INTERSTATE 395 EXPRESS LANES

NORTHERN EXTENSION

AIR QUALITY ANALYSIS

TECHNICAL REPORT | SEPTEMBER 2016

VDOT

U.S. Department of Transportation
Federal Highway Administration

395 ExpressLanes

INTERSTATE 395 EXPRESS LANES

NORTHERN EXTENSION

Air Quality Analysis Technical Report

City of Alexandria, and Arlington and Fairfax Counties
Project Number: 0395-969-205, P101; UPC: 108313
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TABLE OF CONTENTS

Executive Summary 1

1. Introduction 5
   1.1 Description of the study area 5
   1.2 Background 7
   1.3 Existing Conditions 8
   1.4 Purpose and Need 8
   1.5 Description of the Alternatives 8

2. Regulatory Requirements and Guidance 9
   2.1 National Environmental Policy Act of 1969 (NEPA) 9
   2.2 Clean Air Act 9
   2.3 Mobile Source Air Toxics 12
   2.4 MOVES2014/2014a 13
   2.5 VDOT Project-Level Air Quality Resource Document 14

3. Carbon monoxide analysis 15
   3.1 Overview of screening analysis 16
   3.2 Traffic summary information 16
   3.3 CO Receptor Locations 21
   3.4 Modeling Inputs 22
   3.5 No Build scenarios 25
   3.6 Results of CO Screening Analysis – Build Scenarios 25
   3.7 CO Conclusions 26

4. Particulate Matter 27
   4.1 PM regulations and overview 27
   4.2 Interagency Consultation and Discussion of Findings 28
   4.3 PM Conclusions 30

5. Mobile Source Air Toxics 34
   5.1 MSAT Background 34
   5.2 Motor Vehicle Emissions Simulator (MOVES) 35
   5.3 MSAT Research 36
   5.4 Project Quantitative MSAT Analysis 36
   5.5 Incomplete or Unavailable Information for Project-Specific MSAT Health Impacts Analysis . 40

6. Construction Emission Analysis 44
7. Regional Conformity Status of the Project 45
8. Indirect and Cumulative Effects 45
9. Conclusions 46

TABLE OF CONTENTS - CONTINUED

LIST OF TABLES

Table 2-1: National Ambient Air Quality Standards 10
Table 3-1: PM Peak Hour Volumes, Delay, and Level of Service (LOS) at Intersections 19
Table 3-2: Comparison of Forecasted Peak Hour Traffic Volumes and Worst-Case Volumes Assumed for CO Screening Analysis 21
Table 3-3: Maximum Potential CO Concentrations (ppm) 25
Table 5-1: Annual MSAT Emissions by Year, Scenario and Pollutant 41
Table 5-2: Change in Annual MSAT Emissions by Year, Scenario and Pollutant from No-Build and from Existing Emissions 42

LIST OF FIGURES

Figure 1-1: Study Area 6
Figure 3-1: Study Intersections 17
Figure 3-2: Locations Selected for CO Screening Evaluation 20
Figure 4-1: I-395 Express Lanes AADT 26
Figure 4-2: I-395 Express Lanes AADT 32
Figure 4-3: I-395 Express Lanes AADT 33
Figure 5-1: National MSAT Emission Trends 2010-2050 for Vehicles Operating on Roadways Using EPA's MOVES 2010b Model 37
Figure 5-2: 2040 Affected Roadway Network 38

APPENDICES

Appendix A: Interagency Consultation Webinar Presentation and Meeting Minutes
Appendix B: Link Source Type Hour Fractions Calculation Tool
Appendix C: Sample MOVES Input File
Appendix D: Sample CAL3QHC Input/Output Files
Appendix E: CO Modeling Layout

EXECUTIVE SUMMARY

The Virginia Department of Transportation (VDOT), in cooperation with the Federal Highway Administration (FHWA), has initiated a study for the Interstate 395 (I-395) Express Lanes Project (Northern High Occupancy Toll [HOT] Lanes) to extend the I-95 Express Lanes in the City of Alexandria, and Arlington, and Fairfax Counties, Virginia. Pursuant to the National Environmental Policy Act of 1969, as amended, (NEPA) and in accordance with FHWA regulations, an Environmental Assessment (EA) has been prepared to analyze and document the potential social, economic, and environmental effects associated with the proposed transportation improvements.

The study area encompasses approximately eight miles of the I-395 corridor from Turkeycock Run in Fairfax County to the vicinity of Eads Street near the Pentagon in Arlington County. Transition areas extending slightly beyond these termini are included in order to connect the proposed improvements with the existing facility on either end. Crossroads and interchange areas also are included in the study area, as well as lands adjacent to the corridor[1].

This project is located within areas (Fairfax and Arlington Counties, and the City of Alexandria) that are part of a region currently designated non-attainment or maintenance for one or more of the national ambient air quality standards (NAAQS) established by the Environmental Protection Agency (EPA), as follows:

- DC-Maryland-Virginia marginal nonattainment area for the 2008 eight-hour ozone standard, and
- DC-Maryland-Virginia maintenance area for the 1997 primary annual fine particulate matter ($PM_{2.5}$) NAAQS[2].

As such, federal transportation conformity rule (40 CFR Parts 51 and 93) requirements apply, including specifically requirements for inter-agency consultation for conformity (IACC) on the models, methods and assumptions to be applied in project-level air quality analyses (40 CFR 93.105(c)(1)) and the corresponding section of the Virginia Regulation for Transportation Conformity (9 VAC 5-151 Section 70). The IACC requirements were met in two ways:

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[1] The study area is approximately 600 feet to either side of the existing corridor for a distance of eight miles. The study area is established to identify the full extent of environmental resources and their relevance to the project. Specific potential environmental consequences resulting from the expansion and conversion of the two existing reversible High Occupancy Vehicle (HOV) lanes on I-395 to three managed HOT lanes are documented in Chapter 3.0, Environmental Consequences of the EA.

[2] On March 23, 2015, EPA issued a proposed rule (80 FR 15340) on "*Fine Particulate Matter National Ambient Air Quality Standards: State Implementation Plan Requirements*" that stated, in part: *"... EPA is proposing to revoke the 1997 primary annual standard because the EPA revised the primary annual standard in 2012*". This is the $PM_{2.5}$ NAAQS for which the DC-Maryland-northern Virginia region is currently in maintenance. At the time of preparation of this report, EPA has not yet finalized that proposed revocation. If and when it does, then the associated project-level ("hot-spot") air quality analysis requirements as specified in the federal transportation conformity rule would no longer apply. See: https://www.gpo.gov/fdsys/pkg/FR-2015-03-23/pdf/2015-06138.pdf

1. In December 2015, IACC was conducted on all of the models, methods and assumptions specified or referenced in the VDOT Project-Level Air Quality Resource Document[3], which were applied in this analysis either directly or without substantive change. The Resource Document was created by VDOT to facilitate and streamline the preparation of project-level air quality analyses while maintaining high standards for quality. Appendix L of the VDOT Resource Document includes specific technical criteria for screening projects as ones potentially of air quality concern for $PM_{2.5}$, which were developed based on examples provided in EPA guidance. No adverse comments were received.
2. In addition, in the interests of full transparency and notwithstanding the IACC already completed on the Resource Document, IACC was conducted for this project via webinar on July 13th, 2016. No adverse comments were received, including specifically the proposed determination that the project was not one of potential air quality concern for $PM_{2.5}$.

$PM_{2.5}$ Analysis:

For $PM_{2.5}$, the screening criteria presented in Appendix L of the VDOT Resource Document, which were established based on EPA guidance and subjected to IACC as noted above, were applied to determine if this project represents one of local air quality concern. Traffic forecasts developed for this project showed that increases in average daily diesel truck traffic associated with the build scenario would not exceed 2,000 trucks per day[4], the criterion established in the VDOT Resource Document for highway capacity expansion. Additional factors that support the conclusion that this project is not one of local air quality concern for $PM_{2.5}$ include:

- Mainline capacity increases usable by trucks are not part of the proposed action.
- The area has already achieved the 1997, 2006 and 2012 $PM_{2.5}$ NAAQS
- Background concentrations are well below the 1997 NAAQS (8.8 – 9.4 ppb).
- EPA has proposed to revoke the 1997 $PM_{2.5}$ NAAQS in its implementation of the 2012 standard. This would change the status of the area from maintenance to attainment of the NAAQS, eliminating $PM_{2.5}$ conformity requirements.

Based on the weight of evidence it was determined that the proposed improvements are not ones of air quality concern for $PM_{2.5}$ and therefore a detailed quantitative assessment of potential impacts was not required.

CO Analysis:

A quantitative CO hot spot worst-case screening analysis was performed for the project for purposes of both conformity and NEPA, using inputs and procedures specified in the VDOT Resource Document and consistent with applicable EPA and FHWA requirements and guidance. The analysis was conducted as follows:

[3] To be made available on the VDOT website: http://www.virginiadot.org/programs/pr-environmental.asp

[4] This represents 20% of the ten thousand diesel trucks per day criterion established in the VDOT Resource Document (based on the examples provided in EPA guidance) for new highway construction.

- Modeling was completed for existing (2015), the project opening (2020) and design (2040) years.
- The modeling was conducted with EPA models for emissions (MOVES2014a) and dispersion (CAL3QHC and CALINE3), with the dispersion modeling facilitated in part with the FHWA CAL3i interface model (which invokes the EPA models).
- Analysis was conducted for three highly congested major intersections (Little River Turnpike & Beauregard St, Seminary Rd & Beauregard St EB, S. Glebe Rd & NB I-395 Off-ramp) and the interchange between I-395 & Route 27.
- Based on the updated Programmatic Agreement between VDOT and FHWA, only Seminary Rd & Beauregard St EB required detailed modeling.
- Modeling in all cases was conducted using worst-case assumptions for traffic and facility configurations. For example, at the interchange, worst-case traffic volumes were applied, traffic and emissions were concentrated into a single grade separation rather than modeled over broadly dispersed ramps, and receptors were located at twenty feet from the edge of the travelled roadways rather than outside the right of way limits that are outside the footprint of the interchange and therefore much further away from the modeled roadway.
- The results for all of the analyses (intersection and interchange) show that CO concentrations for the Build scenarios are expected to remain well below the CO NAAQS for all locations modeled throughout the corridor for each year modeled.
- Based on the modeling results, implementation of the project is not expected to cause or contribute to a violation of the CO NAAQS.

Mobile Source Air Toxics (MSATs):

Based on FHWA guidance and the forecast total traffic volumes for I-395, this project is categorized as one with high potential effects for MSATs, which include the following: acrolein, benzene, 1,3 butadiene, diesel particulate matter, formaldehyde, naphthalene, and polycyclic organic matter. A detailed quantitative assessment (modeling) following FHWA guidance was therefore conducted for the project to assess the potential impacts for MSATs. The assessment shows that there would be no long-term adverse impacts associated with the Build scenario and that future MSAT emissions across the entire study corridor would be substantially below today's levels, even after accounting for projected VMT growth.

More specifically, the modeling results indicate that MSAT emissions are expected to increase slightly from the no-build to the build scenario in 2020 and 2040, although these increases are not considered substantial. However, when compared to existing conditions, emissions of all MSAT pollutants under the 2020 and 2040 build scenarios are projected to be substantially lower than exist today. EPA's stringent vehicle emission and fuel regulations, combined with fleet turnover, are expected to substantially lower fleet-average emission rates for MSATs in the future relative to today.

Overall, best available information indicates that, nationwide, regional levels of MSATs 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 will show an increase in emissions and ambient levels of these pollutants due to locally increased traffic levels associated with the project.

Indirect Effects and Cumulative Impacts:

Indirect effects are those effects that would be caused by the project but occur later in time or are removed in distance from the project. Cumulative effects are those effects that result from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions. Cumulative effects include indirect effects.

The potential for indirect effects or cumulative impacts to air quality that may be attributable to this project is not expected to be substantial for several reasons. First, regarding indirect effects, much of the area in which the project is located is already highly developed, which limits the potential for incremental indirect effects.

Second, regarding the potential for cumulative impacts, the annual conformity analysis conducted by the Transportation Planning Board (MPO for the Washington, D.C. metropolitan nonattainment/ maintenance area) represents a cumulative impact assessment for purposes of regional air quality. Federal conformity requirements, including specifically 40 CFR 93.114 and 40 CFR 93.115, apply as the area in which the project is located is designated as nonattainment for ozone and maintenance for fine particulate matter. Accordingly, there must be a currently conforming transportation plan and program at the time of project approval, and the project must come from a conforming plan and program (or otherwise meet criteria specified in 40 CFR 93.109(b)).

- The existing air quality designations for the region are based, in part, on the accumulated mobile source emissions from past and present actions, and these pollutants serve as a baseline for the current conformity analysis.
- The conformity analysis quantifies the amount of mobile source emissions for which the area is designated nonattainment/maintenance that will result from the implementation of all reasonably foreseeable (i.e. those proposed for construction funding over the life of the region's transportation plan) regionally significant transportation projects in the region.
- It is anticipated that the conformity analysis currently being conducted will demonstrate that the incremental impact of the proposed project on mobile source emissions, when added to the emissions from other past, present, and reasonably foreseeable future actions, is in conformance with the SIP and will not cause or contribute to a new violation, increase the frequency or severity of any violation, or delay timely attainment of the NAAQS established by EPA.

The indirect and cumulative effects of the project are not expected to be substantial

1. INTRODUCTION

The Virginia Department of Transportation (VDOT), in cooperation with the Federal Highway Administration (FHWA), has initiated a study for the Interstate 395 (I-395) Express Lanes Project (Northern High Occupancy Toll [HOT] Lanes) to extend the I-95 Express Lanes in the City of Alexandria, and Arlington and Fairfax Counties, Virginia. Pursuant to the National Environmental Policy Act of 1969, as amended (NEPA), and in accordance with FHWA regulations, an Environmental Assessment (EA) has been prepared to analyze and document the potential social, economic, and environmental effects associated with the proposed transportation improvements.

The purpose of this Technical Report is to identify and assess the impact to air quality as a result of the project. Information in this report, described below, will support discussions presented in the EA.

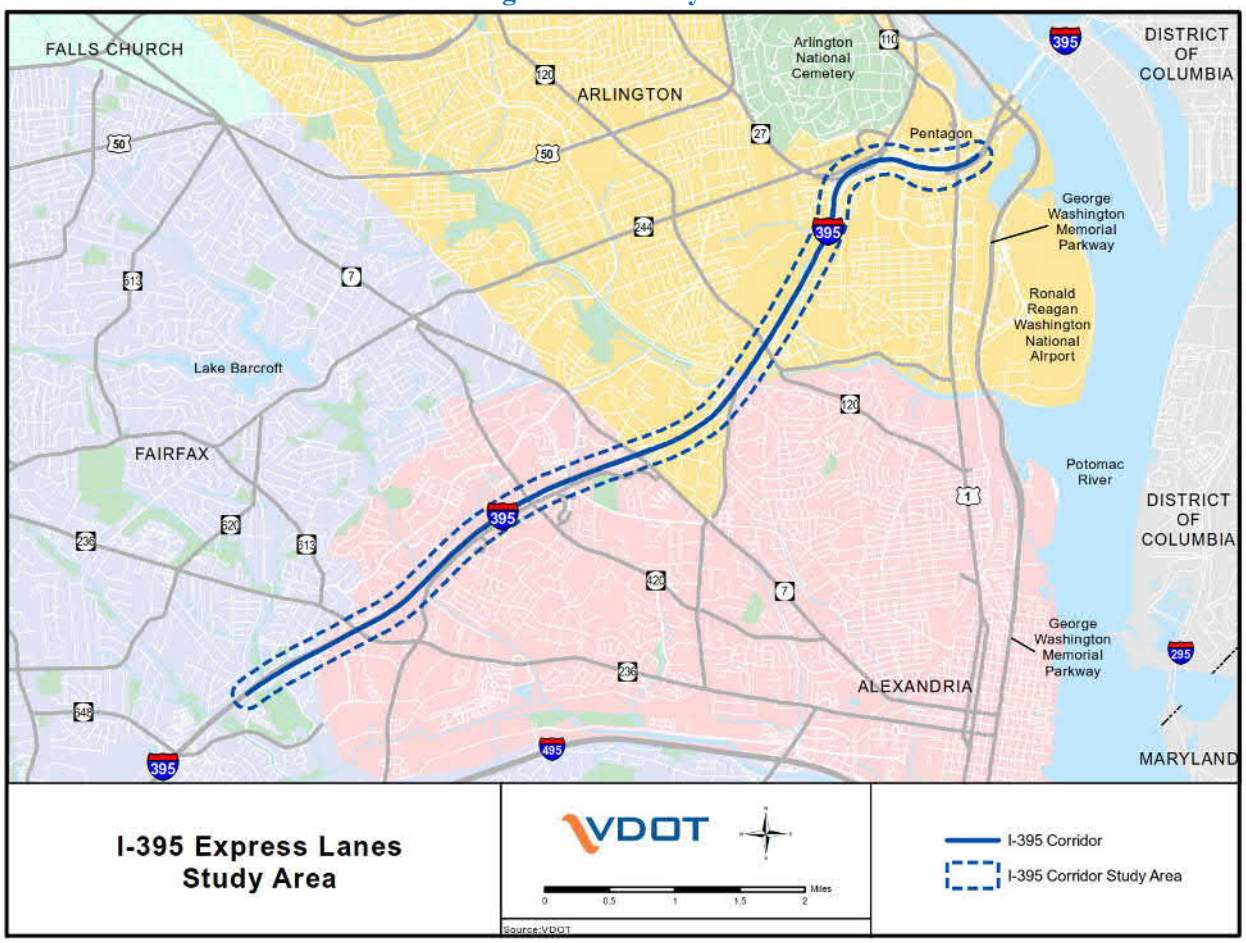
- **Section 1** provides an overview of the study and purpose and need of the project**;**
- **Section 2** describes the regulations and guidance applicable to this project
- **Section 3** describes the methodology and results of the Carbon Monoxide analysis;
- **Section 4** describes the methodology and results of the Particulate Matter analysis;
- **Section 5** describes the methodology and results of the Mobile Source Air Toxics analysis;
- **Section 6** describes the construction emissions,
- **Section 7** describes the regional conformity status of the project;
- **Section 8** describes the Indirect and Cumulative effects of the project; and
- **Section 9** provides the conclusions from the study.

1.1 DESCRIPTION OF THE STUDY AREA

The study area encompasses approximately eight miles of the I-395 corridor from Turkeycock Run in Fairfax County to the vicinity of Eads Street near the Pentagon in Arlington County, as shown in **Figure 1-1**. Transition areas extending slightly beyond these termini are included in order to connect the proposed improvements with the existing facility on either end. Additional signage and maintenance of traffic activities are planned to occur beyond the study area. Crossroads and interchange areas also are included in the study area, as well as lands adjacent to the corridor[5].

[5] The study area is approximately 600 feet to either side of the existing corridor for a distance of eight miles. The study area was established to identify the full extent of environmental resources and their relevance to the project. Specific potential environmental consequences resulting from the expansion and conversion of the two existing reversible High Occupancy Vehicle (HOV) lanes on I-395 to three managed HOT lanes are documented in **Chapter 3.0, Environmental Consequences** of the EA.

Figure 1-1: Study Area



The following interchanges along I-395 are located within the study area, moving south to north:

- Turkeycock Run;
- Duke Street/Little River Turnpike (Route 236);
- Seminary Road (Route 420);
- King Street (Route 7);
- Shirlington Road;
- Glebe Road (Route 120);
- Washington Boulevard (Route 27); and
- Eads Street near the Pentagon.

1.2 BACKGROUND

In 1995, the Public-Private Transportation Act (PPTA) was signed into law and was amended and re-enacted in 2005. PPTA allows for private entities to solicit VDOT to develop and/or operate and maintain transportation facilities that VDOT determines demonstrate a need. In November 2005, the conceptual proposal submitted by Fluor and Transurban was selected by the PPTA Advisory Panel. As proposed at that time, the project improvements would expand the High Occupancy Vehicle (HOV) system in the I-95 / I-395 corridor and apply the HOT concept. As a result of this action, VDOT, in cooperation with FHWA, initiated an environmental analysis on the following proposal:

- Convert the existing two-lane HOV facility to three HOT lanes along I-395 from Eads Street to just south of Route 234 Interchange near Dumfries;
- Construct two new HOT lanes in the median from the existing terminus south of Route 234 to just north of Route 610 (Garrisonville Road);
- Add new entry/exit points between the general purpose lanes and the HOT lanes and modify existing entry/exit points; and
- Build new structures associated with the Lorton Bus-rail transfer station, flyovers, and replace existing structures at Telegraph Road over I-95 and the Franconian-Springfield pedestrian bridge.

In January 2009, FHWA issued a Categorical Exclusion (CE) for the project. In February 2011, VDOT reduced the project scope by eliminating approximately six miles of HOT lanes on I-395 including modifications to the existing interchanges, instead, focusing traffic improvements on the I-95 corridor. VDOT then announced plans for a new I-95 HOT Lanes Project and prepared an EA and then a Revised EA to assess HOT lanes on I-95 from Garrisonville Road in Stafford County to I-395 at Edsall Road in Fairfax County and link those lanes directly to the new I-495 HOT lanes already under construction. In December 2011, upon review of the Revised EA and supporting documentation, FHWA issued a Finding of No Significant Impact.

In 2012, VDOT and 95 Express Lanes, LLC (95 Express) entered into a Comprehensive Agreement for the development of the I-95 Express Lanes. The I-95 Express Lanes project was completed in December 2014. The Comprehensive Agreement allows for the future development of the extension of the I-95 Express Lanes along the I-395 corridor similar to the limits originally proposed in 2005. In 2015, the VDOT signed a Development Framework Agreement with 95 Express to extend the I-395 Express Lanes as a Concessionaire's Enhancement under the Comprehensive Agreement. The Development Framework Agreement outlines the responsibilities of both VDOT and the Concessionaire. The Agreement notes that improvements would be built largely within VDOT's existing right of way, VDOT and 95 Express would work together to finalize the scope, finance plan and agreement, and 95 Express would fund an annual transit payment.

1.3 EXISTING CONDITIONS

The I-395 corridor begins at the I-95 / I-495 Capital Beltway interchange and ends at the New York Avenue NW (Route 50) intersection in northwest Washington, D.C, an approximate distance of 14 miles. I-395 is part of the National Highway System (NHS)[6] and the Strategic Highway Network (STRAHNET)[7]. Additionally, I-395 is the primary north-south interstate into Washington, D.C. from Virginia serving local, commuter, and regional traffic. The existing I-395 facility within the study limits generally includes four northbound (NB) and four southbound (SB) general purpose lanes and two reversible HOV lanes between the NB and SB general purpose lanes. The HOV lanes operate in the NB direction between 2:30 AM and 11:00 AM with HOV 3+ restrictions in effect from 6:00 AM to 9:00 AM. The HOV lanes operate in the SB direction from 1:00 PM to 12:00 AM with HOV 3+ restrictions in effect from 3:30 PM to 6:00 PM. During the summer months, the midday closure of the reversible HOV lanes to reverse the lanes from NB to SB travel occurs one hour earlier, beginning at 10:00 AM to accommodate higher traffic demands in both the general purpose, HOV, and Express Lanes. Nighttime closures remain the same during the summer months.

1.4 PURPOSE AND NEED

The Purpose and Need includes consideration of both the base year 2015 and future year 2040 conditions along the I-395 Corridor. Based on the background information discussed above, information gathered during public and agency meetings, and the analysis of recent data collected for this study, the following transportation needs have been identified for the study area:

- Reduce congestion;
- Provide additional travel choices;
- Improve travel reliability; and,
- Improve roadway safety.

1.5 DESCRIPTION OF THE ALTERNATIVES

VDOT VDOT and 95 Express have been involved in discussions, reviews, and decisions related to HOT lanes proposals in the I-95/I-395 corridor since 2004. The alternatives development process for this project was shaped by this early coordination, the initial project proposal concept and previously completed NEPA documentation and technical studies. The No Build Alternative and the Build Alternative are under consideration for the EA and are assessed in this technical report.

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[6] NHS consists of major roadways important to the nation's economy, defense, and mobility. The NHS includes the interstate highway system as well as other roads connecting to major ports, airports, public transportation facilities, or other intermodal transportation services (http://www.fhwa.dot.gov/planning/national_highway_system/).

[7] STRAHNET is a system of highways important to the United States' strategic defense policy providing defense access, continuity and emergency capabilities for defense purposes (http://www.fhwa.dot.gov/planning/national_highway_system/).

No Build Alternative

The No Build Alternative would retain the existing I-395 interstate and associated interchanges in their present configurations, and allow for routine maintenance and safety upgrades, but assumes there would be no major improvements to the I-395 corridor with the exception of the previously committed projects.

Build Alternative

The Build Alternative extends eight miles along I-395 beginning at Turkeycock Run, just north of Edsall Road Interchange, to the vicinity of Eads Street interchange and converts the two existing reversible HOV lanes to three HOT lanes within the median area between the northbound and southbound I-395 general purpose lanes. Modifications are proposed to the Eads Street interchange to address existing capacity deficiencies and improve transit access to the Pentagon Transit Center and Pentagon Reservation. All other access points to the proposed HOT lanes along the study corridor would remain in their current configuration, but would be converted to HOT access with the exception of the south facing Seminary Road ramp. The south facing Seminary Road ramp will remain an HOV ramp at all times.

2. REGULATORY REQUIREMENTS AND GUIDANCE

This section provides an overview of regulations and guidance applicable to the project-level air quality analysis to support the environmental review of the project.

2.1 NATIONAL ENVIRONMENTAL POLICY ACT OF 1969 (NEPA)

Under NEPA, federal agencies must consider the effects of their decisions on the environment before making any decisions that commit resources to the implementation of those decisions. Changes in air quality, and the effects of such changes on human health and welfare, are among the effects to be considered. A project-level air quality analysis has been performed to assess the air quality impacts of the project, document the findings of the analysis, and make the findings available for review by the public and decision-makers.

2.2 CLEAN AIR ACT

As implemented by the Clean Air Act, the US Environmental Protection Agency (EPA) is required to set the National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and welfare. As shown in Table 2-1, there are currently two types of standards: Primary Standards that are intended to protect public health (including protecting the health of "sensitive" populations such as asthmatics, children and the elderly), and Secondary Standards that are intended to protect the public welfare (e.g., to protect against damage to crops, vegetation, buildings, and animals). 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.

EPA designates geographic regions that do not meet the NAAQS for one or more criteria pollutants as "non-attainment areas." Areas previously designated as non-attainment, but subsequently re-designated to attainment because they no longer violate the NAAQS, are reclassified as "maintenance areas" subject to maintenance plans to be developed and included in a state's SIP. This project is located in Arlington and Fairfax Counties, as well as the city of Alexandria, areas designated as marginal non-attainment for the 2008 8-hour ozone standard and attainment/maintenance for the 1997 annual $PM_{2.5}$ standard. Because of these designations, the project is subject to transportation conformity requirements under the CAA pertaining to ozone and $PM_{2.5}$.

The federal transportation conformity rule (40 CFR Parts 51 and 93) 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)). Transportation-related criteria pollutants, as specified in the conformity rule, include ozone (O_3), CO, nitrogen dioxide (NO_2), PM_{10} and $PM_{2.5}$. Regional conformity analysis requirements apply for plans and programs; hot-spot analysis requirements of 40 CFR 93.116 and 93.123 apply for projects.

