AIR QUALITY TECHNICAL REPORT

FOR THE

6TH AVENUE PARKWAY EXTENSION ENVIRONMENTAL ASSESSMENT

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APCD..... Air Pollution Control Division
CARB..... California Air Resources Board
CO ..... carbon monoxide
CO2 ..... carbon dioxide
CDOT ..... Colorado Department of Transportation
DRCOG ..... Denver Regional Council of Governments
E-470 ..... E-470 Tollway
EA..... Environmental Assessment
EPA ..... Environmental Protection Agency
FHU ..... Felsburg Holt and Ullevig
FHWA..... Federal Highway Administration
GHG ..... greenhouse gas
I-70 ..... Interstate 70
IRIS..... Integrated Risk Information System
LOS ..... level of service
µm ..... micrometers
µg/m^3 ..... micrograms per cubic meter
mph..... miles per hour
MOVES..... Motor Vehicle Emissions Simulator
MMT ..... million metric tons
MSAT..... Mobile Source Air Toxics
NAAQS ..... National Ambient Air Quality Standards
NEPA..... National Environmental Policy Act
NO_x ..... nitrogen oxides
O_3 ..... ozone
$PM_{2.5}$ ..... particulate matter smaller than 2.5 microns
PM_{10}..... particulate matter smaller than 10 microns
ppb..... parts per billion
ppm..... parts per million
RTP ..... Regional Transportation Plan
SH 30 ..... State Highway 30
SIP..... State Implementation Plan
TIP ..... Transportation Improvement Program
VMT ..... vehicle miles traveled
VOC..... volatile organic compound
vph..... vehicles per hour
vpd..... vehicles per day

1. INTRODUCTION

This technical report has been prepared in support of the 6th Avenue Parkway Extension Environmental Assessment (EA) extending 6th Avenue from State Highway 30 (SH 30) to the E-470 Tollway (E-470). This technical report evaluates the effects of the Proposed Action and the No Action Alternative with respect to air quality.

1.1 Proposed Action

The Proposed Action would extend the 6th Avenue Parkway for approximately 2 miles along a new alignment, connecting existing 6th Avenue/SH 30 to the west with the existing 6th Avenue Parkway at E-470 to the east. This would close a gap in the existing major arterial street system, reducing out of direction travel and improving the efficiency and reliability of the transportation system. The Proposed Action would be a six-lane arterial roadway with a raised median and sidewalks.

Six initial alternatives were developed and screened through three screening levels to identify the Proposed Action. The alternatives screening is summarized in **Appendix A1** *Alternatives Technical Report* of the EA. Details of the Proposed Action are presented in **Appendix A2** *Conceptual Design Plans* of the EA.

The Proposed Action is shown on **Figure 1**. Major elements of the Proposed Action are identified by number from west to east on **Figure 1**, and include the following:

Element 1. Tie into existing 6th Avenue/SH 30: 6th Avenue/SH 30 is an existing two-lane arterial. At the western end of the Proposed Action, a signalized "thru-tee" type intersection would be constructed connecting the Proposed Action roadway to existing 6th Avenue/ SH 30. This new signalized intersection would include bypass lanes for the eastbound SH 30 through movement or a thru-tee signalized intersection with bypass lanes for both the eastbound SH 30 through movement. The tie-in would be an urban curb and gutter section with three 12-foot travel lanes in each direction to connect to future 6-lane section to the west. A 10-foot sidewalk would be located on both the north and south sides of the roadway.

Element 2. Triple Creek Trail realignment and connections: A portion of the existing Triple Creek Trail would be realigned and would pass beneath the Proposed Action roadway which would be on a bridge at this location (see Element 3 in **Figure 1**). The Triple Creek Trail would be connected to 6th Avenue via a spur trail to the sidewalk constructed along the south side of the new roadway. The Triple Creek Trail is a 10–foot wide soft surface trail that serves equestrians, bicyclists and pedestrians. The realigned portion would match the existing width and surface. A 10-foot sidewalk on both sides of the bridge (Element 3) would provide connections to the trail. The southern terminus of the trail is currently at the Coal Creek Arena, and further extension to the south is planned by the City of Aurora.

Element 3. Roadway bridge over Sand Creek: Immediately east of the new intersection with existing 6th Avenue/SH 30 (Element 1 in **Figure 1**), the roadway would be elevated onto a six-lane bridge crossing over Sand Creek and its associated floodplain/floodway, and over the Triple Creek Trail. The bridge length and profile would be set to minimize impacts to Sand Creek, while still providing a minimum 10-foot vertical clearance over the Triple Creek Trail. The bridge would have a median and sidewalks. The bridge would be approximately 680 feet in length with 5 variable length spans supported on four piers. The bridge would be

designed to be compatible with the surrounding environment and to allow wildlife connectivity along Sand Creek and the Triple Creek Trail.

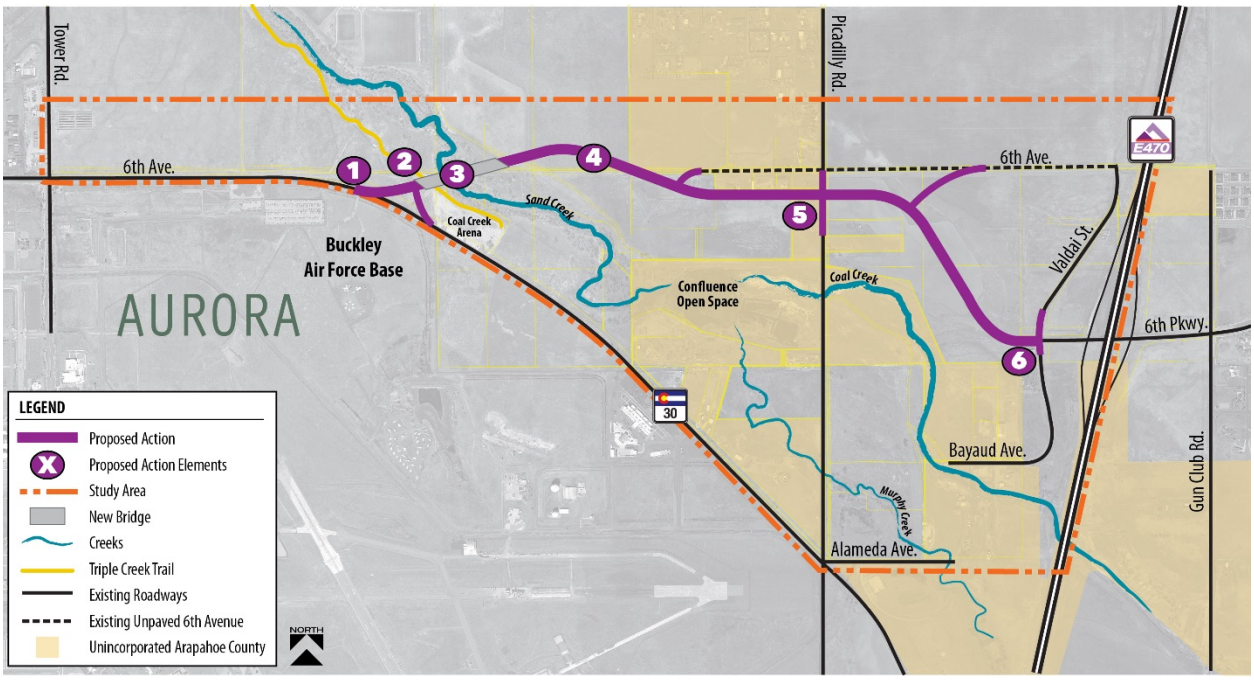
Element 4. 6th Avenue Parkway arterial roadway: The 6th Avenue Parkway extension would consist of a 144-foot wide, six-lane arterial roadway (three lanes in each direction) with a raised vegetated median. There would be curb and gutter and 10-foot wide sidewalks on the north and south sides of the roadway. The Proposed Action would provide two new access connections from the Proposed Action to two existing portions of 6th Avenue. One of these connections would provide access to the existing residences along unpaved 6th Avenue, west of Picadilly Road. The second connection would extend northeast from the Proposed Action to unpaved 6th Avenue to areas planned for development east of Picadilly Road.

Element 5. Intersection with Picadilly Road: The Proposed Action roadway would cross Picadilly Road, which is an existing north-south road. A signalized intersection would be constructed at this location. Picadilly Road is currently two lanes, but the City of Aurora anticipates that expansion to six lanes would occur in the future as a different project. Therefore, the intersection would be configured such that future expansion of Picadilly Road to six lanes can be accommodated and is not precluded.

Element 6. Tie into existing 6th Avenue Parkway at E-470: On its eastern end, the Proposed Action roadway would tie into the existing E-470 interchange, which currently truncates at this location, forming a connection with the existing 6th Parkway to the east of the interchange. The intersection tie-in at Valdai Street and 6th Avenue Parkway would be signalized. This connection would allow access from the west via the Proposed Action to the E-470 interchange and to the existing 6th Avenue Parkway extending to the east of E-470.

In addition to these transportation elements, the Proposed Action would include permanent roadway stormwater drainage with water quality features for roadway runoff and accommodate offsite stormwater flows. Details of drainage and water quality features are presented in **Appendix A6** *Floodplains and Drainage Assessment Technical Report* of the EA.

Figure 1 Proposed Action and Study Area



Note: Numbers in graphic correspond with text above.

1.2 No Action Alternative

If the Proposed Action is not selected for implementation, there would be no improvements made to 6th Avenue beyond the existing and committed transportation system. The No Action Alternative was carried forward as a baseline comparison for environmental analysis purposes.

2. AIR QUALITY ASSESSMENT

2.1 Purpose

The purpose of the air quality document is to present the overall analysis that was performed as part of the EA to assess potential air quality impacts from the Proposed Action. The overall analysis evaluates the emission levels of both criteria air pollutants and mobile source air toxic pollutants (MSATs) in accordance with the Clean Air Act and its amendments for designated nonattainment and/or attainment/maintenance areas. Emissions of these pollutants are a concern because of the potential risk to public health (**Section 3.0**).

For overall perspective, there has been a trend of decreasing total pollutant emissions nationwide from mobile sources for several decades, even when allowing for the growing number of vehicle miles traveled (VMT). These improving results are due to a number of successful emission control regulations. On-road sources account for varying amounts of the overall emissions but tend to be declining even though national VMT more than doubled over the past 30 years. Advances in vehicle technology as well as cleaner fuels have been major reasons for the improvements. Several recent federal regulations on vehicle emissions are expected to continue the trend of improvement and further lower vehicle emissions in the future.

2.2 Background

2.2.1 Regional Conformity

In air quality non-attainment and maintenance areas, the Clean Air Act requires that regional transportation plans (RTP), transportation improvement programs (TIP), and individual projects cannot:

- cause new violations of a National Ambient Air Quality Standard (NAAQS)
- increase the frequency or severity of existing violations of the NAAQS
- delay attainment of the NAAQS

The transportation conformity process is the mechanism used by the responsible metropolitan planning organization, in this case the Denver Regional Council of Governments (DRCOG), to assure that requirements of the Clean Air Act are met for planned transportation improvements within the region. The fiscally-constrained RTP and TIP must identify all projects that are expected to receive federal funds or that will require Federal Highway Administration (FHWA) or Federal Transit Administration approval. These projects and other regionally-significant projects regardless of funding source must be included in a regional emissions analysis that demonstrates conformity to the State Implementation Plans (SIPs) to comply with the Clean Air Act.

Road improvement projects cannot be built unless the regional road system in aggregate conforms to the regional SIPs. Individual projects can demonstrate regional conformity by being part of a conforming fiscally-constrained RTP, which looks at longer-range transportation planning, and either a TIP, which includes projects likely to proceed in the next few years, or the road network used for the RTP/TIP conformity document. The 2040 RTP (DRCOG, 2015a) and the 2016-2021 TIP (DRCOG, 2015b) are the adopted fiscally-constrained conforming plans for DRCOG. The Proposed Action improvements are included in the fiscally constrained RTP

(DRCOG, 2015a), and in the relevant conformity documents. In addition, the Proposed Action is listed in the 2016-2021 TIP Appendix D as a locally funded regionally significant project that is included in the air quality conformity network. Therefore, the Proposed Action demonstrates conformity at the regional level.

2.2.2 Local Conformity

Individual projects within air quality nonattainment or maintenance areas, such as the Denver metropolitan area, must demonstrate that they will not cause violations of the NAAQS in localized areas known as hot spots. Three NAAQS pollutants are primary concerns for the Denver region (carbon monoxide [CO], suspended particulate matter [PM_{10}] and ozone [O_3]), but only two of these (CO and PM_{10}) are potential hot spot pollutants.

CO hot spots are most likely to be a concern where traffic is very congested and slow moving, such as congested, high-volume intersections. Hot spot modeling for CO was performed for the project because of predicted poor intersection performance (**Section 4.3**).

The majority of PM_{10} emissions from vehicles in the Denver region are from road dust. However, a project that involves a high number of heavy trucks or other large diesel vehicles could require a PM_{10} hot spot analysis. Heavy truck volumes in the project corridor are estimated to be a relatively small percentage of traffic (between 0 and 5 percent according to **Appendix A3** *Traffic Analysis Technical Report* of the EA), so this situation is not expected on 6th Avenue Parkway (**Section 4.3**). Therefore, this project is not a "project of air quality concern" in terms of federal conformity screening criteria for particulate matter. Through consultations conducted for the project, the Colorado Department of Health—Air Pollution Control Division (APCD) concurred with this (**Appendix D**).

O_3 is influenced by regional pollutant emissions and is not a hot spot concern—a local analysis is not appropriate for O_3.

The air quality analysis methods are described in **Section 4.1**.

3. AFFECTED ENVIRONMENT

The project is within the largest metropolitan area in Colorado. Based on the 2010 census, the 7-county Denver metropolitan area has approximately 2.8 million residents. The primary air quality issues of concern for this project are pollutants associated with operation of vehicles on roadways. These issues include direct emissions of pollutants from vehicles, secondary pollutants formed from direct emissions, and road dust. Air quality issues related to road construction are also a potential short-term concern.

3.1 Local Setting

The study area lies in the eastern Denver metropolitan area. The study area elevation is approximately 5,500 feet above sea level. The much higher Front Range of the Rocky Mountains is located westward, while the Great Plains are eastward and lower in elevation. The coldest month for the study area usually is January, with an average daily temperature range of 20-48 degrees Fahrenheit. The warmest month usually is July, with an average daily temperature range of 55-90 degrees Fahrenheit. Thermal inversions are known to occur in the study area during times of low winds. The study area generally receives about 19 inches of precipitation annually, with the wettest months generally being May and April. Prevailing winds in the study area can be somewhat variable due to local topography, but the prevailing winds near ground surface tend to be from the south (**Figure 2**).

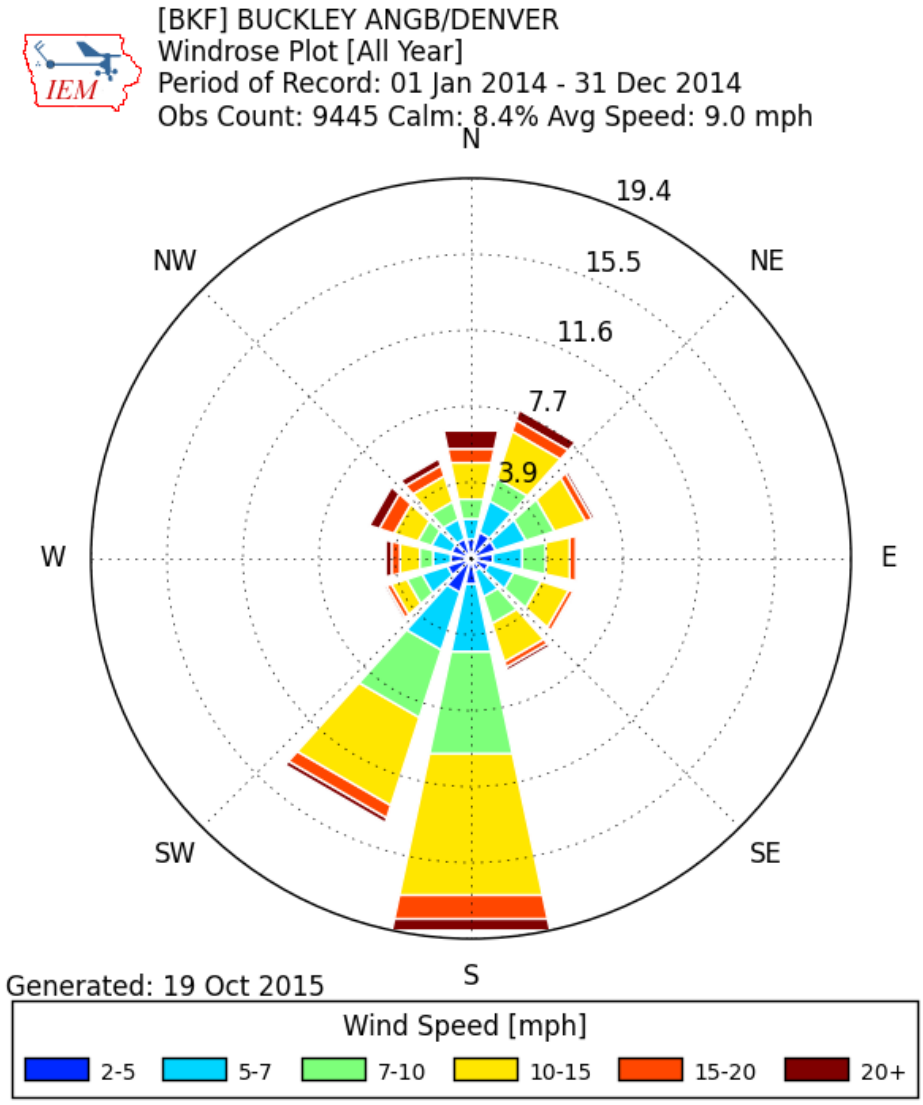
3.2 National Ambient Air Quality Standards Overview

The Clean Air Act of 1970 and its amendments led to the U.S. Environmental Protection Agency (EPA) establishing NAAQS for criteria air pollutants: CO, lead, nitrogen dioxide, O_3, particulate matter, and sulfur dioxide. Multiple revisions to the NAAQS have occurred over time and the current NAAQS are provided in **Table 1**. Motor vehicles are important contributors of CO, nitrogen dioxide, O_3 precursors, and particulate matter, so only these criteria pollutants will be discussed in detail in subsequent sections.

Under the Clean Air Act, cities and regions were required to determine their compliance with the NAAQS. Areas that met the NAAQS were classified as attainment areas while areas that did not meet a NAAQS were classified as nonattainment for that NAAQS. These classifications are long term and do not change often. The Denver metropolitan area has been in attainment of the sulfur dioxide, nitrogen dioxide and lead NAAQSs for more than 30 years. The Denver metropolitan area was a nonattainment area for CO, O_3 (1-hour), and PM_{10} beginning in the early 1970s, so those three pollutants have historically been concerns in the Denver region. The region included in the nonattainment areas at the time was all or parts of the following current counties: Denver, Jefferson, Boulder, Adams, Arapahoe, Douglas and Broomfield. No areas in Colorado have been designated as nonattainment for $PM_{2.5}$, so it is not a major issue in the state.

