CHAPTER 2
SCREENING PROCESS AND ALTERNATIVES CONSIDERED

2.1 INTRODUCTION

The National Environmental Policy Act (NEPA) of 1969 requires that a reasonable range of alternatives be evaluated. This chapter describes the screening process and discusses the alternatives considered and evaluated in the screening process. Each alternative was developed and evaluated in conjunction with an extensive public and agency outreach program, as described in **Chapter 4**.

Alternatives were developed and screened through a three-step screening process in which increasing levels of detail helped distinguish the alternatives and indicate whether they met the purpose and need. Alternatives that did not meet the purpose and need and other implementation objectives derived from the purpose and need were progressively eliminated from further consideration.

Sections 2.2 and 2.3 provide a project history and overview of the alternatives development and screening process. **Section 2.4** discusses alternatives that were carried through the screening process for detailed evaluation in this environmental assessment (EA). **Section 2.5** describes the process through which the Preferred Alternative was identified. Results of this process represent the outcome of the public and agency outreach, in addition to detailed environmental and technical analyses. **Section 2.6** describes alternatives considered during the analysis but which were eliminated from further consideration.

2.2 PROJECT HISTORY AND RELATIONSHIP TO THE PLANNING PROCESS

Highway C-470, in its entirety, has been open to traffic for nearly 15 years, making it one of the region's newest highway facilities operated by the Colorado Department of Transportation (CDOT). The need for a southwest circumferential route for the Denver metropolitan area was first cited in a 1958 report, Transportation in the Denver Region, prepared by the regional planning agency that preceded the Denver Regional Council of Governments (DRCOG). In 1968, I-470 was authorized, following the Federal Aid Highway Act, which allowed additional circumferential interstate mileage for cities. The environmental process took four years. In 1972, CDOT's predecessor, the Colorado Department of Highways submitted a Final Environmental Impact Statement (EIS) for I-470 to the Federal Highway Administration (FHWA).

In 1975, the FHWA directed the Colorado Department of Highways to revise the I-470 EIS. A 12-member I-470 Ad Hoc Commission was convened to recommend alternative solutions to revising the statement. The following year, the Ad Hoc Commission recommended that I-470 be withdrawn from federal interstate funding, and that a portion of the funding be "transferred" to C-470. On July 28, 1977, Colorado's governor signed an I-470 Withdrawal-Substitution Proposal submitted to the U.S. Secretary of Transportation. Federal approval came on September 30, 1977.

The Centennial Parkway (a.k.a. C-470) FEIS was completed in 1980, with a Record of Decision (ROD) issued in July 1980. Highway construction began in April 1982. But uncertain funding plagued the project over the long term. A C-470 Inter-Chamber Task Force was established to focus on federal funding. Task force members included representatives from Englewood, Littleton, Denver, Golden, and the Lakewood and South Jefferson County Chambers of Commerce. A delegation presented testimony before Congressional committees in April 1982. As a result of this delegation, Congress appropriated to Colorado discretionary funds that were used to complete construction of C-470 from I-25 to I-70.

The initial 11.7 mile stretch of C-470, extending from I-25 to Wadsworth Boulevard was opened

to traffic in December of 1985. On September 4, 1987, the second phase was opened, extending C-470 further west to the Ken Caryl interchange. The northern segment of C-470, extending from the access ramps at U.S. 285 to the I-70 interchange, was opened to traffic November 18, 1988. On October 27, 1990 the segment connecting Ken Caryl Boulevard to the new interchange at US 285 was opened. The total cost for the 26.1 miles of C-470 to date was approximately $270 million. Ten years later, the C-470 extension from I-70 to 6th Avenue opened on August 31, 2000.

In 2001, CDOT completed the Colorado Value Express Lanes Feasibility Study, which ranked C-470 from Wadsworth Boulevard to I-25 as a good candidate for further high-occupancy vehicle(HOV)/value express lanes consideration. CDOT then received several unsolicited proposals to finance, design, and construct express lanes on C-470. In 2002, CDOT issued the C-470 Corridor Public-Private Initiative Request for Comparable Proposals. From this process, CDOT selected the team of Fluor & Flatiron Infrastructure, Inc. (F&F) as the most responsive proposer. CDOT subsequently entered into a predevelopment agreement with F&F which gives F&F the first right of refusal to perform the design/build of the express lanes should express lanes be selected as the Preferred Alternative in the decision document of this NEPA study. If this occurs, the Colorado Tolling Enterprise (CTE) and F&F would enter into negotiations to execute a design/build contract to build this facility. F&F has been an observer of the Technical Working Group during the study process.

2.2.1 Regional Planning Process

All transportation projects that are implemented within a Metropolitan Planning Organization (MPO) region must be included in that MPO's fiscally constrained and air quality conforming Regional Transportation Plan (RTP). This ensures that all projects have met air quality conformity requirements and that funding is allocated to projects with the highest regional priority. The FHWA requires that a Preferred Alternative be included in the respective MPO's fiscally constrained, air quality-conforming RTP before a decision document selecting the Preferred Alternative may be approved.

To be added to an RTP, traditionally-funded projects in the Denver region must demonstrate the following:

- The project is consistent with the principles in DRCOG's currently adopted Metro Vision RTP
- Funds are available for implementation
- The project complies with air quality conformity requirements

DRCOG typically updates the RTP every three years, with an amendment process to add other projects to the plan.

Tolling projects will follow a variation of this process. In 2005, the Colorado Legislature passed HB05-1148 that requires the CTE to submit a proposal for all toll projects for review and approval by the MPO located within the highway system. This proposal addresses such items as the operation of the toll highway, technology to be used, project feasibility, project financing, and associated environmental, social, and economic impacts. The CTE Ad Hoc Advisory Committee on Tolling was formed when CDOT, the CTE, the statewide MPOs, Transportation Planning Regions, and other interested parties convened to establish protocol to implement tolls in Colorado and address the requirements of HB05-1148. The process established by this committee, as it pertains to adding a toll project to the RTP is briefly summarized in **Figure 2-1**. Requirements for toll project amendments to the RTP were also established by the committee as outlined in the Toll System/ Regional Transportation Plan Amendment Analysis Framework.

Currently, the Metro Vision Plan has identified 20 potential freeway/tollways as part of the "Key Multimodal Corridor Visions" for the

region. C-470, between I-25 and I-70 is identified as a potential toll corridor.

No funding for the C-470 Corridor is currently identified in DRCOG's 2030 RTP (with the exception of $20 million for the Santa Fe Drive interchange). As part of the analysis for this EA, it has been determined that toll revenues could fund 100 percent of the EL Alternative, thus its identification as the Preferred Alternative. The Preferred Alternative selection is discussed further in Section 2.5. An application to amend DRCOG's RTP to include the EL Alternative and request approval of C-470 as a toll corridor project will be submitted to DRCOG in the Spring of 2006. After the application is accepted, DRCOG would run the air quality conformity analysis, and after approval, the NEPA study would be eligible for a decision document.

2.2.2 Colorado Tolling Enterprise

The CTE was created by CDOT in 2002 based on legislation to fund and operate toll facilities in the state. The formation of the CTE provided the state with an alternative mechanism to address funding shortfalls as traditional funding sources shrink. The non-profit CTE is an extension of CDOT; however, it is operated more as a private business. In accordance with the provisions of the Taxpayer's Bill of Rights (TABOR), the tolling agency was set up as an enterprise to provide it some latitude in business operations, while still being subject to TABOR's limitation on accepting no more than 10 percent of its annual revenue from state and local sources.

Since its formation in 2002, the CTE has been investigating the feasibility of implementing tolling in Colorado and developing its administrative rules for operation. One of the first initiatives undertaken by the CTE was to identify and evaluate potential tolling corridors around the state. The *CTE Preliminary Traffic and Revenue Study*, (December 2004), screened the statewide candidates from 79 down to 12 corridors, most of which are in the Denver metro area, and all of which are on the Front Range. C-470 is one of the corridors that was listed as potentially feasible. The financial analysis performed for the tolled express lanes in this EA went to a greater level of detail and confirmed that the tolling concept appears to be feasible.

2.2.3 Express Lanes Feasibility Study

The *C-470 Express Lanes Feasibility Study* (June 2005) was conducted concurrently with this EA. The goal of that study was to investigate the potential financial feasibility of constructing tolled express lanes from I-70 to I-25. The study concluded that tolled express lanes could potentially be financially feasible for the section from Kipling Parkway to I-25, thus the tolled express lanes concept was determined to be a viable alternative for consideration in this EA. However, the section from I-70 to Kipling Parkway is not feasible by itself in the 2025 time frame. Several conditions would have to be met before that section would become feasible. If, at some point, tolled express lanes west and north of Kipling Parkway were to be pursued, a separate environmental clearance may be necessary for that section.

Subsequent financial evaluation of the tolled express lanes as part of this EA has determined that the EL Alternative is entirely financially self-supporting, and therefore is eligible for amendment into the fiscally-constrained DRCOG

Figure 2-1
Regional Planning Process For Tolling Projects

RTP and subsequent implementation, as discussed further in **Section 2.5**.

2.2.4 Regional Transportation District

In November 2004, voters in the Regional Transportation District (RTD) approved a comprehensive 12-year transit plan called FasTracks, a tax-based bonding program to provide additional transit service throughout the Denver metro area. FasTracks components include extension of the existing Southeast and Southwest Corridor light rail transit (LRT) lines and enhancing local bus service connections. FasTracks does not include any extension of LRT along the C-470 Corridor between the Southwest and Southeast lines. The relevant FasTracks Plan components are included in the travel demand modeling for all alternatives considered.

The Southwest Corridor LRT extension will extend LRT service south along Santa Fe Drive from the Mineral Station over C-470 and east to Lucent Boulevard, as shown in **Figure 2-2**. *The Southwest Transit Corridor Planning and Conceptual Engineering Study* (December 2002), recommended the extension of light rail from the Mineral Station to an end-of-line station at Lucent Boulevard. This service extension will add another 2.5 miles of track. Over 1,000 additional parking spaces will be part of the new Lucent Boulevard station. Roughly 3,500 new riders are expected at the new Lucent Boulevard station, bringing the total Southwest Corridor ridership to over 20,200 riders per day.

The Southeast Corridor LRT extension includes 2.3 miles of additional LRT service from the planned Lincoln Avenue station to a new station at the planned Lone Tree Town Center. Beyond the new town center, the line will cross over I-25 and continue south to an end-of-line station in the RidgeGate development. This LRT extension will include an additional 2,520 parking spaces between the three planned stations, bringing total ridership for the line to more than 51,000 per day.

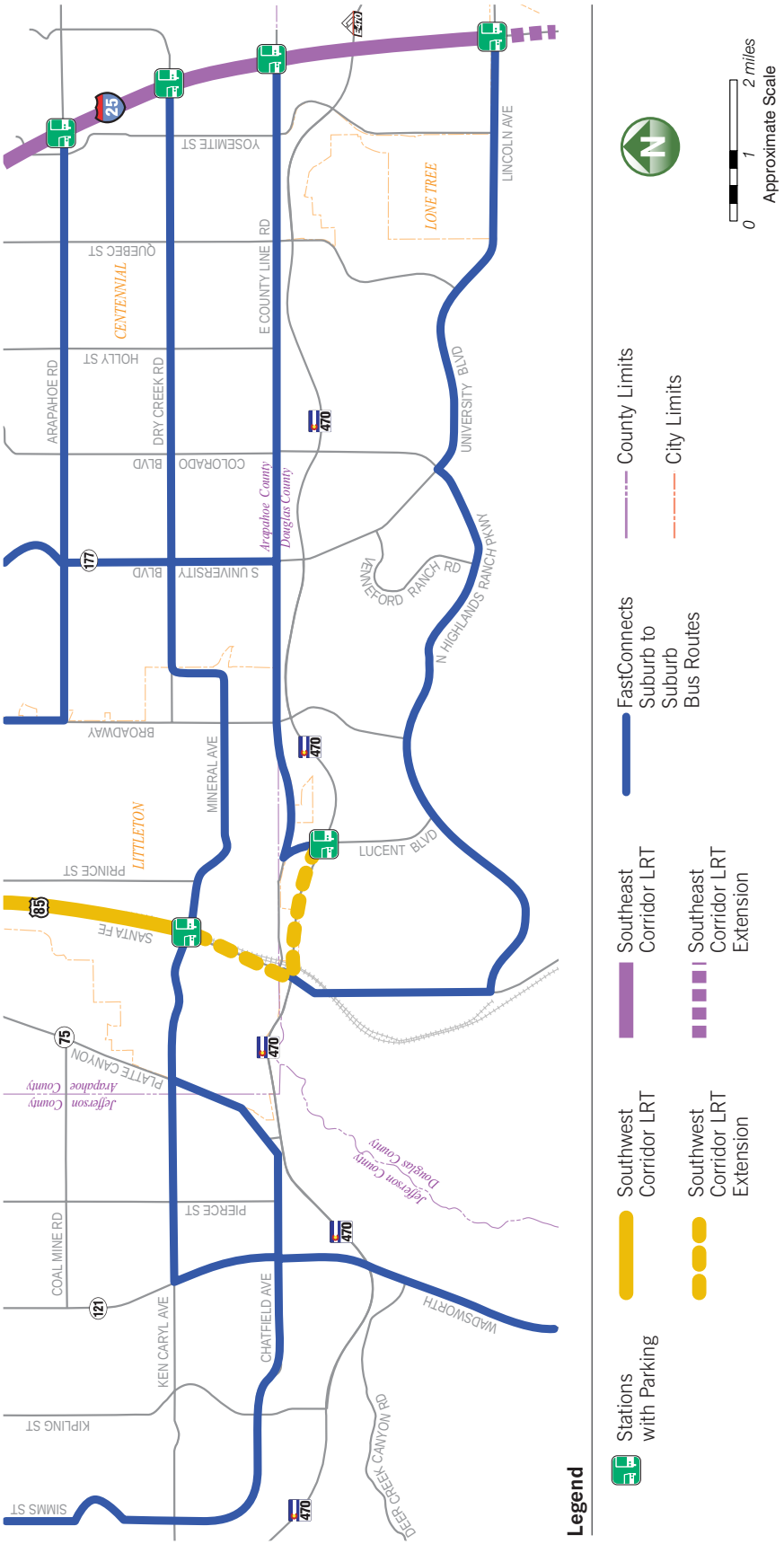
FasTracks also includes a bus component called FastConnects, which consists of local bus service improvements to the future network of suburb-to-suburb bus service links connecting major employment centers and park-n-Rides in the outlying areas. The suburb-to-suburb service is designed around a network of timed connections and transfers. The future expansion of local bus service in the vicinity of the C-470 Corridor includes future bus routes along County Line Road, Dry Creek Road, Arapahoe Road, Ken Caryl Avenue, Lincoln Avenue, and Highlands Ranch Parkway, as shown in **Figure 2-2**.

2.3 ALTERNATIVES DEVELOPMENT AND SCREENING PROCESS

The first step in the screening process was to scope the goals, objectives, issues, and constraints for the C-470 Corridor. Scoping was initiated in April 2003 with outreach meetings to agencies, cities, and counties within the project study area to gain initial understanding of important issues and concerns for the C-470 Corridor. A formal agency scoping meeting was held June 30, 2003. Data collection was completed during the summer of 2003, followed by a scoping meeting with the CDOT Environmental Programs Branch on October 16, 2003. The first round of project public meetings was held October 7, 8, and 9, 2003, at various locations throughout the C-470 Corridor. The input received at these meetings led to the development of the study purpose and need. The purpose and need forms the basis for developing and evaluating a range of alternatives in the screening process.

A performance-based evaluation process was used to assess the nearly 20 different alternatives for mainline C-470 and 14 interchange concepts for the Santa Fe Drive interchange. Each alternative was evaluated using screening criteria derived from the project goals and objectives. These criteria were then used to determine the alternatives that best met the purpose and need. This screening process consisted of three primary steps. Each step involved an increasing level of detail in alternative development. The

Figure 2-2
Planned FastConnects Bus Service



Project Management Team consulted the Technical Working Group and Executive Working Group before taking recommendations to the public for their review and comment. Complete disclosure of the public and agency coordination process as part of the alternatives analysis is in **Chapter 4**. The screening process schedule is illustrated in **Figure 2-3**. The alternatives that were considered in the screening process and were carried forward for detailed environmental analysis are described in **Section 2.4**. The alternatives that were considered in the screening process, but were eliminated from consideration are described in **Section 2.6** and summarized in **Table 2-3**. Details of the alternatives development and screening process are in the *Alternatives Screening Report* (March 2005).