On March 10, 2006, EPA released a rulemaking titled $PM_{2.5}$ and PM_{10} Hot-Spot Analyses in Project-Level Transportation Conformity Determinations for the $PM_{2.5}$ and PM_{10} National Ambient Air Quality Standards (40 CFR Part 93). This rulemaking established the criteria for determining which projects will be required to analyze particulate emissions. In addition, the rule established the criteria for demonstrating conformity for $PM_{2.5}$ standards, and updated the existing criteria for determining conformity for PM_{10} areas. EPA also provided the document *Transportation Conformity Guidance for Quantitative Hot-spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas*, the current version published November 2015.[8] Additionally, the Metropolitan Washington Council of Governments is currently updating their air quality conformity analysis for the 2016 Constrained Long Range Transportation Plan (CLRP), which will include the project.

Note, EPA, with the implementation of the 2012 $PM_{2.5}$ NAAQS, proposed to revoke the 1997 annual primary $PM_{2.5}$ NAAQS[9]. In July 2016, 2016, EPA issued a pre-publication version of the final rule including the revocation as proposed.[10] At the time of preparation of this report, the final rule has not been published in the Federal Register.

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8 PM and CO hot-spot guidance documents are available on the EPA website: http://www3.epa.gov/otaq/stateresources/transconf/projectlevel-hotspot.htm

9 On March 23, 2015, EPA issued a proposed rule (80 FR 15340) on "*Fine Particulate Matter National Ambient Air Quality Standards: State Implementation Plan Requirements*" that stated, in part: "… *EPA is proposing to revoke the 1997 primary annual standard because the EPA revised the primary annual standard in 2012*". See: https://www.gpo.gov/fdsys/pkg/FR-2015-03-23/pdf/2015-06138.pdf.

10 EPA, website notice "*$PM_{2.5}$ NAAQS Implementation Final Rule and Fact Sheet July 2016*", July 2016. See: https://www.epa.gov/pm-pollution/pm25-naaqs-implementation-final-rule-and-fact-sheet-july-2016. From the summary provided in the pre-publication version of the final rule. EPA states that: "*Additionally, in this notice the EPA is revoking the 1997 primary annual standard for areas designated as attainment for that standard because the EPA revised the primary annual standard in 2012.*"

Table 2-1: National Ambient Air Quality Standards[11]

Pollutant		Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide (CO)		Primary	8 hours	9 ppm	Not to be exceeded more than once per year
			1 hour	35 ppm	
Lead (Pb)		Primary and secondary	Rolling 3 month average	0.15 µg/m^3(1)	Not to be exceeded
Nitrogen Dioxide (NO_2)		Primary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Primary and secondary	1 year	53 ppb(2)	Annual Mean
Ozone (O_3)		Primary and secondary	8 hours	0.070 ppm(3)	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 year
Particle Pollution	$PM_{2.5}$	Primary	1 year	12.0 µg/m^3	Annual mean, averaged over 3 years
		Secondary	1 year	15.0 µg/m^3	Annual mean, averages over 3 years
		Primary and secondary	24 hours	35 µg/m^3	98th percentile, averaged over 3 years
	PM_{10}	Primary and secondary	24 hours	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide (SO_2)		Primary	1 hour	75 ppb(4)	99th percentile of 1-hour daily maximum concentrations averaged over 3 years
		Secondary	3 hour	0.5 ppm	Not to be exceeded more than once per year

(1) In areas designated nonattainment for the Pb standards prior to the promulgation of the current (2008) standards, and for which implementation plans to attain or maintain the current (2008) standards have not been submitted and approved, the previous standards (1.5 µg/m^3 as a calendar quarter average) also remain in effect.
(2) The level of the annual NO_2 standard is 0.053 ppm. It is shown here in terms of ppb for the purposes of clearer comparison to the 1-hour standard level.
(3) Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) O_3 standards additionally remain in effect in some areas. Revocation of the previous (2008) O_3 standards and transitioning to the current (2015) standards will be addressed in the implementation rule for the current standards.
(4) The previous SO_2 standards (0.14 ppm 24-hour and 0.03 ppm annual) will additionally remain in effect in certain areas: (1) any area for which it is not yet 1 year since the effective date of designation under the current (2010) standards, and (2)any area for which implementation plans providing for attainment of the current (2010) standard have not been submitted and approved and which is designated nonattainment under the previous SO_2 standards or is not meeting the requirements of a SIP call under the previous SO_2 standards (40 CFR 50.4(3)), A SIP call is an EPA action requiring a state to resubmit all or part of its State Implementation Plan to demonstrate attainment of the require NAAQS.

[11] https://www.epa.gov/criteria-air-pollutants/naaqs-table (Accessed August 8, 2016)

2.3 MOBILE SOURCE AIR TOXICS

On December 6, 2012, FHWA issued updated guidance titled Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA. The purpose of the memorandum was to update the September 2009 interim guidance that advised FHWA Division offices on when and how to analyze MSAT under the NEPA review process for highway projects. Based on FHWA's analysis using MOVES2010b, diesel particulate matter (diesel PM) has become the primary MSAT of concern. Additionally, the updated guidance reflects recent regulatory changes, projects national MSAT emission trends out to 2050 using EPA's MOVES2010b model, and summarizes recent research efforts; however, it did not change any project analysis thresholds, recommendations, or guidelines.

The MSAT guidance includes specific criteria for determining which projects are to be considered exempt from MSAT analysis requirements and which may require a qualitative or quantitative analysis. In accordance with the guidance, the FHWA developed a tiered approach with three categories for analyzing MSAT in NEPA documents, depending on specific project circumstances. Those categories are listed below:

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

Projects considered exempt under section 40 CFR 93.126 of the federal conformity rule are also specifically designated as exempt from MSAT analysis requirements.

2.4 MOVES2014/2014A

On October 7, 2014, the EPA published a Federal Register Notice of Availability that approved the Motor Vehicle Emissions Simulator (MOVES2014) as the latest EPA tool for estimating emissions of volatile organic compounds (VOCs), nitrogen oxide (NO_X), CO, PM_{10}, $PM_{2.5}$ and other pollutants from motor vehicles. With this release, EPA started a 2-year grace period to phase in the requirement of using MOVES2014 for transportation conformity analyses. In July 2014, EPA issued guidance on the use of MOVES2014 for State Implementation Plan Development, Transportation Conformity, and Other Purposes. This guidance specifies that the same grace period be applied to project-level emissions analyses. At the end of the grace period, i.e., beginning October 7, 2016, project sponsors are required to use MOVES2014 to conduct emissions analysis for both transportation conformity and NEPA purposes. In March 2015, EPA published a new EPA guidance document titled *Using MOVES2014 in Project-Level Carbon Monoxide Analyses*[12] for completing project-level carbon monoxide analyses using MOVES2014.

In November 2015 EPA released MOVES2014a to allow MOVES users to benefit from several improvements to the model. MOVES2014a does not substantially change the criteria pollutant emissions results of MOVES2014 and therefore is not considered a new model for SIP and transportation conformity purposes. MOVES2014a incorporates substantial improvements in calculating nonroad equipment emissions, and incorporates additional reporting capabilities for these sources of emissions. For onroad emissions, MOVES2014a adds new options requested by users for the input of local vehicle miles traveled (VMT), includes minor updates to the default fuel tables, and corrects an error in MOVES2014 brake wear emissions. The change in brake wear emissions results in small decreases in PM emissions, while emissions for other criteria pollutants remain essentially the same as MOVES2014. MOVES2014a also corrects an error in the way hydrocarbon emissions are apportioned into the inputs needed by air quality models such as CMAQ and CAMx.[13]

[12] See: *http://www.epa.gov/otaq/stateresources/transconf/documents/420b15028.pdf*

[13] Description of MOVE 2014a adapted from USEPA *MOVES 2014a Questions and Answers*, November 2015. http://www3.epa.gov/otaq/models/moves/documents/420f15046.pdf

2.5 VDOT PROJECT-LEVEL AIR QUALITY RESOURCE DOCUMENT

As the project is located in an area subject to the federal transportation conformity rule (40 CFR Parts 51 and 93), inter-agency consultation was required by the federal rule (40 CFR 93.105(c)(1)) and the corresponding section of the Virginia Regulation for Transportation Conformity (9 VAC 5-151 Section 70). This consultation was conducted on the models, methods and assumptions specified in the VDOT Project-Level Air Quality Resource Document (see: http://www.virginiadot.org/programs/pr-environmental.asp), which were applied in this analysis either directly or without substantive change[14]. The Resource Document was created by VDOT to facilitate and streamline the preparation of project-level air quality analyses while maintaining high standards for quality. Inter-agency consultation for conformity purposes was conducted on the VDOT Resource Document on December 14th, 2015. Federal, state and local agencies, including the following, were invited to participate as required by the federal and Virginia conformity regulations:

- FHWA Virginia Division and Resource Center;
- Virginia Department of Environmental Quality;
- Virginia Department of Transportation;
- Virginia Department of Rail and Public Transit;
- Metropolitan Washington Council of Governments;
- EPA Region 3;
- Local agencies

All comments received on the VDOT Resource Document in the consultation process were considered as appropriate before the models, methods and assumptions (including data and data sources) and the definition of substantive change as provided in the VDOT Resource Document were finalized. No adverse comments were received. A summary of the consultation process, including a list of all individuals and agencies invited to participate, can be found in Appendix A of the VDOT Resource Document.

Due to the high-level of interest from public and stakeholders regarding the I-395 Express Lanes Northern Extensions project, an interagency consultation meeting/webinar for the project was conducted on July 13th, 2016. An overview was provided of the project improvements, traffic data and modeling, and Resource Document screening criteria. The meeting provided an opportunity for stakeholder review and comment.

[14] Note the following definition of "substantive change" was included in the Resource Document and made the subject of inter-agency consultation: "For project-level air quality analyses conducted to meet conformity requirements and/or for purposes of NEPA, a substantive change is defined here as one that would reasonably be expected to affect the modeling results and/or the analysis to the degree that it would change a finding, determination or conclusion that all applicable requirements for the air quality analysis for the project would be met and the project cleared. For analyses involving project-specific dispersion modeling for any pollutants for conformity purposes, this includes whether the project would pass the applicable conformity tests."

All comments received in this additional inter-agency consultation were considered as appropriate before the models, methods and assumptions (including data and data sources) for the project analysis were finalized. A summary of the additional or project-specific consultation and results is also provided in **Appendix A** of this analysis.

3. CARBON MONOXIDE ANALYSIS

Carbon monoxide (CO) is a stable gas that disperses in predictable ways in the environment surrounding a project. Computer modeling can be used to assess both existing and expected future concentrations of CO at selected receptor sites in the vicinity of a project.

In order to better screen projects for CO, a programmatic agreement for project-level air quality (CO) analyses (Programmatic Agreement) was executed between the FHWA Virginia Division Office and VDOT in April 2016. It uses worst-case modeling (defined below) to identify the conditions for which a proposed project or action would require either a quantitative or qualitative CO hot-spot analysis to meet requirements under NEPA[15]. Based on the agreement and applicable federal requirements, the I-395 Express Lanes project exceeds the criteria set forth in the programmatic agreement and a quantitative CO hot-spot analysis for purposes of both NEPA and conformity is indicated. The primary reason this level of analysis was required was that the project exceeds the technical criteria (i.e., exceedance of number of left turn or free flow lanes) specified in the FHWA-VDOT Programmatic Agreement, which applies for both NEPA and conformity purposes per the protocols established in the VDOT Resource Document which completed inter-agency consultation for conformity in December 2015.

CO hot-spot analyses can be completed as either screening analyses or refined analyses. Screening analyses are performed using worst-case modeling assumptions for traffic, meteorological conditions and other inputs to generate estimates of the maximum concentrations that may be expected within the project corridor. If under these worst-case assumptions the applicable NAAQS are still met for the project, then it may be reasonably concluded that the actual proposed action will not result in an exceedance of the applicable NAAQS. All worst-case modeling assumptions for this project were taken as specified in or consistent with the VDOT Resource Document, consistent with EPA and FHWA requirements and guidance, and include (but are not limited to):

- Worst-case traffic volumes that are substantially higher than expected or forecast volumes, set approximately to the theoretical capacity of a level roadway without physical constraints that would affect capacity, which substantially increases the estimated emissions and therefore the expected maximum concentrations in the vicinity of the project.
- Worst-case receptor locations (points for which ambient concentrations are estimated) selected as locations at which CO concentrations were likely to be highest.
    - For intersections, receptors were located on the edge of the roadway right of way.

[15] EPA conformity requirements for CO effective March 16, 2016 with the conclusion of the maintenance status for Arlington County (and Alexandria) for CO.

- For the interchange, receptors were also located along the edge of the roadway mixing zone, i.e., well inside the roadway right of way.

- Worst-case roadway configuration for the interchange
  - A grade separation (with no vertical separation) was applied to represent the interchange, effectively concentrating all of the traffic and emissions in the smallest possible area and resulting in estimates for worst-case concentrations that would be well in excess of those actually expected for the project. While this is not physically possible, the assumption is solely for providing an additional credence to any conclusions.

The modeling inputs and procedures were developed in accordance with FHWA and EPA guidance, including the *Guideline for Modeling Carbon Monoxide from Roadway Intersections, Using MOVES2014 in Project-Level Carbon Monoxide Analyses* and the VDOT Project-Level Air Quality Resource Document.

3.1 OVERVIEW OF SCREENING ANALYSIS

A worst-case screening analysis was applied using the EPA MOVES2014a emission model and CAL3QHC dispersion model. For the latter, which does not have a graphical user interface, the FHWA CAL3i interface was applied to facilitate the analyses. CAL3i[16] provides a convenient and user-friendly means of generating input files and executing CAL3QHC, effectively streamlining the dispersion modeling process. CAL3i is an update to CAL3interface[17,18] which was originally released by the FHWA in December 2006. Following standard procedure for the screening analysis, CAL3i was run first to estimate project contributions to ambient CO concentrations, without including background concentrations; background CO levels were then added to the modeling results to estimate worst-case CO concentrations at each receptor location.

3.2 TRAFFIC SUMMARY INFORMATION

The traffic analysis for this project was completed under a separate effort and the results applied for the purposes of this air quality analysis. Traffic forecasts were developed for existing, 2015 baseline conditions, as well as both no-build and build scenarios for the Interim/Opening Year (2020) and the Design Year (2040). The resulting traffic volume forecasts were then used in selecting the intersections to be analyzed.

A detailed effort was undertaken as part of the traffic analysis to identify all intersections that were likely substantially impacted by the project. A total of 48 intersections were identified by the traffic team and are

[16] CAL3i can be obtained by contacting the FHWA Resource Center: http://www.fhwa.dot.gov/resourcecenter/teams/airquality/

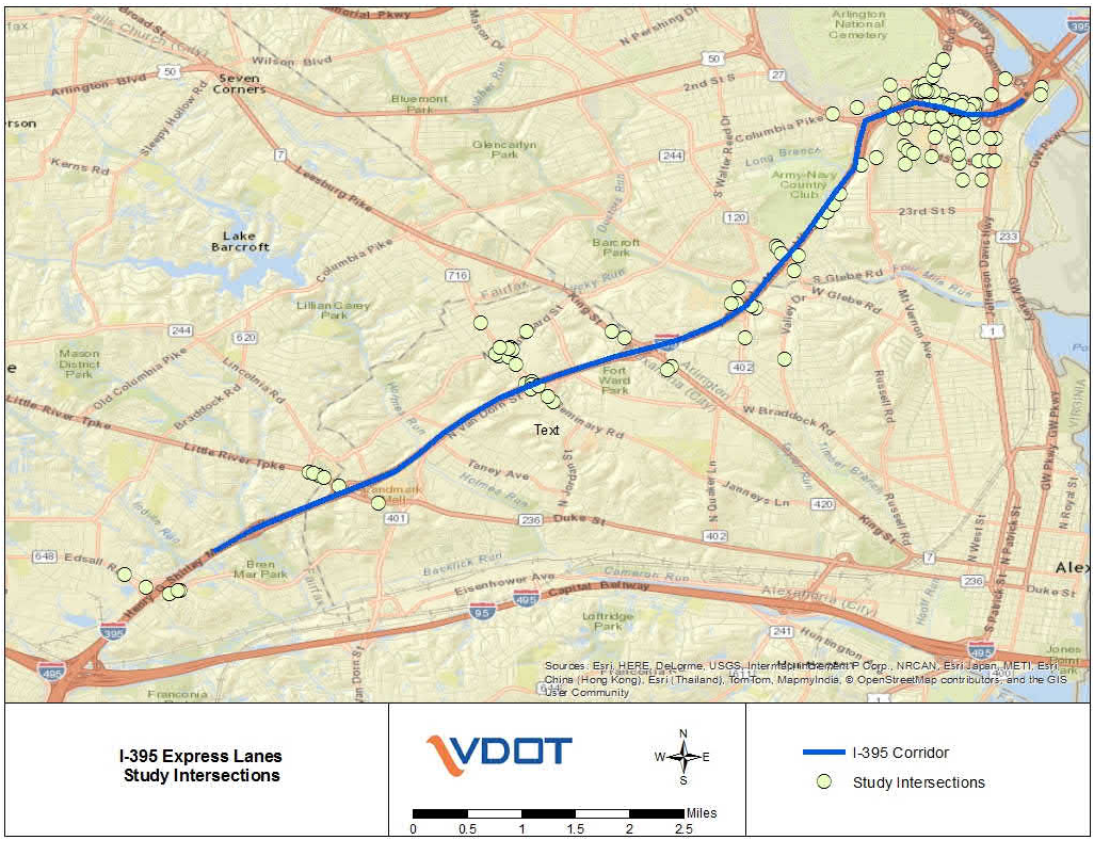
[17] M.Claggett (FHWA), "*CAL3Interface – A Graphical User Interface for the CALINE3 and CAL3QHC Highway Air Quality Models*", ca 2006.

[18] M.Claggett (FHWA), "*Update of FHWA's CAL3Interface – A Graphical User Interface for the CALINE3 and CAL3QHC Highway Air Quality Models*", ca 2008

shown in **Figure 3-1**. These selected intersections served as the starting point for selecting the top three worst-case intersections. The traffic analysis team completed an operations analysis of each intersection using traffic forecasts developed on an intersection-by-intersection basis and the Synchro simulation package. The delay, level of service and traffic volume for every intersection identified was completed, and the results placed in an Excel table in order to rank the intersections. The ranking processed used for this study process is as specified in EPA guidance[19,20]:

1. Rank the top 20 intersections by traffic volumes;
2. Calculate the Level-of-Service (LOS) for the top 20 intersections based on traffic volumes;
3. Rank these intersections by LOS;
4. Model the top 3 intersections based on the worst LOS; and
5. Model the top 3 intersections based on the highest traffic volumes.

Figure 3-1: Study Intersections



[19] EPA guidance was applied although not strictly required for this project, as it is not in a nonattainment or maintenance area for carbon monoxide and therefore not subject to EPA transportation conformity rule requirements or guidance for carbon monoxide.

[20] "*1992 Guideline for Modeling Carbon Monoxide from Roadway Intersections,*" (EPA-454/R-92-005, November 1992); available online at: www.epa.gov/scram001/guidance/guide/coguide.pdf.

Since many of the worst-case intersections had the same LOS, delay was also incorporated into the ranking.[21] It is assumed that if the selected worst-case intersections do not show an exceedance of the NAAQS, none of the ranked intersections will. This is based on the assumption that these intersections will have the highest CO impacts and those intersections with lower traffic volumes and less congestion will have lower ambient air impacts. Thus, if no exceedances of the CO NAAQS occur for the opening and design years when the results of the intersection modeling are added to the urban area-wide component of the CO concentration at each of the worst-case intersections evaluated, then it can reasonably be assumed that the project will not cause or contribute to a violation of the CO NAAQS at any location throughout the project corridor.

The top ten of the 48 intersections as ranked (using the 2040 build scenario results) are shown in **Table 3-1** with the top three worst-case intersections identified as:

- Little River Turnpike & Beauregard Street
- Seminary Road & Beauregard Street Eastbound
- S. Glebe Road & NB I-395 off-ramp

Given the physical size of the interchange (20 lanes along I-395) at I-395 and Route 27, an additional CO screening analysis was conducted for this location. Based on the recent Programmatic Agreement dated April 2016 between FHWA and VDOT only the Seminary Road & Beauregard Street intersection required quantitative modeling. The other intersections met the technical criteria in terms of approach lanes, roadway grade and level of services set forth in the Programmatic Agreement.

Worst-case traffic volumes selected for the screening analysis were consistent with the values in the VDOT Resource Document. Typically, the assumed federal worst-case traffic volumes tend to be substantially higher than the modeled volumes. Table 3-2 below summarizes the traffic estimates developed by the project team on I-395, showing the actual volumes to be substantively lower in each scenario. The map presented in Figure 3-2 showing the physical locations of the locations identified for the CO screening analyses.

[21] Ibid.

Table 3-1: PM Peak Hour Volumes, Delay, and Level of Service (LOS) at Intersections

Signalized Intersection	2015 Existing			2020 No-Build			2020 Build			2040 No-Build			2040 Build		
	Vol.	LOS	Delay*	Vol.	LOS	Delay*	Vol.	LOS	Delay *	Vol.	LOS	Delay *	Vol.	LOS	Delay *
Little River Turnpike & Beauregard St.	4569	E	74.5	4669	E	75.5	4624	E	72.5	4913	E	76.2	4900	E	76.2
Seminary Rd & Beauregard St. EB				4025	D	35.9	4001	D	35.3	4150	D	36.2	4129	D	36.2
S. Glebe Rd & I-395 NB Off-ramp	3551	D	45.4	3759	D	36.5	3758	D	36.7	4009	D	40.3	3970	D	39
S. Shirlington Rd & S. Arlington Mill Dr/Four Mile Run Trail	2533	D	49.2	2606	D	52.1	2440	D	49	2774	D	52.8	2636	D	48.4
Army Navy Dr. & S. Eads St.	2411	B	17.2	2095	C	32.3	2234	C	33.2	2173	C	29.9	2268	D	37.9
S. Eads St. & South Rotary							1914	C	32.4	1927	D	41.6	1860	D	35.3
Duke St. & S. Walker St.	4509	C	29.5	4689	C	29.4	4699	C	29.6	5036	C	31.4	5049	C	31.4
Seminary Rd. & Beauregard St. WB				4188	C	28.7	4148	C	32.3	4346	C	27.3	4330	C	29.5
King St. & Park Center Dr.	3440	B	19.3	3882	C	24.7	3812	C	24.3	4204	C	30.9	4168	C	31.3
Seminary Rd. & Mark Center Dr.	4361	C	22.7	4452	C	24.2	4438	C	24.0	4544	C	27.1	4088	C	24.5

*Delay is in seconds per vehicle
Highlighted cells are the three (3) worst-case intersections selected for analysis

Figure 3-2: Locations Selected for CO Screening Evaluation

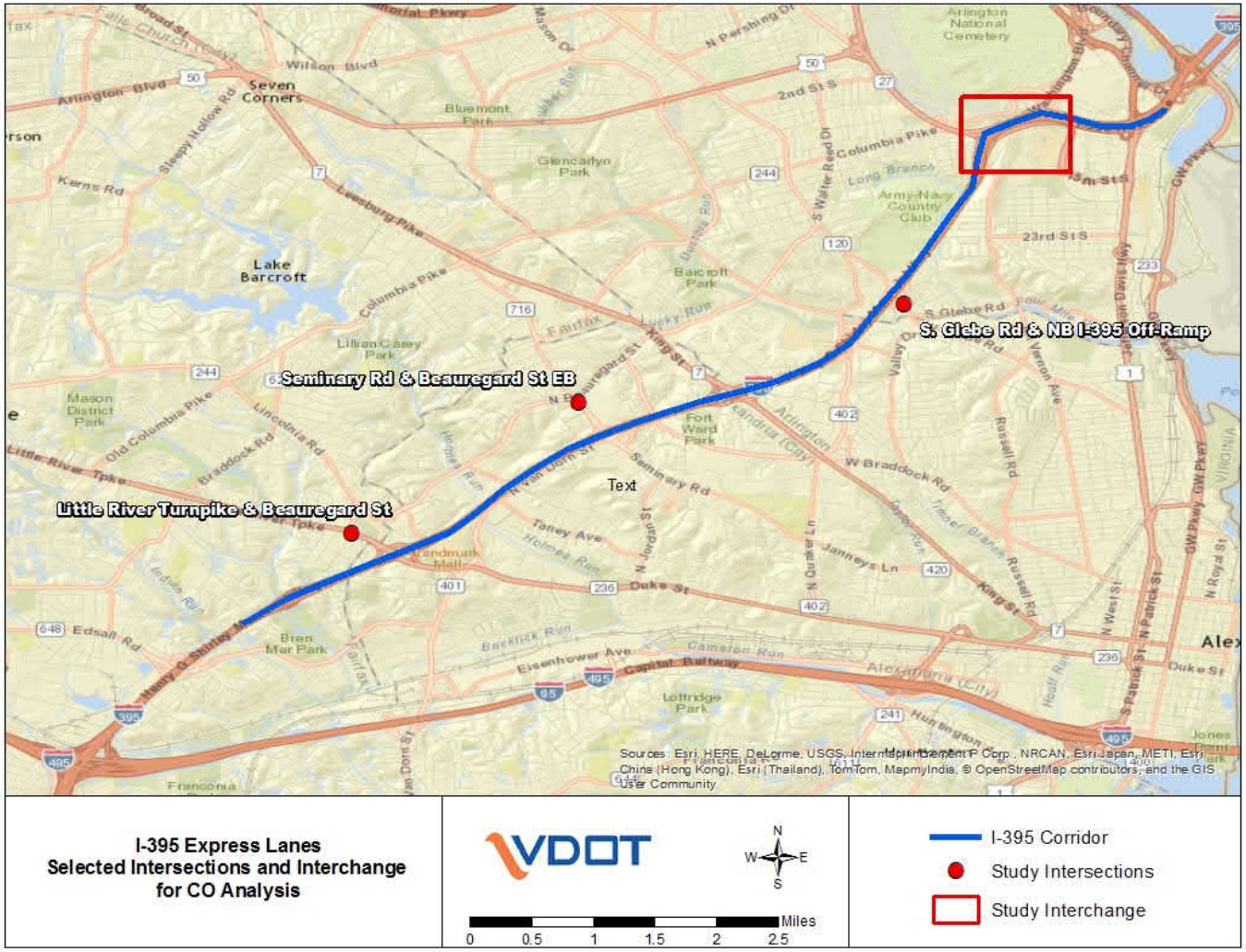


Table 3-2: Comparison of Forecasted Peak Hour Traffic Volumes and Worst-Case Volumes Assumed for CO Screening Analysis

Location	Peak Hour Forecasted Traffic Volumes			Values Used in CO Screening			
	2015	2020	2040	Volume	% Difference		
					2015	2020	2040
Little River Turnpike & Beauregard St.*	4,569	4,624	4,900	17,220	277%	272%	251%
Seminary Rd. & Beauregard St. EB	N/A	4,001	4,129	20,910	N/A	423%	406%
S. Glebe Rd & NB I-395 Off-Ramp*	3,551	3,758	3,970	8,610	142%	129%	117%
I-395 & Rte. 27	16,500	18,500	19,900	67,200	307%	263%	238%

* FHWA VDOT Programmatic Agreement, April 2016 applied for these intersections

3.3 CO RECEPTOR LOCATIONS

Based on EPA guidance, air quality receptor sites are selected based on assessments of where human activity is likely to coincide with the highest CO concentrations. The selected receptor locations are used to quantify both existing and future maximum CO concentrations throughout the project area and satisfy all EPA and FHWA requirements. If the peak CO concentrations at the locations selected in the analysis are below the NAAQS for CO, it is assumed that all other locations in the corridor will also remain below the NAAQS.