The Denver/North Front Range area was designated by EPA as a marginal “nonattainment area” for O_3 in 2012, which added parts of Larimer County and Weld County to the affected area. The designation may change to a moderate nonattainment area in the near future. The O_3 NAAQS was most recently revised in October 2015 to 70 parts per billion over eight hours, which may affect the level of nonattainment status.

Figure 2 Prevailing Winds—Buckley Air Force Base, 2014



Source: Iowa Environmental Mesonet windrose data, accessed October 2015.

Table 1 National Ambient Air Quality Standards

Pollutant	Averaging Time	Primary Standard
Carbon Monoxide	8 hours	9 ppm
	1 hour	35 ppm
Lead	Rolling 3 month average	0.15 µg/m^3
Nitrogen Dioxide	1 hour	100 ppb
	Annual	53 ppb
Ozone	8 hour	0.070 ppm
Particulate Matter <2.5 µm ($PM_{2.5}$)	Annual	12 µg/m^3
	24 hours	35 µg/m^3
Particulate Matter <10 µm (PM_{10})	24 hours	150 µg/m^3
Sulfur Dioxide	1 hour	75 ppb

Source: EPA, 2016
ppb = parts per billion
ppm = parts per million
µg/m^3 = micrograms per cubic meter
µm = micrometers

3.2.1 Carbon Monoxide

CO is an odorless, colorless gas that is most commonly formed by incomplete combustion of fuel. CO is dangerous because it interferes with the body's ability to absorb oxygen. High concentrations of CO can cause dizziness, headaches, loss of vision, impaired dexterity and even death, if the concentration is high enough. Major sources of CO include vehicle exhaust, coal burning and forest fires. CO is most commonly a concern in localized areas around the CO sources, such as near congested road intersections. CO can be a regional concern if concentrations are high enough and disperse into the surrounding area.

3.2.2 Nitrogen Dioxide

The atmosphere is approximately 80 percent nitrogen gas. When fuel is burned at high temperature in air, this nitrogen can react with oxygen that is also present in air to form gases such as nitrogen dioxide and other oxides of nitrogen (NO_x) compounds. NO_x can contribute to O_3 formation, particulate matter formation and acid deposition. Common sources of NO_x are vehicles and coal-fired electrical power plants. Nitrogen dioxide can damage cells in lungs and plants and damage water quality. Nitrogen dioxide can be transported over great distances and is a regional concern.

3.2.3 Ground Level Ozone

Ground-level O_3 is a gas that is formed by chemical reactions between other pollutants in the atmosphere. NO_x and hydrocarbons in the presence of sunlight and certain weather conditions can form O_3. O_3 is a strong oxidizing agent and can damage cells in lungs and plants. O_3 can cause eye irritation, coughing and lung damage.

There are not specific sources of O_3 because it is rarely emitted directly. However, O_3 concentrations are affected through concentrations of the precursor pollutants NO_x and hydrocarbons. Automotive sources of NO_x include vehicle exhaust. Automotive sources of hydrocarbons include fuel evaporation and incomplete combustion of fuel. O_3 is a regional

concern because it takes time for O_3 to form and the pollutants can drift a considerable distance in that time (California Air Resources Board [CARB], 2002). Rural/undeveloped areas can have O_3 problems because of transported pollutants, even if there are not major local emissions of the precursors (CARB, 2002).

3.2.4 Particulate Matter

Particulate matter (both PM_{10} and $PM_{2.5}$) is a complex mix of very small solid particles and liquid droplets. Particulate matter is a concern because it can be inhaled deeply into the lungs and can interfere with lung function or lead to other health effects. Particulate matter can aggravate asthma, diminish lung capacity and cause lung or heart problems. Particulate matter can also cause haze. Sources of particulate matter include road dust, smoke and diesel engine exhaust. Particulate matter can be a concern around the sources, but winds can disperse particulate matter over a larger area and cause regional concerns.

3.3 NAAQS Monitoring Data Overview

There are several air quality monitoring stations in the Denver region that measure the criteria air pollutants, however none are in the study area. The closest active monitoring station for the NAAQS of interest is the CAMP station in downtown Denver. Monitoring stations at other locations in the region have been active in the past. Though the CAMP station is outside the study area, it provides the monitoring data nearest the study area.

The most recent complete data set available from the EPA website was for 2014. In 2014, none of the NAAQS levels were exceeded for CO, PM_{10}, $PM_{2.5}$ or nitrogen dioxide. The 8-hour O_3 NAAQS has been violated in the Denver region but the concentrations at CAMP met the 2008 NAAQS. Monitoring data for the three pollutants subject to maintenance plans in the Denver region (CO, PM_{10} and O_3) are summarized below.

3.3.1 Carbon Monoxide

Measured concentrations of CO in the Denver region have not violated the NAAQS since 1995 (CAQCC, 2004a). For the CAMP station, the 2014 measured values for NAAQS comparison for 1 hour and 8 hours are 3.0 ppm and 2.0 ppm, respectively. These values are below their respective NAAQS (**Table 1**).

3.3.2 Nitrogen Dioxide and Ozone

Nitrogen dioxide is a criteria pollutant and an O_3 precursor. For the CAMP nitrogen dioxide station, the 2014 measured values for NAAQS comparison for 1-hour and annually are 86 and 23 ppb, respectively. The measured values are below their respective NAAQS (**Table 1**). The other major O_3 precursor pollutant (hydrocarbons) is not a NAAQS pollutant.

For the CAMP O_3 monitoring station, the 2014 measured value for NAAQS comparison for 8 hours is 0.061 ppm. The measured O_3 concentration was below the O_3 NAAQS. Note that the highest O_3 concentrations have been in the western metropolitan area and have not been near the study area.

3.3.3 Particulate Matter

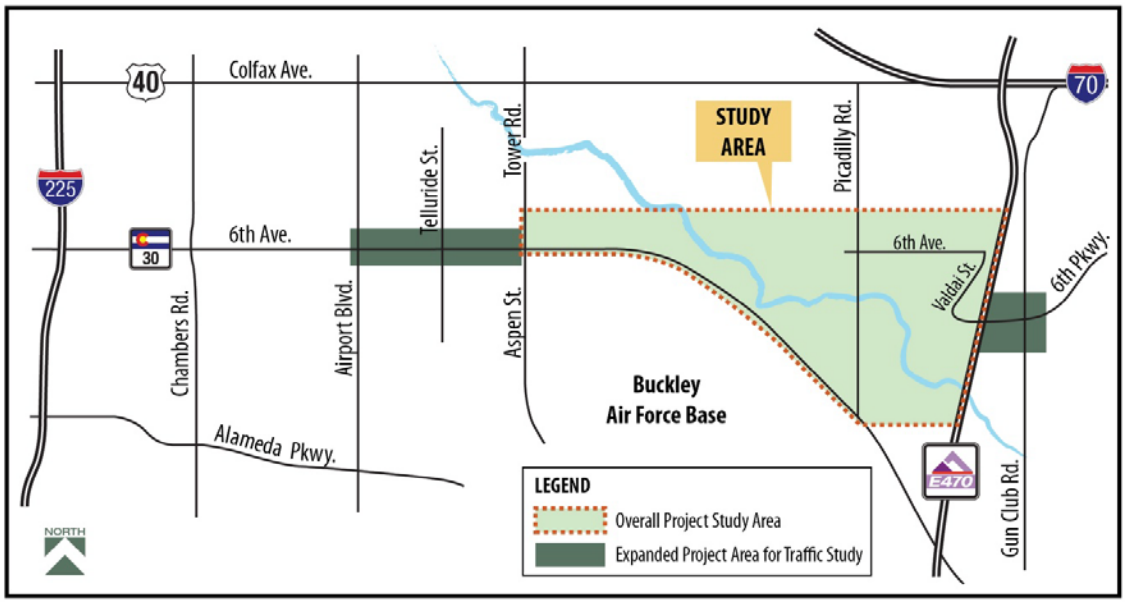
For the CAMP PM_{10} station, the 2014 measured value for NAAQS comparison for 24 hours is 76 µg/m^3. Measured concentrations of PM_{10} in the Denver region generally have not violated the NAAQS since 1993 (CAQCC, 2004a). For the CAMP $PM_{2.5}$ station, the 2014 measured values for NAAQS comparison for 24 hours and annual were 29.3 µg/m^3 and 7.3 µg/m^3, respectively. These values are below their respective NAAQS (**Table 1**).

3.4 Transportation and Circulation System

The transportation and circulation system evaluated for this report includes streets and highways within the study area (**Figure 3**) that were likely to be affected by changes in traffic patterns by the Proposed Action. The traffic data are discussed in more detail in **Appendix A3** *Traffic Analysis Technical Report* of the EA. This group of roads consists of:

- **Airport Boulevard** – This six-lane arterial runs north-south and is the western edge of this project's study area. It has a posted speed limit of 40 miles per hour (mph) and carries about 42,000 vehicles per day (vpd).
- **SH 30** – This state highway has a Non Rural Principal Arterial access classification and consists of two travel lanes. It runs east-west from Airport Boulevard to Tower Road and then turns and follows a southeast-northwest alignment through its intersection with Picadilly Road within the study area. The east-west section has a posted speed limit of 40 mph, carries between 13,000 and 17,000 vehicles per hour (vph) and has turn lanes and traffic signals at major intersections. The section with the southeast-northwest alignment has a posted speed of 55 mph, carries between 10,000 and 12,000 vpd and has no turn lanes with side-street stop control on the minor street at intersections.
- **Picadilly Road** – This north-south roadway runs south from the Interstate 70 (I-70) frontage road to SH 30. It has two travel lanes and a posted speed limit of 45 mph. It carries about 3,000 vpd and has stop control but no turn lanes at its intersections with cross streets.
- **6th Avenue Parkway** – The east-west roadway currently runs east from Valdai Street and has an interchange with E-470. It has two lanes between Valdai Street and Gun Club Road and additional through lanes east of Gun Club Road. All intersections along this roadway have stop control. This street currently does not exist between SH 30 and Picadilly Road.

Figure 3 Traffic Study Area



Data pertaining to traffic volumes and the level of service (LOS) in this report are drawn from **Appendix A3** *Traffic Analysis Technical Report* of the EA. LOS at various intersections of interest was assessed for morning and afternoon peak traffic hours (**Table 2**). LOS provides an indication of intersection congestion and potential hot spots for air pollutants from vehicles. LOS A describes the best traffic operation of free-flowing, light volume traffic and LOS F represents the worst condition of heavy traffic congestion.

Table 2 Study Area 2035 Intersection LOS (AM/PM)

Intersection	2035 Proposed Action LOS (AM/PM)
6th Ave. and Airport Blvd.	F/F
6th Ave. and Telluride St.	C/D
6th Ave. and Tower Rd.	C/D
6th Ave. and SH 30	D/C
6th Ave. Parkway Extension and Picadilly Rd.	E/D
SH 30 and Picadilly Rd.	E/F
6th Pkwy and Valdai Street	D/D
Southbound 6th Pkwy and E-470 Interchange Ramps	B/C
Northbound 6th Pkwy and E-470 Interchange Ramps	A/A
6th Pkwy and Gun Club	C/C

3.5 Sensitive Receptors

Locations where people spend extended periods of time are likely to be the most sensitive receptors. The receptors most likely to be directly affected by pollutants from project roads are those sensitive receptors closest to the roads. These types of locations in the study area include homes and businesses. There are fewer than 10 developed properties within about 100 feet of the major roads that were examined within the study area.

3.6 Other Air Quality Considerations

Two other air quality topics that were considered were air toxics and general construction activities.

3.6.1 Air Toxics

A qualitative analysis was performed to provide a basis for identifying and comparing the potential differences among MSAT emissions, if any, from the various alternatives. The qualitative assessment presented below is derived in part from a study conducted by the FHWA entitled *A Methodology for Evaluating Mobile Source Air Toxic Emissions Among Transportation Project Alternatives*, found at: www.fhwa.dot.go/environment/air_quality/air_toxics/research and_analysis/methodology/methodology00.cfm.

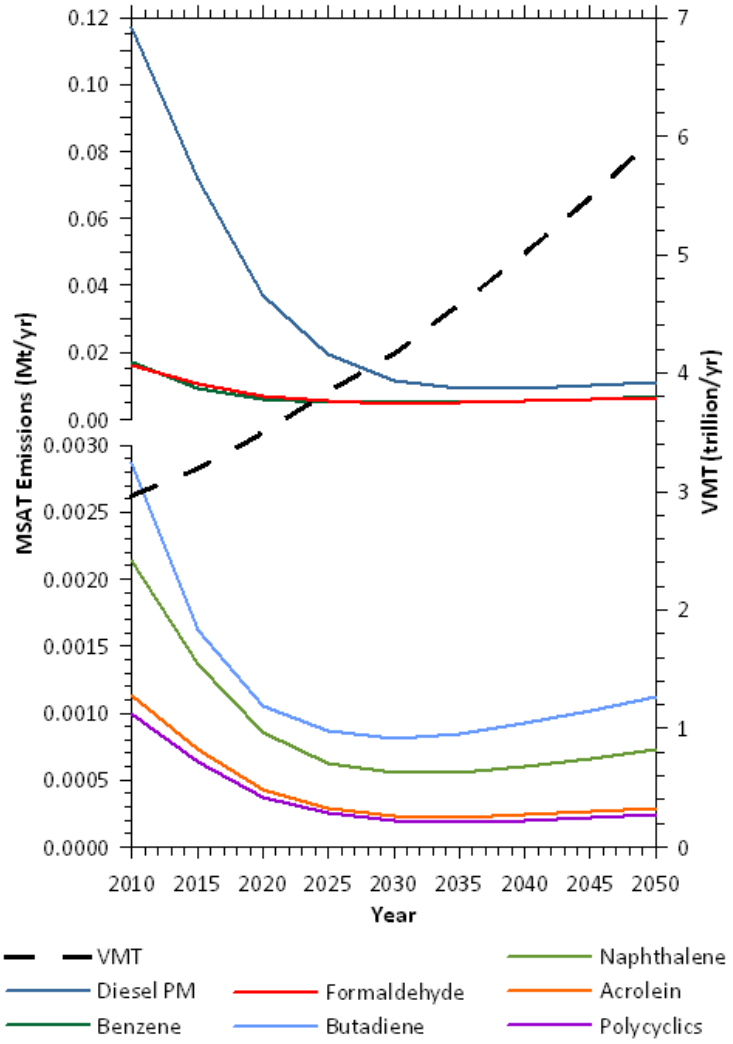
Background

In addition to the criteria air pollutants for which there are NAAQS, EPA also regulates air toxics. Most air toxics 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). Other toxics are emitted from the incomplete combustion of fuels or as secondary combustion products. Metal air toxics also result from engine wear or from impurities in oil or gasoline (EPA, 2000). The EPA has identified seven priority compounds with significant contributions from vehicles that are among the national and regional-scale cancer risk drivers:

- Acrolein;
- Benzene;
- 1,3-Butidiene;
- Diesel particulate matter plus diesel exhaust organic gases;
- Formaldehyde;
- Naphthalene; and
- Polycyclic organic matter

While FHWA considers these the priority mobile source air toxics, the list is subject to change and may be adjusted in consideration of future EPA rules. According to EPA's latest rule on the Control of Hazardous Air Pollutants from Mobile Sources (Federal Register, Vol. 72, No. 37, page 8430, February 26, 2007), controls are required to dramatically decrease MSAT emissions through cleaner fuels and cleaner engines. Based on an FHWA analysis using EPA's Motor Vehicle Emissions Simulator (MOVES) 2010b model, as shown in **Figure 4**, even if VMT increases by 102 percent as assumed from 2010 to 2050, a combined reduction of 83 percent in the total annual emissions for the priority MSAT is projected for the same time period.

Figure 4 Predicted National MSAT Emissions



Source: FHWA, 2012.

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 emissions 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.

EPA is in the process of assessing the risks of various kinds of exposures to these pollutants. The EPA 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 online at http://www.epa.gov/iris. The following toxicity information for the seven priority compounds was taken from the IRIS database. This information is taken verbatim from EPA's

IRIS database and represents the Agency's most current evaluations of the potential hazards and toxicology of these chemicals or mixtures.

- Acrolein – Data are inadequate for an assessment of human carcinogenic potential.
- Benzene – Known/likely human carcinogen.
- 1,3-Butidiene – Carcinogenic to humans.
- Diesel engine exhaust – Likely to be carcinogenic to humans.
- Formaldehyde – Probable human carcinogen - based on limited evidence of carcinogenicity in humans.
- Naphthalene – Possible human carcinogen.
- Polycyclic aromatic hydrocarbon – Currently being assessed by IRIS for the first time.

There have been other studies that address MSAT health impacts in proximity to roadways. The Health Effects Institute, a non-profit organization funded by EPA, 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 additional studies have reported that proximity to roadways is related to adverse health outcomes, particularly respiratory problems (South Coast Air Quality Management District, 2000; Sierra Club, 2004; and Environmental Law Institute, 2005). Much of this research is not specific to MSATs, but instead surveys the full spectrum of both NAAQS and other pollutants. The FHWA cannot evaluate the validity of these studies, but more importantly, the studies do not provide information that would be useful to alleviate the uncertainties listed above and enable a more comprehensive evaluation of the health impacts specific to this project.

3.6.2 Construction

Air quality impacts from construction can be a concern. Long-term construction projects near sensitive receptors can represent health concerns. As with MSATs, there are no ambient air standards specifically for construction or direct mechanisms for assessing such impacts.

4. IMPACT EVALUATION

Because of the past and present regional air quality challenges in the Denver metropolitan area (including the study area), infrastructure projects that might exacerbate the air quality problems must meet certain requirements before they can proceed. In general, projects of the type considered in the EA must be analyzed with respect to the potential impact on air quality at both the regional and local levels. The region of influence examined for air quality in this project is around the highways and streets described in **Section 3.4**.

4.1 Methodology for Impact Evaluation

In June 2015, Colorado Department of Transportation (CDOT) developed a proposed analytical method for review by the APCD. On June 26, 2015, the APCD provided concurrence that the project-level approach is acceptable and appropriate for the Proposed Action EA (**Appendix D**). This analytical method documented that the project's air quality analysis should consist of the following components.

- **Carbon Monoxide Microscale Analysis**: Analysis in **Section 4.3** addresses CO at congested intersections to show that the proposed action will not cause local violations of the NAAQS. For this project, Picadilly Road at both SH 30 and the new 6th Avenue Parkway have projected 2035 LOS of D or worse and therefore will be considered in this analysis (**Figure 5**).