2.3.1 Goals, Objectives, and Evaluation Criteria

Input from the scoping process contributed to the development of project goals and objectives, which served as the basis for evaluation criteria used to assess each alternative. Representatives from numerous agencies and public groups were engaged to gather information that was used to develop the purpose and need. 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 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 2-4.**

2.3.2 Initial Screening

After the scoping process was completed, the alternatives development and evaluation process began. An initial range of alternative categories (collectively called the families of solutions) were developed, refined, and evaluated in a fatal flaw analysis. This process evaluated alternatives on the basis of whether they were feasible for C-470. A fatal flaw analysis was used to eliminate families of solutions (general alternative categories) 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. Families 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 families were carried through to qualitative screening.

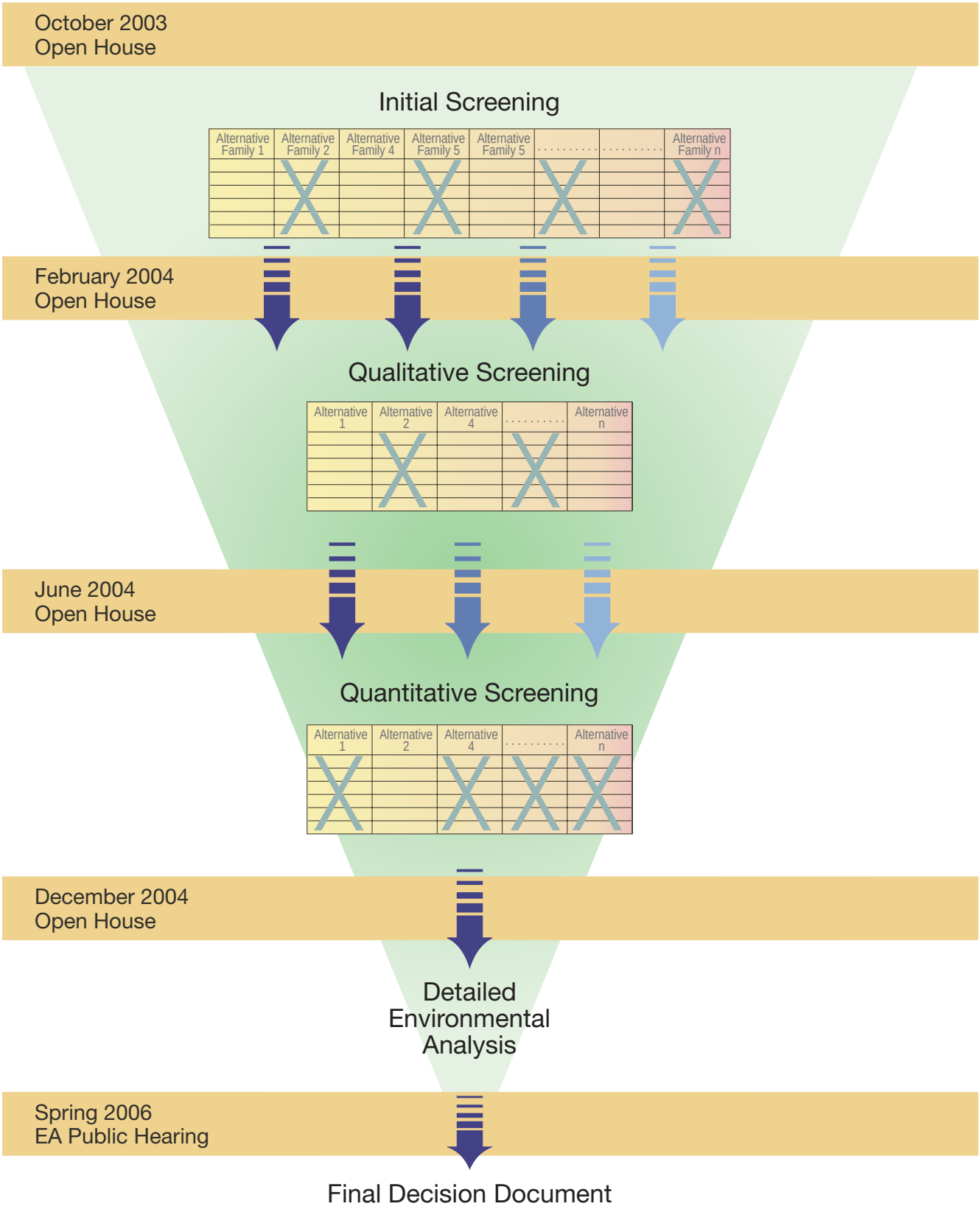
2.3.3 Qualitative Screening

After the initial screening, each family 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.

2.3.4 Quantitative Screening

In this final and most detailed level of analysis, the short-listed alternatives were further developed and refined to avoid and minimize adverse effects. An important element of this refinement process was evaluating and

Figure 2-3
Screening Process Schedule



Note: This exhibit displays the concept of eliminating alternatives (indicated by the "x") through the screening process.

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

	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 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	Mode choice from interchanges on C-470
		Provide a transportation system that is consistent with regional transportation plans	Conformity with regional transportation plans
	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?
	Environment: 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

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

	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	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, archaeo-logical, 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 2-4
Screening Process and Results

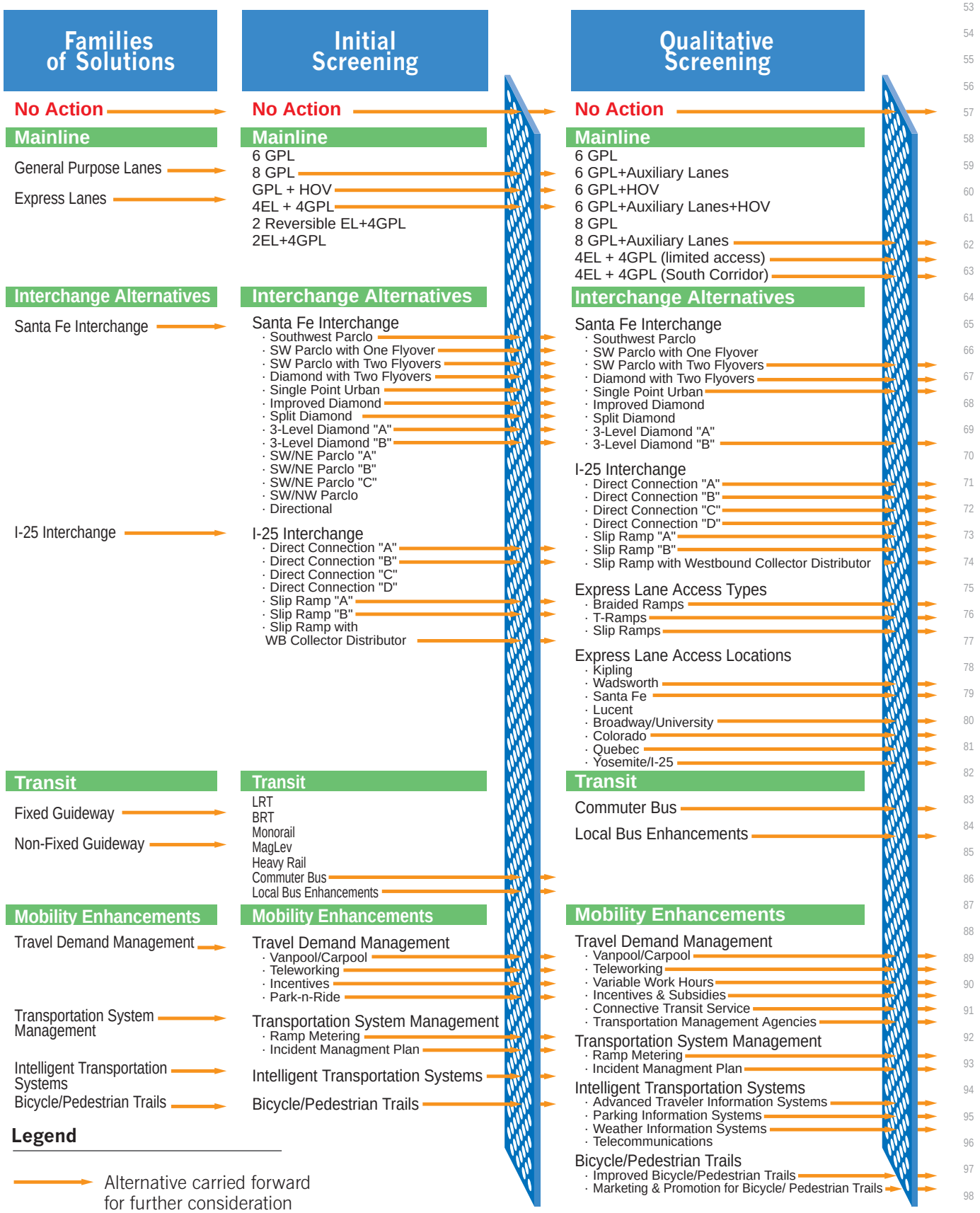
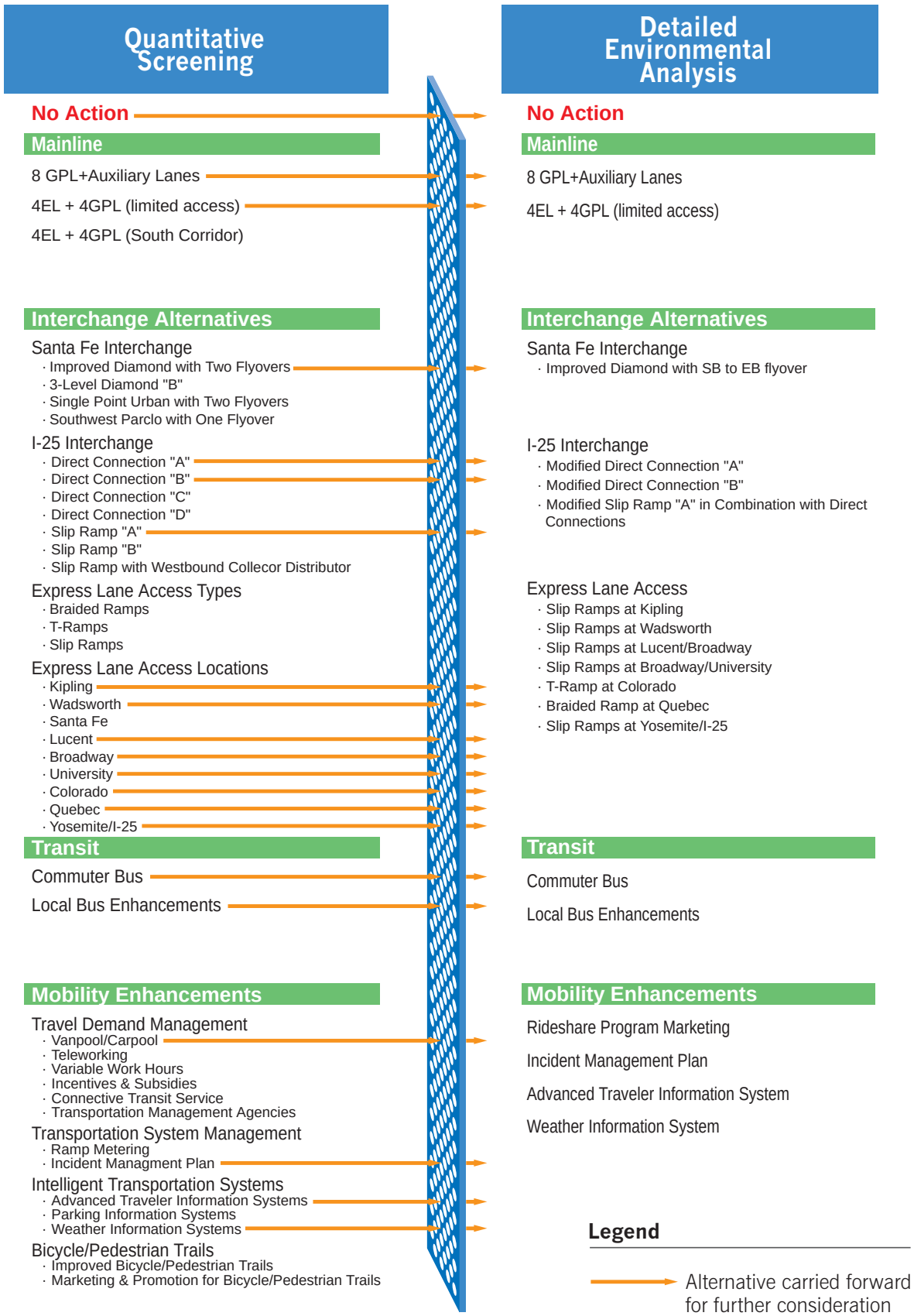


Figure 2-4
Screening Process and Results (continued)



improving traffic operations on the mainline and the arterial street system. At this level, the alternatives were evaluated quantitatively by determining and comparing quantitative values of effects (both positive and negative) for the respective resources. This process resulted in carrying forward two action alternatives and the No-Action Alternative for detailed analysis in the EA.

2.4 ALTERNATIVES CARRIED FORWARD

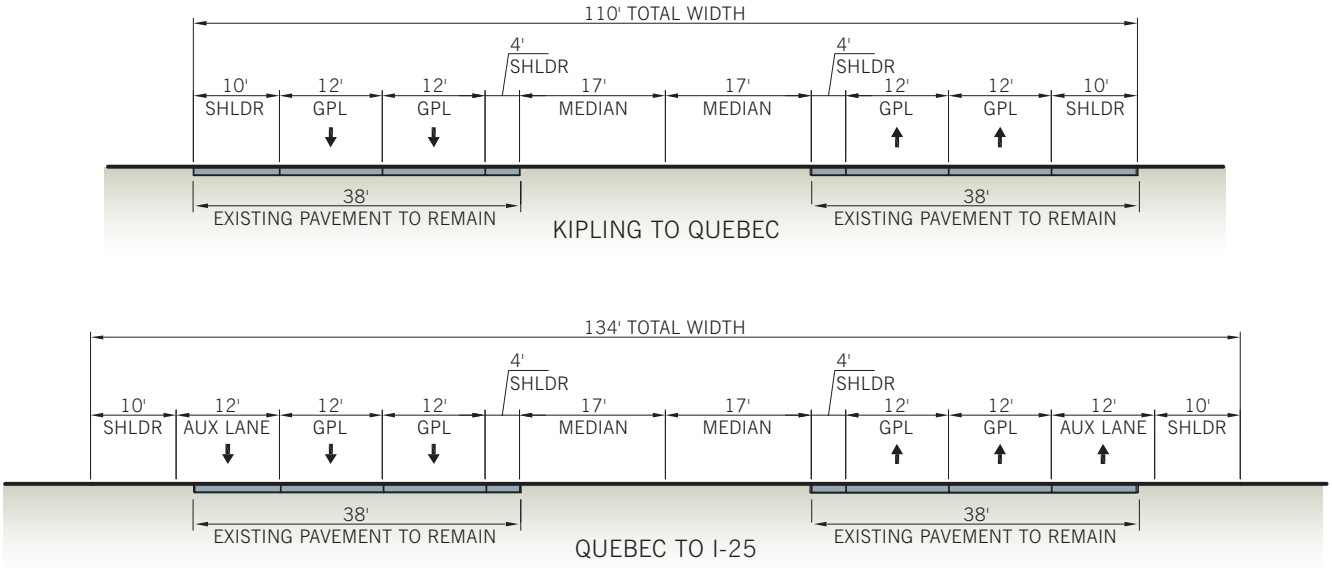
The Eight-Lane General Purpose with Auxiliary Lanes Alternative (hereafter referred to as the GPL Alternative) and the tolled Express Lanes Alternative (hereafter referred to as the EL Alternative) were retained from the screening process and carried forward for detailed environmental analysis. The No-Action Alternative was also retained. While a range of transit alternatives was considered during the screening process, no form of transit service is explicitly included as part of the No-Action, GPL or EL Alternatives. A discussion of opportunities for transit implementation in the C-470 Corridor is contained in **Section 2.4.4.**

2.4.1 No-Action Alternative

The No-Action Alternative includes taking no action to improve the existing roadway other than performing basic maintenance and/or safety improvements to maintain roadway operation. Travel demand forecasting for the future no action scenario does include likely network improvements off of C-470 that are anticipated to be in place by the design year 2025. These may include local municipal capitol improvements or projects included in the DRCOG 2030 fiscally constrained RTP that may affect traffic levels on C-470. Existing conditions in the C-470 Corridor consist of 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, with inside and outside shoulders, plus a 34-foot median, as shown in **Figure 2-5**. Paved shoulder widths vary between four and 10 feet. CDOT has recently installed ramp metering at all entrance ramps to C-470 within the project area, with the exception of Kipling Parkway. Ramp metering will continue to be implemented as a mobility enhancement

Figure 2-5
No-Action Alternative Typical Section



measure to minimize conflicts at freeway entrance points as part of this alternative.