For the worst-case analysis for CO, receptors were automatically placed at the edge of the default right of way (10 feet for arterial streets and 20 feet for freeways), regardless of whether the public even has access to these locations, in order to generate the highest possible (worst-case) estimates for concentrations. That is, the receptors were placed 10 feet (3 meters) from the traveled roadway for intersections and 20 feet (6.1 meters) from the traveled roadway for freeways[22]. For a freeway-to-freeway interchange, this means that receptors are placed well within the actual right of way, resulting in substantially higher modeled estimates for peak concentrations than would be obtained in a refined analysis (i.e., not following worst-case methodology). A refined analysis of the interchange would be more spread out over a wider geography, with traffic more dispersed over ramps and various lane configurations, distributing and defusing emissions over a wider area. The worst-case assumption of modeling the interchange as a grade separation effectively

[22] M.Claggett (FHWA), "*Update of FHWA's CAL3Interface – A Graphical User Interface for the CALINE3 and CAL3QHC Highway Air Quality Models*", ca 2008

assumes all traffic and emissions sources are tightly confined to lanes directly crossing each other, with receptors only 20 feet from the travelled roadway edge instead of outside the actual right of way (i.e., in areas with public access). While these receptor locations are close to the on-road emission sources, they are unlikely to be locations accessible to the public and therefore represent a worst-case assumption, exceeding of what would be required by EPA or FHWA guidance. Because these assumptions are so conservative and by design intended to yield the highest possible estimates for concentrations, if the worst-case screening analysis still does not show an exceedance of the CO NAAQS despite these assumptions then no exceedance of the standard would be possible under a more reasonable and realistic set of assumptions.

3.4 MODELING INPUTS

Key assumptions used in the CO modeling are the recommended values found in the VDOT Project-Level Air Quality Resource Document. This information, along with data and assumptions specific to this project, are detailed below:

- Emission Modeling:
  - MOVES2014a was applied.
  - Inputs into MOVES2014a were consistent with the latest version of VDOT Project-Level Air Quality Resource Document and/or associated supplemental materials distributed with the Document.
  - Modeling was performed for roadway links using the urban area type.
  - The link inputs to MOVES2014a that affect the calculation of CO emission rates included the road type, speed, and road grade.
    - For this analysis, links on I-395 and Route 27 were classified as MOVES road type "urban restricted" while links on all other roads were classified as "urban unrestricted".
    - For the intersections, link grades were developed based on elevation data from GIS files and the National Elevation Dataset provided by USGS.
    - For the interchange only, grades were assumed to be 4% on all approach lanes, the maximum uphill grade present at the interchange. For the departure lanes, a 0% grade was used. Combined these represent the worst case for emissions modeling.
    - The link source type hour fraction data were developed using the Link Source Type Hour calculation tool provided with the VDOT Resource Document. More specifically, the method to estimate a local distribution based on VDOT's DVMT Report 1236 and available MOVES Source Type Population Data was applied (see **Appendix B**).
- Posted speeds were assumed for all freeway links (55 mph) and the intersection analyses as an approximation for congested speeds. Estimates of expected speeds are not available at this time as the operational (micro-simulation) analysis is not complete and the use of posted speed is common practice.

- Dispersion Modeling:
  - CAL3QHC was applied using the FHWA CAL3i interface.
  - CO background concentration values were those developed by VDEQ based on recent monitoring data. Documentation for local background concentrations and associated persistence factors is included in the VDOT Resource Document.
  - All other defaults were based on the VDOT Resource Document.
  - Worst-case traffic volumes of 2,400 vehicles per hour per lane (vphpl) or 1,230 vphpl were applied for the interchange and intersection, respectively, far exceeding the theoretical capacity on any one approach.
  - Receptors were located on the edge of the roadway right-of-way, following federal guidance for worst-case analyses.
  - All other worst case assumptions were consistent with recommendations included in the VDOT Project-Level Air Quality Resource Document including:
    - 3 foot median width for freeways
    - No median width for intersections
    - 20 foot right of way for freeways
    - 10 foot right of way for intersections
    - 2,400 vphpl for each travel lane for freeways
    - 1,230 vphpl for each travel lane for intersections
    - Average red cycle length of 68 seconds
    - Saturation flow rate of 1,900 vphpl

An example MOVES input data file applied in the CO analysis is provided in **Appendix C,** and worst-case emission factors are shown in **Table 3-3.**

Table 3-3: Emission Rates (grams per mile)

Year	Emission Rates (grams per mile)		
	Intersection		Interchange
	Freeflow	Idle	
2015	N/A	N/A	6
2020	3.11	4.15	4.8
2040	0.7	1.1	1.8

Source: Michael Baker International, 2016

CAL3QHC via the CAL3i interface was used for modeling the CO concentrations at the selected locations. Emission factors derived from MOVES2014a, calculated as discussed above, were included as inputs to the CAL3i model. Worst-case traffic operations and atmospheric conditions were incorporated to predict worst-case CO concentrations. The surface roughness coefficient used in the analysis was based on land use in the project area. In addition, a persistence factor of 0.78 (taken from the VDOT Resource Document) was applied to the 1-hour CO concentrations to project the 8-hour CO concentrations following the methodology stipulated in EPA guidance. An example CAL3QHC input

and output file are provided in **Appendix D**, and a complete set of modeling files can be made available upon request. Figures 3-3 and 3-4 show the roadway configuration and receptor locations as modeled for the project.

Figure 3-3: Roadway Configuration and Receptor Locations for Intersection

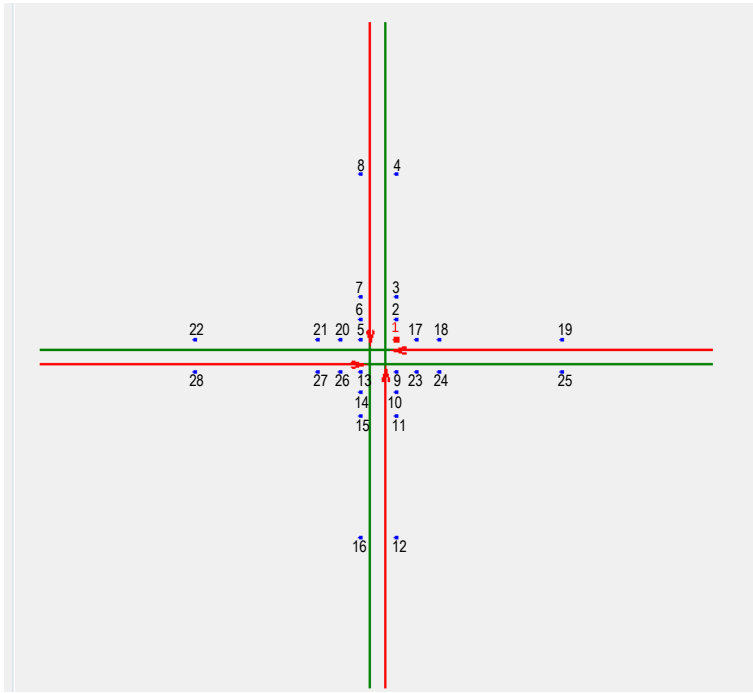
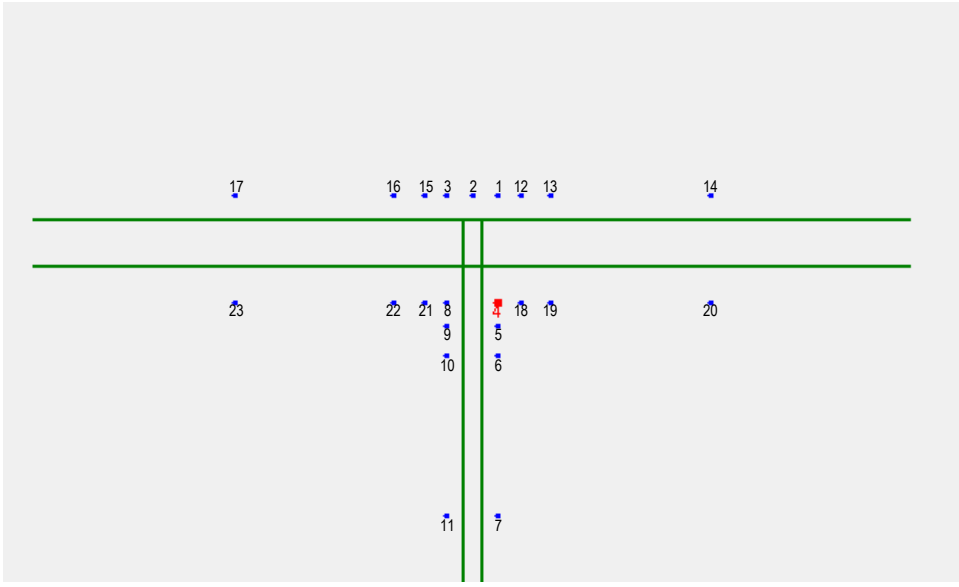


Figure 3-4: Roadway Configuration and Receptor Locations for Interchange



3.5 NO BUILD SCENARIOS

Modeling of No-Build scenarios for the project-level air quality analysis for CO is not required for this analysis in keeping with the FHWA-VDOT 2009 Agreement for No-Build Analyses. Per that Agreement, modeling of a No-Build scenario is not required for projects that qualify for an Environmental Assessment (EA).

A base year analysis was completed using 2015 emission rates, the number of lanes indicative of the No-Build scenario, and the same assumptions as indicated for the build scenario below.

3.6 RESULTS OF CO SCREENING ANALYSIS – BUILD SCENARIOS

For the base year (2015), the worst-case CO concentrations at the I-395/Rte. 27 interchange of 8.6 ppm (1-hour) and 6.9 (8-hour) are observed at receptor 4. For the project-opening year (2020), the worst-case CO concentrations of 7.1 ppm (1-hour) and 5.7 ppm (8-hour) are observed at receptor 4. For the design year (2040), the worst-case CO concentrations of 3.6 ppm (1-hour) and 3.0 ppm (8-hour) are observed at receptor 4. All of these maximum potential CO concentrations are below the CO NAAQS. Thus, these results demonstrate that, under worst-case conditions, the Build scenario will not cause or contribute to a violation of the CO NAAQS at the worst-case interchanges adjacent to the project corridor. The modeling configurations used in the CO analysis can be seen in **Appendix E** and all input and output data for the analysis can be made available upon request. As shown in **Table 3-4** the highest CO concentrations are predicted at the interchange at receptor 4. The maximum observed CO concentrations (in ppm) are shown for the existing and Build condition for each year. The summary table also shows the CO NAAQS for the corresponding averaging period.

Table 3-4: Maximum Potential CO Concentrations (ppm)

Location	Averaging Period	2015	2020	2040	NAAQS
Little River Turnpike & Beauregard St*	1-hour CO	6.8			35
	8-hour CO	5.5			9
Seminary Rd & Beauregard St. EB	1-hour CO	N/A	3.7	2.2	35
	8-hour CO		3.1	1.9	9
S. Glebe Rd & NB I-395 Off-Ramp*	1-hour CO	6.8			35
	8-hour CO	5.5			9
I-395 & Rte. 27	1-hour CO	8.6	7.1	3.6	35
	8-hour CO	6.9	5.7	3.0	9

*Covered under the FHWA VDOT Programmatic Agreement, April 2016. CO concentrations are from Table 2 in the Programmatic Agreement with the appropriate background concentration added in.

The highest concentrations for the intersections shown in Table 3-4 are based on the values found in the FHWA VDOT programmatic agreement.[23] These values are based on an intersection that has six approach lanes on each leg of the intersection, with two of the approach lanes becoming left-turn lanes at the intersection. Four lanes are assumed on each departure leg. The intersection case was modeled at a grade of 2%. The intersection at Seminary Rd & Beauregard St. EB required detailed modeling, since this intersection has 3 left turn lanes on the Northwestern approach. The intersections of Little River Turnpike & Beauregard St and S. Glebe Rd & NB I-395 Off-Ramp are consistent with (and do not exceed) the project types and conditions listed in the agreement between the Federal Highway Administration and the Virginia Department of Transportation for streamlining the project-level air quality analysis process for carbon monoxide. Modeling using 'worst-case' parameters has been conducted for these project types and conditions. It has been determined that projects such as this one would not substantially impact air quality and would not cause or contribute to a new violation, increase the frequency or severity of an existing violation, or delay timely attainment of the National Ambient Air Quality Standard for carbon monoxide.

For the existing, project opening year (2020), and design year (2040) the worst-case intersection has a 1-hour CO concentration of 6.8 ppm and an 8-hour CO concentration of 5.5 ppm.

The analysis of the interchange of I-395 and Route 27 represents a much-exaggerated screening analysis. While the interchange is spread over a wide area, the screening analysis reduces it to a compact roadway crossing with vehicle emissions similarly constrained and concentrated. Traffic volumes are assumed to be at the roadway capacity, and receptors are located adjacent to the roadway at locations that are actually inaccessible to the public. Despite these extreme assumptions, the screening analysis still shows no exceedance of the CO NAAQS. The worst-case 1-hour CO concentration is 8.6 ppm and the 8-hour CO concentration is 6.9 ppm is actually for the existing year (2015), which by definition is not a build scenario. The worst-case result for the build scenario for the 1-hour CO concentration is 7.1 ppm and the 8-hour CO concentration is 5.7 ppm for the 2020 scenario. Given that the actual interchange has lower volumes, is far more spread out and the areas to which the public has access more removed from the roadway edges, it can be confidently stated that, based on this screening analysis, the interchange will not result in a CO exceedance of the NAAQS.

3.7 CO CONCLUSIONS

Based on a worst-case analysis following EPA and FHWA requirements and guidance, and using modeling inputs from or consistent with the VDOT Resource Document, which completed inter-agency consultation for conformity purposes in December 2015, the maximum CO concentrations modeled for this project are below the CO NAAQS. These results demonstrate that, under worst-case conditions, the Build scenario would not cause or contribute to a violation of the CO NAAQS.

[23] FHWA-VDOT Programmatic Agreement for Project Level Air Quality Analyses for Carbon Monoxide, April 2016

4. PARTICULATE MATTER

The I-395 Express Lanes project is located in Arlington and Fairfax Counties and the City of Alexandria; areas designated as maintenance for the 1997 annual $PM_{2.5}$ NAAQS, and as such requires a project-level conformity determination. The VDOT Project-Level Air Quality Resource Document, for which inter-agency consultation for conformity purposes was completed in December 2015, provides guidance and criteria to assist in determining whether a project warrants consideration as a possible project of local air quality concern for $PM_{2.5}$. For more background on inter-agency consultation for conformity conducted for this project, see sections 2.5 and 4.2.

4.1 PM REGULATIONS AND OVERVIEW

Quantitative $PM_{2.5}$ considerations are a requirement under the Transportation Conformity Requirements of the Clean Air Act (CAA). CAA section 176(c)(1) is the statutory requirement that must be met by all projects in nonattainment and maintenance areas that are subject to transportation conformity. Section 176(c)(1)(B) states that federally-supported transportation projects must not "cause or contribute to any new violation of any standard [NAAQS] in any area; increase the frequency or severity of any existing violation of any standard in any area; or delay timely attainment of any standard or any required interim emission reductions or other milestones in any area." Section 93.123(b)(1) of the conformity rule defines the projects that require a $PM_{2.5}$ or PM_{10} hot-spot analysis as:

> (i) New highway projects that have a significant number of diesel vehicles, and expanded highway projects that have a significant increase in the number of diesel vehicles;
>
> (ii) Projects affecting intersections that are at Level-of-Service D, E, or F with a significant number of diesel vehicles, or those that will change to Level-of Service D, E, or F because of increased traffic volumes from a significant number of diesel vehicles related to the project;
>
> (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.

Some examples of projects of local air quality concern that would be covered by 40 CFR 93.123(b)(1)(i) and (ii) are:

- A project on a new highway or expressway that serves a significant volume of diesel truck traffic, such as facilities with greater than 125,000 annual average daily traffic (AADT) and 8% or more of such AADT is diesel truck traffic;

- New exit ramps and other highway facility improvements to connect a highway or expressway to a major freight, bus, or intermodal terminal;
- Expansion of an existing highway or other facility that affects a congested intersection (operated at Level-of-Service D, E, or F) that has a significant increase in the number of diesel trucks; and,
- Similar highway projects that involve a significant increase in the number of diesel transit busses and/or diesel trucks.

Some examples of projects of local air quality concern that would be covered by 40 CFR 93.123(b)(1)(iii) and (iv) are:

- A major new bus or intermodal terminal that is considered to be a "regionally significant project" under 40 CFR 93.1012; and,
- An existing bus or intermodal terminal that has a large vehicle fleet where the number of diesel buses increases by 50% or more, as measured by bus arrivals.

It should be noted that the region currently attains the 2006 and 2012 $PM_{2.5}$ NAAQS based on monitoring data.[24] With the implementation of the 2012 $PM_{2.5}$ NAAQS, USEPA has proposed that the 1997 primary annual standard be revoked, which would eliminate the associated conformity requirements.[25]

Appendix L of the previously referenced VDOT Resource Document specifies criteria for determining whether a project might be considered one of potential air quality concern for fine PM, based on the examples provided by EPA. The VDOT Resource Document including the Appendix L criteria were subjected to inter-agency consultation for conformity purposes in December 2015, as summarized previously, and no adverse comments were received.

4.2 INTERAGENCY CONSULTATION AND DISCUSSION OF FINDINGS

As noted previously, the I-395 Express Lanes project has garnered both media and public attention. All models, methods and assumptions applied for this assessment were taken from or are consistent with those specified in the VDOT Resource Document for which the requisite inter-agency consultation was completed in December 2015 (see section 2.5). In addition, a webinar was held on July 13, 2016 specifically for this project. Agencies invited to participate included:

- FHWA Virginia Division and Resource Center;
- Virginia Department of Environmental Quality;
- Virginia Department of Transportation;
- Virginia Department of Rail and Public Transit;

[24] Attainment status for any region of the country for all NAAQS can be found on the USEPA Greenbook: http://www.epa.gov/airquality/greenbook/

[25] See EPA's March 23, 2015 Notice of Proposed Rulemaking (80 FR 15340-15474) https://www.gpo.gov/fdsys/pkg/FR-2015-03-23/html/2015-06138.htm

- Metropolitan Washington Council of Governments;
- EPA Region 3;
- FTA local and regional offices;
- Fairfax County
- Arlington County; and
- City of Alexandria

Materials distributed to webinar participants and the minutes from the meeting are provided in **Appendix A.**

Traffic forecasts, particularly along I-395 itself, did not indicate a substantial growth in truck or diesel bus traffic as a result of the project. Diagrams summarizing the daily traffic on I-395 can be found in **Figures 4-1 through 4-3**. The absence of substantial growth in Average Annual Diesel Truck Traffic (AADTT) in the project area was expected given that the project involves extending Express lanes and not adding general capacity. There are no new land uses anticipated that would include congregations of idling trucks or diesel vehicles as a result of the proposed action. There is no specific transit component to the project involving diesel buses either traveling through the corridor, for example a dedicated bus lane, or new congregations of idling buses, such as at a major bus-to-bus transfer facility or a new bus yard.

Appendix L of the VDOT Resource Document specifies criteria to determinate whether a proposed project or action is one of potential air quality concern for fine particulate matter ($PM_{2.5}$) that warrants a more detailed investigation. For proposed improvements to existing highways, the applicable criterion is whether the proposed improvement is likely to lead to an increase in AADTT greater than 2,000 vehicles/day. For this project, the forecast changes in traffic volume, even if buses are included in the truck totals, do not attain this 2,000 vehicle/day criterion. This observation holds true in both the opening year of the project (2020) and the design year (2040), years for which traffic forecasts were made available. It can therefore be asserted that this is not a project of local air quality concern for $PM_{2.5}$. This is based both on the previously agreed to thresholds by the IACC, and on a more detailed review of the project specifics. The determination that the proposed improvements do not constitute ones of potential air quality concern for fine particulate matter is supported by the following findings:

- Mainline capacity increases that would be usable by trucks are not part of the proposed action.
- Traffic analysis/traffic modeling performed for this project shows no significant (>2,000 VPD) increase in truck traffic on any of the freeway or arterial roadways in the study corridor that are indirectly impacted by the project, and as such the project does not meet the technical criteria specified in the VDOT Resource Document to be specified to be one of air quality concern for fine particulate matter.[26]

[26] I-395 Express Lane Project: Traffic and Transportation Technical Report – Draft August, 2016 (Under Review)

Additional factors described in the VDOT Air Quality Resource Document also help to support this determination:

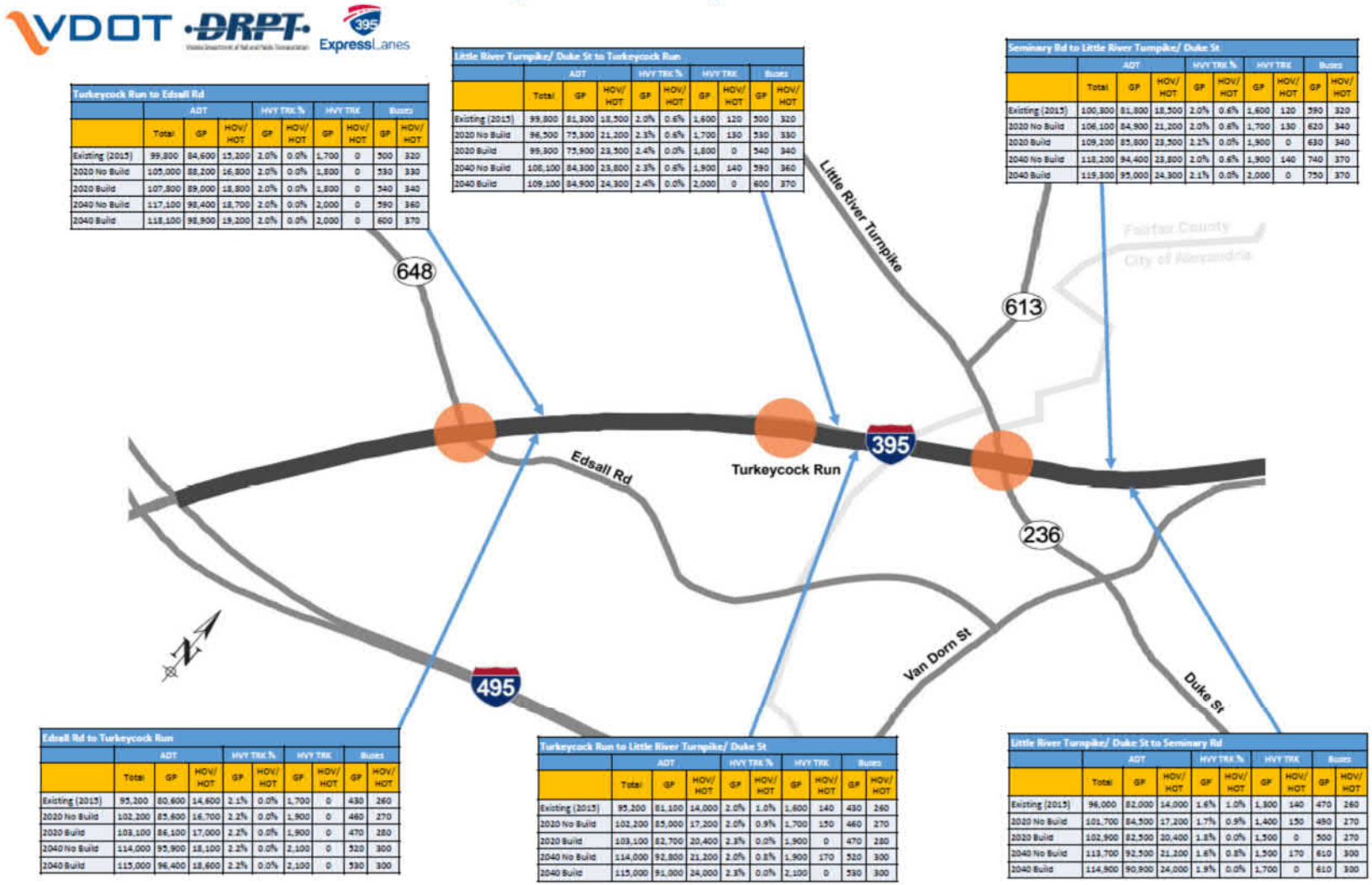
- The area has already achieved the 1997, 2006 and 2012 $PM_{2.5}$ NAAQS
- Background concentrations are well below the 1997 NAAQS (8.8 – 9.4 ppb).[27]
- EPA has signed the final rulemaking that includes the revocation of the 1997 annual PM2.5 NAAQS, which will be effective 60 days after it is published in the Federal Register. This would change the status of the area from Maintenance to Attainment of the standard, eliminating $PM_{2.5}$ conformity requirements.

4.3 PM CONCLUSIONS

Overall, the weight of evidence shows that the I-395 Express Lanes project is not a project of local air quality concern for $PM_{2.5}$. No comments to the contrary were received in inter-agency consultation for conformity purposes for this project.

