Project No. NH 4701-103 (14222)

C-470 Corridor Revised Environmental Assessment

Kipling Parkway to I-25
Arapahoe, Douglas, and Jefferson Counties, Colorado

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Submitted by:
US Department of Transportation
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and
Colorado Department of Transportation

Cooperating Agency:
United States Army Corps of Engineers

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Statute of Limitations

The Federal Highway Administration may publish a notice in the Federal Register, pursuant to 23 United States Code (USC) § 139(1), once the Finding of No Significant Impact is available. If such notice is published, a claim arising under Federal law seeking judicial review of a permit, license, or approval issued by a Federal agency for a highway or public transportation capital project shall be barred unless it is filed within 180 days after publication of a notice in the Federal Register announcing that the permit, license, or approval is final pursuant to the law under which the agency action is taken, unless a shorter time is specified in the Federal law pursuant to which judicial review is allowed. If no notice is published, then the periods of time that otherwise are provided by the Federal laws governing such claims will apply.

Information Availability

During the public comment period for this Revised Environmental Assessment (EA), a copy of the document will be available for review at each of the following locations:

Federal Highway Administration	12300 W. Dakota Avenue	Lakewood
CDOT Headquarters	4201 E. Arkansas Avenue	Denver
CDOT Region 1	2000 S. Holly Street	Denver
Douglas County	100 S. Third Street	Castle Rock
Highlands Ranch Library	9292 Ridgeline Blvd	Highlands Ranch
Columbine Library	7706 West Bowles Avenue	Littleton
Lone Tree Library	8827 Lone Tree Parkway	Lone Tree
Southglenn Library	6972 S Vine St.	Centennial

It is anticipated that this Revised EA will be posted online at the following website address:

https://www.codot.gov/projects/c470 ExpressLanes

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LIST OF ACRONYMS

AADT – Annual Average Daily Traffic
ADT – Average Daily Traffic
APCD – Air Pollution Control Division
APE – Area of Potential Effect
AWDT – Average Weekday Traffic

BMPs – Best Management Practices

C-470 – Colorado State Highway 470
CDOT – Colorado Department of Transportation
CDOW – Colorado Division of Wildlife (now CPW)
CDPHE – Colorado Department of Public Health and Environment
CDPS – Colorado Discharge Permit System
CFR – Code of Federal Regulations
CFS – Cubic Feet per Second
CM – Control Measure
CO – Carbon Monoxide
CPW – Colorado Parks and Wildlife
CWA – Clean Water Act

dB(A) – A-weighted decibels
DOT – Department of Transportation
DRCOG – Denver Regional Council of Governments

EA – Environmental Assessment
EL – Express Lane (tolled)
EPA – Environmental Protection Agency
ESA – Endangered Species Act

FEMA – Federal Emergency Management Agency
FHPRD – Foothills Park and Recreation District
FHWA – Federal Highway Administration
FONSI – Finding of No Significant Impact

GHG – Greenhouse Gas
GIS – Geographic Information Systems
GPL – General Purpose Lane

HOV – High-Occupancy Vehicle
HOV3+ – High Occupancy Vehicle with 3 or more occupants
HPTE – High-Performance Toll Enterprise
HRMD – Highlands Ranch Metro District

I-25 – Interstate Highway 25
IAR – Interstate Access Request
ITS – Intelligent Transportation System

LOS – Level of Service
LRT – Light Rail Transit
LUST – Leaking Underground Storage Tank

LIST OF ACRONYMS (continued)

MBTA – Migratory Bird Treaty Act of 1918
MPH – Miles Per Hour
MS4 – Municipal Separate Storm Sewer System
MSAT – Mobile Source Air Toxic

NAAQS – National Ambient Air Quality Standards
NAC – Noise Abatement Criteria
NDRD – New Development and Redevelopment
NEPA – National Environmental Policy Act
NPDES – National Pollutant Discharge Elimination System
NRHP – National Register of Historic Places

PM_{10} – Particulate Matter smaller than 10 microns in diameter
PPM – Parts per Million

RAMP – Responsible Acceleration of Maintenance and Partnerships
ROW – Right of Way
RTD – Regional Transportation District
RTP – Regional Transportation Plan

SB 40 – (Colorado) Senate Bill 40
SHPO – State Historic Preservation Officer
SIP – State Implementation Plan
SPWRAP – South Platte River Water Related Activities Program
SSPRD – South Suburban Parks and Recreation District
STIP – Statewide Transportation Improvement Plan
SWMP – Stormwater Management Plan

TAZ – Transportation Analysis Zone
TDM – Travel Demand Management
TIP – Transportation Improvement Program
TMA – Transportation Management Area
TSM – Transportation System Management

UDFCD – Urban Drainage and Flood Control District
USACE – United States Army Corps of Engineers
USC – United States Code
USDOT – United States Department of Transportation
USFWS – United States Fish and Wildlife Service
USGS – United States Geological Survey
UST – Underground Storage Tank

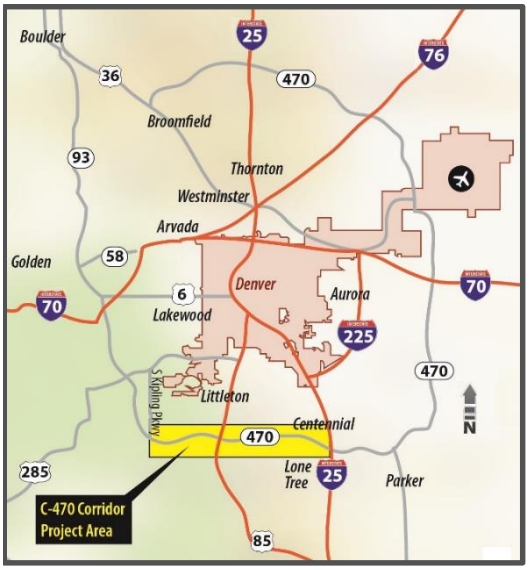
VHT – Vehicle Hours of Travel
VMS – Variable Message Sign
VMT – Vehicle Miles of Travel
VPD – Vehicles per Day

EXECUTIVE SUMMARY

This Revised Environmental Assessment (EA) was prepared by the Federal Highway Administration (FHWA) in conjunction with the Colorado Department of Transportation (CDOT) in compliance with the National Environmental Policy Act (NEPA) of 1969 (42 United States Code § 4321 – 4347). According CDOT's NEPA Manual, "NEPA requires that federal agencies use a systematic, interdisciplinary approach to decision making when actions may affect the quality of the human environment" (CDOT, 2014).

This document evaluates transportation solutions and their associated environmental effects in addressing congestion, delay and reliability problems on the 13.75-mile portion of State Highway 470 (C-470) between Kipling Parkway and Interstate 25 (I-25) in the southern portion of the Denver metro area. The Project Area is shown in **Figure ES-1**. C-470 is a four-lane (two lanes in each direction) freeway where traffic congestion has been of concern for more than a decade.

Figure ES-1
C-470 Corridor Project Area



Evening peak traffic on C-470, 2015.

An EA was approved in 2006 for a Preferred Alternative that would have added tolled express lanes on C-470 between Kipling Parkway and I-25 (CDOT, 2006). Due to lack of funding and other factors, CDOT and FHWA did not prepare a decision document for the project to be implemented.

About five years after approval of the 2006 EA, the cities and counties in the project area established the C-470 Corridor Coalition, with CDOT and FHWA included as affiliate (non-voting) members. This organization's founding Charter specified the following three "overarching goals:

- Develop and evaluate options for the C-470 Corridor which are cost effective
- Reach consensus on technical solution(s) for the C-470 Corridor
- Develop a strategic plan for phased implementation

CDOT and FHWA worked in close cooperation with the C-470 Corridor Coalition to prepare this Revised EA. This Revised EA recommends implementation of a Proposed Action that would add tolled express lanes on C-470 between Kipling

Parkway and I-25. This alternative is substantially similar to the Preferred Alternative from 2006, but it has several key modifications which improve its operations.

The region's long-range *Metro Vision 2035 Regional Transportation Plan* (DRCOG, 2011a) was amended in May 2014 to include the C-470 Express Lanes project. The project is now included in the adopted projects list for the 2040 plan update (DRCOG, 2015). The proposed improvements described in this Revised EA are estimated to cost $385 million. This number will be subject to change over time.

Contents of This Revised EA

This summary highlights the following topics:

- Purpose and Need
- Alternatives Considered
- Environmental Consequences
- Mitigation Measures
- Preferred Alternative Identification
- Public and Agency Involvement

Publication of this Revised EA in 2015 coincides with a 45-day public comment period. Following the public comment period, the FHWA and CDOT will prepare a decision document that responds to comments received on the Revised EA, updates impact analyses as necessary, and identifies any required mitigation.

ES.1 PURPOSE AND NEED

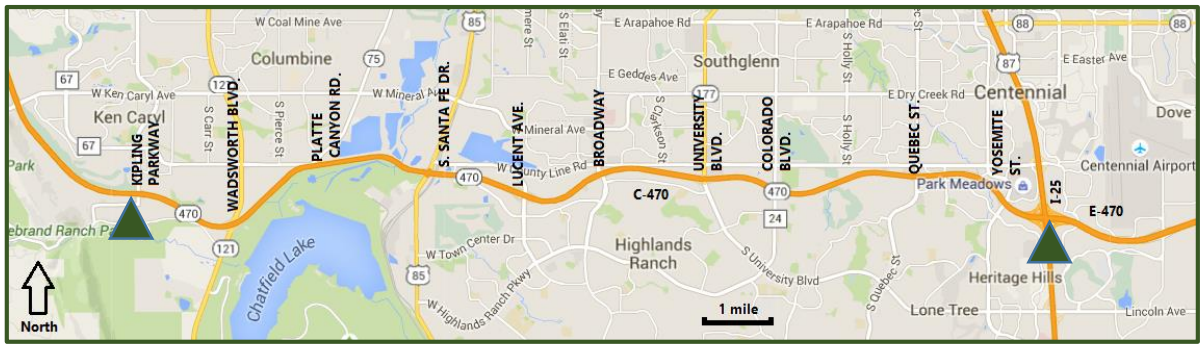
The FHWA and CDOT have identified a need for improvements to C-470 between Kipling Parkway and I-25. The purpose of this project is to provide congestion relief, decrease travel delay, and improve corridor reliability. The FHWA and CDOT seek to select an implementable transportation alternative that provides reliable and consistent travel times and commuting travel choices to accommodate an expected increase in the intensity and duration of congestion forecasted for the design year of 2035.

The need for this project is based on congestion, delay, and reliability. Additional considerations included implementation and safety. Specific need-based statements for the C-470 Corridor from Kipling Parkway to I-25 are highlighted here. **Figure ES-2** indicates the location of C-470 and its crossing arterials referenced below.

ES.1.1 Congestion

The Denver Regional Council of Governments (DRCOG), which is the federally designated transportation planning agency for the region, has identified C-470 as a "key congested area" on the regional transportation system (DRCOG, 2011b). Traffic volumes on C-470 range from 61,000 vehicles per day (vpd) near Kipling Parkway to 106,000 vpd near Yosemite Street. Volumes of 80,000 or more vehicles per day

Figure ES-2
C-470 and Key North-South Roadways in the Project Area



▲ Denotes project limit

for the four-lane freeway (two lanes each direction), are a general indicator of peak period congestion, and are found from Lucent Boulevard east to I-25. The eastern portion of the C-470 project area is congested today and has been for a number of years.

By 2035, projected volumes with the No-Action Alternative are predicted to range from 93,000 vpd to 161,000 vpd, so all 13.75 miles from Kipling Parkway to I-25 will be congested. Compared to existing traffic volumes, these predicted volumes reflect approximately a 50 percent increase, attributed to ongoing local and regional growth.

ES.1.2 Delay

Travel time sampling in 2013 found an average evening peak period travel speed westbound on C-470 (i.e., the homeward commute from downtown Denver to the suburban residential areas) to be 24 miles per hour, which is well below the posted speed limit of 65 miles per hour.

DRCOG estimates that travel delay for all 26 miles of C-470 will increase from 6,650 hours (2006 baseline) of vehicle delay daily to 41,940 daily hours of delay by 2035. The easternmost portion of C-470 from Kipling Parkway to I-25 accounts for at least half of these totals. The increased delay would result from the fact that C-470 is congested today and the predicted additional travel demand will cause the morning and evening peak periods to lengthen in duration, providing slower travel speeds for more hours of the day.

ES.1.3 Reliability

On a heavily congested freeway, any minor incident can cause long traffic backups. Currently, motorists cannot reliably predict how long it will take them to travel on C-470 during peak periods.

DRCOG's regional metric for travel time reliability is the ratio of travel time during peak periods to free flow travel times. On this scale, C-470 at a ratio of 1.44 rates worse than the regional average of 1.27, and DRCOG predicts the ratio will more than double, to 2.93, by the year 2035.

ES.2 ALTERNATIVES CONSIDERED

Numerous alternatives were developed and evaluated during the screening process. These alternatives were carried through a three-step screening process. They were analyzed based on evaluation criteria that were consistent with the project Purpose and Need, and other considerations such as the ability to implement improvements in a short time frame, and minimizing harm to the environment. Alternatives analysis conducted in 2006 was carried forward and updated in the 2015 Revised EA, as explained in **Chapter 2**.

In 2006, initially, categories of alternatives were assessed for their ability to meet the Purpose and Need. The categories included general purpose lanes, tolled express lanes, transit, and mobility enhancements. Of these categories, only the general purpose lanes and tolled express lanes were identified as having the potential to meet the Purpose and Need as stand-alone alternatives, and thus were carried forward as action alternatives. The transit and mobility enhancement categories were not carried forward, but certain elements of them were later repackaged with the action alternatives. The 2006 EA identified Express Lanes as its Preferred Alternative.

A number of modifications have been made to the 2006 Preferred Alternative resulting in the 2015 Proposed Action. These are detailed in **Section 2.6.2, CDOT Works with the C-470 Corridor Coalition to Refine Project.**

Detail on the alternatives considered and the screening process can be found in **Chapter 2**.

A No-Action Alternative is considered in an EA for comparison purposes, whether it meets the project's Purpose and Need or not. The No-Action Alternative differs from the existing conditions: for example, traffic volumes on C-470 in 2035 under the No-Action Alternative will be higher than they are today.

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

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

These new through lanes, plus new auxiliary lanes where warranted, would supplement the existing (free) general purpose lanes. **Figure ES-3** shows typical sections for the eastern portion of the corridor. Painted pavement buffers would separate the tolled lanes from the non-tolled lanes.

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

Toll rates have not been determined at this stage of project development. Toll collection methods would include detection of in-vehicle transponders plus video-surveillance of license plates for automated billing by mail.

The Proposed Action is estimated to cost $385 million but would not be built all at once. An Interim project estimated to cost $269 million is expected to construct a substantial portion of the Proposed Action during 2016-2018.

ES.3 TRANSPORTATION IMPACTS

Transportation impacts of the No-Action Alternative and the Proposed Action are discussed in **Chapter 3**.

Due to continued local and regional growth, traffic will continue to increase on the already-congested C-470 freeway that currently has two through lanes in each direction.

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Figure ES-3
Proposed Action Typical Sections

With the No-Action Alternative, the evening peak hour travel time between I-25 and Kipling Parkway in 2035 is estimated to be 32 to 33 minutes. Since the free-flow speed for this distance is 13 minutes, each vehicle would be experiencing about 20 minutes of delay. As noted earlier, this adds up to thousands of hours over delay on C-470 every weekday. Congested conditions on C-470 would also contribute to higher congestion levels on surrounding arterial streets.

With implementation of the Proposed Action, traffic operations, travel times, and safety would improve on C-470, as compared to the No-Action Alternative. The Express Lanes would offer reliable peak-period travel times with a performance goal that speeds would exceed 55 miles per hour 90 percent of the time. Traffic in the general purpose lanes would experience a slight travel time reduction during peak periods, compared with the No-Action Alternative.

ES.4 ENVIRONMENTAL CONSEQUENCES

The No-Action Alternative and the Proposed Action are evaluated in this Revised EA for their ability to meet the project Purpose and Need, their effect on the environment, and the mitigation measures necessary to address those effects. The direct, indirect, and cumulative environmental effects resulting from each of the alternatives are evaluated in **Chapter 4** of this Revised EA.

ES.4.1 Impacts of the No-Action Alternative

Key environmental impacts of the No-Action Alternative are noted below.

Traffic Flow: Increased travel demand of approximately 50 percent by the year 2035 cannot be accommodated by the current lanes on C-470. Therefore both peak periods would spread, with congested conditions encountered throughout most of the daylight hours.

Traffic Noise: An estimated 235 residences in 14 neighborhoods would experience noise levels higher than CDOT's Noise Abatement Criteria (NAC) in the year 2035. Portions of trails and parks adjacent to C-470 would also have noise levels that exceed the NAC.

Water Quality: Stormwater runoff would continue to discharge directly into receiving waters without being treated, because water quality mitigation features were not required when C-470 was built.

Other Resources: The No-Action Alternative would not cause construction-related traffic congestion and would not affect the C-470 Trail, other park and recreation facilities, the corridor's visual and aesthetic character, or utilities.

ES.4.2 Impacts of the Proposed Action

Key environmental impacts of the Proposed Action are noted below.

Traffic Flow Improvement: With addition of Express Lanes and auxiliary lanes on C-470, Traffic Level of Service would improve on many portions of C-470, especially during the afternoon peak period, as compared with the No-Action Alternative. The Proposed Action would carry more vehicles each day than the No-Action Alternative, but would do so with improved travel speeds and thus less today vehicle delay.

Construction-Related Traffic Congestion: Temporary construction activity would result in traffic congestion that could increase congestion on surrounding arterial streets and intersections.

C-470 Trail: About 5.8 miles of the C-470 trail would be reconstructed to accommodate roadway expansion. The Proposed Action would provide grade-separated crossings of Colorado Boulevard and Quebec Street.

Traffic noise is an important concern along C-470. To supplement existing C-470 noise barriers like the one shown above, this Revised EA recommends installation of an additional three miles of barriers benefitting an estimated 360 households.

Traffic Noise: Without mitigation, an estimated 469 residences in 16 neighborhoods would have noise levels higher than the NAC in 2035. Portions of parks, recreational trails and the C-470 commuter trail would also experience traffic noise levels exceeding the NAC. However, recommended mitigation (e.g., additional C-470 noise barriers) would substantially reduce this number of impacted residences. Mitigation is recommended where it would be reasonable and feasible in accordance with adopted CDOT's adopted, statewide Noise Assessment and Abatement Criteria.

Parks and Recreation: Three existing trails that cross under C-470 would experience temporary closures, and their users would be detoured to other routes. The Mary Carter Greenway Trail would be reconstructed, while the High Line Canal Trail and Willow Creek Trail would not.

Water Quality: Construction improvements would include water quality ponds to meet permitting requirements, thus offering the opportunity to improve the quality of water entering receiving streams. Temporary BMPs would be used to minimize storm runoff from the soil disturbance during construction.

Visual and Aesthetic Character: The visual character of the project area would change from adding structural elements related to the additional lanes, signage and toll collection; new retaining walls along the highway would be visible from neighboring communities and Chatfield State Park.

Utilities: Within the 13.75-mile project area, there are more than 300 utility lines within C-470 right-of-way, including lines that cross the highway. Various utility lines would require relocation.

ES.5 MITIGATION MEASURES FOR THE PROPOSED ACTION

Mitigation measures for project-related direct and indirect effects are discussed in detail in **Chapter 4**. Highlights include:

Construction-Related Traffic Congestion: CDOT will maintain the existing number of

through lanes (two each direction) open to traffic throughout project construction, except in certain circumstances when full closure is needed. Any full closures would be done in a manner that minimizes impacts to traffic.

C-470 Trail: The C-470 trail would remain open during construction, with minor detours to ensure bicycle and pedestrian safety.

Traffic Noise: This Revised EA recommends installation of five new noise barriers along the corridor to reduce noise for residential areas where doing so would be reasonable and feasible according to statewide guidelines. Additionally, an existing noise barrier for the Wolhurst community would be relocated closer to the residences to accommodate modifications of the westbound C-470 on-ramp from South Santa Fe Drive.

Parks and Recreation: CDOT will work closely with affected trail agencies and groups to provide signed detours and advance notice to users for the expected temporary closures of three trails that cross C-470.

Water Quality: Best management practices (BMPs) including provision of water quality ponds would be used to detain stormwater runoff from the highway and filter out sediment before the runoff is discharged to nearby receiving waters.

Visual and Aesthetic Character: Architectural treatments would be employed to maintain consistency throughout the corridor. CDOT has been working with C-470 Corridor Coalition members (e.g., counties, cities, towns) and will continue to do so to ensure that they have adequate input in the selection of specific architectural elements.

Utilities: Utility conflicts would be identified during final design and relocations would be performed in accordance with standard CDOT policy.

ES.6 PUBLIC AND AGENCY INVOLVEMENT

The outreach program for the Revised EA was designed to ensure public input and participation in the planning and environmental process. Public involvement was part of an overall communications program that involved community relations, media relations, and agency coordination.

The agency outreach program for the Revised EA involved federal and state resource agencies in the study regarding evaluation of potential effects to resources under their jurisdiction.

FHWA invited the U.S. Army Corps of Engineers (USACE) to formally participate as a Cooperating Agency on this Revised EA because for the several miles between Wadsworth Boulevard and Santa Fe Drive, C-470 is located on an easement from USACE.

Throughout development of this Revised EA, a project website has been available to provide an overview of the environmental process, the project schedule, frequently asked questions and answers, meeting announcements, exhibits from open house meetings, and other project information. The website address is: https://www.codot.gov/projects/c470ExpressLanes

Quick Response Code for cell phone access to the C-470 Revised EA website

Five telephone town hall events and four public meetings were conducted by the C-470 Corridor Coalition in 2012 to obtain input regarding project funding preferences. Another four public meetings and three town halls were conducted in 2014 to update the public on the status of Revised EA findings.

Traffic noise results became available in 2015. Since this is a key issue of interest to the public, CDOT contacted households in and near impacted areas and held a public information meeting this topic. Numerous additional presentations were made to community groups to keep them informed about the Revised EA process.

As noted earlier, a 45-day public review period and an advertised public hearing will take place upon CDOT and FHWA approval of this Revised EA. See **Chapter 5** for more information about public and agency involvement."

CHAPTER 1
PURPOSE AND NEED

1.1 INTRODUCTION

In 2006, the Federal Highway Administration (FHWA) and Colorado Department of Transportation (CDOT) completed an Environmental Assessment (EA) with a Preferred Alternative for addition of tolled express lanes to address traffic congestion on Colorado State Highway 470 (C-470) between Kipling Parkway and Interstate 25 (I-25), in the southern portion of the Denver metropolitan area. Due to lack of funding and other factors, the project did not advance to a decision document or construction at that time.

Since 2006, CDOT and local governments have worked together and with extensive public outreach to develop the funding and support needed to implement corridor improvements. As the result of those efforts, some design and operational aspects of the 2006 Preferred Alternative have been modified.

Now, in 2015, there is funding and local support for corridor improvements. FHWA and CDOT prepared this Revised EA both because portions of the approved 2006 EA are out of date and because various features of the previous Preferred Alternative have been changed. The project changes are detailed in **Chapter 2, Alternatives Considered**. The purpose and Need from 2006 remain valid and have been carried forward into this Revised EA.

1.1.1 Environmental Requirements

An EA is a document that describes a project's purpose and need, considers alternatives, and examines the social, economic and environmental consequences of alternatives to address the project need, in accordance with the National Environmental Policy Act (NEPA) of 1969.

NEPA applies to actions that would use Federal funds or require Federal approval. NEPA applies to the C-470 Corridor because the proposed improvements would be funded in part by FHWA. Also, C-470 connects to two U.S. highways, I-25 and US 85. Additionally, between Wadsworth Boulevard and US 85 (South Santa Fe Drive), C-470 is located on a property easement granted by the U.S. Army Corps of Engineers (USACE). USACE is a Cooperating Agency but not a signatory party for this Revised EA.

1.1.2 Location

C-470 is a 26-mile freeway beginning at I-70 west of Denver (milepost 0) and looping around the southwestern quadrant of the metro area to end at its junction with north-south I-25. E-470, a private toll highway, proceeds eastward from I-25 and turns northward toward Denver International Airport. This Revised EA addresses the eastern half of C-470, from Kipling Parkway to I-25, a distance of 13.75 miles, as seen in the yellow-highlighted portion of **Figure 1-1**.

Figure 1-1
Project Location

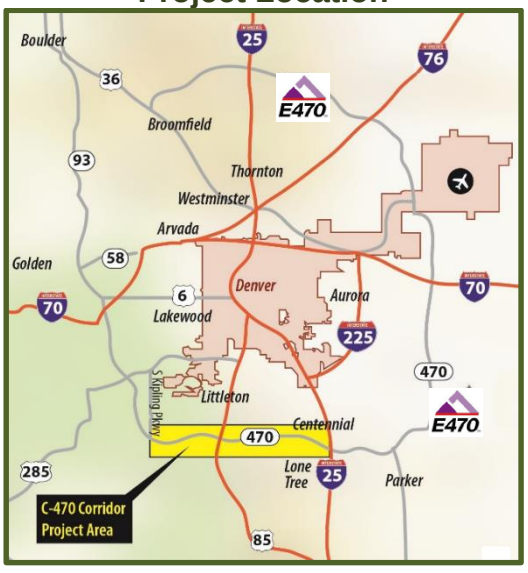


Figure 1-2
C-470 Corridor Project Area

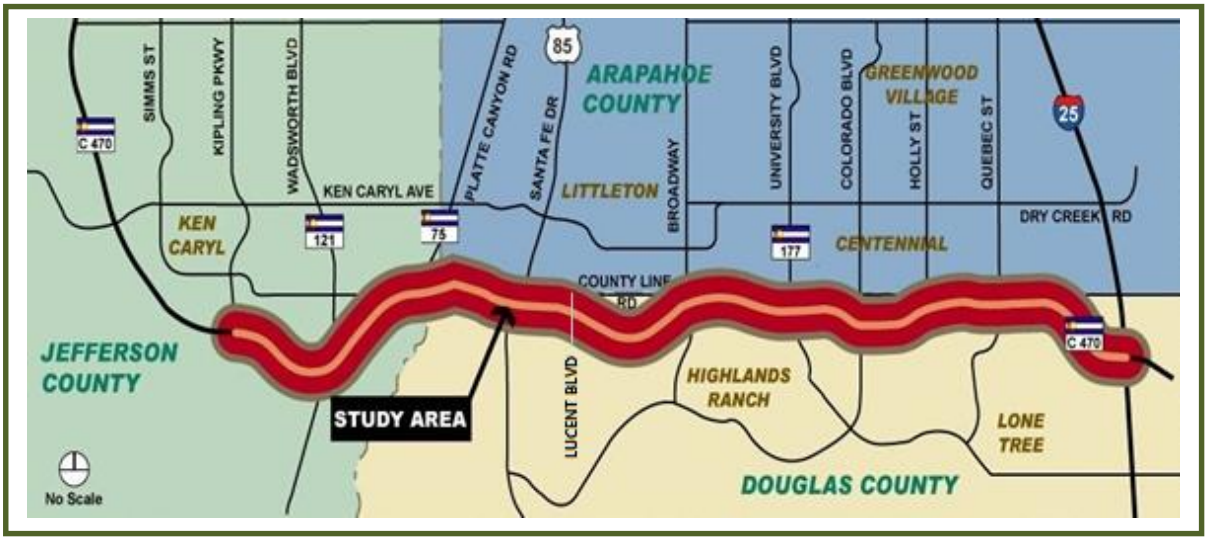


Figure 1-2 shows that the C-470 project area spans portions of three counties, Jefferson, Douglas and Arapahoe. Approximately 75% of this C-470 segment is located within Douglas County, immediately south of County Line Road. Communities adjacent to C-470 include the cities of Littleton, Centennial and Lone Tree, as well as the Highlands Ranch development in unincorporated Douglas County.

All cities and counties along this highway segment are members of the C-470 Corridor Coalition, which formed in early 2011 to find a way to meet the corridor's needs. More information about this group is provided in **Section 2.6.1, C-470 Corridor Coalition Explores Funding Options**.

This Revised EA (with its technical appendices) is a stand-alone analysis that presents all information needed for project decision-making. It does not require the reader to access the 2006 EA. To avoid duplication of effort and cost, it makes use of 2006 EA findings to the extent that they remain applicable. The 2006 EA examined impacts through the 2025 planning horizon. This Revised EA looks out to the year 2035.

This chapter presents the project purpose and need, which are the foundation for consideration of alternative solutions that are discussed in **Chapter 2**.

The Purpose and Need for the project have not changed since 2006, but the supporting projections of future traffic growth, congestion and delay have been updated to address the planning horizon year of the *Metro Vision 2035 Regional Transportation Plan* (RTP) adopted by the Denver Regional Council of Governments (DRCOG). DRCOG adopted a *2040 Fiscally Constrained Element* (i.e., new project listing) of the RTP in February 2015, after this Revised EA was largely completed.

1.2 PURPOSE

The purpose of this project is to address existing and future C-470 congestion between Kipling Parkway and I-25, reduce traveler delay, and improve travel time reliability for corridor users through the year 2035.

1.3 NEED FOR ACTION

C-470 is a four-lane freeway that opened in 1990, with two through lanes in each direction. Extensive and rapid land

development took place along the corridor in the following decade, causing traffic growth to exceed original projections. Unacceptable levels of traffic congestion occurring by 2003 led to the preparation of the 2006 EA. C-470 has experienced routine congestion for years and will be more congested in the future due to continued local and regional growth.

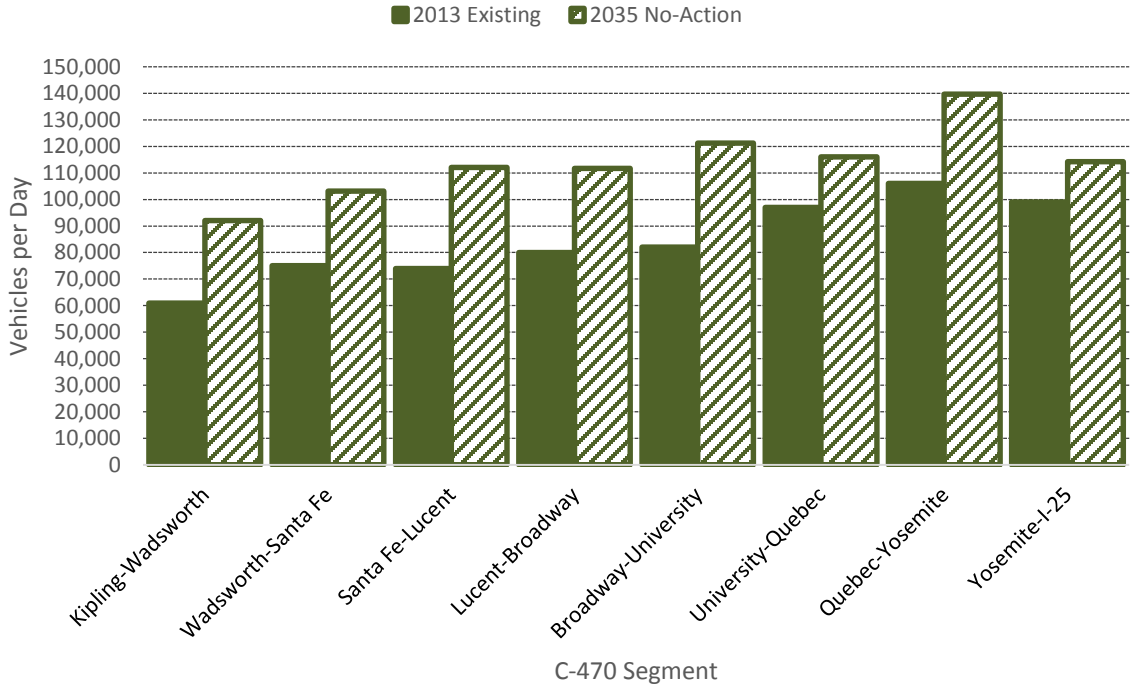
Existing 2013 and predicted 2035 traffic levels on C-470 are presented in **Figure 1-3**. The traffic volumes shown for 2035 assume no improvements to the existing highway, and thus are constrained by current capacity.

As of 2013, C-470 carried a range of 61,000 to 106,000 vehicles per day (vpd) within the project area. The 2013 volumes are CDOT traffic counts and estimates of annual average daily traffic (AADT). The 2035 No-Action Alternative traffic projections are average weekday traffic (AWDT) derived using the FOCUS travel model maintained by DRCOG, which is the federally designated regional transportation planning agency for the Denver metro area.

The western end of the project area, between Kipling Parkway and Santa Fe Drive, carries the least C-470 traffic, while the most traffic is carried near the eastern end, between University Boulevard and I-25. The 55,000 vpd difference in the volumes on opposite ends of the corridor (61,000 vpd near Kipling Parkway, 106,000 vpd near Quebec Street) reflects the fact that C-470 is heavily used to access the cross-streets in-between.

Figure 1-3 shows that daily traffic volumes are 80,000 vehicles or more between Lucent Boulevard and I-25. Traffic will exceed this level corridor-wide by 2035. Generally, this amount of traffic on a four-lane freeway indicates congested conditions during peak hours, as reflected in DRCOG's congestion analysis discussed below.

Figure 1-3
Existing 2013 and Predicted 2035 Daily Traffic Volumes by C-470 Segment



1.3.1 Population and Employment Growth Leads to Congestion

Rapid growth over the past two decades has resulted in the reported 2014 residential build-out of the unincorporated Highlands Ranch development adjacent to C-470 between Santa Fe Drive and Quebec Street. Begun in 1981, Highlands Ranch is a 22,000-acre development with roughly 93,000 residents. Residential build-out reportedly has occurred, but there are plans to boost employment in the area.

Looking to the future, growth in the immediate vicinity of C-470 will continue. The 30 Census tracts that include or are adjacent to C-470 correspond to 88 Transportation Analysis Zones (TAZs) for which DRCOG has developed small area population forecasts. **Table1-1** indicates the total current and projected population and employment for these TAZs, which include part of Highlands Ranch, but not all of it. By 2035, an additional 33,000 residents and 47,000 new jobs are expected in this area.

Table 1-1
DRCOG-Projected Growth along the C-470 Corridor, 2015 to 2035

Year	Population	Employment
2015	123,372	90,584
2035	156,953	137,705
Change	+33,591	+47,121
% Change	+21%	+52%

DRCOG, 2010.

Not reflected in **Table 1-1**, because it is slightly more distant from C-470, is the Sterling Ranch development located four miles south of C-470, west of US 85. Approved in 2013, it is expected to add 12,000 homes in the next 25 years. This will increase traffic at the C-470 interchanges with Santa Fe Drive and Wadsworth Boulevard and on the C-470 mainline. This development is accounted for in regional growth forecasts as discussed below.

Looking at the bigger picture, the DRCOG 2035 RTP reflects projected population growth of 1.4 million residents, or 50% population growth, within its Denver Transportation Management Area (TMA) between 2010 and 2035. The RTP assumes that employment within the TMA will increase by 1 million jobs, a 66% increase, during the same 25 years. As a regional facility, C-470 will receive additional traffic due to this general growth in the region.

C-470 has been identified as a "key congested area" on the regional transportation system by DRCOG.

1.3.2 Congestion

C-470 in the project area has been identified as a "key congested area" in DRCOG's *2013 Annual Report of Traffic Congestion in the Denver Region* (DRCOG, 2013). In this assessment, DRCOG assigned mobility grades based on five criteria: duration and magnitude of congestion, total delay time per mile, variation in travel time between peak and off-peak periods, and the number of crashes per mile. Considering these metrics, they assigned an overall mobility grade of A (best) through F (worst). Roadways scoring a D or F were declared to be congested.

The report specified the following C-470 elements as being "key congested locations" on the regional roadway network:

- C-470 between I-25 and Santa Fe Drive was congested as of 2011.
- C-470 between Santa Fe Drive and Kipling Boulevard will be congested by 2035.
- Two regional freeway system bottlenecks are C-470 between I-25 and Yosemite Street, and C-470 between Lucent Drive and Santa Fe Drive.
- Three congested arterial/ramp intersections are the C-470 ramps at Quebec Street, Broadway, and Santa Fe Drive.

DRCOG's findings regarding freeway mainline congestion match the roadway segments with volumes greater than 80,000 vehicles per day that were identified in **Figure 1-3**. This equates to 2,000 vehicles per lane in the peak direction during the peak hour, with the peak hour comprising one-tenth of all day traffic. (Quantitative congestion analysis uses hourly or even part-hour volumes, not daily traffic.)

Appendix 1 of the RTP includes a C-470 Corridor Vision with DRCOG's specific quantitative projections of travel characteristics for the entire 26-mile C-470 highway. This analysis compared projected 2035 conditions with base conditions in 2006. The DRCOG analysis indicates that C-470 congestion that lasted one to two hours daily in the base year will lengthen to three to four hours daily by 2035, assuming no corridor improvements are made.

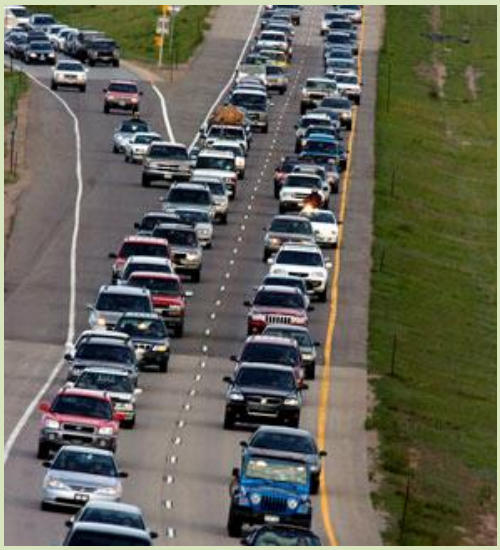
1.3.3 Delay

Congestion slows traffic flow, resulting in longer travel times during peak periods than during off-peak, free-flow conditions. The posted speed limit on C-470 is 65 miles per hour (mph), so in free-flow conditions it takes just under one minute to travel one mile. At a congested travel speed of 30 mph, it takes two minutes to travel one mile, including more than one minute of delay. Travel time sampling in 2013 found an average speed of 24 mph, or 2.5 minutes per mile, westbound during the evening peak between I-25 and Lucent Boulevard. **Appendix 1** of the DRCOG 2035 RTP provides the following estimates regarding daily vehicle hours of delay for the entire 26-mile C-470 highway:

- 2006: 6,650 daily hours of delay
- 2035: 41,940 daily hours of delay

Since the eastern half of C-470 has much higher traffic volumes today than the western half, the project area would account for well over half of the corridor-wide delay estimated by DRCOG.

Another delay metric from the same report is the percentage of peak period travel time in delay. For C-470 as a whole, DRCOG estimated that this would increase from 21 percent in 2006 to 49 percent in 2035. Again, delays for the C-470 project area would be worse than this corridor-wide prediction.



Ramp-metered traffic merges onto four-lane C-470 during the height of rush hour.

1.3.4 Reliability

Under highly congested conditions, travel on the corridor becomes extremely unpredictable. Any minor incident can disrupt upstream traffic flow for miles, and driver curiosity can disrupt flow in the other direction as well.

DRCOG assesses reliability with a metric called travel time variation, calculated as the ratio of peak-hour travel time to non-peak travel time. In its previously cited corridor vision, DRCOG reported a regional baseline average of 1.27 for this metric. DRCOG predicted the following for C-470 as a whole:

- 2006 travel time variation ratio,1.44
- 2035 travel time variation ratio, 2.93

Travel time reliability is important to the successful operation of fixed route bus service. Currently, no bus routes of the

extensive Regional Transportation District (RTD) transit system use C-470. RTD has indicated a willingness to consider using C-470 if reliable travel times can be assured in the future.

1.4 OTHER CONSIDERATIONS

In addition to addressing traffic-related needs, it is appropriate to consider safety and to ensure that any proposed action would be financially feasible. These considerations are discussed below.

Safety

The 2006 EA indicated that C-470 generally did not experience major safety concerns, except at the Santa Fe interchange. Since then, a new flyover ramp opened in 2010 to carry southbound Santa Fe traffic to eastbound C-470. This safety improvement greatly reduces southbound left-turn volumes through the interchange complex, thus reducing traffic backups.

A new C-470 Corridor safety assessment based on 2008-2012 crash data was prepared as part of this Revised EA. This new safety assessment did not identify any crash types that could be attributed to roadway geometric deficiencies in specific locations. However, it shows – as did the prior study – that rear-end collisions account for about half of all reported C-470 crashes, and that rear-end collisions occur at much higher rates during weekday peak hours. Safety improvement is not specifically part of the project need, but the prevalence of rear-end collisions on C-470 is likely to decline if corridor improvements reduce traffic congestion.

Financial Feasibility

Proposed C-470 Corridor improvements will be feasible only if there are funds available for project construction. The 2006 EA examined a non-tolled general purpose lanes alternative and a tolled express lanes alternative. No available funding for general purpose lanes has arisen since then, but the tolled express lane alternative has recently become financially feasible.

CDOT has determined that major reconstruction work on C-470 would be needed to provide adequate pavement condition and address horizontal and vertical curvature deficiencies. In a 2014 grant application to the U.S. Department of Transportation, CDOT estimated that $77 million, or about one third of the C-470 project cost, would be needed for reconstruction to maintain existing lanes, and the remainder would provide for increased capacity (CDOT, 2014). [CDOT was not successful in its effort to secure a TIGER funds grant to help pay for the C-470 Proposed Action.] More recently, this estimate was revised upward due to Colorado highway cost escalation. The DRCOG 2040 RTP currently reflects total costs of $385 million for C-470 improvements.

A new CDOT funding initiative created in 2013 is called the “Responsible Acceleration of Maintenance and Partnerships” (RAMP) Program. In 2013, the Colorado Transportation Commission approved funding for 44 projects totaling $580 million under this one-time program. The largest single allocation was $100 million (17% of the statewide total) awarded for C-470, in response to a C-470 Corridor Coalition request for twice that amount.

The $100 million RAMP allocation could meet the C-470 reconstruction needs discussed above, but would not be sufficient to also provide capacity improvements. No other major sources of government funding appear to be available for the corridor in the foreseeable future. Therefore, the remaining funding for C-470 improvements would need to come from toll revenues collected from users of new C-470 lanes. Preliminary studies indicate that this funding approach would be financially feasible. Local agencies along the corridor are also contributing financially to the project.

1.5 SUMMARY

Nine years have passed since the 2006 EA proposed adding tolled express lanes to address traffic congestion and travel time reliability needs on C-470. Local and regional growth has continued. With continued growth, future traffic demand will increase on this already-congested highway, causing travel speeds to decline and trip reliability to worsen.

DRCOG has identified this portion of C-470 as a “key congested area” on the regional transportation system. If nothing is done to accommodate future traffic demand, DRCOG predicts that C-470 daily delay will increase from thousands of vehicle hours today to tens of thousands of vehicle hours by 2035. The daily duration of congested traffic is expected to double by 2035. DRCOG notes that C-470 travel time reliability is worse than the current regional average and will worsen substantially by 2035.

Cooperative efforts by CDOT and the members of the C-470 Corridor Coalition have made combined reconstruction and capacity improvements financially feasible in 2015, assuming toll collection on newly added lanes.

CHAPTER 2
ALTERNATIVES CONSIDERED

2.1 INTRODUCTION

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

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

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

The contents of this chapter are:

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

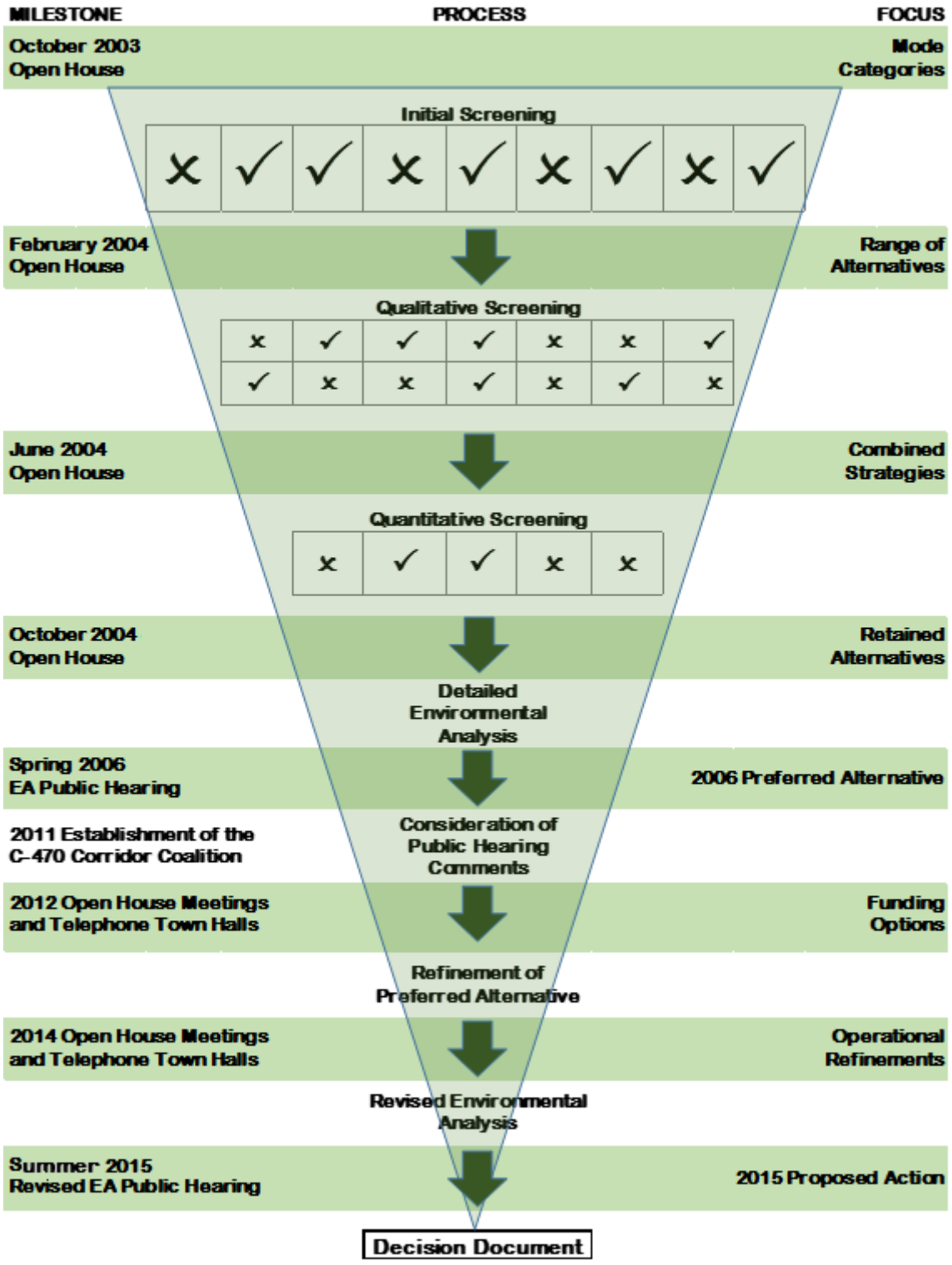
The NEPA process calls for consideration of a No-Action Alternative as a basis for assessing the comparative effects of any action alternative(s). The No-Action Alternative is assessed for future conditions, and thus is not identical to current, existing conditions. The No-Action Alternative is carried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

2.2 ALTERNATIVES DEVELOPMENT AND SCREENING PROCESS

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

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

Figure 2-1
Screening Process Overview



2.2.1 Goals, Objectives, and Evaluation Criteria

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

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

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

2.2.2 Initial Screening

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

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

2.2.3 Qualitative Screening

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

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

2.2.4 Quantitative Screening

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

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

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

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

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

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

Figure 2-2
2006 Screening Process and Results

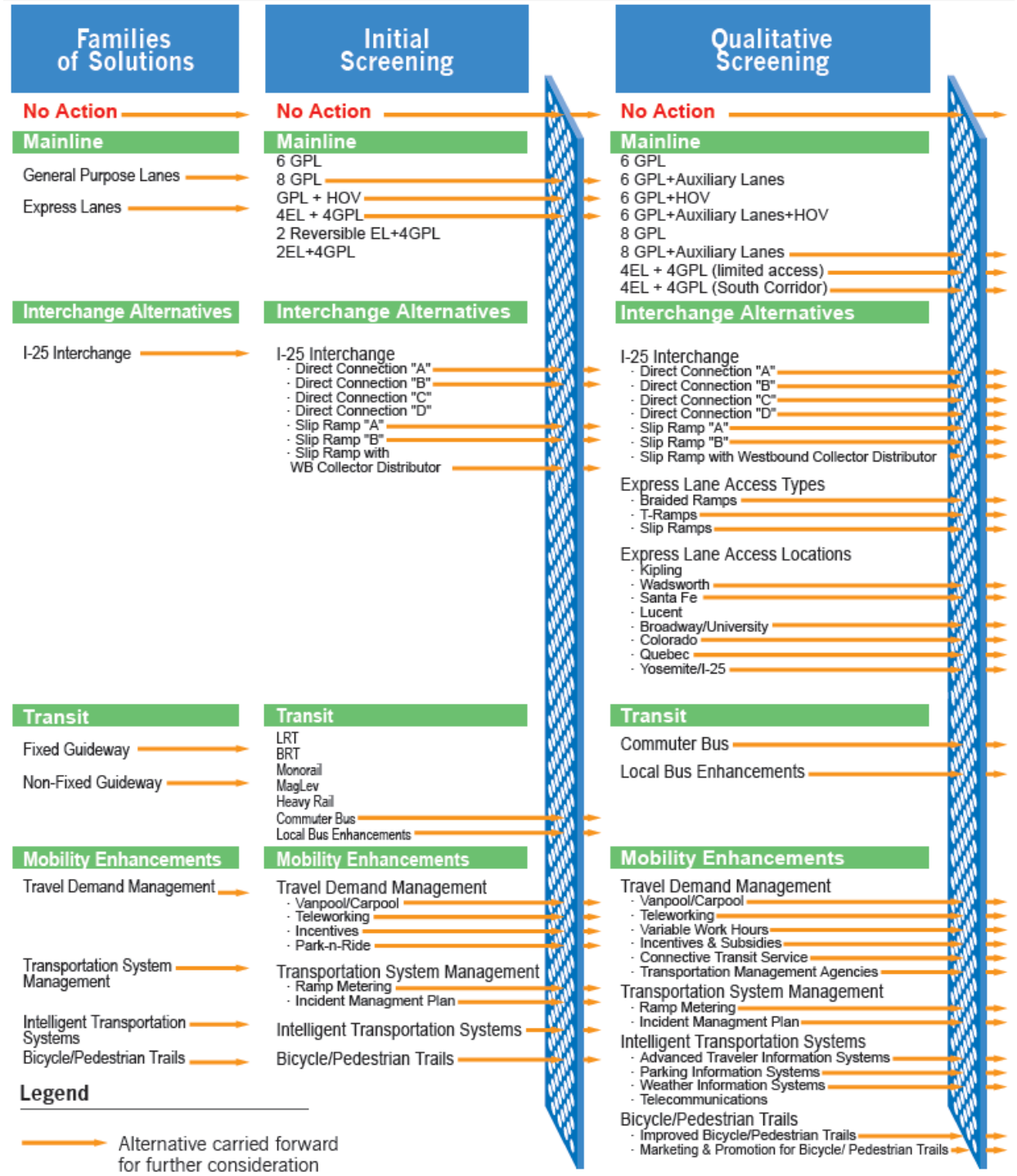
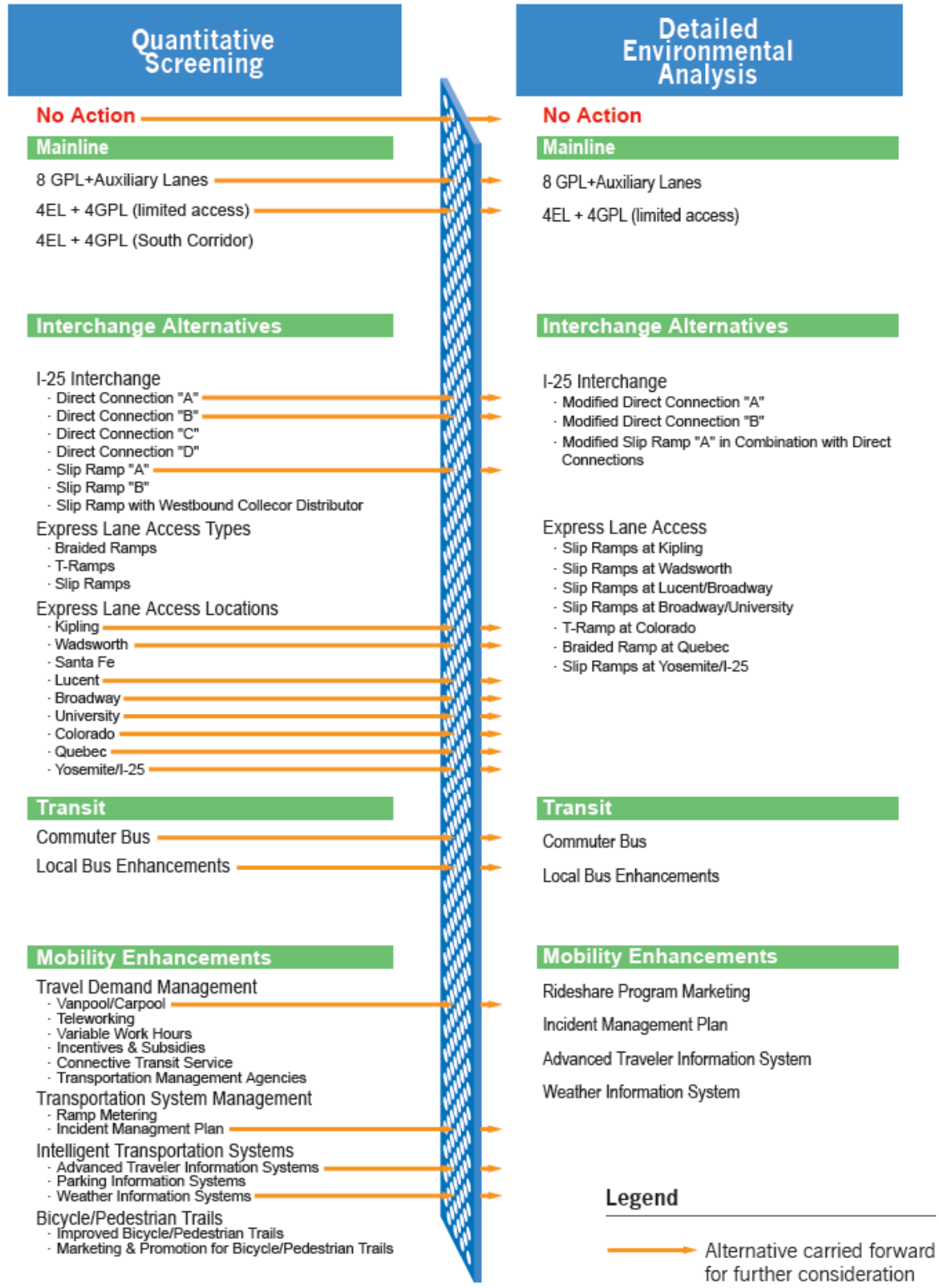


