown Littleton area from Bowles to south of Arapahoe Community College along with grade separating most of the other existing at grade intersections. It is possible that noise walls may be warranted in locations along US 85 once a noise analysis is completed during the preliminary design and environmental clearance phase. The existing right of way is mostly sufficient to accommodate the implementation of Express Lanes that meet current design standards, with right of way required on the north end and in the Littleton downtown area.

5.2.5 Interstate 70 Mountain Corridors

I-70 (SILVERTHORNE TO FRISCO SEGMENT)

Description: Interstate from Frisco (Exit 203) to Silverthorne (Exit 205) is a 3-mile interstate segment with a divided median over 100 feet in width. In the eastbound direction, an Express Lane was analyzed from Exit 203 through the Exit 205 interchange east to the existing interstate metering signal at mile marker 207.5. These Express Lane segments would be isolated short segments to provide additional capacity for high peak traffic volumes between these interchanges.

Express Lane Implementation: The wide median allows for simple inside widening to accommodate new Express Lanes. Between Exit 203 and Exit 205, mountain typical scenario 21 would provide standard design configurations and maintain a depressed median. In the eastbound direction beyond Exit 203, the typical scenario 20 would accommodate inside widening while still maintaining a depressed median. All work would be within the existing interstate median.

I-70 (EJMT TO SILVER PLUME SEGMENT)

Description: Interstate 70 from the Eisenhower Johnson Memorial Tunnel (EJMT) to Silver Plume is a 9.2 mile interstate segment with a narrow depressed median and steep roadway grades. This subsegment would begin and end at the tunnels and continue into the next I-70 Mountain segment on the west side of Silver Plume. This segment would operate as PPSEL where the new pavement functions as an Express Lane during peak-periods when CDOT opens it for operation. For all other times the new pavement would function as a wider inside shoulder.

Express Lane Implementation: The existing median would be paved, and a new center concrete median barrier would be installed. This would provide enough width for an inside PPSEL that is 12 feet wide and has a shoulder of 1 to 4 feet in width (scenario 10). The existing general-purpose lanes and outside shoulder would remain in their current location. There are a couple locations where the eastbound and westbound lanes differ in elevation requiring a short retaining wall in the median (scenario 11). The inside shoulder would require a design exception when the PPSEL is in operation.

I-70 (SILVER PLUME TO GEORGETOWN SEGMENT)

Description: Interstate 70 from west of Silver Plume to Georgetown is a 4 mile interstate segment with a concrete barrier and narrow inside shoulders and steep roadway grades. This segment is constrained by the historic towns and steep mountain faces on the north and south. This subsegment would connect on both ends to potential I-70 Mountain Express Lane segments. This segment would operate as a PPSEL, but due to the constrained corridor, would act as a reversible segment.

Express Lane Implementation: Minor widening to the outside would be required to provide a minimum 16 foot width between eastbound and westbound general-purpose lanes (scenario 11). The existing median concrete barrier would be removed and replaced with a moveable barrier. This barrier would be a continuous string of short barrier segments that can be moved with a special barrier moving machine. This would allow

the barrier to be placed in the center of the median during non-peak periods providing an improved inside shoulder width. During peak-periods the moveable barrier would be moved approximately 5 feet in either direction to provide an 11 foot PPSEL and 1 foot inside shoulder against the moveable barrier and a 2 foot inside shoulder in the opposite direction. It is estimated the moveable barrier would generally be in the center position from Monday afternoon to Thursday morning before moving to provide a westbound PPSEL from Thursday afternoon to Saturday afternoon and then moving to provide an eastbound PPSEL from Saturday afternoon through Monday morning. Anticipated time to move the barrier is approximately 2 hours. The inside shoulders would require a design exception when the PPSEL is in operation.

I-70 (GEORGETOWN TO EMPIRE SEGMENT)

Description: Interstate 70 from the Georgetown to Empire Junction is a 4 mile interstate segment with a narrow depressed median. This subsegment would connect on the west end to a potential I-70 Mountain Express Lane segment and connect to the existing and under construction PPSEL segments at Empire Junction. This segment would operate as a PPSEL where the new pavement functions as an Express Lane during peak-periods when CDOT opens it for operation. For all other times the new pavement would function as a wider inside shoulder.

Express Lane Implementation: The existing median would be paved, and a new center concrete median barrier would be installed. This would provide enough width for an inside PPSEL that is 12 feet wide and has a shoulder of 1 to 4 feet wide (scenario 10). The existing general-purpose lanes and outside shoulder would remain in their current location. There are a couple locations where the eastbound and westbound lanes differ in elevation requiring a short retaining wall in the median (scenario 11). The inside shoulder would require a design exception when the PPSEL is in operation.

I-70 (TWIN TUNNELS TO FLOYD HILL SEGMENT)

Description: CDOT is currently in the preliminary engineering and environmental clearance phase of the I-70 Floyd Hill to Veterans Memorial Tunnel Project. This project would realign and reconstruct the interstate to address safety and design deficiencies and improve interchange operations. This project would provide an additional lane in the westbound direction from the tunnels to the top of Floyd Hill. One Express Lane in each direction would be built. The Express Lane would connect to the existing and under construction PPSEL to the west and terminate and begin at the existing three general-purpose lanes at the top of Floyd Hill.

5.2.6 Direct Connect Ramps

I-270/US36-I-25-I-76 DIRECT CONNECT RAMPS

The existing left exit ramps at I-25 and US 36 along with the existing reversible Express Lanes from I-25 to US 36 complicate direct connections of Express Lanes in the predominant directions of US 36 to I-270. Several connection options were developed to investigate direct connecting continuous Express Lanes within the I-25/I-76/I-270 US 36 interchange complex. To accommodate the direct Express Lane connections between US 36 and I-270 the reversible I-25 lanes termini need to be relocated to I-25. This would allow for direct connections between I-25 and US 36 and US 36 and I-270 (in both directions) via a system of braided bridges. A new flyover would provide Express Lane direct connections between I-25 southbound and I-270 eastbound and I-270 westbound and I-25 northbound. Additional potential Express Lane direct connect ramps in this interchange complex include I-25 southbound to I-76 westbound/I-76 eastbound to I-25 northbound; I-25 northbound to I-76 eastbound/I-76 westbound to I-25 southbound; and I-270 westbound to I-76 westbound/I-76 eastbound to I-270 eastbound.

C-470 TO I-70 DIRECT CONNECT RAMPS

Potential Express Lane direct connect ramps from northbound C-470 Express Lane to I-70 eastbound and in the opposite direction from I-70 westbound to C-470 southbound were developed. The direct connect ramps would include long flyover ramps from the medians of I-70 and C-470 over the existing interstate lanes and interchange ramps. These direct connections would reduce impacts to the I-70 and C-470 system interchange.

I-70 TO I-76 DIRECT CONNECT RAMPS

Due to the existing left exit ramp of eastbound I-70 to eastbound I-76 a direct connect ramp is necessary to continue Express Lanes on I-70 in the eastbound direction, in addition to connecting I-76 westbound to I-70 westbound. Potential Express Lane direct connect ramps from I-70 eastbound to I-70 eastbound and I-76 westbound to I-70 westbound would be braided with I-70 westbound and I-76 Eastbound. This would provide continuous Express Lanes through this interchange on both interstates.

I-70 TO I-270 DIRECT CONNECT RAMPS

The I-70 East EIS identified potential Express Lane direct connect ramps from I-270 to I-70 in both the eastbound to eastbound and westbound to westbound directions. The direct connect ramps would connect median Express Lanes in I-270 to I-70. These future direct connect ramps are being accommodated in the current C70 Project but will require future realignment of I-70 and additional bridges over Sand Creek.

I-70 TO I-225 DIRECT CONNECT RAMPS

The I-70 East EIS identified potential Express Lane direct connect ramps from I-70 to I-225 for I-70 eastbound to I-225 southbound and I-225 northbound to I-70 westbound. This ELMP developed additional direct connect ramps from northbound I-225 to I-70 eastbound and I-70 westbound to I-225 southbound which would complement potential direct connections to I-70 and Pena Blvd to the east. The direct connect ramps would connect median Express Lanes in I-70 and I-225 via flyover ramps within the existing system level interchange ramps. I-70 would need additional widening beyond the current C70 Project to accommodate these ramp connections.

I-70 TO PENA DIRECT CONNECT RAMPS

The I-70 East EIS identified potential Express Lane direct connect ramps from I-70 to Pena Boulevard for I-70 eastbound to Pena eastbound and Pena westbound to I-70 westbound. These direct connect ramps would require realigning mainline I-70 so that inside lanes from Pena Blvd can flyover westbound I-70 lanes and connect to median Express Lanes in I-70. These direct connect ramps would remove vehicles from the heavy weave section between I-225 and Pena Blvd.

I-25 TO I-70 DIRECT CONNECT RAMPS

Alternatives for potential Express Lane direct connect ramps between I-25 and I-70 were developed. The C70 Project will construct Express Lanes that begin and end just east of I-25. The existing I-25 and I-70 mousetrap interchange is highly constrained by adjacent residential and commercial developments and railroad corridors. Due to this, direct connect ramps between northbound I-25 and eastbound I-70, and the opposite direction between I-70 westbound and I-25 southbound

would be completely aerial. Further challenging these direct connect ramps is the existing reversible lanes on I-25. The westbound I-70 to southbound I-25 direct connect ramp would be a long flyover bridge from I-70 to an aerial bridge alignment on the west side of I-25 continuing south before connecting back into the existing median Express Lanes just north of 20th Street. As previously discussed two options were advanced for Express Lanes on I-25. The bifurcated aerial concept would facilitate a direct connection at I-70 from the northbound aerial Express Lanes to the eastbound I-70 Express Lanes. Without the bifurcated aerial northbound alignment an aerial structure on the east side of I-25 beginning near 20th would be required to provide a direct connection from I-25 northbound to eastbound I-70.

I-25 TO SPEER DIRECT CONNECT RAMPS

The existing 20th Street direct connect ramp is beginning to reach capacity, regularly backing up from the downtown termini back to I-25. Additional direct connects into downtown could be necessary to accommodate future Express Lane volumes as the entire system expands. The Speer corridor is a primary entrance into and out of downtown for I-25 to the north. With the need to reconstruct the Speer interchange an opportunity exists to design a new interchange that also provides direct connect ramps between proposed I-25 Express Lanes and Speer. Due to the constraints north of Speer on I-25 a reversible Express Lane that connects to a three level Speer interchange was developed. This would allow I-25 southbound Express Lane traffic to exit to Speer in the AM, and in the PM the heavy Speer northbound on-ramp traffic could utilize the direct connect ramp to enter the I-25 northbound Express Lanes. The reversible ramp operation would be controlled by a zipper barrier on I-25 and through signals on Speer.

I-25 TO AURARIA AND 6TH AVENUE TO I-25 DIRECT CONNECT RAMPS

Auraria Parkway and Colfax are the primary access into and exiting downtown for I-25 traffic from the south. Reconstructing and widening I-25 to provide an Express Lane in each direction provides an opportunity to provide a direct connect ramp from Auraria Parkway to the southbound I-25 Express Lane and from the northbound I-25 Express Lane to Auraria and Colfax. In reviewing origin and destination data there is heavy traffic from eastbound US 6 to both Auraria and Colfax and to I-25 beyond I-70. An alternative with a direct connect ramp from US 6 to the northbound I-25 Express Lanes was developed. Combining the direct connect ramp from US 6 with the direct connect ramp from I-25 to Auraria in an aerial connector distributor road would provide access to and from the northbound I-25 Express Lanes and provide direct connect ramps between US 6 and Auraria and Colfax, reducing weave movements on I-25.

I-25 TO I-225 DIRECT CONNECT RAMPS

Direct connect ramps between I-25 and I-225 could be provided if the I-25 aerial bridge concept advances. The existing I-25 and I-225 interchange is already a four level interchange with both highway and light rail alignments. Any proposed direct connect ramps would go over all the existing ramps as a fifth level. The direct connect ramps would connect both northbound and southbound and eastbound and westbound ramps (four total direct connect ramps). Direct connect ramps could help reduce congestion at this interchange. Without direct connect ramps ingress and egress points would need to be spaced appropriately to reduce short weaves within the interchange area.

C-470 TO SANTA FE DIRECT CONNECT RAMPS

The soon to open C-470 Express Lanes could connect to potential Express Lanes on Santa Fe. An alternative to provide direct connect ramps from southbound Santa Fe to eastbound C-470 and from westbound C-470 to northbound US 85 was developed. This would require long flyover structures to carry the ramps over the existing railroad bridges and up the grade on C-470. This design would still accommodate the future light rail extension. This connection could support a continuous Express Lane system and facilitate north-south traffic opposite of the I-25 corridor.

5.3 Cost Estimation

Capital cost estimates were developed using CDOT's Project Cost Planner (PCP) Tool. Major items such as pavement section (new and rehabilitation), bridges, retaining and noise walls, earthwork, concrete barrier, guardrail, and tolling components (overhead signs and tolling costs) were quantified for each corridor and direct connect ramps and input into the PCP for each corridor and direct connect. Tolling costs include a cost per tolling point based on historical costs from previous CDOT Express Lanes projects. The PCP tool includes construction and preconstruction costs along with a risk reserve factor and cost escalation for time of anticipated construction.

Assumptions and notes on cost estimates include:

- **Pavement Rehabilitation** - Widening scenarios that require shifting existing lanes included a full pavement rehab cost. This included a full depth concrete overlay in Denver metro corridors and an asphalt mil land overlay in the I-70 Mountain Corridors

- **Existing Newer Pavement** – In areas where existing concrete is less than approximately 10 years (such as I-225) in age it is assumed this pavement can be reused and widened regardless of general-purpose lane shifts. A 20% pavement replacement estimate was included in these areas
- **Bridge Widenings** – In corridor estimates it is assumed all simple bridges along the mainline can be widened for the Express Lanes regardless of age
- **Bridge Rehabilitation Costs** – The PCP tool includes programed bridge rehabilitation costs for individual bridges. These costs were included at individual bridges within each corridor
- **Right of Way** – The number of parcels, easements, and relocations were quantified and assigned in the PCP
- **Utilities and Railroad** – Planning level costs for major utility impacts were included and railroad flagging costs were included for bridges over railroads
- **Design / NEPA Cost Assumptions** – The design fee was set based on the current planning level of project understanding and individual NEPA budgets were assigned for each estimate
- **Risk Reserve** – For the purposes of these master plan level cost estimates a 15% risk reserve was used for all estimates
- **Escalation** - All estimates assumed a 3-year construction time frame, begining in January 2022, which equates to a mid-point construction estimate of July 2023
- **Zipper Barrier Options** – Zipper barrier costs of $400 per linear foot and $1 M per zipper barrier moving vehicle were included on zipper options
- Cost Estimates from projects with completed or in-progress preliminary engineering were used including, North I-25, South I-25 (south of C-470), and I-70 at Floyd Hill

6

Travel Demand Analysis
Phase II

SECTION

6

The sketch-level traffic and revenue analysis conducted for the ELMP combined several modeling steps with the goal of developing comparable results across the Phase II corridors, including both interstates and state highways. The analysis incorporated several conservative assumptions to avoid overstating traffic and travel demand on the various facilities.

6.1 Travel Demand Analysis

Traffic & Revenue

Quantitative evaluation using travel demand modeling tools was limited to the Phase II corridors discussed in section 5, which represent most freeway corridors in the Denver Metro Area, as well as I-25 in the North and South Front Range, and the I-70 Mountain Corridor. A detailed description of the modeling methodology is provided in the ELMP memorandum "Memorandum 3 – Modeling Methodology" as part of Appendix C.

Sketch-level forecasts are suitable for high-level planning, making performance comparisons between corridors, and early prioritization, however should not be relied upon to make investment decisions. Additional study of individual corridors should be conducted to more confidently assess and quantify impacts of likely toll policies and traveler behavior in each corridor. The following steps were taken to develop the traffic volume and revenue forecasts used in the ELMP.

1. Developed roadway cross-section and operational concepts for Phase II corridors in early 2019. These projects, located along eight corridors, were divided into over 100 directional segments and "coded" into CDOT's new Statewide Travel Forecasting Model. This model produced base travel demand data for 2045 assuming nominal toll rates, which were used as inputs in the second step of the travel demand modeling effort.

2. The second step of the travel demand modeling effort applied the outputs described above in a proprietary toll optimization model, Rapid-TOM™. Rapid-TOM is a suite of tools designed to derive high-resolution traffic and revenue (T&R) information for planned toll facilities or to evaluate the impact of changes in operational policies on existing facilities. It can provide future T&R forecasts using either regional demand model projections or ADT corridor demand forecasts using its own internal forecasting and peak-spreading capabilities.

Rapid-TOM™ simultaneously solves for vehicles flows, tolls, etc, optimized to the agency goals and constraints and was used to develop the following performance measures for

each of the analysis corridors by lane classification (GP, Express Lane, etc.) and vehicle class (SOV, HOV2, HOV3+, etc.) including such dimensions as:

- Vehicle traffic flow by vehicle class
- Passenger throughput, accounting for vehicle passenger occupancy
- Travel time/speed/delay
- Toll revenue if applicable
- Travel cost in monetary terms accounting for Value of Time (VOT).

The Rapid-TOM model outputs are structured into two toll policies to estimate future revenue potential from each facility. These toll policies include:

- Revenue Maximization: Sets toll rates that maximize the gross revenue from toll operations of the managed lane, which approximates minimizing the delay costs for the managed lane users rather than the whole corridor. This objective results in higher toll rates, which yield lower volumes and higher speeds in the managed lanes, with somewhat higher volumes and lower speeds in the toll-free GP lanes.
- Cost Minimization: Sets toll rates that minimize the total travel costs to all users of the facility, essentially minimizing overall corridor delay costs for both the GP and managed lanes. This objective tends to result in more fully utilized managed lanes with lower differentials in speeds between the managed and GP lanes, and lower revenues resulting from the lower toll rates required to attract the higher volumes in the managed lanes. This leads to lower managed lane speeds, time savings per vehicle, and thus, willingness to pay for the level of time savings provided.

In practice, many toll operators will implement a toll rate setting policy that yields managed lane volumes and revenues that are somewhere in between these two conceptual book-end scenarios. With this in mind, the results of these two cases were averaged to create a third set of outcomes, referred to herein as the Balanced Case. The actual toll rate policy for any individual facility will be honed as traffic and revenue study advances in rigor, eventually reaching an "investment grade" analysis supporting a transaction. The Balanced Case was used in all subsequent toll revenue analyses described herein.

The traffic modeling was conducted assuming that all facilities for a given Operational Alternative ('Alternative 1' and the 'Low Cost' alternatives) were implemented and operational as of 2025. The primary modeled year was 2045, with a further simplified model developed from the 2045 output to derive 2025 values. These two model years were interpolated and extrapolated between 2025 and 2060 for use in financial analysis, as described further in the ELMP memorandum, "Express Lane Traffic and Net Revenue Methodology" in Appendix C.

It should be noted that initial Rapid-TOM model results brought to light certain issues with the functionality of the underlying CDOT Statewide Travel Forecasting Model, such as errors in assumed capacity or coded model links. In nearly all cases, the project team was able to rectify these issues to produce reliable sketch-level results. However, results of the US 85 / Santa Fe Dr corridor were especially problematic, as they resulted in extremely high revenues in the Express Lanes, but untenable congestion conditions in the adjacent general-purpose lanes. Due to these unrealistic sketch-level modeling results, and because of the acknowledgement of a separate upcoming CDOT study that would evaluate the US 85 corridor in much more detail, the Phase II US 85 Express Lane alternative was dropped from further consideration as part of the ELMP process.

7

Financial Feasibility
Phase II

SECTION

7

The Financial Feasibility component of the ELMP includes the synthesis of traffic and revenue data, estimation of operations and maintenance costs, and comparisons of refined revenue forecasts to capital costs to score the projects based on their financial profile. The resulting "Financial Scores" were combined with the Mobility Scores in the overall prioritization matrix. Some of the outputs from this task were also used in the Delivery Analysis. Additional detail on methodology and results are contained in the technical memorandums within Appendix C.

7.1 Traffic and Gross Revenue

The RapidTOM© model outputs for 2025 and 2045 developed as part of prior tasks includes traffic volumes and revenues for the various corridors. The traffic modeling was conducted assuming all facilities for a given Operational Alternative ('Alternative 1' and the 'Low Cost' alternatives) were implemented and operational as of 2025.

Table 7-1 presents the results from the revenue forecasting effort for 15 bi-directional segments representing the continuous project corridors. Note that the analysis contained in Table 7-1 only pertains to the Alternative 1 cross-sections and the revenue figures presented are Gross Toll Revenues in 2019 dollar terms, unmodified to account for leakage, additional fee revenue or other adjustments detailed below. Please note that Table 7-1, and the subsequent financial analysis described in section 7, does not include revenue results from US 85 / Santa Fe Dr, due to the modeling issues with the signalized corridor described in section 6.

Table 7-1 // Balanced Case Gross Revenue and Transaction Forecasts (Alternative 1)

	Revenue			Transactions		
	2025	2045	CAGR	2025	2045	CAGR
Denver Metro Segments						
I-225: I-25 to I-70	$5,182,448	30,730,777	9%	1,064,207	13,636,731	1%
I-25: C-470 to Castle Rock	$3,350,586	26,497,051	11%	6,548,513	8,529,764	1%
I-25: US-36 to C-470	11,696,501	93,452,556	11%	41,166,053	52,846,946	1%
I-25: Longmont to E-470	$1,368,643	$15,307,766	13%	6,524,848	8,823,183	2%
I-70 E: Pena to E-470	$250,320	$4,259,775	15%	8,124,470	11,730,077	2%
I-70 W: C-470 to I-25	$3,987,671	20,369,601	8%	2,742,918	16,030,191	1%
C-470: I-70 to Wads	$1,703,395	14,855,691	11%	16,576,295	22,273,675	1%
I-76: I-70 to E-470	$1,230,030	12,884,785	12%	1,611,171	6,060,483	2%
I-270: I-25 to I-70	11,099,761	66,537,528	9%	1,166,270	13,632,434	1%
Pena: I-70 to E-470	$20,930	$524,159	17%	2,850,993	4,890,285	3%
US 85: C-470 to I-25	$7,733,432	43,706,749	9%	7,599,223	9,504,574	1%
I-70 Mountain Corridors						
Frisco-Silverthorne	$34,222	$187,366	9%	1,563,651	1,997,307	1%
Georgetown-EJMT	$138,502	$462,409	6%	1,571,092	1,966,026	1%
Empire-Georgetown	$64,007	$212,512	6%	1,806,740	2,248,791	1%
Floyd Hill	$91,880	$299,402	6%	1,838,693	2,295,125	1%

The baseline disaggregated daily volumes and revenues provided from the RapidTOM© model were aggregated into total toll trips and revenue by year. Model results from 2025 and 2045 were used as the basis for annualized interpolation between the model years to derive annual volumes and revenue streams extrapolated to 2060. Ramp-up factors were set to 80% in the first full year of operations, 90% in the second year, 95% in the third year, and 100% for the remainder of the forecast horizon. Toll revenues, initially expressed in constant dollars, were escalated to year of collection dollars for each forecast year using a set annual factor.

7.2 Net Revenue & Cost Comparison

Gross revenues were then adjusted to add various fees and subtract portions of revenue reflecting leakage due to unpaid tolls. This calculation renders “Adjusted Gross Revenue Potential.” Additional analysis was conducted to calculate the cost to operate the toll facility and maintain the Express Lane portion of the roadway. These costs, generally referred to as annual operations & maintenance (O&M) costs were then subtracted from Adjusted Gross Revenue Potential to arrive at the forecast of annual "Net Revenue Potential." These revenue forecasts became the basis for the financial prioritization and ranking of corridors relative to their capital costs.

Table 7-2 provides a summary of the time series data between 2025 and 2060, including numbers of toll trips, total revenues, present value of revenues, and estimated capital costs. Footnotes to the table describe some of the column headings, including what is added and netted out of Adjusted Gross Revenues and Net Revenues.

