CHAPTER 2
ALTERNATIVES CONSIDERED

2.1 INTRODUCTION

A key part of the NEPA process is the analysis and consideration of a range of reasonable alternatives, based on the Purpose and Need as presented in **Chapter 1**. The C-470 Corridor Proposed Action presented at the end of **Chapter 2** is the result of a screening process that considered a range of reasonable alternatives.

> Although similar, the C-470 improvements proposed in 2015 differ from the Preferred Alternative in the 2006 EA in several important ways. The 2015 improvements are being referenced with a different name, the Proposed Action.

This chapter describes the screening process that was used, and discusses the alternatives that were considered and evaluated. The alternatives development process was undertaken in conjunction with an extensive public and agency outreach program.

The contents of this chapter are:

- **Section 2.2** provides an overview of the alternatives development and screening process for the 2006 EA and what information is being carried forward into this Revised EA.
- **Section 2.3** describes alternatives considered during the 2006 EA analysis but which were eliminated from further consideration.
- **Section 2.4** discusses alternatives that were carried through the screening process for detailed evaluation in the 2006 EA.
- **Section 2.5** describes the process through which the 2006 EA Preferred Alternative was identified.
- **Section 2.6** discusses modifications of the 2006 EA Preferred Alternative.
- **Section 2.8** identifies alternatives carried forward for environmental evaluation in this Revised EA.
- **Section 2.8** describes the Proposed Action for this Revised EA.
- **Section 2.9** provides a brief conclusion regarding the alternatives development process.

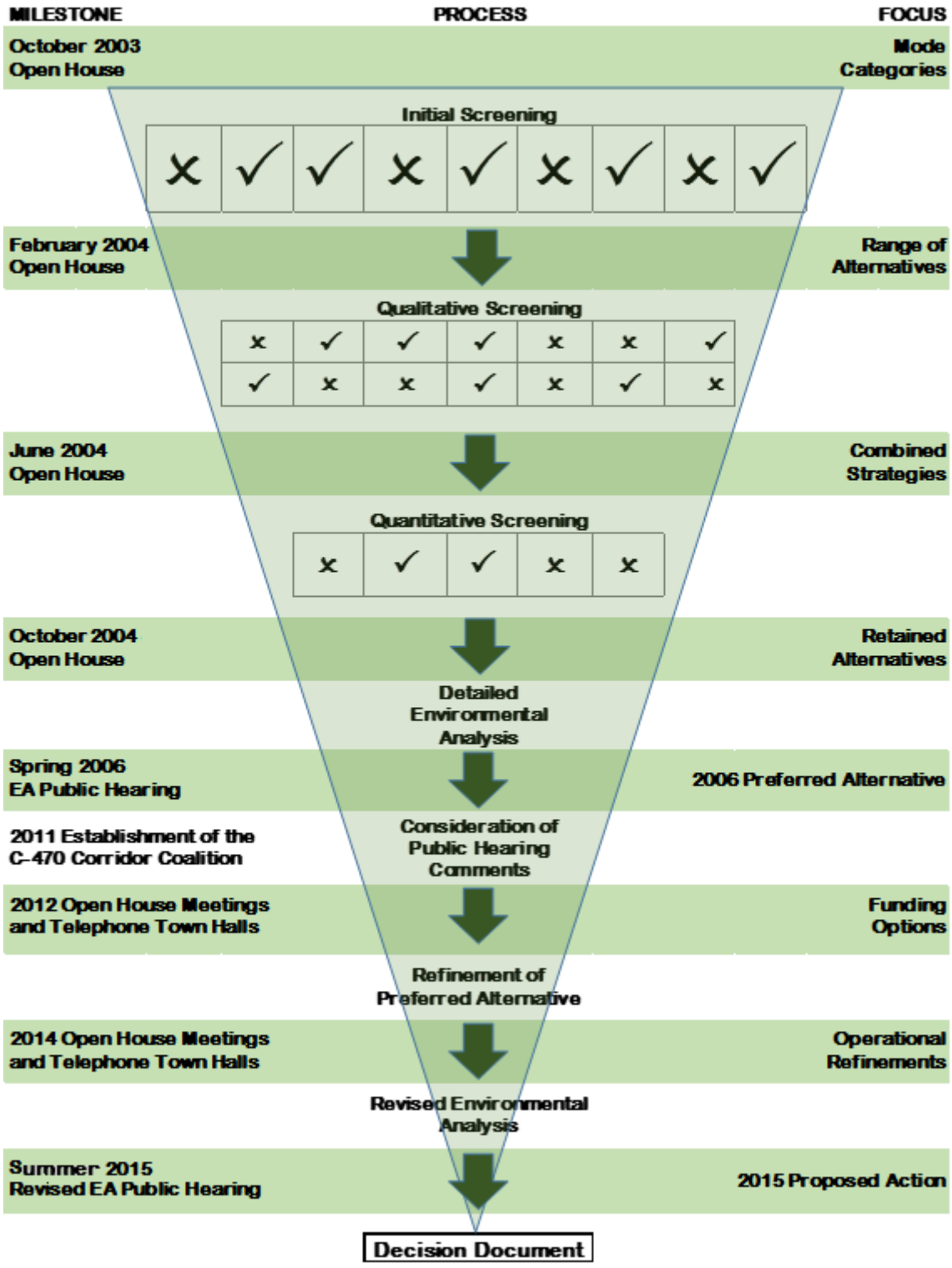
The NEPA process calls for consideration of a No-Action Alternative as a basis for assessing the comparative effects of any action alternative(s). The No-Action Alternative is assessed for future conditions, and thus is not identical to current, existing conditions. The No-Action Alternative is carried through the entire evaluation process, not eliminated in any of the various screening steps. Please see **Section 2.4.1** for more information about the No-Action Alternative.

2.2 ALTERNATIVES DEVELOPMENT AND SCREENING PROCESS

An alternatives development and screening process was completed as part of the 2006 EA. Since that time, the Preferred Alternative from 2006 has been refined to better meet corridor stakeholder needs. Prior conclusions about eliminated alternatives have been reviewed qualitatively to ensure their continued validity in this 2015 Revised EA.

Various transportation technologies were considered initially, resulting in a range of 20 alternatives. Each alternative was evaluated using screening criteria based on project goals and objectives, discussed in **Section 2.2.1**. These criteria were then used to determine the alternatives that best met the project Purpose and Need. **Figure 2-1** depicts the overall process.

Figure 2-1
Screening Process Overview



2.2.1 Goals, Objectives, and Evaluation Criteria

During preparation of the 2006 EA, input from the project scoping process contributed to the development of goals and objectives which served as the basis for evaluation criteria used to assess each alternative. Six study goals were developed from the Purpose and Need. Project goals such as relieving congestion and delay and improving reliability correspond to the project purpose. In addition, project goals such as reasonable and cost-effective implementation, minimizing harmful effects to the environment, creating ease of movement, and improving safety are additional considerations.

The goals, objectives, and evaluation criteria for the 2006 EA are shown in **Table 2-1**. After the goals and objectives were defined, screening criteria were developed for each objective to determine how well the alternative could meet each objective. These screening criteria were then used to evaluate each of the alternatives throughout the screening process. The screening process results are shown in **Figure 2-2.**

In the figure, the abbreviation GPL means General Purpose Lanes, EL means Express Lanes and HOV lanes means High Occupancy Vehicle lanes. These were the terms used in the 2006 EA.

2.2.2 Initial Screening

An initial range of alternative categories was developed, refined, and evaluated in a fatal flaw analysis. This process evaluated alternatives on the basis of whether or not they were feasible for C-470.

