I-70/ Central Park Boulevard Interchange Environmental Assessment

AIR QUALITY TECHNICAL REPORT

Prepared for:

City and County of Denver

in partnership with

US Department of Transportation
Federal Highway Administration
Colorado Department of Transportation

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1.0 INTRODUCTION

The City and County of Denver (CCD) is proposing to build on- and off-ramps, both eastbound and westbound, at the proposed Central Park Boulevard and Interstate 70 interchange. An Environmental Assessment (EA) is being completed for this project to meet the requirements of the National Environmental Policy Act (NEPA). The project would include three northbound through lanes and three southbound through lanes on Central Park Boulevard. Additionally, in the build alternative, two westbound turn lanes and two eastbound turn lanes would be added to Central Park Boulevard at the Interstate 70 interchange. With the addition of westbound and eastbound ramps, two signalized intersections will be added to the interchange. The project area would also extend to the south to 40th Avenue, where in the build alternative, a proposed four-way signalized intersection would be constructed. An air quality analysis was completed for all three signalized intersections, including those at Interstate 70 and Central Park Boulevard, and the intersection of Central Park Boulevard and 40th Avenue. The project has Colorado Department of Transportation (CDOT) and Federal Highway Administration (FHWA) oversight.

2.0 BACKGROUND

The Central Park Boulevard and Interstate 70 interchange project is included in the conforming State Transportation Improvement Program (STIP) and the 2035 Regional Transportation Plan (RTP), and subject to CDOT and FHWA oversight. The project is in an attainment/maintenance area for carbon monoxide (CO), 1-hour ozone and particulate matter 10 micrometer in diameter and smaller (PM_{10}). The project is in a nonattainment area for 8-hour ozone (O_3). Due to the status of these three pollutants in the Denver area, and the fact that there is CDOT and the FHWA oversight, this project is subject to a conformity analysis.

Since the project is not exempt from a conformity analysis, a Level of Service (LOS) analysis is required for intersections where traffic could be affected by the project. A project-level (hot spot) analysis for CO must be completed for selected intersections that operate at a LOS grade of D or worse for the proposed build alternative. PM_{10} project-level analysis was not required for this project.

2.1 Regulations

Federal and State

National air quality policies are regulated through the Federal Clean Air Act of 1970 (Act) and its Amendments (1977, 1990). As required by the Act, the US Environmental Protection Agency (EPA) established national ambient air quality standards (NAAQS) (standards) for six criteria air pollutants. In addition to O_3, CO, and PM_{10}, the criteria pollutants are $PM_{2.5}$ (particulate matter 2.5 micrometer in diameter and smaller), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), and lead (Table 2.1-1). The NAAQS represent levels that likely avoid adverse health and welfare effects associated with each pollutant. The Colorado Department of Public Health and Environment (CDPHE) have adopted the NAAQS, so there are no ambient air quality standards specific to Colorado.

The EPA has delegated authority to the CDPHE to administer many of the requirements of the Act. Within the CDPHE, the Air Pollution Control Division (APCD) oversees air quality policies. The State Implementation Plan (SIP) establishes emission limits for areas designated as nonattainment and attainment/maintenance for specific criteria pollutants . In order to achieve the emission reductions necessary for compliance, Metropolitan Planning Organizations are required to demonstrate that transportation plans and programs stay within these budgets. If the level of any pollutant in an area exceeds the NAAQS (per pollutant prescribed violation conditions), then it is designated as a nonattainment area for that pollutant by the EPA. Nonattainment areas are required to prepare implementation plans for attaining the emission standard for each designated pollutant. Once an area has attained the NAAQS, a maintenance plan must be prepared to ensure that the standard will be maintained. After the maintenance plan is approved by the EPA, the area is re-designated as an attainment/maintenance area and requires continued conformity compliance documentation.