The I-25 Alternative 1 cross sections described herein were developed for performance, safety, and consistency with AASHTO standards. The concepts perform well but are not cost constrained. For example, much of the I-25 corridor Express Lanes are elevated in Alternative 1, which works well in the confined envelope, but is a very expensive design. The Alternative 1 I-25 Central Express Lane segments from US-36 to C-470 are estimated to cost over $3.5 billion, however, Low Cost alternatives were developed that reduce this cost by about 62%, to $1.34 billion.

Table 7-2 // Balanced Case Financial Profile (Alternative 1)

Beltway Segments:

VALUES IN MILLIONS	Toll Trips TOTAL (2025-2060)	HOV Trips TOTAL (2025-2060)	Adj. Gross Revenue[A] YOE (2025-2060)	Net Revenue[B] YOE (2025-2060)	PV of Gross Revenue[C] 2025	PV of Net Revenue[D] 2025	Capital Cost 2025	PV of Gross Revenue / Costs % COVERAGE	PV of Net Revenue / Costs % COVERAGE
C-470 (I-70 to Wadsworth)	748	141	$1,118.8	$570.5	$347.8	$154.7	$709.2	49%	22%
I-225 (I-70 to I-25)	465	118	$1,683.5	$1,307.8	$493.3	$360.2	$725.5	68%	50%
Pena Blvd. (I-70 to E-470)	158	57	$114.1	-$40.7	$39.1	-$14.6	$209.5	19%	-7%

East / West Corridor:

VALUES IN MILLIONS	Toll Trips TOTAL (2025-2060)	HOV Trips TOTAL (2025-2060)	Adj. Gross Revenue[A] YOE (2025-2060)	Net Revenue[B] YOE (2025-2060)	PV of Gross Revenue[C] 2025	PV of Net Revenue[D] 2025	Capital Cost 2025	PV of Gross Revenue / Costs % COVERAGE	PV of Net Revenue / Costs % COVERAGE
I-70 (C-470 to Wadsworth)	279	66	$574.3	$354.7	$178.2	$99.8	$547.6	33%	18%
I-70 (Wadsworth to I-25)	266	62	$672.0	$470.2	$207.2	$135.4	$320.0	65%	42%
I-76 (I-70 to I-270)	220	45	$560.5	$383.0	$159.4	$97.3	$649.8	25%	15%
I-76 (I-270 to E-470)	317	61	$352.2	$105.9	$114.1	$27.5	$439.1	26%	6%
I-270 (I-25 to I-70)	466	74	$3,342.4	$2,951.6	$944.0	$808.9	$613.3	154%	132%
I-70 East (Chambers to E-470)	388	68	$135.1	$149.0	$135.1	$39.0	$228.4	59%	17%

[A] Adjusted Gross Toll Revenue includes toll revenue, incremental license plate revenue, revenue leakage, and some recovered toll revenue

[B] Net Revenue includes adjusted gross toll revenue with reductions for facility operating and maintenance costs, toll collection costs, and agency and enforcement costs

[C] Present Value of adjusted gross toll revenue assumes a 6% discount rate

[D] Present Value of net toll revenue assumes a 6% discount rate

I-25 Segments

VALUES IN MILLIONS	Toll Trips TOTAL (2025-2060)	HOV Trips TOTAL (2025-2060)	Adj. Gross Revenue[A] YOE (2025-2060)	Net Revenue[B] YOE (2025-2060)	PV of Gross Revenue[C] 2025	PV of Net Revenue[D] 2025	Capital Cost 2025	PV of Gross Revenue / Costs % COVERAGE	PV of Net Revenue / Costs % COVERAGE
North (Longmont to E-470)	296	66	$895.2	$640.9	$248.7	$159.8	$142.3	175%	112%
Central (US-36 to 20th St.)	395	75	$1,753.2	$1,446.1	$491.0	$384.3	$814.8	60%	47%
Central (20th St. to Santa Fe)	549	178	$941.5	$551.7	$289.2	$150.8	$1,134.2	25%	13%
Central (Santa Fe to I-225)	418	110	$1,777.5	$1,442.9	$495.8	$379.2	$957.3	52%	40%
Central (I-225 to C-470)	427	126	$903.5	$591.2	$269.8	$159.4	$672.0	40%	24%
South (C-470 to Castle Rock)	288	87	$1,400.5	$1,141.3	$388.9	$298.5	$1,063.1	37%	28%

I-70 Mountain

VALUES IN MILLIONS	Toll Trips TOTAL (2025-2060)	HOV Trips TOTAL (2025-2060)	Adj. Gross Revenue[A] YOE (2025-2060)	Net Revenue[B] YOE (2025-2060)	PV of Gross Revenue[C] 2025	PV of Net Revenue[D] 2025	Capital Cost 2025	PV of Gross Revenue / Costs % COVERAGE	PV of Net Revenue / Costs % COVERAGE
Floyd Hill	78	-	$58.4	-$20.9	$22.0	-$6.7	$615.5	4%	-1%
Empire to Georgetown	77	-	$53.2	-$20.3	$20.4	-$6.2	$43.6	47%	-14%
Georgetown to EJMT	67	-	$60.4	-$52.5	$22.0	-$19.3	$130.3	17%	-15%
Silverthorne to Frisco	68	-	$47.0	-$37.3	$17.7	$0.0	$77.6	23%	0%

[A] Adjusted Gross Toll Revenue includes toll revenue, incremental license plate revenue, revenue leakage, and some recovered toll revenue

[B] Net Revenue includes adjusted gross toll revenue with reductions for facility operating and maintenance costs, toll collection costs, and agency and enforcement costs

[C] Present Value of adjusted gross toll revenue assumes a 6% discount rate

[D] Present Value of net toll revenue assumes a 6% discount rate

The Low Cost alternatives come with additional challenges, for instance, the Express Lanes in the two segments between Santa Fe and C-470 would effectively be shoulder lanes without physical separation from the general-purpose lanes, and would significantly limit the functionality of the facility. Umder this scenario, I-25 may not have consistent or adequate shoulder space for enforcement or for disabled vehicles to pull over, the lack of physical barrier would introduce potential conflicts between general-purpose and Express Lane traffic, and Express Lane traffic may need to be limited in where it can exit due to the impacts that it would cause on general-purpose lane flow. These and other issues with the Low Cost alternatives must be studied and remedied before these roadway concepts can be pursued further.

7.3 Financial Profile Prioritization Results

To complement the comparison and ranking of corridors from a mobility standpoint, a scoring system was developed to compare project segments based on their revenue strength over time relative to their operations and capital costs. The ranking uses "Present Value of Net Revenues," meaning that revenues are reduced by expected O&M costs before calculating the present value. This approach was used because it incorporates the entire investment by CDOT over time.

5	PV of Net Revenues is greater than ten times the Capital Cost
4	PV of Net Revenues is greater than two times the Capital Cost
3	PV of Net Revenues is greater than the Capital Cost
2	PV of Net Revenues is greater than half the Capital Cost
1	PV of Net Revenues is greater than 20% of the Capital Cost
0	PV of Net Revenues is less than 20% of the Capital Cost

The scale above was used to score project segments from five to zero, with five being the highest score possible, and indicating that the segment's PV of Net Revenues far exceeds its capital cost.

Table 7-3 presents all project segments ranked by the PV of Net Revenues divided by Capital Cost, listed in the fourth column. The fifth column shows the Financial Score from five to zero as noted in the scale above. For the I-25 Central Segments, both the Alternative 1 (A1) and the Low Cost (LC) alternatives are listed.

Table 7-3 // Financial Score and Ranking

CORRIDOR / SEGMENT	PV OF NET REVENUES	CAPITAL COST	PV OF NET REVENUES / CAPITAL COST	FINANCIAL SCORE
I-25 Central (Santa Fe to I-225) (LC)	$299.7	$14.3	20.95	5.00
I-25 Central (I-225 to C-470) (LC)	$112.2	$9.1	12.28	5.00
I-25 Central (US-36 to 20th St.) (LC)	$392.5	$185.1	2.12	4.00
I-270 (I-25 to I-70)	$808.9	$613.3	1.32	3.00
I-25 North (Longmont to E-470)	$159.8	$142.3	1.12	3.00
I-225 (I-70 to I-25)	$360.2	$725.5	0.50	2.00

CORRIDOR / SEGMENT	PV OF NET REVENUES	CAPITAL COST	PV OF NET REVENUES / CAPITAL COST	FINANCIAL SCORE
I-25 Central (US-36 to 20th St.) (A1)	$384.3	$814.8	0.47	1.00
I-70 (Wadsworth to I-25)	$135.4	$320.0	0.42	1.00
I-25 Central (Santa Fe to I-225) (A1)	$379.2	$957.3	0.40	1.00
I-25 South (C-470 to Castle Rock)	$298.5	$1,063.1	0.28	1.00
I-25 Central (I-225 to C-470) (A1)	$159.4	$672.0	0.24	1.00
C-470 (I-70 to Wadsworth)	$154.7	$709.2	0.22	1.00
I-70 (C-470 to Wadsworth)	$99.8	$547.6	0.18	0.00
I-70 East (Chambers to E-470)	$39.0	$228.4	0.17	0.00
I-76 (I-70 to I-270)	$97.3	$649.8	0.15	0.00
I-25 Central (20th St. to Santa Fe) (A1)	$150.8	$1,134.2	0.13	0.00
I-76 (I-270 to E-470)	$27.5	$439.1	0.06	0.00
I-70 Silverthorne to Frisco	$-	$77.6	-	0.00
I-70 Floyd Hill	$(6.7)	$615.5	(0.01)	0.00
Pena Blvd. (CCD - I-70 to E-470)	$(14.6)	$209.5	(0.07)	0.00
I-70 Empire to Georgetown	$(6.2)	$43.6	(0.14)	0.00
I-70 Georgetown to EJMT	$(19.3)	$130.3	(0.15)	0.00

Of the 22 corridor segments listed, 16 scored a one or zero. This class includes all the I-70 Mountain Segments, the Beltway Segments except I-225, and the East / West Corridor segments, except for I-270. It also includes I-25 Central from 20th street to Santa Fe, which has the highest capital cost of any individual segment, estimated at over $1.1 billion. This segment of I-25, if unimproved with the other I-25 Central segments, would create a bottleneck and limit the functionality of the other I-25 Central segments.

The highest scoring segments were the Low Cost alternative I-25 Central segments, which had much lower capital costs than their Alternative 1 comparables. As noted above, there are significant safety and operational challenges that accommodate these, and as such will need to be modified to meet standards desired by CDOT and FHWA. The I-270 and I-25 North segments each scored well given their relatively strong revenue performance compared to their capital costs.

While many of the segments did not have strong financial scores in this particular framework, it does not mean they are unworthy projects that should be disregarded. This study uses a broad modeling approach and assumptions to generate a comparison to inform planning for more advanced study. It identified many corridor-specific issues that need to be resolved but, in doing so, CDOT will create more 'financially feasible' project concepts.

8

Mobility Analysis
Phase II

SECTION

8

This section describes the Phase II mobility analysis component of the ELMP, which relied on travel demand and traffic and revenue data to gauge the traffic and congestion impacts of Express Lane alternatives on the Phase II corridors. This mobility analysis resulted in an average "Mobility Score" for each corridor segment, which was used as part of the overall corridor prioritization discussed in section 9.0. More detailed information on methodology and results can be found in Appendix C.

8.1 Mobility Analysis Methodology

Phase II mobility analysis relied on 2045 RapidTOM© model outputs, and underlying data from the CDOT Statewide Travel Demand Model, as discussed in section 6. Traffic data was compared between multiple 2045 model scenarios: 1) 2045 No Build scenario, which included programmed CDOT projects and demographic data; and 2) the Express Lane Build scenarios described in sections 5 through 7 ('Alternative 1' and 'Low Cost' alternatives). The analysis was conducted using the individual Phase II evaluation metrics described below, arrayed in a spreadsheet database. The analysis focused on weekday AM and PM peak-periods for the majority of Phase II corridors and evaluation metrics. Weekend peak-period data was used for the I-70 Mountain Corridor to represent known recreational traffic patterns.

Travel Time savings relative to adjacent general-purpose lanes is one of the most important benefits provided by Express Lanes. As such, the mobility analysis process included a comparison of 2045 peak-period Express Lane travel times to No Build general-purpose lane travel times, in order to gauge the level of relative travel time benefit offered by Express Lanes in each corridor segment. Given that the majority of vehicles operating within Phase II corridors will utilize general-purpose lanes, the mobility analysis also included a comparison of peak-period general-purpose lane travel times within Express Lane corridors, to No Build general-purpose lane travel times. Travel time savings offered to general-purpose lanes is an important traffic performance measure, as it demonstrates the extent to which all drivers within a corridor can benefit from the introduction of Express Lanes.

Trip reliability is another important benefit provided by Express Lanes. For the purpose of the Phase II mobility analysis, trip reliability was measured by comparing an Express Lane's 85th percentile travel time to average Express Lane travel time during peak-

periods. The 85th percentile travel time is a standard measure used in traffic engineering to indicate the amount of time a driver may budget for a high-value trip, such as a trip to the airport. The smaller the difference between the 85th percentile travel time and the average peak-period travel time, the greater the reliability of the Express Lane. This measure was used to compare the relative performance in trip reliability within Express Lane corridors.

Person Throughput The main contribution that an Express Lane makes in reducing congestion is to provide access to available roadway capacity to toll paying drivers and qualifying HOV vehicles. This eases congestion on the adjacent GP lanes by better balancing traffic across the entire freeway corridor, and using variably priced tolls set in real-time manages demand to prevent traffic conditions on the Express Lane from deteriorating below an acceptable level. For the Phase II mobility analysis, this reduction in corridor congestion was measured through person throughput. Person throughput was determined using peak-period vehicle volumes and average occupancies by vehicle type for both Express Lanes and general-purpose lanes. The total person throughput for an entire corridor segment, including both Express Lanes and general-purpose lanes, was then compared between the 2045 No Build and Express Lane scenarios.

Hours of Congestion within a corridor is a key consideration in gauging the extent to which an Express Lane can offer travel time, reliability, and person throughput benefits. For instance, although an Express Lane would provide benefit to a corridor with 1 to 2 hours of congestion on a typical day, it could provide greater benefits to a corridor that is consistently congested throughout the entire day (8+ hours). As such, the Phase II mobility analysis also included scoring on the average total duration of general-purpose lane congestion in a corridor. This calculation was performed by adding the total number of hours on an average day where the general-purpose lane freeway volume to capacity ratio (V/C) was greater than 0.85 (indicating a congested level of service where speeds decrease and maneuverability is increasingly difficult).

Transit & Connectivity are valuable considerations in the evaluation of potential Express Lanes within a corridor, in addition to quantitative traffic impact measures. Transit availability within an Express Lane corridor extends its benefits to additional travel modes and user groups. The connectivity of Express Lanes can also extend its benefits by providing an integrated network of Express Lanes for drivers traveling along multiple corridors. In order to capture these components as part of the Phase II mobility analysis, transit and connectivity scoring for the Phase I initial screening (section 4) was carried over for further consideration.

8.2 Corridor Mobility Performance

Each of the Phase II mobility metrics discussed in section 8.1 were evaluated for each Phase II corridor segment. Scoring thresholds for each metric were assigned based on relative percentile scores, with a higher number indicating superior performance and greater viability of an Express Lane. Each individual metric score was then averaged to determine an average mobility score for each segment. Detailed mobility analysis results for each Phase II corridor segment are shown in T**ables 8-1** through **8-5.**

Table 8-1 // Mobility Performance – Beltway Segments

	GP TRAVEL TIME CHANGE	EXPRESS LANE TRAVEL TIME CHANGE	EXPRESS LANE RELIABILITY	PERSON THROUGHPUT	HOURS OF GP CONGESTION (V/C > 0.85)	TRANSIT & CONNECTIVITY SCORE	OVERALL MOBILITY SCORE
C-470 (I-70 to Wadsworth)	-16% AM -11% PM	-27% AM -29% PM	2% AM 3% PM	2,229 AM 5,649 PM	2.0	5.0	**4.18**
I-225 (I-70 to I-25)	5% AM 9% PM	-11% AM -16% PM	3% AM 5% PM	7,471 AM 9,940 PM	8.8	2.5	**3.45**
Pena Blvd (I-70 to E-470)	1% AM 1% PM	0% AM 0% PM	0% AM 0% PM	1,567 AM 1,894 PM	0.0	2.5	**1.45**

Table 8-2 // Mobility Performance – East / West Segments

	GP TRAVEL TIME CHANGE	EXPRESS LANE TRAVEL TIME CHANGE	EXPRESS LANE RELIABILITY	PERSON THROUGHPUT	HOURS OF GP CONGESTION (V/C > 0.85)	TRANSIT & CONNECTIVITY SCORE	OVERALL MOBILITY SCORE
I-70 (C-470 to Wadsworth)	7% AM 8% PM	-2% AM -9% PM	2% AM 5% PM	4,325 AM 7,005 PM	2.0	0.0	**2.00**
I-70 (Wadsworth to I-25)	-9% AM -10% PM	-19% AM -25% PM	3% AM 4% PM	3,338 AM 5,345 PM	1.5	5.0	**4.00**
I-76 (Wadsworth to I-270)	2% AM 1% PM	-16% AM -22% PM	2% AM 4% PM	4,966 AM 7,538 PM	4.8	2.5	**3.27**
I-76 (I-270 to E-470)	2% AM 6% PM	-6% AM -5% PM	1% AM 2% PM	3,207 AM 3,896 PM	1.5	0.0	**1.82**
I-270 (I-25 to I-70)	-6% AM -6% PM	-19% AM -25% PM	6% AM 5% PM	5,996 AM 7,143 PM	6.3	5.0	**4.27**
I-70 East (Chambers to E-470)	5% AM 8% PM	-11% AM -11% PM	2% AM 2% PM	4,128 AM 5,053 PM	4.8	2.5	**3.27**

Table 8-3 // Mobility Performance – I-25 Segments

	GP TRAVEL TIME CHANGE	EXPRESS LANE TRAVEL TIME CHANGE	EXPRESS LANE RELIABILITY	PERSON THROUGHPUT	HOURS OF GP CONGESTION (V/C > 0.85)	TRANSIT & CONNECTIVITY SCORE	OVERALL MOBILITY SCORE
I-25 North (SH 66 to E-470)	-3% AM -5% PM	-11% AM -19% PM	2% AM 3% PM	3,285 AM 5,795 PM	3.3	5.0	**3.91**
I-25 Central (US 36 to 20th St)	-24% AM -17% PM	-33% AM -35% PM	2% AM 4% PM	2,746 AM 7,081 PM	3.8	5.0	**4.45**
I-25 Central (20th St to Santa Fe)	2% AM 4% PM	-11% AM -19% PM	4% AM 6% PM	6,584 AM 9,438 PM	8.0	5.0	**3.91**
I-25 Central (Santa Fe to I-225)	1% AM 2% PM	-16% AM -23% PM	5% AM 6% PM	7,502 AM 9,558 PM	8.3	2.5	**3.27**
I-25 Central (I-225 to C-470)	3% AM 2% PM	-12% AM -15% PM	4% AM 5% PM	7,125 AM 7,726 PM	5.0	5.0	**4.09**
I-25 South (C-470 to Castle Rock)	2% AM 0% PM	-12% AM -16% PM	3% AM 4% PM	5,550 AM 5,744 PM	3.3	5.0	**3.91**

Table 8-4 // Mobility Performance – I-70 Mountain Segments

	GP TRAVEL TIME CHANGE	EXPRESS LANE TRAVEL TIME CHANGE	EXPRESS LANE RELIABILITY	PERSON THROUGHPUT	HOURS OF GP CONGESTION (V/C > 0.85)	TRANSIT & CONNECTIVITY SCORE	OVERALL MOBILITY SCORE
I-70 MTN (Floyd Hill)	-13% AM -2% PM	-22% AM -3% PM	2% AM 0% PM	3,299 AM 224 PM	2.5	5.0	**3.09**
I-70 MTN (Georgetown to Empire)	-8% AM -3% PM	-13% AM -5% PM	0% AM 0% PM	466 AM 73 PM	0.5	2.5	**2.45**
I-70 MTN (Georgetown to EJMT)	-7% AM -3% PM	-11% AM -4% PM	0% AM 0% PM	231 AM 39 PM	0.5	0.0	**1.82**
I-70 MTN (Frisco to Silverthorne)	-10% AM -3% PM	-15% AM -4% PM	0% AM 0% PM	856 AM 39 PM	2.5	2.5	**2.55**

Table 8-5 shows the mobility analysis results for the Low Cost alternatives on I-25. As shown in the table, the mobility performance of the Low Cost alternatives are quite similar to performance of the I-25 Alternative 1 cross sections (built to AASHTO standards). However, as described previously, the operation of the Low Cost shoulder lane alternatives between Santa Fe and C-470 could face operational challenges due to their lane width and limited separation from adjacent general-purpose lanes. Although mobility scoring is similar compared to the costlier Alternative 1 options, in must be acknowledged that more detailed investigations into safety and enforcement considerations would be necessary prior to eventual project development in these sections.

Table 8-5 // Mobility Performance – Low Cost Alternatives

	GP TRAVEL TIME CHANGE	EXPRESS LANE TRAVEL TIME CHANGE	EXPRESS LANE RELIABILITY	PERSON THROUGHPUT	HOURS OF GP CONGESTION (V/C > 0.85)	TRANSIT & CONNECTIVITY SCORE	OVERALL MOBILITY SCORE
I-25 Central (US 36 to 20th St) [LC]	-32% AM -21% PM	-40% AM -37% PM	2% AM 5% PM	4,985 AM 8,295 PM	3.8	5.0	**4.64**
I-25 Central (Santa Fe to I-225) [LC]	1% AM 4% PM	-15% AM -22% PM	5% AM 7% PM	8,092 AM 9,638 PM	7.3	0.0	**3.00**
I-25 Central (I-225 to C-470) [LC]	2% AM 2% PM	-13% AM -12% PM	3% AM 5% PM	4,870 AM 8,721 PM	3.3	2.5	**3.27**

8.3 Mobility Prioritization Results

All Phase II corridor segments ranked by average mobility score are shown in **Table 8-6**, with both Alternative 1 (A1) and Low Cost (LC) alternatives listed. As shown in the table, new Express Lane capacity would offer the greatest mobility benefit to I-25 Central between US 36 and 20th St, regardless of lane configuration alternative. Other high scoring corridors include I-270, C-470 between I-70 and Wadsworth, I-25 North between E-470 and SH 66, as well as the I-25 segments through central Denver and the TREX corridor. The lowest scoring segments in terms of mobility include the I-70 Mountain Corridor, and Pena Blvd.

Table 8-6 // Mobility Score & Ranking

CORRIDOR / SEGMENT	MOBILITY SCORE	MOBILITY RANK
I-25 Central (US 36 to 20th St) [LC]	4.64	1
I-25 Central (US 36 to 20th St) [A1]	4.45	2
I-270 (I-25 to I-70)	4.27	3
C-470 (I-70 to Wadsworth)	4.18	4
I-25 Central (I-225 to C-470) [A1]	4.09	5
I-70 (Wadsworth to I-25)	4.00	6
I-25 North (E-470 to SH 66)	3.91	7
I-25 South (C-470 to Castle Rock)	3.91	7
I-25 Central (20th St to Santa Fe)	3.91	7
I-225 (I-70 to I-25)	3.45	10
I-25 Central (I-225 to C-470) [LC]	3.27	11
I-76 (Wadsworth to I-270)	3.27	11
I-25 Central (Santa Fe to I-225) [A1]	3.27	11
I-70 East (Chambers to E-470)	3.27	11
I-70 MTN (Floyd Hill)	3.09	15
I-25 Central (Santa Fe to I-225) [LC]	3.00	16
I-70 MTN (Frisco to Silverthorne)	2.55	17
I-70 MTN (Georgetown to EJMT)	2.45	18
I-70 (C-470 to Wadsworth)	2.00	19
I-76 (I-270 to E-470)	1.82	20
I-70 MTN (Georgetown to EJMT)	1.82	20
Pena Blvd (I-70 to E-470)	1.45	22

9

Corridor Prioritization

SECTION

9

This section describes the overall ranking and prioritization of Phase II corridors as a result of the financial and mobility analyses described in sections 7 and 8, as well as input gleaned during the stakeholder engagement efforts described in section 2. This corridor prioritization is intended to act as a strategic guide for the future development of Express Lane facilities throughout Colorado, with the long-term goal of a fully integrated regional Express Lane network.

