These results indicate that the performance of the overall system improves for the EL Alternative, as compared to the No-Action Alternative because it serves more vehicles while reducing the overall time drivers spend on the facility.

TRAVEL PATTERNS. The additional capacity provided by the EL Alternative would result in a higher-intensity peak period, but for a shorter amount of time for both the freeway and arterial system, as compared to the No-Action Alternative. The EL Alternative could accommodate additional demand from the adjacent arterial streets that could not be accommodated in the No-Action Alternative. This is observed at Colorado Boulevard where the proposed express lane access reduces the demand on adjacent interchanges by serving trips oriented to and from the adjacent communities.

Figure 3-12a, **Figure 3-12b**, **Figure 3-13a**, **Figure 3-13b**, **Figure 3-14a**, and **Figure 3-14b** show the volumes derived from the AIMSUN micro-simulation model for the No-Action, GPL, and EL Alternatives, respectively. Compared to No-Action, the EL Alternative traffic volumes would be 18 to 22 percent higher on Wadsworth Boulevard and 10 to 20 percent higher on sections of Chatfield Avenue.

Other differences between the EL and No-Action alternatives would occur on Santa Fe Drive north of County Line Road (seven percent decrease with EL Alternative); Broadway (10 to 25 percent increase with EL Alternative); sections of County Line Road; and along Town Center Drive (50 percent increase with EL Alternative). These differences in the projected EL Alternative traffic volumes can be attributed to the proposed locations of C-470 express lane access between Lucent Boulevard and University Boulevard.

Traffic volume differences between the EL Alternative and the No-Action Alternative on County Line Road (20 to 30 percent increase), Quebec Street (15 to 20 percent increase), and Colorado Boulevard (20 to 30 percent increase) can be attributed to the proposed express lanes access at Colorado Boulevard and between Quebec Street and Yosemite Street.

INTERCHANGES AND ARTERIAL INTERSECTION OPERATIONS. Intersection delays were evaluated to determine the LOS for arterial intersections for 2025 volumes. Overall, projected intersection operations are generally consistent between the No-Action and EL Alternatives. The EL Alternative is expected to provide slightly better intersection operations at the Wadsworth Boulevard interchange than the No-Action Alternative. The intersection of Chatfield Avenue and Platte Canyon Road is projected to operate under severely congested conditions. The LOS analysis indicates that 56 of the 67 intersections operate at LOS D or better during the AM period, and 45 intersections operate acceptably for the PM peak period. Most of the intersections with congested operations are in the eastern section of the project area. Analysis results for the intersections requiring mitigation are shown in **Tables 3-23a** and **3-23b**. Due to the express lane access at Colorado Boulevard, the EL Alternative would increase intersection delay at the Colorado Boulevard intersections with County Line Road and Dry Creek Road.

The EL Alternative would result in the same effects to the local street system as the GPL Alternative.

SAFETY. The EL Alternative is expected to provide similar safety benefits to those described for the GPL Alternative. However, an incremental increase in accident frequency over the GPL Alternative can be expected due to additional turbulence generated in the

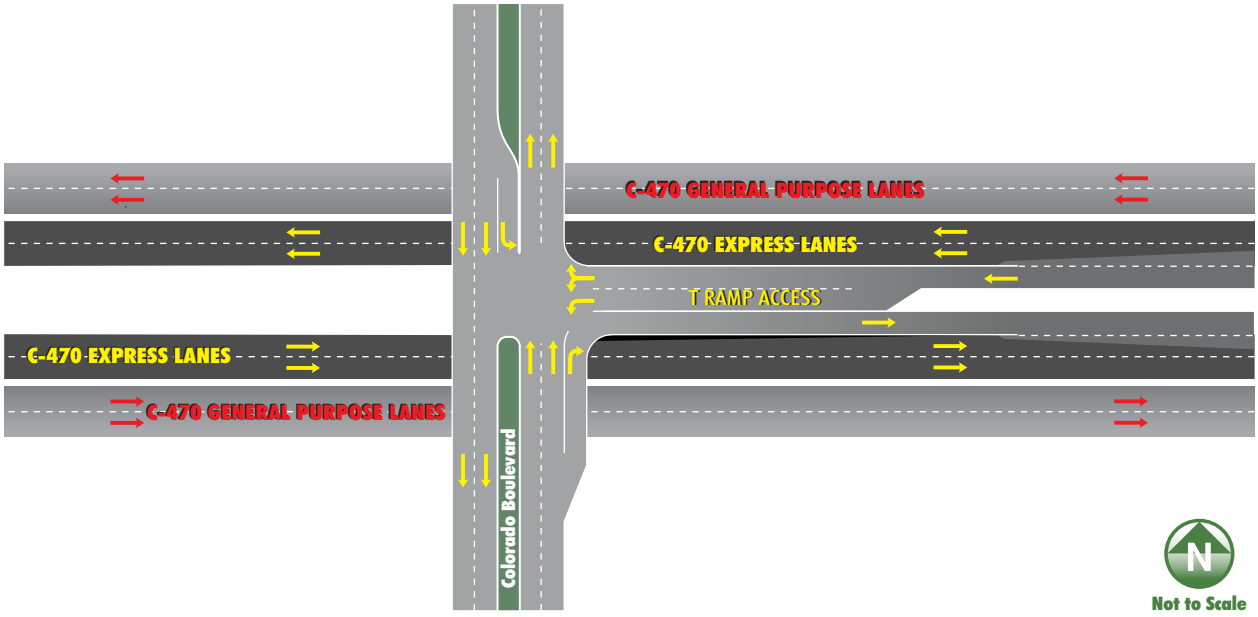
general purpose lanes portion near ingress and egress points to the express lanes. The EL Alternative is also expected to address geometric problems at interchanges identified in the existing conditions analysis.

SANTA FE DRIVE INTERCHANGE OPERATIONS. The Santa Fe Drive interchange under the EL Alternative would have effects similar to the GPL Alternative, as shown in **Tables 3-21a** and **3-21b**. However, the express lane access point between Lucent Boulevard and Broadway carries a portion of Santa Fe Drive-oriented C-470 traffic through Lucent Boulevard and County Line Road, reducing the burden on Santa Fe Drive. This would lead to poorer operations at the Santa Fe Drive/County Line Road intersection for the EL Alternative. As stated previously, the Express Lanes Alternative operates at mainly LOS C/D during both peak hours.

I-25 INTERCHANGE OPERATIONS. Like the GPL Alternative, the I-25 interchange would accommodate 35 to 50 percent higher volumes for the EL Alternative as compared to the No-Action Alternative during peak hours. Also similar to the GPL Alternative, northbound I-25 to C-470/E-470 and the C-470/E-470 to southbound I-25 ramps are expected to operate at LOS F due to high-volume conditions and the unavailability of adequate capacity. This would cause queuing, delays, and LOS F on mainline I-25, C-470, and E-470. Operational problems on C-470 would significantly reduce the desirability of express lanes and adversely influence the arterials and interchanges along C-470. Weave movements on I-25 between C-470/E-470 interchanges and Lincoln Avenue interchange are also projected to operate at LOS F and affect adjacent interchanges and operations on mainline I-25. More information on I-25 interchange design and operations can be found in *I-25 Lane Configuration-County Line to Lincoln* (February 2005).

COLORADO BOULEVARD INTERCHANGE EFFECTS. Express lane T-ramps to and from the east at Colorado Boulevard were identified as an optimal express lane ingress and egress access at this location. The layout for this new interchanges is shown in **Figure 3-15**.

