AIR QUALITY ANALYSIS: Technical Report

Route 58, Martin Luther King Junior Freeway Extension

City of Portsmouth

0058-965-107, P101 UPC 76642

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Virginia Department of Transportation

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I. Executive Summary

The Commonwealth of Virginia plans to extend the MLK Freeway from Interstate 264 (1-264) to London Boulevard in the City of Portsmouth, Virginia. The project would involve highway construction on new location for approximately 1.13 kilometers (0.70 miles) and improvements to 1-264 for a distance of 1.52 kilometers (0.95 miles). An elevated, limited access facility has been selected as the preferred alternative for the project.Federal funding is involved, thus compliance with the National Environmental Policy Act (NEPA) is required. A Revised Environmental Assessment is to be prepared for this project. Part of the NEPA compliance is to determine the potential operational impacts on air quality from the changes in the roadway and conformity with any State Implementation Plan (SIP) for any criteria pollutant in a nonattainment or maintenance area.

This project has been assessed for potential air quality impacts and conformity with applicable air quality regulations and requirements. The project has been found to meet these requirements and as such, it will not cause or contribute to a violation of national ambient air quality standards (NAAQS). In regards to Mobile Source Air Toxics, best available information indicates that nationwide regional levels of air toxics are expected to decrease in the future due to fleet turnover and the continued implementation of more stringent emission and fuel quality regulations. Nevertheless, it is possible that some localized areas may show an increase in emissions and ambient levels of these pollutants due to locally increased traffic levels associated with the project.

This project is located in an eight-hour Ozone maintenance area. It is also located within designated emissions control areas for volatile organic compounds (VOC) and nitrogen oxides (NO_x). All reasonable precautions should be taken to limit the emissions of VOC, NO_x and particulate matter. In addition, the following Virginia Department of Environmental Quality (VDEQ) air pollution regulations must be adhered to during the construction of this project: 9 VAC 5-40-5600 et seq., Open Burning Restrictions; 9 VAC 5-40-5490 et seq., Cutback Asphalt Restrictions; and 9 VAC 5-50-60 et seq., Fugitive Dust Precautions.

Emissions may be produced in the construction of this project from heavy equipment and vehicle travel to and from the site, as well as fugitive sources. Construction emissions are short term or temporary in nature. In order to mitigate these emissions, all construction activities are to be performed in accordance with Virginia Department of Transportation (VDOT) *Road and Bridge Specifications*.

II. Alternatives under Consideration

The No Build Alternative assumes other currently programmed, committed, and funded roadway projects in the VDOT Six Year Plan and the Statewide Transportation Improvement Program will be implemented. The project analyzed herein would not be built. There are no additional known projects that impact the analyzed intersection.

The Build Alternative assumes the expansion of the MLK Freeway from Interstate 264 (1-264) to London Boulevard in the City of Portsmouth, Virginia. Other currently programmed, committed, and funded roadway projects in the VDOT Six Year Plan and the Statewide Transportation Improvement Program will be implemented as well.

III. Regulatory Requirements

A. National Environmental Policy Act (NEPA) and Conformity Requirements, Guidance and Agreements

The National Environmental Policy Act (NEPA) of 1969, as amended, requires detailed analysis of the environmental impacts of a proposed transportation project (42 USC § 4331). Further to that, on August 4, 2004, VDOT and FHWA completed a Memorandum of Understanding addressing NEPA project level air quality analyses for carbon monoxide. Under this agreement, project level, or hot-spot, analyses are conducted when certain criteria, such as traffic thresholds or Level of Service requirements, are met.

On February 3, 2006, FHWA and EPA issued joint guidance for the assessment of Mobile Source Air Toxics (MSATs)[1] in the NEPA process. The guidance includes specific criteria in a three tiered approach for determining the level of analysis required for a particular project. The guidance is consistent with the conformity rule, although MSATs are not considered "criteria pollutants" as defined by EPA in 40 CFR 3.102(b).

On March 29, 2006, EPA and FHWA issued the "Transportation Conformity Guidance for Qualitative Hot-Spot Analyses in $PM_{2.5}$ Nonattainment and Maintenance Areas[2]". The guidance includes criteria for determining whether a project is one of "air quality concern" according to the final $PM_{2.5}$ Rule (40 CFR 93.123(b)(1), and outlines methods for conducting qualitative analyses for such a project to be included in the NEPA document. According to this guidance, if a project still requires a FHWA approval or authorization, a project-level conformity determination is required prior to the first such action on or after April 5, 2006, even if the project has already completed the NEPA process, or for multi-phase projects, even if other phases of the project have already been constructed. At the date of preparation, EPA has not issued quantitative modeling guidance, nor announced in the Federal Register that quantitative analysis requirements are in effect for $PM_{2.5}$, as pursuant to 40 CFR 93.123(b)(4). Therefore, only qualitative analyses are required for projects of air quality concern.

B. Transportation Conformity Rule

The federal transportation conformity rule (40 CFR Parts 51 and 93) in general requires air quality conformity determinations for transportation plans, programs and projects in "non-attainment or maintenance areas for transportation-related criteria pollutants for which the area is designated non-attainment or has a maintenance plan" (40 CFR 93.102(b)). Non-attainment and maintenance areas are those that do not meet or have not met the National Ambient Air Quality Standards (NAAQS) for any of the criteria pollutants, or their precursors as defined in 40 CFR 93.102(b). Currently applicable NAAQS for the pollutants are shown in Table III-1. The federal conformity rule requires a currently conforming plan and program to be in place at the time of project approval (40 CFR 93.114) and for the project to be included in the conforming plan and program (40 CFR 93.115). The design and scope of the project as specified in the plan and program at the time of a regional conformity determination should be properly programmed and adequate to determine its contribution to regional emissions (40 CFR 93.115(c)). If the project is not required to be specifically listed, it still must be consistent with the policies and purpose of the plan and not interfere with other projects specifically included (40CFR.93.115(b)). This project is included in the 2026 Long Range Transportation Plan and included for Right-of-Way only in the FY 2006-2009 Transportation Improvement Program.

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[1] "Interim Guidance on Air Toxic Analysis in NEPA Dcuments," February 3, 2006. http://fhwa.dot.gov/environment/airtoxic/020306guidmem.htm

[2] *Transportation Conformity Guidance for Qualitative Hotspot Analysis in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas.* EPA420-B-06-902. March 29, 2006.

Table III-1: Federal National Ambient Air Quality Standards (NAAQS)

Pollutant	Averaging Time	Primary	Secondary
Ozone (O3) 3	8-hour	0.08 ppm (157 µg/m^3)	0.08 ppm (157 µg/m^3)
Coarse Particulate Matter (PM10)	24-hour	150 µg/m^3	151 µg/m^3
Fine Particulate Matter (PM2.5)	24-hour	35 µg/m^3	35 µg/m^3
	Annual Mean(Arith.)	15 µg/m^3	15 µg/m^3
Carbon Monoxide (CO)	1-hour	35 ppm (40 mg/m^3)	-
	8-hour	9 ppm (10 mg/m^3)	-
Nitrogen Dioxide (NO2)	Annual Mean	0.053 ppm (100 µg/m^3)	0.053 ppm (100 µg/m^3)
Lead (Pb)	Calendar Quarter	1.5 µg/m^3	1.5 µg/m^3
Sulfur Dioxide (SO2)	24-hour	0.14 ppm (365 µg/m^3)	-
	Annual Mean(Arith.)	0.03 ppm (80µg/m^3)	-
	3-hour	-	0.5 ppm (1,300 µg/m^3)

ppm – parts per million

mg/m^3 – milligrams per cubic meter

µ g/m^3 – micrograms per cubic meter

a National standards (other than O_3, PM_{10}, and those based on annual periods) are not to be exceeded more than once per year. The ozone standard is based on a 3-year average of the fourth highest 8-hour concentration in each year. For PM_{10}, the 24-hour standard may not be exceeded more than once per year on average over a three-year period. For $PM_{2.5}$, the 98th percentile of 24-hour concentrations in a year, averaged over 3 years, must be less than or equal to the 24-hour standard. The three-year average of the annual average $PM_{2.5}$ concentration must be less than or equal to the annual standard.

b Equivalent units given in parenthesis are based upon reference conditions of 25 degrees Celsius (°C) and 760 millimeters (mm) mercury.

c Revisions to the ozone standards are expected to be promulgated by the Environmental Protection Agency (EPA)-in 2007, to be effective in 2008.

d Includes revisions effective December 18, 2006 as specified in the Final Rule published in the Federal Register on October 17, 2006 (FR Volume 71, No.200, pp.61144—61233), which changed the 24-hour $PM_{2.5}$ standard from 65 mg/m^3 to 35 mg/m^3. Northern VA was declared a $PM_{2.5}$ nonattainment area under the old standard of 65 mg/m^3, and this standard will continue to apply until April 2011.