9.1 Corridor Prioritization

The technical portion of the Phase II corridor evaluation concluded by averaging the results of the financial scores and mobility scores described previously to determine an overall score for each corridor to compare relative performance. The results of the composite mobility and financial exercise are shown in **Table 9-1** and **Figure 9-1**. Segments were broken into priority tiers based on overall score, and assigned an overall corridor rank between 1 and 22. Consistent with the individual mobility and financial scores, the freeway corridors in the central and northern Denver metro area tend to outperform those in more outlying areas such as the I-70 Mountain Corridor, and the northeast suburban areas near the DEN Airport. Together, these high-ranking segments, along with existing Express Lane facilities and those already under construction, would be expected to form the core of a future Colorado Express Lanes network. Once operational, the higher ranking segments could be expected to generate toll revenues that would cover a greater portion of their own implementation costs, and provide a greater mobility benefit, relative to lower ranking corridors.

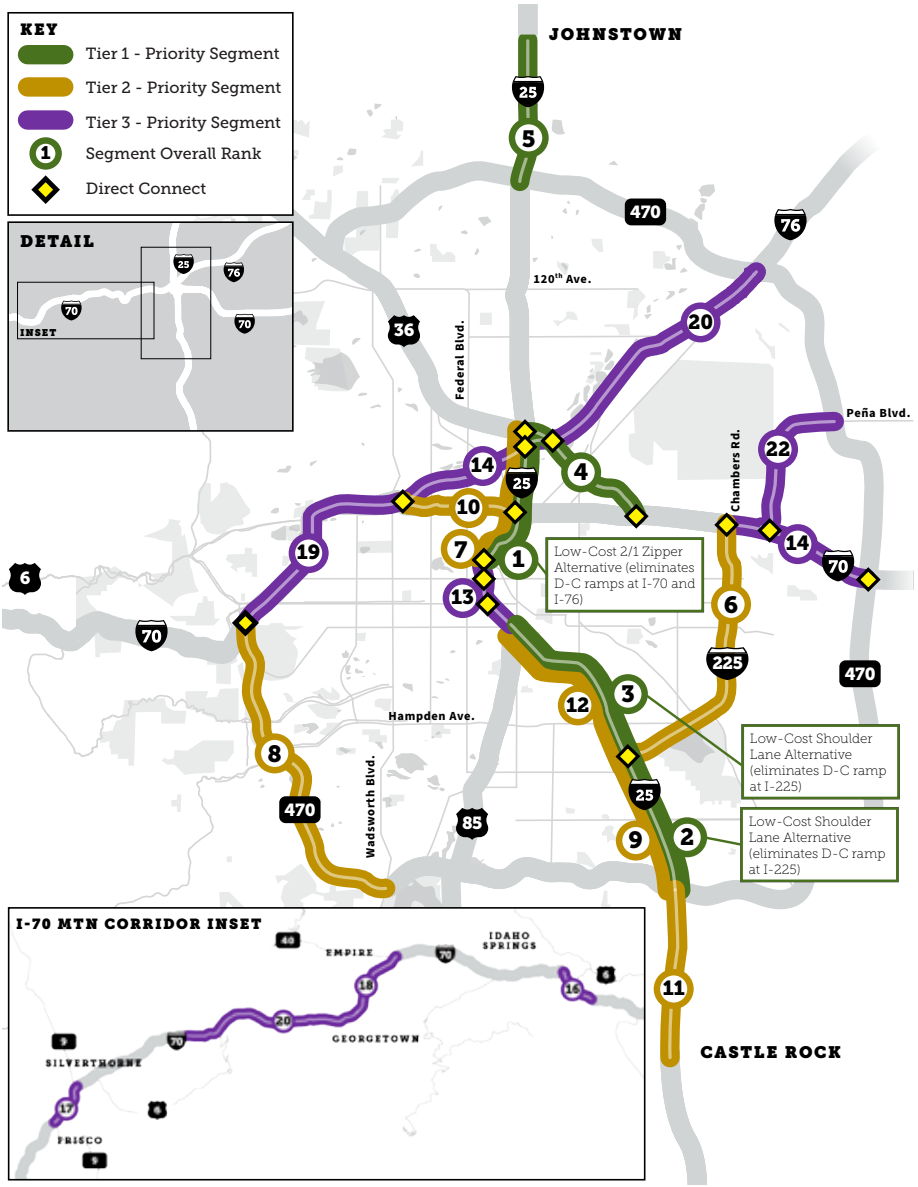
The higher ranking corridors are consistent with those identified as priorities by stakeholders. ELMP Workshop 3, held in November 2019, included a breakout activity where stakeholders were asked to comment on technical analysis and establish 4-5 priority corridors within small groups. A summary of small group results is included as part of Appendix A. However, it should be noted that the corridors of I-270, I-25 North, and I-25 Central were consistently identified as priorities. This input is important in validating the technical results shown in **Table 9-1** and displayed in **Figure 9-1**.

Table 9-1 // Overall Segment Prioritization & Ranking

CORRIDOR / SEGMENT	MOBILITY SCORE	FINANCIAL SCORE	OVERALL SCORE	OVERALL RANK
TIER 1 - PRIORITY				
I-25 Central (US 36 to 20th St) [LC]	4.64	4.00	4.32	1
I-25 Central (I-225 to C-470) [LC]	3.27	5.00	4.14	2
I-25 Central (Santa Fe to I-225) [LC]	3.00	5.00	4.00	3
I-270 (I-25 to I-70)	4.27	3.00	3.64	4
I-25 North (E-470 to SH 66)	3.91	3.00	3.45	5
TIER 2 – PRIORITY				
I-225 (I-70 to I-25)	3.45	2.00	2.73	6
I-25 Central (US 36 to 20th St) [A1]	4.45	1.00	2.73	7
C-470 (I-70 to Wadsworth)	4.18	1.00	2.59	8
I-25 Central (I-225 to C-470) [A1]	4.09	1.00	2.55	9
I-70 (Wadsworth to I-25)	4.00	1.00	2.50	10
I-25 South (C-470 to Castle Rock)	3.91	1.00	2.45	11
I-25 Central (Santa Fe to I-225) [A1]	3.27	1.00	2.14	12
TIER 3 – PRIORITY				
I-25 Central (20th St to Santa Fe)	3.91	0.00	1.95	13
I-76 (Wadsworth to I-270)	3.27	0.00	1.64	14
I-70 East (Chambers to E-470)	3.27	0.00	1.64	14
I-70 MTN (Floyd Hill)	3.09	0.00	1.55	16
I-70 MTN (Frisco to Silverthorne)	2.55	0.00	1.27	17
I-70 MTN (Georgetown to Empire)	2.45	0.00	1.23	18
I-70 (C-470 to Wadsworth)	2.00	0.00	1.00	19
I-76 (I-270 to E-470)	1.82	0.00	0.91	20
I-70 MTN (Georgetown to EJMT)	1.82	0.00	0.91	20
Pena Blvd (I-70 to E-470)	1.45	0.00	0.73	22

The Low Cost (LC) alternatives for I-25 represent the highest ranking three segments. Although these corridors may offer greater combined financial and mobility performance relative to other corridors, it is important to emphasize the sketch-level nature of the Phase II evaluation. In particular, the Low Cost shoulder lane alternatives for the I-25 TREX section between Santa Fe and C-470 require additional analysis into safety and enforcement considerations in order to confirm their viability from a technical perspective and among stakeholders. Some of the safety issues and guidelines to be considered further are described as part of Appendix D. Please note that the tiered priority corridors described in Table 9-1 and shown in Figure 9-1 do not include overall results or rankings for the US 85 / Santa Fe Dr corridor, due to underlying modeling issues and unrealistic revenue results described in section 6.

Figure 9-1 // Overall Segment Prioritization & Ranking



10

Delivery Analysis

SECTION

10

HPTE, relative to most state highway agencies, is advanced in its experience with toll roads, financing, and using alternative delivery mechanisms. It has undertaken toll revenue, availability payment, and more traditional design build projects across the Denver Metropolitan Area and in the I-70 Mountain Corridor, all of which were supported by some sort of debt. There are many variations of borrowing structures that can be used to finance toll roads, and this section describes a somewhat basic tax exempt structure, using the recent C-470 Segment 1 bond issuance as precedent for many of the assumptions.

The assumptions used in this study have been conservatively set to reflect that the transactions would occur several years in the future, and market conditions then could be very different than they are today. Again, the goal of the ELMP study is not to optimize any one corridor, but to compare corridors on a common basis to inform future planning and analytical work.

The bond structure used in this analysis includes senior and junior tranches, with the junior tranche structured as a Transportation Infrastructure Finance and Innovation Act (TIFIA) loan. Each has specific assumptions that forge the repayment structure, but the main premise is that the senior debt is paid first, and with other risk mitigating factors, is considered less risky. The TIFIA loan is repaid after senior obligations are met. All bonds are assumed to be paid from adjusted gross revenues, meaning that bond payments are paid first, before all operations and maintenance costs, which would be backstopped by CDOT by agreement. CDOT is not assumed to backstop debt services payments. Detailed assumptions can be found in the ELMP technical memorandum, “Financing Analysis & Delivery Options.”

Alternative delivery approaches, sometimes referred to as public-private partnerships, are growing in use, particularly for toll roads. If an alternative delivery approach were used instead of the tax exempt bond issuance outlined above, there would likely be a combination of bank debt and equity to fund the capital costs. The bank debt would carry a higher interest rate since it would not be tax exempt, and would likely have a shorter-term, though that depends on the private entity’s financial strategy. Typically, bank debt

requires an interest rate that is two to three percentage points higher than similar tax exempt debt. Equity returns are often between 12% and 18%, but similarly, this depends on the asset, the structure of the transaction, and the equity investor's risk tolerance for a given market. There are an infinite number of ways a public-private partnership can be structured, therefore in this memorandum, we'll focus on the public debt structure described above, and describe potential costs and benefits an alternative delivery approach might introduce.

10.1 Express Lane Corridor Bond Issuance Results

The Express Lane segments were bundled into corridors that had logical fit and the associated revenues were processed in a financial model to estimate the amount of bond proceeds that could be generated using the assumptions outlined above. The following table provides the total revenues for each corridor along with estimated bond proceeds, capital cost, and remaining funding gap.

Table 10-1 // Express Lane Corridor Bond Issuance Net Proceeds

FACILITY	TOTAL ADJUSTED GROSS REVENUE (2025-2060)	GROSS SENIOR BOND PROCEEDS	GROSS TIFIA BOND PROCEEDS	TOTAL GROSS BOND PROCEEDS	TOTAL NET BOND PROCEEDS
I-25 North	$650.6	$40.3	$14.6	$54.9	$40.3
I-25 Central - Alternative 1	$4,103.2	$278.3	$100.6	$378.8	$282.8
I-25 Central - Low Cost	$3,690.8	$250.2	$90.4	$340.7	$254.2
I-25 South	$1,040.4	$60.8	$22.0	$82.8	$60.8
East/West (I-70 - C-470 to I-25)	$1,027.8	$85.2	$30.8	$116.0	$86.3
East/West - I-270	$2,559.2	$154.6	$55.9	$210.5	$155.2
C-470 - Segment 2	$908.0	$79.9	$28.9	$108.8	$81.2
I-225 - Alternative 1	$1,325.3	$92.9	$33.6	$126.5	$93.7
I-225 - Low Cost	$928.7	$72.3	$26.1	$98.5	$73.2
I-70 Mtn - Empire to Frisco	$153.2	$19.8	$7.2	$27.0	$19.7
I-70 Mtn - Floyd Hill	$56.2	$7.4	$2.7	$10.0	$6.9

Table 10-2 compares net bond proceeds to capital costs. The corridors with the highest percentage of capital costs that could be covered by a bond transaction like that outlined above are I-25 North ($40.3 million / 28%), the Low Cost alternative for I-25 Central ($254.2 million / 22%), and I-270 ($155.2 million / 25%). These results, considering many of the assumptions used are very conservative, show that significant additional other funding sources will be needed to deliver even the best performing projects.

Table 10-2 // Estimated Project Funding Gap

FACILITY	TOTAL NET BOND PROCEEDS	CAPITAL COST	NET PROCEEDS PERCENT OF CAPITAL COST	ESTIMATED FUNDING GAP
I-25 North	$40.3	$142.3	28%	$87.4
I-25 Central - Alternative 1	$282.8	$3,578.2	8%	$3,199.4
I-25 Central - Low Cost	$254.2	$1,134.2	22%	$793.5
I-25 South	$60.8	$1,063.1	6%	$980.3
East/West (I-70 - C-470 to I-25)	$86.3	$867.6	10%	$751.6
East/West - I-270	$155.2	$613.3	25%	$402.8
C-470 - Segment 2	$81.2	$709.2	11%	$600.4
I-225 - Alternative 1	$93.7	$725.5	13%	$599.0
I-225 - Low Cost	$73.2	$725.5	10%	$627.0
I-70 Mtn - Empire to Frisco	$19.7	$251.5	8%	$224.5
I-70 Mtn - Floyd Hill	$6.9	$615.5	1%	$605.5

From an alternative delivery perspective, the contribution towards paying for capital costs would not differ significantly on average from what is contained in the table above. It could be somewhat more or less, depending on the private investors access to capital and risk tolerance for Express Lane toll revenue. Capital costs could also be reduced if private entities bring innovations to the design that still achieve CDOT goals, thereby improving the financial profile of the projects.

Bundling of segments has been done in the above analysis to establish logical corridors, but the results don't identify any high-performing corridors that could be paired with weaker corridors to balance out revenue performance. From an operational standpoint, economies of scale could be achieved by bundling, but this analysis assumes a gross revenue pledge, and still the revenues are not sufficient to pay for much more than a quarter of capital costs of the best performing corridors.

Bundling projects based on criteria such as project type, proximity, materials used, or design approaches, has been proven to achieve economies of scale to save money and/or time. This can occur through a reduced unit price on materials, reduced mobilization/demobilization costs, streamlining environmental processes, reducing administrative overhead, and attracting more competitive bids. The ELMP memorandum, "Financial Analysis and Delivery Options," explores the benefits of bundling, best practices particularly relevant to HPTE, and possible risks associated with bundling.

Project bundling will typically occur within a given geographic confine, since performing contract work together as a bundle generally implies proximity needed to capture cost efficiencies. In some cases, however, asset types may be so similar in nature that their acquisition and installation, when bundled together into packaged contracts, may supersede spatial proximity. Examples could include assets such as electric vehicle charging stations, bridges or bridge elements, culverts, highway lighting, or in the case of the ELMP, toll equipment and related operations.

10.2 Federal Discretionary Grant Programs

The most important takeaway from this analysis is that significant gaps between what the respective toll revenue streams can cover in some form of bond transaction and the capital cost of the projects will need to be filled with other revenue sources.

The Federal Highway Administration has several formula programs that allocate funding to states based on the federal-aid highway program authorization, currently the FAST Act. The formula funding is commonly used by CDOT for both capital expansion and maintenance of its system, and a portion trickles down to local governments and transportation authorities. The USDOT also has discretionary grant programs that are targeted at specific types of capital investments. These competitive programs generally have one call for applications each year and attract billions in requests – far more than the available funding. Two of these programs are a good fit for Express Lane projects; the BUILD program and the INFRA program. CDOT has experience and success with both of these programs, so they are mentioned only briefly herein.

The Better Utilizing Investments to Leverage Development (BUILD) grant program (formerly known as TIGER) is a highly competitive USDOT grant program which supports the capital costs of road, rail, transit, and port projects that have a significant impact on the nation, a region, or a metropolitan area. The maximum award per project is $25 million, and total awarded amounts per state cannot exceed $150 million. Because the BUILD program was not authorized under the FAST Act, further rounds cannot be administered without specific Congressional appropriations for the program, which the current Administration has omitted in its budget recommendations. Despite this, the program will likely return in FY 2020. Given the BUILD grant maximum award is $25 million, it would not be a major component of most ELMP project's capital stack, but given the right combination of benefits on a nationally significant facility where there is a significant freight component to overall traffic, it could come into play.

The Infrastructure for Rebuilding America (INFRA) grant program (formerly known as FASTLANE) is a USDOT grant program focusing on nationally significant freight and highway transportation projects that meet four key objectives: (1) support economic vitality at the national and regional level; (2) leverage Federal funding to attract other, non-Federal sources of infrastructure investment, and account for the life-cycle costs of the project; (3) use innovative approaches to improve safety and expedite project delivery; and (4) hold grant recipients accountable for their performance and achievement of specific, measurable outcomes identified by grant applicants. As authorized by the

FAST Act, these funds will support primarily freight and highway projects of national or regional significance, but also intermodal projects. In FY 2019, 20 projects were awarded $855 million. Similar to the BUILD program, the most competitive projects from the ELMP would be ones that showed significant benefits in the form of economic growth and making freight movements more efficient.

These programs have become very popular and all expectations are for them to continue in some form in subsequent reauthorizations. If HPTE desires to use them to supplement other funding sources for the Express Lane projects, it should plan and develop sufficient data to support the benefit cost analyses, ensure that a complete financial plan is developed, showing the project is fundable with the discretionary grant, and coordinate with other divisions of CDOT to avoid competition between applications within the state in any given year. An overall discretionary grant strategy for CDOT going out several years is recommended to maximize funding from these programs.

11

Corridor Profile Sheets

Colorado
Express Lanes Master Plan

C-470
I-70 to Wadsworth Blvd

Design Alternative
The C-470 corridor, between Wadsworth and I-70, assumes one full-time Express Lane in each direction, with an Express Lane direct connect ramp between C-470 and I-70.

Travel Time Improvement

	*General Purpose**	*Express Lane***
AM	**-16%**	**-27%**
PM	**-11%**	**-29%**

* No-Build GP versus Build GP Scenario
** No-Build GP versus Express Lane Build Scenario

Present Value of Net Revenue (2025)
$154.7 million

Capital Cost (2025)
$709.2 million

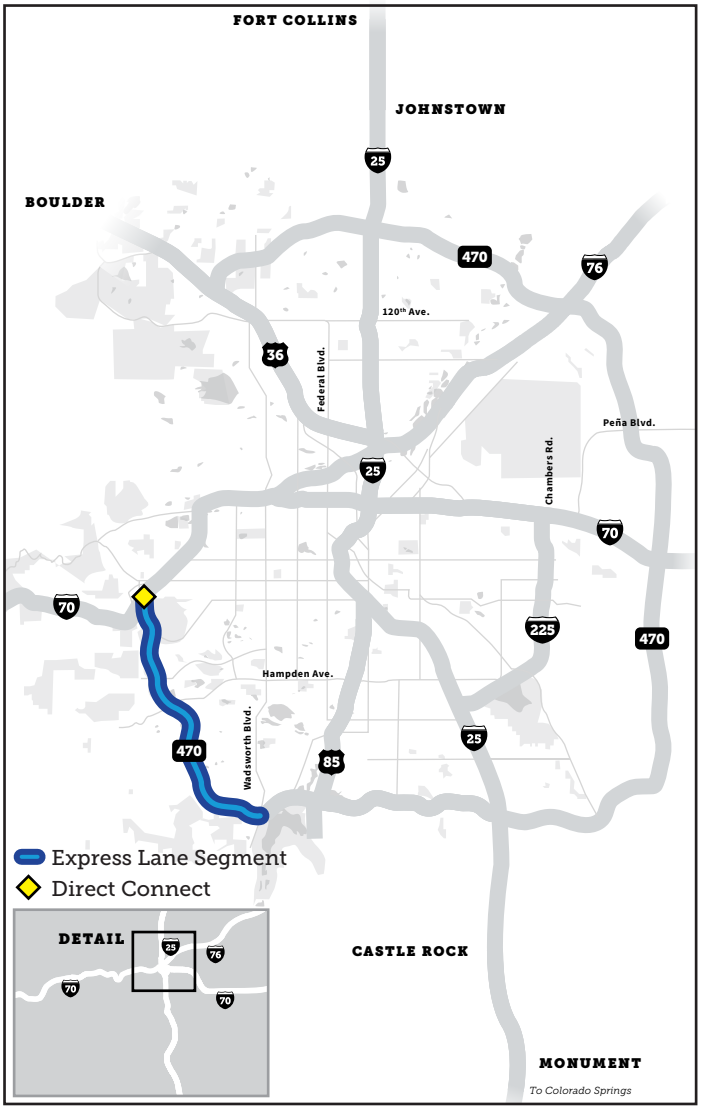
Improvement in Person Throughput
(No-Build versus Build Scenario)

AM **+2,229 people**
PM **+5,649 people**

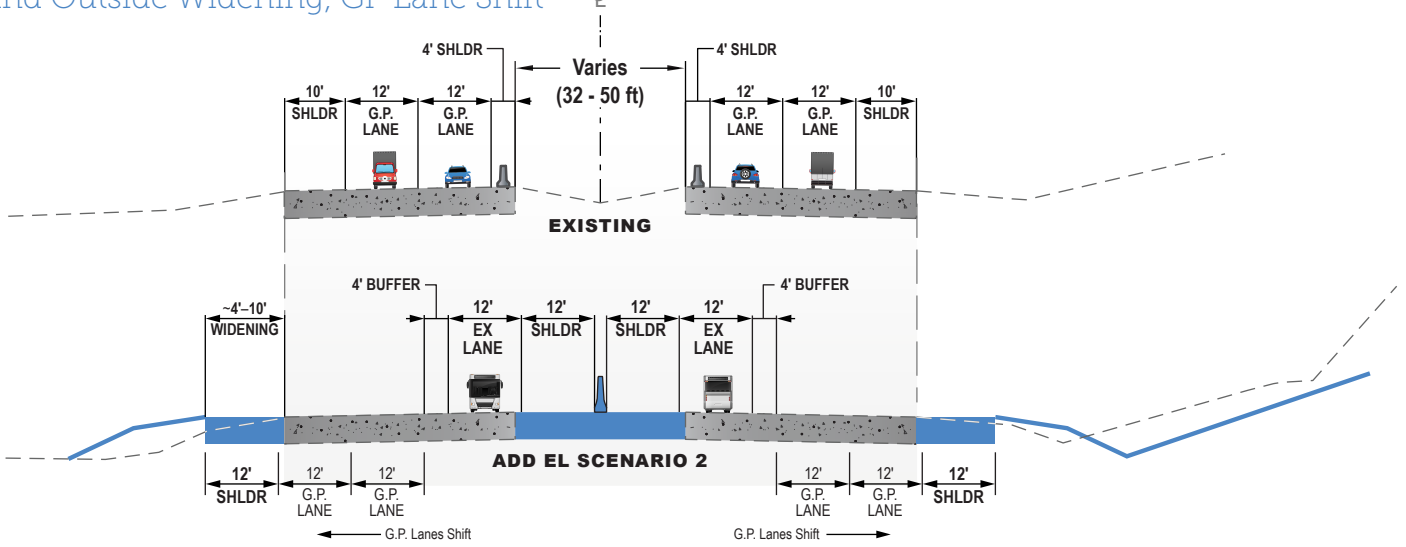
Financial Score: 1.0 out of 5.0
(Comparative measure of financial performance between corridors)

Mobility Score: 4.18 out of 5.0

Overall Score and Rank: 2.59 out of 5.0
(8 out of 22)



Proposed Express Lane Configuration
Inside and Outside Widening, GP Lane Shift



Colorado
Express Lanes Master Plan

I-225
I-25 to I-70

Design Alternative

I-225 assumes one full-time Express Lane in each direction, with Express Lane direct connect ramps at I-25 and I-70. Design assumes Full Standard lane configuration.

