3.8 AIR QUALITY AND ENERGY

This section describes the existing conditions for air quality and energy in the project area, and the potential impacts from the Preferred Alternative.

3.8.1 Air Quality

The Clean Air Act Amendments of 1990 provide the principal framework for national, state, and local efforts to protect air quality. The Act does this by setting standards known as national ambient air quality standards (NAAQS) for pollutants that are considered harmful to people and the environment. The NAAQS are set at levels that will protect human health and welfare with an adequate margin of safety. The six criteria pollutants (the term “criteria” comes from the requirement in the original 1970 Clean Air Act that the Environmental Protection Agency (EPA) must describe the characteristics and potential health and welfare effects of these pollutants, and then set the standards based on these criteria) are:

- CO
- Nitrogen dioxide (NO_2)
- Lead (Pb)
- Ozone (O_3)
- Particulate matter (PM_{10}, $PM_{2.5}$)
- Sulfur dioxide (SO_2)

Regulatory attention has been focused on these six criteria pollutants because they have the potential to endanger public health and the environment, are widespread throughout the U.S., and come from a variety of sources.

O_3 is the only criteria pollutant that is classified as a secondary pollutant; that is, O_3 is not emitted directly into the air, but is formed through complex chemical reactions between the precursor emissions of volatile organic compounds (VOC) and oxides of nitrogen (NO_x) in the presence of sunlight. O_3 is a photochemical oxidant and the major component of smog.

In addition to the NAAQS, EPA has also established a list of 33 urban air toxics (64 Federal Register [FR] 38706). Urban air toxics are pollutants that may cause cancer or other serious health effects or adverse environmental impacts. Most air toxics originate from human-made sources including on-road mobile sources (e.g., vehicles), non-road mobile sources (e.g., airplanes), and stationary sources (e.g., factories or refineries). To better understand the effects that urban air toxics have on human health, EPA developed a list of 21 MSATs that include the following six priority MSATs:

- Acetaldehyde
- Benzene
- Formaldehyde
- Acrolein
- 1,3 butadiene
- Diesel exhaust (diesel particulate matter and diesel exhaust organic gases)

No federal standards equivalent to the NAAQS currently exist for MSATs; however, EPA does develop and refine cancer and non-cancer health benchmarks for MSATs that serve as guidelines for evaluating their effects.

This evaluation of air quality impacts considers how the Preferred Alternative would impact pollutants regulated under the Clean Air Act (i.e., NAAQS) and MSATs. Consideration of NAAQS is limited to three of the six criteria pollutants noted (CO, O_3, and PM_{10}) because these are the only pollutants for which the Denver area has been classified as a nonattainment or maintenance area. Consideration of $PM_{2.5}$ is also included, particularly with respect to mitigation of emissions from diesel-engined on-road and off-road construction equipment. Consideration of MSATs is limited to the six priority pollutants previously noted. More information about how the methodology for evaluating air quality for the Preferred Alternative was developed is in the *East Corridor Air Quality Technical Report* (2009).

Summary of Results
Direct impacts to air quality associated with the Preferred Alternative are:

- No anticipated violations of the CO NAAQS.
- A net decrease in PM_{10} emissions compared to the No-Action Alternative because of the anticipated traffic reduction due to East Corridor ridership.
- Based on the regional vehicle miles traveled (VMT) analysis, the Preferred Alternative should result in a reduction in MSAT emissions compared to the No-Action Alternative.
- The anticipated traffic reduction due to East Corridor ridership would slightly lower future CO_2 emissions. Additionally, the EMU commuter rail technology associated with the Preferred Alternative has no direct CO_2 emissions.

Some temporary construction impacts would be associated with the Preferred Alternative. These impacts are related to disturbed areas, construction methods, and sequencing of construction. These impacts are difficult to quantify until specific construction projects are identified. The Preferred Alternative would result in no secondary and cumulative effects related to air quality. There is no difference in air quality impacts between the Smith Road Realignment Design Options 1 and 2, the 40th Avenue Design Options 1 and 2, or the New Castle Design Options 1 and 2. Impacts and mitigations to air quality are listed in Table 3.8-6.

3.8.1.1 Affected Environment

Implementation of the Preferred Alternative could impact air quality beyond the project area. For this reason, the analysis considers impacts to the air quality of the entire Denver metropolitan area, which includes the counties of Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, Jefferson, and parts of Larimer and Weld.

The concentration of a pollutant in the atmosphere depends on a number of factors including the amount released, the nature of the source (a single stack or emissions released over a large area such as a highway), and the transport and dispersion capabilities of the atmosphere. The transport and dispersion of a pollutant can have a strong influence on the atmospheric concentrations of that pollutant. For example, high winds and turbulent conditions will tend to produce low pollutant concentrations, while low winds and stable or inversion conditions can produce high pollutant concentrations. The Denver metropolitan area is located in the South Platte River drainage area, with mountains located to the west and relatively high terrain to the south and north. Under low wind and inversion conditions, the local topography helps to trap pollutants, thus resulting in elevated ambient air concentrations and poor air quality. These conditions are more likely to occur during the winter when inversions are more common.