Table 2.1-1
National Ambient Air Quality Standards

Pollutant	Averaging Time	NAAQS	
		µg/m^3	ppm
Ozone (O_3)	1 hour[1] 8 hour[2]	235 157	0.12 0.075
Carbon Monoxide	1 hour[3] 8 hour[3]	40,000 10,000	35 9
Sulfur Dioxide (SO_2)	3 hour[3] 24 hour[3] Annual[4]	1,300 365 80	0.5 0.14 0.030
Nitrogen Dioxide	Annual[4]	100	0.053
Particulate Matter (PM_{10})[5]	24 hour[3]	150	
Particulate Matter ($PM_{2.5}$)	24 hour[6] Annual[7]	35 15	
Lead (Pb)	Rolling 3-Month Average	0.15	

Source: CAQCC, 2006 and EPA, 2008a
Notes:
NAAQS = National Ambient Air Quality Standards
µg/m^3 = micrograms per cubic meter
ppm = parts per million
[1](a) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is less than (<) 1.
(b) As of June 15, 2005, EPA revoked the 1-hour ozone standard in all areas except the fourteen 8-hour ozone nonattainment Early Action Compact (EAC) Areas.
[2]To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm (2008 Standard)
[3]Not to be exceeded more than once per year.
[4]The annual arithmetic mean standard is a 3-year average.
[5]Due to a lack of evidence linking health problems to long-term exposure to coarse particle pollution, the agency revoked the annual PM_{10} standard in 2006 (effective December 17, 2006).
[6]The 24-hour $PM_{2.5}$ standard is based on the three-year average of the 98th percentile.
[7]To attain this standard, the 3-year average of the weighted annual mean concentrations from single, or multiple community-oriented monitors must not exceed 15 µg/m^3.

CDOT Clearance Process

Air quality issues must be addressed as part of the project environmental clearance process for transportation projects. The transportation conformity provisions of the Act require regional transportation plans and programs to show that emissions resulting from planned transportation projects are consistent with emissions estimates and necessary emission reduction goals in the SIP. CDOT and the APCD have developed an air quality clearance process to evaluate potential impacts that may result from construction of transportation projects. This process is based on a MOA between the two agencies (CDOT, 1995).

1. The first step in the air quality clearance process is to determine whether the project is exempt from a conformity determination. The conformity regulations require that all transportation plans, transportation improvement programs, and transportation projects:

   - Conform to the SIP's purpose of eliminating or reducing the severity and number of violations of the NAAQS and achieving timely attainment of such standards (CDOT, 2007a).

   - Ensure that transportation activities will not cause or contribute to any new violation of any standard, increase the frequency, or severity of existing violations of any standard, or delay timely attainment of any standard or any required interim emissions reductions (CDOT, 2008a).

   The FHWA and the Federal Transit Administration control the federal funding of highway and transit projects and activities. Therefore, funding can only be approved for projects that comply with the conformity provision of the Act and the EPA transportation air quality conformity regulations (40 Code of Federal Regulations (CFR) 51 Subpart T and 40 CFR 93 Subpart A).

   In nonattainment and maintenance areas, FHWA projects must be found to conform. This means that the project must be included in a conforming Plan RTP and STIP. The design concept and scope of the project that was in place at the time of the RTP and STIP conformity findings must be maintained through implementation. The project design concept must be sufficiently defined to determine emissions at the time of the conformity determination.

2. If the project is not exempt from a conformity determination, then the CDOT Environmental Programs Branch air quality specialist and the CDPHE APCD, determine which roadways and signalized intersections will require a LOS analysis. This typically includes the signalized intersections that will be constructed, reconstructed, or modified as part of the project. Additionally, if the project could result in increased traffic at nearby intersections, those intersections may also be evaluated. A LOS analysis is completed for each intersection based on all project alternatives, including the No-Build alternative. The LOS analysis assesses each intersection based on the average wait time per vehicle and assigns a letter "grade" to each intersection for the morning (AM) and evening (PM) peak hour periods.