Travel Time Improvement

	*General Purpose**	*Express Lane***
AM	**5%**	**-11%**
PM	**9%**	**-16%**

* No-Build GP versus Build GP Scenario
** No-Build GP versus Express Lane Build Scenario

Present Value of Net Revenue (2025)
$360.2 million

Capital Cost (2025)
$725.5 million

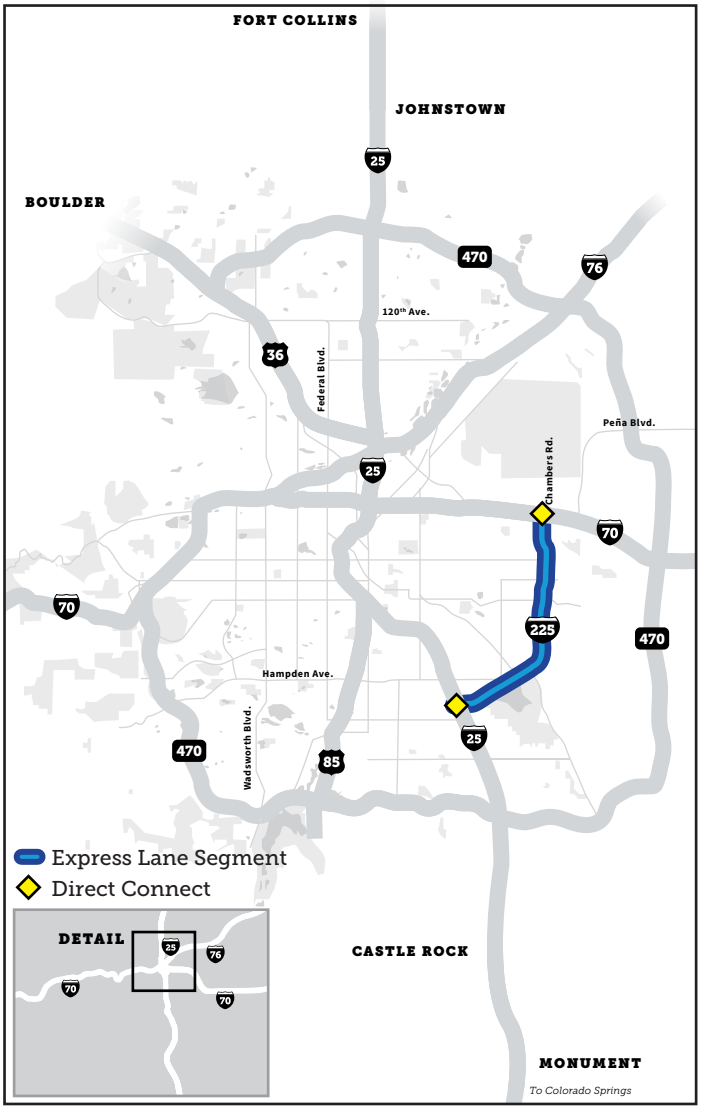
Improvement in Person Throughput
(No-Build versus Build Scenario)

AM **+7,471 people**
PM **+9,940 people**

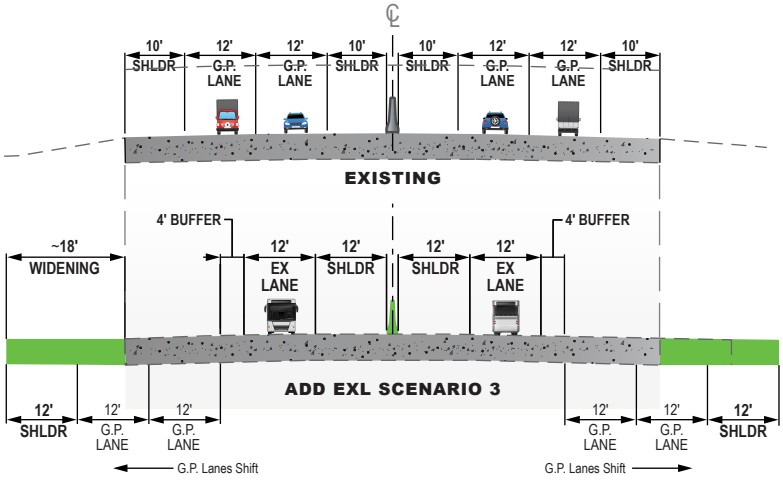
Financial Score: 2.0 out of 5.0
(Comparative measure of financial performance between corridors)

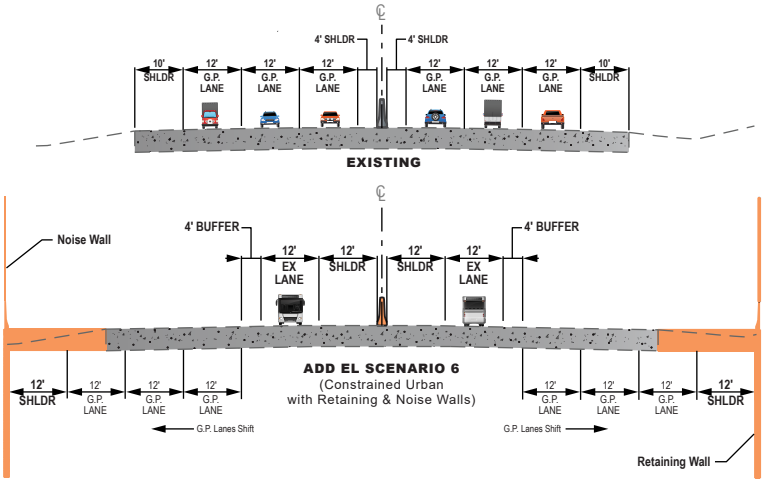
Mobility Score: 3.45 out of 5.0

Overall Score and Rank: 2.73 out of 5.0
(6 out of 22)



Proposed Express Lane Configuration
Outside Widening, GP Lane Shift





Colorado
Express Lanes Master Plan

I-70
C-470 to Wadsworth Blvd

Design Alternative
I-70, between C-470 and Wadsworth, assumes one full-time Express Lane in each direction, with Express Lane direct connect ramps at C-470 and I-76. Design assumes Full Standard lane configuration.

Travel Time Improvement

	*General Purpose**	*Express Lane***
AM	**7%**	**-2%**
PM	**8%**	**-9%**

* No-Build GP versus Build GP Scenario
** No-Build GP versus Express Lane Build Scenario

Present Value of Net Revenue (2025)
$99.8 million

Capital Cost (2025)
$547.6 million

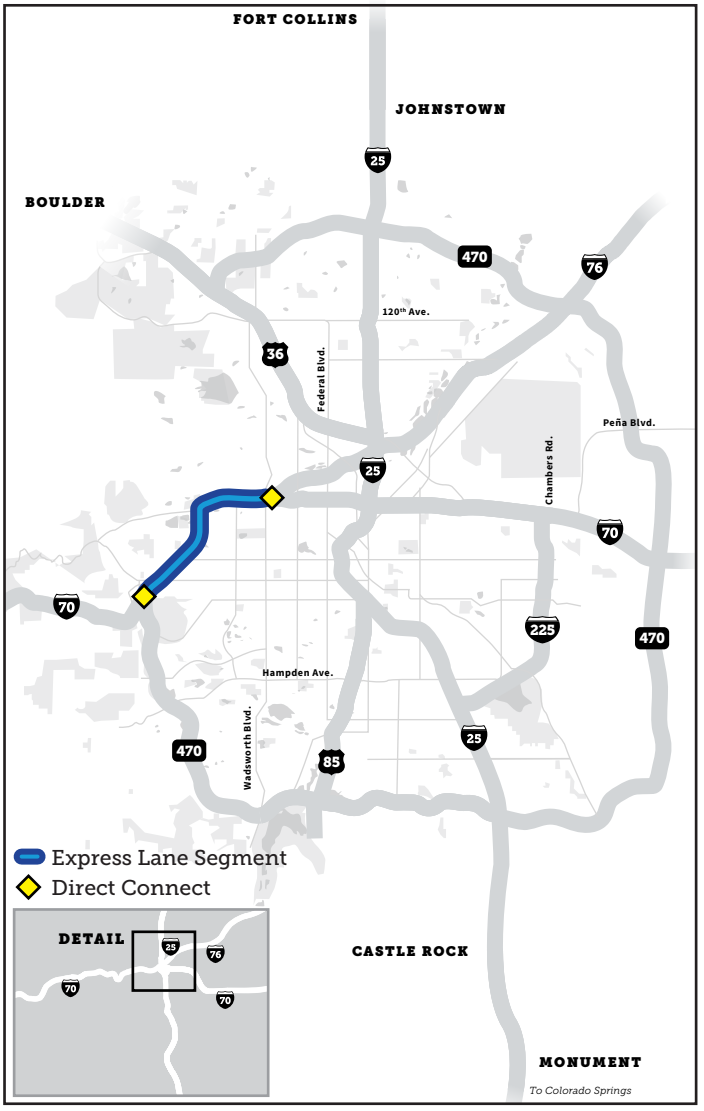
Improvement in Person Throughput
(No-Build versus Build Scenario)

AM **+4,325 people**
PM **+7,005 people**

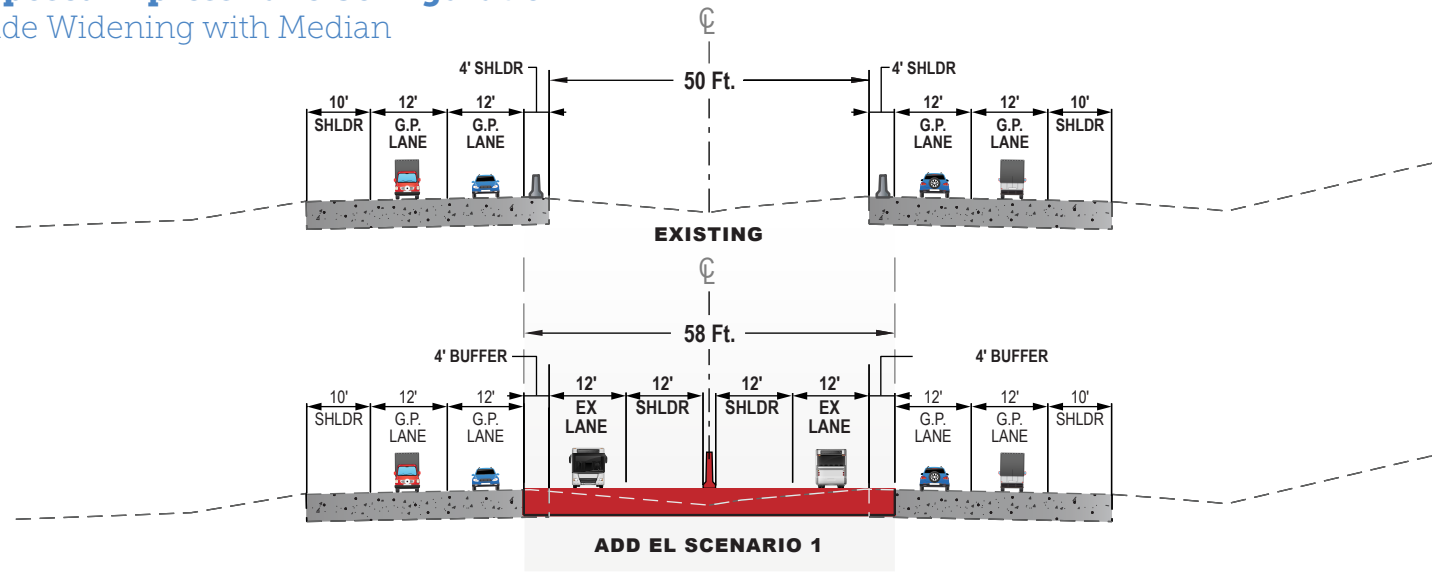
Financial Score: 0.0 out of 5.0
(Comparative measure of financial performance between corridors)

Mobility Score: 2.00 out of 5.0

Overall Score and Rank: 1.00 out of 5.0
(19 out of 22)



Proposed Express Lane Configuration
Inside Widening with Median



Colorado
Express Lanes Master Plan

I-70
Wadsworth Blvd to I-25

Design Alternative
I-70, between Wadsworth and I-25, assumes one full-time Express Lane in each direction. Design assumes Full Standard lane configuration.

Travel Time Improvement

	General Purpose*	Express Lane**
AM	**-9%**	**-19%**
PM	**-10%**	**-25%**

* No-Build GP versus Build GP Scenario
** No-Build GP versus Express Lane Build Scenario

Present Value of Net Revenue (2025)
$135.4 million

Capital Cost (2025)
$320.0 million

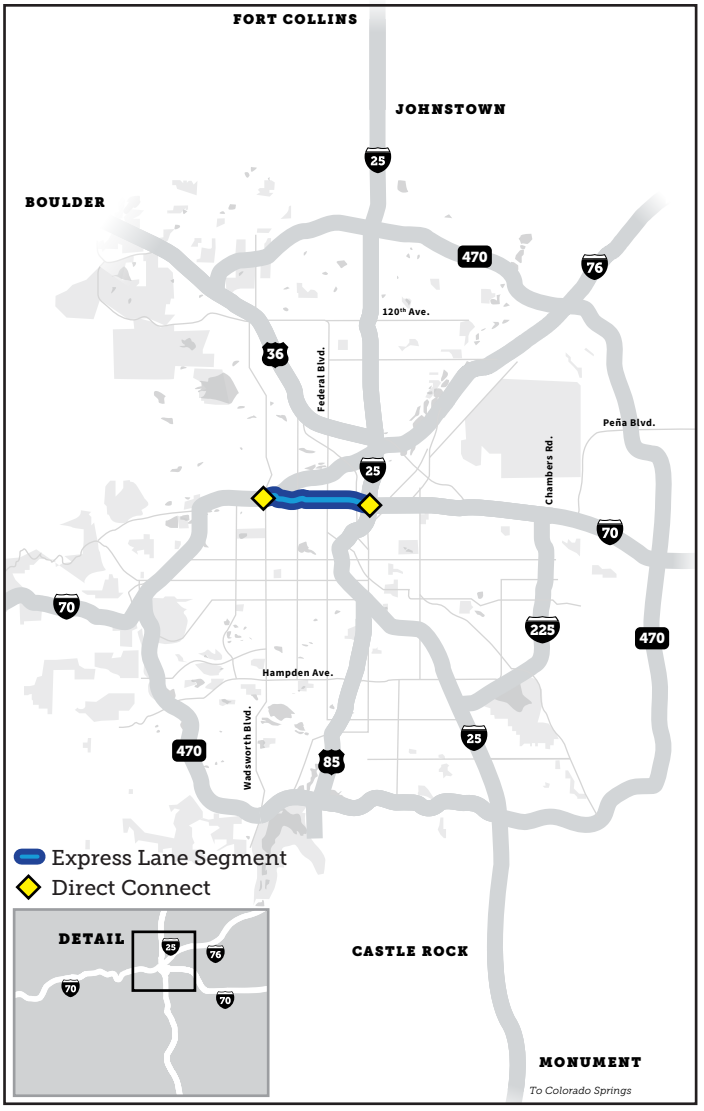
Improvement in Person Throughput
(No-Build versus Build Scenario)

AM **+3,338 people**
PM **+5,345 people**

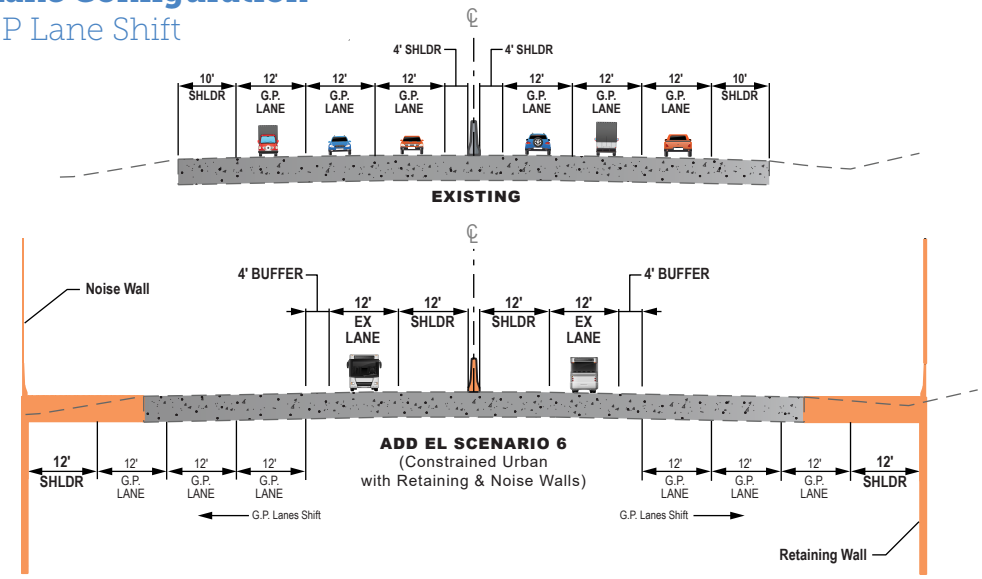
Financial Score: 1.0 out of 5.0
(Comparative measure of financial performance between corridors)

Mobility Score: 4.00 out of 5.0

Overall Score and Rank: 2.50 out of 5.0
(10 out of 22)



Proposed Express Lane Configuration
Outside Widening, GP Lane Shift



Colorado
Express Lanes Master Plan

I-76
Wadsworth Blvd to I-270

Design Alternative
I-76, between I-70 and I-270, assumes one full-time Express Lane in each direction, with Express Lane direct connect ramps at I-70, I-25, and I-270. Design assumes Full Standard lane configuration.

Travel Time Improvement

	*General Purpose**	*Express Lane***
AM	**2%**	**-16%**
PM	**1%**	**-22%**

* No-Build GP versus Build GP Scenario
** No-Build GP versus Express Lane Build Scenario

Present Value of Net Revenue (2025)
$97.3 million

Capital Cost (2025)
$649.8 million

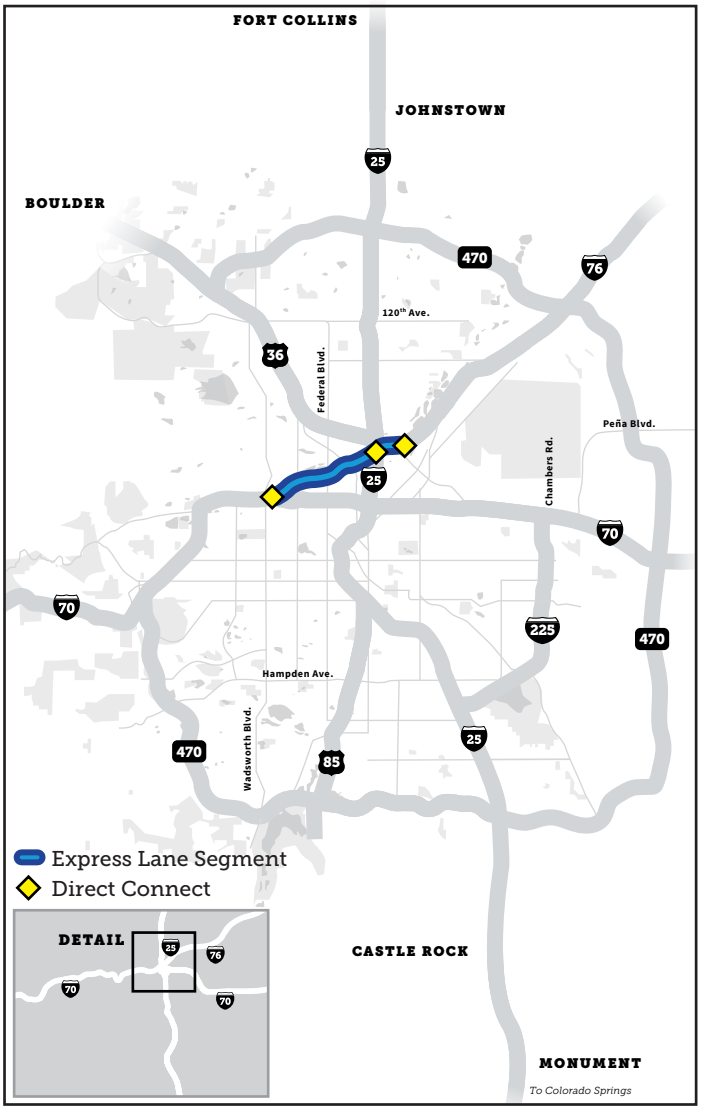
Improvement in Person Throughput
(No-Build versus Build Scenario)

AM **+4,966 people**
PM **+7,538 people**

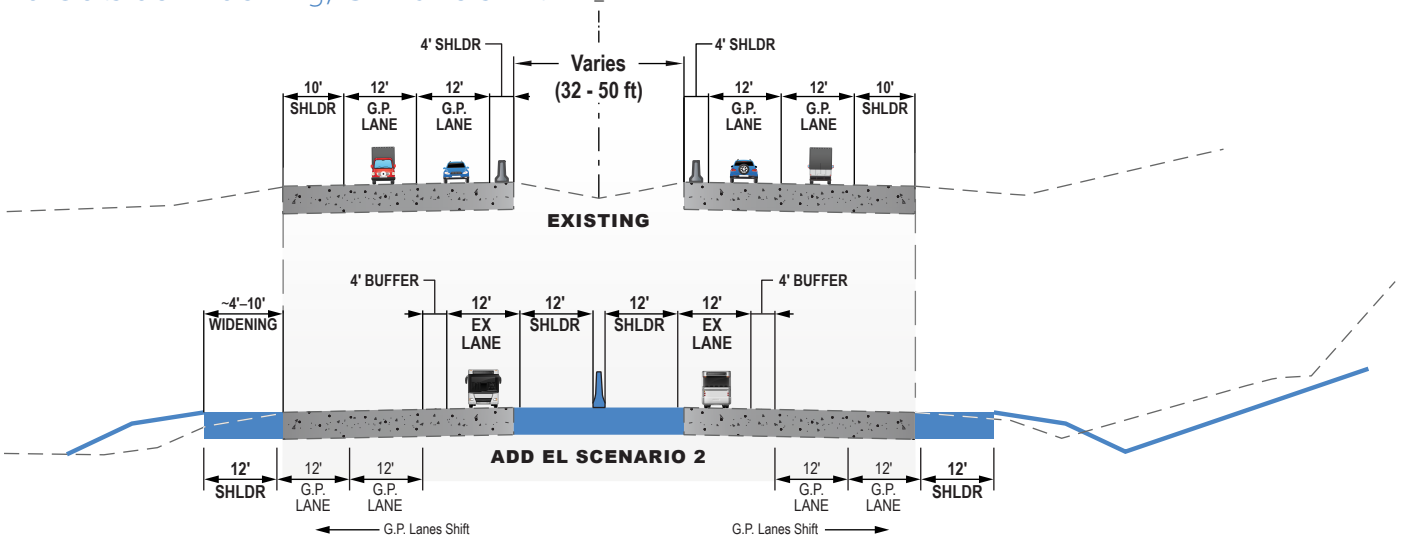
Financial Score: 0.0 out of 5.0
(Comparative measure of financial performance between corridors)

Mobility Score: 3.27 out of 5.0

Overall Score and Rank: 1.64 out of 5.0
(14 out of 22)



Proposed Express Lane Configuration
Inside and Outside Widening, GP Lane Shift

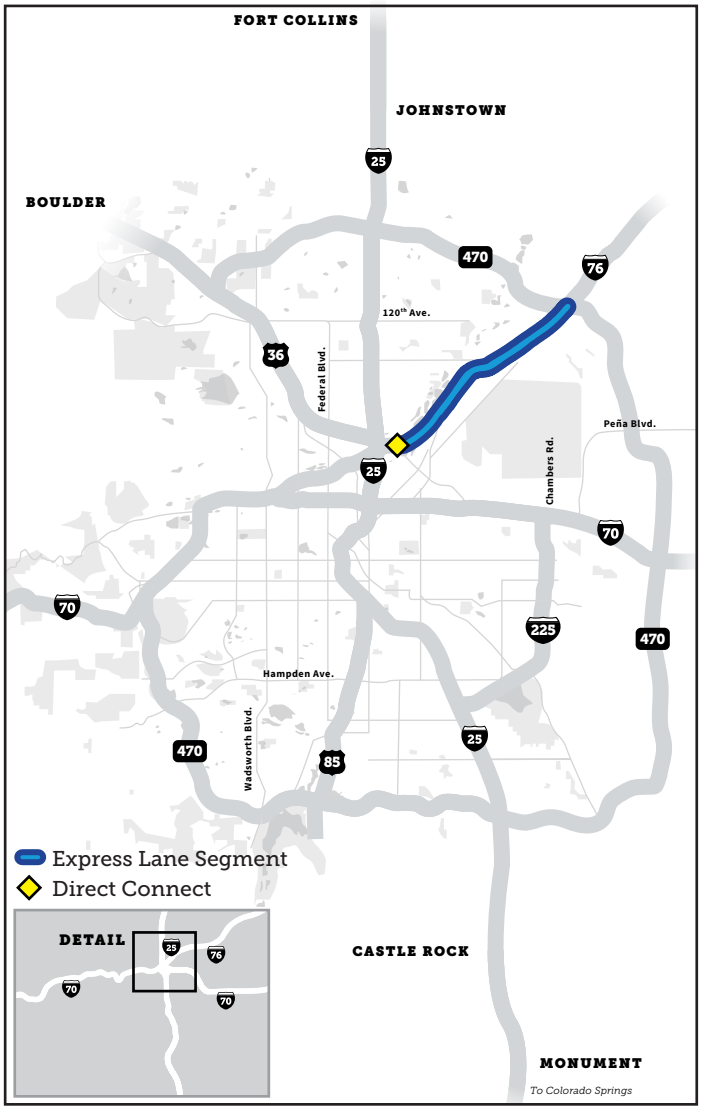


Colorado
Express Lanes Master Plan

I-76
I-270 to E-470

Design Alternative

I-76, between I-270 and E-470, assumes one full-time Express Lane in each direction, with an Express Lane direct connect ramp at I-270. Design assumes Full Standard lane configuration.