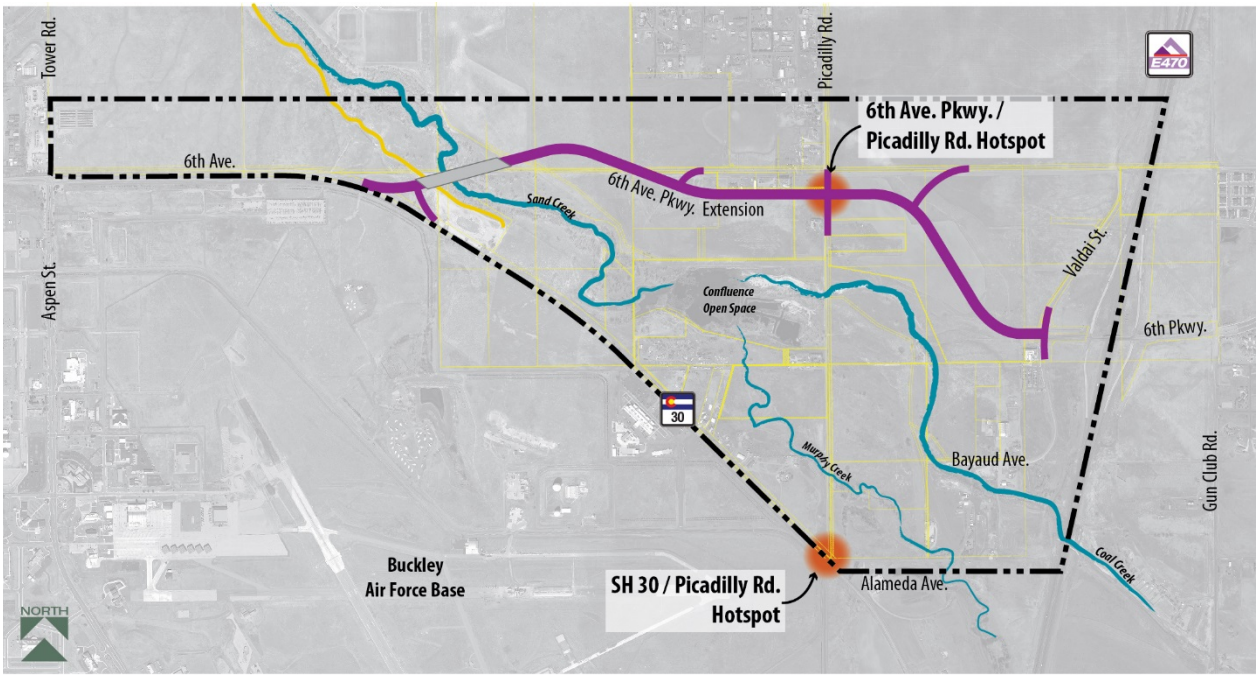
  Areas likely to become CO hot spots are identified based primarily on traffic volumes and congestion, and a determination is then made whether a detailed analysis is needed. Generally, the need for CO hot spot analysis is assessed with respect to three criteria, as provided by the EPA:

  - The LOS of a project intersection is or will be D, E or F
  - The project affects locations identified in the SIP as sites of actual or potential violations of the CO NAAQS
  - A project intersection is one of the top three in the SIP with respect to highest traffic volume or worst LOS

  The goal of the intersection selection process is to choose the most congested and heavily trafficked intersections for CO analysis, with these worst-case intersections also representing less congested intersections and areas. If an intersection does not meet any of the selection criteria, it is unlikely to be a hot spot and need not be assessed further. If an area intersection meets one of the criteria, it may be modeled for CO concentrations. If the congested intersections do not show hot spot pollution problems, less congested intersections will not either.

- **Particulate Matter**: This project is not a "project of air quality concern" in terms of federal conformity screening criteria for particulate matter, so a microscale analysis is not required. A qualitative discussion is included in **Section 3.3**.

Figure 5 CO Hot Spot Analysis Locations



- **Other Criteria Pollutants**: A qualitative discussion is provided in **Section 3.3** for criteria pollutants affecting regional ozone nonattainment, including O_3, NO_x, and hydrocarbons.
- **Air Toxics Emissions**: A qualitative review of the priority MSAT emissions is provided for the project (**Section 3.3**).
- **Greenhouse Gas Emissions:** Per FHWA guidance, a summary assessment (**Section 4**) of the direct, indirect, and cumulative effects of greenhouse gas emissions from the project is provided, including a comparative analysis of global, statewide, and project-generated greenhouse gas emissions.

4.2 Proposed Action

The Proposed Action traffic analysis includes Year 2035 future traffic conditions with construction of the 6th Avenue Parkway Extension. As with the No Action Alternative, the traffic volumes are based on the 2035 DRCOG regional transportation demand model. Additional details are included in **Appendix A3** *Traffic Analysis Technical Report*.

4.2.1 Impacts (Direct and Indirect)

The following sub-sections described anticipated direct and indirect impacts of the Proposed Action.

Carbon Monoxide Microscale Analysis

In consultation with APCD and CDOT, two study area intersections predicted to function at LOS D or worse in 2035 (**Table 2**) were selected for CO hot spot analysis— Picadilly Road at SH 30 and 6th Avenue Parkway at Picadilly Road (**Figure 5**). A "worst case" situation was modeled and reviewed for each intersection to ensure that the year of maximum CO emissions was considered. For this "worst case" model, the highest CO emissions factors (2015) were combined with the highest traffic volumes (2035). These artificial conditions were purposely devised to maximize CO concentrations associated with the project to ensure that the maximum potential CO concentrations were adequately considered. For these CO hot spot analyses, the highest predicted traffic volumes were used in the analysis. For 6th Avenue Parkway at Picadilly Road, the morning peak hour traffic volumes were used. For Picadilly Road at SH 30 the afternoon peak hour traffic volumes were used. The model results were compared to the NAAQS. **Appendix A** includes modeling output, which contains CO emission factors obtained from APCD, traffic volumes, signal data, meteorological data and other modeling input data.

The CO model results are summarized in **Table 3**. The model output data (**Appendix A**) provides 1-hour average CO concentrations. To calculate 8-hour CO results, the 1-hour model results were multiplied by a persistence factor of 0.7. This correction is needed because the average hourly traffic over eight consecutive hours will be less than the peak hour traffic that is modeled, and the meteorological conditions including wind speed and direction may vary during that time.

Year 2015 CO background concentrations were also used for the "worst case" results because it would be higher than 2035. A 1-hour CO background concentration of 2.0 ppm and an 8-hour CO background of 2.0 ppm were provided by APCD. These background concentrations are added into the results in **Table 3** to reflect the total maximum modeled CO concentrations. The maximum 1-hour CO concentration predicted for any intersection was 4.8 ppm, which is below the NAAQS of 35 ppm (**Table 1**). The maximum 8-hour CO concentration predicted was 3.4 ppm, which is below the NAAQS of 9 ppm (**Table 1**). Therefore, no CO hot spots in violation of the NAAQS are predicted and no mitigation for CO is required.

Table 3 Maximum Modeled Carbon Monoxide Concentrations

Intersection	1-Hour CO Result (ppm)	8-Hour CO Result (ppm)
6th Ave. and Picadilly Rd.	4.8	3.4
SH 30 and Picadilly Rd.	4.0	2.8
NAAQS	***35***	***9***

Source: Felsburg Holt and Ullevig (FHU) Modeling Results

Note: These CO results reflect a total of the modeled plus background CO concentrations.

CO concentrations are expected to decrease at the target intersections in the future. This is primarily because vehicles will be emitting less CO. This benefit will be from vehicle emission regulation and will be realized regardless of whether the proposed improvements are made.

Particulate Matter Discussion

The Proposed Action will build an arterial street that is expected to serve primarily commuters, residential areas, and light commercial areas. The corridor and surrounding area is not expected to contain major industrial facilities or significant intermodal or freight facilities. As identified in **Appendix A3** *Traffic Analysis Technical Report*, the percentage of heavy trucks or other large diesel vehicles is expected to be five percent for both the morning peak period at 6th Avenue and Picadilly Road and the evening peak period at SH 30 and Picadilly Road. Consequently, a high percentage of heavy trucks or other large diesel vehicles is not expected on 6th Avenue Parkway. Therefore, this project is not a "project of air quality concern" in terms of federal conformity screening criteria for particulate matter, so a microscale analysis is not required.

PM_{10} is the subject of a comprehensive Maintenance Plan for the Denver area and impacts from traffic are major considerations within the Maintenance Plan. PM_{10} concentrations around Denver have been below the NAAQS even with the past growth in traffic. The proposed improvements are not expected to cause or contribute to violations of the PM_{10} NAAQS. The proposed improvements are not expected to interfere with the Maintenance Plan or its goals. Therefore, no impacts are expected and no mitigation is necessary for PM_{10}.

Other Criteria Pollutants – NO_x, O_3

Although ground-level ozone is not directly emitted by motor vehicles, motor vehicle emissions of NO_x and vaporous hydrocarbons called volatile organic compounds (VOCs) contribute to ozone formation. Ozone is created by the reaction of intense sunlight with NO_x and VOCs. This reaction takes place over several hours, which allows for mixing and dispersion in the atmosphere; therefore, ozone is considered a regional, rather than a localized pollutant.

Emissions of O_3 precursors near a particular location may not be important because the precursors need time to mix and are reliant on particular weather conditions before O_3 is formed. In that time, the precursors can drift a considerable distance, so the pollution may not be near the emission source. The entire Denver metropolitan area is subject to O_3 precursor emission reduction strategies developed for the O_3 Action Plan for the Denver nonattainment area. All projects in the Denver O_3 nonattainment area must, in the aggregate, conform to the O_3 SIP and must be compatible with regional O_3 concentration reductions to comply with the NAAQS. That analysis must occur at the regional level through development of the RTP. Therefore, the inclusion of the proposed project in the conforming 2040 RTP satisfies conformity for the O_3 NAAQS.

Air Toxics Emissions

From the project traffic study, approximately 37,000 vehicles per day are expected for 6th Avenue Parkway in 2035. That is relatively light traffic in terms of air toxics emissions. As such, the proposed improvements do not meet the thresholds requiring a quantitative MSAT analysis (FHWA, 2012), so a qualitative discussion has been prepared.

As described previously (**Section 3.6**), FHWA believes the technical shortcomings of emissions and dispersion models and the uncertain science with respect to health effects prevent meaningful or reliable estimates of MSAT emissions and effects from the Proposed Action.

However, even though reliable methods do not exist to accurately estimate the health impacts of MSATs at the project level, it is possible to assess qualitatively the levels of future MSAT emissions under the alternative. Although a qualitative analysis cannot identify and measure health impacts from MSATs, such an analysis can give a basis for identifying and comparing the potential differences among MSAT emissions—if any—between alternatives. The qualitative assessment presented below is consistent with the FHWA guidance (FHWA, 2012).

For the Proposed Action, the amount of MSAT emitted would be proportional to the VMT. The VMT estimated for the Proposed Action is higher than that for the No Action 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 Proposed Action along the highway corridor, along with 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 EPA's MOVES2010b model, emissions of all of the priority MSAT decrease as speed increases.

Emissions will likely be lower than present levels in the design year as a result of EPA's national control programs that are projected to reduce annual MSAT emissions by over 80 percent between 2010 and 2050. 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 EPA-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.

The alignment of the new Proposed Action will have the effect of placing some traffic closer to nearby homes; therefore, under the Proposed Action there may be localized areas where ambient concentrations of MSATs could be higher than the No Build Alternative. The localized increases in MSAT concentrations would likely be most pronounced along 6th Avenue Parkway west of Picadilly Road. However, the magnitude and the duration of these potential increases compared to the No Build Alternative cannot be reliably quantified due to incomplete or unavailable information in forecasting project-specific MSAT health impacts. In sum, when a highway is widened, the localized level of MSAT emissions for the build alternative could be higher relative to the No Build Alternative from more traffic, but this could be offset due to increases in speeds and reductions in congestion (which are associated with lower MSAT emissions). Also, MSATs will be lower in other locations when traffic shifts away from them. However, on a regional basis, EPA's vehicle and fuel regulations, coupled with fleet turnover, will over time cause substantial reductions that, in almost all cases, will cause region-wide MSAT levels to be significantly lower than today.

Construction Impacts

The overall construction project has the potential to last many months. Construction activities may be sources of temporary air quality impacts from fugitive dust or equipment emissions. Adjoining properties in the study area would be near construction activities when the proposed project is built. Construction emissions differ from regular traffic emissions in several ways:

- construction emissions last only for the duration of the construction period
- construction activities generally are short-term, and depending on the nature of the construction operations, could last from seconds (e.g., a truck passing) to months (e.g., constructing a bridge)

- construction can involve other emission sources, such as fugitive dust from ground disturbance
- construction emissions tend to be intermittent and depend on the type of operation, location, and function of the equipment, and the equipment usage cycle; traffic emissions are present in a more continuous fashion after construction activities are completed
- construction emissions tend to be from mobile sources with diesel engines

Construction emission impacts will be minimized somewhat because most, but not all, of the project improvements do not abut sensitive areas such as residences. Even so, people in neighboring areas could be exposed to construction-related emissions. The Proposed Action would be similar in nature to other highway projects and the construction emissions should be representative of projects of this type and magnitude. These types of projects generally do not cause meaningful air quality impacts.

4.2.2 Mitigation

Given that air pollutants are not predicted to exceed the NAAQS in the future as a result of implementing the Proposed Action, mitigation measures for air quality are not necessary for the project. Future emissions from on-road mobile sources will be minimized globally through several federal regulations. The Denver area SIPs for CO, O_3 and PM_{10} will serve to avoid and minimize pollutant emissions from project roads.

Effects from construction emissions will be minimized somewhat because much of the Proposed Action is located away from sensitive areas such as residences. Even so, neighboring areas could be exposed to construction-related emissions and particular attention will be given to minimizing total emissions near sensitive areas such as homes. To address the temporary elevated air emissions that may be experienced during construction, standard construction best practices should be incorporated into construction contracts where feasible. These include following relevant CDOT construction specifications. These would include:

- Engines and exhaust systems on equipment in good working order. Equipment maintained on a regular basis, and equipment subject to inspection by the project manager to ensure maintenance.
- Fugitive dust systematically controlled through implementation of CDOT's Standard Specifications for Road and Bridge Construction, particularly Sections 107.24, 209 and 250, and APCD's Air Pollutant Emission Notification requirements.
- No excessive idling of inactive equipment or vehicles.
- Stationary equipment located as far from sensitive receivers as possible (when conditions allow).
- Retrofit older construction vehicles to reduce emissions.

5. CUMULATIVE IMPACTS

The National Environmental Policy Act (NEPA) requires assessment of the proposed action in combination with other actions that could result in cumulative environmental impacts. Cumulative impacts are defined in the Council on Environmental Quality regulations as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions." The Council on Environmental Quality notes that "cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." Cumulative impacts were evaluated by comparing the potential impacts from Proposed Action and other past, current, or proposed actions in the area to establish whether, in the aggregate, the actions could result in substantive environmental impacts.

5.1 NAAQS Pollutants

The study area is part of the Denver metropolitan area that has been growing and developing steadily for more than 100 years. This historical growth and development has been a major contributor to air quality problems that have been observed in the metropolitan area, culminating in the designation by EPA of local nonattainment areas in the 1970s. The many air quality improvement actions over the ensuing decades have resulted in better air quality in the Denver area.

For much of the past century, the study area has been rural and mostly undeveloped, but Buckley Air Force Base has been present for several decades. Areas surrounding the study area are currently undergoing increased development. Some areas have become highly developed. Road improvements such as the Proposed Action may be necessary just to accommodate the future local traffic. Such growth would be expected to result in more vehicle traffic in the area and may lead to more vehicle emissions. These changes would be regional in nature and not really specific to a particular location.

There are air maintenance plans in place for the Denver metropolitan area. One of the main purposes of these plans is to ensure compliance with the NAAQS for at least 10 years into the future. These plans consider air quality impacts from probable growth in the maintenance areas from both vehicles and other pollutant sources, so by their nature the plans are cumulative.

DRCOG is responsible for monitoring regional growth and regularly examines regional impacts of this kind through their regional conformity evaluations. These conformity evaluations are regularly updated, particularly for the RTP and TIP, to reflect recent changes including expanded roads. These evaluations are cumulative for the jurisdiction and are necessary to demonstrate ongoing conformity to the SIPs. If an evaluation result ever indicated that NAAQS violations may occur either from a specific project or from general growth, regional preventative actions would be then be necessary to ensure that the NAAQS are met. Therefore, there are mechanisms in place to ensure that cumulative changes in air quality in the study area, regardless of pollutant source, do not lead to violations of the NAAQS.

The Proposed Action is intended to benefit regional transportation, as it would enhance the function of surrounding infrastructure features. The potential improvements may help to alleviate some traffic congestion on adjacent roads. Improved traffic flow generally leads to fewer emissions from mobile sources, and this may lead to reduced emissions over the long term

even with more vehicles in the area. The Proposed Action was calculated to reduce some out-of-direction travel and reduce the area VMT off 6th Avenue. Construction of the Proposed Action may generate additional vehicle trips during construction and require some traffic rerouting, but these would be temporary and not create substantial adverse effects.

There are potentially mixed outcomes from the Proposed Action. More efficient roads may sustain better intersection LOS and higher average vehicle speeds that should reduce most emissions, while the improvements could also attract more traffic that could increase the number of emission sources. Most vehicle emissions per mile are expected to decrease in the future because of cleaner vehicles.

The net cumulative effect on regional air quality with the Proposed Action is taken into account in the regional conformity analysis performed by DRCOG for the RTP and TIP. No violations of the NAAQS were predicted, so the Proposed Action is not expected to cause cumulative impacts. Finally, there are federal air quality regulations that the Denver metropolitan area must continue to meet even with future cumulative growth. Therefore, there are regulatory controls in place to ensure that there are not cumulative air quality impacts from the combination of air pollutant sources in the Denver metropolitan area.

5.2 Global Climate Change

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

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

To date, no national standards have been established regarding GHGs, nor has EPA established criteria or thresholds for ambient GHG emissions pursuant to its authority to establish motor vehicle emission standards for CO_2 under the Clean Air Act. However, there is a considerable body of scientific literature addressing the sources of GHG emissions and their adverse effects on climate, including reports from the Intergovernmental Panel on Climate Change, the US National Academy of Sciences, EPA, and other federal agencies. GHGs are different from other air pollutants evaluated in federal environmental reviews because their impacts are not localized or regional due to their rapid dispersion into the global atmosphere, which is characteristic of these gases. The affected environment for CO_2 and other GHG emissions is the entire planet. In addition, from a quantitative perspective, global climate change is the cumulative result of numerous and varied emissions sources (in terms of both absolute numbers and types), each of which makes a relatively small addition to global atmospheric GHG concentrations. In contrast to broad scale actions such as actions involving an entire industry sector or very large geographic areas, it is difficult to isolate and understand the GHG emissions

impacts for a particular transportation project. Furthermore, presently there is no scientific methodology for attributing specific climatological changes to a particular transportation project's emissions.

