Appendix G
Air Quality Technical Report

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1.0 Introduction

The City of Cincinnati has contracted with Parsons Brinckerhoff (PB) to prepare an Environmental Assessment (EA) document, pursuant to the National Environmental Policy Act (NEPA). As part of the preparation of the EA, an air quality technical study was completed as presented in this document. The following sections describe the potential air quality impacts of the proposed streetcar Build Alternatives.

2.0 Environmental Analysis

2.1 Affected Environment

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, or harming human or animal health.

2.1.1 Clean Air Act Amendments of 1990

The Clean Air Act (CAA) Amendments of 1990 and the Final Transportation Conformity Rule [40 CFR Parts 51 and 93] direct the U.S. Environmental Protection Agency (EPA) to implement environmental policies and regulations that will ensure acceptable levels of air quality. The Clean Air Act and the Final Transportation Conformity Rule affect proposed transportation projects. According to Title I, Section 176 (c) 2:

> "No federal agency may approve, accept, or fund any transportation plan, program, or project unless such plan, program, or project has been found to conform to any applicable State Implementation Plan (SIP) in effect under this act."

The Final Conformity Rule defines conformity as follows:

> "Conformity to an implementation plan's purpose of eliminating or reducing the severity and number of violations of the National Ambient Air Quality Standards (NAAQS) and achieving expeditious attainment of such standards; and that such activities will not:
>
> - 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."

2.1.2 National and State Ambient Air Quality Standards

As required by the Clean Air Act, National Ambient Air Quality Standards (NAAQS) have been established for six major air pollutants. These pollutants, known as criteria pollutants, are: carbon monoxide, nitrogen dioxide, ozone, particulate matter (PM_{10} and $PM_{2.5}$), sulfur dioxide and lead.

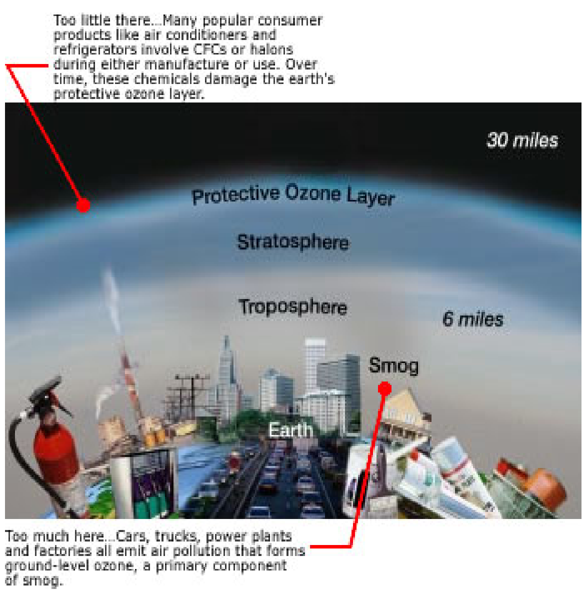
The Federal standards are summarized in Table 1. The "primary" standards have been established to protect the public health. The "secondary" standards are intended to protect the nation's welfare and account for air pollutant effects on soil, water, visibility, materials, vegetation and other aspects of the general welfare.

2.1.3 Criteria Pollutants and Effects

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. The criteria pollutants are ozone (O_3), particulate matter, carbon monoxide (CO), Nitrogen Dioxide (NO_2), Lead (Pb), and Sulfur Dioxide (SO_2). Criteria pollutants that can be traced principally to motor vehicles are relevant to the evaluation of the project's impacts; these pollutants include CO, O_3, PM_{10}, and $PM_{2.5}$. Transportation sources account for a small percentage of regional emissions of SO_2 and Pb. A brief description of each pollutant is provided below.

Ozone. Ozone (O_3) is a colorless, toxic gas. As shown in Figure 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 reactive organic gases (ROG) and nitrogen oxides (NOx), which are emitted from industrial sources and from automobiles. 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 blood stream 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 their growth.