Figure 3-15
Access to Colorado Boulevard From the Express Lanes



A sensitivity analysis was conducted to assess the suitability of providing an express lanes access at Colorado Boulevard. Results of the sensitivity analysis indicated that Colorado Boulevard would be the best express lanes access point that serves the most people. This express lanes access results in increased volumes along Colorado Boulevard, County Line Road, and Highlands Ranch Parkway. However, all the intersections along Colorado Boulevard would operate acceptably (LOS D or better) with reserve capacity to handle additional traffic. In contrast, express lanes access at University Boulevard would place a burden on already-congested intersections on major streets, cause more out-of-direction travel, and create congestion on C-470. These effects would not be offset by the benefits of lower volumes on Colorado Boulevard.

An origin-destination analysis was performed to assess the types and origins of trips that would be served by the express lanes access at Colorado Boulevard. Results of this analysis indicated that this access would be used by residents adjacent to Colorado Boulevard and that it would not create any cut-through trips through adjacent neighborhoods. Moreover, express lane access at Colorado Boulevard would decrease daily trips on some neighborhood streets including Venneford Ranch Road by approximately five percent. A portion of the additional volume on Colorado Boulevard would also affect Dry Creek Road. More information on the sensitivity analysis on Colorado Boulevard can be found in *Assessment of Colorado T-Ramp Access to Express Lanes* (December 2004).

The effects of a potential access to Colorado Boulevard from the express lanes can be summarized as follows:

- Access at this location provides adequate access to traffic oriented to/from the area adjacent to the Colorado Boulevard T-ramps and carry approximately 1800 vehicles in the PM peak hour.
- Intersections adjacent to the T-ramp operate at acceptable levels of service (D or better) despite carrying higher volumes on Colorado Boulevard as compared to the General Purpose Lane or the No-Action Alternative. Colorado Boulevard south of the T-ramps carries high volumes to the residential areas adjacent to Colorado Boulevard and University Boulevard. Residential parcels in the City of Centennial (north of County Line Road) contribute 23-31 percent of the total traffic using the T-ramps. The increase in volume between Dry Creek Road and County Line Road along Colorado can be attributed to trips from these residential areas.
- Trips entering and exiting the express lanes at Colorado Boulevard are primarily residential traffic along with some (10-12 percent) commercial trips. About 80 percent of the additional trips (due to the T-ramps) are contained south of Dry Creek Road. Approximately 50 percent of the PM peak traffic entering the express lanes at Colorado Boulevard are from areas south of C-470 with the other half from north of C-470. Approximately 62 percent of the PM peak traffic exiting the express lanes at Colorado Boulevard travel south of C-470 and the remaining 38 percent travel north on Colorado Boulevard.
- The presence of an access point to the express lanes at Colorado Boulevard provides additional options for traffic traveling west from I-25 to south of C-470 between University Boulevard and Quebec Street. The T-ramps not only provide an alternative route to busy streets like University Boulevard or Quebec Street, but also create additional opportunities for other traffic to share the same route by distributing demand and reducing out-of-direction trips.
- The origin-destination percents for the GPL Alternative as compared to the EL

Alternative would change due to the absence of alternative access to C-470. The origin-destination patterns for the GPL Alternative would be very similar to existing travel patterns in the vicinity of Colorado Boulevard.

- Traffic analysis indicates that most of the trips served by the Colorado Boulevard T-ramps are oriented to/from parcels in the vicinity of Colorado Boulevard and do not induce any "cut-through" or out-of-direction trips.

3.3.1.3 Mitigation

No-Action Alternative

No mitigation measures are anticipated for the No-Action Alternative.

General Purpose Lanes Alternative

To mitigate increased traffic and congestion that would result from the GPL Alternative, intersection improvements would be necessary at the following locations, also shown graphically in **Appendix D**; pages D49-D52.

- Lucent Boulevard/County Line Road – add an additional westbound left turn lane and northbound left turn lane

- Broadway/County Line Road – add a 450-foot right turn acceleration lane on County Line Road west of Broadway; add a 550-foot right turn acceleration lane on County Line Road east of Broadway; add a continuous northbound right turn lane between the C-470 westbound off-ramp and County Line Road; add a 300-foot right turn auxiliary lane on southbound Broadway between County Line Road and C-470

- University Boulevard/County Line Road – add a continuous northbound right turn lane between the C-470 westbound off-ramp and County Line Road; add a 600-foot right turn acceleration lane on University Boulevard south of County Line Road; add a 500-foot right turn deceleration lane for the northbound to eastbound right turn

- Colorado Boulevard/County Line Road – physical constraints prohibit mitigation beyond the County Line Road EA improvements in this area

- Quebec Street/County Line Road – add a continuous southbound right turn acceleration/deceleration lane on Quebec Street north of County Line Road

To mitigate the effects of additional traffic on the I-25 interchange, the GPL Alternative includes four interchange modifications to alleviate these operational deficiencies:

- Westbound C-470 would be modified to receive the left-hand merge from northbound I-25 to westbound C-470 ramp through a lane addition. This modification would provide for higher ramp and merge capacity for the northbound I-25 to westbound C-470 movement

- The C-470/E-470 ramps to the southbound I-25 on-ramp would be converted from a single- to a dual-lane ramp, and I-25 would be reconfigured to receive this ramp through a (fourth) lane addition. The modified design for this ramp would produce better operations for the ramp and subsequently for both C-470 and E-470. The fourth through lane for southbound I-25 would be added at the C-470 ramp gore instead of at the County Line Road ramp, indicating that this lane addition would be more appropriate at I-25 than at County Line Road; the lower traffic volume entering from County Line Road could adequately negotiate a lane drop configuration. The volumes on the C-470/E-470 ramps are significantly higher than the County Line Road ramp. This would also allow the development of a two-lane on-ramp (one lane for the eastbound E-470

ramp and one lane for the westbound E-470 ramp) for the C-470 connection to southbound I-25. The County Line Road ramp would remain a ramp entrance drop as it is today

- This fourth through-lane for southbound I-25 would be carried through the Lincoln Avenue interchange instead of dropping it between the Lincoln Avenue off-ramp and the westbound Lincoln Avenue loop ramp. This would allow a ramp lane (traffic from C-470/E-470) to become the freeway through-lane and eliminates a through-lane drop. The elimination of this lane drop was achieved by maintaining the same configuration of the existing westbound Lincoln Avenue loop ramp. This existing condition is an acceleration lane tapered into the through lanes

- The off-ramp from northbound I-25 to westbound C-470 and eastbound E-470 would be modified from a one-lane to a two-lane ramp, which would facilitate better ramp operations and provide for better operations on I-25 by alleviating some of the weaving intensity on I-25. The modified design for northbound I-25 recommends that the gore of northbound I-25 and the C-470/E-470 ramp be moved farther to the south to allow additional distance from this gore to the gore of the C-470/E-470 ramps. The critical issue of this configuration is that this two-lane ramp splits into one lane for each of the C-470 and E-470 ramps. The existing infrastructure does not allow an additional lane to be continued on either of these ramps. Additional distance between the C-470 and E-470 ramp gores and the I-25 mainline gore would facilitate the signing of the C-470/E-470 ramps and the weaves required to move into the correct lane

Express Lanes Alternative (Preferred Alternative)

Mitigation for the EL Alternative would be the same as for the GPL Alternative.

3.3.2 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). These regulations are enforceable through Colorado's State Implementation Plan (SIP) for air quality. Colorado Air Quality Control Commission Regulation No. 10, "Criteria for Analysis of Conformity" enacts the federal conformity requirements as part of Colorado's SIP.

Since 1996, the Denver area had remained free of air quality violations until the introduction of the new eight-hour standard for ozone. This ozone standard was violated in 2002 and 2003.