Based on air quality monitoring data collected continuously and analyzed over several years, state and federal air quality agencies designate regions as having either “attainment” or “non-attainment” status for criteria pollutants as per the NAAQS. Attainment status indicates compliance with the NAAQS. Once a non-attainment area achieves compliance with the NAAQS, the area is considered an air quality “attainment/maintenance” area until the standard has been maintained for ten years and a long-term maintenance plan has been approved by EPA. Non-attainment status indicates that the region is not compliant with NAAQS. The Denver metropolitan area is designated as an attainment/maintenance area for CO and PM_{10}. No violations of the NAAQS for these pollutants have been recorded in the Denver metropolitan area since 1995.

EPA designated the Denver metropolitan and Northern Front Range area as a nonattainment area for the federal 8-hour O_3 standard as a result of a violation of the 1997 8-hour O_3 standard of 0.080 parts per million (ppm). The effective date of the nonattainment designation was November 20, 2007. A detailed state implementation plan to reduce O_3 has been developed by the Colorado Air Pollution Control Division, along with the Regional Air Quality Council, DRCOG, and the North Front Range Metropolitan Planning Organization. This attainment plan was submitted for review to EPA by July 1, 2009, per court settlement. The plan will require further reductions in O_3 levels beyond what was previously required.

The methodology used to analyze air quality impacts from the Preferred Alternative was developed through a collaborative process involving EPA, CDPHE (which includes the Air Pollution Control District), RTD, and other interested agencies, and it is consistent with the *FasTracks Environmental Policies & Procedures Manual*. It focuses on three criteria pollutants (CO, O_3, and PM_{10}) and the six principal MSATs. How the methodology for evaluating air quality for the Preferred Alternative was developed is described in the *East Corridor Air Quality Technical Report*. The criteria pollutants and MSATs being evaluated are discussed in detail in the following subsections.

Criteria Pollutants (NAAQS)

Criteria pollutants and the standards associated with them are shown in Table 3.8-1. The Clean Air Act established two types of standards. Primary standards set limits to protect public health, including the health of sensitive populations such as asthmatics, children, and the elderly, with an adequate margin of safety. Secondary standards set limits to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings. Units of measure for the standards are ppm by volume, milligrams per cubic meter of air (mg/m^3), and micrograms per cubic meter of air ($\mu g/m^3$). PM_{10} refers to fine particles having a diameter less than or equal to 10 micrometers, and $PM_{2.5}$ refers to finer particles having a diameter less than or equal to 2.5 micrometers.

Air Monitoring Data

CDPHE maintains air monitors throughout the state. These air monitors record existing levels of pollutants. As shown in Table 3.8-2, four air monitors are located in the vicinity of the project area. The table also lists pollutants measured by each of these monitors, along with historical data, indicating that readings did not exceed any of the standards (NAAQS) from 2004 through 2006.

Table 3.8-1
National Ambient Air Quality Standards Criteria Pollutants

Pollutant	Primary Standards	Averaging Times	Secondary Standards
CO	9 ppm (10 mg/m^3)	8-hour(1)	None
	35 ppm (40 mg/m^3)	1-hour(1)	None
Pb	0.15 $\mu g/m^3$	Rolling 3-month Average	Same as Primary
NO_2	0.053 ppm (100 $\mu g/m^3$)	Annual (Arithmetic Mean)	Same as Primary
PM_{10}	Revoked(2)	Annual (Arithmetic Mean)	Same as Primary
	150 $\mu g/m^3$	24-hour(1)	Same as Primary
$PM_{2.5}$	15 $\mu g/m^3$	Annual(3) (Arithmetic Mean)	Same as Primary
	35 $\mu g/m^3$	24-hour(4)	Same as Primary

Table 3.8-1
National Ambient Air Quality Standards Criteria Pollutants

Pollutant	Primary Standards	Averaging Times	Secondary Standards
O_3	0.075 ppm	8-hour[5]	Same as Primary
	Revoked[6]	1-hour	Same as Primary
SO_2	0.03 ppm	Annual (Arithmetic Mean)	None
	0.14 ppm	24-hour[1]	None
	None	3-hour[1]	0.5 ppm (1300 ug/m^3)

(1) *Not to be exceeded more than once per year.*
(2) *The annual average standard for PM_{10} was revoked by EPA in a rulemaking in September 2006.*
(3) *To attain this standard, the 3-year average of the annual arithmetic mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 15 µg/m^3.*
(4) *This standard was revised from 65 to 35 µg/m^3 by EPA in a rulemaking in September 2006, and will be implemented over a lengthy period. To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m3.*
(5) *EPA revised the 8-hour O_3 standard from 0.080 ppm to 0.075 ppm in a rulemaking in March, 2008. To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average O_3 concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm.*
(6) *The 1-hour average standard for O_3 was revoked by EPA in a rulemaking in June 2005.*

Table 3.8-2
Ambient Air Monitoring Levels for Monitoring Stations Near the Project Area