Source: US Environmental Protection Agency (http://www.epa.gov/air/criteria.html, accessed 3/5/07).

Currently, of the six criteria pollutants, only CO, O_3, $PM_{2.5}$ and PM_{10} are required to be addressed in project-level, or hot-spot, analyses to be included in the NEPA document, and only for FHWA or Federal Transit Administration (FTA) projects. FHWA or FTA projects are generally considered as those for which federal funding or approval is required or proposed according to the federal conformity rule (40 CFR 93.100). Other requirements regarding hot-spot analyses for CO and PM can be found in Section 93.116 of the conformity rule. Additionally, the above noted MOU between FHWA and VDOT provides further requirements for analysis of CO. The Air Section of the Environmental Division, VDOT Central Office is responsible for administering the project air evaluation process. Significant changes to the project scope, design or schedule may require additional hotspot modeling to ensure the continuing validity of this air quality analysis.

C. Section 176(c) of the Clean Air Act (CAA) and Current SIP

The CAA, under Section 176(c), provides a framework for ensuring that transportation projects conform to the appropriate state or federal implementation plan (SIP or FIP) for achieving the National Ambient Air Quality Standards (NAAQS). A SIP is a compilation of goals, strategies, schedules, and enforcement actions that will lead the state into compliance with all federal air quality standards. Every change in compliance schedule or plan must be incorporated into the SIP. The CAA Amendments of 1990 established new deadlines for achievement of the NAAQS depending on the severity of nonattainment. Before any agency or department of the federal government engages in, supports in any way, provides financial assistance for, licenses, permits, or approves any activity, that agency has an affirmative responsibility to ensure that such actions conform to the applicable implementation plan. Conformity to an air quality implementation plan is defined in the CAA, as amended in 1990, as meaning conforming to the plan's purpose in eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of these standards. Federal actions must not cause or contribute to any new violation of any standard, increase the frequency or severity of any existing violation, or delay timely attainment of any standard or required interim milestone. If the proposed action does not conform to the SIP, it cannot be approved.

The Hampton Roads Air Quality Committee (HRAQC), in coordination with the Virginia Department of Environmental Quality (DEQ), is responsible for preparing the SIPs for the Hampton Roads maintenance area. The Maintenance Plan was approved by EPA effective June 1, 2007, subsequently corrected in an amendment, effective July 6, 2007.

IV. Project Specific Conditions, Requirements and Analysis

A. Ozone

This project is located in the Hampton Roads 8-hour ozone maintenance area, therefore conformity requirements do apply. This project was modeled in the final analysis year of 2026 in the most recently approved conformity analysis for the 2026 Long Range Plan (LRP) and FY06-09 Transportation Improvement Program (TIP) approved by FHWA/FTA on August 22, 2006. This project was listed as Right-of-Way/Engineering only in the TIP and may need to be included for construction in the TIP if the project advances ahead of schedule.

B. Particulate Matter

The City of Portsmouth lies within a $PM_{2.5}$ attainment area, as such, the project is not required to meet Transportation Conformity requirements found in 40 CFR Part 93 regarding particulate matter.

C. Mobile Source Air Toxics

In February 2006, FHWA issued guidance regarding Mobile Source Air Toxics (MSATs) impacts and when and how to address them in project-level analyses. It has been determined that this project meets the criteria for a qualitative MSAT analysis.

In addition to the criteria air pollutants for which there are National Ambient Air Quality Standards (NAAQS), EPA also regulates air toxics. Most air toxics originate from human-made sources, including on-road mobile sources, non-road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners) and stationary sources (e.g., factories or refineries). Mobile Source Air Toxics (MSATs) are a subset of the 188 air toxics defined by the Clean Air Act. MSAT are compounds emitted from highway vehicles and non-road equipment. Some toxic compounds are present in fuel and are emitted to the air when the fuel evaporates or passes through the engine unburned. Other toxics are emitted from the incomplete combustion of fuels or as secondary combustion products. Metal air toxics also result from engine wear or from impurities in oil or gasoline.

A qualitative assessment of the likely impacts of MSAT is presented because this project has been determined to have an potential impact on vehicle miles traveled (VMT) or diesel traffic, although not to the extent which would warrant a quantitative analysis. The project may result in an increase in VMT or affect truck traffic in a way that would lead to higher MSAT emissions for the build alternative, along with a corresponding decrease in MSAT emissions along the parallel routes. The emissions increase is offset somewhat by lower MSAT emission rates due to increased speeds; and reduced VMT on parallel roadways. According to EPA's MOBILE6 emissions model, emissions of all of the priority MSATs except for diesel particulate matter decrease as speed increases. The extent to which these speed-related emissions decreases will offset VMT-related emissions increases cannot be reliably projected due to the inherent deficiencies of technical models.

Local conditions may differ from these national projections used in the MOBILE model in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the study area are likely to be lower in the future in nearly all cases. Additional travel lanes contemplated as part of the project may have the effect of moving some traffic closer to nearby homes, schools and businesses; therefore, there may be localized areas where ambient concentrations of MSATs could be higher under the Build Alternative than under the No-Build Alternative.

This qualitative assessment was prepared using guidance 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.

Background

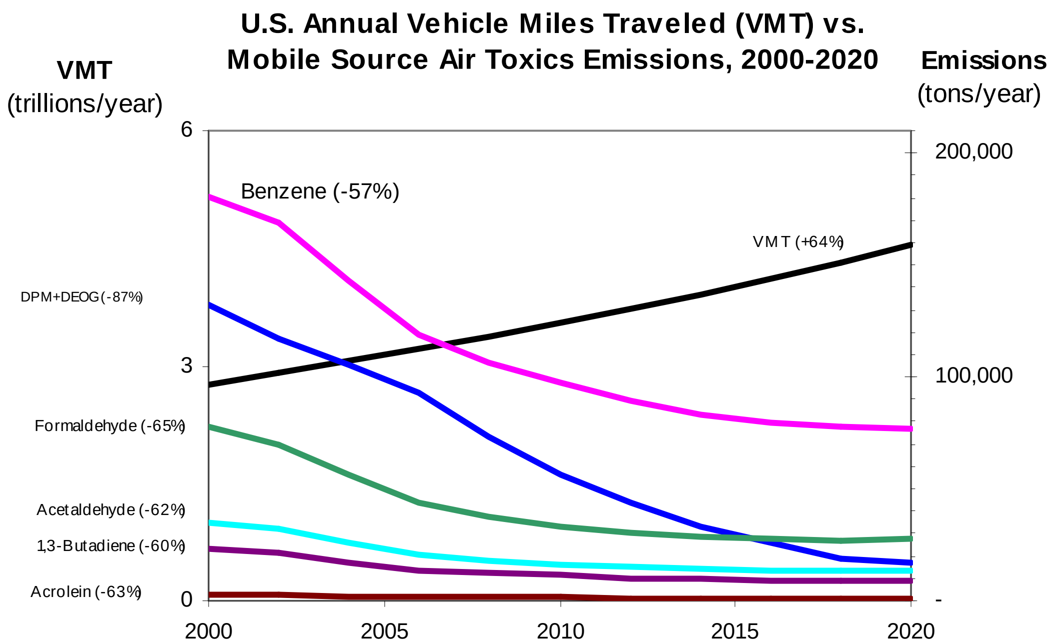
The EPA is the lead Federal Agency for administering the Clean Air Act and has certain responsibilities regarding the health effects of MSATs. The EPA issued a Final Rule on Controlling Emissions of Hazardous Air Pollutants from Mobile Sources (66 FR 17229) on March 29, 2001. This rule was issued under the authority of Section 202 of the Clean Air Act. In its rule, EPA examined the impacts of existing and newly promulgated mobile source control programs, including the reformulated gasoline (RFG) program; the national low emission vehicle (NLEV) standards; Tier 2 motor vehicle emissions standards and gasoline sulfur control requirements; and the proposed heavy duty engine and vehicle standards and on-highway diesel fuel sulfur control requirements. Between 2000 and 2020, FHWA projects that even with a 64 percent increase in VMT, these programs will reduce on-highway emissions of benzene, formaldehyde, 1,3-butadiene, and acetaldehyde by 57 percent to 65 percent, and will reduce on-highway diesel PM emissions by 87 percent, as shown below in Figure IV-1. Although this figure only forecasts emissions through 2020, EPA's new MSAT2 Rule should result in additional emission reductions beyond 2020 that were not envisioned when the MSAT1 Rule or this Figure were developed.

