CDOT PROJECT IM 0703-294

I-70/32nd AVENUE INTERCHANGE ENVIRONMENTAL ASSESSMENT

AIR QUALITY ASSESSMENT REPORT

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1.0 INTRODUCTION

In accordance with the National Environmental Policy Act (NEPA) and its related regulations, the Federal Highway Administration (FHWA), as the Lead Agency, and in cooperation with the Colorado Department of Transportation (CDOT) as the Applicant Agency is preparing an Environmental Assessment (EA) for proposed improvements to the Interstate 70 (I-70)/32nd Avenue interchange (the Proposed Action). The largest changes would be the replacement of the current I-70/32nd Avenue interchange and the addition of a new SH 58/Cabela Drive interchange, though other smaller improvements elsewhere would also be included. The general region included in the EA project area (see **Figure 1-1**) is mostly in Wheat Ridge but also includes parts of Lakewood, Golden and Jefferson County. This consists of the area generally bounded by and including Ward Road, 44th Avenue, McIntyre Street and 32nd Avenue. The EA considers both existing roads and possible new roads. In this Air Quality Assessment Report, two future alternatives have been evaluated for carbon monoxide (CO) hot-spot analysis. Those alternatives were the No-Action Alternative and the Proposed Action.

1.1 No-Action Alternative

NEPA requires the evaluation of a No-Action Alternative. The No-Action Alternative includes safety and maintenance activities that are required to sustain an operational transportation system but does not include any capacity improvements. However, there are several already planned transportation improvements under other projects in the vicinity that are part of the future travel demand forecasting (**Figure 1-2)**. These improvements from other projects include transportation improvement projects that:

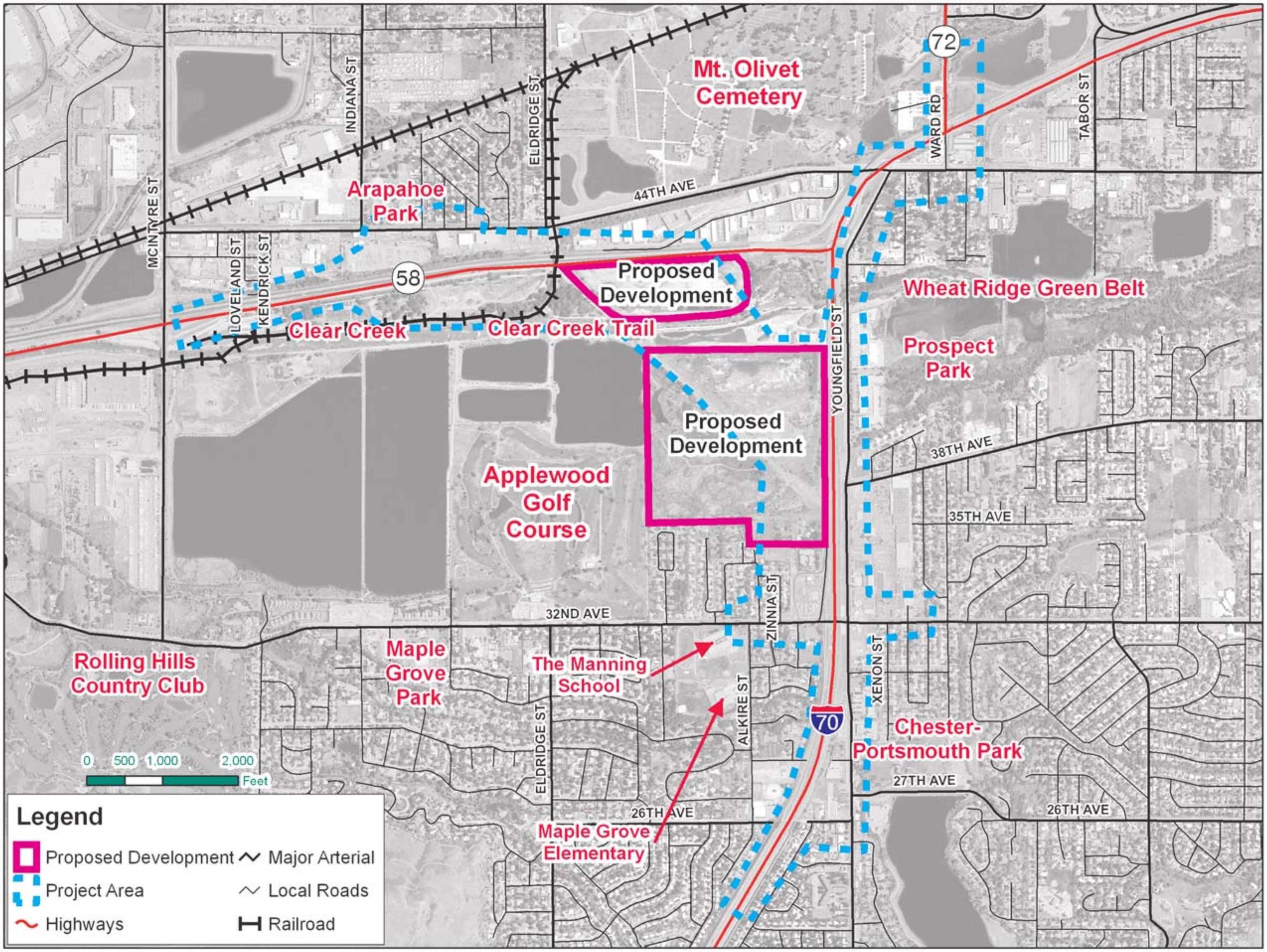
A. have committed funding in the short-range future
   or
B. are considered in the six-year regional Transportation Improvement Program (TIP)
   or
C. have funding identified in city or county Capital Improvement Programs

These other transportation improvements generally have committed or identified funds for construction and will be made regardless of whether the Proposed Action improvements are made. Committed projects that are included in the travel demand forecasting for the No Action Alternative include:

- City of Wheat Ridge planned local agency projects
- Jefferson County planned McIntyre Street improvements
- CDOT planned I-70/State Highway 58 (SH 58) interchange improvements
- Regional Transportation District (RTD) planned Gold Line transit facility

The City of Wheat Ridge local agency projects include:

- Construction of the 40th Avenue underpass of I-70
- Widening of Youngfield Street from 38th Avenue to 44th Avenue
- Construction of Cabela Drive from 40th Avenue to the proposed development just north of Clear Creek



North

Figure 1-1

Project Area

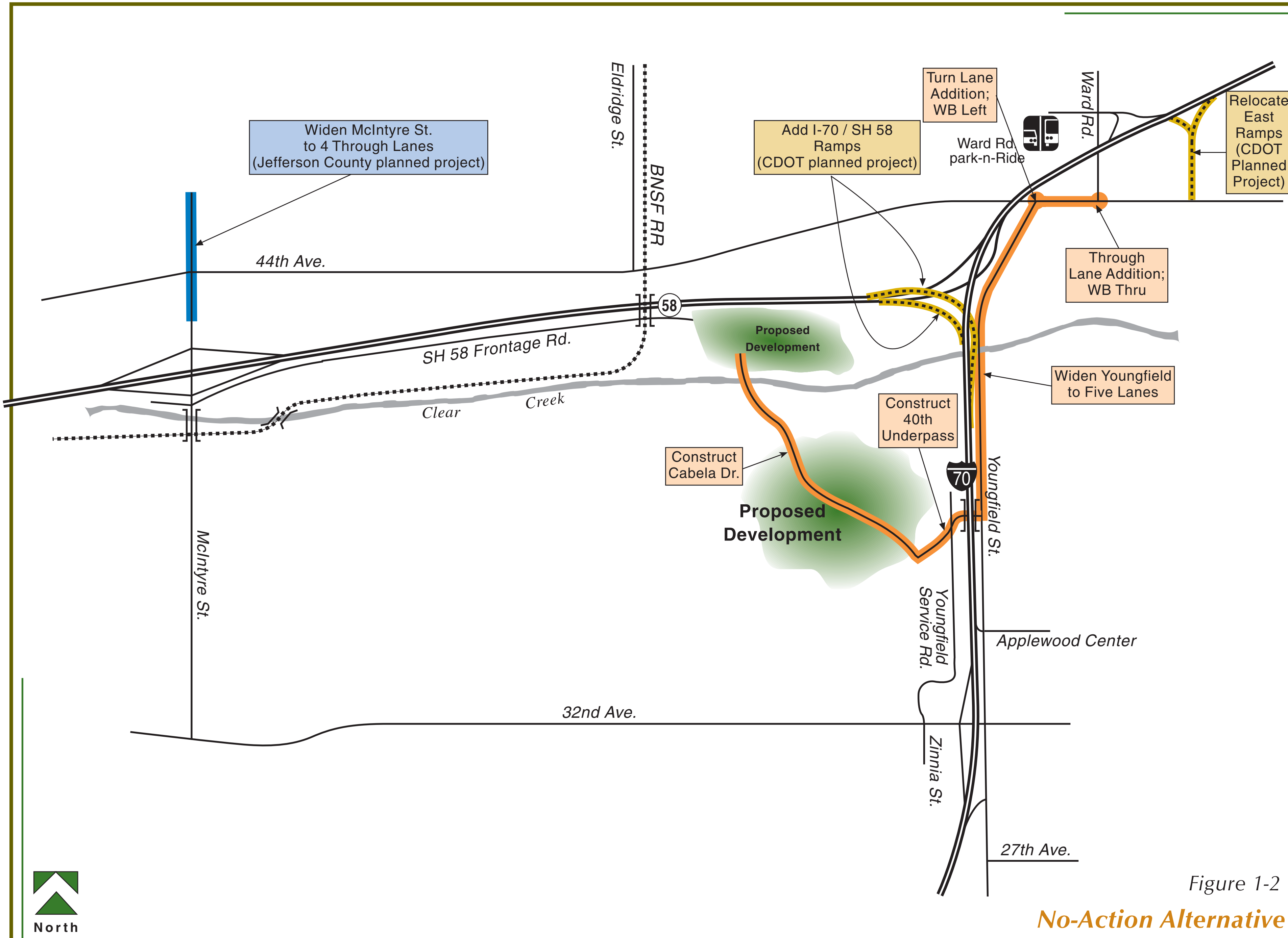


Figure 1-2

No-Action Alternative

Improvements to McIntyre Street between approximately SH 58 and 45th Avenue are planned by Jefferson County and are included in the travel demand forecasting. These improvements consist of the widening of McIntyre Street to two through lanes in either direction from SH 58 to south of 45th Avenue and associated bicycle/pedestrian improvements.

CDOT is currently preparing a Draft Environmental Impact Statement (EIS) for the proposed Northwest Corridor project. Four "build" alternatives and the "no-action" alternative are being analyzed as part of the Draft EIS process. One of the four "build" alternatives, the Combined Alternative, includes a four-lane principal arterial along McIntyre Street to SH 58 with a regional arterial/tollway along SH 93 and US 6 through Golden. As a maximum traffic scenario, the Northwest Corridor Combined Alternative traffic forecasts were included in the travel demand forecasting.

CDOT has planned I-70/SH 58 interchange improvements that are also included in the No-Action Alternative. This project includes:

- The addition of a ramp connection from I-70 eastbound to SH 58 westbound
- The addition of a ramp connection from SH 58 eastbound to I-70 westbound
- The relocation of the eastbound I-70/44th Avenue ramps farther east along I-70 to increase spacing between the ramp from SH 58 and the 44th Avenue ramps
- Relocation of the existing I-70 eastbound on-ramp from the Youngfield Street/38th Avenue intersection south to the Youngfield Street/35th Avenue intersection was also included in the I-70/SH 58 interchange improvements; however, the Proposed Action may supersede this action and relocate the ramp south to the Youngfield Street/27th Avenue intersection

1.2 Proposed Action

The purpose of the improvements under the Proposed Action in the EA is to relieve traffic congestion at the I-70/32nd Avenue and to address the future transportation demands on the interchange and local street network due to regional growth and expanding local retail/commercial development. Relieving traffic congestion at the interchange can be accomplished through improvements and/or through the establishment of alternative routes to serve traffic demands in the project area. The proposed development will have a substantial impact on the I-70/32nd Avenue interchange unless system-level transportation improvements are provided.

The Proposed Action includes the improvements listed for the No-Action Alternative as well as several new project-specific actions. The new improvements are shown in **Figure 1-3** and include the following:

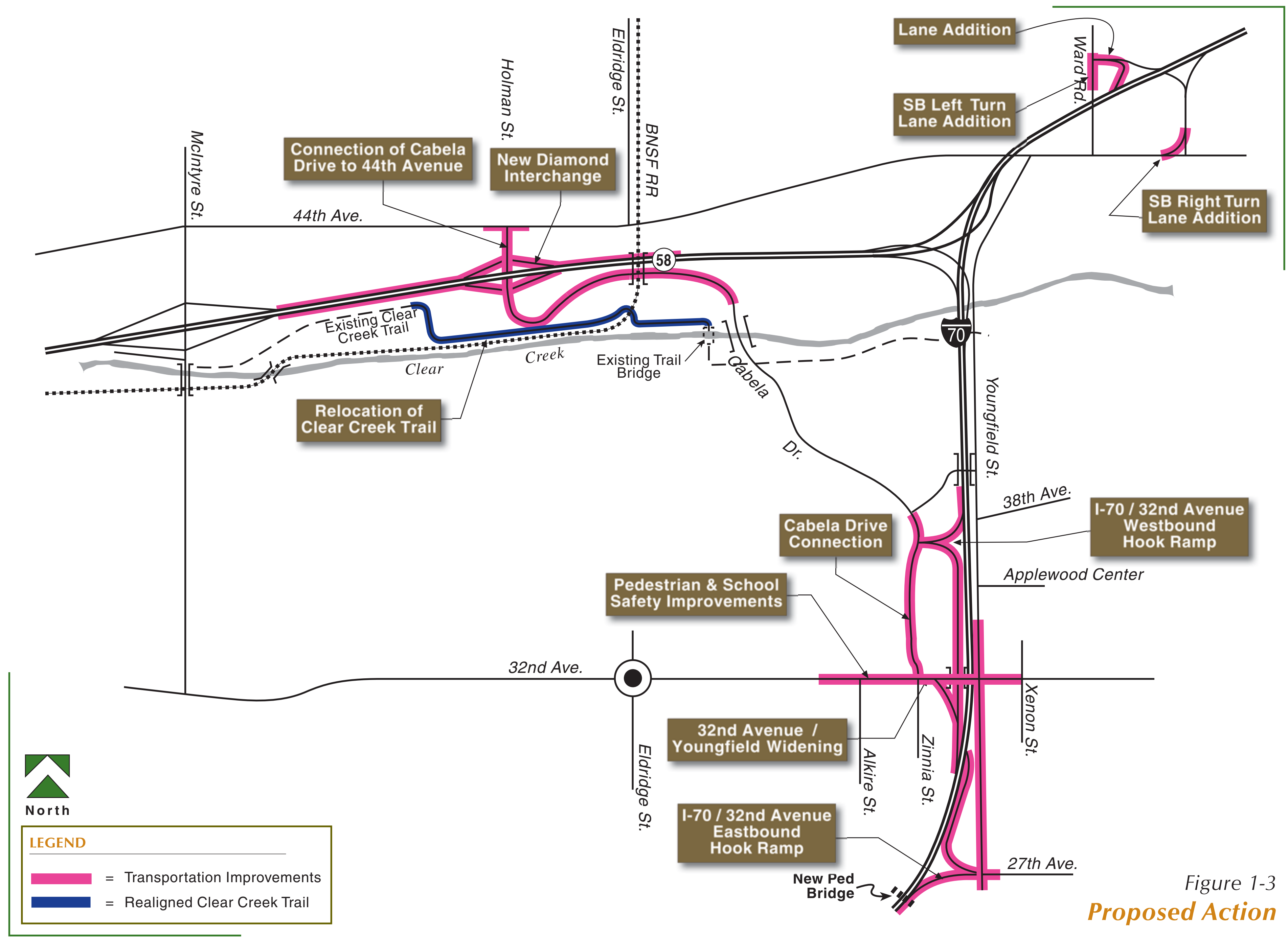


Figure 1-3
Proposed Action

- **New I-70/32nd Avenue Interchange Hook Ramps**
  - Construction of off-set hook ramps at the I-70/32nd Avenue interchange with the westbound hook ramps located north of 32nd Avenue at approximately 35th Avenue and the eastbound hook ramps located at Youngfield Street and 27th Avenue
  - Construction of a third I-70 bridge over 32nd Avenue for the I-70 westbound ramp traffic
  - Closure of the existing westbound I-70 off-ramp that exits to 32nd Avenue. The existing westbound I-70 on-ramp would remain open but access would be limited to eastbound 32nd Avenue traffic only
  - Reconstruction and restriping of Youngfield Street between 27th Avenue and approximately 30th Avenue to achieve a 5-lane roadway section

- **32nd Avenue Improvements**
  - Widening of 32nd Avenue between approximately Alkire Street and approximately Xenon Street and the widening of Youngfield Street between approximately 35th Avenue and 30th Avenue in the vicinity of the I-70/32nd Avenue interchange
  - Connection of the new Cabela Drive with 32nd Avenue west of I-70 (40th Avenue to 32nd Avenue)

- **New SH 58/Cabela Drive Interchange**
  - Construction of a new diamond interchange on SH 58 west of Eldridge Street and connection of Cabela Drive to this interchange
  - Connection of Cabela Drive with 44th Avenue north of the new interchange on SH 58, providing better emergency access to the area

- **I-70/Ward Road Interchange**
  - Restriping of the Ward Road and westbound I-70 on-ramp intersection to add an additional southbound left turn lane onto the ramp and widen the ramp to receive this lane
  - Addition of a second right-turn lane for the eastbound I-70/Ward Road off-ramp

- **Bicycle/Pedestrian Improvements**
  - Relocation of the Jefferson County Open Space Clear Creek trail in the vicinity of the new SH 58/Cabela Drive interchange
  - Replacement of the 32nd Avenue trail detached sidewalk along the south side of 32nd Avenue from Alkire Street to Cabela Drive with an attached sidewalk
  - Improvements to pedestrian and school safety along 32nd Avenue
  - Construction of an Americans with Disabilities Act (ADA) compliant pedestrian bridge at 27th Avenue to replace the existing pedestrian bridge at 26th Avenue as part of the eastbound I-70 hook ramps
  - Provisions for Jefferson County Open Space Clear Creek Trail access through the development site from 32nd Avenue
  - Wider sidewalks under I-70 on the south side of 32nd Avenue to better accommodate bicycles and pedestrians

2.0 EXISTING ENVIRONMENT

This project is in the largest metropolitan area in Colorado. Based on the 2000 census, the 7-county Denver metropolitan area has approximately 2.4 million residents.

The project study corridor involves several jurisdictions and municipalities including:

- Wheat Ridge
- Lakewood
- Golden
- Jefferson County

2.1 Local Setting

The project area lies at the base of foothills that are west of the Denver metropolitan area. The project area elevations are generally about 5,400 feet above sea level. To the west is the much higher Front Range of the Rocky Mountains while to the east and lower is the South Platte River valley leading onto the Great Plains. The project area includes part of the Clear Creek drainage.

The coldest month for the project area usually is January, with average daily temperature ranges of 20-48 degrees Fahrenheit. The warmest month usually is July, with average daily temperature ranges of 55-90 degrees Fahrenheit. Thermal inversions can occur in the project area during times of low winds. The project area generally receives about 19 inches of precipitation annually, with the wettest months generally May and April.

2.2 National Ambient Air Quality Standards Overview

The Clean Air Act of 1970 and its amendments led to the establishment by the U.S. Environmental Protection Agency (EPA) of National Ambient Air Quality Standards (NAAQSs) for several criteria air pollutants: carbon monoxide (CO), sulfur dioxide, ozone (O_3), suspended particulate matter (PM_{10}), nitrogen dioxide and lead (see **Table 2-1**). In 1997, EPA changed the O_3 standard averaging time from 1 hour to 8 hours and added a new standard for very fine particulate matter ($PM_{2.5}$).

Under the Clean Air Act, cities and regions were required to determine their compliance with the NAAQSs. Areas that did not meet a NAAQS were classified as nonattainment for that NAAQS. Areas that met the NAAQS were classified as attainment areas. 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 since monitoring began more than 30 years ago. The Denver metropolitan region had been a nonattainment area for CO, O_3 (1-hour), and PM_{10} since the early 1970s, so those three pollutants have historically been concerns in the Study Area. The region included in the nonattainment areas included all or parts of the following counties: Denver, Jefferson, Boulder, Adams, Arapahoe, Douglas and Broomfield. A number of successful air quality improvement actions over many years have resulted in cleaner air and in the Denver region meeting all of the NAAQS that were in force in 2001. The Denver region was reclassified by EPA as an attainment/maintenance area in 2001 and 2002 for CO, O_3 (1-hour), and PM_{10} and regional maintenance plans are now in effect for all of these pollutants.

Table 2-1 National Ambient Air Quality Standards

Pollutant	Averaging Time	Primary Standard
Carbon Monoxide	8 hours	9 ppm
	1 hour	35 ppm
Sulfur Dioxide	Annual	0.030 ppm
	24 hours	0.14 ppm
Ozone	8 hour	0.08 ppm
	1 hour	0.12 ppm
Particulate Matter <10 µm (PM_{10})	Annual	50 µg/m3
	24 hours	150 µg/m3
Particulate Matter <2.5 µm ($PM_{2.5}$)	Annual	15 µg/m3
	24 hours	65 µg/m3
Nitrogen Dioxide	Annual	0.053 ppm
Lead	Quarterly	1.5 µg/m3

Note: ppm = parts per million
µg/m3 = micrograms per cubic meter
µm = micrometers
SOURCE: EPA 2005c

Nonattainment areas for the new $PM_{2.5}$ and 8-hour ozone NAAQSs were designated by EPA in 2004. No areas in Colorado have been designated as nonattainment for $PM_{2.5}$, so it is not a major issue in the state. The current state implementation plan for particulate matter covers only PM_{10} and new requirements will not be added until the plan must be updated in the future. However, a monitoring station nearest the Study Area (National Renewable Energy Laboratory) has measured several exceedences of the 8-hour ozone NAAQS and often records some of the highest ozone concentrations in the Denver region each year. From this and related monitoring data, the Denver area air quality agencies learned that there was going to be a problem meeting the 8-hour ozone NAAQS and created an Early Action Compact with EPA in 2002 to begin reducing ozone concentrations. The Early Action Compact included strategies for reducing emissions of the air pollutants that lead to ozone (volatile organic compounds [VOCs] and oxides of nitrogen [NOx]). The Early Action Compact requires attainment of the 8-hour ozone NAAQS no later than 2007. EPA designated the Denver region as nonattainment for the 8-hour ozone standard in April 2004. This nonattainment area includes the 7-county metro area plus parts of Larimer and Weld Counties and extends as far north as Wellington. The nonattainment designation for the Denver region is deferred as long as the region meets the milestones of the Early Action Compact. EPA formally approved the Early Action Compact in August 2005.