Because RTD has determined that C-470 is too congested for buses to operate with reliable and acceptable travel times, transit service is not currently provided on C-470. Bus service in the project area is currently provided on local arterial streets rather than on C-470. Under the No-Action Alternative, this situation is expected to continue as congestion on C-470 worsens. LRT is currently not provided on C-470 and, other than the Southwest and Southeast LRT Corridor Extensions, is not planned by RTD within the 2030 planning horizon.

2.4.2 General Purpose Lanes Alternative

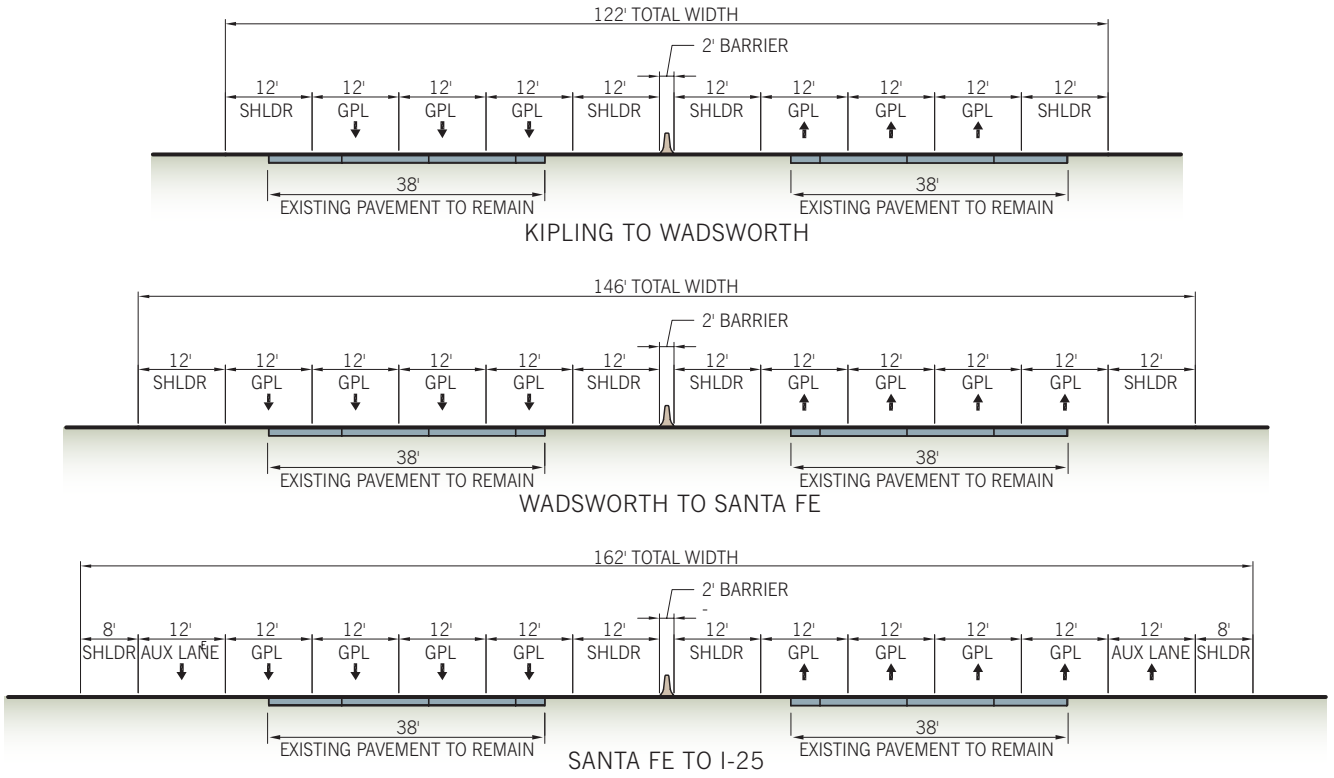
The GPL Alternative would add up to four additional travel lanes and auxiliary lanes to the existing four travel lanes, extending from Kipling Parkway to I-25. It includes improving ramps and reconstructing the C-470/Santa Fe Drive interchange. Access improvements at the Santa Fe Drive interchange would result from a realigned interchange to improve traffic flow. This alternative would reduce congestion and improve travel time on C-470.

2.4.2.1 Typical Section

The typical section for this alternative, as shown in **Figure 2-6**, would include three general purpose lanes in each direction between Kipling Parkway and Wadsworth Boulevard with 12-foot travel lanes and paved shoulders varying from eight to 12 feet and a two-foot concrete barrier separating opposing directions of traffic. This widening would take place in the median of the existing facility.

Between Wadsworth Boulevard and Santa Fe Drive, the typical section would be widened to four general purpose lanes in each direction. The additional lanes would be created by widening and resurfacing the existing pavement. From Santa Fe Drive to I-25, the typical section would widen further to include four general purpose

Figure 2-6
General Purpose Lane Alternative Typical Section



lanes plus one auxiliary lane in each direction. In this section, the existing pavement would be widened and overlaid to create the additional lanes.

2.4.2.2 Access Locations

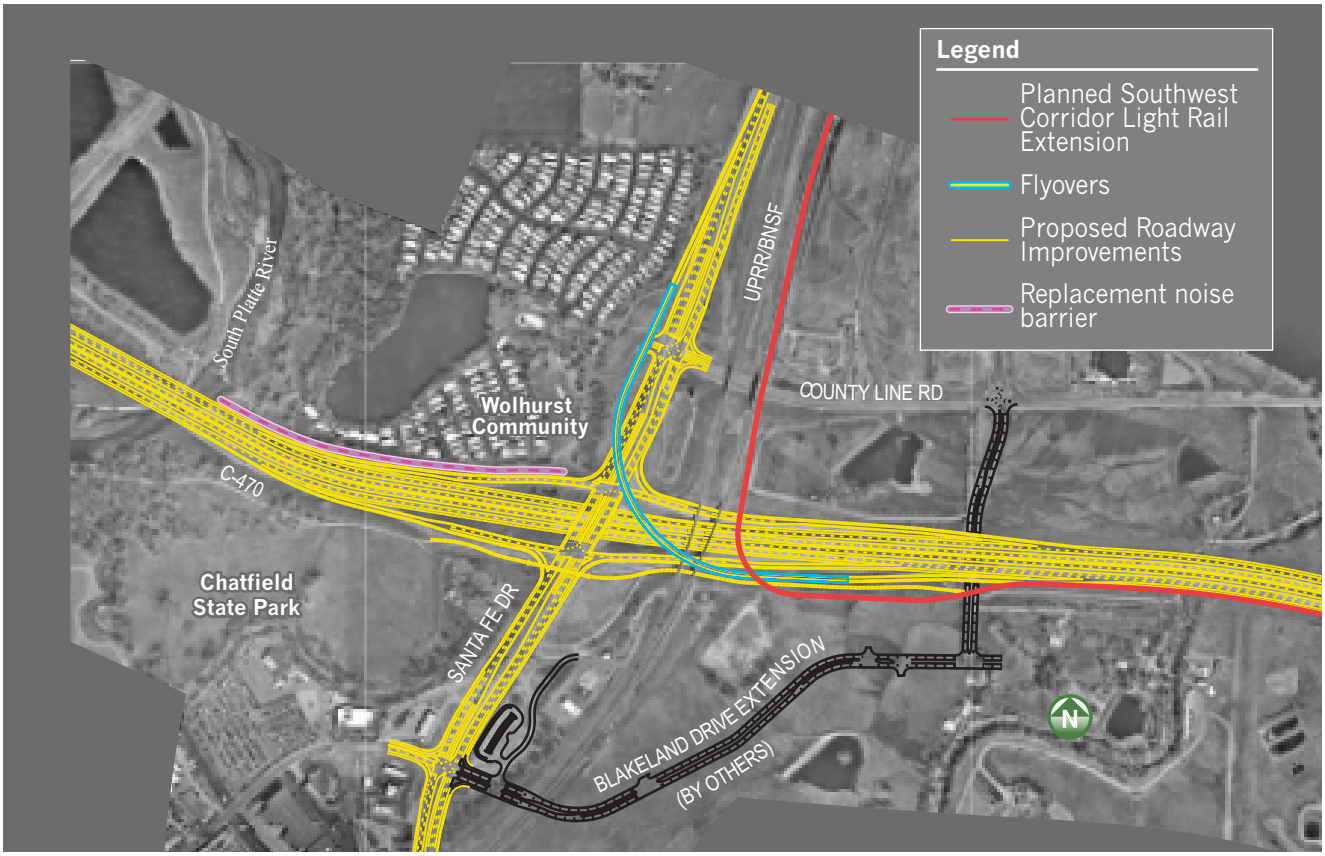
Access locations and interchange types for this alternative would remain the same as they currently exist, with the exception of the Santa Fe Drive and I-25 interchanges, which would be reconfigured. At all other interchanges, only minor ramp modifications would be made to tie the widened mainline into the existing ramp terminals.

Santa Fe Drive Interchange

The Santa Fe Drive interchange would be reconstructed in its current diamond configuration to accommodate additional capacity, and a flyover ramp for southbound to eastbound traffic would be added to improve overall interchange operations. The proposed new interchange configuration is shown in **Figure 2-7**.

This interchange configuration was selected as the most desirable due to several factors. The southbound to eastbound flyover diverges from southbound Santa Fe Drive prior to the County Line Road and C-470 ramp terminal intersections, thereby removing traffic from those congested intersections and greatly improving operations. The ramp leading to the flyover also has the potential to provide Wolhurst residents some noise reduction from the Santa Fe Drive traffic, depending on the structure type selection for the flyover, which will be determined during final design. The flyover configuration for southbound to eastbound traffic improves merging operations onto C-470 as compared to other configurations due to its higher profile and higher design speed, both of which allow traffic to merge into eastbound C-470 at a higher speed

Figure 2-7
Improved Diamond Interchange with Southbound to Eastbound Flyover at Santa Fe Drive



on the steep seven-percent gradient. This configuration would also avoid the need for right-of-way acquisition from Chatfield State Park in the southwest quadrant of the interchange. While this alternative has positive characteristics, the negative aspects are its intrusion into the visual landscape and its higher construction cost. Additional comparative data for the Santa Fe Drive interchange alternatives can be found in the *Alternatives Screening Report* (March 2005).

I-25 Interchange

The I-25 interchange would require only minor modifications with the GPL Alternative. These are limited to reconfiguring the southbound on-ramp to I-25 to consist of two lanes rather than one.

2.4.2.3 Mobility Enhancement Elements

Mobility enhancement elements consist of minimal action strategies to either reduce demand placed on, or maximize the capacity of, the existing facility. In combination with each of the action alternatives, these strategies can help reduce traffic congestion, air pollution, and travel times. The mobility enhancement elements include four general categories: travel demand management, transportation system management, intelligent transportation systems (ITS), and bicycle/pedestrian trails. This alternative family was eliminated from consideration as a stand alone alternative due to its inability to meet the purpose and need on its own. However, certain elements were incorporated into the two action alternatives for their ability to provide some relief to congestion and delay, and to improve reliability.

Travel Demand Management

Travel demand management (TDM) strategies attempt to change driver behavior to reduce demand for a facility, and therefore its congestion. Typical strategies include carpooling, changing work hours to spread the peak, and telecommuting or shifting to other travel modes to reduce the demand. The specific travel demand management recommendation for combination with each action alternative includes enhanced marketing of DRCOG's rideshare program. This approach would help promote the program by installing additional promotional signing along C-470 to encourage program use. A signing plan would be jointly developed with DRCOG and implemented as part of this alternative. The rideshare program allows travelers with common destinations (such as employment centers and park-n-Rides) to travel in one vehicle and share associated vehicle costs. Ridesharing includes both carpooling and vanpooling.

Transportation System Management

Transportation system management (TSM) strategies strive to maximize the capacity of existing transportation systems by making them operate more efficiently, thus reducing congestion. The specific transportation systems management strategy that would be implemented with each action alternative includes developing an incident management plan (IMP) for the C-470 Corridor. C-470 does not currently have a comprehensive IMP. An IMP could provide traffic operations managers with the tools to allow quick and efficient response to accidents, hazardous spills, and other emergencies. An IMP would develop contact lists, detour routes, communication protocols, and identify other innovative technologies to expedite incident response times. By reducing response times and the time it takes to clear an incident, capacity bottlenecks could be removed sooner, allowing traffic to resume normal operations as soon as possible.

Intelligent Transportation Systems

ITS strategies encompass a broad range of communication-based information, control, and electronics technologies that help monitor and manage traffic flow, reduce congestion, and provide alternate routes to travelers. Specific ITS elements that would be combined with each action alternative are an advanced traveler information system and a weather information system. Ramp metering will continue to be implemented as a mobility enhancement

measure to minimize conflicts at freeway entrance points as part of the GPL Alternative.

Advanced traveler information systems include such technologies as electronic variable message signs and other systems to communicate data directly to commuters. These systems deliver data directly to travelers, allowing them to make better choices about alternate routes or transportation modes. Systems include variable message signs, radio, television, internet, closed circuit television, traffic counters, speed monitors, and accident notification.

Installation of a remote weather system along the C-470 Corridor would provide updated weather conditions to maintenance crews, thus enabling them to make more responsive decisions on maintenance activities to help enhance safety and mobility. Weather information could also be provided to travelers to aid in trip planning.

Bicycle and Pedestrian Trails

The GPL Alternative would reconstruct 7.5 miles of the C-470 trail. Generally, the trail is shifted northerly 40 to 50 feet to allow roadway widening. In addition to this linear trail reconstruction, the trail would be realigned and reconstructed at three locations to provide a grade-separated crossing of the arterial streets intersecting C-470. One location is at the new Santa Fe Drive interchange, where grade separation structures would be incorporated into the reconstructed interchange. A second location is at the Colorado Boulevard overpass where no interchange exists. The lack of an interchange at this location facilitates the realignment of the trail under the bridge without any ramp conflicts. Trail spurs would connect the trail to sidewalks on Colorado Boulevard. The third location is at Quebec Street, where the trail would be realigned to pass under the Quebec Street bridge. Because of the interchange at Quebec Street, ramp underpass structures are included in the alternative. A separate discussion regarding effects to the C-470 trail is included in **Section 3.3.16**.

2.4.2.4 Cost

The total cost for the GPL Alternative was estimated at $255 million. Of this, the Santa Fe Drive interchange cost is $60 million. These costs are in 2005 dollars.

2.4.3 Express Lanes Alternative

The EL Alternative would add up to four tolled express lanes to the existing four general purpose lanes, from Kipling Parkway to I-25, improve ramps for the general purpose lanes, and reconstruct the Santa Fe Drive interchange.

2.4.3.1 Typical Section

The express lanes typical section is generally a four-lane, barrier-separated facility constructed in the center of a four-lane general purpose lanes facility. From Kipling Parkway to Platte Canyon Road, the laneage varies in that there are only two express lanes. From Kipling Parkway to Wadsworth Boulevard, the express lanes are not physically separated from the general purpose lanes. Beginning east of Wadsworth Boulevard, the roadway widens to include a four foot buffer-separation between the express lanes and general purpose lanes in each direction. Barrier-separation and an additional express lane in each direction begins east of Platte Canyon Road and continues east to I-25. The term buffer refers to a safety zone between the two facilities delineated by paint stripes only. By using this typical section, most widening could occur within the existing median, minimizing effects. The typical section is illustrated in **Figure 2-8**.

The segment between Platte Canyon Road and I-25, also shown in **Figure 2-8**, would require widening and overlaying the existing pavement to the outside to accommodate the necessary roadway width. Shoulder width would vary to accommodate existing geometric constraints. 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.

2.4.3.2 Access Locations

Because the EL Alternative consists of two parallel facilities, access to the express lanes is different than for the general purpose lanes. The configuration of each is described herein, and illustrated in **Figure 2-9**.