The Denver area is under an EPA approved Early Action Compact (EAC) that voluntarily imposed control measures to lower eight-hour ozone precursors with the goal to clean the air sooner than required by law. If the EAC is successful in achieving its goals, the Denver area will attain the eight-hour ozone NAAQS in 2007.

Conformity requirements apply to transportation plans and programs that are developed by Metropolitan Planning Organizations (MPO) and also to federal transportation projects. The designated MPO for the Denver metro area is DRCOG. DRCOG has demonstrated conformity for the current, approved long-range transportation plan and TIP for the Denver metro area in the following plans:

- *DRCOG Metro Vision 2030 Regional Transportation Plan* (RTP), adopted by DRCOG in January 2005

- *2005-2010 Transportation Improvement Program* (TIP), adopted by DRCOG on March 17, 2004

However, the RTP and TIP do not reflect capacity improvements on C-470 because funding was not identified for the project at the

time DRCOG completed these plans. CDOT is currently working with DRCOG to amend these plans to include the C-470 project. Once the plans are amended, this project can be approved for implementation.

As part of this EA, air quality quantitative and qualitative analyses were performed to determine whether there were differences between the air quality effects of the alternatives under consideration. As required under federal "conformity" regulations, analysis also was conducted to determine whether any alternative would likely cause a conformity emissions budget to be exceeded, and whether localized hotspot concentrations at worst-case intersections would be likely to cause or contribute to a violation of a standard. This detailed analysis is documented in detail in the *Air Quality Technical Report* (March 2005). The type of analysis and the future years assessed for each type of air pollutant were determined based on interagency consultation involving the FHWA, CDOT, DRCOG, the Colorado Department of Public Health and Environment, and the EPA.

3.3.2.1 Affected Environment

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 attainment status for the region with respect to the NAAQS is shown in **Table 3-24**.

DRCOG's latest conformity findings, based on analysis of the *2005-2010 Transportation Improvement Program and Metro Vision 2030 Regional Transportation Plan* (Metro Vision 2030), demonstrated that emissions from on-road motor vehicles will remain within the applicable conformity budgets through 2030, even as the region's population grows by over one million residents and daily vehicle miles of travel

Table 3-24
Denver Regional Air Quality Status, March 2005

Pollutant and Standard	Plan Status	Comments
Carbon monoxide (CO)	Maintenance Plan approved by EPA effective November 2004	Demonstrates attainment through 2013 with a CO emissions budget of 1,520 tons per day
Ozone 1-hour standard	Maintenance Plan approved by EPA in September 2001	Demonstrates attainment through 2013 with emissions budgets of 119 tons per day for Volatile Organic Compounds (VOC) and 134 tons per day for NOx (summer)
Ozone 8-hour standard	Early Action Compact submitted to EPA in July 2004	Demonstrates attainment by 2007. Does not establish new emissions budget
Particulate matter (PM10)	Maintenance Plan approved by EPA in September 2002	Demonstrates attainment through 2013 with emissions budgets of 119 tons per day for PM10 and 134 tons per day for NOx (winter)
Particulate matter (PM2.5)	No violations recorded. No plan required	Not applicable
Sulfur oxides (SO2)		
Nitrogen dioxide (NO2)		
Lead		

Source: Colorado Department of Health and Environment

increase by 50 percent, from 58 million in 2000 to 104 million in 2030.

The air quality analysis for this EA was prepared prior to the adoption of DRCOG's 2030 RTP. At that time, the adopted transportation plan and conformity analysis extended only through the year 2025. This analysis was prepared based on these then-applicable planning assumptions. The results of this analysis show that the No-Action, GPL, and EL alternatives would meet all air quality requirements for all years analyzed.

Subsequent examination of DRCOG's latest conformity findings indicate that the 2030 plan generally meets the standards by slightly increased margins of safety. For example, regional daily carbon monoxide emissions previously were projected to be 1,395 tons in 2025, some 125 tons below the allowable emissions budget (1,520 tons), and now are projected to be 1,207 tons in 2030, or 313 tons under the limit. Similarly, estimated microscale concentrations of carbon monoxide and PM_{10} in the C-470 corridor were so far below the allowable maximums in 2025 that they would clearly not result in any violations of the standards in 2030 either.

Rather than repeat the analysis to incorporate a 2030 planning horizon, when that effort clearly would not yield any different conclusion about project impacts, this EA presents the more conservative results for the 2025 planning horizon, as was required at the time of the analysis. An updated conformity analysis based on the 2030 RTP will be performed by DRCOG as part of the plan amendment process that is needed to approve any C-470 capacity improvements.

One of the inputs to the air quality analysis was the future traffic volume projections on C-470 and on nearby arterial streets that are affected by C-470 traffic. The projections used in the air quality analysis are shown in **Table 3-25**.

Traffic modeling results were obtained from DRCOG, consistent with the planning assumptions used in the RTP. These volumes were used as input to develop turning movements and LOS analysis for the No-Action Alternative using the AIMSUN traffic model. The AIMSUN model was used to project the traffic changes that would occur in response to adding capacity on C-470. The results in **Table 3-25** represent traffic on 13.75 miles of freeway and approximately 80 miles of surrounding arterial streets.

3.3.2.2 Environmental Consequences

The air quality effects of the three C-470 alternatives are discussed in the following sections. They differ among the three respective alternatives, but air quality modeling results indicate that all three alternatives meet federal requirements for all years that were analyzed. Results of the modeling for carbon monoxide are presented in **Table 3-26**. Results pertaining to ozone are

Table 3-25
Projected Daily Vehicle Travel in the C-470 Project Area

Year	Daily Vehicle Miles of Travel in Millions		
	No-Action Alternative	GPL Alternative	EL Alternative
2003	2.66	2.66	2.66
2013	3.13	3.92	3.94
2020	3.30	4.13	4.16
2025	3.42	4.33	4.37
Increase (%) 2003 to 2025:	28.6%	62.8%	64.3%

Source: Derived from C-470 traffic model results

presented in Table 3-27. Results pertaining to particulate matter are presented in Table 3-28.

The discussion of individual alternatives below are followed by a discussion on effects on transportation control measures (TCMs), since all three alternatives have the same impact on TCMs. Discussion of alternatives collectively, rather than individually, is also provided for mobile source air toxics, under the heading of Hazardous Air Pollutants, at the end of this section.

Table 3-26
Modeling Results for Carbon Monoxide

Year		No-Action Alternative	GPL Alternative	EL Alternative
Regional emissions budget is 1,520 tons per day				
2013	Corridor contribution	45.5	61.9	62.3
	Regional total	1,169	1,185	1186
2020	Corridor contribution	52.1	65.3	65.7
	Regional total	1296	1309	1310
2025	Corridor contribution	54.0	68.4	69.0
	Regional total	1381	1395	1396
Modeled microscale concentrations (8-hour standard is 9.0 parts per million)				
2025	Broadway/County Line Road	6.74	6.74	6.54
2025	Quebec Street/County Line Road	6.03	6.28	6.80
2025	Santa Fe Drive/north (westbound) C-470 ramps	4.74	4.74	4.55

Table 3-27
Modeling Results for Ozone Precursor Emissions

Year		No-Action Alternative	GPL Alternative	EL Alternative
Volatile Organic Compounds (VOC) Regional emissions budget is 119 tons per day				
2013	Corridor contribution	3.4	4.3	4.3
	Regional total	84	85	85
2020	Corridor contribution	3.3	4.1	4.2
	Regional total	80	81	81
2025	Corridor contribution	3.4	4.3	4.3
	Regional total	86	87	87
Ozone-related Oxides of Nitrogen (NO_x) Regional emissions budget is 134 tons per day				
2013	Corridor contribution	3.4	5.1	5.1
	Regional total	96	97	97
2020	Corridor contribution	3.3	4.5	4.6
	Regional total	88	89	89
2025	Corridor contribution	3.8	4.8	4.8
	Regional total	93	94	94

Note: This analysis pertains to the traditional 1-hour ozone standard, not the newer 8-hour standard

No-Action Alternative

Under the No-Action Alternative, traffic will continue to build on C-470 and surrounding arterial streets due to planned growth within the project area. Corridor-wide traffic growth of approximately 37 percent will increase emissions due not only to the increased number of vehicle miles traveled, but also to excess emissions attributable to reduced travel speeds caused by worsened traffic congestion.