Travel Time Improvement

	*General Purpose**	*Express Lane***
AM	**2%**	**-6%**
PM	**6%**	**-5%**

* No-Build GP versus Build GP Scenario
** No-Build GP versus Express Lane Build Scenario

Present Value of Net Revenue (2025)
$27.5 million

Capital Cost (2025)
$439.1 million

Improvement in Person Throughput
(No-Build versus Build Scenario)

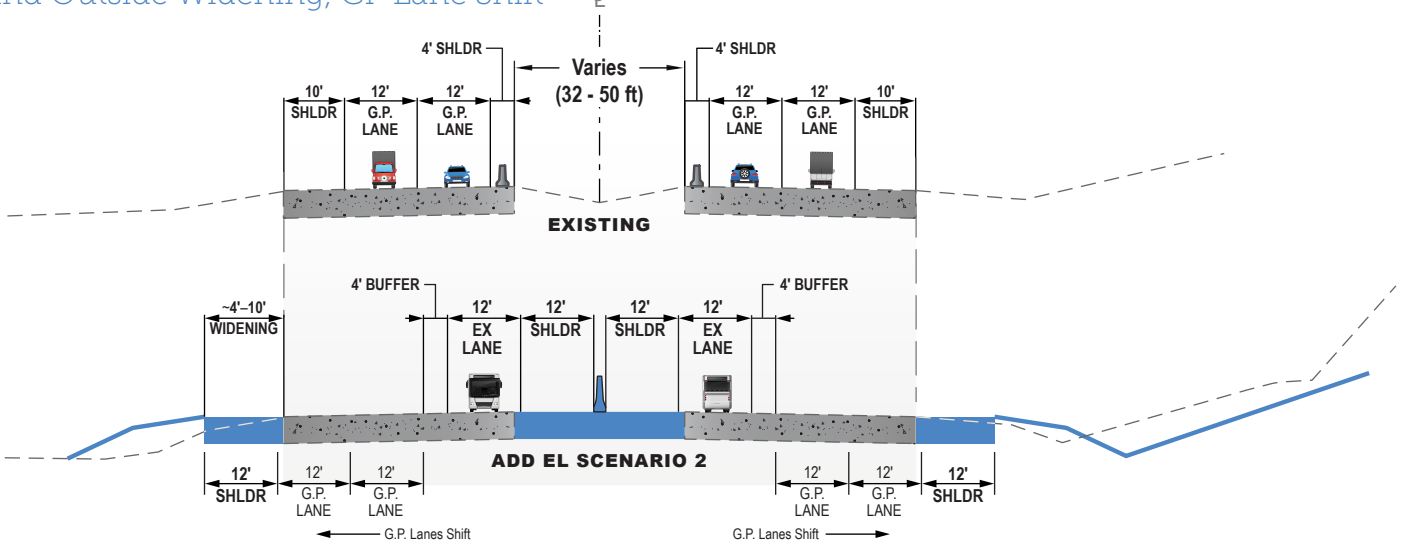
AM **+3,207 people**
PM **+3,896 people**

Financial Score: 0.0 out of 5.0
(Comparative measure of financial performance between corridors)

Mobility Score: 1.82 out of 5.0

Overall Score and Rank: 0.91 out of 5.0
(20 out of 22)

Proposed Express Lane Configuration
Inside and Outside Widening, GP Lane Shift



Colorado
Express Lanes Master Plan

I-270
I-25 to I-70

Design Alternative
I-270 assumes one Express Lane in each direction, with Express Lane direct connect ramps at US 36, I-25, I-76, and I-70. Design assumes Full Standard lane configuration.

Travel Time Improvement

	*General Purpose**	*Express Lane***
AM	**-6%**	**-19%**
PM	**-6%**	**-25%**

* No-Build GP versus Build GP Scenario
** No-Build GP versus Express Lane Build Scenario

Present Value of Net Revenue (2025)
$808.9 million

Capital Cost (2025)
$613.3 million

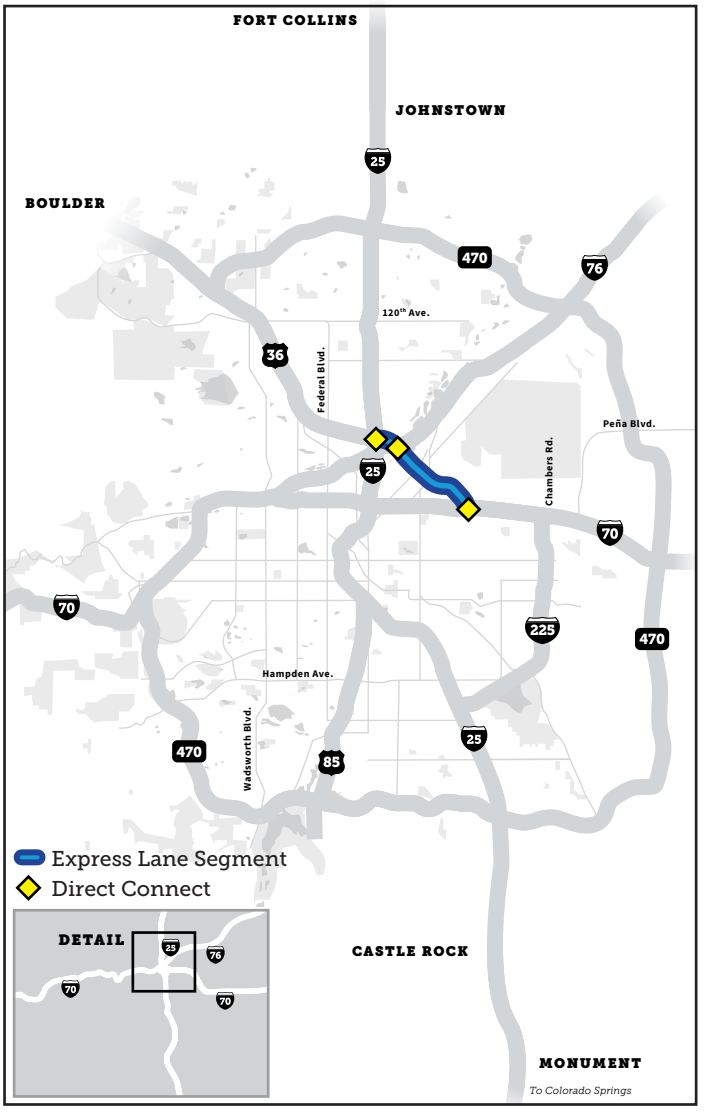
Improvement in Person Throughput
(No-Build versus Build Scenario)

AM **+5,996 people**
PM **+7,143 people**

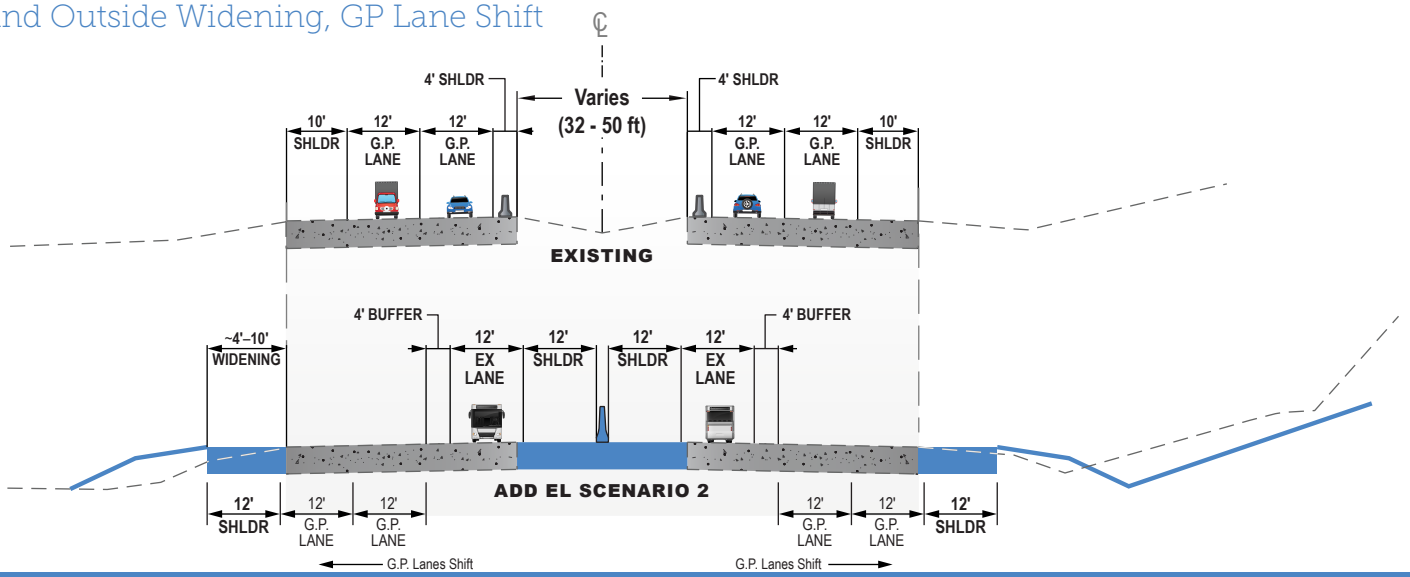
Financial Score: 3.0 out of 5.0
(Comparative measure of financial performance between corridors)

Mobility Score: 4.27 out of 5.0

Overall Score and Rank: 3.64 out of 5.0
(4 out of 22)



Proposed Express Lane Configuration
Inside and Outside Widening, GP Lane Shift



Colorado
Express Lanes Master Plan

I-25 North
E-470 to SH 66

Design Alternative
I-25 North will extend existing I-25 Express Lanes north from E-470 to SH 66, with one full-time Express Lane in each direction. Design assumes Full Standard lane configuration.

Travel Time Improvement

	*General Purpose**	*Express Lane***
AM	**-3%**	**-11%**
PM	**-5%**	**-19%**

* No-Build GP versus Build GP Scenario
** No-Build GP versus Express Lane Build Scenario

Present Value of Net Revenue (2025)
$159.8 million

Capital Cost (2025)
$142.3 million

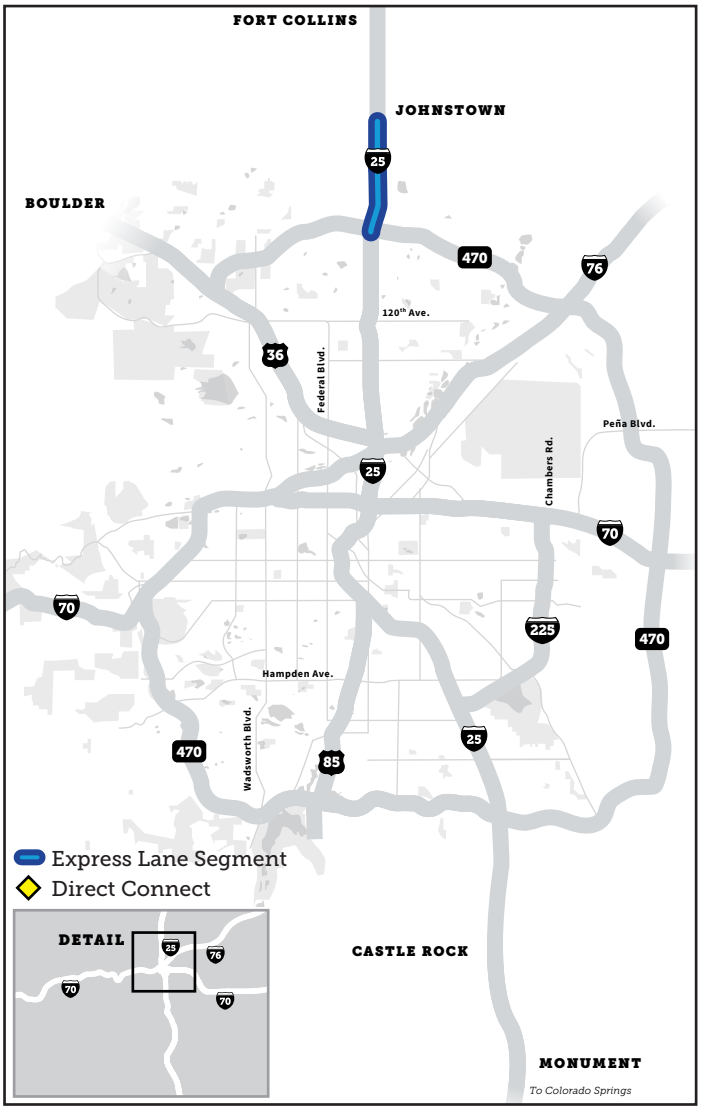
Improvement in Person Throughput
(No-Build versus Build Scenario)

AM **+3,285 people**
PM **+5,795 people**

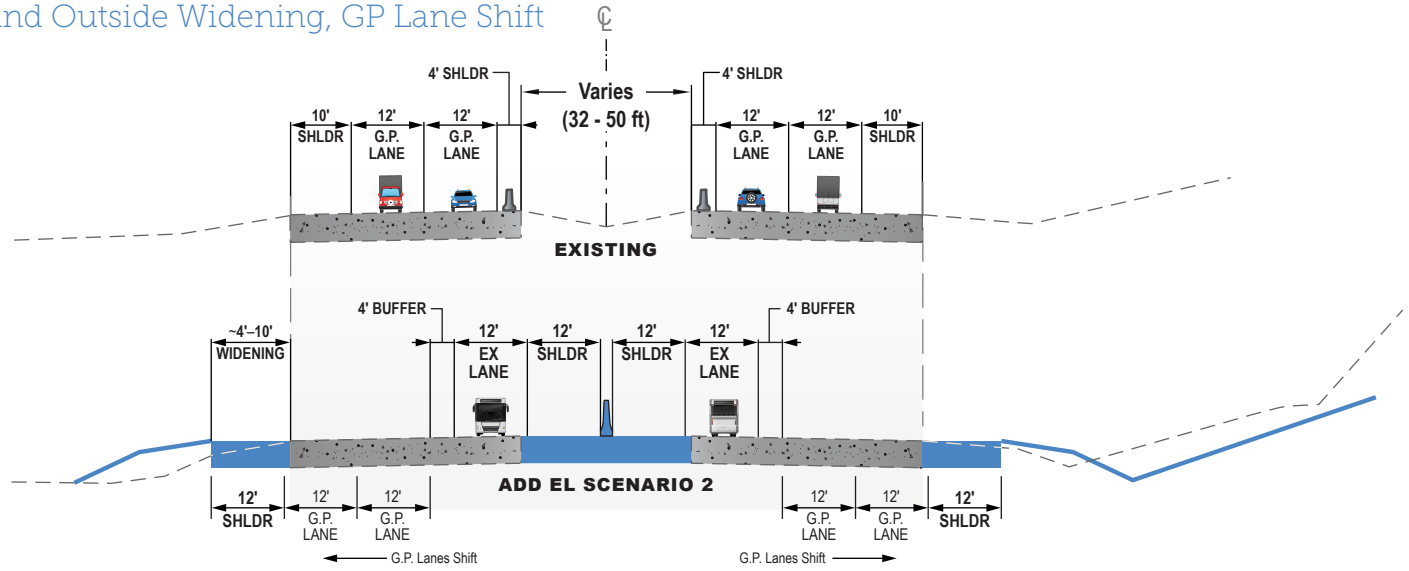
Financial Score: 3.0 out of 5.0
(Comparative measure of financial performance between corridors)

Mobility Score: 3.91 out of 5.0

Overall Score and Rank: 3.45 out of 5.0
(5 out of 22)



Proposed Express Lane Configuration
Inside and Outside Widening, GP Lane Shift



COLORADO HPTE

Colorado
Express Lanes Master Plan

I-25 Alternative 1
20th St to US 36

Design Alternative

I-25 Alternative 1 assumes two new elevated Express Lanes in the northbound direction, and the conversion of the exisitng reversible Express Lanes to two full-time southbound lanes. Design assumes Full Standard lane configuration.

Travel Time Improvement

	*General Purpose**	*Express Lane***
AM	**-24%**	**-33%**
PM	**-17%**	**-35%**

* No-Build GP versus Build GP Scenario
** No-Build GP versus Express Lane Build Scenario

Present Value of Net Revenue (2025)
$384.3 million

Capital Cost (2025)
$814.8 million

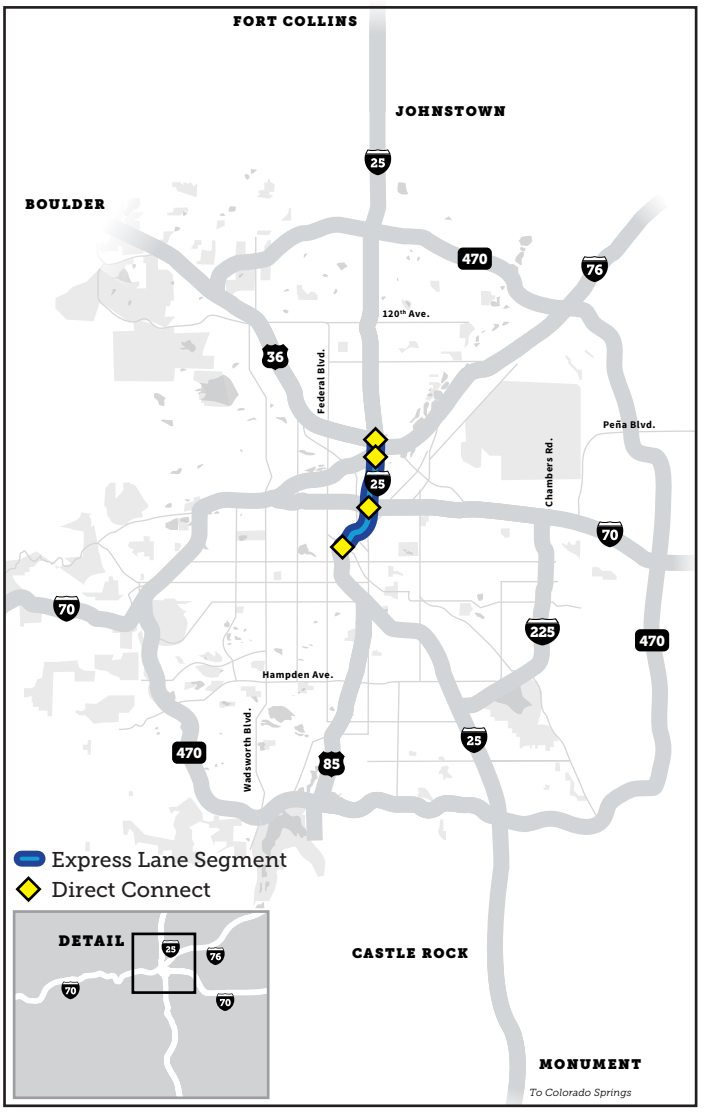
Improvement in Person Throughput
(No-Build versus Build Scenario)

AM **+2,746 people**
PM **+7,081 people**

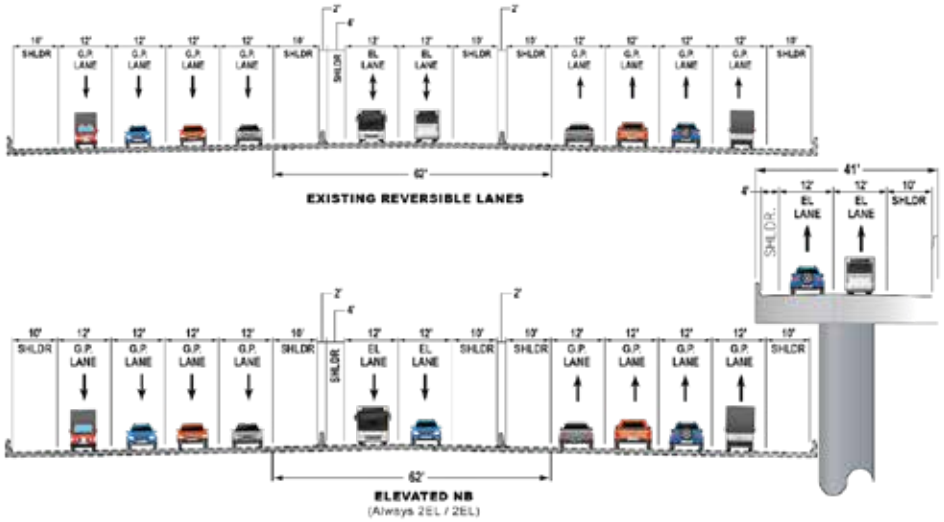
Financial Score: 1.0 out of 5.0
(Comparative measure of financial performance between corridors)

Mobility Score: 4.45 out of 5.0

Overall Score and Rank: 2.73 out of 5.0
(7 out of 22)



Proposed Express Lane Configuration
Two NB Lanes on Aerial Structure, Conversion of Reversible Lanes to SB



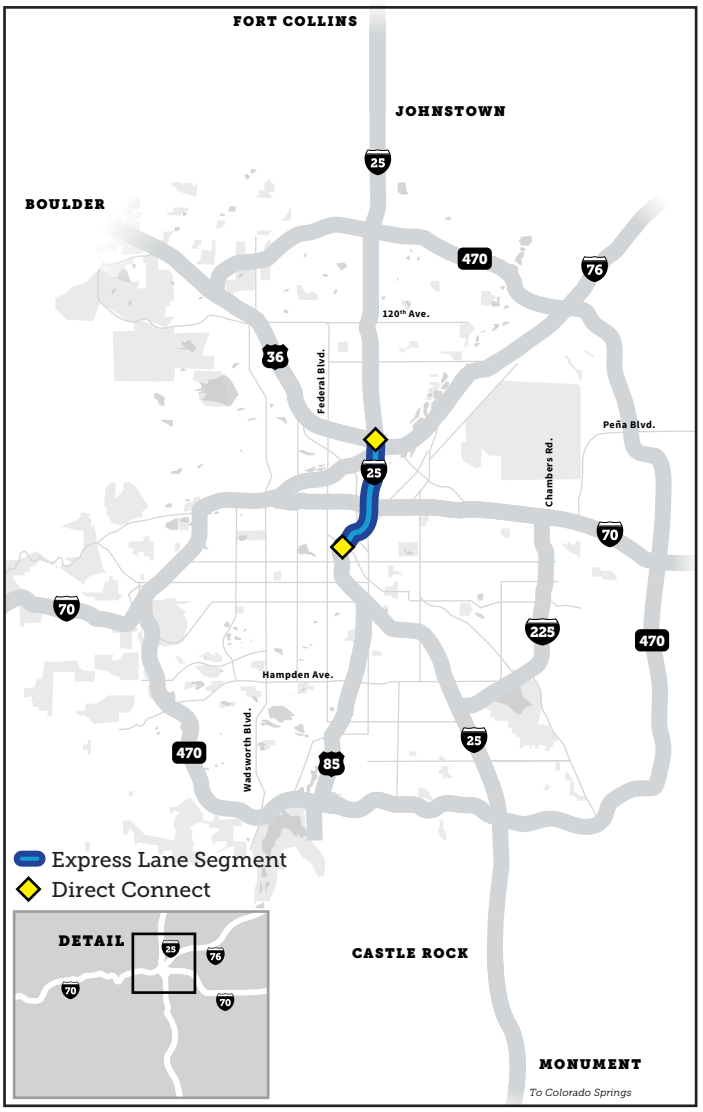
COLORADO HPTE

Colorado
Express Lanes Master Plan

I-25 Alternative 2
20th St to US 36

Design Alternative

I-25 Alternative 2 assumes one new Express Lane and reversible Zipper operation. This provides three total Express Lanes, two southbound and one northbound in the AM, which converts to two northbound and one southbound in the PM. Design assumes a ~8 ft wide inside shoulder.



