US 6/Wadsworth

Environmental Assessment

Air Quality Technical Memorandum

CDOT Project STU #0062-019 (15215)
CH2M HILL Project No. 358660

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CH2MHILL

Contents

Acronyms and Abbreviations

°F	degrees Fahrenheit
$\mu g/m^3$	micrograms per cubic meter
APCD	Air Pollution Control Division
AQCC	Air Quality Control Commission
BMP	best management practice
CAA	Clean Air Act
CCR	Code of Colorado Regulations
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO	carbon monoxide
CDOT	Colorado Department of Transportation
DE	diesel exhaust
DPM	diesel particulate matter
EA	Environmental Assessment
FHWA	Federal Highway Administration
FR	final rule
IRIS	Integrated Risk Information System
LOS	level of service
MSAT	mobile source air toxics
NAAQS	National Ambient Air Quality Standards
NATA	National Air Toxics Assessment
NCHRP	National Cooperative Highway Research Program
NEPA	National Environmental Policy Act
NLEV	national low emission vehicle
NO_2	nitrogen dioxide
NO_x	nitrogen oxide
O_3	ozone

Pb	lead
PM	particulate matter
PM_{10}	particulate matter less than 10 microns in aerodynamic diameter
$PM_{2.5}$	particulate matter less than 2.5 microns in aerodynamic diameter
ppm	parts per million
RFG	reformulated gasoline
RTP	Regional Transportation Plan
SIP	State Implementation Plan
SO_2	sulfur dioxide
TIP	Transportation Improvement Program
TM	technical memorandum
USEPA	U.S Environmental Protection Agency
VMT	vehicle miles traveled
VOC	volatile organic compound

Air Quality

1.0 Introduction

The Colorado Department of Transportation (CDOT), in cooperation with the Federal Highway Administration (FHWA), is preparing an Environmental Assessment (EA) for proposed changes to the US 6/Wadsworth Boulevard interchange within the City of Lakewood, Colorado. Changes are proposed to Wadsworth Blvd. between 4th and 14th Avenues and along US 6 from approximately Broadview Drive on the east to Allison Street on the west (Exhibit 1). Improvements are necessary to replace an outdated roadway and bridges containing inadequate geometrics, to address safety issues, and to accommodate existing and future traffic demand.

This technical memorandum (TM) summarizes the results of the air quality analysis performed for the US 6/Wadsworth Blvd. project. Air quality is evaluated to ensure that the project would not cause or contribute to poor air quality on a regional and local level. The analysis that follows was conducted in accordance with CDOT's *Air Quality Analysis and Documentation Procedures Manual* (CDOT, 2008).