2.2.1 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.

2.2.2 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 interfere with the lungs 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 in around sources, but winds can disperse particulate matter over a larger area and cause regional concerns.

2.2.3 Ground-level Ozone

Ground-level O_3 is a gas that is not typically emitted by any common sources, rather it is formed by chemical reactions between other pollutants in the air. NOx and VOCs 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 no major sources of O_3 because it is not emitted directly. However, O_3 concentrations are affected by the sources of the precursor pollutants NOx and VOC. 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 (CARB 2002). Rural/undeveloped areas can have O_3 problems because of transported pollutants and not local emissions (CARB 2002).

2.2.4 Nitrogen Dioxide

The atmosphere is about 80 percent nitrogen gas. When fuel is burned at high temperature in air, the nitrogen can react with oxygen to form gases such as nitrogen dioxide and other NOx. These gases can contribute to O_3 formation, particulate matter formation and acid deposition. Common sources of nitrogen oxides are vehicles and electrical utilities. Nitrogen dioxide can damage cells in lungs and plants and damage water quality. NOx can be transported over great distances and is a regional concern.

2.2.5 Sulfur Dioxide

Sulfur is present in many raw materials like coal and oil, and sulfur dioxide forms when these materials are burned. The major source of sulfur dioxide is electrical utilities; vehicles are not a major source. Sulfur dioxide can cause respiratory illness and acid deposition. Sulfur dioxide can be transported over great distances and is a regional concern.

2.2.6 Lead

Lead is a naturally-occurring metal. The major sources of lead currently are the metals processing industries and incinerators. Vehicle exhaust was a significant source when leaded gasoline was still in wide use, but that has not been the case for several decades. Residual lead concentrations in soil is a concern in some urban areas. Lead can cause organ and brain damage, particularly in children. Lead typically is a local concern near the lead source.

2.2.7 Vehicle Emissions

Of the NAAQS pollutants, motor vehicles tend to be significant sources of CO, NOx and particulate matter as vehicle exhaust includes direct emission of these pollutants. Vehicles also generate particulate matter from road dust and brake and tire wear. Ground-level ozone is not emitted directly from vehicles but rather is the product of a complex reaction between NOx and VOCs, both of which vehicles emit so vehicles can be contributors to ozone pollution. Heavy duty engines can emit sulfur dioxide, but are not major sources of it. Motor vehicles have not been significant sources of lead since the advent of unleaded gasoline several decades ago.

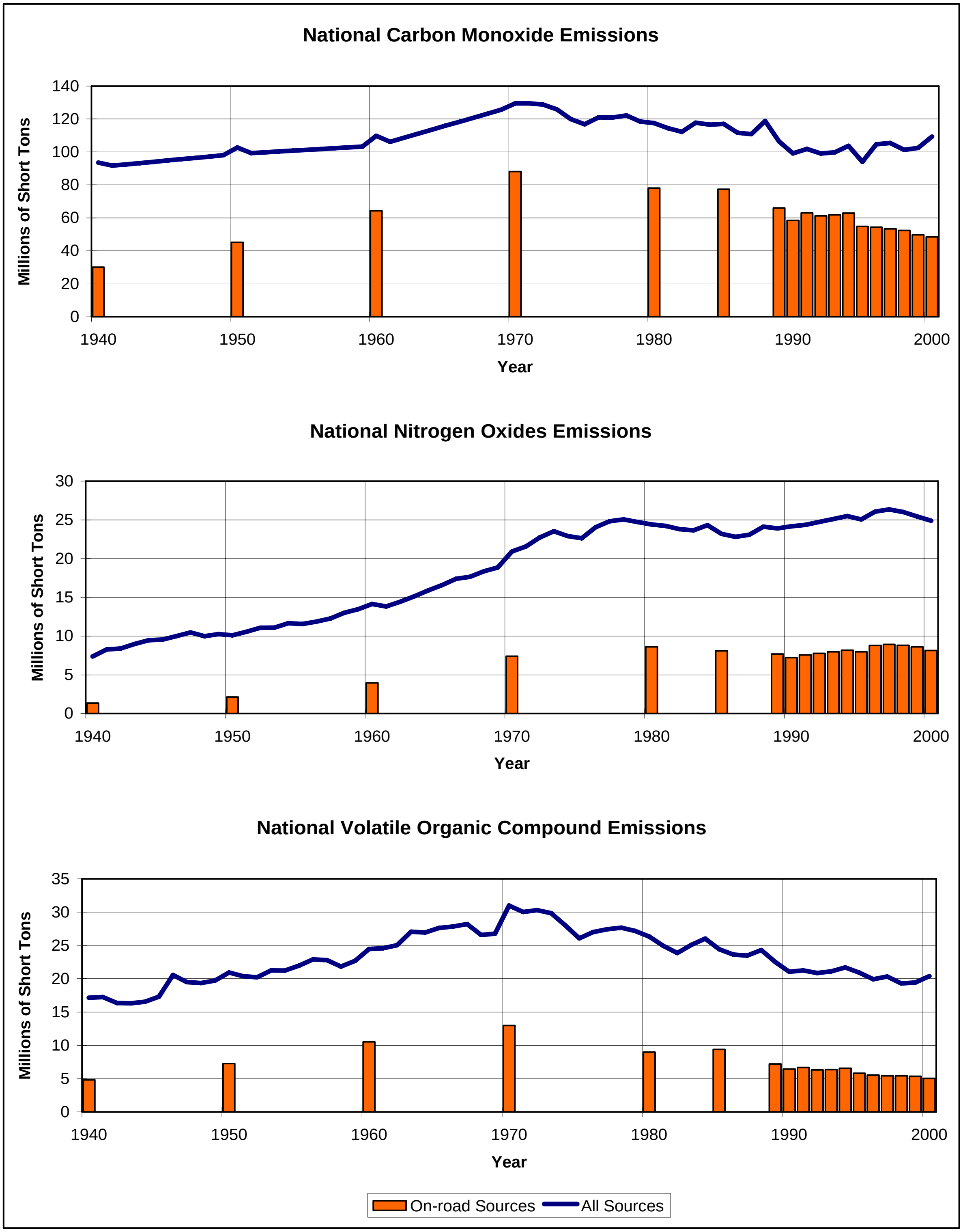
2.3 Emission Trends Overview

For several decades, there has been a trend of decreasing emissions nationwide from mobile sources, even when allowing for the growing number of vehicle miles of travel (VMT). These improving results are due to a number of successful emission control regulations. EPA has estimated the nationwide emissions of several pollutants of interest (EPA 2000a & 2003) and trends for CO, NOx and VOCs are illustrated in **Figure 2-1**. NOx and VOCs are precursors of O_3 and provide an indication of likely O_3 trends. 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.

The estimated emission trends for the Denver region also show decreases (Regional Air Quality Council, 2004), though not necessarily for every pollutant. A large portion of regional CO emissions are from vehicles and this is expected to decrease in the future as vehicles emit proportionally less CO (see **Figure 2-2**). Vehicles are also a major source of PM_{10} and these emissions are actually expected to rise due to more road dust from more VMT (see **Figure 2-3**).Vehicles are significant sources of VOCs and NOx, and regional emissions of these pollutants are expected to decrease due largely to improvements in vehicles and fuel controls (see **Figure 2-4 and 2-5**). Other new or pending regulations, such as Tier 2 and the 2007 heavy duty engine regulations, are expected to continue the trend of improvement and further lower vehicle emissions in the future.

Future trends in average individual vehicle emissions have been estimated using EPA's MOBILE6 software. Emission rates over time for CO, VOCs and NOx for an average vehicle from MOBILE6 are shown in **Figure 2-6,** along with estimates from the older MOBILE5 model. Particulate emissions entail more than just tailpipe emissions and are not shown. Clearly, there is a trend toward fewer emissions per vehicle, though there is also a trend of increasing VMT. So while each vehicle is expected to emit less in the future, more vehicles are expected to be on the roads.

Figure 2-1 National Pollutant Emission Trends



SOURCE: EPA, 2000a

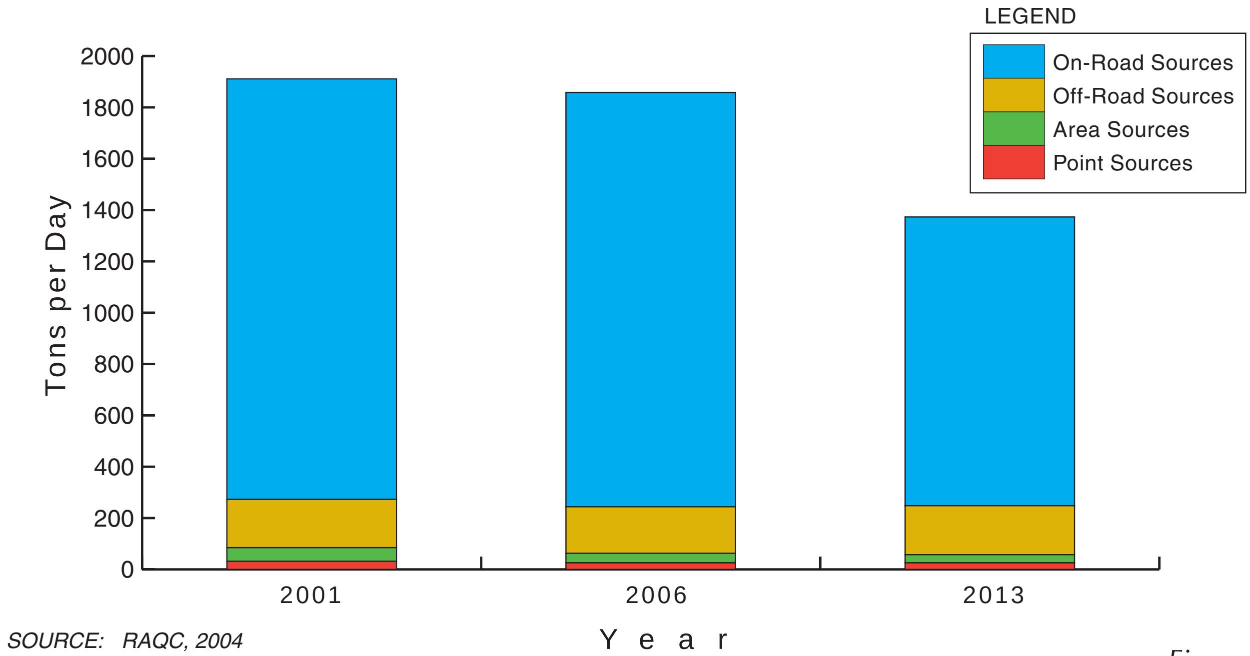


Figure 2-2
Denver Regional Carbon Monoxide Emission Trends

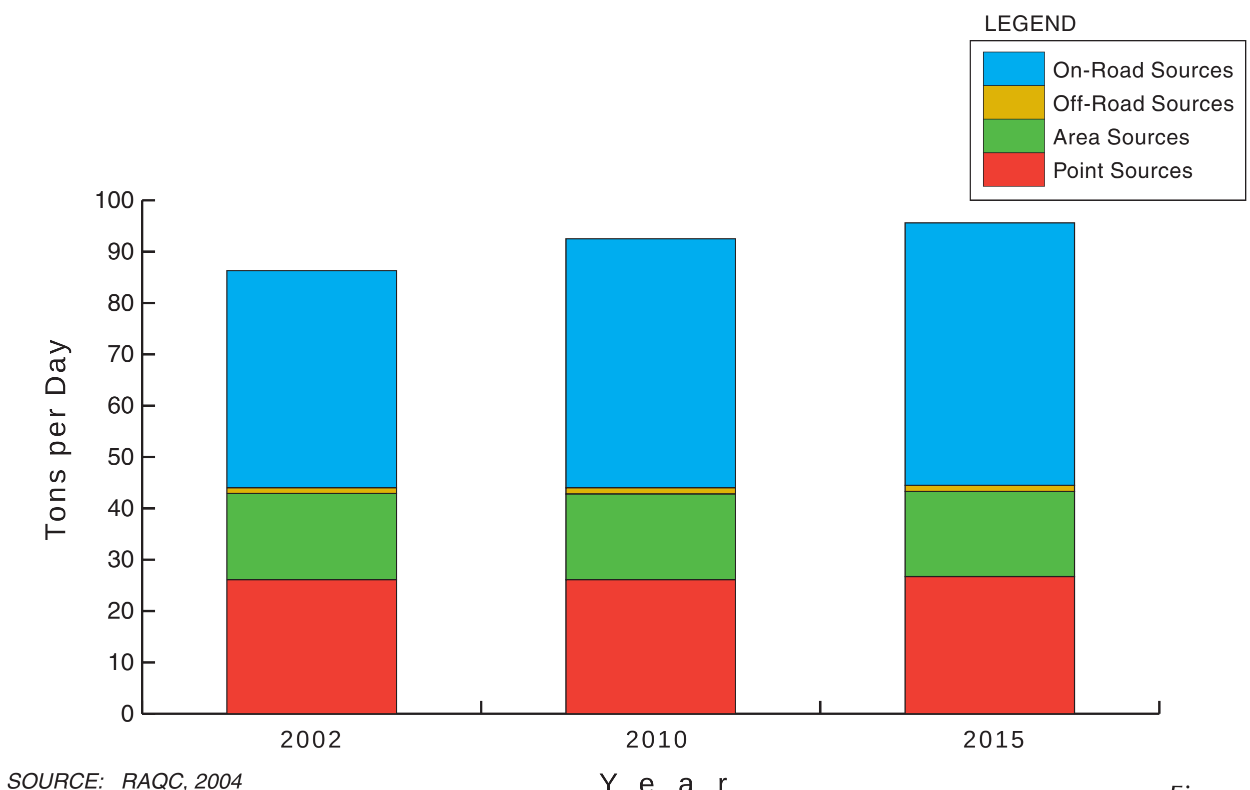
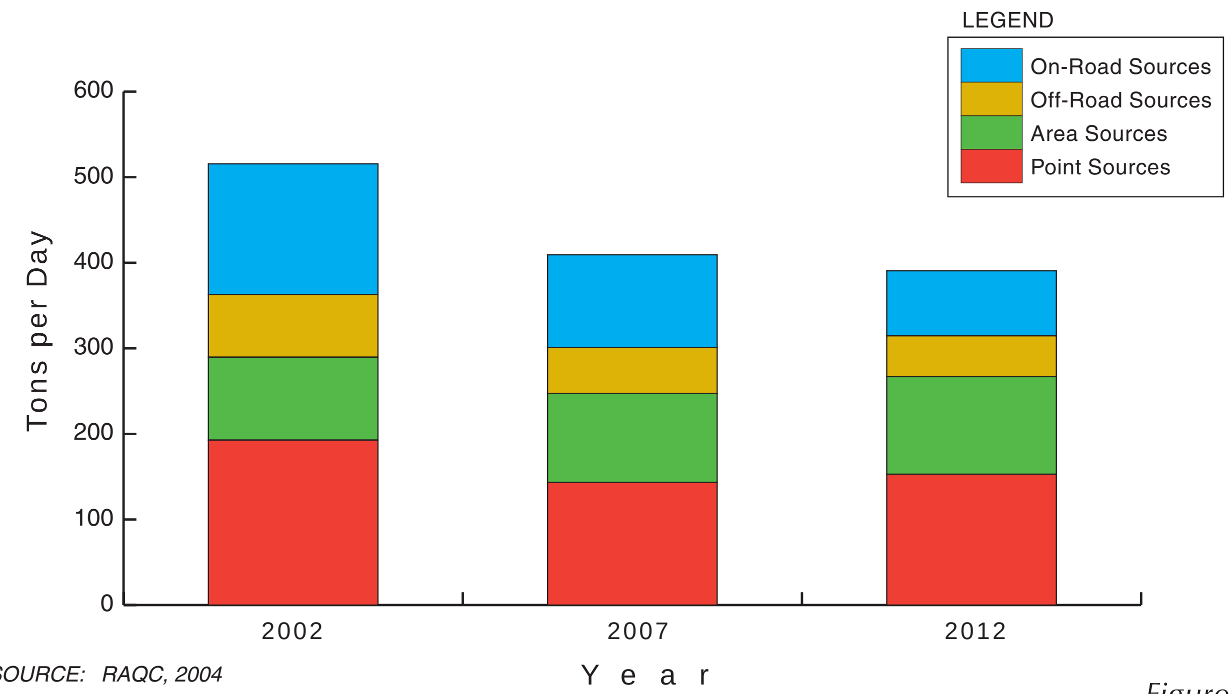


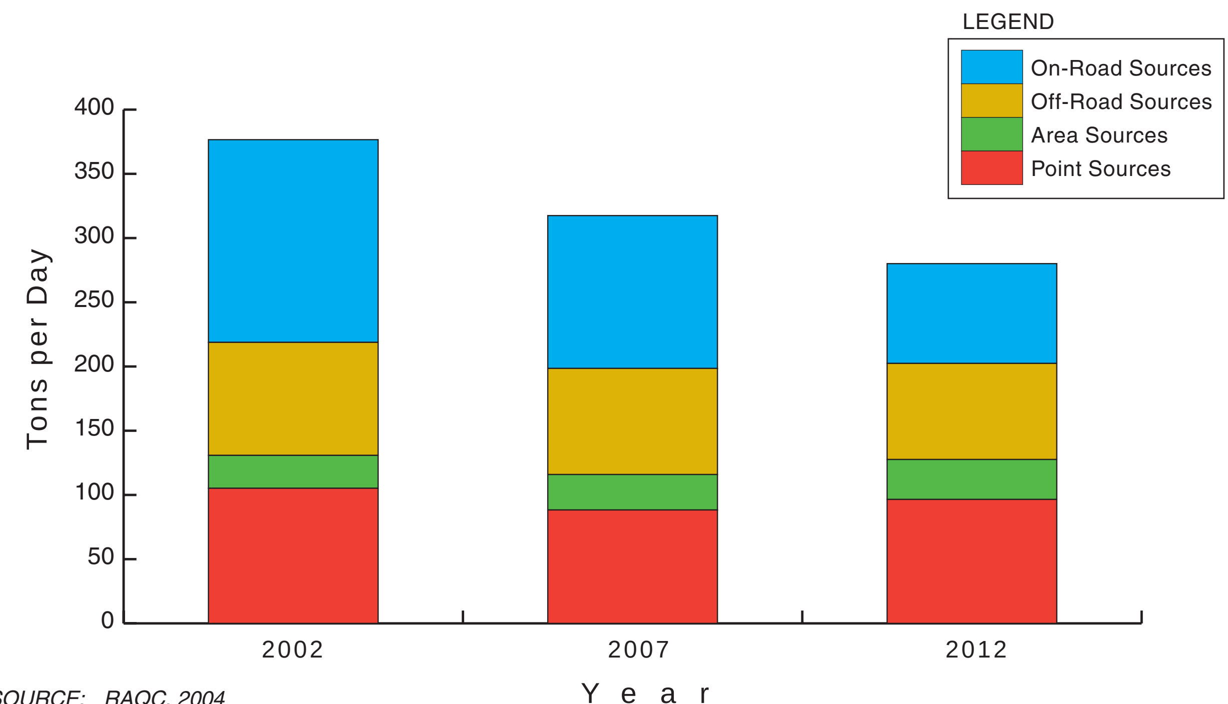
Figure 2-3
Denver Regional PM_{10} Emission Trends



SOURCE: RAQC, 2004

Figure 2-4

Denver Regional VOC Emission Trends

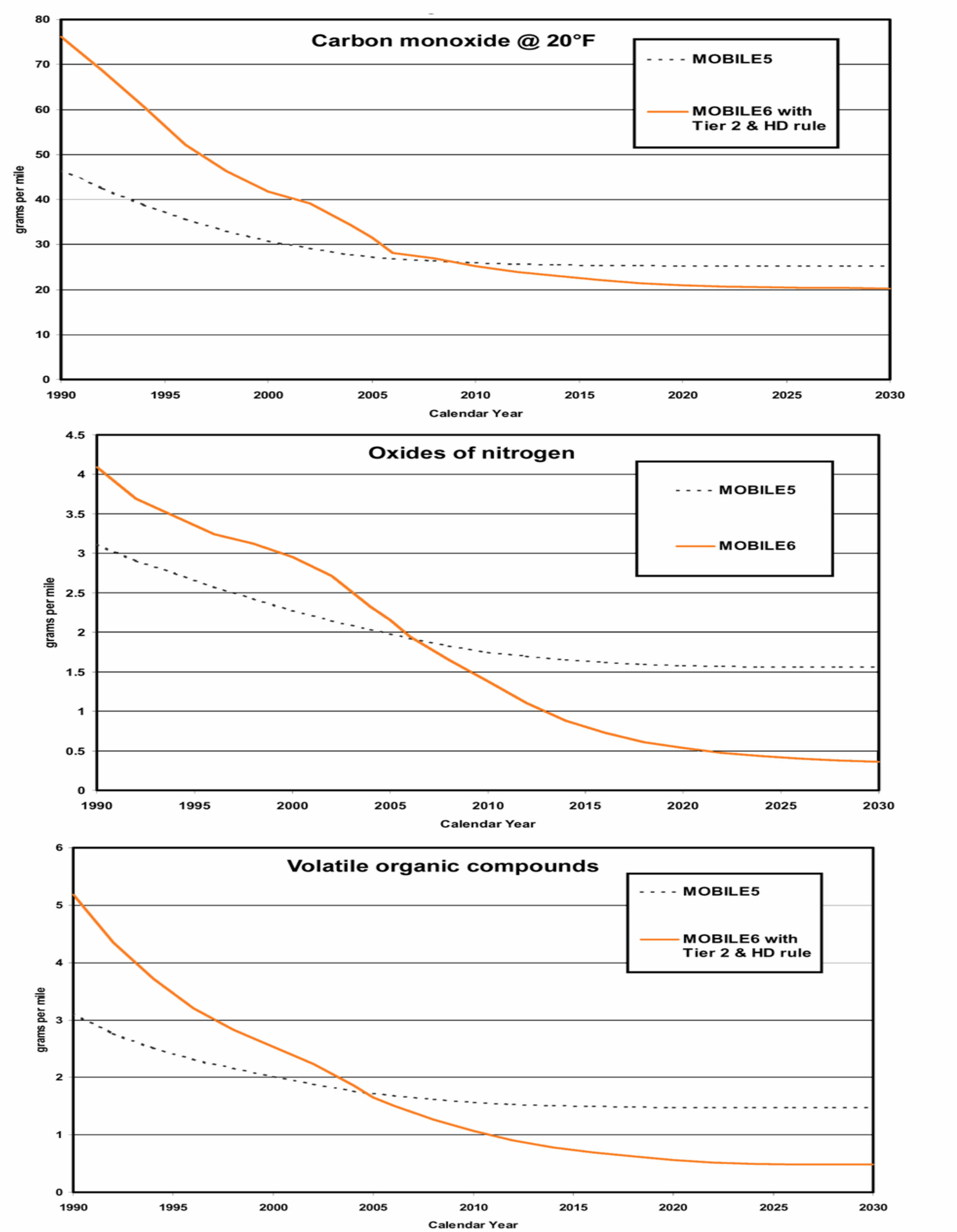


SOURCE: RAQC, 2004

Figure 2-5

Denver Regional NO_X Emission Trends

Figure 2-6 Average Vehicle Emission Rates (from MOBILE6 and MOBILE5)



SOURCE: EPA 2003

2.4 NAAQS Monitoring Data Overview

There are several air quality monitoring stations in the Denver region that measure the criteria air pollutants. None of them are in the project area. The active stations closest to the Study Area and the data used for the EA from each are:

- Arvada (CO, O_3)
- National Renewable Energy Laboratory-Golden (O_3)
- 225 W. Colfax Avenue (PM_{10})
- CAMP-downtown Denver ($PM_{2.5}$, nitrogen dioxide, O_3)

Some of the active stations are outside the Study Area, but overall these stations provide the monitoring data nearest the Study Area. Monitoring stations at other locations have been active in the past. The most recent complete data set from these stations is for 2005.