A fatal flaw analysis was used to eliminate categories of solutions with fundamental safety, mobility, engineering design, or environmental effects, rendering the solutions unreasonable for further consideration. Feasibility was evaluated with respect to meeting the project's Purpose and Need, compatibility with existing technologies on adjacent corridors, and the ability to design and construct the alternative without significant adverse environmental effects. Categories that had fatal flaws or did not address or meet the intent of the project's Purpose and Need were eliminated from further consideration. The remaining categories were carried through to qualitative screening.

2.2.3 Qualitative Screening

After the initial screening, each category of solutions was broken down into a range of alternatives for qualitative evaluation. Preliminary analysis of each alternative was conducted based on data collected during the scoping process. Traffic modeling, conceptual design, and environmental effects analysis were completed to a sufficient level of detail to provide data to qualitatively assess the differences among alternatives.

Alternatives that did not perform well, or those that had substantially more adverse environmental effects to known resources, were eliminated from further consideration. The resulting short list of alternatives was carried forward into quantitative screening.

2.2.4 Quantitative Screening

In this detailed analysis, the short-listed alternatives were further developed and refined to avoid and minimize adverse effects. Alternatives were evaluated by determining and comparing effects for the respective resources. This resulted in carrying forward two action alternatives and the No-Action Alternative for detailed analysis in the 2006 EA.

Application of the above goals, objectives and criteria yielded the screening results that are presented in **Figure 2-2**.

Table 2-1
C-470 Corridor EA Goals, Objectives, and Evaluation Criteria (2006)

	Goals	Objectives	Evaluation Criteria
Project Purpose	**Congestion/Delay**: Reduce forecasted congestion along the C-470 Corridor	Reduce forecasted congestion on C-470 from Kipling Parkway to I-25	PM peak hour level of service (LOS)
		Provide a reasonable balance between interchange capacity and freeway operations	Intersection LOS
		Minimize delay over a limited timeframe	C-470 travel time
	Reliability: Provide consistent travel times along C-470 between similar time periods	Provide predictable travel times	LOS; actively managed lanes
		Manage capacity	Degree of flexible versus fixed capacity
		Manage accidents (vehicle collisions, sun glare, weather, etc.)	Degree of providing accident management
		Provide choices to most users	Number of choices and number of users
		Inform users of system status	Number of intelligent transportation system (ITS) elements included
Additional Considerations	**Implementation**: Provide transportation solutions that can be implemented in the short term and that satisfy the project's Purpose and Need	Implement in a timely fashion	Funding availability
		Minimize total project cost	Total project cost
	Ease of Movement: Provide for the ease of movement through and access to the C-470 Corridor	Provide appropriate access to C-470	Number of access points. Provides access for most users
		Provide appropriate access across C-470	Number of crossings
		Integrate multimodal solutions	Availability of transit service and evaluation of effective ridership potential. Coordination with supporting entities such as RTD
		Provide transportation choices to the most users	Availability of transit service and evaluation of effective ridership potential. Coordination with supporting entities such as RTD
		Provide a transportation system that is consistent with regional transportation plans	Availability of transit service and evaluation of effective ridership potential. Coordination with supporting entities such as RTD
	Safety: Provide for the safe movement of people and goods	Address pavement condition deficiencies	Will alternative reconstruct deficient pavement areas?
		Address existing mainline safety issues	Does alternative meet project design criteria?

Table 2-1
C-470 Corridor EA Goals, Objectives, and Evaluation Criteria (2006, Continued)

	Goals	Objectives	Evaluation Criteria
Additional Considerations (continued)	**Environment (continued)**: Provide transportation solutions that minimize impacts to the natural, cultural, and social environment of the surrounding communities	Minimize impacts to adjacent bicycle/pedestrian trail system	Linear miles of trail relocation
		Minimize noise impacts to the built environment	Number of locations where CDOT noise abatement criteria are exceeded
		Minimize traffic diversion onto local road network	Degree of traffic diversion onto adjacent facilities
		Maintain compatibility with local land use plans	Is alternative consistency with local land use plans?
		Minimize impacts to wetlands and waters of the U.S.	Acres, intensity, and severity of wetlands and known waters of the U.S. impacted
		Minimize impacts to critical water sources that degrade surface and groundwater quality and quantity	Acres of increased impervious surface area
		Minimize impacts to threatened and endangered species habitat	Acres, intensity, and severity of threatened and endangered species habitat impacted
		Minimize encroachment on hazardous materials sites	Intensity and severity of potential environmental disturbance from hazardous material sites impacted
		Minimize impacts to cultural resources (historic, archaeological, and paleontological)	Number, intensity, and severity of cultural sites impacted
		Minimize impacts to recreation and parkland resources	Acres, intensity, and severity of park or recreation land impacted
		Minimize impacts to riparian/ streamside habitat	Acres, intensity, and severity of riparian habitat impacted
		Minimize visual impacts to neighboring communities	Degree and severity of visual impact
		Minimize air quality impacts	Does alternative cause exceedances of National Ambient Air Quality Standards?
		Enhance opportunity for wildlife movement across C-470	Does alternative provide additional opportunity for wildlife movement?
		Minimize impacts to minority and low-income populations	Are impacts disproportionately high and adverse as compared to other populations along the Corridor?
		Minimize floodplain impacts	Is 100-year floodplain impacted? Amount, severity, and location of impact
		Minimize right-of-way acquisition	Number and severity of parcels impacted; acres of ROW acquired
		Minimize economic impacts to local businesses	Net loss to businesses