As a result, EPA concluded that no further motor vehicle emissions standards or fuel standards were necessary to further control MSATs. Additionally, in February 2007, EPA finalized a rule to reduce hazardous air pollutants from mobile sources. The rule, effective April 27, 2007, will limit the benzene content of gasoline and reduce toxic emissions from passenger vehicles and gas cans. EPA estimates that in 2030 this rule would reduce total emissions of mobile source air toxics by 330,000 tons and VOC emissions (precursors to ozone and PM2.5) by over 1 million tons.

Unavailable Information for Project Specific MSAT Impact Analysis

Available technical tools do not enable us to predict the project-specific health impacts of the emission changes associated with the project. Due to these limitations, the following discussion is included in accordance with CEQ regulations (40 CFR 1502.22(b)) regarding incomplete or unavailable information.

Figure IV-1: U.S. Annual Vehicle Miles Traveled vs. Mobile Source Air Toxics Emissions 2000-2020



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

Information that is Unavailable or Incomplete

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

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

analyses between alternatives for very large projects, but it is not sensitive enough to capture the effects of travel changes tied to smaller projects or to predict emissions near specific roadside locations.

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

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

Summary of Existing Credible Scientific Evidence Relevant to Evaluating the Impacts of MSATs

Research into the health impacts of MSATs is ongoing. For different emission types, there are a variety of studies that show that select MSATs are either statistically associated with adverse health outcomes through epidemiological studies (frequently based on emissions levels found in occupational settings) or that animals demonstrate adverse health outcomes when exposed to large doses.

Exposure to air toxics has been a focus of a number of EPA efforts. Most notably, the agency conducted the National Air Toxics Assessment (NATA) in 1996 to evaluate modeled estimates of human exposure applicable to the county level. While not intended for use as a measure of or benchmark for local exposure, the modeled estimates in the NATA database best illustrate the levels of various toxics when aggregated to a national or state level.

The EPA is in the process of assessing the risks of various kinds of exposures to these pollutants. The EPA Integrated Risk Information System (IRIS) is a database of human health effects that may result from exposure to various substances found in the environment. The IRIS database is located at http://www.epa.gov/iris. The following toxicity information for the six prioritized MSATs was taken from the IRIS database Weight of Evidence Characterization summaries. This information is taken verbatim from

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

- Benzene is characterized as a known human carcinogen.
- The potential carcinogenicity of acrolein cannot be determined because the existing data are inadequate for an assessment of human carcinogenic potential for either the oral or inhalation route of exposure.
- Formaldehyde is a probable human carcinogen, based on limited evidence in humans, and sufficient evidence in animals.
- 1,3-butadiene is characterized as carcinogenic to humans by inhalation.
- Acetaldehyde is a probable human carcinogen based on increased incidence of nasal tumors in male and female rats and laryngeal tumors in male and female hamsters after inhalation exposure.
- Diesel exhaust (DE) is likely to be carcinogenic to humans by inhalation from environmental exposures. Diesel exhaust as reviewed in this document is the combination of diesel particulate matter and diesel exhaust organic gases.
- Diesel exhaust also represents chronic respiratory effects, possibly the primary noncancer hazard from MSATs. Prolonged exposures may impair pulmonary function and could produce symptoms, such as cough, phlegm, and chronic bronchitis. Exposure relationships have not been developed from these studies.

There have been other studies that address MSAT health impacts in proximity to roadways. The Health Effects Institute, a non-profit organization funded by EPA, FHWA, and industry, has undertaken a major series of studies to research near-roadway MSAT hot spots, the health implications of the entire mix of mobile source pollutants, and other topics. The final summary of the series is not expected for several years. Some recent studies have reported that proximity to roadways is related to adverse health outcomes -- particularly respiratory problems[3]. Much of this research is not specific to MSATs, instead surveying the full spectrum of both criteria and other pollutants. The FHWA cannot evaluate the validity of these studies, but more importantly, they do not provide information that would be useful to alleviate the uncertainties listed above and enable us to perform a more comprehensive evaluation of the health impacts specific to this project.

Relevance of Unavailable or Incomplete Information to Evaluating Reasonably Foreseeable Significant Adverse Impacts on the Environment, and Evaluation of impacts based upon theoretical approaches or research methods generally accepted in the scientific community.

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

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

FHWA has acknowledged that the project may result in increased exposure to MSAT emissions in certain locations, although the concentrations and duration of exposures are uncertain, and because of this uncertainty, the health effects from these emissions cannot be estimated.

Conclusion

As discussed above, technical shortcomings of emissions and dispersion models and uncertain science with respect to health effects prevent meaningful or reliable estimates of MSAT emissions and effects of this project, however, it can be safely concluded that localized increases of MSATs that may occur as a result of the projects will be offset in the future by the implementation of new and existing mobile emissions control programs.

D. Carbon Monoxide

This project is located in a CO attainment area. The MOU between FHWA and VDOT requires CO hot-spot analysis to be conducted on any project in the Commonwealth which meets the outlined criteria. This project exceeds the traffic threshold of 30,000 vehicles per day for intersections with LOS C or worse. An air dispersion modeling analysis was conducted to assess whether the traffic modifications associated with the proposed project would cause an exceedance of the air quality standard for CO, using guidance from EPA and FHWA.[4,5,6] Emissions and ambient concentrations of CO were modeled using EPA approved models MOBILE6.2 as incorporated into or employed by interface software developed and released by FHWA, and CAL3QHC. The mobile source emissions interface used for this project is the Easy Mobile Inventory Tool, or EMIT, as updated by FHWA in March 2007. Contact and other information is available on the FHWA website[7].

The existing (2003), opening (interim) year (2013) and design year (2032) build and no build scenarios were analyzed for this study. Traffic data was supplied by HW Lochner. The design year provided was 2032, and was extrapolated to 2037 using a growth rate of 1.0033% for Urban Arterials and 1.0081% for Urban Freeways[8] to ensure the continuing validity of this analysis in the event of reasonable delays in the project schedule. The intersection of High Street and US 58/337 was determined to be the worst case intersection for modeling purposes.

Input data for emission factor modeling using EMIT are summarized in Table IV-1. Wherever appropriate, modeling data inputs from the MOBILE6.2 modeling for the State Implementation Plan development and regional conformity analysis for the Hampton Roads ozone maintenance area were incorporated into the model; as well as data specific to the City of Portsmouth. The emission factors that were generated using EMIT are listed in Table IV-2 below. The factors were developed for the roadway operating speed during the peak hour conditions and for idle conditions.

Table IV-1: Key EMIT Interface Software (MOBILE6.2) Inputs

Parameter	Value
Evaluation Month	January
Min/Max Temperature (Fahrenheit)	32
Gasoline Reid Vapor Pressure	13.5
Gasoline Sulfur	Conventional East
Vehicle Registration & Vehicle-Miles-Traveled by Vehicle Class	2005 City Specific Data

4 "*Guidelines for Modeling Carbon Monoxide from Roadway Intersections*," EPA-454/R-95-005, EPA, 1992.