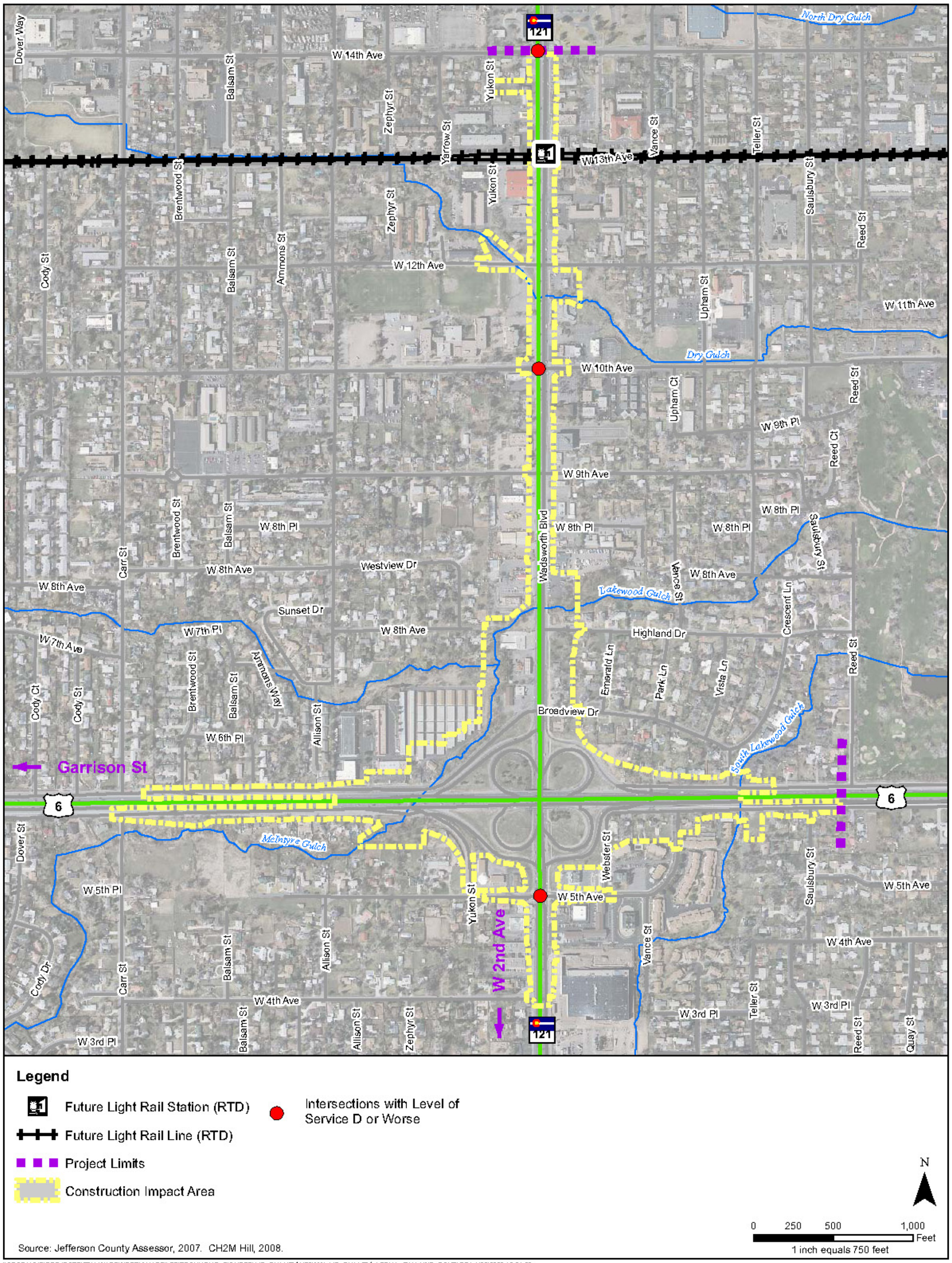
2.0 Summary of Results

The proposed project would not result in adverse effects to air quality. Localized concentrations of carbon monoxide (CO) were evaluated in the vicinity of the three signalized intersections most likely to be affected by the project. All of the scenarios analyzed indicated that concentrations are well below applicable ambient air quality standards; CO concentrations were predicted to be lower for the Build Alternative than the No Build Alternative in 2035. The project is not "a project of air quality concern" as defined in 40 CFR 93.123(b)(1). Therefore, the project-level conformity determination requirements of 40 CFR 93.116 have been satisfied and no qualitative PM hot spot analysis is necessary.

Because the estimated vehicle miles traveled (VMT) under the No Build and Build Alternatives are nearly the same (varying by less than 0.03 percent), it is expected there would be no appreciable difference in overall mobile source air toxics (MSAT) emissions between the two alternatives. Regardless of the alternative selected, emissions will likely be lower than present levels in the design year as a result of U.S. Environmental Protection Agency (USEPA) national control programs, which are projected to reduce MSAT emissions by 57 to 87 percent between 2000 and 2020.

Construction activities may have short-term effects to air quality as a result of fugitive dust during excavation, demolition, and earth moving activities. Emissions would increase as a result of roadway paving, vehicles traveling to and from the construction site, vehicles and construction equipment operating onsite, and detours and delays to local traffic traveling in the vicinity of construction areas. These impacts would be minimized with the implementation of best management practices (BMPs) during construction.

EXHIBIT 1
US 6/Wadsworth Boulevard Project Area



3.0 Regulatory Background

Federally funded transportation projects are required to evaluate impacts to air quality on the human environment under National Environmental Policy Act (NEPA) regulations consistent with Title 23 of the Code of Federal Regulations (CFR) Part 771 (23 CFR 771). The regulatory structure for air quality planning in Colorado includes federal, state, regional, and local agencies. These agencies either have regulatory authority or are responsible for the development and implementation of programs and plans designed to reduce air pollution levels, including emissions from transportation sources.

Federal air quality policies are regulated through the federal Clean Air Act (CAA). The USEPA adopted the CAA in 1970 and its amendments in 1977 and 1990. Pursuant to the CAA, the USEPA has established nationwide air quality standards to protect public health and welfare with an adequate margin of safety. These federal standards, known as the National Ambient Air Quality Standards (NAAQS), represent maximum allowable atmospheric concentrations for seven "criteria" pollutants: CO, sulfur dioxide (SO_2), lead (Pb), ozone (O_3), particulate matter less than 10 microns (PM_{10}) and 2.5 microns ($PM_{2.5}$) in aerodynamic diameter, and nitrogen dioxide (NO_2).

Colorado also has established state ambient air quality standards. The NAAQS and Colorado ambient air quality standards are summarized in Exhibit 2. Primary air quality standards were established for the protection of public health, and secondary standards are intended to protect the natural environment and other welfare considerations.

EXHIBIT 2
National and State Ambient Air Quality Standards

Pollutant	National Primary	National Secondary	Colorado
Carbon Monoxide			
8-Hour Average	9 ppm		
1-Hour Average	35 ppm		
Sulfur Dioxide			
Annual Average	80 $\mu g/m^3$		80 $\mu g/m^3$
24-Hour Average	365 $\mu g/m^3$		365 $\mu g/m^3$
3-Hour Average		1300 $\mu g/m^3$	700 $\mu g/m^3$
Lead			
Quarterly Average	1.5 $\mu g/m^{3\,b}$	1.5 $\mu g/m^3$	1.5 $\mu g/m^3$
Ozone			
1-Hour Average	0.12` ppm	0.12 ppm	
8-Hour Average	0.075 ppm	0.075 ppm	0.075 ppm
Particulate Matter (PM_{10})			
24-Hour Average	150 µg/m^3	150 µg/m^3	150 µg/m^3
Particulate Matter ($PM_{2.5}$)			
Annual Arithmetic Average	15 µg/m^3	15 µg/m^3	15 µg/m^3
24-Hour Average	35 µg/m^3	35 µg/m^3	35 µg/m^3
Nitrogen Dioxide (NO_2)			
Annual Average	0.053 ppm	0.053 ppm	0.05 ppm

[a] ppm = parts per million
[b] µg/m^3 = micrograms per cubic meter
Source: Colorado Air Quality Control Commission (AQCC) 5 Code of Colorado Regulations (CCR) 1001-14.

The 1977 CAA required each state to develop and maintain a State Implementation Plan (SIP) for each criteria pollutant that violates the applicable NAAQS. The SIP serves as a tool to avoid and minimize emissions of pollutants that exceed ambient thresholds, and to achieve compliance with the NAAQS. The Colorado Air Pollution Control Division (APCD) oversees Colorado air quality policies and is responsible for preparing and submitting the SIP to the USEPA.

3.1 Transportation Conformity

In 1990, the CAA was amended to strengthen regulation of both stationary and mobile emission sources for criteria pollutants. These amendments required that federally funded transportation projects located in areas that have been designated as nonattainment or maintenance with respect to one or more NAAQS conform to the SIP. Conformity with the SIP means that transportation activities will not produce new air quality violations, worsen existing violations, or delay timely attainment of the NAAQS.

A conformity determination for CO, PM_{10}, and O_3 was made for this project because a portion of the project area is located in the Denver Metropolitan Area, which is designated a maintenance area for CO and PM_{10}, and nonattainment for 1-hour and 8-hour O_3. In addition to performing a project-level conformity analysis, it is necessary to show that the project is included in a conforming Regional Transportation Plan (RTP) and the *2008-2013 Transportation Improvement Program (*TIP) (DRCOG, 2007a).

