Air Quality
Final Technical Report

WOODWARD AVENUE
LIGHT RAIL TRANSIT PROJECT

Detroit, Michigan

June 2011

U.S. Department
of Transportation
**Federal Transit
Administration**

City of Detroit
Department of Transportation

WOODWARD LIGHT RAIL

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1.0 Introduction

This *Air Quality Technical Report* has been prepared in support of the Woodward Avenue Light Rail Transit (LRT) Project Draft Environmental Impact Statement (DEIS). The objective of this report is to evaluate the Project's potential air quality impacts within the study area. This includes the following:

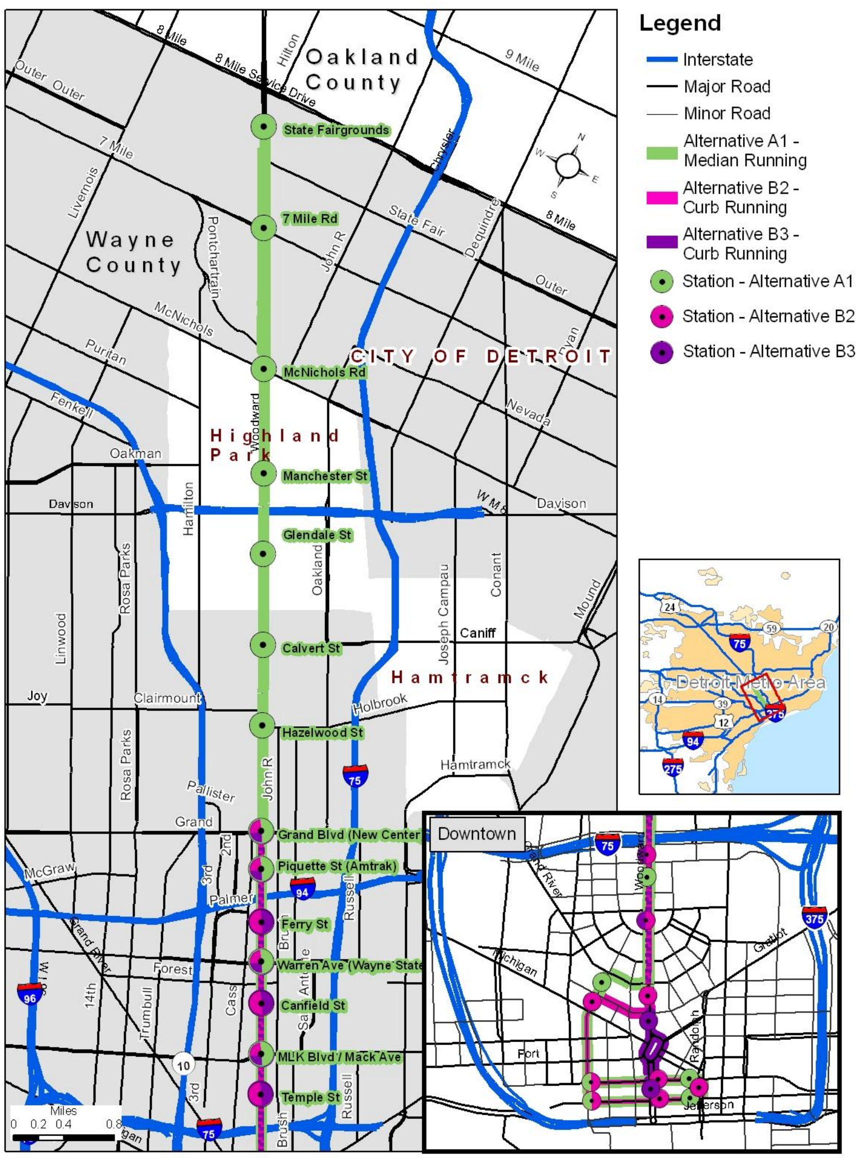
- Evaluate the Project's impact on regional air quality levels;
- Evaluate whether this Project will cause or contribute to a new localized exceedance of carbon monoxide (CO) ambient air quality standards or increase the frequency or severity of any existing exceedance;
- Evaluate potential particulate matter (PM_{10} and $PM_{2.5}$) impacts of the Project;
- Evaluate the mobile source air toxic (MSAT) impacts of the Project;
- Evaluate the construction emissions of the Project.

2.0 Project Description

The study area (Figure 2-1) is located in Wayne County, Michigan. It comprises the Woodward Avenue Corridor (the Corridor), which extends 9.3 miles from Downtown Detroit (Downtown), near the Detroit River, and north to the Michigan State Fairgrounds near 8 Mile Road. The majority of the study area lies within the City of Detroit, while approximately two miles (from Webb to McNichols (6 Mile) Streets) is within the City of Highland Park. The study area boundary extends approximately a half mile to the east and west of Woodward Avenue, the area within which Project impacts may occur.

From south to north, the study area includes the densely developed Downtown Central Business District (CBD) and many of the City's prominent historical sites, civic buildings, sports venues, and cultural attractions; medical, higher education, and additional cultural institutions north of the CBD, as well as residential areas and the Michigan State Fairgrounds.

Figure 2-1. Project Location



2.1 Alternatives

Two alternatives are being evaluated in the DEIS, the No Build Alternative, and the Locally Preferred Alternative (LPA). The alternatives screening process considered alternatives that were identified through previous transit studies, a field review of the Woodward Avenue Corridor, an analysis of current and projected population and employment data for the Corridor, a literature review of technology modes, a rigorous alternatives screening analysis, and public and agency comments received during the formal Project scoping process held to satisfy National Environmental Policy Act (NEPA) [USC 1969] requirements.

The two alternatives being considered are described below.

2.1.1 No Build Alternative

The No Build Alternative includes transit, roadway, and non-motorized elements.

Transit elements include increased service frequencies on Detroit Department of Transportation (DDOT) Route 53 (Woodward Avenue) and reorganization of feeder bus routes to optimize travel times. The No Build Alternative does not include any new bus routes. Also, the No Build Alternative assumes bus services on existing roads in mixed traffic; it does not assume any change in future (2030) bus travel speeds or travel times on Route 53.

The No Build Alternative includes all capacity-related transportation system projects listed in the Southeast Michigan Council of Governments' (SEMCOG) Transportation Improvement Program (TIP) for the Detroit-Warren-Livonia Metropolitan Statistical Area (MSA) for fiscal years 2008 through 2011. In addition to the TIP projects, the No Build Alternative also includes capacity-related transportation projects in the study area that are listed in SEMCOG's financially-constrained Regional Transportation Plan (RTP).

A shared-use path for pedestrians and bicycles is currently being constructed along Kirby Street on either side of Woodward Avenue. There are plans to also construct a shared-use path along Canfield Street on both sides of Woodward Avenue within the next few years. There are no other plans to improve or construct any other non-motorized facilities within the study area.

2.1.2 Locally Preferred Alternative

The LPA is light rail transit (LRT) on Woodward Avenue from Downtown to 8 Mile Road, with two mainline operating options and three Downtown design options still under consideration. The mainline operating options along Woodward Avenue are median-running and separated from traffic (Option A) and curb-running in mixed traffic (Option B).

LRT has been defined as an at-grade system entirely within existing rights-of-way. It would be fully functional as a stand-alone project, but would be designed to accommodate possible future extensions.

LRT uses electric rail vehicles and may operate with just one vehicle or two that are joined; if the latter, the LRT would not be expected to be longer than 180 feet. However, some City blocks in Downtown are shorter than 180 feet; therefore, LRT vehicles would be given priority at traffic signals to avoid blocking intersections and crosswalks by stopped LRT vehicles. LRT vehicles are powered via overhead electric wire (catenary); therefore, the safety issues that are present with a live third rail at ground level are not a factor.

Existing road rights-of-way vary considerably in the study area. In Downtown, it ranges from 78 feet (23.8 m) along Washington Boulevard to 109 feet (33.2 m) along Woodward Avenue south of Adams Street. North of Adams Street, the right-of-way widens along Woodward Avenue to 120 feet (36.6 m) until reaching Grand Boulevard. The narrowest section of Woodward Avenue, at 100 feet (30.5 m), is found north of Grand Boulevard to Manchester Parkway, where the right-of-way then returns to 120 feet (36.6 m). The widest section of right-of-way is found north of McNichols Road where it widens to 204 feet (62.2 m).

Three Downtown design options for the LPA were identified. Their respective alignments are as follows:

- Downtown Option 1: Woodward, Grand River, Washington, Larned, Randolph, Congress;
- Downtown Option 2: Woodward, State, Washington, Larned, Randolph, Congress; and
- Downtown Option 3: Woodward Avenue.

LPA Variations

The LPA alignment follows Woodward Avenue from Downtown Detroit in the south to the Michigan State Fairgrounds near 8 Mile Road in the north. Combining the two mainline alignment operating options and the three Downtown design options, three variations of the LPA were defined for evaluation in this DEIS.

- Alternative A1 – median-running with Downtown design option 1; 15 LRT stations;
- Alternative B2 – curb-running with Downtown design option 2; 21 LRT stations; and
- Alternative B3 – curb-running with Downtown design option 3; 18 LRT stations.

Vehicle Storage and Maintenance Facility

Additionally, three locations were identified for the vehicle storage and maintenance facility (VSMF) required to be constructed with any of the LPA variations.

The proposed VSMF would house administrative offices and provide for indoor storage, inspection, repair, and light maintenance of LRT equipment. It would have its own storm water management system. The square footage of the facility is anticipated to be between 75,000 and 110,000, depending on site size, configuration, and facility design. The three sites under consideration were identified on the basis of proximity to Woodward Avenue, size and configuration, zoning, land use, site ownership, and potential utility and traffic impacts. The three potential sites are as follows:

- MLK Jr. Boulevard Site (4.2 acres) – would occupy two lots north and south of West Stimson Street, just west of Woodward Avenue and south of MLK/Mack Avenue. This site would have frontage on Woodward Avenue.

- Amsterdam Street Site (4.6 acres) – would occupy two lots east and west of Cass Avenue between Amsterdam Street and the two grade-separated tracks owned by Consolidated Rail Corporation (CR) and Canadian National Railway (CN), respectively, just south of Baltimore Avenue. This site would have frontage on Woodward Avenue and is adjacent to the Amtrak station.

- Highland Park Ford Plant Site (19.0 acres) – would occupy one large lot east of Woodward Avenue north of Manchester Street and the former Highland Park Ford Plant. As this site is about 900 feet east of Woodward Avenue, direct access would be via the right-of-way for CR's currently abandoned rail line.

2.1.3 Park and Ride Lot

A park and ride lot, which would be provided with all LPA variations, would be located near the proposed Shoppes at Detroit's Gateway at the southeast corner of 8 Mile Road and Woodward Avenue. The lot is accessible from northbound and southbound Woodward Avenue. A pedestrian overpass would provide access from the parking lot to the median-located rail station. An existing bus stop and transfer station at the Michigan State Fairgrounds would be maintained.

2.1.4 Traction Power Substations

LRT's electric traction power system requires traction power substations (TPSS) approximately every mile, depending on the frequency and size of the vehicles. These substations, which are approximately 25 by 60 feet in dimension, require vehicular access and a relatively small site (30 by 70 feet). These facilities do not need to be immediately adjacent to the tracks. Because of this flexibility, substations can be located to minimize visual intrusions and can be visually shielded by fencing, landscaping, or walls, or can be incorporated into existing buildings. Nine TPSS sites have been preliminarily identified; eight TPSS for Alternatives A1 and B2 and seven for Alternative B3. The locations will be refined during the preliminary engineering phase of project development.