Under NEPA, detailed environmental analysis should be focused on issues that are significant and meaningful to decision-making.[1] FHWA has concluded, based on the nature of GHG emissions and the exceedingly small potential GHG impacts of the Proposed Action, as discussed below and shown in **Table 4**, that the GHG emissions from the Proposed Action will not result in "reasonably foreseeable significant adverse impacts on the human environment" (40 CFR 1502.22(b)). The change in GHG emissions from the Proposed Action will be insignificant, and will not play a meaningful role in a determination of the environmentally preferable alternative or the selection of the preferred alternative. More detailed information on GHG emissions "is not essential to a reasoned choice among reasonable alternatives" (40 CFR 1502.22(a)) or to making a decision in the best overall public interest based on a balanced consideration of transportation, economic, social, and environmental needs and impacts (23 CFR 771.105(b)). For these reasons, no alternatives-level GHG analysis has been performed for this project.

The context in which the emissions from the proposed project will occur, together with the expected GHG emissions contribution from the project, illustrate why the project's GHG emissions will not be significant and will not be a substantial factor in the decision-making. The transportation sector is the second largest source of total GHG emissions in the U.S., behind electricity generation. The transportation sector was responsible for approximately 27 percent of all anthropogenic GHG emissions in the U.S. in 2010.[2] The majority of transportation GHG emissions are the result of fossil fuel combustion. CO_2 makes up the largest component of these GHG emissions. U.S. CO_2 emissions from the consumption of energy accounted for about 18 percent of worldwide energy consumption CO_2 emissions in 2010[3]. U.S. transportation CO_2 emissions accounted for about 6 percent of worldwide CO_2 emissions.[4]

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

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

[2] Calculated from data in U.S. Environmental Protection Agency, Inventory of Greenhouse Gas Emissions and Sinks, 1990-2010.

[3] Calculated from data in U.S. Energy Information Administration International Energy Statistics, Total Carbon Dioxide Emissions from the Consumption of Energy, http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=90&pid=44&aid=8, accessed 2/25/13.

[4] Calculated from data in EIA figure 104: http://www.eia.gov/forecasts/archive/ieo10/emissions.html and EPA table ES-3: http://epa.gov/climatechange/emissions/downloads11/US-GHG-Inventory-2011-Executive-Summary.pdf

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

2010 Global CO_2 Emissions, MMT[5]	2010 Colorado Motor Vehicle CO_2 Emissions, MMT[6]	2010 Colorado Motor Vehicle Emissions, % of Global Total	2035 Project Area VMT % of Statewide Total	% Change in 2035 Colorado VMT due to Proposed Action
29,670	10.3	0.0348	2.3	0.014

Notes:
MMT = million metric tons
Global emissions estimates are from International Energy Outlook 2010.

Based on emissions estimates from EPA's MOVES model[7], and global CO_2 estimates and projections from the Energy Information Administration, CO_2 emissions from motor vehicles in the entire state of Colorado contributed less than one tenth of one percent of global emissions in 2010 (**Table 4**). VMT in an expanded area around the project represents approximately two percent of total Colorado travel activity. The Proposed Action would increase statewide VMT by one-hundredth of a percent. (Note that the project study area, as defined for the MSAT analysis, includes travel on many other roadways in addition to the proposed project.) As a result, FHWA estimates that the Proposed Action could result in a potential increase in global CO2 emissions in 2035 of well under one ten-thousandth of one percent, and no meaningful change in Colorado's portion of global emissions. This very small change in global emissions is well within the range of uncertainty associated with future emissions estimates.[8,9]

[5] These estimates are from the EIA's *International Energy Outlook 2010*, and are considered the best-available projections of emissions from fossil fuel combustion. These totals do not include other sources of emissions, such as cement production, deforestation, or natural sources; however, reliable future projections for these emissions sources are not available.
[6] MOVES projections suggest that Colorado motor vehicle CO_2 emissions may increase by 14.9 percent between 2010 and 2040; more stringent fuel economy/GHG emissions standards will not be sufficient to offset projected growth in VMT.
[7] http://www.epa.gov/otaq/models/moves/index.htm. EPA's MOVES model can be used to estimate vehicle exhaust emissions of carbon dioxide (CO_2) and other GHGs. CO_2 is frequently used as an indicator of overall transportation GHG emissions because the quantity of these emissions is much larger than that of all other transportation GHGs combined, and because CO_2 accounts for 90 to 95 percent of the overall climate impact from transportation sources. MOVES includes estimates of both emissions rates and VMT, and these were used to estimate the Colorado statewide highway emissions in Table 4.
[8] For example, Figure 114 of the Energy Information Administration's *International Energy Outlook 2010* shows that future emissions projections can vary by almost 20%, depending on which scenario for future economic growth proves to be most accurate.
[9]When an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in an environmental impact statement and there is incomplete or unavailable information, the agency is required make clear that such information is lacking (40 CFR 1502.22). The methodologies for forecasting GHG emissions from transportation projects continue to evolve and the data provided should be considered in light of the constraints affecting the currently available methodologies. As previously stated, tools such as EPA's MOVES model can be used to estimate vehicle exhaust emissions of carbon dioxide (CO_2) and other GHGs. However, only rudimentary information is available regarding the GHG emissions impacts of highway construction and maintenance. Estimation of GHG emissions from vehicle exhaust is subject to the same types of uncertainty affecting other types of air quality analysis, including imprecise information about current and future estimates of vehicle miles traveled, vehicle travel speeds, and the effectiveness of vehicle emissions control technology. Finally, there presently is no scientific methodology that can identify causal connections between individual source emissions and specific climate impacts at a particular location.

5.3 Mitigation for Global GHG Emissions

To help address the global issue of climate change, the U.S. Department of Transportation is committed to reducing GHG emissions from vehicles traveling on our nation's highways. The U.S. Department of Transportation and EPA are working together to reduce these emissions by substantially improving vehicle efficiency and shifting toward less carbon-intensive fuels. The agencies have jointly established new, more stringent fuel economy and first ever GHG emissions standards for model year 2012–2025 cars and light trucks, with an ultimate fuel economy standard of 54.5 miles per gallon for cars and light trucks by model year 2025. Further, on September 15, 2011, the agencies jointly published the first ever fuel economy and GHG emissions standards for heavy-duty trucks and buses.[10] Increasing use of technological innovations that can improve fuel economy, such as gasoline- and diesel-electric hybrid vehicles, will improve air quality and reduce CO_2 emissions in future years.

Consistent with its view that broad-scale efforts hold the greatest promise for meaningfully addressing the global climate change problem, FHWA is engaged in developing strategies to reduce transportation's contribution to GHGs—particularly CO_2 emissions—and to assess the risks to transportation systems and services from climate change. In an effort to assist States and MPOs in performing GHG analyses, FHWA has developed a *Handbook for Estimating Transportation GHG Emissions for Integration into the Planning Process.* The Handbook presents methodologies reflecting good practices for the evaluation of GHG emissions at the transportation program level, and will demonstrate how such evaluation may be integrated into the transportation planning process. FHWA has also developed a tool for use at the statewide level to model a large number of GHG reduction scenarios and alternatives for use in transportation planning, climate action plans, scenario planning exercises, and in meeting state GHG reduction targets and goals. To assist states and MPOs in assessing climate change vulnerabilities to their transportation networks, FHWA has developed a draft vulnerability and risk assessment conceptual model and has piloted it in several locations.

At the state level, there are also several programs underway in Colorado to address transportation GHGs. The Governor's Climate Action Plan, adopted in November 2007, includes measures to adopt vehicle CO_2 emissions standards and to reduce vehicle travel through transit, flex time, telecommuting, ridesharing, and broadband communications. CDOT issued a Policy Directive on Air Quality in May 2009. This Policy Directive was developed with input from a number of agencies, including the State of Colorado's Department of Public Health and Environment, EPA, FHWA, the Federal Transit Administration, the Denver Regional Transportation District and the Denver Regional Air Quality Council. This Policy Directive and implementation document, the CDOT Air Quality Action Plan, address unregulated MSATs and GHGs produced from Colorado's state highways, interstates, and construction activities.

As a part of CDOT's commitment to addressing MSATs and GHGs, some of CDOT's program wide activities include:

- Researching pavement durability opportunities with the goal of reducing the frequency of resurfacing and/or reconstruction projects.

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

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

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

5.4 Summary

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

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Appendix A CAL3QHC Model Output Files

CAL3QHC: LINE SOURCE DISPERSION MODEL - VERSION 2.0 Dated 13045 PAGE 1

JOB: 6th Ave Parkway Extension EA RUN: 6th/Picadilly 2035 CO

DATE : 11/ 3/15
TIME : 10: 9:44

The MODE flag has been set for calculating concentrations for POLLUTANT: CO

SITE & METEOROLOGICAL VARIABLES

VS = 0.0 CM/S VD = 0.0 CM/S Z0 = 74. CM
U = 1.0 M/S CLAS = 4 (D) ATIM = 60. MINUTES MIXH = 1000. M AMB = 2.0 PPM

LINK VARIABLES

LINK DESCRIPTION	LINK COORDINATES (FT) X1	Y1	X2	Y2	LENGTH (FT)	BRG (DEG)	TYPE	VPH	EF (G/MI)	H (FT)	W (FT)	V/C	QUEUE (VEH)
1. EB_LT_1 Que	522712.0	********	522370.2	********	342.	271.	AG	102.	100.0	0.0	11.0	1.17	17.4
2. EB_LT_2 Que	522712.0	********	522370.2	********	342.	271.	AG	102.	100.0	0.0	11.0	1.17	17.4
3. EB_T_1 Que	522712.0	********	522631.3	********	81.	270.	AG	61.	100.0	0.0	11.0	0.33	4.1
4. EB_T_2 Que	522712.0	********	522631.3	********	81.	270.	AG	61.	100.0	0.0	12.0	0.33	4.1
5. EB_T_3_RT Que	522712.0	********	522631.3	********	81.	270.	AG	61.	100.0	0.0	12.0	0.33	4.1
6. NB_LT_1 Que	522733.0	********	522733.0	********	12.	180.	AG	102.	100.0	0.0	11.0	0.17	0.6
7. NB_LT_2 Que	522737.0	********	522736.9	********	12.	180.	AG	102.	100.0	0.0	11.0	0.17	0.6
8. NB_T_1 Que	522740.0	********	522739.1	********	147.	180.	AG	83.	100.0	0.0	11.0	0.76	7.4
9. NB_T_2 Que	522744.0	********	522743.1	********	147.	180.	AG	83.	100.0	0.0	12.0	0.76	7.4
10. NB_T_3_RT Que	522747.0	********	522746.1	********	147.	180.	AG	83.	100.0	0.0	12.0	0.76	7.4
11. SB_LT_1 Que	522736.0	********	522736.0	********	55.	360.	AG	106.	100.0	0.0	11.0	0.88	2.8
12. SB_LT_2 Que	522733.0	********	522733.0	********	55.	360.	AG	106.	100.0	0.0	11.0	0.88	2.8
13. SB_T_1 Que	522729.0	********	522729.8	********	117.	0.	AG	83.	100.0	0.0	11.0	0.63	5.9
14. SB_T_2 Que	522726.0	********	522726.8	********	117.	0.	AG	83.	100.0	0.0	12.0	0.63	5.9
15. SB_T_3_RT Que	522722.0	********	522722.8	********	117.	0.	AG	83.	100.0	0.0	12.0	0.63	5.9
16. WB_LT_1 Que	522757.0	********	522826.7	********	70.	90.	AG	97.	100.0	0.0	11.0	0.65	3.5
17. WB_LT_2 Que	522757.0	********	522826.7	********	70.	90.	AG	97.	100.0	0.0	11.0	0.65	3.5
18. WB_T_1 Que	522758.0	********	523002.0	********	244.	91.	AG	57.	100.0	0.0	11.0	0.88	12.4
19. WB_T_2 Que	522758.0	********	523002.0	********	244.	91.	AG	57.	100.0	0.0	12.0	0.88	12.4
20. WB_T_3_RT Que	522758.0	********	523002.0	********	244.	89.	AG	57.	100.0	0.0	12.0	0.88	12.4
21. EB_T_1 Apr	522735.0	********	522552.0	********	183.	270.	AG	320.	6.4	0.0	31.0		
22. EB_T_2 Apr	522735.0	********	522552.0	********	183.	270.	AG	320.	6.4	0.0	32.0		
23. EB_T_3_RT Apr	522735.0	********	522552.0	********	183.	271.	AG	320.	6.4	0.0	32.0		
24. NB_T_1 Apr	522740.0	********	522739.0	********	186.	180.	AG	307.	4.4	0.0	31.0		
25. NB_T_2 Apr	522744.0	********	522743.0	********	186.	180.	AG	307.	4.4	0.0	32.0		

26. NB_T_3_RT Apr	* 522747.0	********	522746.0	******** *	186.	180.	AG	307.	4.4	0.0	32.0
27. SB_T_1 Apr	* 522729.0	********	522730.0	******** *	182.	0.	AG	282.	5.7	0.0	31.0
28. SB_T_2 Apr	* 522726.0	********	522727.0	******** *	182.	0.	AG	282.	5.7	0.0	32.0
29. SB_T_3_RT Apr	* 522722.0	********	522723.0	******** *	182.	0.	AG	282.	5.7	0.0	32.0
30. WB_T_1 Apr	* 522735.0	********	522918.0	******** *	183.	90.	AG	747.	6.4	0.0	31.0
31. WB_T_2 Apr	* 522735.0	********	522918.0	******** *	183.	90.	AG	747.	6.4	0.0	32.0
32. WB_T_3_RT Apr	* 522735.0	********	522918.0	******** *	183.	90.	AG	747.	6.4	0.0	32.0
33. EB_T_1 Dprt	* 522918.0	********	522735.0	******** *	183.	270.	AG	292.	6.4	0.0	31.0
34. EB_T_2 Dprt	* 522918.0	********	522735.0	******** *	183.	270.	AG	292.	6.4	0.0	32.0
35. EB_T_3_RT Dprt	* 522918.0	********	522735.0	******** *	183.	270.	AG	292.	6.4	0.0	32.0
36. NB_T_1 Dprt	* 522741.0	********	522740.0	******** *	180.	180.	AG	457.	4.4	0.0	31.0
37. NB_T_2 Dprt	* 522745.0	********	522744.0	******** *	180.	180.	AG	457.	4.4	0.0	32.0
38. NB_T_3_RT Dprt	* 522748.0	********	522747.0	******** *	180.	180.	AG	457.	4.4	0.0	32.0
39. SB_T_1 Dprt	* 522728.0	********	522729.0	******** *	184.	0.	AG	200.	5.7	0.0	31.0
40. SB_T_2 Dprt	* 522725.0	********	522726.0	******** *	184.	0.	AG	200.	5.7	0.0	32.0
41. SB_T_3_RT Dprt	* 522721.0	********	522722.0	******** *	184.	0.	AG	200.	5.7	0.0	32.0
42. WB_T_1 Dprt	* 522552.0	********	522735.0	******** *	183.	90.	AG	707.	6.4	0.0	31.0
43. WB_T_2 Dprt	* 522552.0	********	522735.0	******** *	183.	90.	AG	707.	6.4	0.0	32.0
44. WB_T_3_RT Dprt	* 522552.0	********	522735.0	******** *	183.	90.	AG	707.	6.4	0.0	32.0

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JOB: 6th Ave Parkway Extension EA RUN: 6th/Picadilly 2035 CO

DATE : 11/ 3/15
TIME : 10: 9:44

ADDITIONAL QUEUE LINK PARAMETERS

LINK DESCRIPTION	*	CYCLE LENGTH (SEC)	RED TIME (SEC)	CLEARANCE LOST TIME (SEC)	APPROACH VOL (VPH)	SATURATION FLOW RATE (VPH)	IDLE EM FAC (gm/hr)	SIGNAL TYPE	ARRIVAL RATE
1. EB_LT_1 Que	*	120	108	1.0	140	1600	42.30	1	3
2. EB_LT_2 Que	*	120	108	1.0	140	1600	42.30	1	3
3. EB_T_1 Que	*	120	65	1.0	227	1600	42.30	1	3
4. EB_T_2 Que	*	120	65	1.0	227	1600	42.30	1	3
5. EB_T_3_RT Que	*	120	65	1.0	227	1600	42.30	1	3
6. NB_LT_1 Que	*	120	108	1.0	20	1600	42.30	1	3
7. NB_LT_2 Que	*	120	108	1.0	20	1600	42.30	1	3
8. NB_T_1 Que	*	120	88	1.0	293	1600	42.30	1	3
9. NB_T_2 Que	*	120	88	1.0	293	1600	42.30	1	3
10. NB_T_3_RT Que	*	120	88	1.0	293	1600	42.30	1	3
11. SB_LT_1 Que	*	120	112	1.0	58	1600	42.30	1	3
12. SB_LT_2 Que	*	120	112	1.0	58	1600	42.30	1	3
13. SB_T_1 Que	*	120	88	1.0	243	1600	42.30	1	3

14. SB_T_2 Que	*	120	88	1.0	243	1600	42.30	1	3
15. SB_T_3_RT Que	*	120	88	1.0	243	1600	42.30	1	3
16. WB_LT_1 Que	*	120	103	1.0	120	1600	42.30	1	3
17. WB_LT_2 Que	*	120	103	1.0	120	1600	42.30	1	3
18. WB_T_1 Que	*	120	60	1.0	667	1600	42.30	1	3
19. WB_T_2 Que	*	120	60	1.0	667	1600	42.30	1	3
20. WB_T_3_RT Que	*	120	60	1.0	667	1600	42.30	1	3

RECEPTOR LOCATIONS

	COORDINATES (FT)		
RECEPTOR	X	Y	Z
1. R-01	522712.0	********	6.0
2. R-02	522700.0	********	6.0
3. R-03	522684.0	********	6.0
4. R-04	522654.0	********	6.0
5. R-05	522772.0	********	6.0
6. R-06	522787.0	********	6.0
7. R-07	522759.0	********	6.0
8. R-08	522818.0	********	6.0
9. R-09	522717.0	********	6.0
10. R-10	522717.0	********	6.0
11. R-11	522717.0	********	6.0
12. R-12	522717.0	********	6.0
13. R-13	522687.0	********	6.0
14. R-14	522716.0	********	6.0
15. R-15	522754.0	********	6.0
16. R-16	522754.0	********	6.0
17. R-17	522754.0	********	6.0
18. R-18	522754.0	********	6.0
19. R-19	522754.0	********	6.0
20. R-20	522784.0	********	6.0

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JOB: 6th Ave Parkway Extension EA RUN: 6th/Picadilly 2035 CO

MODEL RESULTS

REMARKS : In search of the angle corresponding to
the maximum concentration, only the first
angle, of the angles with same maximum
concentrations, is indicated as maximum.

WIND ANGLE RANGE: 0.-355.