5 *Discussion Paper on the Appropriate Level of Highway Air Quality Analysis for a CE, EA/FONSI, and EIS* dated April 7, 1986.

6 "*User's Guide to CAL3QHC Version 2.0: A Modeling Methodology for Predicting Pollutant Concentrations Near Roadways Intersections*," EPA-454/R-92-006 (Revised) EPA 1995.

7 http://www.fhwa.dot.gov/resourcecenter/teams/airquality/index.cfm

8 From the 2005 HPMS Spped and Growth Projections for City of Portsmouth prepared by VDOT Transportation Mobility Planning Division.

*Table IV-2 Emission Factors**

Speed (miles per hour)	Year			
	2006	2013	2032	2037
2.5 (idle)	120.317	78.520	59.849	59.836
35	10.282	7.138	5.403	5.412
45	11.535	8.073	6.163	6.161
60	13.542	9.561	7.360	7.368

* Idle emissions factors are given in grams/vehicle hour. Running emissions factors are given in grams/mile.

The Virginia Department of Environmental Quality (VDEQ) has established ambient CO background concentrations of 6 ppm for the 1-hour averaging time and 3 ppm for the 8-hour averaging period, based on available monitoring data. The option of having the model locate the worst-case wind direction for each receptor was employed to ensure that the maximum possible CO concentration was predicted. To obtain the 8-hour concentration, a persistence factor of 0.7 is applied to the calculated 1-hour values. The persistence factor is provided in the *VDOT Consultant Guide for Air Quality Project-Level Conformity Determinations.*[9]

Table IV-3: Key CAL3QHC Inputs

Parameter	Value
Surface Roughness Coefficient, cm	108
Wind Speed, meters per second	1
Stability Class	4 (Neutral)
Background CO Concentration, ppm*	
-One-hour	6
-Eight-hour	3
Mixing Height, meters	1000
Receptor Height, meters (feet)	1.8 (5.9)
Persistence Factor*	0.7
Signal Cycle Length, seconds	90

* As provided in VDOT's Consultant Guide, 2006

CO impacts are localized and occur when vehicular traffic is likely to impact a roadway's level of service (LOS) and, as a result, subject sensitive receptors to CO hot spots. It is necessary to consider the potential for CO impacts at locations of sensitive receptors. Sensitive receptor locations are sites, commercial or residential, which have the potential for individuals to be present for the averaging period of the given pollutant. The receptor locations are shown in Figure IV-2.

[9] "Consultant Guide: Air Quality Project-Level Conformity Analysis," VDOT Environmental Division, Air Section, 2006.

Figure IV-2: Aerial of Worst-Case Intersection

The receptor with the highest impacts from the modeling analyses for all alternatives is shown below in Table IV-4. The emissions levels for all receptors are presented in Appendix A. Despite the increase in traffic volumes and construction of a new roadway, neither the no-build nor the build scenarios causes a violation of the NAAQS for CO.

Table IV-4: Highest CO Concentrations

Location	Concentration	2006 existing	2013 no build	2013 build	2032 no build	2032 build	2037 build
Receptor 8	Max 1-hour Concentration (ppm) Threshold:35 ppm	6.8	6.7	6.8	6.7	6.5	6.5
	Max 8-hour Concentration (ppm) Threshold: 9 ppm	4.8	4.7	4.8	4.7	4.6	4.6

V. Construction Impacts

Emissions from construction are short term. Construction emissions include emissions from heavy equipment, fugitive dust, and emissions from construction vehicles traveling to and from the site. Construction emissions are not included in the modeled emissions. However, construction activities are to be performed in accordance with the Department's "Road and Bridge Specifications", which would mitigate construction emissions.

VI. Conclusion

This document has demonstrated that the project is in conformity in regards to ozone. The qualitative MSAT analysis demonstrated that there would be no long-term adverse impacts resulting from the project. The CO analysis presented herein demonstrated that the proposed project, if built according to the conceptual designs, would not cause or contribute to a violation of the air quality standards for Carbon Monoxide outlined in the NAAQS. The project is not located in a $PM_{2.5}$ nonattainment area, thus the proposed project meets the conformity hot-spot requirements in 40 CFR 93.116 and 93.123, without detailed analysis. In sum, the proposed project will not create or contribute to an exceedance of the NAAQS for the criteria pollutants.

Appendix A: CAL3QHC/Cal3Interface Output Summary Table

Location	Concentration	2006 existing	2013 no build	2013 build	2032 no build	2032 build	2037 build
Receptor 1	Max 1-hour Concentration (ppm) Threshold:35 ppm	6.2	6.1	6.2	6.1	6.2	6.2
	Max 8-hour Concentration (ppm) Threshold: 9 ppm	4.3	4.3	4.3	4.3	4.3	4.3
Receptor 2	Max 1-hour Concentration (ppm) Threshold:35 ppm	6.2	6.1	6.2	6.1	6.2	6.2
	Max 8-hour Concentration (ppm) Threshold: 9 ppm	4.3	4.3	4.3	4.3	4.3	4.3
Receptor 3	Max 1-hour Concentration (ppm) Threshold:35 ppm	6.2	6.0	6.2	6.0	6.1	6.1
	Max 8-hour Concentration (ppm) Threshold: 9 ppm	4.3	4.2	4.3	4.2	4.3	4.3
Receptor 4	Max 1-hour Concentration (ppm) Threshold:35 ppm	6.2	6.1	6.2	6.0	6.1	6.1
	Max 8-hour Concentration (ppm) Threshold: 9 ppm	4.3	4.3	4.3	4.2	4.3	4.3
Receptor 5	Max 1-hour Concentration (ppm) Threshold:35 ppm	6.8	6.6	6.5	6.5	6.3	6.3
	Max 8-hour Concentration (ppm) Threshold: 9 ppm	4.8	4.6	4.6	4.6	4.4	4.4
Receptor 6	Max 1-hour Concentration (ppm) Threshold:35 ppm	6.4	6.3	6.3	6.2	6.2	6.2
	Max 8-hour Concentration (ppm) Threshold: 9 ppm	4.5	4.4	4.4	4.3	4.3	4.3
Receptor 7	Max 1-hour Concentration (ppm) Threshold:35 ppm	6.6	6.5	6.4	6.5	6.3	6.3
	Max 8-hour Concentration (ppm) Threshold: 9 ppm	4.6	4.6	4.5	4.6	4.4	4.4
Receptor 8	Max 1-hour Concentration (ppm) Threshold:35 ppm	6.8	6.7	6.8	6.7	6.5	6.5
	Max 8-hour Concentration (ppm) Threshold: 9 ppm	4.8	4.7	4.8	4.7	4.6	4.6
Receptor 9	Max 1-hour Concentration (ppm) Threshold:35 ppm	6.2	6.1	6.3	6.0	6.2	6.2
	Max 8-hour Concentration (ppm) Threshold: 9 ppm	4.3	4.3	4.4	4.2	4.3	4.3
Receptor 10	Max 1-hour Concentration (ppm) Threshold:35 ppm	6.2	6.0	6.2	6.0	6.2	6.2
	Max 8-hour Concentration (ppm) Threshold: 9 ppm	4.3	4.2	4.3	4.2	4.3	4.3
Receptor 11	Max 1-hour Concentration (ppm) Threshold:35 ppm	6.1	6.0	6.2	6.0	6.2	6.2
	Max 8-hour Concentration (ppm) Threshold: 9 ppm	4.3	4.2	4.3	4.2	4.3	4.3
Receptor 12	Max 1-hour Concentration (ppm) Threshold:35 ppm	6.0	6.0	6.2	6.0	6.1	6.1
	Max 8-hour Concentration (ppm) Threshold: 9 ppm	4.2	4.2	4.3	4.2	4.3	4.3
Receptor 13	Max 1-hour Concentration (ppm) Threshold:35 ppm	6.0	6.0	6.2	6.0	6.1	6.1
	Max 8-hour Concentration (ppm) Threshold: 9 ppm	4.2	4.2	4.3	4.2	4.3	4.3