[27] Monitored data provided by VDEQ

Figure 4-1: I-395 Express Lanes AADT



Turkeycock Run to Edsall Rd

	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT
Existing (2015)	99,800	84,600	15,200	2.0%	0.0%	1,700	0	500	320
2020 No Build	105,000	88,200	16,800	2.0%	0.0%	1,800	0	530	330
2020 Build	107,800	89,000	18,800	2.0%	0.0%	1,800	0	540	340
2040 No Build	117,100	98,400	18,700	2.0%	0.0%	2,000	0	590	360
2040 Build	118,100	98,900	19,200	2.0%	0.0%	2,000	0	600	370

Little River Turnpike/ Duke St to Turkeycock Run

	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT
Existing (2015)	99,800	81,300	18,500	2.0%	0.6%	1,600	120	500	320
2020 No Build	96,500	75,300	21,200	2.3%	0.6%	1,700	130	530	330
2020 Build	99,300	75,900	23,500	2.4%	0.0%	1,800	0	540	340
2040 No Build	108,100	84,300	23,800	2.3%	0.6%	1,900	140	590	360
2040 Build	109,100	84,900	24,300	2.4%	0.0%	2,000	0	600	370

Seminary Rd to Little River Turnpike/ Duke St

	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT
Existing (2015)	100,300	81,800	18,500	2.0%	0.6%	1,600	120	590	320
2020 No Build	106,100	84,900	21,200	2.0%	0.6%	1,700	130	620	340
2020 Build	109,200	85,800	23,500	2.2%	0.0%	1,900	0	630	340
2040 No Build	118,200	94,400	23,800	2.0%	0.6%	1,900	140	740	370
2040 Build	119,300	95,000	24,300	2.1%	0.0%	2,000	0	750	370

Edsall Rd to Turkeycock Run

	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT
Existing (2015)	95,200	80,600	14,600	2.1%	0.0%	1,700	0	430	260
2020 No Build	102,200	85,600	16,700	2.2%	0.0%	1,900	0	460	270
2020 Build	103,100	86,100	17,000	2.2%	0.0%	1,900	0	470	280
2040 No Build	114,000	95,900	18,100	2.2%	0.0%	2,100	0	520	300
2040 Build	115,000	96,400	18,600	2.2%	0.0%	2,100	0	530	300

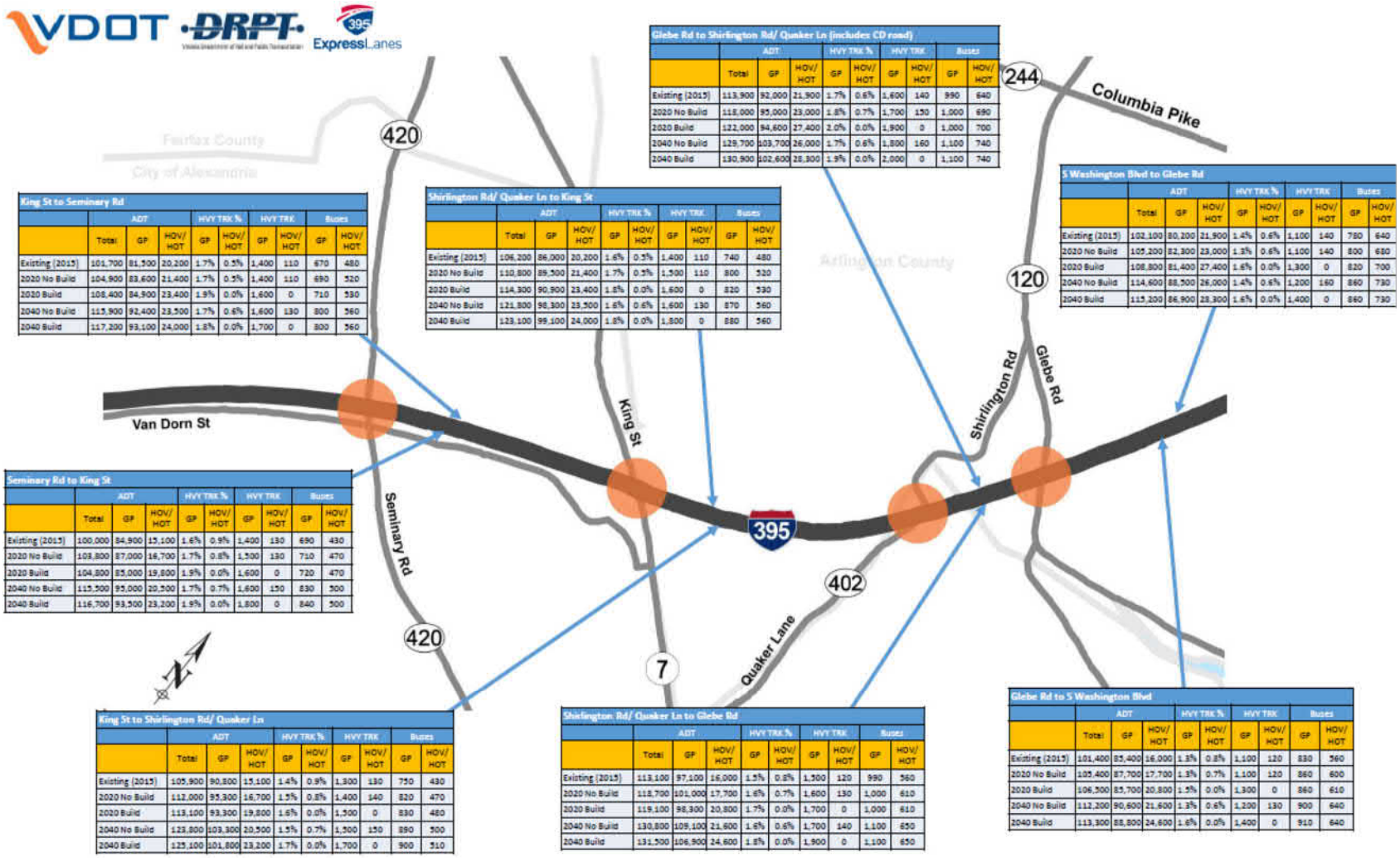
Turkeycock Run to Little River Turnpike/ Duke St

	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT
Existing (2015)	95,200	81,100	14,000	2.0%	1.0%	1,600	140	430	260
2020 No Build	102,200	85,000	17,200	2.0%	0.9%	1,700	150	460	270
2020 Build	103,100	82,700	20,400	2.3%	0.0%	1,900	0	470	280
2040 No Build	114,000	92,800	21,200	2.0%	0.8%	1,900	170	520	300
2040 Build	115,000	91,000	24,000	2.3%	0.0%	2,100	0	530	300

Little River Turnpike/ Duke St to Seminary Rd

	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT
Existing (2015)	96,000	82,000	14,000	1.6%	1.0%	1,300	140	470	260
2020 No Build	101,700	84,500	17,200	1.7%	0.9%	1,400	150	490	270
2020 Build	102,900	82,500	20,400	1.8%	0.0%	1,500	0	500	270
2040 No Build	113,700	92,500	21,200	1.6%	0.8%	1,500	170	610	300
2040 Build	114,900	90,900	24,000	1.9%	0.0%	1,700	0	610	300

Figure 4-2: I-395 Express Lanes AADT



King St to Seminary Rd

	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/HOT	GP	HOV/HOT	GP	HOV/HOT	GP	HOV/HOT
Existing (2015)	101,700	81,500	20,200	1.7%	0.5%	1,400	110	670	480
2020 No Build	104,900	83,600	21,400	1.7%	0.5%	1,400	110	690	520
2020 Build	108,400	84,900	23,400	1.9%	0.0%	1,600	0	710	530
2040 No Build	115,900	92,400	23,500	1.7%	0.6%	1,600	130	800	560
2040 Build	117,200	93,100	24,000	1.8%	0.0%	1,700	0	800	560

Shirlington Rd/ Quaker Ln to King St

	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/HOT	GP	HOV/HOT	GP	HOV/HOT	GP	HOV/HOT
Existing (2015)	106,200	86,000	20,200	1.6%	0.5%	1,400	110	740	480
2020 No Build	110,800	89,500	21,400	1.7%	0.5%	1,500	110	800	520
2020 Build	114,300	90,900	23,400	1.8%	0.0%	1,600	0	820	530
2040 No Build	121,800	98,300	23,500	1.6%	0.6%	1,600	130	870	560
2040 Build	123,100	99,100	24,000	1.8%	0.0%	1,800	0	880	560

Glebe Rd to Shirlington Rd/ Quaker Ln (includes CD road)

	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/HOT	GP	HOV/HOT	GP	HOV/HOT	GP	HOV/HOT
Existing (2015)	113,900	92,000	21,900	1.7%	0.6%	1,600	140	990	640
2020 No Build	118,000	95,000	23,000	1.8%	0.7%	1,700	150	1,000	690
2020 Build	122,000	94,600	27,400	2.0%	0.0%	1,900	0	1,000	700
2040 No Build	129,700	103,700	26,000	1.7%	0.6%	1,800	160	1,100	740
2040 Build	130,900	102,600	28,300	1.9%	0.0%	2,000	0	1,100	740

S Washington Blvd to Glebe Rd

	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/HOT	GP	HOV/HOT	GP	HOV/HOT	GP	HOV/HOT
Existing (2015)	102,100	80,200	21,900	1.4%	0.6%	1,100	140	780	640
2020 No Build	105,200	82,300	23,000	1.3%	0.6%	1,100	140	800	680
2020 Build	108,800	81,400	27,400	1.6%	0.0%	1,300	0	820	700
2040 No Build	114,600	88,500	26,000	1.4%	0.6%	1,200	160	860	730
2040 Build	115,200	86,900	28,300	1.6%	0.0%	1,400	0	860	730

Seminary Rd to King St

	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/HOT	GP	HOV/HOT	GP	HOV/HOT	GP	HOV/HOT
Existing (2015)	100,000	84,900	15,100	1.6%	0.9%	1,400	130	690	430
2020 No Build	103,800	87,000	16,700	1.7%	0.8%	1,500	130	710	470
2020 Build	104,800	85,000	19,800	1.9%	0.0%	1,600	0	720	470
2040 No Build	115,500	95,000	20,500	1.7%	0.7%	1,600	150	830	500
2040 Build	116,700	93,500	23,200	1.9%	0.0%	1,800	0	840	500

King St to Shirlington Rd/ Quaker Ln

	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/HOT	GP	HOV/HOT	GP	HOV/HOT	GP	HOV/HOT
Existing (2015)	105,900	90,800	15,100	1.4%	0.9%	1,300	130	750	430
2020 No Build	112,000	95,300	16,700	1.5%	0.8%	1,400	140	820	470
2020 Build	113,100	93,300	19,800	1.6%	0.0%	1,500	0	830	480
2040 No Build	123,800	103,300	20,500	1.5%	0.7%	1,500	150	890	500
2040 Build	125,100	101,800	23,200	1.7%	0.0%	1,700	0	900	510

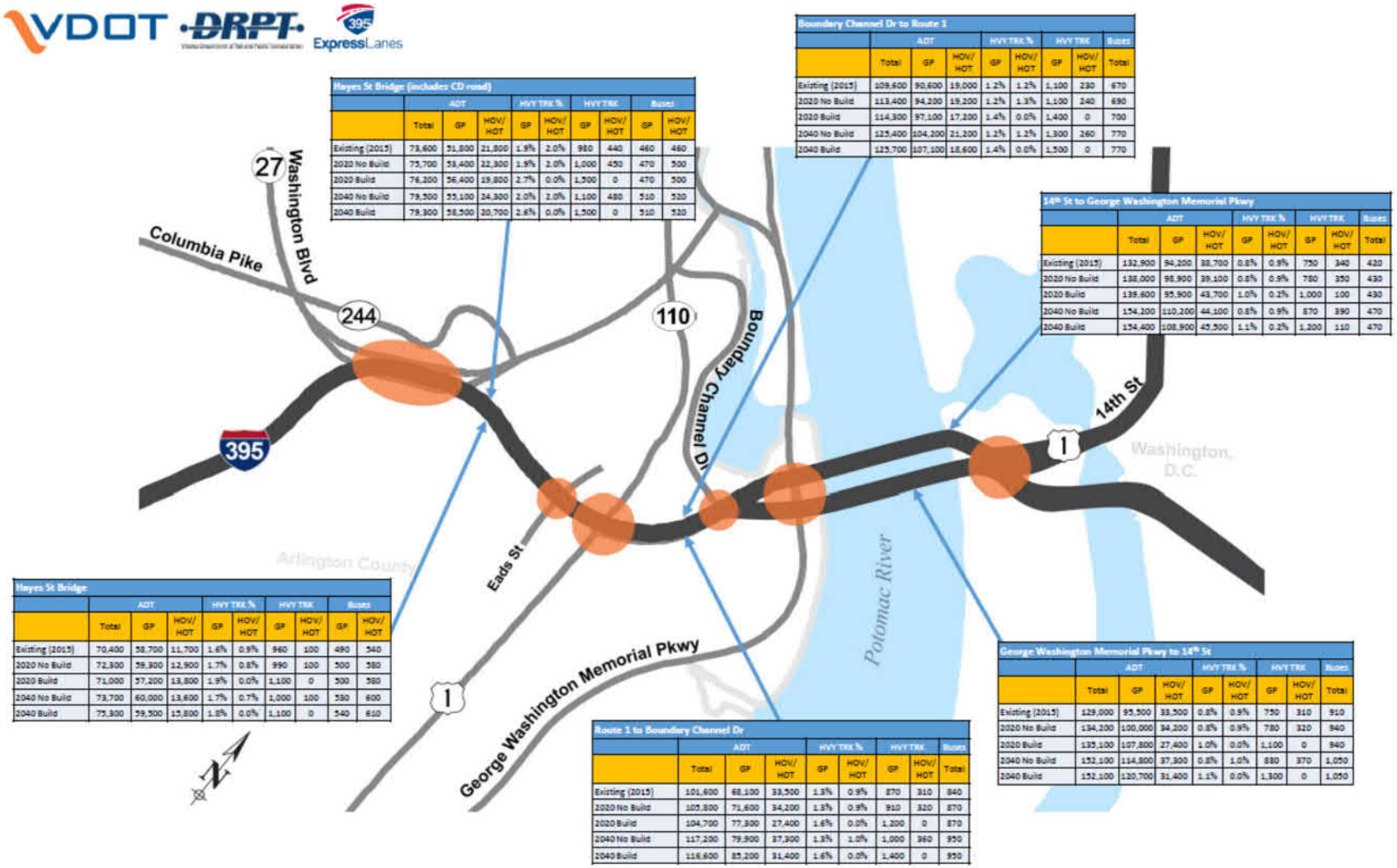
Shirlington Rd/ Quaker Ln to Glebe Rd

	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/HOT	GP	HOV/HOT	GP	HOV/HOT	GP	HOV/HOT
Existing (2015)	113,100	97,100	16,000	1.5%	0.8%	1,500	120	990	560
2020 No Build	118,700	101,000	17,700	1.6%	0.7%	1,600	130	1,000	610
2020 Build	119,100	98,300	20,800	1.7%	0.0%	1,700	0	1,000	610
2040 No Build	130,800	109,100	21,600	1.6%	0.6%	1,700	140	1,100	650
2040 Build	131,500	106,900	24,600	1.8%	0.0%	1,900	0	1,100	650

Glebe Rd to S Washington Blvd

	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/HOT	GP	HOV/HOT	GP	HOV/HOT	GP	HOV/HOT
Existing (2015)	101,400	85,400	16,000	1.3%	0.8%	1,100	120	830	560
2020 No Build	105,400	87,700	17,700	1.3%	0.7%	1,100	120	860	600
2020 Build	106,500	85,700	20,800	1.5%	0.0%	1,300	0	860	610
2040 No Build	112,200	90,600	21,600	1.3%	0.6%	1,200	130	900	640
2040 Build	113,300	88,800	24,600	1.6%	0.0%	1,400	0	910	640

Figure 4-3: I-395 Express Lanes AADT



Hayes St Bridge (includes CD road)

	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT
Existing (2015)	73,600	51,800	21,800	1.9%	2.0%	980	440	460	460
2020 No Build	75,700	53,400	22,300	1.9%	2.0%	1,000	450	470	500
2020 Build	76,200	56,400	19,800	2.7%	0.0%	1,500	0	470	500
2040 No Build	79,500	55,100	24,300	2.0%	2.0%	1,100	480	510	520
2040 Build	79,300	58,500	20,700	2.6%	0.0%	1,500	0	510	520

Boundary Channel Dr to Route 1

	ADT			HVY TRK %		HVY TRK		Buses
	Total	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT	Total
Existing (2015)	109,600	90,600	19,000	1.2%	1.2%	1,100	230	670
2020 No Build	113,400	94,200	19,200	1.2%	1.3%	1,100	240	690
2020 Build	114,300	97,100	17,200	1.4%	0.0%	1,400	0	700
2040 No Build	125,400	104,200	21,200	1.2%	1.2%	1,300	260	770
2040 Build	125,700	107,100	18,600	1.4%	0.0%	1,500	0	770

14th St to George Washington Memorial Pkwy

	ADT			HVY TRK %		HVY TRK		Buses
	Total	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT	Total
Existing (2015)	132,900	94,200	38,700	0.8%	0.9%	750	340	420
2020 No Build	138,000	98,900	39,100	0.8%	0.9%	780	350	430
2020 Build	139,600	95,900	43,700	1.0%	0.2%	1,000	100	430
2040 No Build	154,200	110,200	44,100	0.8%	0.9%	870	390	470
2040 Build	154,400	108,900	45,500	1.1%	0.2%	1,200	110	470

Hayes St Bridge

	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT
Existing (2015)	70,400	58,700	11,700	1.6%	0.9%	960	100	490	540
2020 No Build	72,300	59,300	12,900	1.7%	0.8%	990	100	500	580
2020 Build	71,000	57,200	13,800	1.9%	0.0%	1,100	0	500	580
2040 No Build	73,700	60,000	13,600	1.7%	0.7%	1,000	100	530	600
2040 Build	75,300	59,500	15,800	1.8%	0.0%	1,100	0	540	610

Route 1 to Boundary Channel Dr

	ADT			HVY TRK %		HVY TRK		Buses
	Total	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT	Total
Existing (2015)	101,600	68,100	33,500	1.3%	0.9%	870	310	840
2020 No Build	105,800	71,600	34,200	1.3%	0.9%	910	320	870
2020 Build	104,700	77,300	27,400	1.6%	0.0%	1,200	0	870
2040 No Build	117,200	79,900	37,300	1.3%	1.0%	1,000	360	950
2040 Build	116,600	85,200	31,400	1.6%	0.0%	1,400	0	950

George Washington Memorial Pkwy to 14th St

	ADT			HVY TRK %		HVY TRK		Buses
	Total	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT	Total
Existing (2015)	129,000	95,500	33,500	0.8%	0.9%	750	310	910
2020 No Build	134,200	100,000	34,200	0.8%	0.9%	780	320	940
2020 Build	135,100	107,800	27,400	1.0%	0.0%	1,100	0	940
2040 No Build	152,100	114,800	37,300	0.8%	1.0%	880	370	1,050
2040 Build	152,100	120,700	31,400	1.1%	0.0%	1,300	0	1,050

5. MOBILE SOURCE AIR TOXICS

In December of 2012, the FHWA issued an interim guidance update regarding the evaluation of MSAT in NEPA analyses and included projections utilizing the EPA MOVES emission model and updated research on air toxic emissions from mobile sources. The guidance includes three categories and criteria for analyzing MSATs in a NEPA documents:

1. No meaningful MSAT effects,
2. Low potential MSAT effects, and
3. High potential MSAT effects.

A qualitative analysis is required for projects that meet the low potential MSAT effects criteria while a quantitative analysis is required for projects meeting the high potential MSAT effects criteria.

Projects with Low Potential MSAT Effects are described as:

- Those that serve to improve operations of highway, transit, freight without adding substantial new capacity or without creating a facility that is likely to significantly increase emissions. This category covers a broad range of project types including minor widening projects and new interchanges, such as those that replace a signalized intersection on a surface street or where design year traffic is not projected to meet the 140,000 to 150,000 AADT criteria.

Projects with High Potential MSAT Effects must:

- Create or significantly alter a major intermodal freight facility that has the potential to concentrate high levels of diesel particulate matter in a single location;
- Create new or add significant capacity to urban highways such as interstates, urban arterials, or urban collector-distributor routes with traffic volumes where the AADT is projected to be in the range of 140,000 to 150,000 or greater by the design year; and
- Proposed to be located in proximity to populated areas.

In accordance with the MSAT guidance, the study area is best characterized as a project with "higher potential MSAT effects" since projected design year traffic is expected to exceed the 140,000 to 150,000 AADT thresholds. Specifically, the 2040 Build scenario is expected to have AADT volumes on I-395 that reach 262,400 AADT between Shirlington Road and Glebe Road and this traffic is also in proximity to populated areas. The quantitative assessment of MSATs is discussed **Section 5.4**.

5.1 MSAT BACKGROUND

Controlling air toxic emissions became a national priority with the passage of the Clean Air Act Amendments (CAAA) of 1990, when Congress mandated that the EPA regulate 188 air toxics, also known as hazardous air pollutants (HAPs). The EPA assessed this expansive list in their 2007 rule on the Control of Hazardous Air Pollutants from Mobile Sources and identified a group of 93 compounds emitted

from mobile sources that are listed in their Integrated Risk Information System (IRIS). In addition, EPA identified seven compounds with substantial contributions from mobile sources that are among the national and regional-scale cancer risk drivers from their 1999 National Air Toxics Assessment (NATA). The seven compounds identified were:

1. acrolein;
2. benzene;
3. 1,3 butadiene;
4. diesel particulate matter;
5. formaldehyde;
6. naphthalene; and
7. polycyclic organic matter.

While 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 MSAT emissions through cleaner fuels and cleaner engines.

5.2 MOTOR VEHICLE EMISSIONS SIMULATOR (MOVES)

According to EPA, MOVES improves upon the previous MOBILE model in several key aspects. MOVES is based on a vast amount of in-use vehicle data collected and analyzed since the latest release of MOBILE, including millions of emissions measurements from light-duty vehicles. Analysis of this data enhanced EPA's understanding of how mobile sources contribute to emission inventories and the relative effectiveness of various control strategies. In addition, MOVES accounts for the substantial effects that vehicle speed and temperature have on PM emission estimates, whereas MOBILE did not. MOVES2010b includes all air toxic pollutants in NATA that are emitted by mobile sources. EPA has incorporated more recent data into MOVES2010b to update and enhance the quality of MSAT emission estimates. These data reflect advanced emission control technology and modern fuels, plus additional data for older technology vehicles.

Based on an FHWA analysis using EPA's MOVES2010b model, even if vehicle-miles traveled (VMT) increases by 102 percent as assumed from 2010 to 2050, a combined reduction of 83 percent in the total annual emissions for the priority MSAT is projected for the same time period (see **Figure 5-1**). It should be noted that MOVES2010b does not reflect the impacts of some of the more recent heavy-duty vehicle fuel economy standards or fuel standards intended to reduce emissions. Because of this, application of MOVE2014 (which does include these impacts) would forecast declines that are even more dramatic.

The implications of MOVES on MSAT emissions estimates compared to MOBILE are lower estimates of total MSAT emissions, substantially lower benzene emissions, and substantially higher diesel PM emissions, especially for lower speeds. This reflects the combined impact of more recent vehicle fuel economy standards, vehicle emission standards and fuel formulation not taken into account in MOBILE but fully integrated into MOVES. As a result, diesel PM is projected to be the dominant component of the emissions total.

5.3 MSAT RESEARCH

Air toxics analysis is a continuing area of research. While much work has been done to assess the overall health risk of air toxics, many questions remain unanswered. In particular, the tools and techniques for assessing project-specific health outcomes as a result of lifetime MSAT exposure remain limited. These limitations impede the ability to evaluate how potential public health risks posed by MSAT exposure should be factored into project-level decision-making within the context of NEPA.

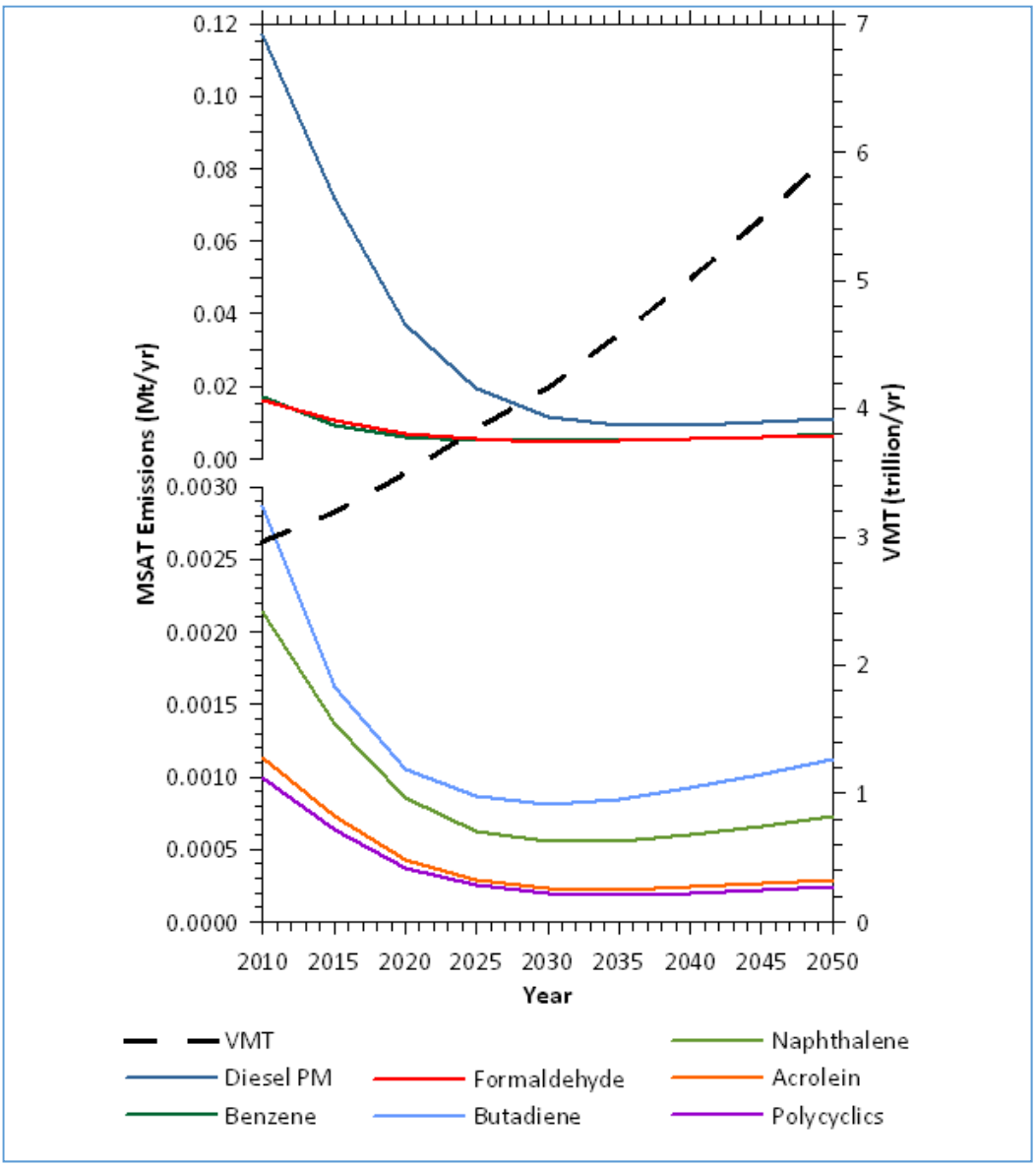
Nonetheless, air toxics concerns continue to be raised on highway projects during the NEPA process. Even as the science emerges, we are duly expected by the public and other agencies to address MSAT impacts in our environmental documents. The FHWA, EPA, the Health Effects Institute, and others have funded and conducted research studies to try to more clearly define potential risks from MSAT emissions associated with highway projects. The FHWA continues to monitor the developing research in this field.

5.4 PROJECT QUANTITATIVE MSAT ANALYSIS

A quantitative MSAT analysis was conducted consistent with the latest guidance developed by FHWA. These include the Interim Guidance Update mentioned earlier, and the FHWA guidance for addressing a quantitative MSAT analysis using MOVES titled "Conducting Quantitative MSAT Analysis for FHWA NEPA Documents—Frequently Asked Questions," from September 2015. The models, methods and assumptions applied in the analysis are also consistent with those specified in the VDOT Resource Document.