3.2 Mobile Source Air Toxics (MSATs)

In addition to regulating the criteria pollutants, the CAA identified 188 air toxics, also known as hazardous air pollutants. The USEPA has assessed this expansive list of toxics and identified a group of 21 as MSATs, which are set forth in a USEPA final rule (FR), "Control of Emissions of Hazardous Air Pollutants from Mobile Sources," 66 FR 17235 (March 29, 2001). The USEPA also extracted a subset of this list of 21 that it now labels as the six priority MSATs. These MSATs are benzene, formaldehyde, acetaldehyde, diesel particulate matter (DPM)/diesel exhaust organic gases, acrolein, and 1,3-butadiene.

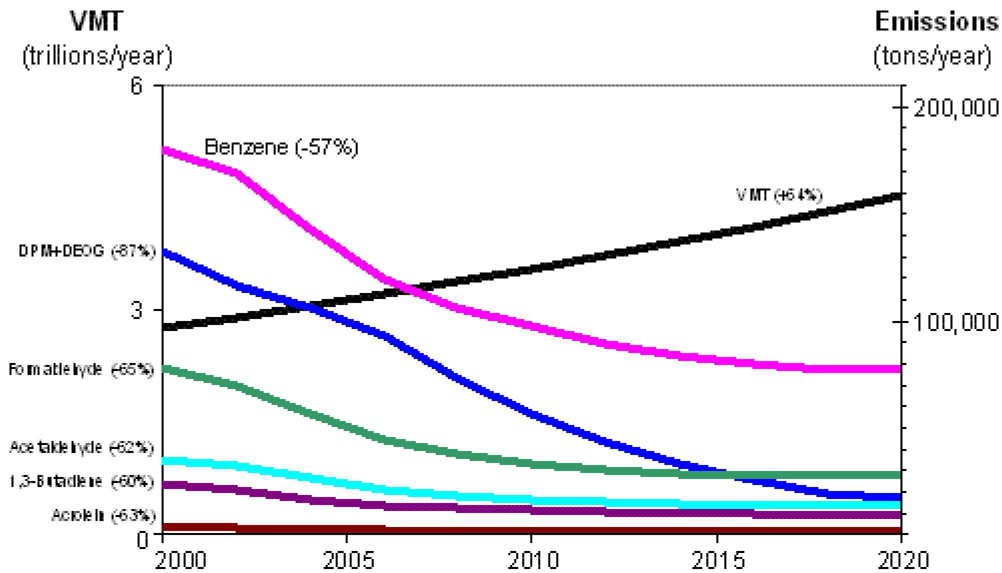
The USEPA has examined the impacts of existing and newly promulgated mobile source control programs, including its reformulated gasoline (RFG) program, national low emission vehicle (NLEV) standards, Tier 2 motor vehicle emissions standards and gasoline sulfur control requirements, and proposed heavy-duty engine and vehicle standards and on-highway diesel fuel sulfur control requirements. According to FHWA analysis, even if VMT increases by 64 percent, MSAT reductions of 57 to 87 percent are projected from 2000 to 2020, as shown in Exhibit 3.

As a result, the USEPA concluded that no further motor vehicle emissions standards or fuel standards were necessary to further control MSATs. The agency is preparing another rule under the authority of CAA Section 202(l) that will address these issues, and could make adjustments to the full 21 and six priority MSATs.

Transportation projects with the potential for MSAT effects are required to perform project-level MSAT analysis

EXHIBIT 3

U.S. Annual Vehicle Miles Traveled (VMT) versus Mobile Source Air Toxics Emissions, 2000-2020



Notes: For on-road mobile sources. Emissions factors were generated using MOBILE6.2. MTBE proportion of market for oxygenates is held constant, at 50%. Gasoline RVP and oxygenate content are held constant. VMT: Highway Statistics 2000, Table VM-2 for 2000; analysis assumes annual growth rate of 2.5%. "DPM + DEOG" is based on MOBILE6.2-generated factors for elemental carbon, organic carbon, and SO_4 from diesel-powered vehicles, with the particle size cutoff set at 10.0 microns.

Unavailable Information for Project-Specific MSAT Impact Analysis

This TM includes a basic analysis of the likely MSAT emission impacts of this project. However, available technical tools do not enable us to predict the project-specific health impacts of the emission changes associated with the No Build and Build Alternatives presented in the EA. Due to these limitations, the following discussion is included in accordance with Council on Environmental Quality (CEQ) regulations [40 CFR 1502.22(b)] regarding incomplete or unavailable information.

Information that is Unavailable or Incomplete

Evaluating the environmental and health impacts from MSATs on a proposed highway project would involve several key elements, including 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 impacts based on the estimated exposure. Each of these steps is encumbered by technical shortcomings or uncertain science that prevents a more complete determination of the MSAT health impacts of this project.

- **Emissions.** The USEPA tools to estimate MSAT emissions from motor vehicles are not sensitive to key variables determining emissions of MSATs in the context of highway projects. While MOBILE6.2 is used to predict emissions at a regional level, it has limited applicability at the project level. MOBILE6.2 is a trip-based model, and emission factors are projected based on a typical trip of 7.5 miles and on average speeds for this typical trip. This means that MOBILE6.2 does not have the ability to predict emission factors for a specific vehicle operating condition at a specific location at a specific time. Because of this limitation, MOBILE6.2 can only approximate the operating speeds and levels of congestion likely to be present on the largest-scale projects, and cannot adequately capture emissions effects of smaller projects. For particulate matter (PM), the model results are not sensitive to average trip speed, although the other MSAT emission rates do change with changes in trip speed. Moreover, the emissions rates used in MOBILE6.2 for both PM and MSATs are based on a limited number of tests of mostly older-technology vehicles. Lastly, in its discussions of PM under the conformity rule, the USEPA has identified problems with MOBILE6.2 as an obstacle to quantitative analysis.

These deficiencies compromise the capability of MOBILE6.2 to estimate MSAT emissions. MOBILE6.2 is an adequate tool for projecting emissions trends as well as performing relative analyses between alternatives for very large projects. However, it is not sensitive enough to capture the effects of travel changes tied to smaller projects or to predict emissions near specific roadside locations.