WIND ANGLE (DEGR)	CONCENTRATION (PPM) 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0.	3.9525	4.0143	3.7534	3.6592	2.2078	2.1131	2.5305	2.0713	3.5229	3.4246	3.2805	3.0371	2.1552	3.4270	2.4960
5.	4.0319	4.1892	3.8532	3.6785	2.1426	2.0871	2.3829	2.0662	3.8224	3.7000	3.5262	3.2390	2.2330	3.4750	2.3804
10.	4.0512	4.3432	3.9777	3.7131	2.1020	2.0727	2.2721	2.0629	4.0753	3.9358	3.7285	3.4117	2.3397	3.4720	2.2843
15.	3.9925	4.4509	4.1232	3.7810	2.0848	2.0711	2.2023	2.0663	4.2494	4.1037	3.8740	3.5413	2.4715	3.4221	2.2081
20.	3.8617	4.4936	4.2798	3.8847	2.0837	2.0778	2.1663	2.0748	4.3457	4.2073	3.9701	3.6208	2.6127	3.3506	2.1507
25.	3.6619	4.4216	4.4018	4.0195	2.0919	2.0885	2.1561	2.0859	4.3128	4.1928	3.9670	3.6120	2.7488	3.2922	2.1124
30.	3.4946	4.3083	4.4795	4.1659	2.1031	2.1012	2.1570	2.0989	4.2745	4.1742	3.9660	3.5903	2.8584	3.2953	2.0855
35.	3.3536	4.1522	4.5006	4.2994	2.1176	2.1162	2.1683	2.1139	4.1964	4.1220	3.9413	3.5380	2.9437	3.3468	2.0672
40.	3.2806	3.9849	4.4715	4.4075	2.1366	2.1352	2.1679	2.1325	4.1052	4.0527	3.9061	3.4695	3.0079	3.4361	2.0555
45.	3.2787	3.8403	4.4041	4.5120	2.1623	2.1605	2.1690	2.1571	3.9873	3.9508	3.8415	3.3753	3.0573	3.5510	2.0531
50.	3.3166	3.7521	4.3430	4.5848	2.1694	2.1674	2.1855	2.1638	3.9135	3.8728	3.8171	3.3273	3.0716	3.6479	2.0448
55.	3.4010	3.7186	4.2742	4.6269	2.2037	2.2010	2.2224	2.1956	3.8519	3.8069	3.7785	3.2653	3.0781	3.7061	2.0390
60.	3.5150	3.7432	4.2370	4.6594	2.2670	2.2623	2.2844	2.2529	3.8041	3.7486	3.7339	3.2153	3.1102	3.7073	2.0344
65.	3.6344	3.7967	4.2095	4.6715	2.3695	2.3607	2.3862	2.3438	3.7785	3.7033	3.6893	3.1720	3.1597	3.6446	2.0313
70.	3.7303	3.8492	4.1772	4.6548	2.5264	2.5111	2.5458	2.4809	3.7914	3.6848	3.6570	3.1461	3.2290	3.5223	2.0316
75.	3.7836	3.8803	4.1233	4.6037	2.7588	2.7327	2.7865	2.6808	3.8787	3.7229	3.6615	3.1566	3.3590	3.3473	2.0399
80.	3.7169	3.8027	3.9874	4.4217	3.0705	3.0247	3.1133	2.9400	4.0306	3.8075	3.6852	3.1850	3.5608	3.1631	2.0693
85.	3.5800	3.6504	3.7805	4.1435	3.4253	3.3532	3.4887	3.2276	4.2372	3.9584	3.7501	3.2383	3.7700	2.9951	2.1314
90.	3.4111	3.4553	3.5297	3.8003	3.7771	3.6756	3.8626	3.5037	4.4568	4.1629	3.8590	3.3200	3.9357	2.8684	2.2316
95.	3.2273	3.2342	3.2537	3.4230	4.0602	3.9314	4.1633	3.7113	4.6150	4.3838	4.0012	3.4305	4.0031	2.7808	2.3639
100.	3.0877	3.0499	3.0168	3.0886	4.2594	4.1114	4.3720	3.8443	4.6669	4.5803	4.1643	3.5708	3.9769	2.7327	2.5166
105.	3.0011	2.9180	2.8394	2.8303	4.3667	4.2110	4.4790	3.8993	4.5997	4.7166	4.3296	3.7310	3.8822	2.7079	2.6716
110.	2.9616	2.8383	2.7267	2.6618	4.3891	4.2413	4.4890	3.8819	4.4547	4.7736	4.4818	3.9056	3.7600	2.6948	2.8093
115.	2.9805	2.8176	2.6649	2.5668	4.3193	4.1942	4.4014	3.7981	4.2016	4.7257	4.5945	4.0750	3.6541	2.7173	2.9114
120.	2.9845	2.7875	2.6178	2.5071	4.2514	4.1506	4.3141	3.7214	3.9729	4.6358	4.6651	4.2409	3.6150	2.7340	2.9851
125.	2.9815	2.7601	2.5878	2.4730	4.1531	4.0786	4.1988	3.6323	3.7714	4.5057	4.6881	4.3831	3.6176	2.7554	3.0334
130.	2.9690	2.7368	2.5725	2.4514	4.0450	3.9941	4.0738	3.5469	3.6189	4.3560	4.6659	4.4959	3.6562	2.7781	3.0648
135.	2.9647	2.7419	2.5790	2.4346	3.9278	3.8958	3.9394	3.4677	3.5349	4.1945	4.6032	4.5967	3.7212	2.8127	3.0827
140.	2.9559	2.7287	2.5633	2.3968	3.8407	3.8190	3.8572	3.4451	3.4959	4.0970	4.5642	4.6939	3.8153	2.8488	3.0716
145.	2.9470	2.7152	2.5391	2.3463	3.7674	3.7545	3.7901	3.4266	3.5062	4.0220	4.4974	4.7452	3.8806	2.8807	3.0572
150.	2.9316	2.6936	2.4986	2.2833	3.7057	3.6974	3.7298	3.4193	3.5341	3.9843	4.4501	4.7787	3.9074	2.8991	3.0663
155.	2.9025	2.6528	2.4367	2.2135	3.6576	3.6490	3.6865	3.4225	3.5943	3.9677	4.4028	4.7848	3.8911	2.8906	3.0834
160.	2.8514	2.5846	2.3562	2.1469	3.6361	3.6201	3.6761	3.4429	3.6471	3.9570	4.3480	4.7588	3.8340	2.8494	3.1011
165.	2.7738	2.4865	2.2617	2.0914	3.6525	3.6150	3.7105	3.4782	3.6870	3.9516	4.2827	4.7032	3.7398	2.7714	3.1695
170.	2.6590	2.3732	2.1785	2.0571	3.7054	3.6296	3.7831	3.5189	3.6580	3.8860	4.1562	4.5394	3.6408	2.6586	3.2674
175.	2.5286	2.2632	2.1133	2.0394	3.8044	3.6748	3.8815	3.5646	3.5940	3.7840	3.9860	4.2963	3.5508	2.5309	3.3645
180.	2.3870	2.1683	2.0693	2.0321	3.9372	3.7474	3.9790	3.6074	3.4878	3.6354	3.7732	3.9973	3.4771	2.4011	3.4346
185.	2.2785	2.1022	2.0420	2.0278	4.0712	3.8332	4.0140	3.6420	3.4020	3.5028	3.5667	3.6853	3.4384	2.2933	3.4453

190.	*	2.1859	2.0597	2.0285	2.0257	4.1904	3.9355	3.9844	3.6892	3.3179	3.3679	3.3719	3.3919	3.4130	2.2043	3.4161
195.	*	2.1252	2.0391	2.0248	2.0268	4.2706	4.0431	3.8895	3.7585	3.2709	3.2725	3.2239	3.1557	3.3988	2.1400	3.3693
200.	*	2.0913	2.0324	2.0262	2.0308	4.3037	4.1456	3.7499	3.8457	3.2627	3.2234	3.1279	2.9853	3.3931	2.0968	3.3381
205.	*	2.0784	2.0343	2.0305	2.0367	4.2585	4.2199	3.5671	3.9553	3.3253	3.2402	3.0848	2.8932	3.4229	2.0708	3.3346

JOB: 6th Ave Parkway Extension EA RUN: 6th/Picadilly 2035 CO

WIND ANGLE RANGE: 0.-355.

WIND ANGLE (DEGR)	*	CONCENTRATION (PPM) 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
210.	*	2.0742	2.0389	2.0365	2.0439	4.1927	4.2668	3.4310	4.0630	3.3817	3.2472	3.0487	2.8253	3.4561	2.0533	3.4032
215.	*	2.0770	2.0457	2.0436	2.0521	4.1037	4.2877	3.3316	4.1588	3.4354	3.2535	3.0243	2.7800	3.4999	2.0418	3.5188
220.	*	2.0746	2.0544	2.0523	2.0619	4.0099	4.2893	3.3088	4.2396	3.4803	3.2611	3.0104	2.7459	3.5470	2.0348	3.6673
225.	*	2.0775	2.0660	2.0635	2.0744	3.9149	4.2725	3.3651	4.3233	3.5420	3.3054	3.0230	2.7135	3.5897	2.0334	3.8432
230.	*	2.0832	2.0689	2.0663	2.0767	3.8978	4.2953	3.4494	4.4224	3.6025	3.3089	2.9952	2.6676	3.6583	2.0284	4.0054
235.	*	2.0981	2.0833	2.0799	2.0889	3.9187	4.3172	3.5719	4.5135	3.6519	3.3017	2.9589	2.6171	3.7188	2.0249	4.1301
240.	*	2.1274	2.1125	2.1064	2.1123	3.9878	4.3664	3.7187	4.6095	3.6819	3.2819	2.9119	2.5561	3.7685	2.0222	4.2039
245.	*	2.1844	2.1667	2.1543	2.1531	4.0859	4.4199	3.8954	4.6930	3.6933	3.2400	2.8455	2.4811	3.7923	2.0205	4.2175
250.	*	2.2875	2.2647	2.2412	2.2253	4.2020	4.4826	4.0623	4.7732	3.6738	3.1626	2.7538	2.3926	3.7940	2.0217	4.1691
255.	*	2.4541	2.4215	2.3812	2.3420	4.3356	4.5417	4.2297	4.8377	3.6261	3.0452	2.6304	2.2913	3.7766	2.0291	4.0572
260.	*	2.7287	2.6794	2.6123	2.5265	4.3677	4.5252	4.2732	4.7861	3.4843	2.8690	2.4873	2.1994	3.6803	2.0554	3.9008
265.	*	3.0882	3.0192	2.9205	2.7725	4.3052	4.4178	4.2200	4.6246	3.2761	2.6649	2.3431	2.1251	3.5188	2.1129	3.7268
270.	*	3.4915	3.4047	3.2764	3.0594	4.1448	4.2140	4.0817	4.3533	3.0183	2.4613	2.2175	2.0742	3.2997	2.2106	3.5651
275.	*	3.8696	3.7731	3.6250	3.3434	3.9003	3.9280	3.8758	3.9931	2.7387	2.2871	2.1239	2.0439	3.0344	2.3466	3.4387
280.	*	4.1696	4.0736	3.9211	3.5955	3.6431	3.6321	3.6605	3.6245	2.4951	2.1619	2.0684	2.0312	2.7725	2.5091	3.3547
285.	*	4.3569	4.2711	4.1304	3.7911	3.4243	3.3788	3.4818	3.3057	2.3177	2.0902	2.0455	2.0311	2.5489	2.6777	3.3071
290.	*	4.4118	4.3458	4.2324	3.9230	3.2724	3.1985	3.3597	3.0691	2.2093	2.0601	2.0426	2.0372	2.3815	2.8335	3.2844
295.	*	4.3516	4.3058	4.2262	3.9724	3.2385	3.1087	3.3539	2.9212	2.1620	2.0570	2.0489	2.0457	2.2762	2.9490	3.3054
300.	*	4.2662	4.2379	4.1835	3.9920	3.2029	3.0336	3.3547	2.8097	2.1379	2.0608	2.0577	2.0551	2.2059	3.0274	3.3200
305.	*	4.1549	4.1410	4.1065	3.9750	3.1831	2.9804	3.3751	2.7236	2.1316	2.0696	2.0681	2.0654	2.1607	3.0705	3.3364
310.	*	4.0410	4.0397	4.0180	3.9377	3.1704	2.9400	3.4031	2.6495	2.1366	2.0821	2.0809	2.0776	2.1336	3.0877	3.3470
315.	*	3.9273	3.9380	3.9242	3.8829	3.1838	2.9168	3.4550	2.5800	2.1416	2.0977	2.0962	2.0925	2.1286	3.0875	3.3657
320.	*	3.8425	3.8515	3.8393	3.8383	3.1412	2.8408	3.4751	2.4879	2.1455	2.1063	2.1048	2.1000	2.1093	3.0627	3.3622
325.	*	3.7624	3.7721	3.7634	3.7725	3.0765	2.7489	3.4762	2.3970	2.1648	2.1307	2.1283	2.1208	2.0956	3.0306	3.3348
330.	*	3.6997	3.7160	3.7081	3.7192	2.9845	2.6425	3.4390	2.3100	2.2048	2.1760	2.1712	2.1574	2.0845	3.0238	3.2792
335.	*	3.6456	3.6687	3.6579	3.6688	2.8641	2.5254	3.3592	2.2313	2.2775	2.2521	2.2424	2.2156	2.0754	3.0278	3.1876
340.	*	3.6254	3.6529	3.6287	3.6315	2.7203	2.4075	3.2348	2.1661	2.3991	2.3732	2.3543	2.3043	2.0686	3.0363	3.0647
345.	*	3.6392	3.6671	3.6191	3.6191	2.5627	2.2967	3.0682	2.1163	2.5808	2.5492	2.5148	2.4298	2.0657	3.0953	2.9192
350.	*	3.7066	3.7321	3.6355	3.6257	2.4179	2.2106	2.8819	2.0872	2.8469	2.7998	2.7397	2.6055	2.0737	3.1996	2.7691
355.	*	3.8197	3.8536	3.6814	3.6430	2.2981	2.1510	2.6980	2.0750	3.1690	3.0983	3.0040	2.8142	2.1019	3.3185	2.6248

MAX	*	4.4118	4.4936	4.5006	4.6715	4.3891	4.5417	4.4890	4.8377	4.6669	4.7736	4.6881	4.7848	4.0031	3.7073	4.2175
DEGR.	*	290	20	35	65	110	255	110	255	100	110	125	155	95	60	245

PAGE 5

JOB: 6th Ave Parkway Extension EA RUN: 6th/Picadilly 2035 CO

MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 0.-355.

WIND ANGLE (DEGR)	*	CONCENTRATION (PPM) 16	17	18	19	20
0.	*	3.5337	3.5092	3.5269	3.5835	3.4167
5.	*	3.4066	3.3458	3.3193	3.3250	3.3677
10.	*	3.3021	3.2092	3.1439	3.0936	3.3383
15.	*	3.2372	3.1172	3.0189	2.9165	3.3236
20.	*	3.2161	3.0729	2.9447	2.7966	3.3256
25.	*	3.2516	3.0894	2.9245	2.7460	3.3489
30.	*	3.2849	3.0951	2.9043	2.7044	3.3784
35.	*	3.3179	3.1009	2.8924	2.6747	3.4124
40.	*	3.3469	3.1081	2.8864	2.6483	3.4468
45.	*	3.3999	3.1457	2.8934	2.6127	3.4970
50.	*	3.4392	3.1404	2.8606	2.5640	3.5326
55.	*	3.4632	3.1181	2.8129	2.5059	3.5520
60.	*	3.4624	3.0739	2.7472	2.4349	3.5507
65.	*	3.4265	2.9985	2.6587	2.3513	3.5122
70.	*	3.3440	2.8864	2.5484	2.2606	3.4302
75.	*	3.2077	2.7346	2.4168	2.1702	3.3013
80.	*	3.0137	2.5604	2.2909	2.1019	3.1186
85.	*	2.7933	2.3895	2.1833	2.0561	2.9096
90.	*	2.5785	2.2475	2.1061	2.0314	2.7047
95.	*	2.3775	2.1367	2.0532	2.0178	2.5051
100.	*	2.2305	2.0694	2.0269	2.0129	2.3472
105.	*	2.1369	2.0355	2.0173	2.0128	2.2320
110.	*	2.0868	2.0232	2.0161	2.0146	2.1556
115.	*	2.0670	2.0216	2.0180	2.0172	2.1119

120.	*	2.0590	2.0241	2.0216	2.0203	2.0831
125.	*	2.0595	2.0292	2.0265	2.0243	2.0647
130.	*	2.0622	2.0362	2.0328	2.0298	2.0538
135.	*	2.0654	2.0452	2.0411	2.0372	2.0522
140.	*	2.0684	2.0477	2.0434	2.0391	2.0439
145.	*	2.0793	2.0597	2.0543	2.0485	2.0381
150.	*	2.1042	2.0848	2.0770	2.0676	2.0337
155.	*	2.1538	2.1329	2.1200	2.1032	2.0301
160.	*	2.2437	2.2179	2.1965	2.1657	2.0282
165.	*	2.3826	2.3478	2.3134	2.2601	2.0298
170.	*	2.5974	2.5492	2.4966	2.4112	2.0420
175.	*	2.8610	2.7982	2.7261	2.6052	2.0734
180.	*	3.1396	3.0651	2.9773	2.8255	2.1301
185.	*	3.3829	3.3052	3.2110	3.0428	2.2122
190.	*	3.5581	3.4847	3.3952	3.2295	2.3159
195.	*	3.6484	3.5847	3.5085	3.3629	2.4286
200.	*	3.6624	3.6076	3.5488	3.4339	2.5321
205.	*	3.5821	3.5307	3.4911	3.4134	2.6089

PAGE 6

JOB: 6th Ave Parkway Extension EA RUN: 6th/Picadilly 2035 CO

WIND ANGLE RANGE: 0.-355.

