

**AIR QUALITY TECHNICAL REPORT**

**Route 286 (Fairfax County Parkway) Proposed Widening from Four to Six Lanes from  
North of Route 29 (Lee Highway) to Route 123 (Ox Road)**

**UPC 107937**

**Northern Virginia District**

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Environmental Division

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# Table of Contents

<b>Executive Summary</b> .....	<b>i</b>
<b>1.0 Project Background</b> .....	<b>1</b>
1.1 Project Description .....	1
1.2 Summary of Traffic Data and Forecasts .....	4
<b>2.0 Regulatory Requirements and Guidance</b> .....	<b>6</b>
2.1 National Environmental Policy Act of 1969 (NEPA) .....	6
2.1.1 FHWA Guidance for Implementing NEPA for Air Quality .....	6
2.1.2 Programmatic Agreements .....	7
2.2 Transportation Conformity .....	8
2.2.1 Project-Inclusion in Regional Transportation Plans and Programs.....	8
2.2.2 FHWA Categorical Finding for Carbon Monoxide .....	9
<b>3.0 Ambient Air Quality</b> .....	<b>9</b>
3.1 National Ambient Air Quality Standards (NAAQS) .....	9
3.2 Air Quality Attainment Status of Project Area.....	11
3.3 Air Quality Data and Trends .....	11
3.3.1 Carbon Monoxide (CO) .....	11
3.3.2 Other Criteria Pollutants .....	12
<b>4.0 Project Assessment</b> .....	<b>15</b>
4.1 Application of the VDOT Resource Document .....	15
4.2 Carbon Monoxide Assessment.....	15
4.2.1 Background .....	15
4.2.2 Level of Analysis Determination.....	18
4.2.3 Worst-Case Modeling Overview .....	18
4.2.4 Traffic Data and Forecasts for the CO Analysis .....	19
4.2.5 Alternatives Modeled .....	21
4.2.6 Worst-Case Modeling Configuration .....	21
4.2.7 Emission Modeling .....	23
4.2.8 Dispersion Modeling .....	27
4.2.9 Construction Emissions .....	32
4.2.10 Summary of Assumptions for the Worst-Case Analysis .....	32
4.3 Mobile Source Air Toxic (MSAT) Assessment .....	33
4.3.1 Level of Analysis Determination.....	34
4.3.2 MSAT Analysis .....	34
4.4 Indirect Effects and Cumulative Impacts (IECI) Assessment .....	41

<b>5.0</b>	<b>Mitigation .....</b>	<b>42</b>
<b>6.0</b>	<b>Consultation .....</b>	<b>43</b>
6.1.1	Public Consultation.....	43
6.1.2	Inter-Agency Consultation - Models, Methods, Assumptions and Protocols Specified in the VDOT Resource Document .....	43
<b>7.0</b>	<b>Conclusions.....</b>	<b>43</b>
<b>Appendix A:</b>	Detailed Design Plots	
<b>Appendix B:</b>	2016 Detailed Existing Traffic Plots	
<b>Appendix C:</b>	2026 Detailed Forecasted Traffic Plots – No-Build and Preferred Alternative (Build)	
<b>Appendix D:</b>	2046 Detailed Forecasted Traffic Plots – No-Build and Preferred Alternative (Build)	
<b>Appendix E:</b>	Memorandum on Traffic Demand Modeling Approach	
<b>Appendix F:</b>	Memorandum on Travel Demand Model Validation and Calibration	
<b>Appendix G:</b>	Memorandum on the Development of Future Year Daily and Peak Period Forecasts	

## List of Exhibits

<b>Exhibit 1.1.1:</b>	Project Location .....	2
<b>Exhibit 1.2.1:</b>	Traffic Study Area and Model Cut-Lines .....	5
<b>Exhibit 3.1.1:</b>	National Ambient Air Quality Standards (US EPA Tabulation) .....	10
<b>Exhibit 3.3.1:</b>	Nationwide Long-Term Trend in Ambient CO Concentrations .....	12
<b>Exhibit 3.3.2:</b>	Ambient Concentrations of Carbon Monoxide in Virginia .....	13
<b>Exhibit 3.3.3:</b>	Trend in Ambient CO Concentrations .....	13
<b>Exhibit 3.3.4:</b>	Trend for 1-hour Sulfur Dioxide (PPM) – Northern Region .....	14
<b>Exhibit 3.3.5:</b>	Trend for 8-hour Ozone (PPM) – Northern Region.....	14
<b>Exhibit 4.2.1:</b>	Public Road Mileage, Lane-Miles and Vehicle Miles Traveled (VMT) .....	16
<b>Exhibit 4.2.2:</b>	Recent Trends in VMT and Related Statistics for Virginia .....	17
<b>Exhibit 4.2.3:</b>	Federal Emission Standards for CO for New Automobiles and Light Trucks ..	18
<b>Exhibit 4.2.4:</b>	Study Intersections Considered for CO Modeling.....	20
<b>Exhibit 4.2.5:</b>	PM Peak Hour Volumes, Delay, and Level of Service (LOS) at Intersections.	22
<b>Exhibit 4.2.6:</b>	Comparison of Project Forecasts for Peak Hour Traffic Volumes and VDOT Resource Document Worst-Case Volumes as Applied for the CO Worst-Case Analysis.....	23
<b>Exhibit 4.2.8:</b>	MOVES Source Types and HPMS Vehicle Types.....	24
<b>Exhibit 4.2.9:</b>	Road Type Mapping .....	25
<b>Exhibit 4.2.10 (a):</b>	MOVES Input Summary for CO – Main Screen .....	25
<b>Exhibit 4.2.10 (b):</b>	MOVES Input Summary for CO – Project Data Manager .....	26
<b>Exhibit 4.2.11:</b>	MOVES Fleet Average Worst-Case CO Emission Factors Summary .....	27
<b>Exhibit 4.2.12:</b>	CAL3QHC Worst-Case Analysis Inputs .....	29
<b>Exhibit 4.2.13 (a):</b>	CO Dispersion Modeling Worst-Case Configuration & Receptor Locations – Route 123 & Fairfax County Pkwy SB Ramps/ Robert Carter Rd .....	30
<b>Exhibit 4.2.13 (b):</b>	CO Dispersion Modeling Worst-Case Configuration & Receptor Locations – Fairfax County Pkwy & Roberts Pkwy/ Karmich St .....	31
<b>Exhibit 4.2.14:</b>	Worst-Case CAL3QHC Modeling Results for CO .....	32
<b>Exhibit 4.3.1:</b>	FHWA Projected National MSAT Emission Trends 2010 – 2050 for Vehicles Operating on Roadways Using EPA’s MOVES2014a Model .....	36

## Executive Summary

The Virginia Department of Transportation (VDOT) has initiated a study to evaluate improvements to widen Fairfax County Parkway (Route 286) from north of US Route 29 (Lee Highway) to Route 123 (Ox Road). The project corridor and extends approximately 1,670 feet north of Route 29 and approximately 2,340 feet south of Route 123. The project area is located in central Fairfax County, approximately 3 miles southwest of the City of Fairfax at the midpoint of the project and 0.5 miles south of I-66 at its northern terminus.

The proposed improvements consist of widening Fairfax County Parkway from four lanes to six lanes and a new interchange to consolidate the Popes Head Road and future Shirley Gate Road. The proposed project would include the extension of the Fairfax County Parkway Trail, modification or elimination of all intersections along the corridor, and minor improvements at the Fairfax County Parkway at Route 123 interchange. The intersections that would be modified include Fairfax County Parkway at Ladues End Lane/Nomes Court and at Burke Centre Parkway. The intersections that would be eliminated include Fairfax County Parkway at Popes Head Road and at Colchester Meadow Lane. The interchange at Popes Head Road is funded for construction and is currently planned to be implemented in advance of the widening.

The proposed improvements were assessed for potential air quality impacts and conformity consistent with all applicable air quality regulations and guidance. All models, methods and assumptions applied in modeling and analyses are consistent with those provided or specified in the VDOT Resource Document<sup>1</sup>. This project level assessment would meet all applicable federal and state transportation conformity regulatory requirements as well as air quality guidance under the National Environmental Policy Act (NEPA). As such, the project will not cause or contribute to a new violation of the National Ambient Air Quality Standards (NAAQS) established by the US Environmental Protection Agency (US EPA). Additional detail on the analyses conducted for this project is provided below.

**Carbon Monoxide (CO):** As the project is located in a region that is attainment of the CO NAAQS, only NEPA applies. EPA project-level (“hot-spot”) transportation conformity requirements do not apply.

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<sup>1</sup> In 2016, in order to facilitate and streamline the preparation of project-level air quality analyses, and maintain high quality standards for modeling and documentation, the Department created a new resource for modeling. Titled the “Resource Document”, it includes a general reference document as well as an associated online data repository (DR) for all modeling inputs needed for project-level air quality analyses in Virginia. The VDOT Resource Document and DR address in a comprehensive fashion the models, methods and assumptions (including data and data sources as well as protocols) needed for the preparation of air quality analyses for transportation projects by or on behalf of the Department. The latest version of the VDOT Resource Document and DR along with air quality-related programmatic agreements are available on or via the Department website ([http://www.virginiadot.org/projects/environmental\\_air\\_section.asp](http://www.virginiadot.org/projects/environmental_air_section.asp)).

For purposes of NEPA, worst-case emission and dispersion modeling for CO was conducted for the project for intersections exhibiting levels of service of D or worse in the 2046 Build scenario, namely Route 123/Fairfax County Pkwy SB Ramps at Robert Carter Rd and Fairfax County Pkwy/Roberts Pkwy at Karmich St. The worst-case modeling assumptions are consistent with EPA and FHWA guidance as well as the VDOT Resource Document and included:

For emission factor modeling:

- Regional registration (age) distributions were applied that were not adjusted (as a limitation of the EPA MOVES model) for mileage accumulation rates that generally decline with age. This assumption effectively weights older higher-emitting vehicles the same as newer lower-emitting vehicles, resulting in higher estimates for fleet-average emission factors.
- Worst-case emission factor selected as that for the maximum (or higher) road grade for each link.
- Although the project is located in an area (northern Virginia) in which it is subject to emission inspection and maintenance (I&M) program requirements, I&M benefits were not incorporated into the emission modeling for this project.

For dispersion modeling:

- Traffic volumes representing LOS E conditions, which typically exceeds actual opening and design year ADT forecasts for build scenarios by substantial margins. Also additional through lane(s) were added to account for auxiliary lanes or ramps.
- Worst-case receptor locations on the edge of the roadway right-of-way, i.e., at the closest possible point to roadway.
- Worst-case geometric assumptions that serve to concentrate traffic, emissions and concentrations to the greatest extent possible:
  - Zero median widths for arterial streets and minimum distance for freeways
  - Lane widths of 12 ft
- Other federal default data for most model inputs (e.g., low wind speeds, surface roughness, and stability class), which result in higher modeled estimates of ambient concentrations than are expected to occur in practice.

**Mobile Source Air Toxics (MSATs):** Federal Highway Administration (FHWA) guidance<sup>2</sup> (2016) states that “EPA identified nine compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers or contributors and non-cancer hazard contributors from the 2011 National Air Toxics Assessment (NATA)<sup>3</sup>. These are 1,3-butadiene, acetaldehyde, acrolein, benzene, diesel particulate matter (diesel PM), ethylbenzene, formaldehyde,

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<sup>2</sup> FHWA, “*INFORMATION: Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents*”, October 18, 2016. See: [http://www.fhwa.dot.gov/environment/air\\_quality/air\\_toxics/](http://www.fhwa.dot.gov/environment/air_quality/air_toxics/)

<sup>3</sup> See: <https://www.epa.gov/national-air-toxics-assessment>

*naphthalene, and polycyclic organic matter.*" The FHWA guidance specifies three possible tiers of MSAT analysis and associated traffic volumes and other criteria, based on which this project was categorized as one with low potential MSAT effects based primarily on the forecast traffic volumes for this project. A qualitative assessment was therefore conducted for the project, following FHWA guidance for projects with low potential impacts.