Figure 2-2
2006 Screening Process and Results (Continued)



2.3 ALTERNATIVES CONSIDERED BUT ELIMINATED

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

2.3.1 Transit Alternatives

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

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

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

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

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

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

2.3.2 Mobility Enhancements

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

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

2.3.3 General Purpose Lane Alternatives

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

2.3.4 Express Lanes Alternatives

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

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

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

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

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

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

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

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

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

2.4 ALTERNATIVES CARRIED FORWARD IN 2006

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

2.4.1 No-Action Alternative

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

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

2.4.2 GPL Alternative

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

Figure 2-3
No-Action Alternative Typical Sections

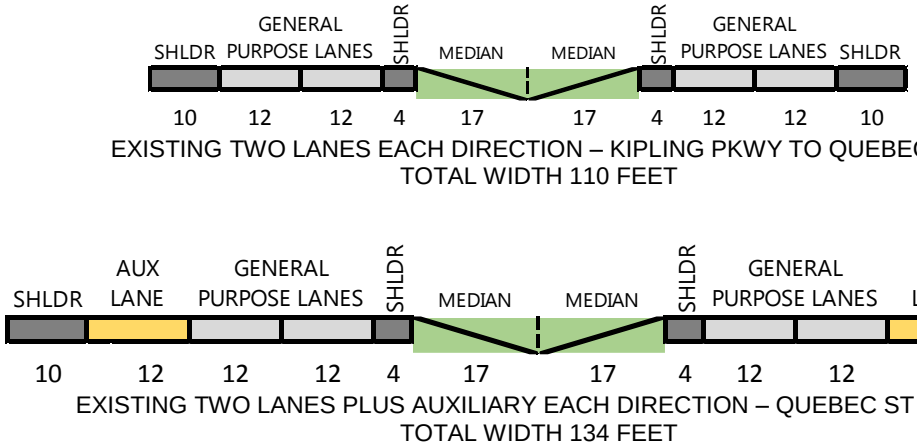
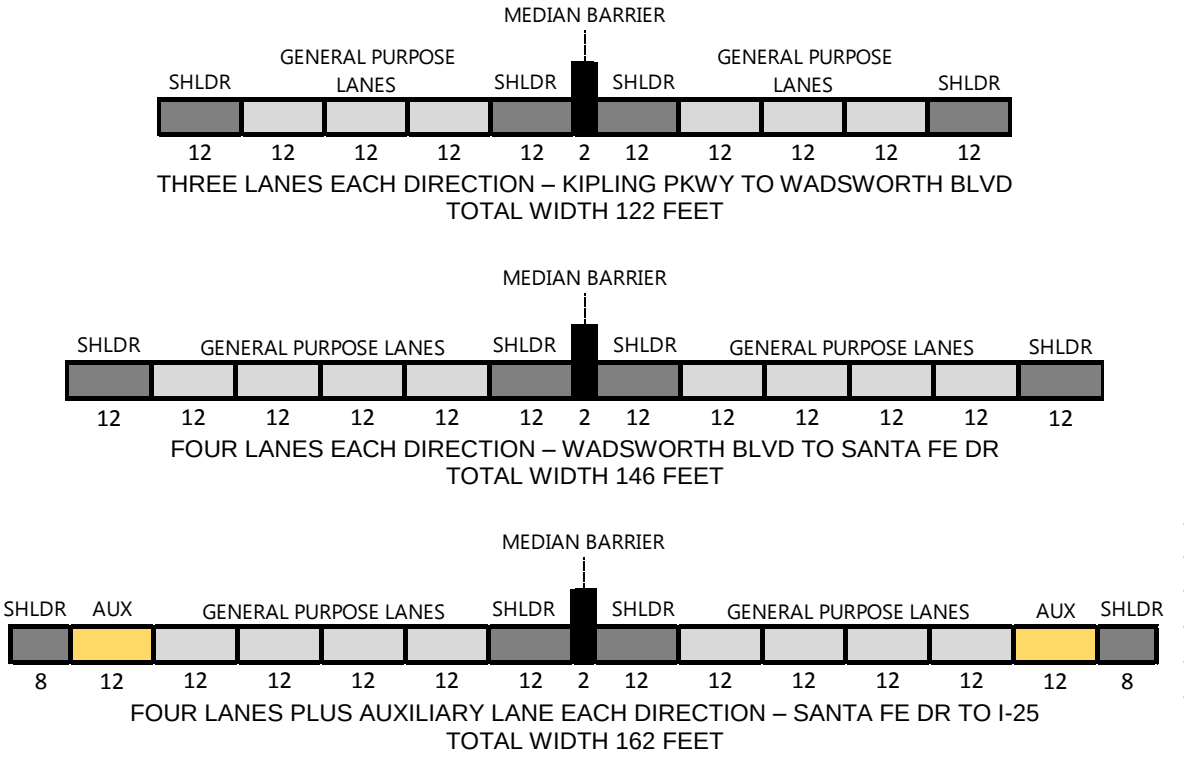


Figure 2-4
2006 GPL Alternative Typical Sections



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

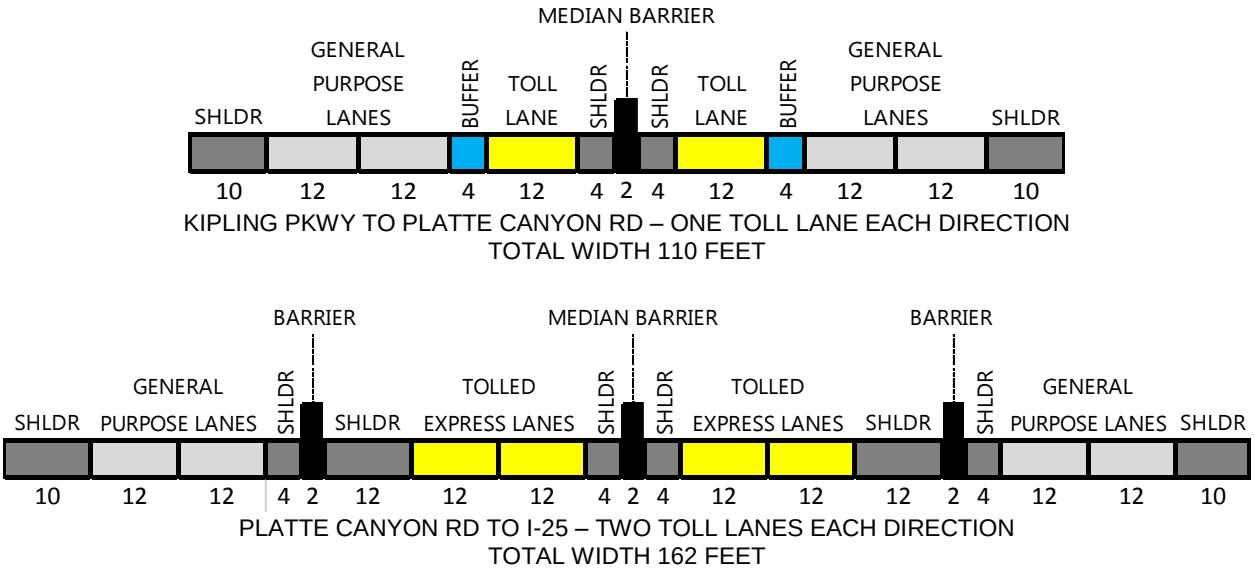
2.4.3 EL Alternative

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

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

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

Figure 2-5
2006 EL Alternative Typical Sections



2.5 PREFERRED ALTERNATIVE IN THE 2006 EA

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

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

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

2.6 REFINEMENTS TO THE 2006 PREFERRED ALTERNATIVE

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

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

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

2.6.1 C-470 Corridor Coalition Explores Funding Options

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

C-470 CORRIDOR COALITION

Voting Members:

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

Affiliate Members:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

2.7 ALTERNATIVES CONSIDERED IN 2015

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

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

2.8 2015 PROPOSED ACTION

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

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

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

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

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

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

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

Figure 2-6
2015 Proposed Action Typical Sections

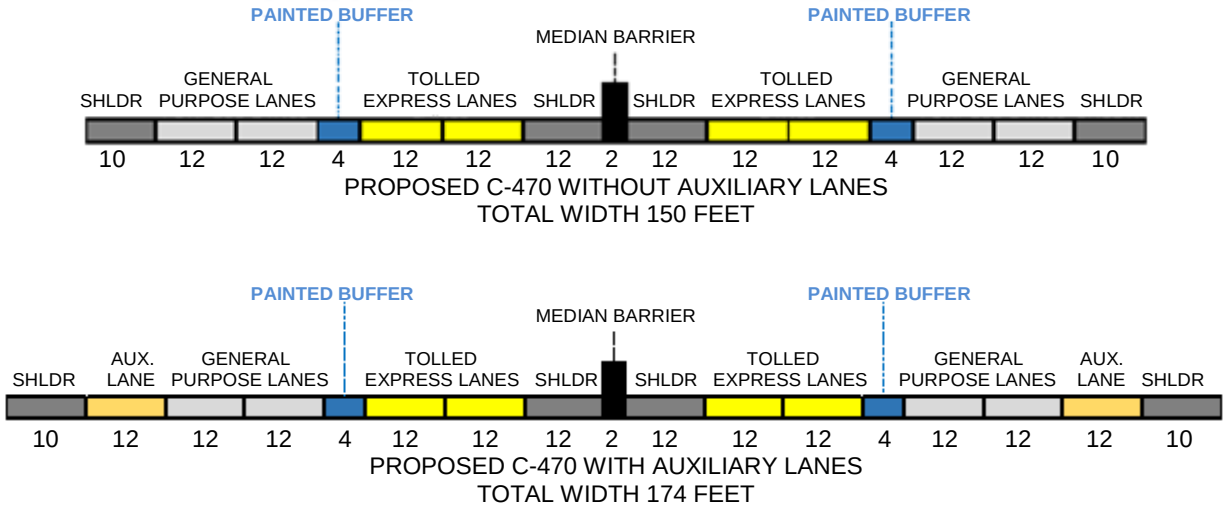


Figure 2-7
Preliminary Locations for Auxiliary Lanes and Express Lane Access

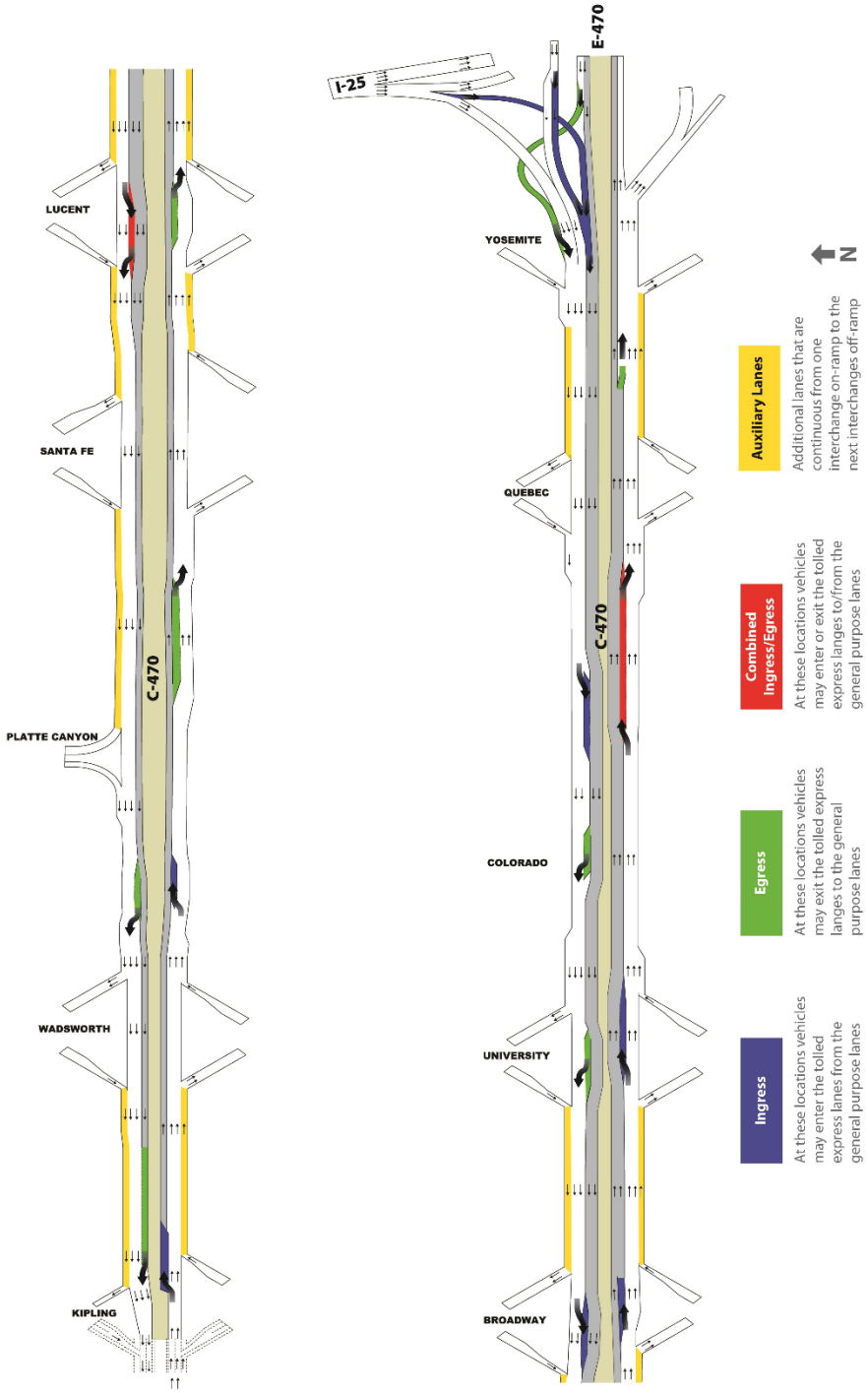
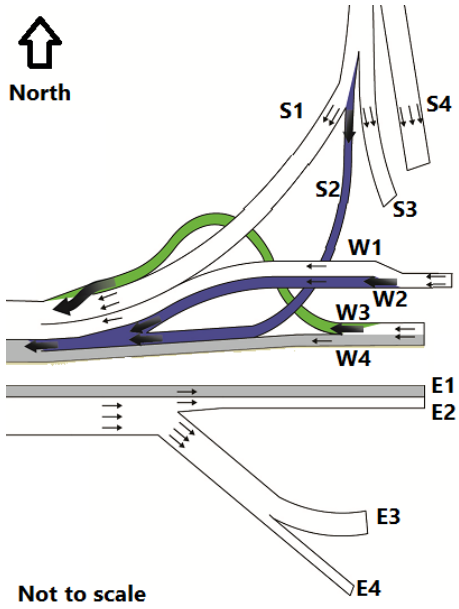


Figure 2-8
Proposed Configuration of C-470/I-25 Direct Connect Ramps



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

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

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

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

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

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

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

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

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

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

Table 2-2
Proposed Action Additional Details

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

2.9 CONCLUSION

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

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

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

CHAPTER 3
TRANSPORTATION IMPACTS

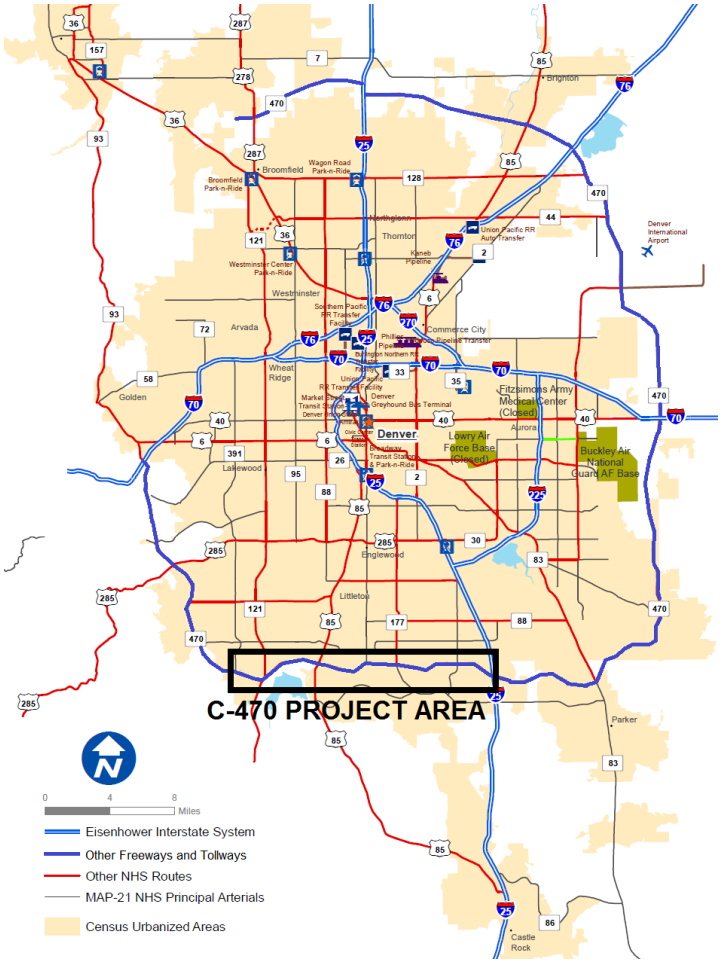
3.1 INTRODUCTION

This chapter describes C-470's current use and its role in the multimodal transportation system serving the southwest portion of the Denver metro area, followed by discussion of how the roadway would function in the future for the 2035 No-Action Alternative and Proposed Action. A discussion of project phasing is included, because a major portion of the project has funding for immediate construction, but a future project would be needed to advance the roadway from the Interim condition to the Ultimate configuration which is the Proposed Action.

3.2 TRANSPORTATION EXISTING CONDITIONS

The location of the C-470 project area in the context of the regional roadway network for the Denver metropolitan area is shown in **Figure 3-1**, a map of designated National Highway System routes. C-470 is part of this system.

Figure 3-1
National Highway System, Denver-Aurora Metro Area



Source: FHWA, 2015.

C-470 is in the southwest quadrant of the region. It was originally planned to be part of the Interstate Highway System (I-470), but was removed from that system in the late 1970s by Colorado's request. Under an arrangement called the Interstate Transfer program, Colorado received Federal funding for C-470 and various other roadway improvements in lieu of the planned Interstate highway.

Figure 3-1 reflects the importance of C-470 to the southwestern portion of the Denver region. There are significant topographical constraints south of C-470 and Highlands Ranch, as well as the Front Range of the Rocky Mountains to the west. Between C-470 in the south and I-70 in the north (approximately 19 miles apart), expressways US 285 and US 6 are alternative regional east-west routes, but the closest of these is 8 miles north of C-470. C-470 is the main east-west route serving the more than 100,000 residents south of it in the Highlands Ranch development of northern Douglas County.

Figure 3-2 displays the functional classification of the highways and arterial roadways within the C-470 project area. This figure was compiled from the municipal and county plans in the project vicinity. Most of the roadways shown are four to six lanes wide, typically with left and right turn lanes at signalized intersections. Congestion and/or crashes sometimes result in C-470 traffic diverting to County Line Road (to the north) or the Highlands Ranch Parkway/ University/Lincoln Avenue arterial system (to the south) in Highlands Ranch. To do so, this traffic also uses the various north-south arterials connecting C-470 with these alternative routes.

Access to C-470 from the surrounding roadway system is provided as detailed in **Table 3-1**. In the 13.75-mile Project Area, full access is available at seven locations, partial access is provided for two intersecting roadways, and three roads that cross C-470 have no access to the freeway.

3.2.1 Freeway Typical Sections

Currently, C-470 has two through-lanes in each direction. From Quebec Street to I-25, the freeway also has auxiliary lanes that connect the on-ramp to the subsequent off-ramp, to provide maximum possible distance for merge and diverge movements to/from the through lanes. Four-foot shoulders are typical to the left of the inside ("fast") lane, and ten-foot breakdown

Figure 3-2
Functional Classification of Highways and Arterial Roads in the C-470 Project Area

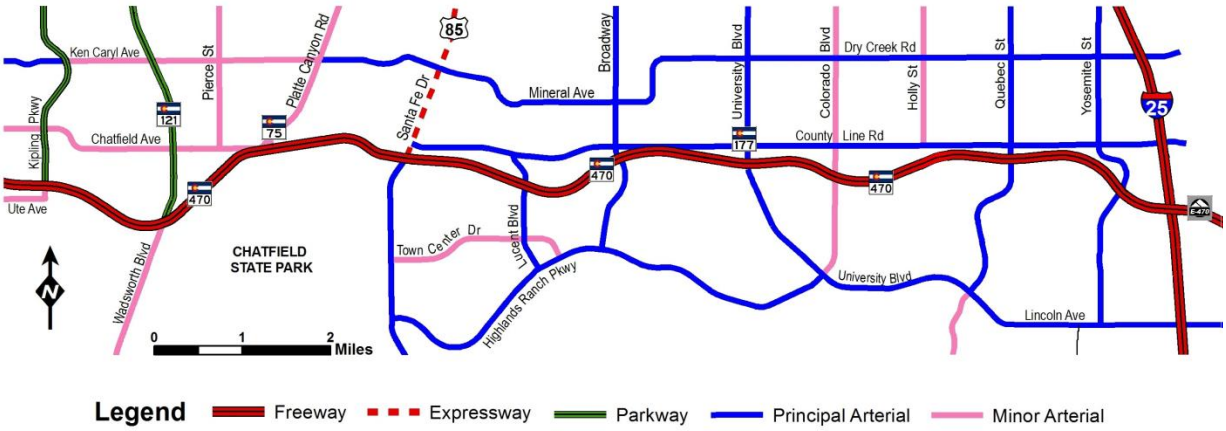


Table 3-1
Description of C-470 Existing Access Conditions

North-South Route	Access	Description (locations ordered from west to east)
Kipling Parkway	Full	Grade-separated interchange with signalized ramp terminal intersections.* Kipling Parkway crosses over C-470.
Wadsworth Boulevard	Full	Grade-separated interchange with signalized ramp terminal intersections. Crosses over C-470.
Platte Canyon Road	Partial	At-grade right-in, right out for westbound C-470 only. Platte Canyon Road does not cross C-470.
South Santa Fe Drive (US 85)	Full	Grade-separated interchange with signalized ramp terminal intersections, plus a flyover ramp from southbound Santa Fe to eastbound C-470. Santa Fe Drive crosses over C-470.
Erickson Road, not shown in Figure 3-2.	None	This collector street crosses under C-470 about one-third mile east of Santa Fe Drive.
Lucent Boulevard	None	Lucent Boulevard crosses over C-470.
Broadway	Full	Grade-separated interchange with signalized ramp terminal intersections. Crosses over C-470.
University Boulevard	Full	Grade-separated interchange with signalized ramp terminal intersections. Crosses over C-470.
Colorado Boulevard	None	No access. Colorado Boulevard crosses over C-470.
Quebec Street	Full	Grade-separated interchange with signalized ramp terminal intersections. Quebec Street crosses over C-470.
Acres Green Drive, not shown in Figure 3-2.	None	Crosses under C-470 between Quebec Street and Yosemite Street. Acres Green Drive is classified as a collector street.
Yosemite Street	Partial	Grade-separated interchange with signalized ramp terminal intersections, with C-470 access only to and from the west. This is a half-diamond interchange. Crosses under C-470.
Interstate 25	Full	Multi-level freeway-to freeway interchange. Free-flowing with no traffic signals. I-25 crosses over C-470.

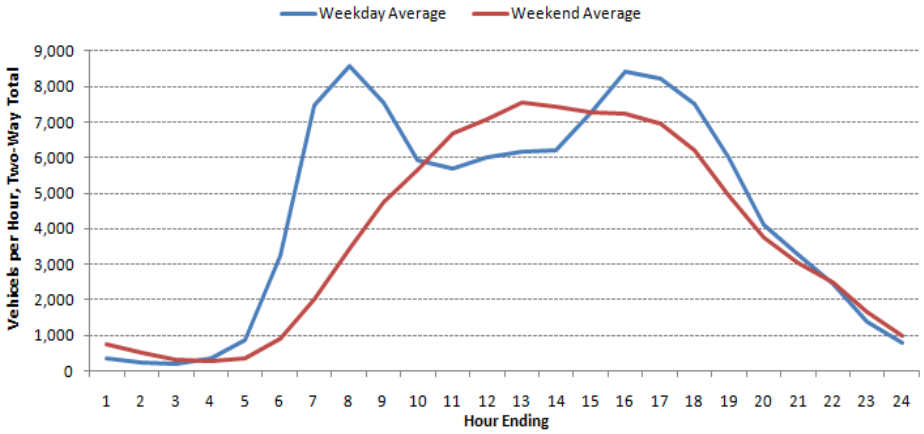
* The grade-separated intersections listed here are diamond interchanges unless otherwise noted.

shoulders are typical to the right of the outside ("slow") lane. Existing typical sections and their widths were presented previously in **Figure 2-3**.

3.2.2 Traffic Composition and Patterns

Figure 3-3 presents average weekday traffic (combined total for eastbound and westbound trips) for average weekday and weekends. Highest combined traffic

Figure 3-3
Existing C-470 Weekday versus Weekend Hourly Volumes*



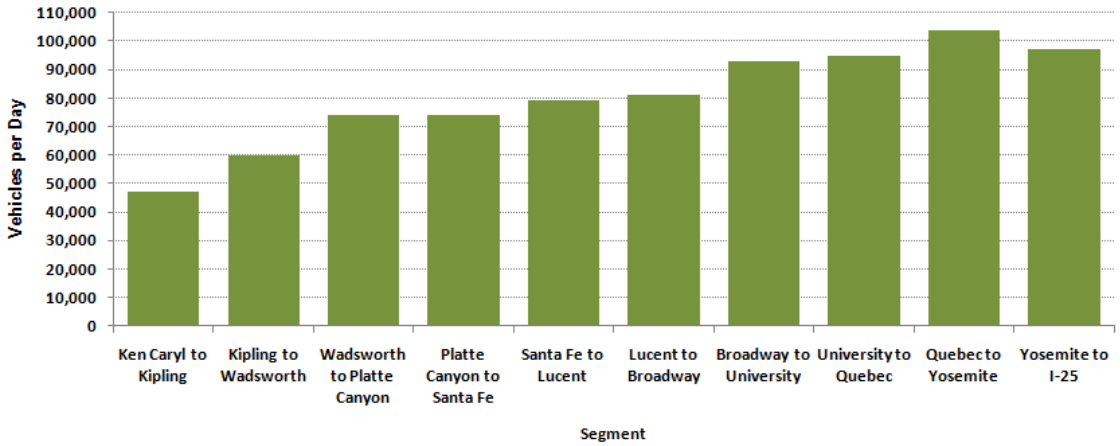
** Data shown are total, two-way traffic from CDOT's permanent, continuous counting station (#105548) located east of Quebec Street, in Lone Tree, from April 2013 (CDOT, 2013).*

volumes during the week occur on weekdays between 7:00 and 8:00 in the morning. Fridays are normally the weekday with the most traffic. These patterns are normal for a freeway in a metropolitan area.

Weekend traffic is steady and moderately heavy during the early afternoon. The source data indicate that traffic is higher on Saturdays than Sundays. Shopping trips to the Park Meadows Mall at the project area's eastern end and recreation trips to parks and open space at the western end (as well as mountain destinations further west) contribute to midday weekend traffic on this particular corridor.

Traffic congestion on weekdays, not weekends, is the focus of this EA. The base year for the analysis is 2013. Average weekday traffic volumes by C-470 segment for 2013 are presented in **Figure 3-4**, from west to east. C-470 traffic volumes are lowest (60,000 vehicles per day) at the western end of the project area and highest near the eastern end (105,000 vpd).

Figure 3-4
C-470 Average Annual Daily Traffic (AADT) by Segment, 2013



(CDOT, 2013)

The average volume west of Kipling Parkway was 47,000 vpd. The volume on tolled E-470, immediately east of the project area, was 37,000 vpd. Both of these numbers are well below the project area minimum, found east of Kipling Parkway.

The number of regional through-trips using all of C-470 from I-25 to I-70 is less than or equal to the lowest volume shown in **Figure 3-4**, which is at the western end of the project area. This demonstrates that the majority of C-470 trips are not through-trips but instead have an origin or destination that is along the corridor.

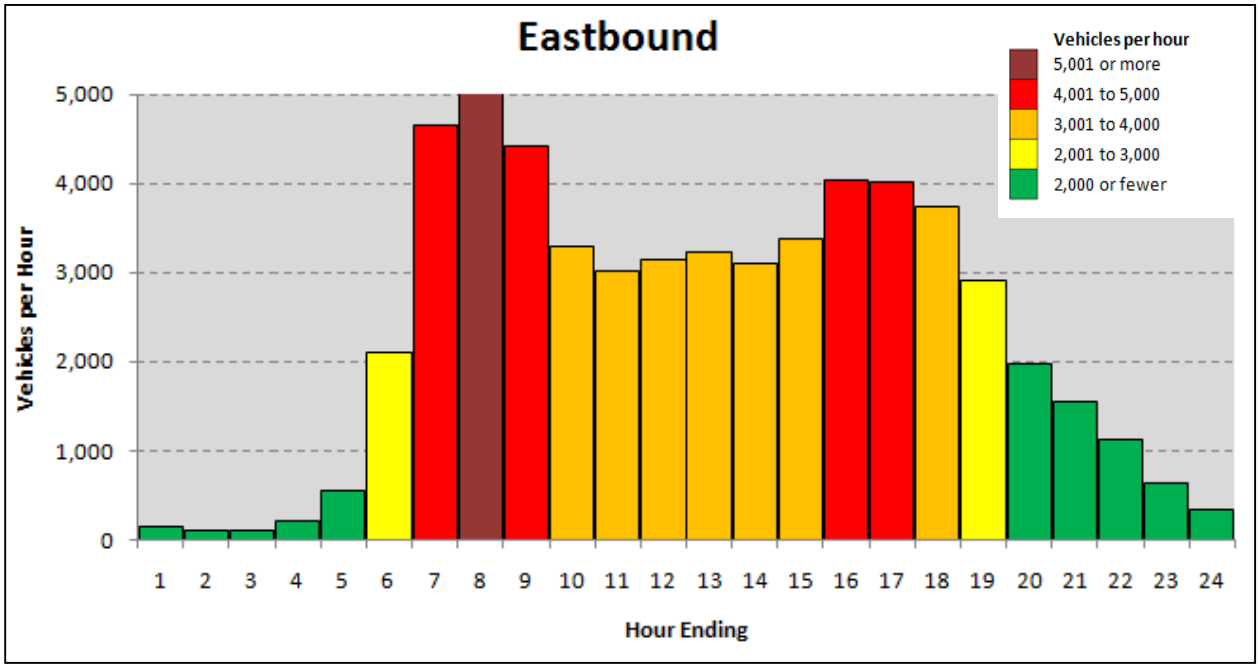
Multiplying the length of each segment by the traffic volume on it yields a corridor total of 1.16 million vehicle miles traveled (VMT) per average weekday.

Figures 3-5 and 3-6 illustrate hourly weekday traffic volumes by direction. The hours with the highest volumes experience the heaviest traffic congestion. The single highest hourly volume in either direction is an average just over 5,000 vehicles per hour (vph) in the eastbound direction for the 7:00 to 8:00 a.m. rush hour.

During the evening peak hours, traffic in each direction is approximately the same, at 4,000 vph, or 2,000 vph per lane. This general balance of traffic in each direction is not well-suited for capacity improvement strategies that include reversible lanes.

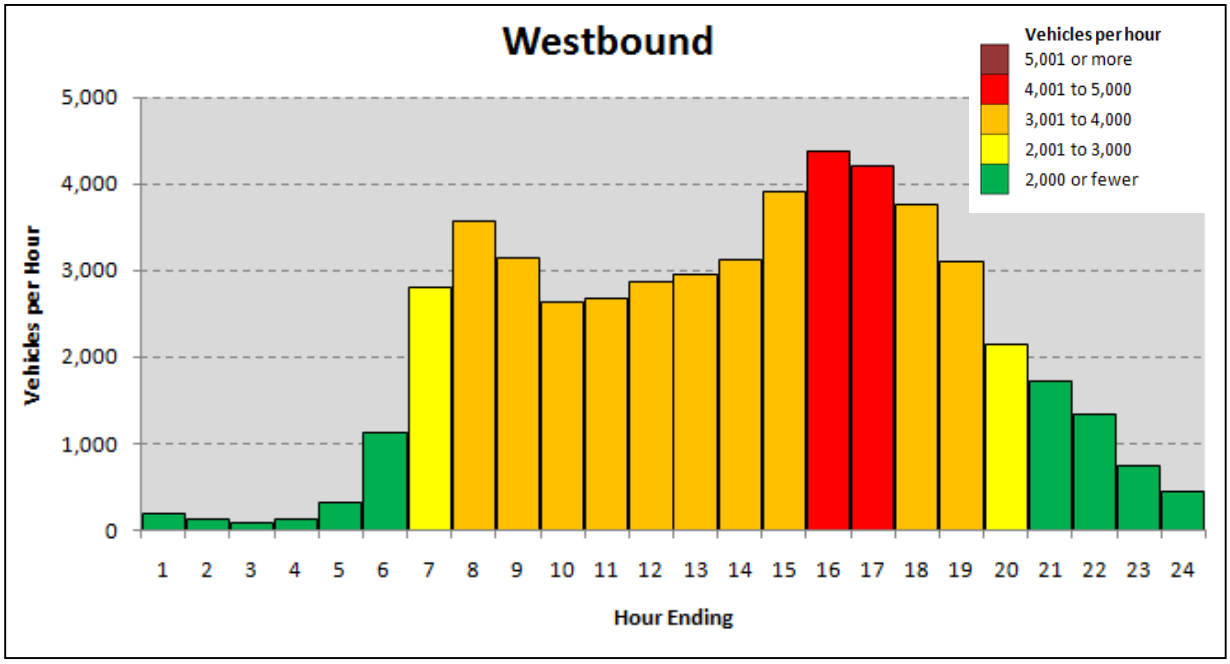
The posted speed limit on all of C-470 is 65 miles per hour (mph). Travel speed observations in May 2013 found traffic flowing at 60 mph westbound in the morning with 3,500 vehicles per hour (vph), 50 mph eastbound in the evening with 4,000 vph, and 25 mph or less during peak hours in the peak directions, with traffic volumes of 4,100 to 5,000 vph. This is consistent with standard traffic engineering models that show travel speed deteriorates rapidly when the volume increases above 4,000 vph.

Figure 3-5
C-470 Hourly Average Weekday Traffic Volumes, Eastbound



(CDOT, 2013)

Figure 3-6
C-470 Hourly Average Weekday Traffic Volumes, Westbound



(CDOT, 2013)

Table 3-2 presents congestion information for the full 26-mile C-470 corridor as found in Appendix 1 (Corridor Visions) of the DRCOG *2035 Metro Vision Regional Transportation Plan.*

The DRCOG estimates in **Table 3-2** can be updated to 2013 and narrowed down to just the 13.75-mile C-470 project area. Calculations based on free-flow speeds, 2013 CDOT traffic volumes, and interpolation of the above DRCOG estimates suggest that total vehicle hours of travel (VHT) on C-470 in the project area were slightly over 23,000 VHT for an average weekday in 2013. This includes 17,847 VHT for free-flow travel, with the remainder being delay due to congestion.

3.2.3 Freeway Volumes and LOS

Traffic volumes on C-470 are shown in **Figure 3-7.** This portion of the analysis was updated to 2014 since new traffic counts became available.

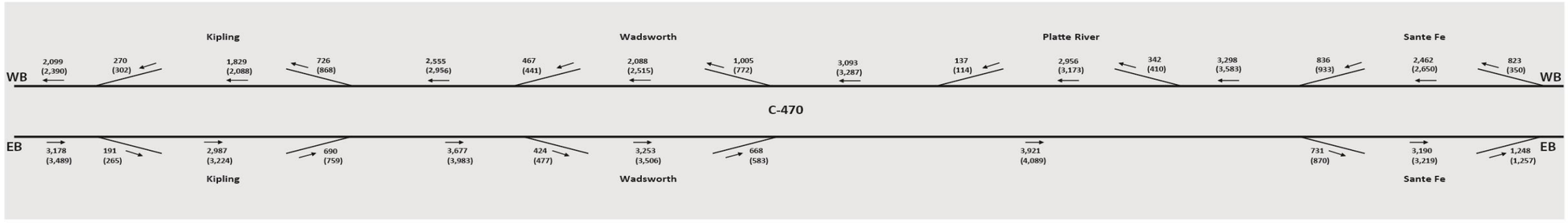
Freeway traffic operations are expressed in terms of LOS, as defined by the *2000 Highway Capacity Manual* (HCM).

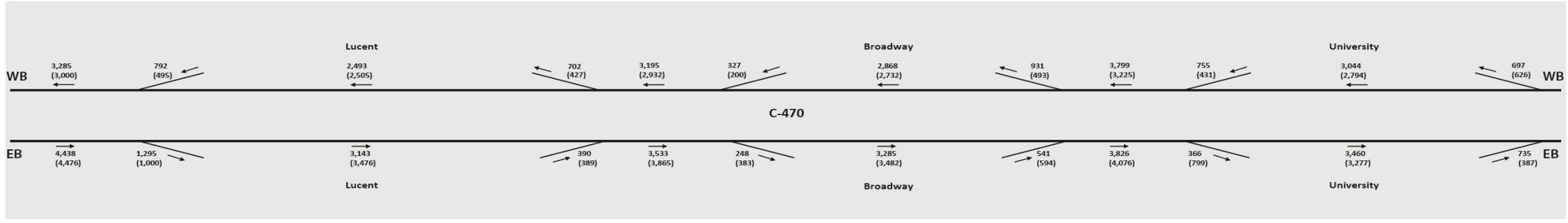
Table 3-2
DRCOG Assessment of Congestion on the 26-mile C-470 Corridor

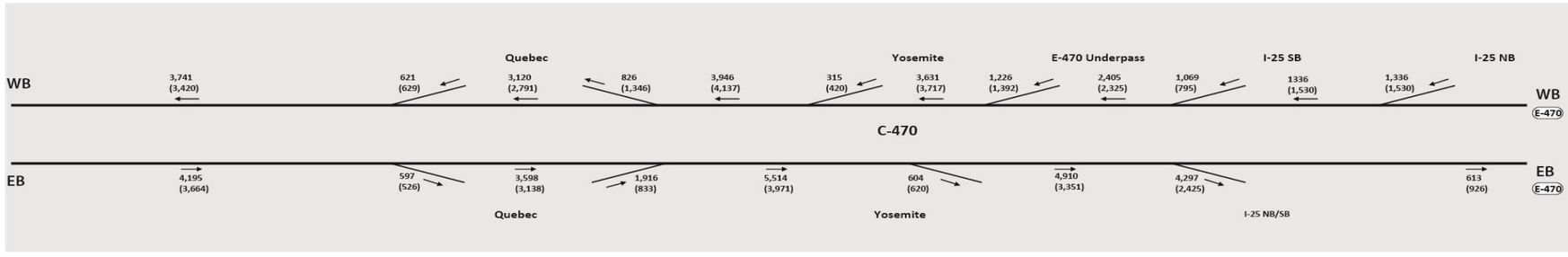
Component	Congestion Measure	2006	2035
Reliability	Travel Time Variation (ratio of peak hour to non-peak hour travel time)	1.44	2.93
Duration	Daily Congestion (hours per day)	1-2	3-4
Severity	Percent of Peak Travel Time in Delay	21%	49%
Delay	Vehicle Delay (hours per day)	6,650	41,940

(DRCOG, 2011a)

Figure 3-7







2014 Existing C-470 Freeway Traffic Volumes

Legend

AM Peak Hour
(#) PM Peak Hour

General Purpose Lanes/Ramps

N

Operational LOS is a congestion measure used to describe service quality and is related to the density of the traffic stream. Free-flow conditions with no restrictions are described as LOS A. LOS B through D conditions demonstrate progressively worse traffic conditions. LOS F represents a breakdown in traffic flow, characterized by the familiar traffic jam.

The entire section of westbound C-470 between Kipling and I-25 generally operates at LOS D or better during the AM and PM peak hours with the exception between I-25 and Yosemite Street where LOS E freeway weave operations were reported.

Eastbound, LOS E/F congested conditions occur for the entire section from Kipling to I-25 for both (AM and PM) peak periods. The existing corridor has traffic operational problems due to high traffic volumes, interchange access points spaced close together, tight weaving and short merging and diverging areas.

The Traffic Technical Report in the Appendix E of this Revised EA provides a comprehensive evaluation and summary of freeway traffic operations for existing conditions and for future conditions with the No-Action Alternative and the Proposed Action.

3.2.4 Interchanges and Arterial Intersections

Interchange ramp terminals and arterial intersection operations in the project area were evaluated using existing signal timing and current intersection geometry. Results of the existing intersection operational analysis are presented in **Table 3-3**.

Table 3-3
Existing (2013) Peak Hour Intersection LOS and Delay

Location (Cross-streets listed from west to east, intersections listed from north to south)	AM Peak Hour		PM Peak Hour	
	Average Delay (seconds)	LOS	Average Delay (seconds)	LOS
Kipling & C-470 Eastbound (EB)	9.6	A	34.8	C
Kipling & C-470 Westbound (WB)	18.0	B	28.3	C
Wadsworth & C-470 EB	12.7	B	12.5	B
Wadsworth & C-470 WB	20.9	C	17.8	B
Santa Fe & C-470 EB	14.1	B	15.3	B
Santa Fe & C-470 WB	21.0	C	28.5	C
Lucent & C-470 EB	26.1	C	12.8	B
Lucent & C-470 WB	36.4	D	36.1	D
Broadway & C-470 EB	9.1	A	9.9	A
Broadway & C-470 WB	18.4	B	23.2	C
University & C-470 EB	12.5	B	30.8	C
University & C-470 WB	11.9	B	14.4	B
Quebec & C-470 EB	115.7	F	14.5	B
Quebec & C-470 WB	15.1	B	186.9	F
Yosemite & C-470 EB	23.1	C	12.7	B
Yosemite & C-470 WB	7.7	A	30.3	C

In the table above, red-shaded cells denote congestion at LOS E or F.

The results show that all of the project area intersections currently operate at an acceptable LOS (LOS D or better for urban conditions) during the peak hours,

The northbound I-25 to westbound C-470 ramp is a left-hand side merge that ends in a lane drop, which leads to slower operating speeds and safety concerns on C-470. In addition, traffic must weave onto I-25 between C-470 and Lincoln in the northbound and southbound directions due to lane drops at the Lincoln and C-470/E-470 interchanges, which lead to slower operating speeds and reduced safety on I-25.

3.2.5 Freeway Travel Times

Travel time data were collected in 2013 to determine current weekday peak and off-peak travel times on C-470. **Table 3-4** summarizes these findings.

3.2.6 C-470/I-25 Traffic Operations

The existing C-470/I-25 interchange area has traffic operational problems due to interchange access points spaced close together, tight weaving areas, and short merging and diverging areas.

Undesirable weaving areas and/or diverge areas were reported along northbound and southbound I-25 between C-470 and Lincoln Avenue. These operational problems will spill back along each of the freeway corridors impacting freeway operations upstream of these locations.

The northbound I-25 to westbound C-470 ramp is a left-hand side merge that ends in a lane drop, which leads to slower operating speeds and safety concerns on C-470. In addition, traffic must weave onto I-25 between C-470 and Lincoln in the northbound and southbound directions due to lane drops at the Lincoln and C-470/E-470 interchanges, which lead to slower operating speeds and reduced safety on I-25.

CDOT has prepared a separate, detailed analysis of operations at the C-470/I-25 interchange. See Section 3.3.2 for more discussion of this analysis called an Interstate Access Request (IAR).

3.2.7 C-470 Crash Data

The Purpose and Need for C-470 improvements is based on the need for congestion relief and improved travel time reliability. However, there is reason to expect that relieving traffic congestion may also have traffic safety benefits.

The *Roadway Safety Technical Report* that is included in **Appendix D** analyzed 1,465 C-470 crashes over a five-year period (2008-2012) and found that rear-end collisions accounted for approximately half (711) of the total. About 75 percent of the rear-end collisions occurred during morning and evening peak hours, during the most congested times of the day. CDOT's Office of Transportation Safety has concluded that most rear-end collisions on C-470 are the direct result of one or more vehicles either.

Table 3-4
Existing (2013) Weekday Average Travel Time and Delay on C-470*

Time Period	Free-Flow Time at 65 mph (Minutes)	Delay (Minutes)		Total Travel Time (minutes)	
		Eastbound	Westbound	Eastbound	Westbound
AM Peak	13	7	1.5	18	14.5
PM Peak	13	0	14.5	13	27.5
Off-Peak	13	N/A	N/A	13	13

** Between I-25 and Kipling Parkway, mileposts 12.449 to 26.195 (13.75 miles)*

unexpectedly slowing or stopping, due to congestion, on the high-speed roadway

Another important finding was that more than half (773 out of 1,465) of the C-470 crashes over five years involved an identifiable driver behavior or condition including: distracted driving, driver inexperience, driver impaired, driver fatigue, aggressive driving, or driver medical condition. Regardless of how safe a roadway design may be, these types of drivers will have crashes.

In the analysis, adverse weather and slick pavement conditions did not appear to be a major cause of crashes. On average, about 300 crashes per year occur on the C-470 mainline, and about 90 percent of them occur when the weather and roads are dry.

The analysis did not identify any locations of high crash frequency for any type of crash that would suggest specific roadway deficiencies. On a mile-by-mile basis, the Broadway interchange vicinity had C-470's highest number of rear-end collisions (average 91 per year, or one every four days) and the most crashes involving cable rail (23 per year).

Only 2.5 percent of the crashes in the C-470 safety database involved heavy trucks. This is approximately proportional to the reported prevalence of heavy trucks on this highway. The corridor does not appear to have design issues causing difficulty for larger, less maneuverable vehicles.

3.2.8 Freight on C-470

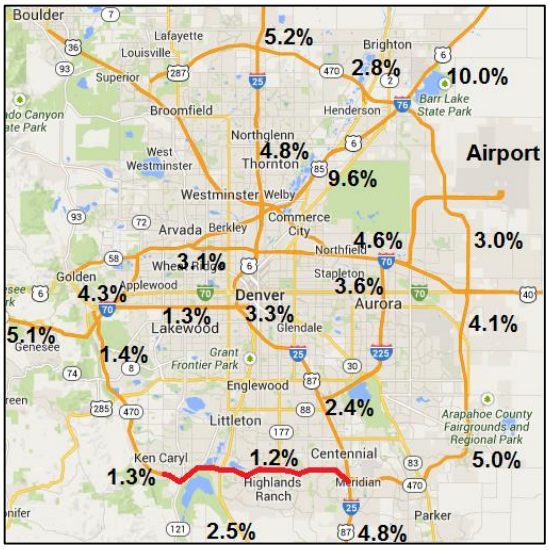
C-470 carries minimal freight trucking in comparison with the other freeways and state highways in the Denver region. High truck volumes occur on east-west I-70, on I-76 bringing freight to and from I-80 in Nebraska, and also delivering freight to and from Denver International Airport (DIA), which is a major hub for many types of cargo including mail and overnight shipping services. DIA is located northeast of downtown Denver, some 30 miles away from the C-470 project area.

Figure 3-8 presents average weekday combination truck (3 or more axles) percentages reported at ten-mile intervals for freeways and other major highways in the Denver region. The 1.2 percent heavy trucks seen on C-470 in the project area (milepost 20) is the lowest percentage noted in the region. Per CDOT's statewide map of bridges with height restrictions, no bridge over C-470 has substandard clearance for trucks.

There are no intermodal freight transfer facilities along the corridor, according to the DRCOG 2035 *Metro Vision Regional Transportation Plan*. The nearest multimodal facility is the Centennial Airport, east of I-25 at County Line Road, which handles some air cargo operations.

Freight railroad tracks cross over C-470 on bridges immediately east of the Santa Fe Drive interchange, but are not found anywhere else in the project area.

Figure 3-8
Heavy Truck Prevalence on C-470 and Other Denver Region Highways



(CDOT, 2103)

C-470 is a designated truck route and a designated hazardous materials route, but not a designated route for transport of nuclear materials.

3.2.9 TDM/TSM

Transportation Demand Management (TDM) and Transportation System Management (TSM) infrastructure or programs that exist within the project area include the following:

- Variable message signs (one each direction) on C-470 approaching Quebec Street
- Ramp metering signals on all C-470 on-ramps (except Kipling Parkway
- DRCOG regional "Way to Go" rideshare matching service and employer outreach program

No congestion management pricing system exists currently on the C-470 corridor. If toll lanes are added, tolls would vary by time interval, with the highest tolls being charged during peak periods. This would encourage off-peak travel for discretionary trips.