2.4.1 Carbon Monoxide

For the CO station, the 2005 measured values for NAAQS comparison for 1 hour and 8 hour are 3.6 ppm and 1.7 ppm, respectively (see **Figure 2-7**). These values are below their respective NAAQS (see **Table 2.2**). Measured concentrations of CO in the Denver region have not violated the NAAQS since 1995 (CAQCC 2004).

2.4.2 Particulate Matter

For the PM_{10} station, the 2005 measured values for NAAQS comparison for 24 hours and annual are 68 µg/m^3 and 27 µg/m^3, respectively (see **Figure 2-8**). For the $PM_{2.5}$ station, the 2005 measured values for NAAQS comparison for 24 hours and annual are 27 µg/m^3 and 9.4 µg/m^3, respectively (see **Figure 2-9**). These values are below their respective NAAQS (see **Table 2.2**). Measured concentrations of PM_{10} in the Denver region have not violated the NAAQS since 1993 (CAQCC 2004), and the PM $_{2.5}$ standard has never been violated during the relatively brief monitoring period.

2.4.3 Ozone

Nitrogen dioxide is an O_3 precursor. For the nitrogen dioxide station, the 2005 measured value for NAAQS comparison for annual average is 0.026 ppm (see **Figure 2-10**). For the O_3 stations, the 2005 range of measured values for NAAQS comparison for 1 hour is 0.095-0.098 ppm and for 8 hours is 0.078-0.079 ppm (see **Figure 2-11**). All of these values are below their respective NAAQS (see **Table 2-2**). Measured concentrations of 1-hour O_3 in the Denver region have not violated the NAAQS since 1987 (CAQCC 2001a). Measured concentrations of 8-hour O_3 in the Denver region violated the NAAQS most recently in 2003.

As was previously stated, the Denver region has an ongoing problem meeting the 8-hour O_3 NAAQS. A closer look at past O_3 data is presented in **Table 2-2**. Clearly, 2003 was a bad year for ozone (see **Figure 2-11** and **Table 1-2**). But, from these data, it also appears that there may be progress toward reducing 8-hour O3 concentrations in the Denver region through the air quality management strategies. The Early Action Compact (CAQCC 2004a) includes several such strategies and measures to ensure that the O_3 reduction milestones are met. Additionally, the Maintenance Plan for O_3 around Denver (CAQCC 2001a) plans for demonstrating NAAQS compliance status in the Study Area: "Since ozone is a regional pollutant, this demonstration is based on quality assured monitoring data collected throughout the Denver area, with focus on the monitors located in the western portion of the metro area near the foothills."

Because O_3 is a regional pollutant and both O_3 and O_3 precursors can be transported over great distances before causing O_3 problem areas, control measures need to be on a regional or larger basis to be effective. To that end, the Early Action Compact (CAQCC 2004a) includes several emission reduction strategies for the northern Front Range area to reduce future O_3 concentrations:

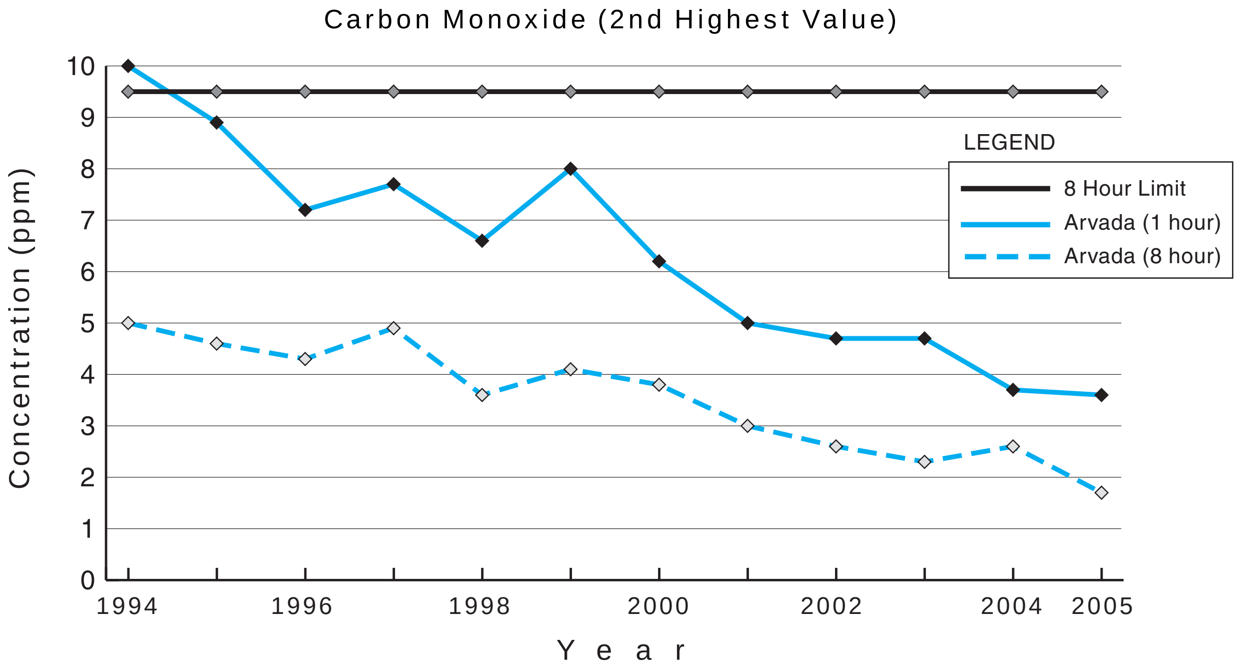
- Reid Vapor Pressure
- Condensate Tank Emissions Controls
- Controls for Stationary Engines
- Controls for Dehydrators
- Revisions to Regulation No. 11 - Automobile Inspection and Readjustment Program

O_3 is analyzed from a regional perspective by DRCOG.

Table 2-2 Summary of 8-Hour Ozone Measurement Data

Year	Range of Measured Compliance Values	Number of Days of NAAQS Violations
2005	0.077 to 0.079 ppm	None
2004	0.065 to 0.078 ppm	None
2003	0.083 to 0.095 ppm	NREL – 9 Arvada – None
2002	0.073 to 0.088 ppm	None
2001	0.074 to 0.082 ppm	None

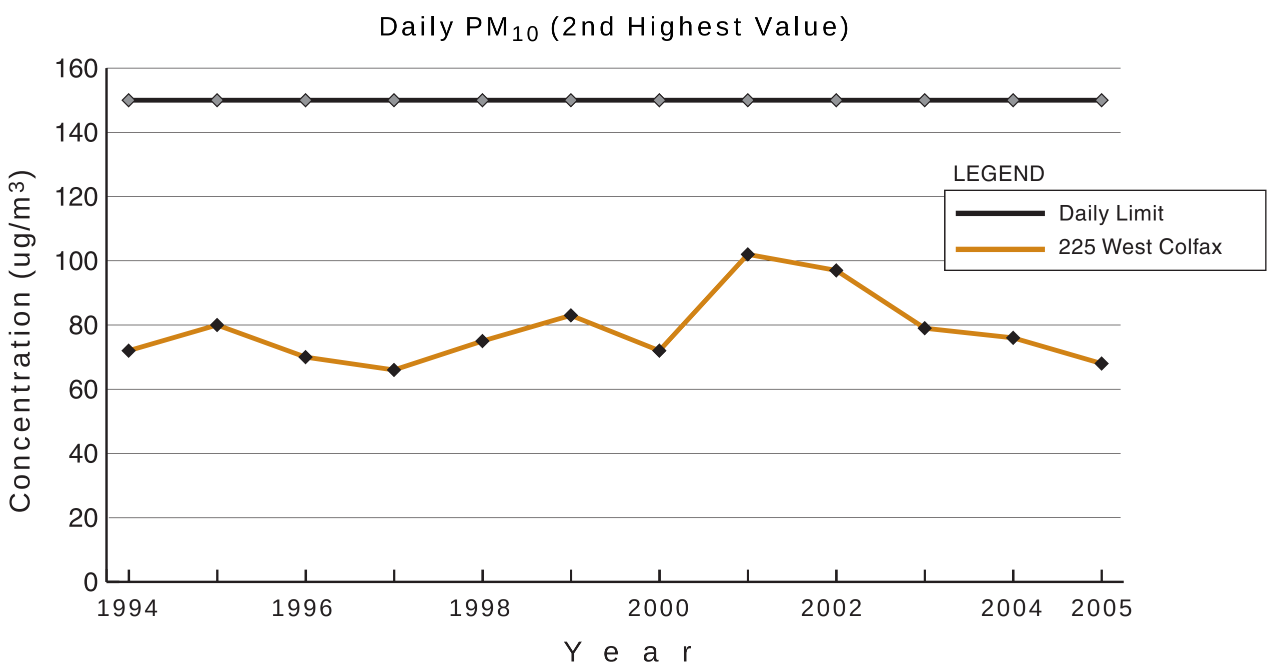
SOURCE: EPA 2005a



SOURCE: EPA, 2005

Figure 2-7

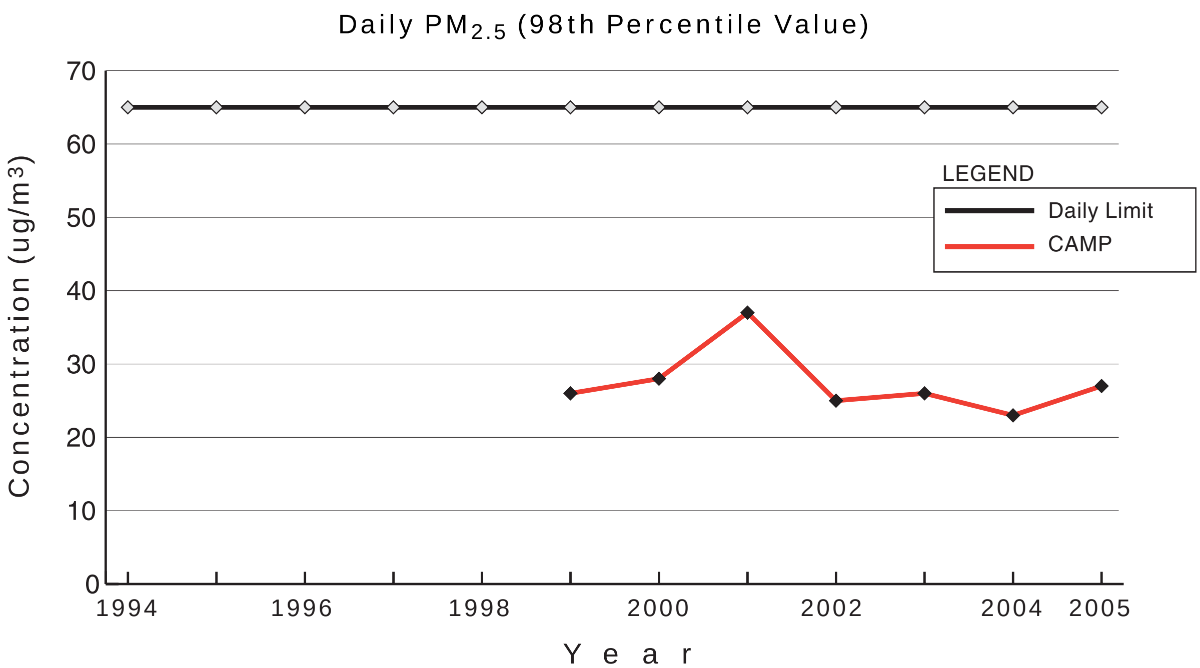
Study Area CO Concentrations



SOURCE: EPA, 2005

Figure 2-8

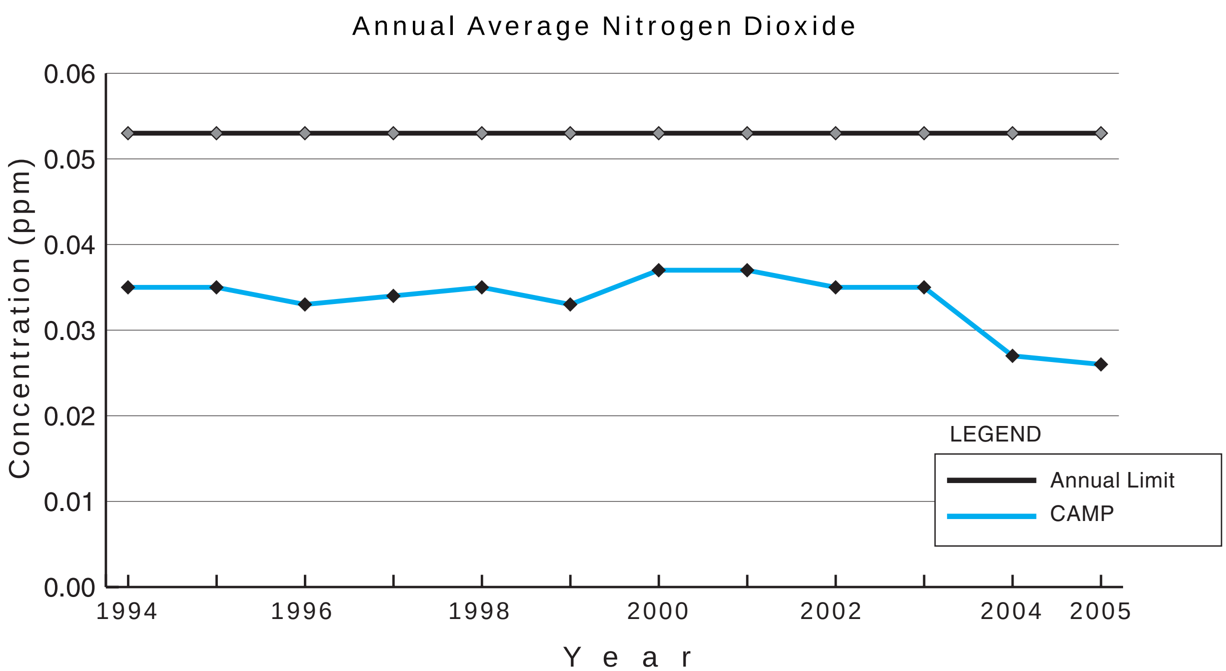
Study Area PM_{10} Concentrations



SOURCE: EPA, 2005

Figure 2-9

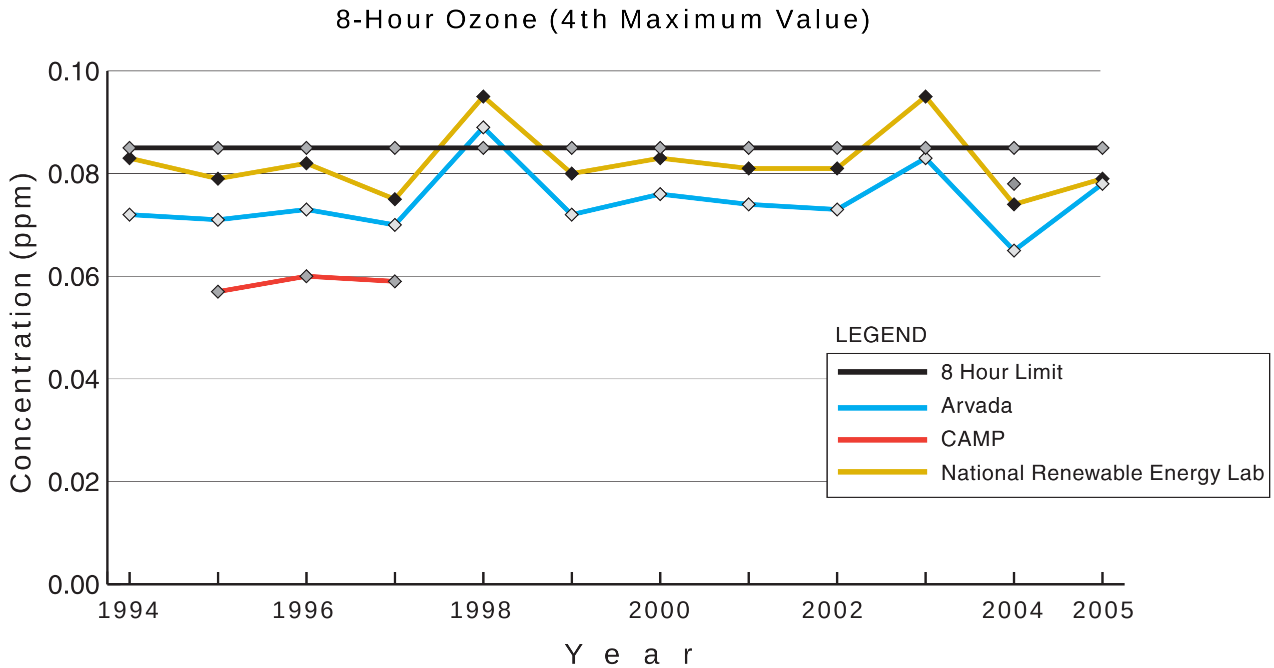
Study Area $PM_{2.5}$ Concentrations



SOURCE: EPA, 2005

Figure 2-10

Study Area Nitrogen Dioxide Concentrations



SOURCE: EPA, 2005

Figure 2-11

Study Area O_3 Concentrations

2.5 Transportation and Circulation System

Data pertaining to traffic volumes and level-of-service (LOS) in this report are drawn from the traffic study prepared for the EA (FHU 2005). The LOSs of the various intersections of interest to the project are listed in **Table 2-3**. LOSs provide an indication of intersection congestion and likely hot spots for air pollutants from vehicles. LOS A is the best traffic operation, LOS F is the worst.

Table 2-3 Study Area Intersection Levels of Service

Intersection Level of Service (AM/PM)			
Intersection	Existing	2030 No-Action	2030 Proposed Action
Ward Road and I-70 Ramps	F/E	F/F	F/F
Ward Road and 44th Ave.	B/E	E/F	C/D
Zinnia St. / 32nd Ave.	A/A	E/F	B/B
Youngfield St. / 32nd Ave.	C/D	F/F	C/C
EB I-70 Ramp to Youngfield St.	B/F	C/F	C/C
SOURCE: FHU 2005			

I-70 is one of the largest freeways in the metropolitan area and carries a corresponding volume of traffic. I-70 has three through lanes in the project area with additional merge/diverge lanes at the various interchanges. I-70 currently carries a traffic load of about 72,000 vehicles per day in the project area.

Ward Road is a 4-lane arterial street with auxiliary turning lanes that extends north from 44th Avenue in the project area. Ward Road carries approximately 40,000 vehicles per day.

Most of 44th Avenue is a 2-lane arterial street through the project area. There are approximately 13,000 vehicles per day on 44th Avenue.

Youngfield Street is primarily a 2-lane arterial street through the project area. There are approximately 17-25,000 vehicles per day on Youngfield Street.

Thirty-second Avenue is a 2-lane arterial street through the project area. There are approximately 10-14,000 vehicles per day on 32nd Avenue.

2.6 Other Air Quality Considerations

Two other air quality topics that were considered for the EA were toxic air pollutants and construction impacts.

2.6.1 Air Toxics

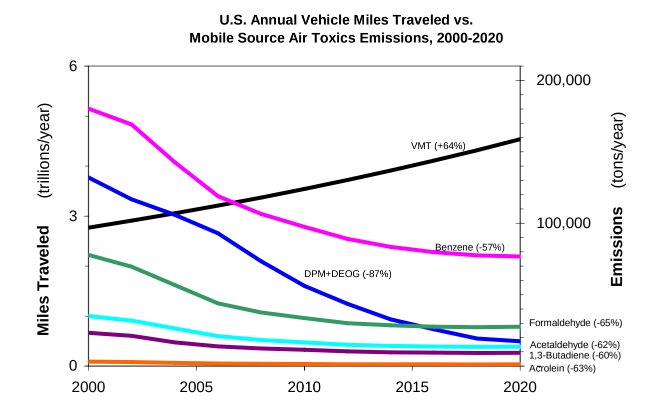
On February 3, 2006, FHWA released its interim guidance on when and how to analyze Mobile Source Air Toxics (MSATs) in the NEPA process. The following MSAT discussions are in accordance with the interim guidance.