Overall, best available information indicates that, nationwide, regional levels of MSATs are expected to decrease in the future due to ongoing fleet turnover and the continued implementation of increasingly more stringent emission and fuel quality regulations. Nonetheless, technical shortcomings of emissions and dispersion models and uncertain science with respect to health effects effectively limit meaningful or reliable estimates of MSAT emissions and effects of this project at this time. While it is possible that localized increases in MSAT emissions may occur as a result of this project, emissions will likely be lower than present levels in the design year of this project as a result of EPA's national control programs that are projected to reduce annual MSAT emissions by over 80 percent between 2010 and 2050. Although local conditions may differ from these national projections in terms of fleet mix and turnover, vehicle-miles-travelled (VMT) growth rates, and local control measures, the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the study area are likely to be lower in the future in nearly all cases.

**Indirect Effects and Cumulative Impacts (IECI):** A qualitative assessment of the potential for indirect effects and cumulative impacts attributable to this project was conducted. It concluded that the potential effects or impacts are not expected to be significant given available information from pollutant-specific analyses (CO and MSATs) and regional conformity analyses.

More specifically, the quantitative assessments conducted for project-specific CO, qualitative analyses for MSAT impacts and the regional conformity analysis conducted for ozone can all be considered indirect effects analyses because they look at air quality impacts attributable to the project that occur in the future. These analyses demonstrate that, in the future: 1) air quality impacts from CO will not cause or contribute to violations of the CO NAAQS; 2) MSAT emissions will be significantly lower than they are today; and 3) the mobile source emissions budgets established for the region for purposes of meeting the ozone NAAQS will not be exceeded.

Regarding the potential for cumulative impacts, the annual regional conformity analysis conducted by the National Capital Region Transportation Planning Board (NCRTPB, which is the Metropolitan Planning Organization or MPO for the Washington, D.C. metropolitan nonattainment area for ozone) represents a cumulative impact assessment for purposes of regional air quality. The conformity analysis quantifies the amount of mobile source emissions for which the area is designated nonattainment that will result from the implementation of all reasonably foreseeable regionally significant transportation projects in the region (i.e. those proposed for construction funding over the life of the region's transportation plan). The most recent conformity analysis was completed in October 2018, with FHWA and FTA issuing a conformity finding on December 18, 2018 for the Transportation Improvement Program and Constrained Long-Range Transportation Plan covered by that analysis. The analysis demonstrated 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 State Implementation (Air Quality) Plan (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.

**Mitigation:** Emissions may be produced in the construction of this project from heavy equipment and vehicle travel to and from the site, as well as from fugitive sources. Construction emissions are short term or temporary in nature. To mitigate these emissions, all construction activities are to be performed in accordance with VDOT *Road and Bridge Specifications*<sup>4</sup>.

The Virginia Department of Environmental Quality (VDEQ) provides general comments for projects by jurisdiction. Their comments in part address mitigation. For Fairfax county, VDEQ comments relating to mitigation are<sup>5</sup> “...all reasonable precautions should be taken to limit the emissions of VOC and NOx. 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<sup>6</sup>; 9 VAC 5-45, Article 7, Cutback Asphalt restrictions<sup>7</sup>; and 9 VAC 5-50, Article 1, Fugitive Dust precautions<sup>8</sup>.”

**Project Status in the Regional Transportation Plan and Program:** Federal conformity requirements, including specifically 40 CFR 93.114<sup>9</sup> and 40 CFR 93.115<sup>10</sup>, apply as the area in which the project is located is designated as nonattainment for ozone. 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))<sup>11</sup>.

As of the date of preparation of this analysis, the project is included in the currently conforming FY 2019-2024 Transportation Improvement Program (TIP) and 2045 Long Range Transportation Plan (LRTP). The LRTP and TIP are developed by the metropolitan planning organization (MPO) for the region, whose members include VDOT<sup>12</sup>.

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<sup>4</sup> See: <http://www.virginiadot.org/business/const/spec-default.asp>

<sup>5</sup> Spreadsheet entitled: “DEQ SERP Comments rev8b”, March 2017, downloaded from the online data repository for the VDOT Resource Document. [http://www.virginiadot.org/projects/environmental\\_air\\_section.asp](http://www.virginiadot.org/projects/environmental_air_section.asp)

<sup>6</sup> See: <https://law.lis.virginia.gov/admincode/title9/agency5/chapter130/section100/>

<sup>7</sup> See: <http://leg1.state.va.us/cgi-bin/legp504.exe?000+reg+9VAC5-45-760>

<sup>8</sup> See: <http://leg1.state.va.us/cgi-bin/legp504.exe?000+reg+9VAC5-50-60>

<sup>9</sup> See: <https://www.gpo.gov/fdsys/pkg/CFR-2014-title40-vol20/xml/CFR-2014-title40-vol20-sec93-114.xml>

<sup>10</sup> See: <https://www.gpo.gov/fdsys/pkg/CFR-2014-title40-vol20/xml/CFR-2014-title40-vol20-sec93-115.xml>

<sup>11</sup> See: <https://www.gpo.gov/fdsys/pkg/CFR-2014-title40-vol20/xml/CFR-2014-title40-vol20-sec93-109.xml>

<sup>12</sup> See: <http://www.mwcog.org/transportation/tpb/>.

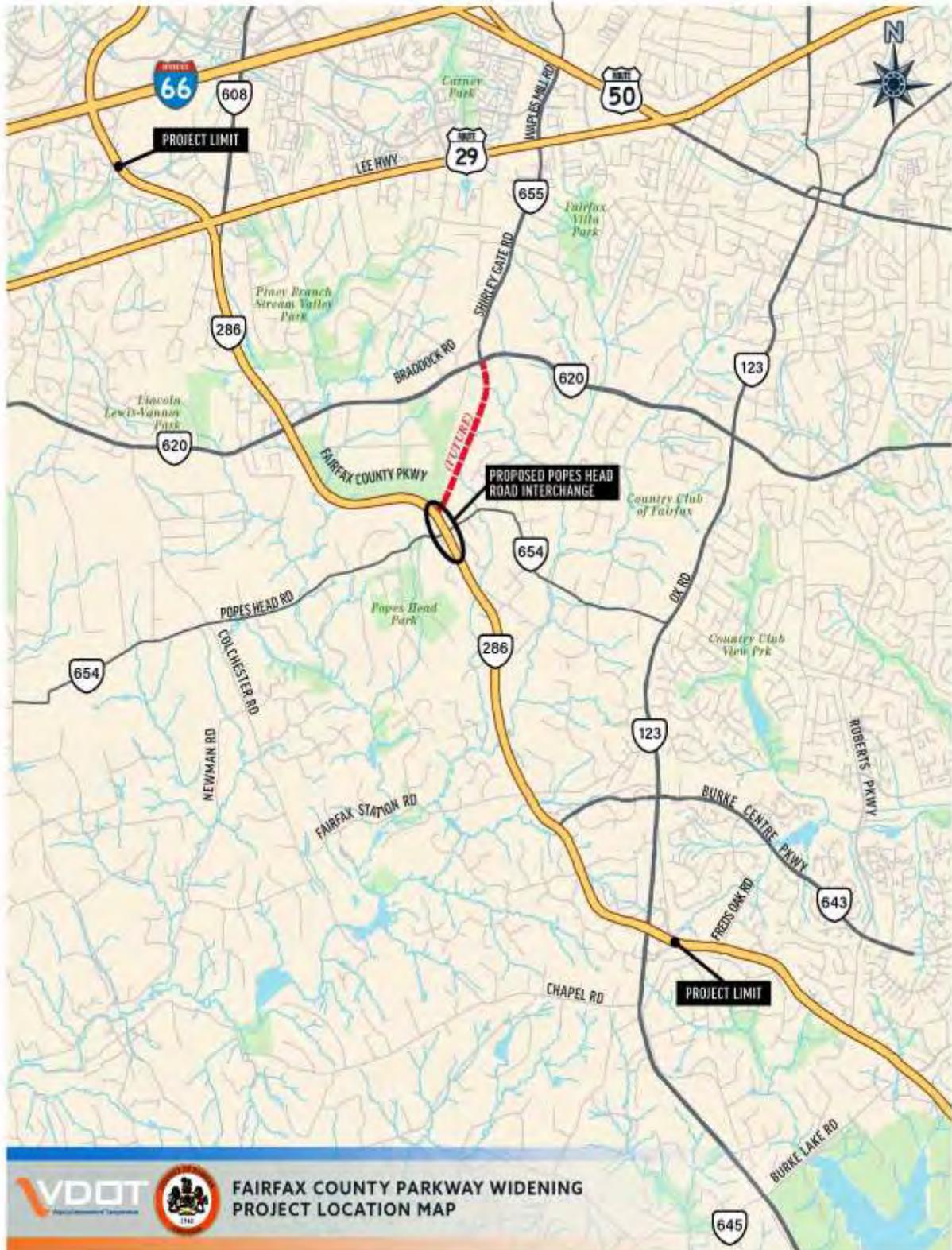
# 1.0 Project Background

## 1.1 Project Description

The Virginia Department of Transportation (VDOT) has initiated a study to evaluate improvements to widen Fairfax County Parkway (Route 286) from north of US Route 29 (Lee Highway) to Route 123 (Ox Road). The proposed improvements consist of widening Fairfax County Parkway from four lanes to six lanes and a new interchange to consolidate the Popes Head Road and future Shirley Gate Road. The proposed project would include the extension of the Fairfax County Parkway Trail, modification or elimination of all intersections along the corridor, and minor improvements at the Fairfax County Parkway at Route 123 interchange. The intersections that would be modified include Fairfax County Parkway at Ladue's End Lane/Nomes Court and at Burke Centre Parkway. The intersections that would be eliminated include Fairfax County Parkway at Popes Head Road and at Colchester Meadow Lane. The interchange at Popes Head Road is funded for construction and is currently planned to be implemented in advance of the widening. Exhibit 1.1.1. and 1.1.2. depict the location of the proposed widening along Fairfax County Parkway. Detailed, preliminary design plots can be found in Appendix A, including the current preferred alternative at the Pope Head Road location where several different alternatives were investigated to respond to the concerns of various agencies and the public.