3.2.10 Transit Service

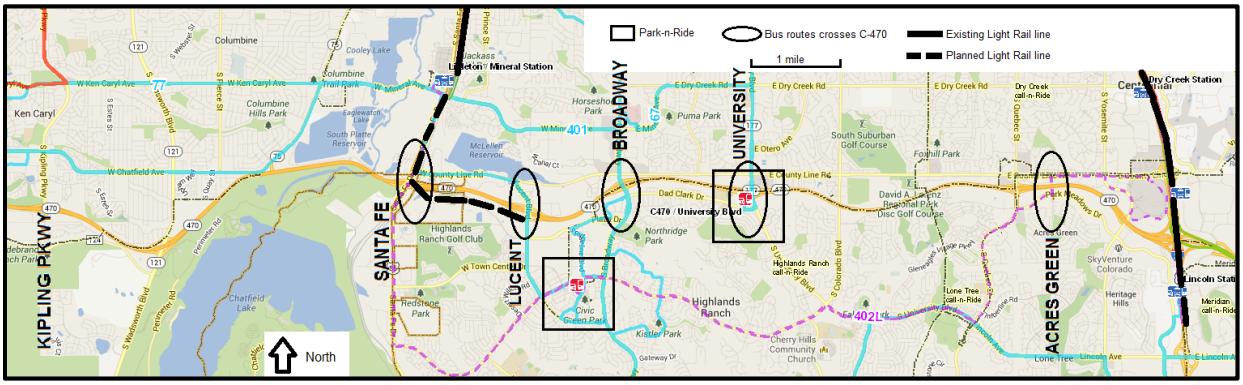
Public transit service in the C-470 project area and throughout the Denver metro area is provided by the Regional Transportation District (RTD). The C-470 project area is at the southern, suburban outskirts of the RTD transit system, with fewer bus routes than in denser, more central parts of the metropolitan area. **Figure 3-9** is an excerpt from RTD's online system map as of early 2014, with local bus routes depicted with various colored lines. The map has been annotated to highlight three transit system features: locations where bus routes cross C-470; Park-n-Ride lots; and light rail lines (existing and planned).

Bus Routes: Currently, no RTD bus routes use C-470. C-470 is not suitable for local bus service as it has no access to adjacent land uses, and is not well suited for express bus routes because crashes and traffic congestion make peak-period travel times highly inconsistent and unreliable.

As of early 2014, bus routes cross C-470 at five locations in the project area, at Santa Fe Drive (US 85), Lucent Boulevard, Broadway, University Boulevard, and Acres Green Drive. Two of these locations (Lucent and Acres Green) do not have freeway interchanges, while the other three pass through interchange ramp intersections. An express route to the town of Parker (east of the project area) uses I-25 and toll highway E-470 but does not use or cross C-470.

Light Rail: Two light rail lines from downtown Denver reach the C-470 project area. The Southeast Corridor follows I-25, with stations at the Park Meadows Mall

Figure 3-9
RTD Transit System Elements in the C-470 Project Area



(RTD, 2014)

north of C-470 and Lincoln Avenue south of C-470. The Southwest Corridor extends southward down Santa Fe Drive to the Mineral Station, and is planned to extend southward across C-470 then turn eastward to a planned new station at Lucent Boulevard. The DRCOG *2035 Metro Vision Regional Transportation Plan* indicates that implementation of this 2.8-mile, $142.5 million extension is anticipated in the 2015-2024 timeframe.

Park-n-Ride Lots: Two RTD Park-n-Ride lots are located within the project area. A 440-space lot is located immediately south of C-470 and west of University Boulevard. Deeper into the interior of the Highlands Ranch development, a 177-space lot is located at the intersection of Highlands Ranch Parkway and Ridgeline Boulevard.

3.2.11 Bicycle and Pedestrian Facilities

C-470 is a freeway, so it does not have adjacent sidewalks or bike lanes. According to the CDOT Colorado Bicycle Map, bicycling on the C-470 shoulder is prohibited on the busiest section of the highway, from I-25 to Quebec Street. However, there is a separate, paved multiuse trail called the Centennial Trail (or C-470 Trail) that parallels the highway for its entire length. See photo in **Figure 3-10**.

The C-470 Trail serves the very important transportation purpose of providing east-west mobility and offering cyclists a safe route that is not on the busy, high-speed freeway.

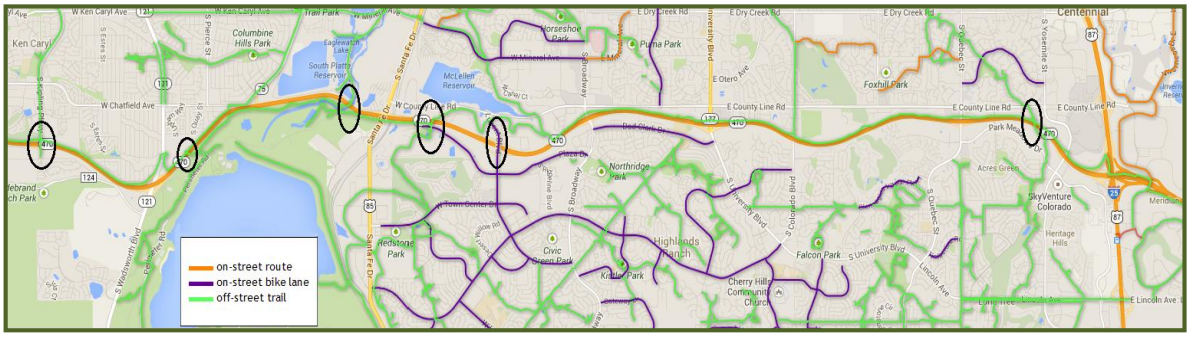
Most of the C-470 Trail is located north of C-470. From I-25 to the High Line Canal, west of Lucent Boulevard, it is north of C-470. It crosses under C-470 with the High Line Canal Trail and remains on the south side of C-470 through Chatfield State Park, then crosses under C-470 at the Massey Draw drainage, east of Wadsworth Boulevard, and remains on the north side of the highway thereafter to the west.

Figure 3-11 is an excerpt of the DRCOG Regional Bicycle Map, depicting on-street routes, on-street bike lanes, and off-street trails. Off-street trails and on-street bike lanes are relatively plentiful south of C-470 between the Chatfield Reservoir and I-25, in the Highlands Ranch development of Douglas County. Black ovals on the figure indicate the six locations where bicycle facilities cross C-470.

Figure 3-10
View of C-470 Trail Next to the Freeway

Facing west, approaching the Colorado Boulevard overpass. In this location, the trail is on the north side of the freeway.

Figure 3-11
Bicycle Facilities in the C-470 Project Area



(DRCOG, 2011a) Note: crossings of C-470 are highlighted with a black oval.

From west to east along the corridor, these are: Kipling Parkway, Massey Draw, South Platte River (Mary Carter Greenway Trail), High Line Canal (east of Erickson Road), Lucent Boulevard, and Willow Creek (west of Yosemite Street). These crossings are heavily concentrated in the western half of the project area, with three of the six occurring in the vicinity of Chatfield State Park.

In addition to crossing the freeway twice, the C-470 Trail makes east-west crossings of the various north-south highways and arterial streets that cross the freeway. Unlike the two C-470 Trail crossings of the freeway, some of the trail's crossings of arterials are at-grade, meaning that cyclists must cross the street in traffic. Over time, these at-grade crossings are being replaced with safer, grade-separated crossings.

3.3 FUTURE TRANSPORTATION CONDITIONS

This section discusses the anticipated impacts of the Proposed Action and No-Action Alternative on the transportation resources and conditions that have been discussed above. As there are only two alternatives under consideration, their effects are discussed simultaneously, in comparison to each other, rather than sequentially (i.e., first discussing all aspects of one alternative and then repeating the discussion for the second alternative).

Traffic modeling for this Revised EA used 2013/2014 baseline conditions and DRCOG model assumptions from the DRCOG *2035 Metro Vision Regional Transportation Plan (RTP).* The DRCOG 2035 plan anticipated several improvements to the roadway network in the vicinity of the C-470 project area within the next two decades. These are:

- County Line Road, widening to add two lanes between University Boulevard and Phillips Avenue (east of Broadway), in the 2015-2024 timeframe.
- E-470 widening to add two lanes between I-25 and Parker Road, in the 2025-2035 timeframe.

Additionally, there are ongoing efforts to widen U.S. 85 (Santa Fe Drive) south of the project area to Castle Rock. This was the subject of an approved and still active *South I-25 Corridor and US 85 Corridor Final Environmental Impacts Statement* (2001) and its subsequent Record of Decision (2002).

In February 2015, DRCOG adopted a 2040 Fiscally Constrained RTP. This new plan specifies some of the upcoming US 85 improvements from the EIS noted above. It

indicates that funding is programmed for widening U.S. 85 from four through lanes to six through lanes as follows:

- 2015 to 2014 - Highlands Ranch Parkway to Blakeland Drive
- 2025 to 2034 – Blakeland Drive to County Line Road
- 2025 to 2034 – Titan Parkway to Highlands Ranch Parkway

These widening efforts have been anticipated since the 2002 ROD, and C-470 improvements in the vicinity of U.S. 85 are compatible with these future needs.

The 2040 RTP also indicates that approximately $50 million is programmed for capacity improvements at the I-25/Lincoln Avenue interchange. This project will be designed to be compatible with the C-470 Proposed Action as well.

3.3.1 Transit Resources

There are no special lanes or other accommodations for buses or High Occupancy Vehicles on C-470. Poor travel time reliability makes C-470 unattractive for bus service. This would continue to be true under the No-Action Alternative, but with the Proposed Action, new toll lanes would be managed through time-of-day pricing to offer improved travel time reliability. Thus, the express lanes would be more attractive for RTD bus use than C-470 is today. Given the limited number of locations where ingress and egress between the express lanes and the adjacent free lanes would be allowed, the new lanes would be better suited for express bus services than for local service routes.

3.3.2 Freeway Volumes and Operations

Year 2035 No-Action and Proposed Action traffic forecasts for the study were developed utilizing the DRCOG 2035 FOCUS travel demand model and the VISSIM traffic micro-simulation models prepared for this study. Model data for 2040 was not available from DRCOG at the time of the analysis.

The calibration of the travel demands was an iterative process that involved refining the demands in the static equilibrium assignment procedure within the FOCUS model and then testing the operations of these demands within the simulation models. The No-Action Alternative AM and PM peak hour volumes on C-470 are shown in **Figure 3-12.** The Proposed Action traffic volumes are shown in **Figure 3-13**.

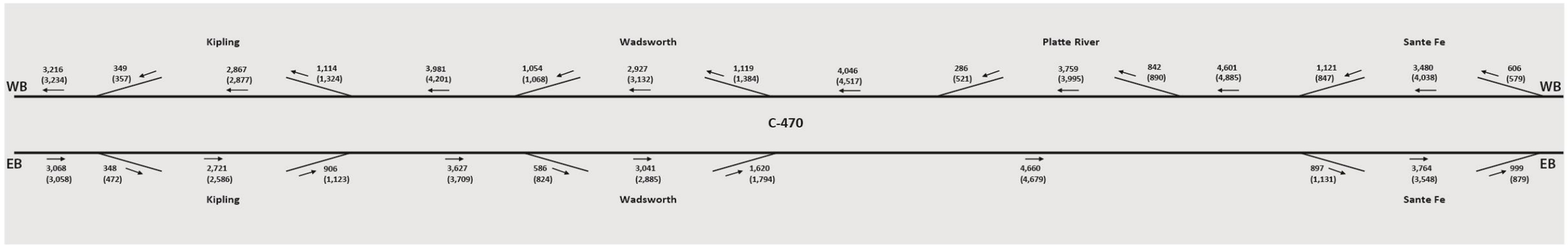
No-Action Alternative

Freeway Traffic Operations: The AM and PM freeway levels of service for the 2035 No-Action Alternative are summarized in **Table 3-5**. The analysis indicates that many of the mainline freeway segments along the C-470 corridor would operate at an unsatisfactory LOS (LOS E or F) for the No-Action Alternative during each of the peak hours. These operational problems will spill back along the C-470 corridor impacting freeway operations upstream of the congested locations.

Along I-25 congested operations are projected in both the northbound and southbound directions between County Line Road and Lincoln Avenue during each of the peak hours. Examination of traffic impacts at the C-470/I-25 interchange was an important element of the overall corridor traffic analysis.

Interchange Traffic Operations: Peak hour traffic operations for 16 signalized intersections were analyzed for the 2035 No-Action Alternative and the results are summarized in **Table 3-6**. Out of the 20 total intersections evaluated, seven intersections exhibited capacity deficiencies.

Figure 3-12



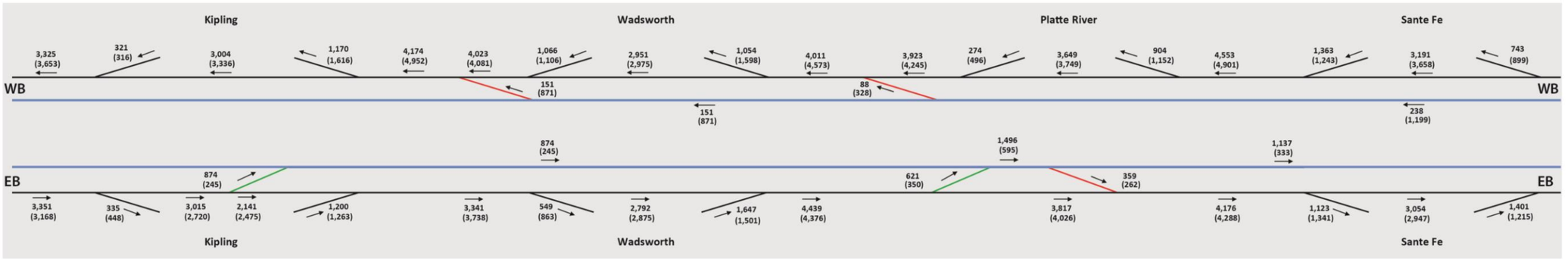
2035 No Action C-470 Freeway Traffic Volumes

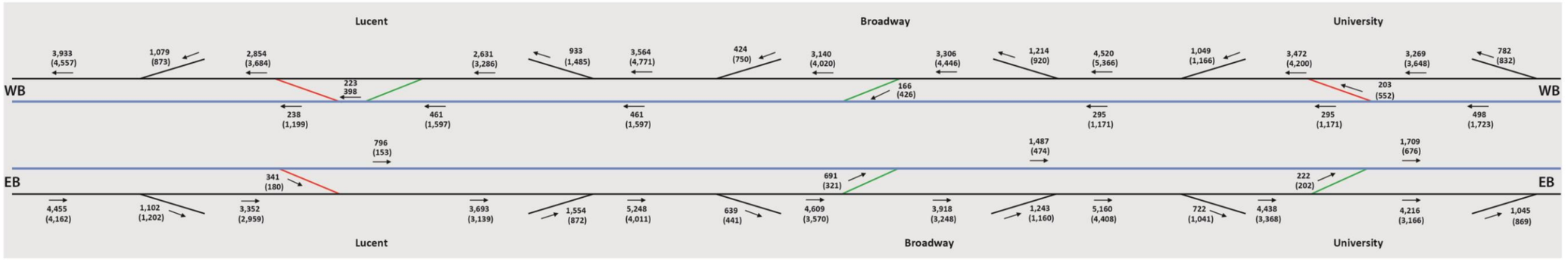
Legend

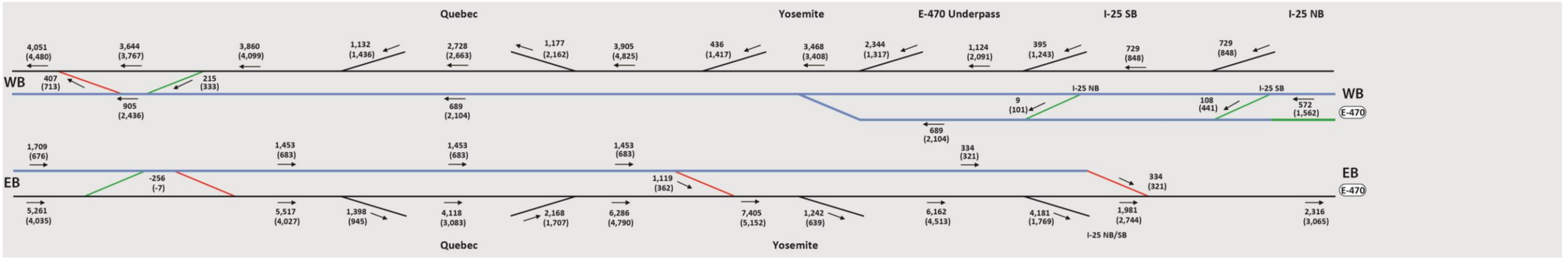
AM Peak Hour
(#) PM Peak Hour
General Purpose Lanes/Ramps

N

Figure 3-13







C-470 Proposed Action Freeway Traffic Volumes

Legend

AM Peak Hour
(#) PM Peak Hour
General Purpose Lanes/Ramps
Toll Managed Lanes
Tolled Managed Lane Egress
Tolled Manged Lane Ingress

N

Table 3-5
2035 Freeway Peak Hour Level of Service
for the No-Action Alternative

	Basic Freeway Segements		2035 No-Build					
			AM peak			PM peak		
	From	To	Volume	Density	LOS	Volume	Density	LOS
Westbound C-470	E of C-470	I-25 Off ramp	4,255	23.4	C	4,475	24.7	C
	E-470	I-25 N/S Ramp Split	1,887	19.4	C	2,030	20.9	C
	I-25 Off ramp	I-25 On ramp	2,369	19.5	C	2,445	20.1	C
	I-25 Ramps	C470	1,464	12.0	B	2,289	18.8	C
	I-25 On ramp	Yosemite On ramp	3,832	21.0	C	4,734	26.4	D
	Yosemite On ramp	Quebec Off ramp	4,261	23.4	C	6,141	38.9	E
	Quebec Off ramp	Quebec On ramp	2,932	24.2	C	3,959	36.6	E
	Quebec On ramp	University On ramp	3,822	34.5	D	4,702	52.9	F
	University Off ramp	University On ramp	3,316	28.1	D	3,892	35.6	E
	University On	Broadway Off	4,329	43.5	E	4,778	55.3	F
	Broadway Off ramp	Broadway On ramp	3,402	29.1	D	4,065	38.4	E
	Broadway On ramp	Lucent Off ramp	3,903	35.7	E	4,880	58.8	F
	Lucent Off ramp	Lucent On ramp	3,163	26.5	D	3,712	33.0	D
	Lucent On ramp	Santa Fe Off ramp	4,086	38.8	E	4,617	50.4	F
	Santa Fe Off ramp	Santa Fe On ramp	3,480	30.0	D	4,038	37.9	E
	Santa Fe On ramp	lane drop	4,601	50.0	F	4,885	59.0	F
	Lane drop	Platte Canyon Off ramp	4,601	25.5	C	4,885	27.5	D
	Platte Canyon Off ramp	Platte Canyon On ramp	3,759	33.6	D	3,995	37.2	E
	Platte Canyon On ramp	Wadworth Off ramp	4,046	38.1	E	4,517	47.8	F
	Wadworth Off ramp	Wadworth On ramp	2,927	24.2	C	3,132	26.2	D
	Wadworth On ramp	Kipling Off ramp	3,981	37.0	E	4,201	40.9	E
	Kipling Off ramp	Kipling On ramp	2,867	23.7	C	2,877	23.7	C
	Kipling On ramp	W of Kipling	3,216	27.0	D	3,234	27.2	D
	Kipling Off ramp	W of Kipling	3,068	25.5	C	3,058	25.4	C
	Kipling Off ramp	Kipling On ramp	2,721	22.4	C	2,586	21.2	C
Eastbound C-470	Kipling On ramp	Wadworth Off ramp	3,627	31.8	D	3,709	32.9	D
	Wadworth Off ramp	Wadworth On ramp	3,041	25.3	C	2,885	23.8	C
	Wadworth On ramp	Santa Fe Off ramp	4,660	51.7	F	4,679	52.3	F
	Santa Fe Off ramp	Santa Fe On ramp	3,764	33.7	D	3,548	30.8	D
	Santa Fe On ramp	Lucent Off ramp	4,763	26.6	D	4,427	24.4	C
	Lucent Off ramp	Lucent On ramp	3,567	31.1	D	3,363	28.6	D
	Lucent On ramp	Broadway Off ramp	4,783	55.4	F	4,034	37.9	E
	Broadway Off ramp	Broadway On ramp	4,013	37.5	E	3,313	28.1	D
	Broadway On ramp	University Off ramp	4,949	61.4	F	4,415	45.4	F
	University Off ramp	University On ramp	4,066	38.4	E	3,384	28.9	D
	University On ramp	Quebec Off ramp	5,017	64.2	F	4,110	39.2	E
	Quebec Off ramp	Quebec On ramp	4,335	43.6	E	3,495	30.2	D
	Quebec On ramp	Yosemite Off ramp	6,675	46.2	F	5,154	29.5	D
	Yosemite Off ramp	I-25 Off ramp	5,796	35.1	E	4,500	24.9	C
	I-25 Off ramp	I-25 On Ramp	1,975	16.2	B	2,819	23.2	C
	C470	I-25 N/S Ramp Split	3,821	33.0	D	1,680	12.8	B
	I-25 N/S On ramp Merge	E-470	1,221	9.3	A	2,231	17.0	B
	I-25 On ramp	E of C-470	3,196	17.5	B	5,050	28.7	D

Table cells with red shading denote congested conditions with LOS E or F.

Table 3-6
2035 Peak Hour Intersection LOS and Delay
for the No-Action Alternative

Location (Cross-streets listed from west to east, intersections listed from north to south)	AM Peak Hour		PM Peak Hour	
	Average Delay (seconds)	LOS	Average Delay (seconds)	LOS
Kipling & C-470 EB	13.3	B	19.5	B
Kipling & C-470 WB	28.1	C	81.1	F
Wadsworth & C-470 EB	73.8	E	74.5	E
Wadsworth & C-470 WB	33.8	C	42.0	D
Santa Fe & C-470 EB	52.7	D	>120	F
Santa Fe & C-470 WB	23.5	C	22.8	C
Lucent & C-470 EB	24.0	C	26.0	C
Lucent & C-470 WB	36.7	D	108.2	F
Broadway & C-470 EB	51.5	D	15.6	B
Broadway & C-470 WB	16.0	B	20.4	C
University & C-470 EB	43.4	D	28.5	C
University & C-470 WB	29.0	C	68.5	E
Quebec & C-470 EB	79.9	E	14.1	B
Quebec & C-470 WB	26.2	C	>120	F
Yosemite & C-470 EB	39.1	D	14.6	B
Yosemite & C-470 WB	14.7	B	47.4	D

Table cells with red shading denote congested conditions with LOS E or F.

Proposed Action

Freeway Traffic Operations: Under the Proposed Action, the tolled express lanes are predicted to operate at LOS C or better in the peak direction and at LOS A in the off-peak direction. The general purpose lanes are generally projected to operate at LOS D or better in both the peak and off peak directions during the AM and PM peak hours. There are sections that are projected to operate at congested levels (LOS E/F), but the number of sections projected to operate at congested levels are less compared to the No-Action Alternative. **Table 3-7** summarizes the AM and PM freeway levels of service for the 2035 Proposed Action.

Along I-25, the laneage on I-25 and ramp laneage and connections to and from I-25 are consistent between the No-Action Alternative and Proposed Action. In addition, peak hour traffic volumes along the I-25 corridor are relatively consistent between these two alternatives, therefore, the traffic operations along the freeway corridor are also consistent. Congested freeway operations (LOS E/F) were reported along I-25 in both directions during each of the peak hours, from County Line Road to Lincoln Avenue.

Express lanes introduce a weave movement at ingress/egress locations, which was analyzed in the Traffic Technical Report (see **Appendix E**). Westbound, weaves with LOS E would occur at two locations. The first of these begins with the westbound Quebec on-ramp, for motorists wishing to cross the general purpose lanes to the next available express lanes ingress location.

Table 3-7
2035 C-470 Peak Hour LOS for the Proposed Action

	Basic Freeway Segements		2035 Ultimate Build					
			AM peak			PM peak		
	From	To	Volume	Density	LOS	Volume	Density	LOS
Westbound C-470 GPL	I-25 On ramp	Yosemite On ramp	3,468	19.0	C	3,408	18.7	C
	Yosemite On ramp	Quebec Off ramp	3,905	21.4	C	4,825	27.0	D
	Quebec Off ramp	Quebec On ramp	2,728	22.4	C	2,663	21.9	C
	Quebec On ramp	ML ingress	3,860	35.1	E	4,099	39.0	E
	ML ingress	ML egress	3,644	32.0	D	3,767	33.7	D
	ML egress	University Off ramp	4,051	38.2	E	4,480	46.9	F
	University Off ramp	ML egress	3,269	27.6	D	3,648	32.1	D
	ML egress	University On ramp	3,472	29.9	D	4,200	40.9	E
	University On ramp	Broadway Off ramp	4,520	25.0	C	5,366	31.2	D
	Broadway Off ramp	ML ingress	3,306	28.0	D	4,446	46.1	F
	ML ingress	Broadway On ramp	3,140	26.2	D	4,020	37.6	E
	Broadway On ramp	Lucent Off ramp	3,564	19.5	C	4,771	26.7	D
	Lucent Off ramp	ML combo	2,631	21.6	C	3,286	27.8	D
	ML combo	Lucent On ramp	2,854	11.7	B	3,684	15.1	B
	Lucent On ramp	Santa Fe Off ramp	3,933	21.6	C	4,557	25.2	C
	Santa Fe Off ramp	Santa Fe On ramp	3,191	26.8	D	3,658	32.2	D
	Santa Fe On ramp	Platte Canyon Off ramp	4,553	25.2	C	4,901	27.6	D
	Platte Canyon Off ramp	Platte Canyon On ramp	3,649	32.1	D	3,749	33.5	D
	Platte Canyon Off ramp	ML egress	3,923	36.1	E	4,245	41.8	E
	ML egress	Wadworth Off ramp	4,011	22.0	C	4,573	25.4	C
	Wadworth Off ramp	Wadworth On ramp	2,957	24.5	C	2,975	24.6	C
	Wadworth On ramp	ML egress	4,023	22.1	C	4,081	22.4	C
	ML egress	Kipling off ramp	4,174	17.2	B	4,952	20.4	C
	Kipling Off ramp	Kipling On ramp	3,004	24.9	C	3,336	28.3	D
	Kipling On ramp	W of C-470	3,325	28.2	D	3,653	32.1	D
	Kipling Off ramp	W of C-470	3,351	28.5	D	3,168	26.5	D
	Kipling Off ramp	ML ingress	3,015	25.0	C	2,720	22.4	C
Eastbound C-470 GPL	ML ingress	Kipling on Ramp	2,141	11.7	B	2,475	13.6	B
	Kipling On ramp	Wadworth Off ramp	3,341	18.3	C	3,738	20.5	C
	Wadworth Off ramp	Wadworth On ramp	2,792	23.0	C	2,875	23.7	C
	Wadworth On ramp	ML ingress	4,439	45.9	F	4,376	44.5	E
	ML ingress	ML egress	3,817	34.4	D	4,026	37.7	E
	ML egress	Santa Fe Off ramp	4,176	40.4	E	4,288	42.6	E
	Santa Fe Off ramp	Santa Fe On ramp	3,054	25.4	C	2,947	24.4	C
	Santa Fe On ramp	Lucent Off ramp	4,455	24.6	C	4,162	22.8	C
	Lucent Off ramp	ML egress	3,352	28.5	D	2,959	24.5	C
	ML egress	Lucent On ramp	3,693	32.7	D	3,139	26.2	D
	Lucent On ramp	Broadway Off ramp	5,248	30.2	D	4,011	22.0	C
	Broadway Off ramp	ML ingress	4,609	50.2	F	3,570	31.1	D
	ML ingress	Broadway On ramp	3,918	36.0	E	3,248	27.4	D
	Broadway On ramp	University Off ramp	5,160	29.5	D	4,408	24.3	C
	University Off ramp	ML ingress	4,438	45.9	F	3,368	28.7	D
	ML ingress	University On ramp	4,216	41.2	E	3,166	26.5	D
	University On ramp	ML Combo	5,261	76.3	F	4,035	37.9	E
	ML Combo	Quebec Off ramp	5,517	32.5	D	4,027	22.1	C
	Quebec Off ramp	Quebec On ramp	4,118	39.3	E	3,083	25.7	C
	Quebec On ramp	ML egress	6,286	40.7	E	4,790	26.8	D
	ML egress	Yosemite Off ramp	7,405	32.8	D	5,152	21.2	C
	Yosemite Off ramp	I-25 Off ramp	6,162	39.2	E	4,513	25.0	C
	C470	I-25 N/S Split	4,181	22.9	C	1,769	9.7	A
	I-25 Off ramp	ML egress	1,981	NA	NA	2,744	NA	NA
	ML egress	I-25 On ramp	2,316	19.0	C	3,065	25.5	C
	I-25 N/S Ramp Merge	I-25 On ramp	1,162	10.4	A	2,072	18.5	C
	I-25 On ramp	E of I-25	3,477	19.0	C	5,137	29.3	D

Table cells with red shading denote congested conditions with LOS E or F.

The second involves traffic from the express lanes egress location working across the general purpose lanes to exit at University Boulevard.

For eastbound traffic, LOS E weaves would occur at three locations: first, for between the Wadsworth Boulevard on-ramp and the next available express lane ingress; second, between the express lane egress and the Santa Fe Drive off-ramp; and finally, between the express lane egress and the Yosemite Street off-ramp (morning peak only).

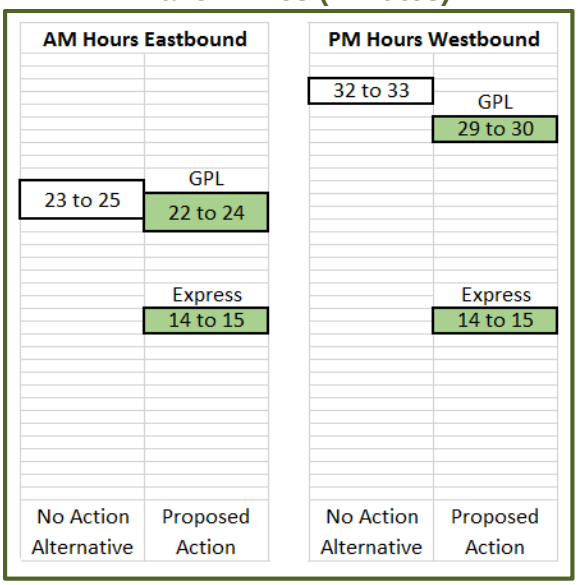
The proposed addition of direct-connect ramps at the C-470 interchange with I-25 requires preparation of a detailed operational analysis in support of an Interstate Access Request (IAR). CDOT has submitted an IAR to FHWA for consideration. Once the IAR is approved, copies will be available upon request to the CDOT Project Engineer. See the contact information at the front of this Revised EA.

Freeway Travel Times: C-470 corridor peak hour, peak direction travel times from I-25 to Kipling were estimated for the No-Action Alternatives and the Proposed Action for the AM and PM peak hours. During the morning the peak direction of travel is in the eastbound direction and during the evening the westbound direction is the peak travel direction.

Travel times for the general purpose lanes and tolled express lanes associated with each alternative were estimated. For the general purpose lanes the peak hour, peak direction travel times were estimated based on current C-470 peak hour, peak direction corridor travel times and travel speed results reported from the HCS analyses for each of the alternatives.

As discussed previously CDOT, will manage the tolled express lanes such that traffic flows freely. LOS C can be considered a reasonable maximum LOS for the tolled express lanes which would reflect a corridor travel speed of approximately 55 mph. The estimated C-470 peak hour, peak direction 13.75-mile corridor travel times are summarized in **Figure 3-14**.

Figure 3-14
2035 Peak Hour Peak Direction C-470 Travel Times (minutes)



As shown, travel time in the express lanes for the C-470 section between Kipling Parkway and I-25 would be approximately 14 to 15 minutes during of each of the peak hours. Peak direction travel times in the general purpose lanes of the Proposed Action would one to three minutes lower than the No-Action Alternative.

The reliability of travel with the No-Action Alternative would continue to worsen, resulting in substantial effects to corridor mobility, affecting economic viability of businesses in the corridor area and quality of life for corridor residents.

The Proposed Action would provide reliable travel times in the tolled express lanes while maintaining consistent and/or better travel times in the general purpose lanes compared to the No-Action Alternative.

System VMT/VHT: The following is contained in the *C-470 Express Toll Lanes Traffic Operations Analysis Report*,

prepared for Douglas County (Cambridge Systematics, 2015).

The two major measures of effectiveness for understanding the overall changes in network-wide performance that were used are the Vehicle Miles Traveled (VMT) and the Vehicle Hours Traveled (VHT). The VMT can show increases in vehicle throughput or be used to analyze changes in routing, where the VHT can be used as an overall statistic to show increases or decreases in congestion and/or delay along the roadway. The future VMT and VHT for both the AM and PM peak periods can be seen below in **Table 3-8**.

It can be seen in **Table 3-8** that the Proposed Action has a beneficial impact on congestion. In 2035, an eight percent reduction in VHT is predicted for the morning, and a 24 percent VHT reduction is predicted for the afternoon and evening.

Another impact that can be seen in the network-wide statistics is that an increase in VMT is achieved with the Proposed Action. This VMT is the result of increase of vehicle throughput along the C-470 mainline as a result of the reduction of congestion and addition of toll lanes to avoid the congestion. The combination of increased VMT decreased VHT clearly indicates that the Proposed Action is improving the operational conditions of the entire network, which includes the general purpose lanes, auxiliary lanes, express lanes, ramps, and the arterials up to the nearest adjacent intersections.

Interchange Traffic Operations for the Proposed Action: Intersection delays were evaluated to determine the LOS for arterial intersections for 2035 volumes. There is some rerouting of traffic through these interchange intersections but overall intersection LOS remains relatively the same between the No-Action Alternative and the Proposed Action. The results are shown in **Table 3-9**.

The Traffic Technical Report for this Revised EA also examined arterial intersections beyond the C-470 interchanges to see how traffic would differ between the No-Action Alternative and Proposed Action. See the report for additional details.

Table 3-8
2035 Forecast WMT and VHT

Alternative	VMT (Millions)		VHT (Thousands)	
	AM*	PM**	AM	PM
No Action	1.67	1.62	53.4	69.1
Proposed Action	1.77	1.90	49.1	52.3
Percent Change	6%	17%	-8%	-24%

**6:00 am to 1:00 pm* ***1:00 pm to 8:00 pm* Source: Cambridge Systematics, Inc.

Table 3-9
Proposed Action (2035) Peak Hour Intersection LOS and Delay

Location (Streets listed from west to east, intersections listed from north to south)	AM Peak Hour		PM Peak Hour	
	Average Delay (seconds)	LOS	Average Delay (seconds)	LOS
Kipling & C-470 EB	15.0	B	21.7	C
Kipling & C-470 WB	25.7	C	110.2	F
Wadsworth & C-470 EB	79.6	E	42.0	D
Wadsworth & C-470 WB	27.0	C	53.3	D
Santa Fe & C-470 EB	95.7	F	72.3	E
Santa Fe & C-470 WB	30.6	C	63.2	E
Lucent & C-470 EB	31.7	C	39.1	D
Lucent & C-470 WB	62.1	E	>120	F
Broadway & C-470 EB	>120	F	11.6	B
Broadway & C-470 WB	23.9	C	25.8	C
University & C-470 EB	49.0	D	51.7	D
University & C-470 WB	39.3	D	64.3	E
Quebec & C-470 EB	159.5	F	35.1	D
Quebec & C-470 WB	26.3	C	>120	F
Yosemite & C-470 EB	54.1	D	12.9	B
Yosemite & C-470 WB	7.0	A	38.2	D

Table cells with red shading denote congested conditions with LOS E or F.

3.3.3 Summary of Proposed Action Traffic Impacts

Figure 3-16 indicated that the Express Lanes would provide a travel time of 14 to 15 minutes for the 13.75-mile corridor. Comparing the mainline LOS for the Proposed Action (**Table 3-7**) and No-Action Alternative (**Table 3-5**), reduced peak period congestion is evident on many portions of the corridor. Finally, as an indicator of overall delay, **Table 3-8** reported substantially reduced VHT on the corridor for the 14 most heavily traveled hours of the day with the Proposed Action, compared with the No-Action Alternative. It is concluded that the Proposed Action would meet the project's Purpose and Need by providing reliable trip times, reducing congestion, and reducing C-470 congestion.

3.4 HIGH OCCUPANCY VEHICLE USE OF EXPRESS LANES

CDOT is considering whether or not to permit high occupancy vehicles (HOVs) with three or more occupants (HOV3+) to use the express lanes in the Proposed Action without paying a toll, as will be the case on other express lane corridors in the Denver region by 2017. This section discusses the factors that are being considered with regard to this issue.

Additional study currently underway, and therefore not included in this Revised EA section, will assist CDOT in making this decision. This will include both C-470 corridor specific HOV financial information via the Level III Traffic and Revenue (T&R) Team and solicitation of public comment on the topic during the public review period following completion of the Revised EA.

All of the information available will be considered by CDOT in making a final decision on whether or not to permit HOV3+ use in the express lanes as part of the Proposed Action. The final decision will be included in the Decision Document for this Revised EA.

3.4.1 Results of Alternatives Analysis

A key consideration in approaching the HOV3+ exempt question is understanding the purpose for taking action to improve C-470. The project's Purpose and Need are detailed in Chapter 1 of this Revised EA. The project purpose is to address existing and future C-470 congestion, reduce traveler delay, and improve travel time reliability for corridor users. Any proposed corridor improvements must be financially feasible based on reasonably foreseeable available funding.

The 2006 EA considered a large number of alternatives, including two that would have provided lanes with HOV use. Both alternatives considered would have widened the existing four–lane highway from two general purpose lanes (GPL) in each direction to and eight-lane highway with three GPL plus one HOV lane in each direction. The second of the two alternatives included the addition of auxiliary lanes at select locations. Both alternatives were eliminated in the 2006 EA because they were projected not to provide appropriate levels of congestion and delay relief.

The updated 2015 alternatives assessment identified no new information to change these conclusions. However, this does not preclude the option of considering HOV3+ exempt use within the Proposed Action. Targeted toll exemptions do not necessarily represent a new "alternative" but instead may be considered as operational options for the Proposed Action.

3.4.2 Traffic and Revenue Studies Are Pertinent to Toll Exemption Issues

The C-470 Express Lanes project has been the subject of a series of traffic and revenue ("T&R") studies to determine how much toll revenue would be generated, as this key information is important in deciding what can be built and when. Near-term "Interim" improvements of the Proposed Action are expected to cost $269 million. CDOT currently has $100 million in approved RAMP funds plus $10 million committed by Douglas County. The remaining $159 million will likely come from debt financing paid back through collection of user tolls.

The C-470 Level I T&R study was conducted to provide gross assurances that toll revenue would be sufficient to make the project financially feasible. The Level II T&R study completed in September 2014 was developed with more detailed information, including specific modeling-based traffic assumptions, and represents the best information currently available.

To support the anticipated $159 million in debt financing, an investment-grade Level III T& R study is currently underway for the purpose of demonstrating to the investment community that future toll revenues would be adequate to repay debt obligations arising from the sale of bonds to finance the project. The Level III T&R study findings will be available prior to the NEPA Decision Document.

The Level II T&R study showed that any toll exemptions would reduce the amount of future revenue as compared to projections with no toll exemptions. This study also indicated that for the busiest 14 hours of the day in 2018 (opening day for the Proposed Action), an estimated 1.7% of C-470 traffic would be carrying 3+ occupants, declining to 1.4% by 2035. This is the base-case condition, without an HOV3+ exemption.

As the result of toll exemption, much of the future traffic carrying 3+ occupants would use the express lanes, thus reducing projected revenue. Also, over time, HOV3+ use would be expected to increase, thereby further reducing toll revenues.

The results of the Level II T&R study suggest that in terms of 2013 dollars, the 30-year accumulated impact of an HOV3+ exemption could result in a revenue reduction of $15 million for the corridor. The full financial impact to the project that would result from HOV3+ exemption is being studied in greater detail by the Level III T&R Team, using newer and more detailed data and assumptions. The Level III T&R study will help to determine how much money CDOT can borrow from the investment community to finance the project. This is a key factor, as almost 60% of the near-term "Interim" project is estimated to be financed.

3.4.3 Other Factors for Consideration Regarding HOV3+ Policy

Some other factors with a bearing on CDOT's decision regarding HOV3+ exemption for C-470 express lanes may potentially include (but are not limited to) the following:

- Regional Transportation Plan calls for increased travel efficiency
- Regional Transportation Plan indicates that local communities should have input on tolling decisions
- Consistency with other CDOT express lanes
- Consistency with connecting beltway segments
- Environmental consequences

Regional Transportation Plan Calls for Increased Travel Efficiency: The adopted DRCOG *2035 Metro Vision Regional Transportation Plan* (RTP) calls for increased travel efficiency in the region, especially for peak period commuting. Consistent with increasing travel efficiency, CDOT plans to change the vehicle occupancy requirements for Denver-region HOV lanes on State Highways from two persons per vehicle (HOV2+) to a minimum of three persons per vehicle (HOV3+) by 2017. HOV3+ vehicles include RTD transit buses and vanpools, as well as carpools. This new occupancy requirement is designed to provide more reliable travel times for the most efficient vehicles and offer an incentive for two-person carpools to add another rider.

Express lanes can also improve commuter travel efficiency by pricing non-essential trips out of peak travel times. Charging higher tolls during peak periods gives motorists an incentive to drive during off-peak periods if they can, which also reduces peak period congestion compared to a system of flat hourly tolls unchanging by hour of day. Thus, express lanes with variable pricing is an energy-saving and pollution-reducing highway option, compared to simply adding general purpose lanes. "Congestion pricing" can be implemented with or without any toll exemptions.

RTP Goal for Local Community Input on Tolling Decisions: The adopted DRCOG *2035 Metro Vision Regional Transportation Plan* (RTP) also includes a specific goal indicating that local communities should have input on tolling decisions for roadways that traverse their jurisdictions. All the affected communities along C-470 in February 2011 joined together as a group called the C-470 Corridor Coalition. They examined various funding options for C-470 corridor improvements and unanimously selected tolled express lanes as their preferred option.

CDOT worked closely with this Coalition throughout development of the Revised EA, and is an affiliate, non-voting member of the group. The C-470 Corridor Coalition has specifically considered the HOV3+ exempt question and does not favor it due to

potential revenue losses that could impact project financing.

Consistency with Other CDOT Express Lanes: CDOT has stated that the decision on whether or not to allow toll exemptions will be made on a corridor-by-corridor basis. One challenge related to HOV being a corridor-by-corridor decision is related to public messaging. The concept of express lanes is already viewed as a transportation complexity by some highway users and a variable HOV policy throughout Colorado could be perceived as a further complicating factor. HOV/Express lanes exist or are currently under construction by CDOT on a number of corridors throughout the Denver region.

CDOT plans to change the vehicle occupancy requirement by 2017 so that toll exemptions are made available only for HOV3+ users, and no longer for HOV2+ users. The north I-25 and US 36 express lanes are allowing toll exemptions. The I-70 Peak Period Shoulder Lanes will not allow HOV toll exemptions.

Consistency with Connecting Beltway Segments: The only tolled facility that currently connects directly with C-470 is the private toll road E-470. E-470 provides no toll exemptions based on vehicle occupancy. E-470 and the Northwest Parkway are toll roads (i.e., with no free general purpose lanes at all) that together with C-470 form a nearly complete regional beltway system.

The busy C-470/E-470/I-25 freeway-to-freeway interchange currently connects facilities with two different pricing conditions (all free on I-25 and C-470; all-tolled on E-470). Adding an HOV3+ exemption on C-470 would introduce a third pricing system, furthering complicating motorists' decisions. This situation is not optimal and is not found elsewhere in the Denver region.

Environmental Consequences: With or without any toll exemptions, C-470would have the same roadway footprint with approximately the same total traffic levels (although shifted from the free, general purpose lane to express lane, or vice versa). Therefore, environmental consequences of the Proposed Action would be largely the same with or without the HOV3+ exempt policy.

The HOV3+ exemption could have a small beneficial impact for air quality by providing an incentive for persons in two-occupant carpools to add a third occupant, or for new carpool formation by solo drivers. In general, however, newly induced carpool formation resulting from toll exemption would be expected to be a fraction of existing HOV3+ use (1.4% in 2035) because many factors other than tolls go into the decision to carpool.

Shifting existing HOV3+ carpools from the general purpose lanes to the express lanes would reduce their emissions. However, this benefit could be partially offset if HOV3+ use results in pricing other (single-occupant) users out of the express lanes to maintain peak-period travel speeds. Level II T&R projections did not analyze air quality but did predict future Vehicle Hours of Travel (VHT) on C-470. The Level II T&R results showed no net VHT reduction within the corridor for the HOV3+ exemption scenario.

3.4.4 Summary of HOV3+ Pros and Cons for the C-470 Express Lanes Project

The considerations discussed above are summarized in **Table 3-13** as "pros" (factors that would tend to favor use of an HOV3+ exempt policy) or "cons" (factors that would favor not offering an exemption) for the Proposed Action. All of these factors can be discussed in a qualitative manner. Some are quantifiable to a degree. Importantly, all of the factors discussed here are not necessarily of equal weight.

Table 3-13
Pros and Cons Regarding an HOV3+ Exempt Policy for C-470*

Factor	Pro (+), Neutral, or Con (-)	Discussion
Revenue impact, per the September 2014 Level II T&R Study	-	It is estimated that HOV3+ exemption could reduce toll revenue by $15 million over a 30-year analysis period. Conceptually, this revenue reduction could impact the scope of the Proposed Action and/or be passed along to express lanes users through higher toll rates.
DRCOG Regional Transportation Plan goals call for increased travel efficiency	+	Toll exemption could slightly increase overall corridor vehicle occupancy, thus slightly reducing the number of vehicles on the roadway.
DRCOG Regional Transportation Plan indicates that local communities should have input on tolling decisions	-	The C-470 Corridor Coalition The Coalition has expressed concerns about revenue loss impacting the financially feasibility of the project.
Consistency with other CDOT express lanes	+	CDOT has stated that the decision on whether or not to allow toll exemptions will be made on a corridor-by-corridor basis. On opening day and into the future, more corridors in Colorado are projected to provide an HOV exemption than not.
Consistency with connecting beltway segments	-	The existing private toll road connected to C-470 is E-470, which provides no toll exemptions to any vehicle class.
Environmental consequences	neutral	The Proposed Action would have the same impacts on most resources (water quality, wildlife, traffic noise) regardless of whether or not an HOV3+ policy were in place. A small reduction in air quality emissions could result if toll exemption results in increased carpooling.

** Note: These factors should not all be assumed to be of equal importance, and their order of presentation also is not intended to imply their relative importance.*

The table summarizes these factors and shows a trend of more “cons” than “pros”. However, as stated previously, CDOT will not make a final decision on the HOV3+ topic until additional public input is received and the ongoing analysis by the Level III T&R Team is complete. The final decision will be included in the Decision Document for this Revised EA.

3.5 PROJECT PHASING

Implementing the Proposed Action identified in **Chapter 2** of this Revised EA will require a substantial investment of financial resources, and is expected to occur in two phases. The interim configuration can be funded in the near-term. The ultimate configuration would be completed in the future, funded by successful toll collection from the Interim phase. The second phase would complete the Proposed Action’s Ultimate configuration. **Table 3-14** provides information about the elements of each construction phase.

Traffic and revenue studies have been performed to determine that the first project phase is financially viable, and that it could generate future revenues sufficient to later build the second phase. Additional

investment-grade revenue studies will be needed to demonstrate financial capacity to satisfy bond market requirements. Revenue bonds would then be sold to finance the first phase, together with $100 million in available public funds from Colorado's Responsible Acceleration of Maintenance and Partnerships (RAMP) program.

3.5.1 Interim versus Ultimate Configuration

A diagram indicating the extent and location of the Interim project and the Ultimate configuration is provided in **Figure 3-15**. The first-phase Interim project would provide managed express lanes as follows:

- Westbound, two express lanes from I-25 to approximately Colorado Boulevard, and one lane from Colorado Boulevard to Wadsworth Boulevard
- Eastbound, one express lane from Platte Canyon Road to I-25

The Ultimate configuration would extend and add lanes to achieve two express lane in each direction between I-25 and Kipling Parkway. As noted in **Chapter 2**, the Proposed Action would maintain two (reconstructed) general purpose lanes in each direction, giving motorists the option to not pay any tolls.

The traffic and environmental analysis of this Revised EA focuses on the Ultimate configuration. As a cost-saving approach, mitigation for water quality, wetlands, traffic noise and other resource impacts would largely occur in conjunction with the near-term project, and thus would not have to be moved or reconstructed in the future.

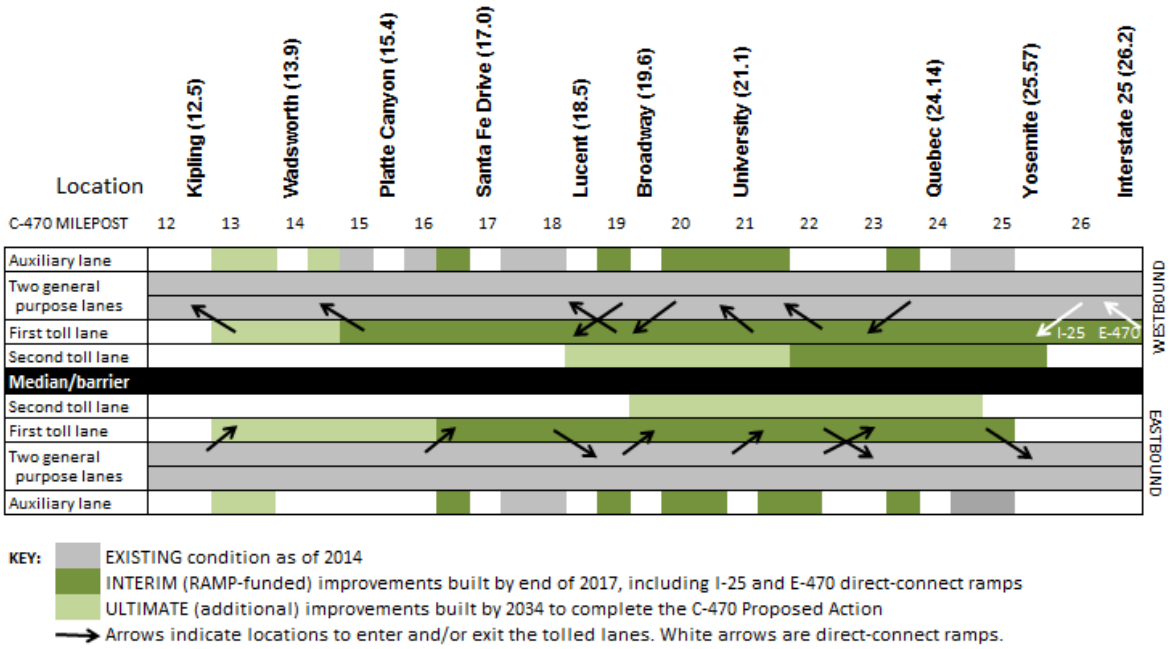
3.5.2 Meeting Current Needs Now, Future Needs Later

The Proposed Action has been developed to address foreseeable needs by the year 2035, with an expected 50 percent increase in traffic demand compared with existing conditions. The extra demand does not exist today, and the corresponding capacity is not all needed today, either. However, C-470's traffic demand already exceeds the highway's capacity and additional capacity is needed now to address today's congestion problems.

Table 3-13
Key Elements of Interim and Ultimate Configurations

Project Element	Near-Term Project to Build Interim Configuration	Future Project to Build Ultimate Configuration
Reconstruction to address existing design deficiencies (estimated cost of over $77 million)	Part of Interim project	--
Replacement of South Platte River bridges	Part of Interim project	--
I-25/C-470 Direct-Connect Ramps	Part of Interim project	--
Environmental mitigation for Ultimate Configuration	Part of Interim project	Additional if needed
Capacity needed for existing demand and near-term growth	Part of Interim project	--
Capacity needed for future Growth through the year 2035		To be provided in Future Phase
Auxiliary lanes	As needed	As needed
Estimated project cost (includes design, right-of-way, engineering and construction)	$269 million	

Figure 3-15
Diagram of Interim and Ultimate Configurations



The DRCOG Fiscally Constrained 2040 RTP includes $220 million in near term funding (including bonded toll revenues) and an additional $165 million in future toll revenues, for a project total of $385 million. These numbers will be subject to change over time. Already, the cost of the near-term $220 million phase has been adjusted upward to $269 million in response to recent construction industry cost trends.

3.5.3 Reconstruction a Key Component of the Interim Project

No part of the Proposed Action consists of "just adding lanes" to the existing C-470 facility. Instead, the conceptual design for the Proposed Action also addresses known existing conditions of suboptimal horizontal and vertical curvature as well as pavement structural needs. Thus, in conjunction with the planned new capacity, CDOT would fix existing design problems.

As noted previously, C-470 was originally planned to be Interstate 470, but it was removed from the Interstate system and Colorado received funds to build its own highway instead. The resulting C-470 highway thus was not designed or constructed in accordance with Interstate Highway standards. The Proposed Action will not be able to bring C-470 into full compliance with Interstate Highway standards, but will make strides in that direction. Providing consistent design on freeways is generally desirable for safety reasons to meet driver expectancy.