MSATs are a subset of the 188 air toxics defined by the Clean Air Act. MSATs are compounds emitted from highway vehicles and non-road equipment. Some toxic compounds are present in fuel and are emitted to the air when the fuel evaporates or passes through the engine unburned. Other toxics are emitted from the incomplete combustion of fuels or as secondary combustion products. Metal air toxics also result from engine wear or from impurities in oil or gasoline (EPA 2000b).

EPA is the lead Federal Agency for administering the Clean Air Act and has certain responsibilities regarding the health effects of MSATs. Most air toxics, as they are called, originate from human-made sources, including on-road mobile sources (automobiles), non-road mobile sources (e.g., airplanes), area sources (e.g. dry cleaners) and stationary sources (e.g., factories or refineries). EPA issued a Final Rule on Controlling Emissions of Hazardous Air Pollutants from Mobile Sources (EPA 2001a). This rule was issued under the authority in Section 202 of the Clean Air Act. Through the rule, EPA examined the impacts of existing and newly promulgated mobile source control programs, including the reformulated gasoline program, the national low emission vehicle standards, the Tier 2 motor vehicle emissions standards and gasoline sulfur control requirements, and the proposed heavy duty engine and vehicle standards and on-highway diesel fuel sulfur control requirements. Through this rule, EPA identified six priority MSATs: acetaldehyde, benzene, formaldehyde, diesel exhaust, acrolein, and 1,3-butadiene (EPA 2001a).

Between 2000 and 2020, FHWA projects that even with a 64 percent increase in VMT, these programs will reduce on-highway emissions of benzene, formaldehyde, 1,3-butadiene, and acetaldehyde by 57 percent to 65 percent, and will reduce on-highway diesel PM emissions by 87 percent (see **Figure 2-12**). As a result, EPA concluded that no further motor vehicle emissions standards or fuel standards were necessary to further control MSATs. EPA is preparing another rule under authority of Section 202(l) of the Clean Air Act that will address these issues and could make adjustments to the full 21 and the primary six MSATs.

Figure 2-12 Predicted MSAT Emissions



Notes: For on-road mobile sources. Emissions factors were generated using MOBILE6.2. MTBE proportion of market for oxygenates is held constant, at 50%. Gasoline RVP and oxygenate content are held constant. VMT: *Highway Statistics 2000*, Table VM-2 for 2000, analysis assumes annual growth rate of 2.5%. "DPM + DEOG" is based on MOBILE6.2-generated factors for elemental carbon, organic carbon and SO4 from diesel-powered vehicles, with the particle size cutoff set at 10.0 microns.

2.6.1.1 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 or that animals demonstrate adverse health outcomes when exposed to large doses. Exposure to toxics has been a focus of a number of EPA efforts. Most notably, EPA conducted the National Air Toxics Assessment (EPA 1996) to evaluate modeled estimates of human exposure applicable to the county level. While not intended for use as a measure of local exposure, the modeled estimates illustrate the levels of various toxics when aggregated to a national or State level.

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 at http://www.epa.gov/iris. The following toxicity information for the six prioritized MSATs was taken from the IRIS database Weight of Evidence Characterization summaries. 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.

- **Benzene** is characterized as a known human carcinogen.
- The potential carcinogenicity of **acrolein** cannot be determined because the existing data are inadequate for an assessment of human carcinogenic potential for either the oral or inhalation route of exposure.
- **Formaldehyde** is a probable human carcinogen, based on limited evidence in humans, and sufficient evidence in animals.
- **1,3-butadiene** is characterized as carcinogenic to humans by inhalation.
- **Acetaldehyde** is a probable human carcinogen based on increased incidence of nasal tumors in male and female rats and laryngeal tumors in male and female hamsters after inhalation exposure.

- **Diesel exhaust** is likely to be carcinogenic to humans by inhalation from environmental exposures. Diesel exhaust as reviewed in this document is the combination of diesel particulate matter and diesel exhaust organic gases.
- **Diesel exhaust** also represents chronic respiratory effects, possibly the primary noncancer hazard from MSATs. Prolonged exposures may impair pulmonary function and could produce symptoms, such as cough, phlegm, and chronic bronchitis. Exposure relationships have not been developed from these studies.

Benzene is unique among the six priority MSATs in that it is present both in fuel and in tailpipe emissions, while the other priority MSATs are generally only in tailpipe emissions. Therefore, benzene emissions can come from more sources than the other priority MSATs and are directly affected by more regulatory controls such as Tier 2 and reformulated gasolines.

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 recent studies have reported that proximity to roadways is related to adverse health outcomes, particularly respiratory problems.[1] 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.

2.6.1.2 Sensitive Receptors

Air toxics from mobile sources are most likely to affect receptors close to roads as this is where concentrations of air toxics from mobile sources will be highest. Locations where people spend extended periods of time are likely to be the most sensitive receptors. These types of locations include homes, schools and hospitals. There are several of these types of receptors along roads in the project area that may be modified by the Proposed Action.

The Manning School and approximately 30 homes front 32nd Avenue. Approximately 18 homes and Arapahoe Park front 44th Avenue. Approximately 13 homes front Youngfield Street. Approximately six homes would be along the proposed Cabela Drive near 32nd Avenue. The Clear Creek bike path passes under I-70. Many homes adjoin I-70 south of 32nd Avenue.

2.6.2 Construction

Finally, 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 mechanism for assessing such impacts.

[1] *South Coast Air Quality Management District, Multiple Air Toxic Exposure Study-II (2000); Highway Health Hazards, The Sierra Club (2004) summarizing 24 Studies on the relationship between health and air quality); NEPA's Uncertainty in the Federal Legal Scheme Controlling Air Pollution from Motor Vehicles, Environmental Law Institute, 35 ELR 10273 (2005) with health studies cited therein.*

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3.0 IMPACTS AND MITIGATIONS

Consultation was held between CDOT, the Federal Highway Administration (FHWA) and the Air Pollution Control Division to discuss air quality issues related to the project and to select the most appropriate approach for this study. From this consultation, it was decided that the air quality analysis for the project should consist of the following components:

- A regional conformity evaluation to show that the alternatives are compatible with the state implementation plans. That analysis would be done by the Denver Regional Council of Governments (DRCOG) as part of the regional planning and conformity demonstration activities.
- A local "hot-spot" analysis for CO to show that the proposed actions will not cause local violations of the NAAQS. Intersections that could be potential hot-spots were identified and analyzed for local conformity.
- Qualitative analyses for particulate matter, O_3 and air toxics.

The methodology is described in the following sections.

3.1 Approach

Because of the past and present regional air quality challenges, infrastructure projects that might exacerbate air quality problems must meet certain requirements before they can proceed. The region of influence examined for air quality impacts in this project is around the highways and streets described in **Section 2.5**. 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.

3.1.1 Regional Conformity

In non-attainment and maintenance areas, the Clean Air Act requires that fiscally-constrained long-range RTPs, TIPs and individual projects can not:

- cause new violations of the 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 (DRCOG) to assure that requirements of the Clean Air Act are met for transportation improvements. The fiscally-constrained RTP and TIP must identify all projects that are expected to receive federal funds or that will require 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 demonstrating conformity. This conformity demonstration requires that RTPs and TIPs:

- are within the motor vehicle emissions budgets in the State Implementation Plans
- implement transportation control measures in a timely manner

A conformity determination is the finding by the metropolitan planning organization policy board, and subsequently by FHWA and/or the Federal Transit Administration, that an RTP/TIP meets the conformity requirements.

Individual projects can demonstrate regional conformity by being part of a conforming fiscally-constrained RTP, which looks at longer-range transportation planning, or either a TIP, which includes projects likely to proceed in the next few years, or the road network used to demonstrate conformity (TIP technical appendix). The 2030 RTP and the 2007-2012 TIP are the adopted fiscally-constrained conforming plan and program for DRCOG. The Proposed Action is in the approved 2007-2012 TIP, so regional conformity has been demonstrated for the Proposed Action.

Improvement projects can not be built unless in the aggregate they conform to regional air quality improvement plans. Along these lines, O_3 is a regional pollutant. O_3 problems often do not occur where the O_3 precursors are emitted, rather they occur at remote locations after the pollutants have had a chance to disperse, mix and interact. Therefore, the regional air quality plan is the appropriate way to consider O_3 impacts.

3.1.2 Local Conformity

Individual projects must demonstrate that they will not violate the NAAQS in localized areas, known as "hot-spots." Among the NAAQS pollutants, an approved quantitative method for hot-spot analysis is available only for CO. Hot-spot modeling for other NAAQS pollutants or other pollutants from mobile sources is generally not required because there are no accepted EPA guidelines for hot-spot analysis of those pollutants at this time.

Potential CO hot-spots were identified through a preliminary evaluation of intersections in the Study Area. This evaluation consisted of two components:

- review of the overall LOS from the traffic report for signalized intersections that are within or proposed to be within the project area
- comparison of LOS from the traffic report for major intersections adjoining the project corridor both with and without the possible improvements

Following CDOT's process, areas likely to become air pollution hot-spots are identified based primarily on traffic volumes and congestion, and a determination is then made whether a detailed analysis is needed for each area. Generally, the need for hot-spot analysis of intersections is assessed with respect to three criteria, as suggested by EPA:

1. Will the LOS of a project intersection be D, E or F?

   or -

2. Will the project affect locations identified in the State Implementation Plan as sites of actual or potential violations of the CO NAAQS?

   or -

3. Is a project intersection one of the top three in the State Implementation Plan with respect to traffic volume or worst LOS?

The goal of the selection process is to choose the most congested and heavily trafficked intersections for CO analysis as a worst case representation of all the project intersections. If an intersection does not meet one of the above criteria, it is unlikely to be a hot-spot and need not be assessed further. If the most congested intersections do not produce hot-spot problems, less congested intersections would not either.

In general, the traffic modeling showed that the Proposed Action would improve Study Area intersection LOS over the No-Action Alternative (see **Table 2-3**), but there would still be some congested intersections. For this project, two intersections from the Proposed Action were calculated to have an LOS of E or worse in 2030 (see **Table 2-3**) and were selected for CO hot-spot analysis. The two intersections were Ward Road and the I-70 westbound ramps and Ward Road and 44th Avenue (see **Figure 3-1**). These intersections were modeled for existing (2005) conditions and predicted future (2030) conditions. For both intersections, the PM peak hour was examined.

CO concentrations were modeled using the CAL3QHC computer model at representative receptor locations, as suggested in EPA guidance. The CAL3QHC program calculates the hourly CO concentrations for each receptor for many wind directions. Years 2005 and 2030 vehicle emission factors from MOBILE6 were obtained from the Air Pollution Control Division (see **Appendix A**). Meteorological conditions were simulated by using CAL3QHC stability class D, based upon projected land use, and low wind speed (1 meter per second).

3.2 Carbon Monoxide Results

The CO concentrations calculated for the 2005 and 2030 scenarios are shown in **Table 3-1**. The model output data are correct for altitude (see **Appendix B**). The CAL3QHC model provides 1-hour average CO concentrations which must then be added to background CO concentrations. To calculate 8-hour CO results, the 1-hour model results were multiplied by a persistence factor of 0.57 and added to the 8-hour background CO concentrations, following CDOT and Air Pollution Control Division guidance. The 8-hour calculation allows for the fact that the average hourly traffic during eight consecutive hours will be less than the peak hour traffic, and that meteorological conditions including wind speed and direction may vary during that time.

For 2005 data, a 1-hour CO background concentration of 7 ppm and an 8-hour CO background of 3.5 ppm were used per guidance from the Air Pollution Control Division. For 2030 data, a 1-hour CO background concentration of 4.8 ppm and an 8-hour CO background of 2.5 ppm were used per guidance from the Air Pollution Control Division.

The maximum 1-hour CO concentration predicted for any model year for either of the intersections was 10.7 ppm (see **Table 3-1**) for 2005, which is below the NAAQS of 35 ppm. The maximum 8-hour CO concentration predicted for any model year for either of the intersections was 5.6 ppm for 2005 (see **Table 3-1**), which is below the NAAQS of 9 ppm. Therefore, no CO hot spots in violation of the NAAQS are predicted and no mitigation is necessary.

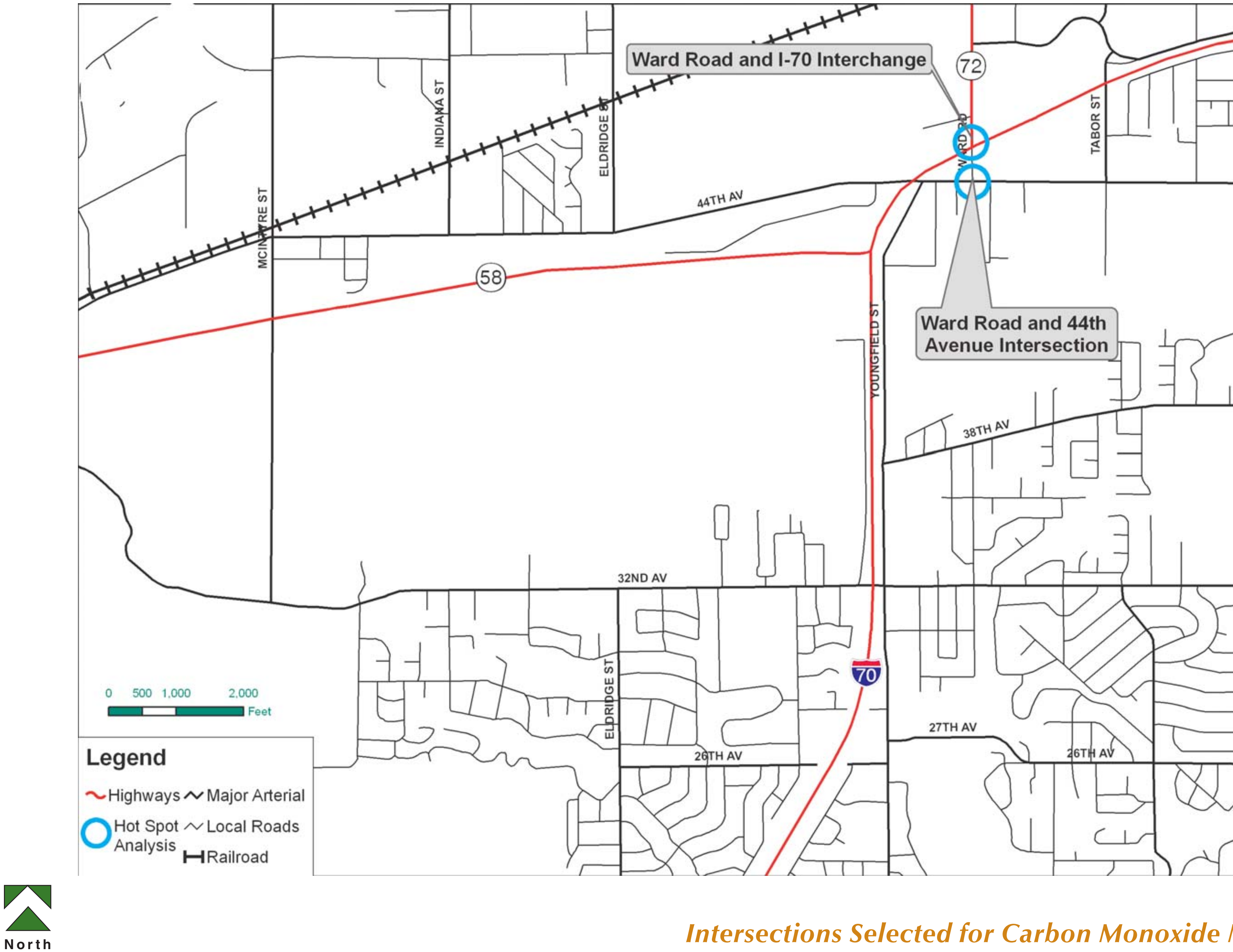

Figure 3-1

Intersections Selected for Carbon Monoxide Modeling

CO concentrations are predicted to decrease at the target intersections in the future, even with higher traffic volumes. This is primarily because vehicles will be emitting less CO in the future. This benefit will be from federal vehicle emission regulation and will be realized regardless of which alternative is selected in the EA.

Overall, the results from modeling potential CO impacts indicated that the Proposed Action being considered would not cause any violations of CO standards and would be acceptable in CO terms.

Table 3-1 Maximum Modeled Carbon Monoxide Concentrations

Intersection	1-Hour CO Result (ppm)			8-Hour CO Result (ppm)		
	2005	No-Action 2030	Proposed Action 2030	2005	No-Action 2030	Proposed Action 2030
Ward Road and I-70 Ramps	10.7	7.3	7.2	5.6	3.9	3.9
Ward Road and 44th Ave.	10.6	6.7	6.8	5.6	3.6	3.6
NAAQS	35			9		
SOURCE: FHU, Modeling Results						

3.3 Particulate Matter Results

Unlike CO, quantitative tools for analysis of PM_{10} and $PM_{2.5}$ pollution have not been developed and approved for mobile sources. Therefore, a qualitative process was used for the analysis.

The active PM_{10} monitor nearest the Study Area is at 225 W. Colfax. There have been no exceedences of the PM_{10} standard at this station for more than a decade, which indicates that PM_{10} pollution has been sustainably reduced from previous levels. The most relevant PM_{10} components from mobile sources are re-entrained fugitive dust and tailpipe emissions, which account for about half the total PM_{10} emissions in the Denver area.

The Colorado Department of Public Health and Environment is responsible for studying and improving the air quality in Colorado. In addition to the air quality monitoring mentioned above, they also perform regional air quality modeling. PM_{10} is modeled in support of the State Implementation Plan and this model includes the local sources of PM_{10}. The model provides predicted PM_{10} concentrations for a grid that covers the Denver metropolitan area (Colorado Department of Public Health and Environment 2005b). More than 250 model grid nodes that cover the project traffic model area were identified and the model results are summarized in **Table 3-2**. These data show that PM_{10} concentrations are predicted to increase over the next 25 years, due mainly to increased vehicle traffic. However, the predicted 2030 PM_{10} concentrations are below the NAAQS of 150 µg/m^3.

Table 3-2 PM_{10} Regional Model Sixth Highest Daily Concentration Summary

Value	2001 Base Year	2030
Number of model grid nodes analyzed	117	117
Average predicted PM_{10} concentration (µg/m^3)	86.9	110.2
Minimum predicted PM_{10} concentration (µg/m^3)	77.7	99.9
Maximum predicted PM_{10} concentration (µg/m^3)	95.0	122.5
NAAQS (µg/m^3)	150	150
SOURCE: APCD 2005b		

As was discussed in Section 3.1.1, the Proposed Action has been added to the TIP. The TIP has been shown to meet the regional pollutant budgets necessary to demonstrate compliance with the NAAQS (DRCOG 2006), so no PM_{10} impacts are predicted for the Proposed Action.

As was previously mentioned, the Final Rule redesignating the Denver area from nonattainment to attainment/maintenance status for PM_{10} became effective on October 16, 2002. This redesignation also included approval of a Maintenance Plan for PM_{10} for the Denver area (Colorado Air Quality Control Commission 2001). These types of plans are required to ensure maintenance of the relevant NAAQS for at least 10 years. The Maintenance Plan included a number of strategies to reduce future PM_{10} emissions to demonstrate maintenance of the NAAQS for 2002 and beyond. These reductions will come mostly from lower tailpipe emissions, better street sanding procedures and ongoing vehicle inspection/maintenance requirements of the AIR Program. Street sanding is controlled by Colorado Air Quality Commission Regulation No. 16 and is expected to be the biggest contributor to PM_{10} control for the Denver area. The Maintenance Plan also includes control of estimated PM_{10} emissions from road construction activities.

Re-entrained road dust tends to be a larger source of PM_{10} then tailpipe emissions for mobile sources. Higher vehicle speeds tend to produce more road dust. The Proposed Action is intended to improve traffic flow in the Study Area, which by itself could lead to higher PM_{10} emissions.

3.4 Ozone Results

As was previously discussed, O_3 is a regional pollutant and as such is controlled at a regional level. Emissions of O_3 precursors nearby a particular location are typically not of the greatest significance because the precursors need time to mix and the right weather conditions must be present before O_3 is formed. In that time, the pollutants can drift a considerable distance. The regional emissions modeling is performed by DRCOG and the modeling considers all of the sources of O_3 precursors. Any of the future alternatives for the EA as well as any other projects in the Denver O_3 maintenance area must, in the aggregate, conform to the O_3 State Implementation Plan and the Early Action Compact and be compatible with regional O_3 concentration reductions to comply with the NAAQS.

As was discussed in Section 3.1.1, the Proposed Action has not been included in the RTP. Therefore, a preliminary evaluation of the potential regional impacts to O_3 was performed. Transportation modeling that was performed for the project (FHU 2005) showed that the Proposed Action would reduce daily VMT over the entire Denver region by about 31,000 (Table 3.3). This is a small amount compared to the daily regional VMT (0.03%), but it is a decrease, which means that overall regional vehicle emissions would be lower with the Proposed Action.

The Proposed Action is expected to reduce the total VMT in the project area and to improve vehicle speeds during peak traffic hours. Both of these changes will reduce the overall emission of O_3 precursors relative to the No-Action Alternative. Because the No-Action Alternative should have higher emissions than the Proposed Action and the No-Action Alternative (through the RTP) has been shown to conform to the O_3 state implementation plan, then the Proposed Action also can be expected to conform for O_3. The estimated regional emissions for O_3 precursors are shown in **Table 3-3**.

3.5 Air Toxics

As discussed in **Section 2.6.1**, 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 qualitatively assess the levels of future MSAT emissions under the Proposed Action. Although a qualitative analysis cannot identify and measure health impacts from MSATs, it can give 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 online at: www.fhwa.dot.gov/environment/airtoxic/msatcompare/msatemissions.htm.

Even though FHWA has not identified reliable quantitative methods to accurately estimate the health impacts of MSATs, it is possible to assess qualitatively future MSAT emissions under the project alternatives. In general, MSAT emissions increase with numbers of vehicles, with VMT and/or with congestion. There are several such traffic characteristics targeted for improvement by the Proposed Action that may affect MSAT emissions. A new interchange is proposed for SH 58 at Holman Street. The I-70 interchange with 32nd Avenue will be reconfigured with pair of hook ramps on either side of I-70. Completion of Cabela Drive will provide a local connection between these new interchanges. The Proposed Action is intended to improve traffic flow, provide more direct routes for major traffic movements and alleviate congestion at several overcapacity intersections.