Air quality modeling and projections that have been prepared for the region's adopted RTP adequately reflect both the future traffic conditions and the future vehicle-related emissions associated with the No-Action Alternative, because the plan does not include capacity improvements on C-470. Regional emissions projections made for DRCOG's conformity analysis indicate that the region will remain within EPA-approved emissions budgets for the foreseeable future. **Tables 3-26, 3-27**, and **3-28** show the results of the emissions analyses for the No-Action Alternative with respect to the various criteria pollutants.

The microscale "hotspot" analysis conducted for the C-470 EA concludes that the No-Action Alternative would not cause localized violations of the air quality standards for carbon monoxide and particulate matter (PM_{10}) during the next two decades. The hotspot analysis for carbon monoxide was performed using the CAL3QHC dispersion model, while the result for particulate matter was derived qualitatively based on detailed modeling prepared for the region's EPA-approved PM_{10} Maintenance Plan. The results are shown in **Table 3-26** and **Table 3-28**. All hotspot results are well within allowable limits, based on the NAAQS.

General Purpose Lanes Alternative

Under the GPL Alternative, traffic would continue to build on C-470 and surrounding arterial streets due to planned growth along the corridor. Of the 73 percent traffic growth on the corridor, half would be due to planned growth along the corridor and half would be due to the addition of capacity lanes on C-470. This would be comparable to, but just slightly less than, the EL Alternative, because the general purpose lanes on C-470 would attract more traffic than the express lanes.

The GPL Alternative would result in increased corridor-wide motor vehicle emissions, due to

Table 3-28
Modeling Results for Particulate Matter

Year		No-Action Alternative	GPL Alternative	EL Alternative
PM_{10} Regional emissions budget is 51 tons per day				
2020	Corridor contribution	2.0	2.5	2.5
	Regional total	47.3	47.8	47.4
2025	Corridor contribution	3.0	2.6	2.6
	Regional total	50.2	50.8	50.8
NO_x Emissions related to PM_{10} Regional emissions budget is 101 tons per day				
2020	Corridor contribution	3.3	4.1	4.2
	Regional total	86	87	87
2025	Corridor contribution	3.4	4.3	4.3
	Regional total	89	90	90
Worst-case modeled microscale concentrations (24-hour standard is 150 micrograms per cubic meter)				
2025	County Line Road at Quebec Street	117	122	122

the increased number of VMT. Emission rates per mile traveled could decline somewhat, due to elimination of excess emissions attributable to traffic congestion. However, as a conservative modeling assumption, regional average emission rates were used in the analysis of this alternative.

The results of the emissions analyses for the GPL Alternative are shown in **Tables 3-26, 3-27**, and **3-28**. For all years and all pollutants analyzed, emissions under the GPL Alternative would be within the EPA-approved emissions budgets.

As shown in **Table 3-26** and **Table 3-28**, the results of the hotspot analyses conducted for the GPL Alternative are within NAAQS requirements.

Express Lanes Alternative (Preferred Alternative)

Under the EL Alternative, traffic will continue to build on C-470 and surrounding arterial streets due to planned growth along the corridor. Of the 73 percent traffic growth on the corridor, half would be due to planned growth along the corridor and half would be due to the addition of capacity lanes on C-470. Motor vehicle emissions within the corridor would increase due to the increased number of VMT. Emission rates per mile traveled could decline somewhat, due to elimination of excess emissions attributable to traffic congestion. However, as a conservative modeling assumption, regional average emission rates were used to analyze this alternative.

Tables 3-26, 3-27, and **3-28** show the results of the emissions analyses for the EL Alternative. For all years and all pollutants analyzed, emissions under the EL Alternative would be within the EPA-approved emissions budgets.

Hotspot analysis conducted for the EL Alternative indicates that no localized violations of the air quality standards for CO and PM_{10} would be anticipated for the next two decades. These results, presented in **Tables 3-26** and **3-28**, are within NAAQS requirements.

Impact on Transportation Control Measures

Federal transportation conformity regulations require that the FHWA projects which are not from a conforming transportation plan or TIP must not "interfere" with the implementation of any transportation control measure in an applicable air quality implementation plan. The region's applicable air quality plans contain strategies that affect vehicle-related emissions, including compliance with federal tailpipe emissions standards, motor vehicle fuel specifications, and reductions in use of sand for street de-icing. However, because none of these are transportation control measures defined in the regulations, all three C-470 alternatives are in compliance with this conformity requirement. Because they also met the emissions budget tests, all three alternatives meet all applicable conformity requirements for a federal project that is not in a conforming regional transportation plan and TIP.

Hazardous Air Pollutants

In addition to the NAAQS, the EPA also regulates air toxics as discussed in the *Air Quality Technical Report* (March 2005). The Clean Air Act identifies 188 compounds that mostly originate from human-made sources, including on-road mobile sources, non-road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners) and stationary sources (e.g., factories or refineries). Of these compounds, the EPA has identified 21 that are emitted from motor vehicle and are known or suspected to cause cancer or other serious health effects. These compounds, known as Mobile Source Air Toxics (MSATs) include various volatile organic compounds, such as acetaldehyde, benzene, formaldehyde, acrolein, and 1,3-butadiene, as well as metals, diesel particulate matter, and diesel exhaust organic gases. Some of these toxic compounds are present in fuel and are emitted to the air when the fuel evaporates or passes through the engine unburned. Other toxics are emitted from the incomplete combustion of fuels or as secondary combustion products. Metal air toxics result from engine wear or from impurities in oil or gasoline.

The EPA has existing and newly promulgated mobile source control programs that include the reformulated gasoline program, national low emission vehicle standards, Tier 2 motor vehicle emissions standards and gasoline sulfur control requirements, and the proposed heavy duty engine and vehicle standards, and on-highway diesel fuel sulfur control requirements. Between 1990 and 2020, the EPA expects that these programs will reduce on-highway emissions of benzene, formaldehyde, 1,3-butadiene, and acetaldehyde by 67 to 76 percent nationally, and will reduce on-highway diesel particulate matter emissions by 90 percent (16 FR 17229, March 29, 2001).

The analysis of air toxics is an emerging field, however. To date, the EPA – the lead Federal agency responsible for the scientific study of air pollutants and for the development of national air quality standards – has not developed NAAQS for MSATs or national project level guidelines or guidance for studying MSATs under various climatic and geographic situations. The EPA has also not established toxicity factors for diesel particulate matter. Without standards and guidance for MSATs, the FHWA does not feel that accurate and reliable estimates of actual human health or environmental impacts from MSATs that may result from transportation projects are scientifically possible at this time.

However, the U.S. DOT and the FHWA are currently working with the EPA to develop and evaluate the technical tools necessary to perform air toxics analysis, including improvements to emissions models and air quality dispersion models. The FHWA's ongoing work in air toxics includes a research program to determine and quantify the contribution of mobile sources to air toxic emissions, the establishment of policies for addressing air toxics in environmental reports, and the assessment of scientific literature on health impacts associated with motor vehicle toxic emissions.