Travel Time Improvement

	*General Purpose**	*Express Lane***
AM	**-32%**	**-40%**
PM	**-21%**	**-37%**

* No-Build GP versus Build GP Scenario
** No-Build GP versus Express Lane Build Scenario

Present Value of Net Revenue (2025)
$392.5 million

Capital Cost (2025)
$185.1 million

Improvement in Person Throughput
(No-Build versus Build Scenario)

AM **+4,985 people**
PM **+8,295 people**

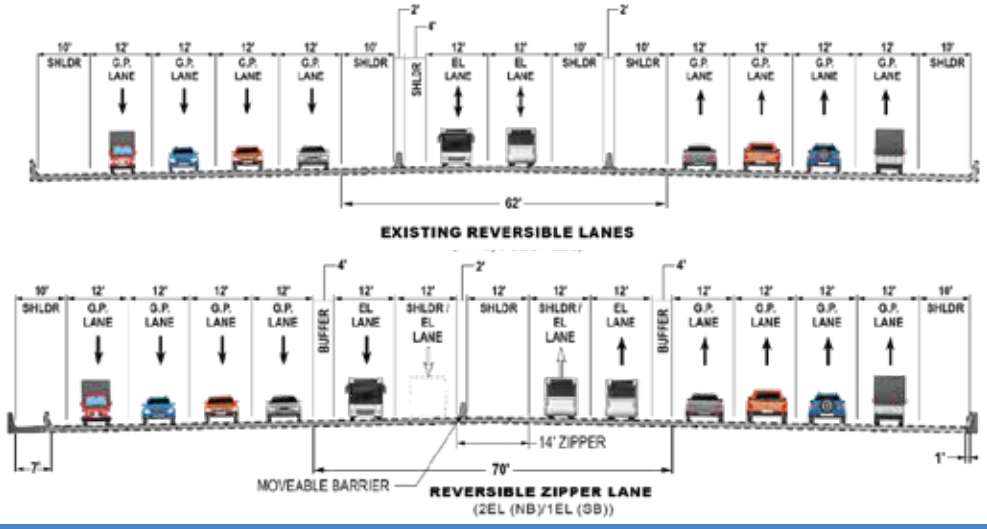
Financial Score: 4.0 out of 5.0
(Comparative measure of financial performance between corridors)

Mobility Score: 4.64 out of 5.0

Overall Score and Rank: 4.32 out of 5.0
(1 out of 22)

Proposed Express Lane Configuration

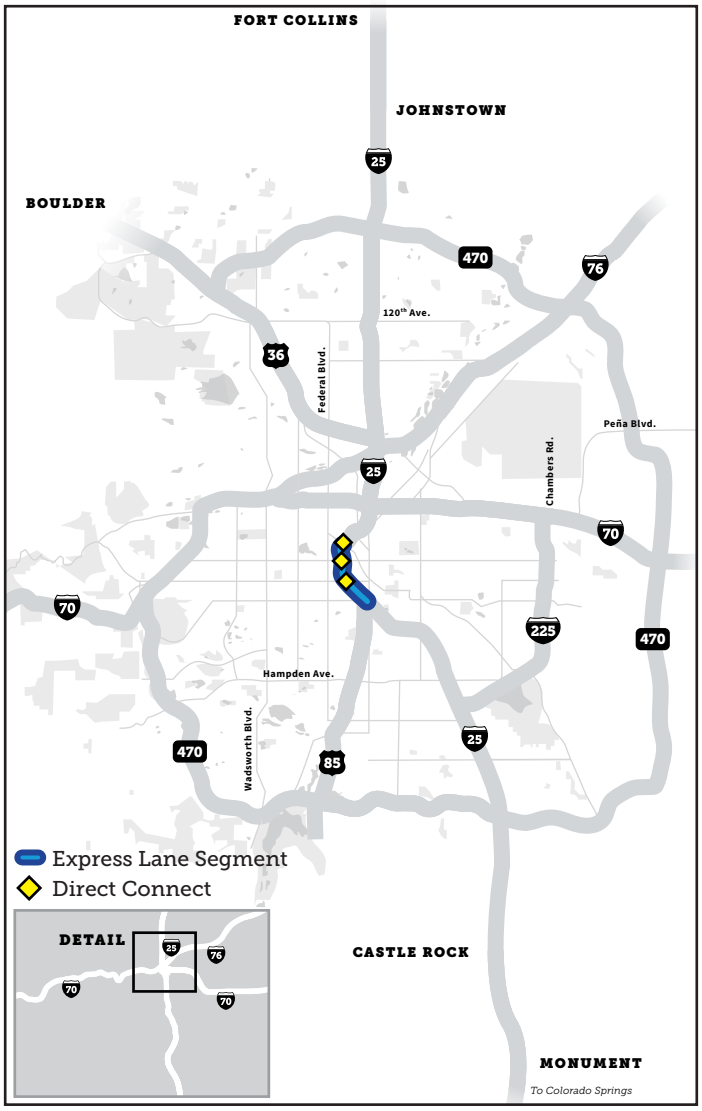
Addition of Single EL & Zipper Operation (2EL / 1EL Reversible), Shoulder Reduction



Colorado
Express Lanes Master Plan

I-25 Central
Santa Fe/US 85 to 20th St

Design Alternative
I-25, between 20th St and Santa Fe, assumes one full-time Express Lane in each direction, with Express Lane direct connect ramps at Speer, Auroria, and US 6. Design assumes a ~4 ft wide inside shoulder.



Travel Time Improvement

	General Purpose*	Express Lane**
AM	2%	-11%
PM	4%	-19%

* No-Build GP versus Build GP Scenario
** No-Build GP versus Express Lane Build Scenario

Present Value of Net Revenue (2025)
$150.8 million

Capital Cost (2025)
$1,134.2 million

Improvement in Person Throughput
(No-Build versus Build Scenario)

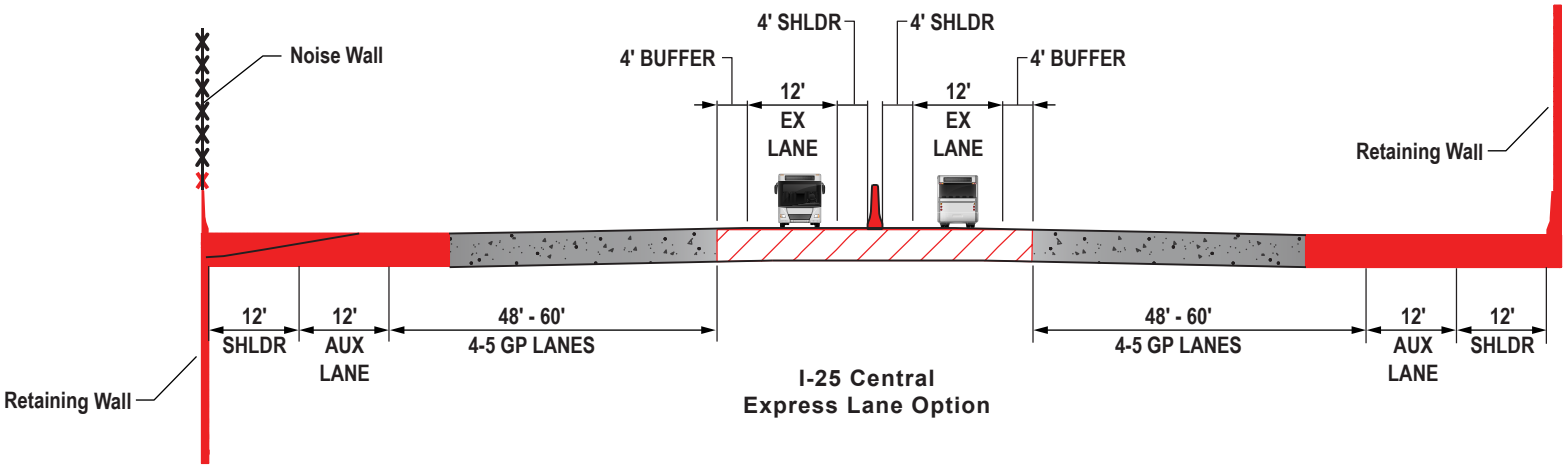
AM **+6,584 people**
PM **+9,438 people**

Financial Score: 0.0 out of 5.0
(Comparative measure of financial performance between corridors)

Mobility Score: 3.91 out of 5.0

Overall Score and Rank: 1.95 out of 5.0
(13 out of 22)

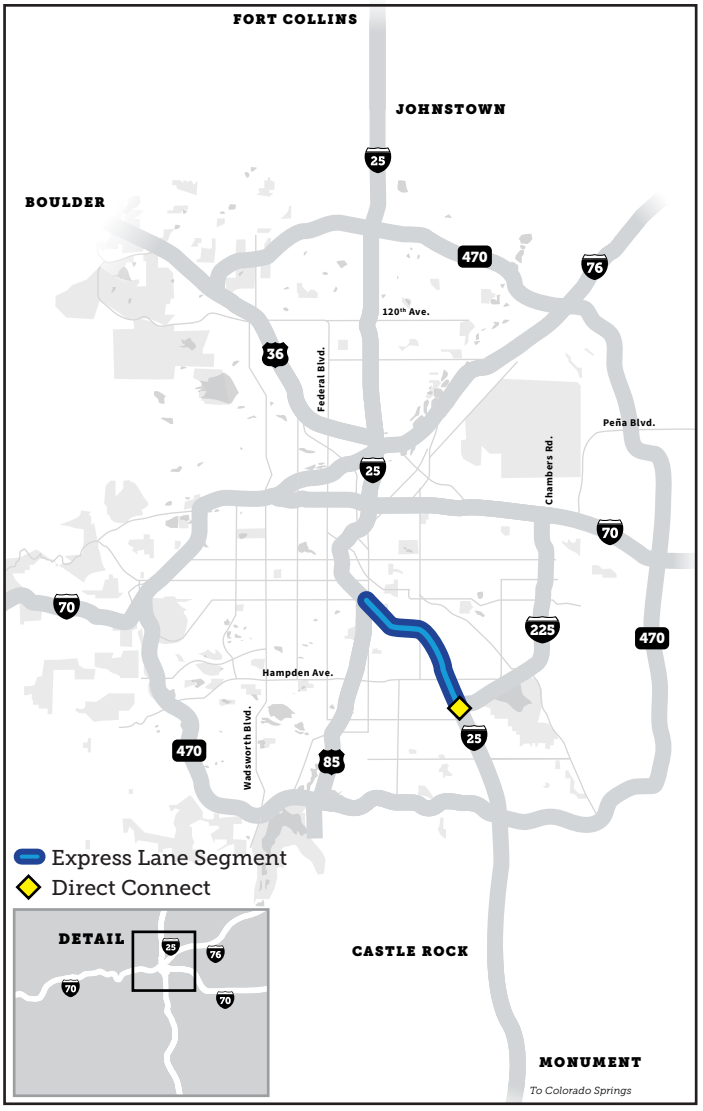
Proposed Express Lane Configuration
Outside Widening, GP Lane Shift, Shoulder Reduction



Colorado
Express Lanes Master Plan

I-25 Alternative 1
I-225 to Santa Fe/US 85

Design Alternative
I-25, between Santa Fe and I-225, assumes one elevated Express Lane in each direction, with an Express Lane direct connect ramp at I-225. Design assumes Full Standard lane configuration.



Travel Time Improvement

	General Purpose*	Express Lane**
AM	1%	-16%
PM	2%	-23%

* No-Build GP versus Build GP Scenario
** No-Build GP versus Express Lane Build Scenario

Present Value of Net Revenue (2025)
$379.2 million

Capital Cost (2025)
$957.3 million

Improvement in Person Throughput
(No-Build versus Build Scenario)

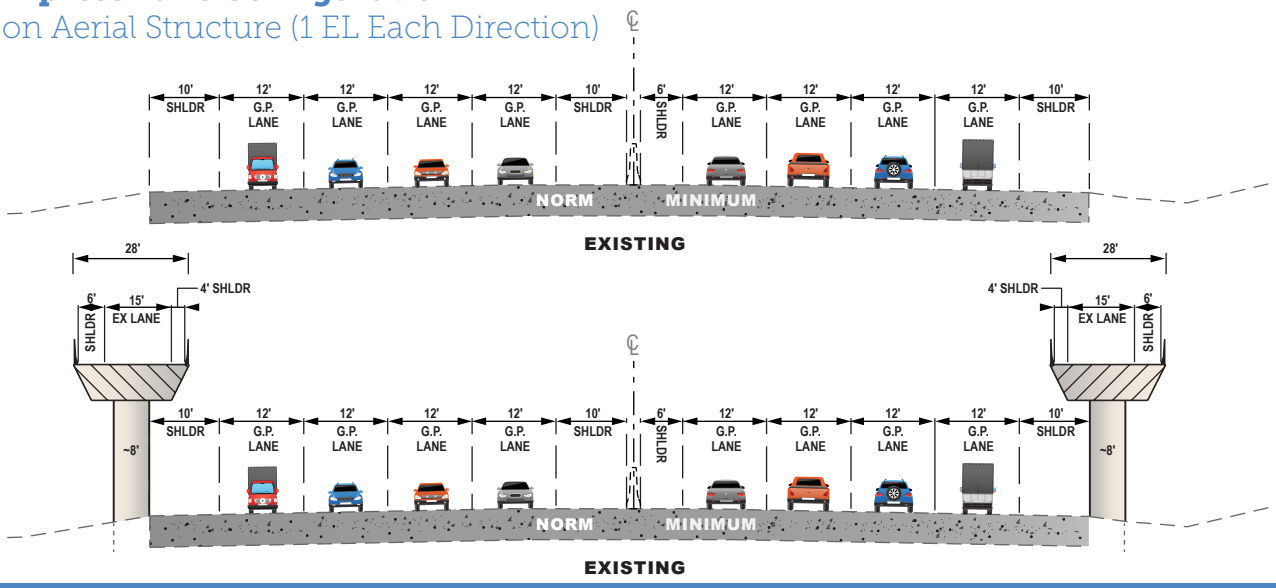
AM **+7,502 people**
PM **+9,558 people**

Financial Score: 1.0 out of 5.0
(Comparative measure of financial performance between corridors)

Mobility Score: 3.27 out of 5.0

Overall Score and Rank: 2.14 out of 5.0
(12 out of 22)

Proposed Express Lane Configuration
Single EL's on Aerial Structure (1 EL Each Direction)



Colorado
Express Lanes Master Plan

I-25 Alternative 2
I-225 to Santa Fe/US 85

Design Alternative
I-25 Alternative 2, assumes a peak-period shoulder lane (PPSL) between Santa Fe and I-225. Design assumes a ~1 ft wide inside shoulder, ~1 ft wide buffer separation, and GP lane widths of 11 ft.

Travel Time Improvement

	*General Purpose**	*Express Lane***
AM	**1%**	**-15%**
PM	**4%**	**-22%**

* No-Build GP versus Build GP Scenario
** No-Build GP versus Express Lane Build Scenario

Present Value of Net Revenue (2025)
$299.7 million

Capital Cost (2025)
$14.3 million

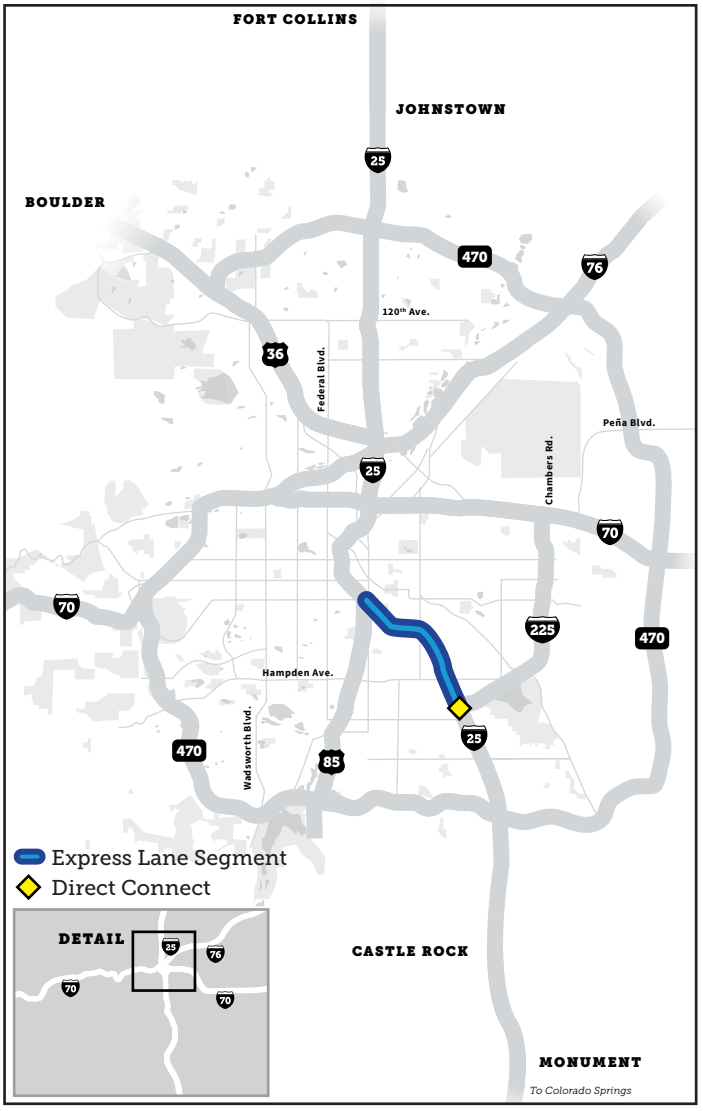
Improvement in Person Throughput
(No-Build versus Build Scenario)

AM **+8,092 people**
PM **+9,638 people**

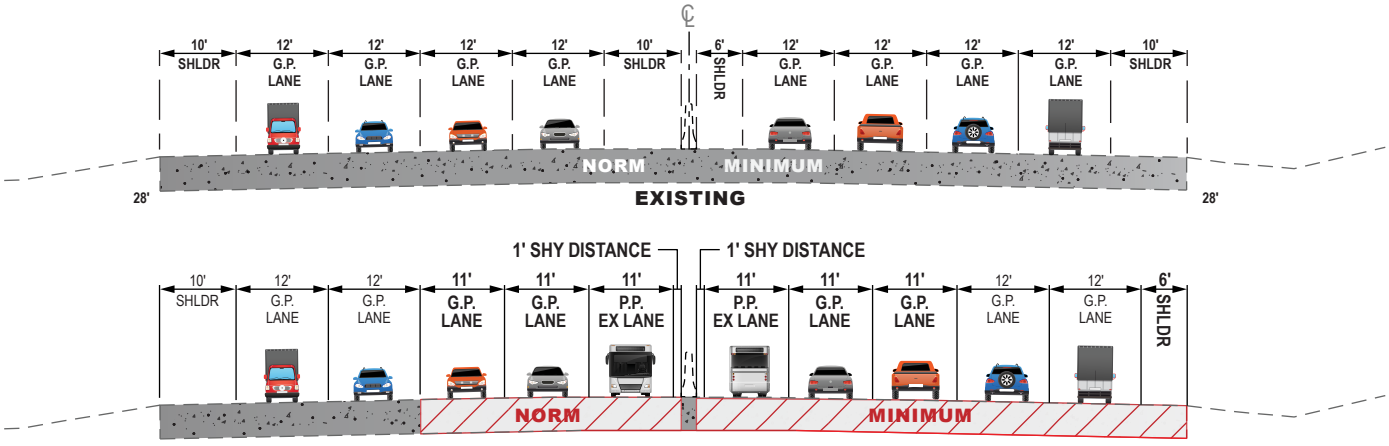
Financial Score: 5.0 out of 5.0
(Comparative measure of financial performance between corridors)

Mobility Score: 3.00 out of 5.0

Overall Score and Rank: 4.00 out of 5.0
(3 out of 22)



Proposed Express Lane Configuration
Addition of PPSL, GP Lane Shift, Shoulder Reduction



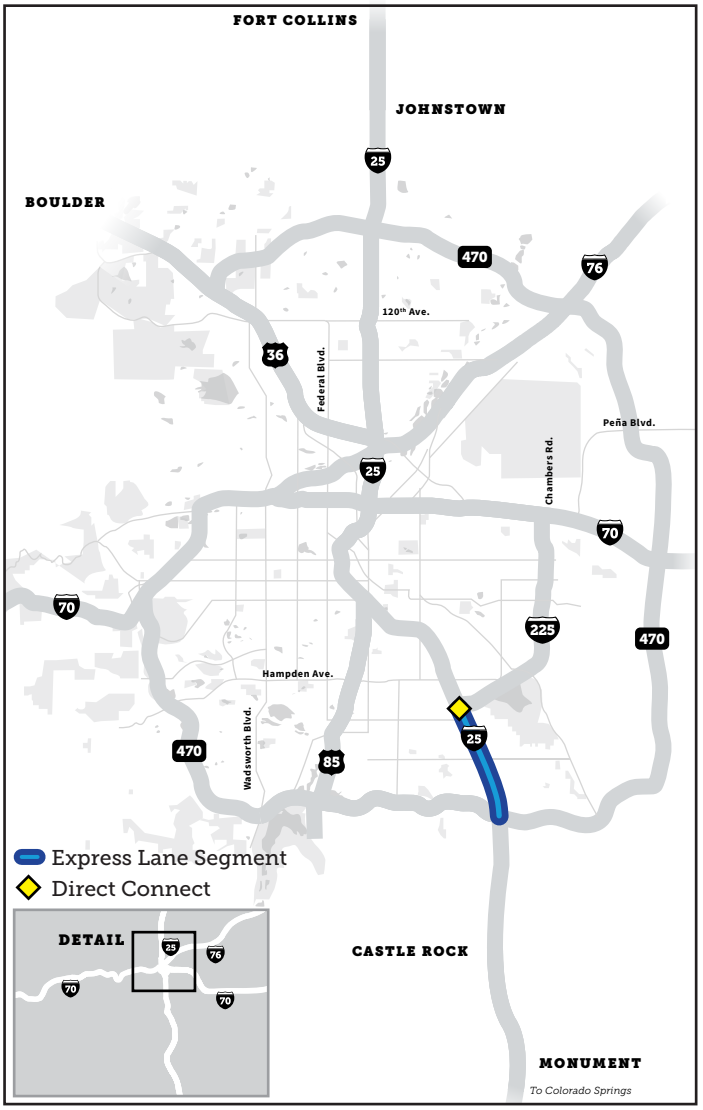
I-25 TREX Area
PEAK PERIOD SHOULER RUNNING
Express Lane Option

COLORADO HPTE

Colorado
Express Lanes Master Plan

I-25 Alternative 1
C-470 to I-225

Design Alternative
I-25, between I-225 and C-470, assumes one elevated Express Lane in each direction, with an Express Lane direct connect ramp at I-225. Design assumes Full Standard lane configuration.