3. An additional analysis, "Hot Spot Modeling," is required for intersections with a LOS of D or worse. Hot spot modeling is a method of calculating the carbon

monoxide concentrations along roadways and near intersections. The purpose of hot spot modeling is to evaluate whether a project could cause, or contribute to, a violation of the carbon monoxide NAAQS.

2.2 Pollutants of Concern

When assessing the impacts of transportation projects, the three main pollutants of concern for the Denver metropolitan area (Denver area) are CO, O_3 and PM_{10}. The Denver area is designated as an attainment/maintenance area for these CO, 1-hour ozone and $PM_{10}$and in nonattainment for 8-hour ozone. Carbon monoxide and PM_{10} concentrations can accumulate near areas of heavy traffic congestion where average vehicle speeds are low. Project-level conformity analyses was completed for these two pollutants. Because ozone is a regional pollutant and not directly emitted from a vehicle source, no project-level dispersion modeling is required. Although mobile source air toxics (MSATs) are pollutants affecting sensitive roadside populations, they is discussed in Section 4.0. Vehicle exhaust also includes emissions of $PM_{2.5}$ and SO_2; however, these two compounds are not currently pollutants of concern in the Denver area.

Ozone

The Denver area is currently considered to be in non-attainment for 8-hour O_3. This pollutant is not directly emitted by motor vehicles. Ground level ozone forms from the reaction of two other motor vehicle emissions, oxides of nitrogen (NOx) and volatile organic compounds (VOCs), with sunlight. Ozone production is common on hot summer days. This reaction takes place over several hours, which allows for mixing and dispersion in the atmosphere; therefore, ozone is generally a regional, rather than localized, pollutant. A transportation project has potential to negatively affect regional air quality if vehicle emissions of ozone precursors (NOx and VOCs) increase as a result of the project. Ozone levels in the Denver metropolitan area have exceeded the EPA 1-hour standard in past decades.

In 1997, the EPA established the current 8-hour standard of 0.08 parts per million (ppm) for ozone. A violation of the standard occurs when the 3-year average of the fourth maximum value at a monitor exceeds the federal standard (CAQCC, 2006).

Based on the 2000-2002, 3-year average, the Denver area demonstrated compliance with the 8-hour ozone NAAQS. However, in the summer of 2003, elevated values of 8-hour ozone caused the Denver metro region's 3-year average to violate the 8-hour ozone NAAQS for 2001-2003. Continued violations have caused the Denver metro area to be designated non-attainment by the EPA in late 2007. In response, the CDPHE developed the Denver Metro Area and North Front Range Ozone Action Plan in 2008 (CDPHE, 2008c). This plan would include a proposed revision to the SIP. The plan was approved by the Regional Air Quality Council and the North Front Range Transportation and Air Quality Planning Council in September 2008. The EPA subsequent lowered the NAAQS concentration for 8-hour O_3 from 0.08ppm to

0.075ppm. A revision to the SIP to assure that conformity would be met under the new standard is required by 2013.

2.3 Existing Conditions

Sources

Both local and regional sources may contribute to air pollution. The two main contributors to air pollution in the project vicinity are industrial facilities and traffic. Light industrial facilities are located to the north of the project location along Interstate 70. Central Park Boulevard with moderate traffic levels would be the main north-south corridor. The primary east-west corridor in the Denver area is Interstate 70. There is heavy traffic on two north-south arterial streets that run parallel to the project location: Quebec and Havana Streets. Therefore, the local industrial air pollution impacts are mostly on the northern side of the project location, while traffic-related air pollution is concentrated on the west and east sides of the project. The project area is located on the eastern edge of the Denver metropolitan area, so the sources of regional air pollution are mostly to the west of the project.

Weather

The concentration of a pollutant in the atmosphere depends on the amount of pollutant released, the nature of the source, and the ability of the atmosphere to transport and disperse the pollutant. The main determinants of transport and dispersion are wind, atmospheric stability or turbulence, topography, and the existence of inversion layers.