Pollutant	Averaging Time	2004	2005	2006	2007
Auraria (Firehouse 6) - 1300 Blake Street					
CO (ppm)	1-hour (2nd Max.)	5.8	4.2	5.7	N/A
	8-hour (2nd Max.)	3.6	2.3	2.9	N/A
CAMP - 2105 Broadway Avenue					
CO (ppm)	1-hour (2nd Max.)	8.7	4.3	4.6	5.9
	8-hour (2nd Max.)	4.1	2.5	3.1	2.8
O_3 (ppm)	8-hour (4th Max)	N/A	0.072	0.085	0.057
PM_{10} µg/m^3	24-hour (Max.)	53	57	59	63
	Annual Arith. Mean	29.1	28.3	27.3	27.4
$PM_{2.5}$ µg/m^3	Annual Mean	9.36	9.34	8.46	9.84
	24-hour (Max.)	40.4	37.2	37.8	60.5
NO_2 (ppm)	Annual Mean	0.0272	0.0276	0.0294	0.0272
SO_2 (ppm)	Annual Mean	0.0026	0.0025	0.0029	0.0028
	24-hour (2nd Max.)	0.011	0.009	0.009	0.011
	3-hour (2nd Max.)	0.030	0.026	0.022	0.024
National Jewish Hospital - 14th Avenue/Albion Street					
CO (ppm)	8-hour (2nd Max.)	3.4	2.4	2.5	N/A
	1-hour (2nd Max.)	6.8	3.6	3.9	N/A
$PM_{2.5}$ µg/m^3	Annual Mean	5.92	8.9	9.77	9.39
	24-hour (Max.)	23.7	30.0	39.6	65.1

Table 3.8-2
Ambient Air Monitoring Levels for Monitoring Stations Near the Project Area

Pollutant	Averaging Time	2004	2005	2006	2007
Welby - 3174 E. 78th Avenue (located north of the project area)					
CO (ppm)	1-hour (2nd Max.)	4.0	3.3	3.8	3.0
	8-hour (2nd Max.)	2.8	2.2	2.5	2.1
O_3 (ppm)	1-hour (Max.)	0.078	0.09	0.089	0.098
	8-hour (4th Max.)	0.066	0.073	0.069	0.070
PM_{10} µg/m^3	24-hour (Max.)	104	70.0	50	78
	Annual Arith. Mean	29.5	32.3	27.8	29.9
NO_2 (ppm)	Annual Mean	0.0217	0.0205	0.0192	0.0206
SO_2 (ppm)	Annual Mean	0.0024	0.0021	0.0020	0.0019
	24-hour (2nd Max.)	0.009	0.008	0.006	0.005
	3-hour (2nd Max.)	0.029	0.023	0.025	0.018

Air Quality Conformity
Federal transportation and air quality conformity regulations were developed during the 1990s to ensure that transportation plans, programs, and projects would not jeopardize attainment of NAAQS. To receive transportation funding or approvals from FTA, state and local transportation agencies with plans, programs, or projects in non-attainment or maintenance areas must demonstrate that they meet the transportation conformity requirements of the Clean Air Act as set forth in the transportation conformity rule. Transportation conformity is a way to ensure that:

- Planning for transportation systems is consistent with and conforms to state air quality plans for attaining and maintaining the health-based NAAQS.
- Neither the transportation system as a whole nor individual transportation projects cause new air quality violations or worsen existing violations.

The East Corridor project meets the transportation conformity requirements by inclusion in the conforming transportation improvement plan and regional transportation plan. The Preferred Alternative is included in the *DRCOG 2007-2012 Transportation Improvement Plan* (2006a) and is consistent with the *DRCOG Metro Vision 2035 Plan*, as adopted in December 2007. More information about conformity requirements is in the *East Corridor Air Quality Technical Report*.

Mobile Source Air Toxics
The primary sources of MSATs are industrial activities and motor vehicle emissions. Scientific research has shown that the health risks to people exposed to urban air toxics at sufficiently high concentrations for lengthy durations include an increased risk of contracting cancer; damage to the immune system; and neurological, reproductive, and/or development problems (EPA, 2000). EPA has not yet issued guidance or regulations establishing unsafe levels for all the MSATs; however, EPA does develop and refine cancer and non-cancer health benchmarks for MSATs, which serve as guidelines for evaluating their effects. More information about the EPA regulation of MSATs is in the *East Corridor Air Quality Technical Report*.

In projects such as the East Corridor, a qualitative approach is used to assess the levels of future MSAT emissions by the Preferred Alternative. Although a qualitative analysis cannot identify and measure health impacts from MSATs, it can give a basis for identifying and comparing potential differences of MSAT emissions between the No-Action Alternative and the Preferred Alternative.

3.8.1.2 Environmental Consequences

Impacts on air quality were analyzed for the No-Action Alternative and the Preferred Alternative. This analysis includes the impacts to air quality from emissions of those criteria pollutants of concern previously discussed and MSATs.

3.8.1.2.1 No-Action Alternative

The No-Action Alternative would result in no direct, indirect, or temporary construction impacts to air quality (criteria pollutants or MSATs). Because there are no stations or facilities, neither a CO nor PM_{10} hot-spot analysis was conducted for the No-Action Alternative.

3.8.1.2.2 Preferred Alternative

This subsection details direct, indirect, and temporary construction impacts.

Direct Impacts
Direct impacts to air quality are discussed by pollutant in the following subsections.