CDOT's April 2014 cost estimate for the Interim project indicated that about one-third of that cost was attributable to C-470 reconstruction rather than the addition of new capacity.

3.6 OTHER TRANSPORTATION IMPACTS

The permanent impacts of the Proposed Action are reduced delay and improved travel time reliability, which do not require mitigation. Two Proposed Action would also have two other transportation impacts discussed below.

Relocating Portions of the C-470 Trail: CDOT's C-470 Trail general parallels the entire length of the 26-mile highway, often very close to the roadway. Expansion of C-470 to add the highway to add express lanes and auxiliary lanes will in some locations result in the need to move the trail.

Based on conceptual design for the Proposed Action, approximately 5.8 miles of the C-470 Trail would be need to be moved. The trail will be shifted up to 167 feet outward from its existing course, but generally 45-50 feet.

CDOT's preferred approach to minimizing disruptions for trail users will be to construct the new trail and shift users over to it before impacting the existing trail. However, this may not be practicable in every situation. In some locations, a temporary trail surface may need to be provided as a detour around work zones. In other locations, an off-site detour may be required if sufficient room is not available to safely pass through the roadway construction zone.

In no case would the trail be closed without providing adequate detour routes. Advance signing of trail closures and detours would be required. A minimum of two weeks' notice would be provided for potential closures and detours. These detours would be posted and presented to trail user groups.

One anticipated temporary closure of the C-470 Trail would occur where it crosses under the highway in a culvert shared with the High Line Canal Trail, between Santa Fe Drive and Lucent Boulevard. Please see **Section 4.2.6, Parks and Recreation**, for a discussion of this impact.

Traffic Congestion Due to Construction Activity: Maintaining traffic flow while also constructing improvements on busy, existing highways is a challenge routinely faced on CDOT projects. Temporary speed reductions and increased congestion in construction cone zones would be experienced on C-470 by the roadway's users.

As part of the Proposed Action, considerable funding would be budgeted for maintenance of C-470 traffic flow during construction. It is anticipated that a three-phase construction sequence would be used: (1) first, shifting traffic on the existing pavement toward the outside while building a portion of the median area; (2) then, shifting traffic to the partially constructed median and constructing the outside portion; (3) and finally, shifting traffic to the outside and completing the interior sections.

Specific construction phasing and maintenance of traffic details have not been developed and would be determined by the design-build contractor. However, these details are likely to include most of the following strategies:

- Develop detailed construction phasing and traffic control plans
- Maintain two 12-foot travel lanes in each direction
- Maintain existing C-470 exit and entrance ramps open to traffic during morning and evening peak traffic periods
- Maintain a minimum of two-foot shoulders throughout the construction zone
- Provide emergency pullout areas when shoulders are less than eight feet wide

- Provide a construction zone assistance vehicle to assist motorists with vehicular problems
- Use signing to announce timing of planned road closures

In a February 2015 Request for Qualifications document issued to the construction community, CDOT clearly communicated that one of its key goals for the C-470 project is: “Minimize impacts to the traveling public during project construction and future construction.”

As discussed in Section 3.5, much of the Proposed Action would be constructed in the near term, producing the Interim configuration, and the remainder of the project would be completed in the future. The near-term improvements would be designed and constructed in a manner that would tend to minimize traffic disruption resulting from the future project.

CHAPTER 4
AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

This chapter describes the existing social, physical, and biological environment of the C-470 Corridor and discloses the effects that would occur under the No-Action Alternative and the Proposed Action, which were described in **Chapter 2**. It also describes mitigation for adverse effects for the Proposed Action. The No-Action Alternative includes no mitigation.

In this chapter, resource topics are organized into the social, physical, and biological environments, followed by a table that summarizes effects and mitigation measures. A cumulative effects discussion follows the summary table. These sections are found on the following page numbers:

Some of the data collected as part of the 2006 EA remain valid for use in this Revised EA, and have been used if feasible. However, where conditions have changed or required analytical methods have changed, new data were collected during 2013 to 2015. Revised analysis is necessary also because the Proposed Action design in 2015 varies from the Preferred Action in the 2006 EA.

4.2 SOCIAL ENVIRONMENT

The social environment of the C-470 project area consists of the people and businesses that exist within one mile of the highway. Transportation improvements can affect the social environment both positively and negatively by altering economic development patterns or changing land use. Social environment effects were evaluated for the following topics:

- 4.2.1 Demographics
- 4.2.2 Minority and low income populations
- 4.2.3 Economic considerations
- 4.2.4 Land use
- 4.2.5 Right-of-way
- 4.2.6 Parks and recreation
- 4.2.7 Land and Water Conservation Fund assisted properties

4.2.1 Demographics

Data from the 2010 Decennial Census were examined to determine the characteristics of the residents within the project area. The project area population consists of persons living within approximately one mile of C-470. This area is composed of 73 Census block groups within 30 Census tracts. The same area corresponds to 88 Transportation Analysis Zones used for traffic modeling by DRCOG when that agency makes small area forecasts for population and employment.

General Population Characteristics: The 2010 Census population within the C-470 Corridor area was 114,465 residents. The total population of the three counties that C-470 traverses was 1.4 million. **Table 4-1** shows the 2010 Census population and its change from 2000 for the project area and for Arapahoe, Douglas, and Jefferson Counties.

Table 4-1
Population Growth, 2000 to 2010

Area	Population		Percent Growth
	2000	2010	
Arapahoe County	487,967	572,003	17.2%
Douglas County	175,766	285,465	62.4%
Jefferson County	527,056	534,543	1.4%
3-County Total	1.2 million	1.4 Million	16.9%
C-470 Corridor	103,467	114,465	10.6%

The 13.75-mile C-470 study corridor is located mostly (75 percent) within Douglas County, which had the smallest population but the highest growth rate of three counties. About one third of Douglas County's population lives in Highlands Ranch (unincorporated area) just south of the freeway. 2010 Census population totals for the three cities along the C-470 Corridor were:

- Centennial 100,377
- Littleton 41,737
- Lone Tree 10,218

Municipal populations are included in the county totals reported in the table, but only portions of these cities are within the C-470 Corridor area.

Table 4-2 shows the projected population from 2010 to 2035 for the three counties. The C-470 Corridor will have approximately 40,000 additional residents while the surrounding three-county area is expected to add half a million new residents. The rate of growth within the C-470 Corridor (34 percent between 2010 and 2035) will be comparable to that within the three-county area as a whole (35.1 percent).

No-Action Alternative Impacts on Population: The DRCOG population forecasts were made in conjunction with the *2035 Metro Vision Regional Transportation Plan* (RTP) that did not include C-470 improvements at the time. The RTP was later amended to include the C-470 Proposed Action. This did not necessitate or result in a change to regional population and employment forecasts.

Proposed Action Impacts on Population: Planned population growth of 34 percent in the C-470 project area and 35.1 percent growth result in the need for improvements on C-470, which DRCOG has identified as a "key congested area". C-470 has been congested for more than a decade, which is why the 2006 EA was begun in 2003. The Proposed Action responds to existing conditions and planned growth; it is not expected to affect future growth. It supports the Metro Vision land use plan which calls for infill and densification within the established regional growth boundaries, providing adequate mobility to planned Urban Centers. No mitigation is needed.

4.2.2 Minority and Low Income Populations

In 1994, Presidential Executive Order12898 directed every Federal agency to make environmental justice part of its mission by identifying and addressing the effects of all programs, policies, and activities on minority populations and low-income populations. The U.S. Department of Transportation (USDOT) and FHWA have internal agency orders and guidance to implement environmental justice

Table 4-2
Projected Population Growth, 2010 to 2035

Area	Projected Population			Growth in Population		
	2010	2020	2035	2010 to 2020	2020 to 2035	2010 to 2035
Arapahoe County	574,819	667,037	805,459	13.8%	20.8%	40.1%
Douglas County	287,124	351,832	454,908	18.4%	29.3%	58.4%
Jefferson County	535,651	575,088	627,315	6.9%	9.1%	17.1%
3-County Total	1.4 million	1.6 million	1.9 million	12.3%	18.4%	35.1%
C-470 Corridor	119,527	134,675	160,129	11.2%	18.9%	34.0%

Source: Colorado Department of Local Affairs (DOLA) County Projections for July 1 of each year; and DRCOG 2010 Cycle 2 Forecasts, 2,832-zone system. 2010 DOLA projections differ slightly from actual 2010 Census results.

ENVIRONMENTAL JUSTICE

The three fundamental principles at the core of Environmental Justice, as expressed by Executive Order 12898 are:

- To avoid, minimize, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on tribal governments, minority, and low-income populations
- To ensure the full and fair participation by all potentially affected communities in the transportation decision-making process
- To prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations

policies. The current USDOT and FHWA guidance documents are discussed in the Environmental Justice Technical Report that is provided in **Appendix E**.

Minority populations include both racial and ethnic minorities. The Census Bureau definition of race is separate and distinct from Hispanic or Latino, which is considered an ethnicity. Thus, non-minority persons are those who reported that they were both "white only" and "not Hispanic or Latino".

Data from the 2010 Census were examined to determine the presence of minority or low income populations along the C-470 Corridor. **Table 4-3 s**hows year 2010 Census race and ethnicity data for the C-470 project area, the three counties where the highway is located, and the State of Colorado.

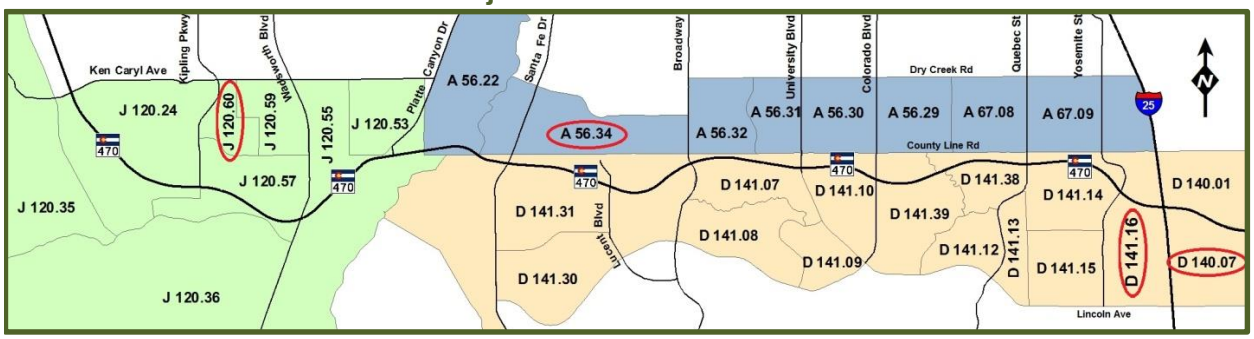
Among the 30 Census Tracts examined, the one with the highest percentage of minorities had 23.4 percent minorities, which is well above the 13.3 percent for the project area, but very consistent with the surrounding counties. This tract also had the highest percentage of African-Americans, at 3.7 percent (compared with 1.2 percent for the project area). This was Douglas County Census Tract 140.07, located southeast of the I-25/C-470 interchange. **Figure 4-1** indicates this location. These percentages are not high in comparison with surrounding counties or the state, but only in comparison with the rest of the project area.

The population of the C-470 project area is substantially more non-minority than its surrounding counties and state.

Table 4-3
Year 2010 Race and Ethnicity in C-470 Project Area and Surrounding Counties

	C-470 Project Area		Three-County Total	State of Colorado
Population by Race and Ethnicity	Persons	Percent of Total	Percent of Total (1,392,011)	Percent of Total (5,029,196)
RACE				
White Alone	104,309	91.1%	82.3%	81.3%
Asian	3,937	3.4%	3.9%	2.8%
African-American	1,346	1.2%	4.8%	4.0%
Other or Combined Races	4,873	4.3%	9.0%	11.9%
Total	114,465	100.0%	100.0%	100.0%
ETHNICITY				
Not Hispanic or Latino	106,622	93.1%	85.4%	89.3%
Hispanic or Latino	7,843	6.9%	14.6%	20.7%
Total	114,465	100.0%	100.0%	100.0%
TOTAL MINORITY				
Non-Minority	99,190	86.7%	80.5%	70.0%
Minority	15,275	13.3%	19.5%	30.0%
Total	114,465	100.0%	100.0%	100.0%

Figure 4-1
Project Area Census Tracts



Note: Letters and colors denote Arapahoe (A), Douglas (D) and Jefferson (J) counties. Tracts highlighted with an oval had the highest percentages of minority or low-income individuals, as detailed in this section.

Figure 4-1 highlights three additional Census tracts, two with minority concentrations and one with relatively low income. Douglas County Census Tract 141.16, immediately southwest of the I-25/C-470 interchange, had the highest percent of Asians, at 9.6 percent, which is well above the level for the surrounding counties and state. This tract had 250 persons from the country of India.

Jefferson County Census Tract 120.60, located north of C-470 along Kipling Parkway, had the highest reported percentage of Hispanic residents, at 11.1 percent. This is well below the level for the surrounding counties and state, but higher than the project area average of 6.9 percent.

The fourth Census tract highlighted in **Figure 4-1** pertains to low-income populations, discussed below.

Low-Income Populations: The U.S. DOT Order 5610.2 defines low-income as "a household income at or below the Department of Health and Human Services poverty guidelines." The *CDOT NEPA Manual* contains detailed procedures for identifying low-income populations to be considered for environmental justice analysis of CDOT transportation projects, consistent with FHWA guidance (CDOT, 2014).

Using the CDOT procedures, it was estimated that 5.9 to 6.9 percent of the households in the C-470 project area meet the low-income threshold. This is slightly higher than the percentage for Douglas County, but lower than the levels for Jefferson County (11.2 percent) and Arapahoe County (14.2 percent).

In the C-470 project area, the Census tract with the greatest percentage of low-income households (14.8 percent) was Arapahoe County Census Tract 56.34, indicated in **Figure 4-1**. This tract includes the Wolhurst Community, located immediately adjacent to C-470 at Santa Fe Drive. Wolhurst is a mobile home community for persons aged 55 years or older, many of whom are retirees. The Wolhurst Community was the only area of environmental justice concern in the 2006 C-470 EA. Extensive outreach was conducted with Wolhurst residents at that time.

Jefferson County Census Tract 120.60, noted earlier as having the project area's highest prevalence of Hispanic residents, had the second greatest prevalence of low-income households (13.4 percent).

The third greatest prevalence of low-income households (12.7 percent) was found in Douglas County Census Tract 140.07, east of I-25, discussed earlier as the tract with the

project area's highest concentration of racial minorities.

Households with Limited English Proficiency: Jefferson County Census Tract 120.60, already discussed above with respect to Hispanic ethnicity and low income, also had the project area's highest prevalence (5.8 percent) of households where no one over age 14 speaks English very well (ACS, 2014).

According to Census data, 82 of the 1,417 households in this tract speak Spanish rather than English. This Spanish-speaking population with limited English proficiency (LEP) is found in the Dakota Station neighborhood, which is not immediately adjacent to C-470. All other Census tracts in the project area had much lower LEP prevalence, ranging from zero to 3.6 percent.

To encourage awareness and participate in the NEPA decision-making process, CDOT will prepare outreach materials in Spanish to distribute or post in the Dakota Station neighborhood in advance of the Public Hearing for the Revised EA. This is not mitigation of a project impact, but instead part of the public involvement process. CDOT routinely publicizes the availability of resources to accommodate Spanish speakers at public hearings.

No-Action Alternative Impacts on Minority and Low-Income Populations: The No-Action Alternative consists of only routine maintenance on C-470, such as resurfacing and re-striping. These activities would affect and benefit all C-470 users alike and would not disproportionately affect any low-income or minority population.

Proposed Action Impacts on Minority Populations: The project area for C-470 improvements is a heavily non-minority corridor. No residences or businesses will be relocated, so there would be no effect on the cohesion of any ethnic neighborhood. Transportation benefits from the Proposed Action would accrue to all C-470 users regardless of race or ethnicity.

Proposed Action Impacts on Low-Income Populations: C-470 widening would require reconfiguration of the westbound C-470 on-ramp at Santa Fe Drive, adjacent to the low-income Wolhurst mobile home community. The existing noise barrier would be replaced with a new barrier of equal or greater height, length and aesthetic quality, slightly north of the existing wall location. Replacement of the existing noise wall is due to design of the Proposed Action. It is unrelated to the neighborhood's low-income status. No other specific neighborhood would be directly affected by the Proposed Action.

Ramp reconfiguration, noise wall demolition and noise wall replacement adjacent to the southern edge of the Wolhurst Community would have construction impacts including dust generation, noise and vibration.

Another issue relating to low-income persons is the Proposed Action's addition of new lanes for which users would pay a toll. The Proposed Action would maintain two free general purpose lanes in each direction as well as adding the tolled express lanes, thus giving motorists a choice. No existing free lanes would be converted to toll lanes.

The charging of tolls on proposed new express lanes could be considered an economic disadvantage to low-income individuals, as they perhaps could not afford to pay the tolls on a regular basis. This was a consideration during the 2006 EA alternatives evaluation, but experience from other tolled express lanes has demonstrated that individuals from all income levels use tolled facilities While lower-income individuals may not use the facility as frequently as those with higher incomes, the data suggest that the imposition of tolls does not preclude low-income individuals or households from using the facility at times when minimizing traffic delay is of importance (FHWA, 2014).

An economic equity issue raised elsewhere in the U.S. has been the requirement to have a transponder and a prepaid account to access toll lanes, as this would be a hardship for low-income persons. The Proposed Action would not require the use of a transponder in the vehicle. For vehicles without a transponder, toll collection would also be accomplished by photo surveillance of license plates and mailing toll bills to the vehicle owner, as is currently done on toll highway E-470 immediately east of the C-470 project area.

On E-470, customers without a transponder pay higher costs to cover administration and postage for paper billing. This is expected to be the case for C-470 as well.

Extensive public outreach by the C-470 Corridor Coalition in 2012 determined that tolled lanes were the preferred funding approach over sales tax and property tax increases. With a user fees approach, low-income populations do not have to pay additional taxes.

The addition of auxiliary lanes under the Proposed Action would improve traffic flow and safety for all motorists, whether they use the tolled express lanes or not.

In summary, there is minimal presence of minority and low-income households in the project area, no households would be displaced, no person would be required to use the toll lanes or obtain a transponder, and all C-470 users would benefit from the addition of auxiliary lanes. It is concluded that no disproportionate high or adverse impacts to low-income and minority populations are anticipated with the Proposed Action.

Mitigation of Proposed Action Impacts to Low-Income Populations: The construction impact mitigation strategies used near the Wolhurst Community are the same strategies that would be used throughout the C-470 Corridor. No separate additional mitigation is necessary for environmental justice reasons.

4.2.3 Economic Conditions

County-level socio-economic conditions are available in community profiles prepared by DRCOG. **Table 4-4** provides indicators for the year 2010, enabling a county-by-county comparison. About 75 percent of the C-470 project is in Douglas County, 20 percent in Jefferson County, and 5 percent in Arapahoe County.

The three counties are comparable in their rates of employment per capita, with approximately one person employed per every two residents. Key differences between counties appear in education and income levels. Of the three counties, Douglas County has the highest percentage of college-educated adults, and the highest percentage of workers employed in the business, science and arts sector of the economy. Douglas County has the highest household income and the lowest poverty rate. Arapahoe County is the most urban of the three counties, 45 percent of its workers in DRCOG-designated Urban Centers.

No-Action Alternative Economic Impacts: With no improvements to C-470, the economic costs associated with congestion would continue to increase. Congestion could affect business location decisions and individual home rental/purchase decisions by making other less congested areas in the region more economically attractive.

No property would be removed from local property tax rolls because no new ROW would be required under the No-Action Alternative. Therefore, the property tax base would not be affected.

Figure 4-2 presents DRCOG-prepared 2010 employment density and projected job growth locations along C-470 through the year 2035. According to the DRCOG small area forecasts (TAZ data), employment in the project area is predicted to increase by 56,000 jobs, from 82,000 in 2010 to 138,000 in 2035. This 68 percent increase in jobs is double the 34 percent projected population growth rate for the area, which was reported in **Table 4-2**.

Table 4-4
2010 Economic Indicators for the Three C-470 Corridor Project Counties

Metric	County		
	Arapahoe	Jefferson	Douglas
Population in thousands	572	535	285
County Rank by Population*	3	4	8
Employment in thousands	191	281	147
Employment per capita	0.51	0.53	0.52
Employment in Urban Centers (1,000s)	130	63	147
Percent Employment in Urban Centers	45%	22%	24%
Employment by Sector			
Production and Transportation	9%	8%	5%
Natural Resources and Construction	9%	9%	5%
Sales and Office	27%	26%	27%
Services	16%	14%	11%
Business, Science and Arts	39%	43%	52%
Total	100%	100%	100%
Education: Bachelor's degree or higher	38%	41%	55%
Education: High school diploma only	21%	22%	14%
Median household income	$59,937	$67,827	$101,193
Poverty Rate	9%	6%	2%
Sales tax collections county rank*	2	4	8

* out of 64 Colorado counties Source: DRCOG, 2013b.

Proposed Action Economic Impacts:
Arapahoe, Douglas, and Jefferson Counties would have a temporary increase in construction employment and perhaps local purchases of construction materials. Post-tax worker income is subsequently spent on consumer purchases and thus has a multiplier effect in the local economy.

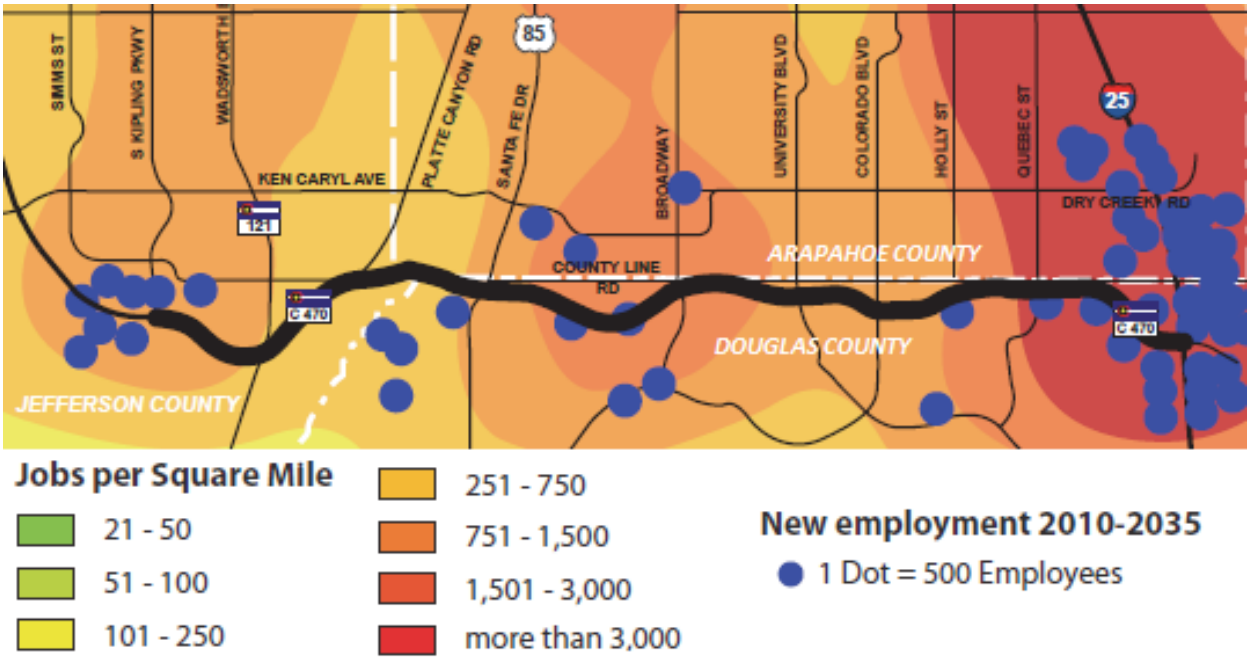
A recent national study indicated that 10.55 short-term jobs are created for each $1 million in construction cost (NCHRP, 2012). Thus, about 2,400 short-term jobs would be created within the next several years as the interim phase of the project is built, and additional short-term construction jobs would be created in the future during completion of the Proposed Action.

Tolls paid by express lane users represent money that could be spent or invested otherwise, if no tolls were charged. However, paid use of the express would typically occur because the motorist decided the expected time savings for the occupants of that vehicle were more valuable than the amount of the toll being paid. The Proposed Action would give consumers the choice to purchase travel time savings that would be unavailable without the new lanes.

Once the borrowed construction costs of the Proposed Action are recovered from toll collection, tolls would continue to be collected. These revenues would be used to pay for operation and maintenance of the express lanes, and possibly to pay for future upgrades or expansion of the express lanes on C-470. No C-470 toll revenue would be transferred to other CDOT highways.

Public meeting attendees asked if C-470 toll collection would end once the construction bonds are paid off. The answer is no, CDOT anticipates that toll collection would continue. Toll collection is a mechanism for managing use of the new lanes to ensure they provide reliable trip times.

Figure 4-2
C-470 Corridor Employment Density and Projected Employment Growth



The Proposed Action would require acquisition of some adjacent land for additional ROW. Some of this land is privately owned, and some is owned by government jurisdictions and not subject to property tax. ROW acquisition would result in a minimal reduction to the tax base of local jurisdictions. About 35 acres would be acquired (including permanent easements) spread out over three counties that total 1.5 million acres. The needed land is mostly vacant. No buildings would be removed, and no business or residential relocations would be necessary. The need for roughly 15 acres of temporary easements has also been identified, as detailed in **Section 4.2.5, Right-of-Way**.

Mitigation for Proposed Action Economic Effects: No mitigation measures are anticipated for permanent effects. Temporary congestion effects from construction activities would be mitigated by maintaining access or providing a temporary or alternative access to area businesses during construction. Advance notice and signage for detours will be provided if necessary. In addition, roadway construction would be conducted in such a way as to minimize travel delay.

4.2.4 Land Use

Land uses along C-470 generally consist of residential, recreational, commercial and office uses. Because much of the development along C-470 has occurred after or immediately before the highway was built, much of the development was planned to accommodate C-470, allowing open space buffers between the highway and residential or commercial structures.

Three counties and three cities have land use jurisdiction within project area. Additionally, Colorado Parks and Wildlife (operator) leases Chatfield State Park from USACE (owner). **Figure 4-3** indicates where these jurisdictions are found. **Table 4-5** indicates the current land use plans applicable in these jurisdictions.

Additionally, several quasi-governmental special improvement districts (e.g., Highlands

Figure 4-3
Government Entities with Land Use Jurisdiction

Table 4-5
Current Land Use Plans

Jurisdiction	Current Plan	Note
Jefferson County	Comprehensive Master Plan, 2013	C-470 is included in the South Plains Area of this plan.
USACE	Final Environmental Impact Statement (FEIS) for Chatfield Reservoir Storage Allocation, 2013	USACE plans to increase water storage at Chatfield Reservoir, resulting in relocation of various Chatfield State Park amenities.
City of Littleton	Citywide Plan, 2014	This is a section of the City of Littleton Comprehensive Plan.
Douglas County	Comprehensive Master Plan 2035	Adopted June 2014
City of Centennial	Comprehensive Plan	Adopted 2004
City of Lone Tree	Comprehensive Plan, 2007 –see note	Updated with 2010 Addendum

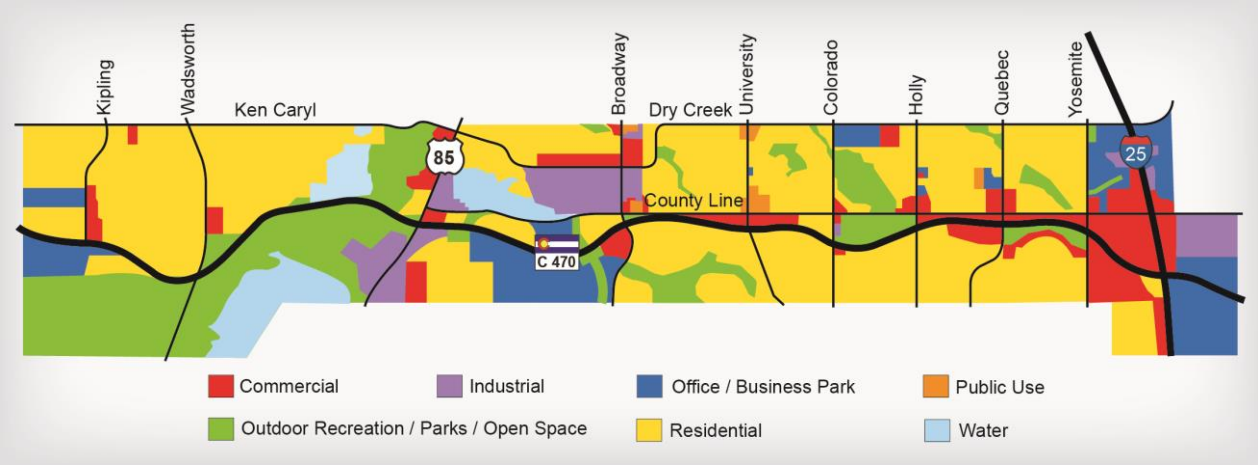
Ranch Metro District) own open space, parks and recreation facilities that might typically be owned by cities or counties elsewhere.

Land use descriptions are codified in local zoning laws and are within the purview of local jurisdictions within the C-470 project area. **Figure 4-4** illustrates general land uses along the corridor, characterized in categories such as residential, commercial, industrial, office, and recreation or open space. Several key concentrations of land uses shown in **Figure 4-4** include the following:

- The predominant land use in this suburban corridor is residential (yellow), sometimes offset from C-470 by other uses such as commercial.
- The office category (dark blue) is clustered near Kipling Parkway (west), south of C 470 near Lucent Boulevard (central), and along I-25 between C 470 and Lincoln Avenue (east).
- Major concentrations of park land and open space (light green) are found west of Santa Fe Drive, especially south of C-470. Recreation land typical surrounds water bodies (light blue).
- Commercial land (red) is concentrated near C 470 interchanges and along County Line Road north of C-470, including the Park Meadows regional shopping mall near I-25.
- Light industrial land (lavender) is found along Santa Fe Drive, south of C-470, near active north-south railroad lines.

The office space concentrations (dark blue) shown in **Figure 4-4** correspond to designated urban centers as identified in the DRCOG 2035 *Metro Vision Plan*, which provides the land use assumptions underlying the DRCOG 2035 *Metro Vision Regional Transportation Plan*. Collectively, the DRCOG member governments have established

Figure 4-4
Existing Land Uses along the C-470 Corridor

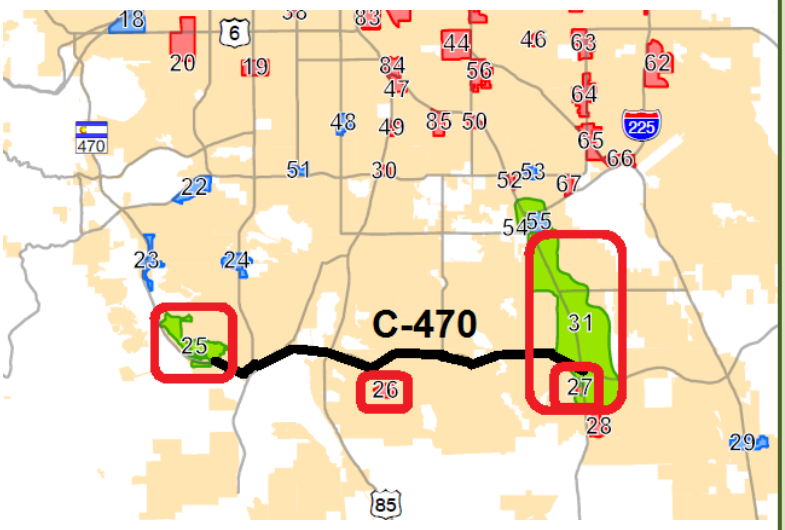


Urban Growth Boundaries to prevent sprawl and make more efficient and sustainable use of public infrastructure. One of the plan's goals is to locate 50percent of new housing and 75 percent of new employment in urban centers. The location of Urban Centers along and near C-470 are shown in **Figure 4-5**.

The DRCOG 2035 *Metro Vision Plan* recommends redevelopment of older areas to achieve increased development density, especially near light rail stations (transit-oriented development). For example, the Santa Fe Drive corridor north of C-470 in the City of Littleton is part of a specific redevelopment plan to increase mixed-use development and create stronger connections between land uses and the existing Southwest Corridor light rail service.

South of Chatfield State Park, the recently approved Sterling Ranch development is expected to add 12,000 homes in the next 25 years, and an adjacent development will add another 1,200 houses. Accessed primarily from Santa Fe Drive (US 85), this growth will

Figure 4-5
DRCOG-Designated Urban Centers



Urban Centers near C-470

25. C-470 Regional Corridor, 826 acres, west of the C-470 project area, with no light rail service.

26. Highlands Ranch Town Center, 165 acres, immediately south of C-470, close to planned Lucent (light rail) Station on the Southwest Corridor.

27. Lincoln Station Transit Oriented Development, 61 acres, south of C-470 along I-25, served by the Southeast Corridor.

31. I-25 Regional Corridor, 5,956 acres, served by multiple light rail stations on the Southeast Corridor.

increase traffic on C-470, especially at the Santa Fe interchange, and also at the Wadsworth Boulevard interchange.

No-Action Alternative Impacts on Land Use: The No-Action Alternative would not result in any ROW acquisition or change the access to and from C-470, it would not require a direct change in land use plans, zoning, or land use types within the project area.

Due to increased traffic congestion, the No-Action Alternative could shift projected development and population growth to areas outside of the project area. However, as traffic congestion on C-470 increases, local arterial congestion will also increase. For this reason, the No-Action Alternative could potentially reduce the viability of land for commercial or new home development compared to existing conditions. Indirectly, these factors may result in future modifications to land use or re-zonings by local jurisdictions in accordance with market demand.

Proposed Action Impacts on Land Use: The Proposed Action would occur largely within CDOT ROW and would require no changes in local agency zoning codes. The C-470 Proposed Action would not change any land use except for converting several acres of undeveloped land to highway ROW, mostly for water quality detention purposes. The Proposed Action is compatible with local land use plans, and those plans call for continued development that depends on maintaining adequate mobility.

Land use decisions are made by cities and counties. Local development plans change over time and can be influenced by better transportation access, water availability, economic conditions, and other factors. While some areas may eventually opt to have higher or lower densities or a slightly different mix of uses, the overall land use patterns surrounding C-470 are not expected to change as a result of the Proposed Action.

Mitigation for Proposed Action Land Use Impacts: Due to lack of land use impacts, no mitigation would be needed.

4.2.5 Right-of-Way

Right-of-way (ROW) is the land on which a highway is constructed and includes ramps, medians, shoulders, drainage ditches, and adjacent land interests owned for highway-related purposes. All highway elements must be located within state-owned ROW or other property under easement or leased to the state. The existing C-470 ROW is generally 300 feet wide along the mainline and varies at interchanges to accommodate ramps.

USACE Easement: The entire C-470 ROW is owned by CDOT, except for the section from Wadsworth Boulevard to Santa Fe Drive. In this three-mile section, C-470 crosses property owned by the USACE under an easement granted to CDOT for the specific purpose of transportation use. The easement on USACE property is approximately 300 feet wide, totaling 124 acres. The easement requires USACE approval of all activity and any proposed changes.

Right-of-way needs for the Proposed Action are detailed in the *Right-of-Way Technical Report* that is provided in **Appendix E**. The results of the analysis are summarized below.

No-Action Alternative Impacts on Right-of-Way: The No-Action Alternative would require no ROW acquisitions or modifications to USACE easement.

Proposed Action Impacts on Right-of-Way: The Proposed Action would have right-of-way impacts affecting 35 adjacent land parcels, as indicated in **Figure 4-6** and **Table 4-6**. Of these, 23 are privately owned. CDOT would acquire six parcels totaling 3.48 acres as new right-of-way, including two total acquisitions and four partial acquisitions. These are the only two total acquisitions needed, and since both are vacant parcels, no business or residential relocations would be needed.

Figure 4-6
Location of Right-of-Way Impacts

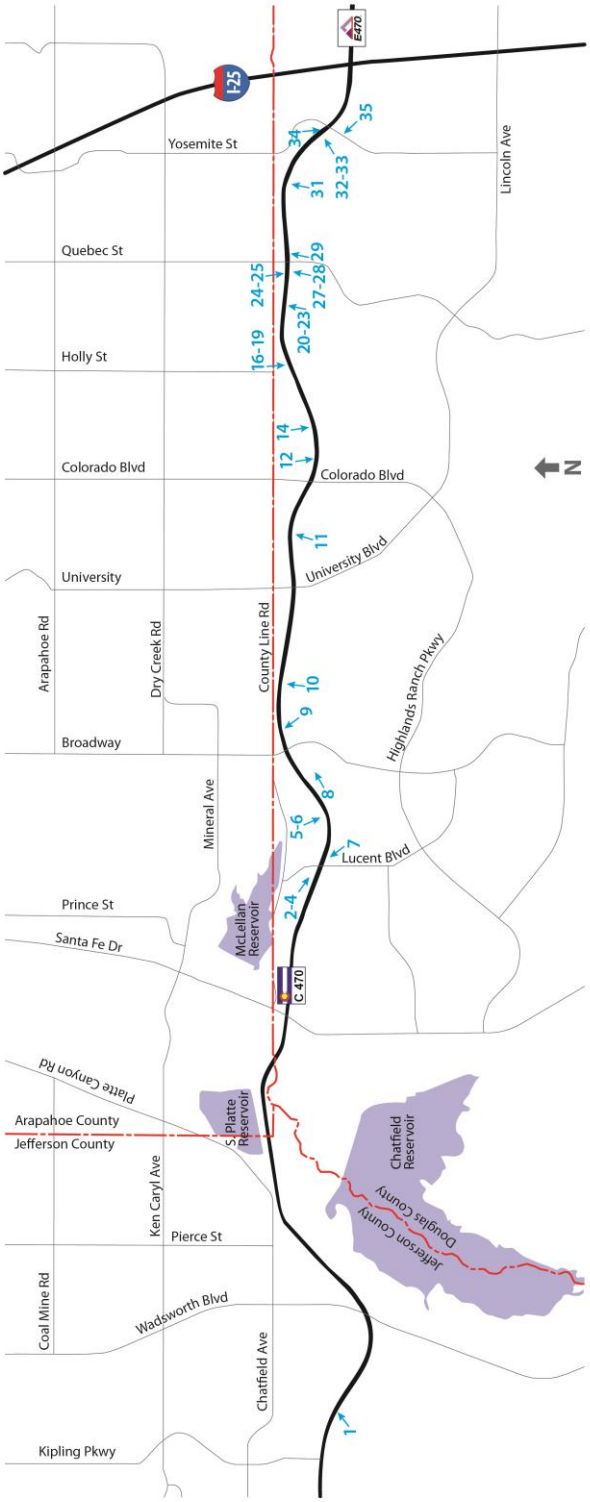


Table 4-6
Right-of-Way Impacts of the Proposed Action
(Listed from west to east across the project area)

Map ID	Current Land Use	Size of Total Parcel (acres)	Size of Parcel Impact (acres)			Percent of Parcel	For Water Qual.
			Acquisition	Easement			
				Permanent	Temporary		
1	vacant	18.05	0.74			4%	0.74
2*	vacant	1.33		1.33		100%	1.33
3	vacant	13.96		12.88		92%	12.88
4	vacant	7.77		7.77		100%	7.77
5	commercial	13.48		0.76		6%	
6	vacant	3.47		3.47		100%	3.47
7	vacant	2.90		0.24		8%	
8	vacant	18.32			5.88	32%	5.88
9	vacant	3.26		2.22		68%	
10	vacant	26.51		1.06		4%	
11	vacant	13.82			9.78	58%	
12	park land**	3.31			0.18	5%	
13	commercial	0.55			0.03	5%	
14	commercial	1.73			0.05	3%	
15	commercial	1.90			0.08	4%	
16	commercial	1.40			0.04	3%	
17	apartments	36.15			0.39	1%	
18	soccer field**	1.95			0.12	6%	
19	vacant	1.51	0.08			5%	
20	vacant	1.64	0.09			5%	
21	commercial	4.09			0.03	1%	
22	commercial	3.63			0.05	1%	
23	commercial	2.96			0.08	3%	
24	commercial	2.48			0.02	1%	
25	commercial	14.78		0.10		1%	
26	vacant (2)	8.89		1.48	0.18	19%	
27	vacant	9.58	0.04			<1%	
28	C-470 ramp	2.18	2.18			100%	
29	C-470 ramp	0.35	0.35			100%	
30	commercial	1.51		0.11		7%	
31	detention pond	3.00			0.13	4%	
32	vacant (2)	0.86			0.10	12%	
33	commercial	12.54			0.07	1%	
34	commercial	14.20			0.01	<1%	
35	commercial	12.03		0.13		1%	
TOTAL ACRES			3.48	31.42	15.42		32.07
PARCELS AFFECTED			6	12	18		
NUMBER OF IMPACTS			6	13	20		

** Shaded rows indicate parcels owned by governmental or quasi-governmental entities.*
*** The "soccer field" temporary easement is vacant land located away from the soccer field and not used for any recreational purpose. All impacts to commercial properties affect unused land adjacent to C-470 ROW, not developed portions of those parcels. No relocation would be needed for any residence, business or other developed land use.*

The Proposed Action would result in acquisition of 13 permanent easements from 12 other parcels. These easements total 31.42 acres.

Additionally, an estimated 20 temporary easements totaling 15.42 acres would be needed. Temporary easements are acquired where access is needed to an owner's property only during construction, sometimes for utility relocation. Typically, permanent physical modifications such as grade changes are not allowed within temporary easement areas.

As noted earlier, the existing C-470 ROW is generally 300 feet wide along the mainline and is wider at interchanges to accommodate ramps. About two-thirds of the ROW impacts of the Proposed Action arise from the need to provide comprehensive stormwater management and detention for highway runoff. This is a requirement today that was not in effect when C-470 opened in 1990.

During the concept design process, efforts were made to avoid and minimize the need for ROW acquisition. This was accomplished by investigating the optimal horizontal and vertical alignment, and by incorporating retaining walls and other features that would limit the required ROW width.

Some of the ROW needed for the Proposed Action is private property that has not been entered for inspection or appraisal. A well database search performed in 2015 indicates that a number of wells exist throughout the formerly agricultural C-470 corridor. Any well(s) found on needed ROW would be taken into account in determining the value of the property.

CDOT will continue to work with affected property owners through final design to further avoid and minimize the need for ROW acquisition.

Proposed Action ROW Impact Mitigation: Property owners would be compensated for the value of the land acquired through the ROW acquisition process, in compliance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended.

All impacted owners will be notified of CDOT's intent to acquire an interest in their property. Each will receive a written offer letter of just compensation specifically describing those property interests. A CDOT ROW specialist will be assigned to each property owner to provide assistance with this process.

If any property is altered within a temporary easement during construction, CDOT will restore the property condition or (more typically) compensate the owner for the damage.

4.2.6 Parks and Recreation

Existing parks and recreation facilities in the C-470 project area include state and local parks, trails, a community swimming pool, and golf courses. There are also open space properties within the project area that are not actively used for public recreation. Recreational resources within and adjacent to the project area are mapped in **Figure 4-7**.

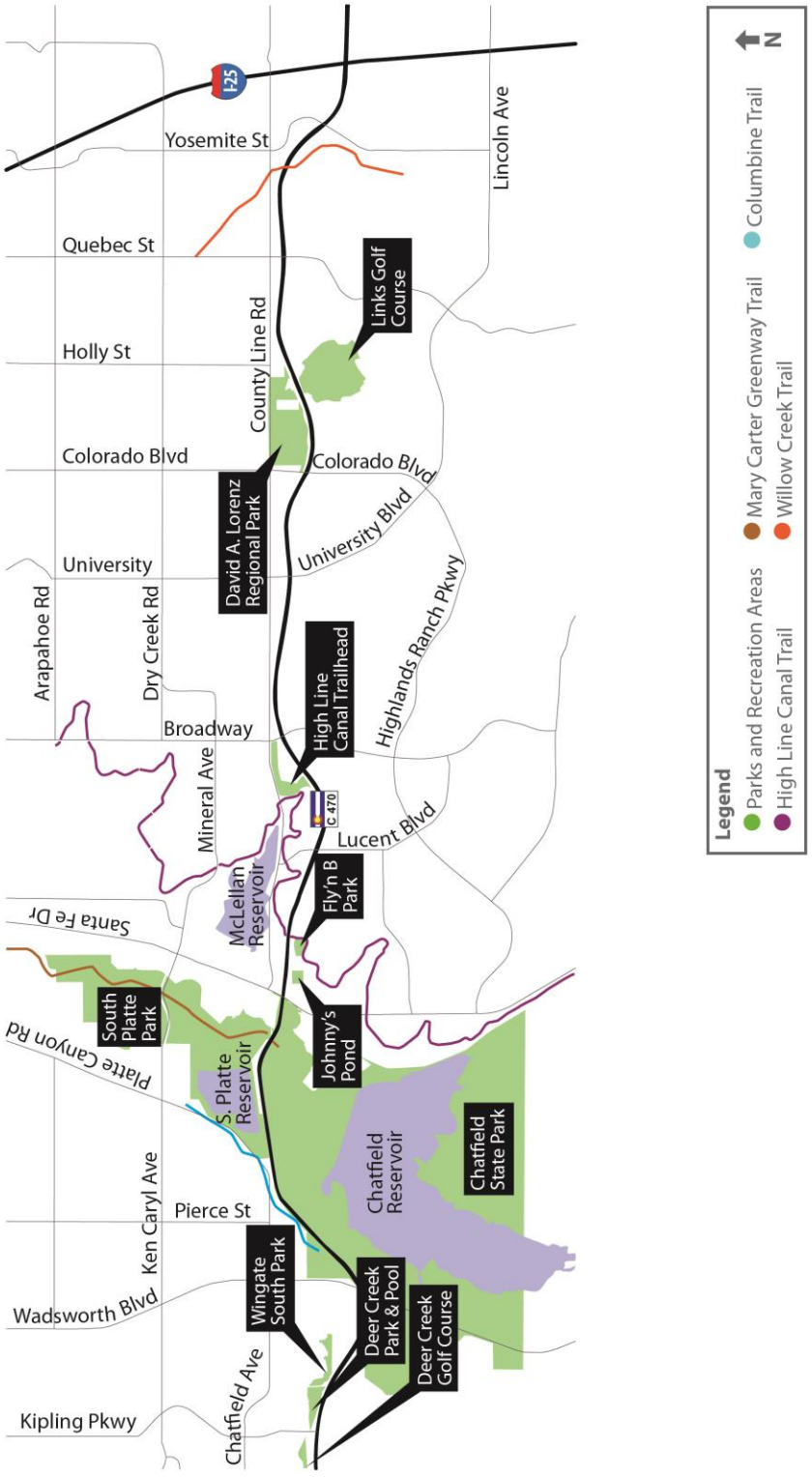
The preeminent recreational resource along C-470 is Chatfield State Park, which includes Chatfield Reservoir. This park attracts 1.6 million visits annually from the Denver metro area and beyond. Encompassing over 5,300 acres, it is by far the largest park in the project area, with boating, fishing, camping, hiking, biking, bird watching and many other activity choices. At the park's northern end, near C-470, is a very popular off-leash dog area that attracts a half million annual visits.

Colorado Parks and Wildlife (CPW) leases the Chatfield property from the U.S. Army Corps of Engineers, which operates the Chatfield Dam for water storage and flood control along the South Platte River.

Across C-470, north of Chatfield State Park, is the regional South Platte Park operated by the South Suburban Parks and Recreation District (SSPRD), offering several small lakes with fishing and bird-watching opportunities. This 880-acre park is just under one fifth the size of its enormous neighbor to the south. The newest lake in this park, South Platte Reservoir, was converted from a gravel pit in 2006. It is used for water supply and not available for active recreation. Within the park, land to the east of the South Platte River is a wildlife viewing area that includes an unpaved East Trail that ends at the north side of C-470.

SSPRD's Mary Carter Greenway Trail connects Chatfield State Park and South Platte Park by crossing under C-470 on the

Figure 4-7
Location of Park and Recreation Resources



west bank of the South Platte River. This is a regional trail, continuing for miles northward. It is estimated that this trail connection under C-470 was used 115,710 times in 2007, an average of 317 users per day (USACE, 2014).

SSPRD's David A. Lorenz Regional Park offers a number of athletic fields looking down over C-470. At its eastern end, east of Big Dry Creek, the park's minimally developed land is used as a disc golf course, with several holes located very close to C-470.

Fly'n B Park and the nearby Johnny's Pond are two new local parks located just south of C-470 between Santa Fe Drive and the Erickson Drive underpass of C-470. These are operated by the Highlands Ranch Metropolitan District (HRMD).

Several schools located adjacent to the south side of C-470 have their own athletic fields (e.g., baseball and soccer) that are not available for public use and are not considered public recreation areas.

Each of the two privately owned golf courses along C-470 has one or more holes located within 100 feet from the freeway.

CDOT's 26-mile paved C-470 Trail (also called the Centennial Trail) is discussed in **Chapter 3, Transportation Resources**. It is not considered a recreational trail, although some recreational use does take place. Non-motorized C-470 Corridor trips may be made safely on this trail rather than the freeway's shoulder. Similarly, on-street bike lanes and sidewalks along the arterial streets that cross C-470 are considered facilities for non-motorized transportation, not recreational facilities.

The Foothills Park and Recreation District (FHPRD) Columbine Trail does not cross C-470 but is near it on the north side between Massey Draw and Platte Canyon Road

Most recreational trails in the project area provide access to the C-470 Trail for connectivity purposes. A short portion of the C-470 Trail also serves as part of the High Line Canal Trail. The combined trail that crosses under C-470 is maintained by HRMD.

The easternmost recreational resource along the corridor is the Willow Creek Trail, which crosses through a culvert under C-470 west of Yosemite Street. This trail is maintained by SSPRD. It is not part of the C-470 Trail.

No-Action Alternative Impacts on Parks and Recreational Areas: The No-Action Alternative would have no direct effects to recreational resources within the project area. Vehicular access to and from the corridor's recreation resources could become more difficult as a result of increased delay from congested conditions on C-470.

Proposed Action Impacts on Parks and Recreational Areas: **Table 4-7** indicates how the various recreational resources along the C-470 Corridor would be affected by the Proposed Action. The impacts of the Proposed Action would be temporary closures and detours for several trails.

Temporary closure of the Mary Carter Greenway Trail –This crossing under C-470 must be closed when the existing bridges are demolished and removed, and when new bridges are constructed overhead. The trail itself will be reconstructed as shown in **Figure 4-8**, improving vertical clearance and sight distance for trail users.

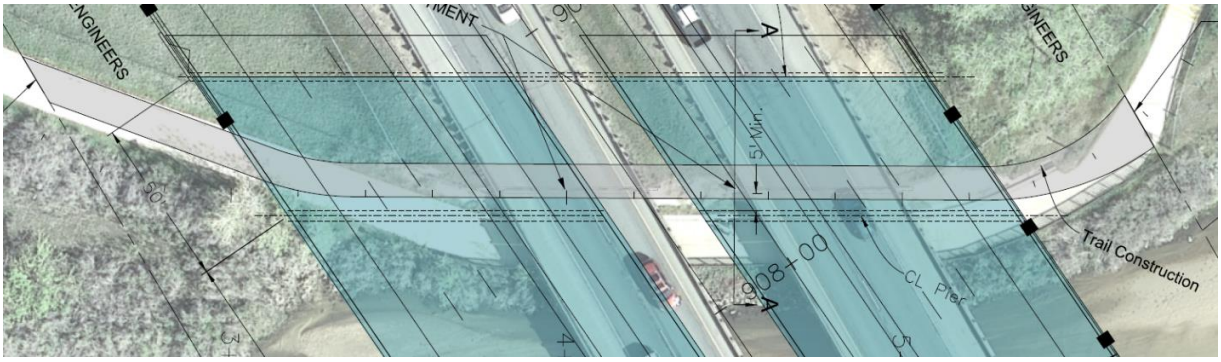
Due to the extensive work needed at this location, closures of this trail are likely to be longer in duration than the closures of the other two trails discussed below. Trail users would be inconvenienced by having to use a detour route during the closure.