Receptor 14	Max 1-hour Concentration (ppm) Threshold:35 ppm	6.1	6.0	6.2	6.0	6.1	6.1
	Max 8-hour Concentration (ppm) Threshold: 9 ppm	4.3	4.2	4.3	4.2	4.3	4.3
Receptor 15	Max 1-hour Concentration (ppm) Threshold:35 ppm	6.6	6.4	6.4	6.4	6.4	6.4
	Max 8-hour Concentration (ppm) Threshold: 9 ppm	4.6	4.5	4.5	4.5	4.5	4.5
Receptor 16	Max 1-hour Concentration (ppm) Threshold:35 ppm	6.7	6.5	6.5	6.5	6.3	6.4
	Max 8-hour Concentration (ppm) Threshold: 9 ppm	4.7	4.6	4.6	4.6	4.4	4.5
Receptor 17	Max 1-hour Concentration (ppm) Threshold:35 ppm	6.6	6.4	6.4	6.3	6.3	6.3
	Max 8-hour Concentration (ppm) Threshold: 9 ppm	4.6	4.5	4.5	4.4	4.4	4.4
Receptor 18	Max 1-hour Concentration (ppm) Threshold:35 ppm	6.2	6.1	6.2	6.1	6.1	6.1
	Max 8-hour Concentration (ppm) Threshold: 9 ppm	4.3	4.3	4.3	4.3	4.3	4.3
Receptor 19	Max 1-hour Concentration (ppm) Threshold:35 ppm	6.2	6.1	6.1	6.1	6.1	6.1
	Max 8-hour Concentration (ppm) Threshold: 9 ppm	4.3	4.3	4.3	4.3	4.3	4.3
Receptor 20	Max 1-hour Concentration (ppm) Threshold:35 ppm	6.1	6.0	6.1	6.0	6.1	6.1
	Max 8-hour Concentration (ppm) Threshold: 9 ppm	4.3	4.2	4.3	4.2	4.3	4.3
Receptor 21	Max 1-hour Concentration (ppm) Threshold:35 ppm	6.2	6.0	6.1	6.1	6.1	6.1
	Max 8-hour Concentration (ppm) Threshold: 9 ppm	4.3	4.2	4.3	4.3	4.3	4.3

Appendix B: Sample CAL3QHC Input File

```
'2006, PM MLK ext 76642'        60. 175. 0. 0.  21  0.3048 1 1
'REC 1'   -179127.87 -729983.14      6.0
'REC 2'   -179087.14 -730049.28      6.0
'REC 3'   -179060.42 -730203.85      6.0
'REC 4'   -179057.42 -730330.58      6.0
'REC 5'   -178994.25 -730467.25      6.0
'REC 6'   -179186.17 -730498.73      6.0
'REC 7'   -179176.00 -730632.38      6.0
'REC 8'   -179066.73 -730629.45      6.0
'REC 9'   -179011.53 -730819.26      6.0
'REC 10'  -179071.55 -730810.12      6.0
'REC 11'  -179089.14 -730879.58      6.0
'REC 12'  -179102.37 -731028.30      6.0
'REC 13'  -179093.56 -731146.41      6.0
'REC 14'  -178697.12 -730947.03      6.0
'REC 15'  -178718.51 -730635.82      6.0
'REC 16'  -178592.20 -730592.13      6.0
'REC 17'  -178749.86 -730478.82      6.0
'REC 18'  -178829.09 -730289.53      6.0
'REC 19'  -178859.55 -730205.58      6.0
'REC 20'  -178784.90 -730204.38      6.0
'REC 21'  -178892.64 -730043.93      6.0
'Existing Conditions     '    23  1  0  'C'
1
'1 high st e'  'AG'   -179917.67 -730643.83  -179453.92 -730615.26 370. 10.282  0. 45.
1
'2 high st e '  'AG'  -179453.92 -730615.26  -178980.90 -730591.55 370. 10.282  0. 45.
1
'3 high st e '  'AG'  -178980.90 -730591.55  -177650.94 -730524.41 455. 10.282  0. 50.
1
'4 high st w '  'AG'  -177657.69 -730498.27  -178860.76 -730563.20 725. 10.282  0. 44.
1
'5 high st w '  'AG'  -178860.76 -730563.20  -179896.82 -730609.82 640. 10.282  0. 44.
1
'6 337 s     '  'AG'  -179128.89 -729815.26  -179032.50 -729972.93 445. 10.282  0. 44.
1
'7 337 s     '  'AG'  -179032.50 -729972.93  -178985.18 -730109.35 445. 10.282  0. 44.
1
'8 337 s     '  'AG'  -178985.18 -730109.35  -178949.36 -730267.97 445. 10.282  0. 44.
1
'9 337 s     '  'AG'  -178949.36 -730267.97  -178952.56 -730534.03 285. 10.282  0. 44.
1
'10 337 s    '  'AG'  -178952.56 -730534.03  -178921.60 -730616.22 155. 10.282  0. 44.
1
'11 337 s    '  'AG'  -178921.60 -730616.22  -178892.73 -731111.53 170. 10.282  0. 36.
1
'12 337 s ltl'  'AG'  -178940.69 -730310.39  -178934.28 -730531.73 160. 10.282  0. 12.
1
'13 337 n    '  'AG'  -178879.73 -731107.75  -178899.83 -730619.06 115. 10.282  0. 36.
1
'14 337 n    '  'AG'  -178899.83 -730619.06  -178937.54 -730185.37 405. 10.282  0. 44.
1
'15 337 n    '  'AG'  -178937.54 -730185.37  -179004.16 -729975.32 405. 10.282  0. 44.
1
'16 337 n    '  'AG'  -179004.16 -729975.32  -179106.07 -729802.08 405. 10.282  0. 44.
1
'17 337 n ltl'  'AG'  -178909.77 -730619.33  -178899.26 -730780.38  15. 10.282  0. 12.
2
'18 337 n ltq'  'AG'   -178899.26 -730780.38 -178909.77 -730619.33    0.   12.  1
          90      45     0.0    15  120.317     1900    2  3
2
'19 337 s ltq'  'AG'   -178934.28 -730531.73 -178940.69 -730310.39    0.   12.  1
          90      45     0.0    160  120.317    1900    2  3
2
'20 337 n q  '  'AG'   -178899.83 -730619.06 -178879.73 -731107.75    0.   16.  1
          90      45     0.0    115   120.317    1900    2  3
2
'21 337 s q  '  'AG'   -178952.56 -730534.03 -178949.36 -730267.97    0.   24.  2
          90      45     0.0    185   120.317   1900    2  3
2
'22 high eq  '  'AG'   -178980.90 -730591.55 -179453.92 -730615.26    0.   24.  2
          90      45     0.0   370   120.317    1900    2  3
2
'23 high wq  '  'AG'   -178860.76 -730563.20 -177657.69 -730498.27   0.    24.  2
          90      45     0.0    725  120.317    1900    2  3
1.0 00. 4 1000. 6.  'Y' 10  0 36
```

Appendix C: Traffic Analysis

2006 AM Peak Hour Turns

US 17 / State Route 337	LT	TH	RT	Approach Total	LOS
Northbound	70	890	240	1200	C
Southbound	30	1065	5	1100	
Eastbound	20	140	100	260	
Westbound	180	80	30	290	

US 17 / Deep Creek Blvd.	LT	TH	RT	Approach Total	LOS
Northbound	5	310	30	345	D
Southbound	85	680	85	850	
Eastbound	180	175	5	360	
Westbound	35	120	75	230	

I-264 / South Street	LT	TH	RT	Approach Total	LOS
Eastbound	130	30	-	160	A
Westbound	-	20	10	30	

Des Moines Ave. / South St	LT	TH	RT	Approach Total	LOS
Northbound	110	-	300	410	A
Eastbound	-	10	10	20	
Westbound	130	50	-	180	