For both alternatives in this EA, the amount of MSATs emitted would be related to the VMT and congestion, assuming that other variables such as fleet mix are the same for each alternative. The No-Action Alternative was calculated to have more total VMT than the Proposed Action in the study area by about one percent (see **Section 3.3**). Lower speeds result in higher MSAT emissions and the No-Action Alternative is expected to have higher MSAT emissions than the Proposed Action because of greater congestion for an equivalent VMT.

Regardless of the alternative chosen, emissions in the design year will likely be lower than present levels as a result of EPA's national control programs that are projected to reduce MSAT emissions by 57 to 87 percent from 2000 to 2020. Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the 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 in virtually all locations.

Because of the specific characteristics of the Proposed Action, there may be localized areas where VMT would increase and other areas where VMT would decrease. Therefore, corresponding localized increases and decreases in MSAT emissions may also occur. The localized increases in MSAT emissions would likely be most pronounced along the new roadway sections that would be built at Cabela Drive and 32nd Avenue and the new interchange on SH 58. However, even if these increases do occur, they too will be substantially reduced in the future due to implementation of EPA's vehicle and fuel regulations. Traffic volumes and congestion should be markedly reduced at the I-70/32nd Avenue interchange under the Proposed Action relative to the No-Action Alternative. This is notable for sensitive receptors such as The Manning School along 32nd Avenue, where VMT is predicted to be reduced by about five percent under the Proposed Action. Based on this analysis, it is likely that the Proposed Action will result in lower MSAT emissions over the No-Action Alternative.

In total, the Proposed Action in 2030 is expected to have reduced MSAT emissions in the project area relative to No-Action, due to the reduced VMT associated with more direct routing, and due to EPA's MSAT reduction programs. MSAT levels could be higher in some locations than others, but current tools and science are not adequate to quantify the differences. On a regional basis, EPA's vehicle and fuel regulations, coupled with fleet turnover, will cause substantial MSAT emission reductions that, in almost all cases, will cause region-wide MSAT levels to be significantly lower than today.

3.5.1 Unavailable Information for Project Specific MSAT Impact Analysis

This analysis includes a basic assessment of the likely MSAT emission impacts from this project. However, the available technical tools do not allow prediction of the project-specific health impacts of the emission changes associated with the alternatives. Due to these limitations, the following discussion is included in accordance with CEQ regulations (40 CFR 1502.22(b)) regarding incomplete or unavailable information.

Evaluating the environmental and health impacts from MSATs on a proposed highway project would involve several key elements, including emissions modeling, dispersion modeling to estimate ambient concentrations resulting from the estimated emissions, exposure modeling to estimate human exposure to the estimated concentrations, and then final determination of health impacts based on the estimated exposure. Each of these steps faces technical shortcomings or uncertain science that prevents a more complete determination of the MSAT health impacts of this project.

1. *Emissions: The EPA tools to estimate MSAT emissions from motor vehicles are not sensitive to key variables in the context of highway projects. While MOBILE 6.2 is used to predict emissions at a regional level, it has limited applicability at the project level. MOBILE 6.2 is a trip-based model--emission factors are projected based on a typical trip of 7.5 miles, and on average speeds for this typical trip. This means that MOBILE 6.2 does not have the ability to predict emission factors for a specific vehicle operating condition at a specific location at a specific time. Because of this limitation, MOBILE 6.2 can only approximate the operating speeds and levels of congestion likely to be present on the largest-scale projects, and cannot adequately capture emissions effects of smaller projects. For particulate matter, the model results are not sensitive to average trip speed, although the other MSAT emission rates do change with changes in trip speed. Also, the emissions rates used in MOBILE 6.2 for both particulate matter and MSATs are based on a limited number of tests of mostly older-technology vehicles. Lastly, in its discussions of PM under the conformity rule, EPA has identified problems with MOBILE6.2 as an obstacle to quantitative analysis.*

   These deficiencies compromise the use of MOBILE 6.2 to estimate MSAT emissions. MOBILE6.2 is an adequate tool for projecting emissions trends, and performing relative analyses between alternatives for very large projects, but it is not sensitive enough to capture the effects of travel changes tied to smaller projects or to predict emissions near specific roadside locations.

2. *Dispersion: The tools to predict how MSATs disperse are also limited. EPA's current regulatory models, CALINE3 and CAL3QHC, were developed and validated more than a decade ago for the purpose of predicting episodic concentrations of CO to determine compliance with the NAAQS. The performance of dispersion models is more accurate for predicting maximum concentrations that can occur at some time at some location within a geographic area. This limitation makes it difficult to predict accurate exposure patterns at specific times at specific highway project locations across an urban area to assess potential health risk. Research is being conducted on best practices in applying models and other technical methods in the analysis of MSATs. This work also will focus on identifying appropriate methods of documenting and communicating MSAT impacts in the NEPA process and to the general public. Along with these general limitations of dispersion models, FHWA is also faced with a lack of monitoring data in most areas for use in establishing project-specific MSAT background concentrations.*

3. *Exposure Levels and Health Effects: Finally, even if emission levels and concentrations of MSATs could be accurately predicted, shortcomings in current techniques for exposure assessment and risk analysis preclude reaching meaningful*

> *conclusions about project-specific health impacts. Exposure assessments are difficult because it is difficult to accurately calculate annual concentrations of MSATs near roadways, and to determine the portion of a year that people are actually exposed to those concentrations at a specific location. These difficulties are magnified for EPA's standard 70-year cancer assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over a 70-year period. There are also considerable uncertainties associated with the existing estimates of toxicity of the various MSATs, because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population. Because of these shortcomings, any calculated difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with calculating the impacts. Consequently, the results of such assessments would not be useful to decision makers, who would need to weigh this information against other project impacts that are better suited for quantitative analysis.*

3.5.2 Relevance of Unavailable or Incomplete Information

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

This air quality analysis provides a qualitative analysis of MSAT emissions relative to the various alternatives, and has acknowledged that all of the project alternatives may result in increased exposure to MSAT emissions in certain locations, although the concentrations and duration of exposures are uncertain. Because of this uncertainty, the health effects from these emissions cannot be estimated.

3.6 Construction Impacts

The overall construction for the Proposed Action has the potential to cause short-term impacts to air quality. Adjoining properties in the Study Area would be near construction activities while the 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

Residents or employees at neighboring properties could be exposed to construction-related emissions. The Proposed Action is 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 historically have shown not to cause significant air quality impacts.

3.7 Mitigation

Given that air pollutants are not predicted to exceed the NAAQS in the future as a result of implementing any of the alternatives, specific project-level mitigation measures for air quality are not required. Future emissions from on-road mobile sources will be minimized globally through several federal regulations. The Denver area maintenance plans for CO, O_3 and PM_{10} will serve to avoid and minimize pollutant emissions from project area roads. Standard emission minimization measures for construction activities are recommended below.

To address the temporary elevated air emissions that may be experienced during construction, standard construction mitigation measures should be incorporated into construction contracts. These include following best management practices and relevant CDOT construction specifications. These could 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 diligent implementation of a dust control plan (this would also control potential exposure to contaminated soil dust)
- no excessive idling of inactive equipment or vehicles
- construction equipment and vehicles use higher-grade fuel to reduce pollutant emissions
- stationary equipment located as far from sensitive receivers as possible

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4.0 CUMULATIVE IMPACTS

A description of the potential impacts that could occur as a result of the improvements being considered by the EA is presented in **Section 3.0**. The National Environmental Policy Act 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 identified by comparing the potential impacts of the proposed project and other past, current, or proposed actions in the area to establish whether, in the aggregate, they could result in significant environmental impacts (see **Section 3.0**).

For many decades, the project area has been an urban area. Neighboring land uses have ranged from light industrial/business to residential. The project area covers an undeveloped area along Clear Creek, though development of this area is a major driver for the EA. Because the proposed project is in a mostly developed urban area and will improve existing highways and streets, the potential for significant cumulative environmental impacts should be lessened.

Development in the Study Area will bring a number of new employers and employees. The development plans will convert a vacant industrial area into a commercial facility. This activity may spur development of other nearby properties, though there are not many vacant sites available. The majority of other surrounding properties are already developed (many are residential) and unlikely to be changed in the foreseeable future. While the changes at the Cabela’s site will be dramatic locally, they constitute relatively small changes in the overall I-70 and SH 58 corridors and the larger metropolitan area.

The proposed project is expected to be beneficial for transportation in the long term, as it will enhance the function of surrounding infrastructure features. I-70 and SH 58 will face continued growing traffic volumes whether the proposed project is built or not. The Proposed Action should help to alleviate some traffic congestion on 32nd Avenue and Youngfield Street, but certainly can not cure the all the congestion in the area. Construction of the project may generate additional vehicle trips during construction and require some traffic rerouting, but these should be temporary and not create substantial adverse effects.

The cumulative effects on regional air quality, relative to future conditions with the Proposed Action, are difficult to estimate at the project level. Whereas more efficiently operating roadways will sustain higher intersection LOS in the area, the proposed improvements could also increase total traffic. Vehicle emissions per mile are expected to decrease in the future because of cleaner vehicles, regardless of the alternative chosen. On the whole, while traffic and emission sources may increase on a local scale, traffic and overall emissions should improve on the larger regional scale. The net effect on regional air quality with the proposed project is taken into account in the regional conformity analysis performed by the DRCOG and that analysis is a cumulative examination of the regional pollutant sources.

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APPENDIX A EMISSION FACTORS

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Table A-1 CO Emission Factors

Pollutant	Situation	Arterial and Freeway Idle Emissions Factor	Arterial Running Emissions Factor	Freeway Running Emissions Factor	Ramp Running Emissions Factor
PM					
Carbon Monoxide (CO)	2005	120 g/hr	10.8 g/mi	13.4 g/mi	18.5 g/mi
Carbon Monoxide (CO)	2030 No-Action	68 g/hr	6.7 g/mi	8.0 g/mi	8.8 g/mi
Carbon Monoxide (CO)	2030 Proposed Action	68 g/hr	6.7 g/mi	8.0 g/mi	8.8 g/mi
SOURCE: APCD, 2005a					

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APPENDIX B MODEL OUTPUT FILES

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1 CAL3QHC: LINE SOURCE DISPERSION MODEL - VERSION 2.0, JANUARY 1992 PAGE 1

(Modified by Balloffet & Associates, April, 1994)

POLLUTANT MODELLED: CARBON MONOXIDE

JOB: Ward Road/44th Ave Intersection RUN: 2005 Existing PM Job#05154

DATE: 03/12/2006 TIME: 20:38

SITE & METEOROLOGICAL VARIABLES

VS = .0 cm/s VD = .0 cm/s Z0 = 175. cm TMPC = 2.0Deg C ALT =1609.0 m

U = 1.0 m/s CLAS = 4 (D) ATIM = 60. Minutes MIXH = 1000. m AMB = .0 ppm

LINK VARIABLES

LINK DESCRIPTION	X1	Y1	X2	Y2	LENGTH (FT)	BRG (DEG)	TYPE	VPH	EF (G/MI)	H (FT)	W (FT)	V/C	QUEUE (VEH)
1. Wb44 1 Que	545.0	500.0	634.0	500.0	89.	90.	AG	261.	100.0	.0	12.0	.71	4.5
2. Wb44 2 Que	545.0	512.0	634.7	512.0	90.	90.	AG	261.	100.0	.0	12.0	.71	4.6
3. Sblt 1 Que	500.0	540.0	500.0	671.8	132.	360.	AG	161.	100.0	.0	12.0	.58	6.7
4. Sblt 2 Que	488.0	540.0	488.0	671.8	132.	360.	AG	161.	100.0	.0	12.0	.58	6.7
5. Eblt 1 Que	460.0	488.0	-559.4	488.0	1019.	270.	AG	267.	100.0	.0	12.0	1.34	51.8
6. Eblt 2 Que	460.0	476.0	-570.0	476.0	1030.	270.	AG	267.	100.0	.0	12.0	1.34	52.3
7. Eb44 3 Que	460.0	464.0	367.4	464.0	93.	270.	AG	200.	100.0	.0	12.0	.45	4.7
8. Eb44 4 Que	460.0	452.0	367.1	452.0	93.	270.	AG	200.	100.0	.0	12.0	.45	4.7
9. Wb44 1 Apr	1000.0	500.0	500.0	500.0	500.	270.	AG	191.	10.8	.0	32.0		
10. Wb44 2 Apr	1000.0	512.0	500.0	512.0	500.	270.	AG	192.	10.8	.0	32.0		
11. WbRT 1 FFL	590.0	524.0	524.0	570.0	80.	305.	AG	1156.	10.8	.0	32.0		
12. SbRT 1 FFL	476.0	570.0	435.0	524.0	62.	222.	AG	491.	10.8	.0	32.0		
13. Eb44 3 Apr	.0	464.0	500.0	464.0	500.	90.	AG	273.	10.8	.0	32.0		
14. Eb44 4 Apr	.0	452.0	500.0	452.0	500.	90.	AG	274.	10.8	.0	32.0		
15. Wb44 1 Dprt	500.0	500.0	.0	500.0	500.	270.	AG	191.	10.8	.0	32.0		
16. Wb44 2 Dprt	500.0	512.0	.0	512.0	500.	270.	AG	192.	10.8	.0	32.0		
17. Eb44 3 Dprt	500.0	464.0	1000.0	464.0	500.	90.	AG	273.	10.8	.0	32.0		
18. Eb44 4 Dprt	500.0	452.0	1000.0	452.0	500.	90.	AG	274.	10.8	.0	32.0		
19. WB70	1000.0	1300.0	.0	800.0	1118.	243.	DP	7530.	13.4	.0	56.0		
20. EB70	.0	700.0	1000.0	1200.0	1118.	63.	DP	8345.	13.4	.0	56.0		

(X1, Y1, X2, Y2: LINK COORDINATES (FT))

1

PAGE 2

JOB: Ward Road/44th Ave Intersection RUN: 2005 Existing PM Job#05154

DATE: 03/12/2006 TIME: 20:38

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. Wb44 1 Que	100	81	2.0	191	1800	120.00	1	3
2. Wb44 2 Que	100	81	2.0	192	1800	120.00	1	3
3. Sblt 1 Que	100	50	2.0	482	1800	120.00	1	3

4. Sblt 2 Que	*	100	50	2.0	482	1800	120.00	1	3
5. Eblt 1 Que	*	100	83	2.0	313	1800	120.00	1	3
6. Eblt 2 Que	*	100	83	2.0	314	1800	120.00	1	3
7. Eb44 3 Que	*	100	62	2.0	273	1800	120.00	1	3
8. Eb44 4 Que	*	100	62	2.0	274	1800	120.00	1	3

RECEPTOR LOCATIONS

RECEPTOR	*	COORDINATES (FT) X	Y	Z	*
1. R-3	*	440.0	436.0	6.0	*
2. R-4	*	390.0	436.0	6.0	*
3. R-5	*	460.0	590.0	6.0	*
4. R-6	*	460.0	640.0	6.0	*
5. R-7	*	540.0	610.0	6.0	*
6. R-8	*	540.0	660.0	6.0	*

1

JOB: Ward Road/44th Ave Intersection RUN: 2005 Existing PM Job#05154

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) REC1	REC2	REC3	REC4	REC5	REC6
0.	*	3.4	3.4	1.7	1.7	1.4	1.6
5.	*	3.5	3.4	1.7	1.7	1.6	1.6
10.	*	3.4	3.4	1.9	1.7	1.6	1.7
15.	*	3.4	3.6	1.9	1.9	1.6	1.7
20.	*	3.1	3.5	2.0	1.9	1.5	1.7
25.	*	3.0	3.5	2.1	1.9	1.4	1.7
30.	*	2.6	3.5	2.0	1.8	1.3	1.5
35.	*	2.3	3.3	1.9	1.8	1.0	1.2
40.	*	1.9	3.0	1.6	1.5	.7	.9
45.	*	1.4	2.7	1.3	1.2	.4	.6
50.	*	1.1	2.5	1.1	1.0	.3	.3
55.	*	.9	2.3	.8	.8	.1	.1
60.	*	1.0	2.2	.8	.6	.0	.0
65.	*	.9	1.8	.7	.5	.0	.0
70.	*	.8	1.7	.6	.5	.0	.0
75.	*	.6	1.4	.6	.6	.0	.0
80.	*	.6	1.3	.6	.6	.0	.0

85.	*	.4	.9	.6	.6	.0	.0
90.	*	.3	.7	.7	.6	.0	.0
95.	*	.3	.4	.7	.6	.0	.0
100.	*	.2	.2	.8	.6	.0	.0
105.	*	.0	.0	1.0	.6	.0	.0
110.	*	.0	.0	1.0	.6	.0	.0
115.	*	.0	.0	1.1	.9	.0	.0
120.	*	.0	.0	1.2	1.0	.0	.0
125.	*	.0	.0	1.2	1.0	.1	.0
130.	*	.0	.0	1.0	1.0	.3	.0
135.	*	.0	.0	.9	1.0	.3	.0
140.	*	.0	.0	.9	1.0	.4	.2
145.	*	.0	.0	.7	1.0	.6	.2
150.	*	.0	.0	.5	1.0	.6	.3
155.	*	.0	.0	.4	.8	.6	.3
160.	*	.0	.0	.2	.5	.7	.4
165.	*	.0	.0	.3	.4	.7	.4
170.	*	.0	.0	.5	.4	.7	.3
175.	*	.0	.0	.6	.6	.5	.4
180.	*	.0	.0	.6	.6	.5	.3
185.	*	.0	.0	.8	.6	.5	.4
190.	*	.0	.0	.8	.7	.3	.3
195.	*	.0	.0	.8	.7	.3	.4
200.	*	.0	.0	.8	.6	.4	.8
205.	*	.0	.0	.8	.6	.7	.9

1

JOB: Ward Road/44th Ave Intersection RUN: 2005 Existing PM Job#05154

WIND ANGLE (DEGR)	*	CONCENTRATION (PPM) REC1	REC2	REC3	REC4	REC5	REC6
210.	*	.0	.0	.9	.6	.8	.9
215.	*	.0	.0	.9	.4	.8	1.1
220.	*	.0	.0	.9	.4	1.0	1.1
225.	*	.0	.0	.7	.4	1.2	1.1
230.	*	.0	.0	.6	.4	1.3	1.0
235.	*	.0	.0	.6	.5	1.3	1.0
240.	*	.0	.0	.6	.6	1.2	.9
245.	*	.0	.0	.7	.6	1.1	.9
250.	*	.0	.0	.7	.5	1.1	.9
255.	*	.4	.3	.7	.4	1.1	1.0
260.	*	.5	.4	.6	.5	1.0	1.0
265.	*	.9	.7	.5	.4	1.0	1.0
270.	*	1.5	1.2	.4	.5	.9	1.1
275.	*	1.8	1.4	.4	.6	1.2	1.2
280.	*	2.1	1.6	.5	.9	1.1	1.3

```
 285.  *   2.4   1.7    .7   1.1   1.4   1.5
 290.  *   2.6   1.9   1.0   1.3   1.6   1.6
 295.  *   2.7   1.8   1.2   1.4   1.8   1.7
 300.  *   2.9   2.2   1.3   1.6   1.8   1.7
 305.  *   3.1   2.4   1.5   1.7   1.9   1.6
 310.  *   3.3   2.5   1.5   1.7   1.9   1.6
 315.  *   3.4   2.8   1.4   1.6   1.8   1.6
 320.  *   3.2   2.8   1.4   1.6   1.7   1.6
 325.  *   3.4   3.1   1.5   1.7   1.7   1.6
 330.  *   3.3   3.2   1.6   1.7   1.7   1.6
 335.  *   3.3   3.2   1.6   1.7   1.5   1.6
 340.  *   3.3   3.4   1.6   1.7   1.5   1.6
 345.  *   3.3   3.4   1.5   1.7   1.4   1.6
 350.  *   3.3   3.4   1.6   1.6   1.4   1.6
 355.  *   3.3   3.4   1.6   1.7   1.4   1.6
 ------*-----------------------------------
 MAX   *   3.5   3.6   2.1   1.9   1.9   1.7
 DEGR. *    5    15    25    15   305    10
 THE HIGHEST CONCENTRATION IS    3.60     AT   15 DEGREES FROM REC2 .
1
                                                                                                                              PAGE  5
      JOB: Ward Road/44th Ave Intersection                          RUN: 2005 Existing PM        Job#05154
      DATE: 03/12/2006   TIME: 20:38
      RECEPTOR - LINK MATRIX FOR THE ANGLE PRODUCING
      THE MAXIMUM CONCENTRATION FOR EACH RECEPTOR
          *    CO/LINK  (PPM)
          *    ANGLE (DEGREES)
          *  REC1  REC2  REC3  REC4  REC5  REC6
   LINK # *     5    15    25    15   305    10
   -------*-----------------------------------
       1  *    .0    .0    .0    .0    .0    .0
       2  *    .0    .0    .0    .0    .0    .0
       3  *    .1    .0    .2    .0    .3    .0
       4  *    .1    .1    .3    .0    .2    .0
       5  *    .3    .4    .0    .0    .0    .0
       6  *    .4    .5    .0    .0    .0    .0
       7  *    .4    .4    .0    .0    .0    .0
       8  *    .6    .6    .0    .0    .0    .0
       9  *    .0    .0    .0    .0    .0    .0
      10  *    .0    .0    .0    .0    .0    .0
      11  *    .0    .0    .0    .0    .0    .0
      12  *    .1    .0    .0    .0    .0    .0
      13  *    .1    .1    .0    .0    .0    .0
      14  *    .1    .1    .0    .0    .0    .0
      15  *    .0    .0    .0    .0    .0    .0
      16  *    .0    .0    .0    .0    .0    .0
      17  *    .0    .0    .0    .0    .0    .0
```

```
      18  *    .0    .0    .0    .0    .0    .0
      19  *    .6    .6    .7    .8    .6    .7
      20  *    .7    .8    .9   1.1    .8   1.0
*******************************************************************************************************************
1                         CAL3QHC: LINE SOURCE DISPERSION MODEL - VERSION 2.0, JANUARY 1992                 PAGE  1
                              (Modified by Balloffet & Associates, April, 1994)
                                        POLLUTANT MODELLED: CARBON MONOXIDE
      JOB: Ward Road/I70 Intersection                           RUN: 2005 Existing PM        Job#05154
      DATE: 03/12/2006   TIME: 20:41
       SITE & METEOROLOGICAL VARIABLES
       -------------------------------
       VS =    .0 cm/s       VD =    .0 cm/s       Z0 = 175. cm          TMPC =  2.0Deg C     ALT =1609.0 m
        U =  1.0 m/s         CLAS =   4  (D)     ATIM =  60. Minutes     MIXH =  1000. m   AMB =   .0 ppm
       LINK VARIABLES
       --------------
         LINK DESCRIPTION     *         LINK COORDINATES (FT)          *    LENGTH  BRG TYPE   VPH    EF      H   W    V/C QUEUE
                              *   X1        Y1        X2        Y2     *     (FT)  (DEG)            (G/MI)  (FT) (FT)       (VEH)
      ------------------------*--------------------------------------*--------------------------------------------------------------
       1. Nblt 1 Que          *    500.0     440.0     500.0     429.9 *      10.   180. AG    296. 100.0    .0 12.0  .28    .5
       2. NbWR 2 Que          *    512.0     440.0     512.0    -561.9 *    1002.   180. AG    180. 100.0    .0 12.0 1.09  50.9
       3. NbWR 3 Que          *    524.0     440.0     524.0    -572.3 *    1012.   180. AG    180. 100.0    .0 12.0 1.09  51.4
       4. Nbrt 4 Que          *    536.0     440.0     536.0     380.0 *      60.   180. AG    180. 100.0    .0 12.0  .27   3.0
       5. Wb70 1 Que          *    560.0     512.0     565.6     512.0 *       6.    90. AG    277. 100.0    .0 12.0  .07    .3
       6. Wbrt 2 Que          *    560.0     524.0    1004.1     524.0 *     444.    90. AG    180. 100.0    .0 12.0 1.01  22.6
       7. Sblt 1 Que          *    500.0     560.0     500.0    2185.6 *    1626.   360. AG    241. 100.0    .0 12.0 1.35  82.6
       8. SbWR 2 Que          *    488.0     560.0     488.0     693.9 *     134.   360. AG    126. 100.0    .0 12.0  .61   6.8
       9. Sbrt 3 Que          *    476.0     560.0     476.0     693.9 *     134.   360. AG    126. 100.0    .0 12.0  .61   6.8
      10. Sbrt 4 Que          *    464.0     560.0     464.0     561.7 *       2.   360. AG    126. 100.0    .0 12.0  .01    .1
      11. Eblt 1 Que          *    440.0     500.0     425.1     500.0 *      15.   270. AG    293. 100.0    .0 12.0  .33    .8
      12. Eb70 2 Que          *    440.0     488.0     433.5     488.0 *       6.   270. AG    293. 100.0    .0 12.0  .14    .3
      13. NbWR 2 Apr          *    512.0        .0     512.0     500.0 *     500.   360. AG    891.  10.8    .0 32.0
      14. NbWR 3 Apr          *    524.0        .0     524.0     500.0 *     500.   360. AG    892.  10.8    .0 32.0
      15. Wb70 1 Apr          *   1000.0     512.0     500.0     512.0 *     500.   270. AG    741.  18.5    .0 32.0
      16. SbWR 2 Apr          *    488.0    1000.0     488.0     500.0 *     500.   180. AG    886.  10.8    .0 32.0
      17. SbWR 3 Apr          *    476.0    1000.0     476.0     500.0 *     500.   180. AG    887.  10.8    .0 32.0
      18. Eb70 2 Apr          *       .0     488.0     500.0     488.0 *     500.    90. AG     43.  10.8    .0 32.0
      19. NbWR 2 Dprt         *    512.0     500.0     512.0    1000.0 *     500.   360. AG   1163.  10.8    .0 32.0
      20. NbWR 2 Dprt         *    524.0     500.0     524.0    1000.0 *     500.   360. AG   1163.  10.8    .0 32.0
      21. Wb70 1 Dprt         *    500.0     512.0        .0     512.0 *     500.   270. AG     40.  10.8    .0 32.0
      22. SbWR 2 Dprt         *    488.0     500.0     488.0        .0 *     500.   180. AG    640.  10.8    .0 32.0
      23. SbWR 3 Dprt         *    476.0     500.0     476.0        .0 *     500.   180. AG    641.  10.8    .0 32.0
      24. Eb70 2 Dprt         *    500.0     488.0    1000.0     488.0 *     500.    90. AG    718.  18.5    .0 32.0
      25. WB70                *   1500.0     375.0        .0    -285.0 *    1639.   246. DP   7530.  13.4    .0 56.0
      26. EB70                *       .0    -415.0    1500.0     250.0 *    1641.    66. DP   8345.  13.4    .0 56.0
1
                                                                                                                        PAGE  2
      JOB: Ward Road/I70 Intersection                           RUN: 2005 Existing PM        Job#05154
```