Access Locations for Express Lanes

Access to the express lanes would be provided at Kipling Parkway, Wadsworth Boulevard, between Lucent Boulevard and Broadway, between Broadway and University Boulevard, Quebec Street, Colorado Boulevard, and I-25. Some locations have full access (ingress and egress), while others have only partial access. Access is provided via slip ramps at Kipling Parkway, Wadsworth Boulevard, between Lucent Boulevard and Broadway, and between Broadway and University Boulevard. T-ramps would provide direct access to the express lanes at Colorado Boulevard. Access at I-25 consists of a combination of both slip ramps and partial direct connection ramps, depending on the movement.

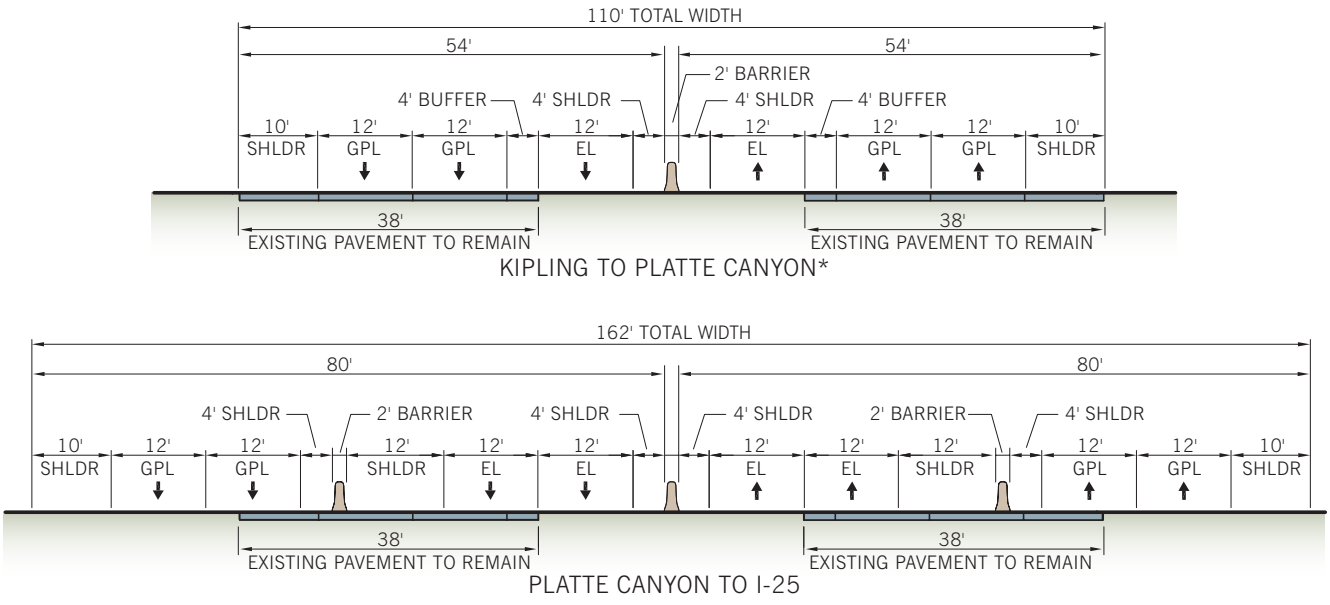
Access Locations for General Purpose Lanes

Access to the general purpose lanes would replicate existing conditions, with the exception of Santa Fe Drive, where a new interchange configuration is included as part of the alternative.

SANTA FE DRIVE INTERCHANGE. The Santa Fe Drive interchange would be reconstructed under the EL Alternative in the same way as under the GPL Alternative, as shown in **Figure 2-7**. The only difference between the two is that the EL Alternative would have only one lane exiting westbound at Santa Fe Drive, whereas the GPL Alternative would have two.

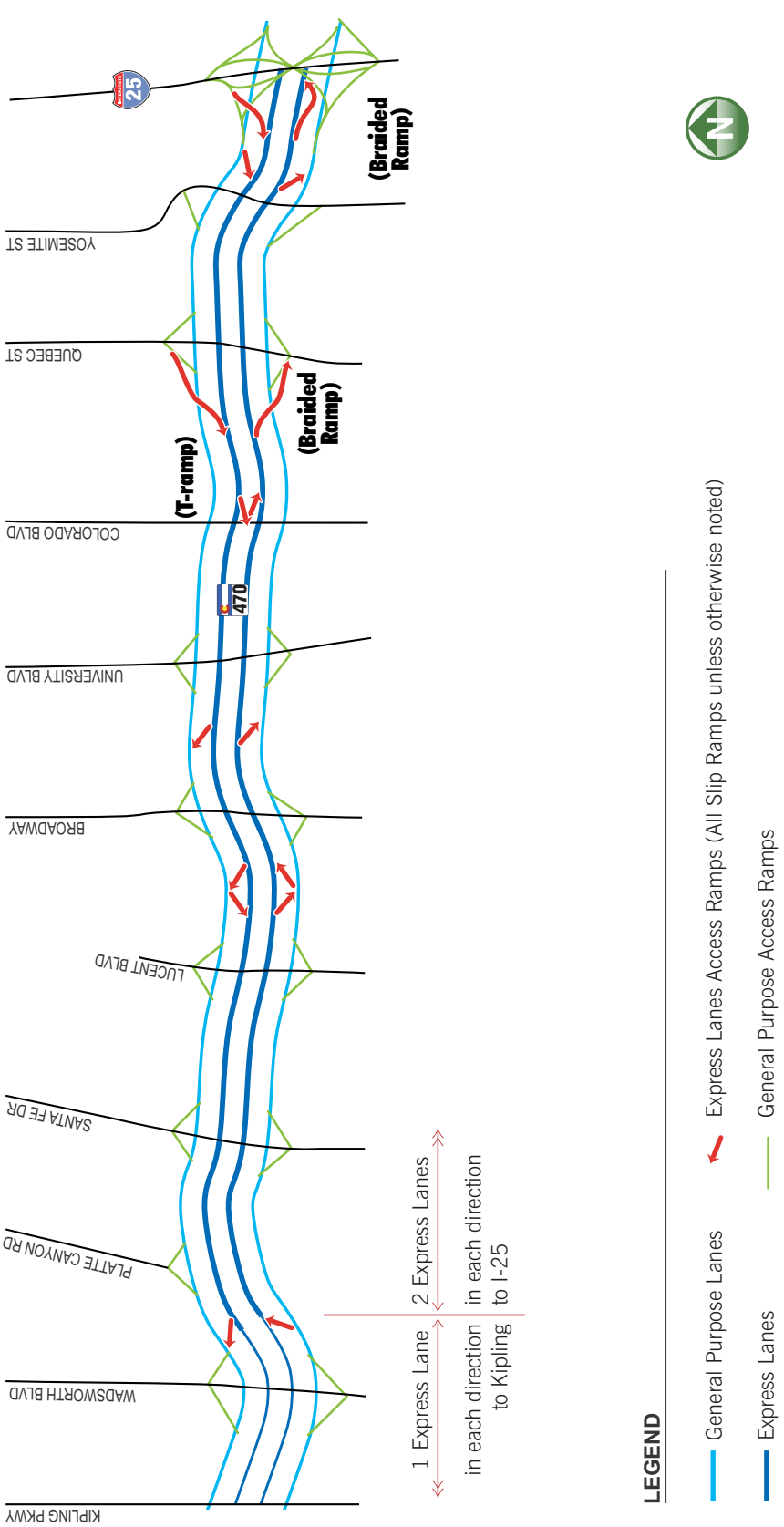
COLORADO BOULEVARD INTERCHANGE. The EL Alternative would add access at Colorado Boulevard to the express lanes only. No access would be provided to the general purpose lanes. A T-ramp interchange configuration would be used to provide direct access to the express lanes to and from the east only (westbound off and eastbound on).

Figure 2-8
Express Lanes Alternative Typical Section



** Typical section from Kipling to Wadsworth does not include buffer separation. Total pavement width is 100'.*

Figure 2-9
Express Lanes Alternative Access Types and Locations



I-25 INTERCHANGE. The I-25 interchange would require substantial reconfiguration to accommodate the EL Alternative. As a result, several configurations were evaluated. The final layout determined to best serve traffic operations for all facilities at the interchange is included in the EL Alternative. The final configuration is shown in **Figure 2-10**. Direct connections are provided to the C-470 express lanes from southbound I-25 and from eastbound express lanes to northbound I-25 to accommodate heavy volumes to and from the north toward Denver. Express lanes access to and from I-25 to the south are accommodated with slip ramp access just east of Yosemite Street.

2.4.3.3 Managed Lanes Concept

The EL Alternative represents an emerging congestion management strategy called managed lanes, which seeks to manage congestion rather than solve it by adding capacity. The concept is to provide an alternative choice to congestion, rather than continuing to add more capacity as traffic increases and the lanes become congested again. The ability to provide a congestion-free facility is greatly enhanced by charging tolls to users, which would provide a mechanism to manage the volume in the lanes and thereby hold congestion to acceptable levels.

Because traffic volumes vary throughout the day, so too would the tolls charged to use the express lanes. During peak periods of heavy congestion, toll prices would be the highest in response to facility demand. During off-peak periods of lighter congestion, the toll would be lowered to reflect less demand. This strategy reflects the concept of value pricing, meaning that the price to use the facility varies in direct relation to the demand for it.

Figure 2-10
I-25 Interchange Express Lanes Alternative

Tolls collected by the facility would be used to pay off bonds issued to fund the capital construction, operation, and maintenance of the facility. The CTE would collect revenues, issue bonds, and construct, operate, and maintain the facility. Detailed information on the philosophy, traffic engineering concepts, roadway design elements, tolling, and financial aspects is contained in the *C-470 Express Lanes Feasibility Study* (June 2005).

Toll Collection System

The express lanes would use electronic toll collection, by employing vehicle-mounted transponders and overhead toll collection gantries. This eliminates the need for traditional toll collection booths and allows drivers to maintain full travel speed. The lack of toll booths would minimize the environmental effects of the alternative due to the smaller footprint required. All drivers using the facility would be required to have a vehicle-mounted transponder to access the express lanes. The C-470 toll collection system would be interoperable with E-470 and Northwest Parkway, so the EXpressToll transponders currently used on these other Denver Metro toll facilities would also work on the C-470 express lanes. Enforcement would be conducted by photo and video surveillance, as well as conventional patrols.

Assumed Toll Schedule

A preliminary toll schedule was developed to estimate revenues and determine potential financial feasibility of the express lanes facility. Toll rates were established in the *C-470 Express Lanes Feasibility Study* (June 2005), based on travel demand and user acceptance, and are consistent with current toll rates on other toll roads in the Denver Metro area. The value of time used in toll diversion modeling is discussed in the *C-470 – Value of Time Analysis Technical Memo* (September 2004). The assumed toll schedule is shown in **Table 2-2**. While the values

Table 2-2
Assumed Toll Schedule

Time Period	Hours	2008 (Opening Year)		2025 (Planning Year)	
		Toll Rate/Mile ($)	Toll ($)	Toll Rate/Mile ($)	Toll ($)
AM Off-Peak	5:00–5:30	0.06	0.71	0.10	1.25
AM Shoulder	5:30–6:30	0.10	1.25	0.14	1.75
AM Peak	6:30–8:00	0.20	2.50	0.29	3.63
AM Shoulder	8:00–9:00	0.10	1.25	0.14	1.75
AM Off-Peak	9:00–12:00	0.06	0.75	0.10	1.25
PM Off-Peak	12:00–2:00	0.06	0.75	0.10	1.25
PM Shoulder	2:00–3:00	0.10	1.25	0.14	1.75
PM Peak	3:00–6:00	0.20	2.50	0.29	3.63
PM Shoulder	6:00–7:00	0.10	1.25	0.14	1.75
PM Shoulder	7:00–10:00	0.06	0.75	0.10	1.25

All dollar amounts are in 2005 dollars.
Through trip assumes travel on the entire 12.5-mile express lanes distance through the C-470 Corridor.

shown in **Table 2-2** reflect those used in the feasibility analysis, the CTE would ultimately determine the actual toll schedule based on additional, more detailed revenue studies that would be conducted if the EL Alternative is implemented.

The revenue analysis conducted for the *C-470 Express Lanes Feasibility Study* (June 2005) assumed a conservative scenario in which all tolls collected were at the lowest, two-axle passenger car rate. In reality, the expected toll structure for a potential express lanes facility would vary by number of axles; public transit buses would ride free, and HOVs would not be exempt from paying tolls. This toll schedule is assumed for planning purposes only; the actual toll schedule that would be charged for a potential facility would be established by the CTE during final design and implementation. The assumed toll schedule consists of three collection periods during weekdays and one period on weekends. The three weekday periods are peak, shoulder, and off-peak, while weekends would have only an off-peak period. The peak period toll rate for a 2008 opening would be $0.20 per mile in 2005 dollars, and the peak period toll rate for 2025 would be $0.29 per mile in 2005 dollars. These rates produce a toll of approximately $2.50 in 2008 and $3.63 in 2025 to travel the entire C-470 Corridor from Kipling Parkway to I-25 (all 2005 dollars).

Signing

Because the EL Alternative consists of two parallel and adjoining facilities, a separate set of signing would be necessary for each of the two roads. Signing of the express lanes would guide drivers to a different set of interchanges than the general purpose lanes, and dynamic message signs would notify express lanes users of projected time savings and toll prices. As a result, the number and intensity of signing on C-470 would be greater with the EL Alternative than with a conventional general purpose lane facility. This would result in two effects: an environment that would require more attention and decision-making by drivers on both roadways, and more intrusion of structural/signing elements into the visual landscape. These effects are discussed in **Sections 3.3.1** and **3.3.15** on transportation and traffic and visual resources, respectively.

2.4.3.4 Mobility Enhancement Elements

Mobility enhancement elements for the EL Alternative would be the same as for the GPL Alternative with a couple exceptions. Two particular differences of note between the two action alternatives are:

- The need for an incident management plan is especially important for the EL Alternative because it represents an unusual scenario where two parallel and adjoining facilities exist. The two facilities present not only the possibility that an incident in one could contribute to an effect on the other, but also, they afford the opportunity for one to provide an alternative relief route for the other. These potential strategies present technical, logistical, and operational challenges that would need to be resolved at a policy level before they could be implemented. The IMP would serve to accomplish this.

- The EL Alternative would require 8.1 miles of trail reconstruction. Other than specific differences at isolated locations along C-470, the trail would generally be relocated north 40 to 50 feet. The new trail layout would be essentially the same for the EL Alternative as it is for the GPL Alternative. The express lanes T-ramps at Colorado Boulevard would not conflict with the trail because they are in the center of the roadway. A separate discussion regarding effects to the C-470 trail is included in **Section 3.3.16**.

2.4.3.5 Cost

The EL Alternative cost was estimated at $385 million. Of this, the Santa Fe Drive interchange cost is $60 million. These costs are in 2005 dollars.

2.4.4 Opportunities for Transit in the C-470 Corridor

RTD believes that commuter service on C-470 might be a viable option if congestion levels are sufficiently reduced to permit reliable service to its patrons. The sections herein discuss how commuter bus service or LRT could be accommodated in each of the action alternatives should RTD choose to do so. It should be clear, however, that commuter bus service and LRT are not explicitly part of either action alternative.