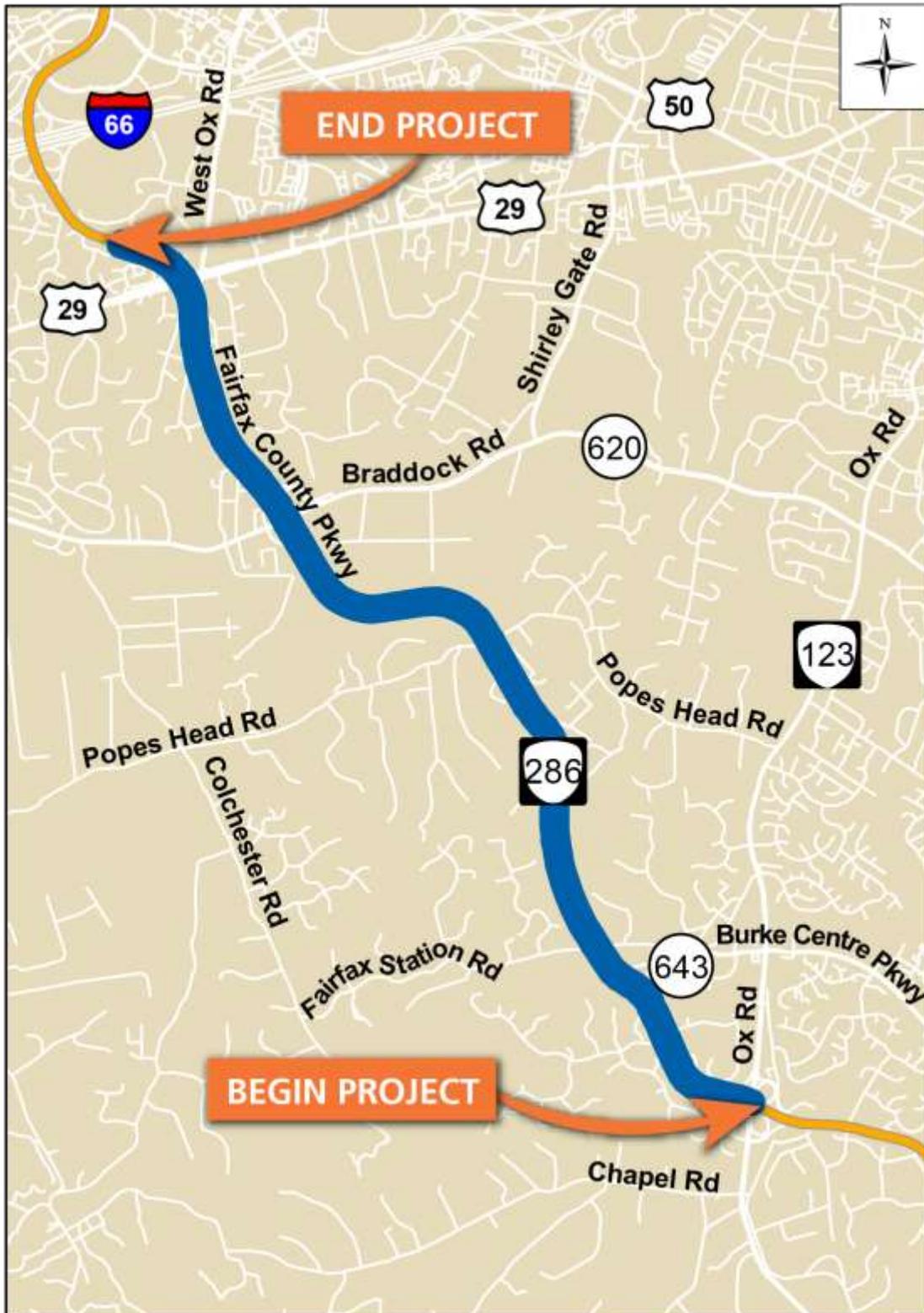
The project area for the proposed roadway spans approximately 1,180 acres in area along the roadway corridor and extends approximately 1,670 feet north of Route 29 near the northern limit of the project and approximately 2,340 feet south of Route 123 near the southern limit of the project. The study area consists primarily of low-density residential. The project area is located in central Fairfax County, approximately 3 miles southwest of the City of Fairfax at the midpoint of the project and 0.5 miles south of I-66 at its northern terminus. Planned land uses in this area include public facilities, private open space, 0.1-0.2 dwelling units (du)/acre (ac), 0.2-0.5 du/ac, 1-2 du/ac, and public parks.

Exhibit 1.1.1: Project Location



Source: VDOT Project Manager

Exhibit 1.1.2: Detailed Project Location Source: VDOT Project Manager



Source: VDOT Project Website, accessed 10/7/2019  
[http://www.virginiadot.org/projects/northernvirginia/ffx\\_co\\_pkwy\\_widening.asp](http://www.virginiadot.org/projects/northernvirginia/ffx_co_pkwy_widening.asp)

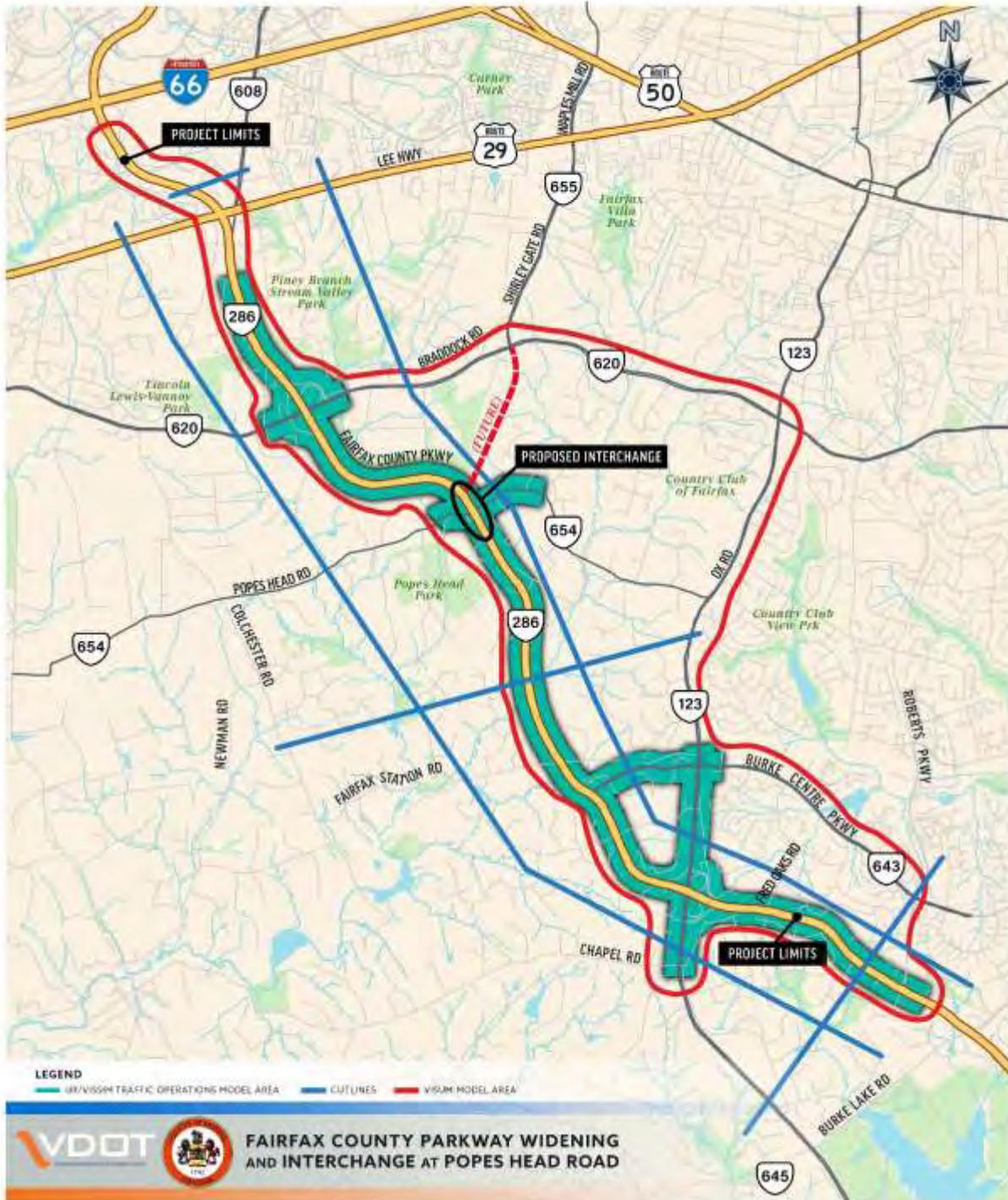
## 1.2 Summary of Traffic Data and Forecasts

Review of the traffic impacts of the Fairfax County Parkway widening project included detailed travel demand forecasting using the Fairfax County Transportation Model (FCTM) and a traffic operations analysis using VISSIM. The initial work was completed to support the Intersection Justification Report (IJR) required for the project. Exhibit 1.2.1 shows the extent of the area evaluated.

Exhibit 1.2.2 presents a summary of base (2016) and design year (2046) average weekday daily traffic (AWDT) forecasts on the Fairfax County Parkway itself. In addition, Appendices B, C and D show the peak hour intersection forecasts for base/calibration, opening and design years: 2016, 2026 and 2046, respectively. As average vehicle emissions are generally anticipated to outpace traffic growth, the 2026 opening year was anticipated the year with highest emissions once the project is in place. The peak mainline AWDT forecast for the design year is 118,500; the corresponding no-build forecast is 107,700, which is about 10.0% lower. The facility is not expected to disproportionately attract or generate truck and heavy-duty vehicle traffic. The traffic study retains the same forecasted truck proportions as is native to the models employed, ranging from 6.1% to 6.8% of daily traffic being trucks.

Copies of the detailed traffic forecast reports are provided in Appendix E to G to this report.

Exhibit 1.2.1: Traffic Study Area and Model Cut-Lines



Source: Memorandum: Development of Future Year Daily and Peak Period Forecasts, Route 286 (Fairfax County Parkway) Widening from north of Route 29 to Route 123 and Interchange at Popes Head Road – Whitman, Reardon and Associates, LLP. April 2018

Exhibit 1.2.2: 2016 and 2046 Forecasted Average Weekday Daily Traffic Volumes

Fairfax County Parkway		2016 AWDT	2046 AWDT	
From	To	Base	No Build	Build
I-66	Lee Hwy	83,000	91,700	99,900
Lee Hwy	Braddock Rd	91,000	107,700	118,500
Braddock Rd	Popes Head Rd	78,000	95,100	109,400
Popes Head Rd	Burke Centre Pkwy	74,000	91,500	116,400
Burke Centre Pkwy	Route 123	67,000	82,800	113,900
Route 123	Roberts Pkwy	51,700	57,800	69,300
Roberts Pkwy	Burke Lake Rd	56,400	64,100	70,700

## 2.0 Regulatory Requirements and Guidance

### 2.1 National Environmental Policy Act of 1969 (NEPA)

Federal requirements for air quality analyses for transportation projects derive from the National Environmental Policy Act (NEPA) and, where applicable, the federal transportation conformity rule (40 CFR Parts 51 and 93). NEPA guidance for air quality analyses for transportation projects may be found on or via the Federal Highway Administration (FHWA) website for planning and the environment<sup>13</sup>.

#### 2.1.1 FHWA Guidance for Implementing NEPA for Air Quality

For purposes of NEPA, general guidance for project-level air quality analyses is provided in the FHWA 1987 Technical Advisory 6640.8A, “*Guidance for Preparing and Processing Environmental and Section 4(f) Documents*”<sup>14</sup>. That guidance focuses on carbon monoxide. FHWA provides separate guidance for mobile source air toxics (MSATs)<sup>15,16</sup>, including responses to “Frequently Asked Questions” (FAQs)<sup>17</sup>.

<sup>13</sup> See: <http://www.fhwa.dot.gov/environment/index.cfm>

<sup>14</sup> See: <https://www.environment.fhwa.dot.gov/projdev/impTA6640.asp>

<sup>15</sup> FHWA, “*INFORMATION: Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents*”, October 18, 2016. See: [http://www.fhwa.dot.gov/environment/air\\_quality/air\\_toxics/](http://www.fhwa.dot.gov/environment/air_quality/air_toxics/)

<sup>16</sup> See: [http://www.fhwa.dot.gov/environment/air\\_quality/air\\_toxics/policy\\_and\\_guidance/](http://www.fhwa.dot.gov/environment/air_quality/air_toxics/policy_and_guidance/)

<sup>17</sup> See: [https://www.fhwa.dot.gov/environment/air\\_quality/air\\_toxics/policy\\_and\\_guidance/moves\\_msat\\_faq.cfm](https://www.fhwa.dot.gov/environment/air_quality/air_toxics/policy_and_guidance/moves_msat_faq.cfm)

## 2.1.2 Programmatic Agreements

In order to streamline the preparation of project-level air quality analyses conducted for purposes of NEPA, VDOT has implemented several programmatic agreements with FHWA. Copies of current agreements are available on the VDOT website<sup>18</sup>.

### 2.1.2.1 Project-Level Air Quality Analyses for Carbon Monoxide

In 2016, FHWA and VDOT executed the “*Programmatic Agreement for Project-Level Air Quality Analyses for Carbon Monoxide*” (2016 FHWA-VDOT PA, or 2016 PA), updating the prior (2009) PA. It specifies technical criteria for determining whether project-specific modeling for carbon monoxide will be needed and was developed based on templates originally created in the 2015 NCHRP study “*Programmatic Agreements for Project-Level Air Quality Analyses*”<sup>19</sup>. As the NCHRP template did not include skewed intersections, the 2016 FHWA-VDOT PA incorporates by reference the thresholds that were established for skewed intersections in the 2009 FHWA-VDOT PA. It is noteworthy that the 2015 NCHRP study report specifically acknowledged that its national-level templates were modeled on the 2009 FHWA-VDOT PA<sup>20</sup>.