Based on traffic projections for the analysis years, the segments directly associated with the project and those roadways in the affected network where the Annual Average Daily Traffic (AADT) is expected to change +/- 5% and greater than 50 vehicles for the Build alternative compared to the No-Build alternative were identified. In addition, the roadway segments where the travel time is expected to change +/- 10% for the Build alternative compared to the No-Build alternative as well roadway segments that would experience a change in congested speed of +/- 2.5 mph were also included. Finally, links farther from the project where large changes are obviously isolated "modeling artifacts" were discounted and excluded, while a limited number of smaller links were added to make the affected network more contiguous. The full extent of the affected network can be seen in **Figure 5-2.**

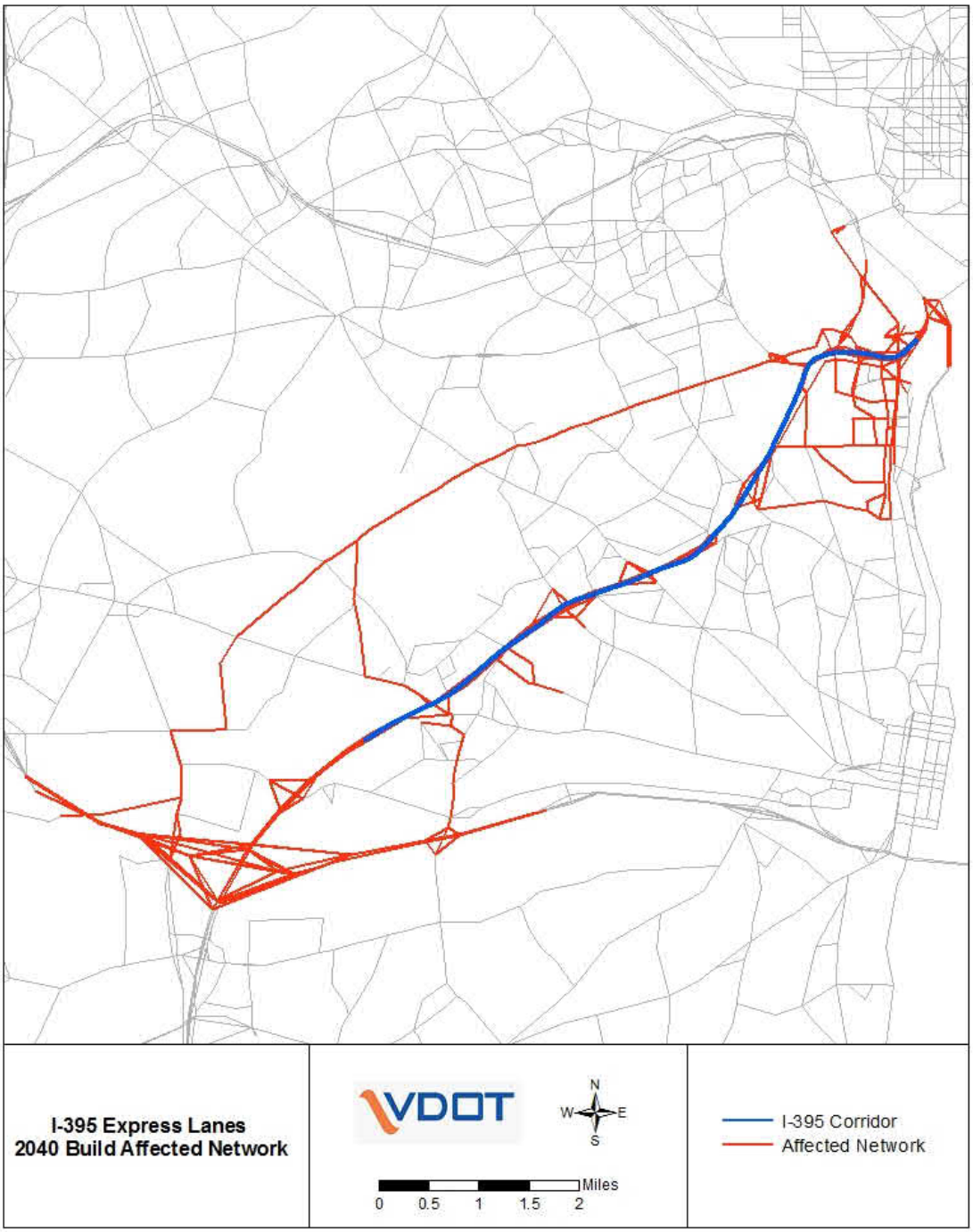
Figure 5-1: National MSAT Emission Trends 2010-2050 for Vehicles Operating on Roadways Using EPA's MOVES 2010b Model



Source: EPA MOVES2010b model runs conducted during May-June 2012 by FHWA.

Note: 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.

Figure 5-2: 2040 Affected Roadway Network



The following describes the approach and methodology used for conducting the quantitative MSAT analysis:

- AADT volumes, peak hour volumes and diurnal traffic distribution for I-395 and other roadways in the affected network along with the estimated network speeds for congested periods and for free-flow conditions were obtained from the travel network data files.
- Speed distributions were based on the congested speeds provided in the Travel Demand Model (TDM) output. Eight time periods were provided with the PM peak traffic broken into three periods, the AM peak and nighttime traffic broken into two periods, plus a single midday period. The AM peak periods include 6 am to 9 am and 9 am to 11 am. The PM peak periods include 1 pm to 3 pm, 3 pm to 6 pm, and 6 pm to 7 pm. The midday period covers 11 am to 1 pm, and the nighttime periods cover 7 pm to 5 am and 5 am to 6 am. The developed speed distributions are specific to each evaluation year, scenario, road type, and county. The fractions of vehicle hours of travel within each speed bin were estimated from the vehicle hours of travel and vehicle speeds contained in the traffic demand model output for each link included in the affected network and were apportioned using the MOVES AvgSpeedBin table of bins (i.e., 1 through 16) for each road type and county. The calculated speed distribution representing each time period was then applied to each hour in the time period. For the hours that include two time periods, a weighted average speed distribution was created from the two applicable speed distributions.
- The road type distributions were based on the functional class of the roadways. Interstates were assigned to MOVES road type category 4 (urban restricted access roadways), while other roads were assigned to MOVES road type category 5 (urban unrestricted access roadways). Road type distributions for each county were developed using the MWCOG distribution of VMT by source type for road types 4 and 5 as well as the total VMT by road type from the TDM network output.
- The MOVES2014a model was run with local parameters for the four quarters of each analysis year (using January, April, July, and October meteorological and fuel data as surrogates for each quarter). Annual MSAT emissions were then calculated by multiplying the seasonal day emissions by the number of days in the season and summing the resulting emissions from the four seasons. The resulting, existing, interim, and design year emissions for the no-build and build conditions were compared.
- All inputs for MOVES were consistent with those specified in the VDOT Resource Document**.**
- The analysis reflects only running exhaust, crankcase running exhaust, evaporative permeation, and evaporative fuel leaks, in accordance with FHWA guidance. Diesel PM exhaust consists of exhaust PM10 emissions from diesel vehicles only. The polycyclic organic matter (POM) was summarized consistent with the pollutants listed in the FHWA guidance for POM.

The results of the quantitative MSAT analysis are presented in **Table 5-1. Table 5-2** shows the change in emissions between the Build and No-Build scenarios and between the Build and Existing scenarios. These tables show that all of the MSAT emissions are expected to increase slightly for both the 2020 and 2040 Build scenario when compared to the corresponding No-Build scenario. However, when compared to the 2015 Existing conditions, emissions of all pollutants in the Build scenarios for both years show substantial decreases. These reductions occur despite projected increases in VMT from 2015 to the 2020 and 2040 Build scenarios of 4.9 and 13.9 percent, respectively. In 2020, the increased emissions from the No-Build to the Build scenario are between 0.8 - 1.7% with a corresponding 2.5% increase in VMT. In 2040, the increased emissions from the No-Build to the Build scenario are between 0.6 - 2.7% with a corresponding 1.8% increase in VMT.

In all cases, the magnitude of the MSAT emissions is small in the projection years and substantially lower than exists today. Over the 5-year period from 2015 to 2020, MSAT emissions are reduced by 49.4% to 70%. By 2040, emissions of all pollutants are further reduced from 2015 levels. Over the 25-year period from 2015 to 2040, MSAT emissions are reduced by 75.2% to 99.0%. The air quality modeling results indicate that MSAT emissions are expected to increase slightly from the No-Build to the Build scenario in both 2020 and 2040, although these increases are not considered substantial. However, when compared to existing conditions, emissions of all MSAT pollutants under the 2020 and 2040 Build scenarios are projected to be dramatically lower than exist today. EPA's stringent vehicle emission and fuel regulations, combined with fleet turnover, are expected to substantially lower fleet-average emission rates for MSATs in the future relative to today.

Overall, best available information indicates that, nationwide, regional levels of MSATs 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.

5.5 INCOMPLETE OR UNAVAILABLE INFORMATION FOR PROJECT-SPECIFIC MSAT HEALTH IMPACTS ANALYSIS

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

Table 5-1: Annual MSAT Emissions by Year, Scenario and Pollutant

Pollutant	2015 (tpy)	2020 (tpy)		2040 (tpy)	
	Existing	No Build	Build	No Build	Build
1,3 Butadiene	0.42	0.125	0.126	0.004	0.004
Acrolein	0.33	0.152	0.154	0.055	0.055
Benzene	3.95	1.705	1.729	0.592	0.599
Diesel PM	24.21	10.347	10.523	2.211	2.234
Formaldehyde	4.93	2.470	2.493	1.214	1.221
Naphthalene	0.56	0.258	0.260	0.098	0.098
Polycyclic Organic Matter	0.29	0.130	0.132	0.031	0.031
VMT (million annual vehicle-miles)	1,633	1,671	1,713	1,828	1,860

Table 5-2: Change in Annual MSAT Emissions by Year, Scenario and Pollutant from No-Build and from Existing Emissions

Pollutant	Change from No-Build				Change from Existing			
	2020 Build		2040 Build		2020 Build		2040 Build	
	TPY	%	TPY	%	TPY	%	TPY	%
1,3 Butadiene	0.001	0.8%	0	0%	-0.29	-70.0%	-0.4162	-99.0%
Acrolein	0.002	1.3%	0	0%	-0.18	-53.3%	-0.275	-83.3%
Benzene	0.024	1.4%	0.007	1.2%	-2.22	-56.2%	-3.351	-84.8%
Diesel PM	0.176	1.7%	0.023	1.0%	-13.69	-56.5%	-21.976	-90.8%
Formaldehyde	0.023	0.9%	0.007	0.6%	-2.44	-49.4%	-3.709	-75.2%
Naphthalene	0.002	0.8%	0	0.6%	-0.30	-53.6%	-0.462	-82.5%
Polycyclic Organic Matter	0.002	1.5%	0	0%	-0.16	-54.5%	-0.259	-89.3%
VMT (million annual vehicle-miles)	42	2.5%	32	1.8%	80	4.9%	227	13.9%

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

Other organizations are also active in the research and analyses of the human health effects of MSAT, including the Health Effects Institute (HEI). Two HEI studies are summarized in Appendix D of FHWA's Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA Documents. Among the adverse health effects linked to MSAT compounds at high exposures are cancer in humans in occupational settings, cancer in animals, and irritation to the respiratory tract, including the exacerbation of asthma. Less obvious is the adverse human health effects of MSAT compounds at current environmental

concentrations (HEI, http://pubs.healtheffects.org/view.php?id=282) or in the future as vehicle emissions substantially decrease (HEI, http://pubs.healtheffects.org/view.php?id=306).

The methodologies for forecasting health impacts include emissions modeling, dispersion modeling, exposure modeling, and then final determination of health impacts, with each step in the process building on the model predictions obtained in the previous step. All are encumbered by technical shortcomings or uncertain science that prevents a more complete differentiation of the MSAT health impacts among a set of project alternatives. These difficulties are magnified for lifetime (i.e. 70 year) assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over that time frame, since such information is unavailable.

It is particularly difficult to reliably forecast 70-year lifetime MSAT concentrations and exposure near roadways to (1) determine the portion of time that people are actually exposed at a specific location; and (2) establish the extent attributable to a proposed action especially given that some of the information needed is unavailable.

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

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

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

5.5 MSAT CONCLUSIONS

The understanding of mobile source air toxics is an area of continued study. Information is currently incomplete or unavailable to credibly predict the project-specific health impacts due to changes in MSAT emissions associated with each of the project scenarios. Emissions of all MSAT pollutants were projected to increase slightly from the No-Build to the Build scenario in 2020 and 2040, although these increases are not considered substantial. However, when compared to existing conditions, emissions of all MSAT pollutants under the 2020 and 2040 Build scenarios are projected to be substantially lower than exist today.

EPA's vehicle and fuel regulations are expected to result in substantially lower MSAT levels in the future than exist today due to cleaner engine standards coupled with fleet turnover. The magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the study area will be substantially lower in the future than they are today, regardless of the scenario (No Build or Build) chosen.

6. CONSTRUCTION EMISSION ANALYSIS

The temporary air quality impacts from construction are not expected to be substantial. Emissions will be produced during the construction of this project by heavy equipment and vehicle travel to and from the site. Earthmoving and ground-disturbing operations will generate airborne dust. 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 VDOT's current *Road and Bridge Specifications*. These Specifications require compliance with all applicable local, state, and federal regulations.

This project is located within a Marginal 8-hour Ozone Nonattainment area, a $PM_{2.5}$ Maintenance area, and a volatile organic compounds (VOC) and nitrogen oxides (NO_X) Emissions Control Area[28]. As such, all reasonable precautions should be taken to limit the emissions of VOC, NOx, and particulate matter. In addition, the following VDEQ air pollution regulations must be adhered to during the construction of this project: 9 VAC 5-130, Open Burning restrictions; 9 VAC 5-45, Article 7, Cutback Asphalt restrictions; and 9 VAC 5-50, Article 1, Fugitive Dust precautions.

[28] http://law.lis.virginia.gov/admincode/title9/agency5/chapter20/section206/

7. REGIONAL CONFORMITY STATUS OF THE PROJECT

EPA transportation conformity rule requirements, including specifically 40 CFR 93.114 and 40 CFR 93.115, apply as the area in which the project is located is designated as nonattainment for ozone and maintenance for fine particulate matter[29] as noted above. Accordingly, there must be a currently conforming transportation plan and program at the time of project approval, and the project must come from a conforming plan and program (or otherwise meet criteria specified in 40 CFR 93.109(b)). The National Capital Region Transportation Planning Board is currently updating its Constrained Long Range Plan and associated Transportation Improvement Program, and the I-395 Express Lanes project will be included in the associated regional conformity analysis.

For background, the Clean Air Act Amendments (CAAA) of 1990 mandate improvements to the nation's air quality. The final conformity regulations promulgated by the US EPA in 1997, as part of 40 CFR Part 93, require transportation plans and programs conform to the SIP. The final conformity rule requires that transportation plans in ozone nonattainment areas be consistent with the most recent estimates of mobile source emissions; provide for the expeditious implementation of transportation control measures in the applicable implementation plan; and contribute to annual emission reductions in ozone and carbon monoxide nonattainment areas.

8. INDIRECT AND CUMULATIVE EFFECTS

Indirect effects are those effects that would be caused by the project but occur later in time or are removed in distance from the project. Cumulative effects are those effects that result from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions. Cumulative effects include indirect effects.

The potential for indirect effects or cumulative impacts to air quality that may be attributable to this project is not expected to be substantial for several reasons. First, regarding indirect effects, much of the area in which the project is located is already highly developed, which limits the potential for incremental indirect effects.

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[29] On July 29th,2016 EPA announced that it is finalizing one of the proposed options for revoking the 1997 primary annual $PM_{2.5}$ NAAQS, which has been replaced by the more health protective 2012 primary annual $PM_{2.5}$ NAAQS. The EPA is finalizing the option that calls for revoking the 1997 primary annual PM2.5 NAAQS in areas that have always been designated attainment for that NAAQS and in areas that have been redesignated to attainment for that NAAQS. As a result, after the effective date of the revocation, areas that have been redesignated to attainment for the 1997 annual $PM_{2.5}$ NAAQS (i.e., maintenance areas for the 1997 annual $PM_{2.5}$ NAAQS) will not be required to make transportation or general conformity determinations for the 1997 annual $PM_{2.5}$ NAAQS. This action however is not final until publication in the Federal Register and completion of waiting period specified in the final rule.

Second, regarding the potential for cumulative impacts, the annual conformity analysis conducted by the Transportation Planning Board (MPO for the Washington, D.C. metropolitan nonattainment/maintenance area) represents a cumulative impact assessment for purposes of regional air quality.

- The existing air quality designations for the region are based, in part, on the accumulated mobile source emissions from past and present actions, and these pollutants serve as a baseline for the current conformity analysis.
- The conformity analysis quantifies the amount of mobile source emissions for which the area is designated nonattainment/maintenance that will result from the implementation of all reasonably foreseeable (i.e. those proposed for construction funding over the life of the region's transportation plan) regionally significant transportation projects in the region.
- It is anticipated that the conformity analysis currently being conducted will demonstrate that the incremental impact of the proposed project on mobile source emissions, when added to the emissions from other past, present, and reasonably foreseeable future actions, is in conformance with the SIP and will not cause or contribute to a new violation, increase the frequency or severity of any violation, or delay timely attainment of the NAAQS established by EPA.

Therefore, the indirect and cumulative effects of the project are not expected to be significant.

9. CONCLUSIONS

In order to meet NEPA, a quantitative CO hot-spot screening analysis was performed for the I-395 Express Lanes project. A CO screening analysis was performed using worst-case traffic and meteorological inputs to identify in order to determine if CO exceedances could occur as a result of the proposed improvements. The results of the analysis show that the worst-case CO concentrations for the Build scenarios are predicted to be well below the CO NAAQS in both the Interim/Opening Year Build (2020) and Design Year Build (2040) scenarios for each of the worst-case locations analyzed along the proposed project corridor. This screening analysis included the worst-case signalized intersections and the worst-case interchange. Therefore, it is expected that all other locations within the project corridor will remain well below the CO NAAQS and no mitigation measures are required.

Additionally, Arlington and Fairfax Counties and the City of Alexandria are included in the DC-Maryland-Northern Virginia area designated by EPA as non-attainment for the 8-hour ozone and attainment/maintenance for the annual $PM_{2.5}$ standards, and therefore transportation conformity requirements apply. Following EPA regulations and guidance, and using the technical criterion specified in the VDOT Resource Document for which inter-agency consultation for conformity was completed in December 2015, the project was determined not to be one of air quality concern for $PM_{2.5}$.

Notwithstanding that inter-agency consultation for conformity on the VDOT Resource Document, on which the models, methods and assumptions were based, inter-agency was conducted for this project in July 2016. No comments were received.

The study Build scenarios were also evaluated for MSAT impacts following the latest FHWA guidance. This project was identified as one with High Potential MSAT Effects; therefore, a quantitative MSAT analysis was conducted consistent with the guidance. Emissions of all MSAT pollutants were projected to increase slightly in 2020 and 2040 between the no-build and build scenarios, although these changes are small and not considered to be substantial. However, when compared to existing conditions, emissions of all MSAT pollutants under the 2020 and 2040 Build scenarios are projected to be substantially lower than those estimated for 2015. EPA's vehicle and fuel regulations are expected to result in substantially lower MSAT levels in the future than exist today due to cleaner engine standards coupled with fleet turnover. The quantitative MSAT analysis demonstrated that there would be no long-term adverse impacts associated with the Build scenario, and that future MSAT emissions across the entire study corridor are expected to be substantially below today's levels, even after accounting for projected VMT growth.

Appendix A: Interagency Consultation Webinar Presentation and Meeting Minutes

I-395 Express Lanes Northern Extension Project

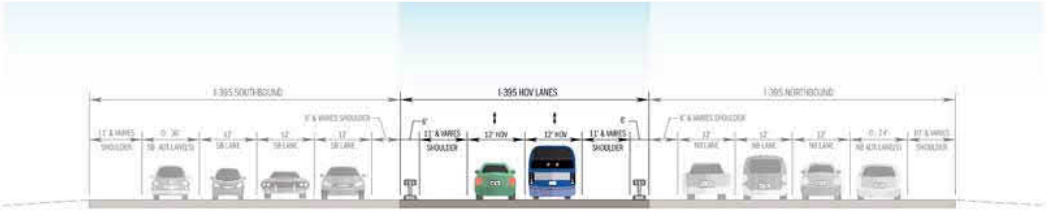
Virginia Air Quality Interagency Consultation Group Meeting
July 13, 2016

Agenda

- Project Background/Overview
- Traffic Analysis
- Air Quality Overview

Existing Conditions

- I-395 study area extends from north of Edsall Road (Turkeycock Run) to Eads Street interchange (near the Pentagon)
- Two barrier-separated reversible HOV-3 lanes
- Three / four general purpose lanes per direction



Existing Conditions

- Operation of Reversible HOV Lanes

Time Period	HOV Lane Operation
12 AM – 2:30 AM	Closed
2:30 AM – 6 AM	NB - All Vehicles Permitted
6 AM – 9 AM	**NB HOV-3 Only**
9 AM – 11 AM	NB - All Vehicles Permitted
11 AM – 1 PM	Closed
1 PM – 3:30 PM	SB - All Vehicles Permitted
3:30 PM – 6 PM	**SB HOV-3 Only**
6 PM – 12 AM	SB - All Vehicles Permitted

- Permitted Vehicle Types During HOV-3 Only Periods
  - HOV-3
  - Buses
  - Motorcycles
  - Hybrid vehicles
  - Emergency vehicles
  - Trucks (with 3 or more people)

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Existing Conditions

- Lack of capacity and congestion on I-395 north of current Express Lanes terminus near Edsall Road especially during periods without HOV restrictions
- Access challenges to and from the Pentagon at I-395/Eads Street Interchange

Purpose and Need

- Develop a transportation solution that improves roadway conditions throughout the corridor by:
  - Reducing congestion
  - Providing additional travel choices
  - Improving travel predictability
  - Improving roadway safety

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395 ExpressLanes

DRPT

Project Background

- Comprehensive Agreement executed in 2012 with 95 Express Lanes, LLC (95 Express) for 95 Express Lanes contemplated potential future development of the Northern Express Lanes in the I-395 corridor
- In November 2015, VDOT and 95 Express signed a Development Framework Agreement outlining roles and responsibilities
- VDOT and 95 Express working together to finalize the scope, finance plan and agreement
- 95 Express will provide long-term transit investment through an annual transit payment
- Improvements to be built largely within VDOT's right of way

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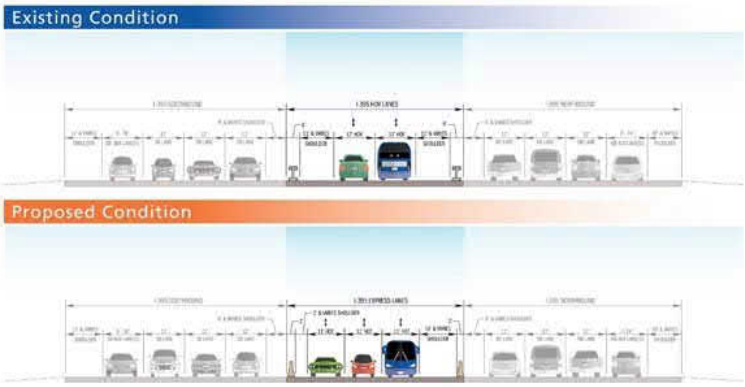
395 ExpressLanes

DRPT

Project Scope

- Expand and convert the two existing reversible High Occupancy Vehicle (HOV) lanes on I-395 to three managed High Occupancy Toll (HOT) or Express Lanes for eight miles along I-395 from north of Edsall Road to the vicinity of Eads Street near the Pentagon
- Provide improved connections between the proposed I-395 Express Lanes and Eads Street
- Install signage, toll systems, and an Active Traffic Management System
- Provide sound walls
- Conduct a transit/TDM study to identify projects to be funded through an annual transit payment from 95 Express



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395 ExpressLanes

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Express Lanes
Operation and Access

- Dynamic toll prices manage demand to ensure free-flow travel speeds
- Permitted Vehicle Types
  - HOV-3
  - Buses
  - Motorcycles
  - Tolled vehicles
  - No trucks (3+ axles)
  - Hybrid vehicles no longer exempt from restrictions

- All existing access points to remain the in the same configuration except for Eads Street interchange
  - Capacity and operational improvements at Eads Street under evaluation
  - Seminary Road South facing ramp remains limited to HOV-only at all times

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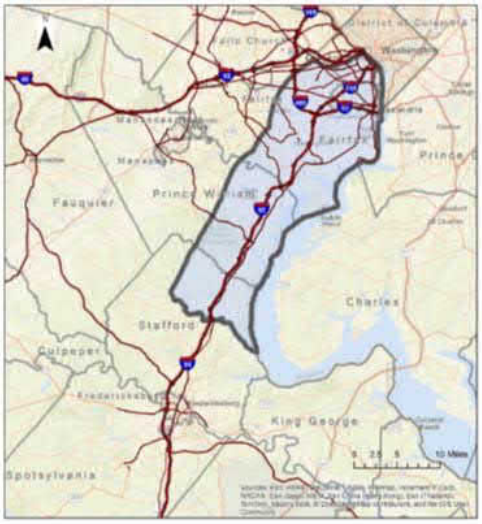
I-95/I-395 Transit/TDM Study

- DRPT is leading a new I-95/I-395 Transit/Transportation Demand Management (TDM) Study in coordination with key stakeholders
- Will identify transit services and TDM program enhancements that can be funded by Annual Transit Investment payments
  - Amount of Annual Transit Investment has not yet been determined
- Study area extends from southern terminus of I-95 Express Lanes (at Garrisonville Road) north to the Potomac River and includes parallel commuting corridors and routes, and modes of transportation
- Eligible projects will increase mobility and move more people along I-95 and I-395 and benefit toll payers in the I-395 corridor.