2.1.5 Construction Staging Areas

During construction of the LRT, several small sites will be required for the temporary storage of materials and equipment and will be located in the general vicinity of the LPA. Following construction of the LPA, the construction staging areas would be made available for other, more permanent development. Four construction staging areas have been initially identified. Two sites, located north of I-75 and west of Woodward Avenue, are approximately 0.9 and 1.6 acres in size, respectively. A third site, 1.6 acres in size, is proposed for the northeast corner of East Bethune Street and Woodward Avenue. A fourth site, 0.9 acre in size, is proposed in Highland Park at the southwest corner of Sears Street and Woodward Avenue. Each of these four parcels is presently undeveloped and vacant.

3.0 Existing Conditions

"Air Pollution" is a general term that refers to one or more chemical substances that degrade the quality of the atmosphere. Individual air pollutants degrade the atmosphere by reducing visibility, damaging property, reducing the productivity or vigor of crops or natural vegetation, and/or reducing human or animal health. Air quality is a term used to describe the amount of air pollution the public is exposed to.

Air quality in the United States is governed by the Federal Clean Air Act (CAA) and is administered by the United States Environmental Protection Agency (USEPA).

3.1 U.S. Environmental Protection Agency

The USEPA is responsible for establishing the National Ambient Air Quality Standards (NAAQS) and enforcing the CAA, and regulates emission sources, such as aircraft, ships, and certain types of locomotives, under the exclusive authority of the Federal government. The USEPA also has jurisdiction over emission sources outside State waters (e.g., beyond the outer continental shelf) and establishes various emission standards. For additional information about the USEPA, the reader can access its website at www.epa.gov. Additional information on the activities of USEPA's Office of Mobile Sources can be found at www.epa.gov/omswww/mshome.htm.

3.2 Clean Air Act Amendments of 1990

The Clean Air Act Amendments (CAAA) of 1990 direct the USEPA to implement environmental policies and regulations that will ensure acceptable levels of air quality.

Under the CAAA, a project cannot:

- Cause or contribute to any new violation of any NAAQS in any area;
- Increase the frequency or severity of any existing violation of any NAAQS in any area; or
- Delay timely attainment of any NAAQS or any required interim emission reductions or other milestones in any area.

3.3 National and State Ambient Air Quality Standards

As required by the CAA, NAAQS have been established for six major air pollutants. These pollutants are: carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM_{10} and $PM_{2.5}$), sulfur dioxide (SO_2), and lead (Pb). These standards are summarized in Table 3-1. The "primary" standards have been established to protect the public health. The "secondary" standards are intended to protect the nation's welfare and account for air pollutant effects on soil, water, visibility, materials, vegetation, and other aspects of the general welfare.

Table 3-1. National Ambient Air Quality Standards

	Primary Standards		Secondary Standards	
Pollutant	**Level**	**Averaging Time**	**Level**	**Averaging Time**
Carbon Monoxide	9 ppm (10 mg/m^3)	8-hour [(1)]	None	
	35 ppm (40 mg/m^3)	1-hour [(1)]		
Lead	0.15 µg/m^3 [(2)]	Rolling 3-Month Average	Same as Primary	
	1.5 µg/m^3	Quarterly Average	Same as Primary	
Nitrogen Dioxide	0.053 ppm (100 µg/m^3)	Annual (Arithmetic Mean)	Same as Primary	
	0.100 ppm	1-hour [(3)]	None	
Particulate Matter (PM_{10})	150 µg/m^3	24-hour [(4)]	Same as Primary	
Particulate Matter ($PM_{2.5}$)	15.0 µg/m^3	Annual [(5)] (Arithmetic Mean)	Same as Primary	
	35 µg/m^3	24-hour [(6)]	Same as Primary	
Ozone	0.075 ppm (2008 std)	8-hour [(7)]	Same as Primary	
	0.08 ppm (1997 std)	8-hour [(8)]	Same as Primary	
	0.12 ppm	1-hour [(9)]	Same as Primary	
Sulfur Dioxide	0.03 ppm	Annual (Arithmetic Mean)	0.5 ppm (1300 µg/m^3)	3-hour [(1)]
	0.14 ppm	24-hour [(1)]		

[(1)] Not to be exceeded more than once per year.

[(2)] Final rule signed October 15, 2008.

[(3)] To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 0.100 ppm (effective January 22, 2010).

[(4)] Not to be exceeded more than once per year on average over 3 years.

[(5)] To attain this standard, the 3-year average of the weighted annual mean PM2.5 concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m3.

[(6)] 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 (effective December 17, 2006).

[(7)] To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm. (effective May 27, 2008)

[(8)] (a) To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.

(b) The 1997 standard—and the implementation rules for that standard—will remain in place for implementation purposes as EPA undertakes rulemaking to address the transition from the 1997 ozone standard to the 2008 ozone standard.

(c) EPA is in the process of reconsidering these standards (set in March 2008).

[(9)] (a) EPA revoked the 1-hour ozone standard in all areas, although some areas have continuing obligations under that standard (“anti-backsliding”).

(b) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is ≤ 1.

3.4 Ambient Air Quality Data

3.4.1 Local Meteorology

The nature of the surrounding atmosphere is an important element in assessing the ambient air quality of an area. Detroit and the immediate suburbs, including nearby urban areas in Canada, occupy an area approximately 25 miles in radius. The waterways—consisting of the Detroit River, St. Clair River, Lake St. Clair, and the west end of Lake Erie—are at an elevation of 568 to 580 feet above sea level. Nearly flat land slopes up gently from the water's edge northwestward for approximately 10 miles and then gives way to increasingly rolling terrain. The Irish Hills, parallel to and about 40 miles northwest of the waterway, have tops of 1,000 – 1,250 feet above sea level. On the Canadian side of the waterway, the land is relatively level.

The current climate of Detroit is influenced by its location with respect to major storm tracks and the influence of the Great Lakes. The normal wintertime storm track is south of the City; on average, the storm track brings three-inch snowfalls. Winter storms can bring combinations of rain, snow, freezing rain, and sleet with heavy snowfall accumulations possible at times. In summer, most storms pass to the north allowing for intervals of warm, humid, and sunny skies with occasional thunderstorms followed by days of mild, dry, and fair weather. Temperatures of 90 degrees or higher are reached during each summer.

Northwest winds in winter bring snow flurry accumulations to all of Michigan except in the Detroit metropolitan area, while summer showers moving from the northwest weaken and sometimes dissipate as they approach Detroit. Much of the heaviest precipitation in winter — especially in the City's northwest suburbs — comes from southeast winds.

Lake and land breezes are conditions induced by the Great Lakes. They occur because of a difference in the heating and cooling rates between land and water. During a clear summer day, a lake breeze might develop in which winds flow on-shore from the body of water and orient themselves perpendicular to the shoreline. The development of this phenomenon is due to the ability of the land to absorb and re-radiate the incoming solar radiation. This characteristic allows for more efficient heating of the surface and causes a large temperature gradient between the surface of the land and water.

During the night, just the opposite occurs: The land cools faster than the lake and a land breeze develops. Here, winds blow offshore from the cooler land surface to the warmer water. Wind speed direction and its variability have a large influence on the dispersion of atmospheric pollutants.

On warm days in late spring or early summer, lake breezes often lower temperatures by 10 – 15 degrees in the eastern part of the City and the northeastern suburbs. The general result is a warming in the winter and a cooling effect in the summer. The cooler temperatures in the summer are beneficial from an air quality perspective since high ambient temperatures combined with strong insulation enhance the formation of ozone. Indirectly, extremes of temperatures have a bearing on the energy consumption required for heating and cooling; this affects emissions going into the atmosphere.

3.4.2 Local Monitored Air Quality

The monitored information for the three monitoring stations nearest the Project area is presented in Table 3-2. This table presents the last three years of available data monitored at each of these stations in order to illustrate the study area's general air quality trends. Detailed monitored data can be found in Appendix A.

3.5 Pollutant Description

3.5.1 Criteria Pollutants

Pollutants that have established national standards are referred to as "criteria pollutants." The sources of these pollutants, their effects on human health and the nation's welfare, and their final deposition in the atmosphere vary considerably. A brief description of each pollutant is provided below.

Ozone

Ozone (O_3) is a colorless toxic gas. As shown in Figure 3-1, O_3 is found in both the earth's upper and lower atmospheric levels. In the upper atmosphere, O_3 is a naturally occurring gas that helps to prevent the sun's harmful ultraviolet rays from reaching the earth. In the lower layer of the atmosphere, O_3 is man-made. Although O_3 is not directly emitted, it forms in the lower atmosphere through a chemical reaction between hydrocarbons (HCs), also referred to as Volatile Organic Compounds (VOCs), and nitrogen oxides (NOx), which are emitted from industrial sources and automobiles. HCs are compounds comprised primarily of atoms of hydrogen and carbon.

Substantial O_3 formations generally require a stable atmosphere with strong sunlight; thus high levels of O_3 are generally a concern in the summer. O_3 is the main ingredient of smog. O_3 enters the bloodstream through the respiratory system and interferes with the transfer of oxygen, depriving sensitive tissues in the heart and brain of oxygen. O_3 also damages vegetation by inhibiting its growth. The effects of changes in VOC and NOx emissions for the proposed Project are examined on a regional and statewide level.

Figure 3-1. Ozone in the Atmosphere

Source: Ozone NY

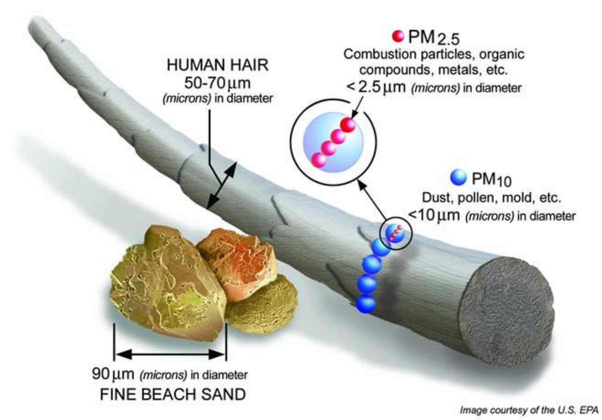
Table 3-2. Air Quality Summary for Study Area Monitoring Stations