Criteria Pollutant Emissions
The Preferred Alternative would result in a small decrease in regional VMT compared to the No-Action Alternative for an average weekday in 2030. These figures are shown in Table 3.8-3. The decrease in 2030 is projected to be 204,000 VMT (0.2 percent) due to personal vehicle trips that are not taken due to transit ridership. This would result in slightly lower criteria pollutant and MSAT emissions, although without a complete analysis of VMT changes by vehicle types, the exact reduction can't be quantified.

Table 3.8-3
Annual Regional Vehicle Miles Traveled
No-Action Alternative versus the Preferred Alternative

	Existing	Preferred Alternative 2015	No-Action Alternative 2030	Preferred Alternative 2030
Regional Linked Transit Trips	185,800	285,200	370,000	390,500
Regional VMT	71,903,00	90,633,000	116,124,000	115,920,000

Emissions associated with the CRMF would be lower for PM_{10} and $PM_{2.5}$ compared to the No-Action Alternative and existing conditions. Emissions of VOCs from the CRMF are slightly higher than the No-Action Alternative but are lower when compared to the existing condition.

The CRMF NO_x and CO emissions would be higher than the existing condition and No-Action Alternative, due to the in-yard diesel multiple unit (DMU) operations and the increase in worker commutes to the facility in future years; however, ambient CO concentrations near the facility are far below the NAAQS, and the slight increase of emissions from the CRMF is not expected to exceed CO standards.

Carbon Monoxide Microscale Hot-Spot Analysis
A CO hot-spot analysis is required for those locations within the project area that have a level of service (LOS) that is predicted to degrade from acceptable (LOS A to C) to unacceptable (LOS

D to F) for the Preferred Alternative when compared to the No-Action Alternative. A hot-spot analysis calculates the ambient concentrations of CO at selected worst-case intersections and compares the predicted concentrations with the NAAQS for CO.

LOS is a qualitative measure used to describe the operational conditions in a stream of traffic, and includes factors such as speed, travel time, freedom to maneuver, and traffic interruptions. On a scale of A to F, intersections designated LOS A have the shortest delays and those designated LOS F have the longest delays. Longer delays have the potential to result in increased ambient (surrounding) levels of CO, due to higher concentrations of vehicle exhaust while the vehicles are moving slowly or idling.

A screening analysis was performed to identify the intersections within the project area that were predicted to have the highest volumes and longest delays, with LOS designations that were unacceptable. Four intersections were chosen for this analysis, all of which are predicted to have LOS F designations in 2030.

CO emission factors in grams per VMT were obtained from the EPA MOBILE6.2 emissions model, using model input parameters consistent with the CDPHE CO state implementation plan revision modeling, so that it was consistent with the other emission inventories within the Denver region. The EPA CAL3QHC dispersion model was used in accordance with EPA modeling guidance to calculate the ambient concentrations of CO for 2030 at the selected worst-case intersections.

The modeled CO concentrations (converted from 1-hour to 8-hour) were added to obtain the maximum CO background concentration (8-hour) measured in the area to determine the CO hot-spot impacts. The results (shown in Table 3.8-4) demonstrate there are no anticipated violations of the CO NAAQS.

Table 3.8-4
Carbon Monoxide Hot-Spot Modeling Results
Preferred Alternative Station Locations in 2030

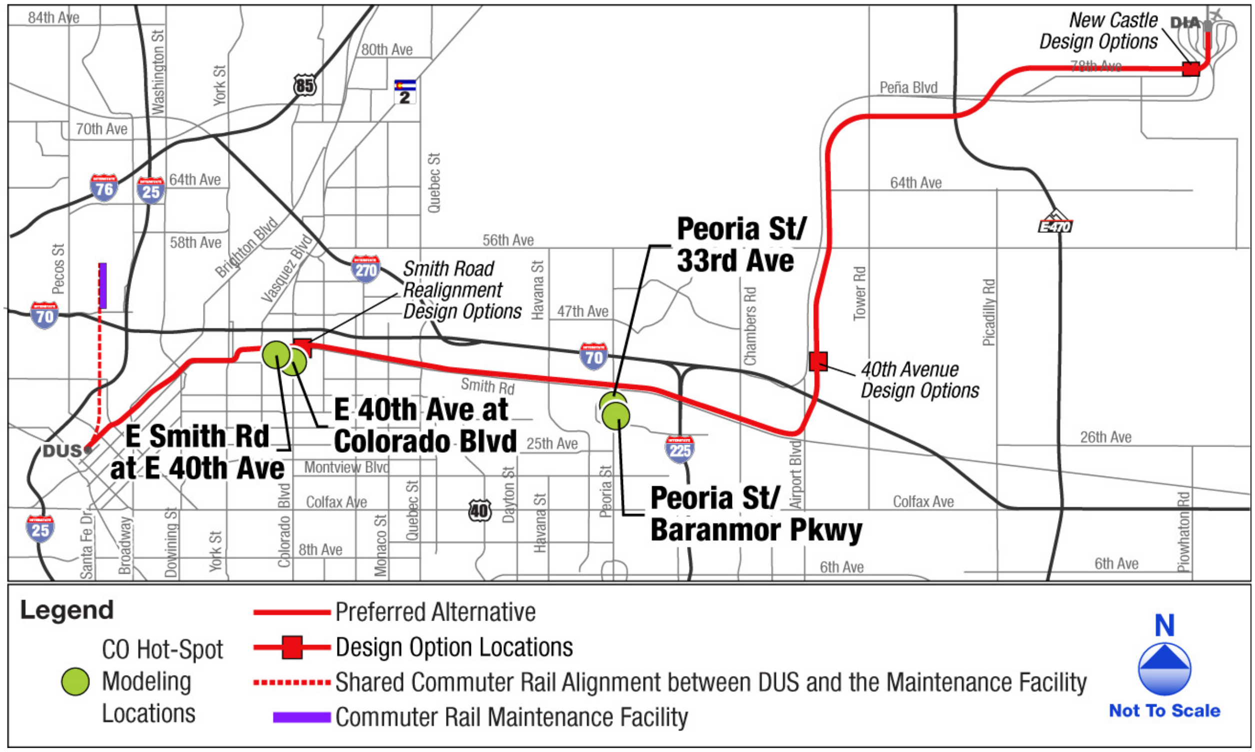
Location		Total Traffic Volume (peak hour)	LOS	Concentration (ppm)		
				Modeled	Background	Total
Intersection where LOS Changes from Non-Congested to Congested						
Peoria Street/33rd Avenue (Peoria station)		8,023	F	2.2	4.1	6.3
Peoria Street/Baranmor Parkway (Peoria station)		5,701	F	0.8	4.1	4.9
E. Smith Road at E. 40th Avenue (Colorado station)		4,724	F	0.7	4.1	4.8
E. 40th Avenue at Colorado Boulevard	Smith Road Design Option 1	7,863	F	3.0	4.1	7.1
	Smith Road Design Option 2	7,863	E	2.4	4.1	6.5
CO 8-hour NAAQS limit (ppm)						9.0