2.4.4.1 Commuter Bus

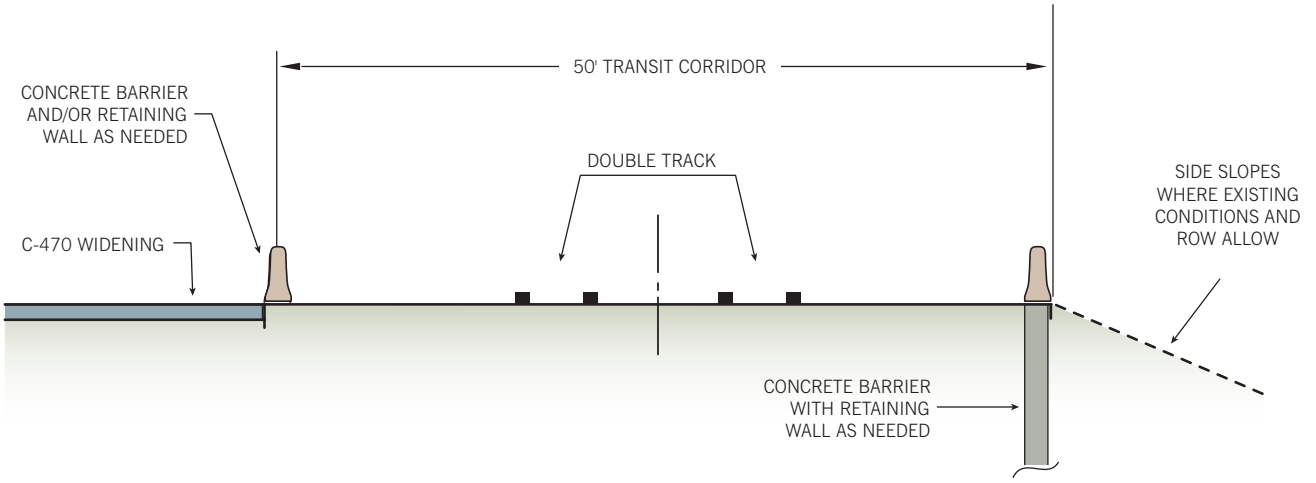
If RTD should choose to operate commuter bus service under the GPL Alternative, it would operate in mixed traffic in the general purpose lanes. As such, it would be subject to any delays that would result from congestion on the lanes. If RTD chooses to operate commuter bus service under the EL Alternative, it would operate in the express lanes. Because the express lanes are specifically managed to maintain LOS C or better, the commuter bus service would not be subject to delays due to congestion. They would, of course, still be subject to delays once they return to mixed traffic in the general purpose lanes.

Although no access to the express lanes is proposed east of the University Boulevard park-n-Ride, access could easily be provided if RTD determined there was sufficient demand. Discussions with RTD indicated there would not be sufficient demand for commuter bus service between University Boulevard and I-25 to warrant access at this time. The rationale was that because the distance is short, potential users would likely prefer to travel on arterial streets to their destinations.

2.4.4.2 Long-Term Light Rail Transit Vision

Although LRT and other forms of fixed-guideway transit were eliminated from consideration during the screening process, CDOT and RTD will continue to work with local agencies to accommodate the potential for future LRT in the C-470 Corridor at a conceptual level. As part of this EA, a cursory assessment of a potential LRT envelope adjacent to C-470 was performed in an effort to assist the City of Lone Tree and Douglas County in future land use planning and ROW preservation. No attempt was made to determine the actual LRT alignment, such as at interchange crossings. The assessment sought only to illustrate where additional ROW may need to be acquired, so that the respective planning departments could work to preserve the corridor as development occurs. A 50-foot LRT typical section was assumed, which accounted for track, platforms, barriers, and fences. **Figure 2-11** shows the assumed typical section used for this conceptual planning effort.

Figure 2-11
Light Rail Transit Typical Section Concept on the C-470 Corridor



The investigation identified several locations in which the conceptual alignment would lie outside of existing CDOT ROW. **Figure 2-12** shows the conceptual LRT alignment in the Corridor. After preliminary engineering, the number of locations requiring additional right-of -way could increase. Further, more ROW would be necessary to accommodate LRT stations and park-n-Ride facilities. A strong reliance on park-n-Ride capacity would be expected in this corridor due to the nature of the residential development patterns. These concepts were presented to and discussed with RTD, the Project Management Team, and Technical Working Group meetings throughout the screening process.

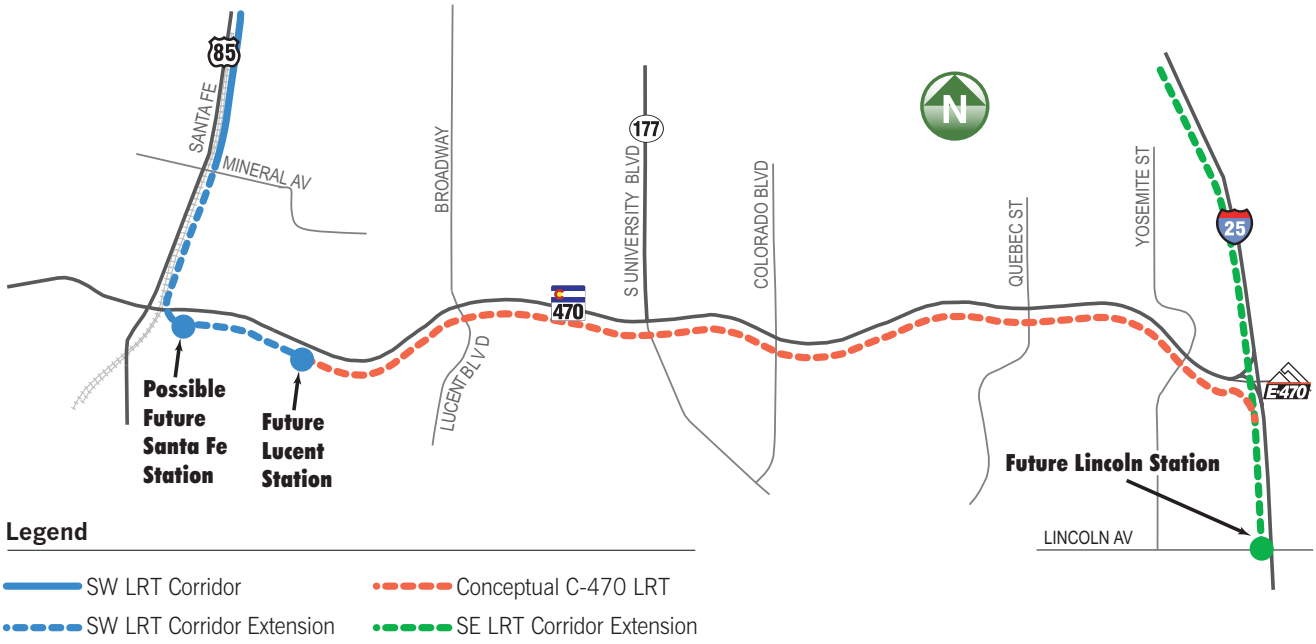
As part of the Master Inter-Governmental Agreement between CDOT and RTD signed in April 2004, CDOT will continue to work with local agencies to accommodate the potential for future light rail in the C-470 Corridor at a conceptual level, based on the following principles:

- Accommodation of a future rail line within the C-470 Corridor ROW should be made to the maximum extent possible so that an envelope might be available for future transit options
- Design of facilities (such as bridge structures or retaining walls) should not purposefully block future transit opportunities

2.5 PREFERRED ALTERNATIVE

Following the environmental analysis of the three alternatives carried forward, as discussed in **Section 2.4**, the FHWA and CDOT identified a Preferred Alternative. This was based on the ability to fund and implement one of the alternatives, as evaluated during the Financial Analysis and Implementation Committee (FAIC) process. This section describes the purpose and findings of the FAIC, and ultimately how the Preferred Alternative was identified.

Figure 2-12
Conceptual Light Rail Transit Alignment on the C-470 Corridor



2.5.1 Financial Analysis and Implementation Committee

The FAIC was developed as a collaborative process with cities, counties, and other agencies within the project area to investigate potential funding strategies for the two action alternatives and provide input to FWHA and CDOT on the identification of the preferred approach for improving C-470. The group was composed of representatives from jurisdictions with a direct financial interest in improvements to C-470 including the FHWA; CDOT; the CTE; the E-470 Public Highway Authority; RTD; Arapahoe, Douglas, and Jefferson Counties; the Cities of Centennial, Littleton, and Lone Tree; the Highlands Ranch Community Association, and the Highlands Ranch Metro District. Over the course of four months, this committee met as a group three times to evaluate potential strategies to create funding partnerships and consider potential mechanisms to fund improvements. Additional one-on-one meetings were also held with individual jurisdiction representatives to better understand funding opportunities and constraints within the context of C-470 improvements.

The FAIC investigated potential funding mechanisms and assessed the extent to which these mechanisms were practicable. The following sections summarize the findings for the two action alternatives.

2.5.1.1 General Purpose Lanes Alternative Funding

The Santa Fe Drive interchange is included in DRCOG's 2030 RTP. However, full funding for the interchange has not currently been identified. Funding for any other part of the GPL Alternative has not been identified and is not included in the RTP.

The primary potential funding source identified during the FAIC for the GPL Alternative was through the formation of a multi-jurisdictional, metro-wide Regional Transportation Authority (RTA) that would be determined by a vote of the people no earlier than November 2007. Through the RTA, participating jurisdictions would assess a sales tax which would be used to pay off bonds for C-470 improvements and other transportation improvements projects throughout the metropolitan area. The ability to implement the GPL Alternative would be demonstrated only if all potential members of the RTA made specific commitments to form the RTA, pursue a referendum for the sales tax, and earmark the necessary revenues specifically for these C-470 improvements. If all of these conditions were to be met, the GPL Alternative could be considered to have a viable funding source and could then be eligible for inclusion in DRCOG's RTP. However, to date these conditions have not yet been met.

2.5.1.2 Express Lanes Alternative Funding

The Santa Fe Drive interchange is included in DRCOG's 2030 RTP. However, full funding for the interchange has not currently been identified. Funding for any other part of the EL Alternative is not included in the RTP.

Based on the financial analysis completed as part of the *C-470 Express Lanes Feasibility Study* (June 2005), tolled revenue could cover approximately 70 to 80 percent of the $325 million capital construction cost of the EL Alternative, after payment of financing, annual operations and maintenance, and future rehabilitation. Refinements made to the express lanes traffic and revenue forecasts during the FAIC process demonstrated that the full $325 million capital cost could be funded with toll revenue. The CTE's detailed financial analysis also indicated that toll revenues could potentially fund the Santa Fe Drive interchange improvements. By demonstrating that toll revenues could fund the initial construction, annual operation and maintenance, and future rehabilitation on the C-470 Corridor, the EL Alternative has a viable funding source, which makes it eligible for inclusion in DRCOG's RTP. Prior to implementation of the tolled EL Alternative, the CTE

would perform an investment grade traffic and revenue study, which is required before funds can be secured for this alternative. Through this effort and procurement of a design/build contractor, the final financing and implementation steps would be formed, including specific strategies for construction phasing that may be necessary to achieve an investment grade rating.

2.5.2 Preferred Alternative Identification

Based on the funding information analyzed during the FAIC process, it was concluded that there is a reasonable expectation that the EL Alternative is financially self-supporting, and therefore is eligible for amendment into the fiscally-constrained DRCOG RTP and subsequent implementation. Financing options for the GPL Alternative are not yet finalized, therefore it is not considered to be implementable at this time.

While both action alternatives meet this project's purpose and need and have comparable environmental effects, only the EL Alternative has the demonstrated ability to be implemented. As a result, the FHWA and CDOT have identified the EL Alternative as the Preferred Alternative.

After the appropriate public review period and public hearing on this EA, the FHWA and CDOT will consider public comments and issue a decision document. If it is determined that the implementation of the Preferred Alternative would not result in significant adverse effects, then the FHWA would issue a Finding of No Significant Impact (FONSI) to finalize the decision to implement the Preferred Alternative. If it is determined that the Preferred Alternative would result in significant negative effects, then an EIS would be initiated. Until the decision document is issued, all of the alternatives are still under consideration and could be selected.

2.6 ALTERNATIVES CONSIDERED BUT ELIMINATED

The alternatives considered in the screening process but eliminated from consideration are summarized in **Table 2-3**. Detailed discussions of each alternative eliminated are contained in the remaining subsections of **Section 2.6**.

2.6.1 Transit

The transit family consisted of fixed guideway and non-fixed guideway alternatives. These technologies included LRT, commuter rail, monorail, MagLev, and bus rapid transit. They require substantial capital investment in infrastructure design and construction and are less compatible with adjacent corridor technologies. RTD's FasTracks plan does not include the extension of any form of fixed guideway transit between the proposed Southwest Corridor LRT Extension and Southeast Corridor LRT line. 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. It was recognized however, that other transit service, such as a commuter bus, is beneficial to the community and can provide some limited congestion relief, as discussed in **Section 2.4.4.1.** A long-term vision for LRT along the C-470 Corridor is discussed in **Section 2.4.4.2**.

2.6.2 Mobility Enhancements

The mobility enhancement family included several minimal action strategies that could contribute to relieving congestion and delay on the C-470 Corridor and improve reliability. Because these strategies in themselves do not have the ability to address the purpose and need, this family was eliminated from further consideration as a stand alone action alternative. Some elements of the family, however, were carried forward for repackaging with the action alternatives. Those elements are discussed with the

Table 2-3
Alternatives Considered But Eliminated

Alternative/Family	Alternative Description	Reason Eliminated
Transit		
Fixed Guideway and Non-Fixed Guideway	LRT, commuter rail, monorail, MagLev, and bus rapid transit	Regional plans, service type, difficulties in serving the dispersed land use base, origin and destination patterns, low potential ridership, cost, and lack of congestion reduction, collectively lead to elimination of this alternative family
Mobility Enhancements		
	The mobility enhancement family included several minimal action strategies that could contribute to relieving congestion and delay and improve reliability	These strategies by themselves do not have the ability to address the purpose and need, so this family was eliminated from further consideration as a standalone action alternative. Some elements of the family were carried forward for repackaging with the action alternatives
	Teleworking. Establish home-based employment programs	Does not provide the ability to divert sufficient numbers of vehicles off of C-470 to effectively reduce congestion and delay and improve reliability
	Variable Work Hours. Alternative work hours made available by major employment centers in the region	Does not provide the ability to divert sufficient numbers of vehicles off of C-470 to effectively reduce congestion and delay and improve reliability
	Incentives and Subsidies. Employer and employee-based rewards, cash, time off, or recognition for commuters	Does not provide the ability to divert sufficient numbers of vehicles off of C-470 to effectively reduce congestion and delay and improve reliability
	Connective Transit Service. Linkage to transit services within the C-470 Corridor, such as park-n-Rides and LRT stations, with a bus feeder system	Does not provide the ability to divert sufficient numbers of vehicles off of C-470 to effectively reduce congestion and delay and improve reliability
	Transportation Management Organizations. Cooperate with employers, residents, and homeowners associations to support and encourage transportation programs that reduce traffic congestion and offer commuters viable options	The Southeast Business Partnership already serves as southeast Denver's Transportation Management Association and could expand its outreach to the C-470 Corridor
	Ramp Metering. Monitors and manages traffic flow on freeways by metering on-ramp flows	Ramp metering is already in place on the corridor

Table 2-3
Alternatives Considered But Eliminated (Continued)

Alternative/Family	Alternative Description	Reason Eliminated
Mobility Enhancements (continued)		
	Parking Information System. Employ signing to indicate remaining capacity at parking facilities	Emerging technology to implement this system is not well proven
	Telecommunication. Computerized electronics that connect a driver or a vehicle to external services, such as navigation systems, pricing, and emergency signals	Does not provide the ability to divert sufficient numbers of vehicles off of C-470 to effectively reduce congestion and delay and improve reliability
	Improved Bicycle/Pedestrian Trails. Provide connections between the C-470 trail and other trails in nearby communities	Existing or improved trail system would not generate sufficient usage to reduce congestion and delay on C-470 to improve reliability
	Marketing/Promotion for Bicycle/ Pedestrian Trails	Does not provide the ability to divert sufficient numbers of vehicles off of C-470 to effectively reduce congestion and delay and on C-470 to improve reliability
General Purpose Lanes Family		
Six-Lane General Purpose Lanes Alternative	Could be implemented within the existing median without widening to the outside	Existing and future traffic volumes produce operations from LOS D to F during peak hours, resulting in unpredictable travel times
Six-Lane General Purpose Lanes with Auxiliary Lanes Alternative	Same as Six-Lane GPL Alternative but with a 12-foot auxiliary lane in each direction	The auxiliary lanes provide some congestion relief, but it does not provide active management of reliability, especially between Quebec Street and Broadway
Six-Lane General Purpose Lanes with HOV Lanes Alternative	Same as Six-Lane GPL Alternative, but an HOV Lane is added	Low usage of HOV lanes results in minimal improvement of congestion over the Six-lane GPL Alternative. Reliability in HOV Lanes can not be actively managed
Six-Lane General Purpose Lanes with Auxiliary and HOV Lanes Alternative	This alternative combines the capacity improvements of the Six-Lane GPL with Auxiliary Lanes Alternative with an HOV Lane	Operations are only slightly improved over the Six-Lane GPL Alternative. No active management of reliability
Eight-Lane General Purpose Lanes Alternative	Four general purpose lanes in each direction	Operations were good except in the highest-volume segments where they broke down. No active management of reliability

Table 2-3
Alternatives Considered But Eliminated (Continued)