Although there are quantitative methods that can be used, the FHWA does not consider them appropriate and accurate for estimation of the health impacts of MSATs. However, it is possible to qualitatively assess future MSAT emissions. Since the amount of MSATs emitted are proportional to the amount of vehicle miles traveled, or VMT and congestion, it is possible to compare the difference in VMT and congestion between the GPL and EL Alternatives to the No-Action Alternative and determine which alternative is likely to produce greater MSAT emissions in the future, assuming that other variables, such as the mix of vehicle types and age, are the same. For the DRCOG regional air quality planning area, although it is estimated that VMT in 2030 for the No-Action Alternative will be lower than the GPL or EL Alternatives, congestion in the GPL or EL Alternatives would be lower than the No-Action Alternative. Therefore, total MSAT emissions are likely to be lower in the future for the GPL or EL Alternatives than the No-Action Alternative. Furthermore, regardless of the alternative selected for C-470, regional MSAT emissions will likely be lower in 2030 than they are today. This is due to the implementation of EPA's national control programs that are projected to reduce national MSAT emissions by 67 to 90 percent. Although local conditions, such as the age and type of vehicles in the fleet, VMT growth rates, and local control measures, may differ from those used to derive these national projections, the magnitude of the projected reductions by EPA are so great that MSAT emissions in the region and along the C-470 Corridor are likely to be much lower in the future as well.

The science and modeling of project specific MSAT health impacts has not developed to the point where there is certainty or acceptance by the scientific community. Accordingly, health effects have not been provided for the No-Action or the action alternatives evaluated in this EA, and the means to obtain this information have not been fully developed. When this is the case, Federal regulations require the FHWA to include the following information: "1) A statement that

such information is incomplete or unavailable; 2) a statement of the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment; 3) a summary of existing credible scientific evidence which is relevant to evaluating reasonably foreseeable significant adverse impacts on the human environment, and 4) the agency's evaluation of such impacts based on theoretical approaches or research methods generally accepted in the scientific community" (40 CFR 1502.22(b)). These provisions are addressed as follows:

1. Project specific MSAT analysis is an emerging field and the science has not been fully developed and is therefore unavailable. The FHWA is aware that MSAT releases to the environment may cause some level of pollution. What is not scientifically definable is an accurate level of human health or environmental effects that will result from the construction of new transportation facilities or modification of existing facilities. Project-level MSAT risk assessment involves four major steps: emissions modeling, dispersion modeling in order to estimate ambient concentrations resulting from the estimated emissions, exposure modeling in order to estimate human exposure to the estimated concentrations, and then final determination of health effects based on the estimated exposure. Each of these steps is currently encumbered by technical shortcomings that prevent a formal determination of the MSAT effects of this project. The air quality emissions model (MOBILE 6.2) is based on limited data raising concerns over the accuracy of the final estimates. Further, the particulate emissions rates from MOBILE 6.2 are not sensitive to vehicle speed, which is an important determinant of emissions rates (this is a shortcoming for diesel particulate matter, but not the remaining priority MSATs) or acceleration. Given uncertainties in the emissions estimation process, subsequent calculated concentrations would be equally uncertain. But beyond this, the available dispersion models have not been successfully validated for estimating ambient concentrations of particulate matter or reactive organic MSATs. Available exposure models are not well designed to simulate roadside environments. Finally, the toxicity value of at least one of the priority MSATs, that of diesel particulate matter, has not been nationally established, which would prevent the determination of health impacts of this pollutant even if the other necessary tools were available. Thus, current scientific techniques, tools, and data make it impossible to accurately estimate actual human health or environmental impacts from MSATs that would result from a transportation project.

2. Without this project specific MSATs analysis, it is impossible to quantitatively evaluate the air toxic impacts at the project level. Therefore, this unavailable or incomplete information is very relevant to understanding the "significant adverse impacts on the human environment," since the significance of the likely MSAT levels cannot be assessed.

3. Research into the health impacts of MSATs is ongoing. For different emission types, there are a variety of studies that show that some either are statistically associated with negative health outcomes through epidemiological studies (frequently based on emissions levels found in occupational settings) or that animals demonstrate negative health outcomes when exposed to large doses. There have been other studies and papers that suggest MSATs have health impacts. However, noting that unresolved issues still remain, the Health Effects Institute, a non-profit organization jointly funded by EPA and industry, has undertaken a major series of studies to determine whether MSAT hot spots exist and what the health implications are if they do. The final summary of these studies is not expected to be completed for several more years.

Recent studies have been reported to show that close proximity to roadways is related to negative health outcomes – particularly respiratory problems. Yet these studies are often not specific to MSATs. Instead they have encompassed the full spectrum of both criteria pollutants and other pollutants. Thus it is impossible to determine whether MSATs are responsible for the health outcomes or the criteria pollutants.

There is also considerable literature on the uncertainties associated with the emissions modeling process. The most significant of these is an assessment conducted by the National Research Council of the National Academy of Sciences, entitled "Modeling Mobile-Source Emissions" (2000). This review noted numerous problems associated with then current models, including the predecessor to the current MOBILE 6.2 model. The review found that, "significant resources will be needed to improve mobile source emissions modeling." The improvements cited include model evaluation and validation, and uncertainty analysis to raise confidence in the model's output. While the release of MOBILE 6.2 represents an improvement over its predecessor, the MSAT emission factors have not been fully validated due to limits on dispersion modeling and monitoring data. The MOBILE 6.2 model is currently being updated and its results will not be evaluated and validated for several years.

4. Even though there is no accepted model or accepted science for determining the impacts of project specific MSATs, as noted above, EPA predicts that its national control programs will result in meaningful future reductions in MSAT emissions, as measured on both a per vehicle mile and total fleet basis. The FHWA believes that these projections are credible, because the control programs are required by statute and regulation. Also, since the congestion for both the action alternatives will be lower than the No-Action Alternative, the FHWA is confident that MSAT emissions will also be lower in the project area in the design year (2025). There could be slightly elevated but unquantifiable increases in MSATs to residents and others in a few localized areas where VMT increase, which may be important particularly to any members of sensitive populations. Because MSAT emissions on a per VMT basis are expected to decline due to EPA's control program, the FHWA does not believe that there will be significant adverse impacts on the human environment.

3.3.2.3 Mitigation

No permanent air quality effects were identified for which mitigation would be required. 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. Temporary air quality effects related to construction are discussed further in **Section 3.3.17**.

3.3.3 Highway Noise

The FHWA has developed methods and procedures for the evaluation and mitigation of highway noise for federal aid projects in the CFR Title 23, Section 772. The FHWA's requirements for highway noise analysis are implemented on CDOT projects using *CDOT Noise Analysis and Abatement Guidelines* (December 2002). These guidelines define criteria for what is considered a noise impact and how mitigation measures should be evaluated. The guidelines state that a noise impact occurs when a noise-sensitive receptor (such as a residence, park, or business) is subjected to noise levels equal to or exceeding CDOT's noise abatement criteria (NAC), as shown in **Table 3-29.** Noise mitigation must be considered for all impacted areas. The guidelines also state that an impact is considered to occur at receptors where predicted noise levels for future conditions are greater than existing noise levels by 10 dBA or more. This is referred to as the Increase Criterion.

Noise levels are measured in decibels (dB). For most environmental noise measurements, including highway noise, 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 dBA; all A-weighted noise readings in this EA are shown as dBA levels.