The project lies within the Platt River drainage basin, a topographic low point within the Denver metro area. Prevailing winds are generally out of the south. Diurnal wind shifts downslope off the Front Range foothills and upslope from the east, characterize the local wind patterns. The Denver metro area is prone to inversions that trap warm air beneath heavy layers of cold air. This limits the movement of air and can result in the accumulation of pollutants (EPA, 2008b).

Air Quality Monitoring Stations

The APCD operates a network of ambient air quality monitoring stations within the Denver/Boulder area. Recorded concentrations of pollutants from air quality stations closest to the project are summarized in Table 2.3-1. This table shows the data catured for each pollutant as it is statistically reported on an annual basis. Violations of pollutant standards are typically based on averaging annual data over a window of multiple years. Since each station monitors only certain pollutants, stations were selected at increasing distances from the project area until all of the pollutants of concern (CO, PM_{10}, and $O_{3)}$ were covered. Data for $PM_{2.5}$ was also collected at three of the stations and is also included for reference. All of the stations are located closest to the northwest end of the project location.

The only criteria pollutant that exceeded the standard at these stations was ozone in 2003 and 2007 at the 2325 Irving Street Station. The standard was also exceeded for $PM_{2.5}$ in 2005 and 2007 at the 4650 Columbine Street Station and at the 2150 Broadway Station in 2008. However, since a violation of the $PM_{2.5}$ standard is based on a 3-year average, this singular exceedance did not result in a violation of the standard (Table 2.3-1).

Sensitive Receptors

People who are very young, very old, or in poor health are more sensitive to air pollution than the general population. Therefore, schools, nursing homes, and hospitals are classified as sensitive receptors for MSATs. Sensitive receptors within 450 (Pinyon, 2008) feet of a project are considered to be at risk of being impacted by a project. The project area is mostly industrial, and there are no sensitive receptors within 450 feet of the project.

Table 2.3-1
Summary of Annual Air Quality Monitoring At Central Park Boulevard & I-70 Interchange

Monitoring Station[1]	Averaging Time	NAAQS Standard	2002	2003	2004	2005	2006	2007
Carbon Monoxide (ppm)								
Denver-2325 Irving Street	1-hour (2nd Max) 8-hour (2nd Max)	35 9	4.6 2.7	4.5 3.2	4.9 3.4	3.4 2.1	3.5 3.0	No Data
Denver-14th and Albion	1-hour (2nd Max) 8-hour (2nd Max)	35 9	6.0 3.1	6.5 3.3	6.8 3.4	3.6 2.4	3.9 2.5	No Data
Denver-2105 Broadway	1-hour (2nd Max) 8-hour (2nd Max)	35 9	7.4 3.7	14.9 4.5	8.7 4.1	4.3 2.5	4.6 3.1	5.9 2.8
Welby-3174 E. 78th Avenue	1-hour (2nd Max) 8-hour (2nd Max)	35 9	4.4 2.6	5.2 3.0	4.0 2.8	3.3 2.2	3.8 2.5	3.0 2.1
PM_{10} ($\mu g/m^3$)[2]								
Welby-3174 East 78th Avenue	24-hour (2nd Max) Annual Arith Mean	150 50	122 35.2	98 32.9	71 28.6	64 29.4	82 27.8	68 27
$PM_{2.5}$ ($\mu g/m^3$)[2]								
Denver-2105 Broadway	24-hour (98th percentile) Annual Arith. Mean	35 15	25.7 10.25	26.2 10.41	22.2 9.0	29.4 9.82	24.3 8.99	**37.2** 10.73
Denver-4650 Columbine Street[3]	24-hour (98th percentile) Annual Arith Mean	35 15	No Data	No Data	13.2 14.6	**37.40** 10.14	34.80 8.98	30.0 10.17
Commerce City-7101 Birch Street	24-hour (98th percentile) Annual Arith Mean	35 15	25.8 10.16	27.7 10.3	18.9 9.49	24.2 10.17	26.3 9.85	**40.3** 10.50
Ozone (O_3) (ppm)								
Denver-2325 Irving Street	1-hour (Max) 8-hour (4th Max)	0.12 0.075[4]	0.092 0.073	0.096 **0.085**	0.078 0.066	0.087 0.074	0.087 0.072	0.097 **0.076**