Air Pollutant	Standard/ Exceedance	11600 East 7 Mile Rd Detroit			6050 Linwood Detroit			6921 West Fort Detroit		
		2006	2007	2008	2006	2007	2008	2006	2007	2008
Carbon Monoxide (CO)	Max. 1-hour Concentration (ppm)	NM	NM	NM	3.7	2.0	NM	NM	NM	NM
	Max. 8-hour Concentration (ppm)	NM	NM	NM	2.8	1.2	NM	NM	NM	NM
	# Days>Federal 1-hour Std. of >35 ppm	NM	NM	NM	0	0	NM	NM	NM	NM
	# Days>Federal 8-hour Std. of >9 ppm	NM	NM	NM	0	0	NM	NM	NM	NM
Ozone (O_3)	Max. 1-hour Concentration (ppm)	0.096	0.122	0.096	0.089	NM	NM	0.083	NM	NM
	Max. 8-hour Concentration (ppm)	0.084	0.097	0.083	0.081	NM	NM	0.074	NM	NM
	# Days>Federal 8-hour Std. Of >0.075 ppm	4	16	4	1	NM	NM	0	NM	NM
Nitrogen Dioxide (NO_2)	Max. 1-hour Concentration (ppm)	0.055	0.053	0.058	0.058	0.045	NM	NM	NM	NM
	Annual Average (ppm)	0.014	0.014	0.012	0.016	0.017	NM	NM	NM	NM
Sulfur Dioxide (SO_2)	Max. 24-hour Concentration (ppm)	0.016	0.017	NM	0.032	0.022	NM	0.072	0.046	0.053
	Annual Average (ppm)	0.003	0.004	NM	0.004	0.003	NM	0.006	0.005	0.005
	# Days>Federal 24-hour Std. of >0.14 ppm	0	0	NM	0	0	NM	0	0	0
Suspended Particulates (PM_{10})	Max. 24-hour Concentration ($\mu g/m^3$)	NM	NM	NM	NM	NM	NM	86	74	58
	#Days>Fed. 24-hour Std. of>150 $\mu g/m^3$	NM	NM	NM	NM	NM	NM	0	0	0
Suspended Particulates ($PM_{2.5}$)	Max. 24-hour Concentration ($\mu g/m^3$)	42.5	33.3	33.7	53.7	39.2	36.3	45.9	42.5	39.6
	#Days>Fed. 24-hour Std. of>35 $\mu g/m^3$	1	0	0	1	0	0	1	0	0
	National Annual Average ($\mu g/m^3$)	12.71	13.01	11.33	13.04	13.86	11.94	14.68	14.54	12.85
	#Days>Fed. Annual Std. of>15.0 $\mu g/m^3$	0	0	0	0	0	0	0	0	0
Lead	Maximum 24-Hour Concentration ($\mu g/m^3$)	0.02	0.01	NM	NM	NM	NM	1.39	0.02	NM
	# Quarters Exceeding Federal Std.	0	0	NM	NM	NM	NM	0	0	NM

Particulate Matter

Particulate pollution is composed of solid particles or liquid droplets that are small enough to remain suspended in the air. In general, particulate pollution can include dust, soot, and smoke; these can be irritating but usually are not poisonous. Particulate pollution also can include bits of solid or liquid substances that can be highly toxic. Of particular concern are those particles that are smaller than, or equal to, 10 microns (PM_{10}) or 2.5 microns ($PM_{2.5}$) in size.

Figure 3-2. Relative Particulate Matter Size



Source: EPA Office of Air and Radiation

PM_{10} refers to particulate matter less than 10 microns in diameter, about one seventh the thickness of a human hair (Figure 3-2). Particulate matter pollution consists of very small liquid and solid particles floating in the air, which can include smoke, soot, dust, salts, acids, and metals. Particulate matter also forms when gases emitted from motor vehicles undergo chemical reactions in the atmosphere.

Major sources of PM_{10} include motor vehicles; wood-burning stoves and fireplaces; dust from construction, landfills, and agriculture; wildfires and brush/waste burning; industrial sources; windblown dust from open lands; and atmospheric chemical and photochemical reactions. Suspended particulates produce haze and reduce visibility.

Data collected through numerous nationwide studies indicate that most of the PM_{10} comes from the following:

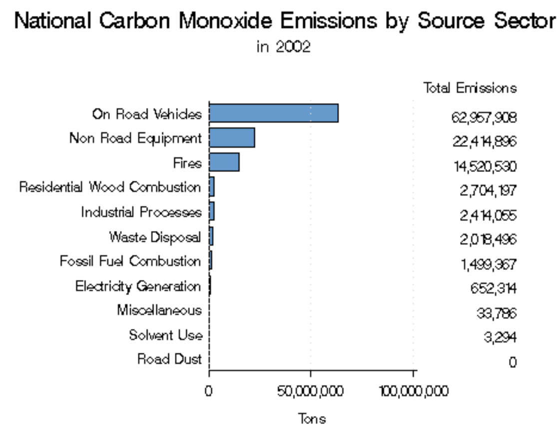
- Fugitive dust
- Wind erosion
- Agricultural and forestry sources

A small portion of PM is the product of fuel combustion processes. In the case of $PM_{2.5}$, the combustion of fossil fuels accounts for a significant portion of this pollutant. The main health effect of airborne PM is on the respiratory system. $PM_{2.5}$ refers to particulates that are 2.5 microns or less in diameter, roughly 1/28th the diameter of a human hair. $PM_{2.5}$ results from fuel combustion (from motor vehicles, power generation, and industrial facilities), residential fireplaces, and wood stoves. In addition, $PM_{2.5}$ can be formed in the atmosphere from gases such as sulfur dioxide, nitrogen oxides, and volatile organic compounds. Like PM_{10}, $PM_{2.5}$ can penetrate the human respiratory system's natural defenses and damage the respiratory tract when inhaled. Whereas particles 2.5 to 10 microns in diameter tend to collect in the upper portion of the respiratory system, particles 2.5 microns or less are so tiny that they can penetrate deeper into the lungs and damage lung tissues. The effects of PM_{10} and $PM_{2.5}$ emissions for the Project are examined on a localized or microscale basis, which is a regional and statewide basis.

Carbon Monoxide

Carbon monoxide (CO) is a colorless gas that interferes with the transfer of oxygen to the brain. CO is emitted almost exclusively from the incomplete combustion of fossil fuels. As shown in Figure 3-3, on-road motor vehicle exhaust is the primary source of CO. In cities, 85 to 95 percent of all CO emissions may come from motor vehicle exhaust. Prolonged exposure to high levels of CO can cause headaches, drowsiness, loss of equilibrium, or heart disease. CO levels are generally highest in the colder months of the year when inversion conditions (when warmer air traps colder air near the ground) are more frequent.

Figure 3-3. Sources of CO



Source: USEPA

CO concentrations can vary greatly over relatively short distances. Relatively high concentrations of CO are typically found near congested intersections, along heavily used roadways carrying slow-moving traffic, and in areas where atmospheric dispersion is inhibited by urban –street canyon” conditions. Consequently, CO concentrations must be predicted on a microscale basis.

Nitrogen Dioxide

Nitrogen dioxide (NO_2) is a brownish gas that irritates the lungs. It can cause breathing difficulties at high concentrations. As with O_3, NO_2 is not directly emitted but is formed through a reaction between nitric oxide (NO) and atmospheric oxygen. NO and NO_2 are collectively referred to as nitrogen oxides (NOx) and are major contributors to ozone formation. NO_2 also contributes to the formation of PM_{10}. At atmospheric concentrations, NO_2 is only potentially irritating. In high concentrations, the result is a brownish-red cast to the atmosphere and reduced visibility. There is some indication of a relationship between NO_2 and chronic pulmonary fibrosis. An increase in bronchitis in children (two and three years old) has also been observed at concentrations below 0.3 parts per million (ppm).

Lead

Lead (Pb) is a stable element that persists and accumulates both in the environment and in animals. Its principal effects in humans are on the blood-forming, nervous, and renal systems. Lead levels from mobile sources in the urban environment have decreased significantly due to the federally-mandated switch to lead-free gasoline, and they are expected to continually decrease. An analysis of lead emissions from transportation projects is therefore not warranted.

Sulfur Dioxide

Sulfur Dioxide (SO_2) is a product of high-sulfur fuel combustion. The main sources of SO_2 are coal and oil used in power stations, industry, and domestic heating. Industrial chemical manufacturing is another source of SO_2. SO_2 is an irritant gas that attacks the throat and lungs. It can cause acute respiratory symptoms and diminished ventilator function in children. SO_2 can also cause a yellowing effect of plant leaves and corrode iron and steel. Although diesel-fueled heavy duty vehicles emit SO_2, transportation sources are not considered by USEPA (and other regulatory agencies) to be significant sources of this pollutant.

3.5.2 Mobile Source Air Toxics

Air Toxics

In addition to the criteria pollutants for which there are NAAQS, the USEPA also regulates air toxics. Toxic air pollutants are those pollutants known or suspected to cause cancer or other serious health issues. Most air toxics originate from human-made sources, including on-road mobile sources, non-road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners), and stationary sources (e.g., factories or refineries).

Controlling air toxic emissions became a national priority with the passage of the CAAA of 1990, whereby Congress mandated that the USEPA regulate 188 air toxics, also known as hazardous air pollutants. The USEPA has assessed this expansive list in their latest rule on the Control of Hazardous Air Pollutants from Mobile Sources (Federal Register, Vol. 72, No. 37, page 8430, February 26, 2007) and identified a group of 93 compounds emitted from mobile sources that are listed in their Integrated Risk Information System (IRIS) (http://www.epa.gov/ncea/iris/index.html). In addition, USEPA identified seven compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers from their 1999 National Air Toxics Assessment (NATA) (http://www.epa.gov/ttn/atw/nata1999/). These are acrolein, benzene, 1,3-butadiene, diesel PM plus diesel exhaust organic gases (diesel PM), formaldehyde, naphthalene, and polycyclic organic matter. While Federal Highway Administration (FHWA) considers these the priority mobile source air toxics, the list is subject to change and may be adjusted in consideration of future USEPA rules.

The 2007 USEPA rule mentioned above requires controls that will dramatically decrease MSAT emissions through cleaner fuels and cleaner engines. According to an FHWA analysis using USEPA's MOBILE6.2 model, even if vehicle activity (vehicle-miles traveled, VMT) increases by 145 percent as assumed, a combined reduction of 72 percent in the total annual emission rate for the priority MSAT is projected from 1999 to 2050.

A brief description of the seven priority MSATs is given below.

Acrolein is a water-white or yellow liquid that burns easily, is readily volatilized, and has a disagreeable odor. It is present as a product of incomplete combustion in the exhausts of stationary equipment (e.g., boilers and heaters) and mobile sources. It is also a secondary pollutant, formed through the photochemical reaction of VOC and NO_X in the atmosphere. Acrolein is considered to have high acute toxicity, and it causes upper respiratory tract irritation and congestion in humans. The major effects from chronic (long-term) inhalation exposure to acrolein in humans consist of general respiratory congestion and eye, nose, and throat irritation. No information is available on the reproductive, developmental, or carcinogenic effects of acrolein in humans. USEPA considers acrolein data to be inadequate for an assessment of human carcinogenic potential.

Benzene is a volatile, colorless, highly flammable liquid with a sweet odor. Most of the benzene in ambient air is from incomplete combustion of fossil fuels and evaporation from gasoline service stations. Acute inhalation exposure to benzene causes neurological symptoms, such as drowsiness, dizziness, headaches, and unconsciousness in humans. Chronic inhalation of certain levels of benzene causes blood disorders in humans. Benzene specifically affects bone marrow (the tissues that produce blood cells). Aplastic anemia, excessive bleeding, and damage to the immune system (by changes in blood levels of antibodies and loss of white blood cells) may develop. Available human data on the developmental effects of benzene are inconclusive due to concomitant exposure to other chemicals, inadequate sample size, and lack of quantitative exposure data. USEPA has classified benzene as a known human carcinogen by inhalation.

1,3-Butadiene is a colorless gas with a mild gasoline-like odor. Sources of 1,3-butadiene released into the air include motor vehicle exhaust, manufacturing and processing facilities, forest fires or other combustion, and cigarette smoke. Acute exposure to 1,3-butadiene by inhalation in humans results in irritation of the eyes, nasal passages, throat, and lungs. Neurological effects, such as blurred vision, fatigue, headache, and vertigo, have also been reported at very high exposure levels. One epidemiological study reported that chronic exposure to 1,3-butadiene via inhalation resulted in an increase in cardiovascular diseases, such as rheumatic and arteriosclerotic heart diseases, while other human studies have reported effects on the blood. No information is available on reproductive or developmental effects of 1,3-butadiene in humans. USEPA has classified 1,3-butadiene as a probable human carcinogen by inhalation.