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Traffic Analysis

- Forecasts developed using MWCOG Travel Demand Forecasting Model (Version 2.3 Build 57a) and post-processed for the following scenarios:
  - Existing Conditions (2015)
  - 2020 No Build Conditions
  - 2020 Build Conditions
  - 2040 No Build Conditions
  - 2040 Build Conditions
- Operations analyses underway for the AM and PM peak periods
  - Synchro analyses completed for 48 signalized intersections
  - VISSIM analyses of the I-395 mainline, ramps, and adjacent arterials/intersections (underway)

Average Daily Traffic Volume (ADT)
Northbound I-395

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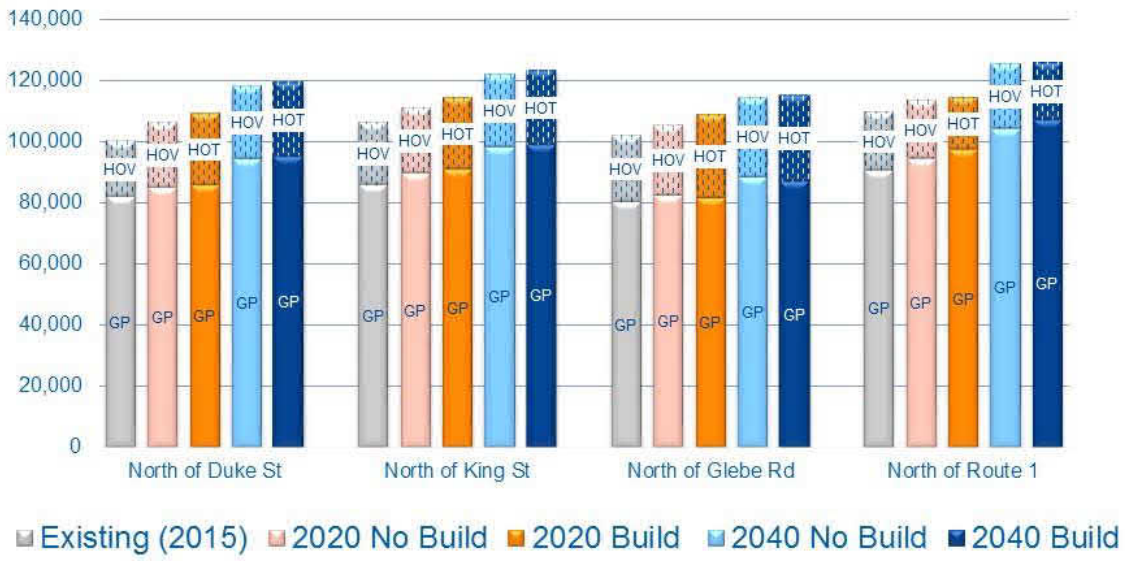
Average Daily Traffic Volume (ADT)
Southbound I-395



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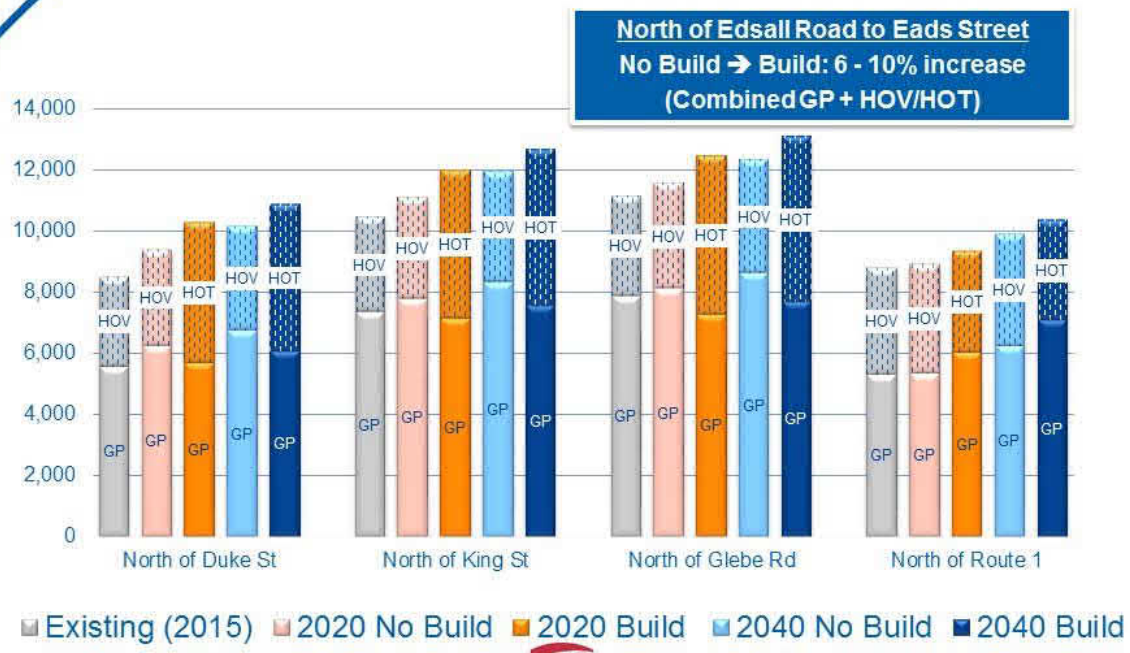
Peak Hour Volumes (7 - 8 AM)
Northbound I-395



VDOT Virginia Department of Transportation

395 ExpressLanes

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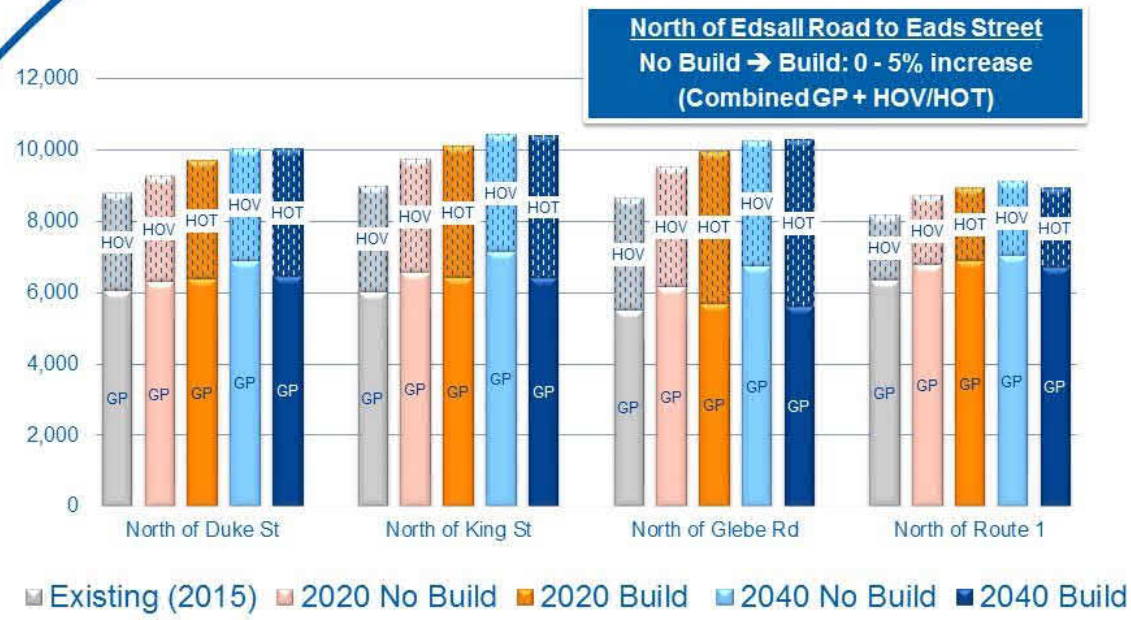
Peak Hour Volumes (5 – 6 PM)
Southbound I-395



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Existing / 2020 / 2040
ADT, Truck, and Bus Volumes

Turkeycock Run to Edsall Rd

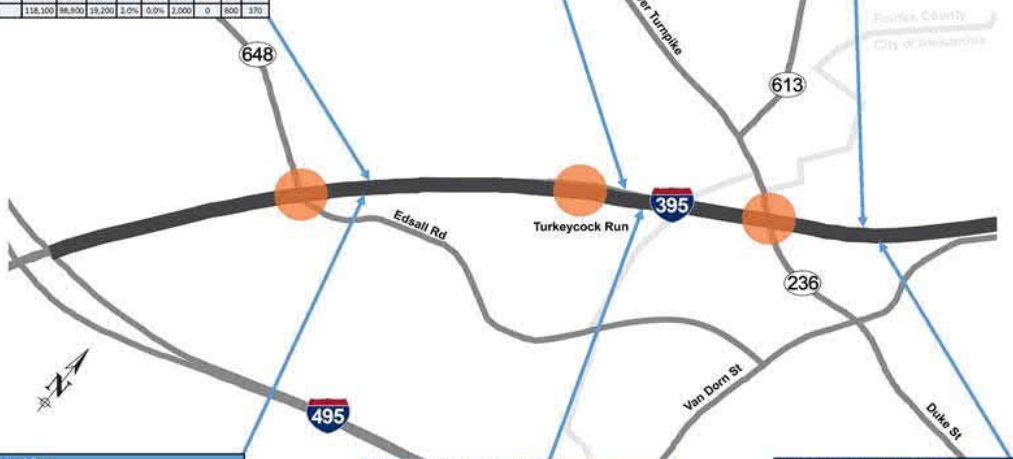
	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT
Existing (2015)	99,800	84,600	15,200	2.0%	0.0%	1,700	0	300	320
2020 No Build	105,000	88,200	16,800	2.0%	0.0%	1,800	0	330	330
2020 Build	107,800	89,000	18,800	2.0%	0.0%	1,800	0	340	340
2040 No Build	117,100	98,400	18,700	2.0%	0.0%	2,000	0	390	360
2040 Build	118,100	98,900	19,200	2.0%	0.0%	2,000	0	800	370

Little River Turnpike/ Duke St to Turkeycock Run

	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT
Existing (2015)	99,800	81,300	18,500	2.0%	0.6%	1,600	120	500	320
2020 No Build	96,500	75,300	21,200	2.3%	0.6%	1,700	130	530	330
2020 Build	99,300	75,900	23,500	2.4%	0.0%	1,800	0	540	340
2040 No Build	108,100	84,300	23,800	2.3%	0.6%	1,900	140	580	360
2040 Build	109,100	84,900	24,300	2.4%	0.0%	2,000	0	600	370

Seminary Rd to Little River Turnpike/ Duke St

	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT
Existing (2015)	100,300	81,800	18,500	2.0%	0.6%	1,600	120	590	320
2020 No Build	106,100	84,900	21,200	2.0%	0.6%	1,700	130	620	340
2020 Build	109,200	85,800	23,500	2.2%	0.0%	1,900	0	630	340
2040 No Build	118,200	94,400	23,800	2.0%	0.6%	1,900	140	740	370
2040 Build	119,300	95,000	24,300	2.1%	0.0%	2,000	0	750	370



Edsall Rd to Turkeycock Run

	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT
Existing (2015)	95,200	80,600	14,600	2.1%	0.0%	1,700	0	430	260
2020 No Build	102,200	85,600	16,700	2.2%	0.0%	1,900	0	460	270
2020 Build	103,100	86,100	17,000	2.2%	0.0%	1,900	0	470	280
2040 No Build	114,000	95,900	18,100	2.2%	0.0%	2,100	0	520	300
2040 Build	115,000	96,400	18,600	2.2%	0.0%	2,100	0	530	300

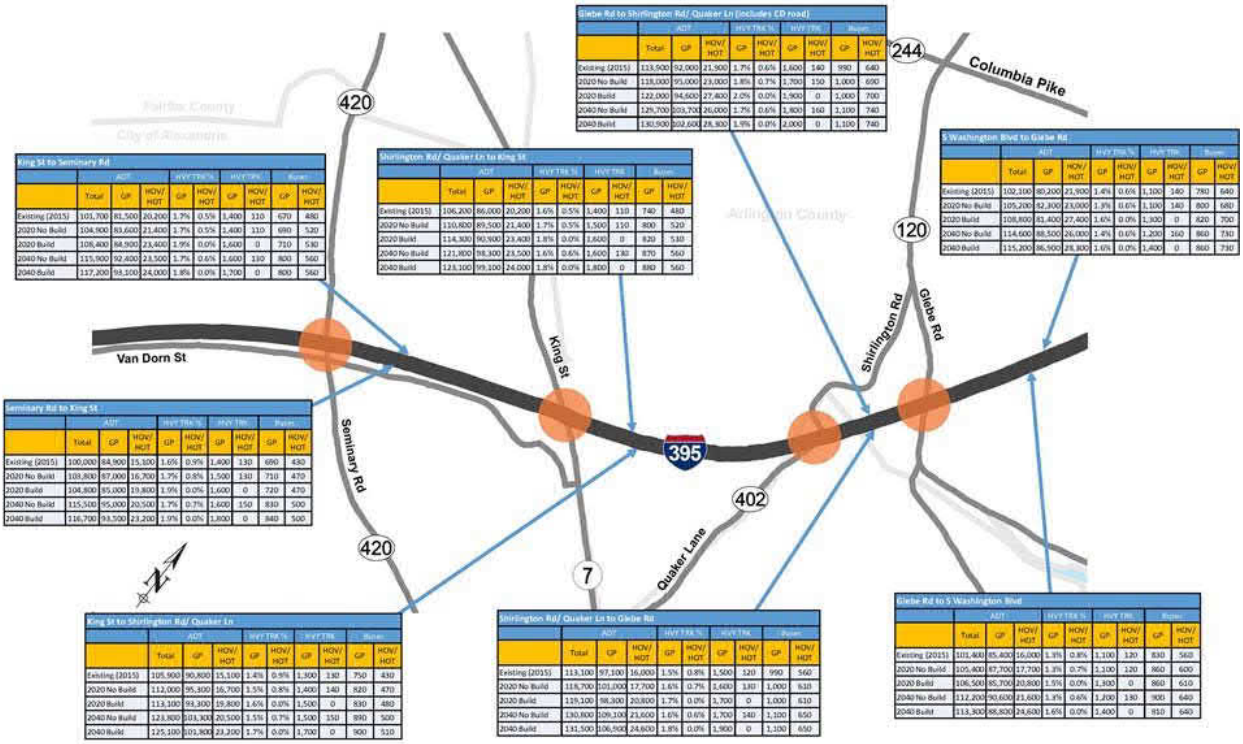
Turkeycock Run to Little River Turnpike/ Duke St

	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT
Existing (2015)	85,200	81,100	14,000	2.0%	1.0%	1,600	140	430	260
2020 No Build	102,200	85,000	17,200	2.0%	0.9%	1,700	150	460	270
2020 Build	103,100	82,700	20,400	2.3%	0.0%	1,900	0	470	280
2040 No Build	114,000	92,800	21,200	2.0%	0.8%	1,900	170	520	300
2040 Build	115,000	91,000	24,000	2.3%	0.0%	2,100	0	530	300

Little River Turnpike/ Duke St to Seminary Rd

	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT
Existing (2015)	96,000	82,000	14,000	1.6%	1.0%	1,300	140	470	260
2020 No Build	101,700	84,500	17,200	1.7%	0.9%	1,400	150	490	270
2020 Build	102,900	82,500	20,400	1.8%	0.0%	1,500	0	500	270
2040 No Build	113,700	92,500	21,200	1.6%	0.8%	1,500	170	610	300
2040 Build	114,900	90,900	24,000	1.9%	0.0%	1,700	0	610	300

Existing / 2020 / 2040
ADT, Truck, and Bus Volumes



Glebe Rd to Shirlington Rd/ Quaker Ln (includes CD road)

	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT
Existing (2015)	113,900	92,000	21,900	1.7%	0.6%	1,600	140	990	640
2020 No Build	118,000	95,000	23,000	1.8%	0.7%	1,700	150	1,000	690
2020 Build	122,000	94,600	27,400	2.0%	0.0%	1,900	0	1,000	700
2040 No Build	129,700	103,700	26,000	1.7%	0.6%	1,800	160	1,100	740
2040 Build	130,900	102,600	28,300	1.9%	0.0%	2,000	0	1,100	740

King St to Seminary Rd

	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT
Existing (2015)	101,700	81,500	20,200	1.7%	0.5%	1,400	110	670	480
2020 No Build	104,900	83,600	21,400	1.7%	0.5%	1,400	110	690	520
2020 Build	108,400	84,900	23,400	1.9%	0.0%	1,600	0	710	530
2040 No Build	115,900	92,400	23,500	1.7%	0.6%	1,600	110	820	560
2040 Build	117,200	93,100	24,000	1.8%	0.0%	1,700	0	800	560

Shirlington Rd/ Quaker Ln to King St

	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT
Existing (2015)	106,200	86,000	20,200	1.6%	0.5%	1,400	110	740	480
2020 No Build	110,800	89,500	21,400	1.7%	0.5%	1,500	110	800	520
2020 Build	114,300	90,900	23,400	1.8%	0.0%	1,600	0	820	530
2040 No Build	121,800	98,300	23,500	1.6%	0.6%	1,600	130	870	560
2040 Build	123,100	99,100	24,000	1.8%	0.0%	1,800	0	880	560

S Washington Blvd to Glebe Rd

	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT
Existing (2015)	102,100	80,200	21,900	1.4%	0.6%	1,100	140	780	640
2020 No Build	105,200	82,300	23,000	1.3%	0.6%	1,100	140	800	680
2020 Build	108,800	81,400	27,400	1.6%	0.0%	1,300	0	820	700
2040 No Build	114,600	88,500	26,000	1.4%	0.6%	1,200	160	860	730
2040 Build	115,200	86,900	28,300	1.6%	0.0%	1,400	0	860	730

Seminary Rd to King St

	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT
Existing (2015)	100,000	84,900	15,100	1.6%	0.9%	1,400	130	690	430
2020 No Build	103,800	87,000	16,700	1.7%	0.8%	1,500	130	710	470
2020 Build	104,800	85,000	19,800	1.9%	0.0%	1,600	0	720	470
2040 No Build	115,500	95,000	20,500	1.7%	0.7%	1,600	150	830	500
2040 Build	116,700	93,500	23,200	1.9%	0.0%	1,800	0	840	500

King St to Shirlington Rd/ Quaker Ln

	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT
Existing (2015)	105,900	90,800	15,100	1.4%	0.9%	1,300	130	750	430
2020 No Build	112,000	95,300	16,700	1.5%	0.8%	1,400	140	820	470
2020 Build	113,100	93,300	19,800	1.6%	0.0%	1,500	0	830	480
2040 No Build	123,800	103,300	20,500	1.5%	0.7%	1,500	150	890	500
2040 Build	125,100	101,800	23,200	1.7%	0.0%	1,700	0	900	510

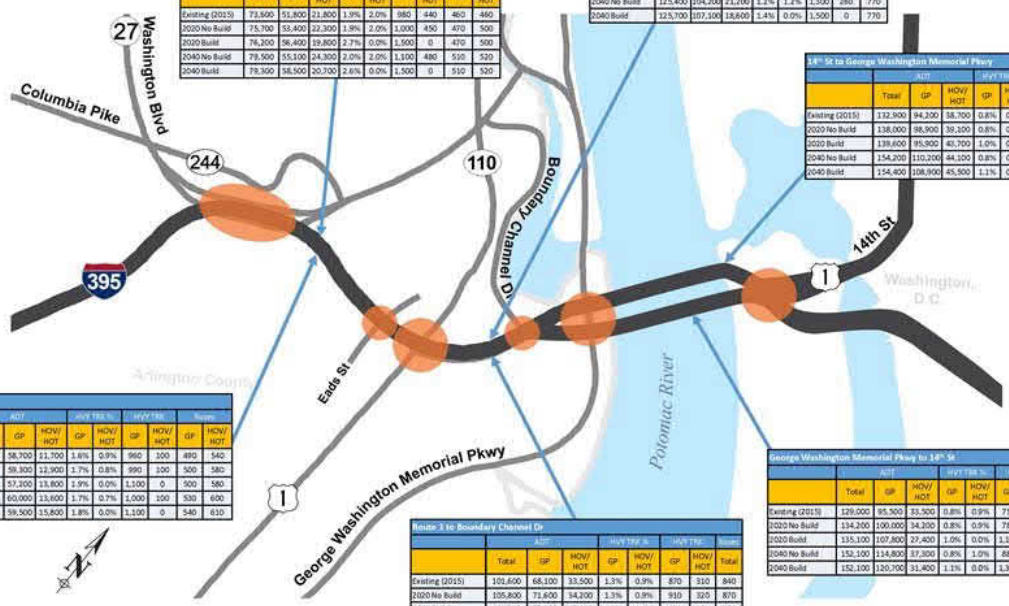
Shirlington Rd/ Quaker Ln to Glebe Rd

	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT
Existing (2015)	113,100	97,100	16,000	1.5%	0.8%	1,500	120	990	560
2020 No Build	118,700	101,000	17,700	1.6%	0.7%	1,600	130	1,000	610
2020 Build	119,100	98,300	20,800	1.7%	0.0%	1,700	0	1,000	610
2040 No Build	130,800	109,100	21,600	1.6%	0.6%	1,700	140	1,100	650
2040 Build	131,500	106,900	24,600	1.8%	0.0%	1,900	0	1,100	650

Glebe Rd to S Washington Blvd

	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT
Existing (2015)	101,400	85,400	16,000	1.3%	0.8%	1,100	120	830	560
2020 No Build	105,400	87,700	17,700	1.3%	0.7%	1,100	120	860	600
2020 Build	106,500	85,700	20,800	1.5%	0.0%	1,300	0	860	610
2040 No Build	112,200	90,600	21,600	1.3%	0.6%	1,200	130	900	640
2040 Build	113,300	88,800	24,600	1.6%	0.0%	1,400	0	910	640

Existing / 2020 / 2040
ADT, Truck, and Bus Volumes



Hayes St Bridge (Includes CD road)

	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT
Existing (2015)	73,500	51,800	21,800	1.9%	2.0%	980	440	460	460
2020 No Build	75,700	53,400	22,300	1.9%	2.0%	1,000	450	470	500
2020 Build	76,200	56,400	19,800	2.7%	0.0%	1,500	0	470	500
2040 No Build	79,500	55,100	24,300	2.0%	2.0%	1,100	480	510	520
2040 Build	79,300	58,500	20,700	2.6%	0.0%	1,500	0	510	520

Boundary Channel Dr to Route 1

	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT
Existing (2015)	109,600	90,600	19,000	1.2%	1.2%	1,100	230	670	
2020 No Build	113,400	94,200	19,200	1.2%	1.3%	1,100	240	690	
2020 Build	114,300	97,100	17,200	1.4%	0.0%	1,400	0	700	
2040 No Build	125,400	104,200	21,200	1.2%	1.2%	1,300	280	770	
2040 Build	125,700	107,100	18,600	1.4%	0.0%	1,500	0	770	

14th St to George Washington Memorial Pkwy

	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT
Existing (2015)	132,900	94,200	38,700	0.8%	0.9%	750	340	420	
2020 No Build	138,000	98,900	39,100	0.8%	0.9%	780	350	430	
2020 Build	139,600	95,900	43,700	1.0%	0.2%	1,000	100	430	
2040 No Build	154,200	110,200	44,100	0.8%	0.9%	870	390	470	
2040 Build	154,400	108,900	45,500	1.1%	0.2%	1,200	110	470	

Hayes St Bridge

	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT
Existing (2015)	70,400	58,700	11,700	1.6%	0.9%	960	100	490	540
2020 No Build	72,300	59,300	12,900	1.7%	0.8%	990	100	500	580
2020 Build	71,000	57,200	13,800	1.9%	0.0%	1,100	0	500	580
2040 No Build	73,700	60,000	13,600	1.7%	0.7%	1,000	100	530	600
2040 Build	75,300	59,500	15,800	1.8%	0.0%	1,100	0	540	610

George Washington Memorial Pkwy to 14th St

	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT
Existing (2015)	129,000	95,500	33,500	0.8%	0.9%	750	310	910	
2020 No Build	134,200	100,000	34,200	0.8%	0.9%	780	320	940	
2020 Build	135,100	107,800	27,400	1.0%	0.0%	1,100	0	940	
2040 No Build	152,100	114,800	37,300	0.8%	1.0%	880	370	1,050	
2040 Build	152,100	120,700	31,400	1.1%	0.0%	1,300	0	1,050	

Route 1 to Boundary Channel Dr

	ADT			HVY TRK %		HVY TRK		Buses	
	Total	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT	GP	HOV/ HOT
Existing (2015)	101,600	68,100	33,500	1.3%	0.9%	870	310	840	
2020 No Build	105,800	71,600	34,200	1.3%	0.9%	910	320	870	
2020 Build	104,700	77,300	27,400	1.6%	0.0%	1,200	0	870	
2040 No Build	117,200	79,900	37,300	1.3%	1.0%	1,000	360	950	
2040 Build	116,600	85,200	31,400	1.6%	0.0%	1,400	0	950	

Preliminary Findings & Project Benefits

- Increases movement of people through the corridor during peak hours (minimal increase in trucks)
- Reduces congestion in Express Lanes at Eads Street interchange area
- Reduces congestion in Express Lanes before and after currently designated HOV periods
- Provides commuters an additional travel option
- Minimal impact on parallel arterial network
- Creates funding for multi-modal improvements

Key Milestones

Key Milestones	Begin Dates
Public Outreach	Ongoing
Begin NEPA – Environmental Assessment	January 2016
Begin Transit/TDM Study	March 2016
Public Hearing	Fall 2016
Adopted in Constrained Long Range Plan	November 2016
Design Build Contract Award (95 Express)	December 2016
Final NEPA Decision	December 2016
Final Transit/TDM Study	December 2016
Final Agreement	January 2017
Begin Construction (95 Express)	Spring 2017
Project Completion (95 Express)	Summer 2019

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Air Quality Overview

- Environmental Assessment underway (complete December)
- The project falls within maintenance or non-attainment area(s) for Ozone and $PM_{2.5}$
  - Regional conformity determination is currently in process
  - $PM_{2.5}$ conformity requirements currently apply

Air Quality Overview

- Changes in conformity requirements for NoVA PM and CO
  - With the implementation of the 2012 $PM_{2.5}$ NAAQS, EPA proposed to revoke the 1997 $PM_{2.5}$ annual primary NAAQS for which NOVA is currently in maintenance
    - Related conformity requirements would therefore no longer apply
  - CO maintenance plan expired March 16, 2016
    - Related conformity requirements no longer apply

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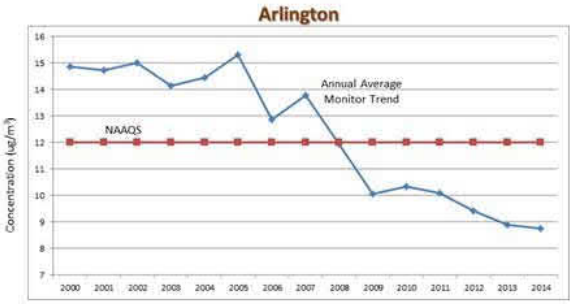
$PM_{2.5}$ Hot-Spot Overview

- Quantitative $PM_{2.5}$ considerations are a requirement under the Transportation Conformity Requirements of the Clean Air Act
- Project located in area that is in maintenance for 1997 Annual Primary $PM_{2.5}$ NAAQS (EPA proposal to revoke this NAAQS is pending finalization)
- Area already achieves the 1997, 2006 and 2012 $PM_{2.5}$ NAAQS



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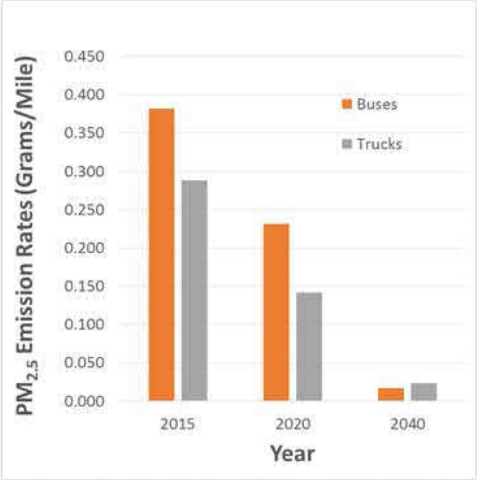
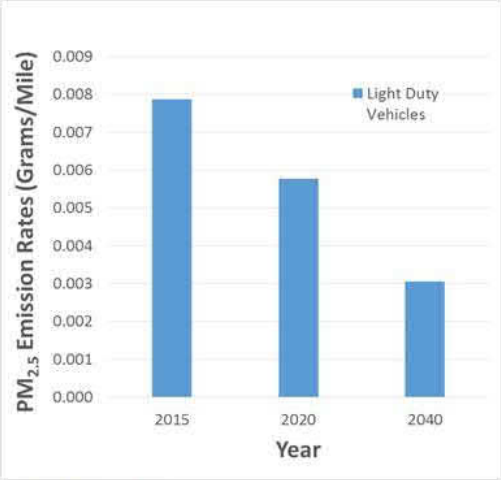
$PM_{2.5}$ Hot-Spot Overview

Diesel trucks and buses have been a primary source of transportation-related $PM_{2.5}$, they are expected to be much cleaner in future years due to more stringent EPA vehicle exhaust and fuel quality standards





Source: MOVES2014a Analysis – Data for City of Alexandria

Determining a Need for a Quantitative Analysis

- Criteria in the VDOT Project-Level Air Quality Resource Document shows this not to be a project of "Air Quality Concern"