DATE: 03/12/2006   TIME: 20:41

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. Nblt 1 Que	100	92	2.0	20	1800	120.00	1	3
2. NbWR 2 Que	100	56	2.0	783	1800	120.00	1	3
3. NbWR 3 Que	100	56	2.0	784	1800	120.00	1	3
4. Nbrt 4 Que	100	56	2.0	196	1800	120.00	1	3
5. Wb70 1 Que	100	86	2.0	12	1800	120.00	1	3
6. Wbrt 2 Que	100	56	2.0	729	1800	120.00	1	3
7. Sblt 1 Que	100	75	2.0	509	1800	120.00	1	3
8. SbWR 2 Que	100	39	2.0	628	1800	120.00	1	3
9. Sbrt 3 Que	100	39	2.0	628	1800	120.00	1	3
10. Sbrt 4 Que	100	39	2.0	8	1800	120.00	1	3
11. Eblt 1 Que	100	91	2.0	30	1800	120.00	1	3
12. Eb70 2 Que	100	91	2.0	13	1800	120.00	1	3

RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (FT) X	Y	Z
1. R-1	552.0	420.0	6.0
2. R-2	552.0	370.0	6.0
3. R-3	424.0	468.0	6.0
4. R-4	374.0	468.0	6.0
5. R-5	448.0	580.0	6.0
6. R-6	448.0	630.0	6.0
7. R-7	576.0	544.0	6.0
8. R-8	626.0	544.0	6.0

1

JOB: Ward Road/I70 Intersection   RUN: 2005 Existing PM   Job#05154

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) REC1	REC2	REC3	REC4	REC5	REC6	REC7	REC8
0.	1.7	1.7	1.0	.2	1.2	1.0	.6	.2

5.	*	1.3	1.2	1.5	.4	1.5	1.2	.4	.1
10.	*	.8	.9	1.7	.7	1.9	1.6	.2	.0
15.	*	.7	.7	2.0	.7	2.0	1.7	.0	.0
20.	*	.6	.5	2.0	.8	2.2	2.0	.0	.0
25.	*	.6	.5	1.9	1.1	2.2	2.0	.0	.0
30.	*	.6	.5	1.7	1.2	2.3	2.0	.0	.0
35.	*	.7	.5	1.6	1.1	2.3	2.2	.0	.0
40.	*	.7	.6	1.5	1.2	2.1	2.1	.0	.0
45.	*	.7	.6	1.3	1.0	2.0	2.0	.0	.0
50.	*	.7	.6	1.3	.8	2.0	2.0	.0	.0
55.	*	.7	.6	1.1	.7	1.9	1.9	.0	.0
60.	*	.7	.5	1.1	.8	1.9	1.9	.0	.0
65.	*	.7	.4	1.4	.8	1.8	1.8	.0	.0
70.	*	.7	.4	1.4	1.0	1.8	1.8	.1	.1
75.	*	.7	.4	1.4	1.3	1.8	1.8	.2	.2
80.	*	.5	.4	1.5	1.5	1.9	1.8	.3	.3
85.	*	.7	.5	1.4	1.2	1.9	1.8	.6	.6
90.	*	.6	.6	1.4	1.3	2.2	1.9	1.0	.9
95.	*	.8	.9	1.5	1.4	2.5	2.1	1.5	1.5
100.	*	.9	1.1	1.9	1.7	2.7	2.4	1.8	1.7
105.	*	1.1	1.2	1.9	1.7	2.9	2.8	2.1	2.1
110.	*	1.2	1.3	2.1	1.7	2.8	2.9	2.3	2.3
115.	*	1.3	1.3	2.1	1.8	2.9	3.1	2.3	2.3
120.	*	1.2	1.3	2.3	1.7	2.9	3.3	2.4	2.5
125.	*	1.2	1.3	2.2	1.7	2.9	3.3	2.4	2.5
130.	*	1.2	1.3	2.2	1.8	2.7	3.2	2.4	2.5
135.	*	1.2	1.3	2.2	1.8	2.5	3.3	2.3	2.4
140.	*	1.2	1.3	2.2	1.8	2.6	3.1	2.2	2.3
145.	*	1.2	1.3	2.2	1.8	2.5	3.2	2.2	2.2
150.	*	1.2	1.3	2.3	1.8	2.8	3.0	2.2	2.2
155.	*	1.2	1.3	2.3	1.8	2.9	3.0	2.2	2.2
160.	*	1.2	1.3	2.2	1.8	2.5	3.1	2.2	2.2
165.	*	1.5	1.6	2.0	1.8	2.7	2.9	2.2	2.2
170.	*	1.7	1.8	1.9	1.5	2.7	2.2	2.4	2.3
175.	*	2.1	2.1	1.8	1.2	2.3	2.1	2.7	2.5
180.	*	2.6	2.6	1.4	1.2	2.1	1.9	3.0	2.5
185.	*	2.9	2.9	1.4	1.0	1.6	1.5	3.5	2.9
190.	*	3.3	3.2	1.0	1.0	1.4	1.1	3.5	2.9
195.	*	3.5	3.3	1.0	.9	.9	.8	3.6	3.1
200.	*	3.7	3.3	.9	.7	.8	.7	3.6	3.2
205.	*	3.4	3.2	.7	.5	.7	.5	3.2	3.2

1

JOB: Ward Road/I70 Intersection RUN: 2005 Existing PM Job#05154

WIND ANGLE (DEGR)	*	CONCENTRATION (PPM) REC1	REC2	REC3	REC4	REC5	REC6	REC7	REC8

```
 ------*--------------------------------------------------
 210.  *   3.4   3.0    .5    .3    .4    .3   2.9   3.1
 215.  *   3.2   2.9    .3    .2    .2    .2   2.5   2.9
 220.  *   2.9   2.5    .2    .1    .1    .0   2.1   2.4
 225.  *   2.5   2.0    .0    .0    .0    .0   1.8   2.2
 230.  *   2.1   1.8    .0    .0    .0    .0   1.5   2.0
 235.  *   2.0   1.6    .0    .0    .0    .0   1.4   1.8
 240.  *   2.0   1.5    .0    .0    .0    .0   1.5   1.7
 245.  *   2.0   1.5    .0    .0    .0    .0   1.3   1.6
 250.  *   1.9   1.4    .0    .0    .0    .0   1.0   1.4
 255.  *   1.9   1.4    .0    .0    .0    .0    .9   1.1
 260.  *   1.9   1.4    .0    .0    .0    .0    .8   1.1
 265.  *   2.0   1.4    .0    .0    .0    .0    .8    .9
 270.  *   2.0   1.4    .0    .0    .0    .0    .9    .9
 275.  *   2.0   1.4    .0    .0    .0    .0   1.0    .9
 280.  *   2.0   1.5    .0    .0    .0    .0   1.0    .9
 285.  *   1.8   1.5    .0    .0    .0    .0   1.1   1.0
 290.  *   1.8   1.6    .0    .0    .0    .0   1.1   1.0
 295.  *   1.8   1.6    .0    .0    .0    .0   1.2   1.0
 300.  *   1.8   1.7    .0    .0    .0    .0   1.3   1.0
 305.  *   1.7   1.8    .0    .0    .0    .0   1.3   1.0
 310.  *   1.6   1.9    .0    .0    .0    .0   1.4   1.0
 315.  *   1.5   2.0    .0    .0    .0    .0   1.5   1.0
 320.  *   1.6   2.2    .0    .0    .0    .0   1.5   1.0
 325.  *   1.8   2.3    .0    .0    .0    .0   1.6    .9
 330.  *   2.0   2.7    .0    .0    .0    .0   1.6    .9
 335.  *   2.2   2.6    .0    .0    .0    .0   1.5    .9
 340.  *   2.3   2.6    .1    .0    .0    .0   1.3    .9
 345.  *   2.4   2.8    .1    .0    .2    .2   1.2    .7
 350.  *   2.3   2.2    .2    .0    .4    .3   1.1    .5
 355.  *   1.8   2.0    .6    .1    .7    .7   1.0    .4
 ------*--------------------------------------------------
 MAX   *   3.7   3.3   2.3   1.8   2.9   3.3   3.6   3.2
 DEGR. *  200   195   120   115   105   120   195   200
 THE HIGHEST CONCENTRATION IS    3.70     AT  200 DEGREES FROM REC1 .
1
                                                                                                                     PAGE  5
      JOB: Ward Road/I70 Intersection                                 RUN: 2005 Existing PM        Job#05154
      DATE: 03/12/2006   TIME: 20:41
      RECEPTOR - LINK MATRIX FOR THE ANGLE PRODUCING
      THE MAXIMUM CONCENTRATION FOR EACH RECEPTOR
          *    CO/LINK  (PPM)
          *    ANGLE (DEGREES)
          *  REC1  REC2  REC3  REC4  REC5  REC6  REC7  REC8
   LINK # *   200   195   120   115   105   120   195   200
   -------*------------------------------------------------
       1  *    .0    .0    .1    .0    .0    .0    .0    .0
```

2	*	.5	.5	.2	.1	.0	.0	.3	.2
3	*	.6	.6	.2	.1	.0	.0	.3	.2
4	*	.4	.0	.1	.1	.0	.0	.1	.1
5	*	.0	.0	.0	.0	.0	.0	.1	.0
6	*	.0	.0	.0	.0	.3	.2	.4	.5
7	*	.0	.0	.0	.0	.2	.4	.0	.0
8	*	.0	.0	.0	.0	.2	.2	.0	.0
9	*	.0	.0	.0	.0	.2	.3	.0	.0
10	*	.0	.0	.0	.0	.0	.0	.0	.0
11	*	.0	.0	.0	.0	.0	.0	.0	.0
12	*	.0	.0	.0	.0	.0	.0	.0	.0
13	*	.3	.3	.2	.1	.0	.0	.2	.1
14	*	.4	.4	.1	.1	.0	.0	.3	.1
15	*	.0	.0	.0	.0	.3	.2	.4	.4
16	*	.0	.0	.0	.0	.2	.3	.0	.0
17	*	.0	.0	.0	.0	.3	.3	.0	.0
18	*	.0	.0	.0	.0	.0	.0	.0	.0
19	*	.0	.0	.0	.0	.2	.2	.0	.0
20	*	.0	.0	.0	.0	.2	.2	.0	.0
21	*	.0	.0	.0	.0	.0	.0	.0	.0
22	*	.2	.1	.1	.1	.0	.0	.1	.1
23	*	.1	.1	.2	.1	.0	.0	.1	.1
24	*	.0	.0	.0	.0	.2	.2	.3	.3
25	*	.6	.7	.6	.6	.4	.4	.5	.6
26	*	.6	.6	.5	.5	.2	.4	.5	.5

****

(Modified by Balloffet & Associates, April, 1994)

POLLUTANT MODELLED: CARBON MONOXIDE

JOB: Ward Road/44th Ave Intersection RUN: 2030 No Build PM Job#05154

DATE: 03/12/2006 TIME: 20:43

SITE & METEOROLOGICAL VARIABLES

VS = .0 cm/s VD = .0 cm/s Z0 = 175. cm TMPC = 2.0Deg C ALT =1609.0 m

U = 1.0 m/s CLAS = 4 (D) ATIM = 60. Minutes MIXH = 1000. m AMB = .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. Wb44 1 Que	*	545.0	500.0	622.3	500.0	*	77.	90.	AG	135.	100.0	.0	12.0	.48	3.9
2. Wb44 2 Que	*	545.0	512.0	622.7	512.0	*	78.	90.	AG	135.	100.0	.0	12.0	.48	3.9
3. Sblt 1 Que	*	500.0	540.0	500.0	695.5	*	156.	360.	AG	108.	100.0	.0	12.0	.72	7.9
4. Sblt 2 Que	*	488.0	540.0	488.0	695.5	*	156.	360.	AG	108.	100.0	.0	12.0	.72	7.9
5. Eblt 1 Que	*	460.0	488.0	329.1	488.0	*	131.	270.	AG	133.	100.0	.0	12.0	.76	6.7
6. Eblt 2 Que	*	460.0	476.0	328.4	476.0	*	132.	270.	AG	133.	100.0	.0	12.0	.76	6.7
7. Eb44 3 Que	*	460.0	464.0	392.8	464.0	*	67.	270.	AG	82.	100.0	.0	12.0	.30	3.4

8. Eb44 4 Que	*	460.0	452.0	392.6	452.0 *	67.	270.	AG	82.	100.0	.0	12.0	.30	3.4
9. Wb44 1 Apr	*	1000.0	500.0	500.0	500.0 *	500.	270.	AG	382.	6.7	.0	32.0		
10. Wb44 2 Apr	*	1000.0	512.0	500.0	512.0 *	500.	270.	AG	383.	6.7	.0	32.0		
11. WbRT 1 FFL	*	590.0	524.0	524.0	570.0 *	80.	305.	AG	905.	6.7	.0	32.0		
12. SbRT 1 FFL	*	476.0	570.0	435.0	524.0 *	62.	222.	AG	520.	6.7	.0	32.0		
13. Eb44 3 Apr	*	.0	464.0	500.0	464.0 *	500.	90.	AG	355.	6.7	.0	32.0		
14. Eb44 4 Apr	*	.0	452.0	500.0	452.0 *	500.	90.	AG	355.	6.7	.0	32.0		
15. Wb44 1 Dprt	*	500.0	500.0	.0	500.0 *	500.	270.	AG	382.	6.7	.0	32.0		
16. Wb44 2 Dprt	*	500.0	512.0	.0	512.0 *	500.	270.	AG	383.	6.7	.0	32.0		
17. Eb44 3 Dprt	*	500.0	464.0	1000.0	464.0 *	500.	90.	AG	355.	6.7	.0	32.0		
18. Eb44 4 Dprt	*	500.0	452.0	1000.0	452.0 *	500.	90.	AG	355.	6.7	.0	32.0		
19. WB70	*	1000.0	1300.0	.0	800.0 *	1118.	243.	DP	7530.	8.0	.0	56.0		
20. EB70	*	.0	700.0	1000.0	1200.0 *	1118.	63.	DP	8345.	8.0	.0	56.0		

1

JOB: Ward Road/44th Ave Intersection RUN: 2030 No Build PM Job#05154
DATE: 03/12/2006 TIME: 20:43

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. Wb44 1 Que	*	100	74	2.0	191	1800	68.00	1	3
2. Wb44 2 Que	*	100	74	2.0	192	1800	68.00	1	3
3. Sblt 1 Que	*	100	59	2.0	482	1800	68.00	1	3
4. Sblt 2 Que	*	100	59	2.0	482	1800	68.00	1	3
5. Eblt 1 Que	*	100	73	2.0	313	1800	68.00	1	3
6. Eblt 2 Que	*	100	73	2.0	314	1800	68.00	1	3
7. Eb44 3 Que	*	100	45	2.0	273	1800	68.00	1	3
8. Eb44 4 Que	*	100	45	2.0	274	1800	68.00	1	3

RECEPTOR LOCATIONS

RECEPTOR	*	COORDINATES (FT) X	Y	Z	*
1. R-3	*	440.0	436.0	6.0	*
2. R-4	*	390.0	436.0	6.0	*
3. R-5	*	460.0	590.0	6.0	*
4. R-6	*	460.0	640.0	6.0	*
5. R-7	*	540.0	610.0	6.0	*
6. R-8	*	540.0	660.0	6.0	*

1

JOB: Ward Road/44th Ave Intersection RUN: 2030 No Build PM Job#05154

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)					
	REC1	REC2	REC3	REC4	REC5	REC6
0.	1.8	1.5	1.0	1.0	.9	1.0
5.	1.9	1.5	1.0	1.0	.9	1.0
10.	1.8	1.5	1.1	1.1	.9	1.0
15.	1.8	1.6	1.3	1.2	.9	1.0
20.	1.7	1.8	1.3	1.2	.9	1.0
25.	1.6	1.9	1.4	1.2	.8	1.0
30.	1.4	1.9	1.3	1.3	.8	.8
35.	1.2	1.7	1.3	1.2	.6	.8
40.	.9	1.5	1.1	1.1	.4	.6
45.	.6	1.5	.9	1.0	.3	.3
50.	.6	1.1	.8	.7	.1	.2
55.	.5	1.0	.5	.5	.0	.1
60.	.5	.9	.4	.5	.0	.0
65.	.7	.9	.4	.4	.0	.0
70.	.8	.8	.4	.4	.0	.0
75.	.6	.7	.4	.4	.0	.0
80.	.4	.6	.4	.4	.0	.0
85.	.3	.4	.4	.4	.0	.0
90.	.3	.3	.4	.4	.0	.0
95.	.2	.2	.5	.4	.0	.0
100.	.0	.1	.5	.4	.0	.0
105.	.0	.0	.5	.4	.0	.0
110.	.0	.0	.7	.4	.0	.0
115.	.0	.0	.8	.4	.0	.0
120.	.0	.0	.8	.4	.0	.0
125.	.0	.0	.7	.5	.0	.0
130.	.0	.0	.7	.8	.0	.0
135.	.0	.0	.5	.8	.1	.0
140.	.0	.0	.5	.8	.3	.0
145.	.0	.0	.4	.8	.3	.0
150.	.0	.0	.4	.4	.3	.1
155.	.0	.0	.2	.3	.3	.2
160.	.0	.0	.2	.3	.3	.3
165.	.0	.0	.2	.3	.3	.3
170.	.0	.0	.1	.2	.3	.3
175.	.0	.0	.1	.1	.3	.3
180.	.0	.0	.3	.2	.3	.1
185.	.0	.0	.3	.2	.1	.2