Source: EPA CAL3QHC model results.

No existing or projected air quality problems are associated with CO hot-spots at the proposed CRMF site. The LOS at the only signalized intersection near the proposed site (53rd Avenue and Bannock Street) would not change when comparing the No-Action Alternative and existing conditions. Because the intersection is projected to operate at LOS C or better, a hot-spot analysis is not required. Because the estimated future conditions are similar to existing conditions at the site, no CO hot-spot violations of the 1- or 8-hour standards are projected.

The locations of hot-spot analyses are shown in Figure 3.8-1.

Figure 3.8-1
Hot-Spot Analysis Locations



<u>PM_{10} Hot-Spot Analysis</u>

The project area is located in a PM_{10} maintenance area, but a qualitative hot-spot analysis for PM_{10} is not required for the Preferred Alternative based on current EPA guidance. PM_{10} emissions are expected to have a net decrease compared to the No-Action Alternative due to the anticipated traffic reduction from the East Corridor ridership. The predicted overall reduction in regional VMT due to the East Corridor project is relatively small (0.2 percent), but the effect should be greatest in the areas closest to the East Corridor, as nearby residents are more likely to take advantage of the transit option, thereby resulting in locally lower PM_{10} levels.

PM_{10} emissions associated with the CRMF in 2015 and 2030 would be much lower than those in 2005 (existing condition) and the No-Action Alternative. CRMF PM_{10} emissions would be less than six percent of the existing PM_{10} emissions from the current site condition. Because PM_{10} standards have not been exceeded at the site during the past three years, a 94 percent reduction of these emissions would result in no violations of future standards with implementation of the CRMF.

Mobile Source Air Toxics

Based on the regional VMT analysis, the Preferred Alternative would result in a small reduction in VMT in 2030 compared to the No-Action Alternative, which should result in an equivalent reduction in MSAT emissions assuming the vehicle mix is similar.

A large reduction in MSAT emissions from vehicles for both the Preferred Alternative and the No-Action Alternative will occur by 2030 as a result of the EPA vehicle and fuel regulations, which are currently being implemented. Over time, these new regulations will cause substantial reductions in MSAT emissions. Net highway emissions of benzene, formaldehyde, 1,3-butadiene, and acetaldehyde will be reduced by 67 to 76 percent, while diesel particulate emissions will be reduced by approximately 90 percent. These reductions will occur even after the growth in VMT is taken into account.

The CRMF MSAT emissions would be higher compared to the existing conditions and the No-Action Alternative due to an increase in worker commutes and the in-yard DMU operations. It may also be due to an underestimate of emissions under existing conditions and the No-Action Alternative. The only MSAT emissions included for the existing facility operation were from worker commutes. Other MSAT emissions, such as those from the delivery trucks associated with the existing facilities operation, were not included due to lack of information. Considering the information available, it can be reasonably assumed that MSAT emission levels would be similar for the CRMF and the No-Action Alternative.

For neighborhoods surrounding the CRMF, MSAT emissions would be similar to the No-Action Alternative for 2015 and 2030. Due to stricter EPA emission standards, MSAT emissions are predicted to be significantly lower in future years than under existing conditions.

Indirect Impacts

There would be no indirect emissions of criteria pollutants, MSATs, or greenhouse gases (GHG) from the EMUs used in the East Corridor, as they are electrically powered.