Alternative/Family	Alternative Description	Reason Eliminated
Express Lanes Family		
Reversible Express Lanes	Two lanes in between the general purpose lanes, in which the direction of travel can be reversed to accommodate the peak period flows	Because the express lanes are only available to one direction of travel, the volumes are effectively cut in half, as are the revenues. The feasibility is marginally reduced. High volumes in opposite direction of travel experience no benefit
2-Lane Express Lanes	A single express lane in each direction, buffer separated	The addition of a single lane in each direction would not provide enough capacity to meet the project's purpose and need. Revenues are cut in half with this alternative, negating the cost savings. The inability to pass slower vehicles makes it less attractive to potential customers and further reduces revenue
Express Lanes Access Locations		
Platte Canyon Road	N/A	As a minor interchange, Platte Canyon Road did not attract sufficient numbers of users
Santa Fe Drive	N/A	Only moderate demand was forecasted at Santa Fe Drive, which was more than offset by complexity and cost of providing access. Slip ramps could not provide adequate operations, and direct ramps were too costly
University Boulevard	N/A	Average peak hour express lanes ramp volumes at University Boulevard were moderate compared to others
Yosemite Street	N/A	The proximity to Quebec Street and I-25 made it infeasible to provide access
Santa Fe Interchange Family		
Split Diamond Interchange	Split Diamond with west ramps at Santa Fe Drive and east ramps at Blakeland to redistribute traffic	Required additional signalized intersections on County Line Road. Larger footprint was undesirable due to increased environmental effects
Three-Level Diamond Interchange (a)	Northbound and southbound through movements would be separated from turning movements by placing them on flyover structures above a standard diamond interchange	The lane configuration at the Santa Fe Drive/Blakeland Drive intersection precludes certain movements or adds separate signal phases that were undesirable

Table 2-3
Alternatives Considered But Eliminated (Continued)

Alternative/Family	Alternative Description	Reason Eliminated
Santa Fe Interchange Family (continued)		
Three-Level Diamond Interchange (b)	This variation of the Three-Level Diamond Interchange (a) Alternative extends the through-lane bypass beyond the Santa Fe Drive/Blakeland Drive intersection	Higher cost, effects to existing railroad bridges south of the Santa Fe Drive/ Blakeland Drive intersection, and effects to Chatfield State Park were more severe than other alternatives
Southwest Partial Cloverleaf Interchange	A loop ramp in the southwest quadrant of the interchange for the southbound to eastbound movement	LOS at County Line Road and C-470 ramp terminal intersections is not greatly improved. Eastbound on-ramp traffic would have difficulty merging with C-470 traffic due to steep grade and lower entrance speed. Eastbound off-ramp terminal would be too close to Blakeland Drive. Extensive effects at Chatfield State Park were more severe than other alternatives
Southwest Partial Cloverleaf Interchange with One Flyover	A variation of the Southwest Partial Cloverleaf, with the addition of a flyover ramp for the northbound to westbound movement	This alternative resulted in the same operational and environmental issues as the Southwest Partial Cloverleaf. The flyover did not improve operations sufficiently to change the disposition
Southwest Partial Cloverleaf Interchange with Two Flyovers	A variation of the Southwest Partial Cloverleaf, with the addition of two flyover ramps for the northbound to westbound and eastbound to northbound movements	This alternative provides optimal operations for three of the four movements at this interchange, but it resulted in the greatest environmental effects, especially at Chatfield State Park. The operational improvement of the northbound to westbound flyover was not sufficient to warrant the additional effects
Improved Diamond Interchange	An expanded version of the existing interchange. Add lanes to Santa Fe Drive over C-470 and improve signal phasing at ramp intersections	The operation of this alternative is less than optimal and by itself does not meet the congestion and delay aspects of the project's purpose and need
Improved Diamond with Two Flyovers	A variation of the Improved Diamond, with flyover ramps for northbound to westbound and eastbound to northbound movements	The operational improvement of the northbound to westbound flyover was not sufficient to warrant the additional environmental effects to the Wolhurst Community
Single Point Urban Interchange	All through- and left-turning movements at this interchange would converge at a single traffic signal on a raised structure above C-470	This alternative could not provide sufficient operational results. Size and cost of structure required, and difficulty to construct while maintaining traffic were all greater than other alternatives

Table 2-3
Alternatives Considered But Eliminated (Continued)

Alternative/Family	Alternative Description	Reason Eliminated
Santa Fe Interchange Family (continued)		
Single Point Urban Interchange with One Flyover	A variation of the Single Point Urban Interchange, with one flyover for the southbound to eastbound movement	This alternative provides optimal operations. However, the size and cost of required structure and difficulty to construct while maintaining traffic outweighed the operational benefits
Single Point Urban Interchange with Two Flyovers	A variation of the Single Point Urban Interchange, with two flyovers for the southbound to eastbound and northbound to westbound movements	Northbound to westbound flyover was not necessary to achieve adequate traffic operations
SW/NE Partial Cloverleaf Interchange (a)	Loop ramps in the southwest and northeast quadrants for southbound to eastbound and northbound to westbound movements	The loop ramp in the northeast quadrant did not meet design standards for safety and speed requirements. Westbound C-470 would intersect with County Line Road rather than Santa Fe Drive, adding traffic to the Santa Fe Drive/County Line Road intersection
SW/NE Partial Cloverleaf Interchange (b)	Same as the SW/NE Partial Cloverleaf (a) except the Santa Fe Drive alignment was shifted west to improve the northeast loop geometry	The westerly shift to Santa Fe Drive resulted in adverse effects to the Wolhurst Community
SW/NE Partial Cloverleaf Interchange (c)	Same as the SW/NE Partial Cloverleaf (a) and (b), except the Santa Fe Drive alignment was shifted further west to provide direct access ramps from C-470 to Santa Fe Drive	The westerly shift to Santa Fe Drive resulted in adverse effects to the Wolhurst Community. Design inadequacies included a substandard NE loop ramp and substandard intersection spacing between County Line Road and the westbound exit ramp intersection
SW/NW Partial Cloverleaf Interchange	Loop ramps in both the northwest and southwest quadrants. Northwest loop allows direct access from westbound C-470 to northbound Santa Fe Drive without an additional intersection	The Santa Fe Drive alignment was shifted east to provide room for the northwest loop ramp. The resulting design for the loop ramp in the northwest quadrant did not meet design standards for safety and speed
Directional Interchange	Flyover ramps would handle all left-turns; right turns would be accomplished with free-flow right turns, eliminating signalized intersections	Future traffic volumes do not warrant fully directional ramps for all intersection movements. This alternative does not provide relief for the Santa Fe Drive/ Blakeland Drive and Santa Fe Drive/ County Line Road intersections

Table 2-3
Alternatives Considered But Eliminated (Continued)

Alternative/Family	Alternative Description	Reason Eliminated
I-25 Interchange Family		
I-25 Direct Connection A	This alternative includes a direct connection from southbound I-25 to westbound express lanes and eastbound express lanes to the existing northbound I-25 flyover ramp. No connection is provided from northbound I-25 to westbound C-470 express lanes or from eastbound C-470 express lanes to southbound I-25	This alternative by itself was not feasible to provide adequate operations to and from I-25. However, this concept was combined with Slip Ramp Alternative B to provide express lanes access to I-25 to and from the south
I-25 Direct Connection B	This alternative is a variation of Alternative A, but with a direct connection from southbound I-25 to the westbound C-470 express lanes. This alternative provides a separate flyover for eastbound C-470 express lanes to northbound I-25, bypassing the existing C-470 ramps	As in Alternative A, this concept does not include a direct connection from northbound I-25 to westbound C-470 express lanes or from eastbound C-470 express lanes to southbound I-25
I-25 Direct Connection C	This alternative varies slightly from Alternative A, but it lacks access to Yosemite Street from the eastbound express lanes	Contains substandard geometry
I-25 Direct Connection D	This alternative varies slightly from Alternative B, and consists of a separate flyover for eastbound C-470 express lanes to northbound I-25	As with Alternative C, the ramp geometry is substandard
I-25 Slip Ramp Alternative A	Slip ramps provide full access to and from the express lanes between Yosemite Street and the existing directional interchange at C-470 /I-25	Inability to serve traffic to and from Yosemite Street
I-25 Slip Ramp Alternative B	Similar to Slip Ramp Alternative A, but has full access to and from the express lanes west of I-25 from the general purpose lanes. Because the slip ramps are located further west than in Alternative A, this alternative allows access to and from Yosemite Street and I-25 traffic	This alternative by itself was determined not feasible to provide adequate operations to and from I-25. However, this concept was combined with Direct Connection Alternative A to provide access to I-25 to and from the south
I-25 Slip Ramp Alternative with Westbound Collector Distributor	With the introduction of a westbound collector-distributor, this modification of Slip Ramp Alternative A provides access to and from Yosemite Street	Although an improvement over the other slip ramp alternatives, it does not provide adequate operations for all movements to and from I-25

action alternatives. Elements eliminated from further consideration are shown here.

- Telecommuting. Establish home-based employment programs
- Variable Work Hours. Alternative work hours made available by major employment centers in the region
- Incentives and Subsidies. Employer and employee-based rewards, cash, time off, or recognition for commuters
- Connective Transit Service. Linkage to transit services within the C-470 Corridor, such as park-n-Rides and LRT stations, with a bus feeder system
- Transportation Management Organizations. Works with employers, residents, and homeowners associations to support and encourage transportation projects and programs that reduce traffic congestion and offer commuters viable options
- Parking Information System. Employ signing to indicate remaining capacity at parking facilities
- Telecommunication. Computerized electronics that connect a driver or a vehicle to external services, such as navigation systems, pricing, and emergency signals
- Traffic Management Centers. Monitors roadway conditions to coordinate traffic control, emergency response and warning systems, roadbed sensors, and traveler information

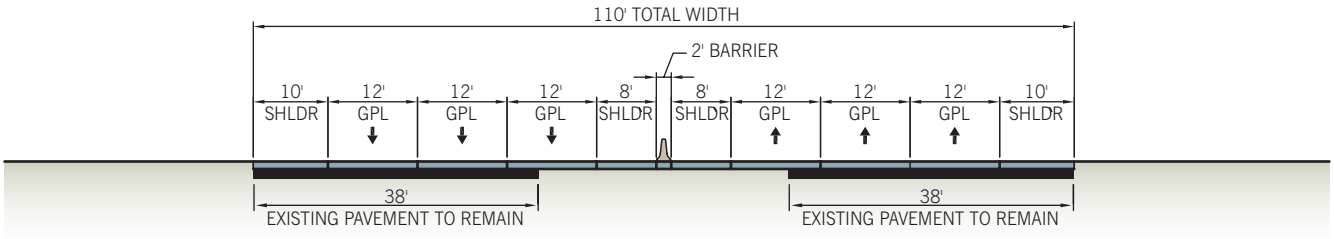
2.6.3 General Purpose Lane Alternatives

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

2.6.3.1 Six-Lane General Purpose Lanes Alternative

The typical section for the Six-Lane GPL Alternatives consists of three 12-foot lanes in each direction, with 10-foot shoulders and a barrier median, as shown in **Figure 2-13**. Generally, this set of alternatives had the distinct advantage of ease of implementation; most variations of it could be implemented within the existing median without widening to the outside. This alternative affords minimal relief to congestion and delay and it does not provide the means to actively manage reliability. Current and projected traffic volumes indicate that operational LOS for the C-470 Corridor will range from LOS D to F during peak hours, resulting in unpredictable travel times for all but 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

Figure 2-13
Six-Lane General Purpose Lanes Alternative



the majority of the Corridor because it does not meet the project's purpose and need, nor does it provide the means by which to actively manage reliability.

2.6.3.2 Six-Lane General Purpose Lanes with Auxiliary Lanes Alternative

This alternative is the same as the Six-Lane GPL Alternative but with the addition of a 12-foot auxiliary lane in each direction, as shown in **Figure 2-14**. The auxiliary lanes act as continuous acceleration/deceleration lanes between interchanges and facilitate better traffic operations at interchanges, thus increasing capacity. While the addition of auxiliary lanes provides some additional congestion relief, operationally, the facility would still only achieve LOS E on several segments, thus it still does not address the project's reliability goal, nor does it provide active management of reliability. Because the congestion relief was not determined significant enough to create consistently reliable travel times on the C-470 Corridor, especially between Quebec Street and Broadway, this alternative was eliminated from further consideration because it does not meet the project's purpose and need.

2.6.3.3 Six-Lane General Purpose Lanes with High-Occupancy Vehicle Lanes Alternative

This alternative includes the addition of one 12-foot HOV lane in each direction to the Six-Lane GPL Alternative, as shown in **Figure 2-15**. 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.

Figure 2-14
Six-Lane General Purpose Lanes with Auxiliary Lanes Alternative

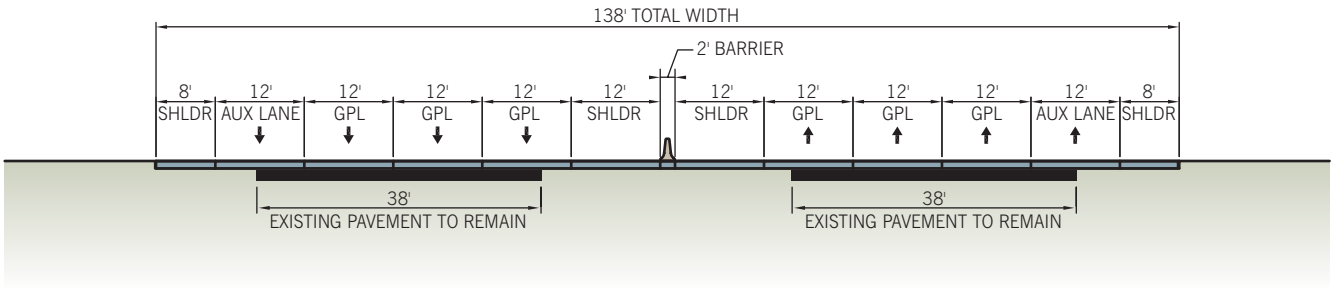
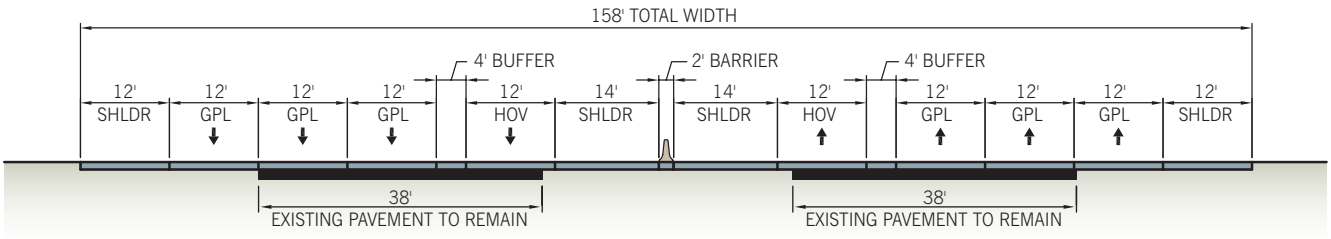


Figure 2-15
Six-Lane GPL with High-Occupancy Vehicle Lanes Alternative



2.6.3.4 Six-Lane General Purpose Lanes with Auxiliary and High-Occupancy Vehicle Lanes Alternative

This alternative combines the capacity improvements of the Six-Lane GPL with Auxiliary Lanes Alternative with one 12-foot HOV lane in each direction, as shown in **Figure 2-16**. 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.

2.6.3.5 Eight-Lane GPL Alternative

The Eight-Lane GPL Alternative is the same as the Six-Lane GPL Alternative, but with the addition of one additional 12-foot lane in each direction, as shown in **Figure 2-17**. This alternative provides comparable operational improvements to the Six-Lane GPL with Auxiliary Lanes Alternative. However, the Eight Lane GPL Alternative provides four continuous lanes in each direction. Traffic volume forecasts indicate that this alternative provides optimal traffic operations for western sections of the corridor (Santa Fe Drive to Wadsworth Boulevard) during the peak period, with operational breakdown in the highest-volume segments between Quebec Street and Santa Fe Drive. Because an eight-lane typical section addresses the purpose and need for part of the corridor, it was included in the GPL Alternative from Santa Fe Drive to Wadsworth Boulevard. 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.