Temporary closure of the High Line Canal Trail - The High Line Canal Trail crosses under C-470 in a concrete box culvert that will be lengthened to accommodate additional C-470 lanes. For the safety of trail users, temporary trail closures would occur during culvert extension. Trail users would be

Table 4-7
Proposed Action Impacts to Park and Recreation Resources

Facility	Operator	Direct Impact of Proposed Action (other than noise or visual)
Deer Creek Golf Club	Private firm	None
Deer Creek Park and Pool	FHPRD	None
Wingate South Park	FHPRD	None
Chatfield State Park	Colorado Parks and Wildlife	None
Columbine Trail	FHPRD	None
South Platte Park	SSPRD	None
Mary Carter Greenway Trail	SSPRD	Temporary closure and detour during trail reconstruction and bridge replacement
East Trail/ South Platte Park	SSPRD	During construction, fencing may be installed to keep users of this dead-end trail from continuing southward onto CDOT's easement from USACE. There will be no impact to the park itself.
Johnny's Pond	HRMD	None
Fly'n B Park	HRMD	None
Mission Viejo Buffer/High Line Canal Trailhead	SSPRD	None
High Line Canal Trail	HRMD	Temporary closure and detour during culvert widening
David A. Lorenz Regional Park	SSPRD	None
The Links Golf Course	Private firm	None
Willow Creek Trail	SSPRD	Temporary closure and detour during culvert widening

Figure 4-8
Existing and Proposed Alignment of Mary Carter Greenway Trail under C-470



inconvenienced by having to use a detour route during the closure.

Temporary closure of Willow Creek Trail - The Willow Creek Trail crosses under C-470 in a concrete box culvert that will be lengthened to accommodate additional C-470 lanes. For the safety of trail users, temporary trail closures would occur during culvert extension. Trail users would be inconvenienced by having to use a detour route during the closure.

Detour routes have not been finalized, pending further coordination with trail agencies, but for each trail closure a potential detour has been identified. These are discussed in **Section 4.5, Section 4(f)** Impacts. One of the three potential detour routes is shown here as an example, in **Figure 4-9**.

The Proposed Action would increase traffic noise levels for all recreational facilities adjacent to C-470, and result in increased visual intrusion for some facilities. Noise impacts are discussed In **Section 4.3.1** of this Revised EA.

Figure 4-9
Potential Detour for Temporary Closure of Willow Creek Trail under C-470

Clockwise from the closure (red X) this detour follows Park Meadows Drive to Acres Green Drive, then Parkway Drive back to Willow Creek Trail.

Many park and recreation facilities are located close to C-470. The addition of Express Lanes, auxiliary lanes in some locations, and new structures for signage and toll collection would make the highway more visually apparent from these facilities.

Mitigation for Proposed Action Impacts to Parks and Recreation Areas: CDOT will continue to work closely with the owners of any affected trails, as well as with bicycle groups and other interested parties to minimize any disruption of trail systems due to the Proposed Action. Feasible detour routes for the three trails facing temporary closures have been identified. CDOT will provide detour signage indicating not only the temporary routes but the approximate duration of the detour timeframe. CDOT will provide a minimum two-week advance notice to SSPRD and HRMD prior to any temporary trail closure.

The contractor will also be required to obtain SSPRD's schedule of major bicycle events scheduled for the Mary Carter Greenway Trail, with the goal of minimizing any construction conflicts with planned major events.

4.2.7 Land and Water Conservation Fund Assisted Properties

Pursuant to Section 6(f) of the Land and Water Conservation Fund Act (LWCF) Act (Public Law 88-578, as amended), property purchased or improved with LWCF grant funds must remain in "continuing recreation use". If some portion of LWCF-protected property is acquired for other use, replacement property of equivalent or greater value must be provided in compensation.

In Colorado, the U.S. Department of the Interior (National Parks Service) administers the LWCF grant program through CPW.

The Colorado LWCF grants database was reviewed and two assisted properties within the C-470 project area were identified:

- South Platte Park
- Chatfield State Park

No land from any of these Section 6(f) resources would be needed for the No-Action Alternative or the Proposed Action. Thus, there would be no Section 6(f) impacts and no mitigation is necessary.

4.3 PHYSICAL ENVIRONMENT

The physical environment of the C-470 project area includes the non-living features of the environment that can be affected by transportation projects. Effects to the physical environment evaluated in this Revised EA include:

4.3.1 Highway Noise

This discussion about highway noise reviews key points and findings from the more detailed *Traffic Noise Technical Report* that is included in **Appendix E**.

The C-470 Proposed Action would use FHWA funding and thus is subject to the requirements contained in Part 772 of Title 23 of the Code of Federal Regulations (23 CFR 772). These regulations describe the methods that must be followed in the evaluation and abatement of traffic noise in Federal-aid and Federal action highway projects.

Federal regulations require each state highway agency to prepare and adopt written guidelines specific to that state which must demonstrate compliance with 23 CFR 772. CDOT's Noise Analysis and Abatement Guidelines dated January 15, 2015 describe CDOT policy and program to implement 23 CFR 772. These guidelines specify impact criteria, design and cost requirements for noise mitigation (CDOT, 2015).

Noise Basics: Noise levels are measured in decibels (dB). For most highway noise analyses, the measured levels are filtered such that they more accurately represent what the human ear hears. This process is known as A-weighting. A-weighted decibels are abbreviated dB(A).

A change of 3 dB(A) in traffic noise levels is barely noticeable. A 5 dB(A) change is typically always noticed, and if a 10 dB(A) change occurs, most perceive the noise to be doubled (or cut in half).

The main components of highway traffic noise are due to vehicle engines, vehicle exhaust, and tire/pavement interaction. Engine braking by heavy trucks can also be a noise contributor, but is not included in the noise model. Trucks and motorcycles are typically much louder than automobiles.

How highway noise affects a nearby residence or other receptor depends on the distance and the path the noise must travel. If terrain or some type of solid barrier blocks the direct noise path to the receptor, this level is generally reduced by at least 5 dB(A). Receptors that are outside of the study zone of 500 feet around the extents of work for the individual project are generally not considered for analysis, unless there is a reasonable expectation that noise impacts would extend beyond that boundary.

Travel speeds affect noise levels. Traffic volumes on C-470 currently exceed highway capacity during the morning and evening rush hours, which reduces travel speeds and therefore reduces noise levels. Traffic noise is loudest when heavy amounts of traffic travel at relatively high speeds. These conditions typically occur just before and after periods of congestion, not during peak traffic hours.

Noise-sensitive land uses are identified as receptor types. CDOT defines the noise impacts for all types of receptors in its Noise Analysis and Abatement Guidelines. A key threshold for residential noise impact analysis is 66 dB(A). This is comparable to the sound of two people six feet away from each other holding a normal conversation. Noise levels at this level or above would interfere with such a conversation. Traffic noise levels of 66 dB(A) or more at an active outdoor use area such as a residential back yard or a public park would constitute a noise impact. The place affected by that impact is called a noise receptor. The impact criterion for outdoor activity areas at a business (e.g., outdoor seating at a restaurant) is 71 dB(A).

Receptors with noise that would exceed CDOT's Noise Abatement Criteria are analyzed to determine whether or not mitigation would be both feasible and reasonable. Noise mitigation is provided only if it would meet all of these criteria and a majority of the benefitted property owners desire it.

Existing Noise Levels: Consistent with CDOT noise analysis guidelines, sampling of C-470 noise levels was conducted at 15 locations in July 2013. These measurements were taken at different distances from the roadway, at different times of day. They were not intended to monitor worst-hour noise hours, but locations were selected to include likely impacted receptor areas. The purpose of the noise monitoring was to generate enough data to calibrate and validate a noise model that would predict corridor-wide noise levels within FHWA-required levels of modeling accuracy.

C-470 noise levels were measured at 15 locations in July 2013 for use in validating the TNM Noise Model.

While noise levels were being collected, C-470 traffic was counted, consistent with CDOT noise analysis guidelines. Vehicles were classified as heavy trucks, medium trucks, light-duty vehicles, buses, recreational vehicles or motorcycles, since the model has different noise emission factors for each of these vehicle types.

C-470 Noise Modeling: A computer model of noise conditions along C-470 was developed using the TNM noise modeling software, version 2.5, as required by FHWA regulations. Consistent with CDOT noise analysis guidelines, this model was run to yield theoretical loudest-hour noise levels for the existing roadway configuration, assuming the maximum possible vehicles that can travel at free-flow speeds.

The current roadway configuration would be unchanged under the No-Action Alternative, so the predicted theoretical loudest-hour noise levels would be the same for both cases. The model was used in the same way to predict theoretical loudest-hour noise for the Proposed Action Alternative, with more lanes full of vehicles at free-flow speeds.

Consideration of Potential Noise Mitigation: By CDOT policy, no noise mitigation is provided in the No-Action Alternative.

Mitigation by CDOT can be provided only in conjunction with a construction project.

To be funded by FHWA or CDOT, a proposed noise mitigation measure must first be found to be both feasible and reasonable. Feasibility issues include:

- Can a 5dB(A) noise reduction be achieved by constructing a noise barrier or berm?
- Are there any fatal flaw drainage, terrain, safety, or maintenance issues involving the proposed noise barrier or berm?
- Can a barrier less than 20 feet tall provide effective noise reduction?

Reasonableness issues include:

- Has the design goal of 7 dB(A) noise reduction for abatement measure been met for at least one impacted receptor?
- Is the Cost Benefit Index below $6,800 per receptor per dB(A)?
- Are more than 50 percent of benefitted resident/owners in favor of the recommended noise abatement measure?

The most common way to mitigate highway noise is to use noise walls or earthen berms. Alternative mitigation measures include shifting the highway (vertical and horizontal), restricting trucks, reducing speed limits, or acquiring buffer lands. The alternative strategies are not considered practical for this project.

No-Action Alternative Noise Impacts: Increased congestion by 2035 could lengthen the duration of the peak period, shifting the loudest traffic hours to new times of the day, compared with current conditions. Fourteen residential areas along the corridor would have one or more impacted receptors, and the total number of impacted receptors would be 235 residences, as indicated in **Table 4-7**.

Proposed Action Noise Impacts: Noise levels from C-470 would increase with the Proposed Action due to changes in traffic volume and speed, and also due to widening that will add traffic on new pavement located closer to nearby receptors. **Table 4-8** indicates that 469 residences in 16 residential areas would experience loudest-hour noise levels of 66 dB(A) or more.

Noise impact findings and abatement determinations are presented in **Table 4-9**.

Table 4-8
Predicted Loudest-Hour Noise Levels Affecting Residences

Neighborhood	Receptors with 66.0 dB(A) or more	
	No-Action	Proposed Action
Redstone Ranch	0	0
Chatfield Bluffs	8	24
Meadowbrook	4	13
Chatfield Ave.	2	14
Columbine Hills	4	10
Wolhurst	0*	0
Littleton Commons	19	27
Villas at Verona	49	59
Bluffs Apartments	19	28
Township at Highlands Ranch	0	12
Highlands Ranch Dad Clark, west	7	17
Highlands Ranch, Dad Clark, east	1	27
Highlands Ranch, Venneford Ranch	3	6
Three Complexes	70	100
Shadow Canyon	32	41
Gleneagles Village	0	7
Palomino Park	4	8
Crest	13	76
Totals	**235**	**469**

Table 4-9
Results of Noise Impact and Abatement Analysis

Location	Exceeds Noise Criterion		Potential Mitigation		
	No-Action	Proposed Action	Feasible	Reasonable	Recommended
RESIDENTIAL AREAS (west to east) – for locations, see Figure 4-10					
Redstone Ranch	No	No	n/a	n/a	No
Chatfield Bluffs	Yes	Yes	Yes	No	No
Meadowbrook	Yes	Yes	Yes	No	No
Chatfield Avenue	Yes	Yes	Yes	Yes	**YES**
Columbine Hills	Yes	Yes	Yes	No	No
Wolhurst	No	No	n/a	n/a	**REPLACE**
Littleton Commons	Yes	Yes	Yes	Yes	**YES**
Villas at Verona	Yes	Yes	Yes	Yes	**YES**
Bluffs Apartments	Yes	Yes	Yes	Yes	**YES**
Township at Highlands Ranch	No	Yes	No	n/a	No
Highlands Ranch Dad Clark	Yes	Yes	Yes	No	No
Highlands Ranch, Venneford Ranch	Yes	Yes	Yes	No	No
Three Complexes* (listed below)	Yes	Yes	Yes	Yes	**YES**
Shadow Canyon	Yes	Yes	Yes	Yes	**YES**
Gleneagles Village	No	Yes	Yes	No	No
Palomino Park	Yes	Yes	Yes	No	No
Crest	Yes	Yes	Yes	Yes	**YES**
PARKS AND RECREATION AREAS – for locations, see Figure 4-7					
Deer Creek Golf Club*	Yes	Yes	Yes	No	No
Deer Creek Park and Pool	Yes	Yes	Yes	No	No
Wingate South Park	No	No	n/a	n/a	No
Columbine Trail	Yes	Yes	Yes	No	No
Chatfield State Park, C-470 Trail	No	Yes	Yes	No	No
S. Platte Park, MC Greenway Trail	Yes	Yes	Yes	No	No
Johnny's Pond*	Yes	Yes	No	n/a	No
Fly'n B Park	No	No	n/a	n/a	No
High Line Canal Trail	Yes	No**	n/a	n/a	No
Mission Viejo Open Space	No	No	n/a	n/a	No
D. Lorenz Regional Park fields	Yes	Yes	No	n/a	No
D. Lorenz Regional Park disc golf	Yes	Yes	Yes	No	No
The Links Golf Course	Yes	Yes	Yes	No	No
Athletic fields – HR Christian School	Yes	Yes	Yes	No	No
Athletic field – Skyview Charter Ac.	Yes	Yes	Yes	No	No
Willow Creek Trail	Yes	Yes	No	n/a	No
HISTORIC RESOURCES – for locations, see Figure 4-13					
Hildebrand Ranch Historic District	No	No	n/a	n/a	No
Selzell Ditch	No	No	n/a	n/a	No
City Ditch	Yes	Yes	No frequent human use		No
Littleton Large Animal Clinic/Barn	No	No	n/a	n/a	No
Denver & Rio Grande Railroad	Yes	Yes	No frequent human use		No
ATSF Railroad	Yes	Yes	No frequent human use		No
High Line Canal	Yes	Yes	No frequent human use		No
COMMERCIAL OUTDOOR AREAS – for locations, See Appendix D					
On the Border, LODO, and Brothers	No	Yes	Yes	No	No

* Autumn Chase, Copper Canyon and Copper Ranch apartments
** Proposed Action changes roadway and blocks noise to receptor

Please see additional information regarding abatement analysis in **Appendix D**, which provides a short summary of the mitigation analysis. As noted at the outset of this section, the full *Traffic Noise Technical Report* is included in **Appendix E**.

In **Table 4-9**, the Chatfield State Park modeled receptor was along the C-470 Trail, north of the South Platte River. The C-470 Trail is located between C-470 and many of the residential resources shown in the table, and thus would typically have higher noise levels than the receptors listed in the table.

Many portions of the C-470 Trail are located adjacent to the freeway, so there is no expectation of quiet conditions there. Much of the trail is subjected to noise impacts today (i.e., 66 decibels or more) and these noise levels are expected to increase with the Proposed Action.

Several bar-and-grill restaurants located near the C-470/Quebec Street interchange have outdoor seating areas where traffic noise would exceed the commercial business threshold (Noise Abatement Criteria Category E) of 71 decibels with implementation of the Proposed Action.

Recommended noise mitigation locations are listed in **Table 4-10** and shown in **Figure 4-10.** New noise mitigation is recommended at seven residential locations. One of these recommended noise barriers would benefit three adjacent apartment communities.

It was seen in **Table 4-8** that no residences in the Wolhurst community would be impacted by noise with the Proposed Action. That is because a pair of overlapping CDOT noise barriers totaling approximately 1,675 linear feet currently exist adjacent to Wolhurst, providing noise reduction. Due to the design of westbound on-ramp for the C-470/Santa Fe Drive interchange, it will be necessary to remove the existing noise barriers and construct a replacement wall closer to the residences. Preliminary noise modeling indicates that a single, continuous wall approximately 1,500 feet long and 15.5 feet tall would be needed to replace the existing pair of overlapping walls at Wolhurst.

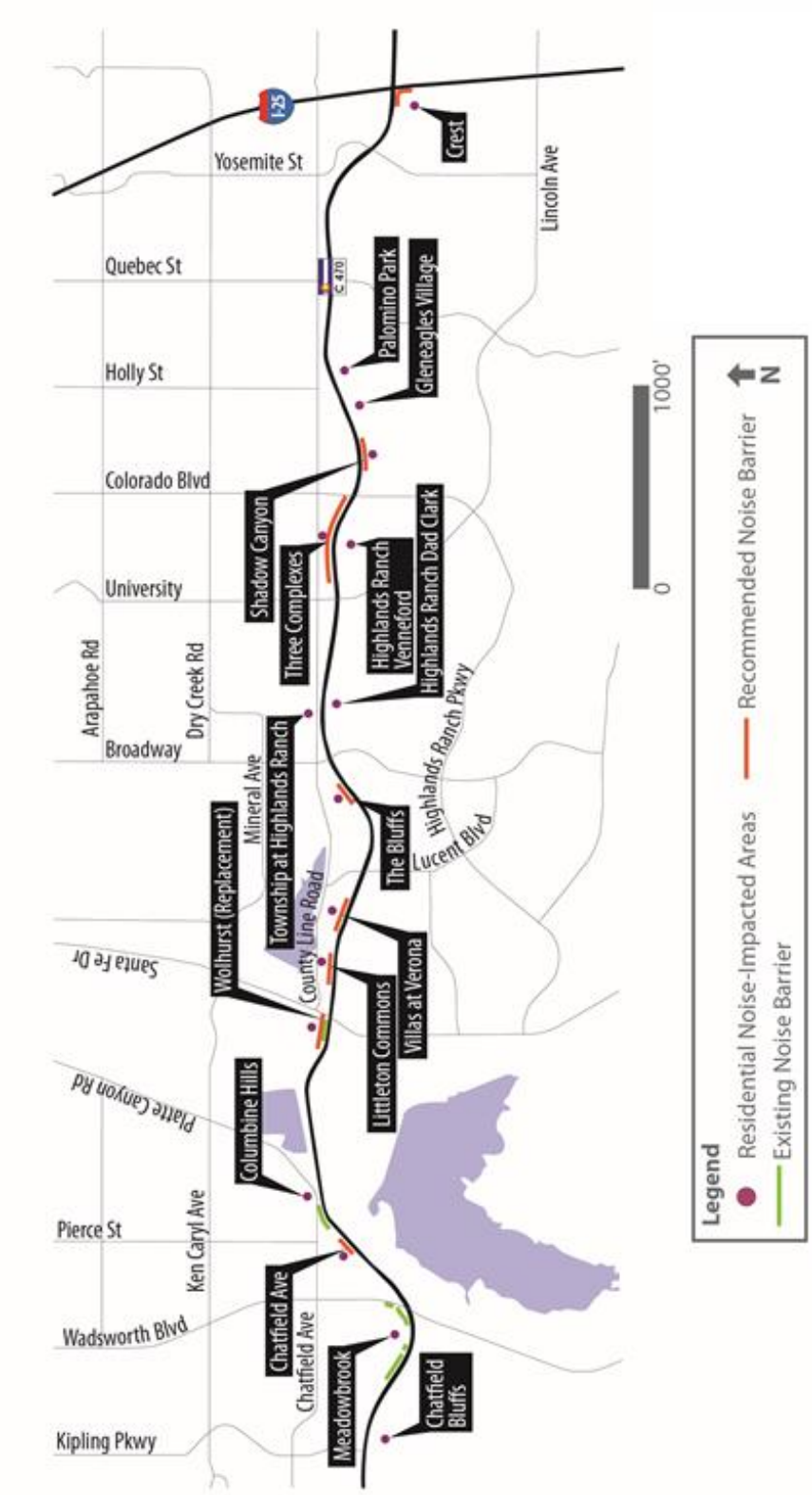
Current mitigation recommendations are based on preliminary analysis. For example, no utility conflicts were investigated as part of this analysis. This noise mitigation analysis will be revisited during final design when more information is available, to verify that the current recommendations would still be valid.

Table 4-10
Recommended Noise Mitigation

Neighborhood	Approximate Wall Height (feet)	Approximate Wall Length (feet)	Approximate Cost (millions)	Number of Benefitted Receivers
Chatfield Ave.	13.5	900	$0.5	14
Wolhurst	15.5	1,500	$1.0	n/a*
Littleton Commons	7	2,200	$0.7	36
Villas at Verona	18.5	2,720	$1.4	74
Bluffs Apartments	17.7	1,200	$1.0	28
Three Complexes**	Wall #1: 15.7 Wall #2: 8	Wall #1: 4,300 Wall #2: 390	$3.2	87
Shadow Canyon	18.7	1,700	$1.4	39
Crest	18.2	2,300	$1.9	82
Total for new walls	N/A	17,210	$11.1 million	360 households

* New Wall at Wolhurst would replace existing wall, not newly benefitting additional receptors
** Autumn Chase, Copper Canyon, and Canyon Ranch

Figure 4-10
Location of Recommended Noise Mitigation



All noise mitigation recommendations noted in **Table 4-10** will be reviewed during final design to ensure their constructability. All proposed wall heights shown are the maximum height of the potential wall. Actual constructed heights will depend on re-analysis during final design and input to be solicited from benefitted property owners and residents. In final design, the actual lengths and locations of the recommended mitigation may vary for reasons such as terrain, utilities, property owner desires or easements.

The benefited receptor preference survey process is detailed in the *2015 CDOT Noise Analysis and Abatement Guidelines*, which are an attachment to the *Traffic Noise Technical Report* for this Revised EA (See **Appendix E**). Once final design of the project and the re-evaluated abatement analyses are completed, a public involvement process shall be utilized to solicit the views of current residential occupants and property owners on whether to build noise abatement or not.

Temporary Construction-Related Noise and Vibration: The use of heavy equipment operation and earth moving machinery during construction of the Proposed Action would create noise and vibration. Accordingly, CDOT will require its design-build contractor to prepare a mitigation plan addressing noise and vibration. The plan shall consider options including but not limited to the following:

- If practicable, construct noise barriers in early construction phases, so the barriers block construction noise
- Avoid weekend work, with the exception of activities best suited for off-peak hours
- Combine noisy operations to occur in the same time period
- Use noise blankets or other muffling devices on equipment and quiet-use generators
- Use well-maintained equipment, especially with respect to mufflers
- Use alternative construction methods, such as sonic or vibratory pile driving, in sensitive areas

4.3.2 Air Quality

Federal transportation and air quality conformity regulations were developed during the 1990s to ensure that transportation plans, programs, and projects would not jeopardize attainment of National Ambient Air Quality Standards (NAAQS). Conformity requirements apply to transportation plans and programs that are developed by Metropolitan Planning Organizations (MPO) and also to regionally significant transportation projects, regardless of funding source. The designated MPO for the Denver metro area is DRCOG.

As part of this Revised EA, air quality analysis was performed to determine the differences between the air quality effects of the alternatives under consideration, and to determine whether or not localized hotspot concentrations at worst-case intersections would be likely to cause or contribute to a violation of a standard. For more detailed information, please see the *Air Quality Technical Report* in **Appendix E**. That report includes a letter of concurrence regarding CDOT's air quality analysis methodology from the Air Pollution Control Division (APCD) of the Colorado Department of Public Health and Environment.

Current Regional Air Quality Status and Outlook: C-470 is within the Denver Metropolitan Air Quality Control Region. This airshed includes the entire City and County of Denver, those portions of Adams and Arapahoe Counties west of Kiowa Creek, Douglas and Jefferson Counties, and all of Boulder County except Rocky Mountain National Park.

The region has had ongoing violations of the national standard for ozone pollution, but no violations for other pollutants for approximately two decades. Colorado's 2008 8-Hour Ozone Attainment plan was deemed adequate for conformity budget purposes by EPA effective March 2010. The 2005 CO Maintenance Plan was approved by EPA effective October 2007, and the 2005 PM_{10}

Maintenance Plan was approved by EPA effective January 2008.

The prospects for continued maintenance of air quality standards (except for ozone) and continued emission reductions are good. In February 2015, DRCOG adopted its *Metro Vision 2040 Regional Transportation Plan.* DRCOG's analysis demonstrated that emissions from on-road motor vehicles will remain within the applicable conformity budgets through 2040 even as the region's population grows by 1.2 million residents and daily vehicle miles increase by 37 million (35 percent) between 2015 and 2040.

The DRCOG 2016-2021 Transportation Improvement Program (TIP), the 2040 RTP, and their respective conformity analyses include the Proposed Action. The TIP includes $100 million in RAMP funding as part of the $269 million needed to build the Interim configuration. CDOT will borrow funds as needed through the sale of bonds that will be repaid using toll revenues. The RTP includes additional funding for completion of the Ultimate configuration (i.e. the Proposed Action).

In November 2014, the EPA formally proposed a tightening of the national ozone standard (EPA, 2014). A Final Rule could be promulgated in 2015. Since the Denver region does not meet the current standard, a tougher standard would likely require addition of further control strategies in Colorado's air quality State Implementation Plan.

Mobile Source Air Toxics: In addition to the pollutants discussed above, for which national ambient air quality standards (NAAQS) have been established, EPA also identifies some mobile source pollutants for which NAAQS have not been established. These include various mobile source air toxics (MSATs), discussed below.

MSATs are compounds emitted from highway vehicles and non-road equipment which are known or suspected to cause cancer or other serious health and environmental effects. Mobile sources are responsible for direct emissions of air toxics and contribute to precursor emissions which react to form secondary pollutants. Examples of mobile source air toxics include benzene, 1,3-butadiene, formaldehyde, acetaldehyde, acrolein, polycyclic organic matter (POM), and diesel particulate matter.

Quantitative assessment of MSAT emissions is normally required for capacity improvements on roadways expected to carry 140,000 vehicles per day or more. The busiest portions of C-470 would carry this amount of traffic by 2035 if the Proposed Action is built. Therefore, MSAT emissions were calculated for this project.

Carbon Monoxide Hotspot Analysis: Microscale or "hotspot" analysis is conducted to determine whether or not a project is likely to cause or contribute to a localized exceedance of the national air quality standards for CO. For the Revised EA, hotspot analysis was conducted for the most congested signalized intersection at a C-470 interchange ramp of at the next closest signalized intersection. This was the Quebec Street/County Line Road intersection, which was also modeled in the 2006 EA (and met all air quality requirements in that analysis).

The 2015 CO hotspot analysis was conducted using worst-case (2035) traffic volumes and worst-case (2015) CO emission rates. If there would be no CO hotspot violation at this most congested intersection using these rigorous assumptions, then there would be little probability of any violation elsewhere in the project area under actual future conditions. This approach was approved by APCD for this project.

The results of the microscale CO analysis, presented in **Table 4-11**, suggest that no localized CO violation would be expected in the project area over the next two decades

Table 4-11
Predicted Worst Case CO Concentrations*(parts per million)

	8-hour average		1-hour average	
	No-Action Alternative	Proposed Action	No-Action Alternative	Proposed Action
Background Concentration	0.7	0.7	2.1	2.1
Total Concentration	4.1	4.5	8.0	8.8
National standard	9.0	9.0	35.0	35.0
Meets the standard	Yes	Yes	Yes	Yes

** Worst-case future (2035) traffic with worst-case 2015 emission rates at the corridor's most congested, signalized intersection. Actual future concentrations would be lower.*

with either the No-Action Alternative or the Proposed Action. The predicted worst-case 1-hour average concentrations (8.0 ppm for No-Action, 8.8 ppm for Proposed Action) are well below the NAAQS of 35.0 ppm, and the corresponding predictions (4.1 ppm, 4.5 ppm) are well below the 8-hour average NAAQS of 9.0 ppm. Thus, worst-case analysis shows that concentrations would be below the NAAQS, are not expected to cause or contribute to violations of the CO NAAQS in the project corridor, and are not expected to interfere with the region's CO Maintenance Plan or its goals. Accordingly, no mitigation is required for CO.

Consideration of PM_{10} Hotspot Modeling:
Federal air quality conformity requirements call for microscale modeling of PM_{10} concentrations in cases where a high number of diesel vehicles are likely to be operating in a given location, such as at bus terminals or intermodal transfer facilities with large numbers of diesel trucks, or locations where there would be a significant increase in diesel vehicles.

Conditions that would require PM_{10} hotspot modeling are not present along the C-470 Corridor. C-470 carries no RTD transit buses, has no DRCOG-identified intermodal transfer facilities and no truck stops. C-470 has essentially the lowest heavy truck percentage (1.2 percent) of any freeway or major highway in the Denver metro area. The Proposed Action would not induce increased concentration of diesel vehicles. The proposed tolling structure would discourage heavy truck use of the express lanes. Based on these facts, CDOT determined and APCD concurred that PM_{10} hotspot analysis is not required for this project.

No-Action Alternative Air Quality Impacts:
Under the No-Action Alternative, traffic would continue to build on C-470 and surrounding arterial streets due to planned growth within the project area. Projected daily emissions for the No-Action Alternative are provided in **Table 4-12**. On the network links that were modeled with MOVES, corridor-wide daily VMT would increase by 22 percent (constrained by the fact that C-470 demand would exceed capacity). However, pollutant emission rates per mile continue to decline due to cleaner vehicle technology. Therefore despite increased traffic and increased congestion, tailpipe emissions generated in the corridor in 2035 would be less than in 2025 and less than today. However, road dust is not subject to technology improvement and therefore would increase in conjunction with increased VMT.

Projected MSAT emissions for the No-Action Alternative are provided in **Table 4-13**. Despite traffic growth, emissions in 2025 and 2035 would be lower than current emissions due to Federally-mandated cleaner vehicle technology (e.g., higher fuel efficiency standards).

Proposed Action Air Quality Impacts:
Project-level emissions analysis is prepared to compare the expected emissions of criteria pollutants for the No-Action Alternative and

Table 4-12
Projected C-470 Criteria Pollutant Vehicle Emissions (tons per day)

Pollutant	Month	2025		2035	
		No-Action	Interim Project	No-Action	Proposed Action
Carbon Monoxide	Feb	4.0	4.7	2.6	3.3
Volatile Organic Compounds (VOC)	Jul	0.13	0.15	0.07	0.11
Oxides of Nitrogen (NOx)		0.42	0.48	0.23	0.26
Particulate Matter ($PM_{2.5}$) exhaust	Feb	0.02	0.02	0.01	0.02
Particulate Matter (PM_{10}) exhaust		0.08	0.08	0.03	0.14
$PM_{2.5}$ road dust	Ann. Avg.	0.17	0.19	0.21	0.23
PM_{10} road dust		0.69	0.78	0.80	0.94

Table 4-13
Estimated Emissions of MSATs on C-470 (pounds per day)

Pollutant	2025		2035	
	No-Action	Interim Project	No-Action	Proposed Action
Benzene	5.9	6.9	3.0	4.8
Formaldehyde	2.5	2.9	1.5	2.7
1,3-Butadiene	0.2	0.2	<0.1	<0.1
Acrolein	0.1	0.2	0.1	0.1
Naphthalene	0.3	0.3	0.2	0.3
Polycyclic organic matter (POM)	0.1	0.2	0.1	0.1
Diesel particulate matter	4.1	4.8	1.9	3.0

Proposed Action. **Table 4-12** shows the results of this analysis. The numbers in the table are daily total emissions on C-470, its connecting north-south arterials, and nearby east-west alternative routes, incorporating the effects of potential shifts to alternative routes due to C-470 congestion levels.

For all pollutants other than particulate matter, future emissions with the Proposed Action would continue to decline over time, due to vehicle technology improvements. For example, No-Action Alternative CO emissions decline from 4.0 tons daily in 2025 to 2.6 tons daily in 2035, a reduction of 35 percent, despite increased traffic. The continuing emission reductions will result in improved air quality.

For particulate matter ($PM_{2.5}$ and PM_{10}), DRCOG forecasts prepared for RTP conformity analysis indicate that regional emissions budgets will not be exceeded. Additionally, there are no locations along the C-470 corridor where PM hotspots would be expected.

During construction of the Proposed Action, the use of heavy equipment operation and earth moving machinery would create exhaust emissions and fugitive dust. Fugitive dust also may result from disturbed surfaces and material storage piles.

No-Action Alternative Mitigation for Air Quality Impacts: No mitigation would be required for changes in vehicle-generated emissions resulting from the No-Action Alternative.

Proposed Action Mitigation for Air Quality Impacts: During construction, CDOT would require contractor implementation of dust control practices in accordance with *Colorado Air Quality Control Commission Regulation No. 1* on fugitive emissions. The contractor

would also be required to minimize airborne dust during construction through construction phasing to prevent exposing bare dirt on the whole site at once; stabilize soils through seeding and mulching; and suppressing dust suppression through regular watering.

No mitigation would be required for changes in vehicle-generated emissions resulting from the Proposed Action.

4.3.3 Greenhouse Gases

Climate change is an important national and global concern. While the earth has gone through many natural changes in climate in its history, there is general agreement that the earth's climate is currently changing at an accelerated rate and will continue to do so for the foreseeable future. Anthropogenic (human-caused) greenhouse gas (GHG) emissions contribute to this rapid change. Carbon dioxide (CO_2) makes up the largest component of these GHG emissions. Other prominent transportation GHGs include methane (CH_4) and nitrous oxide (N_2O).

Many GHGs occur naturally. Water vapor is the most abundant GHG and makes up approximately two thirds of the natural greenhouse effect. However, the burning of fossil fuels and other human activities are adding to the concentration of GHGs in the atmosphere. Many GHGs remain in the atmosphere for time periods ranging from decades to centuries. GHGs trap heat in the earth's atmosphere. Because atmospheric concentration of GHGs continues to climb, our planet will continue to experience climate-related phenomena. For example, warmer global temperatures can cause changes in precipitation and sea levels.

To date, no national standards have been established regarding GHGs, nor has EPA established criteria or thresholds for ambient GHG emissions pursuant to its authority to establish motor vehicle emission standards for CO_2 under the Clean Air Act. However, there is a considerable body of scientific literature addressing the sources of GHG emissions and their adverse effects on climate, including reports from the Intergovernmental Panel on Climate Change, the U.S. National Academy of Sciences, and EPA and other Federal agencies.

GHGs are different from other air pollutants evaluated in Federal environmental reviews because their impacts are not localized or regional due to their rapid dispersion into the global atmosphere, which is characteristic of these gases.

The *affected environment* for CO_2 and other GHG emissions is the entire planet. In addition, from a quantitative perspective, global climate change is the cumulative result of numerous and varied emissions sources (in terms of both absolute numbers and types), each of which makes a relatively small addition to global atmospheric GHG concentrations.

In contrast to broad scale actions such as actions involving an entire industry sector or very large geographic areas, it is difficult to isolate and understand the GHG emissions impacts for a particular transportation project. Furthermore, presently there is no scientific methodology for attributing specific climatological changes to a particular transportation project's emissions.

Under NEPA, detailed environmental analysis should be focused on issues that are significant and meaningful to decision-making.[1] FHWA has concluded, based on the nature of GHG emissions and the exceedingly small potential GHG impacts of the proposed action, as discussed below and shown in **Table 4-14**, that the GHG emissions from the Proposed Action will not result in "reasonably foreseeable significant adverse impacts on the human environment" (40 CFR 1502.22(b)).

[1] See 40 CFR 1500.1(b), 1500.2(b), 1500.4(g), and 1501.7

The GHG emissions from the Proposed Action will be insignificant. More detailed information on GHG emissions "is not essential to a reasoned choice among reasonable alternatives" (40 CFR 1502.22(a)) or to making a decision in the best overall public interest based on a balanced consideration of transportation, economic, social, and environmental needs and impacts (23 CFR 771.105(b)). For these reasons, no alternative-level GHG analysis has been performed for this project.

The context in which the emissions from the proposed project will occur, together with the expected GHG emissions contribution from the project, illustrate why the project's GHG emissions will not be significant and will not be a substantial factor in the decision-making. The transportation sector is the second largest source of total GHG emissions in the U.S., behind electricity generation.

The transportation sector was responsible for approximately 27 percent of all anthropogenic (human caused) GHG emissions in the U.S. in 2010.[2]
The majority of transportation GHG emissions are the result of fossil fuel combustion. CO_2 makes up the largest component of these GHG emissions. U.S. CO_2 emissions from the consumption of energy accounted for about 18 percent of worldwide energy consumption CO_2 emissions in 2010.[3]

U.S. transportation CO_2 emissions accounted for about six percent of worldwide CO_2 emissions.[4]

While the contribution of GHGs from transportation in the U.S. as a whole is a large component of U.S. GHG emissions, as the scale of analysis is reduced the GHG contributions become quite small. Using CO_2 because of its predominant role in GHG emissions, **Table 4-14** presents the relationship between current and projected Colorado highway CO_2 emissions and total global CO_2 emissions, as well as information on the scale of the project relative to statewide travel activity.

Table 4-14
Statewide and Project Emissions Potential, Relative to Global Totals

Year	Global CO_2 emissions, MMT [a,b]	Colorado motor vehicle CO_2 emissions, MMT [c]	Colorado motor vehicle emissions, percent of global total	Project area VMT as a percentage of statewide VMT	Percent change in statewide VMT with Proposed Action
2010	29,570	10.3	0.0348%	1.66%	none
2040	45,500	11.9	0.0261%	2.18%	0.008%

[a] MMT = million miles of travel.
[b] These estimates are from the EIA's International Energy Outlook 2010, and are considered the best-available projections of emissions from fossil fuel combustion. These totals do not include other sources of emissions, such as cement production, deforestation, or natural sources; however, reliable future projections for these emissions sources are not available.
[c] MOVES projections suggest that Colorado motor vehicle CO2 emissions may increase by 15.5% between 2010 and 2040; more stringent fuel economy/GHG emissions standards will not be sufficient to offset projected growth in VMT.

[2] Calculated from data in U.S. Environmental Protection Agency, Inventory of Greenhouse Gas Emissions and Sinks, 1990-2010.
[3] Calculated from data in U.S. Energy Information Administration International Energy Statistics, Total Carbon Dioxide Emissions from the Consumption of Energy, http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=90&pid=44&aid=8, accessed 2/25/13.
[4] Calculated from data in EIA figure 104: http://www.eia.gov/forecasts/archive/ieo10/emissions.html and EPA table ES-3: : http://epa.gov/climatechange/emissions/downloads11/US-GHG-Inventory-2011-Executive-Summary.pdf

Based on emissions estimates from EPA's MOVES model[5], and global CO_2 estimates and projections from the Energy Information Administration, CO_2 emissions from motor vehicles in the entire state of Colorado contributed less than one tenth of one percent of global emissions in 2010 (0.0348 percent). These emissions are projected to contribute an even smaller fraction (0.0261 percent) in 2040.[6]

Vehicle miles traveled (VMT) in the project area represents 1.66 percent of total Colorado State Highway travel; and the project itself would increase statewide VMT by 0.8 percent. For this analysis, only travel on the C-470 mainline and ramps was included.

As a result, FHWA estimates that the Proposed Action could result in a potential increase in global CO_2 emissions in 2040 of 0.02 percent (two hundredths of one percent), and a corresponding increase in Colorado's share of global emissions in 2040 of 0.0002 percent. This very small change in global emissions is well within the range of uncertainty associated with future emissions estimates. [7, 8]

Mitigation for Global GHG Emissions:
To help address the global issue of climate change, USDOT is committed to reducing GHG emissions from vehicles traveling on our nation's highways. USDOT and EPA are working together to reduce these emissions by substantially improving vehicle efficiency and shifting toward lower carbon intensive fuels. The agencies have jointly established new, more stringent fuel economy and first ever GHG emissions standards for model year 2012-2025 cars and light trucks, with an ultimate fuel economy standard of 54.5 miles per gallon for cars and light trucks by model year 2025. Further, on September 15, 2011, the agencies jointly published the first ever fuel economy and GHG emissions standards for heavy-duty trucks and buses.[9]

Increasing use of technological innovations that can improve fuel economy, such as gasoline- and diesel-electric hybrid vehicles, will improve air quality and reduce CO_2 emissions future years.

Consistent with its view that broad-scale efforts hold the greatest promise for meaningfully addressing the global climate change problem, FHWA is engaged in developing strategies to reduce transportation's contribution to GHGs—particularly CO_2 emissions—and to assess the risks to transportation systems and services from climate change.

[5] http://www.epa.gov/otaq/models/moves/index.htm. EPA's MOVES model can be used to estimate vehicle exhaust emissions of carbon dioxide (CO_2) and other GHGs. CO_2 is frequently used as an indicator of overall transportation GHG emissions because the quantity of these emissions is much larger than that of all other transportation GHGs combined, and because CO_2 accounts for 90 to 95 percent of the overall climate impact from transportation sources. MOVES includes estimates of both emissions rates and VMT, and these were used to estimate the Colorado statewide highway emissions in **Table 4-14**.

[6] Colorado emissions represent a smaller share of global emissions in 2040 because global emissions increase at a faster rate.

[7] For example, Figure 114 of the Energy Information Administration's *International Energy Outlook 2010* shows that future emissions projections can vary by almost 20 percent, depending on which scenario for future economic growth proves to be most accurate.

[8] When an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in an environmental impact statement and there is incomplete or unavailable information, the agency is required make clear that such information is lacking (40 CFR 1502.22). The methodologies for forecasting GHG emissions from transportation projects continue to evolve and the data provided should be considered in light of the constraints affecting the currently available methodologies. As previously stated, tools such as EPA's MOVES model can be used to estimate vehicle exhaust emissions of carbon dioxide (CO_2) and other GHGs. However, only rudimentary information is available regarding the GHG emissions impacts of highway construction and maintenance.

Estimation of GHG emissions from vehicle exhaust is subject to the same types of uncertainty affecting other types of air quality analysis, including imprecise information about current and future estimates of vehicle miles traveled, vehicle travel speeds, and the effectiveness of vehicle emissions control technology. Finally, there presently is no scientific methodology that can identify causal connections between individual source emissions and specific climate impacts at a particular location.

[9] For more information on fuel economy proposals and standards, see the National Highway Traffic Safety Administration's Corporate Average Fuel Economy website: http://www.nhtsa.gov/fuel-economy/.

In an effort to assist States and MPOs in performing GHG analyses, FHWA has developed a *Handbook for Estimating Transportation GHG Emissions for Integration into the Planning Process.* The Handbook presents methodologies reflecting good practices for the evaluation of GHG emissions at the transportation program level, and will demonstrate how such evaluation may be integrated into the transportation planning process. FHWA has also developed a tool for use at the statewide level to model a large number of GHG reduction scenarios and alternatives for use in transportation planning, climate action plans, scenario planning exercises, and in meeting state GHG reduction targets and goals. To assist states and MPOs in assessing climate change vulnerabilities to their transportation networks, FHWA has developed a draft vulnerability and risk assessment conceptual model and has piloted it in several locations.

At the state level, there are also several programs underway in Colorado to address transportation GHGs. The Governor's Climate Action Plan, adopted in November 2007, includes measures to adopt vehicle CO2 emissions standards and to reduce vehicle travel through transit, flex time, telecommuting, ridesharing, and broadband communications. CDOT issued a Policy Directive on Air Quality in May 2009. This Policy Directive was developed with input from a number of agencies, including the State of Colorado's Department of Public Health and Environment, EPA, FHWA, the Federal Transit Administration, the Denver Regional Transportation District and the Denver Regional Air Quality Council.

This Policy Directive and implementation document, the CDOT Air Quality Action Plan address unregulated MSATs and GHGs produced from Colorado's state highways, interstates, and construction activities. As a part of CDOT's commitment to addressing MSATs and GHGs, some of CDOT's program wide activities include:

- Researching pavement durability opportunities with the goal of reducing the frequency of resurfacing and/or reconstruction projects.
- Developing air quality educational materials, specific to transportation issues, for citizens, elected officials, and schools, including development of vehicle idling reduction programs for schools and communities.
- Offering outreach to communities to integrate land use and transportation decisions to reduce growth in VMT, such as smart growth techniques, buffer zones, transit-oriented development, walkable communities, access management plans, etc.
- Committing to research additional concrete additives that would reduce the demand for cement.
- Expanding Transportation Demand Management efforts statewide to better utilize the existing transportation mobility network.
- Continuing to diversify the CDOT fleet by retrofitting diesel vehicles, specifying the types of vehicles and equipment contractors may use, purchasing low-emission vehicles, such as hybrids, and purchasing cleaner burning fuels through bidding incentives where feasible. Exploring congestion and/or right-lane only restrictions for motor carriers.
- Funding truck parking electrification Researching additional ways to improve freight movement and efficiency statewide.
- Committed to use of ultra-low sulfur diesel for non-road equipment statewide.
- Developing a low-VOC emitting tree landscaping specification.

Even though project-level mitigation measures will not have a substantial impact on global GHG emissions because of the exceedingly small amount of GHG emissions involved, the above-identified activities are part of a program-wide effort by FHWA and CDOT to adopt practical means to avoid and minimize environmental impacts in accordance with 40 CFR 1505.2(c).

Summary: This document does not incorporate an analysis of the GHG emissions or climate change effects of each of the alternatives because the potential change in GHG emissions is very small in the context of the affected environment. Because of the insignificance of the GHG impacts, those impacts will not be meaningful to a decision on the environmentally preferable alternative or to a choice among alternatives. As outlined above, FHWA is working to develop strategies to reduce transportation's contribution to GHGs—particularly CO_2 emissions—and to assess the risks to transportation systems and services from climate change. FHWA will continue to pursue these efforts as productive steps to address this important issue. Finally, the construction best practices described above represent practicable project-level measures that, while not substantially reducing global GHG emissions, may help reduce GHG emissions on an incremental basis and could contribute in the long term to meaningful cumulative reduction when considered across the Federal-aid highway program.

4.3.4 Water Quality

Stormwater that drains off of highways (and other land uses) finds its way into various drainages, some of which eventually discharge into streams or rivers that may be classified as waters of the United States. In the C-470 project area, the South Platte Rivers and other drainages have this classification. Under Federal and state regulations pursuant to the Clean Water Act, all facilities that discharge pollutants from any point source into waters of the U.S. are required to obtain a permit under the National Pollutant Discharge Elimination System (NPDES) permit program. In Colorado, NPDES requirements are implemented through Colorado Regulation 61, Colorado Discharge Permit System Regulations.

MS4 Permit Requirements: Colorado Regulation 61 identifies CDOT as a regulated Municipal Separate Storm Sewer System (MS4). By definition, a separate storm sewer system includes not only a storm drainage system but also ditches, gutters, or other similar means of collecting and conveying stormwater runoff that do not connect with a wastewater collection system or wastewater treatment facility.

CDPHE most recently issued CDOT a Phase 1 MS4 permit on December 2006 that applies to state and interstate highways and their rights-of-ways within "urbanized areas," as defined by the CDPHE. The CDOT MS4 permit area covers nearly all of the C-470 project area. That permit expired at the end of January 2012, but has remained in effect pending issuance of a new permit.

In 2014, CDPHE modified CDOT's New Development & Redevelopment (NDRD) Program significantly, in response to a modification requested by CDOT on April 17, 2014. The request was approved with conditions issued on April 22, 2014 (CDPHE, 2014b) and May 22, 2014 (CDPHE, 2014c). The result is the 2014 CDOT NDRD Interim Guidance dated September 18, 2014 (CDOT, 2014). The initial conditional approvals and the Interim Guide were further modified by a CDPHE letter to CDOT dated January 8, 2015 (CDPHE, 2015b).

To simplify contracting and administration of the requirements, the requirements of the 2014 CDOT Interim NDRD Program will be applied to the entire project area.

The 2014 Interim NDRD Program includes a change of terminology from "Best Management Practices (BMPs) to "Control Measures (CMs)" for Permanent Water Quality facilities. However, since the new MS4 permit has not been received and the terminology could change again at that time, this Technical Report will continue to refer to permanent water quality facilities and activities as "BMPs".

CDOT has extensive experience in implementing permanent BMPs for post-construction mitigation as well as temporary

BMPs addressing potential water quality degradation during construction.

Water Quality in the Project Area: Section 303(d) of the Clean Water Act requires states to identify waters that do not or are not expected to meet applicable water quality standards with technology-based controls alone. This identification of water quality-limited waters is presented in Colorado's 303(d) list, updated every two years maintained by CDPHE.

The most recent Colorado 303(d) list indicates that several receiving waters in the C-470 Corridor are impaired, as follows:

- South Platte River – high priority impairment for arsenic
- Four drainages – low priority impairment for selenium (Dad Clark Gulch, Lee Gulch, Big Dry Creek, and Willow Creek)

Arsenic and selenium are elements naturally found in the soils in the project area. If they get into receiving waters in sufficiently high concentrations, they can impair the waters' beneficial uses. Controlling construction-related and long-term erosion along highways may be helpful with regard to these issues and is a top CDOT MS4 permit priority.

Surface Waters: Surface waters within the project area are shown in **Figure 4-11**. Color variations on the highway line indicate to which receiving water each C-470 segment drains.

The largest water body in the area is Chatfield Reservoir, owned and operated by the USACE. It was built as a flood control reservoir on the South Platte in response to major regional flooding in 1965. Denver Water and other entities use their water rights to fill and maintain water in this reservoir. A 2013 Environmental Impact Statement by USACE detailed plans to greatly increase the amount of water stored there (USACE, 2014).

McClellan Reservoir is a man-made water storage facility located north of C-470 between Santa Fe Drive and Broadway. The reservoir acts as a drinking water supply for the City of Englewood and Highlands Ranch. The City of Englewood and Centennial Water and Sanitation District pump water directly from McClellan Reservoir to supply water to Highlands Ranch.

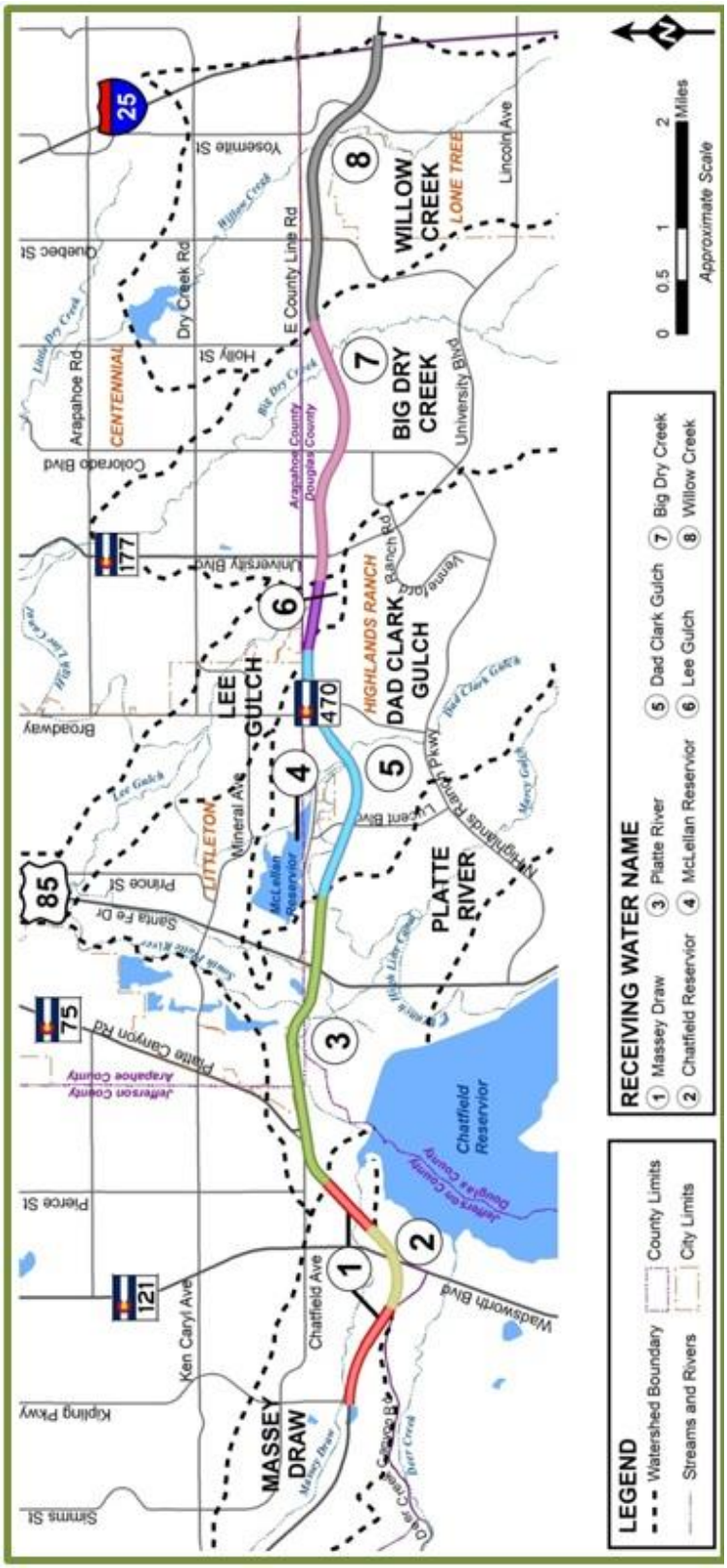
Regarding domestic drinking water, the Centennial Water and Sanitation District provides water to most of the C-470 project area. The water is supplied through a conjunctive system (both surface and groundwater). Water supplies in the northern portion of the project area are provided by both Denver and Aurora Water, which primarily gain water through surface waters located outside of the project area. No water from the South Platte River below Chatfield Reservoir is used for drinking water supply.