Travel Time Improvement

	*General Purpose**	*Express Lane***
AM	**3%**	**-12%**
PM	**2%**	**-15%**

* No-Build GP versus Build GP Scenario
** No-Build GP versus Express Lane Build Scenario

Present Value of Net Revenue (2025)
$159.4 million

Capital Cost (2025)
$672.0 million

Improvement in Person Throughput
(No-Build versus Build Scenario)

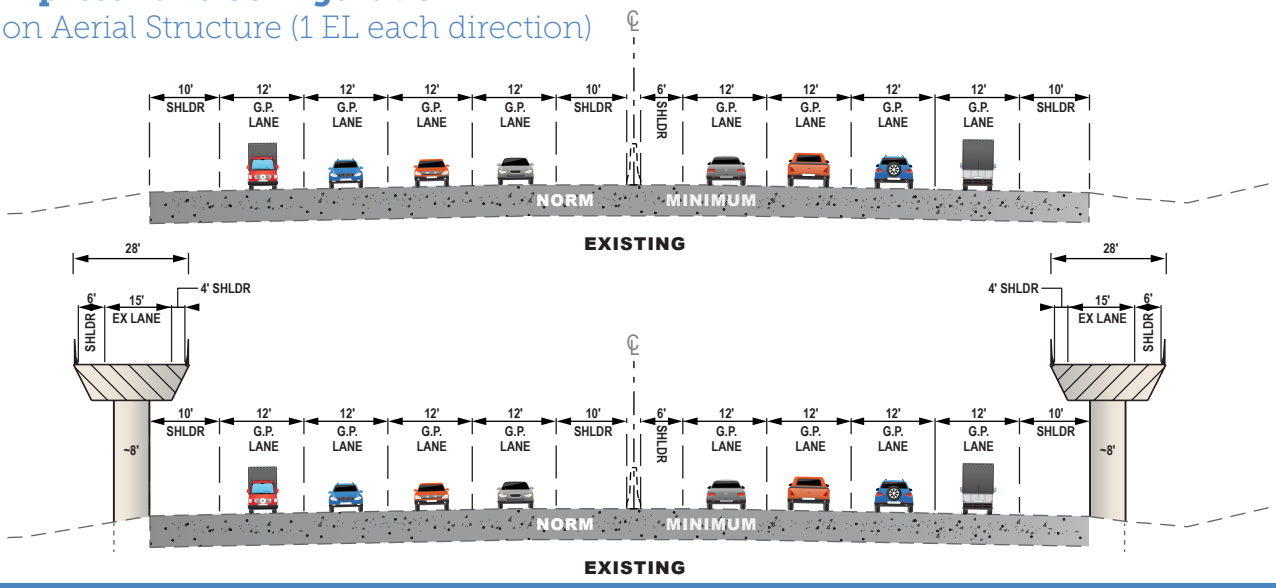
AM **+7,125 people**
PM **+7,726 people**

Financial Score: 1.0 out of 5.0
(Comparative measure of financial performance between corridors)

Mobility Score: 4.09 out of 5.0

Overall Score and Rank: 2.55 out of 5.0
(9 out of 22)

Proposed Express Lane Configuration
Single EL's on Aerial Structure (1 EL each direction)



Colorado
Express Lanes Master Plan

I-25 Alternative 2
C-470 to I-225

Design Alternative
I-25 Alternative 2, assumes a peak-period shoulder lane (PPSL) between I-225 and C-470. Design assumes a ~1 ft wide inside shoulder, ~1 ft wide buffer separation, and GP lane widths of 11 ft.

Travel Time Improvement

	*General Purpose**	*Express Lane***
AM	**2%**	**-13%**
PM	**2%**	**-12%**

* No-Build GP versus Build GP Scenario
** No-Build GP versus Express Lane Build Scenario

Present Value of Net Revenue (2025)
$112.2 million

Capital Cost (2025)
$9.1 million

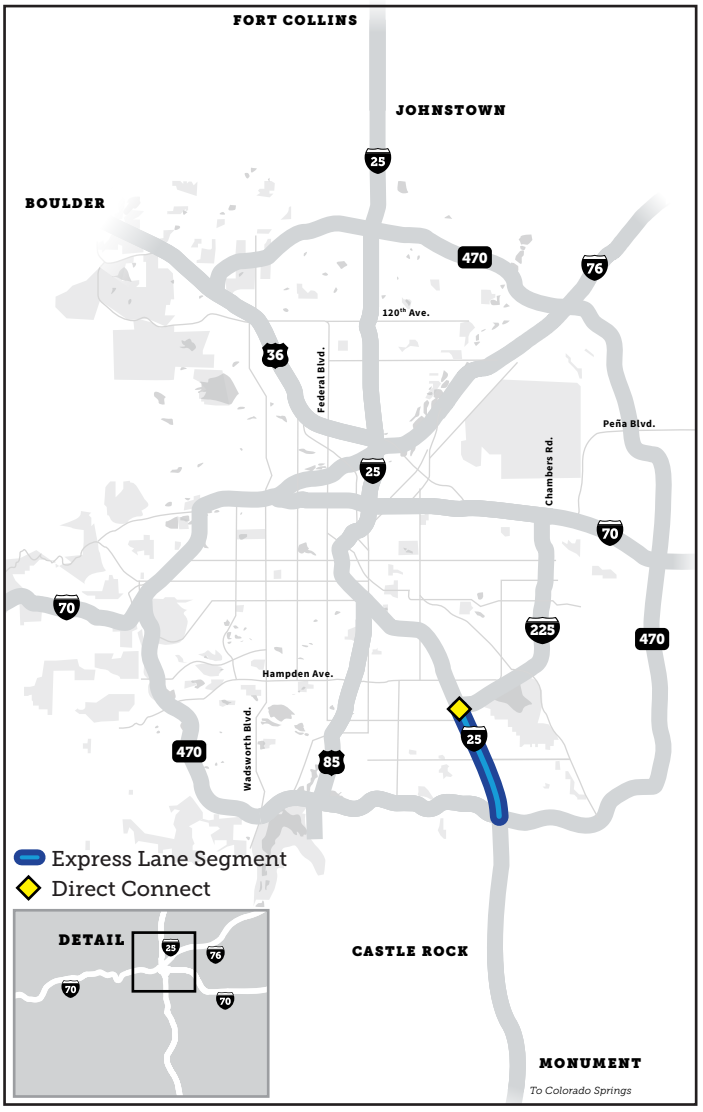
Improvement in Person Throughput
(No-Build versus Build Scenario)

AM **+4,870 people**
PM **+8,721 people**

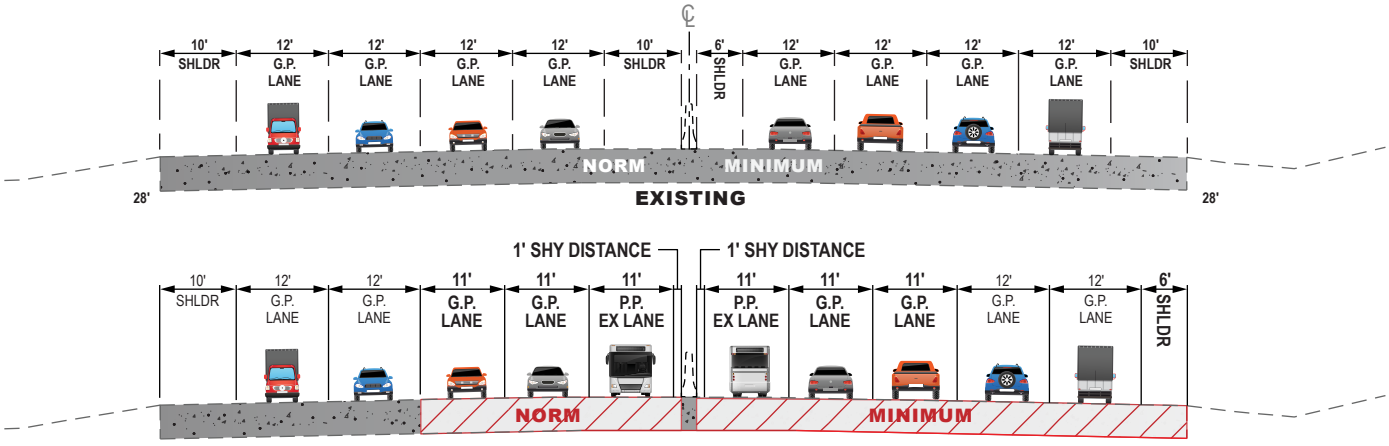
Financial Score: 5.0 out of 5.0
(Comparative measure of financial performance between corridors)

Mobility Score: 3.27 out of 5.0

Overall Score and Rank: 4.14 out of 5.0
(2 out of 22)



Proposed Express Lane Configuration
Addition of PPSL, GP Lane Shift, Shoulder Reduction



I-25 TREX Area
PEAK PERIOD SHOULER RUNNING
Express Lane Option

COLORADO HPTE

Colorado
Express Lanes Master Plan

I-25
Castle Rock to C-470

Design Alternative
I-25, between C-470 and Castle Rock, assumes one full-time Express Lane in each direction. Design assumes a Full Standard lane configuration.

Travel Time Improvement

	*General Purpose**	*Express Lane***
AM	**2%**	**-12%**
PM	**0%**	**-16%**

* No-Build GP versus Build GP Scenario
** No-Build GP versus Express Lane Build Scenario

Present Value of Net Revenue (2025)
$298.5 million

Capital Cost (2025)
$1,063.1 million

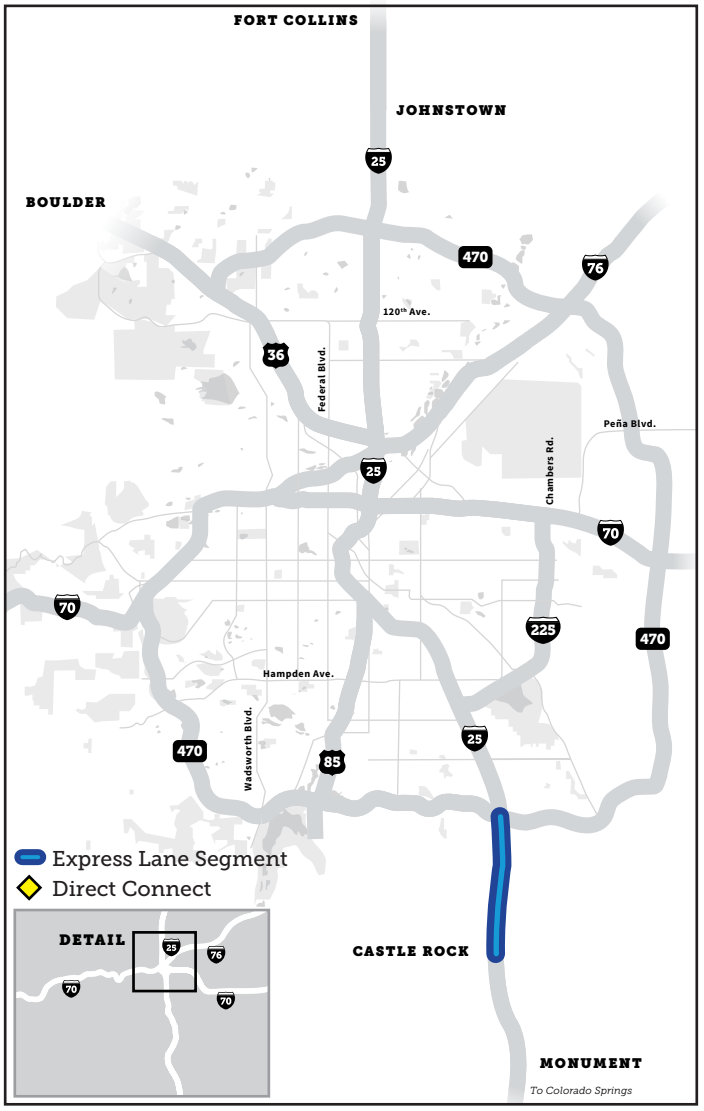
Improvement in Person Throughput
(No-Build versus Build Scenario)

AM **+5,550 people**
PM **+5,744 people**

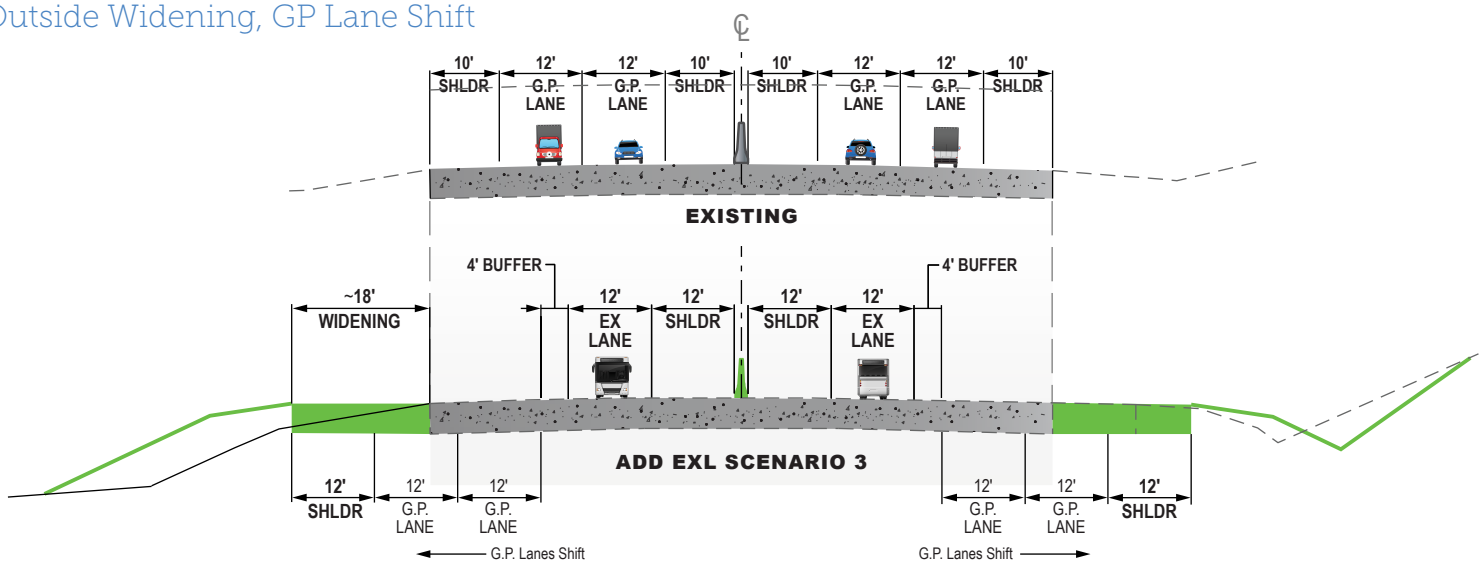
Financial Score: 1.0 out of 5.0
(Comparative measure of financial performance between corridors)

Mobility Score: 3.91 out of 5.0

Overall Score and Rank: 2.45 out of 5.0
(11 out of 22)



Proposed Express Lane Configuration
Outside Widening, GP Lane Shift



Colorado
Express Lanes Master Plan

I-70 MTN
Frisco to Silverthorne

Design Alternative
The I-70 MTN corridor, assumes one peak-period shoulder lane (PPSL) in each direction between Frisco and Silverthorne. Design assumes a Full Standard lane configuration.

Travel Time Improvement

	*General Purpose**	*Express Lane***
AM	**-10%**	**-15%**
PM	**-3%**	**-4%**

* No-Build GP versus Build GP Scenario
** No-Build GP versus Express Lane Build Scenario

Present Value of Net Revenue (2025)
$0.0 million

Capital Cost (2025)
$77.6 million

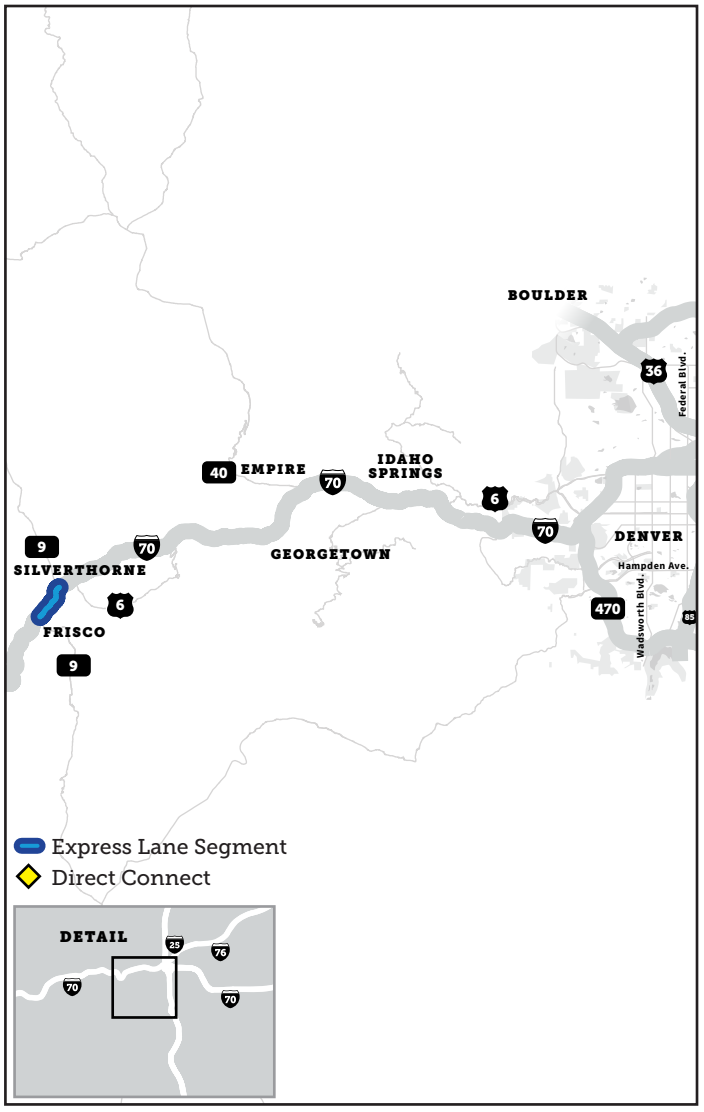
Improvement in Person Throughput
(No-Build versus Build Scenario)

AM **+856 people**
PM **+39 people**

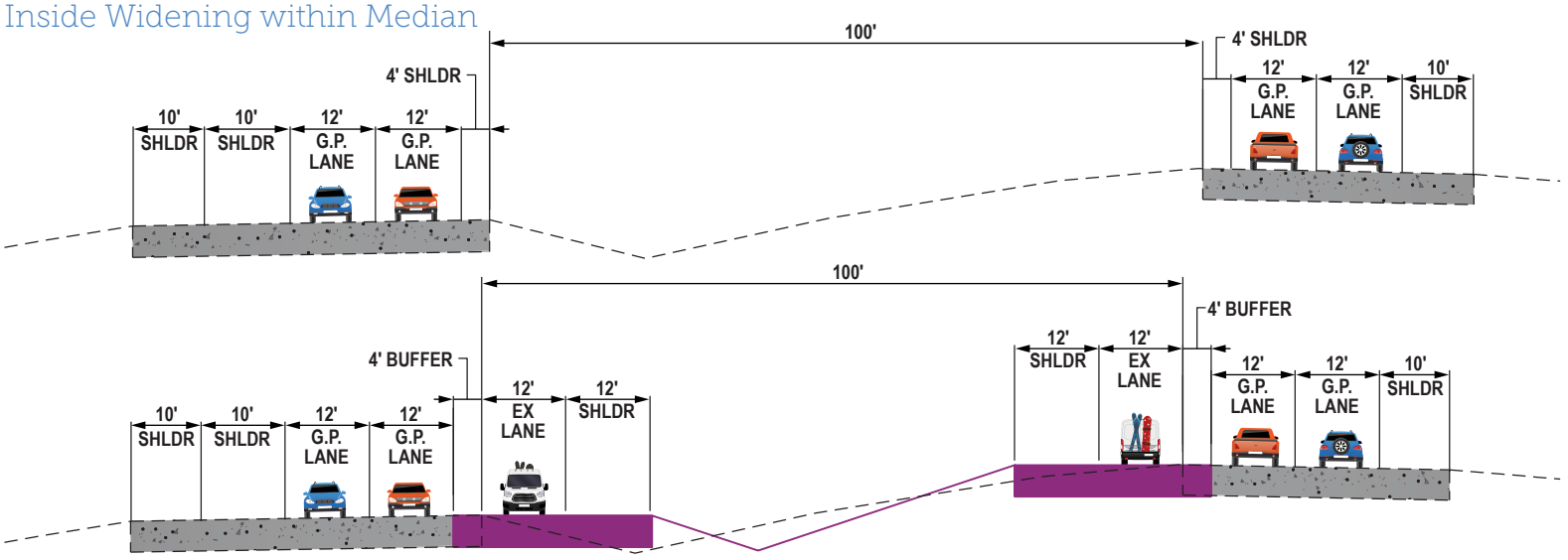
Financial Score: 0.0 out of 5.0
(Comparative measure of financial performance between corridors)

Mobility Score: 2.55 out of 5.0

Overall Score and Rank: 1.27 out of 5.0
(17 out of 22)



Proposed Express Lane Configuration
Inside Widening within Median



Colorado
Express Lanes Master Plan

I-70 MTN
EJMT to Georgetown

Design Alternative
The I-70 MTN corridor, assumes one peak-period shoulder lane (PPSL) in each direction between the EJMT and Silverplume, and one reversible lane between Silverplume and Georgetown. Design assumes a ~2-4 ft wide inside shoulder and no buffer separation.

Travel Time Improvement

	*General Purpose**	*Express Lane***
AM	**-7%**	**-11%**
PM	**-3%**	**-4%**

* No-Build GP versus Build GP Scenario
** No-Build GP versus Express Lane Build Scenario

Present Value of Net Revenue (2025)
($19.3 million)

Capital Cost (2025)
$130.3 million

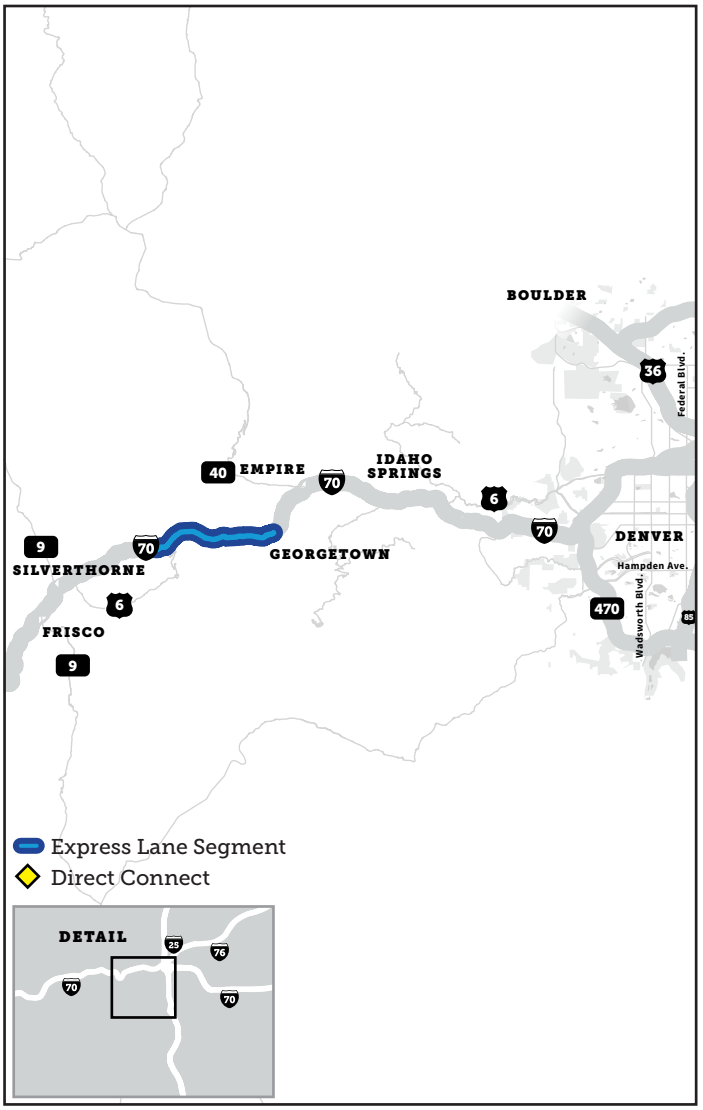
Improvement in Person Throughput
(No-Build versus Build Scenario)

AM **+231 people**
PM **+39 people**

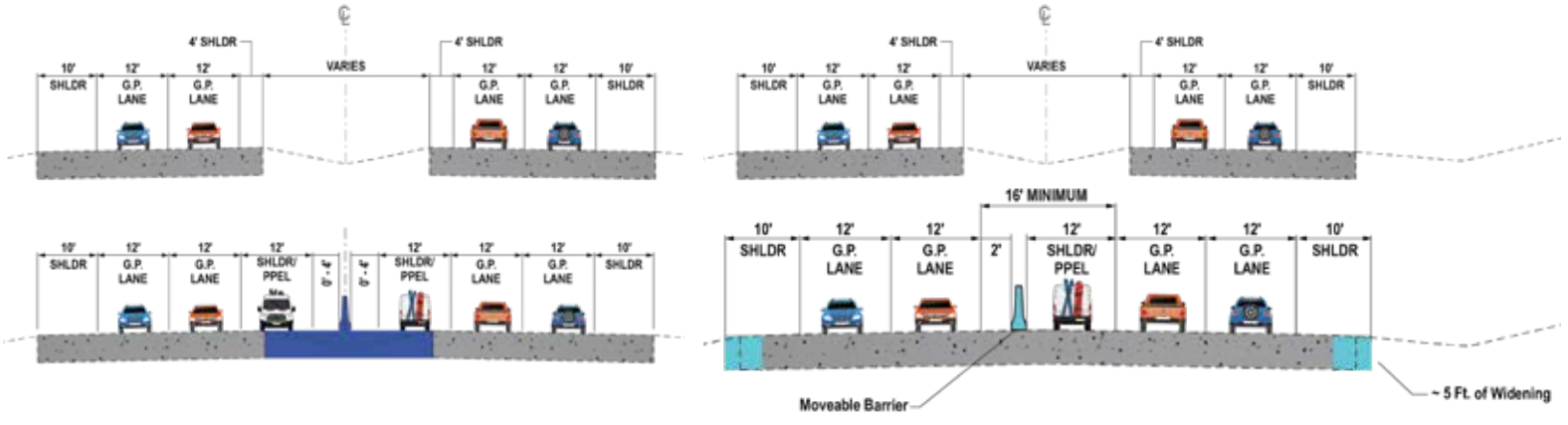
Financial Score: 0.0 out of 5.0
(Comparative measure of financial performance between corridors)

Mobility Score: 1.82 out of 5.0

Overall Score and Rank: 0.91 out of 5.0
(20 out of 22)



Proposed Express Lane Configuration
Inside Widening within Median & Outside Widening with Reversible Zipper Operation



Colorado
Express Lanes Master Plan

I-70 MTN
Georgetown to Empire

Design Alternative
The I-70 MTN corridor, assumes one peak-period shoulder lane (PPSL) in each direction between Georgetown and Empire. Design assumes a ~2-4 ft wide inside shoulder and no buffer separation.