Assessment Level	Who Makes Decision?
LEVEL 1 Is the project exempt?	VDOT
LEVEL 2 Is the project clearly not of AQ concern?	VDOT **(Using ICG-Reviewed Resource Document)**
LEVEL 3 For projects that cannot be excluded in Level 1 or 2, is the project of AQ concern?	VDOT (Project-Specific Consultation)

Determination if Project is of "Air Quality Concern"

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Air Quality Overview

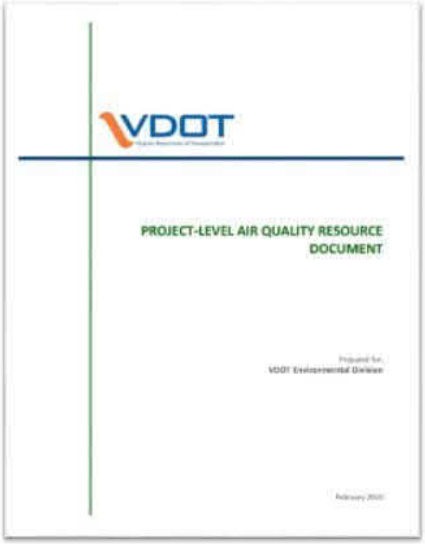
VDOT Resource Document

- Developed to assist analyst in the selection of appropriate models, methods and assumptions/data for project-level air quality analyses
- Interagency Consultation for Conformity (IACC) of the document completed in December 2015
  - Consulted parties included FHWA, EPA and local agencies
  - As a result, IACC for this project need only refer to the Resource Document and its IACC, unless substantive changes are planned in models, methods and/or assumptions (which are not proposed for this project)
  - IACC still being undertaken for this project, in the interest of transparency/ providing an opportunity for discussion
- The final version of the Resource Document is available on the VDOT website: *http://www.virginiadot.org/projects/environmental_air_section.asp*

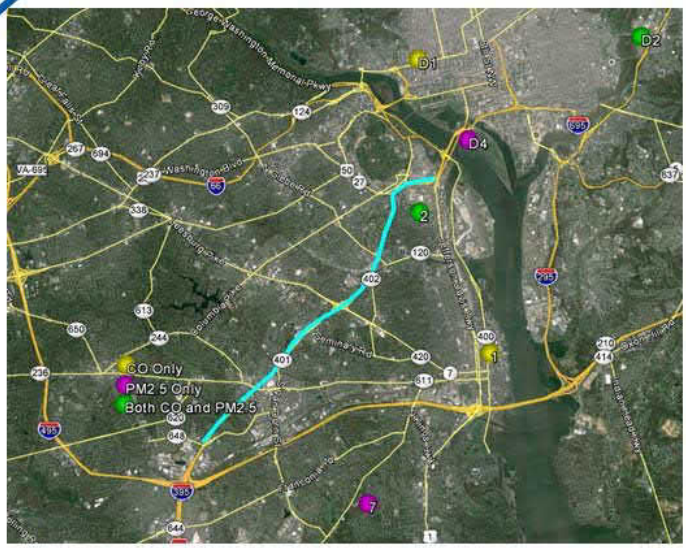
Determining a Need for a Quantitative Analysis

Project meets the criteria specified in the Resource Document to be considered one ***not*** of local air quality concern for $PM_{2.5}$

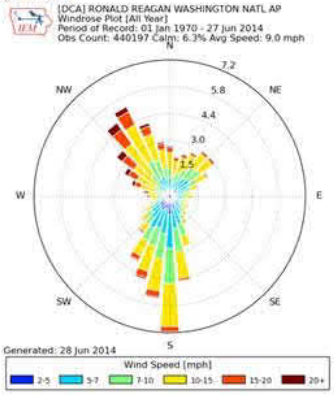
- Looked at highway capacity expansion criteria
  - Change in Opening Year AADTT <2,000
- Opening Year (2020) Diesel Truck Traffic Change (Build vs No-Build) <200 AADTT
- Highest total 2040 AADT for trucks and buses 3,650 (Just south of Glebe Road)
- Inter-Agency Consultation for Conformity conducted 12/14/2015



$PM_{2.5}$ Background Concentrations



-Monitors in DC and Maryland ***not*** representative of background concentrations in Virginia based on wind conditions



2011-2013 $PM_{2.5}$ Monitor Data				2011-2013 Three Year Average ($\mu g/m^3$)
Site	Region	Site ID	County/City	Annual
2	NOVA	510130020	Arlington	9.4
7		510590030	Fairfax	8.8

Monitored data provided by VDEQ

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Determining a Need for a Quantitative Analysis

- Additional considerations:
  - Congestion limits traffic growth on parallel roads (including trucks)
    - Trucks avoid the area or shift travel times to avoid congestion
    - Network is at capacity – volume increases are constrained
  - Diesel Buses
    - No significant increase in buses due to the proposed action
      - Other transit projects would be subject to individual review

Determining a Need for a Quantitative Analysis

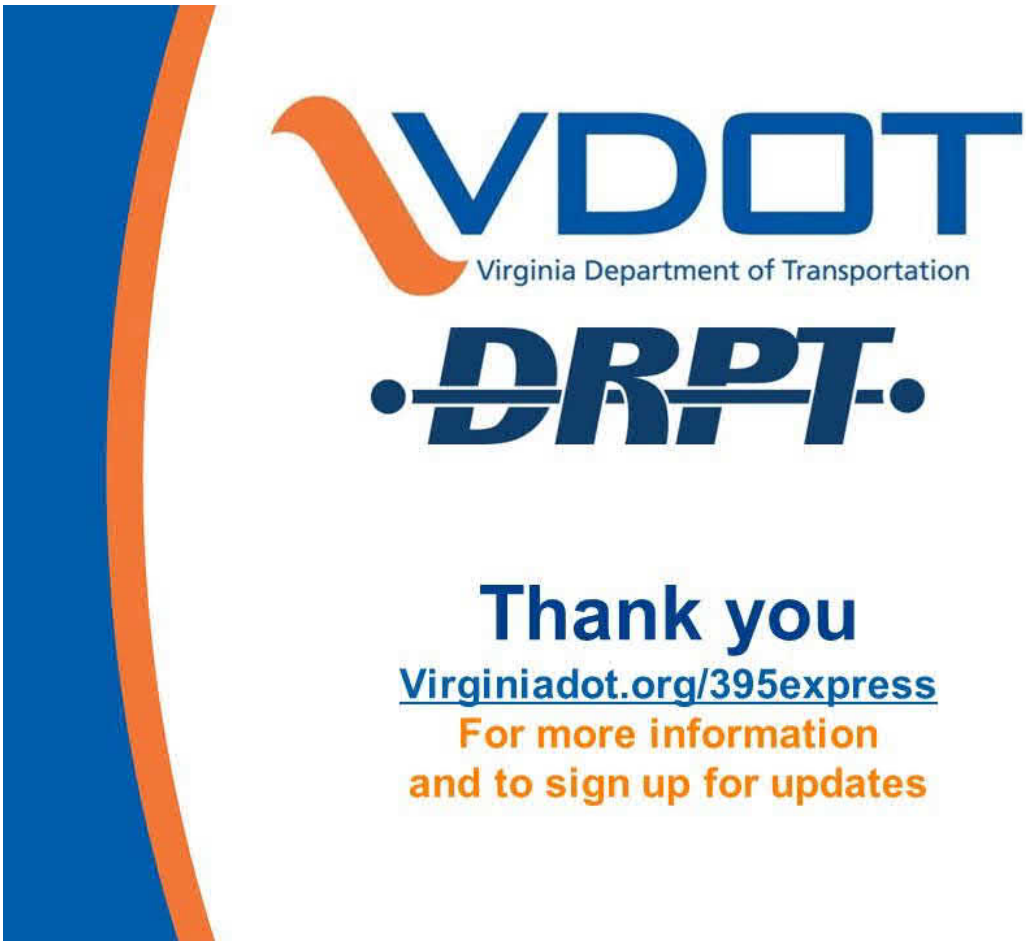
- Traffic Analysis/Modeling shows no significant changes in diesel traffic (truck or bus).
  - Both for freeway and arterial criteria
  - AADT for truck and bus < 3,700
    - Criteria for new highway is 10,000
    - VDOT Resource Document Appendix L criterion for new highways
  - Change in AADTT less than 200
    - Criteria for highway capacity expansion is 2,000
    - VDOT Resource Document Appendix L criterion for expanded highways
  - No new local sources of emissions associated with the project
- Criteria provided in VDOT Project-Level Resource Document indicates this is ***not*** a project of air quality concern.
  - Both for freeway and arterial criteria met

VDOT Virginia Department of Transportation 395 ExpressLanes DRPT

Determining a Need for a Quantitative Analysis

- Background $PM_{2.5}$ concentrations well below the NAAQS and decreasing.
- EPA has proposed to revoke the 1997 primary $PM_{2.5}$ NAAQS.
  - Conformity requirements would no longer apply

Weight of evidence shows this is not a project of local air quality concern for $PM_{2.5}$



Thank you

Virginiadot.org/395express

For more information
and to sign up for updates

Meeting Minutes

07/13/2016

(3:00– 4:00 PM)

Interagency Consultation for Air Quality Conformity

I-395 Express Lanes Norther Extension

Attendees:

Name	Agency/Firm
Christopher Voigt	VDOT
Jim Ponticello	VDOT
Dan Grinnell	VDOT
Lovejoy Muchenje	VDOT
Heather Williams	VDOT
Rahul Trivedi	VDOT
Paul Heishman	FHWA-Resource Center
Ed Sundra	FHWA-Virginia
Tim Roseboom	DRPT
Ron Milone	MWCOG
Jane Posey	MWCOG
Erin Morrow	MWCOG
Lisa Jaatinen	Alexandria
Allan Fye	Alexandria
Sonya Lewis-Cheatham	VDEQ
Dana Trone	Whitman, Requardt & Associates (WRA)
Jonathan Avner	Whitman, Requardt & Associates (WRA)
Asrah Khadr	USEPA Region III
Jeff Moore	Whitman, Requardt & Associates (WRA)
Tom Harrington	Cambridge Systematics
Maureen Mullen	SC&A, Inc.
Robert d'Abadie	Michael Baker International
Robyn Hartz	Michael Baker International

Introduction and Roll Call (Jim Ponticello, VDOT)

- After a brief welcome and procedural overview by Robert d'Abadie, Jim Ponticello gave a brief introduction, and performed a roll call.

Presentation: Description of Project and Traffic Modeling Overview (Dana Trone, WRA)

- A brief overview of the project, the nature of the planned improvements and the current status was provided by Dana Trone (WRA), lead for the traffic forecasting effort being undertaken for the project.
- During the overview a number of key aspects of the project were noted:
  - Project area extends from the Turkeycock Ramps to the Eads Street Interchange near the Pentagon.
  - The project will expand and convert the 2 High Occupancy Vehicle (HOV) lanes to 3 High Occupancy Toll (HOT) or Express Lanes, and will improve the connections with Eads Street.
    - All the existing access points will remain the same with the exception of the Eads Street Interchange.
    - The Seminary Road South facing ramp remains limited to HOV only at all times.
  - DRPT is leading a new I-95/395 transit/TDM study to identify the projects to be funded through the annual transit payment from 95 Express.
  - Operational analyses for 2015, 2020 No Build, 2020 Build, 2040 No Build, and 2040 Build.
  - Project does not greatly increase traffic (between No Build and Build conditions).
    - Highest increase is 3%.
    - With the project, a larger percentage of vehicles will use HOT lanes, resulting in the movement of more people through the corridor.
  - Minimal impact on parallel arterial network.
  - Project will be adopted into the Constrained Long Range Plan November 2016, and the final NEPA decision will be December 2016.

Questions on Traffic

(Comment) Rahul Trivedi – Please make sure traffic is consistent with other studies in the corridor.

(Response) Dana Trone – The modeling results will be consistent internally and with other studies as is reasonable.

Air Quality Presentation (Rob d'Abadie, Michael Baker International)

- VDOT has finalized their Project Level Air Quality Resource Document.
  - Developed to assist analyst in the selection of appropriate models, methods and assumptions/data for project-level air quality analyses.
  - Interagency Consultation for Conformity (IACC) of the document completed in December 2015.
    - Consulted parties included FHWA, EPA and local agencies.
    - As a result, IACC for this project need only refer to the Resource Document and its IACC, unless substantive changes are planned in models, methods and/or assumptions (which are not proposed for this project).

        - IACC still being undertaken for this project, in the interest of transparency/ providing an opportunity for discussion.
    - The final version of the Resource Document is available on the VDOT website: http://www.virginiadot.org/projects/environmental_air_section.asp

- This project is located in the counties of Arlington and Fairfax, and the City of Alexandria. This area is part of the Washington, DC-MD-VA maintenance area for the 1997 $PM_{2.5}$ standard and nonattainment area for the 8 hour ozone standard.
- Northern Virginia is likely to be classified as attainment with the implementation of the 2012 PM NAAQS. (discussed later in presentation)
- Northern Virginia is now classified as attainment under the current CO NAAQS.
    - CO Maintenance plan expired March 16, 2016.
- After consideration of the available traffic forecasts VDOT was of the opinion this was not a project of local air quality concern for $PM_{2.5}$. The remainder of the presentation provided the reasoning behind this determination and included the following main points:
    - National Ambient Air Quality Standards (NAAQS)
        - As per the Air Quality Conformity Regulations of the Clean Air Act (CAA), this project falls within an area designated as maintenance of the 1997 $PM_{2.5}$ Annual standard and therefore is subject to project level conformity, including interagency consultation requirements.
        - Based on monitoring stations, the area attainments the 1997, 2006, and 2012 NAAQS for $PM_{2.5}$.
        - With the implementation of the 2012 PM NAAQS, the 1997 standard is proposed to be revoked, at which time PM conformity would no longer apply.
    - Traffic discussion
        - The project intent is to optimize person throughput.
        - Trucks avoid the area or shift travel times to avoid congestion.
        - Other transit projects analyzed separately.
        - Traffic analysis/modeling shows no significant changes in diesel traffic (truck or bus):
        - As a result, this is not a project of air quality concern as the criteria provided in VDOT Project-Level Resource Document are met.
            - VDOT Resource Document Appendix L Criterion for highway capacity expansion is 2,000 AADTT.
                - Forecast change in AADTT is less than 200, so easily meets criterion.
            - The project would also meet the VDOT Resource Document criterion for new highways (10,000 AADTT).
                - Not a new highway so strictly speaking this criterion does not apply.
                - AADT for truck and bus < 3,700, so this project would also easily meet this criterion (if it were applicable).
- A review of the trends in emission rates and expected traffic growth between 2015 and 2040 shows a significant decline in vehicle related emissions is inevitable in the corridor.
- Overall, the project meets the criteria specified in the VDOT Project Level Air Quality Resource Document to be considered one <u>not</u> of local air quality concern.

Overall it was noted that the weight of evidence indicated that this is not a project of local air quality concern for $PM_{2.5}$.

Comments on Air Quality

(Comment) Tim Roseboom – There is significant operational improvements planned for transit access at the pentagon, which will provide a large benefit for buses in and out of the area.

(Response) Rob d'Abadie – Improvements in congestion will only further benefit air quality.

Summary (Rob d'Abadie, Michael Baker International)

- Robert d'Abadie restated that the project meets the criterion in the VDOT Project Level Air Quality Resource Document (App.L) and is therefore not considered to be one on air quality concern for fine PM.
- Since the VDOT Resource Document and its criteria for projects of air quality concern for fine PM have already been subjected to interagency consultation for conformity in December 2015, the project has also already met the consultation requirements. (Today's consultation was in addition to that consultation.)
- Robert d'Abadie stated that agencies were welcome to submit additional comments including support and/or concurrence that this is not a project of air quality concern for $PM_{2.5}$.
- Both Rob d'Abadie and Jim Ponticello thanked everyone for their participation.

Appendix B: Link Source Type Hour Fractions Calculation Tool

Link Source Type Hour Fractions Calculation Tool

(Optional tool to assist in calculation of VMT by MOVES Source Types)

See Appendix E1-E2/F1-F2 of VDOT's Project-Level Air Quality Resource Document. This spreadsheet supports the development of Link Source Type Hour Fraction files based on regional VDOT traffic data and Source Type Population files from the regional air quality analyses. This approach is appropriate in cases where the preferred inputs listed in Appendix E1-E2 are not available.

Instructions:

1. Update "Input County and Traffic Data" tab:

Update cells highlighted in yellow per instructions.

Note this spreadsheet can be applied separately for indvidual roadway segments or for regional averages as

2. Update "Input SourceTypePopulation" tab (columns A-C):

Copy regional source type population inputs from **SourceTypePopulation** subfolders in online data

3. Review Results in "Output LinkSourceTypeHour" tab

Extract information for development of MOVES2014 Link Source Type Hour Input files

Enter County FIPS Code: 51013 (See Column B of "VDOT DVMT Report 1236" tab for values by county)

Enter Roadway Functional Class: 11 (Functional Class must exist for County in Column I of "VDOT DVMT Report 1236" tab for the County specified above)

Provide Available Traffic Data Classes:
(Choose Analysis Method 1a, 1b, 1c, 2) 2

Provide Count Data for Chosen Option Specified Above (Others cell inputs can be left blank as they are not used)

											sum
1a	Data Available for 5 HPMS Vehicle Classes*:	10		25		40		50		60	0.0%
1b	Data Available for 2 HPMS Vehicle Classes*:	10-25		40-60							0.0%
1c	Data Available for 3 HPMS Vehicle Classes*:	10-25		50-60		40					0.0%
2	No Local Traffic Count Data Available:										

This is not a preferred option - Recommend Using Traffic Count Data if available **Make sure sum = 100%**

Notes on Analysis Methods:

1a	*This method will estimate a distribution using your traffic count categories disaggregated to MOVES source types based on available MOVES Source Type Population Data*
1b	*This method will estimate a distribution using your traffic count categories disaggregated to MOVES source types based on VDOT's DVMT Report 1236 and available MOVES Source Type Population Data*
1c	*This method will estimate a distribution using your traffic count categories disaggregated to MOVES source types based on VDOT's DVMT Report 1236 and available MOVES Source Type Population Data*
2	*This method will estimate a default distribution based on VDOT's DVMT Report 1236 and available MOVES Source Type Population Data*

**** HPMS Vehicle Class Definitions***

HPMS Vehicle Category	FHWA Vehicle Class
10 - Motorcycles	01 - Motorcycles
25 - Light Duty Vehicles	02 - Passenger Cars 03 - Two Axle, 4 Tire Single Unit Vehicles
40 - Busses	04 - Busses
50 - Single Unit Trucks	05 - Two Axle, 6 Tire Single Unit Trucks 06 - Three Axle Single Unit Trucks 07 - Four or More Axle Single Unit Trucks
60 - Combination Trucks	08 - Four Axle or Fewer Single Trailers 09 - Five Axle Single Trailers 10 - Six or More Axle Single Trailers 11 - Five Axle or Fewer Multi-Trailers 12 - Six Axle Multi-Trailers 13 - Seven or More Axle Multi-Trailers

Note on Prior Entry

The default source type distribution provided in this tool is based on county level data. Attainment of the CO NAAQS is met generally met by such a wide margin in a given build scenario that using vehicle classification at a specific location, while increasing the precision, in the tool would make no substantive difference to the analysis should vehicle classification data not be readily available. A substantive difference is defined in the VDOT Project-Level Air Quality Analysis Resource Document as "…one that would significantly affect the modeling results and/or the analysis to the degree that it would change a finding, determination or conclusion that all applicable requirements for the air quality analysis for the project would be met and the project cleared."***

*** From section 1.3 of the VDOT Project-Level Air Quality Analysis Resource Document retrieved on August 22, 2016. http://www.virginiadot.org/projects/environmental_air_section.asp

yearID	sourceTypeID	sourceTypePopulation
2015	11	2572
2015	21	90109
2015	31	42934
2015	32	13104
2015	41	35
2015	42	105
2015	43	149
2015	51	7
2015	52	223
2015	53	17
2015	54	16
2015	61	119
2015	62	94

Provide Available County MOVES2014 Source Type Population Data:

(This data is available for Virginia counties. See MOVES_INPUT folder and look for subfolder data under SourceTypePopulation)

(Copy data to Yellow section to left)

(Do not include header in Yellow section)

Calculated Link Source Type Hour Fractions by Input Road Type (for MOVES Project Level Analysis)

FIPS	51013	Source Type Hour Fractions
sourceTypeID	Source Type	
11	Motorcycle	0.0041
21	Passenger Car	0.6032
31	Passenger Truck	0.2874
32	Light Commercial Truck	0.0877
41	Intercity Bus	0.0008
42	Transit Bus	0.0024
43	School Bus	0.0034
51	Refuse Truck	0.0002
52	Single Unit Short-haul Truck	0.0066
53	Single Unit Long-haul Truck	0.0005
54	Motor Home	0.0005
61	Combination Short-haul Truck	0.0018
62	Combination Long-haul Truck	0.0014
	sum	*1.0000*

Appendix C: Sample MOVES Input File

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City of Alexandria
CO
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sourcetypeid="32" sourcetypename="Light Commercial Truck"/>
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sourcetypeid="21" sourcetypename="Passenger Car"/>
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sourcetypeid="31" sourcetypename="Passenger Truck"/>
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sourcetypeid="51" sourcetypename="Refuse Truck"/>
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```

```
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pollutantname="Carbon Monoxide (CO)" processkey="15" processname="Crankcase
Running Exhaust"/>
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gies.rateofprogress.RateOfProgressStrategy"><![CDATA[
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```

]]></internalcontrolstrategy>
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</savedata>

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Appendix D: Sample CAL3QHC Input/Output Files

CAL3QHC Input

```
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,1230,1230,12,12,12,12,10,10,10,10,0,0,-1200,1200,0,0,1200,-1200,-
1200,1200,0,0,1200,-1200,0,0,0,0,0,0,0,0,0,0,0.9,0.9,1.1,0.9,0.7,0.7,0.7,0.7
120,120,120,120,68,68,68,68,2,2,2,2,1900,1900,1900,1900,1,1,1,1,3,3,3,3
'I-395 Express Lanes Northern Extension',60,108,0.0,0.0,56,0.3048,1,0
'N Leg, E Side-Corner',70.0,70.0,5.9
'N Leg, E Side - 25 m',70.0,142.0,5.9
'N Leg, E Side - 50 m',70.0,224.0,5.9
'N Leg, E Side-Midblk',70.0,660.0,5.9
'N Leg, W Side-Corner',-58.0,70.0,5.9
'N Leg, W Side - 25 m',-58.0,142.0,5.9
'N Leg, W Side - 50 m',-58.0,224.0,5.9
'N Leg, W Side-Midblk',-58.0,660.0,5.9
'S Leg, E Side-Corner',70.0,-46.0,5.9
'S Leg, E Side - 25 m',70.0,-118.0,5.9
'S Leg, E Side - 50 m',70.0,-200.0,5.9
'S Leg, E Side-Midblk',70.0,-636.0,5.9
'S Leg, W Side-Corner',-58.0,-46.0,5.9
'S Leg, W Side - 25 m',-58.0,-118.0,5.9
'S Leg, W Side - 50 m',-58.0,-200.0,5.9
'S Leg, W Side-Midblk',-58.0,-636.0,5.9
'E Leg, N Side - 25 m',142.0,70.0,5.9
'E Leg, N Side - 50 m',224.0,70.0,5.9
'E Leg, N Side-Midblk',660.0,70.0,5.9
'W Leg, N Side - 25 m',-130.0,70.0,5.9
'W Leg, N Side - 50 m',-212.0,70.0,5.9
'W Leg, N Side-Midblk',-648.0,70.0,5.9
'E Leg, S Side - 25 m',142.0,-46.0,5.9
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'E Leg, S Side-Midblk',660.0,-46.0,5.9
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'W Leg, S Side - 50 m',-212.0,-46.0,5.9
'W Leg, S Side-Midblk',-648.0,-46.0,5.9
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1
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2
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1
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1
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'E Leg App - FreeFlow','AG',0,30,1200,30,6150,0.9,0.0,79.7
2
'E Leg App - Queue','AG',60,30,1200,30,0.0,60.0,5
120,68,2,6150,0.7,1900,1,3
1
```

```
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2
'W Leg App - Queue','AG',-48,-18,-1200,-18,0.0,36.0,3
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1
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1.0,0,4,1000,0.0,'Y',10,1,36
```

CAL3QHC Output

```
     CAL3QHC: LINE SOURCE DISPERSION MODEL - VERSION 2.0 Dated 13045
PAGE  1

      JOB: I-395 Express Lanes Northern Extension               RUN: 2040
Seminary Rd & Beauregard St

      DATE :  7/22/16
      TIME : 13:11:23

         The MODE flag has been set for calculating concentrations for
POLLUTANT:  CO

       SITE & METEOROLOGICAL VARIABLES
       -------------------------------
       VS =   0.0 CM/S       VD =   0.0 CM/S       Z0 = 108. CM
        U =  1.0 M/S         CLAS =   4  (D)     ATIM =  60. MINUTES     MIXH
=  1000. M   AMB =  0.0 PPM