Figure 1. Ozone in the Atmosphere



Source: *www.epa.gov/oar/oaqps/gooduphigh/good.html*

Table 1. Federal Ambient Air Quality Standards

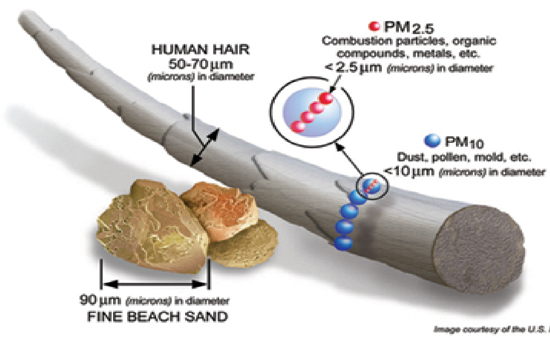
Pollutant	Primary Standards		Primary Standards	
	Level	**Averaging Time**	**Primary Standards**	**Primary Standards**
Carbon Monoxide	9 ppm (10 mg/m^3)	8-hour [(1)]	None	
	35 ppm (40 mg/m^3)	1-hour [(1)]		
Lead	0.15 µg/m^3 [(2)]	Rolling 3-Month Average	Same as Primary	
	1.5 µg/m^3	Quarterly Average	Same as Primary	
Nitrogen Dioxide	0.053 ppm (100 µg/m^3)	Annual (Arithmetic Mean)	Same as Primary	
	0.100 ppm	1-hour [(3)]	0.053 ppm (100 µg/m^3)	Annual (Arithmetic Mean)
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)]		

Notes:
[(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.

Abbreviations: ppm = parts per million, µg/m^3 = micrograms per cubic meter.
Source: USEPA, 2010.

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.

Figure 2. Relative Particulate Matter Size



Source: http://www.epa.gov/airscience/images/pm2.5_graphic.jpg

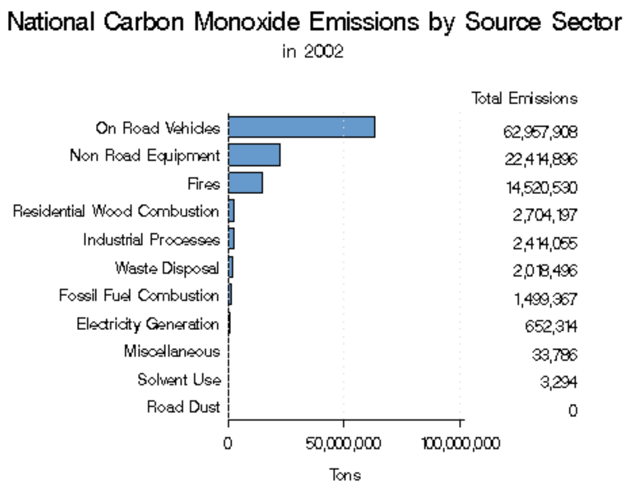
Particulate pollution also can include bits of solid or liquid substances that can be highly toxic. Of particular concern are those particles that are smaller than, or equal to, 10 microns (PM_{10}) and 2.5 microns ($PM_{2.5}$) in size.

PM_{10} refers to particulate matter less than 10 microns in diameter, about one/seventh the thickness of a human hair (Figure 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 and industry 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 most PM_{10} comes from fugitive dust, wind erosion, and/or agricultural and forestry sources. A small portion of particulate matter 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 particulate matter 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.

Carbon Monoxide. Carbon Monoxide (CO), a colorless gas, 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, 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 (warmer air traps colder air near the ground) are more frequent. 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 localized, or microscale, basis.

Figure 3. Sources of Carbon Monoxide



Source: *http://www.epa.gov/air/emissions/co.htm*

Nitrogen Dioxide. Nitrogen Dioxide (NO_2), a brownish gas, irritates the lungs. It can cause breathing difficulties at high concentrations. Like 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}, small liquid and solid particles that are less than 10 microns in diameter (see discussion of PM_{10}). At atmospheric concentration, 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. Some 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 in the urban environment from mobile sources have significantly decreased due to the federally mandated switch to lead-free gasoline.

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 for 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 yellow plant leaves and erode iron and steel.