WIND ANGLE (DEGR)	*	CONCENTRATION (PPM) 16	17	18	19	20
210.	*	3.5205	3.4585	3.4302	3.3777	2.6531
215.	*	3.4571	3.3766	3.3556	3.3207	2.6720
220.	*	3.4064	3.2985	3.2820	3.2578	2.6767
225.	*	3.3668	3.2237	3.2101	3.1924	2.6779
230.	*	3.3611	3.1692	3.1564	3.1421	2.6719
235.	*	3.3577	3.1172	3.1020	3.0895	2.6689
240.	*	3.3648	3.0833	3.0608	3.0501	2.6925
245.	*	3.3754	3.0627	3.0231	3.0134	2.7339
250.	*	3.4043	3.0711	2.9970	2.9853	2.8060
255.	*	3.4799	3.1378	3.0056	2.9848	2.9119
260.	*	3.6081	3.2626	3.0340	2.9880	3.0990
265.	*	3.7957	3.4646	3.1072	3.0123	3.3172
270.	*	4.0026	3.7251	3.2254	3.0560	3.5215
275.	*	4.1641	4.0052	3.3817	3.1209	3.6611
280.	*	4.2300	4.2545	3.5617	3.2104	3.7170
285.	*	4.1832	4.4326	3.7497	3.3272	3.6991
290.	*	4.0345	4.5138	3.9287	3.4619	3.6481

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295.   *  3.7997  4.4731  4.0639  3.5887  3.5852
300.   *  3.5931  4.3675  4.1517  3.7074  3.5954
305.   *  3.4193  4.2112  4.1881  3.7987  3.6536
310.   *  3.3062  4.0408  4.1829  3.8596  3.7513
315.   *  3.2729  3.8812  4.1453  3.9201  3.8705
320.   *  3.2912  3.7729  4.1092  3.9639  3.9780
325.   *  3.3555  3.7112  4.0724  3.9982  4.0423
330.   *  3.4618  3.7154  4.0624  4.0418  4.0448
335.   *  3.5876  3.7551  4.0602  4.0858  3.9844
340.   *  3.6901  3.7970  4.0455  4.1127  3.8747
345.   *  3.7683  3.8327  4.0141  4.1185  3.7303
350.   *  3.7377  3.7778  3.9034  4.0159  3.5995
355.   *  3.6509  3.6631  3.7340  3.8297  3.4929
------*-----------------------------------------
MAX    *  4.2300  4.5138  4.1881  4.1185  4.0448
DEGR.  *     280     290     305     345     330

THE HIGHEST CONCENTRATION OF   4.8377 PPM OCCURRED AT RECEPTOR     8.
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     JOB: 6th Ave Parkway Extension EA                        RUN: 6th/Picadilly 2035 CO

     DATE : 11/ 3/15
     TIME : 10: 9:44


     RECEPTOR - LINK MATRIX FOR THE ANGLE PRODUCING
     THE MAXIMUM CONCENTRATION FOR EACH RECEPTOR

         *    CO/LINK  (PPM)
         *    ANGLE (DEGREES)
         *      1     2     3     4     5     6     7     8     9    10    11    12    13    14    15
  LINK # *   290    20    35    65   110   255   110   255   100   110   125   155    95    60   245
  -------*-------------------------------------------------------------------------------------------
      1  *  0.3429  0.1756  0.2181  0.2209  0.0000  0.1618  0.0000  0.1126  0.0000  0.0000  0.0000  0.0011  0.0061  0.0000  0.1770
      2  *  0.3846  0.2104  0.2508  0.2666  0.0000  0.1692  0.0000  0.1192  0.0000  0.0000  0.0000  0.0012  0.0017  0.0000  0.1713
      3  *  0.2014  0.1476  0.1720  0.1918  0.0000  0.0619  0.0000  0.0414  0.0000  0.0000  0.0000  0.0008  0.0004  0.0000  0.0527
      4  *  0.2881  0.1852  0.2163  0.2748  0.0000  0.0629  0.0000  0.0437  0.0000  0.0000  0.0000  0.0008  0.0000  0.0000  0.0473
      5  *  0.3655  0.2076  0.2428  0.3488  0.0000  0.0617  0.0000  0.0439  0.0000  0.0000  0.0000  0.0007  0.0000  0.0000  0.0432
      6  *  0.0000  0.0000  0.0000  0.0008  0.0000  0.0035  0.0000  0.0096  0.0000  0.0000  0.0000  0.0042  0.0001  0.0842  0.0000
      7  *  0.0000  0.0000  0.0000  0.0008  0.0000  0.0026  0.0000  0.0091  0.0000  0.0000  0.0000  0.0060  0.0002  0.0910  0.0000
      8  *  0.0000  0.0000  0.0000  0.0009  0.0000  0.0035  0.0000  0.0151  0.0000  0.0001  0.0007  0.0329  0.0004  0.1536  0.0000
      9  *  0.0000  0.0000  0.0000  0.0009  0.0000  0.0021  0.0000  0.0138  0.0000  0.0002  0.0010  0.0388  0.0006  0.1344  0.0000
     10  *  0.0000  0.0000  0.0000  0.0009  0.0000  0.0015  0.0000  0.0126  0.0000  0.0004  0.0014  0.0427  0.0009  0.1179  0.0000
     11  *  0.0000  0.1038  0.0962  0.0417  0.0000  0.0059  0.0000  0.0063  0.0650  0.1893  0.2362  0.2357  0.0278  0.0000  0.2516
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12	*	0.0000	0.1128	0.0997	0.0402	0.0000	0.0060	0.0000	0.0063	0.0725	0.2256	0.2709	0.2861	0.0277	0.0000	0.2245
13	*	0.0000	0.1480	0.1104	0.0368	0.0000	0.0086	0.0000	0.0071	0.1509	0.2360	0.2574	0.2946	0.0337	0.0000	0.1596
14	*	0.0000	0.1572	0.1131	0.0355	0.0000	0.0087	0.0000	0.0071	0.1991	0.2670	0.3061	0.3883	0.0356	0.0000	0.1502
15	*	0.0000	0.1597	0.1112	0.0331	0.0000	0.0085	0.0000	0.0070	0.2510	0.2964	0.3429	0.5080	0.0368	0.0000	0.1312
16	*	0.0000	0.0000	0.0004	0.0277	0.1705	0.0397	0.2072	0.1445	0.1110	0.1071	0.1022	0.0466	0.0889	0.1041	0.0000
17	*	0.0000	0.0000	0.0007	0.0323	0.2210	0.0714	0.2583	0.1888	0.1294	0.1196	0.1073	0.0444	0.0954	0.0960	0.0000
18	*	0.0000	0.0003	0.0007	0.0291	0.2409	0.0704	0.2435	0.1475	0.1415	0.1210	0.0825	0.0263	0.1058	0.0854	0.0000
19	*	0.0000	0.0005	0.0010	0.0337	0.3296	0.1649	0.3333	0.2420	0.1542	0.1291	0.0846	0.0253	0.1104	0.0847	0.0000
20	*	0.0000	0.0001	0.0017	0.0393	0.3883	0.2697	0.3898	0.3528	0.1559	0.1238	0.0812	0.0228	0.1091	0.0832	0.0000
21	*	0.1199	0.0672	0.0754	0.1010	0.0000	0.0524	0.0000	0.0358	0.0000	0.0000	0.0001	0.0045	0.0120	0.0005	0.0409
22	*	0.1250	0.0653	0.0716	0.1048	0.0000	0.0517	0.0000	0.0368	0.0000	0.0000	0.0001	0.0041	0.0057	0.0012	0.0381
23	*	0.1229	0.0583	0.0627	0.1022	0.0000	0.0500	0.0000	0.0370	0.0000	0.0000	0.0000	0.0037	0.0029	0.0023	0.0355
24	*	0.0000	0.0001	0.0001	0.0032	0.0000	0.0093	0.0000	0.0104	0.0003	0.0007	0.0009	0.0124	0.0036	0.0412	0.0000
25	*	0.0000	0.0000	0.0001	0.0029	0.0000	0.0089	0.0000	0.0106	0.0005	0.0010	0.0015	0.0139	0.0040	0.0386	0.0000
26	*	0.0000	0.0000	0.0001	0.0027	0.0000	0.0084	0.0000	0.0106	0.0008	0.0013	0.0019	0.0149	0.0042	0.0366	0.0000
27	*	0.0000	0.0544	0.0386	0.0200	0.0000	0.0187	0.0000	0.0101	0.0530	0.0541	0.0604	0.0821	0.0331	0.0002	0.0464
28	*	0.0000	0.0589	0.0403	0.0203	0.0000	0.0176	0.0000	0.0097	0.0483	0.0501	0.0549	0.0834	0.0354	0.0001	0.0446
29	*	0.0000	0.0637	0.0421	0.0206	0.0000	0.0161	0.0000	0.0091	0.0421	0.0437	0.0467	0.0798	0.0382	0.0000	0.0420
30	*	0.0000	0.0044	0.0054	0.0475	0.2803	0.1964	0.2839	0.2417	0.1851	0.1496	0.1107	0.0569	0.1377	0.1009	0.0003
31	*	0.0000	0.0063	0.0080	0.0527	0.2894	0.2180	0.2913	0.2612	0.2095	0.1668	0.1168	0.0578	0.1437	0.0956	0.0010
32	*	0.0000	0.0079	0.0105	0.0572	0.2805	0.2245	0.2823	0.2641	0.2236	0.1800	0.1214	0.0583	0.1449	0.0902	0.0025
33	*	0.0000	0.0005	0.0005	0.0129	0.0733	0.0305	0.0754	0.0478	0.0469	0.0438	0.0377	0.0216	0.0429	0.0466	0.0000
34	*	0.0000	0.0003	0.0003	0.0109	0.0622	0.0195	0.0644	0.0355	0.0402	0.0398	0.0361	0.0215	0.0384	0.0497	0.0000
35	*	0.0000	0.0001	0.0001	0.0093	0.0532	0.0123	0.0551	0.0271	0.0349	0.0366	0.0344	0.0212	0.0342	0.0522	0.0000
36	*	0.0000	0.0508	0.0421	0.0234	0.0000	0.0285	0.0000	0.0141	0.0587	0.0570	0.0645	0.0695	0.0330	0.0010	0.0680
37	*	0.0000	0.0462	0.0403	0.0233	0.0000	0.0321	0.0010	0.0154	0.0548	0.0536	0.0601	0.0585	0.0312	0.0017	0.0651
38	*	0.0000	0.0427	0.0388	0.0231	0.0000	0.0348	0.0034	0.0164	0.0518	0.0511	0.0566	0.0506	0.0297	0.0023	0.0590
39	*	0.0000	0.0010	0.0004	0.0031	0.0000	0.0076	0.0000	0.0081	0.0000	0.0001	0.0001	0.0068	0.0015	0.0405	0.0001
40	*	0.0008	0.0026	0.0007	0.0034	0.0000	0.0079	0.0000	0.0082	0.0000	0.0000	0.0001	0.0061	0.0012	0.0380	0.0002
41	*	0.0030	0.0069	0.0013	0.0039	0.0000	0.0080	0.0000	0.0082	0.0000	0.0000	0.0000	0.0050	0.0008	0.0328	0.0004
42	*	0.1766	0.1235	0.1390	0.1458	0.0000	0.1092	0.0000	0.0686	0.0239	0.0019	0.0013	0.0132	0.1523	0.0001	0.1121
43	*	0.1511	0.1156	0.1286	0.1209	0.0000	0.1022	0.0000	0.0633	0.0671	0.0075	0.0026	0.0151	0.1890	0.0001	0.1221
44	*	0.1300	0.1082	0.1183	0.0997	0.0000	0.0929	0.0000	0.0573	0.0945	0.0193	0.0045	0.0168	0.2019	0.0000	0.1303

JOB: 6th Ave Parkway Extension EA RUN: 6th/Picadilly 2035 CO

DATE : 11/ 3/15
TIME : 10: 9:44

RECEPTOR - LINK MATRIX FOR THE ANGLE PRODUCING
THE MAXIMUM CONCENTRATION FOR EACH RECEPTOR

* CO/LINK (PPM)

LINK #	*	ANGLE (DEGREES) 16 280	17 290	18 305	19 345	20 330
1	*	0.2452	0.2135	0.1478	0.0212	0.0002
2	*	0.2625	0.2223	0.1486	0.0194	0.0001
3	*	0.0964	0.0871	0.0730	0.0091	0.0000
4	*	0.1088	0.0958	0.0760	0.0081	0.0000
5	*	0.1127	0.0986	0.0762	0.0076	0.0000
6	*	0.0602	0.1398	0.0821	0.0407	0.0000
7	*	0.0692	0.1769	0.0736	0.0469	0.0000
8	*	0.1008	0.2096	0.2304	0.1811	0.0000
9	*	0.1381	0.2529	0.2866	0.2851	0.0000
10	*	0.1795	0.2793	0.3209	0.4031	0.0000
11	*	0.0000	0.0000	0.0001	0.0479	0.0975
12	*	0.0000	0.0000	0.0003	0.0511	0.0912
13	*	0.0000	0.0001	0.0011	0.0724	0.1048
14	*	0.0000	0.0002	0.0014	0.0760	0.1024
15	*	0.0000	0.0004	0.0021	0.0773	0.0959
16	*	0.0000	0.0000	0.0000	0.0099	0.2264
17	*	0.0000	0.0000	0.0000	0.0102	0.2005
18	*	0.0000	0.0000	0.0000	0.0047	0.1017
19	*	0.0000	0.0000	0.0000	0.0047	0.0885
20	*	0.0000	0.0000	0.0000	0.0051	0.0790
21	*	0.0785	0.0639	0.0478	0.0160	0.0002
22	*	0.0884	0.0710	0.0502	0.0163	0.0001
23	*	0.0941	0.0764	0.0522	0.0162	0.0000
24	*	0.0460	0.0443	0.0498	0.0651	0.0003
25	*	0.0416	0.0432	0.0474	0.0718	0.0007
26	*	0.0379	0.0395	0.0427	0.0734	0.0013
27	*	0.0008	0.0015	0.0020	0.0304	0.0338
28	*	0.0013	0.0020	0.0027	0.0309	0.0325
29	*	0.0021	0.0026	0.0036	0.0310	0.0305
30	*	0.0002	0.0001	0.0004	0.0292	0.1437
31	*	0.0000	0.0000	0.0002	0.0275	0.1343
32	*	0.0000	0.0000	0.0002	0.0258	0.1252
33	*	0.0110	0.0010	0.0007	0.0141	0.0658
34	*	0.0291	0.0037	0.0015	0.0154	0.0621
35	*	0.0404	0.0088	0.0025	0.0167	0.0547
36	*	0.0000	0.0004	0.0005	0.0326	0.0500
37	*	0.0000	0.0002	0.0003	0.0303	0.0532
38	*	0.0000	0.0001	0.0002	0.0281	0.0553
39	*	0.0320	0.0311	0.0349	0.0255	0.0000
40	*	0.0303	0.0297	0.0330	0.0204	0.0000

41	*	0.0279	0.0277	0.0302	0.0146	0.0000
42	*	0.1137	0.1062	0.0923	0.0351	0.0026
43	*	0.0975	0.0965	0.0884	0.0354	0.0042
44	*	0.0835	0.0874	0.0844	0.0351	0.0058

CAL3QHC: LINE SOURCE DISPERSION MODEL - VERSION 2.0 Dated 13045 PAGE 1

JOB: 6th Avenue Parkway Extension EA RUN: SH 30 and Picadilly CO 2035

DATE : 11/ 3/15
TIME : 10: 1:52

The MODE flag has been set for calculating concentrations for POLLUTANT: CO

SITE & METEOROLOGICAL VARIABLES

VS = 0.0 CM/S VD = 0.0 CM/S Z0 = 74. CM
U = 1.0 M/S CLAS = 4 (D) ATIM = 60. MINUTES MIXH = 1000. M AMB = 2.0 PPM

LINK VARIABLES

LINK DESCRIPTION	LINK COORDINATES (FT) X1	Y1	X2	Y2	LENGTH (FT)	BRG (DEG)	TYPE	VPH	EF (G/MI)	H (FT)	W (FT)	V/C	QUEUE (VEH)
1. NB_LT Que	522726.0	********	522726.0	********	11.	180.	AG	86.	100.0	0.0	12.0	0.07	0.6
2. NB_RT Que	522733.0	********	522732.9	********	18.	180.	AG	86.	100.0	0.0	12.0	0.12	0.9
3. NB_T Que	522729.0	********	522729.0	********	127.	180.	AG	86.	100.0	0.0	12.0	0.78	6.5
4. NWB_LT Que	522744.0	********	522759.2	********	22.	136.	AG	63.	100.0	0.0	12.0	0.10	1.1
5. NWB_RT Que	522743.0	********	522836.2	********	133.	136.	AG	63.	100.0	0.0	12.0	0.61	6.8
6. NWB_T Que	522744.0	********	522858.2	********	163.	136.	AG	63.	100.0	0.0	12.0	0.75	8.3
7. SB_LT Que	522726.0	********	522734.8	********	1402.	0.	AG	81.	100.0	0.0	12.0	1.28	71.2
8. SB_RT Que	522719.0	********	522719.0	********	3.	360.	AG	53.	100.0	0.0	12.0	0.01	0.1
9. SB_T Que	522722.0	********	522722.8	********	119.	0.	AG	53.	100.0	0.0	12.0	0.53	6.0
10. SEB_LT Que	522704.0	********	522700.5	********	5.	316.	AG	63.	100.0	0.0	12.0	0.02	0.3
11. SEB_RT Que	522706.0	********	522682.8	********	33.	316.	AG	63.	100.0	0.0	12.0	0.15	1.7
12. SEB_T Que	522705.0	********	521625.2	********	1545.	316.	AG	63.	100.0	0.0	12.0	1.18	78.5
13. NB_T Apr	522730.0	********	522729.0	********	192.	180.	AG	325.	7.7	0.0	32.0		
14. NWB_T Apr	522725.0	********	522865.0	********	201.	136.	AG	955.	7.7	0.0	32.0		
15. SB_T Apr	522722.0	********	522723.0	********	184.	0.	AG	935.	6.8	0.0	32.0		
16. SEB_T Apr	522723.0	********	522592.0	********	188.	316.	AG	885.	7.7	0.0	32.0		
17. NB_T Dprt	522731.0	********	522730.0	********	191.	180.	AG	675.	7.7	0.0	32.0		
18. NWB_T Dprt	522598.0	********	522725.0	********	182.	136.	AG	525.	7.7	0.0	32.0		
19. SB_T Dprt	522721.0	********	522722.0	********	199.	0.	AG	590.	6.8	0.0	32.0		
20. SEB_T Dprt	522859.0	********	522723.0	********	194.	316.	AG	1310.	7.7	0.0	32.0		

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JOB: 6th Avenue Parkway Extension EA RUN: SH 30 and Picadilly CO 2035

DATE : 11/ 3/15
TIME : 10: 1:52

ADDITIONAL QUEUE LINK PARAMETERS

LINK DESCRIPTION	CYCLE LENGTH (SEC)	RED TIME (SEC)	CLEARANCE LOST TIME (SEC)	APPROACH VOL (VPH)	SATURATION FLOW RATE (VPH)	IDLE EM FAC (gm/hr)	SIGNAL TYPE	ARRIVAL RATE
1. NB_LT Que	110	83	2.0	25	1600	42.30	1	3
2. NB_RT Que	110	83	2.0	40	1600	42.30	1	3
3. NB_T Que	110	83	2.0	260	1600	42.30	1	3
4. NWB_LT Que	110	61	2.0	65	1600	42.30	1	3
5. NWB_RT Que	110	61	2.0	400	1600	42.30	1	3
6. NWB_T Que	110	61	2.0	490	1600	42.30	1	3
7. SB_LT Que	110	79	2.0	500	1600	42.30	1	3
8. SB_RT Que	110	51	2.0	10	1600	42.30	1	3
9. SB_T Que	110	51	2.0	425	1600	42.30	1	3
10. SEB_LT Que	110	61	2.0	15	1600	42.30	1	3
11. SEB_RT Que	110	61	2.0	100	1600	42.30	1	3
12. SEB_T Que	110	61	2.0	770	1600	42.30	1	3

RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (FT) X	Y	Z
1. R-01	522738.0	********	6.0
2. R-02	522738.0	********	6.0
3. R-03	522738.0	********	6.0
4. R-04	522772.0	********	6.0
5. R-05	522755.0	********	6.0
6. R-06	522765.0	********	6.0
7. R-07	522747.0	********	6.0
8. R-08	522736.0	********	6.0
9. R-09	522695.0	********	6.0
10. R-10	522684.0	********	6.0
11. R-11	522703.0	********	6.0
12. R-12	522717.0	********	6.0
13. R-13	522714.0	********	6.0
14. R-14	522714.0	********	6.0
15. R-15	522714.0	********	6.0
16. R-16	522689.0	********	6.0
17. R-17	522663.0	********	6.0
18. R-18	522714.0	********	6.0
19. R-19	522786.0	********	6.0

20. R-20 * 522738.0 ******** 6.0 *

JOB: 6th Avenue Parkway Extension EA RUN: SH 30 and Picadilly CO 2035

MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 0.-355.