Travel Time Improvement

	*General Purpose**	*Express Lane***
AM	**-8%**	**-13%**
PM	**-3%**	**-5%**

* No-Build GP versus Build GP Scenario
** No-Build GP versus Express Lane Build Scenario

Present Value of Net Revenue (2025)
($6.2 million)

Capital Cost (2025)
$43.6 million

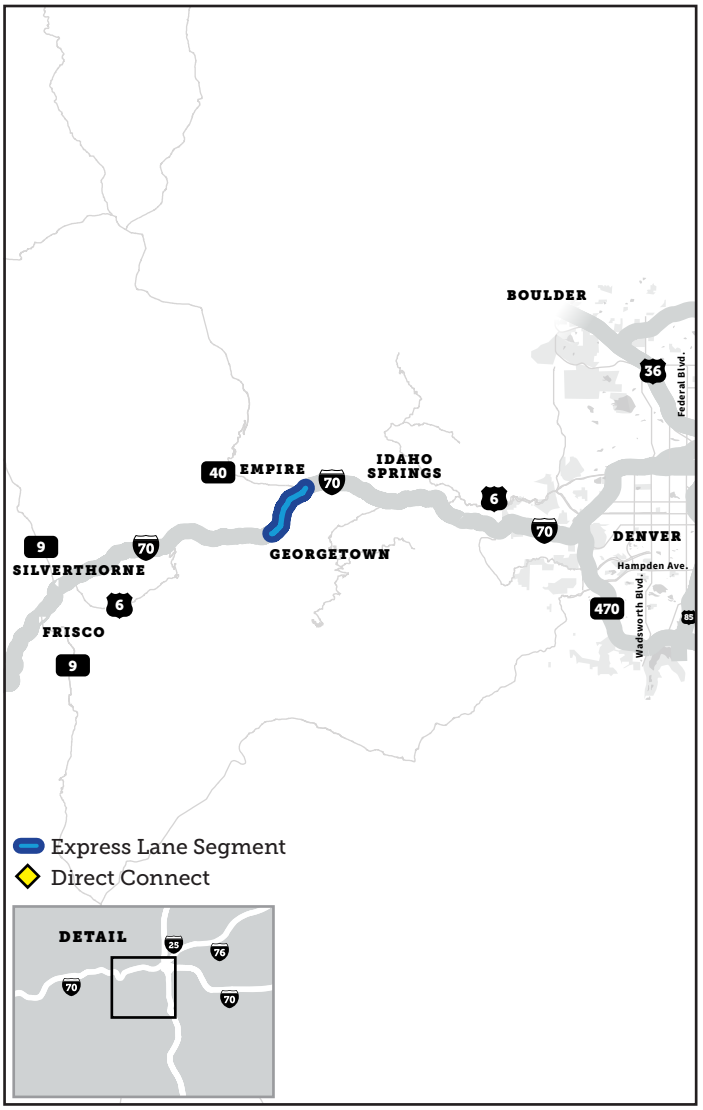
Improvement in Person Throughput
(No-Build versus Build Scenario)

AM **+466 people**
PM **+73 people**

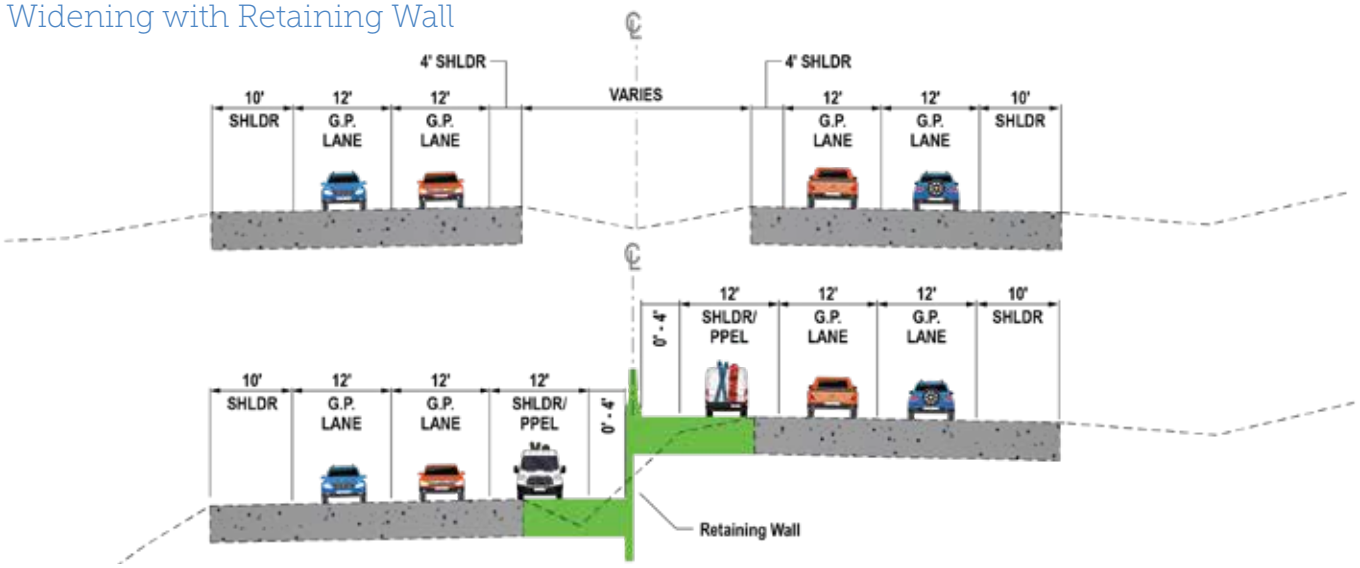
Financial Score: 0.0 out of 5.0
(Comparative measure of financial performance between corridors)

Mobility Score: 2.45 out of 5.0

Overall Score and Rank: 1.23 out of 5.0
(18 out of 22)



Proposed Express Lane Configuration
Inside Widening with Retaining Wall



Colorado
Express Lanes Master Plan

I-70 MTN
Floyd Hill

Design Alternative
The I-70 MTN corridor, assumes one peak-period shoulder lane (PPSL) in each direction throughout the Floyd Hill corridor. Design assumes a Full Standard lane configuration, as part of a greater viaduct or tunnel construction.

Travel Time Improvement

	*General Purpose**	*Express Lane***
AM	**-13%**	**-22%**
PM	**-2%**	**-3%**

* No-Build GP versus Build GP Scenario
** No-Build GP versus Express Lane Build Scenario

Present Value of Net Revenue (2025)
($6.7 million)

Capital Cost (2025)
$615.5 million

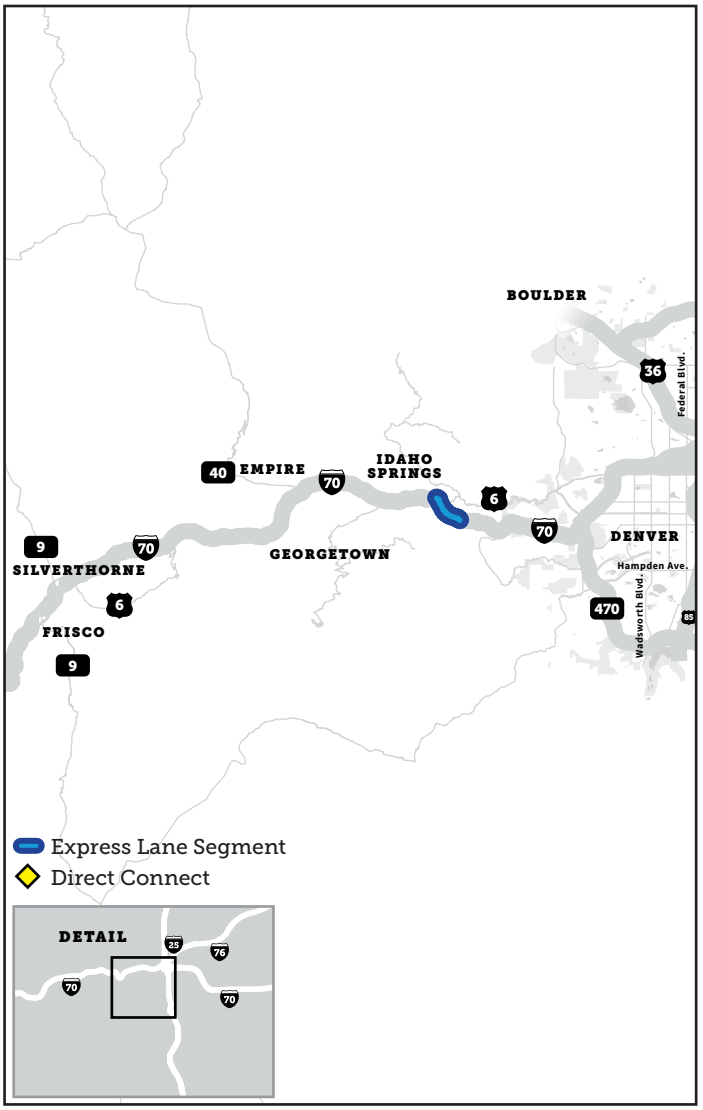
Improvement in Person Throughput
(No-Build versus Build Scenario)

AM **+3,299 people**
PM **+224 people**

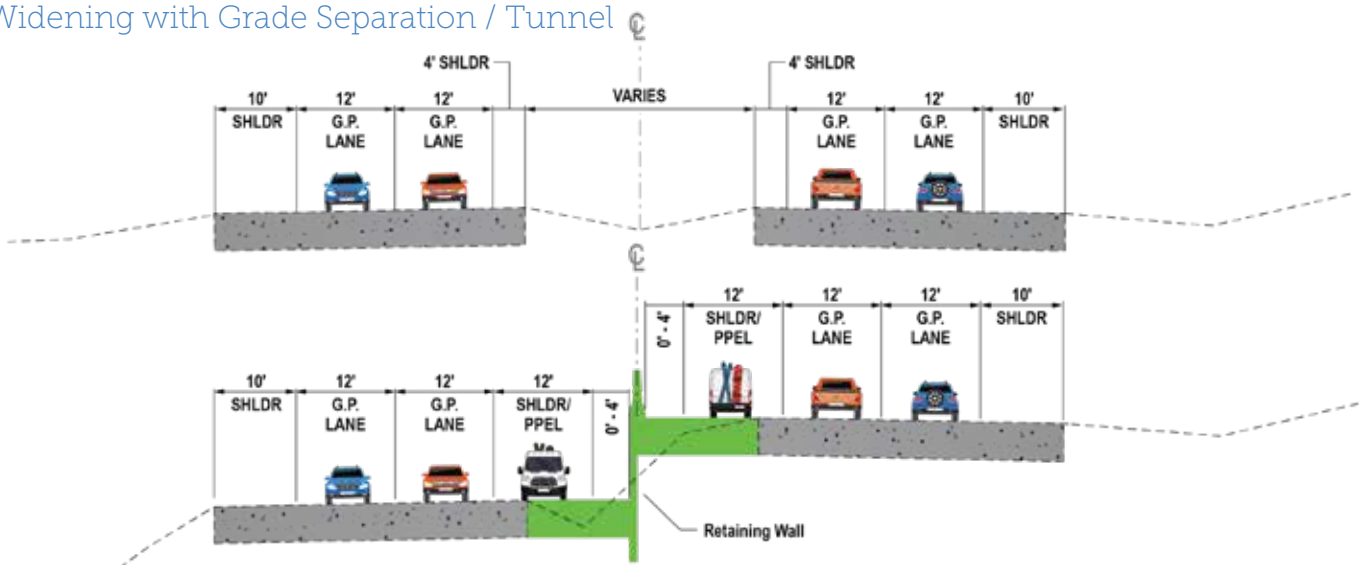
Financial Score: 0.0 out of 5.0
(Comparative measure of financial performance between corridors)

Mobility Score: 3.09 out of 5.0

Overall Score and Rank: 1.55 out of 5.0
(16 out of 22)



Proposed Express Lane Configuration
Inside Widening with Grade Separation / Tunnel



Colorado
Express Lanes Master Plan

I-70 East
Chambers Rd to E-470

Design Alternative
I-70, between Chambers Rd and E-470, assumes one full time Express Lane in each direction, with Express Lane direct connect ramps at Pena and E-470. Design assumes Full Standard lane configuration.

Travel Time Improvement

	*General Purpose**	*Express Lane***
AM	**5%**	**-11%**
PM	**8%**	**-11%**

* No-Build GP versus Build GP Scenario
** No-Build GP versus Express Lane Build Scenario

Present Value of Net Revenue (2025)
$39.0 million

Capital Cost (2025)
$228.4 million

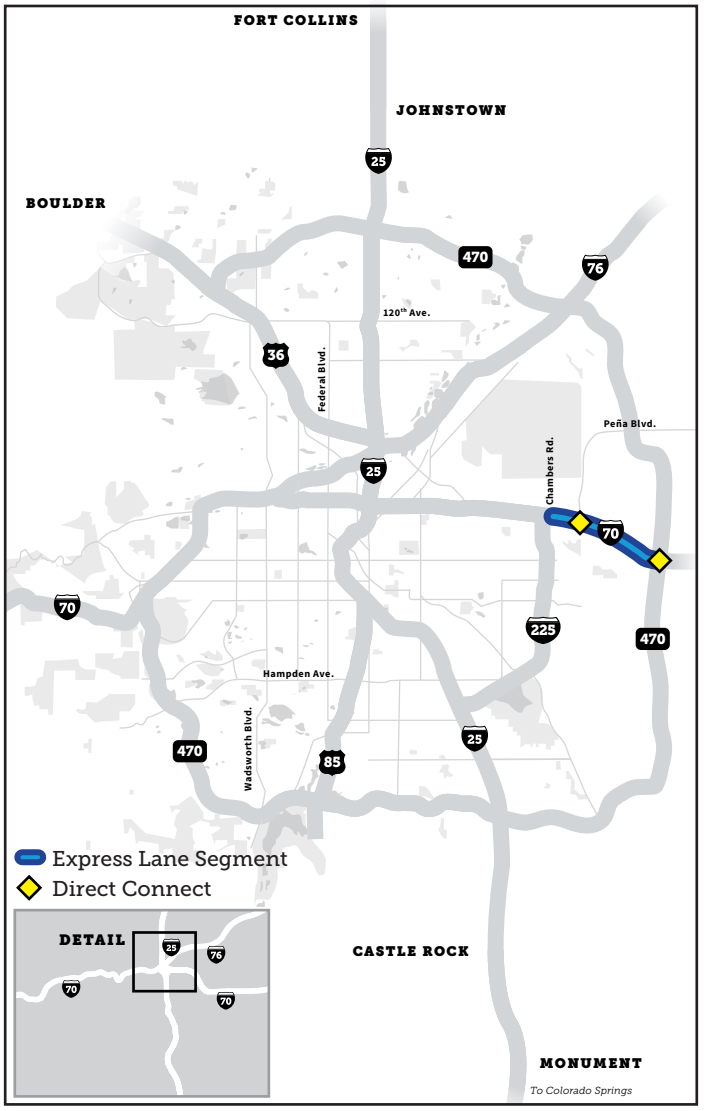
Improvement in Person Throughput
(No-Build versus Build Scenario)

AM **+4,128 people**
PM **+5,053 people**

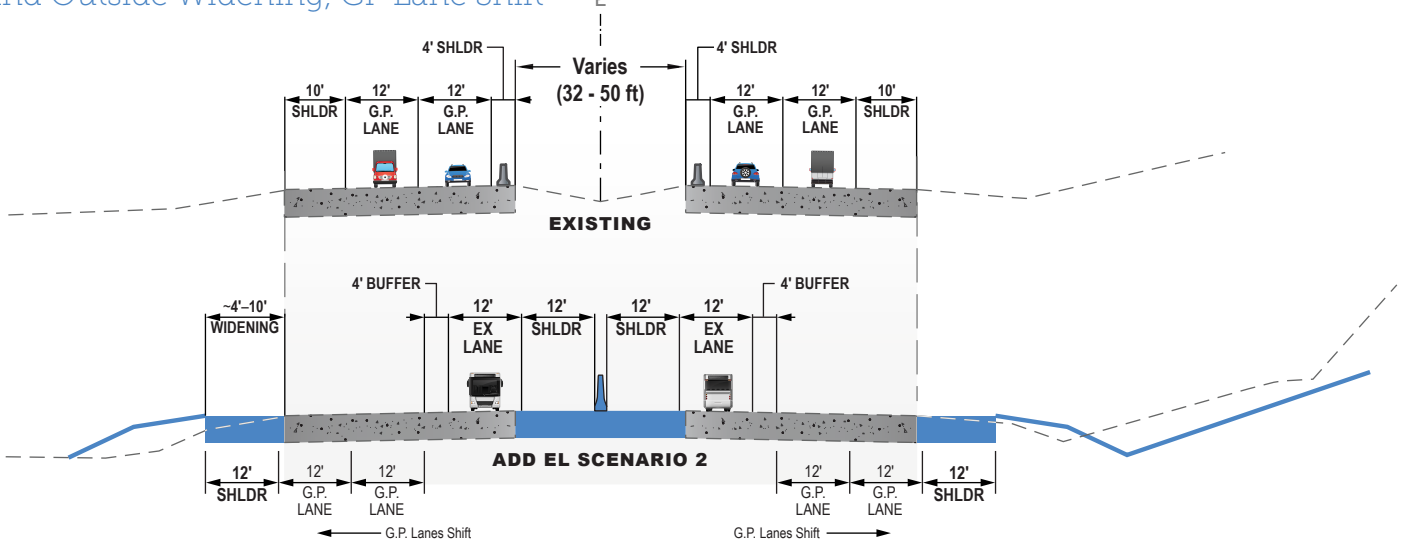
Financial Score: 0.0 out of 5.0
(Comparative measure of financial performance between corridors)

Mobility Score: 3.27 out of 5.0

Overall Score and Rank: 1.64 out of 5.0
(14 out of 22)



Proposed Express Lane Configuration
Inside and Outside Widening, GP Lane Shift



Colorado
Express Lanes Master Plan

Pena Blvd
I-70 to E-470

Design Alternative
Pena Blvd, between I-70 and E-470, assumes one full time Express Lane in each direction, with an Express Lane direct connect ramp at I-70. Design assumes Full Standard lane configuration.

Travel Time Improvement

	*General Purpose**	*Express Lane***
AM	**1%**	**0%**
PM	**1%**	**0%**

* No-Build GP versus Build GP Scenario
** No-Build GP versus Express Lane Build Scenario

Present Value of Net Revenue (2025)
($14.6 million)

Capital Cost (2025)
$209.5 million

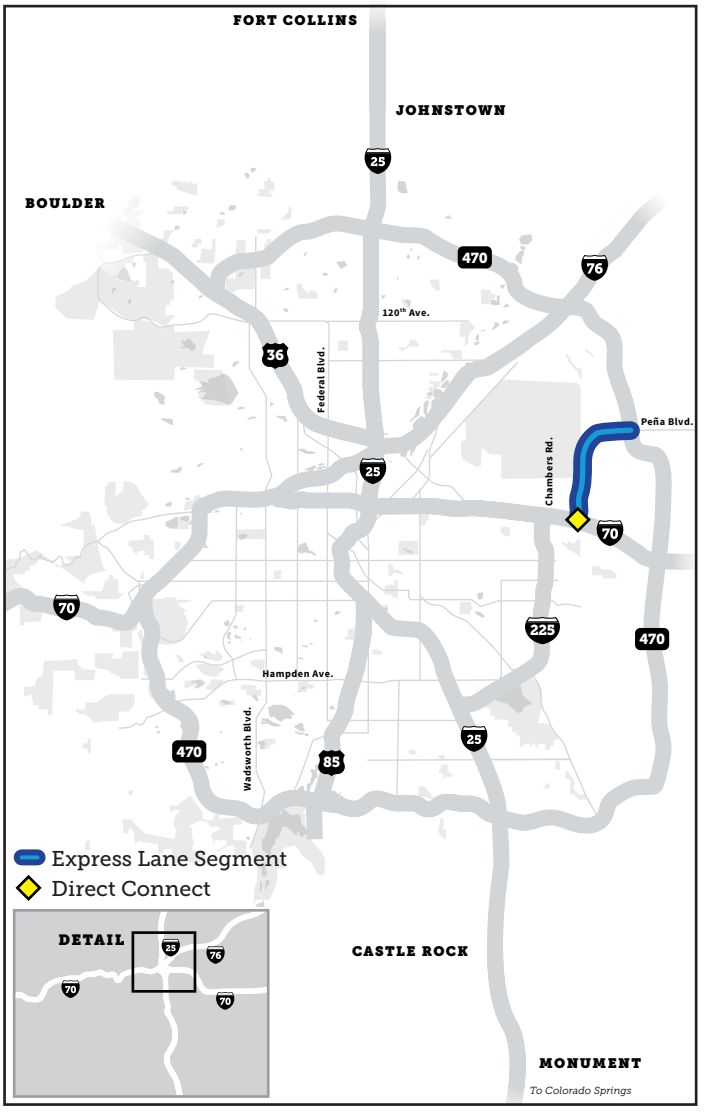
Improvement in Person Throughput
(No-Build versus Build Scenario)

AM **+1,567 people**
PM **+1,894 people**

Financial Score: 0.0 out of 5.0
(Comparative measure of financial performance between corridors)

Mobility Score: 1.45 out of 5.0

Overall Score and Rank: 0.73 out of 5.0
(22 out of 22)



Proposed Express Lane Configuration
Inside Widening within Median