Interagency Cooperation: The cities and counties along C-470 also are subject to MS4 requirements and they have developed their own water quality ponds and other BMPs needed for compliance. These systems are not static but change as needed to address new development and redevelopment needs. Interagency cooperation among MS4 permittees offers opportunities for shared mitigation that can avoid unnecessarily expensive and redundant systems. For this reason, CDOT contacted many of the adjacent jurisdictions to explore cooperative approaches. A number of the water quality features proposed for the Proposed Action involve cooperative solutions.

Meetings to discuss opportunities for cooperation, stormwater management issues and planned improvements were held with:

- City of Englewood (Englewood McLellan Reservoir District)
- Highlands Ranch Metropolitan District
- City of Lone Tree
- Arapahoe County
- Douglas County
- Jefferson County

Figure 4-11
Surface Water Resources



Additionally, drainage reports were collected from the various agencies with water quality jurisdiction along the corridor.

Water quality impacts associated with the No-Action Alternative and Proposed Action are summarized below. Additional details are provided in the Water Quality Technical Report in **Appendix E.**

No-Action Alternative Water Quality Impacts: The No-Action Alternative would neither improve nor degrade current water quality conditions in the C-470 project area. Current streams and their courses would not be altered. The amount of impervious surface would remain unchanged for the 13.75 miles of C-470 and its ramps.

Proposed Action Water Quality Impacts: Impervious surface area would increase from 204.9 acres for the existing condition and No-Action condition to 324.7 acres with the Proposed Action. The increase in impervious surface from the highway widening would cause greater volumes of water to runoff into receiving waters. Average daily traffic on C-470 will increase with the Proposed Action from an existing range of 61,000 to 106,000 to about 93,000 to 161,000 in 2035.

Chemical pollutants resulting from increased impervious surface and traffic would flow into roadside drainage systems. However, water quality facilities constructed as part of the Proposed Action would be effective in preventing chemicals from entering the receiving waters within the project area.

Water quality in the project area's receiving waters should benefit from the Proposed Action since more runoff from C-470 would be treated than is treated today. Permanent water quality BMPs constructed with the Proposed Action would treat runoff from an area of roadway surface equal to or greater than 90 percent of the increased roadway surface added due to the Proposed Action.

Because the South Platte River segment receiving runoff from the project is listed for arsenic, one of the seven pollutants specified in the 2014 NDRD Interim Program requirements, 90 percent of the increased roadway surface area within this specific drainage basin will be treated by facilities within the basin.

The increase in impervious area due to the Proposed Action is 119.8 acres. About 4.4 acres of the new impervious area will be treated by existing facilities at Santa Fe Drive. According to the 2014 Interim NDRD Program, runoff from 90 percent of this area, or 107.8 acres, must be treated. The Proposed Action would provide water quality treatment for runoff from an additional 185.1 impervious acres, or about 172 percent of the required area. By treating more than the minimum required area, CDOT is committing not only to preserve stormwater quality in the corridor, but to improve it.

Temporary Impacts during construction are expected to include working within and adjacent to some of the identified receiving waters. For example, the Proposed Action would remove and replace the two parallel C-470 bridges over the South Platte River. Implementation of temporary BMPs will be required to prevent the transport of sediment from exposed, erodible soils into the receiving waters.

The management and handling of materials and equipment during the construction phase would be conducted in accordance with pertinent sections of the CDOT Standard Specifications for Road and Bridge Construction and the CDOT Erosion Control and Stormwater Quality Guide, in compliance with a CDPS Construction Stormwater Permit.

Mitigation of Proposed Action Impacts on Water Quality: A Stormwater Management Plan (SWMP) detailing how and where temporary BMPs will be used before, during and after construction will be developed for the Proposed Action. This document will evolve as the construction progresses to meet the changing needs of the project.

Work on the project shall conform to the requirements of the CDOT Standard Specifications for Road and Bridge Construction and the CDOT Erosion Control and Stormwater Quality Guide. A Stormwater Construction Permit issued by CDPHE will be required for the project. Work on the project will be monitored by CDOT through its "Construction Sites Program".

Numerous temporary BMPs will be required during the construction phase of the project. Temporary BMPs are described in the CDOT Erosion Control and Stormwater Quality Guide. The SWMP will include, but not be limited to, the following general measures:

- Erosion Control Measures including minimizing soil disturbances and adequately stabilizing disturbed areas as soon as possible to prevent erosion;
- Sediment Control Measures including using adequate BMPs to collect and remove pollutants from runoff before it is discharged from areas under construction;
- Using adequate measures to prevent materials from being tracked by vehicles or carried by wind and deposited off-site; and
- Proper spill prevention, management and control measures.

Permanent BMPs proposed for implementation with the Proposed Action will dominantly consist of, but not be limited to extended detention basins. Design will maximize ease of safe access, and will include input from Maintenance staff to accommodate available maintenance equipment. Depending on site conditions, local agency requirements, and space available, CDOT will also consider the use of ecology embankments/media filter drains, and pre-manufactured mechanical treatment devices.

4.3.5 Hydrology and Hydraulics

Hydrologic and hydraulic analysis for the study consisted of two elements: regional hydrology and cross culverts carrying regional drainages under C-470, and roadway drainage carrying storm runoff from the roadway itself.

The regional assessment was conducted to check bridges and cross culverts for adequate hydraulic capacity and, in some cases, for other considerations such as roadway profile changes, trail underpasses, and wildlife passage. The roadway storm drainage system was designed at a conceptual level to locate and size the collection system and to locate and size detention storage and water quality ponds.

The major streams and drainages in the project area include Massey Draw, South Platte River, Dad Clark Gulch, Big Dry Creek, and Willow Creek, as shown previously in **Figure 4-11**.

Massey Draw flows through a double box culvert under C-470 between Wadsworth Boulevard and Santa Fe Drive. The existing bridge at the South Platte River is a three-span bridge. Dad Clark Gulch crosses C-470 through an existing water quality detention outlet structure. A bridge carries C-470 over Big Dry Creek. Willow Creek crosses under C-470 in an existing triple box culvert. Existing culverts and bridges are described in **Table 4-14**. Details on potential floodplain impacts are discussed in the *Hydraulics Study* in **Appendix E**.

Flows to the cross drainages were determined using master plans and drainage studies that cover the project area and by delineating basins that contribute runoff to culverts that are 48 inches in diameter and larger. Basins were analyzed further if no published information was available on the basin and/or culvert crossing.

One crossing of hydraulic importance is the South Platte River bridges, just west of Santa Fe Drive. This crossing is downstream of the Chatfield Reservoir dam and spillway. The Chatfield Dam outlet permits a maximum flow of 8,000 cubic feet per second (cfs), but the actual discharge permitted is currently limited to 5,000 cfs by state statute.

The USACE recently completed a storage reallocation study for Chatfield Reservoir to evaluate its storage capacity and operation (USACE, 2014).That study considered a possible increase in the maximum allowable discharge rate, but the study's selected alternative calls for no change to the existing operation (i.e., 5,000 cfs). Therefore, the regulated release rate of 5,000 cfs is being used for the 100 and 500-year design flows at the South Platte River crossing.

Currently, median and roadside ditches handle all existing roadway storm drainage. Therefore, no storm sewers are present, except at low points that require outlets to the roadside ditches or receiving watercourses.

No-Action Alternative Hydrology Impacts: No changes to the existing hydrology or hydraulics would result from the No-Action Alternative.

Proposed Action Hydrology Impacts: Many culverts that cross C-470 would be extended to accommodate the wider typical section. Culvert headwater depths have been calculated to determine if the culverts along C-470 have adequate capacity to pass the 100-year storm event and meet CDOT criteria for this project.

Almost all of the culverts crossing C-470 are adequately sized to pass the 100-year design flow based on allowable headwater criteria. However, the existing 72-inch culvert east of Spring Creek (1,200 feet west of Quebec St.) is undersized and cannot pass the 100-year storm. It can only pass 336 cfs at a headwater to diameter ratio of 1.5, but needs to pass 490 cfs for the 100-year storm.

Based on this assessment, no existing buildings would be impacted by any changes in headwater elevations at the culvert crossings.

The box culvert carrying Willow Creek under C-470 would be extended on the south side to accommodate the wider highway. Lengthening the culvert and raising the inverted would cause a minor rise in the 100-year floodplain, but the property adjacent to the floodplain is publicly owned and not available for development.

The existing bridges over the South Platte River would be replaced to improve the horizontal and vertical geometry of the crossing. This replacement would not modify the main 100-foot wide river channel. The bridge opening would be widened and raised to provide improved trail clearances and sight distances for the regional Mary Carter Greenway trail. The revised section also provides a wildlife corridor. The design passes the 5,000 cfs maximum hourly discharge from the Chatfield Dam without significant adverse impacts to the floodplain.

A preliminary analysis of the floodplain, using the standard step method provided in the USACE HEC-RAS software, showed that widening the bridges can cause a small rise in the 100-year floodplain at the downstream face of the bridges, however, the longer bridge span will widen the floodplain under the bridges and cause a small decrease in the 100-year water surface upstream of the crossing. A more detailed analysis of this crossing will be required to determine if a FEMA map revision will be required.

The bridges over Big Dry Creek would be widened to adjust to the wider roadway section, but no changes would be made to the channel. The bridge at Big Dry Creek was evaluated for capacity using Manning's equation. Widening of the bridge abutments may cause some minor encroachment into the adjacent floodplain.

The total impervious area for 13.75 miles of C-470 and its ramps would change from 204.9 acres to 324.7 acres, an increase of 119.8 acres. This will increase stormwater runoff, both in volume and peak flow rates.

The storm drainage collection system was analyzed to locate and size inlets, pipelines and outfalls to the drainageways. Detention storage and water quality ponds were also

located and sized to strategically address increases in runoff and to comply with CDOT's MS4 permit requirements.

At some locations, increases in flow rates will be discharged to drainageways without peak flow reduction. At these locations the increase is not large relative to the flows expected in the receiving waters. These increases in flow could result in erosion along ditches, and downstream drainageways and could impact water quality.

A more detailed discussion of the hydraulic capacity of crossings and potential impacts on receiving waters and floodplains is provided in the *C-470 Hydraulic Study* in **Appendix E**.

Mitigation of Hydrology Impacts: Most of the proposed culvert extensions would still be within the existing ROW, but in cases where they would not fit, additional ROW would be acquired as part of the alternative.

To correct the potential flooding at the culvert east of Spring Creek, the culvert would be replaced with an 84-inch-diameter reinforced concrete pipe culvert to allow for adequate passage of the estimated 100-year frequency design flows.

The longer bridges over the South Platte River will not affect the capacity of the crossing, but a more detailed analysis of the crossing will be necessary to determine if a FEMA map revision process is required.

The construction of detention storage ponds with water quality features will reduce runoff from the project to pre-project peak flow rates where it was feasible to place these facilities. Erosion mitigation measures will be provided to address the potential impact from increased runoff where detention storage facilities were not feasible.

Water quality ponds are included in the alternative as permanent BMPs to improve water quality of storm runoff, as discussed in **Section 4.3.4, Water Quality**. A more detailed discussion of the Proposed Action water quality impacts and mitigation measures is provided in the *Water Quality Technical Report* (April 2015).

4.3.6 Floodplains

Executive Order 11988, Floodplain Management, requires federal agencies to avoid direct or indirect support of floodplain development whenever a practicable alternative exists. The base flood (100-year flood) is the regulatory standard used by federal agencies and most states to administer floodplain management programs. Flood insurance rate maps (FIRM) from the Federal Emergency Management Agency (FEMA) were used to identify drainages with 100-year floodplains within the C-470 project area. Locations of the floodplains are shown in relation to C-470 in **Figure 4-12**.

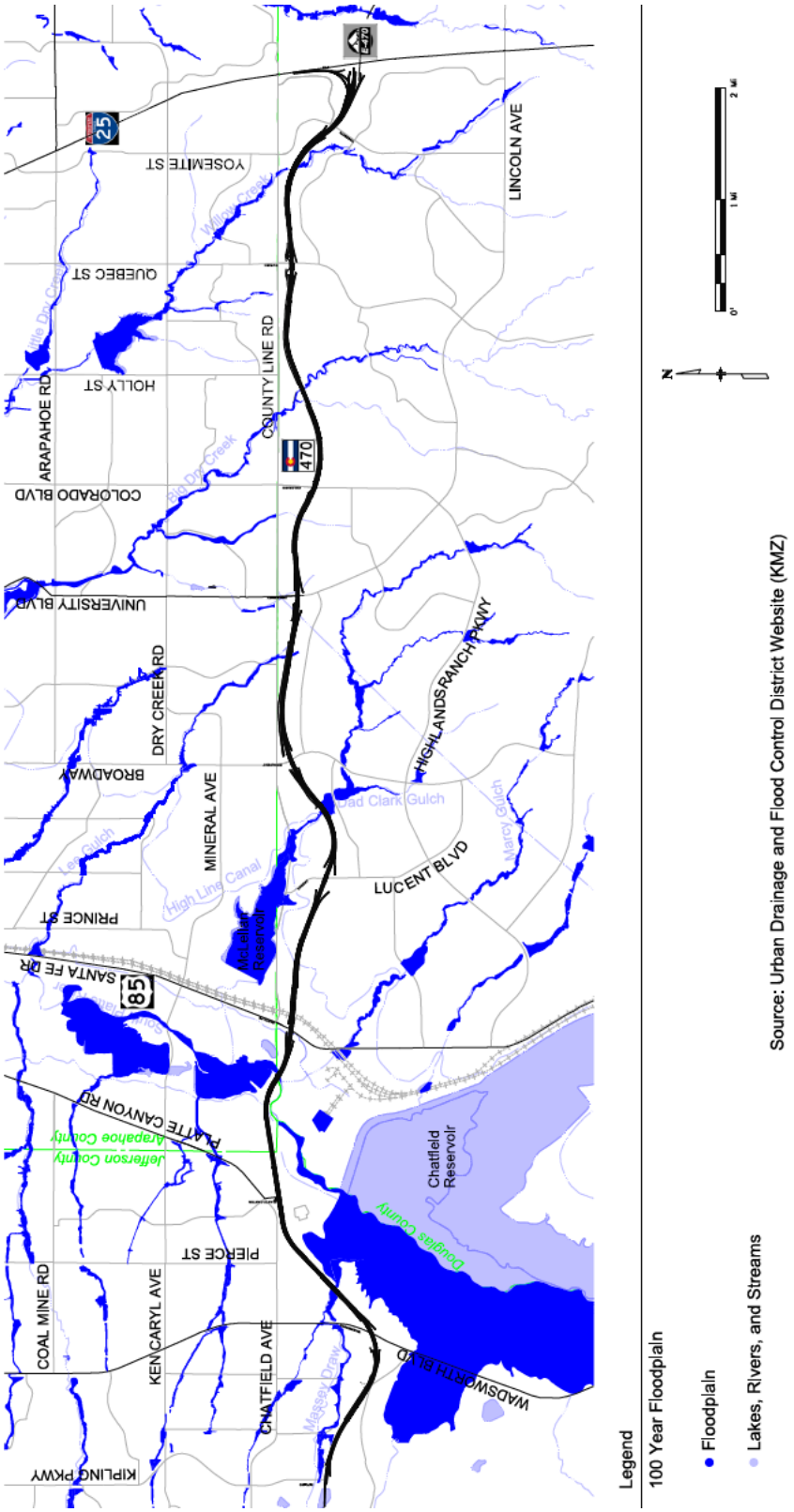
C-470 intersects five drainages with 100-year floodplains including; Massey Draw, the South Platte River, Dad Clark Gulch, Big Dry Creek, and Willow Creek. Flood Hazard Area Delineations (FHAD), Master Plans, and Outfall Planning Studies are available for these drainages and their tributaries through the Urban Drainage and Flood Control District (UDFCD). The South Platte River and Big Dry Creek floodplains have regulated floodwater elevations (base flood elevations, Zone AE) and Massey Draw, Dad Clark Gulch and Willow Creek have approximate floodplains without base flood elevations (Zone A).

Flooding in the C-470 project area is typically due to short-duration, high-intensity events from May to September. Since Chatfield Reservoir is upstream of C-470 on the South Platte River, flow rates passing under the parallel C-470 bridges are controlled by the Chatfield Dam outlet works.

Further discussion of floodplains and potential project impacts is provided in the *C-470 Hydraulic Study* presented in **Appendix E**. Floodplain findings from that study are summarized below.

No-Action Alternative Impacts on Floodplains: The No-Action Alternative would result in no

Figure 4-12
FEMA Floodplains in the C-470 Corridor



effects to the regulated 100-year floodplains within the project area.

Proposed Action Impacts on Floodplains: Project improvements have been planned to eliminate or limit and mitigate potential adverse impacts to floodplains.

Culvert crossings at Massey Draw and Dad Clark Gulch will not be lengthened due to the construction of retaining walls that will constrain the wider roadway embankment. Therefore, there is no potential impact to the adjacent floodplains at these locations.

Potential impacts to the South Platte River floodplain may occur due to the longer and wider bridge spans of the replacement bridges. The longer bridge spans provide improved clearances and sight distances for the regional Mary Carter Greenway Trail and a wildlife corridor. No widening of the main river channel is required, but the longer bridge span allows flood flows to expand westerly adjacent to the proposed bridge abutment.

A preliminary analysis shows that potential adverse impacts to the floodplain water surface elevation will be limited to the C-470 easement through USACE land. All of the land adjacent to the bridge crossing is publicly owned and not available for development. Therefore no increased risk to developed property is expected. Potential impacts will need to be assessed in more detail to determine if a FEMA map revision is required.

Widening of the C-470 bridges over Big Dry Creek will extend bridge abutments upstream and downstream parallel to the existing floodplain. However, no modifications to the channel section are planned. Therefore, impacts to the floodplain are expected to be minimal.

Extension of the south entrance to the existing culvert at Willow Creek, and the corresponding rise in the culvert invert, may cause a minor increase in the floodplain water surface elevation. However, a preliminary analysis showed that the rise would be within the allowable one-foot increase for approximate floodplains. The area adjacent to the floodplain is public land and is not available for development. Therefore, no additional risk to adjacent developed property is expected.

4.3.7 Historic Resources

Consistent with requirements of Section 106 of the National Historic Preservation Act of 1966, historic resources were inventoried and evaluated within the C-470 project's Area of Potential Effect (APE), as defined by the FHWA and CDOT with concurrence from the State Historic Preservation Officer (SHPO) in May 2004. The APE was defined as approximately 150 feet on either side of the existing C-470 centerline from Kipling Parkway to I-25, with additional width identified at interchanges, and locations where historic resource property boundaries were known to occur within the project area.

Complete details regarding the study of historic resources for this Revised EA are provided in the *Historic Resources Survey* in **Appendix E**.

Only one resource in the project area, Hildebrand Ranch (5JF188), is listed in the National Register of Historic Places (NRHP). Research conducted for the 2006 EA identified additional resources that were found to be eligible for NRHP listing. All of these resources are located west of Broadway. No historic resources were identified in the eastern half of the C-470 project area.

A new survey in 2013 identified and recorded two additional resources that were determined *eligible* to the NRHP. These are:

- the Chatfield Dam (Jefferson County portion 5JF5142 and Douglas County portion 5DA3091) and
- the Columbine Hills neighborhood (5JF5143), a post World War II subdivision located north and west of Platte Canyon Road.

The *Historic Resource Survey: C-470 Kipling Parkway to I-25* (June 2013) contains details regarding the historic context and all historic resources within the project area (Please see **Appendix E, Technical Reports**). This report summarizes the NRHP determinations of eligibility for resources within the APE and contains findings of Section 106 effect (36 CFR 800.5). Effect determinations under Section 106 (36 CFR 800.5) may be:

- *no historic properties affected*,
- *no adverse effect*, or
- *adverse effect*

The Proposed Action results in findings of *no historic properties affected* or *no adverse effect* with regard to the resources in the APE. The project does not result in *adverse effects* to historic properties.

CDOT's assessment of eligibility and effects for C-470 was submitted to the SHPO in formal Section 106 consultation The SHPO provided written concurrence with these determinations of eligibility and effects on September 6, 2013 for all but one resource, and concurrence for the final resource on October 16, 2013. The consultation process also included the following parties:

- City of Littleton Historic Preservation Board
- Arapahoe County Commissioners
- Jefferson County Historical Commission
- C-470 Corridor Coalition
- Douglas County Historic Preservation Board

All correspondence from the consultation process is provided in **Appendix A**.

Figure 4-13 shows the locations of the properties identified as officially eligible or on the NRHP. **Table 4-15** lists them and indicates the effect determination for each due to the Proposed Action.

No-Action Alternative Impacts on Historic Properties: The No-Action Alternative would not impact historic resources.

Proposed Action Impacts on Historic Properties: The resources listed in **Table 4-16** with a finding of *no adverse effect* are discussed below. These are:

- Chatfield Dam
- Columbine Hills neighborhood
- City Ditch
- High Line Canal

Chatfield Dam (5JF5142 and 5DA3091)
The USACE built the Chatfield Dam, reservoir, and associated recreational areas over a ten year period between 1967 and 1977, after a devastating flood in 1965 in the South Platte River Valley. Chatfield Dam is historically significant under NRHP Criterion A for its association with the USACE and their role as dam builders. The rolled-earth dam is significant under NRHP Criterion C for its embodiment of the distinctive characteristics and method of construction for a Rolled Earth-Fill Dam used by the USACE. The distinctive construction began in 1967, which is 48 years ago. When assessing potentially historic properties, CDOT considers sites that are 45 or more years old, approaching the 50-year age normally needed (together with other factors) for historic eligibility.

The Proposed Action would result in no direct effects to Chatfield Dam. Indirect effects would include increased noise and visual intrusion. The C-470 expanded pavement would be visible only from the top of the west embankment overlook. At the top of the embankment, ranging from 1,000 to 3,000 feet from the highway, the potential effect of increased noise is minimal. Because the project would not diminish the significant features of the resource, it results in a finding of *no adverse effect* to the Chatfield Dam.

Columbine Hills (5JF5143)
The Columbine Hills subdivision is a good example of a multiple filing subdivision based on a Master Plan that includes amenities, such as shopping, schools, churches, and parks constructed between 1959 and 1977.

Figure 4-13
Historic Resources

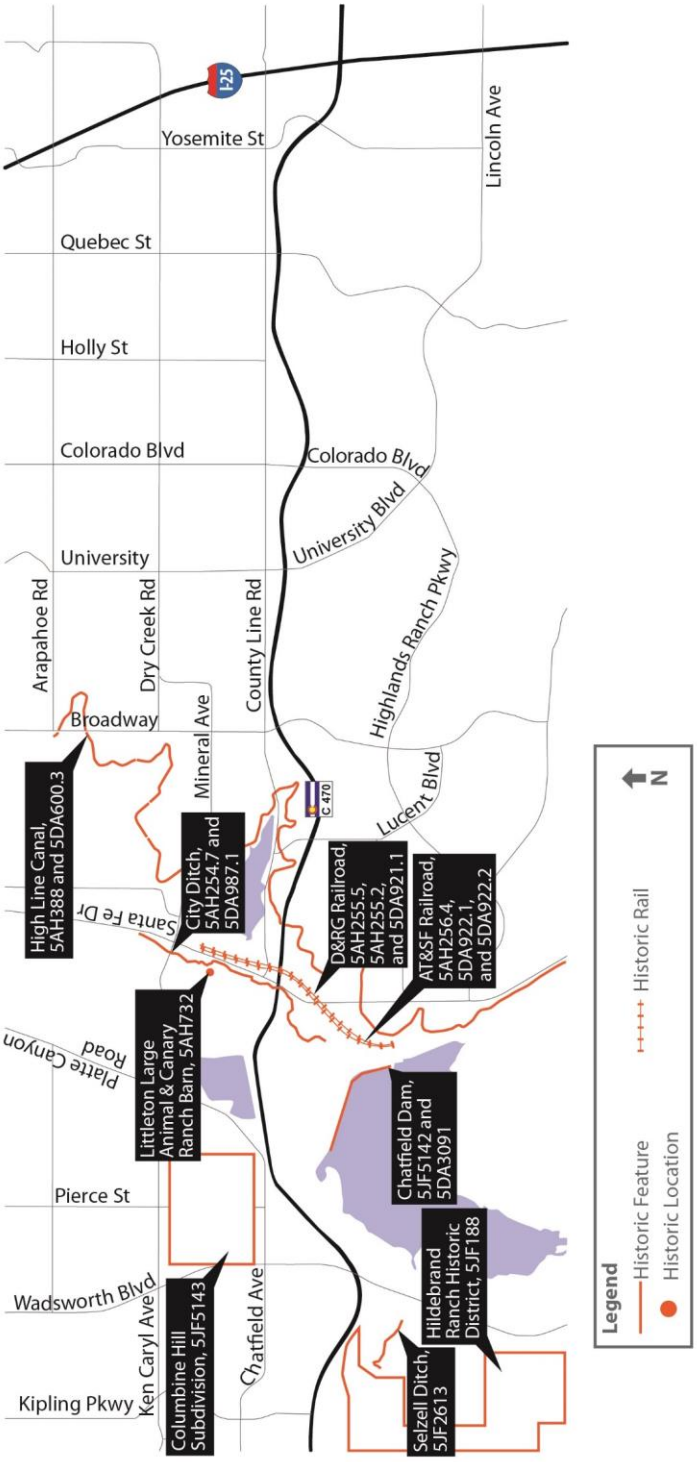


Table 4-15
Officially Eligible or Listed Historic Properties

Site Number	Resource	Location	Effect
5JF188	Hildebrand Ranch	South of C-470; west of Wadsworth Boulevard	No historic properties affected
5JF2613	Selzell Ditch	South of C-470; west of Wadsworth Boulevard	No historic properties affected
5JF5142 and 5DA3091	Chatfield Dam*	South of C-470; between Wadsworth Boulevard and Santa Fe Drive	No adverse effect
5JF5143	Columbine Hills*	North of C-470; along Platte Canyon Road	No adverse effect
5AH254.7 and 5DA987.1	City Ditch	Crosses under C-470 at the Santa Fe Drive interchange	No adverse effect
5AH732	Littleton Large Animal Clinic and Canary Ranch Barn	North of C-470 on the west side of Santa Fe Drive	No historic properties affected
5AH255.5, 5AH255.2, and 5DA921.1	Denver & Rio Grande Railroad	Crosses over C-470 immediately east of Santa Fe Drive	No historic properties affected
5AH256.4, 5DA922.1, and 5DA922.2	Atchison Topeka & Santa Fe Railroad	Crosses over C-470 immediately east of Santa Fe Drive	No historic properties affected
5AH388 and 5DA600.3	High Line Canal	Crosses C-470 east of Erickson Drive	No adverse effect

** Chatfield Dam and Columbine Hills have newly been determined eligible; they were not assessed in the 2006 EA.*

This subdivision is significant under NRHP Criterion A for its association with postwar development in the Denver metropolitan region to meet growing demand for housing for young professionals who worked in the region's expanding industrial and technological markets.

Under NRHP Criterion C, the Columbine Hills subdivision is representative of patterns of the metro area's postwar community planning and development that utilized a master plan to create a cohesive, individual community for its residents.

The C-470 Proposed Action would not encroach on the historic boundaries of the Columbine Hills subdivision, and thus would have no direct effects on this resource. However, it would result increased traffic noise levels for the subdivision. Noise analysis conducted for this Revised EA concluded that the eight southernmost homes in this 1,300-home subdivision would experience noise levels of 66 decibels or more in the year 2035. This level of noise would interfere with ordinary outdoor conversation. These homes on West Alder Avenue receive noise not only from C-470, but also from Chatfield Avenue, which is even closer to them, right behind their back yards.

Nearby Columbine Hills residences are protected by an existing CDOT noise barrier. Extension of that barrier to protect eight more homes is considered unlikely, as it would not meet the current FHWA and CDOT standard for reasonable cost-effectiveness. However, if the noise barrier on CDOT right-of-way were to be extended, the same homes would experience a visual impact instead of a noise impact. The assessment of effects evaluated both possibilities for indirect effects to the resource, stemming from increases in noise or the visual impact of a new noise wall. As neither option would diminish the historic integrity of the resource, the project results in a finding of *no adverse effect* with regard to Columbine Hills.

City Ditch (5AH254.7 and 5DA987.1)
The entire City Ditch was determined officially eligible to the NRHP under Criterion A for its historic significance in engineering and irrigation on the Plains and its association with Early High Plains Irrigation and Farming to 1900. This ditch crosses the APE just once but has two Smithsonian identification numbers (one indicating Arapahoe County and one indicating Douglas County) because it crosses the county line.

The two City Ditch segments intersecting the APE have each been determined non-supporting of the overall eligibility of the City Ditch. These segments demonstrate diminished historic integrity due to realignment and routing the historic ditch into pipes during the construction of C-470 between 1985 and 1990.

As part of the Proposed Action, the portion of City Ditch located under C-470 in the vicinity of the Santa Fe Drive interchange would be re-aligned and re-constructed.

The City Ditch in this area lacks historical integrity because during the initial construction of this section of C-470 between 1982 and 1985, these sections of City Ditch were significantly altered. Specifically, they were re-aligned and put into pipes south of C-470, under the highway, and north of the highway along Santa Fe Drive. Because the subject segments lack integrity, reconstruction of the ditch pipeline at each segment will not alter or diminish historic features of the resource, and the proposed action results in a finding of *no adverse effect* with regard to the City Ditch, including the subject segments.

High Line Canal (5AH388 and 5DA600.3)
The High Line Canal was determined officially NRHP-eligible under Criterion A for its association with Colorado's early agricultural development. The segment evaluated within the APE has historic integrity. It has two Smithsonian identification numbers (one indicating Arapahoe County and one indicating Douglas County) because it crosses the county line. In 1880 plans were completed for the canal, and construction crews began work on the High Line Canal. It would ultimately extend for 70 miles with several laterals. It was completed in 1883. The canal was used extensively by farmers and ranchers in northern Douglas County. In 1924, it became the property of Denver. The High Line Canal is still in use today, now flanked by a major regional recreation trail. During the initial construction of C-470 in the 1980s, the section of the High Line Canal within the APE was put in a low, concrete-box culvert to allow the highway to cross over the ditch and not interrupt the flow of water.

Despite the widening of the highway, there would be no need to extend the existing box culvert. Instead, a concrete retaining wall would be extended from the edge of the pavement down the slope to within 15 feet of the box culvert on both the north and south sides. The concrete wall would stabilize the earthen slope protecting the High Line Canal from erosion associated with the highway. An earthen slope would continue from the edge of the wall down to the head wall of the box culvert. Because the proposed work would not diminish the characteristics of the resource qualifying it for inclusion on the NRHP, the project will result in a finding of *no adverse effect* with regard to the Highline Canal, including segments 5AH388 and 5DA600.3.

Mitigation of Proposed Action Impacts on Historic Properties: No mitigation measures for historic resources are required because the project does not result in adverse effects under Section 106 for any historic resources present in the APE.

4.3.8 Archaeological Resources

In July and August 2004, CDOT archaeologists completed archival research for the project area. This research involved investigating the site and study files housed at the Colorado Office of Archaeology and Historic Preservation and reviewing CDOT records. The entire length of C-470 between I-25 and I-70 was initially inventoried for archaeological resources by the Colorado

Department of Highways in 1976, as part of the Section 106 compliance process that preceded highway construction (*The Archaeological Survey of I-470 – Southwest Circumferential. Highway Salvage Report No. 14, 1976*).

The parcel within the current project area located east of I-25, along the E-470 alignment, was surveyed under the auspices of the E-470 Authority in 1987 (*Final Report of Cultural Resource Inventory for the Proposed E-470 Corridor, Douglas, Arapahoe and Adams Counties, Colorado, 1988*).

From the late 1970s to early 2000s, a number of additional cultural resource studies included portions of C-470, some of which were transportation-related, while others were undertaken as a result of ancillary developments. No additional field survey to identify archaeological sites was necessary for the current study.

The file search identified eight prehistoric sites located completely or partially within the 1,000-foot wide APE established for the archaeological resources assessment (500-feet on either side of the highway centerline). All eight sites were documented during the mid- to late 1970s, well before C-470 was constructed. However, official determinations of National Register eligibility were never completed for many of these resources, a task ultimately undertaken by CDOT for the 2006 C-470 EA.

The eight sites have been entirely or partially destroyed by transportation, residential, or commercial construction activities such that they no longer retain physical integrity and/or exhibit the potential to contain significant buried cultural deposits.

In September 2004, the SHPO concurred with the FHWA and CDOT evaluations of not eligible for listing on the NRHP for all archaeological sites within the project area. Records of agency correspondence are located in **Appendix B**.

No archaeological sites listed on or eligible for the NRHP are located within the project area. As such, the No-Action and Proposed Action would have no effect on this type of historic properties. In the event archaeological remains are exposed during any phase of construction associated with the study, the CDOT Senior Staff Archaeologist will be contacted to evaluate the discovery and coordinate appropriate Section 106 compliance actions with the SHPO and other agencies or entities, as necessary.

Mitigation for Impacts to Archaeological Resources: If archaeological remains are exposed during any phase of construction associated with the study, the CDOT Senior Staff Archaeologist will be contacted to evaluate the discovery and coordinate appropriate Section 106 compliance actions with the SHPO and other agencies or entities, as necessary.

4.3.9 Native American Consultation

Section 106 of the National Historic Preservation Act (as amended) and the Advisory Council on Historic Preservation regulations (36 CFR 800.2[c][2][ii]) mandate that federal agencies coordinate with interested Native American tribes in the planning and environmental process for federal undertakings.

Consultation with Native American tribes recognizes the government-to-government relationship between the United States government and sovereign tribal groups, and federal agencies must be sensitive to the fact that historic properties of religious and cultural significance to one or more tribes may be located on ancestral, aboriginal, or ceded lands beyond modern reservation boundaries.

Consulting tribes are offered the opportunity to identify concerns about cultural resources and comment on how the project might affect them. If it is found that the project would impact cultural resources that are eligible for inclusion on the NRHP and are of religious or cultural significance to one or more consulting

tribes, their role in the consultation process could also include participation in resolving how best to avoid, minimize, or mitigate those effects.

By describing the proposed undertaking and the nature of known cultural sites, and consulting with the interested Native American community, the FHWA and CDOT strive to effectively protect areas important to American Indian people.

The USACE administers several linear miles of land within the project area, where C-470 is located on an easement from that agency. For the C-470 project, the USACE delegated consultation responsibilities to the FHWA, the lead agency, but in so doing did not relinquish its obligations, as mandated by federal statute. The USACE maintains an ongoing role in the consultation process.

Tribes Contacted: Tribes were initially contacted for the 2006 EA and those that expressed interest in the project were contacted again as the project transitioned into the Revised EA. In March 2004, FHWA contacted 15 federally recognized tribes with an established interest in Arapahoe, Douglas and Jefferson Counties, and invited them to participate as consulting parties. These parties are:

- Ute Mountain Ute Tribe (CO),
- Southern Ute Indian Tribe (CO),
- Ute Tribe of the Uintah and Ouray Agency ("Northern" Ute) (UT),
- White Mesa Ute Tribe (UT),
- Cheyenne River Sioux Tribe (SD), Crow Creek Sioux Tribe (SD), Oglala Sioux Tribe (SD),
- Rosebud Sioux Tribe (SD), Standing Rock Sioux Tribe (ND), Cheyenne and Arapaho Tribes of Oklahoma (OK): two tribes administered by a unified tribal government,
- Pawnee Nation of Oklahoma (OK),
- Comanche Nation of Oklahoma (OK),
- Kiowa Tribe of Oklahoma (OK), Northern Arapaho Tribe (WY), and
- Northern Cheyenne Tribe (MT).

Four tribes responded to the invitation in writing (Northern Arapaho, Southern Ute, Pawnee Nation, and Standing Rock Sioux), of which two (Northern Arapaho and Southern Ute) expressed the desire to be consulting parties for the study. Neither of the two consulting tribes raised specific issues of concern regarding the C-470 project.

CDOT contacted the Northern Arapaho and Southern Ute tribes in September 2013 to renew consultation for this Revised EA. An October 2013 response from the Southern Ute Indian Tribe indicated their conclusion that the project would have no effect on resources of cultural or religious significance to that tribe. This correspondence is located in **Appendix A**, **Agency Correspondence**.

Each consulting tribe will continue to receive information about the study as it becomes available, to facilitate their involvement in the planning and environmental process. In so doing, the FHWA and CDOT will have fulfilled their legal obligations for tribal consultation under federal law.

4.3.10 Paleontological Resources

Paleontological resource compliance is mandated by the Colorado Historical, Prehistorical, and Archaeological Resources Act of 1973. In September 2004, the CDOT paleontologist completed archival research for the project area. A literature survey was conducted to evaluate the potential for scientifically substantial paleontological resources within the geologic units of the project area.

Because of heavy residential and commercial development along C-470 in recent years, there are no potentially fossil-bearing bedrock exposures within the project area that merit on-site reconnaissance for paleontological resources. Thus, no additional field survey was necessary for this Revised EA.

No-Action Alternative Impacts to Paleontological Resources: The No-Action Alternative would have no effect on paleontological resources.

Proposed Action Impacts to Paleontological Resources: Construction activity at or above the present ground surface will have no effect on scientifically important paleontological resources. However, potentially fossil-bearing units found in pre-Holocene and Pleistocene, Late Cretaceous and Paleocene formations mapped within the C-470 project area have produced scientifically important fossils within a few miles of the highway. These units are not, for the most part, well-exposed naturally, but could be encountered during excavation associated with roadway depression or highway widening within the existing ROW.

Subsurface excavation during project construction could affect scientifically important paleontological resources, but it is impossible at this time to determine which potentially fossil-bearing deposits, if any, would be affected. Most of the known fossil localities in the project area were uncovered during earth-moving activities associated with sand and gravel mining, housing and commercial development, and highway and railroad construction.

Mitigation for Proposed Action Impacts to Paleontological Resources: CDOT will ensure that a qualified paleontologist is on site during major construction excavation to monitor for buried paleontological resources where known fossil-bearing deposits are mapped, but not currently exposed at the ground surface. If any potential fossils are unearthed during construction, work will be halted until the paleontologist can assess the significance of the find and make recommendations regarding resource protection.

4.3.11 Geology and Soils

Geologic conditions present within the C-470 project area were identified using information from geologic maps, topographic maps, USGS reports, Colorado Geological Survey publications, United States Department of Agriculture soil survey reports, and geotechnical reports. This information was supplemented with field reconnaissance and communications with local engineering and planning personnel. Evaluation of existing geologic conditions was based on proximity to the corridor, history of occurrence, and effect of occurrence on transportation and mobility. Additional details regarding geotechnical analysis can be found in the *Geology Technical Report* in **Appendix E**.

Existing Conditions: The geologic units along the C-470 Corridor range from recent unconsolidated river deposits to sedimentary bedrock between 55 and 70 million years old and are directly related to the formation of the Rocky Mountains located west of the highway. Much of the mountainous terrain associated with the Rocky Mountains began during a mountain building event known as the Laramide Orogeny, which began near the end of the Cretaceous Period about 72 million years ago.

Bedrock along the C-470 Corridor typically consists of hard sedimentary rock, exposed at or near the surface at the western end of the corridor. These rock formations are the oldest at the western end of the corridor, with the younger formations exposed progressively to the east.

Overlying the bedrock formations are deposits of surficial material. These surficial deposits are the result of geomorphic activity that has shaped the present landforms and vary considerably in depth. This activity is primarily related to processes involving wind and water including former and modern streams and rivers. The surficial deposits are younger than the bedrock and are unconsolidated and loose by comparison.

Artificial fill is also found at various locations along the corridor ranging from zero to 15 feet above ground and is used for highway and other road fills, flood control, canal embankments, trash dumps, and sanitary landfills. This material is composed of various

amounts of clay, silt, sand, gravel, concrete, brick, and trash. For construction purposes, it is assumed that this material is not suitable unless it can be removed and re-compacted to specified CDOT standards.

No-Action Alternative Geologic Impacts: The No-Action Alternative would not disturb existing soils and geological conditions. Therefore, no effects to the existing roadway from geologic and soil conditions are anticipated.

Proposed Action Geologic Impacts: Geologic conditions and soils in the C-470 project area would need to be considered during design and construction. However, none of these geologic conditions would be sufficient to alter the location of the Proposed Action. These conditions include:

- expansive soils and bedrock
- corrosive soils
- steeply dipping bedrock
- collapsible soils
- unstable slopes

The Proposed Action would result in excavation, soil disturbance, and exposure of previously buried and stable geological and soil units to precipitation, air, and weathering. Expansive soils and bedrock and corrosive soils may cause increasing damage to transportation system components over a period of years. Differential movement in steeply dipping bedrock has damaged local pavement and transportation structures. Collapsible soils could also damage the highway infrastructure by either large settlement areas or differential settlement. Unstable slopes could also cause failure at cut and fill areas.

Mitigation of Proposed Action Geologic Impacts: Mitigation of geological and soil conditions for the Proposed Action is described in terms of engineering design solutions. These engineering details are not of general interest and therefore are not detailed here. However, some of the engineering solutions are of interest due to the additional environmental issues related to them. Pile driving and pier drilling needed in response to expansive or collapsible soils would result in increased construction noise and vibration. Over-excavation, re-compaction and importation of structural fill would result in additional dust emissions, noise, vibration, and construction truck traffic.

4.3.12 Hazardous Materials

Hazardous materials are any product that is flammable, corrosive, or toxic. Hazardous material sites are found in association with a variety of industrial, mining, and municipal land uses. Hazardous material sites located adjacent to the highway ROW could result in project delays and increased cost if contaminated soils or groundwater are exposed during construction activity, particularly if they have not been identified prior to construction. Advance knowledge of contaminated conditions can reduce health hazards for construction workers and the general public.

Some types of contamination commonly found along an urban highway include:

- Soil and groundwater pollution due to fuel leaking from an underground storage tank (e.g., commercial gasoline station)
- Soil and groundwater contamination due to landfills, chemical or material spills, dry cleaners or industrial operations
- Asbestos found in nearby structures that are acquired for highway ROW and in soil where building debris has been buried
- Lead paint found on highway bridge structures or in buildings acquired for ROW.

Additionally, C-470 is a CDOT-designated route for hazardous material transport, not including nuclear materials. However, north-south nuclear material transport is permitted on I-25, at the eastern end of the C-470 project area. Despite extensive safety regulations for hazardous cargos, there is always some potential for hazardous material spillage on these routes, especially in case of a major collision. The database research

described below includes research regarding hazardous spills along highways.

Database Searches: A hazardous material database search was conducted in 2013 for this Revised EA. This search included data available from the EPA, CDPHE, Tri-County Health Department, and the Colorado Department of Labor and Employment Division of Oil and Public Safety. The results are documented in the Phase I Environmental Site Assessment (ESA) provided in **Appendix E**.

A second database search was completed in early 2015 to bring the findings up to date. It found no new hazmat concerns in the project area.

A total of 11 sites were identified as having "recognized environmental conditions". These sites are listed in **Table 4-16** and the locations are shown in **Figure 4-14**.

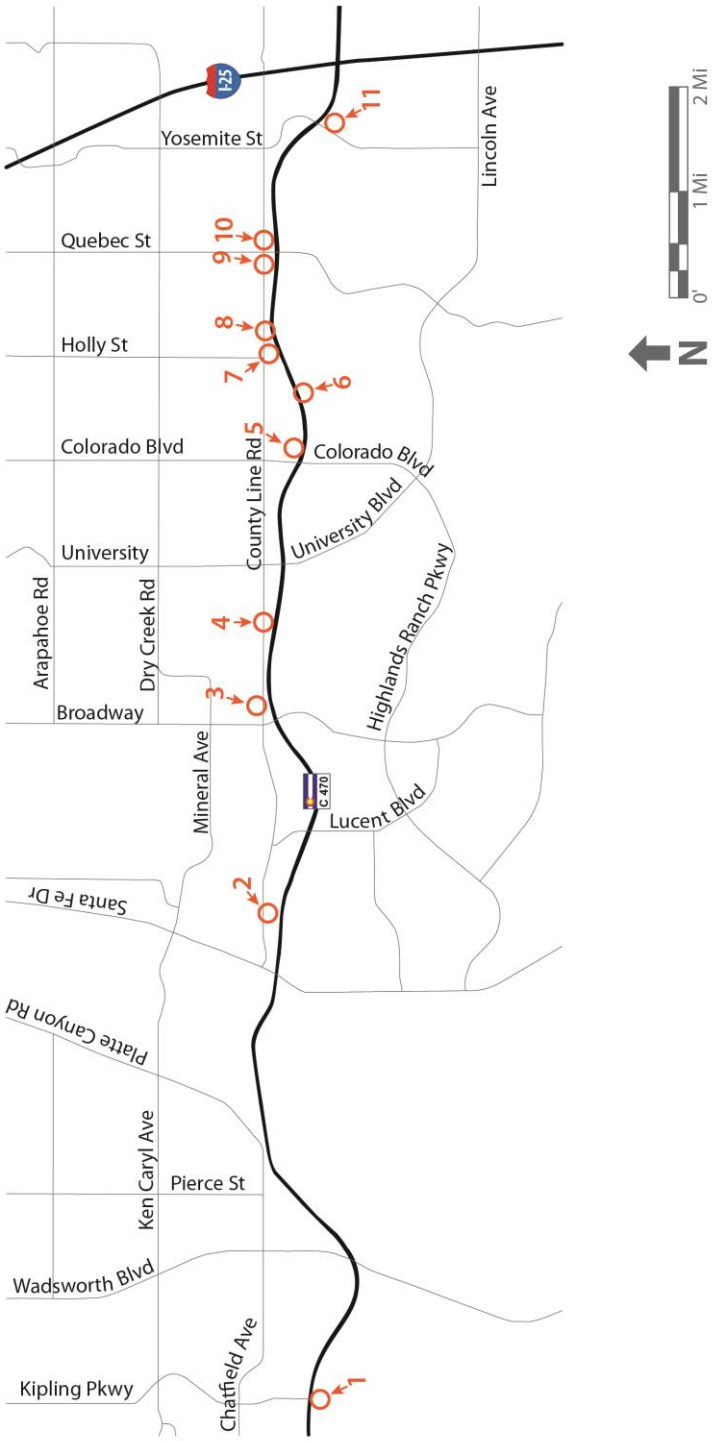
No-Action Alternative Hazardous Material Impacts: The No-Action Alternative would not affect any hazardous material sites identified along C-470.

Proposed Action Hazardous Material Impacts: Four hazardous material sites were ranked with a high potential for concern within the C-470 project area. Potential impacts from these sites resulting from the Proposed Action are detailed in **Table 4-16.**

Table 4-16
Hazardous Material Recognized Environmental Conditions

Map ID	Location	Entity	Finding
1	9509 W. Ute Ave. Littleton	Jeffco Road and Bridge	Improper oil disposal in 1996.
2	3220 W. County Line Rd. Littleton	Bowen Farms	Site of gasoline leak from underground storage tank in 2006.
3	201 E. County Line Rd. Littleton	Chevron (now Waffle House)	Gasoline leak from underground storage tank in 1990.
4	1650 E. County Line Rd. Highlands Ranch	Jiffy Lube	Oil and other contaminants possibly drained to storm sewer
5	8422 S. Colorado Blvd. Littleton	County Line Disposal	Landfill closed in 1987 has methane and contaminated groundwater. Now covered by David A. Lorenz Regional Park.
6	8606 Canongate Ln. Littleton	Centennial Water and Sanitation	Lift station is site of reported waste-water spills in 2003 and 2005.
7	6086 E. County Line Rd. Littleton	Dry Cleaning Station	Tetrachloroethylene solvent is used on site. No known spills.
8	6028 E. County Line Rd. Littleton	AAMCO	Leak from underground storage tank reported in 2001.
9	7132 E. County Line Rd. Littleton	Heritage Cleaners	Tetrachloroethylene solvent is used on site. No known spills.
10	7130 E. County Line Rd. Littleton	K & G Stores	Confirmed gasoline leak from an underground storage tank in 2002.
11	8750 S Yosemite St. Lone Tree	7-Eleven	Leaking underground (gasoline) storage tanks were closed in 2003 and 2010.

Figure 4-14
Hazardous Material Sites



Mitigation of Proposed Action Hazardous Material Impacts: Because contaminated soil and groundwater may be encountered along C-470, mitigation measures would include development of a site-specific Materials Handling Plan, in accordance with CDOT's *Standard Specifications for Road and Bridge Construction*.

During final design, soil and groundwater testing would be conducted, if necessary, for hazardous material sites that would be directly impacted by construction. In cases where total avoidance of contaminated materials is not possible, measures would be developed to protect workers during construction, in compliance with environmental regulations.

Prior to alteration or demolition of bridges (e.g., over South Platte River), guardrails or sign structures, an asbestos hazardous materials survey and a lead paint survey would be conducted per CDOT's *Standard Specifications for Road and Bridge Construction* and other relevant Occupational Safety and Health Administration, state, and federal regulatory requirements.

4.3.13 Visual and Aesthetic Character

C-470 was constructed as the Centennial Parkway and is generally a visually appealing corridor with abundant open space and parks nearby. Adjacent land uses include commercial development at the eastern and of the project area, residential areas in the central portion and western end. There is minimal adjacent development with unattractive industrial uses.

A viewshed analysis conducted for the 2006 EA identified five viewsheds visible from the highway. Three of these are views towards mountains or bodies of water, and two are views towards distant concentrations of buildings (Denver Tech Center and downtown Denver Skyline). For more information about viewshed analysis, please see the *Visual Character and Aesthetics Technical Report*, found in **Appendix E**.

Generally the eastern portion of the project area near I-25 and the Park Meadows regional mall has a busier, more urban feel than the rest of the corridor. At the project's eastern terminus, the C-470/I-25 freeway-to freeway interchange is a busy network of on-ramps, off-ramps and directional signage.

Corridor landscaping along C-470 consists of native grasses, not irrigated plantings. Nearly two dozen prairie dog colonies are located within CDOT ROW, with their mounds distinctively interrupting the grasses.

Planted trees are very common in nearby developments including neighborhoods and commercial areas. Within highway ROW (typically a total of 300 feet), trees may pose a safety hazard if they are too close to the highway. Due to available water, trees occur along the drainages that cross the highway, including the South Platte River. Generally, no rock outcroppings are visible within CDOT ROW. The concrete C-470 Trail is often visible the highway.

The existing grassy median helps to instill a rural or suburban character to the roadway, although the median is not necessarily picturesque. Due to the severity of past head-on crashes, the median includes a cable barrier for safety. Signs in the median are fairly rare, and roadway lighting is found primarily at interchanges, not along the mainline in-between them.

Figure 4-15 shows the existing typical four-lane highway with a grassy median and the C-470 Trail at right. Visual clutter at this location includes the cable barrier, guardrail protecting a lighted median sign, a radio antenna pole, and a massive cell phone tower in the distance (at Colorado Boulevard. Snow-capped mountains are visible on the (western) horizon, behind the radio antenna.

C-470 crosses over a number or arterial cross-streets, but passes under bridges structures at Quebec Street, Colorado Boulevard and Santa Fe Drive (and railroad bridges also at Santa Fe Drive).

Figure 4-15
Representative View along the C-470 Corridor

Figure 4-16 shows the southbound to eastbound flyover ramp at the Santa Fe interchange, which is the most notable roadway feature along the corridor. The flyover ramp was originally included as part of the Preferred Alternative in the 2006 C-470 EA, but was funded and built separately as a safety improvement project, so it is not part of the 2015 Proposed Action.