The components of highway traffic noise include noise from vehicle engines, vehicle exhaust, and tire/pavement interaction. How highway noise is propagated to an adjacent noise receptor, such as a residence, depends on the distance and the path the noise must travel. If terrain or some type of solid barrier blocks the noise path, this level is generally reduced by 5 to 10 dBA. Topography also affects the propagation by absorbing some of the noise if the terrain is grassy, or by reflecting the noise if it is hard pavement or water. Noise is a subjective topic, as some types are considered to be more irritating or noticeable to some than others. Typically, a change of 3 dBA in traffic noise levels is needed for most individuals to notice a difference. A 5 dBA change is typically always noticed, and if a 10 dBA change occurs, most perceive the noise to be doubled (or cut in half).

3.3.3.1 Affected Environment

A noise analysis was conducted for the C-470 Corridor from Ken Caryl Avenue to I-25. Existing noise levels were determined through a combination of measurements and predictions, and the noise levels from the No Action, EL, and GPL Alternatives were predicted. The predicted levels were compared to CDOT's NAC and Increase Criterion to determine impact.

Existing noise levels within the project area were determined through a combination of measurements and predictions. The purpose of these measurements was to determine the current day-to-day noise trends and to validate the computer noise model for the corridor. Noise levels were measured for approximately one week at each of the 11 locations listed in **Table 3-30**. The table shows the measured loudest hour noise level at each location.

A computer model of noise conditions along C-470 was developed using STAMINA (v2.0). The model was validated by comparing measured and predicted noise levels at the 11

Table 3-29
CDOT Noise Abatement Criteria

Activity Category	L_{eq} (1),(2) (dBA)	Description of Activity Category
A	56 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose
B	66 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals
C	71 (Exterior)	Developed lands, properties, or activities not included in Categories A or B above
D	--	Undeveloped lands
E	51 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals and auditoriums

(1) Hourly A-weighted equivalent level for the noisiest hour of the day in the design year
(2) CDOT noise impact criteria are 1 dBA lower (more stringent) than the FHWA values in 23 CFR 772, to identify noise levels that "approach" the FHWA criteria

locations. Results were compared using both traffic monitored during the noise measurements and typical loudest hour traffic volumes. Field investigations and analyses concluded that conditions exist along portions of the corridor that result in higher measured than predicted noise levels which could be due to the rolling topography, typical wind conditions, and the worn concrete pavement. As the STAMINA noise model does not account for all of these conditions, it was determined that a correction factor was needed for locations east of Kipling Parkway in which C-470 was the primary noise source. As a result, a positive 3 dBA correction factor was added to all predicted noise levels in this study. The *Noise Analysis Technical Report* (July 2005) describes the analysis and result in detail.

3.3.3.2 Environmental Consequences No-Action Alternative

Noise levels from C-470 will change between existing and 2025 no build conditions, primarily due to changes in traffic volume and speed. Traffic noise is loudest when significant amounts of traffic travel at relatively high speeds; this is referred to as LOS C/D conditions. When more traffic is added to the flow, noise levels will increase as long as there is no decrease in speed. As is the case in many sections of the existing highway, the peak period traffic volumes exceed highway capacity, resulting in a decrease in speeds and noise levels. Therefore, the loudest hour occurs just before and just after periods of congestion.

For nearly the entire project area, the rush hour periods are congested. Additional traffic, with no increase in capacity, will increase the amount of congestion each day. During these times, noise levels will decrease by as much as 5 to 10 dBA compared to the noise level of free-flow traffic. The loudest hour will shift in time, but will not get louder. Thus, the No-Action (2025) loudest hour is equivalent to the existing conditions (2003). When the highway is not congested, noise levels will increase by 1 to 2 dBA, since there will be an increase in volume with no decrease in speed.

Table 3-30
Existing Measured Loudest-Hour Noise Levels

Location	Distance to C-470 (Feet)	Measured Loudest Hour Noise Level (dBA)
Crest Apartments at C-470/I-25	420	64
Canyon Ranch Apartments/north of C-470 at Colorado Boulevard	330	72
Highlands Ranch homes south of C-470, east of University Boulevard	430	71
Highlands Ranch homes between Dad Clark Drive and C-470	350	69
Kensington Ridge Neighborhood/north of County Line Road	320	66
Bluffs Apartments/north of C-470	200	73
Bowen Farms/ South of C-470	340	70
Gleneagles Village/ second row of homes south of C-470	640	62
Willow Creek Neighborhood/north of County Line Road	1,000	65
Chatfield Bluffs residences/south of C-470	250	64
Meadowbrook Heights/north of C-470	290	64
Average	~400	~64

General Purpose Lanes Alternative

For the GPL Alternative, noise levels are predicted to range from 55 dBA to 74 dBA at the residential areas, an increase of 1 and 6 dBA over existing conditions. A total of 28 residential locations and 15 commercial locations exceed the NAC.

For this alternative, the mainline traffic volumes are greater, Colorado Boulevard volumes are less, and ramp traffic from C-470 to I-25 southbound is further away than for the EL Alternative. Overall, the GPL Alternative would be 1 dBA louder than the EL Alternative.

All noise effects are due to exceeding the NAC under Category B or C, as listed in **Table 3-29**. For the GPL Alternative, one additional residential impact would occur when compared to the EL Alternative, due to Province Center and Hunting Hill being impacted only under the GPL Alternative, and the Crest Apartment Homes only being impacted under the EL Alternative. In accordance with CDOT's *Noise Analysis and Abatement Guidelines* (2002), all impacted locations are required to be analyzed for potential noise mitigation, as described in **Section 3.3.3.3**.

Express Lanes Alternative (Preferred Alternative)

For the EL Alternative, noise levels are predicted to range from 54 dBA to 74 dBA at the residential areas located within the corridor. Noise levels are predicted to increase by 1 dBA to 5 dBA over existing conditions. A total of 27 residential locations and 15 commercial locations exceed the NAC.

The primary differences in noise between the two action alternatives are that the mainline traffic volumes would be greater for the GPL Alternative; Colorado Boulevard volumes would be greater for the EL Alternative; and ramp traffic from C-470 to I-25 southbound would be shifted closer to the nearby residences for the EL Alternative. Overall, the EL Alternative is 1 dBA quieter than the GPL Alternative; however, this difference would not be distinguishable to the human ear.

Noise effects were assessed by comparing the predicted noise levels and noise level increases to CDOT criteria. The impacted Category B (residential type) locations are shown in **Figure 3-16** and are listed in **Table 3-31** for the No-Action, GPL, and EL alternatives. A summary of the NAC C (commercial type) impacted locations is in **Table 3-32**. An overall comparison of all three alternatives is in **Table 3-33**.