2.1.4 Mobile Source Air Toxics

In addition to the criteria pollutants for which there are NAAQS, the EPA also regulates air toxics. Toxic air pollutants are those pollutants known or suspected to cause cancer or other serious health effects. 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 Clean Air Act Amendments of 1990, whereby Congress mandated that the EPA regulate 188 air toxics, also known as hazardous air pollutants. The EPA 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, EPA 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 particulate matter plus diesel exhaust organic gases (diesel PM), formaldehyde, naphthalene, and polycyclic organic matter. While the 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 EPA rules.

The 2007 EPA rule mentioned above requires controls that will dramatically decrease mobile source air toxics (MSAT) emissions through cleaner fuels and cleaner engines. According to an FHWA analysis using EPA'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.

2.1.5 Attainment Status/Regional Air Quality Conformity

Section 107 of the 1977 Clean Air Act Amendment requires that the EPA publish a list of all geographic areas in compliance with the NAAQS, as well as those areas not in attainment of the NAAQS. Areas not in compliance with the NAAQS are termed nonattainment areas. Areas that have insufficient data to make a determination are unclassified, and are treated as being in attainment areas until proven otherwise. The designation of an area is made on a pollutant-by-pollutant basis. The EPA’s area designations are shown in Table 2. Hamilton County is classified as an attainment area for CO, PM_{10}, NO_2 and SO_2 and a nonattainment area for O_3 and $PM_{2.5}$.

Table 2. Attainment Classifications and Definitions

Attainment	Unclassified	Maintenance	Nonattainment
Area is in compliance with the NAAQS.	Area has insufficient data to make a determination and is treated as being in attainment.	Area once classified as nonattainment but has since demonstrated attainment of the NAAQS.	Area is not in compliance with the NAAQS.

2.1.6 Transportation Conformity

The Federal Clean Air Act requires that all transportation plans and programs pass the air quality conformity test. This process involves forecasting future emissions of air pollution to determine whether the amount of future pollution resulting from the plan or program would be within the allowable limit for motor vehicle emissions.

Transportation conformity must be determined for all nonattainment area pollutants classified as regional pollutants. In Hamilton County, those pollutants are O_3 and $PM_{2.5}$. Transportation projects also generate CO, which is considered a localized pollutant. CO micro-scale modeling is required to determine whether a transportation project would cause or contribute to localized violations of CO NAAQS.

Regional conformity must be determined based on a full study at least every three years. In Ohio, it is determined at least every two years when the state-required Regional Transportation Plan (RTP) updates are done. In addition, a new federal Transportation Improvement Program (TIP) is required every four years, for which a conformity determination is required. Amendments to both the RTP and TIP between mandated conformity analyses also must have conformity demonstrated, including a full-scale revision of the regional analysis if regionally significant projects are added, deleted, or significantly modified.

Regional conformity is demonstrated by showing that the project is included in a conforming RTP and TIP with substantially the same design concept and scope that was used for the regional conformity analysis.

Project level conformity is demonstrated by showing that it will not cause a localized exceedance of CO and/or PM_{10} standards, and that it will not interfere with "timely implementation" of Transportation Control Measures called out in the State Implementation Plan.

The Final Rule has the following Key Elements:

- This rule requires that $PM_{2.5}$ hot spot analyses be performed only for new transportation projects with significant diesel traffic. Examples of such "projects of air quality concern" include intermodal freight or bus terminals, and major highway projects and congested intersections involving significant diesel traffic. No hot spot analyses will be required for most projects in $PM_{2.5}$ areas, because most projects are not of air quality concern. This final rule also streamlines existing PM_{10} hot spot requirements in a similar way.
- The streamlined approach in this final rule will ensure that transportation and air quality agencies in $PM_{2.5}$ and PM_{10} areas use their resources efficiently, while achieving clean air goals.
- In both $PM_{2.5}$ and PM_{10} areas, a quantitative hot spot analysis is not required until EPA issues a new motor vehicles emissions model capable of estimating local emissions as well as future hot spot modeling guidance. Qualitative analyses will apply in the interim.
- This rule extends an existing flexibility by allowing the U.S. Department of Transportation to make "categorical hot spot findings," which waive $PM_{2.5}$ and PM_{10}

hot spot reviews for categories of projects where modeling shows that there is no air quality concern.