- **Dispersion.** The tools to predict how MSATs disperse are also limited. The USEPA's current regulatory models, CALINE3 and CAL3QHC, were developed and validated more than a decade ago for the purpose of predicting episodic concentrations of CO to determine compliance with the NAAQS. The performance of dispersion models is more accurate for predicting maximum concentrations that can occur at some time at some location within a geographic area. This limitation makes it difficult to predict accurate exposure patterns at specific times at specific highway project locations across an urban area to assess potential health risk. The National Cooperative Highway Research Program (NCHRP) is conducting research on best practices in applying models and other technical methods in the analysis of MSATs. This work also will focus on identifying appropriate methods of documenting and communicating MSAT impacts in the NEPA process and to the general public. Along with these general limitations of dispersion models, FHWA is also faced with a lack of monitoring data in most areas for use in establishing project-specific MSAT background concentrations.
- **Exposure Levels and Health Effects.** Finally, even if emission levels and concentrations of MSATs could be accurately predicted, shortcomings in current techniques for exposure assessment and risk analysis preclude reaching meaningful conclusions about project-specific health impacts. Exposure assessments are difficult because it is difficult to accurately calculate annual concentrations of MSATs near roadways, and to determine the portion of a year that people are actually exposed to those concentrations at a specific location. These difficulties are magnified for 70-year cancer assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over a 70-year period. There are also considerable uncertainties associated with the existing estimates of toxicity of the various MSATs because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population. Because of these shortcomings, any calculated difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with calculating the impacts. Consequently, the results of such assessments would not be useful to decision makers, who would need to weigh this information against other project impacts that are better suited for quantitative analysis.

Summary of Existing Credible Scientific Evidence Relevant to Evaluating the Impacts of MSATs

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 adverse health outcomes through epidemiological studies (frequently based on emissions levels found in occupational settings) or that animals demonstrate adverse health outcomes when exposed to large doses.

Exposure to toxics has been a focus of a number of USEPA efforts. Most notably, the USEPA conducted the National Air Toxics Assessment (NATA) in 1996 to evaluate modeled estimates of human exposure applicable to the county level. While not intended for use as a measure of or benchmark for local exposure, the modeled estimates in the NATA database best illustrate the levels of various toxics when aggregated to a national or state level.

The USEPA is in the process of assessing the risks of various kinds of exposures to these pollutants. The USEPA Integrated Risk Information System (IRIS) is a database of human health effects that may result from exposure to various substances found in the environment. The IRIS database is located at http://www.epa.gov/iris. The following toxicity information for the six priority MSATs was taken from the IRIS database "Weight of Evidence Characterization" summaries. This information is taken verbatim from USEPA's IRIS database and represents the agency's most current evaluations of the potential hazards and toxicology of these chemicals or mixtures.

- **Benzene** is characterized as a known human carcinogen.
- The potential carcinogenicity of **acrolein** cannot be determined because the existing data are inadequate for an assessment of human carcinogenic potential for either the oral or inhalation routes of exposure.
- **Formaldehyde** is a probable human carcinogen, based on limited evidence in humans, and sufficient evidence in animals.
- **1,3-butadiene** is characterized as carcinogenic to humans by inhalation.
- **Acetaldehyde** is a probable human carcinogen based on increased incidence of nasal tumors in male and female rats as well as laryngeal tumors in male and female hamsters after inhalation exposure.
- **Diesel exhaust** (DE) is likely to be carcinogenic to humans by inhalation from environmental exposures. DE as reviewed in this document is the combination of diesel PM and DE organic gases.
- **DE** also represents chronic respiratory effects, possibly the primary noncancer hazard from MSATs. Prolonged exposures may impair pulmonary function and could produce symptoms, such as cough, phlegm, and chronic bronchitis. Exposure relationships have not been developed from these studies.

There have been other studies that address MSAT health impacts in proximity to roadways. The Health Effects Institute, a non-profit organization funded by the USEPA, FHWA, and industry, has undertaken a major series of studies to research near-roadway MSAT hot spots, the health implications of the entire mix of mobile source pollutants, and other topics. The final summary of the series is not expected for several years.

Some recent studies have reported that proximity to roadways is related to adverse health outcomes, particularly respiratory problems. Much of this research is not specific to MSATs, instead surveying the full spectrum of both criteria and other pollutants. The FHWA cannot evaluate the validity of these studies, but more importantly, they do not provide information that would be useful to alleviate the uncertainties listed above and enable us to perform a more comprehensive evaluation of the health impacts specific to this project.

Relevance of Unavailable or Incomplete Information to Evaluating Reasonably Foreseeable Significant Adverse Impacts on the Environment, and Evaluation of Impacts Based upon Theoretical Approaches or Research Methods Generally Accepted in the Scientific Community

Because of the uncertainties outlined above, a quantitative assessment of the effects of air toxic emissions impacts on human health cannot be made at the project level. While available tools do allow us to reasonably predict relative emissions changes between alternatives for larger projects, the amount of MSAT emissions from each of the alternatives and MSAT concentrations or exposures created by each cannot be predicted with sufficient accuracy to be useful in estimating health impacts (as noted above, the current emissions model is not capable of serving as a meaningful emissions analysis tool for smaller projects). Therefore, the relevance of the unavailable or incomplete information is that it is not possible to make a determination of whether any of the alternatives would have "significant adverse impacts on the human environment."

In this TM, FHWA has provided a qualitative analysis of MSAT emissions relative to the No Build and Build Alternatives, and has acknowledged that both alternatives may result in increased exposure to MSAT emissions in certain locations, although the concentrations and duration of exposures are uncertain. Because of this uncertainty, the health effects from these emissions cannot be estimated.

4.0 Existing Conditions

Existing air quality conditions were determined by reviewing air monitoring data available for the area (measured concentrations of specific pollutants in the air). Local air quality is then compared to the NAAQS, which have been established for the protection of human health and welfare.