The 2009 FHWA-VDOT “*Project-Level Carbon Monoxide Air Quality Studies Agreement*”<sup>21</sup> (2009 PA) was based on the results of extensive modeling of worst-case analyses, which are presented in a separate Technical Support Document<sup>22</sup>. The 2009 PA incorporated new technical criteria and thresholds (based on the worst-case modeling results) and represented a major update to prior agreements executed in 2004<sup>23</sup> and 2000<sup>24</sup>.

### 2.1.2.2 No-Build Analysis Agreement for Air and Noise Studies

On May 22, 2009, FHWA and VDOT executed a “*No-Build Analysis Agreement for Air and Noise Studies*” (2009 No-Build Agreement)<sup>25</sup>. With regard to air quality, the 2009 No-Build Agreement only addresses CO. It requires:

...for transportation projects within the Commonwealth of Virginia that require a carbon monoxide (CO) air study under the current Project-Level CO Air Quality Studies Agreement in

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<sup>18</sup> See: [http://www.virginiadot.org/projects/environmental\\_air\\_section.asp](http://www.virginiadot.org/projects/environmental_air_section.asp)

<sup>19</sup> ICF International, Zamurs and Associates LLC, and Volpe Transportation Systems Center, “Programmatic Agreements for Project-Level Air Quality Analyses”, NCHRP 25-25 (78), 2015. <http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=3311>

<sup>20</sup> *Ibid*, page x.

<sup>21</sup> “*Project-Level Carbon Monoxide Air Quality Studies Agreement*”, FHWA-VDOT letter agreement executed February 27, 2009.

<sup>22</sup> “*FHWA-VDOT Agreement On Project-Level Carbon Monoxide Air Quality Studies - Technical Support Document*”, February 2009.

<sup>23</sup> FHWA-VDOT, “*Project Level Air Quality Studies Agreement*”, letter dated August 4, 2004 from FHWA to VDOT.

<sup>24</sup> FHWA-VDOT, “*VDOT request to raise the ADT threshold at which quantitative project-level carbon monoxide analyses are conducted*”, letter dated August 7, 2000.

<sup>25</sup> FHWA-VDOT, “*No-Build Analysis Agreement for Air and Noise Studies*”, letter dated May 22, 2009.

effect between VDOT and FHWA, the following will govern the need for analysis of the interim and design year no-build alternatives in CO air studies:

A. Any project that qualifies for a Categorical Exclusion (CE) will be exempt from analysis of the no-build alternatives, although VDOT may choose to analyze the no-build alternatives if they determine it appropriate;

B. Any project that qualifies for an Environmental Assessment (EA) will generally be exempt from analysis of the no-build alternatives, although VDOT may choose to analyze the no-build alternatives if they determine it appropriate;

C. Any project that qualifies for an Environmental Impact Statement (EIS) will require analysis of the no-build alternative; ...

## 2.2 Transportation Conformity

The US Environmental Protection Agency (US EPA) issued the federal transportation conformity rule (40 CFR Parts 51 and 93) pursuant to requirements in the Clean Air Act (CAA) as amended<sup>26,27</sup>. Copies of the EPA conformity regulation and associated guidance are available on the EPA website<sup>28</sup>. In general, the rule requires 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 nonattainment or has a maintenance plan” (40 CFR 93.102(b))<sup>29</sup>.

### 2.2.1 Project-Inclusion in Regional Transportation Plans and Programs

For projects in nonattainment or maintenance areas, the federal transportation conformity rule requires a currently conforming transportation plan and program at the time of project approval (40 CFR 93.114)<sup>30</sup> and for the project to be from a conforming plan and program (40 CFR 93.115)<sup>31</sup>. If the project is of a type that is not required to be specifically identified in the plan, the project must be consistent with the policies and purpose of the transportation plan and not interfere with other projects specifically included in the transportation plan (40 CFR 93.115(b)).

Additionally, the design concept and scope of the project as specified in the program at the time of the regional conformity determination should be adequate to determine its contribution to regional emissions, and any mitigation measures associated with the project should have written commitments from the project sponsor and/or operator (40 CFR 93.115(c)).

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<sup>26</sup> See: <http://www.epa.gov/air/caa/>.

<sup>27</sup> While corresponding state regulations for transportation conformity may apply, they generally focus on consultation requirements (rather than technical) and are therefore not addressed here. See: <http://law.lis.virginia.gov/admincode/title9/agency5/chapter151/>

<sup>28</sup> See: <http://www.epa.gov/otaq/stateresources/transconf/index.htm>

<sup>29</sup> See Sections 3.1-3.2 for more information on nonattainment and maintenance areas and the attainment status of the project area.

<sup>30</sup> See: <https://www.gpo.gov/fdsys/pkg/CFR-2014-title40-vol20/xml/CFR-2014-title40-vol20-sec93-114.xml>

<sup>31</sup> See: <https://www.gpo.gov/fdsys/pkg/CFR-2014-title40-vol20/xml/CFR-2014-title40-vol20-sec93-115.xml>

## 2.2.2 FHWA Categorical Finding for Carbon Monoxide

The federal transportation conformity rule at 40 CFR 93.123(a)(3) provides an option for the US Department of Transportation (US DOT), in consultation with EPA, to make a categorical hot-spot finding for CO based on appropriate modeling. In February 2014, the FHWA implemented a new categorical finding for CO, which they developed in consultation and cooperation with EPA. The FHWA updated the finding in 2017<sup>32</sup>. In concept, the FHWA categorical finding serves effectively the same purpose for conformity purposes as a programmatic agreement does for NEPA. Note, under the terms of the 2016 FHWA-VDOT PA previously referenced and/or the VDOT Resource Document (via the protocol stated in Sections 3.22 & 4.2.3), and although Virginia no longer has a maintenance area for CO, the federal categorical finding for CO may still be applied for NEPA purposes at the discretion of the Department.

## 3.0 Ambient Air Quality

### 3.1 National Ambient Air Quality Standards (NAAQS)

Exhibit 3.1.1 presents the national ambient air quality standards (NAAQS) established by the EPA for criteria air pollutants, namely: carbon monoxide (CO), sulfur dioxide (SO<sub>2</sub>), ozone (O<sub>3</sub>), particulate matter (PM), nitrogen dioxide (NO<sub>2</sub>), and lead (Pb). There are two types of NAAQS—primary and secondary: *“Primary standards provide public health protection, including protecting the health of “sensitive” populations such as asthmatics, children, and the elderly. Secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings.”*<sup>33</sup>

Areas that have never been designated by EPA as nonattainment for one or more of the NAAQS are classified as attainment areas, while areas that do not meet one or more of the NAAQS may be designated by EPA as nonattainment areas for that or those criteria pollutants. Areas that have failed to meet the NAAQS in the past but have since re-attained them may be re-designated as attainment (maintenance) areas, which are commonly referred to as maintenance areas.

Note EPA revoked the 1997 annual primary PM<sub>2.5</sub> NAAQS effective October 24, 2016 with the implementation of the 2012 PM<sub>2.5</sub> NAAQS<sup>34</sup>. With that revocation, conformity requirements were eliminated for northern Virginia for PM<sub>2.5</sub>, which had been in maintenance for that pollutant.

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<sup>32</sup> See: [https://www.fhwa.dot.gov/environment/air\\_quality/conformity/policy\\_and\\_guidance/cmcf\\_2017/index.cfm](https://www.fhwa.dot.gov/environment/air_quality/conformity/policy_and_guidance/cmcf_2017/index.cfm)

<sup>33</sup> From the preamble to the EPA NAAQS table: <https://www.epa.gov/criteria-air-pollutants/naaqs-table>

<sup>34</sup> On August 24, 2016, EPA issued a final rule (81 FR 58010), effective October 24, 2016, on “*Fine Particulate Matter National Ambient Air Quality Standards: State Implementation Plan Requirements*” that stated, in part: “*Additionally, in this document 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.*”

See: <https://www.gpo.gov/fdsys/pkg/FR-2016-08-24/pdf/2016-18768.pdf>.

Exhibit 3.1.1: National Ambient Air Quality Standards (US EPA Tabulation)

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 $\mu\text{g}/\text{m}^3$ <sup>(1)</sup>	Not to be exceeded
Nitrogen Dioxide (NO <sub>2</sub> )		Primary	1 hour	100 ppb	98 <sup>th</sup> percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Primary and secondary	1 year	53 ppb <sup>(2)</sup>	Annual Mean
Ozone (O <sub>3</sub> )		Primary and secondary	8 hours	0.070 ppm <sup>(3)</sup>	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 year
Particle Pollution	PM <sub>2.5</sub>	Primary	1 year	12.0 $\mu\text{g}/\text{m}^3$	Annual mean, averaged over 3 years
		Secondary	1 year	15.0 $\mu\text{g}/\text{m}^3$	Annual mean, averages over 3 years
		Primary and secondary	24 hours	35 $\mu\text{g}/\text{m}^3$	98 <sup>th</sup> percentile, averaged over 3 years
	PM <sub>10</sub>	Primary and secondary	24 hours	150 $\mu\text{g}/\text{m}^3$	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide (SO <sub>2</sub> )		Primary	1 hour	75 ppb <sup>(4)</sup>	99 <sup>th</sup> 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  $\mu\text{g}/\text{m}^3$  as a calendar quarter average) also remain in effect.

(2) The level of the annual NO<sub>2</sub> 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<sub>3</sub> standards additionally remain in effect in some areas. Revocation of the previous (2008) O<sub>3</sub> standards and transitioning to the current (2015) standards will be addressed in the implementation rule for the current standards.

(4) The previous SO<sub>2</sub> 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<sub>2</sub> standards or is not meeting the requirements of a SIP call under the previous SO<sub>2</sub> 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.

Source: Excerpted from: <https://www.epa.gov/criteria-air-pollutants/naaqs-table>, accessed 10/9/2019.

EPA provides the following background information on CO<sup>35</sup>:

*Carbon monoxide (CO) is a colorless, odorless gas emitted from combustion processes. Nationally and, particularly in urban areas, the majority of CO emissions to ambient air come from mobile sources. CO can cause harmful health effects by reducing oxygen delivery to the body's organs (like the heart and brain) and tissues. At extremely high levels, CO can cause death.*

## **3.2 Air Quality Attainment Status of Project Area**

The EPA Green Book<sup>36</sup> lists non-attainment, maintenance, and attainment areas across the nation. It lists the jurisdictions within the area in which the project is located as being in attainment for all of the NAAQS except ozone.

The Virginia Department of Environmental Quality (VDEQ) provides general comments by jurisdiction on proposed projects. With regard to attainment status for the area in which project is located, their comment<sup>37</sup> is:

*This project is located within a Marginal 8-hour Ozone Nonattainment area, and a volatile organic compounds (VOC) and nitrogen oxides (NOx) Emissions Control Area. As such, all reasonable precautions should be taken to limit the emissions of VOC and NOx. 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.*

## **3.3 Air Quality Data and Trends**

### **3.3.1 Carbon Monoxide (CO)**

As shown in Exhibit 3.3.1, and due primarily to the implementation of more stringent vehicle emission and fuel quality standards, the national trend in ambient concentrations of CO is and has been downward for decades. The national trend is reflected in the relatively very low ambient CO concentrations observed in Virginia, as summarized in Exhibits 3.3.2 and 3.3.3. Currently, all values in Virginia are well under the one- and eight-hour NAAQS for CO.