Greenhouse Gas Emissions

One of the main strategies to reduce GHG emissions is to provide choices for travel so that options other than single-occupant vehicle (SOV) travel are available. The Preferred Alternative would provide a transit travel option that does not currently exist. At the stations, the Preferred Alternative would support TOD, which has been found to reduce travel, and, consequently, greenhouse emissions. Feeder bus service would also be provided to encourage access to the stations rather than by SOVs.

Although no direct GHG emissions are produced by the EMUs, an estimate can be made of indirect GHG emissions associated with the electric power used by the EMUs operating in the East Corridor. It should be recognized that the power facilities generating the electricity are required to report their overall GHG emissions; these calculations are presented simply as a disclosure of estimated indirect impacts from the Preferred Alternative.

The calculation of indirect GHG emissions is based on the estimated energy consumption by the EMUs, as provided in Subsection 3.8.2, Energy. The EMU energy consumption was converted from British thermal units (BTU) into megawatt hours (MWh) of electricity usage per year, and then emissions of individual GHG (carbon dioxide, methane, and nitrous oxide) were calculated by using emission factors developed for the Western Electric Coordinating Council – Rockies (EPA, 2008b). Table 3.8-5 presents the estimated indirect GHG emissions for the Preferred Alternative.

This increase in indirect emissions of GHG will be offset by a reduction of direct GHG emissions, due to decreased SOV travel resulting from transit ridership. Table 3.8-3 shows a projected annual decrease in 2030 of 204,000 VMT from personal vehicle trips resulting from the Preferred Alternative.

Table 3.8-5
Indirect Greenhouse Gas Emissions from Regional Power Plants Supplying Electricity to East Corridor Electric Multiple Units (Preferred Alternative)

GHG Sources	Carbon Dioxide Emissions (tons/yr)	Methane Emissions (tons/yr)	Nitrous Oxide Emissions (tons/yr)
Power plants providing electricity to East Corridor EMUs	27,200	0.33	0.41

Temporary Construction Impacts
The use of construction equipment will result in emissions of fugitive dust (PM_{10} emissions), as well as CO, NO_X, VOCs, $PM_{2.5}$, and MSAT from on-road and non-road gasoline and diesel engines. These emissions resulting from construction activities are difficult to quantify until specific construction projects (including disturbed areas, construction methods, and construction sequencing) are identified. The short-term construction impacts will be minimized with an extensive program of comprehensive mitigation measures.

A PM_{10} monitoring plan will be included to allow for real-time modification or implementation of various dust control measures. The fugitive dust emissions, estimated as PM_{10}, associated with construction of the proposed project would be 100 to 200 pounds per day, based on the assumption that the maximum disturbed area would be 10 to 20 acres per day. The construction emissions would be temporary and are not anticipated to cause any air quality violations. In addition, the temporary construction emissions would be spread out geographically across the project area and would occur over a period of several years. The overall emissions level along the Preferred Alternative would be low to moderate when considering the project construction timeframe and the size of the project area, although some localized, temporary small-scale impacts may occur. A construction management plan will include site-specific mitigation measures.

For MSAT impacts due to construction activity, PM_{10} monitoring will assist in the monitoring for MSAT emissions. This type of monitoring allows for real-time mitigation of potential impacts that will assist in minimizing the exposure of MSATs within the corridor during construction.

Fugitive dust (PM_{10}) related to the construction phase of the CRMF was estimated using the emissions factor from the URBEMIS2007 model. The fugitive dust emissions associated with construction of the CRMF would be 100 pounds per day, assuming that the maximum disturbed area would be 10 acres per day. Emissions of other criteria pollutants would be associated with the engine exhaust from construction equipment and vehicles. Construction emissions would be temporary and are not anticipated to cause air quality violations.

Secondary and Cumulative Effects
The Preferred Alternative would result in no secondary and cumulative effects related to air quality. The regional analysis of the No-Action Alternative and Preferred Alternative shows that due to current EPA programs to reduce pollutant emissions, future emissions will be significantly lower than existing conditions. Because the Preferred Alternative would result in even lower

future regional VMT than the No-Action Alternative, it is the alternative that would have the least potential impact on air quality. The cumulative benefit to air quality from the FasTracks program as a whole is detailed in the RTD PCEA. The analysis predicts a savings of 5 tons of CO per day due to FasTracks operations.

3.8.1.3 Mitigation

Table 3.8-6 summarizes the impacts to air quality by the Preferred Alternative and mitigation measures.

Table 3.8-6
Air Quality Impacts and Mitigation Related to the Preferred Alternative

Impacts	Mitigation

Direct Impacts
• Reduction in regional VMT.
• Slight decrease in the regional vehicle emissions (CO, NO_X, VOC, PM_{10}).
• Significant decreases in MSATs from existing conditions.
• No CO hot-spot violations.
	• No mitigation required; however, general air quality mitigation strategies for the FasTracks program will be implemented. These may include:
	  • Encouraging people to use alternate methods of traveling from nearby neighborhoods to the transit stations, including bus, pedestrian access, and bicycle.
	  • Idling reduction technologies to reduce idling times for diesel engines (applicable to trucks and buses). RTD could give priority to contractors that use these technologies on new equipment, or will retrofit older equipment.
	  • Purchasing new RTD vehicles and retrofitting the existing vehicle fleet with emissions equipment.
	  • Modifying buses with more efficient electronic engine controls and fuel injections.
	  • Purchasing new buses equipped with particulate filters and exhaust recirculators.
	  • Using low-sulfur diesel fuel or bio-diesel (B20) in buses.
	  • RTD currently uses a three-minute bus idle limit that requires drivers to shut down their engines after idling for more than three minutes.
	  • RTD currently has maintenance procedures to reduce emissions; these include periodic emission opacity testing, scheduled front-end alignments to improve fuel efficiency, and optimizing transmission shifting points.
	  • RTD is currently conducting a demonstration program using hybrid diesel-electric buses for service routes.
	  • Optimizing signal timing at intersections leading to stations to minimize idling time.