Figure 2-2
2006 Screening Process and Results

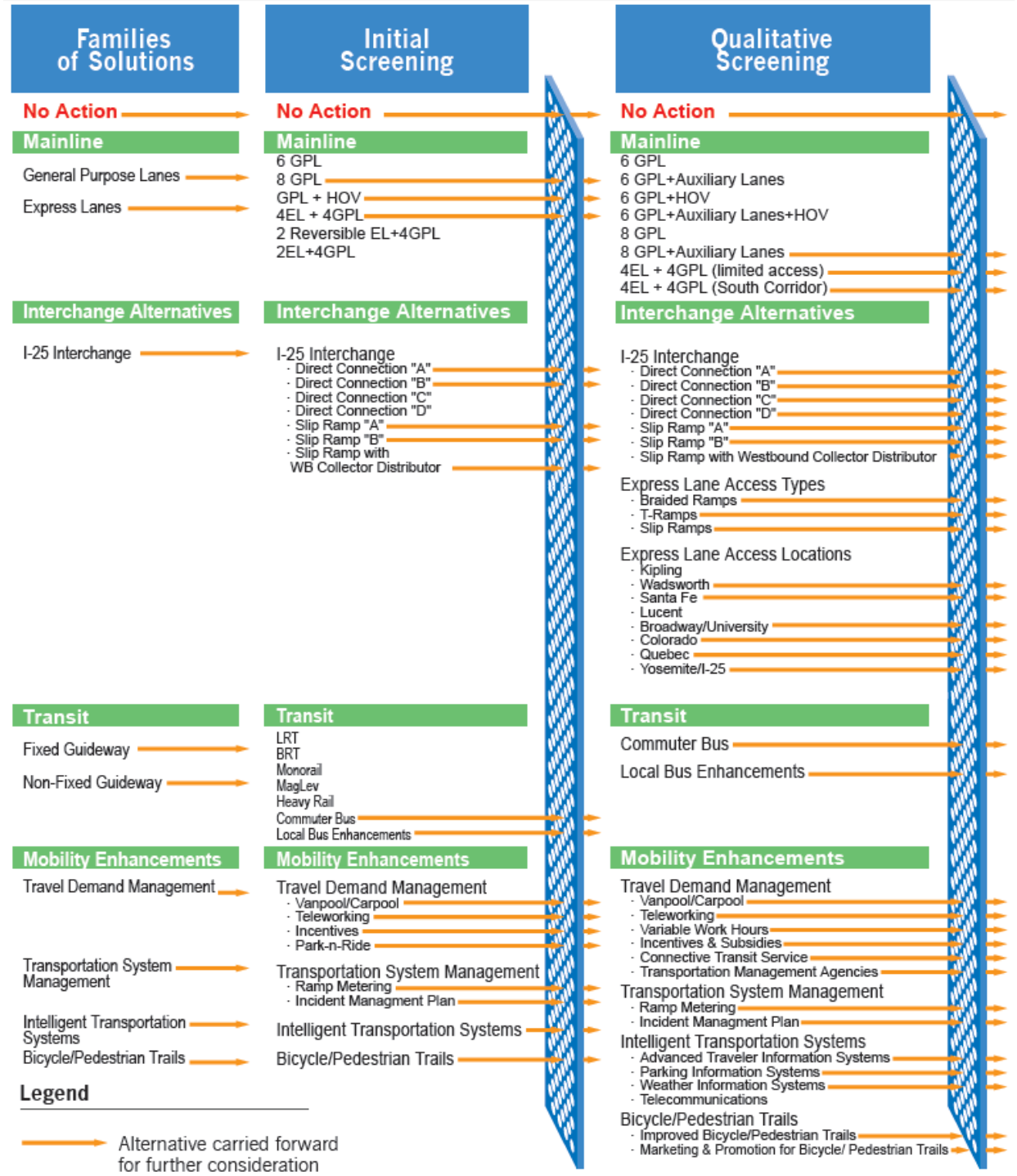
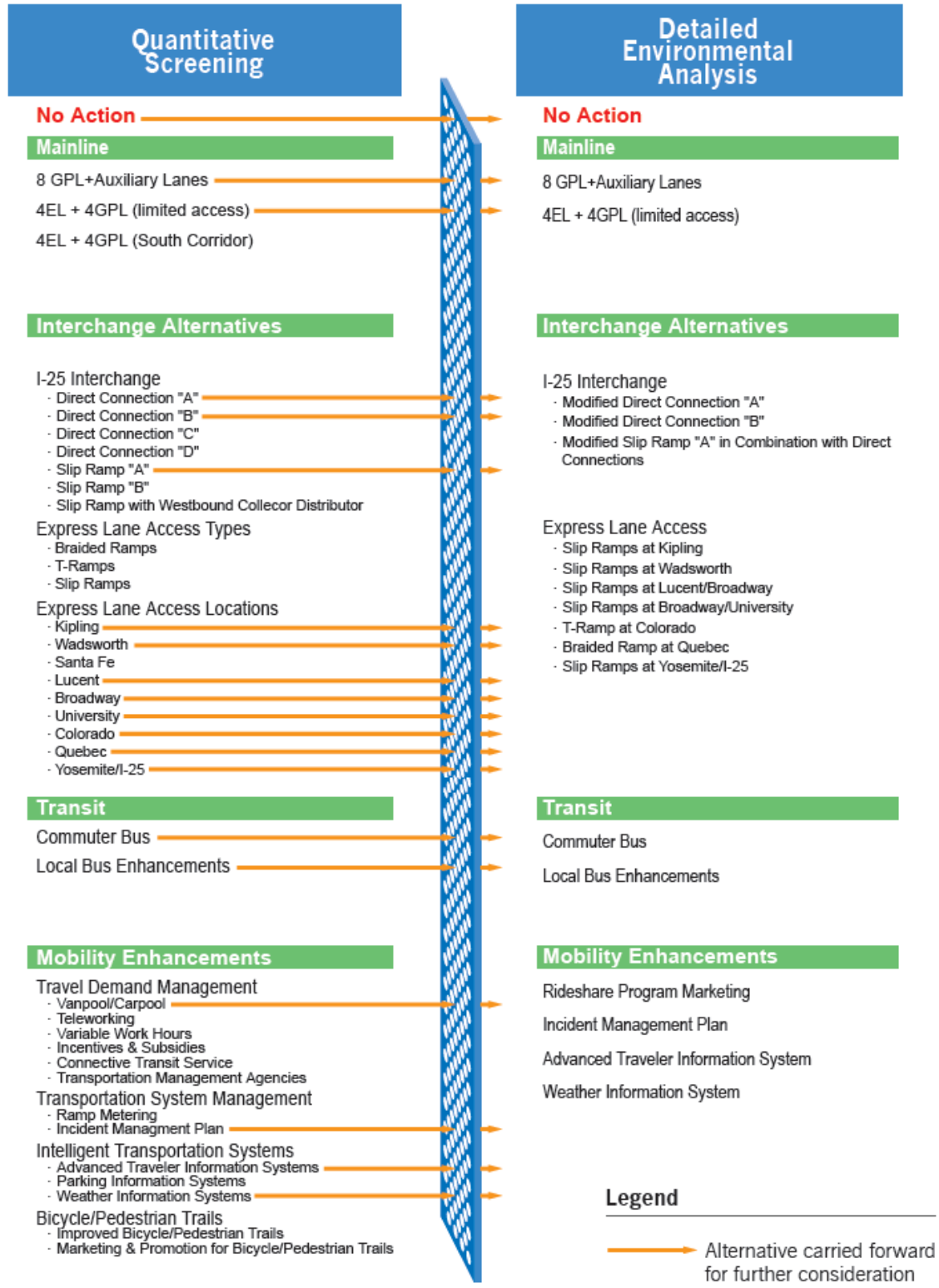


Figure 2-2
2006 Screening Process and Results (Continued)



2.3 ALTERNATIVES CONSIDERED BUT ELIMINATED

The following alternatives were eliminated from further consideration during the screening process in 2006 for the reasons stated. More detail is provided in the in the *Alternatives Screening Report* (March 2005).

2.3.1 Transit Alternatives

The transit category consisted of fixed guideway and non-fixed guideway alternatives. These technologies included light rail transit (LRT), commuter rail, monorail, magnetic levitation ("MagLev") transit, and bus rapid transit. They require substantial capital investment in infrastructure design and construction and are less compatible with adjacent corridor technologies.

RTD is the public transit provider for the Denver metropolitan area. RTD's Southwest Corridor light rail line extends southward along Santa Fe Drive south to Mineral Avenue (north of C-470), with a proposed future extension across C-470 and eastward to Lucent Boulevard. RTD's Southeast Corridor follows I-25 southward to a station at the Parks Meadows Mall near C-470 and Yosemite Street. RTD's adopted FasTracks Plan does not include any planned east-west line along C-470 to connect these stations. Nevertheless, the non-transit alternatives developed for the 2006 EA would not preclude such an addition in the future.

RTD currently does not operate any commuter buses on C-470 because the highway does not provide reliable travel times necessary for fixed-route bus service.

Many factors, such as regional plans, service type, difficulties in serving the dispersed land use base, origin and destination patterns, low potential ridership, and lack of congestion reduction were considered in the decision to eliminate these alternatives.

RTD currently operates no buses on C-470 and has no plans to build light rail between I-25 and Lucent Boulevard. C-470 roadway alternatives do not preclude future transit development.