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<sup>35</sup> See: <https://www.epa.gov/co-pollution>

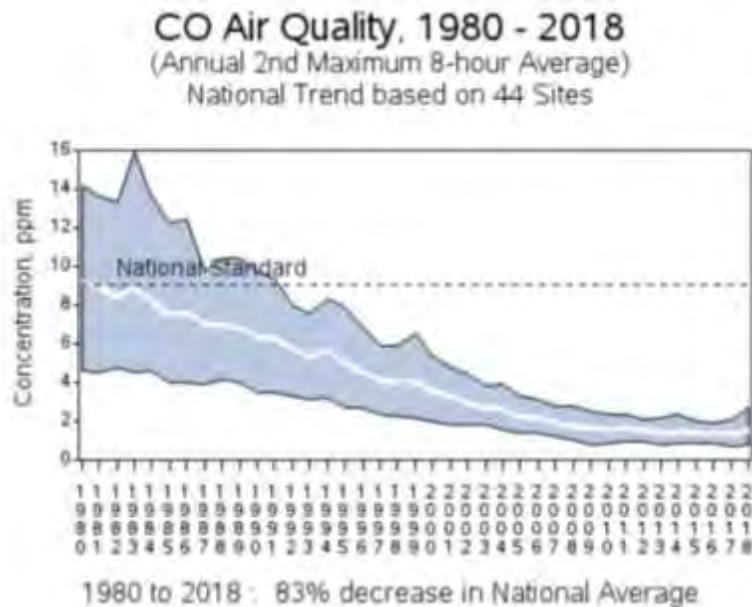
<sup>36</sup> EPA Green Book: <https://www.epa.gov/green-book>

<sup>37</sup> Spreadsheet entitled: "DEQ SERP Comments rev8b", March 2017

### 3.3.2 Other Criteria Pollutants

VDEQ issues an annual report summarizing air quality monitoring data for the previous year and updating long-term trend data for certain of the criteria pollutants tabulated in Exhibit 3.1.1<sup>38</sup>. Exhibits 3.3.3 through 3.3.6 are excerpts from that report showing ambient air quality trends by pollutant over the previous decade. The trend lines are generally flat or downward, reflecting the benefit of emission reduction measures or programs implemented for both mobile sources (e.g., more stringent emission and fuel quality standards) and stationary sources (industry etc.). For these figures, pollutants are measured in parts per million (ppm) or parts per billion (ppb).

Exhibit 3.3.1: Nationwide Long-Term Trend in Ambient CO Concentrations



Source: <https://www.epa.gov/air-trends/carbon-monoxide-trends>, accessed October 7, 2019.

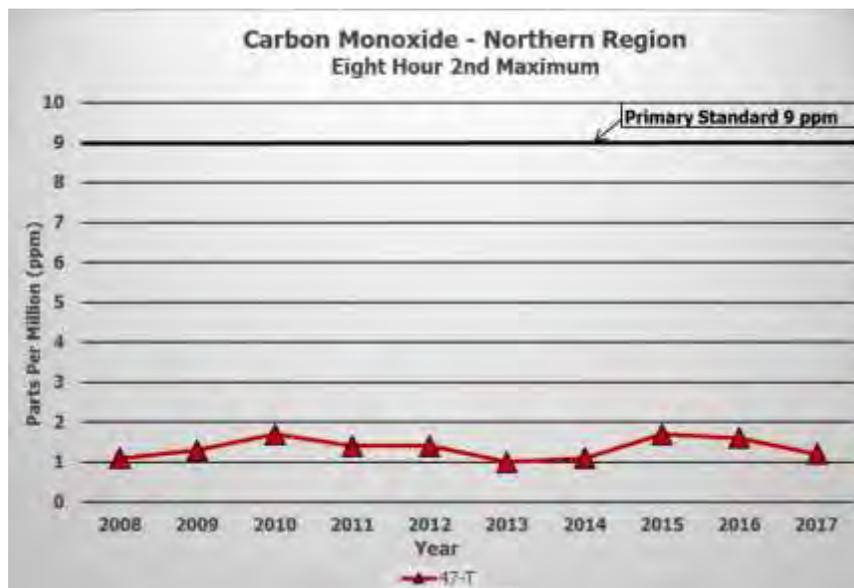
<sup>38</sup> The current edition (2016) of the VDEQ Annual Report does not provide a comparable chart showing recent trend lines for Pb, PM<sub>2.5</sub> or PM<sub>10</sub>.

Exhibit 3.3.2: Ambient Concentrations of Carbon Monoxide in Virginia

Site	2017			
	1-Hour Avg. (ppm)		8-Hour Avg. (ppm)	
	1 <sup>st</sup> Max.	2 <sup>nd</sup> Max.	1 <sup>st</sup> Max.	2 <sup>nd</sup> Max.
(19-A6) Roanoke Co.	1.2	1.0	.8	.7
(72-M) Henrico Co.	1.2	1.1	.9	.8
(158-X) Richmond	1.7	1.5	1.3	1.1
(179-K) Hampton	.9	.8	.6	.6
(181-A1) Norfolk	1.7	1.7	1.3	.9
(46-C2) Fairfax Co.	1.5	1.5	1.1	1.1
(47-T) Arlington Co.	2.1	2.0	1.6	1.2

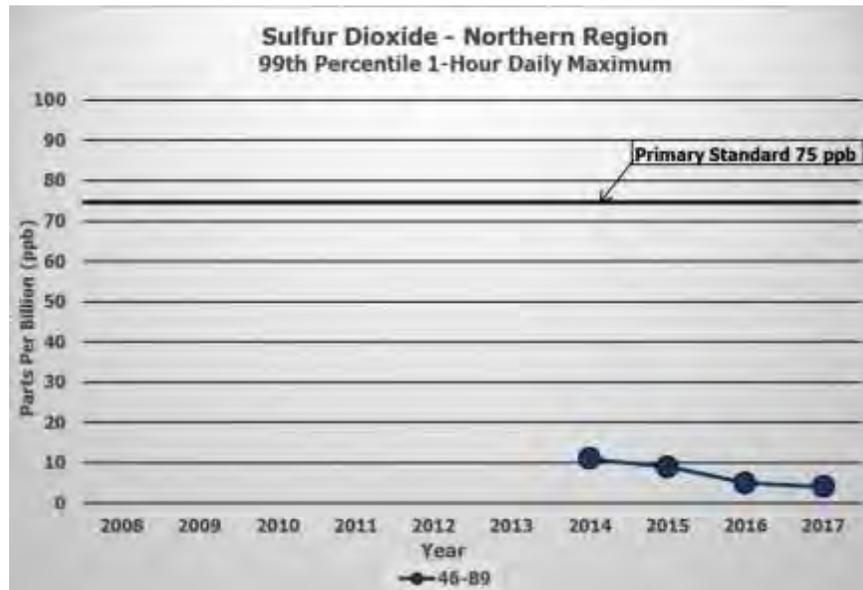
Source: Virginia Department of Environmental Quality, "Virginia Ambient Air Monitoring 2017 Data Report", November 2018. See: <http://www.deq.virginia.gov/Programs/Air/AirMonitoring/Publications.aspx>

Exhibit 3.3.3: Trend in Ambient CO Concentrations



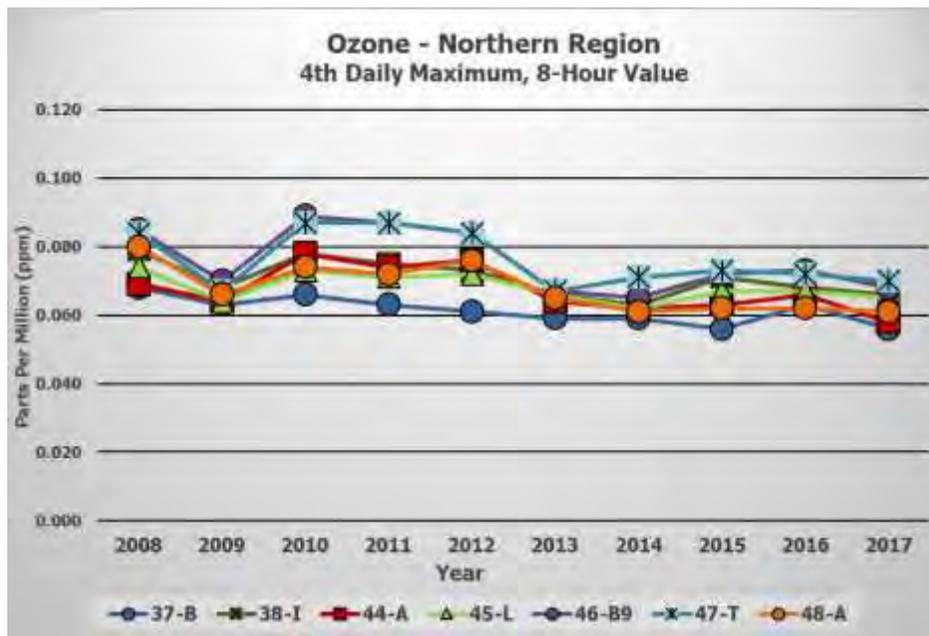
Source: Virginia Department of Environmental Quality, "Virginia Ambient Air Monitoring 2017 Data Report", November 2018. See: <http://www.deq.virginia.gov/Programs/Air/AirMonitoring/Publications.aspx>

Exhibit 3.3.4: Trend for 1-hour Sulfur Dioxide (PPM) – Northern Region



Source: Virginia Department of Environmental Quality, "Virginia Ambient Air Monitoring 2017 Data Report", November 2018. See: <http://www.deq.virginia.gov/Programs/Air/AirMonitoring/Publications.aspx>

Exhibit 3.3.5: Trend for 8-hour Ozone (PPM) – Northern Region



Source: Virginia Department of Environmental Quality, "Virginia Ambient Air Monitoring 2017 Data Report", November 2018. See: <http://www.deq.virginia.gov/Programs/Air/AirMonitoring/Publications.aspx>

## **4.0 Project Assessment**

### **4.1 Application of the VDOT Resource Document**

In 2016, the Department created the “VDOT Resource Document” and associated online data repository to facilitate and streamline the preparation of project-level air quality analyses for purposes of NEPA and conformity<sup>39</sup>. Inter-agency consultation was conducted with FHWA Division and Headquarters and other agencies (including EPA) before the Resource Document was finalized. The Resource Document was updated in 2018 to address changes in applicable regulation and guidance.

With regards to this project, the models, methods/protocols and assumptions as specified or referenced in the VDOT Resource Document were applied without substantive change as defined in that document.

### **4.2 Carbon Monoxide Assessment**

#### **4.2.1 Background**

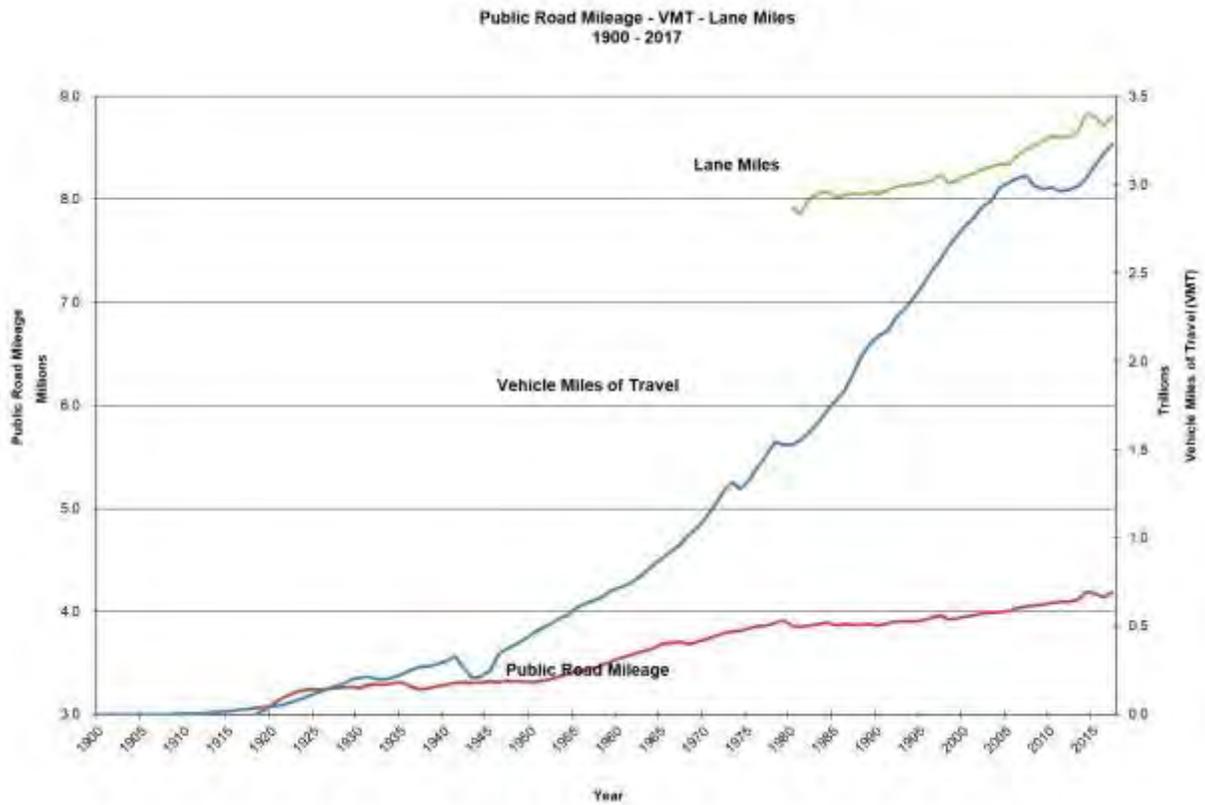
As presented previously (Section 3.3), ambient concentrations of CO both nationally and locally have decreased over the long term to levels well below the applicable NAAQS. This has occurred as a result of improved emission control technology, and despite long-term increases in VMT. That is, the reduced levels of CO are the result of continued fleet turnover to new vehicles constructed to ever more stringent emission standards along with implementation of more stringent fuel quality standards.