C-470 was constructed years prior to the development of CDOT's current design standards, as described in CDOT's *Urban Design for Region 6* (note: now reorganized into CDOT Region 1). For this reason, there are many highway design inconsistencies along the corridor.

Several jurisdictions have expressed interest in incorporating interchanges within the project area into gateways to their respective communities. As such, they have requested some flexibility in the design treatments for

Figure 4-16
Santa Fe Flyover Ramps and Freight Railroad Bridges over C-470

these interchanges to achieve their community goals. Both Lone Tree and Highlands Ranch (Douglas County) use the Quebec Street interchange as gateways to their communities.

Looking at the roadway from nearby areas such as the Wolhurst Community or Chatfield State Park, the existing view includes a four lane highway, with a large grassy median, as seen in the typical section presented earlier in **Figure 2-3**.

Near C-470 interchanges, a moderate amount of signage is present, mostly directional overhead signs.

No-Action Alternative Visual Effects: The No-Action Alternative would result in no visual effects along C-470. This alternative would retain current aesthetic design inconsistencies.

Proposed Action Visual Effects: Adding two express lanes in each direction on most of the corridor and auxiliary lanes in many locations would change the visual character of C-470 from rural to more urban. Other major changes would be the elimination of the grassy median between I-25 and Broadway, and the addition of overhead toll collection gantries plus a large number of new roadway signs instructing motorists as to where they can enter or exit the express lanes and how much it would cost to use them. Because the toll collection gantries and added signage would require vertical structures, they would be visible from some nearby parks, trails and neighborhoods.

The Proposed Action would alter the character of the C-470 Corridor with regard to the following elements:

- Grassy median elimination
- Larger highway and interchange footprints
- Longer ramps
- Larger abutments
- More lighting
- More noise barriers
- More retaining walls
- More water detention ponds
- Tolling surveillance equipment
- Express lane signage
- C-470/I-25 direct-connect ramps
- New bridges over South Platte River

Clearly, the result of all of these changes would be a corridor than is more urban in character than the existing highway. C-470 would still traverse a suburban landscape with plentiful open space and parks, but the roadway itself would be more visually imposing. This will affect views of and to the roadway, but will only minimally affect motorists' views from the roadway.

The discussion of historic resources in this Revised EA separately notes the ways in which nearby historic resources are or are not affected by visual impacts under the Proposed Action. The C-470 project's visual impacts would not adversely affect the qualities that make those resources eligible for their historic status.

Mitigation of Proposed Action Impacts on Visual Resources: CDOT has developed a set of corridor-wide standard architectural treatments that would be used to create a more consistent appearance of the corridor, both when looking out from the roadway, and when looking in towards the roadway from nearby. After discussions with adjacent jurisdictions along C-470, design standards were created using existing features and unifying elements. This work was documented in the 2006 C-470 EA technical report on Visual and Aesthetic Character. That 241-page report is incorporated by reference. Common themes would order to provide a uniform suburban corridor look. Color would be added where practical, and subtle changes would be made to existing features to avoid reconstruction of the many architectural treatments on the existing highway.

New structures would incorporate existing colors on C-470 for bridges, lights, sign structures, sound barriers, retaining walls, and concrete railings. To add more interest, an accent pin stripe would be added to the

exterior sides of the new bridge rails and the tops of sound barriers and retaining walls.

Generally, retaining walls necessary for this project would be constructed with forms and textures consistent with CDOT design standards and existing features along the C-470 Corridor. Retaining walls constructed near Chatfield State Park would be textured and colored to match the existing native grasses in the area to create a more natural appearance for trail users and park users looking towards the highway. The largest retaining wall near the Chatfield dam would be tiered to provide a visual break in the height of the wall. CDOT will continue to work with Chatfield State Park during final design to develop the exact details for retaining walls in this area.

For the Proposed Action, overhead toll collection devices and signing would follow a region-wide standard for consistent viewing and driver expectancy/recognition, to be set by the High-Performance Toll Enterprise (HPTE) at a later date. These standards would remain flexible to comply with statewide unifying elements for other HPTE toll facilities, as they are developed.

If an adjacent jurisdiction such as Douglas County, Lone Tree, Highlands Ranch, and Littleton wishes to upgrade a particular interchange or other architectural feature beyond the established corridor standards at their expense, CDOT will coordinate with them to ensure that such upgrades would be compatible. To maintain a consistent appearance, an aesthetic treatment plan or menu of design features has been set by CDOT from which upgrades could be selected. As examples, upgrades could include textured sound walls, landscaping, and bridge identification markings.

4.3.14 Utilities

The location of utility lines is an important factor to consider during roadway construction. Minor utility lines are simple to relocate, but major utility lines are more problematic, potentially affecting project design. Major utilities in the project area include water mains 60 inches or greater in diameter; electrical transmission lines; fiber optic lines, including backbone, trunk lines, and fiber considered critical to national security; and large sanitary sewer lines 60 inches or greater in diameter. All major utilities in the project area were inventoried and included in the utility impact analysis.

The results of this effort are presented in the *Utilities Technical Report* in **Appendix E**. **Table 4-17** indicates that CDOT and three private owners account for more than half of the utility lines in the project area.

Table 4-17
Potential Utility Conflicts along C-470

Resource Type and Operator	Number of Resources		
	Total	%	Major
Electric: Xcel Energy	28	15%	3
Fiber Optic: CDOT ITS	25	14%	4
Water: Denver Water	21	11%	5
Natural gas: Xcel Energy	15	8%	7
Fiber Optic: Comcast	12	7%	9
All others, including two railroads	83	45%	17
TOTALS	**184**	**100%**	**45**

Most utility infrastructure is privately owned by corporations providing telephone, communication, electrical, and gas service to communities in the C-470 project area. Local government typically provides public water and sanitary service to its respective jurisdictions. Above ground and overhead infrastructure is present throughout the project area, located within and outside the existing ROW.

No-Action Alternative Utility Impacts: No effects to utilities would occur under the No-Action Alternative. Therefore, no mitigation would be needed.

Proposed Action Utility Impacts: The Proposed Action would require a number of utility relocations. Exact details would be determined during final design. In some locations, the existence of major utility lines

parallel to C-470 creates potential design conflicts that would preclude various other project mitigation features, such as creation of a water detention pond or a noise berm. These issues have been considered in the conceptual design of the Proposed Action to identify solutions that best balance any conflicting needs.

Mitigation for Proposed Action Utility Impacts: Where ROW acquisition is required, or when a publicly held utility must be relocated to accommodate a highway project, it is generally the project's responsibility to fund the related construction for relocation. Utility relocation requirements would be defined during final design.

4.4 BIOLOGICAL ENVIRONMENT

The biological environment for the project area consists of the natural resources within one mile of C-470. The following resources are assessed in this section:

4.4.1 Common Wildlife
4.4.2 Threatened and Endangered Species
4.4.3 Wetlands and Waters of the United States
4.4.4 Prime and Unique Farmlands
4.4.5 Vegetation, including Noxious Weeds

4.4.1 Common Wildlife

Although much of the project area is highly developed, a large number of wildlife species make use of riparian habitat and undeveloped or protected areas. Most species in the project area are well adapted to human disturbance. Common mammals in the area include:

- mule deer
- elk
- coyote
- red fox
- raccoon
- cottontail rabbit
- striped skunk
- deer mouse

A *Biological Resources Technical Report* prepared for this Revised EA is provided in **Appendix E**. Key findings from that report are presented in this section. In addition to consumption or disturbance of wildlife habitat, a key issue for a highway project is the subject of wildlife movement across or under the roadway.

Figure 4-17 indicates the location of known wildlife habitat along the project area. Most of the stream crossings along C-470 serve as wildlife corridors under the highway. The most significant wildlife corridors are along the South Platte River and Big Dry Creek, where highway bridges allow for wildlife passage.

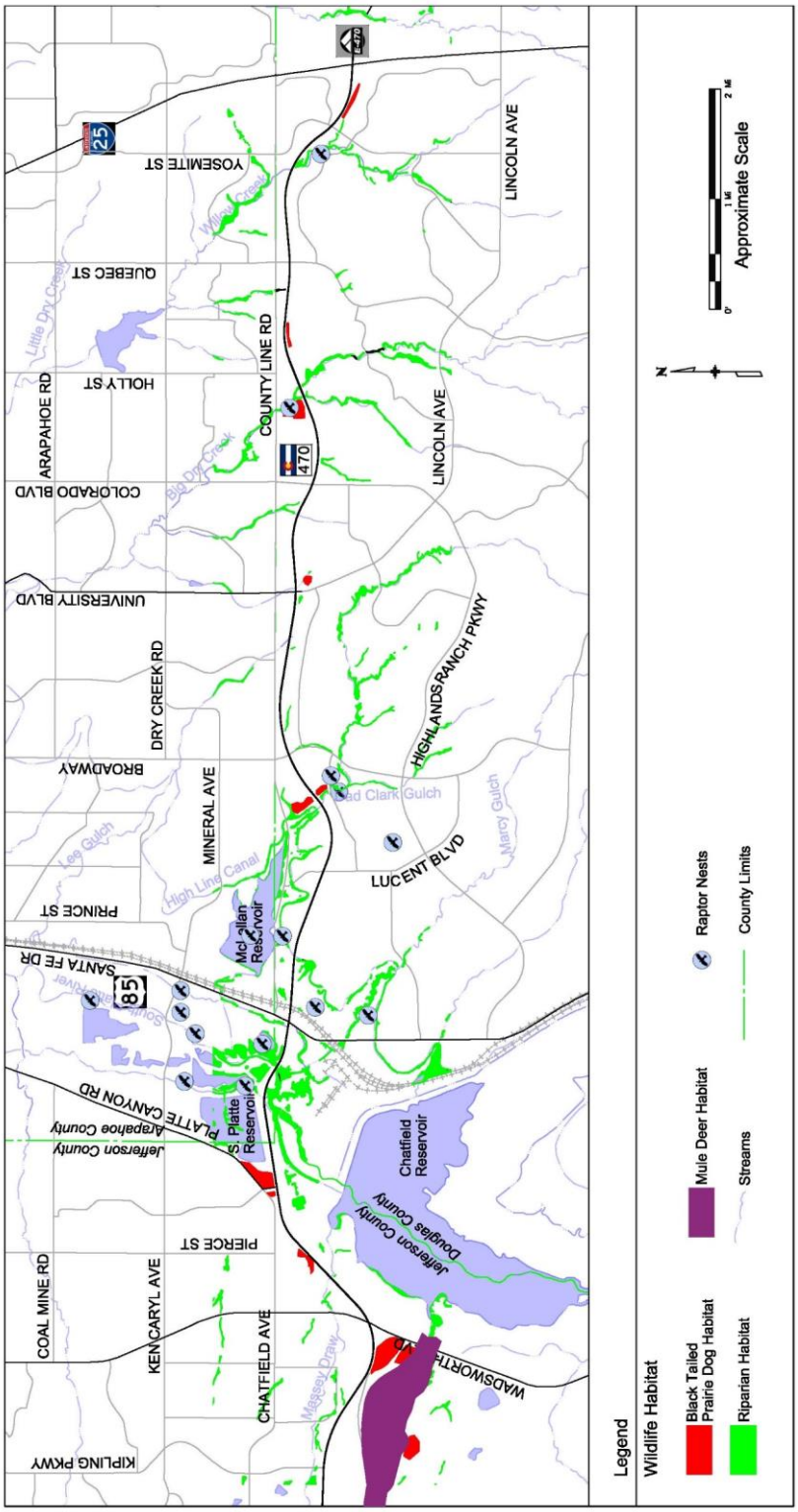
Other wildlife crossings include Willow Creek, Dad Clark Gulch, and the High Line Canal, where box culverts allow for some wildlife movement. Fifteen culverts have been inventoried along C-470 between Kipling Parkway and Broadway, with an additional eight culverts east of Broadway. The smallest of these is 36 inches in diameter. These culverts often serve as small mammal crossings.

C-470 poses a substantial barrier to movement for these large animals. Mule deer are likely to use the South Platte River and Big Dry Creek bridges as movement corridors. Although the South Platte River is a major movement corridor, the existing C-470 bridges provide little room for wildlife movement along the river banks due to the existing trail and riprap. An existing chain link fence extending east and west from the South Platte River currently serves as deer fence.

An average of about six vehicle-wildlife collisions per year have been reported on C-470 in the project area. Most of these crashes involved deer and occurred at night. The highest localized concentration of vehicle-wildlife collisions along C-470 in the project area was in the vicinity of the South Platte River (eight crashes over five years).

No-Action Alternative Wildlife Impacts: The No-Action Alternative would have no direct effect on wildlife resources in the project area. Indirect effects could result as traffic volumes increase, making movement across the highway even more difficult. Any adverse effects on aquatic resources from

Figure 4-17
Wildlife Habitat



stormwater runoff would continue at historical levels.

Proposed Action Wildlife Impacts: Impacts to various types of wildlife are summarized in **Table 4-18**. The table specifically addresses impacts to mule deer and elk, birds, and aquatic species. The black-tailed prairie dog, a well-known inhabitant of the C-470 Corridor, is discussed in the following section, regarding threatened and endangered species. It is neither threatened or endangered, but is considered a Colorado Species of Special Concern.

In general, adding travel lanes in the Proposed Action would increase the difficulty of wildlife movement across the highway, but would not appreciably change wildlife movement. While the Proposed Action would result in lengthening existing culverts and bridges, it would not eliminate any existing wildlife crossings. The reconstruction of the existing bridges over the South Platte River would benefit a variety of wildlife species, as noted below. During construction, birds and other wildlife may be disturbed by intrusion of human activity, noise and lights.

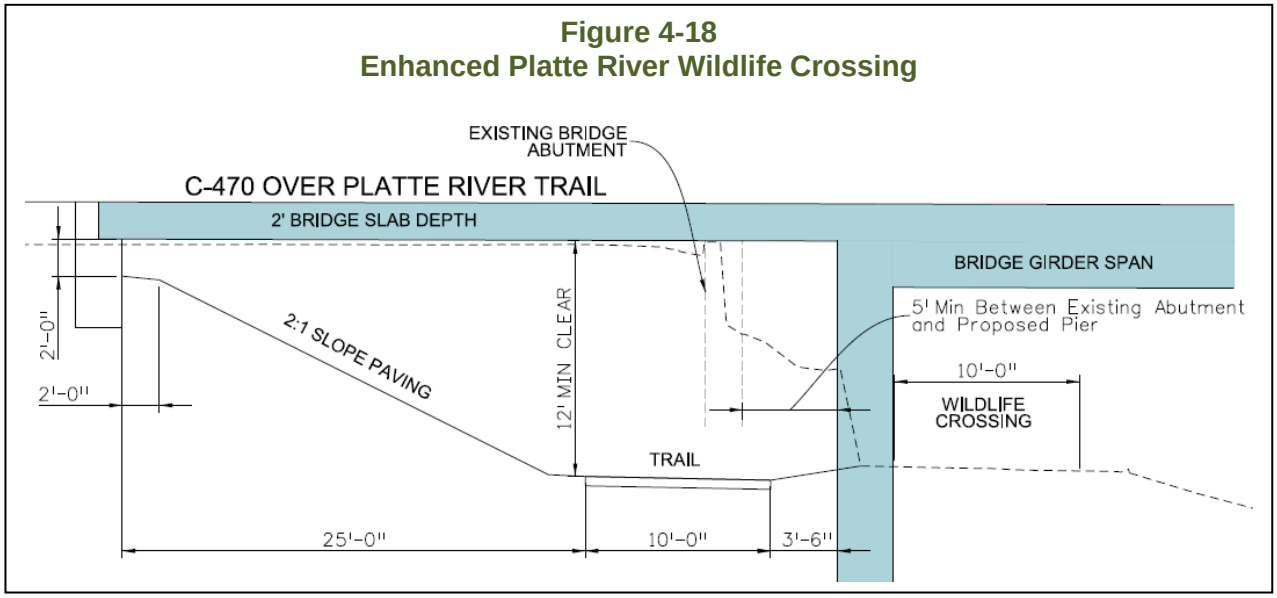
Mitigation of Proposed Action Impacts to Common Wildlife: The Proposed Action would remove and replace the parallel C-470 bridges over the South Platte River. The new bridges would be wider and taller than the existing bridge and would better accommodate wildlife movement between Chatfield State Park and South Platte Park. It would also provide more distance between the trail and the wildlife movement space. This design is shown in **Figure 4-18**.

After construction, re-vegetation near the bridge would include native riparian shrubs such as skunk brush and willow in attempt to attract deer to cross under C-470. The existing chain link fence that extends from the South Platte River along the north and south side of C-470 would also be replaced to serve as deer fence, directing large mammals to safely cross under C-470 at the South Platte River.

Table 4-18
Potential Project Impacts to Wildlife

Wildlife Type	Existing Conditions	Potential Project Impacts
Mule deer and elk	These mammals are common in the vicinity of the South Platte River and to the west. Most reported vehicle-wildlife crashes involve deer and occur at night.	Minor loss of roadside habitat. Adding more lanes would make C-470 more difficult to cross.
Birds	• A large variety of birds visit Chatfield Reservoir and South Platte Park, on either side of C-470 along the South Platte River. • Swallow nests exist on the C-470 bridges over the South Platte, Willow Creek and Erickson Boulevard. • Active Red-Tailed Hawk nests are found within 1/3 mile of C-470. Other raptors, including Bald Eagles, may be found along the South Platte River.	Land-clearing and bridge construction activities have potential to disturb the nests of birds protected under the Migratory Bird Treaty Act. Construction noise and activity during nesting season could disturb raptor breeding and foraging. Loss of prairie dog colonies would slightly reduce available raptor prey.
Aquatic species	Water flow in the South Platte River depends on release from the Chatfield Dam. The river has a major drop structure immediately north (downstream) of the C-470 bridges.	Downstream turbidity (suspended sediment) would be increased during construction involving bridges or culverts. This could affect downstream fish and invertebrates.

Figure 4-18
Enhanced Platte River Wildlife Crossing



In response to SSPRD input requesting an improved wildlife crossing, CDOT developed a bridge design that moves the western bridge abutments farther to the west. The new design reduces the curvature of the trail under the bridge, increases the vertical clearance for bicyclists and pedestrians, and provides a wider buffer space between the trail and the river for use by wildlife. This wildlife use area will have a natural substrate and is expected to offer approximately eight feet of vertical clearance.

Any culverts replaced as part of this project would be maintained at current size or upgraded, subject to drainage restrictions, to maintain connectivity across C-470 for small and medium sized mammals.

Implementing water quality BMPs along the C-470 Corridor would improve wildlife habitat in riparian and aquatic areas by discharging cleaner stormwater runoff to receiving waters.

Although this wildlife corridor would be disrupted during construction, the post-construction condition would be an improved crossing that would improve wildlife movement through this area.

Regarding **raptors**, a survey for nesting raptors within one-third mile of C-470 would be performed to ensure that nesting raptors would not be disturbed by construction.

For the Red-Tailed Hawk, Colorado Parks and Wildlife (CPW) recommends no surface occupancy from February 15 to July 15 within a one-third mile radius of nest sites and associated alternate nests. The CDOW has developed recommended buffer zones and seasonal restrictions for new surface occupancy within certain distances of nest sites of several raptor species, including the Red-Tailed Hawk. Surface occupancy is defined as human-occupied buildings and other structures such as oil and gas wells, roads, railroad tracks, and trails.

If restricting construction within nest buffers during the breeding season is not practicable, prior to construction CDOT would coordinate with USFWS and CPW to develop a mitigation strategy to offset potential lost productivity.

Regarding **other bird nests,** prior to construction, CDOT would survey areas out to 50 feet beyond limits proposed for disturbance for the presence of migratory bird nests. If nests are present, CDOT would avoid

disturbing active nests by removing trees and shrubs during the non-nesting season and timing construction activity to avoid active nests during the nesting season. Bird nests found under existing bridge structures would be removed after August 31, but prior to April 1 in compliance with the Migratory Bird Treaty Act (MBTA) of 1918. Work outside the buffer area would be conducted in compliance with CDOT Standard Specification 240.

To prevent new nests from being constructed, netting would be installed under bridges and culverts during the non-breeding season or new nests under construction would be visited every three to four days to prevent new nests from being completed, unless project construction activity is continuous on a daily basis during active nesting season.

4.4.2 Threatened and Endangered Species

Federally threatened and endangered species are protected under the Endangered Species Act (ESA) of 1973 as amended. **Table 4-19** lists federal threatened and endangered species that could occur in the C-470 project area, as provided by USFWS. As part of this Revised EA, study biologists assessed the project area for the presence of habitat for listed species. The *Biological Resources Technical Report* in **Appendix E** documents these study efforts and findings.

The list begins with a group of five species that are included in the South Platte River Water Related Activities Program (SPWRAP). Actions undertaken in Colorado have the potential to affect these species many miles downstream, in Nebraska and other states. In consultation for the 2006 EA, USFWS concurred that the Preferred Alternative would not affect these species. The Proposed Action in this Revised EA is also additional of express lanes and would not affect these species.

Based on species-specific habitat requirements and the known conditions in the C-470 project area, ESA Section 7 consultation was conducted with regard to three Federally-listed threatened or endangered species listed in **Table 4-19**:

- Preble's meadow jumping mouse
- Ute ladies'-tresses orchid
- Colorado butterfly plant

Based on documentation submitted to USFWS for this Revised EA, the USFWS provided a letter of concurrence dated June 15, 2015 indicating that results from the Proposed Action are not likely to adversely affect these species. This letter is included with the *Biological Resources Technical Report* in **Appendix E**.

State Listed Threatened and Endangered Species: The State of Colorado has developed a list of wildlife species that it considers to be threatened or endangered within Colorado. Some Federally listed species occur in Colorado and are on the state's list. Due to this overlap, **Table 4-19** includes all species on either list.

Of the state-listed terrestrial species shown in the table**,** based on habitat requirements and current distribution, the Burrowing Owl is the only terrestrial species likely to occur in the area. A state Threatened species, this small migratory owl occupies sparsely vegetated areas on the plains (typically prairie dog towns in eastern Colorado) during the summer breeding season. Twenty black-tailed prairie dog colonies covering a total of about 90 acres were observed within the project area. These colonies provide potential habitat for the Burrowing Owl and may support active nests during the breeding season. However, no Burrowing Owls were observed in the project area during site visits undertaken for the 2006 EA or this Revised EA.

Two State-listed fish species, the northern redbelly dace and the common shiner, could potentially occur in the South Platte River, Big Dry Creek and Willow Creek. However, based on available information, it is unlikely that these species are present in the C-470 project area. Therefore, the Proposed Action is unlikely to affect them.

Table 4-19
Potential of Threatened and Endangered Species to Occur in the C-470 Project Area

Species	Status Federal/State	Habitat Considerations	C-470 Project Area Potential
South Platte River SPWRAP Federally-listed Species			
Interior Least Tern *Sternula antillarum*	Endangered/ Not State listed	Inhabits reservoirs, lakes, and rivers with sandy shorelines or islands.	No suitable habitat
Pallid Sturgeon *Scaphirhynchus albus*	Endangered/ Not State listed	The closest documented occurrence of this species is in Nebraska.	Not known to occur in Colorado
Piping Plover *Charadrius melodus*	Endangered/ Not State listed	Inhabits reservoirs, lakes, and river habitat with bare, non-vegetated shorelines.	No suitable habitat
Whooping Crane *Grus Americana*	Endangered/ Not State listed	Uses wetlands, meadows, reservoirs, and river sandbars during migration.	No suitable habitat
Western prairie fringed orchid *Platanthera praeclara*	Threatened/ Not State listed	Occurs in Nebraska and several other states.	Not known to occur in Colorado
Federally Listed Non-SPWRAP Species (some are also State-Listed)			
Canada lynx *Lynx Canadensis*	Threatened/ Endangered	Could occur in Jefferson County high-elevation conifer forests.	No suitable habitat
Preble's meadow jumping mouse *Zapus hudsonius preblei*	Threatened/ Threatened	Occurs upstream of Chatfield Dam. C-470 is southern boundary of block clearance zone.	Potential habitat between C-470 and Chatfield Dam, but this area is isolated from known populations
Mexican Spotted Owl *Strix occidentalis lucida*	Threatened/ Threatened	Prefers mature conifer forests in the montane vegetation community.	No suitable habitat
Greenback Cutthroat trout *Oncorhynchus clarki ssp. stomias*	Threatened/ Not State listed	Could occur in Jefferson County cold water streams	No suitable habitat
Pawnee montane skipper *Hesperia leonardus montana*	Threatened/ Not State listed	The species prefers dry, open, ponderosa pine woodlands.	No suitable habitat
Ute ladies'-tresses orchid *Spiranthes diluvialis*	Threatened/ Not State listed	C-470 is the southern boundary of a USFWS-approved block clearance zone.	Unlikely to occur along project area streams due to dense vegetation present in riparian zones
Colorado butterfly plant *Gaura neomexicana var. coloradensis*	Threatened/ Not State listed	C-470 is the southern boundary of a USFWS approved block clearance zone.	Unlikely to occur along project area streams due to dense vegetation present in riparian zones
Colorado-Listed Species that are not Federally Listed			
Common shiner *Luxilus cornutus*	NA/ Endangered	Found in South Platte River and tributaries, including West Plum Creek.	Has potential to occur in the project area
Northern redbelly dace *Phoxinus eos*	NA/ Threatened	The fish requires slow moving streams and cold water temperatures.	Has potential to occur in the project area
Burrowing Owl *Athene cunicularia*	NA/ Threatened	Uses prairie dog towns for nesting and hunting.	Has potential to occur in C-470 prairie dog towns
Plains Sharp-tailed Grouse *Tympanuchus phasianellus jamesii*	NA/ Threatened	Could occur in Douglas County shrublands	No suitable habitat

Colorado Species of Special Concern: Colorado also lists Species of Special Concern, shown in **Table 4-20**. These species do not have statutory protection but are considered important to ecosystem health.

Four species of special concern are potentially present in Arapahoe, Douglas or Jefferson County. Two of these are birds for which there is no suitable nesting habitat in the C-470 project area. The other two species are small mammals. The black-tailed prairie dog is known to occur in the project area, with 20 active colonies using about 90 acres of land within CDOT ROW. The Northern pocket gopher could inhabit some of the open grasslands in the project area.

No-Action Alternative Impacts on Threatened and Endangered Species: The No-Action Alternative would not involve activity that would have a direct or indirect effect on any federally listed threatened, endangered, or candidate species.

Proposed Action Impacts on Threatened and Endangered Species: No adverse effects to Federally-listed threatened or endangered species are anticipated. Habitat for the State Threatened Burrowing Owl would be reduced with the loss of about 14 acres of black-tailed prairie dog colonies. Due to the abundance of habitat available along the Colorado Front Range, this loss of habitat would have only a minor effect on the Burrowing Owl and the black-tailed prairie dog. Any impact to the northern pocket gopher would be minimal, as roadside land to be converted to highway use is already highly disturbed and therefore not good quality habitat. Their habitat consists usually of good soil in meadows or along streams.

Mitigation of Proposed Action Impacts on Threatened and Endangered Species: Black-tailed prairie dogs are the only sensitive species for which specific mitigation would be provided. Prior to construction, colonies in the areas that would be impacted by the Proposed Action would be re-surveyed for any changes in activity. Construction would be phased to avoid and minimize direct effects to occupied prairie dog colonies. In areas where avoidance is not possible, CDOT would follow the 2009 *CDOT Impacted Black-tailed Prairie Dog Policy*. This policy consists of a series of steps which include avoiding and minimizing effects, relocating affected individuals if possible, and coordinating with CPW on approved removal methods if relocation is not feasible.

For colonies that would be only partially affected, prior to construction a visual barrier would be installed between the burrows that would be impacted and undisturbed portions of the colony. Following barrier installation, burrow openings in the construction area would be collapsed. The visual barrier and collapsed burrows encourage abandonment of burrows that would be affected, which

Table 4-20
Colorado Species of Special Concern Potentially Present in Arapahoe, Douglas or Jefferson County

Species	Habitat Considerations	C-470 Project Area Potential
Black-tailed prairie dog *Cynomys leucurus*	Uses grassland habitat.	Known to occur within C-470 ROW: 20 active colonies on 90 acres
American Peregrine Falcon *Falco peregrinus anatum*	Requires rocky outcrops for nesting.	No suitable nesting habitat; may use project area during migration
Mountain Plover *Charadrius montanus*	Requires open grassland for nesting.	No suitable nesting habitat; may use project area during migration
Northern pocket gopher *Thomomys talpoides macrotis*	Occupies a wide variety of habitats.	Has potential to occur in the project area

would reduce the likelihood of direct effects to individual prairie dogs.

4.4.3 Wetlands and Waters of the U.S.

In recognition of the ecological value of wetlands and open water, two major Federal mandates protect these resources. These are the Clean Water Act passed by Congress in 1972 and an Executive Order issued in 1977.

The Clean Water Act gives the USACE regulatory authority over the discharge of dredged or fill material into regulated surface water and any associated wetlands. The USACE's jurisdiction applies only to wetlands that have a surface connection to regulated surface water. Effects to all wetlands and waters of the U.S. must be avoided or minimized to the best extent possible, and unavoidable effects must be mitigated.

Executive Order 11990, Protection of Wetlands, protects isolated wetlands (those not connected to a regulated water of the U.S.) by directing the lead agency (in this case the FHWA) to avoid direct or indirect effects to wetlands wherever there is a practicable alternative for projects with federal funding or oversight. Executive Order 11990 and Department of Transportation Order 5660.1A, Preservation of the Nation's Wetlands (1978), require FHWA to mitigate for impacts to non-jurisdictional wetlands. For additional information on wetland delineation, see the *Wetland Delineation Report* (April 2013).

In accordance with the USACE delineation manual, *U.S. Army Corps of Engineers Wetlands Delineation Manual* (1987), wetlands were identified and mapped on the basis of three environmental characteristics including the prevalence of wetland vegetation, wetland hydrology, and hydric soils.

Using National Wetland Inventory maps and Natural Resource Conservation Service soil maps, the biologists initially identified locations where wetlands were likely to occur within the project area. These areas were then field verified based on the presence of vegetation, hydrology, and soils as outlined in the USACE delineation manual.

Existing Conditions: During the summer of 2013, the project biologist surveyed wetlands within the project area in accordance with current CDOT and USACE wetland delineation requirements. This effort focused on just the wetlands that would be affected by the Proposed Action. Follow-up field work was performed in 2015.

The majority of the wetlands in the project area are adjacent to perennial streams that are tributary to the South Platte River. The principal streams and rivers within the C-470 project area include Massey Draw, the South Platte River, Dad Clark Gulch, Lee Gulch, Big Dry Creek, and Willow Creek.

Other wetlands are associated with hillside seeps or with drainage ditches along roads and do not have a surface connection to a regulated water of the United States. These are considered to be non-jurisdictional, meaning not within USACE regulatory jurisdiction.

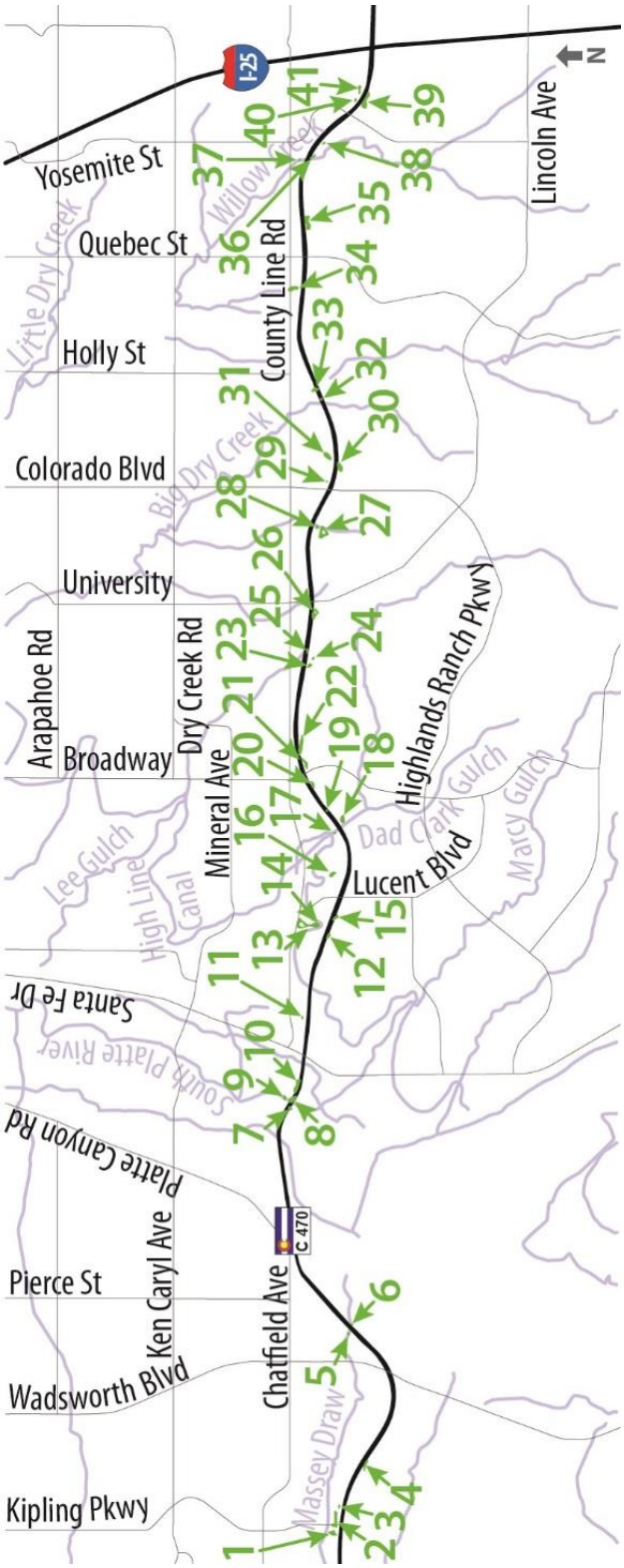
The wetlands identified in the study are shown in **Figure 4-19**. Wetland numbers are identified in Table 1 of the Wetland Finding located in **Appendix C**.

Wetlands with no surface connection to a stream or open water are typically located in roadside drainage swales along C-470 or in small depressions in the highway ROW.

In addition to natural streams, portions of two irrigation waterways, the High Line Canal and City Ditch, pass through the project area. The High Line Canal passes through the project area approximately one mile east of the South Platte River, and again as it crosses Dad Clark Gulch.

All wetlands do not perform all of their potential functions equally. CDOT uses a system called Functional Assessment of Wetlands (FACWet) to assess wetland

Figure 4-19
Location of Anticipated Wetland Impacts



functions and values. FACWet analysis was performed for four groups of wetlands along the C-470 Corridor, with the following results:

- South Platte River wetlands scored 0.78 (high end of functioning)
- Big Dry Creek wetlands scored 0.75 (high end of functioning)
- Willow Creek wetlands scored 0.71 (low end of functioning)
- Non-jurisdictional wetlands scored 0.60 (low end/impaired)

Every potentially affected wetland within the C-470 project corridor is represented by the groupings listed above.

Avoidance and Minimization of Wetland Impacts: During the development and design of proposed alternatives, effects to wetlands and waters of the U.S. were avoided and minimized to the extent practicable. Because wetland locations within the project area were identified early in the study process, and delineated prior to the completion of quantitative screening, measures were taken to avoid wetland effects by varying widths in sensitive areas and using retaining walls to limit encroachment into wetlands where total avoidance was not possible.

No-Action Alternative Wetland Impacts: The No-Action Alternative would not result in any direct effects to wetlands or waters of the U.S., although indirect effects such as water quality degradation due to untreated stormwater runoff would continue at historical levels.

Proposed Action Wetland Impacts: The Proposed Action would result in about 0.7 acre of permanent impacts and 1.3 acres of and temporary wetland effects, as indicated in **Table 4-21**.

A formal USACE determination of jurisdiction has not been requested by CDOT for the various wetlands that would be affected, but wetlands along streams are likely jurisdictional and isolated roadside ditches likely are not. New national policy on determining jurisdiction was promulgated jointly by USACE and EPA in June 2015, effective August 28, 2015 (EPA).

Indirect effects to wetlands, such as changing drainage patterns, increasing runoff volumes, changing wetland hydrology, and increasing delivery of non-point source pollution (such as sediment, de-icer, and petroleum products) could result from increasing the impervious surface area of the roadway. These effects will be avoided and minimized by implementing construction and post-construction BMPs as described in **Section 4.3.4** on water quality. For more information on wetland effects and mitigation, see the Wetland Finding, provided in **Appendix C**.

Mitigation for Proposed Action Wetland Impacts: Despite making every effort during alternative development and conceptual design to avoid and minimize impacts to all wetlands and open waters, previously described unavoidable impacts would result from implementing the Proposed Action.

Table 4-21
Wetlands Affected by the Proposed Action

Impact Type	Potentially Jurisdictional*	Potentially Non-Jurisdictional	Total
Wetland Impacts, Permanent	0.10	0.60	0.70
Wetland Impacts, Temporary	0.30	1.00	1.30

*Jurisdiction is based on USACE determination, subject to future consultation.

Section 404 of the CWA requires compensatory mitigation for permanent, direct impacts to waters of the U.S., including wetlands. Additionally, at the direction of Executive Order 11990, Protection of Wetlands (1977), and Department of Transportation Order 5660.1A, Preservation of the Nation's Wetlands (1978), the FHWA and CDOT also mitigate for impacts to non-jurisdictional wetlands.

In general, locally-important functions and values are present along existing stream banks, and the reliability of existing stream flows support adequate hydrology resulting in a high likelihood for long-term wetland sustainability. Therefore, on-site mitigation will be considered (but not required) for impacts to wetlands along existing stream banks. As an alternative, CDOT will consider purchasing mitigation bank credits instead, which is the expected mitigation for impacts to low-functioning non-streamside wetlands such as a roadside ditch.

4.4.4 Prime and Unique Farmlands

Prime and unique farmlands are protected under the Farmland Protection Policy Act of 1981. Prime farmlands are those considered to be of national importance and have been defined as land with the best combination of physical and chemical characteristics for producing feed, forage, fiber, and oilseed crops, and are available for these uses. Unique farmland is land other than prime farmland that is used for the production of specific, high-value crops.

According to Federal regulations at 7 CFR 658.2, "'farmland' does not include land already in or committed to urban development," which includes lands identified as being within an urban area. Since all of the C-470 project area is included within the metro Denver urbanized area, no Federally-protected farmland is present. Accordingly, there would be no direct or indirect effects to this resource with the No-Action Alternative or the Proposed Action.

4.4.5 Vegetation, Including Noxious Weeds

The term vegetation refers to the collective plant cover present in an area. Vegetation communities are classified as distinct grouping of individual species that recur in areas with similar physical environmental characteristics (e.g., climate, moisture availability, and soils). They are also defined by the presence of a few dominant species and their physical appearance.

The C-470 project area is located in the westernmost edge of the plains shortgrass ecosystem. Historically, this ecosystem has been dominated by blue grama and buffalo grass. However, because of the high level of human development within the project area, little of this ecosystem remains. Most of the area is a mixture of commercial and residential uses with parks and open space scattered throughout, especially in the western third of the project area. Humans have influenced the vegetation to one degree or another, from the highly disturbed commercial areas to the woody riparian banks of the South Platte River.

Grasslands: Portions of the project area, primarily in Chatfield State Park and in undeveloped uplands along drainages, support disturbed native grasslands. Most of the disturbed native grasslands in the project area have been altered by the combined effects of past agricultural practices and urban development. Commercial and residential areas, primarily between I-25 and Lucent Boulevard, consist of maintained, irrigated landscape including Kentucky bluegrass and planted ornamental trees and shrubs around the buildings.

Riparian Areas: Of all the vegetation types present within the C-470 project area, riparian vegetation has the highest ecological value. Riparian vegetation is found along most of the principal streams and in drainage ditches, ponds, and other water sources. Riparian areas generally consist of woody vegetation with an understory of grasses and forbs. Dominant

vegetation typically includes various species of trees and shrubs including plains cottonwood (*Populus deltoides*), willow (*Salix* spp.), chokecherry (*Prunus virginiana*), three-leaf sumac (*Rhus trilobata*), and Russian olive (*Elaeagnus angustifolia*) (a non-native weed species).

Listed as rare by the Colorado Natural Heritage Program, the American currant (*Ribes americanum*) shrub occurs in drainages with dense woody vegetation. Most of the riparian areas in the C-470 project area, including the South Platte River, provide potential habitat for this species. American currant populations are known to occur in South Platte Park, located on the north side of C470, just west of Santa Fe Drive interchange, in the South Platte River floodplain.

The Colorado Legislature passed Senate Bill 40 (SB 40) in order to protect and preserve fish, fishing waters, and all wildlife resources, including riparian vegetation associated with the streams of Colorado. SB 40 gives CPW jurisdiction over impacts to riparian areas and their associated streams resulting from state agency projects.

Noxious Weeds: Noxious weeds are non-native plant species that have been introduced into an environment with few, if any, natural biological controls. This gives them a competitive advantage in dominating and crowding out native plant species and can threaten the integrity of native plant communities. Because of the adverse environmental effects of weeds, both the federal and state governments have issued regulations regarding noxious weeds.

Executive Order 13112 directs federal agencies (including FHWA) to prevent the introduction of invasive species, control and monitor invasive species, and restore native species and habitats that have been invaded. Additionally, in 1990 the State of Colorado passed the Colorado Noxious Weed Act. As amended in 2003, the Act requires land managers (in this case CDOT), to control certain species of noxious weeds.

CDOT mapped the noxious weeds and prepared a Noxious Weed Control Plan for the 2006 EA, but that plan is now outdated. More recently, CDOT statewide weed mapping efforts have included C-470, and field visits were made in 2013 to document weed-infested areas for this Revised EA.

No-Action Alternative Impacts on Vegetation: The No-Action Alternative would have no effect on vegetation in the project area.

Proposed Action Impacts on Vegetation: Direct effects to vegetation resulting from the Proposed Action would include construction activities associated with roadway widening, and bridge construction. In addition to herbaceous vegetation, hundreds of trees and shrubs likely would be removed during construction. Temporary and permanent impacts totaling up to 2.77 acres of riparian habitat are anticipated at eight sites in four drainages: Massey Draw (4 sites), Willow Creek (2), Big Dry Creek, and the South Platte River.

Indirect effects to vegetation include the introduction or spread of noxious weeds. Most of the disturbance associated with the Proposed Action would be to areas mapped as maintained uplands, which includes the ROW.

Mitigation of Proposed Action Impacts on Vegetation: To minimize the adverse effects of disturbance to all the vegetation types resulting from the Proposed Action, CDOT's revegetation practices will be followed. Areas temporarily disturbed during construction would be reseeded after construction with a native seed mix reviewed and approved by a CDOT landscape architect. Seeding would occur during appropriate seasonal timeframes to ensure that seeds take root and geminate. If out of season, the earth would be

protected from erosion with mulch and mulch tackifier.

Permanent seeding would occur throughout the project, and disturbed areas would be completely revegetated as soon as practicable. Trees adjacent to the project area that would not be removed would be protected by erecting plastic barricade fencing to avoid unintentional damage. Removed native trees greater than 2 inches in diameter at breast height will be replaced on at least a one to one basis.

The Colorado Department of Natural Resources and CDOT entered into a memorandum of agreement in 2005 that requires Colorado Parks and Wildlife to review plans submitted by state agencies proposing actions with adverse impacts to streams protected under SB 40 and grants SB 40 Certification for actions that include appropriate measures to eliminate or diminish adverse effects to such streams or their banks or tributaries.

In compliance with the memorandum of agreement, CDOT would apply to CPW for SB 40 Certification at least 60 days prior to construction.

Prior to construction, CDOT will update its weed mapping of the project area and prepare a current Integrated Noxious Weed Management Plan. The plan will include a variety of species-specific control methods based on the size of the weed populations and the surrounding landscape. Some of these methods include cutting and removing the noxious weeds, mowing vegetation in the ROW, and using carefully selected herbicides targeted for the particular species and growth stage.

Following construction, the site would be monitored for the need for follow-up weed control at least twice over the first growing season.

4.5 SECTION 4(f) IMPACTS

Under Section 4(f) of the USDOT Act of 1966, FHWA (and other USDOT agencies) cannot approve the use of land from historic sites, publicly owned parks, recreation areas, or wildlife refuges unless there is no feasible and prudent alternative to the use and the action includes all possible planning to minimize harm to the property, or if the use will have a *de minimis* impact to the property. (See text box, next page).

The Proposed Action would not require land from any protected property identified in **Section 4.2.6, Parks and Recreation**, or **Section 4.3.7, Historic Resources**. However, it would affect the following four Section 4(f) resources in ways that necessitate consultation with affected parties:

- City Ditch (historic)
- Mary Carter Greenway Trail (recreation)
- High Line Canal Trail (recreation)
- Willow Creek Trail (recreation)

These Section 4(f) resources are discussed below.

The C-470 Trail was not listed in **Section 4.2.6, Parks and Recreation**, but instead was described in **Section 3.2.11, Bicycle and Pedestrian Facilities**. As noted there, CDOT owns this paved, multiuse trail that parallels C-470 for its entire length. The C-470 Trail serves the important transportation purpose of providing east-west mobility and offering cyclists a safe route that is not on the busy, high-speed freeway. As a CDOT-owned transportation facility, it is not considered a Section 4(f) recreation resource.

4.5.1 *De Minimis* Finding for City Ditch

The City Ditch (5AH254.7 and 5DA987.1) was described previously as an historic resource in **Section 4.7**. Past actions including C-470 original construction in 1982 to 1985 caused much of the

historically open-channel City Ditch to be piped underground, resulting in a loss of historic integrity for this short segment of the overall multi-mile historic ditch. The segment affected by the C-470 Proposed Action has been determined non-supporting of the overall eligibility of this resource.

Although no easement or right-of-way acquisition is needed at the Ditch's C-470 crossing, the project will require realignment and reconstruction of the ditch to accommodate highway construction. This constitutes a "use" under Section 4(f) because it requires the permanent incorporation of a small area of land associated with the resource to be incorporated into the transportation infrastructure.

In August 2013, CDOT contacted with the State Historic Preservation Office (SHPO), as the Official with Jurisdiction over historic resources, as well as five Section 106 (36 CFR 800) Consulting Parties regarding recommended findings of eligibility and Section 106 effect for the City Ditch resource.

Through this Section 106 consultation process, it was determined that the C-470 Proposed Action would result in *no adverse effect* to the City Ditch (resource 5AH254/5DA987, including segment 5AM254.7/5DA987.1). In accordance with 23 CFR 774.17 a finding of *no adverse effect* means that effects to this Section 4(f) resource would be *de minimis*.

In accordance with the coordination requirements of 23 CFR 774.5(b)(1), notification of *de minimis* findings for this resource was sent to SHPO and the consulting parties by letters dated November 26, 2013. CDOT provided full documentation of this process to FHWA in a letter dated January 21, 2014, and FHWA provided written concurrence with this *de minimis* finding on March 21, 2014.

> ***23 CFR 774.17, Definitions***
> *De minimis impact.*
> (1) For historic sites, *de minimis* impact means that the Administration has determined, in accordance with 36 CFR part 800 that no historic property is affected by the project or that the project will have "no adverse effect" on the historic property in question.

In summary, all applicable Section 4(f) requirements have been satisfied for the Proposed Action's impacts to the City Ditch. Documentation regarding this finding is found in **Appendix A, Agency Correspondence**.

4.5.2 Section 4(f) Determination for Trail Impacts

For the three trail crossings that would be temporarily closed to construct the Proposed Action, USACE owns the land at one site (Mary Carter Greenway Trail) and CDOT owns the land for the other two (High Line Canal Trail and Willow Creek Trails), although in each case the trail is maintained by a separate recreational district.

Mary Carter Greenway Trail: The Mary Carter Greenway Trail begins inside Chatfield State Park at its junction with the C-470 Trail and extends northward for many miles, first crossing under C-470 and then traversing South Platte Park. Like C-470 itself, The Mary Carter Greenway Trail is located on an easement granted by USACE. The trail was built and is maintained by the South Suburban Parks and Recreation District (SSPRD).

CDOT plans to reconstruct and improve this trail in conjunction with replacement of the two parallel C-470 bridges that cross over the South Platte River and the trail located on its west bank. The existing crossing is depicted in **Figure 4-20**.

CDOT met twice with SSPRD staff in developing of the conceptual design for the South Platte River bridges, including the Mary Carter Greenway Trail. The first meeting was held to learn SSPRD's concerns about the existing trail crossing.

Figure 4-20
Mary Carter Greenway Trail Crossing under C-470 (view southward)

SSPRD indicated its strong desire that horizontal and vertical clearances under C-470 should be improved, and that the new bridges should offer an improved wildlife crossing under C-470.

The second meeting was held to review the conceptual design, shown previously in **Figure 4-18**. The second meeting also included a review of potential detours for use during temporary trail closures, as shown in **Figure 4-21.**

The conceptual design for the new C-470 bridges includes a trail and wildlife crossing that meet SSPRD's desires and represent a substantial enhancement over the existing trail crossing. Accordingly, this trail impact will be cleared using FHWA's transportation enhancement exception. It is anticipated that written agreement from SSPRD will be received in July or August 2015.

Section 4(f)
Transportation Enhancement Exception

The proposed impacts to the Mary Carter Greenway Trail meet the requirements of 23 CFR 774.13(g), the exception allowed for transportation enhancement projects because:
(1) The use of the Section 4(f) property is solely for the purpose of preserving or enhancing an activity, feature, or attribute that qualifies the property for Section 4(f) protection; and
(2) The official(s) with jurisdiction over the Section 4(f) resource (i.e., SSPRD) agrees in writing to the statement above.

Figure 4-21
Potential Temporary Detours for Mary Carter Greenway Trail

Two detours are available to link the Mary Carter Greenway Trail north of C-470 to the C-470 Trail south of the highway.

Western detour: From the west, follow the Columbine Trail along Chatfield Avenue and Platte Canyon Road. Then take the Mineral Trail along Mineral Avenue to Mary Carter Greenway Trail.

Eastern detour: From the east, follow the High Line Canal Trail to the Mineral Trail. After crossing Santa Fe Drive, continue on the Railroad Spur Trail to Mary Carter Greenway Trail.

High Line Canal Trail: The High Line Canal Trail closely parallels another historic irrigation feature, the High Line Canal, which has historic use taking water from the South Platte River south of C-470 downstream to the Denver metro area. The trail and the canal are conveyed under C-470 through separate culverts just east of Erickson Boulevard, which is east of the C-470/ Santa Fe intersection. **Figure 4-21** presents an aerial view of this crossing.

This portion of the trail is maintained by the Highlands Ranch Metro District (HRMD). This crossing also is part of CDOT's C-470 commuter trail that parallels the highway. Impacts at this crossing will be temporary closures with signed detours for the safety of trail users during construction of the C-470 improvements passing over it. No reconstruction of this trail is needed.

Denver Water has a permanent easement allowing its staff to use this trail for inspection of the canal. After receiving documentation of the proposed impacts from CDOT, Denver Water staff indicated in June 2015 that they have no issues with the project but request at least a two-week advance notice before any closure.

Since the trail is maintained by HRMD under an agreement with HRMD and CDOT, CDOT will also coordinate closures and detours with HRMD staff when the project gets underway. CDOT anticipates receiving documentation from HRMD pursuant to 23 CFR 774.14(d)(5) in July or August 2015.

CDOT has identified a potential detour route to mitigate the temporary trail closure, as shown in **Figure 4-22**. This route is subject to change during ongoing coordination with HRMD and CDOT's design-build contractor.

The temporary closure of the High Line Canal Trail meets the requirements for Section 4(f) temporary occupancy, pursuant to 23 CFR 774.13(d), because:

(1) The duration of any trail closures will be limited and much shorter than the duration of the entire project, and there would be no change in the ownership of the land.

(2) The scope of the work must be minor, not changing the trail.

(3) There are no anticipated permanent adverse physical impacts, nor will there be interference with the protected activities, features, or attributes of the property, on either a temporary or permanent basis; a detour route is available to convey non-motorized traffic across C-470 at a nearby location.

(4) The land being used (if any) would be returned to a condition which is at least as good as that which existed prior to the project.

(5) Documented agreement regarding the above conditions will be obtained from the official(s) with jurisdiction (i.e., HRMD) over the High Line Canal Trail.