WIND ANGLE (DEGR)	* CONCENTRATION (PPM) 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0.	3.7054	3.6789	3.4903	3.2683	2.5105	2.4029	2.6933	3.2060	3.3334	3.0776	3.4743	3.5109	3.2311	3.1731	3.1310
5.	3.5397	3.4963	3.3173	3.1304	2.3585	2.2783	2.4964	2.9888	3.4384	3.1482	3.5667	3.5215	3.3835	3.3277	3.2846
10.	3.3478	3.2871	3.1197	3.0027	2.2237	2.1775	2.3199	2.7458	3.5268	3.2149	3.6297	3.4582	3.4608	3.4120	3.3730
15.	3.1684	3.0855	2.9312	2.9256	2.1293	2.1106	2.1877	2.5238	3.5783	3.2658	3.6183	3.3399	3.4620	3.4219	3.3908
20.	3.0315	2.9259	2.7871	2.8817	2.0739	2.0717	2.1067	2.3524	3.6011	3.2996	3.5458	3.2025	3.4150	3.3823	3.3606
25.	2.9494	2.8201	2.6967	2.8600	2.0479	2.0512	2.0697	2.2480	3.5840	3.3124	3.4082	3.0644	3.3130	3.2852	3.2731
30.	2.9025	2.7508	2.6342	2.8528	2.0337	2.0391	2.0496	2.1783	3.5678	3.3211	3.2842	2.9845	3.2305	3.2044	3.1973
35.	2.8802	2.7126	2.6017	2.8497	2.0289	2.0353	2.0424	2.1363	3.5356	3.3207	3.1588	2.9284	3.1451	3.1200	3.1165
40.	2.8703	2.6924	2.5852	2.8513	2.0306	2.0376	2.0438	2.1136	3.4993	3.3237	3.0467	2.8904	3.0663	3.0417	3.0401
45.	2.8621	2.6814	2.5793	2.8499	2.0342	2.0411	2.0489	2.1103	3.4504	3.3213	2.9459	2.8678	2.9937	2.9691	2.9685
50.	2.8370	2.6625	2.5686	2.8508	2.0320	2.0390	2.0473	2.0943	3.3870	3.2991	2.8648	2.8530	2.9515	2.9231	2.9232
55.	2.8053	2.6459	2.5609	2.8508	2.0287	2.0355	2.0441	2.0823	3.3080	3.2606	2.8055	2.8496	2.9134	2.8805	2.8812
60.	2.7745	2.6358	2.5568	2.8522	2.0303	2.0370	2.0439	2.0728	3.2375	3.2422	2.7641	2.8672	2.8813	2.8426	2.8433
65.	2.7562	2.6344	2.5557	2.8593	2.0377	2.0447	2.0483	2.0652	3.1741	3.2336	2.7430	2.8995	2.8537	2.8097	2.8103
70.	2.7603	2.6493	2.5638	2.8703	2.0493	2.0571	2.0576	2.0591	3.1164	3.2321	2.7361	2.9476	2.8341	2.7858	2.7862
75.	2.7727	2.6594	2.5640	2.8943	2.0627	2.0714	2.0711	2.0546	3.0913	3.2387	2.7579	3.0028	2.8289	2.7825	2.7822
80.	2.7900	2.6678	2.5637	2.9273	2.0771	2.0869	2.0893	2.0524	3.0768	3.2589	2.8030	3.0543	2.8226	2.7818	2.7810
85.	2.8083	2.6761	2.5659	2.9673	2.0934	2.1052	2.0933	2.0532	3.0764	3.2795	2.8757	3.0994	2.8271	2.7918	2.7901
90.	2.8456	2.7090	2.5901	3.0121	2.1140	2.1283	2.1068	2.0541	3.1013	3.2972	2.9503	3.1530	2.8270	2.8020	2.7990
95.	2.8731	2.7187	2.5818	3.0936	2.1219	2.1367	2.1207	2.0533	3.1611	3.3500	3.0231	3.2041	2.8005	2.7934	2.7908
100.	2.8965	2.7169	2.5569	3.1777	2.1474	2.1648	2.1476	2.0522	3.2284	3.4177	3.0931	3.2579	2.7624	2.7803	2.7784
105.	2.9139	2.7004	2.5150	3.2574	2.1935	2.2151	2.1951	2.0552	3.3143	3.4977	3.1840	3.3176	2.7416	2.7758	2.7742
110.	2.9153	2.6609	2.4541	3.3136	2.2702	2.2966	2.2751	2.0655	3.4180	3.5803	3.3017	3.3753	2.7393	2.7891	2.7849
115.	2.8851	2.5919	2.3755	3.3512	2.3933	2.4241	2.4042	2.0887	3.5170	3.6571	3.4221	3.4102	2.7752	2.8286	2.8151
120.	2.8183	2.4913	2.2828	3.3754	2.5737	2.6080	2.5942	2.1308	3.6418	3.7371	3.5558	3.4290	2.8681	2.8987	2.8663
125.	2.6988	2.3799	2.2018	3.3413	2.8292	2.8626	2.8637	2.2182	3.6895	3.7471	3.6033	3.3826	3.0337	3.0208	2.9535

130.	*	2.5535	2.2738	2.1365	3.2647	3.1252	3.1531	3.1771	2.3561	3.6655	3.6810	3.5733	3.2912	3.2390	3.1844	3.0786
135.	*	2.4083	2.1875	2.0933	3.1468	3.4226	3.4569	3.4886	2.5375	3.5650	3.5365	3.4622	3.1812	3.4443	3.3654	3.2351
140.	*	2.2839	2.1205	2.0644	2.9838	3.6557	3.6596	3.7278	2.7259	3.3877	3.3224	3.3146	3.0888	3.6182	3.5558	3.4228
145.	*	2.2053	2.0866	2.0577	2.8066	3.8012	3.7878	3.8729	2.9139	3.1795	3.0857	3.1415	3.0234	3.7162	3.6969	3.5917
150.	*	2.1726	2.0809	2.0671	2.6373	3.8560	3.8235	3.9197	3.0699	2.9824	2.8675	2.9850	2.9878	3.7342	3.7663	3.7128
155.	*	2.1839	2.1001	2.0916	2.4899	3.8414	3.7879	3.8905	3.1797	2.8181	2.6878	2.8587	2.9744	3.6883	3.7618	3.7667
160.	*	2.2405	2.1448	2.1347	2.3766	3.7415	3.6663	3.7794	3.2235	2.6964	2.5539	2.7654	2.9759	3.5819	3.6754	3.7314
165.	*	2.3311	2.2133	2.1986	2.2942	3.6756	3.5701	3.7092	3.2708	2.5877	2.4367	2.6805	2.9724	3.5193	3.6013	3.6798
170.	*	2.4656	2.3149	2.2922	2.2380	3.6190	3.4753	3.6529	3.3128	2.4750	2.3339	2.5742	2.9238	3.4493	3.5113	3.5900
175.	*	2.6243	2.4365	2.4049	2.2091	3.5869	3.3979	3.6243	3.3470	2.3644	2.2464	2.4546	2.8413	3.3611	3.4027	3.4699
180.	*	2.7894	2.5640	2.5251	2.2185	3.5786	3.3379	3.6167	3.3565	2.2736	2.1819	2.3382	2.7269	3.2468	3.2839	3.3192
185.	*	2.9128	2.6753	2.6329	2.2169	3.6198	3.3355	3.6429	3.3249	2.1930	2.1258	2.2274	2.5898	3.0950	3.1386	3.1487
190.	*	3.0006	2.7566	2.7158	2.2315	3.6658	3.3515	3.6528	3.2559	2.1314	2.0873	2.1447	2.4500	2.9635	2.9958	2.9803
195.	*	3.0476	2.8000	2.7651	2.2605	3.6939	3.3718	3.6152	3.1689	2.0907	2.0631	2.0916	2.3276	2.8462	2.8677	2.8300
200.	*	3.0486	2.7966	2.7721	2.2994	3.6956	3.3972	3.5288	3.0717	2.0661	2.0473	2.0590	2.2354	2.7630	2.7672	2.7115
205.	*	3.0277	2.7685	2.7525	2.3371	3.6709	3.4234	3.4110	2.9746	2.0515	2.0360	2.0431	2.1699	2.7220	2.7007	2.6299

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JOB: 6th Avenue Parkway Extension EA RUN: SH 30 and Picadilly CO 2035

WIND ANGLE RANGE: 0.-355.

WIND ANGLE (DEGR)	*	CONCENTRATION (PPM) 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
210.	*	3.0019	2.7309	2.7206	2.3654	3.6485	3.4665	3.3025	2.9079	2.0422	2.0279	2.0343	2.1271	2.7142	2.6632	2.5731
215.	*	2.9726	2.6874	2.6807	2.3851	3.6141	3.5075	3.1919	2.8468	2.0385	2.0242	2.0321	2.0994	2.7212	2.6415	2.5338
220.	*	2.9441	2.6444	2.6402	2.3986	3.5848	3.5566	3.0978	2.8040	2.0397	2.0256	2.0354	2.0830	2.7351	2.6305	2.5077
225.	*	2.9142	2.6032	2.6004	2.4030	3.5406	3.5819	3.0134	2.7781	2.0424	2.0290	2.0413	2.0796	2.7529	2.6272	2.4950
230.	*	2.8809	2.5719	2.5700	2.3953	3.4672	3.5734	2.9386	2.7626	2.0411	2.0270	2.0415	2.0755	2.7438	2.5998	2.4664
235.	*	2.8508	2.5488	2.5468	2.3840	3.3742	3.5338	2.8739	2.7725	2.0390	2.0241	2.0401	2.0669	2.7270	2.5689	2.4413
240.	*	2.8359	2.5239	2.5220	2.3840	3.2905	3.5012	2.8307	2.7963	2.0412	2.0254	2.0406	2.0605	2.7079	2.5408	2.4226
245.	*	2.8159	2.5013	2.4996	2.3895	3.2262	3.4793	2.8087	2.8223	2.0481	2.0307	2.0442	2.0560	2.6913	2.5198	2.4111
250.	*	2.8037	2.4915	2.4897	2.3921	3.1785	3.4648	2.7971	2.8595	2.0582	2.0389	2.0518	2.0526	2.6774	2.5096	2.4095
255.	*	2.7926	2.4841	2.4820	2.4126	3.1576	3.4758	2.8079	2.9035	2.0698	2.0488	2.0636	2.0501	2.6730	2.5075	2.4097
260.	*	2.7914	2.4858	2.4831	2.4398	3.1490	3.4949	2.8298	2.9481	2.0827	2.0588	2.0669	2.0489	2.6743	2.5118	2.4132
265.	*	2.8003	2.4954	2.4912	2.4751	3.1502	3.5176	2.8886	2.9929	2.0983	2.0664	2.0719	2.0490	2.6782	2.5207	2.4208
270.	*	2.8106	2.5061	2.4979	2.5200	3.1642	3.5332	2.9603	3.0467	2.1190	2.0784	2.0825	2.0490	2.6859	2.5408	2.4437
275.	*	2.8079	2.5084	2.4917	2.5377	3.2030	3.5883	3.0216	3.0965	2.1257	2.0836	2.0959	2.0484	2.7044	2.5557	2.4522
280.	*	2.8062	2.5153	2.4822	2.5756	3.2538	3.6438	3.0756	3.1465	2.1504	2.1012	2.1202	2.0484	2.7273	2.5712	2.4567
285.	*	2.8171	2.5345	2.4789	2.6360	3.3161	3.7001	3.1370	3.1945	2.1942	2.1318	2.1605	2.0522	2.7520	2.5906	2.4600
290.	*	2.8468	2.5697	2.4864	2.7197	3.3843	3.7509	3.2160	3.2420	2.2641	2.1824	2.2260	2.0642	2.7860	2.6097	2.4583
295.	*	2.8982	2.6250	2.5054	2.8348	3.4476	3.7822	3.2956	3.2683	2.3729	2.2646	2.3319	2.0928	2.8221	2.6188	2.4457
300.	*	2.9717	2.7044	2.5420	2.9959	3.5272	3.8220	3.3907	3.2938	2.5308	2.3888	2.4899	2.1470	2.8618	2.6150	2.4193

305.	*	3.0774	2.8192	2.6041	3.2002	3.5589	3.8187	3.4377	3.2850	2.7425	2.5641	2.7099	2.2508	2.8534	2.5740	2.3789
310.	*	3.2265	2.9685	2.6949	3.4193	3.5332	3.7577	3.4307	3.2497	2.9742	2.7626	2.9511	2.3959	2.8034	2.5061	2.3281
315.	*	3.3876	3.1380	2.8200	3.6175	3.4632	3.6293	3.3714	3.1945	3.1862	2.9493	3.1842	2.5681	2.7066	2.4196	2.2731
320.	*	3.5268	3.3100	2.9644	3.7526	3.3199	3.4459	3.2703	3.1745	3.3262	3.0780	3.3219	2.7094	2.5657	2.3140	2.2067
325.	*	3.6361	3.4661	3.1137	3.8279	3.1670	3.2402	3.1652	3.1679	3.3893	3.1411	3.3933	2.8357	2.4410	2.2402	2.1701
330.	*	3.7029	3.5905	3.2523	3.8538	3.0425	3.0620	3.0871	3.1945	3.3883	3.1478	3.3967	2.9240	2.3574	2.2103	2.1687
335.	*	3.7418	3.6853	3.3764	3.8472	2.9582	2.9247	3.0470	3.2456	3.3523	3.1224	3.3607	2.9899	2.3375	2.2341	2.2092
340.	*	3.7566	3.7435	3.4710	3.7893	2.9077	2.8263	3.0377	3.3122	3.2879	3.0623	3.2901	3.0382	2.3987	2.3210	2.3005
345.	*	3.8018	3.8113	3.5738	3.7320	2.8602	2.7355	3.0353	3.3930	3.2534	3.0309	3.2736	3.1373	2.5289	2.4663	2.4449
350.	*	3.8226	3.8340	3.6179	3.6112	2.7723	2.6324	2.9732	3.4031	3.2498	3.0182	3.3017	3.2706	2.7380	2.6809	2.6533
355.	*	3.7987	3.7954	3.5943	3.4505	2.6502	2.5168	2.8550	3.3447	3.2844	3.0352	3.3724	3.4086	2.9844	2.9277	2.8922
MAX	*	3.8226	3.8340	3.6179	3.8538	3.8560	3.8235	3.9197	3.4031	3.6895	3.7471	3.6297	3.5215	3.7342	3.7663	3.7667
DEGR.	*	350	350	350	330	150	150	150	350	125	125	10	5	150	150	155

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JOB: 6th Avenue Parkway Extension EA RUN: SH 30 and Picadilly CO 2035

MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 0.-355.

WIND ANGLE (DEGR)	*	CONCENTRATION (PPM) 16	17	18	19	20
0.	*	2.3319	2.7804	3.0326	2.2667	3.3275
5.	*	2.4158	2.7942	3.1779	2.1834	3.1723
10.	*	2.4935	2.8112	3.2703	2.1207	2.9536
15.	*	2.5583	2.8239	3.3027	2.0806	2.7704
20.	*	2.6076	2.8380	3.2936	2.0564	2.6381
25.	*	2.6348	2.8599	3.2281	2.0414	2.5579
30.	*	2.6459	2.8886	3.1704	2.0321	2.5072
35.	*	2.6440	2.9132	3.1022	2.0292	2.4823
40.	*	2.6360	2.9359	3.0338	2.0315	2.4698
45.	*	2.6232	2.9467	2.9665	2.0351	2.4668
50.	*	2.6080	2.9420	2.9234	2.0329	2.4596
55.	*	2.5867	2.9181	2.8813	2.0294	2.4543
60.	*	2.5804	2.9102	2.8440	2.0305	2.4488
65.	*	2.5748	2.9148	2.8112	2.0376	2.4422
70.	*	2.5703	2.9255	2.7871	2.0490	2.4367
75.	*	2.5673	2.9426	2.7823	2.0624	2.4261
80.	*	2.5761	2.9671	2.7815	2.0768	2.4151

85.	*	2.5873	2.9920	2.7907	2.0932	2.4020
90.	*	2.5982	3.0215	2.7992	2.1140	2.3841
95.	*	2.5930	3.0762	2.7922	2.1211	2.3405
100.	*	2.5965	3.1484	2.7823	2.1449	2.2844
105.	*	2.6214	3.2374	2.7817	2.1869	2.2224
110.	*	2.6778	3.3385	2.7935	2.2552	2.1614
115.	*	2.7736	3.4420	2.8091	2.3635	2.1094
120.	*	2.9177	3.5622	2.8452	2.5209	2.0725
125.	*	3.1026	3.6057	2.8976	2.7412	2.0502
130.	*	3.2973	3.5663	2.9707	2.9992	2.0405
135.	*	3.4672	3.4179	3.0831	3.2970	2.0409
140.	*	3.5502	3.2332	3.2389	3.4815	2.0400
145.	*	3.5774	2.9936	3.4094	3.6263	2.0472
150.	*	3.5406	2.7622	3.5690	3.6917	2.0605
155.	*	3.4695	2.5665	3.6877	3.6904	2.0820
160.	*	3.3830	2.4253	3.7314	3.6017	2.1161
165.	*	3.2920	2.3078	3.7432	3.5214	2.1652
170.	*	3.1735	2.2174	3.6715	3.4269	2.2384
175.	*	3.0427	2.1503	3.5427	3.3336	2.3287
180.	*	2.9041	2.1111	3.3608	3.2462	2.4295
185.	*	2.8066	2.0792	3.1603	3.1967	2.5256
190.	*	2.7145	2.0597	2.9467	3.1660	2.6084
195.	*	2.6542	2.0484	2.7586	3.1436	2.6690
200.	*	2.6116	2.0404	2.6122	3.1349	2.6974
205.	*	2.5809	2.0339	2.5181	3.1422	2.6985

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JOB: 6th Avenue Parkway Extension EA RUN: SH 30 and Picadilly CO 2035

WIND ANGLE RANGE: 0.-355.