4.1 Local Climate

Ambient air quality is a function of many factors, including climate, topography, meteorological conditions, and the production of airborne pollutants by natural or artificial sources. The climates of local areas are profoundly affected by differences in elevation and, to a lesser degree, by the orientation of mountain ranges and valleys with respect to general air movements. Lakewood is located along the Front Range of the Rocky Mountains within the eastern plains. The climate is characterized by low relative humidity, abundant sunshine, light rainfall, moderate to high wind movement, and a large daily range in temperature. The climate, while generally mild compared to the mountains to the west and the plains further east, can often be unpredictable.

Average annual rainfall measured in Denver is 15.3 inches, a large proportion of which is during the growing season from April through September. Summer precipitation is largely from thunderstorm activity and is sometimes extremely heavy. Strong winds occur frequently in winter and spring. The average daily temperature in January is 29.5 degrees Fahrenheit (°F), and the average daily temperature in July is 73.3°F (Gale Research Company, 1985).

4.2 Monitoring Data

Areas of the country where air pollution levels persistently exceed the NAAQS may be designated "nonattainment." A maintenance area is a region previously designated as nonattainment, and subsequently redesignated to attainment. Based on local air quality monitoring data and Colorado APCD analysis, the USEPA has determined that the Denver Metropolitan Area is a nonattainment area for 1-hour and 8-hour O_3. It is a maintenance area for CO and PM_{10}, and it is either in attainment or unclassified for each of the other standards.

In December 2002, 33 states submitted compact agreements pledging to meet the 1997 8-hour O_3 standard earlier than required. The states had to meet a number of criteria and certain milestones. The voluntary Early Action Compact (EAC) program provided a flexible approach to reducing pollution to assist 14 communities that did not meet the 1997 8-hour O_3 standard, as well as 15 communities which met the standard and want to be proactive in reducing air pollution. Despite efforts in the EAC Ozone Action Plan, the Denver area failed to achieve the standard due to high readings in July 2007, resulting in a 3-year (2005-2007) design value of 0.085 parts per million (ppm) at one monitor that violated the 8-hour O_3 NAAQS. On November 20, 2007, the USEPA did not continue the deferral of the effective date for non-attainment in Denver area and the official nonattainment designation became effective.

On June 15, 2005, the 1-hour O_3 standard was revoked for all areas except the 8-hour O_3 nonattainment EAC areas. The 1-hour standard was revoked for 13 of the 14 areas 1 year after the effective date (April 15, 2008) of their designation as attainment or nonattainment for the 8-hour O_3 standard. The Denver CO Subpart 1 EAC did not meet the requirements, and the area was designated nonattainment for 8-hour O_3, thereby delaying the revocation of the 1-hour O_3 standard until April 15, 2009. At this time, the 1-hour O_3 standard will no longer be applicable.

The Colorado APCD operates a network of ambient air quality monitoring stations within the Denver Metropolitan Area to assess the levels of regulated pollutants and to verify continued compliance with the NAAQS. Exhibit 4 summarizes monitoring data for the past 3 years at the two stations closest to the project area, and also shows the highest monitored values of each criteria pollutant.

Data show that the 8-hour O_3 standard was exceeded in Jefferson County in 2005 and 2006, and the 24-hour $PM_{2.5}$ standard was exceeded in 2005, 2006, and 2007. The ambient air concentrations of the other pollutants have been below the NAAQS for the last several years.

EXHIBIT 4
Ambient Air Quality Monitoring Data

Pollutant	Monitor Location	2005 Max Conc.	2006 Max Conc.	2007 Max Conc.	NAAQS
Particulate Matter < 10 microns (PM_{10})					
24-Hour Average ($\mu g/m^3$)	2105 Broadway, Denver Denver County	71	85	75	150
Particulate Matter < 2.5 microns ($PM_{2.5}$)					
Annual Arithmetic Mean ($\mu g/m^3$)	2105 Broadway, Denver Denver County	9.82	8.90	10.73	15
24-Hour Average ($\mu g/m^3$)		**37.2**	**37.8**	**61.4**	35
Carbon Monoxide (CO)					
1-Hour Average (ppm)	2105 Broadway, Denver	4.6	6.4	6.0	35
8-Hour Average (ppm)	Denver County	2.9	3.4	3.2	9
Sulfur Dioxide (SO_2)					
Annual Arithmetic Mean (ppm)	2105 Broadway, Denver Denver County	0.003	0.003	0.003	0.030
3-Hour Average (ppm)		0.028	0.022	0.028	0.5
24-Hour Average (ppm)		0.011	0.009	0.013	0.14
Ozone (O_3)					
1-Hour Average (ppm)	12400 W. Hwy 285, Lakewood Jefferson County	0.098	0.112	0.081	0.12
8-Hour Average (ppm)	12400 W. Hwy 285, Lakewood Jefferson County	**0.085**	**0.096**	0.071	0.075
Nitrogen Dioxide (NO_2)					
Annual Arithmetic Average (ppm)	2105 Broadway, Denver Denver County	0.028	0.029	0.027	0.053

Source: USEPA, 2008.
Bold numbers indicate exceedances.

5.0 Environmental Consequences

Air quality is a consideration for all transportation projects. The level of consideration appropriate for a given project depends on a number of factors, but particularly on the air quality status and history of the area, the nature of the project, and the projected traffic growth and characteristics. CDOT has outlined the air quality analysis process in its *Air Quality Analysis and Documentation Procedures Manual* (CDOT, 2008). Quantitative analyses, qualitative text, and conformity determination procedures are outlined in this document and applied to the analysis that follows.

5.1 Construction

Construction emissions were evaluated qualitatively. Construction emissions would be temporary and are not anticipated to cause air quality violations.

No Build Alternative

If the project is not built, no construction effects would occur.

Build Alternative

Construction activities that could affect air quality include soil-disturbing activities, heavy-duty equipment exhaust, commuting workers' motor vehicle exhaust, and asphalt paving. The total emissions and the timing of the emissions from these sources would vary depending on the phasing of the construction activities, and would not all occur simultaneously. Construction-related emissions would be temporary and, in some cases, of short duration.