I-264 / Des Moines Ave.	LT	TH	RT	Approach Total	LOS
Northbound	-	255	-	255	B
Southbound	-	140	-	140	
Eastbound	155	-	50	205	

South St. / VA141	LT	TH	RT	Approach Total	LOS
Northbound	30	1245	25	1300	B
Southbound	40	905	10	955	
Eastbound	10	30	40	80	
Westbound	10	10	10	30	

Effingham St. / Bart St.	LT	TH	RT	Approach Total	LOS
Northbound	5	645	70	720	F
Southbound	230	1075	10	1315	
Eastbound	45	65	10	120	
Westbound	10	10	45	65	

Port Center Pkw. / Crawford Connector South	LT	TH	RT	Approach Total	LOS
Northbound	30	45	5	80	B
Southbound	15	820	200	1035	
Eastbound	5	130	20	155	
Westbound	5	125	15	145	

Court Street / Crawford Connector North	LT	TH	RT	Approach Total	LOS
Northbound	20	40	5	65	B
Southbound	5	410	15	430	
Eastbound	50	120	620	790	
Westbound	5	20	5	30	

VA 141 / Broadway	LT	TH	RT	Approach Total	LOS
Southbound	90	-	75	165	A
Eastbound	135	670	-	805	
Westbound	435	-	105	540	

Turnpike Rd / US 58	LT	TH	RT	Approach Total	LOS
Southbound	10	-	145	155	B
Eastbound	155	190	-	345	
Westbound	-	105	10	115	

US 58 / High St.	LT	TH	RT	Approach Total	LOS
Northbound	10	140	15	165	C
Southbound	215	135	70	420	
Eastbound	110	365	10	485	
Westbound	10	265	95	370	

VA 141 / Constitution Ave.	LT	TH	RT	Approach Total	LOS
Northbound	40	5	5	50	B
Southbound	40	5	75	120	
Eastbound	45	1290	25	1360	
Westbound	5	755	50	810	

2006 PM Peak Hour Turns

US 17 / State Route 337	LT	TH	RT	Approach Total	LOS
Northbound	195	1090	125	1410	D
Southbound	45	820	40	905	
Eastbound	25	185	135	345	
Westbound	330	285	50	665	

US 17 / Deep Creek Blvd.	LT	TH	RT	Approach Total	LOS
Northbound	5	950	35	990	D
Southbound	100	410	180	690	
Eastbound	150	205	10	365	
Westbound	65	215	145	425	

I-264 / South Street	LT	TH	RT	Approach Total	LOS
Eastbound	255	20	-	275	A
Westbound	-	20	15	35	

Des Moines Ave. / South St	LT	TH	RT	Approach Total	LOS
Northbound	160	-	260	420	B
Southbound	-	10	10	20	
Eastbound	255	115	-	370	

I-264 / Des Moines Ave.	LT	TH	RT	Approach Total	LOS
Northbound	-	320	-	320	B
Eastbound	-	265	-	265	
Westbound	100	-	75	175	

South St. / VA141	LT	TH	RT	Approach Total	LOS
Northbound	70	1140	35	1245	A
Southbound	5	1030	25	1060	
Eastbound	10	20	35	65	
Westbound	20	15	15	50	

Effingham St. / Bart St.	LT	TH	RT	Approach Total	LOS
Northbound	25	960	25	1010	C
Southbound	110	720	30	860	
Eastbound	30	50	15	95	
Westbound	130	90	315	535	

Port Center Pkw. / Crawford Connector South	LT	TH	RT	Approach Total	LOS
Northbound	5	460	5	470	B
Southbound	15	150	75	240	
Eastbound	5	230	45	280	
Westbound	5	175	50	230	

Court Street / Crawford Connector North	LT	TH	RT	Approach Total	LOS
Northbound	310	190	15	515	B
Southbound	5	215	80	300	
Eastbound	60	70	20	150	
Westbound	5	240	10	255	

VA 141 / Broadway	LT	TH	RT	Approach Total	LOS
Southbound	90	-	190	280	B
Eastbound	130	480	-	610	
Westbound	865	-	170	1035	

Turnpike Rd / US 58	LT	TH	RT	Approach Total	LOS
Southbound	10	-	160	170	B
Eastbound	125	180	-	305	
Westbound	-	210	5	215	

US 58 / High St.	LT	TH	RT	Approach Total	LOS
Northbound	15	110	5	130	B
Southbound	160	155	130	445	
Eastbound	75	290	5	370	
Westbound	10	495	220	725	

VA 141 / Constitution Ave.	LT	TH	RT	Approach Total	LOS
Northbound	15	15	5	35	C
Southbound	55	10	70	135	
Eastbound	85	565	20	670	
Westbound	15	1380	65	1460	

2010 No Build AM Peak Hour Turns

US 17 / State Route 337	LT	TH	RT	Approach Total	LOS
Northbound	70	935	240	1245	C
Southbound	30	1090	5	1125	
Eastbound	20	140	100	260	
Westbound	180	80	30	290	

US 17 / Deep Creek Blvd.	LT	TH	RT	Approach Total	LOS
Northbound	5	335	30	370	D
Southbound	85	705	85	875	
Eastbound	180	175	5	360	
Westbound	35	120	75	230	

I-264 / South Street	LT	TH	RT	Approach Total	LOS
Eastbound	-	20	5	25	A
Westbound	140	30	-	170	

Des Moines Ave. / South St	LT	TH	RT	Approach Total	LOS
Northbound	115	315	-	430	A
Eastbound	-	10	10	20	
Westbound	140	50	-	190	

I-264 / Des Moines Ave.	LT	TH	RT	Approach Total	LOS
Northbound	-	265	-	265	B
Southbound	-	150	-	150	
Eastbound	165	-	55	220	

South St. / VA141	LT	TH	RT	Approach Total	LOS
Northbound	30	1270	25	1325	B
Southbound	40	920	10	970	
Eastbound	10	30	40	80	
Westbound	10	10	10	30	

Effingham St. / Bart St.	LT	TH	RT	Approach Total	LOS
Northbound	5	670	70	745	D
Southbound	230	1105	10	1345	
Eastbound	45	55	10	110	
Westbound	10	10	45	65	

Port Center Pkw. / Crawford Connector South	LT	TH	RT	Approach Total	LOS
Northbound	30	45	5	80	B
Southbound	15	835	210	1060	
Eastbound	5	140	20	165	
Westbound	5	125	15	145	

Court Street / Crawford Connector North	LT	TH	RT	Approach Total	LOS
Northbound	20	40	5	65	B
Southbound	5	435	15	455	
Eastbound	55	120	620	795	
Westbound	5	20	5	30	

VA 141 / Broadway	LT	TH	RT	Approach Total	LOS
Southbound	90	-	75	165	A
Eastbound	135	685	-	820	
Westbound	-	450	105	555	

Turnpike Rd / US 58	LT	TH	RT	Approach Total	LOS
Southbound	10	-	145	155	B
Eastbound	170	195	-	365	
Westbound	-	110	10	120	

US 58 / High St.	LT	TH	RT	Approach Total	LOS
Northbound	10	155	15	180	B
Southbound	215	135	70	420	
Eastbound	110	375	10	495	
Westbound	10	265	95	370	

2010 No Build PM Peak Hour Turns

US 17 / State Route 337	LT	TH	RT	Approach Total	LOS
Northbound	195	1145	125	1465	D
Southbound	45	840	40	925	
Eastbound	25	185	135	345	
Westbound	330	285	50	665	

US 17 / Deep Creek Blvd.	LT	TH	RT	Approach Total	LOS
Northbound	5	975	35	1015	D
Southbound	100	420	180	700	
Eastbound	150	250	10	410	
Westbound	65	215	145	425	

I-264 / South Street	LT	TH	RT	Approach Total	LOS
Eastbound	-	20	10	30	A
Westbound	270	20	-	290	

Des Moines Ave. / South St	LT	TH	RT	Approach Total	LOS
Northbound	170	275	-	445	B
Eastbound	-	10	10	20	
Westbound	275	120	-	395	