Exhibits 4.2.1 and 4.2.2 present, respectively, the long-term trends in vehicle-miles-traveled (VMT) at the national level (public road) and recent trends in VMT and related statistics for Virginia. At the national level, VMT has increased significantly over the past several decades, with local trends generally reflecting the national. Exhibit 4.2.3 presents the increasingly more stringent new vehicle exhaust emission standards for CO as introduced by the US EPA over the past few decades, which served to offset the growth in VMT.

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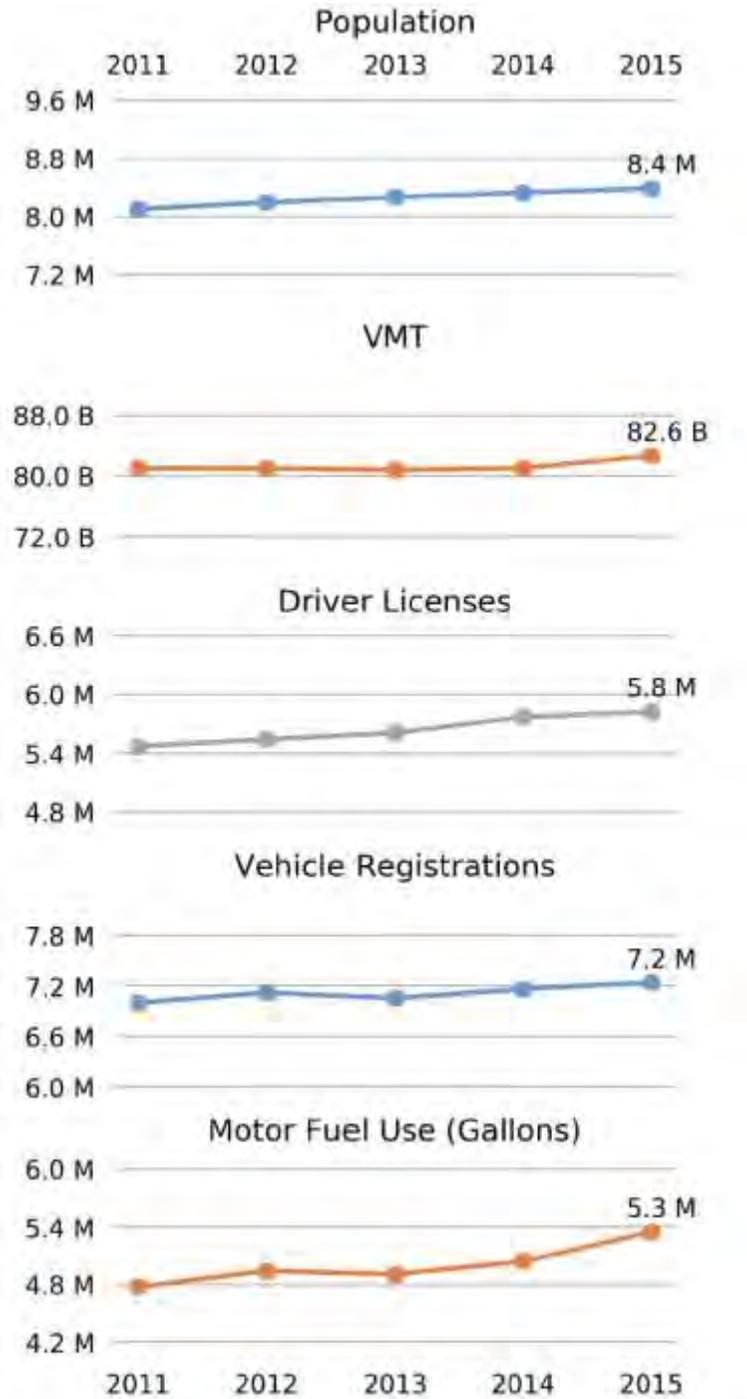
<sup>39</sup> See: [http://www.virginiadot.org/projects/environmental\\_air\\_section.asp](http://www.virginiadot.org/projects/environmental_air_section.asp)

Exhibit 4.2.1: Public Road Mileage, Lane-Miles and Vehicle Miles Traveled (VMT)



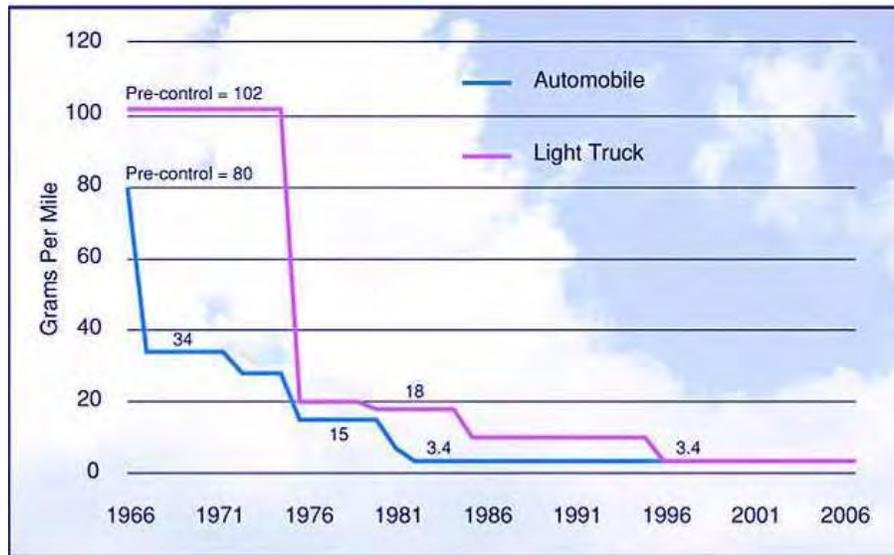
Source: FHWA Office of Highway Policy Information web site, accessed 10/7/2019.  
 See: <https://www.fhwa.dot.gov/policyinformation/statistics/2017/vmt421c.cfm>

Exhibit 4.2.2: Recent Trends in VMT and Related Statistics for Virginia



Source: FHWA Office of Highway Policy Information web site, accessed 10/7/2019.  
[https://www.fhwa.dot.gov/policyinformation/statistics/abstracts/2015/virginia\\_2015.pdf](https://www.fhwa.dot.gov/policyinformation/statistics/abstracts/2015/virginia_2015.pdf)

Exhibit 4.2.3: Federal Emission Standards for CO for New Automobiles and Light Trucks



Source: U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy. Transportation Energy Data Book: Edition 24, ORNL-6973. December 2004.

## 4.2.2 Level of Analysis Determination

### 4.2.2.1 Screening for Quantitative or Qualitative Analysis

The project is neither exempt nor does it meet the criteria for application of either the 2016 FHWA-VDOT PA or the FHWA Categorical Finding for CO. The project however has received significant public input on the development of the preferred design of the Popes Head Road interchange. A quantitative project-specific analysis for CO was determined to be appropriate for this project.

### 4.2.2.2 Application of Other Programmatic Agreements

The 2009 FHWA-VDOT No-Build Agreement (Section 2.1.3.3) may be applied for this project, therefore project-specific modeling of the no-build alternative is not required. The criteria specified in the No-Build Agreement are met for this project given that:

- the project location is not within a maintenance area for CO, and
- an EIS is not planned.

## 4.2.3 Worst-Case Modeling Overview

A worst-case modeling approach was applied for this analysis. This is a very conservative approach that by design uses worst-case assumptions for modeling inputs so that the results (modeling estimates for emissions and ambient concentrations) will be significantly worse than (i.e., in excess of) what may reasonably be expected for the project. If the applicable NAAQS for CO are still met despite the worst-case modeling assumptions, then there is a high level of confidence that the potential for air quality impacts from the project would be minimal.

It bears noting that the underlying reason that a worst-case modeling approach may be applied for CO is that emission rates are currently very low as a result of more stringent emission and fuel quality standards. That is, improved fuel quality and continuing turnover nationwide of the on-road motor vehicle fleet to vehicles designed and constructed to meet increasingly more stringent EPA exhaust emissions standards have resulted in a long-term downward trend in emissions. As a result of the reduced emissions, the long-term trend in ambient concentrations for CO has also been steadily downward, despite increasing VMT nationwide and locally. Background concentrations for CO are now very low and well under the NAAQS, both nationwide and in Virginia.

All modeling for this project was conducted consistent with applicable federal requirements and guidance (as referenced in Section 2) as well as the VDOT Resource Document. Note the more detailed EPA guidance, which was applied for this project, is strictly only required for conformity applications.

#### **4.2.4 Traffic Data and Forecasts for the CO Analysis**

A traffic analysis was completed for this project and the results were applied to this air quality analysis. Traffic forecasts were developed for existing, 2016 baseline conditions, as well as both no-build and build scenarios for the Interim/Opening Year (2026) and the Design Year (2046). The resulting traffic volume forecasts were used in selecting the worst-case intersections to be analyzed.

A detailed effort was undertaken as part of the traffic analysis to identify all intersections that were likely significantly impacted by the project. A total of 9 intersections were identified by the traffic team and are shown in Exhibit 4.2.4. While there are interchanges in the corridor, they are freeway to arterial in nature and all of which are anticipated to operate without delay. The absence of delays at the interchanges meant that the air quality evaluation focused on intersections as the critical locations. The intersections analyzed 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 VISSIM 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 process used for this study is as specified in EPA guidance<sup>40,41</sup>:

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<sup>40</sup> EPA guidance was applied (directly or modified, e.g., to rank only the top ten intersections) 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.

<sup>41</sup> “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](http://www.epa.gov/scram001/guidance/guide/coguide.pdf).

1. Rank the top intersections by traffic volumes, up to 20;
2. Calculate the Level-of-Service (LOS) for the top 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.

Exhibit 4.2.4: Study Intersections Considered for CO Modeling

Signalized Intersection	2046 Build		
	Vol.	LOS	Delay *
Route 123 & Fairfax County Pkwy SB Ramps/ Robert Carter Rd	5,577	F	80
Fairfax County Pkwy & Roberts Pkwy/ Karmich St	5,571	E	67
Route 123 & Chapel Rd	5,631	≤C	27
Burke Centre Pkwy & Route 123	4,227	≤C	33
Fairfax Co Pkwy SB Ramps & Braddock Rd	4,227	≤C	17
Fairfax County Pkwy & Burke Centre Pkwy	3,692	≤C	27
Fairfax Co Pkwy NB Ramps & Braddock Rd	3,575	≤C	13
Route 123 & Clara Barton Dr	2,313	≤C	8
Route 123 & Fairfax County Pkwy NB Ramps	2,063	≤C	10

It is assumed that if the selected worst-case intersections do not show an exceedance of the NAAQS, then none of the ranked intersections will. This assumes 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 (i.e., background concentration) 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.