Diesel Particulate Matter/Diesel Exhaust Organic Gases are a complex mixture of hundreds of constituents in either a gaseous or particle form. Gaseous components of diesel exhaust (DE) include CO_2, oxygen, nitrogen, water vapor, CO, nitrogen compounds, sulfur compounds, and numerous low-molecular-weight hydrocarbons. Among the gaseous hydrocarbon components of DE that are individually known to be of toxicological relevance are several carbonyls (e.g., formaldehyde, acetaldehyde, acrolein), benzene, 1,3-butadiene, and polycyclic aromatic hydrocarbons (PAHs) and nitro-PAHs. DPM is composed of a center core of elemental carbon and adsorbed organic compounds, as well as small amounts of sulfate, nitrate, metals, and other trace elements. DPM consists primarily of $PM_{2.5}$, including a subgroup with a large number of particles having a diameter <0.1 μm. Collectively, these particles have a large surface area, which makes them an excellent medium for adsorbing organics. Also, their small size makes them highly respirable and able to reach the deep lung. A number of potentially toxicologically-relevant organic compounds, including PAHs, nitro-PAHs, and oxidized PAH derivatives, are on the particles. Diesel exhaust is emitted from on-road mobile sources, such as automobiles and trucks, and from off-road mobile sources (e.g., diesel locomotives, marine vessels, and construction equipment). DPM is directly emitted from diesel-powered engines (primary PM) and can be formed from the gaseous compounds emitted by diesel engines (secondary PM).

Acute or short-term (e.g., episodic) exposure to DE can cause acute irritation (e.g., eye, throat, bronchial), neurophysiological symptoms (e.g., lightheadedness, nausea), and respiratory symptoms (cough, phlegm). Evidence also exists for an exacerbation of allergenic responses to known allergens and asthma-like symptoms. Information from the available human studies is inadequate for a definitive evaluation of possible non-cancer health effects from chronic exposure to DE. On the basis of extensive animal evidence, however, DE is judged to pose a chronic respiratory hazard to humans. USEPA has determined that DE is ―likely to be carcinogenic to humans by inhalation" and that this hazard applies to environmental exposures.

Formaldehyde is a colorless gas with a pungent, suffocating odor at room temperature. The major emission sources of formaldehyde appear to be power plants, manufacturing facilities, incinerators, and automobile exhaust. However, most of the formaldehyde in ambient air is a result of secondary formation through photochemical reaction of VOC and NO_X. The major toxic effects caused by acute formaldehyde exposure via inhalation are eye, nose, and throat irritation and effects on the nasal cavity. Other effects seen from exposure to high levels of formaldehyde in humans are coughing, wheezing, chest pains, and bronchitis. Chronic exposure to formaldehyde by inhalation in humans has been associated with respiratory symptoms and eye, nose, and throat irritation. USEPA considers formaldehyde to be a probable human carcinogen.

Naphthalene is used in the production of phthalic anhydride; it is also used in mothballs. Acute (short-term) exposure of humans to naphthalene by inhalation, ingestion, and dermal contact is associated with hemolytic anemia, damage to the liver, and neurological damage. Cataracts have also been reported in workers acutely exposed to naphthalene by inhalation and ingestion. Chronic (long-term) exposure of workers and rodents to naphthalene has been reported to cause cataracts and damage to the retina. Hemolytic anemia has been reported in infants born to mothers who “sniffed” and ingested naphthalene (as mothballs) during pregnancy. Available data are inadequate to establish a causal relationship between exposure to naphthalene and cancer in humans. USEPA has classified naphthalene as a Group C, possible human carcinogen.

The term **Polycyclic Organic Matter** (POM) defines a broad class of compounds that includes the polycyclic aromatic hydrocarbon compounds (PAH), of which benzo[a]pyrene is a member. POM compounds are formed primarily from combustion and are present in the atmosphere in particulate form. Sources of air emissions are diverse and include cigarette smoke, vehicle exhaust, home heating, laying tar, and grilling meat. Cancer is the major concern from exposure to POM. Epidemiologic studies have reported an increase in lung cancer in humans exposed to coke oven emissions, roofing tar emissions, and cigarette smoke; all of these mixtures contain POM compounds. Animal studies have reported respiratory tract tumors from inhalation exposure to benzo[a]pyrene and forestomach tumors, leukemia, and lung tumors from oral exposure to benzo[a]pyrene. USEPA has classified seven PAHs (benzo[a]pyrene, benz[a]anthracene, chrysene, benzo[b]fluoranthene, benzo[k]fluoranthene, dibenz[a,h] anthracene, and indeno[1,2,3-cd]pyrene) as Group B2, probable human carcinogens.

3.6 Attainment Status

Section 107 of the 1977 CAAA requires that the USEPA publish a list of all geographic areas in compliance with the NAAQS, plus those not attaining the NAAQS. Areas not in NAAQS compliance are deemed nonattainment areas. Areas that have insufficient data to make a determination are deemed unclassified, and are treated as being attainment areas until proven otherwise. An area’s designation is based on the data collected by the State monitoring network on a pollutant-by-pollutant basis.

The Project area is located in Wayne County, Michigan. As shown in Table 3-3, the USEPA has classified the county as a nonattainment area for $PM_{2.5}$. The monitors in the region are currently measuring $PM_{2.5}$ at attainment levels. The Southeast Michigan Council of Governments (SEMCOG) is working with the State on a request to USEPA for redesignation to “attainment/maintenance” for both the $PM_{2.5}$ annual and 24-hour standard.

Table 3-3. Project Area Attainment Status

Pollutant	Federal Attainment Status Wayne County, MI
Ozone (O_3)	Attainment / Maintenance
Nitrogen Dioxide (NO_2)	Attainment
Carbon Monoxide (CO)	Attainment / Maintenance
Particulate Matter (PM_{10})	Attainment / Maintenance
Particulate Matter ($PM_{2.5}$) – Annual and 24-Hour	Nonattainment
Lead (Pb)	Attainment

Source: Environmental Protection Agency (USEPA), 2010

3.7 State Implementation Plan and Transportation Improvement Program Status

Under the CAAA of 1990, the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), and the Transportation Equity Act for the 21st Century (TEA-21), proposed transportation projects must be derived from a long-range transportation plan (LRP) or RTP that conforms with the State air quality plans as outlined in the SIP. The SIP sets forth the State's strategies for achieving air quality standards. Projects must also be included in a Transportation Improvement Program (TIP) that conforms with the SIP, and localized impacts from proposed projects must conform to State air quality plans in nonattainment and maintenance areas.

SEMCOG is the Metropolitan Planning Organization (MPO) for the greater Detroit area. *Direction2035* is the region's long-range vision for transportation, also known as the Regional Transportation Plan (RTP). Adopted in October 2009 by SEMCOG's General Assembly, the RTP demonstrates how the transportation system can lend itself to improving the region overall by contributing to transportation goals, economic recovery, environmental health, community revitalization and stability, and quality of life. It consists of transportation projects anticipated over the next 26 years, as well as policies and initiatives to be carried out by both SEMCOG and its partner agencies to keep moving the region in the right direction.

Projects to be completed in the near term are included in the region's TIP. The TIP is a list of roadway and transit projects selected as priorities for funding by cities, county road commissions, transit agencies, and the Michigan Department of Transportation. The current TIP covers the period from fiscal year (FY) 2011 through FY 2014.

The Woodward Avenue Light Rail Project is included in the RTP, *Direction2035*, as project I.D. #4430. The Project is included in the 2011-2014 TIP as project I.D. #2010353.

4.0 Environmental Impact/Environmental Consequences

Pollutants that can be traced principally to motor vehicles are relevant to the evaluation of the Project’s impacts; these pollutants include CO, HC, NO_x, O_3, PM_{10}, $PM_{2.5}$, and mobile source air toxic (MSAT). Transportation sources account for a small percentage of regional emissions of SO_x and Pb; thus, a detailed analysis is not required.

HC (VOC) and NO_x emissions from automotive sources are a concern primarily because they are precursors in the formation of O_3 and particulate matter (PM). Ozone is formed through a series of reactions that occur in the atmosphere in the presence of sunlight. Since the reactions are slow and occur as the pollutants are diffusing downwind, elevated O_3 levels often are found many miles from the sources of the precursor pollutants. Therefore, the effects of HC and NO_x emissions generally are examined on a regional or ―mesoscale” basis.

PM_{10} and $PM_{2.5}$ impacts are both regional and local. A significant portion of PM, especially PM_{10}, comes from disturbed vacant land, construction activity, and paved road dust. $PM_{2.5}$ also comes from these sources. Motor vehicle exhaust, particularly from diesel vehicles, is also a source of PM_{10} and $PM_{2.5}$. PM_{10}, and especially $PM_{2.5}$, can also be created by secondary formation from precursor elements such as sulfur dioxide (SO_2), nitrogen oxides (NO_X), volatile organic compounds (VOCs), and ammonia (NH_3). Secondary formation occurs due to chemical reaction in the atmosphere generally downwind some distance from the original emission source. Thus it is appropriate to predict concentrations of PM_{10} and $PM_{2.5}$ on both a regional and a localized basis.

CO impacts are generally localized. Even under the worst meteorological conditions and most congested traffic conditions, high concentrations are limited to a relatively short distance (300 to 600 feet) of heavily traveled roadways. Vehicle emissions are the major sources of CO. The Project could change traffic patterns within the Project area. Consequently, it is appropriate to predict concentrations of CO on both a regional and a localized or ―microscale” basis.

MSAT impacts are both regional and local. On February 3, 2006, the Federal Highway Administration (FHWA) released *Interim Guidance on Air Toxic Analysis in NEPA Documents.* This guidance was superseded on September 30, 2009 by FHWA’s *Interim Guidance Update on Air Toxic Analysis in NEPA Documents.* According to these documents, regardless of the alternative chosen, MSAT emissions will likely be lower than present levels in the design year as a result of USEPA's national control programs that are projected to reduce annual MSAT emissions by 72 percent between 1999 and 2050. Local conditions may differ from these national projections in terms of fleet mix and turnover, vehicle miles traveled (VMT) growth rates, and local control measures. However, the magnitude of the USEPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the study area are likely to be lower in the future in nearly all cases.

4.1 Regional Emissions Analysis

The regional (or mesoscale) analysis of a project determines its overall impact on regional air quality levels. A transportation project is analyzed as part of a regional transportation network developed by the County or State. Projects included in this network are found in the area’s Transportation Improvement Plan (TIP). The TIP is the basis for the regional analysis which utilizes VMT and vehicle hours traveled (VHT) within the region to estimate daily ―pollutant burden" levels. The results of this analysis determine if an area is in conformity with regulations set forth in the Final Conformity Rule.

The Woodward Avenue Light Rail Project is included in the RTP, *Direction2035*, as project I.D. #4430. The Project is included in the 2008-2011 TIP as project I.D. #2010353. This analysis found that the plan and, therefore, the individual projects contained in the plan, are conforming projects, and will have air quality impacts consistent with those identified in the state implementation plans (SIPs) for achieving the National Ambient Air Quality Standards (NAAQS).

The conformity analysis conducted by Southeast Michigan Council of Governments (SEMCOG) determined that the Project conforms to the air quality goals of the area; a project level regional analysis was therefore not conducted.