2.6.4 Express Lanes Alternatives

All express lane alternatives discussed here assume four general purpose lanes are included in the alternative. In other words, the express lanes element would essentially be added to the existing four-lane general purpose lanes. Further, each alternative has varying access

Figure 2-16
Six-Lane General Purpose Lanes with Auxiliary and High-Occupancy Vehicle Lanes Alternative

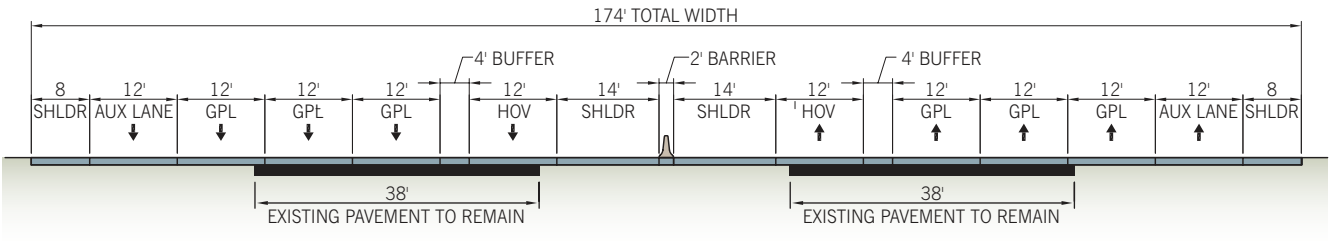
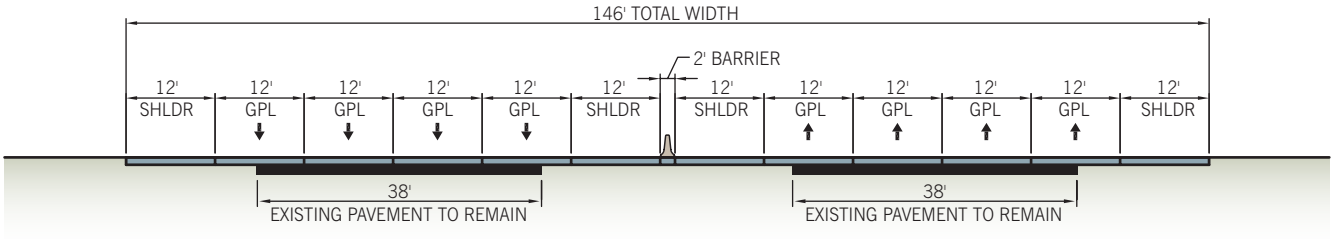


Figure 2-17
Eight-Lane General Purpose Lanes



types and locations. Express lanes feasibility was studied in the *C-470 Express Lanes Feasibility Study* (June 2005).

2.6.4.1 Reversible Express Lanes Alternative

Forecasted 2025 volumes showed no distinct directional split, indicating that the demand for the facility was approximately the same in both directions. As a result, the reversible lanes concept is less appropriate to handle the volumes in both directions. Usually this approach works only when the volumes are heavy in one direction and light in the other, thus allowing the facility to be reversed in the middle of the day. A typical reversible lanes facility is shown in **Figure 2-18**. By building only half of the express lanes facility, the construction cost would also be approximately half. However, only half the volumes and revenue are realized. Because revenue generation was determined insufficient to construct, maintain, and operate the facility, this concept was eliminated from further consideration.

2.6.4.2 Two-Lane Express Lanes Alternative

Another variation of the express lanes studied was a two-lane concept (one lane in each direction), as shown in **Figure 2-19**. As with the Reversible Express Lanes Alternative, the construction, operation, and maintenance costs would be about half. This single-lane section does not provide the capacity and operational improvements to meet the project's purpose and need. It would also not provide the reliability that is expected in an express lanes facility because it does not provide the opportunity for slower vehicles to be passed. As a result, the demand for these express lanes was considerably less, offsetting the cost savings and making this alternative not feasible. It was therefore eliminated from further consideration.

2.6.4.3 Express Lanes Access Locations

The screening of access locations sought to evaluate existing and proposed interchange locations to determine the locations that had enough demand to warrant access to the express lanes. Access locations were screened in three steps, with an increasing level of detail. The

Figure 2-18
Reversible Express Lanes Alternative

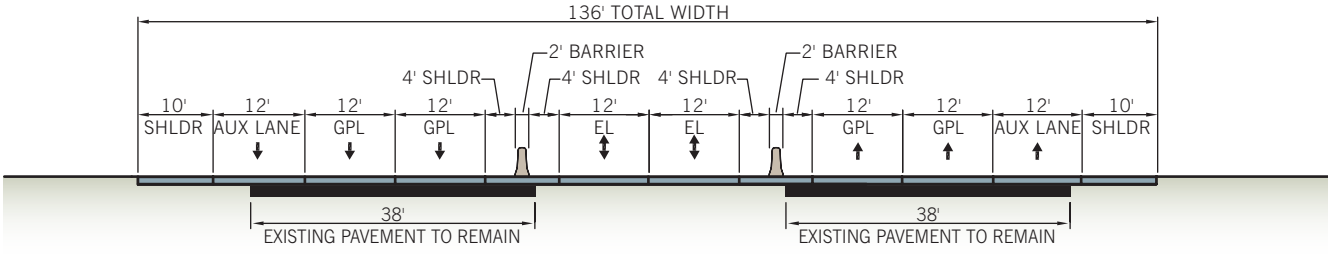
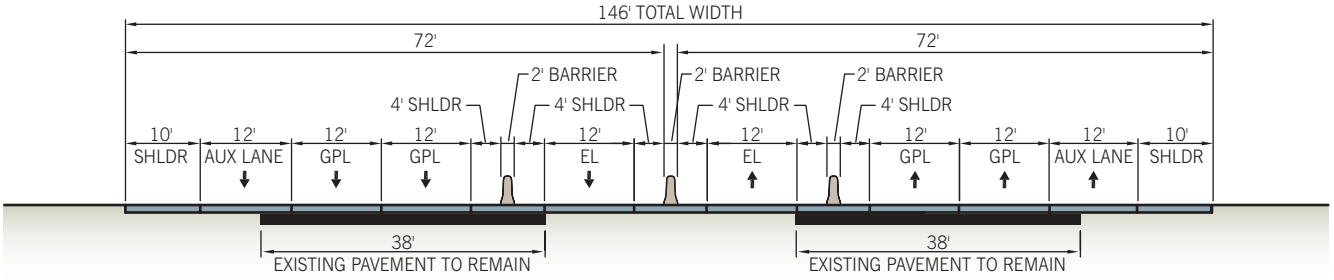


Figure 2-19
Two-Lane Express Lanes Alternative



locations eliminated during the screening process are described below.

Platte Canyon Road

As a minor interchange, Platte Canyon Road did not attract sufficient numbers of users, and was therefore eliminated from consideration.

Santa Fe Drive

Based on model results, average AM and PM peak hour ramp volumes to and from the express lanes at Santa Fe Drive were moderate compared to other interchange locations. Slip ramp access did not provide acceptable traffic operations due to the seven percent grade and proximity of the Lucent Boulevard interchange. Braided ramps were too costly for the lower volume of traffic that would be served. The presence of both freight and light rail combined with other topographic constraints caused the braided ramps to be too complex.

University Boulevard

Average peak hour express lanes ramp volumes at University Boulevard were moderate compared to others. A strong consideration was the RTD park-n-Ride location in the southwest quadrant. However, due to the short trip length from University Boulevard to I-25, RTD did not feel that access at University Boulevard was critical, especially if access would be provided further east and west for longer trips through the C-470 Corridor. Ultimately, this location was eliminated from further consideration because it did not attract enough drivers to the express lanes.

Yosemite Street

Because of the proximity of Yosemite Street to Quebec Street and I-25, it was not feasible to provide access. Slip ramps are proposed in the vicinity of I-25, but for the purpose of access to Quebec Street and I-25, not Yosemite Street.

2.6.5 Santa Fe Drive Interchange Alternatives

Although this EA generally studied mainline congestion and reliability more so than interchanges, the Santa Fe Drive interchange is unique in that it currently has severe congestion and safety issues. For these reasons, new interchange configurations were studied at Santa Fe Drive to address congestion, delay, and safety. Numerous alternatives were developed and modified through the screening process. The following sections discuss the alternatives eliminated from further consideration.

2.6.5.1 Split Diamond Interchange Alternative

The Split Diamond Interchange Alternative was developed to alleviate extreme congestion at the Santa Fe Drive/County Line Road intersection. This concept would split access between two locations – Santa Fe Drive and the Blakeland Drive Extension. **Figure 2-20** shows the concept. Traffic volume projections indicate that this alternative operates well during the peak hour. However, as a function of the interchange

Figure 2-20
Split Diamond Interchange Alternative

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Planned Southwest Corridor Light Rail Extension — Flyovers — Roadway

operation, the Blakeland Drive Extension and additional signalized intersections along the C-470 Corridor and on County Line Road would be a necessary part of the design, and thus would be included in this alternative. As such, this resulted in a larger impact footprint and additional cost, as compared to other alternatives. This alternative was therefore eliminated from further consideration.

2.6.5.2 Three-Level Diamond Interchange (a) Alternative

The Three-Level Diamond Interchange Alternative was developed to produce additional capacity at the County Line Road and C-470 ramp intersections by elevating through traffic on a structure. **Figure 2-21** illustrates this concept. The operational characteristics of this alternative successfully achieve the congestion and safety goals north of the interchange, but the lane configuration at the Santa Fe Drive/ Blakeland Drive intersection precludes movements or adds separate signal phases that were undesirable from an operational perspective. For this reason, the alternative was eliminated from further consideration.

2.6.5.3 Three-Level Diamond Interchange (b) Alternative

This is a variation of the Three-Level Diamond Interchange (a) Alternative, but extends the through-lane bypass beyond the Santa Fe Drive/ Blakeland Drive intersection, as shown in **Figure 2-22**. While this concept bypasses two troublesome intersections and achieves operational goals for the interchange and arterial street intersections, it requires an extensive structure, resulting in higher construction costs. Ultimately, the unavoidable effects at Chatfield State Park led this alternative to be eliminated from further consideration.

Figure 2-21
Three-Level Diamond Interchange (a) Alternative

Figure 2-22
Three-Level Diamond Interchange (b) Alternative

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Planned Southwest Corridor Light Rail Extension — Flyovers — Roadway

2.6.5.4 Southwest Partial Cloverleaf Interchange Alternative

The Southwest Partial Cloverleaf Interchange, as shown in **Figure 2-23**, consists of a diamond interchange with the exception of the southbound to westbound movement, which is handled by a loop ramp in the southwest quadrant. This alternative was eliminated primarily because of its extensive effects on Chatfield State Park. Other considerations were carefully weighed, as this alternative was more desirable for many local area stakeholders during the screening process. This alternative would not alleviate congestion at the County Line Road and C-470 ramp terminal intersections as well as the other alternatives that would remove southbound to eastbound traffic. Operations on C-470 and Santa Fe Drive would be adversely affected because the loop ramp would reduce vehicle speeds to 25 mph. More importantly, the loop ramp would merge onto eastbound C-470 at the bottom of a steep incline just east of Santa Fe Drive, which would further degrade traffic operations at this interchange. The eastbound off-ramp terminal intersection would need to be shifted further south to accommodate the loop ramp. This reduces the spacing of the eastbound ramp terminal and Blakeland Drive intersections along Santa Fe Drive from approximately 1,000 feet to approximately 500 feet. One positive aspect of this alternative is that it would not include the visual effects of the flyover. This factor, however, did not outweigh the other negative characteristics.

2.6.5.5 Southwest Partial Cloverleaf Interchange with One Flyover Alternative

This configuration is a variation of the Southwest Partial Cloverleaf Interchange, with the addition of a flyover ramp to allow free movement for northbound to westbound traffic. The configuration is shown in **Figure 2-24**. Similar to the Southwest Partial Cloverleaf, this alternative was

Figure 2-23
Southwest Partial Cloverleaf Interchange Alternative

Figure 2-24
Southwest Partial Cloverleaf Interchange with One Flyover Alternative

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eliminated due to its effects on Chatfield State Park as well as the other considerations discussed under the Southwest Partial Cloverleaf Interchange Alternative.

2.6.5.6 Southwest Partial Cloverleaf Interchange with Two Flyovers Alternative

This interchange alternative is also similar to the Southwest Partial Cloverleaf Interchange, with the addition of two flyover ramps providing free movements for the northbound to westbound movements and eastbound to northbound movements, as shown in Figure 2-25. While this alternative provides optimal operations for three of the four directional movements at this interchange, it also resulted in the greatest environmental effects of all the alternatives considered, especially at Chatfield State Park. Also, the second flyover is not necessary to achieve acceptable traffic operations and was therefore eliminated from further consideration.

2.6.5.7 Improved Diamond Interchange Alternative

This alternative consists of an expanded version of the existing interchange configuration, achieved by widening Santa Fe Drive over C-470 and improving the geometry and signal phasing at ramp intersections, as shown in Figure 2-26. The benefit of this concept is the small design footprint. However, the operation of this alternative is less than optimal and by itself does not meet the congestion and delay aspects of the purpose and need. This alternative was therefore eliminated from further consideration.

2.6.5.8 Improved Diamond Interchange with Two Flyovers Alternative

This alternative is a variation of the Improved Diamond Interchange, but with the addition of flyover ramps that would provide free movements for southbound to eastbound movements and northbound to westbound movements as shown in Figure 2-27. This alternative would meet the

Figure 2-25
Southwest Partial Cloverleaf Interchange with Two Flyovers Alternative

Figure 2-26
Improved Diamond Interchange Alternative

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operational goals for the interchange and local adjacent street intersections. The flyover ramps would provide the opportunity to implement interchange improvements in phases, as congestion increases and as funding is procured. The northbound to westbound flyover is not necessary to achieve acceptable traffic operations through the horizon year 2025. This alternative was therefore eliminated from further consideration. However, CDOT recognizes that beyond 2025, congestion levels at this interchange could result in poor traffic operations, and may reconsider adding the northbound to westbound flyover as part of a separate action at a later date. Future planning in this area that would not preclude construction of this northbound to westbound flyover would be desirable.

2.6.5.9 Single Point Urban Interchange Alternative

This alternative was developed as an alternative to the Improved Diamond Interchange, by which all through- and left-turning movements at this interchange would converge at a single traffic signal on a raised structure above C-470, as shown in **Figure 2-28**. Like the Improved Diamond Interchange, this alternative would also have a small footprint with few environmental effects. Although very minimally, this alternative would impact the northeast corner of Chatfield State Park. Because the alternative would not provide optimal operation, it was combined with the flyover concept. Ultimately, this alternative was eliminated from further consideration because of the size and cost of the structure required, and its difficulty to construct.

2.6.5.10 Single Point Urban Interchange with One Flyover Alternative

This alternative is a variation of the Single Point Urban Interchange Alternative, with the addition of one flyover to accommodate the southbound to eastbound movement, as shown in **Figure 2-29**. Operationally, this alternative performs equally as well as the Improved Diamond with One Flyover Alternative, while the effects to Wolhurst and Chatfield State Park

Figure 2-27
Improved Diamond Interchange with Two Flyovers Alternative

Figure 2-28
Single Point Urban Interchange Alternative

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Planned Southwest Corridor Light Rail Extension — Flyovers — Roadway

were slightly higher. Comparatively, however, the size and cost of the required structure and construction difficulty outweighed the benefits for this alternative. This alternative was therefore eliminated from further consideration.

2.6.5.11 Single Point Urban Interchange with Two Flyovers Alternative

This alternative is also a variation of the Single Point Urban Interchange Alternative, with the addition of two flyovers to accommodate southbound to eastbound and northbound to westbound movements, as shown in **Figure 2-30**. While this alternative performed better operationally than the first two Single Point Urban Interchange Alternatives, and would meet the goals for the interchange and adjacent arterial intersections, it resulted in additional environmental effects to Chatfield State Park and the Wolhurst Community. It was also determined that the northbound to westbound flyover was not necessary to achieve adequate traffic operations. This alternative was therefore eliminated from further consideration.

2.6.5.12 Southwest-Northeast Partial Cloverleaf Interchange (a) Alternative

This alternative consists of loop ramps in the southwest and northeast quadrant of the interchange providing free movements for southbound to eastbound and northbound to westbound traffic, as shown in **Figure 2-31**. This alternative was eliminated because the loop ramp in the northeast quadrant did not meet design standards for safety and speed requirements. Under this alternative, westbound C-470 does not directly access Santa Fe Drive. Instead, the exit ramp was aligned to access County Line Road, adding trips to the Santa Fe Drive/County Line Road intersection.