Indirect Impacts • No impacts.	• No mitigation required.

Table 3.8-6
Air Quality Impacts and Mitigation Related to the Preferred Alternative

Impacts	Mitigation

Temporary Construction Impacts
• Expected to be low to moderate; however, localized, small-scale impacts may occur.
	• Include site-specific mitigation measures in a construction management plan.
	• Minimize construction-related fugitive emissions by implementing dust control practices that may include:
	  • Using water or wetting agent to control dust.
	  • Using wind barriers and wind screens to prevent spreading of dust from the site.
	  • Having a wheel wash station and/or crushed stone apron at egress/ingress areas to prevent dirt being tracked onto public streets.
	  • Using vacuum-powered street sweepers to remove dirt tracked onto streets.
	  • Covering all dump trucks leaving sites.
	  • Covering or wetting temporary excavated materials.
	  • Using a binding agent for long-term excavated materials.
	  • Monitoring for PM_{10} to allow for the real-time modification or implementation of various dust control measures.

	• Implement potential mitigation strategies to reduce emissions during construction; possible strategies include:
	  • Prohibiting unnecessary idling of construction equipment.
	  • Locating diesel engines and motors as far away as possible from residential areas.
	  • Locating staging areas as far away as possible from residential uses.
	  • For winter construction, installing engine pre-heater devices to eliminate unnecessary idling.
	  • Prohibiting tampering with equipment to increase horsepower or to defeat emission control devices effectiveness.
	  • Requiring construction vehicle engines to be properly tuned and maintained.
	  • Using construction vehicles and equipment with the minimum practical engine size for the intended job.
	  • Schedule work outside of normal hours for sensitive receptors or adjust facilities (should be necessary only in extreme circumstances, such as construction immediately adjacent to a health care facility, church, outdoor playground, or school).

Secondary and Cumulative Impacts • No impacts.	• No mitigation required.

3.8.2 Energy

Energy is consumed through the use of transportation systems. Automobiles, trucks, and buses directly consume fuel, while light rail, EMU vehicles, and transportation-related infrastructure (such as signals and lighting) draw from existing electrical networks.

Summary of Results
Energy consumption would be less under the Preferred Alternative than the No-Action Alternative; thus, the Preferred Alternative would have beneficial environmental consequences. During construction, energy would be required; however, no extraordinary energy demands are anticipated. There is no difference in energy impacts between the Smith Road Realignment Design Options 1 and 2, the 40th Avenue Design Options 1 and 2, or the New Castle Design Options 1 and 2. Impacts and mitigations to energy are shown in Table 3.8-9.

3.8.2.1 Affected Environment

According to the U.S. Energy Information Administration, gross energy use in the U.S. was estimated at 99.8 quadrillion BTUs in 2006. Of this total, 28.3 quadrillion BTUs were consumed by the transportation sector, representing approximately 28 percent of the nation's gross energy consumption. Energy sources used for transportation include petroleum products, coal, natural gas, and electricity. Petroleum products accounted for 96 percent of the energy used by the transportation sector, whereas natural gas and renewable energy each comprised two percent.

The primary sources of energy in the project area are hydrocarbons, including petroleum (gasoline/diesel), natural gas, and coal. Automobiles, commercial trucks, buses, and rail vehicles are the major transportation energy consumers within the Denver metropolitan area. Electricity generated in Colorado is largely produced from coal-fired sources (66 percent) and natural gas (30 percent) and totaled 200 terawatts in 2005.

Energy consumed through present-day transit (i.e., public transportation) activity is derived from multipliers provided by the *Transportation Energy Data Book* (U.S. Department of Energy, 2007) and RTD service data for 2008. From this information, it can be estimated that approximately 1.2 billion BTUs were expended from 32,946 daily bus miles and 59 light rail miles within the project area in 2008. The light rail miles are associated with the existing light rail line terminating at 30th Street/Downing Street. Table 3.8-7 summarizes existing energy consumption estimates by transit technology in the project area.

Table 3.8-7
Existing Transit Energy Consumption within the Project Area

Transit Technology	Daily Vehicle Miles	BTU per Vehicle Mile	Daily Energy Consumption (BTU in billions)
Transit Buses	32,946	38,175	1.258
Light Rail	58.5	70,170	0.002
Total			**1.260**

Sources: Transportation Energy Data Book (U.S. Department of Energy, 2007); RTD service data (2008).