Typical sources of emissions during construction of transportation projects include the following:

- Fugitive dust generated during excavation, grading, loading, and unloading activities.
- Dust generated during demolition of structures and pavement.
- Engine exhaust emissions from construction vehicles, worker vehicles, and diesel fuel-fired construction equipment.
- Increased motor vehicle emissions associated with increased traffic congestion during construction.
- Volatile organic compounds (VOCs) and odorous compounds emitted during asphalt paving.

The regulated pollutants of concern for the first two activities are $PM_{2.5}$ and PM_{10}. Engine and motor vehicle exhaust would result in emissions of VOCs, nitrogen oxide (NO_x), PM_{10}, air toxics, and greenhouse gases.

5.2 Operations

Emissions of VOCs, CO, NO_x, and PM_{10} were estimated for the No Build and Build Alternatives to determine the level of impacts. Air quality impacts were analyzed for the existing condition (2007) and project horizon (2035).

No Build Alternative

A decision not to proceed with the proposed improvements to the US 6/Wadsworth Blvd. interchange would perpetuate the traffic conflicts that currently exist in the study area. The improvements to traffic flow and resulting lower vehicle emissions expected to result from the Build Alternative would not occur. Instead, it is likely that traffic conflicts, congestion, and vehicle idle times would increase with the passage of time, resulting in local increases in vehicle emissions in the study area above present levels.

No exceedance of the NAAQS for CO is predicted for the No Build Alternative. As with the Build Alternative, local CO concentrations under the No Build Alternative are expected to decrease from existing conditions (refer to Exhibits 7 and 8).

Although the No Build Alternative would not cause an impact to the federal NAAQS, projected increases in traffic volumes on local streets would likely increase delays and lower travel speeds of motor vehicles, both of which would mean higher emissions from vehicle exhaust in the study area. These emissions would include other pollutants of concern, especially $PM_{2.5}$ and diesel PM.

Build Alternative

CO Emissions

Hot spot modeling is a procedure for calculating CO concentrations along roadways and near intersections. The USEPA-approved model CAL3QHC was used to calculate CO concentrations, according to the USEPA's *Guideline for Modeling Carbon Monoxide from Roadway Intersections* (USEPA, 1992a).

The traffic and level of service (LOS) analysis serve as a screening method to determine if a CO hot spot analysis is needed. On a scale of A to F, intersections designated LOS A have the shortest delays and those designated LOS F have the longest delays. Longer delays result in greater pollutant emissions from vehicle exhaust while the vehicles are moving slowly or idling. Hot spot modeling is required at intersections where the LOS is D or worse, indicating vehicle delays that translate to higher exhaust emissions.

Exhibit 5 provides a comparison of LOS for signalized intersection (AM/PM peaks) under both the No Build and Build Alternatives. Level of service would be better under the Build Alternative at all three intersections modeled for the worst hours of service (PM peak).

EXHIBIT 5
Comparison of 2035 Level of Service for Signalized Intersections – No Build and Build Alternatives

Scenario	Intersection	AM LOS	AM Volume	PM LOS	PM Volume
Existing	10th Ave./Wadsworth Blvd.	B	3,540	D	4,270
	14th Ave./Wadsworth Blvd.	B	3,400	C	4,170
	5th Ave./Wadsworth Blvd.	B	4,470	B	5,090
2035 No Build Alternative	10th Ave./Wadsworth Blvd.	C	4,350	F	5,260
	14th Ave./Wadsworth Blvd.	D	4,520	E	5,700
	5th Ave./Wadsworth Blvd.	C	5,490	D	6,250
2035 Build Alternative	10th Ave./Wadsworth Blvd.	C	4,830	D	6,030
	14th Ave./Wadsworth Blvd.	C	4,890	D	6,160
	5th Ave./Wadsworth Blvd.	B	5,620	B	6,540
	US 6/Wadsworth Blvd. (South)	C	6,420	C	7,320
	US 6/Wadsworth Blvd. (North)	A	5,210	A	5,880

Source: *US 6 and Wadsworth Boulevard Traffic Study Report*, CH2M HILL, 2008.

The following three intersections showed a PM LOS of D or worse under the Build Alternative:

- 5th Avenue and Wadsworth Blvd.
- 10th Avenue and Wadsworth Blvd.
- 14th Avenue and Wadsworth Blvd.

These intersections were analyzed quantitatively to determine localized CO impacts. PM peak-hour traffic volumes were estimated using current traffic model and forecast data provided in the *Traffic Study Report* prepared for the EA. Traffic volumes were used in the air quality model to estimate a 1-hour maximum CO concentration and derive the 8-hour maximum CO concentration. The analysis was performed for existing conditions (2007) and the horizon year (2035).

Emission factors from USEPA's MOBILE6.2 model were provided by the Colorado APCD (APCD, 2008). MOBILE6.2 calculates emission factors for each type of vehicle typically present in the fleet, including gasoline-fueled light-duty vehicles, trucks, and heavy-duty vehicles; motorcycles; and diesel-fueled light-duty vehicles, trucks, and heavy-duty vehicles. These are averaged into a fleet-wide emission factor based on local vehicle registration data. The model accounts for progressively more stringent tailpipe emission standards over the vehicle model years evaluated.

The USEPA CAL3QHC dispersion model was used to calculate ambient concentrations of CO near roadway intersections (USEPA, 1992b). Modeled receptors were located at sites accessible to the public, generally near intersection corners and near each approach and departure link, according to USEPA guidance (USEPA, 1992a). The receptors were placed no closer than 3 meters (10 feet) from the edge of the road, at the corners, and at distances of 25 and 50 meters (82 and 164 feet) from each corner along each approach and departure.

As specified in the USEPA guidelines (USEPA, 1992b), CAL3QHC was run with meteorological input parameters consisting of a 1-meter (3-foot) per-second wind speed, 1,000 meter (3,250-foot) mixing height, and a neutral (Class D) atmosphere to simulate winter conditions, when elevated CO concentrations most frequently occur. Class D stability is recommended in USEPA's *Guideline for Modeling Carbon Dioxide From Roadway Intersections* (USEPA, 1992a) for urban areas. One-hour average ambient CO concentrations were calculated to estimate the impact during peak-hour traffic conditions. CAL3QHC model inputs are summarized in Exhibit 6.