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 190.  *    .0    .0    .3    .2    .1    .1
 195.  *    .0    .0    .3    .2    .1    .2
 200.  *    .0    .0    .3    .2    .2    .2
 205.  *    .0    .0    .3    .2    .2    .3
1
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      JOB: Ward Road/44th Ave Intersection               RUN: 2030 No Build PM        Job#05154
 WIND  * CONCENTRATION
 ANGLE *      (PPM)
 (DEGR)* REC1  REC2  REC3  REC4  REC5  REC6
 ------*------------------------------------
 210.  *    .0    .0    .3    .2    .3    .5
 215.  *    .0    .0    .2    .2    .4    .6
 220.  *    .0    .0    .2    .2    .5    .6
 225.  *    .0    .0    .2    .0    .5    .6
 230.  *    .0    .0    .2    .0    .5    .5
 235.  *    .0    .0    .2    .0    .6    .4
 240.  *    .0    .0    .1    .0    .6    .4
 245.  *    .0    .0    .1    .0    .5    .4
 250.  *    .0    .0    .0    .0    .4    .4
 255.  *    .1    .1    .0    .0    .4    .4
 260.  *    .1    .1    .0    .1    .4    .5
 265.  *    .1    .1    .0    .1    .5    .6
 270.  *    .3    .2    .1    .2    .5    .8
 275.  *    .5    .3    .1    .4    .6    .9
 280.  *    .5    .3    .2    .5    .8   1.0
 285.  *    .8    .3    .4    .7    .9   1.0
 290.  *   1.1    .6    .6    .7   1.0   1.2
 295.  *   1.1    .6    .7    .9   1.2   1.3
 300.  *   1.4    .8    .8   1.0   1.2   1.2
 305.  *   1.6   1.0    .8   1.0   1.3   1.2
 310.  *   1.8   1.0    .9   1.0   1.3   1.2
 315.  *   1.9   1.1    .9   1.0   1.3   1.0
 320.  *   1.9   1.3    .9   1.0   1.2   1.0
 325.  *   1.8   1.4    .9   1.0   1.2    .9
 330.  *   1.7   1.3    .9   1.0   1.2   1.0
 335.  *   1.7   1.3    .9   1.0   1.1   1.0
 340.  *   1.7   1.3    .9   1.0   1.0   1.0
 345.  *   1.7   1.3    .9   1.0   1.0    .9
 350.  *   1.7   1.3    .9   1.0    .9    .9
 355.  *   1.7   1.4    .9   1.0    .9   1.0
 ------*------------------------------------
 MAX   *   1.9   1.9   1.4   1.3   1.3   1.3
 DEGR. *  315    25    25    30   305   295
 THE HIGHEST CONCENTRATION IS    1.90     AT  315 DEGREES FROM REC1 .
1
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JOB: Ward Road/44th Ave Intersection RUN: 2030 No Build PM Job#05154
DATE: 03/12/2006 TIME: 20:43
RECEPTOR - LINK MATRIX FOR THE ANGLE PRODUCING
THE MAXIMUM CONCENTRATION FOR EACH RECEPTOR

CO/LINK (PPM)
ANGLE (DEGREES)

LINK #	REC1 315	REC2 25	REC3 25	REC4 30	REC5 305	REC6 295
1	.0	.0	.0	.0	.0	.0
2	.0	.0	.0	.0	.0	.0
3	.0	.1	.2	.1	.2	.2
4	.0	.1	.2	.2	.2	.1
5	.2	.2	.0	.0	.0	.0
6	.3	.2	.0	.0	.0	.0
7	.2	.2	.0	.0	.0	.0
8	.3	.2	.0	.0	.0	.0
9	.0	.0	.0	.0	.0	.0
10	.0	.0	.0	.0	.0	.0
11	.0	.0	.0	.0	.0	.0
12	.0	.0	.0	.0	.0	.0
13	.1	.1	.0	.0	.0	.0
14	.1	.1	.0	.0	.0	.0
15	.1	.0	.0	.0	.0	.0
16	.0	.0	.0	.0	.0	.0
17	.0	.0	.0	.0	.0	.0
18	.0	.0	.0	.0	.0	.0
19	.2	.3	.4	.4	.4	.4
20	.4	.4	.6	.6	.5	.6

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POLLUTANT MODELLED: CARBON MONOXIDE

JOB: Ward Road/I70 Intersection RUN: 2030 No Build PM Job#05154
DATE: 03/12/2006 TIME: 20:45

SITE & METEOROLOGICAL VARIABLES

VS = .0 cm/s VD = .0 cm/s Z0 = 175. cm TMPC = 2.0Deg C ALT =1609.0 m
U = 1.0 m/s CLAS = 4 (D) ATIM = 60. Minutes MIXH = 1000. m AMB = .0 ppm

LINK VARIABLES

LINK DESCRIPTION	X1	Y1	X2	Y2	LENGTH (FT)	BRG (DEG)	TYPE	VPH	EF (G/MI)	H (FT)	W (FT)	V/C	QUEUE (VEH)
1. Nblt 1 Que	500.0	440.0	500.0	429.8	10.	180.	AG	170.	100.0	.0	12.0	.37	.5
2. NbWR 2 Que	512.0	440.0	512.0	-1472.5	1912.	180.	AG	115.	100.0	.0	12.0	1.26	97.2
3. NbWR 3 Que	524.0	440.0	524.0	-1462.1	1902.	180.	AG	115.	100.0	.0	12.0	1.26	96.6

4. Nbrt 4 Que	536.0	440.0	536.0	336.7	103.	180.	AG	115.	100.0	.0	12.0	.51	5.3
5. Wb70 1 Que	560.0	512.0	652.5	512.0	93.	90.	AG	142.	100.0	.0	12.0	.66	4.7
6. Wbrt 2 Que	560.0	524.0	1587.1	524.0	1027.	90.	AG	106.	100.0	.0	12.0	1.10	52.2
7. Sblt 1 Que	500.0	560.0	500.0	676.4	116.	360.	AG	102.	100.0	.0	12.0	.53	5.9
8. SbWR 2 Que	488.0	560.0	488.0	900.0	340.	360.	AG	102.	100.0	.0	12.0	.99	17.3
9. Sbrt 3 Que	476.0	560.0	476.0	900.0	340.	360.	AG	102.	100.0	.0	12.0	.99	17.3
10. Sbrt 4 Que	464.0	560.0	464.0	563.1	3.	360.	AG	102.	100.0	.0	12.0	.01	.2
11. Eblt 1 Que	440.0	500.0	426.7	500.0	13.	270.	AG	148.	100.0	.0	12.0	.11	.7
12. Eb70 2 Que	440.0	488.0	433.4	488.0	7.	270.	AG	148.	100.0	.0	12.0	.06	.3
13. NbWR 2 Apr	512.0	.0	512.0	500.0	500.	360.	AG	907.	6.7	.0	32.0		
14. NbWR 3 Apr	524.0	.0	524.0	500.0	500.	360.	AG	908.	6.7	.0	32.0		
15. Wb70 1 Apr	1000.0	512.0	500.0	512.0	500.	270.	AG	965.	8.8	.0	32.0		
16. SbWR 2 Apr	488.0	1000.0	488.0	500.0	500.	180.	AG	910.	6.7	.0	32.0		
17. SbWR 3 Apr	476.0	1000.0	476.0	500.0	500.	180.	AG	910.	6.7	.0	32.0		
18. Eb70 2 Apr	.0	488.0	500.0	488.0	500.	90.	AG	90.	6.7	.0	32.0		
19. NbWR 2 Dprt	512.0	500.0	512.0	1000.0	500.	360.	AG	1137.	6.7	.0	32.0		
20. NbWR 2 Dprt	524.0	500.0	524.0	1000.0	500.	360.	AG	1138.	6.7	.0	32.0		
21. Wb70 1 Dprt	500.0	512.0	.0	512.0	500.	270.	AG	30.	6.7	.0	32.0		
22. SbWR 2 Dprt	488.0	500.0	488.0	.0	500.	180.	AG	825.	6.7	.0	32.0		
23. SbWR 3 Dprt	476.0	500.0	476.0	.0	500.	180.	AG	825.	6.7	.0	32.0		
24. Eb70 2 Dprt	500.0	488.0	1000.0	488.0	500.	90.	AG	695.	8.8	.0	32.0		
25. WB70	1500.0	375.0	.0	-285.0	1639.	246.	DP	7530.	8.0	.0	56.0		
26. EB70	.0	-415.0	1500.0	250.0	1641.	66.	DP	8345.	8.0	.0	56.0		

1

JOB: Ward Road/I70 Intersection RUN: 2030 No Build PM Job#05154

DATE: 03/12/2006 TIME: 20:45

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. Nblt 1 Que	100	93	2.0	20	1800	68.00	1	3
2. NbWR 2 Que	100	63	2.0	747	1800	68.00	1	3
3. NbWR 3 Que	100	63	2.0	746	1800	68.00	1	3
4. Nbrt 4 Que	100	63	2.0	300	1800	68.00	1	3
5. Wb70 1 Que	100	78	2.0	215	1800	68.00	1	3
6. Wbrt 2 Que	100	58	2.0	750	1800	68.00	1	3
7. Sblt 1 Que	100	56	2.0	380	1800	68.00	1	3
8. SbWR 2 Que	100	56	2.0	715	1800	68.00	1	3
9. Sbrt 3 Que	100	56	2.0	715	1800	68.00	1	3
10. Sbrt 4 Que	100	56	2.0	10	1800	68.00	1	3
11. Eblt 1 Que	100	81	2.0	30	1800	68.00	1	3
12. Eb70 2 Que	100	81	2.0	15	1800	68.00	1	3

RECEPTOR LOCATIONS

RECEPTOR	*	COORDINATES (FT) X	Y	Z	*
1. R-1	*	552.0	420.0	6.0	*
2. R-2	*	552.0	370.0	6.0	*
3. R-3	*	424.0	468.0	6.0	*
4. R-4	*	374.0	468.0	6.0	*
5. R-5	*	448.0	580.0	6.0	*
6. R-6	*	448.0	630.0	6.0	*
7. R-7	*	576.0	544.0	6.0	*
8. R-8	*	626.0	544.0	6.0	*

1

JOB: Ward Road/I70 Intersection RUN: 2030 No Build PM Job#05154

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) REC1	REC2	REC3	REC4	REC5	REC6	REC7	REC8
0.	*	1.0	.9	.5	.0	.7	.7	.2	.0
5.	*	.6	.7	.7	.0	.8	.8	.1	.0
10.	*	.6	.7	.8	.4	1.1	1.0	.0	.0
15.	*	.4	.4	1.1	.6	1.3	1.2	.0	.0
20.	*	.4	.4	1.0	.6	1.4	1.3	.0	.0
25.	*	.4	.4	1.0	.6	1.5	1.3	.0	.0
30.	*	.4	.4	1.0	.6	1.5	1.4	.0	.0
35.	*	.4	.4	.9	.7	1.4	1.3	.0	.0
40.	*	.4	.3	.8	.7	1.3	1.3	.0	.0
45.	*	.4	.3	.5	.7	1.4	1.3	.0	.0
50.	*	.4	.3	.6	.6	1.3	1.2	.0	.0
55.	*	.4	.3	.7	.4	1.3	1.1	.0	.0
60.	*	.3	.3	.8	.6	1.2	1.1	.0	.0
65.	*	.3	.3	1.0	.7	1.2	1.1	.0	.0
70.	*	.3	.3	.9	.5	1.1	1.1	.0	.0
75.	*	.3	.3	.9	.5	1.1	1.1	.1	.1
80.	*	.4	.2	1.1	.6	1.2	1.1	.3	.3
85.	*	.4	.4	1.2	.8	1.2	1.2	.3	.3
90.	*	.4	.4	1.0	.9	1.3	1.3	.7	.7
95.	*	.4	.5	1.0	1.0	1.6	1.4	1.0	.8
100.	*	.5	.7	1.2	1.1	1.9	1.6	1.2	1.1
105.	*	.7	.7	1.3	1.2	1.9	1.7	1.2	1.1

110.	*	.7	.8	1.3	1.3	2.0	1.8	1.6	1.3
115.	*	.7	.8	1.3	1.3	2.0	2.1	1.7	1.4
120.	*	.7	.8	1.3	1.3	1.9	2.1	1.7	1.5
125.	*	.8	.8	1.3	1.3	1.9	2.1	1.7	1.4
130.	*	.8	.8	1.3	1.2	1.6	2.1	1.6	1.4
135.	*	.8	.8	1.3	1.2	1.6	2.1	1.6	1.4
140.	*	.7	.8	1.3	1.2	1.6	1.9	1.6	1.5
145.	*	.7	.8	1.3	1.2	1.5	1.8	1.6	1.5
150.	*	.7	.8	1.4	1.2	1.8	2.1	1.6	1.5
155.	*	.7	.8	1.5	1.2	1.6	2.0	1.6	1.5
160.	*	.7	.8	1.4	1.2	1.6	1.8	1.5	1.5
165.	*	.8	.9	1.4	1.0	1.6	1.6	1.5	1.5
170.	*	1.1	1.1	1.4	.9	1.5	1.8	1.7	1.5
175.	*	1.5	1.4	1.1	.8	1.5	1.6	1.8	1.7
180.	*	1.8	1.6	1.0	.8	1.3	1.3	2.2	1.7
185.	*	2.2	2.0	.8	.6	1.0	1.1	2.3	1.7
190.	*	2.4	2.2	.6	.6	.8	.7	2.3	2.0
195.	*	2.4	2.3	.6	.6	.5	.4	2.4	2.1
200.	*	2.5	2.4	.5	.4	.4	.4	2.3	2.4
205.	*	2.4	2.2	.4	.3	.4	.3	2.0	2.2

1

JOB: Ward Road/I70 Intersection RUN: 2030 No Build PM Job#05154

WIND ANGLE (DEGR)	*	CONCENTRATION (PPM) REC1	REC2	REC3	REC4	REC5	REC6	REC7	REC8
210.	*	2.3	2.3	.3	.2	.2	.2	1.9	2.2
215.	*	2.1	2.0	.2	.1	.1	.1	1.6	2.1
220.	*	1.8	1.8	.1	.0	.0	.0	1.4	2.0
225.	*	1.7	1.7	.0	.0	.0	.0	1.1	1.7
230.	*	1.6	1.5	.0	.0	.0	.0	1.1	1.5
235.	*	1.5	1.4	.0	.0	.0	.0	1.0	1.4
240.	*	1.5	1.4	.0	.0	.0	.0	.7	1.3
245.	*	1.4	1.4	.0	.0	.0	.0	.5	1.0
250.	*	1.3	1.3	.0	.0	.0	.0	.7	.8
255.	*	1.3	1.3	.0	.0	.0	.0	.6	.7
260.	*	1.3	1.3	.0	.0	.0	.0	.6	.6
265.	*	1.3	1.3	.0	.0	.0	.0	.6	.6
270.	*	1.3	1.3	.0	.0	.0	.0	.5	.6
275.	*	1.4	1.3	.0	.0	.0	.0	.5	.5
280.	*	1.4	1.3	.0	.0	.0	.0	.8	.6
285.	*	1.4	1.3	.0	.0	.0	.0	.8	.7
290.	*	1.3	1.3	.0	.0	.0	.0	.8	.7
295.	*	1.3	1.4	.0	.0	.0	.0	.8	.7
300.	*	1.2	1.4	.0	.0	.0	.0	.8	.7
305.	*	1.1	1.5	.0	.0	.0	.0	.9	.7

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 310.  *   1.0   1.5    .0    .0    .0    .0    .9    .7
 315.  *   1.1   1.5    .0    .0    .0    .0    .9    .7
 320.  *   1.0   1.5    .0    .0    .0    .0    .9    .6
 325.  *   1.0   1.4    .0    .0    .0    .0    .9    .6
 330.  *   1.2   1.5    .0    .0    .0    .0    .9    .6
 335.  *   1.3   1.7    .0    .0    .0    .0    .9    .6
 340.  *   1.4   1.5    .0    .0    .0    .0    .8    .5
 345.  *   1.4   1.5    .0    .0    .0    .0    .8    .2
 350.  *   1.2   1.4    .1    .0    .2    .2    .7    .2
 355.  *   1.2   1.3    .3    .0    .4    .4    .2    .0
 ------*------------------------------------------------
 MAX   *   2.5   2.4   1.5   1.3   2.0   2.1   2.4   2.4
 DEGR. *  200   200   155   110   110   115   195   200
 THE HIGHEST CONCENTRATION IS    2.50     AT  200 DEGREES FROM REC1 .
1
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      JOB: Ward Road/I70 Intersection                              RUN: 2030 No Build PM        Job#05154
      DATE: 03/12/2006   TIME: 20:45
      RECEPTOR - LINK MATRIX FOR THE ANGLE PRODUCING
      THE MAXIMUM CONCENTRATION FOR EACH RECEPTOR
          *    CO/LINK  (PPM)
          *    ANGLE (DEGREES)
          *  REC1  REC2  REC3  REC4  REC5  REC6  REC7  REC8
   LINK # *   200   200   155   110   110   115   195   200
   -------*------------------------------------------------
       1  *    .0    .0    .0    .0    .0    .0    .0    .0
       2  *    .3    .3    .2    .1    .0    .0    .2    .2
       3  *    .4    .4    .2    .1    .0    .0    .2    .2
       4  *    .4    .2    .0    .1    .0    .0    .1    .1
       5  *    .0    .0    .0    .0    .1    .1    .2    .3
       6  *    .0    .0    .0    .0    .1    .1    .3    .3
       7  *    .0    .0    .0    .0    .1    .2    .0    .0
       8  *    .0    .0    .0    .0    .1    .2    .0    .0
       9  *    .0    .0    .0    .0    .2    .2    .0    .0
      10  *    .0    .0    .0    .0    .0    .0    .0    .0
      11  *    .0    .0    .0    .0    .0    .0    .0    .0
      12  *    .0    .0    .0    .0    .0    .0    .0    .0
      13  *    .2    .2    .1    .1    .0    .0    .1    .1
      14  *    .3    .3    .1    .1    .0    .0    .2    .1
      15  *    .0    .0    .0    .0    .2    .1    .2    .2
      16  *    .0    .0    .0    .0    .2    .2    .0    .0
      17  *    .0    .0    .0    .0    .2    .2    .0    .0
      18  *    .0    .0    .0    .0    .0    .0    .0    .0
      19  *    .0    .0    .0    .0    .1    .1    .0    .0
      20  *    .0    .0    .0    .0    .1    .1    .0    .0
      21  *    .0    .0    .0    .0    .0    .0    .0    .0
      22  *    .1    .1    .1    .1    .0    .0    .1    .1
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23	*	.1	.1	.2	.1	.0	.0	.1	.1
24	*	.0	.0	.0	.0	.1	.1	.1	.1
25	*	.4	.4	.3	.3	.3	.3	.3	.3
26	*	.3	.4	.3	.3	.2	.2	.3	.3

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(Modified by Balloffet & Associates, April, 1994)

POLLUTANT MODELLED: CARBON MONOXIDE

JOB: Ward Road/44th Ave Intersection RUN: 2030 ProposedAction PM Job#05154

DATE: 03/12/2006 TIME: 20:46

SITE & METEOROLOGICAL VARIABLES

VS = .0 cm/s VD = .0 cm/s Z0 = 175. cm TMPC = 2.0Deg C ALT =1609.0 m

U = 1.0 m/s CLAS = 4 (D) ATIM = 60. Minutes MIXH = 1000. m AMB = .0 ppm

LINK VARIABLES

LINK DESCRIPTION	X1	Y1	X2	Y2	LENGTH (FT)	BRG (DEG)	TYPE	VPH	EF (G/MI)	H (FT)	W (FT)	V/C	QUEUE (VEH)
1. Wb44 1 Que	545.0	500.0	649.4	500.0	104.	90.	AG	91.	100.0	.0	12.0	.46	5.3
2. Wb44 2 Que	545.0	512.0	649.7	512.0	105.	90.	AG	91.	100.0	.0	12.0	.46	5.3
3. Sblt 1 Que	500.0	540.0	500.0	1108.3	568.	360.	AG	120.	100.0	.0	12.0	1.05	28.9
4. Sblt 2 Que	488.0	540.0	488.0	1108.3	568.	360.	AG	120.	100.0	.0	12.0	1.05	28.9
5. Eblt 1 Que	460.0	488.0	-52.1	488.0	512.	270.	AG	131.	100.0	.0	12.0	1.05	26.0
6. Eblt 2 Que	460.0	476.0	-52.1	476.0	512.	270.	AG	131.	100.0	.0	12.0	1.05	26.0
7. Eb44 3 Que	460.0	464.0	354.7	464.0	105.	270.	AG	91.	100.0	.0	12.0	.46	5.3
8. Eb44 4 Que	460.0	452.0	354.7	452.0	105.	270.	AG	91.	100.0	.0	12.0	.46	5.3
9. Wb44 1 Apr	1000.0	500.0	500.0	500.0	500.	270.	AG	382.	6.7	.0	32.0		
10. Wb44 2 Apr	1000.0	512.0	500.0	512.0	500.	270.	AG	383.	6.7	.0	32.0		
11. WbRT 1 FFL	590.0	524.0	524.0	570.0	80.	305.	AG	905.	6.7	.0	32.0		
12. SbRT 1 FFL	476.0	570.0	435.0	524.0	62.	222.	AG	257.	6.7	.0	32.0		
13. SbRT 2 FFL	464.0	570.0	423.0	524.0	62.	222.	AG	258.	6.7	.0	32.0		
14. Eb44 3 Apr	.0	464.0	500.0	464.0	500.	90.	AG	385.	6.7	.0	32.0		
15. Eb44 4 Apr	.0	452.0	500.0	452.0	500.	90.	AG	385.	6.7	.0	32.0		
16. Wb44 1 Dprt	500.0	500.0	.0	500.0	500.	270.	AG	382.	6.7	.0	32.0		
17. Wb44 2 Dprt	500.0	512.0	.0	512.0	500.	270.	AG	383.	6.7	.0	32.0		
18. Eb44 3 Dprt	500.0	464.0	1000.0	464.0	500.	90.	AG	385.	6.7	.0	32.0		
19. Eb44 4 Dprt	500.0	452.0	1000.0	452.0	500.	90.	AG	385.	6.7	.0	32.0		
20. WB70	1000.0	1700.0	.0	1200.0	1118.	243.	DP	7530.	8.0	.0	56.0		
21. EB70	.0	1100.0	1000.0	1600.0	1118.	63.	DP	8345.	8.0	.0	56.0		