2.1.7 Ambient Air Quality in the Study Area

2.1.7.1 Local Meteorology

Cincinnati is located in the south west corner of the state of Ohio and situated north of the Ohio River. Cincinnati is located within the northern limit of the humid subtropical climate and the southern limit of the humid continental climate zone, with average temperatures by United States standards. Summers are hot, humid and wet. July is the warmest month, with an average high of 87°F (31°C) and an average low of 68°F (20°C). Winters are generally cool to cold, with occasional snowfall. January is the coldest month, with an average high of 38°F (3°C) and an average low of 21°F (-6°C). Precipitation is fairly evenly distributed each month, averaging 41 inches of rainfall and 14 inches of snowfall annually.

2.1.7.2 Monitored Air Quality

Ambient air quality monitor data at the monitoring stations closest to the study area for the years 2006-2008 are presented in Table 3. As shown in Table 3, no violations of the CO, PM_{10} or NO_2 standard have been observed. Several violations of the 8-hour O_3 standard have been observed throughout the 3-years worth of monitored data at the locations which monitor this pollutant near the project area. The monitors have also observed violations of the $PM_{2.5}$ standards, though no violations in the most recent year of available data (2008) have been observed. These monitored values support the O_3 and $PM_{2.5}$ nonattainment status of the project area as well as the attainment status of the project area for the other criteria pollutants.

Table 3. Ambient Air Quality Monitored Data 2006-2008

			100 E 5th Street Cincinnatti, OH Hamilton County Site ID#: 390610021			250 Wm Howard Taft Cincinnati, OH Hamilton County Site ID#: 390610040			11590 Grooms Road Cincinnati, OH Hamilton County Site ID#: 390610006			6950 Ripple Road Cincinnati, OH Hamilton County Site ID#: 390610010			Seymour & Vine Street Cincinnati, OH Site ID#: 390610014		
			2006	2007	2008	2006	2007	2008	2006	2007	2008	2006	2007	2008	2006	2007	2008
Carbon Monoxide (CO) [ppm]	1-Hour	Maximum	10.6	4.9	5.9												
		2nd Maximum	9.9	4.1	5.1												
		# of Exceedences	0	0	0												
	8-Hour	Maximum	4.3	3.1	3.6												
		2nd Maximum	3	2.8	2.7												
		# of Exceedences	0	0	0												
Particulate Matter [ug/m ^{3}]	PM_{10}	Maximum 24-Hour				43	46	49							53	51	48
		Mean Annual				19	25	19							23	26	26
		# of Exceedences				0	0	0							0	0	0
	$PM_{2.5}$	Maximum 24-Hour				34.5	41.9	31.5	35	40.8	33.9	36.3	41.5	37.7	36.3	41.5	37.7
		Mean Annual				13.57	15.09	12.13	13.29	14.63	12.03	15.51	16.59	14.52	15.51	16.59	14.52
		# of Exceedences				0	0	0	0	0	0	1	1	0	1	1	0
Ozone (O_3) [ppm]	8-Hour	First Highest				0.089	0.097	0.086	0.084	0.1	0.093	0.098	0.093	0.085			
		Second Highest				0.08	0.093	0.083	0.084	0.092	0.089	0.092	0.091	0.079			
		Third Highest				0.079	0.088	0.081	0.082	0.091	0.087	0.082	0.088	0.079			
		Fourth Highest				0.078	0.086	0.08	0.081	0.089	0.086	0.081	0.086	0.077			
		# of Days Standard Exceeded				8	15	7	9	33	12	10	23	7			
Nitrogen Dioxode (NO_2) [ppm]		1-Hour Maximum				0.061	0.081	0.079									
		1-Hour Second Maximum				0.061	0.072	0.073									
		Annual Mean				0.018	0.017	0.016									
		# of Days Standard Exceeded				0	0	0									