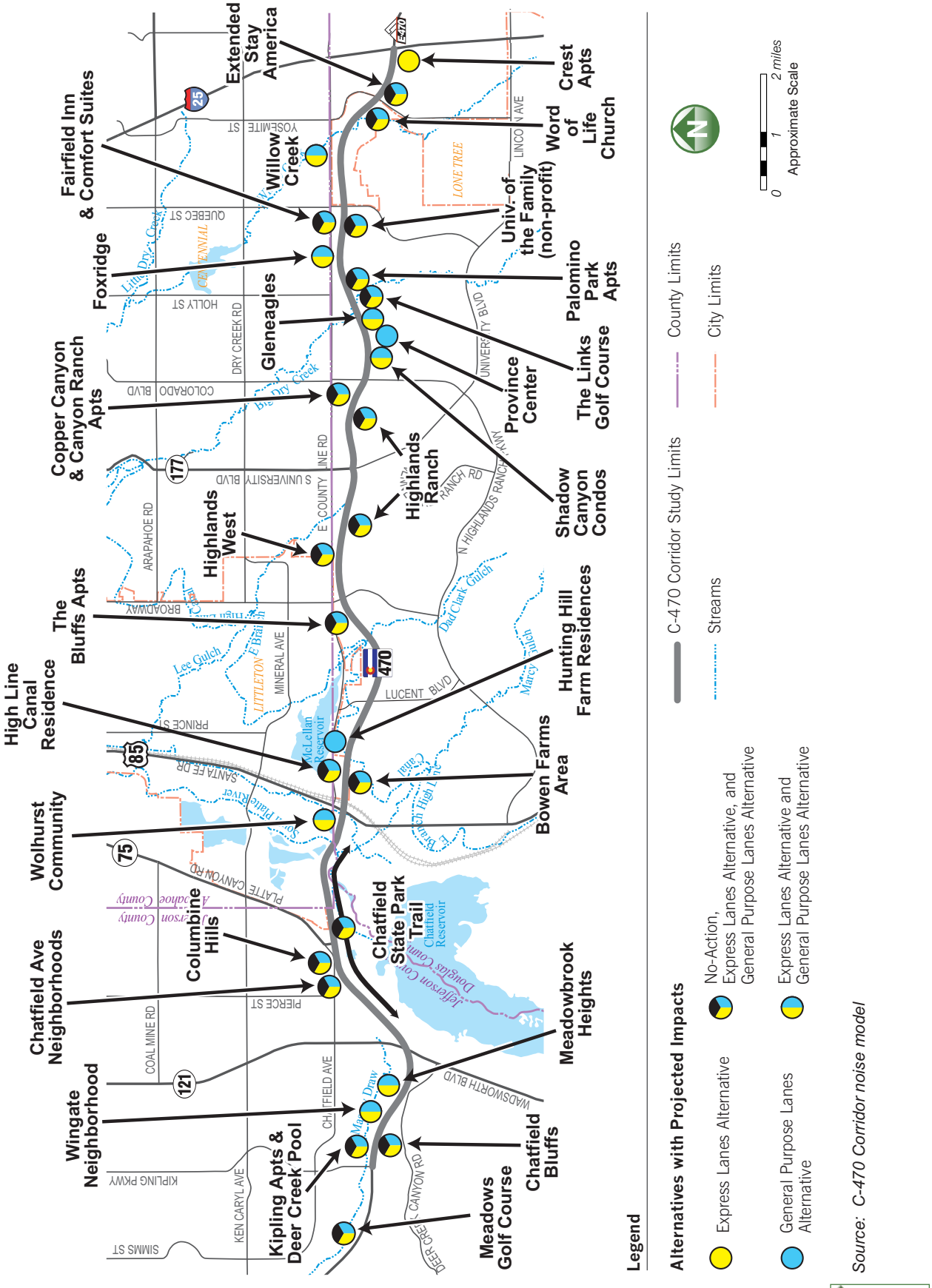
As the maximum noise increase is less than 10 dBA, all noise effects are due to exceeding the NAC. The differences in effects between the action alternatives are that the Province Center and Hunting Hill Farm Residences are impacted only under the GPL Alternative, and the Crest Apartment Homes are impacted only under the EL Alternative. In accordance with CDOT *Noise Analysis and Abatement* Guidelines (2002), all impacted locations are required to be analyzed for potential noise mitigation.

3.3.3.3 Mitigation

To be included in a project, a proposed noise mitigation measure must first be found to be feasible; this process involves reviewing the issues described below:

- The proposed mitigation measure must be predicted to achieve at least 5 dBA of noise reduction at front row receptors
- The proposed mitigation measure must not create any fatal flaw safety or maintenance issues such as reduced sight distances, shadowing of ice-prone areas, and interference with snow/debris removal
- If a barrier, it must be possible to construct it in a continuous manner, as gaps in noise barriers (e.g., for driveways) significantly degrade their performance

Figure 3-16
NAC B (Residential Type) Noise Impact Locations



Source: C-470 Corridor noise model

Table 3-31
NAC B (Residential Type) Impact Summary

Impacted Location	Property Type	Alternative Affected
Meadows Golf Course	Golf course	EL, GPL, No-Action
Kipling Apartments and Deer Creek Pool	Multi-family homes and public facility	EL, GPL, No-Action
Wingate Neighborhood	Single-family homes	EL, GPL
Chatfield Bluffs Neighborhood	Single-family homes	EL, GPL, No-Action
Meadowbrook Heights	Single-family homes	EL, GPL
Chatfield Avenue Neighborhoods	Single-family homes	EL, GPL, No-Action
Columbine Hills	Single-family homes	EL, GPL, No-Action
Chatfield State Park	Park	EL, GPL, No-Action
Wolhurst Community	Single-family homes	EL, GPL
Bowen Farms Area	Single-family homes	EL, GPL, No-Action
High Line Canal Residence	Single-family home	EL, GPL, No-Action
Hunting Hill Farm Residences	Single-family homes	GPL
The Bluffs Apartments	Multi-family homes	EL, GPL, No-Action
Highlands West	Single-family homes	EL, GPL, No-Action
Highlands Ranch - Broadway to University Boulevard	Single-family homes, school, ball field, church	EL, GPL, No-Action
Canyon Ranch and Copper Canyon Apartments	Multi-family homes	EL, GPL, No-Action
Highlands Ranch - west of Colorado	Single-family homes	EL, GPL, No-Action
Shadow Canyon Condominiums (under construction)	Multi-family homes	EL, GPL
Province Center	Single-family homes	GPL
Links Golf Course	Golf course	EL, GPL, No-Action
Gleneagles Village	Single-family homes	EL, GPL
Palomino Park Apartments	Multi-family homes	EL, GPL, No-Action
Foxridge	Single-family homes	EL, GPL
Fairfield Inn and Comfort Suites Hotels	Hotel	EL, GPL, No-Action
Willow Creek	Single-family homes	EL, GPL
University of the Family	Church	EL, GPL, No-Action
Word of Life Christian Center Church	Church	EL, GPL, No-Action
Extended Stay America Hotel	Hotel	EL, GPL, No-Action
Crest Apartment Homes	Multi-family homes	EL

Table 3-32
NAC C (Commercial Type) Impact Summary

Impacted Location	Property Type	Alternative Affected
Southwest Kipling Parkway - W. Toller Drive	Office buildings	EL, GPL
Southeast Kipling Parkway - W. Ute Drive	Office buildings	EL, GPL, No-Action
Southeast Wadsworth Boulevard - Chatfield State Park Offices	Office buildings	EL, GPL
Southeast Lucent Boulevard - Plaza Drive	Office buildings	EL, GPL
Southwest Broadway - Centennial Boulevard	Office buildings	EL, GPL
Northwest Broadway - County Line Road	Office buildings	EL, GPL
County Line Road - Clarkson Street to University Boulevard	Office buildings, storage, retail	EL, GPL
Northeast Colorado Boulevard	Retail	EL, GPL
County Line Road - Holly Street to Niagara Street	Offices, retail, storage	EL, GPL, No-Action
Northwest Quebec Street	Retail	EL, GPL
Southwest Quebec Street - Business Center	Offices, retail	EL, GPL
Southeast Quebec Street - Park Meadows	Retail	EL, GPL
East Parkway Drive - Quebec Street to Yosemite	Retail, auto dealership	EL, GPL
Southwest Yosemite Street - Park Meadows	Retail, miniature golf	EL, GPL
Northeast Yosemite Street - Park Meadows	Retail	EL, GPL

Table 3-33
Comparison of Future (2025) Noise Impacts between the Alternatives

Comparison	No-Action Alternative	EL Alternative	GPL Alternative
Average Noise Level Increase (dBA)	0	3	4
Maximum Noise Level Increase (dBA)	0	5	6
Number of Residential Type Impact Locations* (NAC B)	19	27	28
Number of Commercial Type Impact* (NAC C)	2	15	15
Total Impact Locations* (NAC B and C)	21	42	43

** The above represents the number of impacted locations. However, each location can represent more than one residence. These values are recommended only for comparative purposes between the alternatives*

If a mitigation measure is found to be feasible, it is then analyzed for its "reasonableness."