Data source: EPA, 2008c.
Notes:
1 Station locations are mapped on Figure 1.
2 If a monitoring station has more than one monitor for a pollutant, the highest reading among the monitors was used.
3 $PM_{2.5}$ monitoring data are not available at this station during 2002 and 2003.
4 2008 Standard
NAAQS = National Ambient Air Quality Standards
$\mu g/m^3$ = micrograms per cubic meter
Max. = maximum
O_3 = ozone
PM_{10} = respirable particulate matter less than 10 micron size
$PM_{2.5}$ = respirable particulate matter less than 2.5 micron size
ppm = parts per million
Numbers in **BOLD** exceed NAAQS Standards

3.0 METHODS

3.1 Project-Level Carbon Monoxide Analysis

Carbon monoxide hot spot modeling was completed for signalized intersections with a 2010 and 2035 forecast Level of Service (LOS) of D or worse, for the build and no-build alternatives during the morning (AM) and evening (PM) peak hours. LOS is measured using a letter designation from A to F, with LOS A being the best free-flowing traffic operations, and LOS F being the worst, highly congested traffic conditions. The Synchro (Version 6.0) traffic analysis software package was used by URS to complete all detailed traffic analyses of this project. Results of the LOS analysis are included in Appendix A. Worst-case scenario emission factors (2005) were used with 2035 traffic volumes to analyze CO hot spot impacts.

The Environmental Protection Agency (EPA) CAL3QHC dispersion model was used for CO hot-spot analysis. CAL3QHC is a computer-based modeling program that predicts carbon monoxide concentrations from motor vehicles at roadway intersections. The CAL3QHC model accounts for emissions from both moving and idling vehicles. Inputs for the model included projected traffic volumes and movements, motor vehicle emission rates, roadway geometry, traffic signal timing and worst-case meteorological conditions.

Worst-case meteorological conditions included low wind speed (1 meter/second) and atmospheric stability class D. The CAL3QHC model determines the worst-case wind direction by selecting the wind direction that results in the highest CO concentration at each receptor.

The methodology for this air quality analysis was consistent with the two Environmental Protection Agency (EPA) guidance manuals related to intersection "hot-spot" analysis:

1. *"Guidelines for Modeling Carbon Monoxide from Roadway Intersections,"* EPA, November 1992.

2. *"User's Guide to CAL3QHC Version 2.0: A Modeling Methodology for Predicting Pollutant Concentrations near Roadway Intersections,"* EPA, November 1992.

Per EPA guidance, receptors were modeled 10 feet from the edge of the outside travel lane on the queue links at the selected intersections. Receptors located according to EPA guidance represent worst-case locations for modeling possible violations of federal CO standards.

The following two formulas were used to convert the modeled 2035 1-hour CO concentrations (1-hour) to an overall 8-hour CO concentration (8-hour). Background concetrations of CO were acquired from Nancy Chick, CDPHE-APCD. This estimate is based on 2004-2006 data at 23rd and Julian in Denver.

- Modeled 8-hour value = Modeled 1-hour value X Colorado Persistence Factor X Altitude Adjustment Factor
- Overall 8-hour CO concentration = Modeled 8-hour value + Background CO Concentration

The following values were used:

- Colorado Persistence Factor = 0.57
- Altitude Adjustment Factor = 1.13
- Background 8-hour CO Concentration provided by the Air Pollution Control Division (APCD) = 3.0 ppm[1]
- Background 1-hour CO Concentration provided by the Air Pollution Control Division (APCD) = 4.0 ppm[1]

Therefore, the formulas used were:

1. Modeled 8-hour value = Modeled 1-hour value(ppm) X 0.57 X 1.13
2. Overall 8-hour CO concentration = Modeled 8-hour value (ppm) + 3.0 ppm
3. Overall 1-hour CO concentration = Modeled 1-hour value (ppm) x 1.13 x 4.0 ppm

3.2 PM_{10}

The potential effects of the project were assessed qualitatively by evaluating nearby monitoring station data (EPA, 2008c and CDPHE, 2008a), the Colorado Department of Public Health and Environment (CDPHE) 2006 Emissions Inventory. A comparative PM10 analysis was not required for this project. Quantitative analysis is not currently required for particulate matter 10 (PM_{10}) since EPA has not released monitoring guidance (FHWA, 2006a).

[1] Nancy Chick, "RE: CO Background for 56th Avenue," e-mail message, November 14, 2008.

4.0 RESULTS

4.1 Carbon Monoxide Hot Spot Analysis Results

There were three intersections associated with the Central Park Boulevard and Interstate 70 interchange project which, in the 2035 build alternative, would operate with the level of service (LOS) of D or worse (Central Park Boulevard/Interstate 70 eastbound and westbound intersections and Central Park Boulevard/40th Avenue intersection). All Intersections would operate at a LOS of C or above in the 2010 LOS analysis; therefore, a 2010 Hot Spot analysis was not warranted. This was the case during the AM and PM rush hours. In the No-Action alternative, Central Park Boulevard would continue on a north/south travel direction, without signalization and the Interstate 70 interchange ramps; therefore, there are no signalized intersections in the No-Action scenario. Since the No Build Alternative would not include signalized intersections, a No-Action hot spot analysis was not performed.

Four CAL3QHC model runs were completed. Based on the model, none of the intersections are expected to exceed the 8-hour and 1-hour carbon monoxide standard. The results are presented in **Error! Reference source not found.**. The build alternative model data are presented in Appendix B.

Table 4.1-1
Carbon Monoxide Hot Spot Analysis Results

Intersection of Central Park Boulevard and:	**Level of Service (LOS)[1]**				**8-hour Carbon Monoxide (ppm)[2, 3]**				**1-hour Carbon Monoxide (ppm)[4, 5]**			
	No-Action		**Build**		**No-Action**		**Build Alt 4**		**No-Action**		**Build Alt 4**	
	AM	**PM**	**AM**	**PM**	**AM**	**PM**	**AM**	**PM**	**AM**	**PM**	**AM**	**PM**
Interstate 70 east bound	NS	NS	**E**	C	N/A	N/A	4.48	N/A	N/A	N/A	6.59	N/A
Interstate 70 west bound	NS	NS	**D**	C	N/A	N/A	5.13	N/A	N/A	N/A	7.73	N/A
40th Avenue	NS	NS	**D**	**D**	N/A	N/A	5.38	4.99	N/A	N/A	8.18	7.50

Notes
1 Hot spot analysis is required for each intersection with a 2035 LOS of D or worse
2 The 8-hour maximum for carbon monoxide is 9 ppm
3 Results include a background carbon monoxide level of 3 ppm (APCD)
4 The 1-hour maximum for carbon monoxide is 35 ppm
5 Results include a background carbon monoxide level of 4 ppm (APCD)
AM/PM = morning/evening rush hours
NS = No signal
PPM = parts per million
LOS D or below
N/A= Not Applicable
Bold: The highest carbon monoxide modeled

The highest carbon monoxide modeled occurred at the intersection of Central Park Boulevard and 40th Avenue at a concentration of 5.38 ppm for the 8-hour period. The maximum 8-hour carbon monoxide concentration is 9 ppm. The highest carbon monoxide modeled occurred at the intersection of Central Park Boulevard and 40th Avenue at a concentration of 8.18 ppm for the 1-hour period. The maximum 1-hour carbon monoxide concentration is 15 ppm Most traffic congestion was experienced during the morning rush hour period for all three intersection for the Build alternative. Only the 40th Avenue intersection demonstrated a deficient level of service during the evening rush hour period.