WIND ANGLE (DEGR)	*	CONCENTRATION (PPM) 16	17	18	19	20
210.	*	2.5585	2.0293	2.4489	3.1691	2.6866
215.	*	2.5437	2.0279	2.4049	3.1982	2.6618
220.	*	2.5325	2.0302	2.3765	3.2368	2.6309
225.	*	2.5241	2.0336	2.3667	3.2613	2.5963
230.	*	2.5190	2.0317	2.3477	3.2516	2.5658
235.	*	2.5176	2.0283	2.3351	3.2254	2.5437
240.	*	2.5150	2.0284	2.3265	3.2205	2.5202
245.	*	2.5192	2.0321	2.3198	3.2413	2.4985
250.	*	2.5258	2.0381	2.3145	3.2710	2.4882
255.	*	2.5431	2.0449	2.3099	3.3261	2.4807

260.	*	2.5662	2.0522	2.3099	3.3870	2.4823
265.	*	2.5931	2.0614	2.3154	3.4434	2.4907
270.	*	2.6167	2.0746	2.3286	3.4995	2.4972
275.	*	2.6718	2.0786	2.3211	3.5784	2.4915
280.	*	2.7247	2.0954	2.3054	3.6638	2.4832
285.	*	2.7782	2.1246	2.2863	3.7534	2.4817
290.	*	2.8293	2.1719	2.2652	3.8416	2.4898
295.	*	2.8809	2.2482	2.2440	3.9191	2.5007
300.	*	2.9403	2.3618	2.2257	4.0083	2.5286
305.	*	2.9579	2.5179	2.2084	4.0125	2.5702
310.	*	2.9341	2.6907	2.1898	3.9324	2.6278
315.	*	2.8560	2.8681	2.1713	3.7326	2.7093
320.	*	2.7186	2.9593	2.1403	3.5076	2.8111
325.	*	2.5572	3.0109	2.1314	3.2347	2.9229
330.	*	2.4069	3.0111	2.1463	2.9900	3.0391
335.	*	2.2900	2.9803	2.1913	2.7959	3.1566
340.	*	2.2194	2.9156	2.2760	2.6630	3.2660
345.	*	2.1852	2.8666	2.4063	2.5487	3.3787
350.	*	2.1945	2.8220	2.5945	2.4454	3.4356
355.	*	2.2454	2.7939	2.8116	2.3481	3.4192
MAX	*	3.5774	3.6057	3.7432	4.0125	3.4356
DEGR.	*	145	125	165	305	350

THE HIGHEST CONCENTRATION OF 4.0125 PPM OCCURRED AT RECEPTOR 19.

JOB: 6th Avenue Parkway Extension EA RUN: SH 30 and Picadilly CO 2035

DATE : 11/ 3/15
TIME : 10: 1:52

RECEPTOR - LINK MATRIX FOR THE ANGLE PRODUCING
THE MAXIMUM CONCENTRATION FOR EACH RECEPTOR

		CO/LINK (PPM)														
		ANGLE (DEGREES)														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
LINK #	*	350	350	350	330	150	150	150	350	125	125	10	5	150	150	155
1	*	0.0523	0.0641	0.0476	0.0036	0.0000	0.0000	0.0000	0.0000	0.0077	0.0077	0.0000	0.0000	0.0039	0.0014	0.0024
2	*	0.2107	0.2792	0.1405	0.0011	0.0000	0.0000	0.0001	0.0000	0.0085	0.0087	0.0000	0.0000	0.0147	0.0103	0.0114
3	*	0.0802	0.1777	0.2524	0.0017	0.0002	0.0000	0.0010	0.0000	0.0118	0.0137	0.0000	0.0000	0.0271	0.0188	0.0259
4	*	0.0142	0.0157	0.0139	0.0749	0.0408	0.0001	0.0917	0.0000	0.0367	0.0276	0.0000	0.0000	0.0342	0.0277	0.0223

5	*	0.0177	0.0160	0.0151	0.1090	0.4543	0.4565	0.4598	0.0000	0.1218	0.1008	0.0000	0.0000	0.1031	0.1011	0.0813
6	*	0.0146	0.0147	0.0138	0.1454	0.3480	0.3622	0.3311	0.0000	0.1270	0.1043	0.0000	0.0000	0.1100	0.1035	0.0837
7	*	0.1811	0.1628	0.1463	0.0633	0.0000	0.0000	0.0000	0.5010	0.0000	0.0000	0.2858	0.2663	0.0034	0.1359	0.2263
8	*	0.0022	0.0017	0.0014	0.0019	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0072	0.0044	0.0485	0.0210	0.0041
9	*	0.0616	0.0528	0.0450	0.0357	0.0000	0.0000	0.0000	0.1707	0.0000	0.0000	0.1209	0.0904	0.0182	0.1643	0.2200
10	*	0.0025	0.0029	0.0030	0.0024	0.0000	0.0000	0.0000	0.0000	0.0000	0.0119	0.0390	0.0035	0.0000	0.0000	0.0004
11	*	0.0152	0.0178	0.0187	0.0209	0.0000	0.0000	0.0000	0.0000	0.1783	0.2708	0.2072	0.0153	0.0001	0.0001	0.0007
12	*	0.0247	0.0293	0.0322	0.0809	0.0000	0.0000	0.0000	0.0001	0.0124	0.0923	0.1219	0.0152	0.0000	0.0001	0.0005
13	*	0.1112	0.1243	0.1355	0.0265	0.0005	0.0000	0.0099	0.0000	0.0454	0.0325	0.0000	0.0585	0.0399	0.0273	0.0274
14	*	0.1488	0.1082	0.0832	0.3590	0.4796	0.4722	0.4847	0.0000	0.2936	0.2397	0.0000	0.0788	0.2825	0.2412	0.1905
15	*	0.1655	0.1403	0.1188	0.0979	0.0000	0.0000	0.0000	0.3816	0.0386	0.0499	0.3077	0.2544	0.2417	0.2800	0.3136
16	*	0.0863	0.0865	0.0819	0.1023	0.0000	0.0000	0.0000	0.0000	0.2332	0.2901	0.2403	0.1652	0.1114	0.0390	0.0289
17	*	0.1457	0.1199	0.0993	0.0853	0.0000	0.0000	0.0000	0.3489	0.0380	0.0439	0.1526	0.2166	0.1807	0.2117	0.2269
18	*	0.0550	0.0521	0.0480	0.0662	0.0000	0.0000	0.0000	0.0007	0.0697	0.0918	0.1473	0.0800	0.1181	0.0710	0.0354
19	*	0.1370	0.1542	0.1701	0.0324	0.0001	0.0000	0.0009	0.0000	0.0944	0.0657	0.0000	0.1356	0.0567	0.0358	0.0373
20	*	0.2959	0.2138	0.1512	0.5434	0.5325	0.5324	0.5405	0.0000	0.3724	0.2956	0.0000	0.1374	0.3402	0.2761	0.2278

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JOB: 6th Avenue Parkway Extension EA RUN: SH 30 and Picadilly CO 2035

DATE : 11/ 3/15
TIME : 10: 1:52

RECEPTOR - LINK MATRIX FOR THE ANGLE PRODUCING
THE MAXIMUM CONCENTRATION FOR EACH RECEPTOR

		CO/LINK (PPM)				
		ANGLE (DEGREES)				
		16	17	18	19	20
LINK #	*	145	125	165	305	350
1	*	0.0097	0.0055	0.0051	0.0036	0.0218
2	*	0.0149	0.0068	0.0129	0.0004	0.0528
3	*	0.0344	0.0119	0.0460	0.0013	0.3400
4	*	0.0189	0.0166	0.0150	0.0726	0.0108
5	*	0.0679	0.0708	0.0469	0.3723	0.0129
6	*	0.0788	0.0730	0.0479	0.2333	0.0123
7	*	0.0041	0.0044	0.2712	0.0140	0.1215
8	*	0.0036	0.0015	0.0028	0.0011	0.0010
9	*	0.0046	0.0034	0.2584	0.0102	0.0338
10	*	0.0235	0.0149	0.0021	0.0033	0.0027
11	*	0.0520	0.1280	0.0052	0.0282	0.0170
12	*	0.0767	0.2324	0.0047	0.1277	0.0358
13	*	0.0365	0.0210	0.0346	0.0268	0.1510

14	*	0.1852	0.1647	0.1140	0.3987	0.0578
15	*	0.1104	0.0626	0.3577	0.0523	0.0875
16	*	0.2849	0.3674	0.0392	0.1468	0.0727
17	*	0.0663	0.0484	0.2486	0.0467	0.0713
18	*	0.1976	0.1436	0.0306	0.0738	0.0426
19	*	0.0605	0.0369	0.0520	0.0403	0.1923
20	*	0.2470	0.1918	0.1481	0.3591	0.0980

Appendix B Resource Impact Table

Resource	Context	No Action Alternative	Proposed Action
Air Quality	The study area lies in the eastern Denver metropolitan area. The study area elevation is approximately 5,500 feet above sea level. The Denver metropolitan area was a nonattainment area for CO, O_3 (1-hour), and PM_{10} beginning in the early 1970s, so those three pollutants have historically been concerns in the Denver region.	Out of direction travel would continue and intersection congestion would worsen over time. These conditions typically increase emissions, although this would be countered by improvements in the vehicle fleet over time. Would not cause exceedances of criteria for any priority pollutants, nor would it result in changes in traffic volumes, vehicle mix, or any other factor that would cause an increase in mobile source air toxics.	Out of direction travel and intersection congestion would be reduced, thereby reducing overall emissions. Would not cause exceedances of criteria for any priority pollutants. Despite an increase in traffic volume, MSAT emissions in the study area are likely to be lower in the future based on EPA's national control programs projected to reduce annual MSAT. Construction activities would generate dust from earthmoving and diesel emissions from construction equipment. These would be temporary, lasting only during the construction period.

Appendix C Resource Mitigation Table

Mitigation Category	Proposed Action Impact	Mitigation Commitments for the 6th Avenue Extension Project	Responsible Branch	Timing/Phase that Mitigation will be Implemented
Air Quality	Air emissions during construction	■ Maintain engines and exhaust systems on equipment in good working order. Maintain equipment on a regular basis. Equipment will be subject to inspection by the project manager to ensure maintenance. ■ Control fugitive dust through implementation of CDOT's Standard Specifications for Road and Bridge Construction, particularly Sections 107.24, 209 and 250, and APCD's Air Pollutant Emission Notification requirements. ■ No excessive idling of inactive equipment or vehicles.	City of Aurora	Design and Construction

Appendix D APCD Consultation and Concurrence Letter

COLORADO
Department of Transportation
Division of Transportation Development

Environmental Programs Branch
4201 E. Arkansas Ave. Shumate Bldg.
Denver, CO 80222-3400

June 18, 2015

Chris Colclasure
Planning and Policy Program Manager
Air Pollution Control Division
Colorado Department of Public Health and Environment
4700 Cherry Creek Drive South
Denver, CO 80901

RE: 6th Avenue Roadway Extension project between State Highway (SH) 30 and E-470, Aurora, Colorado.

Dear Mr. Colclasure:
The City of Aurora (City), in consultation with the Federal Highway Administration (FHWA) and the Colorado Department of Transportation Region 1 (CDOT), are preparing an Environmental Assessment (EA) for a proposed 6th Avenue Extension project between State Highway (SH) 30 and E-470. An air quality analysis will be conducted for the EA to satisfy requirements of the National Environmental Policy Act and federal air quality conformity regulations. The City and CDOT are requesting your review and concurrence on the proposed methodology.

This letter describes the proposed analytical methodology for air quality and the supporting rationale. I am requesting that the Air Pollution Control Division (APCD) review these details and provide concurrence on the analytical approach. Our team is eager to resolve any methodology issues expeditiously and can provide any additional information you may need or answer questions about the proposed project, methodology or assumptions.

PROJECT BACKGROUND
The proposed project is to construct the 6th Avenue Parkway Extension between SH 30 (east of Tower Road) and the existing 6th Avenue Parkway interchange on E 470—slightly more than two miles—northeast of Buckley Air Force Base (Figure 1). The project will build a new east-west arterial street on a new alignment within the City of Aurora and unincorporated Arapahoe County. The project currently does not have funding for construction, but the EA is being prepared to facilitate acquisition of federal funding. Note that the project is included in the 2040 Fiscally Constrained Regional Transportation Plan of the Denver Regional Council of Governments.

The 6th Avenue Parkway will open as a two-lane street, but is expected to expand to a six-lane arterial street as development occurs and is anticipated to reach full build-out per the Denver Regional Council of Governments Regional Transportation Plan.
The project is needed to:

- Provide an efficient transportation link in the Aurora arterial system;
- Reduce travel time and vehicle miles traveled for motorists and emergency vehicles;
- Enhance and support existing and future multimodal connectivity ; and,
- Provide transportation infrastructure that does not preclude planned economic development and capacity for growth. As stated above, the project will build a new road on a new alignment. The 6th

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Avenue Parkway will open as a two-lane street, but is expected to be expanded to a six-lane street not later than 2035.

CARBON MONOXIDE MICROSCALE ANALYSIS

Although the last violation of the National Ambient Air Quality Standard (NAAQS) for carbon monoxide (CO) in the Denver region was in 1995, microscale CO analysis ("hot-spot") is conducted to ensure that a proposed action will not cause or contribute to a future NAAQS violation.

Intersection level of service (LOS) analysis was performed as part of a traffic study for the proposed project. Two congested intersections within or adjacent to the project area were identified for 2035 with projected LOS's of D or worse—Picadilly Road at SH 30 and the new 6th Avenue Parkway at Picadilly Road (Figure 1).

From these data, both intersections are proposed for CO microscale hot-spot analyses using CAL3QHC software. MOVES2014 emissions rates will be provided by APCD. The two intersections will be modeled separately using "worst case" screening hot-spot modeling, which will combine the highest traffic volumes expected over the project planning timeline (2035 volumes) with the worst tailpipe emissions rates expected over that timeline (2015 rates). The results from these analyses will over-estimate actual local CO concentrations to ensure adequate simulation of the highest potential CO concentrations possible over the 20-year timeframe; thus, eliminating the need for interim year hot-spot analyses. If the results from the worst-case analyses are less than the NAAQS for CO, then no violation of the NAAQS is likely to be caused by the project. If the results indicate an exceedence of the NAAQS may occur, then more extensive CO analyses will be required by comparing "no build" and "build" traffic and emissions for 2035. The U.S. Environmental Protection Agency (EPA) has approved this approach for several prior projects like this.

PARTICULATE MATTER MICROSCALE ANALYSIS

The proposed project will build an arterial street that is expected to serve primarily commuters, residential areas and light commercial areas. The corridor and surrounding area is not expected to contain major industrial facilities, or significant intermodal or freight facilities. Consequently, a high percentage of heavy trucks or other large diesel vehicles is not expected on 6th Avenue Parkway. Therefore, this project is not a "project of air quality concern" in terms of federal conformity screening criteria for particulate matter, so a microscale analysis is not required. This finding will be discussed in the technical report.

OTHER CRITERIA POLLUTANTS

In addition to the CO and particulate matter items described above, a qualitative discussion will be prepared of criteria pollutants affecting regional ozone nonattainment, including ozone, nitrogen oxides and volatile organic compounds, as well as the other NAAQS criteria pollutants.

AIR TOXICS EMISSION ANALYSIS

From the project traffic study, approximately 37,000 vehicles per day are expected for 6th Avenue Parkway in 2035. That is relatively light traffic in terms of air toxics emissions. Therefore, a qualitative review of the priority Mobile Source Air Toxic emissions is proposed for the project using prescribed FHWA 2012 Interim Guidance for Analysis of Mobile Source Air Toxics. EPA has identified seven priority compounds with significant contributions from vehicles that are among the national and regional-scale cancer risk drivers that will be considered:

- acrolein;
- benzene;
- 1,3-butidiene;
- diesel particulate matter plus diesel exhaust organic gases;

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- formaldehyde;
- naphthalene; and
- polycyclic organic matter

GREENHOUSE GAS EMISSIONS
Per FHWA guidance, a summary assessment of the direct, indirect and cumulative effects of greenhouse gas emissions from the project will be provided, including a comparative analysis of global, statewide and project-generated greenhouse gas emissions.

Thank you for your consideration of this proposed analytical approach for air quality. For your convenience, a concurrence signature block is provided below for your use. Please return your completed concurrence electronically to Jordan Rudel. If you feel there is a need for an interagency consultation meeting regarding this project, please contact Mr. Rudel at (303) 757-9881 or jordan.rudel@state.co.us so that a meeting can be scheduled as soon as possible. Again, if you or your staff has any questions regarding this project-level air quality analysis, please let me know.

Sincerely,

for 6/16/15

Jane Hann
Manager
Environmental Programs Branch

Cc/ Dennis Eden, City of Aurora
Jordan Rudel, CDOT Region 1

APCD CONCURRENCE:
For the Air Pollution Control Division of the Colorado Department of Public Health and Environment, I concur that the project-level analytical approach described above for the 6th Avenue Extension Environmental Assessment is acceptable and appropriate for this project.

Chris Colclasure — Signature
6/26/15 — Date

APCD Planning and Policy Program Manager
Title

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Chris Colclasure
June 18, 2015
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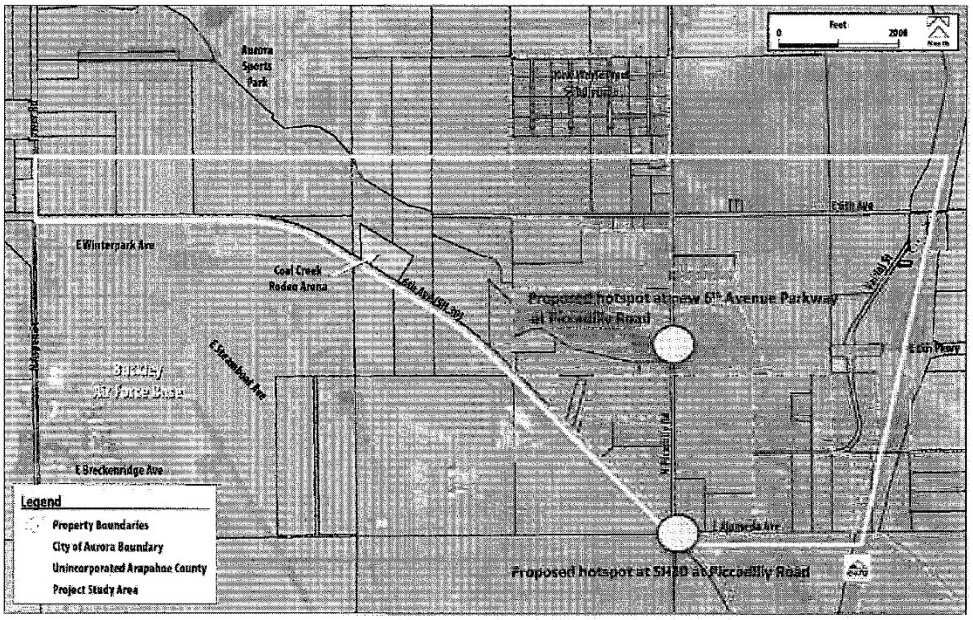
Figure 1. Location of Project



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