Figure 2-29
Single Point Urban Interchange with One Flyover Alternative

Figure 2-30
Single Point Urban Interchange with Two Flyovers Alternative

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Planned Southwest Corridor Light Rail Extension — Flyovers — Roadway

2.6.5.13 Southwest-Northeast Partial Cloverleaf Interchange (b) Alternative

This alternative consists of loop ramps in the southwest and northeast quadrant of the interchange providing free movements for southbound to eastbound and northbound to westbound C-470 traffic, as shown in **Figure 2-32**. To get the northeast loop to meet design standards and fit between Santa Fe Drive mainline and the railroads, the Santa Fe Drive alignment was shifted to the west, closer to the Wolhurst Community. This alternative was eliminated due to potential effects to the Wolhurst Community, and a lack of a direct connection from C-470 to Santa Fe Drive, as with the Partial Cloverleaf Interchange (a) Alternative.

2.6.5.14 Southwest-Northeast Partial Cloverleaf Interchange (c) Alternative

This alternative consists of the same loop ramps in the southwest and northeast quadrants as in the Partial Cloverleaf Interchange (a) and (b) alternatives. This design was developed to provide direct access to Santa Fe Drive from westbound C-470, as shown in **Figure 2-33**. To achieve the direct access, the Santa Fe Drive alignment was shifted to the west. In addition, the design resulted in a substandard northeast

Figure 2-31
Southwest-Northeast Partial Cloverleaf Interchange (a) Alternative

Figure 2-32
Southwest-Northeast Partial Cloverleaf Interchange (b) Alternative

Figure 2-33
Southwest-Northeast Partial Cloverleaf Interchange (c) Alternative

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loop ramp. This alternative was eliminated due to potential effects to the Wolhurst Community, the substandard loop ramp, and substandard intersection spacing between County Line Road and the westbound exit ramp intersection.

2.6.5.15 Southwest-Northwest Partial Cloverleaf Interchange Alternative

This alternative consists of loop ramps in both the northwest and southwest quadrants of the interchange, as shown in **Figure 2-34.** This concept still provides a free movement for the southbound to eastbound traffic. The northwest loop ramp allows for direct access from westbound C-470 to southbound Santa Fe Drive without the conflict of an additional intersection. To achieve this design, the Santa Fe Drive alignment was shifted east to provide room for the northwest loop ramp. The resulting design for the loop ramp in the northwest quadrant did not meet design standards for safety and speed requirements. This alternative was eliminated because safety and speed requirements could not be met with this design.

2.6.5.16 Directional Interchange Alternative

This alternative consists of flyover ramps connecting all left-turning movements between C-470 and Santa Fe Drive, while right turns would be accomplished through right exit ramps. Access to and from County Line Road and Blakeland Drive would still require left turn movements at signalized intersections at the existing ramp terminals. However, the volumes at these intersections would be greatly reduced. The concept is shown in **Figure 2-35**. This alternative was eliminated because future traffic volumes do not warrant fully directional ramps. It also does not provide relief for the Santa Fe Drive/Blakeland Drive and Santa Fe Drive/County Line Road intersections, and requires that signalized intersections remain at these locations.

2.6.6 I-25 Interchange Alternatives

As a function of express lanes access at the I-25 interchange, seven alternatives were developed

Figure 2-34
Southwest-Northwest Partial Cloverleaf Interchange Alternative

Figure 2-35
Directional Interchange Alternative

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Planned Southwest Corridor Light Rail Extension

Roadway

and evaluated during the screening process. The alternatives included both direct and non-direct connections between the two facilities. Alternatives eliminated during the process are described below.

2.6.6.1 I-25 Direct Connection Alternative A

This alternative includes a direct connection from southbound I-25 to westbound express lanes and eastbound express lanes to the existing northbound I-25 flyover ramp, as shown in **Figure 2-36**. No connection is provided from northbound I-25 to westbound C-470 express lanes or from eastbound C-470 express lanes to southbound I-25. It was determined that this alternative by itself did not provide adequate access to and from the express lanes at I-25. However, this concept was combined with Slip Ramp Alternative B to provide express lanes access to I-25 to and from the south in the action alternative.

2.6.6.2 I-25 Direct Connection Alternative B

Figure 2-37 illustrates the concept, which provides a separate flyover for eastbound C-470 express lanes to northbound I-25, bypassing the existing C-470 ramps. As in Alternative A, this concept does not include a direct connection from northbound I-25 to westbound C-470 express lanes or from eastbound C-470 express lanes to southbound I-25. It was therefore eliminated from further consideration.

2.6.6.3 I-25 Direct Connection Alternative C

This alternative varies slightly from Alternative A, but it lacks access to Yosemite Street from the eastbound express lanes, as shown in **Figure 2-38**. It was eliminated from further consideration because it did not meet Corridor design standards.

Figure 2-36
I-25 Direct Connection Alternative A

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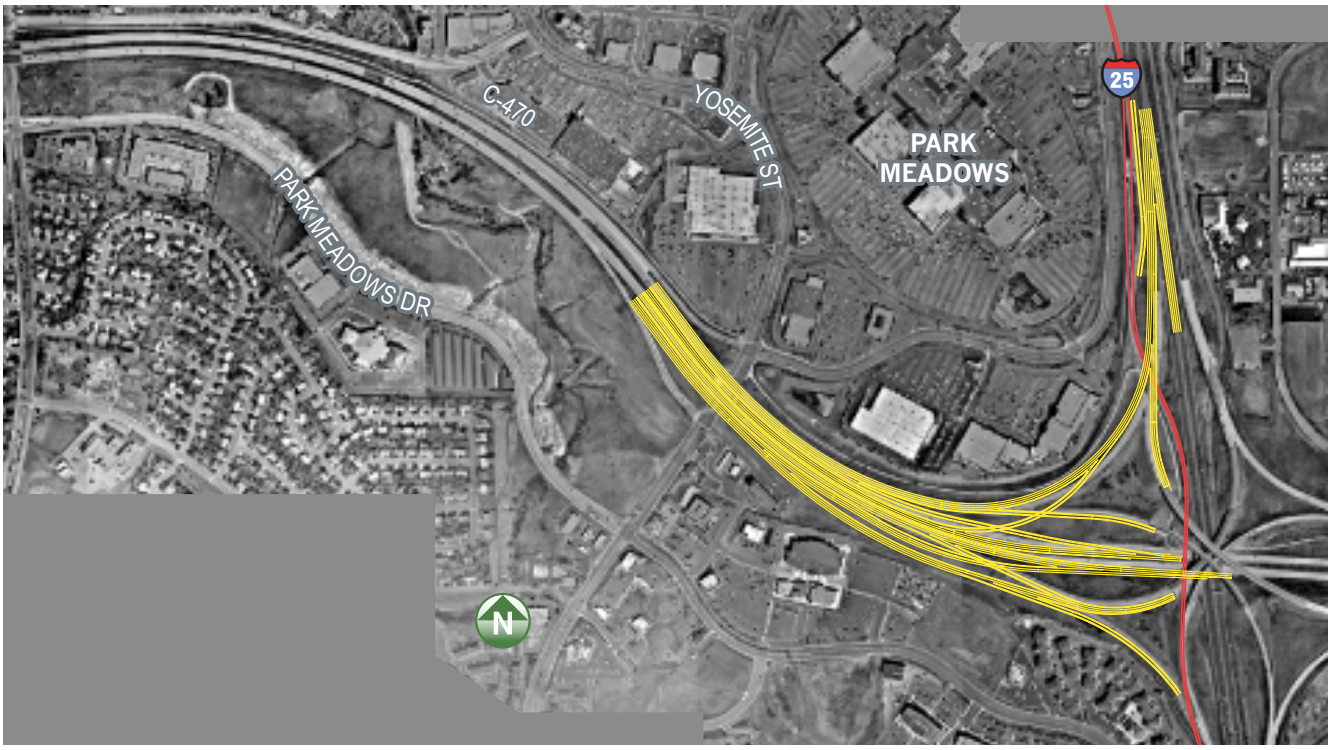
Planned Southwest Corridor Light Rail Extension — Roadway

Figure 2-37
I-25 Direct Connection Alternative B

Figure 2-38
I-25 Direct Connection Alternative C



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Planned Southeast Corridor Light Rail — Flyovers — Roadway

2.6.6.4 I-25 Direct Connection Alternative D

This alternative varies from Alternative B, and consists of a separate flyover for eastbound C-470 express lanes to northbound I-25, as shown in **Figure 2-39**. However, as with Alternative C, the ramp configurations do not meet Corridor design standards, and the alternative was therefore removed from further consideration.

2.6.6.5 I-25 Slip Ramp Alternative A

Slip ramp alternatives provide access to and from the express lanes without the additional infrastructure associated with flyover ramps. This alternative provides full access to and from the express lanes at Yosemite Street and I-25, as shown in **Figure 2-40**.

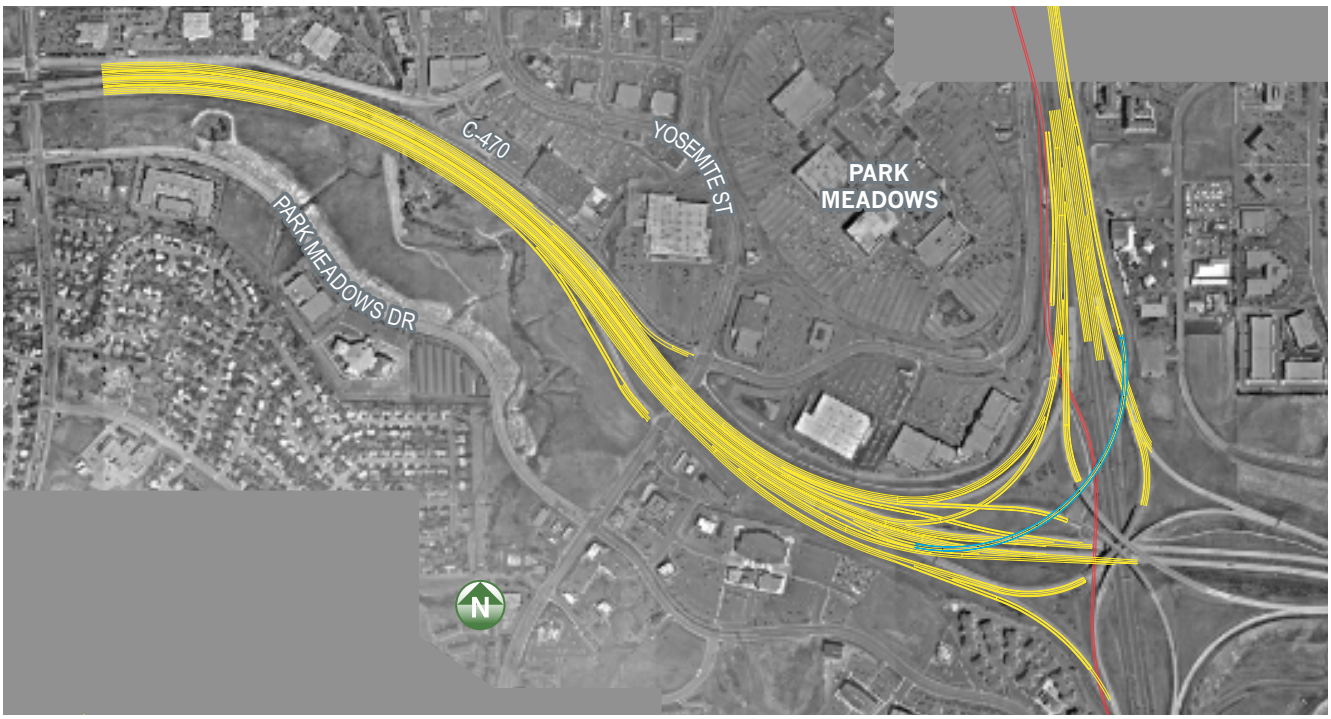
2.6.6.6 I-25 Slip Ramp Alternative B

This alternative is an improvement over Slip Ramp Alternative A, and has full access to and from the express lanes west of Yosemite Street. Because the slip ramps are located further west than in Slip Ramp Alternative A, this alternative allows access to Yosemite Street and I-25 traffic, as shown in **Figure 2-41**. However, it was determined that this alternative by itself does not provide adequate access to and from the express lanes at I-25. Therefore, this concept was combined with Direct Connection Alternative A to provide access to and from the south at I-25 in the action alternatives.

2.6.6.7 I-25 Slip Ramp Alternative with Westbound Collector Distributor

With the introduction of a westbound collector-distributor, this modification of Slip Ramp Alternative A provides access to Yosemite Street as shown in **Figure 2-42**. While this is an improvement over the previous alternative, it still does not provide adequate operations for all movements to and from I-25 and was therefore eliminated from further consideration.

Figure 2-39
I-25 Direct Connection Alternative D



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Planned Southeast Corridor Light Rail | Flyovers | Roadway

Figure 2-40
I-25 Slip Ramp Alternative A

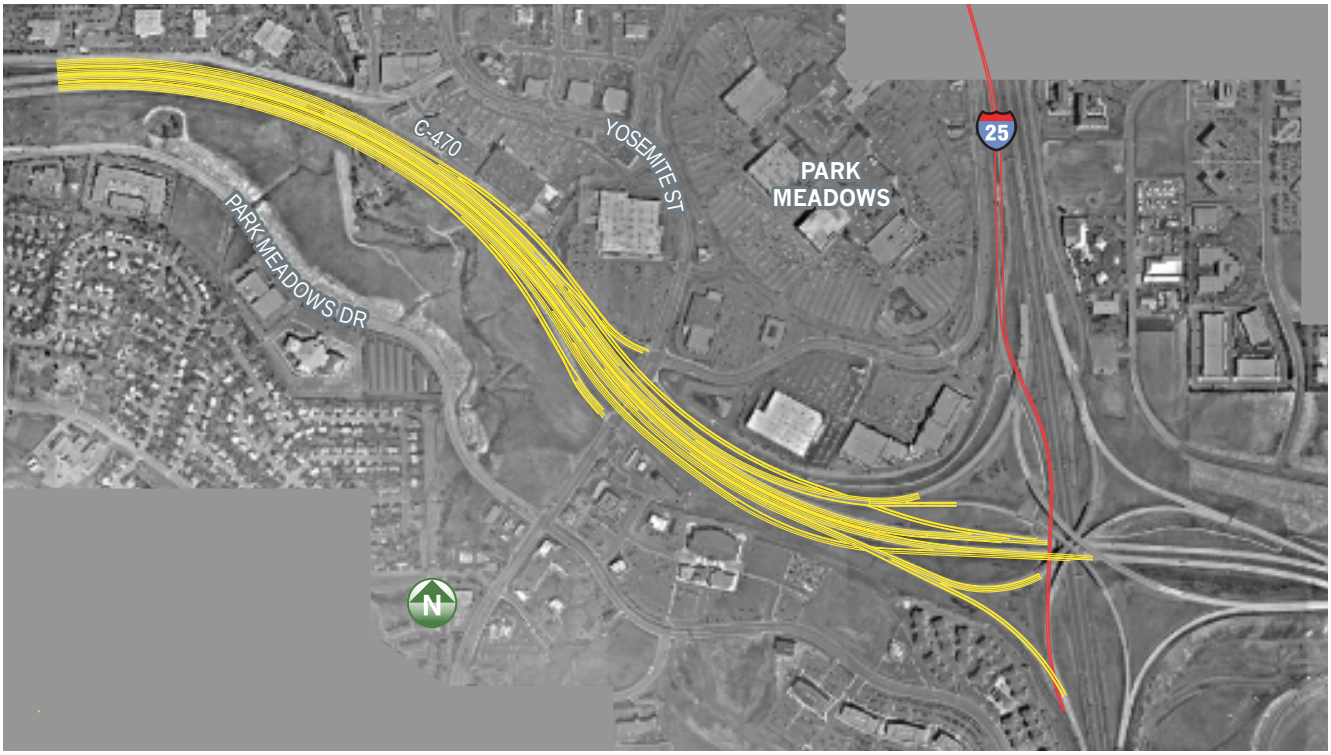

Figure 2-41
I-25 Slip Ramp Alternative B

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Planned Southwest Corridor Light Rail Extension — Roadway

Figure 2-42
I-25 Slip Ramp Alternative with Westbound Collector Distributor

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Planned Southeast Corridor Light Rail

Roadway