EXHIBIT 6
Summary of CAL3QHC Inputs

Description	Value
Surface roughness coefficient	108 cm[1]
Signal type	Actuated[2]
Intersection arrival rate	Average progression[2]
Saturation flow rate	Provided by traffic model output
Clearance lost time	2 seconds[2]

[1] Surface roughness recommended in guidance for office land use type (USEPA, 1992b).
[2] Values recommended by USEPA guidance (USEPA, 1992a).

Because the 8-hour average CO NAAQs are lower and more limiting than the 1-hour standard, the results of the air quality analyses of traffic emissions are typically reported for this averaging period. Regulatory guidance recommends adjusting the 1-hour concentrations to 8-hour concentrations using a factor of 0.7, which conservatively accounts for variations in meteorology over an 8-hour period. Results are reported here for both 1-hour and 8-hour CO concentrations. One-hour and 8-hour background CO concentrations were provided by the Colorado APCD.

Exhibits 7 and 8 summarize the CAL3QHC modeling results for CO under existing conditions, the No Build Alternative, and the Build Alternative. Existing concentrations at all intersections are below the 1-hour and 8-hour NAAQS. The project would neither cause new violations of the 1 hour or 8-hour CO NAAQS in future years, nor increase the frequency or severity of any existing violation.

EXHIBIT 7
CO Hot Spot Modeling Results for 1-Hour Average

Intersection	Scenario	1-Hour Maximum Modeled CO Concentration (ppm)	Background CO Concentration (ppm)	Total CO Concentration (ppm)
5th Ave./ Wadsworth Blvd.	Existing	5.9	4.2	10.1
	2035 No Build	4.3	3.0	7.3
	2035 Build	4.1	3.0	7.1
10th Ave./ Wadsworth Blvd.	Existing	6.2	3.7	9.9
	2035 No Build	3.7	2.6	6.3
	2035 Build	4.1	2.6	6.7
14th Ave./ Wadsworth Blvd.	Existing	5.5	3.0	8.5
	2035 No Build	4.2	2.2	6.4
	2035 Build	4.2	2.2	6.4

EXHIBIT 8
CO Hot Spot Modeling Results for 8-Hour Average

Intersection	Scenario	8-Hour Maximum Modeled CO Concentration (ppm)	Background CO Concentration (ppm)	Total CO Concentration (ppm)
5th Ave./ Wadsworth Blvd.	Existing	4.1	2.4	6.6
	2035 No Build	3.0	1.7	4.7
	2035 Build	2.9	1.7	4.6
10th Ave./ Wadsworth Blvd.	Existing	4.3	2.5	6.8
	2035 No Build	2.6	1.7	4.3
	2035 Build	2.9	1.7	4.6
14th Ave./ Wadsworth Blvd.	Existing	3.9	2.0	5.9
	2035 No Build	2.9	1.4	4.4
	2035 Build	2.9	1.4	4.4

$PM_{2.5}$ and PM_{10} Emissions

On March 10, 2006, the USEPA issued amendments to the Transportation Conformity Rule to address localized impacts of PM. These amendments, titled "$PM_{2.5}$ and PM_{10} Hot-Spot Analyses in Project-Level Transportation Conformity Determinations for the New $PM_{2.5}$ and Existing PM_{10} National Ambient Air Quality Standards" (71 FR 12468), require the assessment of localized air quality impacts in $PM_{2.5}$ and PM_{10} nonattainment and maintenance areas for projects of air quality concern, which are defined in the following manner:

- New or expanded highway projects that have a significant number of, or significant increase in, the number of diesel vehicles.
- Projects affecting intersections that are at LOS D, E, or F with a significant number of diesel vehicles, or those that would change to LOS D, E, or F because of increased traffic volumes from a significant number of diesel vehicles related to the project.
- New bus and rail terminals, and transfer points that have a significant number of diesel vehicles congregating at a single location.
- Expanded bus and rail terminals, and transfer points that significantly increase the number of diesel vehicles congregating at a single location.
- Projects in or affecting locations, areas, or categories of sites that are identified in the $PM_{2.5}$ or PM_{10} applicable implementation plan or implementation plan submission, as appropriate, as sites of violation or possible violation.

The US 6/Wadsworth Blvd. project would not be considered of air quality concern for PM based on the above criteria. The proposed undertaking is not "a project of air quality concern" as defined in 40 CFR 93.123(b)(1). Therefore, the project-level conformity determination requirements of 40 CFR 93.116 have been satisfied and no qualitative PM hot spot analysis is necessary.

Emissions due to the construction activities for this project will be minimized by the implementation of BMPs identified in the mitigation section of this TM.

MSATs

FHWA guidance suggests a three-tiered approach to analyzing the effects of a transportation project in terms of public exposure to MSAT emissions. The level of analysis is related to expected size and impact of the project, as follows:

1. No analysis for projects with no potential for meaningful MSAT effects; or
2. Qualitative analysis for projects with low potential MSAT effects; or
3. Quantitative analysis to differentiate alternatives for projects with higher potential MSAT effects.

The amount of MSATs emitted would be proportional to the VMT, assuming that other variables such as fleet mix are the same for each alternative. The VMT was estimated on a regional scale and is 122,035,112 for No Build Alternative versus 122,071,405 for the Build Alternative. The regional VMT estimated for the Build Alternative is slightly higher than that for the No Build Alternative because the additional capacity increases the efficiency of the roadway and attracts rerouted trips from elsewhere in the transportation network. This increase in VMT would lead to higher MSAT emissions for the Build Alternative along the highway corridor and a corresponding decrease in MSAT emissions along the parallel routes. The emissions increase is offset somewhat by lower MSAT emission rates due to increased speeds; according to USEPA's MOBILE6 emissions model, emissions of all of the priority MSATs, except for diesel PM, decrease as speed increases. The extent to which these speed-related emissions decreases will offset VMT-related emissions increases cannot be reliably projected due to the inherent deficiencies of technical models.