Source: http://www.epa.gov/air/data/geosel.html

2.2 Environmental Consequences

2.2.1 Traffic Analysis Overview

The traffic analysis followed a conventional approach that included data collection, investigation of existing roadway and traffic conditions, and analysis of opening year operational impacts. Most of the background data were obtained from the Synchro traffic model for this project, which included 2009 traffic volumes (vehicular and pedestrian), existing signal timing data, roadway geometry, peak hour factor, heavy vehicle percentage and lane configurations. The model served as a sufficient foundation for conducting the analysis. Refinements were required in order to tailor the information to the existing traffic conditions (lane configuration, signal timing, transit and on-Street parking information) in the study area. The additional data collected as part of the initial reconnaissance task were related to lane geometry and on-street parking.

The year 2012 was considered as the project opening year. An annual growth rate of one percent was assumed to adjust the 2009 traffic volumes to opening year 2012 volumes. The evening rush hour (PM peak) traffic was considered as the heavy traffic condition during the day. The following scenarios were analyzed to study the impact of streetcar operations on the roadway system for the opening year during the PM peak hour.

- 2009 Existing Conditions - The roadway network includes existing roadway conditions.

- 2012 No Build - The roadway network will remain the same as the existing 2009 roadway conditions with the addition of The Banks street grid.
- 2012 Build Alternative 1 - The roadway geometry, traffic control and roadway capacity will remain the same as the No Build scenario. The proposed Streetcar will occupy one lane and require on-street parking adjustments as noted in the conceptual engineering plans. Six Streetcar trips per hour were included in the Build scenario. The lane with the Streetcar can also be used by traffic. Both Build Alternatives will have the same impacts between Freedom Way and Henry Street. This alternative includes an analysis of Vine Street.
- 2012 Build Alternative 2 - The roadway geometry, traffic control and roadway capacity will remain the same as the No Build scenario. The proposed Streetcar will occupy one lane and will cause parking adjustments as noted in the conceptual engineering plans. Six Streetcar trips per hour were included in the Build scenario. The lane with the Streetcar can also be used by traffic. Impacts between Freedom Way and Henry Street were analyzed. This alternative also includes an analysis of West Clifton Avenue instead of Vine Street.

Analyses of roadway and intersection operational performance for the study scenarios were performed using the Synchro/SimTraffic simulation analysis package (Version 7). The determinations of level of service for existing traffic conditions and future traffic conditions were based on the *Highway Capacity Manual 2000*. The analyses results are expressed using level of service (LOS), intersection capacity utilization, and intersection delay. Level of service is a qualitative measure ranging from LOS A (free-flow) to LOS F (congested), to describe operational conditions within a traffic stream and the perception of traffic operational conditions by motorists and passengers.

2.2.2 Criteria Pollutants

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

HC and NO_x emissions from automotive sources are a concern primarily because they are precursors in the formation of O_3 and particulate matter. O_3 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. However, because the project alternatives are not projected to measurably affect regional travel patterns, no significant increase in regional emissions is anticipated.

2.2.2.1 Particulate Matter Analysis

PM_{10} and $PM_{2.5}$ impacts are both regional and local. A significant portion of particulate matter, 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.

Following the guidelines in USEPA's Transportation Conformity Guidance for Qualitative Hot-Spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas (March 29, 2006, referred to as "PM_{10} Guidance"), 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:

> (i) New or expanded highway projects that have a significant number of or significant increase in diesel vehicles;
>
> (ii) Projects affecting intersections that are at Level of Service (LOS) D, E, or F with a significant number of diesel vehicles, or those that would change to LOS D, E or F because of increased traffic volumes from a significant number of diesel vehicles;
>
> (iii) New bus and rail terminals and transfer points that have a significant number of diesel vehicles congregating at a single location;
>
> (iv) Expanded bus and rail terminals and transfer points that significantly increase the number of diesel vehicles congregating at a single location; and
>
> (v) 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.