Exhibit 4.2.5 shows the volumes and measures of effectiveness used to rank the intersections in order to identify the worst-case locations. The three locations of interests were the following intersections:

- Route 123 & Fairfax County Pkwy SB Ramps/ Robert Carter Rd
- Fairfax County Pkwy & Roberts Pkwy/ Karmich St
- Route 123 & Chapel Rd

Of these intersections, only the first two were found to have LOS of D or worse. Generally, CO analyses need not be performed for intersections showing levels of service C or better as per the FHWA guidance on the topic. An air quality analysis at these two (2) locations was deemed sufficient as a new exceedance of the standard is highly improbable elsewhere in the study area.

Exhibit 4.2.6 below compares the assumed worst-case traffic volumes (which are consistent with the values specified in the VDOT Resource Document) to the forecasts developed by the project team for the Fairfax County Parkway. The forecast volumes are substantially lower than the assumed worst-case volumes in each scenario.

#### **4.2.5 Alternatives Modeled**

There is only one preferred alternative for this study. While there are detailed projections of the expected traffic volumes at each of the worst-case intersections, a worst-case analysis was performed with traffic volumes set to the maximum throughput, as suggested in the VDOT Project-Level Resource Document. Analysis was done for the opening year (2026) and the design year (2046) of the project.

#### **4.2.6 Worst-Case Modeling Configuration**

The two intersections identified as the worst-case locations remain relatively unchanged from the current configuration in all future year scenarios, both the build and no-build. The lack of meaningful improvements (due to project constraints) explains in part their relatively poor performance. As noted earlier all other intersections are forecasted to operate at LOS A-C, and as such need no further evaluation to ensure no new additional exceedances of the CO NAAQS will occur in the project area. As the project is high profile, a quantitative assessment utilizing worst-case assumptions was completed to help allay any concerns regarding adverse air quality impacts.

As the two intersections will remain unchanged, and as there is only one preferred alternative being pursued at this time, the worst-case modeling configurations at these locations would be as follows:

- At both locations, 4-lanes in each direction was assumed on the Fairfax County Parkway itself, 3-through/through-&-right lanes plus an additional lane to account for the left turn storage lanes.
- The cross-streets were modeled as 3 lanes all directions.
- Volumes per lane were set to 1230 vehicles/hour/lane. This far exceeds all the forecasted traffic volumes.
- Grades were set to +5% on all approaches, and 0% on all departures. While this combination of grades is unlikely, 0% departure grades have higher emissions than the -5% one would normally expect. This combination yields a conservative estimate of overall emission and is recommended in cases where grades are unknown. When compared to the available grades in the preliminary design work, this combination will lead to higher emissions being calculated than if actual grades (where known) were used.
- Speeds were assumed to be 45 MPH in all directions as, for the MOVES modeling undertaken for this project, this yielded the highest emission rates among average speeds analyzed (25, 35 and 45 MPH.)

Exhibit 4.2.5: PM Peak Hour Volumes, Delay, and Level of Service (LOS) at Intersections

Signalized Intersection	2016 Existing			2026 No-Build			2026 Build			2046 No-Build			2046 Build		
	Vol.	LOS	Delay*	Vol.	LOS	Delay*	Vol.	LOS	Delay*	Vol.	LOS	Delay*	Vol.	LOS	Delay*
Route 123 & Fairfax County Pkwy SB Ramps/ Robert Carter Rd	3744	E	62	3970	F	117	4333	D	49	4812	F	148	5577	F	80
Fairfax County Pkwy & Roberts Pkwy/ Karmich St	4778	<C	26	5017	<C	27	5497	E	71	4703	<C	33	5571	E	67
Route 123 & Chapel Rd	3652	<C	16	3864	F	130	4233	<C	22	4723	<C	27	5631	<C	27
Burke Centre Pkwy & Route 123	4010	<C	34	4289	<C	34	3590	<C	33	5154	<C	34	4227	<C	33
Fairfax Co Pkwy SB Ramps & Braddock Rd	3768	E	57	3834	E	63	3891	<C	17	3959	E	67	4227	<C	17
Fairfax County Pkwy & Burke Centre Pkwy	5883	<C	27	6150	E	69	4175	<C	17	5645	F	306	3692	<C	27
Fairfax Co Pkwy NB Ramps & Braddock Rd	3345	<C	14	3258	<C	13	3139	<C	12	3590	<C	13	3575	<C	13
Route 123 & Clara Barton Dr	2647	<C	8	2705	<C	8	2035	<C	9	3416	<C	7	2313	<C	8
Route 123 & Fairfax County Pkwy NB Ramps	2346	<C	7	2424	<C	8	1687	<C	5	3148	<C	9	2063	<C	10

\*Delay is in seconds per vehicle

HIGHLIGHTED CELLS ARE THE 3 WORST-CASE INTERSECTIONS.

Exhibit 4.2.6: Comparison of Project Forecasts for Peak Hour Traffic Volumes and VDOT Resource Document Worst-Case Volumes as Applied for the CO Worst-Case Analysis

Location	Peak Hour Forecast Traffic Volumes			Worst-Case Volumes for CO Screening			
	2016	2026	2046	Volume	% Difference		
					2015	2020	2040
Route 123 & Fairfax County Pkwy SB Ramps/ Robert Carter Rd	3,744	4,333	5,577	17,220	460%	397%	309%
Fairfax County Pkwy & Roberts Pkwy/ Karmich St	4,778	5,497	5,571	17,220	360%	313%	309%

## 4.2.7 Emission Modeling

Modeling inputs are summarized in this section, with a summary of the key worst-case assumptions provided at the end. Appendix B provides additional background on modeling inputs as applied in this analysis.

### 4.2.7.1 Model Selection

The current official EPA emission model, MOVES2014b, was applied for this analysis<sup>42</sup>. It is the most recent and up-to-date version of the software from EPA.

### 4.2.7.2 Mapping of MOVES Model Vehicle and Road Types

For reference, Exhibit 4.2.8 presents the mapping for vehicle types between the MOVES model and the Highway Performance Monitoring System (HPMS). Exhibit 4.2.9 presents the corresponding mapping for road types between the MOVES model and federal functional classes.

### 4.2.7.3 MOVES Model Input Summary

Exhibit 4.2.10(a) and (b) present a summary of data and data sources for MOVES model inputs for the main screen and the project data manager respectively, as applied for the worst-case emission factor modeling for this project. As noted above, all modeling inputs were taken from or otherwise made consistent with those specified or referenced in the VDOT Resource Document<sup>43</sup>, which includes data from the NCRTPB Air Quality Conformity Determination for the Visualize 2045 Long Range Transportation Plan and Fiscal Year 2019-2024 Transportation

<sup>42</sup> See: <https://www.epa.gov/moves>

<sup>43</sup> The tables are based on the one presented in Appendix E1 of the VDOT Resource Document (2016),

Improvement Program (Visualize 2045 Conformity Analysis). Note that the default files were available for 2025 and 2045, which did not correspond to the actual opening (2026) and design (2046) years of the project. Interpolating the inputs to 2026 and 2046 would introduce variability into the analysis without increasing the precision. In addition, average emission rates are forecasted to trend downwards over time as older vehicles meeting less stringent standards are retired and replaced with cleaner vehicles. As such, 2025 and 2045 emissions rates were used as a surrogate for 2026 and 2046, respectively, to simplify the development of inputs for the MOVES model. This was considered to be a conservative worst-case assumption, as the 2026 and 2046 emissions rates would be lower. Hour 5:00-5:59p.m. was selected in MOVES modeling to represent PM peak hour scenario as PM peak hour has higher traffic volumes than AM peak hour, thus representing the worse-case traffic condition.

A representative example of a MOVES run specification file as applied in this project is provided in Appendix H.

Exhibit 4.2.8: MOVES Source Types and HPMS Vehicle Types

<b>MOVES Source Types and HPMS Vehicle Types</b>			
<b>Source Type ID</b>	<b>Source Types</b>	<b>HPMS Vehicle Type ID</b>	<b>HPMS Vehicle Type</b>
11	Motorcycle	10	Motorcycles
21	Passenger Car	25	Light Duty Vehicles Short and Long Wheelbase
31	Passenger Truck		
32	Light Commercial Truck		
41	Intercity Bus	40	Buses
42	Transit Bus		
43	School Bus		
51	Refuse Truck	50	Single Unit Trucks
52	Single Unit Short-haul Truck		
53	Single Unit Long-haul Truck		
54	Motor Home		
61	Combination Short-haul Truck	60	Combination Trucks
62	Combination Long-haul Truck		

Source: Excerpted from US EPA, "MOVES2014 and MOVES2014a Technical Guidance: Using MOVES to Prepare Emission Inventories for State Implementation Plans and Transportation Conformity", EPA-420-B-15-093, November 2015

Exhibit 4.2.9: Road Type Mapping

FFC	Federal Functional Class	MOVES RTypeID	MOVES Road Type
0	Off-Network	1	Off-Network
1	Rural Principal Arterial - Interstate	2	Rural Restricted Access
2	Rural Principal Arterial - Other	3	Rural Unrestricted Access
6	Rural Minor Arterial		
7	Rural Major Collector		
8	Rural Minor Collector		
9	Rural Local System		
11	Urban Principal Arterial - Interstate	4	Urban Restricted Access
12	Urban Principal Arterial - Other Freeways or Expressways		
14	Urban Principal Arterial - Other	5	Urban Unrestricted Access
16	Urban Minor Arterial		
17	Urban Collector		
19	Urban Local System		

Exhibit 4.2.10 (a): MOVES Input Summary for CO – Main Screen

Parameter	MOVES Input
Scale	Project
Time Spans	<u>MOVES Time Aggregation</u> Level: Hour <u>Years</u> : Opening (2025), and Horizon (2045) <u>Month, Day &amp; Hour</u> : January, Weekday, 5:00-5:59 p.m.
Geographic Bounds	Fairfax County, VA
Vehicles/Equipment	Consistent with those files specified in the MOVES2014a files from Visualize 2045 Air Quality Conformity Analysis for Fairfax County
Road Types	Urban Unrestricted Access
Pollutants and Processes	CO Exhaust and Crankcase Exhaust (running emissions only)
Output	<u>Units</u> : grams, joules, and miles
Emission Factor Script	CO_CAL3QHC_EF.sql (EPA)

Exhibit 4.2.10 (b): MOVES Input Summary for CO – Project Data Manager

Hoteling	MOVES Defaults
I/M Programs	Consistent with the MOVES2014a files from Visualize 2045 Air Quality Conformity Analysis for Fairfax County
Retrofit Data	MOVES Defaults
Age (Vehicle Registration) Distributions	Consistent with the MOVES2014a files from Visualize 2045 Air Quality Conformity Analysis for Fairfax County
Fuels	Consistent with the MOVES2014a files from Visualize 2045 Air Quality Conformity Analysis for Fairfax County
Meteorology Data	Consistent with the MOVES2014a files from Visualize 2045 Air Quality Conformity Analysis for Fairfax County
Links	Generic links including: <i>a.</i> Idle links: assume average speed 0, average road grades from 5% to -5% with 1 degree increment, and MOVES road type 5 (urban unrestricted road type) <i>b.</i> Free flow links: assume average speed from 25mph to 45mph with 5 mph increment, average road grades from 5% to -5% with 1 degree increment, and MOVES road type 5 (urban unrestricted road type)
Link Source Type Hour Fraction	Estimated from source type population MOVES2014a inputs consistent with the Visualize 2045 Air Quality Conformity Analysis for Fairfax County
Link Drive Schedule (optional)	Not applied.
Operating Mode Distribution (optional)	
Off-Network	Not applicable

#### 4.2.7.4 Modeling Results for Emission Factors

Exhibit 4.2.11 presents the final set of emission factors that were generated using MOVES2014b and applied for dispersion modeling for the worst-case analyses for this project. For purposes of worst-case modeling, 5% grades exceed those in the preliminary design, making them conservative. Also, 2025 and 2045 are one year earlier than the 2026 opening year and the 2046 design year, respectively. As average emission rates are anticipated to decrease over time, the emissions rates used are slightly higher than if the rates for the exact years were developed. Since the MOVES input files for 2025 and 2045 were readily available, it was decided to develop these slight higher rates rather than interpolate the inputs.