Because the estimated regional VMT under the No Build and Build Alternatives are nearly the same (varying by less than 0.03 percent), it is expected there would be no appreciable difference in overall MSAT emissions between the two alternatives. Additionally, regardless of the alternative selected, emissions will likely be lower than present levels in the design year as a result of the USEPA's national control programs, which are projected to reduce MSAT emissions by 57 to 87 percent between 2000 and 2020. Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the USEPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the study area are likely to be lower in the future in nearly all cases.

The additional travel lanes contemplated as part of the Build Alternative would have the effect of moving some traffic closer to nearby homes, schools, and businesses; therefore, there may be localized areas where ambient concentrations of MSATs could be higher under the Build Alternative than the No Build Alternative. The localized increases in MSAT concentrations would likely be most pronounced along the expanded roadway sections that would be built along Wadsworth Blvd. However, as discussed above, the magnitude and duration of these potential increases compared to the No Build Alternative cannot be accurately quantified due to the inherent deficiencies of current models. In sum, when a highway is widened and, as necessity, moves closer to receptors, the localized level of MSAT emissions for the Build Alternative could be higher relative to the No Build Alternative, but this could be offset by improved levels of service, increases in speeds, and reductions in congestion (which are associated with lower MSAT emissions). Moreover, MSATs will be lower in other locations when traffic shifts away from them. However, on a regional basis, USEPA's vehicle and fuel regulations, coupled with fleet turnover, will over time cause substantial emissions reductions that, in almost all cases, will cause region-wide MSAT levels to be significantly lower than today.

Ozone Emissions

The results for CO can be extrapolated to conclude that the roadway improvements proposed by this project would not result in adverse effects on air quality from other pollutants, including O_3. Roadway improvements proposed by the project have the overall effect of improving traffic flow and reducing idling time, when motor vehicle emissions are highest. Therefore, the project is not expected to result in any increase in emissions of O_3 or O_3 precursors that would contribute to a violation of the NAAQS. Ozone is a pollutant that is formed downwind of its precursor emissions of VOCs and NO_x, in the presence of sunlight. It is, therefore, considered a pollutant of regional concern, and conformity is demonstrated on a regional level through a conforming RTP and TIP.

6.0 Conformity Statement

Because the project is not expected to create any new violations or increase the frequency of an existing violation of the standards, it is determined to conform with the purpose of the current SIP and the requirements of the CAA. The proposed project is included in the RTP, the *2035 Metro Vision Regional Transportation Plan* (DRCOG, 2007b), and in the *2008-2013 Transportation Improvement Program (*DRCOG, 2007a). The RTP and the TIP meet the conformity requirements identified by federal and state regulations for CO, PM_{10}, and O_3. Because the project is included in these plans, which conform to federal and state regulations, the project is also considered to demonstrate project-level conformity for O_3.

7.0 Mitigation

Construction

For temporary effects during construction, state law requires construction site owners and/ or operators to use ultra-low-sulfur diesel fuel and to take reasonable precautions to prevent fugitive dust from becoming airborne.

Federal regulations also require the use of ultra-low-sulfur diesel fuel in on-road trucks and will require the use of ultra-low-sulfur diesel fuel for construction equipment by 2010. This will reduce the sulfur content of diesel fuel by 97 percent from its current level of 500 ppm to about 15 ppm, and will result in a decrease in both SO_2 and PM emissions from these engines. CDOT would require contractors to reduce idling time of equipment and vehicles, and to use newer construction equipment or equipment with add-on emission controls.

Fugitive dust may become airborne during demolition, material transport, and grading, while driving vehicles and machinery both onsite and offsite, and through wind events. Site-specific mitigation methods would be determined during construction. Controlling fugitive dust emissions could require some of the following actions:

- Spray exposed soil with water or other suppressants to reduce emissions of PM_{10} and deposition of PM.
- Use phased development to keep disturbed areas to a minimum.
- Use wind fencing to reduce disturbance to soils.
- Minimize dust emissions during transport of fill material or soil by wetting down the contents or by ensuring adequate freeboard (space from the top of the material to the top of the truck bed) on trucks.
- Promptly clean up spills of transported material on public roads.
- Schedule work tasks to minimize disruption of the existing vehicle traffic on streets.
- Restrict onsite traffic to reduce soil upheaval and the transport of material to roadways.
- Locate construction equipment and truck staging areas away from sensitive receptors as practicable and in consideration of potential effects on other resources.

- Provide wheel washers to remove PM that would otherwise be carried offsite by vehicles to decrease deposition of PM on area roadways.
- Cover dirt, gravel, and debris piles as needed to reduce dust and wind-blown debris.
- Minimize odors onsite by covering loads of hot asphalt.

Emissions of diesel particulate, PM_{10}, $PM_{2.5}$, VOCs, NO_x, sulfur oxides, and CO would be minimized whenever reasonable and possible. Because these emissions result primarily from construction equipment, machinery engines would be maintained in good working order to minimize exhaust emissions.

Operations

Operations address mitigation for impacts that would result from the ongoing use and maintenance of the highway. Because the Build Alternative is in compliance with the regional transportation conformity requirements and would not result in long-term or permanent adverse effects to air quality, mitigation following construction is not required.

8.0 Conclusion

The air analysis indicated that the roadway improvements proposed by this project would not result in adverse effects on air quality from air pollutants. This is because the project would have an overall effect of improving traffic flow, thereby reducing idling time.

Localized concentrations of CO were evaluated in the vicinity of the three signalized intersections shown in Exhibit 1. All of the scenarios analyzed indicated that CO concentrations would be below applicable ambient air quality standards with the Build Alternative. In fact, for the three analyzed intersections, CO concentrations were predicted to be lower for both the No Build and Build Alternatives.

Because the estimated VMT under the No Build and Build Alternatives are nearly the same (varying by less than 0.03 percent), it is expected there would be no appreciable difference in overall greenhouse gases or MSAT emissions between the two alternatives. Regardless of the alternative selected, MSAT emissions will likely be lower than present levels in the design year as a result of USEPA national control programs, which are projected to reduce MSAT emissions by 57 to 87 percent between 2000 and 2020. Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the USEPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the study area are likely to be lower in the future in nearly all cases.

9.0 References

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