I-264 / Des Moines Ave.	LT	TH	RT	Approach Total	LOS
Northbound	-	340	-	340	B
Southbound	-	285	-	285	
Eastbound	105	-	85	190	

South St. / VA141	LT	TH	RT	Approach Total	LOS
Northbound	70	1165	35	1270	A
Southbound	5	1045	25	1075	
Eastbound	10	20	35	65	
Westbound	20	15	15	50	

Effingham St. / Bart St.	LT	TH	RT	Approach Total	LOS
Northbound	25	1015	25	1065	C
Southbound	110	725	30	865	
Eastbound	30	45	15	90	
Westbound	115	75	315	505	

Port Center Pkw. / Crawford Connector South	LT	TH	RT	Approach Total	LOS
Northbound	5	435	5	445	B
Southbound	15	160	80	255	
Eastbound	5	250	45	300	
Westbound	5	175	50	230	

Court Street / Crawford Connector North	LT	TH	RT	Approach Total	LOS
Northbound	285	190	15	490	B
Southbound	5	230	80	315	
Eastbound	70	70	20	160	
Westbound	5	240	10	255	

VA 141 / Broadway	LT	TH	RT	Approach Total	LOS
Southbound	90	-	190	280	B
Eastbound	130	490	-	620	
Westbound	-	900	170	1070	

Turnpike Rd / US 58	LT	TH	RT	Approach Total	LOS
Southbound	10	-	160	170	B
Eastbound	135	185	-	320	
Westbound	-	220	5	225	

US 58 / High St.	LT	TH	RT	Approach Total	LOS
Northbound	15	120	5	140	B
Southbound	160	155	130	445	
Eastbound	75	295	5	375	
Westbound	10	495	220	725	

VA 141 / Constitution Ave.	LT	TH	RT	Approach Total	LOS
Northbound	40	5	5	50	B
Southbound	40	5	75	120	
Eastbound	45	1320	20	1385	
Westbound	5	770	50	825	

VA 141 / Constitution Ave.	LT	TH	RT	Approach Total	LOS
Northbound	15	15	5	35	C
Southbound	55	10	70	135	
Eastbound	85	580	20	685	
Westbound	15	1410	65	1490	

2010 Build AM Peak Hour Turns

US 17 / State Route 337	LT	TH	RT	Approach Total	LOS
Northbound	70	835	60	965	C
Southbound	35	955	5	995	
Eastbound	20	65	100	185	
Westbound	55	30	35	120	

VA 141 / Broadway	LT	TH	RT	Approach Total	LOS
Southbound	90	-	75	165	A
Eastbound	135	715	-	850	
Westbound	-	630	105	735	

US 58 SB On-Ramp / High St.	LT	TH	RT	Approach Total	LOS
Eastbound	-	350	305	655	A
Westbound	60	380	-	440	

US 58 NB Off-Ramp / High St.	LT	TH	RT	Approach Total	LOS
Northbound	260	-	200	460	B
Eastbound	-	350	-	350	
Westbound	-	180	-	180	

London Blvd / Constitution Ave	LT	TH	RT	Approach Total	LOS
Northbound	40	5	5	50	B
Southbound	40	5	75	120	
Eastbound	45	920	25	990	
Westbound	5	620	50	675	

US 17 / Deep Creek Blvd	LT	TH	RT	Approach Total	LOS
Northbound	5	430	30	465	C
Southbound	105	765	70	940	
Eastbound	190	175	5	370	
Westbound	130	115	110	355	

Effingham St. / Bart St.	LT	TH	RT	Approach Total	LOS
Northbound	5	655	60	720	D
Southbound	230	955	10	1195	
Eastbound	45	55	10	110	
Westbound	10	10	45	65	

Effingham St / South St	LT	TH	RT	Approach Total	LOS
Northbound	35	875	30	940	B
Southbound	40	535	10	585	
Eastbound	10	30	40	80	
Westbound	10	10	10	30	

Port Center Pkw. / Crawford Connector South	LT	TH	RT	Approach Total	LOS
Northbound	30	55	5	90	B
Southbound	15	820	210	1045	
Eastbound	5	140	20	165	
Westbound	5	125	15	145	

Court Street / Crawford Connector North	LT	TH	RT	Approach Total	LOS
Northbound	20	50	15	85	B
Southbound	5	435	15	455	
Eastbound	55	120	605	780	
Westbound	5	20	5	30	

2010 Build PM Peak Hour Turns

US 17 / State Route 337	LT	TH	RT	Approach Total
Northbound	195	1110	35	1340
Southbound	55	735	40	830
Eastbound	25	90	135	250
Westbound	105	110	60	275

VA 141 / Broadway	LT	TH	RT	Approach Total
Southbound	90	-	190	280
Eastbound	130	645	-	775
Westbound	-	995	170	1165

US 58 SB On-Ramp / High St.	LT	TH	RT	Approach Total
Eastbound	-	280	190	470
Westbound	120	705	-	825

US 58 NB Off-Ramp / High St.	LT	TH	RT	Approach Total
Northbound	300	-	125	425
Eastbound	-	280	-	280
Westbound	-	525	-	525

London Blvd / Constitution Ave	LT	TH	RT	Approach Total
Northbound	15	5	5	25
Southbound	55	10	70	135
Eastbound	85	415	20	520
Westbound	15	1130	65	1210

US 17 / Deep Creek Blvd	LT	TH	RT	Approach Total
Northbound	5	1110	35	1150
Southbound	120	540	150	810
Eastbound	155	205	10	370
Westbound	240	205	200	645

Effingham St. / Bart St.	LT	TH	RT	Approach Total
Northbound	25	990	20	1035
Southbound	110	530	30	670
Eastbound	30	45	15	90
Westbound	115	75	325	515

Effingham St / South St	LT	TH	RT	Approach Total
Northbound	80	650	45	775
Southbound	5	610	25	640
Eastbound	10	20	35	65
Westbound	20	15	15	50

Port Center Pkw. / Crawford Connector South	LT	TH	RT	Approach Total
Northbound	5	500	5	510
Southbound	15	160	80	255
Eastbound	5	250	45	300
Westbound	5	175	50	230

Court Street / Crawford Connector North	LT	TH	RT	Approach Total
Northbound	295	245	15	555
Southbound	5	230	80	315
Eastbound	70	70	20	160
Westbound	5	240	10	255

2032 No Build AM Peak Hour Turns

US 17 / State Route 337	LT	TH	RT	Approach Total	LOS
Northbound	75	1135	250	1460	C
Southbound	35	1280	5	1320	
Eastbound	40	160	120	320	
Westbound	190	85	40	315	

US 17 / Deep Creek Blvd.	LT	TH	RT	Approach Total	LOS
Northbound	10	410	35	455	C
Southbound	90	840	90	1020	
Eastbound	190	180	10	380	
Westbound	40	125	80	245	

I-264 / South Street	LT	TH	RT	Approach Total	LOS
Eastbound	-	20	10	30	A
Westbound	135	35	-	170	

Des Moines Ave. / South St	LT	TH	RT	Approach Total	LOS
Northbound	130	-	345	475	A
Eastbound	-	10	10	20	
Westbound	160	40	-	200	

I-264 / Des Moines Ave.	LT	TH	RT	Approach Total	LOS
Northbound	-	310	-	310	B
Southbound	-	170	-	170	
Eastbound	165	-	55	220	

South St. / VA141	LT	TH	RT	Approach Total	LOS
Northbound	55	1420	30	1505	C
Southbound	55	940	15	1010	
Eastbound	15	40	70	125	
Westbound	15	15	15	45	

Effingham St. / Bart St.	LT	TH	RT	Approach Total	LOS
Northbound	10	790	50	850	E
Southbound	230	1180	15	1425	
Eastbound	55	35	15	105	
Westbound	5	5	40	50	

Port Center Pkw. / Crawford Connector South	LT	TH	RT	Approach Total	LOS
Northbound	40	35	10	85	B
Southbound	25	865	300	1190	
Eastbound	10	200	10	220	
Westbound	10	130	20	160	