4.2 Carbon Monoxide

Microscale air quality modeling was performed using the most recent version of the USEPA mobile source emission factor model (MOBILE6.2) and the CAL3QHC version 2.0 air quality dispersion model to estimate future no build (without the proposed Project) and build (with the proposed Project) alternative CO levels at selected locations in the study area.

4.2.1 Site Selection and Receptor Locations

The sites chosen for the CO analysis were selected using a screening analysis based on overall intersection volume, changes in intersection volume, and changes in traffic level of service (LOS). Intersections that demonstrate a LOS of A, B, or C pass the screening test. That is, they are not expected to cause a violation of the National Ambient Air Quality Standards (NAAQS). Intersections that the Project causes to operate at or below LOS D, increase delay of an intersection with a LOS of worse than D, or increase overall volumes, have the potential to cause a violation of the NAAQS, and thus fail the screening analysis.

As shown in Table 4-1, a total of 70 intersections within the study corridor were screened based on this methodology. Three sites failed the screening analysis. These sites are highlighted in Table 4-2. All three sites that failed were chosen for detailed analysis. These sites are:

- **Woodward and Euclid –** This intersection worsens from LOS A in the No Build morning peak period to LOS D in both the Build Option A and Option B AM peak periods.
- **Woodward and Bethune –** This intersection worsens from LOS A in the No Build morning peak period to LOS D in both the Build Option A and Option B morning peak periods.
- **Woodward and MLK Jr./Mack** – This intersection worsens from LOS B in the No Build evening peak period to LOS D in the Build Option A evening peak period.

The sites chosen for detailed analysis are shown in Figure 4-1 and listed in Table 4-2. Receptors were chosen at each site in accordance with the guidelines found in the USEPA's *Guideline for Modeling Carbon Monoxide from Roadway Intersections* (EPA-454/R-92-005). Microscale CO levels were modeled at these locations using the USEPA-authorized MOBILE6.2 program to develop emissions and the CAL3QHC dispersion program to calculate concentrations.

Table 4-1. CO Site Selection Screening Analysis

Intersection	No Build						Build – Option A						Build – Option B					
	AM			PM			AM			PM			AM			PM		
	LOS	Delay	Volume	LOS	Delay	Volume	LOS	Delay	Volume	LOS	Delay	Volume	LOS	Delay	Volume	LOS	Delay	Volume
Woodward & State Fair	B	12.8	3,517	B	19.0	3,468	A	4.5	3,496	B	15.7	3,131	A	4.5	3,496	B	15.7	3,131
Woodward & Crossover north of 7 Mile	A	2.7	3,370	A	3.9	2,923	C	22.6	3,402	B	12.4	2,928	C	22.6	3,402	B	12.4	2,928
Woodward & 7 Mile	A	7.8	4,153	B	10.3	4,067	C	27.2	4,306	B	19.1	4,380	C	27.2	4,306	B	19.1	4,380
Woodward & Crossover south of 7 Mile	A	2.6	3,370	A	4.4	2,923	B	16.3	3,402	C	24.9	2,928	B	16.3	3,402	C	24.9	2,928
Woodward & Grixdale	A	3.7	3,244	A	2.9	2,838	B	15.7	3,376	B	11.6	3,010	B	15.7	3,376	B	11.6	3,010
Woodward & Nevada	A	2.3	3,248	A	4.1	3,032	A	8.4	3,383	A	8.9	3,352	A	8.4	3,383	A	8.9	3,352
Woodward & Merrill Plaisance	A	5.0	3,570	A	7.3	3,426	B	14.8	3,642	C	22.6	3,537	B	14.8	3,642	C	22.6	3,537
Woodward & McNichols	A	9.8	3,804	B	14.4	4,105	B	16.3	3,804	B	17.8	4,105	B	16.3	3,804	B	17.8	4,105
Woodward & Ferris/Pilgrim	A	5.5	3,087	C	21.6	3,230	B	11.4	3,087	A	1.9	3,230	B	11.4	3,087	A	1.9	3,230
Woodward & Sears	A	2.1	3,101	A	5.2	3,106	C	29.5	3,101	B	11.4	3,106	C	29.5	3,101	B	11.4	3,106
Woodward & Manchester	A	9.8	3,413	B	12.3	3,664	C	20.7	3,427	C	22.3	3,754	C	20.7	3,427	C	22.3	3,754
Woodward & Gerald	A	4.8	2,973	A	2.8	3,134	A	9.3	2,960	A	2.8	3,121	A	9.3	2,960	A	2.8	3,121
Woodward & Grand Street	A	4.9	835	A	4.4	3,369	B	10.2	3,014	A	1.8	3,255	B	10.2	3,014	A	1.8	3,255
Woodward & WB M-8	A	5.5	3,338	A	8.3	3,669	B	11.7	3,346	B	10.6	3,579	B	11.7	3,346	B	10.6	3,579
Woodward & EB M-8	A	8.9	3,291	B	16.0	3,829	B	17.7	3,299	B	17.8	3,828	B	17.7	3,299	B	17.8	3,828
Woodward & Buena Vista	A	3.8	2,890	B	13.1	3,024	B	15.2	2,889	B	10.6	3,024	B	15.2	2,889	B	10.6	3,024
Woodward & Glendale/McLean	A	9.3	2,926	A	9.6	3,043	B	15.1	2,931	C	26.9	3,069	B	15.1	2,931	C	26.9	3,069

Table 4-1. CO Site Selection Screening Analysis

Intersection	No Build						Build – Option A						Build – Option B					
	AM			PM			AM			PM			AM			PM		
	LOS	Delay	Volume	LOS	Delay	Volume	LOS	Delay	Volume	LOS	Delay	Volume	LOS	Delay	Volume	LOS	Delay	Volume
Woodward & Cortland	A	1.2	2,744	A	6.0	2,942	A	2.7	2,787	A	6.8	3,117	A	2.7	2,787	A	6.8	3,117
Woodward & Tuxedo/Tennyson	A	7.1	2,723	A	9.8	2,837	C	21.7	2,761	C	28.5	2,886	C	21.7	2,761	C	28.5	2,886
Woodward & Calvert/Trowbridge	A	6.3	2,726	A	5.0	2,664	B	18.5	2,726	B	14.5	2,664	B	18.5	2,726	B	14.5	2,664
Woodward & Chicago/Arden Park	A	9.1	2,851	A	8.7	2,792	B	17.4	2,851	C	25.2	2,792	B	17.4	2,851	C	25.2	2,792
Woodward & Clairmount/Owen	A	6.6	2,924	A	7.3	3,010	C	24.2	2,924	B	12.5	3,010	C	24.2	2,924	B	12.5	3,010
Woodward & Hazelwood/Holbrook	A	4.8	2,946	A	6.2	2,693	B	17.0	2,946	C	25.1	2,693	B	17.0	2,946	C	25.1	2,693
Woodward & Euclid	A	5.9	3,007	A	8.1	2,923	D	43.7	3,012	C	27.9	2,934	D	43.7	3,012	C	27.9	2,934
Woodward & Seward/Marston	A	4.1	2,908	A	3.1	2,932	C	20.6	2,915	A	5.3	2,967	C	20.6	2,915	A	5.3	2,967
Woodward & Bethune	A	7.3	3,105	B	13.3	3,194	D	35.4	3,116	C	26.4	3,327	D	35.4	3,116	C	26.4	3,327
Woodward & Grand Blvd	B	10.8	4,680	B	12.8	4,856	C	25.0	4,680	B	17.7	4,856	C	27.2	4,680	C	27.6	4,856
Woodward & Baltimore	A	6.0	3,172	A	9.1	3,484	B	13.5	3,226	B	17.0	3,561	A	9.9	3,172	B	15	3,484
Woodward & Milwaukee	A	3.8	3,390	A	8.5	3,748	A	6.5	3,316	B	15.2	3,686	A	6.5	3,390	B	14.2	3,748
Woodward & Endicott													A	5		C	20.7	
Woodward & Piquette							B	15.4		C	26.0							
Woodward & Antoinette/Medbury	A	7.9	3,366	A	7.9	3,667	B	15.6	3,366	C	24.9	3,667	B	11.8	3,366	A	18.9	3,667
Woodward & Palmer	A	5.6	3,251	A	7.5	3,628	B	15.9	3,291	C	21.1	3,681	A	5.6	3,251	A	7.5	3,628
Woodward & Kirby	A	4.7	3,021	A	7.4	3,433	A	2.4	3,109	A	7.1	3,556	A	4.7	3,021	A	7.4	3,433
Woodward & Putnam	A	3.0	2,980	A	8.1	2,959	A	5.0	3,029	C	22.8	3,530	A	4.2	2,980	A	6.2	2,959

Table 4-1. CO Site Selection Screening Analysis

Intersection	No Build						Build – Option A						Build – Option B					
	AM			PM			AM			PM			AM			PM		
	LOS	Delay	Volume	LOS	Delay	Volume	LOS	Delay	Volume	LOS	Delay	Volume	LOS	Delay	Volume	LOS	Delay	Volume
Woodward & MLK Jr./Mack	B	11.4	3,408	B	19.7	4,446	C	26.3	3,437	D	36.5	4,477	C	25.2	3,408	C	29.9	4,446
Woodward & Peterboro/Erskine	A	5.5	1,725	B	11.2	2,238	A	1.0	1,786	A	4.6	2,313	A	5.5	1,725	B	11.2	2,238
Woodward & Charlotte	A	0.7	1,665	A	2.5	2,076	A	1.5	1,725	A	5.9	2,146	A	0.7	1,665	A	2.5	2,076
Woodward & Temple													A	9.3		A	5.8	
Woodward & SB I-75	C	20.2	3,726	B	18.2	2,192	B	15.2	1,682	C	23.4	2,304	B	11.1	3,726	B	14.2	2,192
Woodward & NB I-75	B	10.7	1,905	B	10.4	2,274	B	10.6	1,976	B	18.4	2,455	A	7.9	1,905	B	11.6	2,274
Woodward & Montcalm	A	6.4	1,647	A	6.9	2,004	A	9.8	1,647	B	19.6	2,004	B	13.5	1,647	B	12.4	2,004
Woodward & Elizabeth	A	7.9	1,543	B	11.4	1,828	B	17.6	1,543	B	14.5	1,828	B	14	1,543	A	5.4	1,828
Woodward & Adams	A	4.7	1,592	A	5.1	1,879	B	16.8	1,592	C	20.2	1,897	B	11.1	1,592	B	13.5	1,879
Woodward & Park	B	13.5	1,735	B	15.0	1,890	C	23.3	1,735	C	26.4	1,890	C	26.1	1,735	B	19.3	1,890
Woodward & John R	B	11.5	1,265	B	17.7	1,551	B	11.4	1,265	B	18.3	1,557	B	11.3	1,265	B	16.1	1,551
Woodward & Grand River	B	11.3	1,570	B	10.7	1,533	B	10.3	1,752	C	20.9	1,533	B	15.4	1,570	B	14	1,533
Woodward & State/Gratiot	C	20.8	1,290	C	25.1	1,645	C	20.1	1,290	B	14.6	1,645	C	26.5	1,290	C	30.3	1,645
Griswold & Grand River	B	15.3	982	B	12.1	604	B	10.5	982	B	12.5	604	B	16	982	B	12.5	604
Washington & Grand River	B	15.4	1,084	B	19.8	939	C	23.1	1,084	B	15.5	939	B	13.7	1,084	B	17.6	939
Griswold & State	B	19.1	715	C	22.2	616	C	23.7	715	C	21.7	616	C	25.3	715	C	30.1	616
Washington & State	B	15.2	664	B	11.0	702	A	8.7	664	B	10.2	702	C	23.5	664	B	18.3	702
Washington & Michigan	B	17.5	1,272	C	24.8	1,694	B	15.4	1,272	B	19.0	1,694	B	14.2	1,272	C	20.8	1,694