4.2 PM_{10}

The study area is in attainment for particulate matter 10 (PM_{10}) and there have been no exceedances of National Ambient Air Quality Standards (NAAQS) standards at the nearest air quality stations (Tabel 4.2-1 Error! Reference source not found.**). According to the Colorado Department of Public Health and Environment (CDPHE) Emission Inventories for Denver and Adams Counties, the major sources of particulate matter in the study area are construction, road dust, and stationary sources (Table 4.2-1).**

Table 4.2-1
Denver and Adams County PM_{10} Emissions for 2006

County	Three Highest Emission Categories Tons per Year (Percent of Total Tons/Year)			Total Tons of PM_{10}/Year
	Construction	Road Dust	Stationary Sources	
Adams	2,674 (18%)	3,944 (27%)	2,870 (19%)	14,807
Denver	3,613 (47%)	2,308 (30%)	580 (8%)	7,711

Source: CDPHE, 2008b

Nationally, PM_{10} levels have been decreasing over the past 30 years (CDPHE 2008a). The overall levels of this pollutant in the northern Front Range have been fairly constant since 1997 (CDPHE, 2008a). The greatest impact to PM_{10} as a result of this project is expected to occur during construction. Since this a temporary impact, it is not considered part of the analysis (CDOT, 2007a).

Permanent impacts would result from changes in traffic volume and congestion. Since the project would add capacity along Central Park Boulevard, it is expected to increase total traffic volume and decrease congestion. These changes in volume and congestion are expected to offset each other, so that traffic-related changes to PM_{10} would be insignificant.

Mobile Source Air Toxics

In addition to the NAAQS, EPA also regulates air toxics and CDOT provides guidance on this topic (CDOT, 2007a). MSAT's are a subset of the 188 air toxics defined by the Act. MSATs are compounds emitted from highway vehicles and non-road equipment. Some toxic components 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 toxics result from engine wear or from impurities in oil and gasoline. The EPA has identified six priority MSATs: acetaldehyde, benzene, formaldehyde, diesel exhaust, acrolein, and 1, 3 butadiene (EPA, 2001).

The analysis of air toxics is an emerging field. The U.S. Department of Transportation (DOT) and EPA are currently working to develop and evaluate the technical tools necessary to perform air toxics analysis, including improvements to emissions models and air quality dispersion models. Limitations with the existing modeling tools preclude performing the same level of analysis that is typically performed for other pollutants, such as CO.

Although accurate quantitative methods do not exist to estimate the health impacts of MSAT's, it is possible to qualitatively assess future MSAT emissions. However, 40 CFR 1502.22(b) requires FHWA to address four provisions:

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 the reasonably foreseeable significant adverse impacts on the human environment; and
4. The agency's evaluation of such impacts based upon theoretical approaches or research methods generally accepted in the scientific community.

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. FHWA is aware that MSAT's released to the environment may cause some level of pollution. What is not scientifically definable is an accurate level of human health or environmental impacts that may 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 to estimate ambient concentrations resulting from the estimated emissions, exposure modeling to estimate human exposure to the estimated concentrations, and then final determination of health impacts based on the estimated exposure. Each of these steps is currently encumbered by technical shortcomings that prevent a formal determination of the MSAT impacts of this project. The 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. However, 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 impact health. 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.

   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 the 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. FHWA believes that these projections are credible, because the control programs are required by statute and regulation.

Cumulative Impacts

The Build Alternative would not result in any cumulative impacts to air quality. The project level analysis of the No-Action Alternative and Build Alternative show that due to current EPA programs to reduce pollutant emissions, future emissions will be significantly lower than existing conditions.

5.0 MITIGATION

Although motor vehicle emissions in the project area may increase, they would not result in any exceedance of the National Ambient Air Quality Standards (NAAQS); therefore, no direct project air quality mitigation is necessary. However, since the construction of the project will require submittal of an Air Pollution Emission Notice and Application for Construction Permit from the CDPHE APCD, preparation of a Fugitive Dust Control Plan will be required. Adherence to this plan will reduce air pollution resulting from construction.