Reasonableness criteria are:

- The cost benefit index of the proposed measure should not exceed $4,000 per dB of reduction per benefited receptor
- The predicted design year noise levels should equal or exceed the noise abatement criteria
- At least 50 percent of the affected properties should approve of the proposed measure
- Land use in the affected area should be at least 50 percent Category B

In accordance with the FHWA and CDOT noise guidelines, the feasibility and reasonableness of providing noise mitigation was analyzed at each impacted area shown in **Table 3-34**. Mitigation is not recommended for any of the impacted commercial receptors because none of these appear to have active outdoor use. If it is determined that outdoor use does occur or the property owner desires noise mitigation at impacted commercial sites, CDOT's feasible and reasonable test would be applied to determine if mitigation meets the approved criteria.

The most common way to mitigate highway noise is to use noise walls and earthen berms. Other mitigation measures include shifting the highway (vertical and horizontal), restricting trucks, reducing speed limits, or acquiring buffer lands. These other strategies are not considered practical for this project. Potential noise mitigation locations are shown in **Figure 3-17** and summarized in **Table 3-34**. These locations are identical for both the GPL and EL Alternatives, except for the Province Center and Crest Apartment Home locations. In determining the cost benefit of proposed mitigation, costs were calculated using $30 per square foot for walls and $10 per cubic yard for berms using 3:1 slopes. For some proposed mitigation locations, the noise barrier needs to be located beyond the planned ROW acquisitions to be considered feasible. Additional ROW costs were approximated using $6.50 per square foot. No utility conflicts were investigated as part of this analysis. This noise mitigation analysis will be revisited during final design when more accurate information is available.

Potential noise mitigation is considered both feasible and reasonable for approximately 40 percent of the impacted Category B areas. No noise mitigation is recommended for any of the impacted commercial locations, as none appear to have active outdoor use, nor do they typically desire noise mitigation that would block their exposure to the highway. Overall, approximately 30,000 linear feet of noise wall, 3,200 linear feet of noise berm, and 1,500 linear feet of safety barrier are being recommended for inclusion in the project. As most of the analysis sites were done independent of one another, some of the potential noise mitigation for one site overlaps with other sites, thus the actual linear feet of mitigation should be slightly less.

All potential noise mitigation recommendations noted in **Table 3-34** will be reviewed during final design to ensure their validity. For locations that currently have noise mitigation recommended, these should stand, provided there are no flaws in the analysis, unforeseen additional costs, or other environmental issues. All noise mitigation heights represent the maximum height analyzed, and the actual constructed heights will vary depending on re-analysis during final design and input to be solicited from affected property owners. Thus, for some locations where a 20-foot tall wall is shown as reasonable, a shorter wall may also be reasonable and more desirable by either the affected property owners or the project. Similarly, the actual lengths and locations of the recommended mitigation may vary depending on terrain, utilities, property owner desires or easements.

Table 3-34
Summary of the NAC B (Residential Type) Noise Mitigation Analyses

Mitigation Location	Mitigation Type	Mitigation Size Length x Height (feet)[1]	Cost-Benefit Without Additional Right-of-Way Costs ($/dB/Receptor)	Cost-Benefit With Additional Right-of-Way Costs ($/dB/Receptor)	Mitigation Recommendation (Yes/No)
Meadows Golf Course [2]	None	n/a	n/a	n/a	No
Kipling Apartments and Deer Creek Park n Pool	Wall	1,950 x 15	$7,020	n/a	No
Wingate Neighborhood	Wall	2,290 x 20	$6,123	n/a	No
Chatfield Bluffs Neighborhood	Wall	1,845 x 18	$2,731	$4,272	Yes
Meadowbrook Heights	Wall Wall Wall	1,700 x 20 460 x 12 1,605 x 5	$3,070	$3,574	Yes
Chatfield Avenue Neighborhoods	Wall	2,070 x 20	$4,210	n/a	Yes
Columbine Hills	Wall Berm	800 x 20 850 x 20	$4,376	n/a	Yes
Chatfield State Park [3]	None	n/a	n/a	n/a	No
Wolhurst Community [4]	Wall Retaining Wall	1,550 x 20 1,300 x 30	n/a	n/a	Yes
Bowen Farms Area [5]	None	n/a	n/a	n/a	No
High Line Canal Residence [6]	Wall	n/a	n/a	n/a	No
Hunting Hill Farm Residences [7]	Wall	n/a	n/a	n/a	No
The Bluffs Apartments [8]	Wall	1,600 x 20	$2,963	n/a	Yes
Highlands West [7]	None	n/a	n/a	n/a	No
Highlands Ranch - Broadway to University Boulevard[9]	Wall	5,600 x 20	$5,185	$12,593	No

Table 3-34
Summary of the NAC B (Residential Type) Noise Mitigation Analyses (continued)

Mitigation Location	Mitigation Type	Mitigation Size Length x Height (feet)(1)	Cost-Benefit Without Additional Right-of-Way Costs ($/dB/Receptor)	Cost-Benefit With Additional Right-of-Way Costs ($/dB/Receptor)	Mitigation Recommendation (Yes/No)
Canyon Ranch and Copper Canyon Apartments	Wall Wall	1,220 x 12 4,000 x 20	$4,078	$4,394	Yes
Highlands Ranch west of Colorado	Wall Wall	1,400 x 12 3,575 x 20	$4,430	$4,875	Yes
Shadow Canyon Condominiums (5)	None	n/a	n/a	n/a	No
Province Center	Berm Berm	710 x 15 820 x 15	$3,146	$5,448	Yes
Gleneagles Village	Wall Berm	1,300 x 20 850 x 20	$3,795	$4,713	Yes
Palomino Park Apartments	Wall	2,050 x 15	$2,997	$3,189	Yes
Foxridge (7)	None	n/a	n/a	n/a	No
Fairfield Inn and Comfort Suites Hotels (10)	None	n/a	n/a	n/a	No
Willow Creek (10)	None	n/a	n/a	n/a	No
University of the Family (10)	None	n/a	n/a	n/a	No
Word of Life Christian Center Church (10)	None	n/a	n/a	n/a	No
Extended Stay America Hotel (10)	None	n/a	n/a	n/a	No
Crest Apartment Homes (EL Alternative Only)	Safety barrier	1,500 x 3	n/a	n/a	Yes

(1) Wall heights shown are the maximum heights considered feasible and reasonable; final wall dimensions will be determined during final design
(2) Mitigation for the golf course is not reasonable per CDOT criteria
(3) Mitigation for the C-470 trail is not feasible or reasonable for CDOT criteria
(4) The existing noise wall on the south end of Wolhurst will be replaced. Final configuration of the flyover retaining wall will be determined and additional noise analysis will be conducted during final design.
(5) New development not eligible for noise mitigation as a part of this study
(6) Excessively high cost benefit for low number residences
(7) Primarily impacted from County Line Road and addressed by County Line Road EA
(8) Does not include additional ROW cost if applicable
(9) Noise mitigation for this location is not recommended at this time. However, a commitment will be made to perform a full noise analysis during final design to determine if feasibility and reasonableness criteria can be met
(10) No active outdoor use areas. Interior noise levels do not exceed impacts level