Table 4-1. CO Site Selection Screening Analysis

Intersection	No Build						Build – Option A						Build – Option B					
	AM			PM			AM			PM			AM			PM		
	LOS	Delay	Volume	LOS	Delay	Volume	LOS	Delay	Volume	LOS	Delay	Volume	LOS	Delay	Volume	LOS	Delay	Volume
Washington & Lafayette	B	19.3	659	B	17.6	850	C	26.7	659	C	21.3	850	B	16.3	659	B	10.3	850
Washington & Fort	B	14.1	1,654	B	13.7	1,707	C	28.6	1,655	C	27.8	1,707	C	25.9	1,654	C	29.5	1,707
Washington & Congress	B	17.6	1,491	B	16.8	1,181	C	23.6	1,491	B	12.6	1,181	C	27.3	1,491	A	9.7	1,181
Washington & Larned	C	20.8	2,595	B	17.3	925	B	18.3	2,595	C	25.5	925	B	19.6	2,595	C	27.7	925
Shelby & Larned	C	20.2	1,829	B	13.3	772	B	19.5	1,829	B	14.1	772	B	10.6	1,829	B	13.6	772
Griswold & Larned	C	24.7	2,002	B	16.8	1,255	B	17.8	2,045	A	6.1	1,275	A	9.8	2,002	A	6.2	1,255
Woodward & Larned	B	18.0	2,556	B	14.8	1,762	B	12.5	2,556	B	18.5	1,762	B	18.3	2,556	C	20.2	1,762
Randolph & Larned	C	22.0	2,095	C	24.6	1,276	C	23.3	2,095	C	24.4	1,276	C	23	2,095	B	16.9	1,276
Randolph & Congress	C	26.9	1,202	C	34.2	1,523	C	23.7	1,202	C	34.4	1,412	C	23.3	1,202	C	33.9	1,523
Woodward & Congress	B	18.8	1,634	C	24.0	1,799	C	29.5	1,634	C	26.8	1,799	C	21.1	1,634	C	24.3	1,799
Griswold & Congress	B	18.3	1,311	B	14.5	1,441	C	28.2	1,311	B	10.5	1,441	C	22.9	1,311	B	12.2	1,441
Shelby & Congress	B	18.3	650	C	20.5	899	C	27.6	650	C	24.5	897	C	22	650	C	22.3	899

Emission Model

Vehicular emissions were estimated using the USEPA MOBILE6.2 vehicular emission factor model. (*User's Guide to MOBILE6.2, Mobile Source Emission Factor Model, Ann Arbor, Michigan,* EPA420-R-02-028*,* October 2002). Input parameters were provided by SEMCOG.

MOBILE6.2 is a mobile source emission estimate program that provides current and future estimates of emissions from highway motor vehicles. The latest in the MOBILE series, which dates back to 1978, MOBILE6.2 was designed by the USEPA to address a wide variety of air pollution modeling needs. This latest version of MOBILE differs significantly in both structure and data requirements from previous versions. MOBILE6.2 incorporates updated information on basic emission rates, more realistic driving patterns, separate start and running emissions, improved correction factors, and changing fleet composition. Input and output files for the MOBILE6.2 program can be found in Appendix B.

Dispersion Model

Mobile source models are the basic analytical tools used to estimate CO concentrations expected under given traffic, roadway geometry, and meteorological conditions. The mathematical expressions and formulations that comprise the various models attempt to describe an extremely complex physical phenomenon as closely as possible. The dispersion modeling program used in this study for estimating pollutant concentrations near roadway intersections is the CAL3QHC (Version 2.0) dispersion model developed by the USEPA and released in 1992.

CAL3QHC is a Gaussian model recommended in the *EPA Guidelines for Modeling Carbon Monoxide from Roadway Intersections* (EPA-454/R-92-005). Gaussian models assume that the dispersion of pollutants downwind of a pollution source follow a normal distribution from the center of the pollution source.

Different emission rates occur when vehicles are stopped (idling), accelerating, decelerating, and moving at different average speeds. CAL3QHC simplifies these different emission rates into two components:

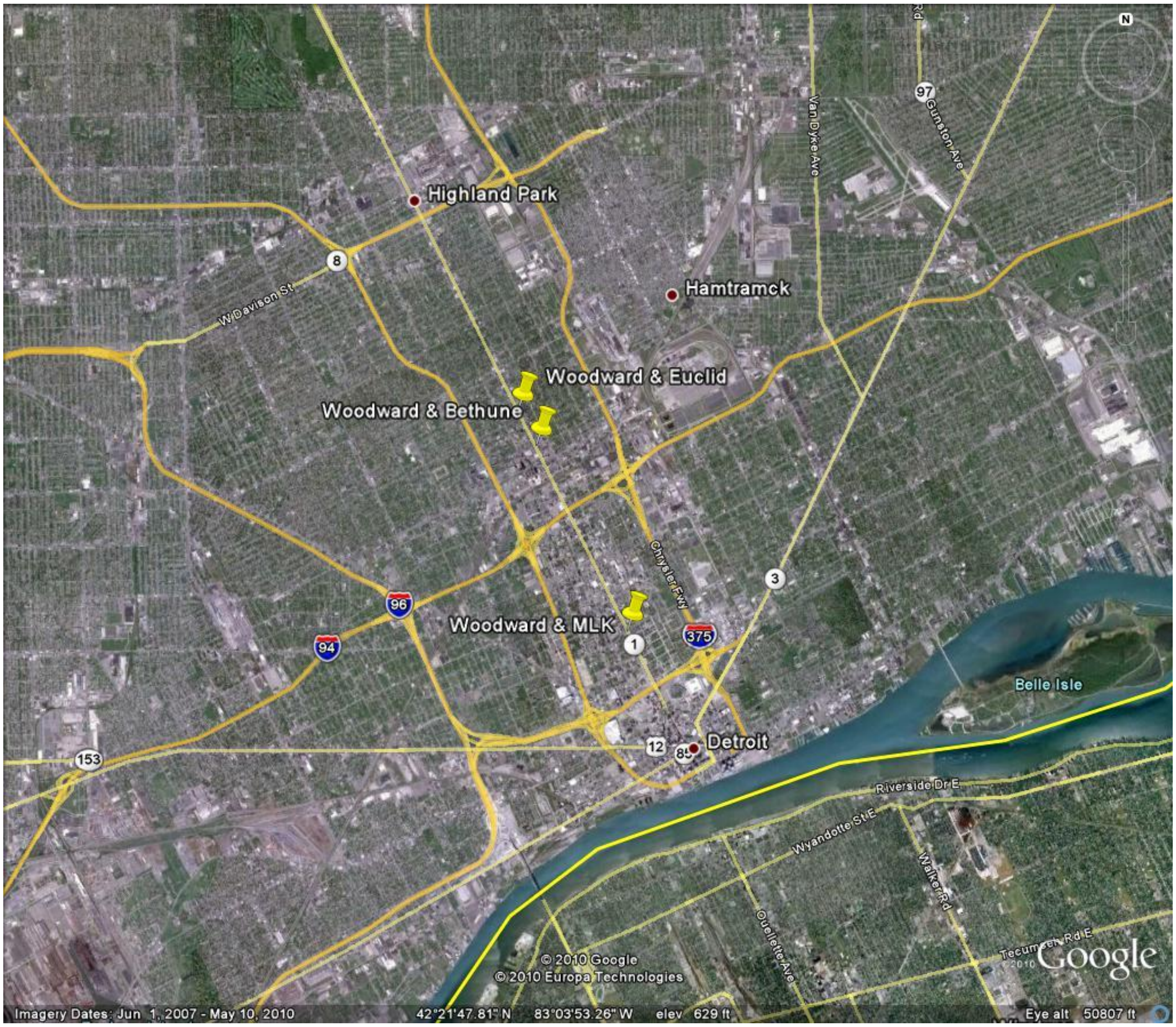
- Emissions when vehicles are stopped (idling) during the red phase of a signalized intersection
- Emissions when vehicles are in motion during the green phase of a signalized intersection

Table 4-2. CO Microscale Analysis Sites

Analysis Site #	Location
1	Woodward & Euclid
2	Woodward & Bethune
3	Woodward & MLK Jr. / Mack

The CAL3QHC (Version 2.0) air quality dispersion model has undergone extensive testing by USEPA and has been found to provide reliable estimates of inert (nonreactive) pollutant concentrations resulting from motor vehicle emissions. A complete description of the model is in the *User's Guide to CAL3QHC version 2.0: A Modeling Methodology for Predicting Pollutant Concentrations near Roadway Intersections* (EPA-454/R-92-006). The CAL3QHC input and output files used for the microscale modeling are presented in Appendix C**.**

Figure 4-1. Carbon Monoxide Microscale Analysis Locations



Meteorological Conditions

The transport and concentration of pollutants emitted from motor vehicles are influenced by three principal meteorological factors: wind direction, wind speed, and the temperature profile of the atmosphere. The values for these parameters were chosen to maximize pollutant concentrations at each prediction site (i.e., to establish a conservative worst case situation).

- Wind Direction. Maximum CO concentrations are normally found when the wind is assumed to blow approximately parallel to a single roadway adjacent to the receptor location. At complex intersections, however, it is difficult to predict which wind angle will result in maximum concentrations. At each receptor location, therefore, the approximate wind angle that would result in maximum pollutant concentrations was used in the analysis. All wind angles from 0° to 360° (in 5° increments) were considered.
- Wind Speed. CO concentrations are greatest at low wind speeds. A conservative wind speed of 1.0 meter per second (2.2 miles per hour) was used to predict CO concentrations during peak traffic periods.

- Temperature and Profile of the Atmosphere. Minimum and maximum winter temperatures of 19°C and 37°C, respectively, a —mixing" height (the height in the atmosphere to which pollutants rise) of 1000 meters, and neutral atmospheric stability (stability class D) conditions will be used in estimating microscale CO concentrations.

The selection of these meteorological parameters was based on USEPA's guidelines.

The CO levels estimated by the model are the maximum concentrations which could be expected to occur at each air quality receptor site analyzed, given the assumed simultaneous occurrence of a number of worst-case conditions: peak-hour traffic conditions, conservative vehicular operating conditions, low wind speed, low atmospheric temperature, neutral atmospheric conditions, and maximizing wind direction.

Persistence Factor

Peak eight-hour concentrations of CO were obtained by multiplying the highest peak hour CO estimates by a persistence factor. The persistence factor accounts for the fact that:

- Over eight-hours (as distinct from a single hour) vehicle volumes will fluctuate downward from the peak hour.
- Vehicle speeds may vary.
- Meteorological conditions including wind speed and wind direction will vary compared to the conservative assumptions used for the single hour.

A persistence factor of 0.7 was used in this analysis. This factor is recommended for use by the USEPA.