The EPA's Integrated Risk Information System states that diesel exhaust appears "likely to be carcinogenic to humans by inhalation from environmental conditions." Diesel exhaust is the combination of diesel particulate matter (DPM) and diesel exhaust gases which include $PM_{2.5}$. As the vast majority of the construction equipment likely to be used on this project would be both on-road and non-road diesel equipment, mitigation measures should be performed in order to minimize the impact of DPM.

Construction phase air quality impacts (fugitive road dust and engine exhaust emissions) will be controlled by implementing the following measures:

- Wetting exposed soils and soil piles for dust suppression
- Covered trucks hauling soil and other fine materials
- Stabilized and covered stockpile areas
- Re-vegetation of exposed areas
- Minimization of off-site tracking of mud and debris by washing construction equipment and temporary stabilization
- Limit vehicle speed of construction-related equipment when off road
- Prohibiting unneccesarry idling of construction equipment
- Using low-sulfur fuel
- Locating diesel engines and motors as far away as possible from residential areas
- Locating staging areas as far away as possible from residential areas
- Requiring heavy construction equipment to use the cleanest available engines or to be retrofitted with diesel particulate control technology
- Using alternatives for diesel engines and/or diesel fuels (such as: biodiesel, liquefied natural gas, compressed natural gas, fuel cells, or electric engines)
- Installing engine pre-heater devices to eliminate unnecessary idling during winter time construction
- Prohibiting tampering with equipment to increase horsepower or to defeat emission control devices effectiveness
- Requiring construction vehicle engines to be properly tuned and maintained

- Using construction vehicles and equipment with the minimum practical engine size for the intended job

6.0 CONCLUSIONS

This project is expected to result in increased traffic volume and decreased congestion. Based on hot spot modeling for carbon monoxide and qualitative analysis of particulate matter 10 (PM_{10}) data, no exceedances of the National Ambient Air Quality Standards (NAAQS) are expected as a result of this project during the No-Action Alternative and the Build Alternative.

Based on the project construction phase duration (2010-2012), it is likely that construction operations could contribute to an increase in air quality emissions at the project area. A list of proposed mitigation measures as presented in Section 5.0, which will assist in Denver Metro Area in the maintenance and attainment of the NAAQS. In addition, adherence to the suggested mitigation measures will also assist the EAC submitted in the SIP.

The construction phase of this project will be greater than 25 acres in size, take longer than six months, and is expected to have several diesel emitting sources, which could affect air quality conditions during the construction phase of this project. Therefore, the City and County of Denver will need to follow the requirements of filing Air Pollution Emission Notifications (APEN) to fulfill EPA's concerns regarding air quality impacts.

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8.0 LIST OF ACRONYMS

APCD	Air Pollution Control Division
CCD	City and County of Denver
CDOT	Colorado Department of Transportation
CDPHE	Colorado Department of Public Health and Environment
CFR	Code of Federal Regulations
CO	Carbon Monoxide
CO_2	Carbon Dioxide
DOT	Department of Transportation
EA	Environmental Assessment
EAC	Early Action Compact
EPA	Environmental Protection Agency
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
LOS	Level of Service
MOA	Memorandum of Agreement
MSAT	Mobile Source Air Toxics
N/A	Not Applicable
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
N_2O	Nitrous Oxide
NO_2	Nitrogen Dioxide
NO_x	Oxides of Nitrogen
NS	Not Signalized
O_3	Ozone
Pb	Lead
$PM<_{10}$	Particulate matter of 10 microns in diameter or smaller
$PM<_{2.5}$	Particulate matter of 2.5 microns in diameter or smaller
ppm	Parts per million
RTP	Regional Transportation Plan
SIP	State Implementation Plan
SO_2	Sulfur Dioxide
STIP	State Transportation Improvement Program
ug/m3	micrograms per cubic meter of air
VOC	Volatile Organic Compounds