For this Revised EA, the prior assessment of transit's potential on C-470 remains unchanged. The C-470 Corridor Coalition has indicated willingness to exempt RTD commuter buses from tolls and RTD has indicated it would consider possibly using C-470 in the future if travel time reliability can be provided.

2.3.2 Mobility Enhancements

The mobility enhancement category included several non-construction strategies that could contribute to relieving congestion and delay on the C-470 Corridor and improve reliability. These strategies included use of teleworking, variable work hours, employer carpooling subsidies and incentives, connective transit service, transportation management organizations, improved bicycle/pedestrian trails and trail marketing, and freeway ramp metering. Some of these facilities or practices are already in place to some extent along the C-470 Corridor, so their further potential for congestion relief is limited. Note that CDOT has no control over some of these ongoing community programs but can only make recommendations to the entities that do.

Because these strategies in themselves do not have the ability to address the project's Purpose and Need, this category was eliminated from further consideration as a stand-alone action alternative. However, it was noted that beneficial elements such as mobility enhancements could be added to alternatives carried forward. For this Revised EA, no new information or corridor developments would alter this conclusion.

2.3.3 General Purpose Lane Alternatives

The general purpose lane alternatives category included all non-tolled capacity expansion options, including combinations with HOV lanes.

Six General Purpose Lanes: The typical section for the Six-Lane GPL Alternative would provide three 12-foot lanes in each direction, an 8-foot inside shoulder, a 10-foot outside shoulder and a barrier median. An advantage of 6-lane alternatives is that they could be built within the existing median without widening to the outside.

This alternative would afford minimal relief to congestion and delay, but it would not provide the means to actively manage travel time reliability. Projected traffic Level of Service (LOS) would range from D to F during peak hours, resulting in unpredictable travel times for all of C-470 except the section between Wadsworth Boulevard and Kipling Parkway. Because a six-lane typical section provides acceptable traffic operations for this part of the Corridor, it was included as part of the GPL Alternative from Wadsworth Boulevard to Kipling Parkway. This alternative was not advanced for further consideration for corridor-wide use because it does not meet the project's Purpose and Need, nor does it provide the means by which to actively manage reliability.

The Revised EA uses the 2035 planning horizon year, reflecting even more population and employment growth than was considered in the 2006 EA. This alternative that did not meet traffic needs for 2025 also would not meet them for 2035.

Six General Purpose Lanes with Auxiliary Lanes: This alternative is the same as the six-lane GPL alternative but with the addition of a 12-foot auxiliary lane in each direction. The auxiliary lanes act as continuous acceleration/deceleration lanes between interchanges and facilitate better traffic operations at interchanges, thus increasing capacity. While the auxiliary lanes provide some additional congestion relief, the facility would still only achieve LOS E on several segments. Thus, it does not address the project's reliability goal, nor does it provide active management of reliability. This alternative was eliminated from further consideration because it would not provide reliable travel times, especially between Quebec Street and Broadway.

Auxiliary lanes connect one on-ramp with the next off-ramp. This improves merging operations, improving safety, but does not add as much capacity as an ordinary through lane.

Six General Purpose Lanes with High-Occupancy Vehicle Lanes: This alternative includes the addition of one 12-foot HOV lane in each direction to the Six-Lane GPL Alternative. While the HOV lane provides the potential for increased reliability due to lower expected volumes, there is no mechanism to ensure that volumes do not increase to a level at which congestion degrades reliability.

While this concept does provide some congestion relief for the general purpose lanes, volume forecasts indicated that the overall operations of the facility are still not acceptable in many eastern highway segments, largely due to limited usage of the HOV lanes. Because this alternative does not provide appropriate levels of congestion and delay relief, it was removed from further consideration, as it did not meet the project's Purpose and Need.

As noted for other alternatives, shifting to the 2035 planning horizon year in the Revised EA does not improve the viability of this previously eliminated alternative.

Six General Purpose Lanes with Auxiliary and High-Occupancy Vehicle Lanes: This alternative combines the capacity

improvements of the Six-Lane GPL with Auxiliary Lanes Alternative with one 12-foot HOV lane in each direction. With the additional capacity from the auxiliary lanes and reliability component of the HOV lanes, the traffic volume forecasts for this alternative indicate only slightly improved operations over the Six-Lane GPL Alternative. Reliability is similar to that discussed under Six-Lane GPL with HOV Alternative. Because this alternative does not provide necessary levels of congestion and delay relief, it was eliminated from further consideration.

No new conditions in 2015 resolve the previously identified deficiencies of this alternative.

Eight General Purpose Lanes: This is the same as the Six-Lane GPL Alternative, but with the addition of one 12-foot lane in each direction. This alternative provides comparable operational improvements to the Six-Lane GPL with Auxiliary Lanes Alternative. This alternative would provide good peak period traffic operations between Santa Fe Drive and Wadsworth Boulevard, with operational breakdown in the highest volume segments between Quebec Street and Santa Fe Drive.

The uncertainty of the consistent reliability for the eastern segments led this alternative to be eliminated from further consideration as a typical section from I-25 to Santa Fe Drive. This deficiency identified in 2006 remains valid in 2015.

A variation of this alternative that adds auxiliary lanes is discussed in **Section 2.4** as the General Purpose Lanes Alternative carried forward for additional consideration.

2.3.4 Express Lanes Alternatives

In both alternatives discussed here, tolled express lanes would be added to the existing four-lane general purpose lanes.

Reversible Express Lanes: This alternative would add a single express lane to C-470. Reversible lanes are lanes that are operated only in one direction during the morning peak period and only in the opposite direction during the evening peak period. They can be operated for a larger portion of the day, as long as there is a period of non-use in-between so that the lanes are completely empty before the direction of flow reverses. This concept can be successfully in an area with highly imbalanced peak period traffic flows, typically from residential areas and major employment centers. A benefit is cost savings accrued from having the same lane(s) serving both peak traffic flows instead of building separate lanes to serve these directional flows.

Forecasted 2025 volumes showed no distinct directional split, indicating that the demand for the facility was approximately equal in both directions. As a result, the reversible lanes concept is not appropriate. This alternative would not provide congestion relief for westbound morning traffic or eastbound evening traffic and thus would not fully meet the project's Purpose and Need.

As updated in 2015, projected directional volumes on C-470 for the year 2035 remain too balanced to make reversible lane concepts attractive.

> Reversible lanes works best when traffic is heavily oriented one way in the morning and the other direction in the afternoon. C-470 traffic volumes are more balanced, because employment opportunities are dispersed throughout the region.

Two Express Lanes (one lane in each direction): Another variation of the express lanes studied was a two-lane concept, providing one new express lane in each direction. This alternative does not provide

the capacity and operational improvements to meet the project's Purpose and Need. It was therefore eliminated from further consideration.

No new conditions or projections in 2015 correct the issues for which this alternative was eliminated in 2006.

An alternative that adds four express lanes (two in each direction) is discussed in **Section 2.4** as the Express Lanes Alternative, carried forward for additional consideration.

2.4 ALTERNATIVES CARRIED FORWARD IN 2006

In the 2006 EA, the Eight-Lane General Purpose with Auxiliary Lanes Alternative (hereafter referred to as the GPL Alternative) and the tolled Express Lanes Alternative (hereafter referred to as the EL Alternative) were retained from the screening process and carried forward for detailed environmental analysis. The No-Action Alternative was also retained.