Background Concentrations

Microscale modeling is used to predict CO concentrations resulting from emissions from motor vehicles using roadways immediately adjacent to the locations at which predictions are being made. A CO background level must be added to this value to account for CO entering the area from other sources upwind of the receptors. MDOT obtains CO background information from the most recent Michigan Department of Natural Resources and Environment (MDNRE) Air Quality Report. The latest report is from 2009, and the CO monitor located in Allen Park showed the highest CO value to be 2.0 ppm for that year. Therefore, as recommended by MDOT, a CO background level of 2.0 ppm was applied to one-hour CO levels. This background level was also conservatively applied to eight-hour CO levels. Future CO background levels are anticipated to be lower than existing levels due to mandated emission source reductions.

Traffic Information

Traffic data for the air quality analysis were derived from traffic counts and other information developed as part of an overall traffic analysis for the Project. The microscale CO analysis was performed based on data from this analysis for the morning and evening peak traffic periods. These are the periods when maximum traffic volumes occur on local streets and when the greatest traffic and air quality effects of the proposed Project are expected.

Analysis Years

CO concentrations were predicted for the existing (2005) and design year (2030) of the Project.

4.2.2 Analysis Results

Maximum one-hour and eight-hour CO levels were predicted at receptor sites along the proposed Project corridor. Maximum one-hour CO concentrations are shown in Table 4-3. Maximum eight-hour CO concentrations are shown in Table 4-4.

No violations of the NAAQS are predicted under any alternative.

Table 4-3. Predicted Worst-Case One-Hour CO Concentrations (ppm)

No.	Site Description	Existing		No Build		Option A		Option B	
		Morning	Evening	Morning	Evening	Morning	Evening	Morning	Evening
1	Woodward & Euclid	4.7	4.4	3.6	3.4	3.6	3.3	3.6	3.3
2	Woodward & Bethune	4.8	4.9	3.7	3.9	3.4	3.5	3.6	3.7
3	Woodward & MLK Jr. / Mack	5.6	6.1	3.7	4.0	3.7	4.1	3.5	3.8

Note: Concentrations include one-hour CO background = 2.0 ppm; One-hour NAAQS = 35 ppm

Table 4-4. Predicted Worst-Case Eight-Hour CO Concentrations (ppm)

No.	Site Description	Existing		No Build		Option A		Option B	
		AM	PM	AM	PM	AM	PM	AM	PM
1	Woodward & Euclid	3.9	3.7	3.1	3.0	3.1	2.9	3.1	2.9
2	Woodward & Bethune	4.0	4.0	3.2	3.3	3.0	3.1	3.1	3.2
3	Woodward & MLK Jr. / Mack	4.5	4.9	3.2	3.4	3.2	3.5	3.1	3.3

Note: Concentrations include one-hour CO background = 2.0 ppm; Eight-hour NAAQS = 9 ppm

4.3 Particulate Matter (PM_{10} and $PM_{2.5}$)

Because the Project area is classified as a nonattainment area for $PM_{2.5}$, a qualitative hotspot analysis following USEPA's March 29, 2006 guidance ―*Transportation Conformity Guidance for Qualitative Hot-spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas* (EPA420-B-06-902) was conducted, as recommended in USEPA's Final Rule regarding the localized or ―hot-spot” analysis of $PM_{2.5}$ and PM_{10} (40 CFR Part 93 – issued on March 10, 2006).

Following these guidelines a $PM_{2.5}$ hot-spot analysis should be conducted according to qualitative guidance only if the Project is a project of air quality concern, defined in 40 CFR 93.123(b)(1) as:

- New or expanded highway projects that have a significant number of or significant increase in diesel vehicles.
- Projects affecting intersections that are at LOS D, E, or F with a significant number of diesel vehicles, or those that will change to LOS D, E or F because of increased traffic volumes from a significant number of diesel vehicles.
- New bus and rail terminals and transfer points that have a significant number of diesel vehicles congregating at a single location.

- Expanded bus and rail terminals and transfer points that significantly increase the number of diesel vehicles congregating at a single location.
- Projects in or affecting locations, areas, or categories of sites which are identified in the $PM_{2.5}$ or PM_{10} applicable implementation plan or implementation plan submission, as appropriate, as sites of violation or possible violation.

Examples of projects of air quality concern that would be covered by 40 CFR 93.123(b)(1)(i) and (ii) include:

- A project on a new highway or expressway that serves a significant volume of diesel truck traffic, such as facilities with greater than 125,000 annual average daily traffic (AADT) where 8 percent or more of such AADT is diesel truck traffic.
- New exit ramps and other highway facility improvements to connect a highway or expressway to a major freight, bus, or intermodal terminal.
- Expansion of an existing highway or other facility that affects a congested intersection (operated at LOS D, E, or F) that has a significant increase in the number of diesel trucks.
- Similar highway projects that involve a significant increase in the number of diesel transit buses and/or diesel trucks.

Examples of projects of air quality concern that would be covered by 40 CFR 93.123(b)(1)(iii) and (iv) include:

- A major new bus or intermodal terminal that is considered to be a ―regionally significant project" under 40 CFR 93.101.
- An existing bus or intermodal terminal that has a large vehicle fleet where the number of diesel buses increases by 50 percent or more, as measured by bus arrivals.

An interagency consultation between the concerned agencies, including MDOT, SEMCOG, and the appropriate Federal agencies, determines if a project is one of air quality concern. In general, the interagency consultation includes a review of the Project's impact on roadways in the study area along with representative monitored data. The interagency panel will determine if the Project will be classified as a project of air quality concern.

The Project is not proposing to expand or create new bus or rail terminals. The Project is not expected to increase diesel truck traffic in the Project area, nor will it significantly affect regional VMT. As such, it is anticipated that the Project will not be classified as a project of air quality concern.

4.4 Mobile Source Air Toxics

The USEPA is the lead Federal agency for administering the Clean Air Act (CAA) and has certain responsibilities regarding the health effects of MSATs. The USEPA issued a Final Rule on Controlling Emissions of Hazardous Air Pollutants from Mobile Sources (66 Federal Register 17229, March 29, 2001). This rule was issued under the authority in Section 202 of the CAA. In its rule, USEPA examined the impacts of existing and newly promulgated mobile source control programs, including its reformulated gasoline program, its national low emission vehicle standards, its Tier 2 motor vehicle emissions standards and gasoline sulfur control requirements, and its proposed heavy duty engine and vehicle standards and on-highway diesel fuel requirements. Future emissions likely would be lower than present levels as a result of the

USEPA's national control programs that are projected to reduce MSAT emissions by 72 percent from 1999 to 2050, even if VMT increases by 145 percent, as shown in Figure 4-2.

On February 9, 2007 and under authority of CAA Section 202(l), USEPA signed a Final Rule, Control of Hazardous Air Pollutants from Mobile Sources, which sets standards to control MSATs from motor vehicles. Under this rule, USEPA is setting standards on fuel composition, vehicle exhaust emissions, and evaporative losses from portable containers. The new standards are estimated to reduce total emissions of MSATs by 330,000 tons in 2030, including 61,000 tons of benzene. Concurrently, total emissions of VOCs will be reduced by over 1 .1 million tons in 2030 as a result of adopting these standards.

On February 3, 2006, the FHWA released ―Interim Guidance on Air Toxic Analysis in NEPA Documents." This guidance was superseded on September 30, 2009 by FHWA's ―Interim Guidance Update on Air Toxic Analysis in NEPA Documents." The purpose of FHWA's guidance is to advise on when and how to analyze MSATs in the NEPA process for highways. This guidance is interim, because MSAT science is still evolving. As the science progresses, FHWA will update the guidance.

A qualitative analysis provides a basis for identifying and comparing the potential differences among MSAT emissions, if any, from the various alternatives. The qualitative assessment presented below is derived in part from a study conducted by the FHWA entitled ―A Methodology for Evaluating Mobile Source Air Toxic Emissions Among Transportation Project Alternatives," found at: www.fhwa.dot.gov/environment/airtoxic/msatcompare/msatemissions.htm. FHWA's Interim Guidance groups projects into the following tier categories:

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

Based on the recommended tiering approach, this Project falls within the Tier 2 approach. Tier 2 is appropriate for this Project because it does not fall under the Tier 1 category, which includes:

- Projects qualifying as a categorical exclusion under 23 CFR, part 771.117(c);
- Projects exempt under the CAA conformity rule under 40 CFR, part 93.126; or
- Other projects with no meaningful impacts on traffic volumes or vehicle mix.

The Project also does not fall under the Tier 3 category. Tier 3 includes projects that:

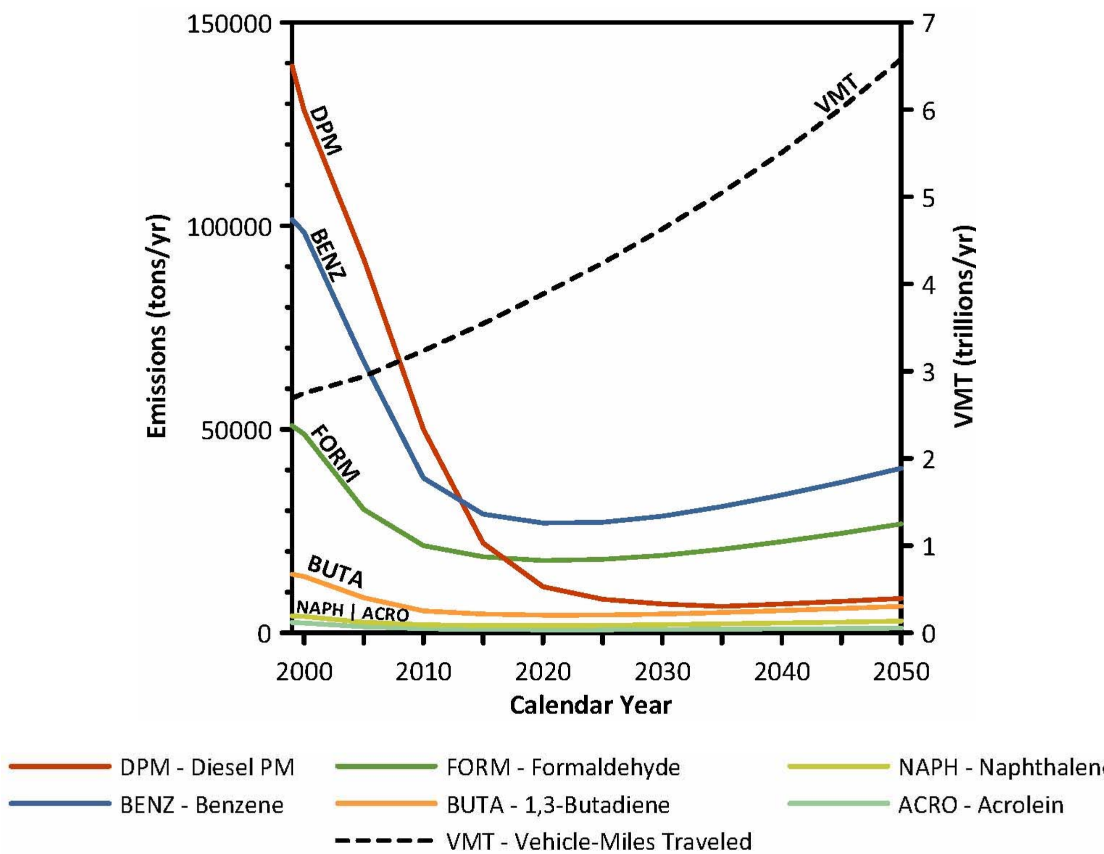
- Create or significantly alter a major intermodal freight facility that has the potential to concentrate high levels of diesel PM in a single location; or
- Create new or add significant capacity to urban highways such as interstates, urban arterials, or urban collector-distributor routes with traffic volumes where the AADT is projected to be in the range of 140,000 to 150,000 vehicles per day (vpd), or greater, by the design year.