JOB: Ward Road/44th Ave Intersection RUN: 2030 ProposedAction PM Job#05154

DATE: 03/12/2006 TIME: 20:46

ADDITIONAL QUEUE LINK PARAMETERS

LINK DESCRIPTION	CYCLE	RED	CLEARANCE	APPROACH	SATURATION	IDLE	SIGNAL	ARRIVAL

	LENGTH (SEC)	TIME (SEC)	LOST TIME (SEC)	VOL (VPH)	FLOW RATE (VPH)	EM FAC (gm/hr)	TYPE	RATE
1. Wb44 1 Que	100	50	2.0	382	1800	68.00	1	3
2. Wb44 2 Que	100	50	2.0	383	1800	68.00	1	3
3. Sblt 1 Que	100	66	2.0	565	1800	68.00	1	3
4. Sblt 2 Que	100	66	2.0	565	1800	68.00	1	3
5. Eblt 1 Que	100	72	2.0	455	1800	68.00	1	3
6. Eblt 2 Que	100	72	2.0	455	1800	68.00	1	3
7. Eb44 3 Que	100	50	2.0	385	1800	68.00	1	3
8. Eb44 4 Que	100	50	2.0	385	1800	68.00	1	3

RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (FT) X	Y	Z
1. R-3	440.0	436.0	6.0
2. R-4	390.0	436.0	6.0
3. R-5	460.0	590.0	6.0
4. R-6	460.0	640.0	6.0
5. R-7	540.0	610.0	6.0
6. R-8	540.0	660.0	6.0

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JOB: Ward Road/44th Ave Intersection RUN: 2030 ProposedAction PM Job#05154

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) REC1	REC2	REC3	REC4	REC5	REC6
0.	1.8	1.7	.9	1.0	.8	.9
5.	2.0	1.8	1.0	1.1	.7	.7
10.	1.9	1.8	1.1	1.2	.6	.6
15.	1.8	1.8	1.2	1.2	.5	.5
20.	1.8	1.7	1.2	1.2	.4	.4
25.	1.3	1.6	1.1	1.1	.3	.3
30.	1.1	1.5	.9	.9	.2	.2
35.	.9	1.4	.8	.8	.1	.1
40.	.7	1.3	.6	.7	.0	.0
45.	.5	1.3	.5	.5	.0	.0
50.	.4	1.1	.5	.5	.0	.0

55.	*	.4	1.0	.5	.5	.0	.0
60.	*	.5	.9	.5	.5	.0	.0
65.	*	.8	.9	.5	.5	.0	.0
70.	*	.9	.7	.5	.5	.0	.0
75.	*	.5	.6	.5	.5	.0	.0
80.	*	.3	.7	.5	.5	.0	.0
85.	*	.3	.5	.5	.5	.0	.0
90.	*	.3	.3	.5	.5	.0	.0
95.	*	.2	.2	.6	.5	.0	.0
100.	*	.0	.1	.6	.5	.0	.0
105.	*	.0	.0	.6	.5	.0	.0
110.	*	.0	.0	.8	.5	.0	.0
115.	*	.0	.0	.9	.5	.0	.0
120.	*	.0	.0	.9	.5	.0	.0
125.	*	.0	.0	.8	.6	.0	.0
130.	*	.0	.0	.8	.7	.0	.0
135.	*	.0	.0	.5	.7	.1	.0
140.	*	.0	.0	.3	.6	.3	.0
145.	*	.0	.0	.3	.6	.3	.0
150.	*	.0	.0	.3	.5	.3	.1
155.	*	.0	.0	.2	.5	.3	.2
160.	*	.0	.0	.1	.3	.3	.3
165.	*	.0	.0	.1	.3	.3	.3
170.	*	.0	.0	.1	.2	.3	.2
175.	*	.0	.0	.1	.1	.2	.1
180.	*	.0	.0	.3	.2	.1	.1
185.	*	.0	.0	.5	.2	.1	.2
190.	*	.0	.0	.6	.2	.1	.1
195.	*	.0	.0	.6	.2	.1	.2
200.	*	.0	.0	.5	.2	.2	.3
205.	*	.0	.0	.5	.2	.3	.4

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JOB: Ward Road/44th Ave Intersection RUN: 2030 ProposedAction PM Job#05154

WIND ANGLE (DEGR)	*	CONCENTRATION (PPM) REC1	REC2	REC3	REC4	REC5	REC6
210.	*	.0	.0	.5	.2	.4	.6
215.	*	.0	.0	.4	.2	.5	.6
220.	*	.0	.0	.2	.2	.5	.6
225.	*	.0	.0	.2	.2	.5	.6
230.	*	.0	.0	.3	.2	.6	.6
235.	*	.0	.0	.4	.2	.6	.6
240.	*	.0	.0	.4	.2	.6	.6
245.	*	.0	.0	.4	.2	.6	.6
250.	*	.0	.0	.2	.2	.6	.6

255.	*	.1	.1	.2	.2	.6	.6
260.	*	.3	.2	.2	.0	.6	.4
265.	*	.5	.3	.2	.0	.5	.4
270.	*	.7	.5	.0	.0	.4	.4
275.	*	1.0	.8	.0	.0	.4	.4
280.	*	1.1	.9	.0	.0	.4	.4
285.	*	1.3	.9	.0	.0	.4	.4
290.	*	1.5	1.2	.0	.0	.4	.4
295.	*	1.6	1.4	.0	.0	.4	.4
300.	*	1.5	1.3	.0	.0	.4	.5
305.	*	1.4	1.2	.0	.1	.5	.5
310.	*	1.4	1.2	.1	.1	.6	.7
315.	*	1.3	1.2	.2	.3	.7	.7
320.	*	1.4	1.4	.3	.3	.8	1.0
325.	*	1.4	1.4	.3	.5	1.0	1.0
330.	*	1.4	1.3	.5	.5	1.0	1.0
335.	*	1.5	1.4	.5	.5	1.0	1.0
340.	*	1.5	1.5	.5	.6	1.0	1.1
345.	*	1.6	1.6	.6	.7	1.0	1.1
350.	*	1.7	1.6	.7	.8	1.0	1.0
355.	*	1.8	1.6	.8	.9	.9	1.0
MAX	*	2.0	1.8	1.2	1.2	1.0	1.1
DEGR.	*	5	5	15	10	325	340

THE HIGHEST CONCENTRATION IS 2.00 AT 5 DEGREES FROM REC1 .

1

JOB: Ward Road/44th Ave Intersection RUN: 2030 ProposedAction PM Job#05154

DATE: 03/12/2006 TIME: 20:46

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

		CO/LINK (PPM)					
	*	ANGLE (DEGREES)					
	*	REC1	REC2	REC3	REC4	REC5	REC6
LINK #	*	5	5	15	10	325	340
1	*	.0	.0	.0	.0	.0	.0
2	*	.0	.0	.0	.0	.0	.0
3	*	.2	.1	.3	.3	.3	.3
4	*	.2	.1	.4	.3	.2	.2
5	*	.2	.2	.0	.0	.0	.0
6	*	.2	.2	.0	.0	.0	.0
7	*	.2	.2	.0	.0	.0	.0
8	*	.3	.3	.0	.0	.0	.0
9	*	.0	.0	.0	.0	.0	.0
10	*	.0	.0	.0	.0	.0	.0
11	*	.0	.0	.0	.0	.0	.0

12	*	.0	.0	.0	.0	.0	.0
13	*	.0	.0	.0	.0	.0	.0
14	*	.1	.1	.0	.0	.0	.0
15	*	.1	.1	.0	.0	.0	.0
16	*	.0	.0	.0	.0	.0	.0
17	*	.0	.0	.0	.0	.0	.0
18	*	.0	.0	.0	.0	.0	.0
19	*	.0	.0	.0	.0	.0	.0
20	*	.2	.2	.2	.3	.2	.3
21	*	.3	.3	.3	.3	.3	.3

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1 CAL3QHC: LINE SOURCE DISPERSION MODEL - VERSION 2.0, JANUARY 1992 PAGE 1

(Modified by Balloffet & Associates, April, 1994)

POLLUTANT MODELLED: CARBON MONOXIDE

JOB: Ward Road/I70 Intersection RUN: 2030 ProposedAction PM Job#05154

DATE: 03/12/2006 TIME: 20:37

SITE & METEOROLOGICAL VARIABLES

VS = .0 cm/s VD = .0 cm/s Z0 = 175. cm TMPC = 2.0Deg C ALT =1609.0 m

U = 1.0 m/s CLAS = 4 (D) ATIM = 60. Minutes MIXH = 1000. m AMB = .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. Nblt 1 Que	*	500.0	440.0	500.0	429.8	*	10.	180.	AG	170.	100.0	.0	12.0	.37	.5
2. NbWR 2 Que	*	512.0	440.0	512.0	-1105.6	*	1546.	180.	AG	111.	100.0	.0	12.0	1.19	78.5
3. NbWR 3 Que	*	524.0	440.0	524.0	-1095.3	*	1535.	180.	AG	111.	100.0	.0	12.0	1.18	78.0
4. Nbrt 4 Que	*	536.0	440.0	536.0	339.9	*	100.	180.	AG	111.	100.0	.0	12.0	.48	5.1
5. Wb70 1 Que	*	560.0	512.0	563.7	512.0	*	4.	90.	AG	124.	100.0	.0	12.0	.02	.2
6. Wbrt 2 Que	*	560.0	524.0	1953.5	524.0	*	1393.	90.	AG	109.	100.0	.0	12.0	1.16	70.8
7. SbWlt1 Que	*	500.0	560.0	500.0	1736.7	*	1177.	360.	AG	166.	100.0	.0	12.0	2.11	59.8
8. SbWlt2 Que	*	488.0	560.0	488.0	1736.7	*	1177.	360.	AG	166.	100.0	.0	12.0	2.11	59.8
9. SbWR 3 Que	*	476.0	560.0	476.0	1590.8	*	1031.	360.	AG	109.	100.0	.0	12.0	1.10	52.4
10. SbWR 4 Que	*	464.0	560.0	464.0	1590.8	*	1031.	360.	AG	109.	100.0	.0	12.0	1.10	52.4
11. Sbrt 5 Que	*	452.0	560.0	452.0	563.3	*	3.	360.	AG	109.	100.0	.0	12.0	.02	.2
12. Eblt 1 Que	*	440.0	500.0	425.7	500.0	*	14.	270.	AG	159.	100.0	.0	12.0	.19	.7
13. Eb70 2 Que	*	440.0	488.0	432.9	488.0	*	7.	270.	AG	159.	100.0	.0	12.0	.09	.4
14. NbWR 2 Apr	*	512.0	.0	512.0	500.0	*	500.	360.	AG	907.	6.7	.0	32.0		
15. NbWR 3 Apr	*	524.0	.0	524.0	500.0	*	500.	360.	AG	908.	6.7	.0	32.0		
16. Wb70 1 Apr	*	1000.0	512.0	500.0	512.0	*	500.	270.	AG	760.	8.8	.0	32.0		
17. SbWR 3 Apr	*	476.0	1000.0	476.0	500.0	*	500.	180.	AG	910.	6.7	.0	32.0		
18. SbWR 4 Apr	*	464.0	1000.0	464.0	500.0	*	500.	180.	AG	910.	6.7	.0	32.0		
19. Eb70 2 Apr	*	.0	488.0	500.0	488.0	*	500.	90.	AG	45.	6.7	.0	32.0		
20. NbWR 2 Dprt	*	512.0	500.0	512.0	1000.0	*	500.	360.	AG	1137.	6.7	.0	32.0		
21. NbWR 2 Dprt	*	524.0	500.0	524.0	1000.0	*	500.	360.	AG	1138.	6.7	.0	32.0		
22. Wb70 1 Dprt	*	500.0	512.0	.0	512.0	*	500.	270.	AG	40.	6.7	.0	32.0		

23. SbWR 3 Dprt	*	476.0	500.0	476.0	.0 *	500.	180. AG	922.	6.7	.0	32.0
24. SbWR 4 Dprt	*	464.0	500.0	464.0	.0 *	500.	180. AG	923.	6.7	.0	32.0
25. Eb70 2 Dprt	*	500.0	488.0	1000.0	488.0 *	500.	90. AG	695.	8.8	.0	32.0
26. WB70	*	1500.0	375.0	.0	-285.0 *	1639.	246. DP	7530.	8.0	.0	56.0
27. EB70	*	.0	-415.0	1500.0	250.0 *	1641.	66. DP	8345.	8.0	.0	56.0

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JOB: Ward Road/I70 Intersection RUN: 2030 ProposedAction PM Job#05154
DATE: 03/12/2006 TIME: 20:37

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. Nblt 1 Que	*	100	93	2.0	20	1800	68.00	1	3
2. NbWR 2 Que	*	100	61	2.0	747	1800	68.00	1	3
3. NbWR 3 Que	*	100	61	2.0	746	1800	68.00	1	3
4. Nbrt 4 Que	*	100	61	2.0	300	1800	68.00	1	3
5. Wb70 1 Que	*	100	68	2.0	10	1800	68.00	1	3
6. Wbrt 2 Que	*	100	60	2.0	750	1800	68.00	1	3
7. SbWlt1 Que	*	100	91	2.0	190	1800	68.00	1	3
8. SbWlt2 Que	*	100	91	2.0	190	1800	68.00	1	3
9. SbWR 3 Que	*	100	60	2.0	715	1800	68.00	1	3
10. SbWR 4 Que	*	100	60	2.0	715	1800	68.00	1	3
11. Sbrt 5 Que	*	100	60	2.0	10	1800	68.00	1	3
12. Eblt 1 Que	*	100	87	2.0	30	1800	68.00	1	3
13. Eb70 2 Que	*	100	87	2.0	15	1800	68.00	1	3

RECEPTOR LOCATIONS

RECEPTOR	*	COORDINATES (FT) X	Y	Z	*
1. R-1	*	552.0	420.0	6.0	*
2. R-2	*	552.0	370.0	6.0	*
3. R-3	*	424.0	468.0	6.0	*
4. R-4	*	374.0	468.0	6.0	*
5. R-5	*	436.0	580.0	6.0	*
6. R-6	*	436.0	630.0	6.0	*
7. R-7	*	576.0	544.0	6.0	*
8. R-8	*	626.0	544.0	6.0	*

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JOB: Ward Road/I70 Intersection RUN: 2030 ProposedAction PM Job#05154

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) REC1	REC2	REC3	REC4	REC5	REC6	REC7	REC8
0.	*	1.2	1.3	1.1	.4	1.2	1.2	.7	.2
5.	*	1.0	1.0	1.6	.6	1.6	1.5	.3	.0
10.	*	.7	.8	1.8	.8	1.8	1.8	.1	.0
15.	*	.3	.3	1.9	1.1	2.1	2.1	.0	.0
20.	*	.3	.3	1.9	1.1	2.0	2.0	.0	.0
25.	*	.3	.3	1.4	1.0	2.0	1.9	.0	.0
30.	*	.3	.3	1.4	1.0	2.0	2.0	.0	.0
35.	*	.3	.3	1.1	1.0	1.8	1.8	.0	.0
40.	*	.3	.3	1.0	.8	1.7	1.7	.0	.0
45.	*	.3	.3	.8	.8	1.7	1.7	.0	.0
50.	*	.3	.3	.7	.7	1.6	1.6	.0	.0
55.	*	.3	.3	.8	.7	1.6	1.6	.0	.0
60.	*	.3	.3	.9	.6	1.5	1.5	.0	.0
65.	*	.3	.3	.7	.7	1.5	1.5	.0	.0
70.	*	.4	.3	.7	.6	1.5	1.4	.0	.0
75.	*	.4	.2	.8	.4	1.4	1.4	.1	.1
80.	*	.4	.2	1.0	.6	1.5	1.4	.3	.3
85.	*	.3	.4	1.1	.7	1.5	1.5	.4	.4
90.	*	.4	.4	1.0	.9	1.8	1.5	.8	.7
95.	*	.4	.5	1.1	1.0	1.9	1.6	.8	.8
100.	*	.5	.7	1.2	1.1	2.0	1.8	1.0	1.0
105.	*	.7	.7	1.4	1.2	1.9	2.0	1.1	1.1
110.	*	.7	.8	1.4	1.3	1.9	2.1	1.4	1.3
115.	*	.7	.8	1.4	1.3	1.9	2.2	1.5	1.4
120.	*	.7	.8	1.4	1.3	1.9	2.2	1.5	1.5
125.	*	.8	.8	1.4	1.3	1.7	2.3	1.4	1.3
130.	*	.8	.8	1.4	1.2	1.5	2.4	1.2	1.2
135.	*	.8	.8	1.5	1.2	1.7	2.2	1.2	1.2
140.	*	.7	.8	1.5	1.2	1.5	2.1	1.2	1.2
145.	*	.7	.8	1.4	1.2	1.4	2.0	1.2	1.2
150.	*	.7	.8	1.5	1.2	1.6	2.1	1.2	1.2
155.	*	.7	.8	1.6	1.2	1.6	1.9	1.2	1.2
160.	*	.7	.8	1.6	1.2	1.5	1.8	1.2	1.2
165.	*	.8	.9	1.6	1.0	1.8	1.6	1.2	1.2
170.	*	1.1	1.1	1.5	1.0	1.7	1.7	1.4	1.2
175.	*	1.5	1.4	1.1	.8	1.5	1.5	1.5	1.3
180.	*	1.8	1.6	1.0	.8	1.1	1.2	1.8	1.4
185.	*	2.0	1.9	.9	.6	1.0	1.1	1.9	1.4
190.	*	2.4	2.2	.6	.6	.7	.6	2.1	1.6

195.	*	2.4	2.3	.6	.6	.5	.4	2.2	1.7
200.	*	2.4	2.4	.5	.4	.4	.4	2.1	2.0
205.	*	2.4	2.2	.4	.3	.3	.3	1.8	1.9

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WIND ANGLE (DEGR)	*	CONCENTRATION (PPM) REC1	REC2	REC3	REC4	REC5	REC6	REC7	REC8
210.	*	2.3	2.2	.3	.2	.2	.2	1.7	1.8
215.	*	2.0	1.9	.2	.1	.1	.1	1.4	1.7
220.	*	1.8	1.8	.1	.0	.0	.0	1.3	1.6
225.	*	1.7	1.7	.0	.0	.0	.0	1.0	1.3
230.	*	1.6	1.5	.0	.0	.0	.0	1.0	1.1
235.	*	1.4	1.4	.0	.0	.0	.0	1.0	1.0
240.	*	1.4	1.4	.0	.0	.0	.0	.7	1.0
245.	*	1.3	1.3	.0	.0	.0	.0	.4	.7
250.	*	1.3	1.3	.0	.0	.0	.0	.5	.7
255.	*	1.3	1.3	.0	.0	.0	.0	.6	.6
260.	*	1.3	1.3	.0	.0	.0	.0	.6	.5
265.	*	1.3	1.3	.0	.0	.0	.0	.5	.5
270.	*	1.3	1.3	.0	.0	.0	.0	.5	.6
275.	*	1.4	1.3	.0	.0	.0	.0	.7	.6
280.	*	1.4	1.3	.0	.0	.0	.0	.9	.8
285.	*	1.3	1.3	.0	.0	.0	.0	.9	.8
290.	*	1.3	1.3	.0	.0	.0	.0	.9	.8
295.	*	1.3	1.3	.0	.0	.0	.0	1.1	.8
300.	*	1.2	1.3	.0	.0	.0	.0	1.1	.8
305.	*	1.1	1.4	.0	.0	.0	.0	1.2	.9
310.	*	1.0	1.5	.0	.0	.0	.0	1.2	1.0
315.	*	1.0	1.5	.0	.0	.0	.0	1.2	1.0
320.	*	1.0	1.4	.0	.0	.0	.0	1.2	1.0
325.	*	1.3	1.5	.0	.0	.0	.0	1.2	1.0
330.	*	1.4	1.7	.0	.0	.0	.0	1.3	1.0
335.	*	1.5	1.8	.0	.0	.0	.0	1.3	1.0
340.	*	1.7	1.7	.0	.0	.0	.0	1.5	.9
345.	*	1.7	1.8	.0	.0	.1	.1	1.4	.8
350.	*	1.8	1.8	.5	.0	.5	.5	1.1	.8
355.	*	1.6	1.7	.7	.3	.8	.8	.8	.4
MAX	*	2.4	2.4	1.9	1.3	2.1	2.4	2.2	2.0
DEGR.	*	190	200	15	110	15	130	195	200

THE HIGHEST CONCENTRATION IS 2.40 AT 190 DEGREES FROM REC1 .

1

DATE: 03/12/2006 TIME: 20:37

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

* CO/LINK (PPM)

* ANGLE (DEGREES)

	*	REC1	REC2	REC3	REC4	REC5	REC6	REC7	REC8
LINK #	*	190	200	15	110	15	130	195	200
1	*	.0	.0	.0	.0	.0	.0	.0	.0
2	*	.3	.3	.0	.1	.0	.0	.2	.1
3	*	.4	.4	.0	.1	.0	.0	.2	.2
4	*	.3	.2	.0	.1	.0	.0	.1	.1
5	*	.0	.0	.0	.0	.0	.0	.0	.0
6	*	.0	.0	.0	.0	.0	.1	.3	.3
7	*	.0	.0	.3	.0	.3	.2	.0	.0
8	*	.0	.0	.3	.0	.4	.2	.0	.0
9	*	.0	.0	.2	.0	.3	.2	.0	.0
10	*	.0	.0	.2	.0	.4	.3	.0	.0
11	*	.0	.0	.0	.0	.0	.0	.0	.0
12	*	.0	.0	.2	.0	.0	.0	.0	.0
13	*	.0	.0	.1	.0	.0	.0	.0	.0
14	*	.2	.2	.0	.1	.0	.0	.1	.1
15	*	.2	.3	.0	.1	.0	.0	.2	.1
16	*	.0	.0	.0	.0	.0	.1	.2	.2
17	*	.0	.0	.2	.0	.2	.2	.0	.0
18	*	.0	.0	.2	.0	.3	.2	.0	.0
19	*	.0	.0	.0	.0	.0	.0	.0	.0
20	*	.0	.0	.1	.0	.1	.1	.0	.0
21	*	.0	.0	.1	.0	.1	.1	.0	.0
22	*	.0	.0	.0	.0	.0	.0	.0	.0
23	*	.1	.1	.0	.1	.0	.0	.1	.1
24	*	.1	.1	.0	.1	.0	.0	.1	.1
25	*	.0	.0	.0	.0	.0	.1	.1	.1
26	*	.4	.4	.0	.3	.0	.3	.3	.3
27	*	.4	.4	.0	.3	.0	.3	.3	.3