2.4.1 No-Action Alternative

Under the No-Action Alternative, CDOT would not improve the existing C-470 roadway other than performing basic maintenance and/or safety improvements to maintain roadway operation. Currently, C-470 has two general purpose lanes in each direction from Kipling Parkway to I-25. An auxiliary lane in each direction exists between the Quebec Street interchange and the I-25 interchange, serving as continuous acceleration and deceleration lanes.

The existing roadway consists of 12-foot travel lanes, including auxiliary lanes in some locations, with inside and outside shoulders, plus a 34-foot median, as shown in **Figure 2-3**. Paved shoulder widths vary between four and 10 feet.

2.4.2 GPL Alternative

The 2006 GPL Alternative would add up to four additional travel lanes and auxiliary lanes to the existing four travel lanes, extending from Kipling Parkway to I-25. It would include improving ramps and reconstruction of the C-470/Santa Fe Drive interchange. The typical sections are shown in **Figure 2-4**.

Figure 2-3
No-Action Alternative Typical Sections

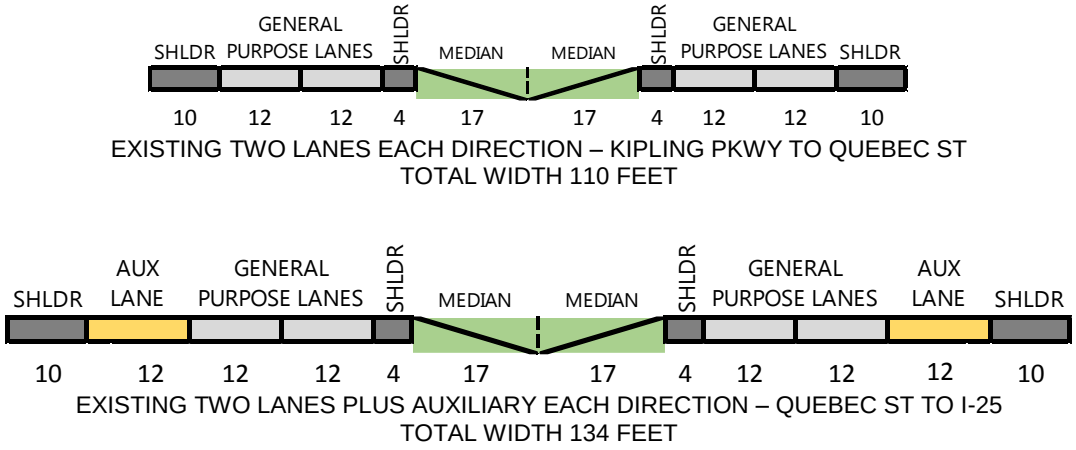
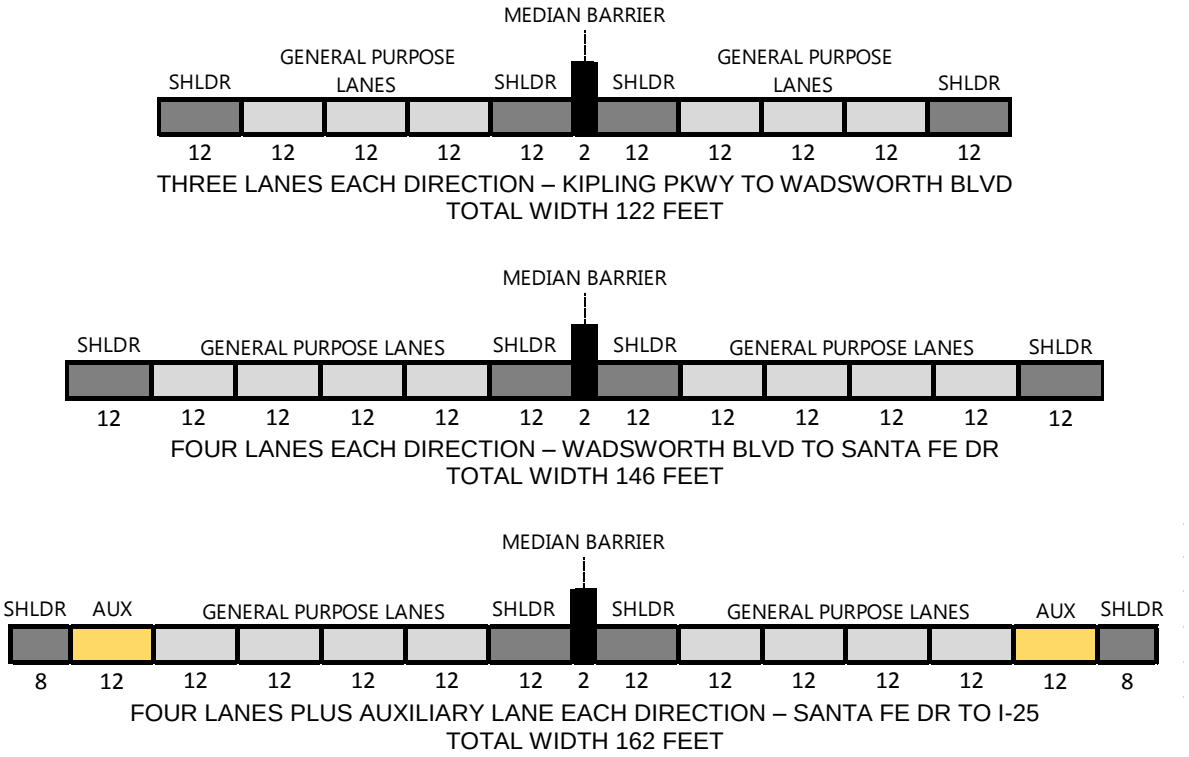


Figure 2-4
2006 GPL Alternative Typical Sections



The width of the GPL alternative would vary by location. The westernmost segment between Kipling Parkway and Wadsworth Boulevard would be 122 feet wide, due to addition of only one new through lane in each direction. From there to Santa Fe Drive, two through lanes each way would be added, requiring a total width of 146 feet. Between Santa Fe Drive and I-25, auxiliary lanes would typically be present, pushing the total roadway width to 162 feet.