Figure 4-22
High Line Canal Trail Crossing under C-470

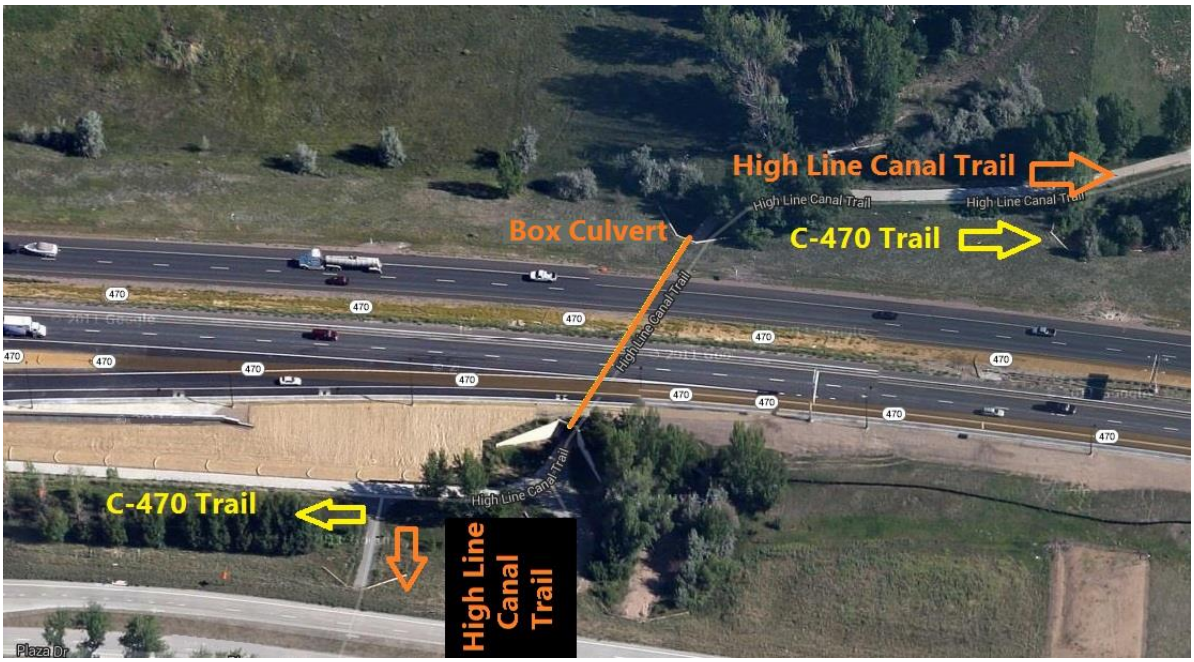
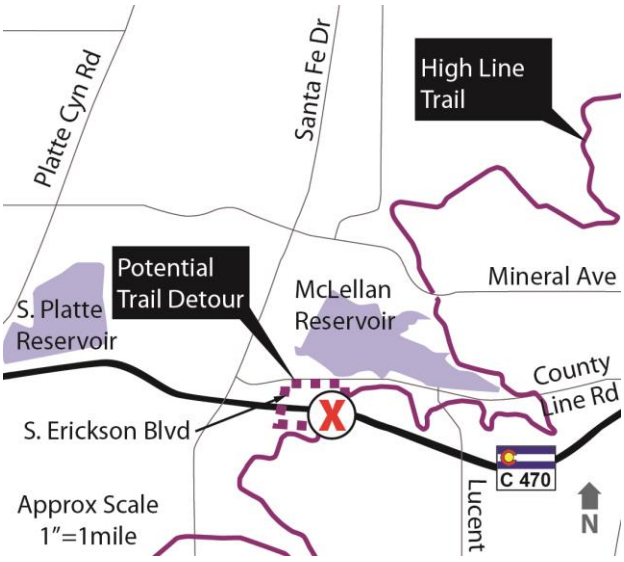


Figure 4-23
Potential Detour for Temporary Closure of High Line Canal Trail



Clockwise from the closure (red X), this detour uses the C-470 Trail to Erickson Boulevard, then County Line Road to Primo Road, back to the High Line Canal Trail.

Willow Creek Trail: The Willow Creek Trail is another trail maintained by SSPRD. It crosses C-470 along with its namesake drainage through a double culvert located west of Yosemite Street. An aerial view of the site is provided in **Figure 4-23**.

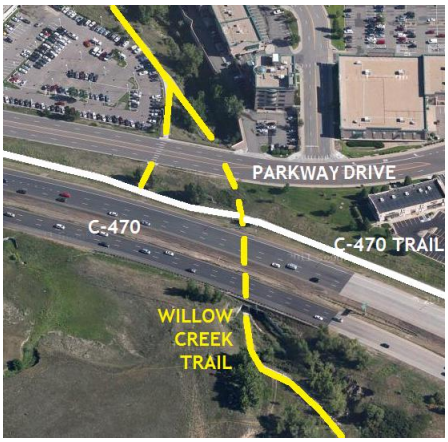
This trail would be subject to temporary closures for the safety of its users while C-470 reconstruction and widening takes place overhead. No reconstruction of this trail is needed. The trail culvert will be extended slightly to the south. This impact would result in a Section 4(f) temporary occupancy (see text box). CDOT has identified a potential detour as shown in **Figure 4-24**.

CDOT anticipates receiving documentation from SSPRD pursuant to 23 CFR 774.14(d)(5) in July or August 2015.

Figure 4-25
Potential Detour for Temporary Closure of Willow Creek Trail

Clockwise from the closure (red X) this detour follows Park Meadows Drive to Acres Green Drive, then Parkway Drive back to Willow Creek Trail.

Figure 4-24
Willow Creek Trail Crossing under C-470



The temporary closure of the Willow Creek Trail meets the requirements for Section 4(f) temporary occupancy, pursuant to 23 CFR 774.13(d), because:

(1) The duration of any trail closures will be limited and much shorter than the duration of the entire project, and there would be no change in the ownership of the land.

(2) The scope of the work will be minor, extending one end of the existing culvert under C-470.

(3) There are no anticipated permanent adverse physical impacts, nor will there be interference with the protected activities, features, or attributes of the property, on either a temporary or permanent basis; a detour route is available to convey non-motorized traffic across C-470 at a nearby location.

(4) The land being used (owned by CDOT) would be returned to a condition which is at least as good as that which existed prior to the project.

(5) Documented agreement regarding the above conditions will be obtained from the official(s) with jurisdiction (i.e., SSPRD) over the Willow Creek Trail.

Mitigation for Temporary Trail Closures:
The mitigation for Section 4(f) trail closures was specified earlier in the discussion of Park and Recreation Resources (EA **Section 4.2.6**) and is as follows:

CDOT will continue to work closely with the owners of any affected trails, as well as with bicycle groups and other interested parties to minimize any disruption of trail systems due to the Proposed Action. Feasible detour routes for the three trails facing temporary closures have been identified. CDOT will provide detour signage indicating not only the temporary routes but the approximate duration of the detour timeframe. CDOT will provide a minimum two-week advance notice to SSPRD and HRMD prior to any temporary trail closure.

Additionally, CDOT's contractor will be required to obtain SSPRD's schedule of major bicycle events scheduled for the Mary Carter Greenway Trail, with the goal of minimizing any construction conflicts with planned major events.

4.6 SUMMARY OF EFFECTS AND MITIGATION

Table 4-22 summarizes the effects for the No-Action Alternative and the Proposed Action, as discussed in **Sections 4.2** through **4.4** of this chapter. The purpose of this table is to provide a concise, side-by-side comparison of the effects of these two alternatives.

Table 4-22
Summary of Effects

Resource	Effects of No-Action Alternative	Effects of Proposed Action
Transportation, Chapter 3	Limited available capacity on C-470 would constrain traffic getting to/from the adjacent local arterials and lengthen the peak period. Future congestion and delay would worsen from current conditions.	Operations and travel times on mainline would improve along the express lanes while general purpose lanes would operate at the levels comparable to existing conditions, as detailed in **Chapter 3**. Approximately 5.8 miles of the C-470 Trail would be relocated/replaced. In affected portions, the trail will be shifted up to 167 feet outward from its existing course, but generally 45-50 feet. During construction, C-470 traffic speeds may be reduced in work zones and by construction-related congestion.
Demographics, page 4-2	Continued population and employment growth is expected along the corridor, even with a congested C-470.	The Proposed Action is not expected to alter expected population and employment growth along the corridor.
Minority and Low Income Populations, page 4-6	No effects to minority or low-income populations	An existing noise wall along the Westbound on-ramp from Santa Fe Drive will be relocated a few feet closer to the adjacent, low-income Wolhurst Mobile Home Community. These effects are not disproportionately high and adverse.
Economic Considerations, page 4-7	Increased cost of travel time due to congestion may affect business location and home rental/purchase decisions	Construction activity would increase temporary employment opportunities. Local construction material purchases would benefit businesses in the region. Motorists, passengers and freight would incur economic cost (value of time) due to C-470 congestion during construction.
Land Use, page 4-11	No change in land use patterns.	Same as No-Action Alternative. The Proposed Action would not add or eliminate local access to the freeway.
Right-of-Way, page 4-14	No right-of-way acquisition	The Proposed Action results in the need to acquire 3.48 acres of right-of-way, 31.14 acres of permanent easement, and 15.42 acres of temporary easement. The 3.48 acres are partial acquisitions from six (larger) parcels that are all privately-owned, non-residential land. No business or residential relocations would be necessary. No change to the USACE easement is needed.
Parks and Recreation, page 4-16	Increased traffic would increase noise levels at adjacent parks and recreation areas; access would become more difficult and time consuming with increased congestion	The Mary Carter Greenway Trail under C-470 would be reconstructed to provide better vertical clearance and sight distance; three trails would experience temporary closures and detours during construction – Mary Carter Greenway Trail, Highline Canal Trail, and Willow Creek Trail. Parks and trails near the freeway would experience increased noise levels. New retaining walls would alter views from inside Chatfield State Park looking north.

Table 4-22 (continued)
Summary of Effects

Resource	Effects of No-Action Alternative	Effects of Proposed Action
Land and Water Conservation Fund Assisted Properties, page 4-18	No LWCF properties affected	No land LWCF property would be acquired.
Highway Noise, page 4-21	Model predictions indicate that 235 households in 14 neighborhoods would exceed CDOT Noise Abatement Criteria, as would parks and trails near the freeway.	Without mitigation, 469 households in 16 neighborhoods would exceed CDOT Noise Abatement Criteria, as would parks and trails near C-470, and outdoor areas at several restaurants. Unlike the No-Action Alternative, the Proposed Action includes new noise barriers recommended for seven affected locations. One of these barriers would benefit three apartment complexes.
Air Quality, page 4-27	Carbon monoxide, ozone, and particulate matter levels would be within EPA-approved emission budgets.	Carbon monoxide, ozone, and particulate matter levels would be within EPA-approved emission budgets. The Proposed Action would not attract increased truck traffic so would have little effect on mobile source air toxics. Fugitive dust emissions and exhaust from heavy machine would be generated during project construction.
Water Quality, page 4-36	Increased traffic due to regional growth will increase pollutant loading in roadway runoff. No change to existing impervious surface area (204.9 acres); limited opportunity to decrease highway runoff into adjacent water sources.	Increased traffic due to regional growth will increase pollutant loading in roadway runoff. Impervious surface would increase to 324.7 acres, adding 119.8 acres to the 2015 existing condition. An estimated 185.1 acres would be addressed with BMPs to improve water quality of highway run-off into adjacent water sources.
Hydrology and Hydraulics, page 4-38	No effects	More impervious surface area would cause increased runoff volume and peak flow rates from highway. The C-470 culvert east of Spring Creek and bridges over South Platte River would be replaced and enlarged; both would provide increased flow capacity.
Floodplains, page 4-41	No effects	Minor changes to flood elevations. A localized increase of less than one foot is expected at the Willow Creek crossing of C-470.
Historic Resources, page 4-42	No effects	Construction effects to City Ditch and the High Line Canal would result in no adverse effects.
Archaeological Resources, page 4-46	No effects	No effects to known archaeological resources; project excavation activity has potential to result in new finds, but this is not expected.
Native American Resources, page 4-47	No effects	No effects to known Native American resources of cultural or religious significance; project excavation activity has potential to result in new finds, but this is not expected.

Table 4-22 (continued)
Summary of Effects

Resource	Effects of No-Action Alternative	Effects of Proposed Action
Paleontological Resources, page 4-48	No effects	No effects to known paleontological resources; project excavation activity has potential to result in new finds, but this is not expected.
Geology and Soils, page 4-49	No effects	Geologic and soil conditions that may affect project design and construction include: expansive soils and bedrock, corrosive soils, steeply dipping bedrock, collapsible soils, and unstable slopes.
Hazardous Materials, page 4-50	No effects	During construction activity, especially excavation, contaminated soil or groundwater could be encountered.
Visual and Aesthetic Character, page 4-54	No effects	New visual elements will include added signage, tolling gantries, loss of grassy median, wider typical section, additional retaining walls and noise walls.
Utilities, page 4-55	No effects	Various utility lines would require relocation, most at public expense but some at CDOT expense. Accidental service interruptions, not anticipated, are possible but would be very short in duration.
Common Wildlife, page 4-56	Increased traffic would exacerbate existing disturbance to wildlife near the roadway and make crossing the highway slightly more difficult.	Minor habitat loss for mule deer and elk; additional travel lanes would increase difficulty for wildlife movement across the highway; foraging behaviors for raptors may be temporarily affected; minor reduction to raptor foraging habitat; swallow nests under existing bridges would be disturbed; 14.3 acres of black-tailed prairie dog habitat would be eliminated, reducing availability of prey for raptors including the Bald Eagle; minor, temporary disturbance to aquatic resources during construction; new, improved South Platte River bridges will enhance wildlife movement.
Threatened and Endangered Species, page 4-62	No effects	The Burrowing Owl has the potential to be found in the C-470 project area because of the existence of prairie dog colonies which provide its habitat and prey. Loss of 14.3 acres of prairie dog colonies would reduce the amount of potential Burrowing Owl habitat in the area. There are approximately 90 acres of prairie dog colonies in the CDOT project area and more colonies in other nearby areas.

Table 4-22 (continued)
Summary of Effects

Resource	Effects of No-Action Alternative	Effects of Proposed Action
Wetlands and Waters of the U.S. page 4-65	No effects	0.10 acre permanent effects and 0.30 acre temporary impact to likely jurisdictional wetlands; 0.60 acre permanent effects and 1.00 acre temporary effects to likely non-jurisdictional wetlands; CDOT's policy is to ensure no net loss of wetlands. Use of offsite wetland mitigation banks is anticipated.
Prime and Unique Farmlands, page 4-66	No effects (no resource in project area)	No effects (no resource in project area)
Vegetation, page 4-67	No effects	Up to 2.77 acres riparian habitat would be eliminated at eight locations in four drainages: Massey Draw (4 sites), Willow Creek (2), Big Dry Creek, and South Platte River. Hundreds of existing trees would be removed. Roadside areas would be disturbed during construction, potentially resulting in increased occurrence of noxious weeds.
Section 4(f) Resources, page 4-68	No effects	The Proposed Action effects trails and an historic site (as already noted above) that are protected by Section 4(f) of the U.S. DOT Act of 1966. The portion of the historic City Ditch that is beneath C-470 would be realigned and reconstructed (*de minimis* finding completed). The Mary Carter Greenway Trail would be reconstructed under C-470 (transportation enhancement exception), resulting in temporary trail closures/detours. The High Line Canal Trail and the Willow Creek Trail (culvert to be extended) that cross under C-470 would experience temporary closures/detours (temporary occupancy exception).

Table 4-23 summarizes the mitigation measures that would be part of the Proposed Action. These potential measures are described in detail in the respective sections of **Chapter 4.**

Table 4-23
Summary of Mitigation Commitments

#, Resource	Impact	Mitigation Commitment from Source Document	Responsible Branch	Timing/Phase that Mitigation Will Be Implemented
1. Transportation	C-470 congestion due to construction activity	CDOT will maintain at least two through lanes in each direction open for public travel throughout the construction process.	CDOT Region 1 Project Engineer	Construction
2. Transportation	C-470 temporary closure	Any necessary roadway closures (e.g., possibly for Santa Fe bridge replacement) would be limited to night time and extensive media notice would be provided, with safe detours identified and marked.	CDOT Region 1 Project Engineer	Construction
3. Transportation	Relocation of 5.8 miles of the C-470 Trail	New sections of trail will be constructed prior to closing any portion of the existing C-470 trail, to avoid disruption. However, closure and detour will be unavoidable where the C-470 Trail and High Line Canal Trail cross C-470 through a shared culvert. See commitment #5, Parks and Recreation, below.	CDOT Region 1 Project Engineer	Construction
4. Right-of-Way	CDOT would need to acquire 3.48 acres of right-of-way, 31.14 acres of permanent easement, and 15.42 acres of temporary easement.	All right-of-way transactions will be conducted in accordance with the Uniform Relocation Assistance and Real Property Acquisition Act of 1970, as amended. A CDOT ROW specialist will be assigned to each property owner to provide assistance with the ROW process.	CDOT Right-of-Way Branch	Pre-construction
5. Right-of-Way	Construction activity on temporary easement property may result in damage to that property.	Any temporary easement property disturbed during construction would be restored to its prior condition, or appropriate compensation will be provided.	CDOT Region 1 Project Engineer	Construction
6. Parks and Recreation	Temporary closure of Mary Carter Greenway Trail, High Line Canal Trail, and Willow Creek Trail	A minimum two-week advance notice would be provided to SSPRD and HRMD prior to any temporary trail closure. CDOT has identified available detour routes for each closure and would provide signage for trail users to inform them of the detour routes.	CDOT Region 1 Project Engineer	Construction

Table 4-23 (continued)
Summary of Mitigation Commitments

#, Resource	Impact	Mitigation Commitment from Source Document	Responsible Branch	Timing/Phase that Mitigation Will Be Implemented
7. Parks and Recreation	Temporary closure of the Mary Carter Greenway Trail could conflict with major bicycle events planned by SSPRD.	CDOT's contractor will be required to obtain SSPRD's schedule of major bicycle events scheduled for the Mary Carter Greenway Trail, with the goal of minimizing any construction conflicts with planned major events.	CDOT Region 1 Project Engineer	Construction
8. Highway Noise	A number of neighborhoods would experience noise impacts (> 66 decibels)	Noise barriers will be constructed where they are found to be reasonable and feasible, and where the majority of benefitted households voting on mitigation favor its installation. In final design, the actual lengths and locations of the recommended mitigation may vary for reasons such as terrain, utilities, property owner desires or easements.	CDOT Region 1 Project Engineer	Pre-construction; Construction
9. Highway Noise	Construction activities would result in noise and vibration.	CDOT will require its contractor to prepare a mitigation plan for noise and vibration, to consider a number of options identified in **Section 4.3.1**.	CDOT Region 1 Project Engineer	Pre-construction
10. Air Quality	Construction activities would cause fugitive dust emissions	CDOT would require contractor implementation of dust control practices in accordance with Colorado Air Quality Control Commission Regulation No. 1 on fugitive emissions.	CDOT Region 1 Project Engineer	Construction
11. Water Quality	Increased runoff due to 120 acres of additional impervious surface	Permanent water quality features that are incorporated into the project's conceptual design to comply with CDOT's MS4 Permit for water quality treatment.	CDOT Region 1 Project Engineer	Pre-construction, Construction
12. Water Quality	Construction activity poses risks for spills, erosion, and other water quality problems during construction.	CDOT will prepare and implement a Stormwater Management Plan (SWMP) detailing how and where temporary BMPs will be used before, during and after construction, including rigorous compliance monitoring.	CDOT Region 1 Project Engineer	Pre-construction; Construction

Table 4-23 (continued)
Summary of Mitigation Commitments

#, Resource	Impact	Mitigation Commitment from Source Document	Responsible Branch	Timing/Phase that Mitigation Will Be Implemented
13. Hydrology and Hydraulics	Increased stormwater runoff could increase flows under C-470.	To prevent flooding, CDOT will replace an existing, undersized 72-inch culvert east of Spring Creek with a larger, 84-inch reinforced concrete pipe culvert to safely convey the estimated 100-year frequency design flow.	CDOT Region 1 Project Engineer	Construction
14. Floodplains	Replacing C-470 bridges over South Platte may trigger need for a FEMA map revision.	CDOT will prepare a more detailed analysis to determine if a FEMA map revision is required based on the final design of the new bridges. CDOT will prepare a FEMA map revision if needed.	CDOT Region 1 Engineering Staff	Pre-construction
15. Archaeological Resources	Excavation could unearth archaeological resources	If archaeological remains are exposed during any phase of construction associated with the study, work will be halted and the CDOT Senior Staff Archaeologist will be contacted to evaluate the discovery and coordinate appropriate Section 106 compliance actions with the SHPO and other agencies or entities, as necessary.	CDOT Region 1 Project Engineer, assistance from Staff Archaeologist if needed	Construction
16. Paleontological Resources	Excavation could unearth paleontological resources	CDOT will ensure that a qualified paleontologist is on site during major construction excavation to monitor for buried paleontological resources where known fossil-bearing deposits are mapped, but not currently exposed at the ground surface. If any potential fossils are unearthed during construction, work will be halted until the paleontologist can assess the significance of the find and make recommendations regarding resource protection.	CDOT Region 1 Project Engineer assistance from qualified paleontologist as needed	Construction

Table 4-23 (continued)
Summary of Mitigation Commitments

#, Resource	Impact	Mitigation Commitment from Source Document	Responsible Branch	Timing/Phase that Mitigation Will Be Implemented
17. Geology and Soils	Known conditions along C-470 require consideration in project design.	Geologic and soil conditions will be taken into consideration during final design in accordance with ordinary due diligence in engineering practice. Appropriate design features and construction methods will be used as needed in response to such conditions.	CDOT Region 1 Project Engineer	Pre-construction; construction
18. Hazardous Materials	During construction, especially excavation, contaminated soil or groundwater could be encountered.	CDOT will require its contractor to develop of a site-specific Materials Handling Plan, in accordance with CDOT's Standard Specifications for Road and Bridge Construction.	CDOT Region 1 Project Engineer	Pre-construction; construction
19. Hazardous Materials	Demolition of bridges and other structures may result in exposure to asbestos materials or lead paint.	CDOT will require its contractor to conduct an asbestos hazardous materials survey and a lead paint survey prior to alteration or demolition of bridges, guardrails or sign structures. If found, proper handling and disposal of these materials would be required.	CDOT Region 1 Project Engineer	Pre-construction; construction
20. Visual and Aesthetic Character	C-470 visual character will become more urban due to new lanes, signage, noise barriers and toll equipment.	CDOT will design corridor improvements in accordance with Region 1 design standards to improve design consistency. If local governments desire to fund localized upgrades above the corridor standards, CDOT will work with them to pursue these possibilities.	CDOT Region 1 Project Engineer	Pre-construction
21. Utilities	Numerous utility lines under, over or near C-470 would need to be relocated.	The owners of private utility lines within CDOT ROW pay for relocation of their utilities. If utilities are on land newly being acquired for ROW, CDOT pays for the relocation.	CDOT Region 1 Project Engineer	Pre-construction; construction
22. Common Wildlife	Adding lanes would increase the difficulty of wildlife movement across C-470.	At the South Platte River, which is the corridor's most ecologically sensitive location, existing parallel C-470 bridges will be replaced and the new bridges have been designed specifically to enhance wildlife movement, providing a 10-foot wildlife movement corridor separated from the adjacent Mary Carter Greenway Trail.	CDOT Region 1 Project Engineer	Pre-construction; construction

Table 4-23 (continued)
Summary of Mitigation Commitments

#, Resource	Impact	Mitigation Commitment from Source Document	Responsible Branch	Timing/Phase that Mitigation Will Be Implemented
23. Common Wildlife	Adding lanes would increase the difficulty of wildlife movement across C-470.	The existing chain link fence that extends from the South Platte River along the north and south side of C-470 would also be replaced to serve as deer fence, directing large mammals to safely cross under C-470 at the South Platte River.	CDOT Region 1 Project Engineer	Construction
24. Common Wildlife	Adding lanes would increase the difficulty of wildlife movement across C-470.	After construction, re-vegetation near the bridge would include native riparian shrubs such as skunk brush and willow in attempt to attract deer to cross under C-470.	CDOT Region 1 Project Engineer	Post-construction
25. Common Wildlife/ Migratory Bird Treaty Act	Construction would occur within 1/3 mile from active nests of Red-Tailed Hawks and possibly other raptors, disturbing their breeding and foraging behaviors.	Prior to construction, CDOT will conduct additional field surveys to confirm the location of active raptor nests. Seasonal construction restrictions and exclusion areas will be established as necessary to comply with CPW buffer recommendations. If restricting construction within nest buffers during the breeding season is not practicable, prior to construction CDOT would coordinate with USFWS and CPW to develop a mitigation strategy to offset potential lost productivity.	CDOT Region 1 Biologist	Pre-construction; construction
26. Common Wildlife/ Migratory Bird Treaty Act	Nests of MBTA-protected birds may be disturbed during construction	Prior to construction, CDOT would survey areas proposed for disturbance for the presence of migratory bird nests. CDOT would avoid disturbing active nests by removing trees and shrubs during the non-nesting season and timing construction activity to avoid active nests during the nesting season.	CDOT Region 1 Biologist	Pre-construction; construction

Table 4-23 (continued)
Summary of Mitigation Commitments

#, Resource	Impact	Mitigation Commitment from Source Document	Responsible Branch	Timing/Phase that Mitigation Will Be Implemented
27. Common Wildlife/ Migratory Bird Treaty Act	Swallow nests on CDOT bridges and in culverts would be disturbed during construction	Bird nests found under existing bridge structures would be removed after August 31 but prior to April 1 for MBTA compliance. To prevent new nest establishment, netting would be installed under bridges and culverts during the non-breeding season or new nests under construction would be visited every three to four days to prevent new nests from being completed, unless construction activity is continuous on a daily basis during active nesting season.	CDOT Region 1 Biologist	Pre-construction; construction
28. Common Wildlife/ Aquatic Species	Construction activity would increase turbidity downstream from bridges or culverts.	Construction in riparian areas will be minimized and mitigated in accordance with SB 40 requirements and the SB 40 permit to be obtained from CPW when final design is completed. In compliance with the SB 40 memorandum of agreement, CDOT would apply to CPW for SB 40 Certification at least 60 days prior to construction. Water quality temporary BMPs will be implemented during construction, and permanent BMPs will be incorporated in the project design, improving long-term water quality.	CDOT Region 1 Biologist	Pre-construction; construction
29. Threatened/ Endangered Species	The Proposed Action would displace an estimated 14.3 acres of black-tailed prairie dog colonies.	Colonies in the areas that would be impacted by construction would be re-surveyed for any changes in activity. CDOT would follow the 2009 *CDOT Impacted Black-tailed Prairie Dog Policy*.	CDOT Region 1 Biologist	Pre-construction; construction
30. Threatened/ Endangered Species	The Proposed Action would displace an estimated 14.3 acres of black-tailed prairie dog colonies.	For colonies that would be only partially affected, prior to construction a visual barrier would be installed between the burrows that would be impacted and undisturbed portions of the colony. Following barrier installation, burrow openings in the construction area would be collapsed. The visual barrier and collapsed burrows encourage abandonment of burrows that would be affected, which would reduce the likelihood of direct effects to individual prairie dogs.	CDOT Region 1 Biologist	Pre-construction; construction

Table 4-23 (continued)
Summary of Mitigation Commitments

#, Resource	Impact	Mitigation Commitment from Source Document	Responsible Branch	Timing/Phase that Mitigation Will Be Implemented
31. Wetlands and Waters of the U.S.	0.70 acres of permanent wetland impacts and 1.30 acres of temporary impacts may occur.	CDOT has already minimized wetland impacts in conceptual design and will strive for further minimization during final design. Clean Water Act Section 401 and 404 permits will be obtained as appropriate. All impacts will be mitigated under CDOT's "no net loss" policy. Wetland replacement within the corridor will be considered but most likely an offsite wetland mitigation bank will be used.	CDOT Region1 Biologist	Pre-construction; construction
32. Vegetation – Riparian Area	Temporary and permanent impacts to riparian areas could total up to 2.77 acres.	CDOT will develop mitigation plans and submit them to CPW for SB 40 Certification at least 60 days prior to construction.	CDOT Region1 Biologist	Pre-construction; construction
33. Vegetation – Trees	Loss of hundreds of trees.	Trees not being removed would be protected by erecting plastic barricade fencing to prevent damage. In riparian areas, removed native trees at least two inches in diameter at breast height would be replaced on-site on a one-to-one basis. Trees four or more inches in diameter removed from non-riparian areas would be replaced elsewhere in the project area.	CDOT Region1 Biologist	Construction
34. Vegetation	Construction of the Proposed Action would damage roadside vegetation	Areas temporarily disturbed during construction would be seeded after construction with a native seed mix reviewed and approved by a CDOT landscape architect. Seeding would occur during appropriate seasons to ensure that seeds take root and geminate during the next growing season. If out of season, the earth would be protected from erosion with mulch and mulch tackifier. Permanent seeding would occur throughout the project.	CDOT Region1 Biologist	Construction; post-construction

Table 4-23 (continued)
Summary of Mitigation Commitments

#, Resource	Impact	Mitigation Commitment from Source Document	Responsible Branch	Timing/Phase that Mitigation Will Be Implemented
35. Vegetation – Noxious Weeds	Soil disturbance and importation of construction equipment would enable the spread of noxious weeds, already a problem along C-470.	Prior to construction, CDOT will update its weed mapping of the project area and prepare a current Integrated Noxious Weed Management Plan. The plan will include a variety of species-specific control methods based on the size of the weed populations and the surrounding landscape. The plan will be implemented throughout project construction as appropriate. Following construction, mitigated sites will be monitored at least twice over the first growing season and follow-up weed control will be provided where needed.	CDOT Region1 Biologist; CDOT Maintenance	Pre-construction; construction
36. Section 4(f) Resources	Construction of Proposed Action would involve reconstruction of Mary Carter Greenway Trail (transportation enhancement exception), plus temporary closure (temporary occupancy exceptions) for High Line Canal Trail and Willow Creek Trail.	CDOT will work with its contactor to minimize closure durations. CDOT and the contractor will coordinate with the entities that operate these trails (HRMD and SSPRD) to identify and sign suitable detours. At least two week's advance notice would be given to trail users. The contractor will be required to obtain SSPRD's schedule of major events on the Mary Carter Greenway Trail for use in planning to minimize conflicts.	CDOT Region 1 Project Engineer	Construction

4.7 CUMULATIVE EFFECTS

Regulations implementing NEPA require federal agencies to consider direct, indirect, and cumulative effects of a proposed federal action on the social, physical, and biological environment. Cumulative effects result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over time.

4.7.1 Past, Present and Reasonably Foreseeable Actions

Past, present, and reasonably foreseeable actions affecting the C-470 project area are summarized in **Table 4-23**. The actions show the effects of adding one million new residents to the Denver metro area since 1990 and another one million residents projected between 2015 and 2035. This growth has converted large quantities of grassland to urban development with paved and built surfaces. Each resident consumes land, air, water, food, shelter, energy and transportation services, which can be at the expense of the natural environment.

Urbanization from the Denver metro area has already occurred southward across C-470 into Douglas County between I-25 and US 85, and now is beginning to push southward along US85. In-fill is occurring north of C-470 with redevelopment and increased densities along Santa Fe Drive in Littleton, especially in areas served by light rail transit stations.

The South Platte River corridor including Chatfield State Park, South Platte Park and other parks and trails are increasingly used for public recreation. They are used by urban-adapted wildlife but are increasingly less able to sustain sensitive species. Hence, for example, the USFWS exclusion zone for the threatened Preble's Meadow Jumping Mouse indicates that the species is unlikely to occur north of C-470.

4.7.2 Potential for Cumulative Effects from the C-470 Proposed Action

If an individual study has no direct or indirect effects upon a resource, then it also has no cumulative effects upon that resource. The direct and indirect impacts of the Proposed Action were listed earlier in **Table 4-23**. Some of those findings are already cumulative in nature, such as traffic noise and air quality. Predictions of future noise are loudest-hour levels accounting for existing traffic plus future traffic growth. Carbon monoxide hotspot predictions for future air quality include estimated background concentrations coming into the area from the rest of the region, and emissions estimates for conformity analysis consider all regional vehicular emissions.

An assessment of the potential for cumulative effects to resources directly or indirectly affected by the C-470 Proposed Action is provided in **Table 4-25**.

A study of potential area-wide cumulative effects was prepared for CDOT by University of Colorado researchers in 2008 (Muller et al., 2008). It used C-470 as a case study for exploring cumulative effects relevant data and impact metrics. However, it focused on the western half of C-470 between I-70 and Kipling Parkway. The western half of C-470 has strong similarity to the eastern half in certain ways. The 2008 research study focused on two key metrics: increased impervious surface and loss of habitat for the black-tailed prairie dog. Impervious surface was identified as an indicator of water quality impacts, while prairie dog habitat was an indicator of overall ecological conditions.

These correspond to the largest-acreage impacts of the C-470 Proposed Action, which would add approximately 120 acres of impervious surface area and eliminate about 14 acres of roadside prairie dog habitat.

Table 4-24
Past, Present and Reasonably Foreseeable Future Actions

Action	Effects
PAST ACTIONS	
1975 – Chatfield Dam and Lake completed (begun in 1967 after devastating South Platte River flood in 1965). USACE land leased to Colorado State Parks in 1974 and Chatfield State Park opened in 1976.	Altered flow of South Platte River; replaced prairie with lake ecosystem and major attraction for birds; attracted vehicular recreation trips from throughout the region; floodplains downstream along South Platte converted to park and recreation uses
1980 to 1990 - existing C-470 built in stages as a State Highway, after being withdrawn as a planned Interstate Highway 470	Provided main east-west transportation link for high-growth area, replacing prairie habitat and hampering wildlife movement; introduced highway noise to the area; increased vehicle-related air pollution emissions in the area
1980 to 2015 Urban growth along C-470, includes the region's largest shopping mall (Park Meadows opened in 1996) and other retail development; Highlands Ranch residential development (100,000 residents) reached Buildout in 2014	Replaced prairie with urban land uses, displacing wildlife and hampering wildlife movement; increased impervious surface, contributing to water pollution; area increases demand for water supply, leading to South Platte Reservoir and others; major traffic growth increases highway noise
1991 – Toll highway E-470 opened, connected to C-470.	Provided direct route to Denver International Airport, which opened in 1995. Supported increased growth in the southeastern portion of the metro area.
2002 – NEPA Record of Decision for South I-25 Corridor and US 85 Corridor	Provided environmental clearance to widen I-25 from Denver to Castle Rock (done) and US85 from Castle Rock to Littleton (still underway). US85 corridor impacts wildlife movement and black-tailed prairie dogs
2003 – E-470 Extension to I-25 in northern Adams County in 2003 completed 75 percent of a beltway around the Denver region.	Together, C-470, E-470 and the Northwest Parkway total 85 miles. As more of the beltway is completed, likelihood of regional trips on C-470 increases.
2004 – Voters approve $4.7 billion FasTracks light rail system	Southwest Line ends near Mineral Avenue, along Santa Fe Drive, north of C-470. Southeast Line has stations at Park Meadows Mall and Lincoln Avenue, at eastern end of C-470. Transit plan implemented with strong emphasis on increased density of development near stations.
2006 – Completion on $1.67 billion T-REX I-25 expansion through Denver, including highway widening and the Southeast Corridor Light Rail Line	The newly added capacity enables more vehicles to get to and from C-470, potentially worsening C-470 congestion.
2006 – Denver's mayor (now Colorado's governor) announced the Mile High Million initiative to plant one million additional trees in Denver by 2025.	Increasing Denver's forest from 2.2 million trees (baseline) to 3.2 million could capture CO2 from the environment and reduce cooling costs thus reducing fossil fuel use. Related studies estimated that Littleton (abutting C-470) had an estimated 316,000 trees and the regional total was 9.6 million.
2011 – South Santa Fe flyover ramp at C-470 opens, to improve safety	Ramp is adjacent to Wolhurst Mobile Home Community, with visual effects, but relieving gridlock in front of the Wolhurst community entrance, improving mobility for residents.

Table 4-24 (continued)
Past, Present and Reasonably Foreseeable Future Actions

Action	Effects
PRESENT ACTIONS (2015)	
Developments along C-470 between Lucent and Santa Fe Drive – Children's Hospital (175,000 square feet), Wind Crest retirement community and 2015 expansion (1,800 living units); Villas at Verona (550 patio homes), Littleton Commons (386 apartments), car dealership and commercial sites	These in-fill developments are rapidly converting grassland to dense development just east of Santa Fe Drive.
Sterling Ranch development (12,000 homes planned) beginning development along US 85 (South Santa Fe Drive), south of Chatfield Reservoir	Construction will attract truck traffic and development will eventually generate increased traffic demand at C-470 Santa Fe intersection; encroaching development will reduce wildlife habitat and access to Chatfield State Park from the south.
USACE Water Reallocation Project – NEPA ROD approved in 2014 allows USACE to increase water storage in Chatfield Lake	Action will raise water levels, inundating existing shoreline and necessitating relocation of various Chatfield Park amenities. Also resulting in loss of 350 acres of trees plus Preble's Mouse habitat. Will require some construction traffic and may temporarily reduce park visitation.
FUTURE ACTIONS	
US 85 widening south of C-470, pursuant to 2002 NEPA ROD or subsequent decision	Funding recently approved by DRCOG would address immediate traffic needs south of C-470 interchange, but additional interchange improvements are anticipated in the future.
Shea Homes Plum Creek Development along US 85 south of Chatfield State Park, 1,250 additional new homes	Further loss of habitat and further surrounding of Chatfield State Park with development from the southeast.
RTD Light Rail extension to Lucent Boulevard, planned but does not have approval or funding	RTD continues to plan for future extension of the Southwest Line from Mineral Station southward across C-470 then eastward to Lucent Boulevard. Light rail stations attract vehicular traffic to parking lots and promote dense, transit-oriented development.
E-470, immediately east of C-470, will be widening to add two lanes between I-25 and Parker Road, in the 2025-2035 timeframe.	The I-25/C-470 interchange will need to be able to accommodate appropriate connections to the new lanes.
Continued local and regional development – between 2015 and 2035, 33,000 additional residents and 47,000 additional jobs in the C-470 area, and 1 million additional residents in the Denver metro area, using regional transportation facilities	Additional traffic, congestion, impervious surface, water consumption, loss of wildlife habitat can all be expected. However, by increasing density and establishing urban growth boundaries, the region is avoiding additional land consumption that would have resulted from past development practices.

Table 4-25
C-470 Proposed Action Cumulative Effects Potential

Resource	Effects of Proposed Action	Cumulative Effects Potential
Transportation	Proposed Action would provide travel time reliability, potentially enabling RTD to run bus routes on C-470. It would improve mobility in one of the region's key congested corridors as identified by DRCOG.	LOW: Improving mobility in this corridor would address a regional congestion bottleneck, potentially benefitting the entire regional transportation system.
Demographics	By improving mobility, the Proposed Action may provide opportunities for development in the project area to occur more quickly than under the No-Action Alternative.	NONE.
Minority and Low Income Populations	Existing noise wall relocated slightly closer to Wolhurst low-income mobile home community for persons 55 years or older.	LOW: Past flyover construction, current nearby land development, future Santa Fe Drive improvements, and future light rail extension are intensifying the urban surroundings of this community.
Economic Considerations	Short-term increased employment for roadway construction. Long-term mobility enhancement could keep the area more economically viable compared with worse congestion under the No-Action Alternative.	NONE.
Land Use	The Proposed Action would not directly change land use and would not add or eliminate local access to the freeway.	NONE.
Right-of-Way	About 5.5 acres of vacant land to be acquired for right-of-way, requiring no relocation of residences, businesses or other land uses.	NONE.
Parks and Recreation	The project would result in temporary closures for three trails, and increased noise for parks and trails close to the highway. The new C-470 bridges over the South Platte River would provide an improved, safer crossing for the Mary Carter Greenway Trail.	LOW: Apart from the direct impacts of the Proposed Action, no other past, present or reasonably foreseeable actions would adversely affect these facilities.
Visual and Aesthetic Character	Corridor visual character will shift from rural/suburban to more urban with added lanes, additional signage, and loss of grassy median. Use of CDOT Region 1 standards will improve design consistency.	MODERATE: The character of the C-470 Corridor has greatly changed since the highway opened and rapid change has occurred in recent years, with residential build-out of Highlands Ranch recently completed and infill development occurring along C-470 at Erickson Boulevard and along South Santa Fe Drive.

Table 4-25 (continued)
C-470 Proposed Action Cumulative Effects Potential

Resource	Effects of Proposed Action	Cumulative Effects Potential
Utilities	Numerous utilities would be relocated.	LOW: Utility relocation is a routine occurrence. Utility service is not ordinarily disrupted. Relocation costs ultimately get passed along to customers through rate increases.
Transportation	Key impact is typical construction-related congestion for up to two years. It is anticipated that there will be a near-term Interim project and a future project to complete the Ultimate configuration.	LOW: Major highway improvement projects have been underway in the Denver region for the past two decades (e.g. TREX project, central I-25, I-25 Douglas County lane balancing).
Common Wildlife	Minor loss of deer habitat; wider roadway more difficult to cross; black-tailed prairie dogs displaced, reducing prey for raptors; temporary disruption to raptors and other birds; key South Platte River wildlife crossing will be improved.	LOW: The C-470 Corridor is largely developed, with large areas of park land and open space. Continued growth region-wide (one million additional residents by 2035) and in northern Douglas County will consume habitat, confining wildlife to parks, open spaces and drainage corridors.
Threatened/ Endangered Species	Loss of 14.3 roadside acres of prairie dog colonies would reduce the amount of potential Burrowing Owl habitat in the area. This State Threatened owl may occur but is not known to occur in CDOT right-of-way along the freeway.	LOW: Prairie dog colonies within the metro area are continually being displaced and more confined to undevelopable lands with lower quality habitat (e.g., adjacent to freeway).
Wetlands and Waters of the U.S.	Permanent impacts of 0.70 acre and will be mitigated on one-to-one basis. No net loss.	LOW: Mitigated C-470 project impact would have negligible effect.
Prime and Unique Farmlands	No resource present in project area	NONE.
Vegetation	Hundreds of existing trees would be removed, but many of them of them would be replaced: in riparian areas, those over two inches in diameter at breast height would be replace on-site; for non-riparian areas, those over four inches in diameter would be replaced somewhere within the project area. Up to 2.77 acres of riparian habitat affected (temporary and/or permanent), but impacts will be avoided, minimized and mitigated in accordance with SB 40 requirements.	LOW: These are specific, localized effects to resources generally not impacted by other foreseeable actions.

Impervious Surface Area and Water Quality

Quantitatively, the largest impact of the C-470 Proposed Action would be the creation of new pavement, or impervious surface area. Impervious surface area would increase from 204.9 acres for the existing condition and No-Action condition to 324.7 acres with the Proposed Action. This is an increase of 119.8

acres over the 13.75-mile Proposed Action. This roughly 120-acre increase is spread out over a number of drainage sub-basins, although eventually they all flow to the South Platte River, a watershed size of over 3,000 square miles.

The 12 drainage sub-basins that receive C-470 runoff conservatively average at least two square miles (1,280 acres) in size, so the roughly 120 acre impervious surface increase from the Proposed Action would equate to less than a 1 percent increase in impervious surface area for sub-basins along the corridor.

In the case of C-470 Proposed Action, the roughly 120-acre increase in impervious surface area is being offset having 185 acres of C-470 ROW will newly addressed with water quality BMPs. The expected result of the Proposed Action is a net water quality improvement.

Black-Tailed Prairie Dog Colonies: It was noted earlier that the C-470 Proposed Action would consume about 14.3 acres of black-tailed prairie dog habitat, out of the 90 acres found within CDOT ROW along the project corridor. This animal is not officially threatened or endangered but is considered a Species of Special Concern by CPW as it offers prey and habitat for other species. In some cases, a colonies would only be partially affected, in terms of the physical area involved, but partial disruption could affect the viability of the entire colony.

The loss of 14 of 90 acres is about a 16 percent reduction (or more, depending on partial colony abandonment). This is consistent with an estimated 18 percent loss regionally that was predicted within the DRCOG Urban Growth Boundary in a 2008 study called *Areawide Coordinated Cumulative Effects Analysis* prepared by University of Colorado researchers (Muller et al., 2008). That study estimated there to be over one million acres of black-tailed prairie dog habitat in the region, and predicted that continuation of prevailing development patterns would result in the loss of over 180,000 acres by 2030. Thus, the C-470 Proposed Action would contribute a minute fraction of the overall ongoing regional trend.

These animals are found within CDOT ROW in part because they have been displaced by adjacent development, and the highway roadside is what remains available to them. The same problem is encountered elsewhere around the state, which resulted in the need for a statewide policy on how to deal with the issue. Section 4.4.1 noted that for C-470 Corridor impacts, CDOT will follow this *2009 CDOT Impacted Black-tailed Dog Policy.* This policy prioritizes animal relocation as a first option (for colonies two acres or larger), followed by other humane and environmentally responsible options if relocation is not feasible.

4.7.3 Cumulative Effects Conclusion

The C-470 Proposed Action direct effects most likely to have cumulative effects are the water quality impacts of adding 120 acres of impervious surface and the ecological impacts of displacing about 14 acres of prairie dog colonies. However, water quality BMPS being designed as mitigation for the Proposed Action will more than offset direct impacts, resulting in improved water quality. Additionally, the loss of 14 acres of low-quality roadside prairie dog habitat is negligible in the context of ongoing regional development that is making the Denver metropolitan area increasingly incompatible as habitat for this animal and the other grassland species that depend on it for prey.

It is concluded that no cumulative effects mitigation is needed to augment mitigation of direct project impacts.

CHAPTER 5
PUBLIC AND AGENCY COORDINATION

5.1 INTRODUCTION

Public and agency coordination is an essential element of the NEPA process. It is critical that stakeholders with an interest in the outcome of the transportation decision making process be informed of the proposed improvements and have an opportunity to inform the decision makers about how the improvements would affect the resources within their jurisdiction.

5.2 PUBLIC INVOLVEMENT

Public and agency involvement for the C-470 Express Lanes project has occurred in several parts over time:

- 2003-2006 - Extensive public and agency involvement throughout development of the 2006 EA
- 2012 – Public meetings and telephone town hall events to solicit input on project funding alternatives
- 2014 – Public meetings and telephone town hall events to share preliminary findings of the Revised EA
- 2015 – Follow-up small group meetings with various groups; a formal public hearing is planned during the final Revised EA public review period.

5.2.1 Public Involvement for the 2006 EA

The public involvement efforts undertaken for the 2006 EA were reported in Chapter 4 of that document. They included 17 public open house meetings as well as a formal public hearing after the EA was approved.

As these efforts took place roughly a decade ago, they are not being recounted in detail here. They are mentioned for the purpose of demonstrating that the NEPA process was carried out in accordance with FHWA and CDOT requirements.

Image from an ABC Channel 7 News report about a C-470 Public Meeting in 2014.

Subsequently, some of the decisions and findings from the 2006 EA were carried forward and used in this Revised EA.

5.2.2 Public Involvement in 2012

In February 2011, about five years after the 2006 EA was completed, the counties and cities along the C-470 corridor formed the C-470 Corridor Coalition. CDOT is an affiliate, non-voting member of this local government group.

The group's adopted Charter consists of three "overarching" goals for the C-470 corridor:

- Develop and evaluate options for the C-470 Corridor which are cost effective;
- Reach consensus on technical solution(s) for the C-470 Corridor; and
- Develop a strategic plan for phased implementation.

Working together, CDOT and the C-470 Corridor Coalition conducted a set of five telephone town hall events that reached over 21,000 local residents in July and August 2012. These were followed by four Public Open House Meetings in the fall and a public opinion survey in November. The purpose of these efforts was to obtain public input on funding options, including not just tolls but also sales tax and property tax increases. Road tolls were the approach that received the most public support.

CDOT worked closely with the C-470 Corridor Coalition on preparation of this Revised EA.

5.2.3 Public Involvement in 2014

Another set of three telephone town hall events and four open house public meetings was held in September 2014 for the purpose of reporting Revised EA progress to date, including announcement that the coalition in February 2013 unanimously agreed on tolling as the recommended funding option.

In the telephone town halls, residences in the project area were called automatically to invite them to participate. Citizens were invited to submit questions that were then answered by project technical staff and local elected officials. The telephone town halls were also used to announce the upcoming open house meetings, where detailed questions could be answered in greater depth.

5.2.4 Public Involvement in 2015

Preliminary environmental findings presented in the 2014 public meetings did not include the results of traffic noise analysis, but when these became available, additional Open House Public Meetings were scheduled for this topic in February 2015. CDOT participated in additional presentations on this topic to community organizations and other interested groups.

Information presented at some of the C-470 public meetings is available online at the project website discussed in **Section 5.2.6**.

As practiced by CDOT and FHWA, the NEPA process for an EA normally provides an opportunity for a public hearing if one is desired, and a 30-day public review and comment period once the EA is completed. For the C-470 Express Lanes Project, a formal public hearing will be conducted and the public comment period will be extended to 45 days in response to a public request already received.

MAJOR PUBLIC MEETING EVENTS FOR THE C-470 REVISED EA

- Telephone Hall Meeting, July 31, 2012
- Telephone Hall Meeting, August 1, 2012
- Telephone Hall Meeting, August 2, 2012
- Public Open House meeting, September 24, 2012, Littleton
- Public Open House meeting, September 25, 2012, Highlands Ranch
- Public Open House meeting, September 26, 2012, Centennial
- Public Open House meeting, September 27, 2012, Lone Tree
- HPTE Public Open House meeting, August 19, 2014, Highlands Ranch
- Telephone Hall Meeting, September 9, 2014
- Telephone Hall Meeting, September 10, 2014
- Telephone Hall Meeting, September 11, 2014
- Public Open House meeting, September 25, 2014, Littleton
- Public Open House meeting, September 16, 2014, Highlands Ranch
- Public Open House meeting, September 17, 2014, Lone Tree
- Public Open House meeting, September 18, 2012, Centennial
- Public Open House Meetings on Noise Analysis Results, February 10 and 11, 2015, Highlands Ranch

- ANTICIPATED PUBLIC HEARING August 2015

In recognition of the identified cluster of households with limited English proficiency in the Dakota Station neighborhood a half mile north of C-470 and east of Kipling Parkway, CDOT will prepare outreach materials in Spanish to distribute or post in that neighborhood in advance of the Public Hearing for the Revised EA. CDOT routinely publicizes the availability of resources to accommodate Spanish speakers at public hearings.

5.2.5 Traditional News Media

To provide timely and accurate press and broadcast media coverage of the C-470 Corridor Revised EA, calendar alerts, press releases, and media advisories were produced throughout the study when decision points were reached in advance of each public open house meeting. The study received media coverage in local news publications, including the *Denver Post, Highlands Ranch Herald, Denver Voice*, and on local broadcast television. Paid advertisements were also printed in local newspapers to promote public interest and participation in the planning and environmental process.

5.2.6 Project Website

The C-470 Corridor Coalition developed and maintained a website of project information for much of the Revised EA process, before later transferring this responsibility to CDOT. The current web address for project information is: https://www.codot.gov/projects/c470ExpressLanes.

5.3 AGENCY COORDINATION

The Revised EA process began with an environmental scoping meeting that was held on May 13, 2013. The purpose of this meeting was to introduce the Revised EA approach to affected stakeholder agencies and to solicit their early input regarding any key issues needing to be addressed. In addition to FHWA and CDOT, other agencies represented included the Denver Regional Council of Governments, U.S. Army Corps of Engineers, and Colorado Parks and Wildlife.

Coordination activities with federal and state resource agencies included phone calls, e-mails, letters, and meetings to provide study information to these agencies, and to gain necessary acceptance through the planning and environmental process. The agencies consulted are shown here:

- U.S. Army Corps of Engineers
- South Suburban Parks and Recreation District
- Colorado Parks and Wildlife
- Chatfield State Park
- National Park Service
- U.S. Fish and Wildlife Service
- Colorado Division of Wildlife
- State Historic Preservation Office
- Colorado Department of Public Health and Environment

In conjunction with the 2013 Agency Scoping Meeting, FHWA invited USACE to participate formally as a Cooperating Agency in the Revised EA. It was noted earlier in this Revised EA that for several miles between Wadsworth Boulevard and South Santa Fe Drive, C-470 is located on an easement granted to CDOT (formerly Colorado Department of Highways) by USACE.

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