3.8.2.2 Environmental Consequences

An alternative is considered to have negative environmental consequences to energy consumption if it created a significant increase in project area energy usage. Conversely, it is considered to have positive environmental consequences if it decreased energy consumption.

Operational energy consumption was estimated by calculating energy consumed by transit and non-transit VMT. VMT were calculated using the DRCOG traffic model. Vehicle mix and energy intensity rates (per vehicle mile) were derived from the *Transportation Energy Data Book.* Because this information was unavailable for trucks, energy consumption was calculated by estimating fuel consumption per mile and applying BTU conversions supplied by the U.S. Energy Information Administration.

3.8.2.2.1 No-Action Alternative

The No-Action Alterative would result in no direct, indirect, or temporary construction impacts on energy consumption. The No-Action Alternative would not reduce the number of VMT by buses or automobiles, and it would fail to provide energy savings over the Preferred Alternative.

3.8.2.2.2 Preferred Alternative

This subsection describes the direct, indirect, and temporary construction impacts on energy usage from the Preferred Alternative. There is essentially no difference in impacts between the Smith Road Realignment Design Options 1 and 2, the 40th Avenue Design Options 1 and 2, or the New Castle Design Options 1 and 2.

Direct Impacts

Energy consumption would be less under the Preferred Alternative than the No-Action Alternative; thus, the Preferred Alternative would have positive environmental consequences. Automobiles and transit vehicles (buses) would travel fewer miles under the Preferred Alternative due to riders switching to commuter rail service. It has been estimated that approximately 1.25 billion fewer BTUs per day would be expended if the Preferred Alternative were implemented, as shown in Table 3.8-8. As the table indicates, vehicle travel would be reduced by 204,000 miles under the Preferred Alternative, creating a savings of approximately 1.25 billion BTUs from buses alone.

CRMF-related commuter trips would result in a per-day energy usage of 12.2 million BTUs. This total includes out-of-service trips to and from the Fox North Site. The operation of CRMF buildings would result in an additional 36.9 million BTUs based on the RTD 2007 Elati facility costs, proportioned to the CRMF building area.

The power used to operate EMUs on the Preferred Alternative would come from the electricity grid, which would likely come from a continually shifting network of coal plants, gas plants, and even nuclear plants. Therefore, a realistic quantification of the impacts from this energy use cannot be accomplished. It was assumed that the Preferred Alternative’s power needs would require no additional power generation capacity, and the impacts from power plants have already been evaluated as part of their respective environmental clearance process analyses.

Table 3.8-8
Daily Energy Consumption by Alternative (2030)

Alternative		Vehicle Miles Traveled	BTU per Vehicle Mile Traveled	Energy Consumption (billion BTU)	
				Total Per Mode	Total Per Alternative
No-Action	Vehicles (all)*	116,124,000	7,438	863.75	**863.75**
Preferred	Vehicles (all)*	115,920,000	7,438	862.23	**862.50**
	Commuter Rail (EMU)	3,814	70,170	0.27	

Sources: Fuel BTU conversions from Energy Information Administration; vehicle miles traveled from DRCOG traffic model; RTD service data (2008).
** Vehicle mix, energy intensities, and fuel economy from the Transportation Energy Book (U.S. Department of Energy, 2007).*

Indirect Impacts
The Preferred Alternative would result in no indirect impacts on energy consumption.

Temporary Construction Impacts
Energy, primarily fossil fuels, would be required for construction of the Preferred Alternative. Energy would be expended through earthwork and construction machinery as well as the physical construction of rail lines (such as embedding track and erecting retaining walls and bridges). Nevertheless, no extraordinary energy demands are anticipated. Increases in fuel and electricity consumption for construction would have no substantial impact on energy consumption.

3.8.2.3 Mitigation

No mitigation is required for the Preferred Alternative; however, RTD has supplemental policies for implementation of capital improvement projects that reduce energy consumption and overall VMT. These policies include:

- Creating multiple access points for parking lots, where possible.
- Designing kiss-n-Ride drop-off points to maximize efficiency and minimize the number of vehicles idling.
- Positioning stations to be more easily accessible by pedestrians and bicyclists.
- Improving park-n-Ride locations to decrease energy consumption consistent with RTD's sustainability policy.

Table 3.8-9 summarizes the impacts to energy consumption by the Preferred Alternative and mitigation measures.

Table 3.8-9
Energy Consumption Impacts and Mitigation
Related to the Preferred Alternative

Impacts	Mitigation
Direct Impacts • Approximately 862.50 billion BTUs of energy consumed by the Preferred Alternative, which is a decrease of 1.25 billion BTUs daily as compared to the No-Action Alternative. • Approximately 12.2 million BTUs would be used daily for commuter rail vehicle movements served by the CRMF. • CRMF buildings would expend 36.9 million BTUs daily.	• RTD will investigate the use of energy-efficient design and Leadership in Energy and Environmental Design certification for the CRMF.
Indirect Impacts • No impacts.	• No mitigation required.
Temporary Construction Impacts • Minimal consumption of fossil fuels during construction.	• Incorporate best management practices (BMPs) into the project to reduce energy use during construction and implement environmental sustainability policies. These BMPs may include energy-efficient lighting, electrical systems, mechanical equipment, and building insulation.