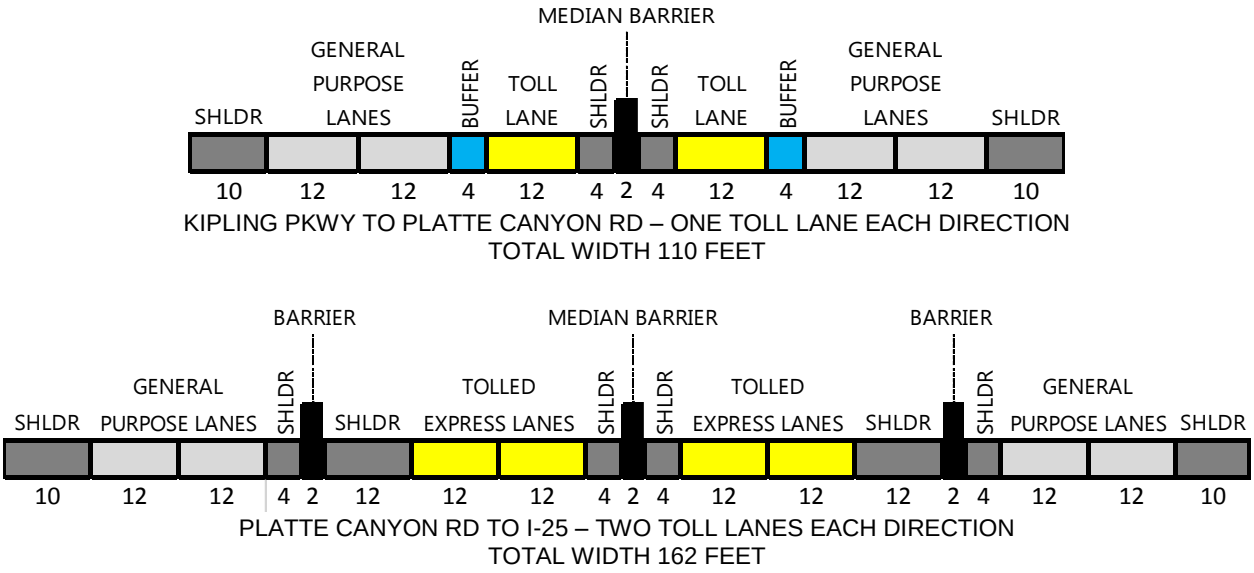
2.4.3 EL Alternative

The EL alternatives described in Section 2.3.4 both added a total of two new lanes (one each way, or two reversible) and were eliminated, but an EL alternative adding four new lanes (two each way) was carried forward for environmental evaluation. This alternative would add two barrier-separated express lanes each direction on the eastern portion of the corridor, between I-25 and Platte Canyon Road, where existing and future predicted traffic volumes are highest, and one buffer-separated express lane each direction between Platte Canyon Road and Kipling Parkway. The typical cross sections are shown in **Figure 2-5**.

The barrier-separated EL lanes would be accessed from the general purpose lanes at only six locations: Kipling Parkway; Wadsworth Boulevard; between Lucent Boulevard and Broadway; between Broadway and University Boulevard; Quebec Street; Colorado Boulevard; and I-25.

Between Platte Canyon Road and I-25, C-470 would require widening to the outside to accommodate the necessary roadway width. The overall roadway width for the section between Kipling Parkway and Platte Canyon Road is 110 feet; from Platte Canyon Road to I-25, the width is 162 feet.

Figure 2-5
2006 EL Alternative Typical Sections



2.5 PREFERRED ALTERNATIVE IN THE 2006 EA

Based on the decision-making process described above, FHWA and CDOT identified a Preferred Alternative in the 2006 EA. They concluded that there was a reasonable expectation that the EL Alternative would be financially self-supporting, and therefore would be eligible for amendment into the fiscally-constrained DRCOG RTP and subsequent implementation. No available funding options for the GPL Alternative were foreseen, and therefore it was not considered to be implementable.

While both action alternatives would meet the project's Purpose and Need and have comparable environmental effects, only the EL Alternative had the demonstrated ability to be implemented. As a result, FHWA and CDOT identified the EL Alternative shown in **Figure 2-5** as the Preferred Alternative for the 2006 EA.

No updated traffic analysis has been performed for the 2006 EL alternative because that alternative is no longer under consideration. It has been modified and updated for 2015 conditions as described below.

2.6 REFINEMENTS TO THE 2006 PREFERRED ALTERNATIVE

In 2006, there was not yet widespread public acceptance of the fact that the Federal Highway Users Trust Fund has been depleted and that State highway funding resources also are insufficient to keep pace with rising costs and maintenance demands. The Denver region had just witnessed the 2006 completion of the $1.67 billion "T-REX" widening project on I-25. Users of C-470 wondered why they should have to pay tolls when previous major projects simply received government funding instead. A decision document was never obtained for the 2006 EA and progress on corridor improvements to C-470 halted.

Since then, other corridors in the region including US 36 and I-25 North have faced similar funding constraints and have moved forward with tolling programs. These projects have increased public awareness

and acceptance of modern transportation funding limitations. The conclusion in 2006 that funds were not available to implement the General Purpose Alternative has proven to be correct.

2.6.1 C-470 Corridor Coalition Explores Funding Options

In 2011, the cities, counties and other stakeholders along the highway corridor formed the C-470 Corridor Coalition. CDOT and FHWA were welcomed as affiliate (non-voting) members of this organization, whose voting members and affiliates are listed in the accompanying text box.

C-470 CORRIDOR COALITION

Voting Members:

- Douglas County
- Arapahoe County
- Jefferson County
- City of Centennial
- City of Lone Tree
- City of Littleton
- Highlands Ranch Metro District

Affiliate Members:

- City of Greenwood Village
- Town of Bow Mar
- Town of Castle Rock
- Town of Parker
- Southeast Business Partnership
- South I-25 Urban Corridor Transportation Management Association
- South Metro Denver Chamber of Commerce
- Jefferson County Economic Development Corporation
- CDOT
- FHWA

The purpose of this coalition has been to provide a forum for local governments, business organizations and citizens to consider technical solutions, funding options, and to ultimately reach consensus on a plan to pay for implementing improvements on the full 26-mile extent of C-470 between I-25 and I-70. The C-470 Corridor Coalition is seeking solutions not only for the eastern half of the highway that is examined in this EA, but also to the western half (entirely within Jefferson County) which will be addressed in future studies.

The C-470 Corridor Coalition held numerous public meetings and telephone town hall events during 2012 to explore potential revenue sources for C-470 improvements, including tolls and sales tax or property tax districts. Through this process it became clear that local residents were generally opposed to increasing sales and property taxes to fund transportation improvements. The community preferred the idea of toll lanes that would provide a choice to pay for express lane trips or to instead use the existing (free) lanes and not pay tolls. The public was encouraged to suggest other funding alternatives, but no better funding solutions were identified.

In 2013, the C-470 Corridor Coalition reached consensus that tolled express lanes would be the best way to move forward for corridor improvement. The group continued to hold public meetings and telephone town hall events in 2012 and 2014 to obtain further public input and to raise public awareness and support for the project.

2.6.2 CDOT Works With the C-470 Corridor Coalition to Refine Project

CDOT has worked in partnership with the C-470 Corridor Coalition since 2011 to refine the design of the 2006 Preferred Alternative to optimize its operational performance and financial feasibility. A number of refinements were made, as described below.

Colorado Boulevard: The 2006 EA public process had identified strong opposition to the proposed addition of T-ramps providing direct access between the express lanes and Colorado Boulevard, where there is no C-470 access today. New access at that

location would have substantially altered local traffic patterns. Based on strong public opposition, the Colorado Boulevard access proposal was eliminated. This change, in turn, allowed reassessment of the entire express lane access plan. Stakeholder support for the Proposed Action is based on the assumption that there would be no C-470 access at Colorado Boulevard.

Toll Collection Advancements: In July 2009, the private E-470 toll highway located east of C-470 eliminated the use of tollbooths as it had become more economical and efficient to collect tolls from casual users (i.e., vehicles without a transponder) via license-plate photo surveillance and computerized billing. Lane users without transponders pay

The 2006 Preferred Alternative had proposed to allow express lane use only by vehicles with transponders. Adoption of the new E-470 toll collection approach with transponders not required would encourage more widespread use of the C-470 express lanes, improving their financial feasibility.

Buffer Separation: Use of photo surveillance for toll collection makes it unnecessary for a physical barrier to separate the express lanes from the existing general purpose lanes. Use of a painted pavement buffer instead of a physical barrier would reduce potential fixed-object crash hazards. Recent CDOT express lanes projects using buffers instead of barriers include U.S. 36 and I-25 North. A four-foot buffer width is proposed for C-470.

Buffer separation also eliminates the need for safety shoulder width on each side of the barrier, freeing up right-of-way for the addition of more auxiliary lanes between interchange on- and off-ramps. Extensive addition of auxiliary lanes would greatly improve merge and diverge movements, improving traffic flow and safety for all C-470 users.