       LINK VARIABLES
       --------------
         LINK DESCRIPTION     *         LINK COORDINATES (FT)          *
LENGTH  BRG TYPE   VPH    EF      H   W    V/C QUEUE
                              *   X1        Y1        X2        Y2     *
(FT)  (DEG)            (G/MI)  (FT) (FT)       (VEH)
      ------------------------*----------------------------------------*-----
-----------------------------------------------------
       1. N Leg App - FreeFlow*    -24.0       0.0     -24.0    1200.0 *
1200.   360. AG   4920.   0.9   0.0 67.7
       2. N Leg App - Queue   *    -24.0      60.0     -24.0    5360.1 *
5300.   360. AG      4. 100.0   0.0 48.0 1.62 269.2
       3. N Leg Dep - FreeFlow*     30.0       0.0      30.0    1200.0 *
1200.   360. AG   6150.   0.9   0.0 79.7
       4. S Leg App - FreeFlow*     30.0       0.0      30.0   -1200.0 *
1200.   180. AG   6150.   0.9   0.0 79.7
       5. S Leg App - Queue   *     30.0     -36.0      30.0   -5336.1 *
5300.   180. AG      5. 100.0   0.0 60.0 1.62 269.2
       6. S Leg Dep - FreeFlow*    -24.0       0.0     -24.0   -1200.0 *
1200.   180. AG   4920.   0.9   0.0 67.7
       7. E Leg App - FreeFlow*      0.0      30.0    1200.0      30.0 *
1200.    90. AG   6150.   0.9   0.0 79.7
       8. E Leg App - Queue   *     60.0      30.0    5360.1      30.0 *
5300.    90. AG      5. 100.0   0.0 60.0 1.62 269.2
       9. E Leg Dep - FreeFlow*      0.0     -18.0    1200.0     -18.0 *
1200.    90. AG   3690.   1.1   0.0 55.7
      10. W Leg App - FreeFlow*      0.0     -18.0   -1200.0     -18.0 *
1200.   270. AG   3690.   1.1   0.0 55.7
      11. W Leg App - Queue   *    -48.0     -18.0   -5348.1     -18.0 *
5300.   270. AG      3. 100.0   0.0 36.0 1.62 269.2
      12. W Leg Dep - FreeFlow*      0.0      30.0   -1200.0      30.0 *
1200.   270. AG   6150.   0.9   0.0 79.7
```

JOB: I-395 Express Lanes Northern Extension RUN: 2040
Seminary Rd & Beauregard St

DATE : 7/22/16
TIME : 13:11:23

ADDITIONAL QUEUE LINK PARAMETERS

LINK DESCRIPTION	CYCLE LENGTH (SEC)	RED TIME (SEC)	CLEARANCE LOST TIME (SEC)	APPROACH VOL (VPH)	SATURATION FLOW RATE (VPH)	IDLE EM FAC (gm/hr)	SIGNAL TYPE	ARRIVAL RATE
2. N Leg App - Queue	120	68	2.0	4920	1900	0.70	1	3
5. S Leg App - Queue	120	68	2.0	6150	1900	0.70	1	3
8. E Leg App - Queue	120	68	2.0	6150	1900	0.70	1	3
11. W Leg App - Queue	120	68	2.0	3690	1900	0.70	1	3

RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (FT) X	Y	Z
1. N Leg, E Side-Corner	70.0	70.0	5.9
2. N Leg, E Side - 25 m	70.0	142.0	5.9
3. N Leg, E Side - 50 m	70.0	224.0	5.9
4. N Leg, E Side-Midblk	70.0	660.0	5.9
5. N Leg, W Side-Corner	-58.0	70.0	5.9
6. N Leg, W Side - 25 m	-58.0	142.0	5.9
7. N Leg, W Side - 50 m	-58.0	224.0	5.9
8. N Leg, W Side-Midblk	-58.0	660.0	5.9
9. S Leg, E Side-Corner	70.0	-46.0	5.9
10. S Leg, E Side - 25 m	70.0	-118.0	5.9
11. S Leg, E Side - 50 m	70.0	-200.0	5.9
12. S Leg, E Side-Midblk	70.0	-636.0	5.9
13. S Leg, W Side-Corner	-58.0	-46.0	5.9
14. S Leg, W Side - 25 m	-58.0	-118.0	5.9
15. S Leg, W Side - 50 m	-58.0	-200.0	5.9
16. S Leg, W Side-Midblk	-58.0	-636.0	5.9
17. E Leg, N Side - 25 m	142.0	70.0	5.9
18. E Leg, N Side - 50 m	224.0	70.0	5.9
19. E Leg, N Side-Midblk	660.0	70.0	5.9
20. W Leg, N Side - 25 m	-130.0	70.0	5.9
21. W Leg, N Side - 50 m	-212.0	70.0	5.9
22. W Leg, N Side-Midblk	-648.0	70.0	5.9
23. E Leg, S Side - 25 m	142.0	-46.0	5.9
24. E Leg, S Side - 50 m	224.0	-46.0	5.9
25. E Leg, S Side-Midblk	660.0	-46.0	5.9

26. W Leg, S Side - 25 m *	-130.0	-46.0	5.9	*
27. W Leg, S Side - 50 m *	-212.0	-46.0	5.9	*
28. W Leg, S Side-Midblk *	-648.0	-46.0	5.9	*

JOB: I-395 Express Lanes Northern Extension RUN: 2040
Seminary Rd & Beauregard St

MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 10.-360.

WIND ANGLE (DEGR)	* CONCENTRATION (PPM) 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
10.	0.1279	0.1256	0.1233	0.1042	0.3801	0.3765	0.3718	0.3269	0.3673	0.2714	0.2313	0.1876	0.6180	0.5111	0.4708
20.	0.0504	0.0448	0.0444	0.0407	0.3663	0.3618	0.3605	0.3423	0.2772	0.1825	0.1385	0.0920	0.5931	0.4871	0.4438
30.	0.0330	0.0221	0.0220	0.0217	0.3316	0.3226	0.3224	0.3186	0.2655	0.1599	0.1219	0.0671	0.5566	0.4514	0.4113
40.	0.0328	0.0174	0.0174	0.0174	0.3027	0.2913	0.2913	0.2908	0.2782	0.1610	0.1209	0.0624	0.5424	0.4290	0.3869
50.	0.0329	0.0152	0.0152	0.0152	0.2771	0.2649	0.2649	0.2648	0.3036	0.1715	0.1241	0.0576	0.5459	0.4194	0.3720
60.	0.0335	0.0110	0.0109	0.0109	0.2653	0.2479	0.2478	0.2478	0.3382	0.1780	0.1251	0.0393	0.5666	0.4109	0.3598
70.	0.0522	0.0070	0.0056	0.0054	0.2785	0.2372	0.2356	0.2354	0.3742	0.1775	0.1143	0.0163	0.6045	0.4039	0.3427
80.	0.1340	0.0167	0.0043	0.0004	0.3703	0.2535	0.2401	0.2355	0.3900	0.1443	0.0741	0.0035	0.6284	0.3819	0.3123
90.	0.2935	0.0713	0.0266	0.0008	0.5459	0.3259	0.2796	0.2501	0.2946	0.0719	0.0267	0.0007	0.5449	0.3235	0.2767
100.	0.3842	0.1436	0.0735	0.0036	0.6153	0.3839	0.3144	0.2395	0.1338	0.0167	0.0042	0.0004	0.3692	0.2510	0.2375
110.	0.3647	0.1769	0.1137	0.0163	0.5828	0.4053	0.3449	0.2500	0.0499	0.0070	0.0056	0.0054	0.2798	0.2347	0.2332
120.	0.3261	0.1768	0.1248	0.0391	0.5454	0.4118	0.3625	0.2813	0.0299	0.0110	0.0109	0.0109	0.2657	0.2448	0.2447
130.	0.2975	0.1705	0.1239	0.0572	0.5316	0.4215	0.3741	0.3095	0.0292	0.0154	0.0154	0.0154	0.2749	0.2610	0.2610
140.	0.2721	0.1614	0.1198	0.0625	0.5336	0.4356	0.3919	0.3366	0.0294	0.0177	0.0177	0.0177	0.2973	0.2869	0.2869
150.	0.2577	0.1624	0.1201	0.0665	0.5477	0.4633	0.4206	0.3676	0.0304	0.0225	0.0225	0.0222	0.3242	0.3173	0.3171
160.	0.2725	0.1822	0.1393	0.0905	0.5789	0.4974	0.4600	0.4122	0.0503	0.0467	0.0463	0.0429	0.3592	0.3555	0.3541
170.	0.3659	0.2725	0.2322	0.1838	0.5998	0.5168	0.4832	0.4451	0.1347	0.1327	0.1305	0.1121	0.3732	0.3697	0.3652
180.	0.5423	0.4344	0.3952	0.3547	0.5173	0.4216	0.3885	0.3551	0.2975	0.2932	0.2879	0.2453	0.2786	0.2742	0.2690

```
 190.  *  0.6150  0.5194  0.4794  0.4375  0.3476  0.2606  0.2241  0.1811
0.3914  0.3879  0.3835  0.3412  0.1236  0.1217  0.1194
 200.  *  0.5824  0.4916  0.4466  0.4020  0.2607  0.1745  0.1330  0.0867
0.3711  0.3677  0.3663  0.3493  0.0450  0.0414  0.0410
 210.  *  0.5454  0.4503  0.4068  0.3562  0.2471  0.1556  0.1141  0.0626
0.3305  0.3242  0.3240  0.3205  0.0268  0.0190  0.0190
 220.  *  0.5304  0.4180  0.3793  0.3251  0.2600  0.1540  0.1139  0.0585
0.3009  0.2913  0.2912  0.2909  0.0262  0.0145  0.0145
 230.  *  0.5268  0.4048  0.3590  0.2978  0.2827  0.1627  0.1180  0.0536
0.2767  0.2636  0.2635  0.2635  0.0263  0.0125  0.0125
 240.  *  0.5386  0.3960  0.3475  0.2694  0.3103  0.1691  0.1192  0.0361
0.2651  0.2450  0.2450  0.2450  0.0278  0.0087  0.0087
 250.  *  0.5712  0.3926  0.3338  0.2404  0.3475  0.1697  0.1089  0.0139
0.2809  0.2360  0.2344  0.2342  0.0494  0.0056  0.0042
 260.  *  0.5992  0.3716  0.3048  0.2321  0.3659  0.1376  0.0701  0.0024
0.3747  0.2546  0.2411  0.2366  0.1361  0.0166  0.0039
 270.  *  0.5280  0.3158  0.2714  0.2435  0.2792  0.0674  0.0245  0.0004
0.5491  0.3277  0.2810  0.2518  0.2973  0.0710  0.0259
 280.  *  0.3590  0.2458  0.2332  0.2291  0.1271  0.0153  0.0036  0.0002
0.6283  0.3837  0.3145  0.2398  0.3919  0.1423  0.0724
 290.  *  0.2713  0.2284  0.2270  0.2268  0.0490  0.0055  0.0042  0.0040
0.6060  0.4034  0.3428  0.2482  0.3751  0.1738  0.1111
 300.  *  0.2575  0.2368  0.2367  0.2367  0.0308  0.0087  0.0087  0.0087
0.5701  0.4082  0.3572  0.2780  0.3376  0.1734  0.1209
 310.  *  0.2703  0.2543  0.2543  0.2542  0.0299  0.0125  0.0125  0.0125
0.5533  0.4196  0.3700  0.3074  0.3053  0.1663  0.1193
 320.  *  0.2950  0.2811  0.2811  0.2806  0.0298  0.0146  0.0146  0.0146
0.5479  0.4363  0.3922  0.3351  0.2791  0.1556  0.1159
 330.  *  0.3221  0.3125  0.3122  0.3083  0.0302  0.0193  0.0192  0.0190
0.5600  0.4638  0.4217  0.3682  0.2658  0.1548  0.1164
 340.  *  0.3585  0.3532  0.3517  0.3333  0.0483  0.0426  0.0422  0.0387
0.5928  0.5028  0.4594  0.4168  0.2768  0.1776  0.1326
 350.  *  0.3741  0.3704  0.3657  0.3209  0.1275  0.1253  0.1230  0.1040
0.6176  0.5242  0.4893  0.4527  0.3658  0.2658  0.2237
 360.  *  0.2826  0.2785  0.2730  0.2284  0.2843  0.2803  0.2747  0.2302
0.5426  0.4313  0.3967  0.3641  0.5398  0.4218  0.3830
 ------*-------------------------------------------------------------------
-------------------------------------------------
 MAX   *  0.6150  0.5194  0.4794  0.4375  0.6153  0.5168  0.4832  0.4451
0.6283  0.5242  0.4893  0.4527  0.6284  0.5111  0.4708
 DEGR. *    190     190     190     190     100     170     170     170
280     350     350     350      80      10      10
```

JOB: I-395 Express Lanes Northern Extension RUN: 2040
Seminary Rd & Beauregard St

MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

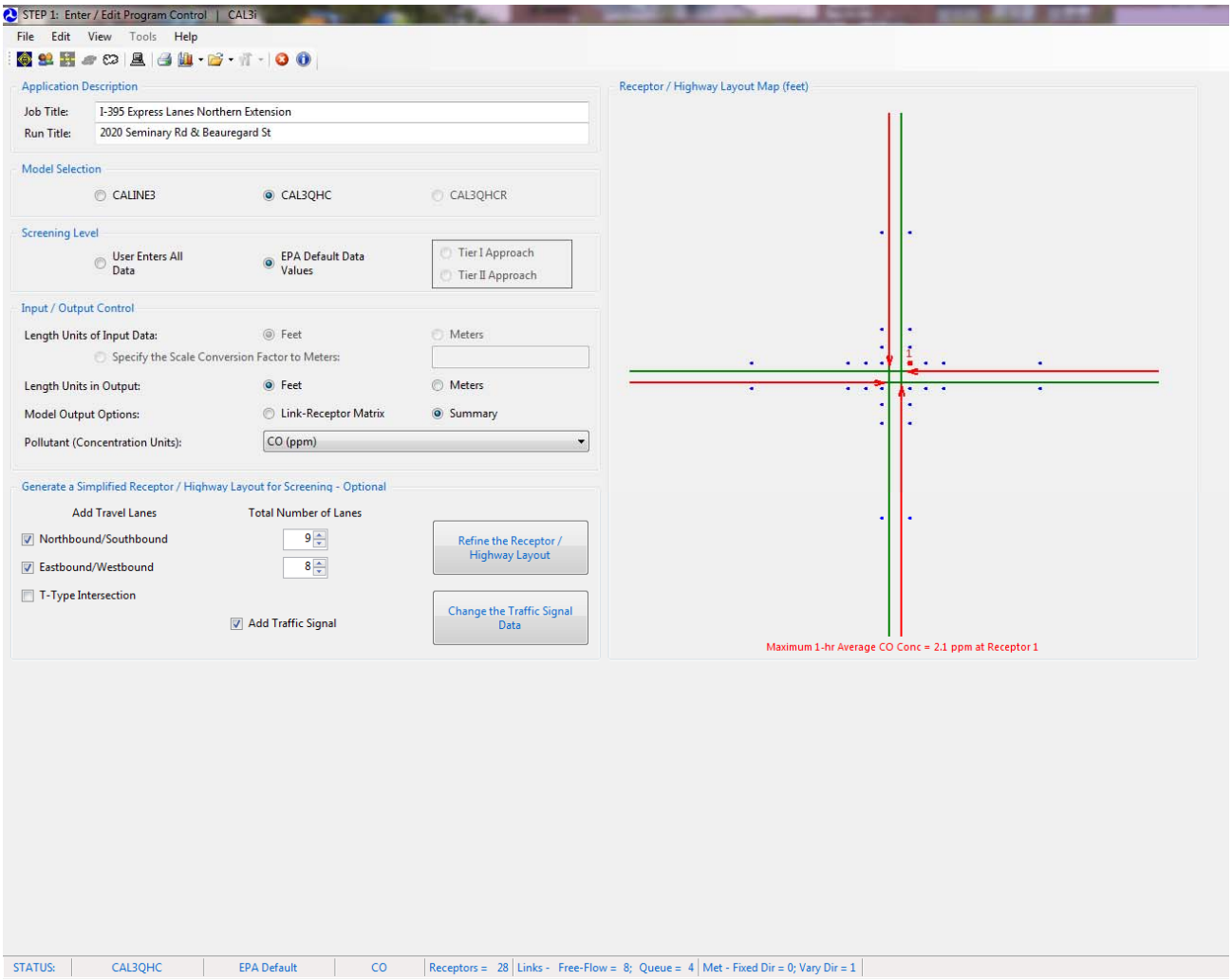
WIND ANGLE RANGE: 10.-360.

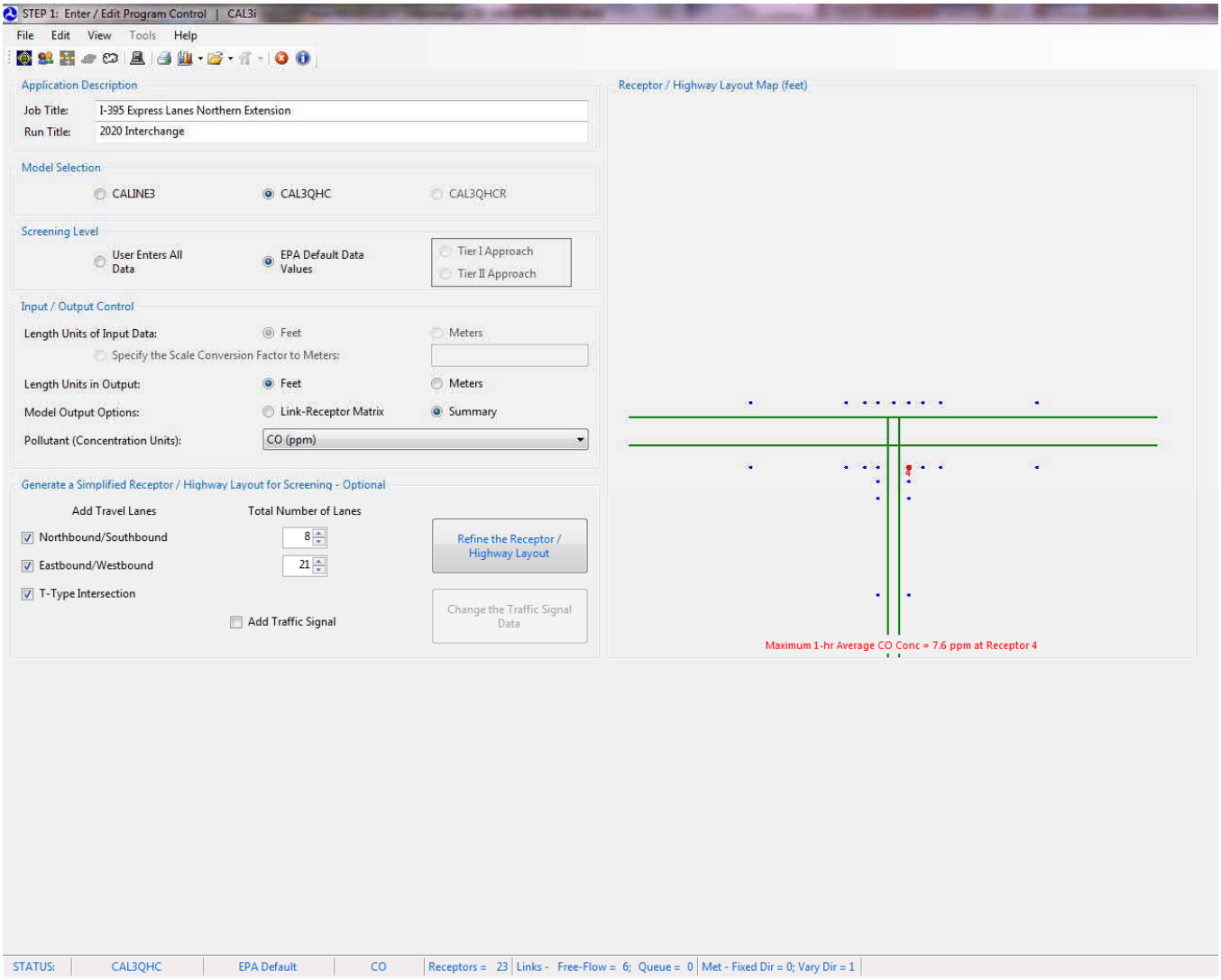
WIND ANGLE (DEGR)	* CONCENTRATION (PPM) 16	17	18	19	20	21	22	23	24	25	26	27	28
10.	0.4336	0.0156	0.0038	0.0004	0.1434	0.0732	0.0031	0.2551	0.2424	0.2384	0.3856	0.3160	0.2409
20.	0.4043	0.0069	0.0056	0.0054	0.1791	0.1156	0.0156	0.2400	0.2386	0.2384	0.4092	0.3486	0.2511
30.	0.3622	0.0110	0.0109	0.0109	0.1802	0.1274	0.0393	0.2522	0.2521	0.2521	0.4196	0.3686	0.2848
40.	0.3318	0.0154	0.0154	0.0154	0.1737	0.1265	0.0585	0.2707	0.2707	0.2706	0.4317	0.3827	0.3163
50.	0.3057	0.0177	0.0177	0.0177	0.1632	0.1235	0.0632	0.2975	0.2975	0.2971	0.4450	0.4024	0.3434
60.	0.2784	0.0225	0.0225	0.0222	0.1626	0.1237	0.0684	0.3305	0.3303	0.3271	0.4723	0.4323	0.3776
70.	0.2477	0.0466	0.0461	0.0425	0.1857	0.1404	0.0925	0.3709	0.3697	0.3538	0.5123	0.4714	0.4238
80.	0.2369	0.1318	0.1295	0.1107	0.2761	0.2342	0.1844	0.3866	0.3823	0.3405	0.5382	0.5007	0.4573
90.	0.2469	0.2896	0.2842	0.2412	0.4341	0.3948	0.3519	0.2907	0.2855	0.2417	0.4433	0.4087	0.3698
100.	0.2330	0.3807	0.3763	0.3340	0.5165	0.4753	0.4308	0.1315	0.1292	0.1097	0.2788	0.2394	0.1928
110.	0.2330	0.3596	0.3583	0.3417	0.4880	0.4395	0.3952	0.0442	0.0437	0.0400	0.1860	0.1398	0.0930
120.	0.2447	0.3165	0.3162	0.3128	0.4464	0.4042	0.3497	0.0189	0.0189	0.0186	0.1610	0.1209	0.0658
130.	0.2610	0.2837	0.2837	0.2833	0.4170	0.3777	0.3178	0.0138	0.0138	0.0138	0.1599	0.1204	0.0601
140.	0.2865	0.2563	0.2563	0.2562	0.4046	0.3562	0.2919	0.0117	0.0117	0.0117	0.1702	0.1235	0.0561
150.	0.3138	0.2371	0.2370	0.2370	0.3955	0.3440	0.2619	0.0079	0.0079	0.0079	0.1771	0.1251	0.0378
160.	0.3374	0.2287	0.2271	0.2268	0.3922	0.3312	0.2325	0.0050	0.0036	0.0034	0.1775	0.1149	0.0148
170.	0.3228	0.2486	0.2351	0.2304	0.3698	0.3012	0.2249	0.0169	0.0042	0.0002	0.1441	0.0747	0.0033
180.	0.2264	0.3229	0.2758	0.2453	0.3098	0.2645	0.2352	0.0736	0.0277	0.0008	0.0705	0.0265	0.0007

```
 190.  *  0.1012  0.3832  0.3122  0.2345  0.2382  0.2253  0.2210  0.1481
0.0764  0.0035  0.0158  0.0038  0.0002
 200.  *  0.0377  0.4046  0.3418  0.2422  0.2191  0.2177  0.2175  0.1810
0.1164  0.0151  0.0048  0.0035  0.0034
 210.  *  0.0187  0.4064  0.3556  0.2721  0.2270  0.2270  0.2270  0.1797
0.1264  0.0380  0.0079  0.0079  0.0079
 220.  *  0.0145  0.4150  0.3686  0.3031  0.2453  0.2453  0.2452  0.1728
0.1248  0.0562  0.0117  0.0117  0.0117
 230.  *  0.0125  0.4294  0.3895  0.3305  0.2715  0.2715  0.2711  0.1636
0.1207  0.0604  0.0139  0.0139  0.0138
 240.  *  0.0087  0.4603  0.4176  0.3636  0.3026  0.3024  0.2992  0.1656
0.1214  0.0657  0.0191  0.0190  0.0187
 250.  *  0.0040  0.4979  0.4553  0.4113  0.3432  0.3419  0.3260  0.1885
0.1414  0.0922  0.0450  0.0446  0.0410
 260.  *  0.0003  0.5175  0.4843  0.4469  0.3624  0.3581  0.3172  0.2797
0.2386  0.1897  0.1340  0.1317  0.1127
 270.  *  0.0005  0.4297  0.3956  0.3618  0.2749  0.2701  0.2279  0.4411
0.4025  0.3637  0.2931  0.2883  0.2455
 280.  *  0.0025  0.2713  0.2332  0.1882  0.1251  0.1229  0.1045  0.5294
0.4903  0.4515  0.3886  0.3843  0.3438
 290.  *  0.0142  0.1839  0.1410  0.0935  0.0447  0.0443  0.0408  0.5008
0.4640  0.4211  0.3720  0.3708  0.3556
 300.  *  0.0365  0.1640  0.1229  0.0686  0.0220  0.0220  0.0217  0.4647
0.4279  0.3768  0.3309  0.3307  0.3277
 310.  *  0.0539  0.1638  0.1225  0.0637  0.0174  0.0174  0.0174  0.4397
0.4002  0.3437  0.2974  0.2974  0.2970
 320.  *  0.0582  0.1728  0.1264  0.0586  0.0152  0.0152  0.0152  0.4284
0.3820  0.3164  0.2705  0.2705  0.2704
 330.  *  0.0626  0.1787  0.1270  0.0392  0.0110  0.0109  0.0109  0.4186
0.3690  0.2855  0.2514  0.2514  0.2514
 340.  *  0.0860  0.1781  0.1151  0.0156  0.0069  0.0056  0.0054  0.4096
0.3492  0.2522  0.2390  0.2376  0.2373
 350.  *  0.1771  0.1423  0.0726  0.0029  0.0162  0.0040  0.0004  0.3854
0.3162  0.2416  0.2547  0.2418  0.2375
 360.  *  0.3456  0.0689  0.0251  0.0005  0.0700  0.0258  0.0007  0.3260
0.2808  0.2526  0.3266  0.2808  0.2521
 ------*-----------------------------------------------------------------
-----------------------------------
 MAX   *  0.4336  0.5175  0.4843  0.4469  0.5165  0.4753  0.4308  0.5294
0.4903  0.4515  0.5382  0.5007  0.4573
 DEGR. *     10     260     260     260     100     100     100     280
280     280      80      80      80

 THE HIGHEST CONCENTRATION OF   0.6284 PPM OCCURRED AT RECEPTOR    13.
```

Appendix E: CO Modeling Layout


STEP 1: Enter / Edit Program Control | CAL3
File Edit View Tools Help
Application Description
Job Title: I-395 Express Lanes Northern Extension
Run Title: 2020 Seminary Rd & Beauregard St
Model Selection
CALINE3
CAL3QHC
CAL3QHCR
Screening Level
User Enters All Data
EPA Default Data Values
Tier I Approach
Tier II Approach
Input / Output Control
Length Units of Input Data:
Feet
Meters
Specify the Scale Conversion Factor to Meters:
Length Units in Output:
Feet
Meters
Model Output Options:
Link-Receptor Matrix
Summary
Pollutant (Concentration Units):
CO (ppm)
Generate a Simplified Receptor / Highway Layout for Screening - Optional
Add Travel Lanes
Total Number of Lanes
Northbound/Southbound
9
Eastbound/Westbound
8
T-Type Intersection
Add Traffic Signal
Refine the Receptor / Highway Layout
Change the Traffic Signal Data
Receptor / Highway Layout Map (feet)
Maximum 1-hr Average CO Conc = 2.1 ppm at Receptor 1
STATUS:
CAL3QHC
EPA Default
CO
Receptors = 28
Links - Free-Flow = 8; Queue = 4
Met - Fixed Dir = 0; Vary Dir = 1


STEP 1: Enter / Edit Program Control | CAL3i
File Edit View Tools Help
Application Description
Job Title: I-395 Express Lanes Northern Extension
Run Title: 2020 Interchange
Model Selection
CALINE3
CAL3QHC
CAL3QHCR
Screening Level
User Enters All Data
EPA Default Data Values
Tier I Approach
Tier II Approach
Input / Output Control
Length Units of Input Data:
Feet
Meters
Specify the Scale Conversion Factor to Meters:
Length Units in Output:
Feet
Meters
Model Output Options:
Link-Receptor Matrix
Summary
Pollutant (Concentration Units):
CO (ppm)
Generate a Simplified Receptor / Highway Layout for Screening - Optional
Add Travel Lanes
Total Number of Lanes
Northbound/Southbound
8
Eastbound/Westbound
21
T-Type Intersection
Add Traffic Signal
Refine the Receptor / Highway Layout
Change the Traffic Signal Data
Receptor / Highway Layout Map (feet)
Maximum 1-hr Average CO Conc = 7.6 ppm at Receptor 4
STATUS: CAL3QHC EPA Default CO Receptors = 23 Links - Free-Flow = 6; Queue = 0 Met - Fixed Dir = 0; Vary Dir = 1

INTERSTATE 395 EXPRESS LANES NORTHERN EXTENSION

VDOT

U.S. Department of Transportation
Federal Highway Administration

395
ExpressLanes