The streetcar project is not expected to change the vehicle mix (gasoline cars and diesel trucks) within the study area. Therefore, the streetcar project would not cause a significant increase in diesel vehicles, nor would it affect intersections operating at LOS D, E or F because of increased traffic volumes from a significant number of diesel vehicles. As such, the streetcar project is not considered a project of air quality concern, and EPA has determined that such projects meet the Clean Air Act's conformity requirements without any further hot-spot analysis. Therefore, $PM_{2.5}$/PM_{10} impacts are not expected with either Build Alternative.

2.2.2.2 Carbon Monoxide Analysis

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. Traffic analyses determined that the streetcar project would not increase overall annual average daily traffic (AADT) within the study area and would improve traffic flows within the study area as compared to the No Build scenario. For all roadway segments within the study area, the level of service estimates for the Build scenario, when compared to the No Build scenario, were either the same or better. The roadway segments analyzed include:

Walnut Street & Freedom Way	Race Street & Liberty Street
Walnut Street & 2nd Street	Race Street & 15th Street
Walnut Street & 3rd Street	Race Street & 14th Street
Walnut Street & 4th Street	Race Street & 13th Street
Walnut Street & 5th Street	Race Street & 12th Street

Walnut Street & 6th Street	12th Street & Vine Street
Walnut Street & 7th Street	12th Street & Walnut Street
Walnut Street & 8th Street	Main Street & 12th Street
Walnut Street & 9th Street	Main Street & Central Parkway
Walnut Street & Court Street	Main Street & Court Street
Central Parkway &Walnut Street	Main Street & 9th Street
Central Parkway & Vine Street	Main Street & 8th Street
Central Parkway & Race Street	Main Street & 7th Street
Elm Street & 12th Street	Main Street & 6th Street
Elm Street & 14th Street	Main Street & 5th Street
Elm Street & Liberty Street	Main Street & 4th Street
Elm Street & Findlay Street	Main Street & 3rd Street
Race Street & Findlay Street	Main Street & 2nd Street
Race Street & Green Street	Main Street & Freedom Way

Since the streetcar project is not predicted to cause any location to have a LOS below B, the project is not anticipated to substantially increase CO levels. As such, the streetcar project is not anticipated to cause a violation of the NAAQS for CO.

While it is possible that CO levels at sensitive land uses directly adjacent to the affected roadway could change as a result of locating travel lanes closer to these receptors, it is unlikely, based on the projected vehicular volumes and levels of service that CO levels at these locations would approach the NAAQS.

2.2.3 Mobile Source Air Toxics

On February 3, 2006, the FHWA released “Interim Guidance on Air Toxic Analysis in NEPA Documents.” This guidance was superceded 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 Mobile Source Air Toxics (MSATs) in the NEPA process for highways. As the science progresses, FHWA will update the guidance.

FHWA’s Interim Guidance groups projects into the following categories:

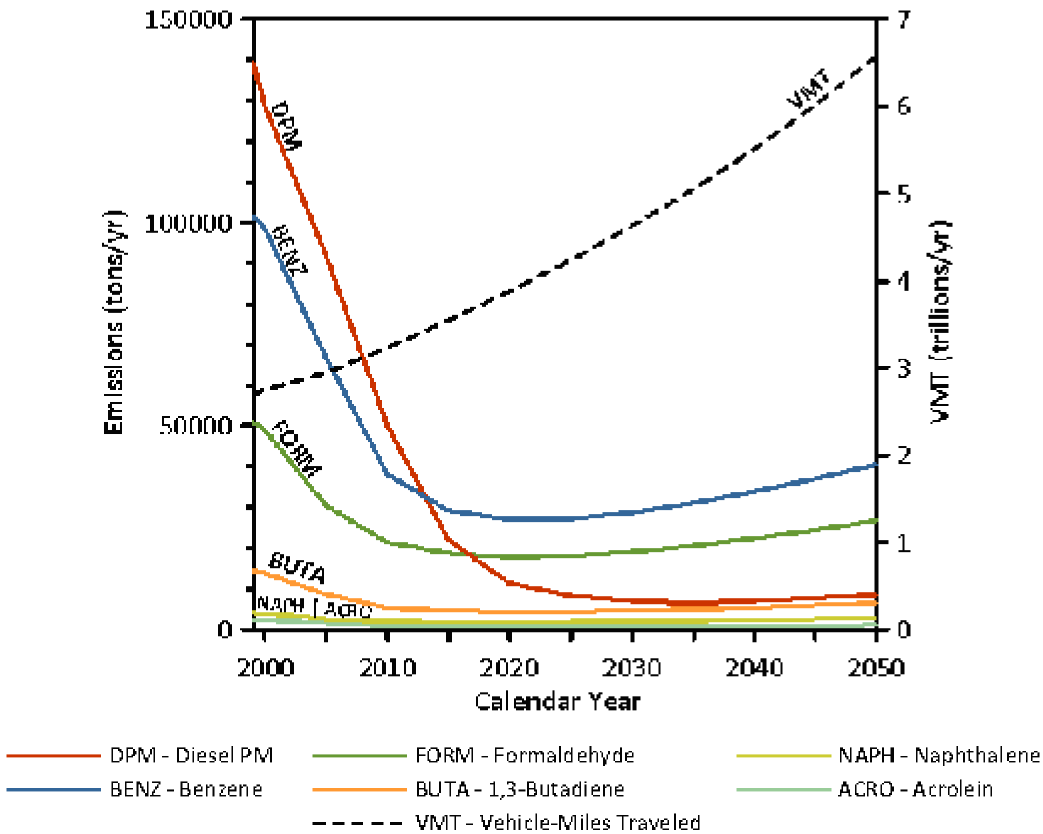
- Exempt Projects and Projects with no Meaningful Potential MSAT Effects;
- Projects with Low Potential MSAT Effects; and,
- Projects with Higher Potential MSAT Effects.

Since the streetcar project does not add capacity, add a new interchange or involve a new road on a new alignment, it is considered a Project with no Meaningful Potential MSAT Effects.

One purpose of the streetcar project is to improve transportation through improved regional transit service by constructing and operating a 3.7 mile modern streetcar system and a maintenance and storage facility. This project has been determined to generate minimal air quality impacts for CAAA criteria pollutants and has not been linked with any special MSAT concerns. As such, this project will not result in changes in traffic volumes, vehicle mix, or any other factor that would cause an increase in MSAT impacts of the project from that of the No Build Alternative.

Moreover, EPA regulations for vehicle engines and fuels will cause overall MSAT emissions to decline significantly over the next several decades. Based on regulations now in effect, an analysis of national trends with EPA's MOBILE6.2 model forecasts a combined reduction of 72 percent in the total annual emission rate for the priority MSAT from 1999 to 2050 while vehicle-miles of travel are projected to increase by 145 percent as shown in Figure 5. This will both reduce the background level of MSAT as well as the possibility of even minor MSAT emissions from this project.

Figure 4. National MSAT Emission Trends 1999–2050 for Vehicles Operating on Roadways Using EPA's Mobile6.2 Model



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

Notes:

(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 travelled, vehicle speeds, vehicle mix, fuels, emission control programs, meteorology, and other factors

2.3 Construction Impacts on Air Quality

In general, construction-related effects of the streetcar 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.

2.3.1 Fugitive Dust Emissions

Fugitive dust is airborne particulate matter, 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 caused by particulate matter that is 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 to 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.

To minimize the amount of construction dust generated, the guidelines below should be followed. The following prevention and mitigation measures should be taken to minimize the potential particulate pollution problem.

<u>Site Preparation</u>

- 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 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 to prevent dirt from washing onto paved roadways.

<u>Construction</u>

- 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.

<u>Post-Construction</u>

- 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.

2.3.2 Mobile Source Emissions

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

2.4 Conclusions

The proposed streetcar project is not predicted to cause or exacerbate a violation of the NAAQS. The Build Alternatives are not predicted to affect the overall VMT within the study area, and the project is considered a Project with no Meaningful Potential MSAT Effects. Therefore, no $PM_{2.5}$ or MSAT impacts are expected to result from the streetcar project. 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.

3.0 References

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