Express Lane Access: The change from barrier separation to buffer separation and the elimination of proposed Colorado Boulevard T-ramps allowed a complete reconsideration of express lane ingress and egress points, taking into account both operational safety and potential revenue maximization. Subject to safety constraints, it is desirable for express lanes to carry as much traffic as possible at a reliable, uncongested speed, both to relieve congestion on the general purpose lanes and to ensure financial feasibility of the express lanes.

I-25 Direct-Connect Ramps: As revised express lane access plans were developed, traffic analysis indicated that the previously proposed ramp configuration at I-25 would not operate efficiently, leading to reconsideration of direct-access ramps at that location. Direct-connect ramps between I-25 and the C-470 express lanes were shown to greatly improve access and user benefits to the point that the increased express lane use would fully pay for the added construction cost, while improving traffic for general purpose lanes as well.

All of these design refinements to the 2006 Preferred Alternative were incorporated into the 2015 Proposed Action as discussed in **Section 2.7** below.

2.7 ALTERNATIVES CONSIDERED IN 2015

As noted above, alternatives eliminated in the 2006 EA were reviewed in this Revised EA and the reasons for their prior elimination remain valid. In 2006, the GPL alternative met the Purpose and Need but did not have reasonably foreseeable funding. Nine years later, funding for the GPL alternative still is not available. It was eliminated in 2015 for this reason. Additionally, express lanes provide the opportunity to adjust tolls by time of day to ensure travel time reliability, a feature not available with general purpose lanes.

Updated traffic and revenue studies indicate that available public funding plus projected toll collection would be adequate to finance an Express Lanes alternative. The EL alternative from 2006 has been modified and the result in the 2015 Proposed Action. Thus only alternatives carried forward for environmental evaluation in 2015 are the Proposed Action and the No-Action Alternative.

2.8 2015 PROPOSED ACTION

The Proposed Action of this Revised EA for C-470 would add one managed, tolled express lane in each direction between I-25 and Kipling Parkway, and a second managed express lane as follows:

- Westbound, I-25 to Lucent Boulevard
- Eastbound, Broadway to I-25

These new through lanes, plus new auxiliary lanes where warranted, would supplement the existing (free) general purpose lanes. **Figure 2-6** shows typical sections for the eastern portion of the corridor. Painted pavement buffers would separate the tolled lanes from the non-tolled lanes.

Figure 2-7 shows preliminary locations for auxiliary lanes and express lane access.

New direct-connect ramps would be provided to serve some movements at the C-470/I-25 interchange, as shown in **Figure 2-8**.

In conjunction with the construction of added lanes, the project would also reconstruct existing pavement to address known structural deficiencies. This would be a major reconstruction effort, amounting to roughly one-third the overall project cost.

Concept design plans for the Proposed Action have been developed to the degree necessary to allow assessment of likely environmental impacts. Some operational details such as toll rates and express lane access locations will be finalized based on further revenue studies.