Court Street / Crawford Connector North	LT	TH	RT	Approach Total	LOS
Northbound	15	40	10	65	B
Southbound	10	600	20	630	
Eastbound	175	130	580	885	
Westbound	10	20	10	40	

VA 141 / Broadway	LT	TH	RT	Approach Total	LOS
Southbound	95	-	80	175	B
Eastbound	140	765	-	905	
Westbound	-	580	110	690	

Turnpike Rd / US 58	LT	TH	RT	Approach Total	LOS
Southbound	15	-	155	170	C
Eastbound	185	225	-	410	
Westbound	-	125	20	145	

US 58 / High St.	LT	TH	RT	Approach Total	LOS
Northbound	15	165	25	205	C
Southbound	340	135	105	580	
Eastbound	180	395	20	595	
Westbound	15	270	160	445	

2032 No Build PM Peak Hour Turns

US 17 / State Route 337	LT	TH	RT	Approach Total	LOS
Northbound	205	1395	130	1730	E
Southbound	55	985	55	1095	
Eastbound	50	210	160	420	
Westbound	345	305	65	715	

US 17 / Deep Creek Blvd.	LT	TH	RT	Approach Total	LOS
Northbound	10	1060	40	1110	D
Southbound	110	500	190	800	
Eastbound	155	215	20	390	
Westbound	75	255	155	485	

I-264 / South Street	LT	TH	RT	Approach Total	LOS
Eastbound	-	20	15	35	A
Westbound	265	20	-	285	

Des Moines Ave. / South St	LT	TH	RT	Approach Total	LOS
Northbound	190	-	300	490	B
Eastbound	-	10	10	20	
Westbound	320	95	-	415	

I-264 / Des Moines Ave.	LT	TH	RT	Approach Total	LOS
Northbound	-	385	-	385	C
Eastbound	-	330	-	330	
Westbound	105	-	85	190	

South St. / VA141	LT	TH	RT	Approach Total	LOS
Northbound	130	1300	45	1475	B
Southbound	5	1065	35	1105	
Eastbound	15	25	65	105	
Westbound	30	25	25	80	

Effingham St. / Bart St.	LT	TH	RT	Approach Total	LOS
Northbound	40	1235	20	1295	C
Southbound	110	790	40	940	
Eastbound	35	25	25	85	
Westbound	90	50	290	430	

Port Center Pkw. / Crawford Connector South	LT	TH	RT	Approach Total	LOS
Northbound	5	325	10	340	B
Southbound	25	205	115	345	
Eastbound	10	355	25	390	
Westbound	10	185	60	255	

Court Street / Crawford Connector North	LT	TH	RT	Approach Total	LOS
Northbound	195	180	25	400	B
Southbound	10	315	105	430	
Eastbound	140	75	20	235	
Westbound	10	255	20	285	

VA 141 / Broadway	LT	TH	RT	Approach Total	LOS
Southbound	95	-	200	295	B
Eastbound	135	550	-	685	
Westbound	-	1090	180	1270	

Turnpike Rd / US 58	LT	TH	RT	Approach Total	LOS
Southbound	15	-	165	180	B
Eastbound	150	215	-	365	
Westbound	-	245	15	260	

US 58 / High St.	LT	TH	RT	Approach Total	LOS
Northbound	25	130	10	165	C
Southbound	255	155	195	605	
Eastbound	120	315	10	445	
Westbound	15	505	375	895	

VA 141 / Constitution Ave.	LT	TH	RT	Approach Total	LOS
Northbound	50	10	10	70	B
Southbound	45	10	85	140	
Eastbound	50	1545	35	1630	
Westbound	10	855	55	920	

VA 141 / Constitution Ave.	LT	TH	RT	Approach Total	LOS
Northbound	20	25	10	55	C
Southbound	65	20	75	160	
Eastbound	95	650	25	770	
Westbound	25	1565	75	1665	

2032 Build AM Peak Hour Turns

US 17 / State Route 337	LT	TH	RT	Approach Total	LOS
Northbound	75	1005	70	1150	C
Southbound	40	1120	5	1165	
Eastbound	40	75	120	235	
Westbound	60	35	50	145	

VA 141 / Broadway	LT	TH	RT	Approach Total	LOS
Southbound	95	-	80	175	A
Eastbound	140	1060	-	1200	
Westbound	-	810	110	920	

US 58 SB On-Ramp / High St.	LT	TH	RT	Approach Total	LOS
Eastbound	-	375	380	755	A
Westbound	40	535	-	575	

US 58 NB Off-Ramp / High St.	LT	TH	RT	Approach Total	LOS
Northbound	280	-	220	500	B
Eastbound	-	375	-	375	
Westbound	-	295	-	295	

London Blvd / Constitution Ave	LT	TH	RT	Approach Total	LOS
Northbound	50	10	10	70	B
Southbound	45	10	85	140	
Eastbound	50	1415	35	1500	
Westbound	10	795	55	860	

US 17 / Deep Creek Blvd	LT	TH	RT	Approach Total	LOS
Northbound	10	490	35	535	D
Southbound	120	900	75	1095	
Eastbound	195	180	10	385	
Westbound	150	125	125	400	

Effingham St. / Bart St.	LT	TH	RT	Approach Total	LOS
Northbound	10	785	40	835	D
Southbound	230	1280	15	1525	
Eastbound	55	35	15	105	
Westbound	5	5	45	55	

Effingham St. / South St	LT	TH	RT	Approach Total	LOS
Northbound	55	925	40	1020	B
Southbound	55	550	15	620	
Eastbound	15	40	70	125	
Westbound	15	15	15	45	

Port Center Pkw. / Crawford Connector South	LT	TH	RT	Approach Total	LOS
Northbound	40	35	10	85	B
Southbound	25	860	300	1185	
Eastbound	15	200	10	225	
Westbound	10	130	20	160	

Court Street / Crawford Connector North	LT	TH	RT	Approach Total	LOS
Northbound	15	50	10	75	B
Southbound	10	610	20	640	
Eastbound	75	130	565	770	
Westbound	10	20	10	40	

2032 Build PM Peak Hour Turns

US 17 / State Route 337	LT	TH	RT	Approach Total
Northbound	205	1385	35	1625
Southbound	65	865	55	985
Eastbound	50	95	160	305
Westbound	110	120	85	315

VA 141 / Broadway	LT	TH	RT	Approach Total
Southbound	95	-	200	295
Eastbound	135	920	-	1055
Westbound	-	1350	180	1530

US 58 SB On-Ramp / High St.	LT	TH	RT	Approach Total
Eastbound	-	295	230	525
Westbound	90	870	-	960

US 58 NB Off-Ramp / High St.	LT	TH	RT	Approach Total
Northbound	380	-	135	515
Eastbound	-	295	-	295
Westbound	-	580	-	580

London Blvd / Constitution Ave	LT	TH	RT	Approach Total
Northbound	20	25	10	55
Southbound	65	20	75	160
Eastbound	95	645	25	765
Westbound	25	1455	75	1555

US 17 / Deep Creek Blvd	LT	TH	RT	Approach Total
Northbound	10	1210	40	1260
Southbound	130	645	160	935
Eastbound	165	215	20	400
Westbound	280	225	220	725

Effingham St. / Bart St.	LT	TH	RT	Approach Total
Northbound	40	1315	15	1370
Southbound	110	715	40	865
Eastbound	35	25	25	85
Westbound	90	50	305	445

Effingham St. / South St	LT	TH	RT	Approach Total
Northbound	130	695	55	880
Southbound	5	620	35	660
Eastbound	15	25	65	105
Westbound	30	25	25	80

Port Center Pkw. / Crawford Connector South	LT	TH	RT	Approach Total
Northbound	5	350	10	365
Southbound	25	210	115	350
Eastbound	15	355	25	395
Westbound	10	185	60	255

Court Street / Crawford Connector North	LT	TH	RT	Approach Total
Northbound	170	235	25	430
Southbound	10	320	105	435
Eastbound	90	75	20	185
Westbound	10	255	20	285