And also:

- Proposed to be located in proximity to populated areas.

As stated in FHWA’s guidance, Tier 2 includes projects that “serve to improve operations of highway, transit, or freight without adding substantial new capacity or without creating a facility that is likely to meaningfully increase MSAT emissions. This category covers a broad range of projects.” Based on this guidance, the Project was analyzed using the Tier 2 approach.

Figure 4-2. National MSAT Emission Trends 1999-2050 for Vehicles Operating on Roadways Using USEPA’s Mobile6.2 Model



Source: U.S. Environmental Protection Agency. MOBILE6.2 Model run 20 August 2009.

Note:

(1) Annual emissions of polycyclic organic matter are projected to be 561 tons/yr for 1999, decreasing to 373 tons/yr for 2050.

(2) Trends for specific locations may be different, depending on locally derived information representing vehicle-miles traveled, vehicle speeds, vehicle mix, fuels, emission control programs, meteorology, and other factors.

For each alternative in this analysis, the amount of MSATs emitted would be proportional to the VMT, assuming that other variables such as fleet mix are the same for each detailed study alternative. This Project is not expected to measurably affect regional VMT. Furthermore, the Project is expected to decrease traffic congestion in the Project area and increase local travel speeds. According to USEPA’s Mobile6.2 emissions model, emissions of all of the priority MSATs except for diesel PM decrease as speed increases. However, the extent to which these speed-related emissions decreases will affect overall MSATs levels cannot be reliably projected because of the inherent deficiencies of technical models.

Since the Project is not expected to measurably affect VMT, it is not expected to affect MSAT levels in the Project area in comparison to the No Build Alternative. In comparing various Project alternatives, MSAT levels could be higher in some locations than others, such as the station locations, but current tools and science are not adequate to quantify them. Regardless of the alternative chosen, emissions likely would be lower than present levels in the design year as a result of USEPA's national control programs that are projected to reduce annual MSAT emissions by 72 percent between 1999 and 2050. Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the USEPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the Project area likely would be lower in the future in nearly all cases.

This document has provided a qualitative analysis of MSAT emissions and has acknowledged that the detailed study alternatives could increase exposure to MSAT emissions in certain locations, although the concentrations and duration of exposures are uncertain. However, available technical tools do not enable prediction of the Project-specific health impacts of the emission changes associated with the detailed study alternatives. Because of these limitations, the following discussion is included in accordance with the President's Council on Environmental Quality (CEQ) regulations (40 CFR, Section 1502.22[b]) regarding incomplete or unavailable information.

4.4.1 Information that is Unavailable or Incomplete

In FHWA's view, information is incomplete or unavailable to credibly predict the Project-specific health impacts due to changes in MSAT emissions associated with a proposed set of highway alternatives. The outcome of such an assessment, adverse or not, would be influenced more by the uncertainty introduced into the process through assumption and speculation rather than any genuine insight into the actual health impacts directly attributable to MSAT exposure associated with a proposed action.

The USEPA is responsible for protecting the public health and welfare from any known or anticipated effect of an air pollutant. They are the lead authority for administering the CAA and its amendments and have specific statutory obligations with respect to hazardous air pollutants and MSAT. The USEPA continually assesses human health effects, exposures, and risks posed by air pollutants. They maintain the Integrated Risk Information System (IRIS), which is ~~"a~~ compilation of electronic reports on specific substances found in the environment and their potential to cause human health effects" (USEPA, http://www.epa.gov/ncea/iris/index.html). Each report contains assessments of non-cancerous and cancerous effects for individual compounds and quantitative estimates of risk levels from lifetime oral and inhalation exposures with uncertainty spanning perhaps an order of magnitude.

Other organizations are also active in the research and analyses of the human health effects of MSAT, including the Health Effects Institute (HEI). Two HEI studies are summarized in Appendix D of FHWA's Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA Documents. Among the adverse health effects linked to MSAT compounds at high exposures are cancer in humans in occupational settings, cancer in animals, and irritation to the respiratory tract, including the exacerbation of asthma. Less obvious is the adverse human health effects of MSAT compounds at current environmental concentrations (HEI, http://pubs.healtheffects.org/view.php?id=282) or in the future as vehicle emissions substantially decrease (HEI, http://pubs.healtheffects.org/view.php?id=306).

Emissions

The methodologies for forecasting health impacts include emissions modeling, dispersion modeling, exposure modeling, and then final determination of health impacts. Each step in the process builds on the model predictions obtained in the previous step. All are encumbered by technical shortcomings or uncertain science that prevents a more complete differentiation of the MSAT health impacts among a set of Project alternatives. These difficulties are magnified for lifetime (i.e., 70 year) assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over that time frame, since such information is unavailable. The results produced by the USEPA's MOBILE6.2 model, the California EPA's Emfac2007 model, and the USEPA's DraftMOVES2009 model in forecasting MSAT emissions are highly inconsistent. Indications from the development of the MOVES model are that MOBILE6.2 significantly underestimates diesel PM emissions and significantly overestimates benzene emissions.

Dispersion

Regarding air dispersion modeling, an extensive evaluation of USEPA's guideline CAL3QHC model was conducted in an National Cooperative Highway Research Program (NCHRP) study (http://www.epa.gov/scram001/dispersion_alt.htm#hyroad), which documents poor model performance at 10 sites across the country; three sites had intensive monitor, plus there were an additional seven with less intensive monitoring. The study indicates a bias of the CAL3QHC model to overestimate concentrations near highly-congested intersections and underestimate concentrations near uncongested intersections. The consequence of this is a tendency to overstate the air quality benefits of mitigating congestion at intersections. Such poor model performance is less difficult to manage for demonstrating compliance with NAAQS for relatively short time frames than it is for forecasting individual exposure over an entire lifetime, especially given that some information needed for estimating 70-year lifetime exposure is unavailable. It is particularly difficult to reliably forecast MSAT exposure near roadways, and to determine the portion of time that people are actually exposed at a specific location.

Exposure Levels and Health Effects

There are considerable uncertainties associated with the existing estimates of toxicity of the various MSAT, because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population, a concern expressed by HEI (http://pubs.healtheffects.org/view.php?id=282). As a result, there is no national consensus on air dose-response values assumed to protect the public health and welfare for MSAT compounds, and in particular for diesel PM. The USEPA (http://www.epa.gov/risk/basicinformation.htm#g) and the HEI (http://pubs.healtheffects.org/getfile.php?u=395) have not established a basis for quantitative risk assessment of diesel PM in ambient settings.

A national consensus on an acceptable level of risk is also lacking. The current context is the process used by the USEPA as provided by the CAA to determine whether more stringent controls are required in order to provide an ample margin of safety to protect public health or to prevent an adverse environmental effect for industrial sources subject to the maximum achievable control technology standards, such as benzene emissions from refineries. The decision framework is a two-step process. The first step requires the USEPA to determine a ―safe” or ―acceptable” level of risk due to emissions from a source, which is generally no greater than approximately 100 in a million. Additional factors are considered in the second step, the goal of which is to maximize the number of people with risks less than 1 in a million due to emissions from a source. The results of this statutory two-step process do not guarantee that cancer risks from exposure to air toxics are less than 1 in a million. In some cases, the residual risk determination could result in maximum individual cancer risks that are as high as approximately 100 in a million. In a June 2008 decision, the U.S. Court of Appeals for the District of Columbia Circuit upheld USEPA's approach to addressing risk in its two-step decision framework. Information is incomplete or unavailable to establish that even the largest of highway projects would result in levels of risk greater than safe or acceptable.

Because of the limitations in the methodologies for forecasting health impacts described, any predicted difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with predicting the impacts. Consequently, the results of such assessments would not be useful to decision-makers, who would need to weigh this information against Project benefits, such as reducing traffic congestion, accident rates, and fatalities plus improved access for emergency response, that are better suited for quantitative analysis.

4.5 Construction Assessment

Construction-related effects of the Project would be limited to short-term increased fugitive dust and mobile-source emissions during construction. State and local regulations regarding dust control and other air quality emission reduction controls should be followed.

Once a detailed construction schedule is developed, a more refined construction analysis will be conducted to determine the air quality impacts of construction.

4.5.1 Fugitive Dust Emissions

Fugitive dust is airborne PM, generally of a relatively large particulate size. Construction-related fugitive dust would be generated by haul trucks, concrete trucks, delivery trucks, and earth-moving vehicles operating around the construction sites. This fugitive dust would be due primarily to PM re-suspended (―kicked up") by vehicle movement over paved and unpaved roads, dirt tracked onto paved surfaces from unpaved areas at access points, and material blown from uncovered haul trucks.

Generally, the distance that particles drift from their source depends on their size, the emission height, and the wind speed. Small particles (30 – 100 micron range) can travel several hundred feet before settling to the ground. Most fugitive dust, however, is comprised of relatively large particles (that is, particles greater than 100 microns in diameter). These particles are responsible for the reduced visibility often associated with this type of construction. Given their relatively large size, these particles tend to settle within 20 to 30 feet of their source.

In order to minimize the amount of construction dust generated, the guidelines below should be followed. The following preventive and mitigative measures should be taken to minimize the potential particulate pollution problem:

- Site Preparation
  - Minimize land disturbance.
  - Use watering trucks to minimize dust.
  - Cover trucks when hauling dirt.
  - Stabilize the surface of dirt piles if they are not removed immediately.
  - Use windbreaks to prevent accidental dust pollution.
  - Limit vehicular paths and stabilize these temporary roads.

  - Pave all unpaved construction roads and parking areas to road grade for a length no less than 50 feet from where such roads and parking areas exit the construction site. This prevents dirt from washing onto paved roadways.
- Construction
  - Cover trucks when transferring materials.
  - Use dust suppressants on unpaved traveled paths.
  - Minimize unnecessary vehicular and machinery activities.
  - Minimize dirt track-out by washing or cleaning trucks before leaving the construction site. An alternative to this strategy is to pave a few hundred feet of the exit road just before entering the public road.
- Post-Construction
  - Re-vegetate any disturbed land not used.
  - Remove unused material.
  - Remove dirt piles.
  - Re-vegetate all vehicular paths created during construction to avoid future off-road vehicular activities.

4.5.2 CO Construction Emissions

Since CO emissions from motor vehicles generally increase with decreasing vehicle speed, disruption of traffic during construction (such as the temporary reduction of roadway capacity and the increased queue lengths) could result in short-term, elevated concentrations of CO. In order to minimize the amount of emissions generated, every effort should be made during the construction phase to limit disruption to traffic, especially during peak travel hours.

5.0 Conclusion

The Woodward Avenue Light Rail Project is included in the Regional Transportation Plan (RTP), *Direction2035*, as project I.D. #4430. The Project is included in the 2011-2014 Transportation Improvement Program (TIP) as project I.D. #2010353. This analysis found that the plan and, therefore, the individual projects contained in the plan, are conforming projects, and will have air quality impacts consistent with those identified in the state implementation plans (SIPs) for achieving the National Ambient Air Quality Standards (NAAQS). In addition, the result of the air quality analyses conducted for the proposed Project is that it would not cause or exacerbate an exceedance of the carbon monoxide (CO) NAAQS. Furthermore, the Project is not expected to measurably affect Mobile Source Air Toxics (MSAT) or $PM_{2.5}$levels in the Project area, and was found not to be a project of air quality concern by the Inter Agency Working Group on August 13, 2009.

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