Figure 2-6
2015 Proposed Action Typical Sections

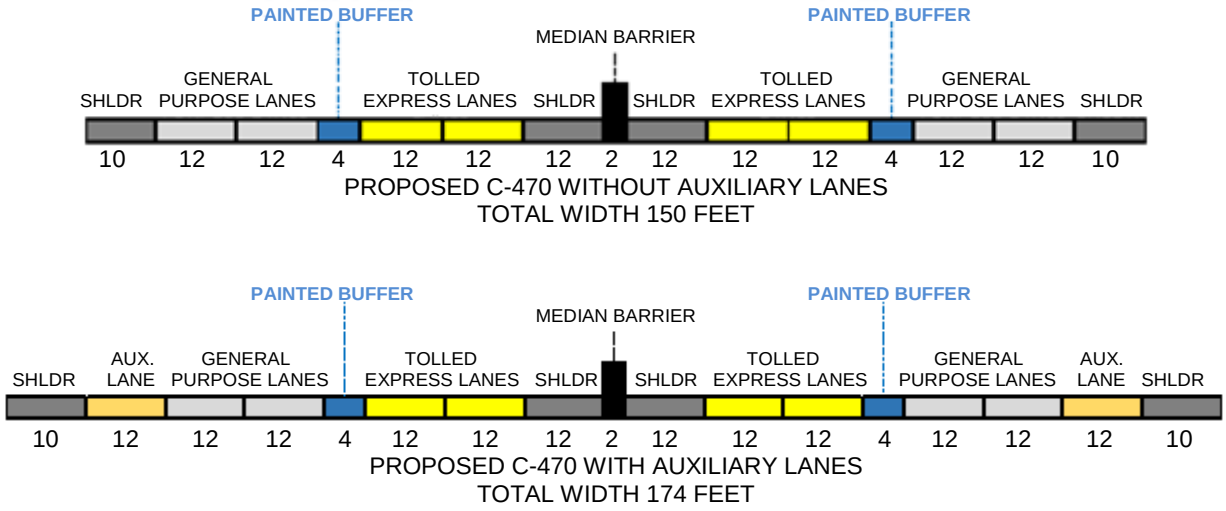


Figure 2-7
Preliminary Locations for Auxiliary Lanes and Express Lane Access

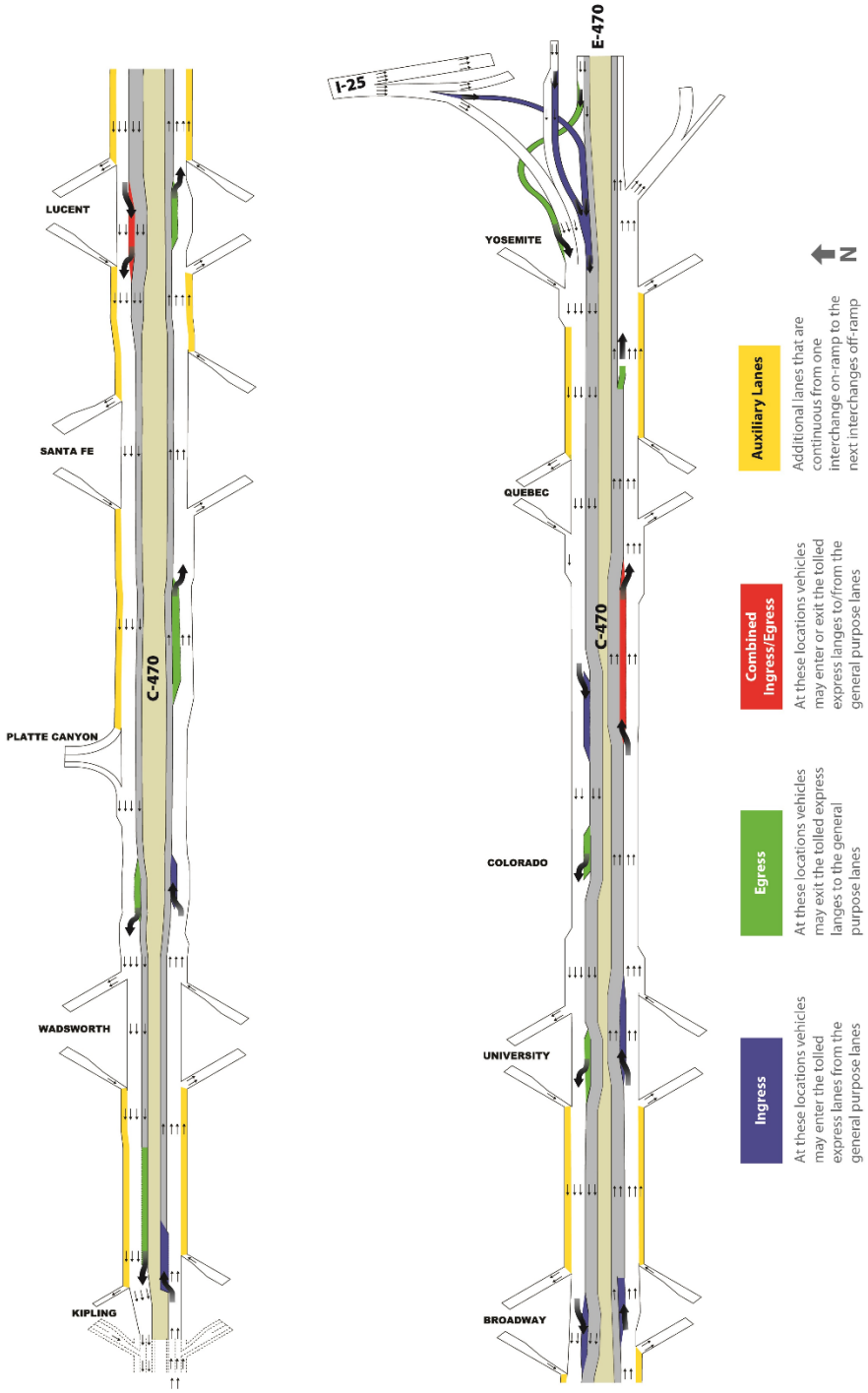
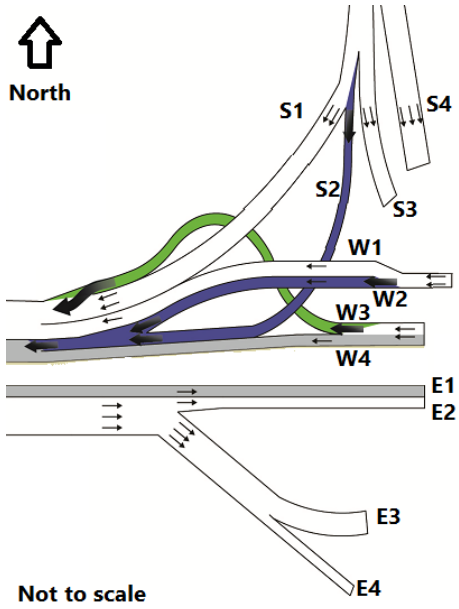


Figure 2-8
Proposed Configuration of C-470/I-25 Direct Connect Ramps



S1 = Existing ramp, SB I-25 to WB C-470
S2 = **NEW** direct connect, SB 1-25 to WB Express Lane
S3 = Existing ramp, SB I-25 to EB E-470
S4 = Existing SB I-25 mainline

W1 = Existing ramp, NB I-25 to WB C-470
W2 = **NEW** direct connect, NB I-25 to WB Express Lane
W3 = **NEW** direct connect, WB E-470 to WB C-470
W4 = Existing EB E-470 to WB C-470 (Express)

E1 = Existing EB C-470 (Express) to EB E-470
E2 = Existing EB C-470 to EB E-470
E3 = Existing ramp, EB C-470 to NB I-25
E4 = Existing ramp, EB C-470 to SB I-25

Note: SB = southbound, NB = northbound, EB = eastbound, WB = westbound

Many engineering details will be decided in the subsequent design-build phase of the project. Unlike conventional project delivery, where the final design is completed and then presented to a construction contractor to build, under design-build delivery the contractor receives preliminary plans which the contractor finalizes in conjunction with the construction process. This can reduce overall costs and delivery time by providing the contractor flexibility to develop time- or money-saving solutions.

Toll rates have not been determined at this stage of project development, but some conceptual information has been developed. At public meetings for this Revised EA, CDOT indicated that peak period toll costs for the full length of the Proposed Action were anticipated to be in the $4 to $6 range. Tolls would be lower in off-peak periods.

The Level II Traffic and Revenue study completed in 2014 indicated that tolls would vary by time of day according to a fixed schedule. Tolls would not vary dynamically in response to real-time traffic conditions. Thus, drivers would be able to know the toll rates in advance and be able to plan their trip timing accordingly.

An investment-grade Level III T&R study is being prepared in 2015. It will provide updated information about potential toll rates.

Table 2-2 provides additional information regarding some aspects of the project. **Table 2-2** is not intended to be comprehensive, but merely to point out that the Proposed Action includes mitigation.

Transportation impacts of the Proposed Action are detailed in **Chapter 3.** Environmental impacts and mitigation commitments are detailed in **Chapter 4**.

Table 2-2
Proposed Action Additional Details

Project Element	Proposed Treatment
Bridges	Most existing C-470 bridges will be widened to accommodate the expanded project lanes and width. However, the two parallel C-470 bridges crossing the South Platte River will need to be fully replaced.
Pavement	All existing pavement will be replaced. Pavement substructure will be improved where necessary.
Ramps	C-470 improvements will tie into existing interchange on- and off-ramps. No reconstruction will be needed at ramp terminal intersections, except for the Santa Fe Drive westbound onramp to westbound C-470. New direct-connect ramps will link I-25 to the westbound express lanes.
Signage	New signage will be needed to provide advance notice of express lane ingress and egress locations. Some signage will be needed outside of the basic project area (i.e., along I-25 northbound and southbound, E-470 eastbound, and eastbound C-470 west of Kipling Parkway).
Electronic tolling equipment	Devices for transponder detection and license plate video surveillance will be installed. There will be no tollbooths and no physical handling of any money onsite.
Variable message signs (VMS)	Several VMS exist along C-470 now and more likely will be added. Congestion information will help motorists decide whether or not to enter or exit the tolled express lanes. Motorists also need to know the currently effective toll rates.
Intelligent transportation systems (ITS)	Various technologies exist on C-470 for traffic management purposes and will also be provided under the Proposed Action, being replaced, relocated or upgraded as necessary.
Ramp metering	Ramp metering exists and is currently used at all C-470 on-ramps except Kipling Parkway. Continued use of ramp metering corridor-wide is anticipated. The Proposed Action does not call for ramp metering at Kipling Parkway, but the Proposed Action would not preclude its installation in the future when warranted.
C-470 trail	Some portions of the existing C-470 trail will need to be relocated outward away from the existing highway. Grade separations will be constructed to take the trail under two arterial cross-streets, Colorado Boulevard and Quebec Street.
Environmental impact mitigation	Stormwater management and water detention facilities will be added. Noise barriers may be installed where deemed to be feasible and reasonable. The project will provide other mitigation as needed (e.g., replacement of impacted wetlands or mature trees).

2.9 CONCLUSION

Based on extensive input from stakeholders in response to the efforts of the CDOT and the C-470 Corridor Coalition, the 2006 Preferred Alternative has been modified extensively, resulting in development of the 2015 Proposed Action. These modifications were made for the purpose of improving the operational performance of the express lanes concept.

The express lanes concept remains the only approach that can provide travel time reliability, and it is the only alternative which is implementable in terms of reasonably foreseeable funding resources. Alternatives eliminated in 2006 remain infeasible for the reasons previously identified, as revisited in this chapter.

The Proposed Action would provide travel time reliability by providing managed lanes, where toll pricing would enable CDOT to maintain moderate traffic volumes at high speeds during peak period congestion. Additionally, the Proposed Action would afford traffic congestion relief. Its projected operations are described in **Chapter 3**.