For reference, Appendix H provides detailed exhibits that present the modeled emission factors for this project as a function of average speed and average road grade for local streets (urban unrestricted access facilities), for each of the project opening and design years respectively. For this project, emission factors were taken directly from the modeling results. Note modeled emissions are sensitive to both speed and average road grade.

Exhibit 4.2.11: MOVES Fleet Average Worst-Case CO Emission Factors Summary

MOVES Road Type	Speed (mph)	Emission Factor (g/mi)*		Road Grade (%)
		2025	2045	
5	Idle	4.50	1.92	-
5	45	4.48	2.11	5

\*Grams per vehicle hour for idle operation

## 4.2.8 Dispersion Modeling

Worst-case modeling inputs for dispersion modeling are summarized in this section. Appendix B provides detailed dispersion (and emission) modeling inputs for CO as applied in this analysis.

### 4.2.8.1 Model Selection

The current official EPA emission model, CAL3QHC, was applied for this analysis<sup>44</sup>. Consistent with the VDOT Resource Document, a graphical user interface (*Cal3i*) was applied to streamline the file preparation and modeling process. *Cal3i* was developed by FHWA and its predecessor *Cal3Interface* was initially released in December 2006, with subsequent periodic updates. By assisting modelers in specifying appropriate inputs for worst-case scenario modeling and screening analyses, the FHWA software interface helps guide and streamline the modeling process, improve quality control and assurance, and minimize time and costs for modeling<sup>45</sup>.

### 4.2.8.2 CAL3QHC Modeling Inputs

Exhibit 4.2.12 presents the worst-case modeling inputs applied for this analysis. As noted with the table, the inputs were taken from or made consistent with those specified in the VDOT Resource Document. Sample copies of CAL3QHC input files and output files (generated using CAL3i) are provided in Appendix I to this report.

<sup>44</sup> CAL3QHC may be applied for screening analyses for CO, per Section 4.2.3.1(b) of “Revisions to the Guideline on Air Quality Models: Enhancements to the AERMOD Dispersion Modeling System and Incorporation of Approaches to Address Ozone and Fine Particulate Matter”. See: <https://www.gpo.gov/fdsys/pkg/FR-2017-01-17/pdf/2016-31747.pdf>

<sup>45</sup> FHWA develops and maintains graphical user interface software to facilitate and streamline dispersion modeling for state DOTs and other users. *Cal3Interface* was originally designed as a user-friendly interface model for the US EPA CALINE3 and CAL3QHC models. It was released in December 2006 and has been updated periodically since. The latest version (“*Cal3i*”) is based upon their initial version and includes significant new features and enhancements. For more background on the *Cal3Interface* model and the FHWA worst-case scenario modeling guidance, see:

- M. Claggett (FHWA), “CAL3Interface – A Graphical User Interface for the CALINE3 and CAL3QHC Highway Air Quality Models”, ca 2006.
- M. Claggett (FHWA), “Update of FHWA’s Cal3Interface – A Graphical User Interface for the CALINE3 and CAL3QHC Highway Air Quality Models”, ca 2008

Receptor locations (geographical locations or points for which CO concentrations are estimated with the model) were generally determined following EPA guidance as incorporated into the FHWA Cal3i software package. For worst-case modeling purposes, all receptors were located along the default right-of-way edge. The receptors were located:

- at the corners of the roadway intersections or crossings (i.e., at the intersection of the right-of-way edges);
- along each side of the intersecting roadways at 82 feet (25 meters) and 164 feet (50 meters) from the corners (as the segment length permits); and
- at or near the midpoint of each side of the intersecting roadways.

Exhibit 4.2.13 (a) and Exhibit 4.2.13 (b) present the worst-case configuration for the build alternative as modeled for the project. Note, to simplify the modeling and as a conservative (worst-case) approach, turn lanes were treated as full length through and turn lanes. All the lanes would carry worst-case traffic volumes. Receptor locations are shown in the exhibit.

#### **4.2.8.1 Modeling Results for Carbon Monoxide**

Exhibit 4.2.14 presents the forecast maximum concentrations for CO for the worst-case scenarios modeled. All forecasts include background concentrations as noted previously.

As shown in Exhibit 4.2.14, Modeled emissions and maximum concentrations are highest for the project-opening year. For the Route 123 & Fairfax County Pkwy SB Ramps/ Robert Carter Rd intersection, the forecast maximum concentrations for CO reach 4.1 and 3.4 ppm in the project opening year, respectively, against the one- and eight-hour standards of 35 and 9 ppm. The location of the forecast maximum concentration for the intersection is the receptor highlighted in red in Exhibit 4.2.13 (a), located at the northeast corner of the intersection. The forecast peak concentrations drop to 2.9 and 2.4 ppm respectively for the one- and eight-hour standards for the design year.

For the Fairfax County Pkwy & Roberts Pkwy/ Karmich St intersection, the forecast maximum concentrations for CO reach 4.2 and 3.4 ppm in the project opening year, respectively, against the one- and eight-hour standards of 35 and 9 ppm. The location of the forecast maximum concentration for the intersection is the receptor highlighted in red in Exhibit 4.2.13 (b), located at the northeast corner of the intersection. The forecast peak concentrations drop to 2.8 and 2.3 ppm respectively for the one- and eight-hour standards for the design year.

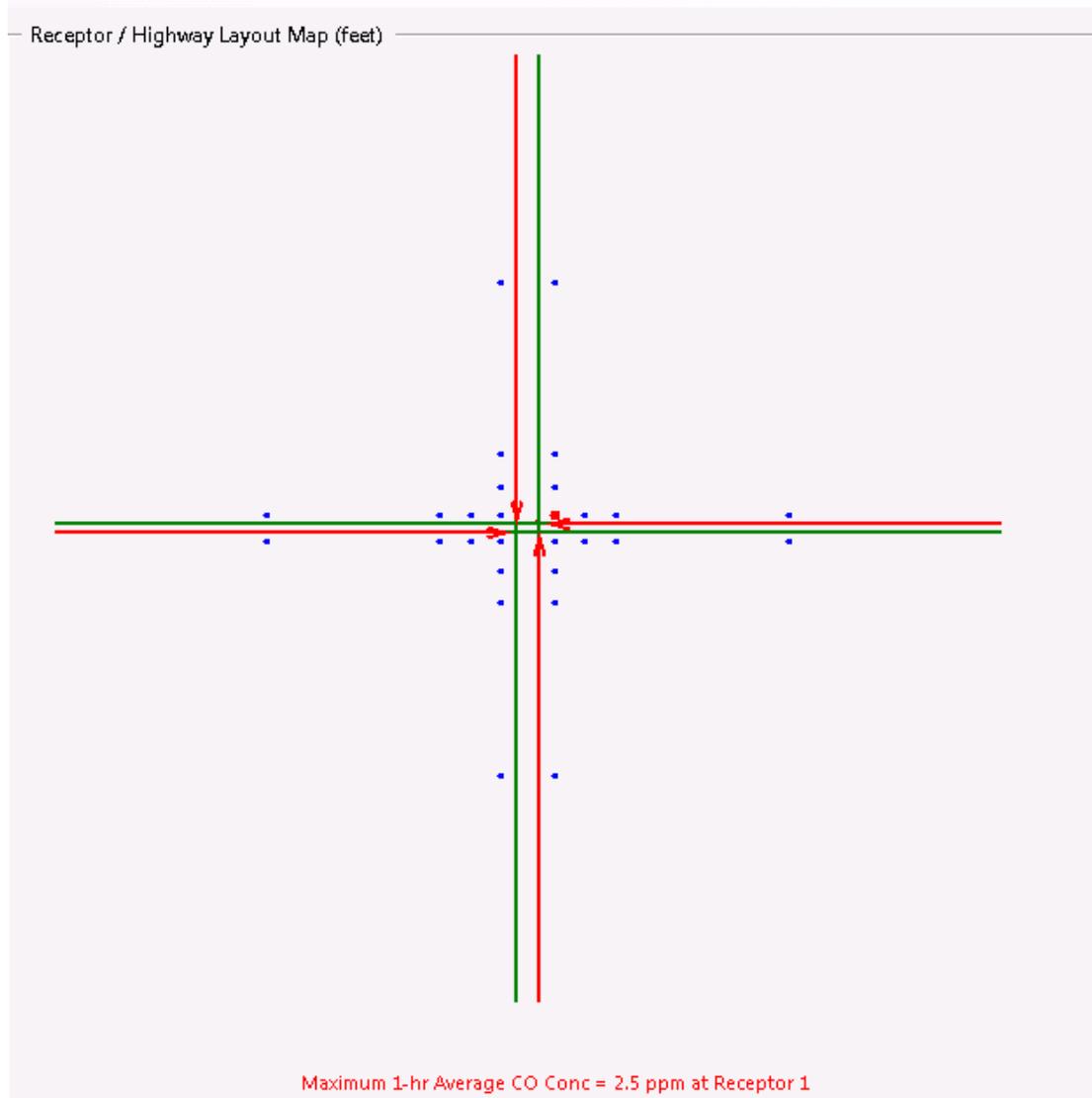
In all scenarios, forecast peak concentrations for CO are well below the respective one- and eight-hour standards of 35 and 9 ppm. In general, emissions and ambient concentrations drop significantly over time (through the opening and design years) due to continued fleet turnover to vehicles constructed to more stringent emission standards.

Exhibit 4.2.12: CAL3QHC Worst-Case Analysis Inputs

<b>CAL3QHC Parameters</b>	<b>Typical Worst-Case Analysis Inputs*</b>
Surface Roughness Coefficient (cm)	Urban = 108 (consistent with FHWA Categorical Finding)
Wind Speed (meters per second)	1.0
Wind Direction Increments (degrees, multipliers)	10 (1-36)
Stability Class	Urban Areas: 4 (D-Neutral)
Mixing Height (meters)	1000
Setting Velocity (cm/s)	0
Deposition Velocity (cm/s)	0
Median Width (ft)	Zero
Source Height (ft)	0
Receptor Height (ft)	5.9
Receptor Locations	Along the right of way edge, with defaults of 10 feet for intersections.
Background Concentration (ppm)	Zero (as input to CAL3QHC) <i>1.6 ppm (One-hour) &amp; 1.4 ppm (eight-hour), as added to CAL3QHC modeling results (VDOT Resource Document values for northern Virginia).</i>
Persistence Factor	0.78 (default for NOVA from VDOT Resource Document)
Averaging Time (min)	60min
Volumes (vehicle per hour) (vph)	VDOT Resource Document defaults, which are based on the HCM (2010): <ul style="list-style-type: none"> <li>▪ Street (Metropolitan Areas): 1,230 vphpl x no. of lanes</li> </ul>
Saturation Flow Rate (vphpl)	VDOT Resource Document default for a metropolitan area with population >250,000 (based on HCM 2010, Exhibit 18-28): 1,900 veh/h/ln
Signal Data	<ul style="list-style-type: none"> <li>▪ Defaults per HCM 2010 (Exhibit 18-28) and the CAL3QHC User's Guide, EPA-454/R-92-006 (Revised), 1995: <ul style="list-style-type: none"> <li>- Signal Type = 1 (pre-timed)</li> <li>- Arrival Rate = 3 (average)</li> </ul> </li> <li>▪ Defaults per CAL3QHC User's Guide: <ul style="list-style-type: none"> <li>- Clearance Lost Time (s) = 2</li> </ul> </li> <li>▪ Worst-case defaults where project-specific information is not available: <ul style="list-style-type: none"> <li>- Average Cycle Length (s): 120</li> <li>- Average Red Time Length (s): 68</li> </ul> </li> </ul>
Link Width (ft)	<ul style="list-style-type: none"> <li>• Free flow link width = width of the traveled roadway (all lanes), plus 3 m (10 ft) on each side of the roadway to account for the mixing zone created by the wake of moving vehicles</li> <li>• Queue link width = the width of the traveled roadway only</li> <li>• Lane width = 12</li> </ul>

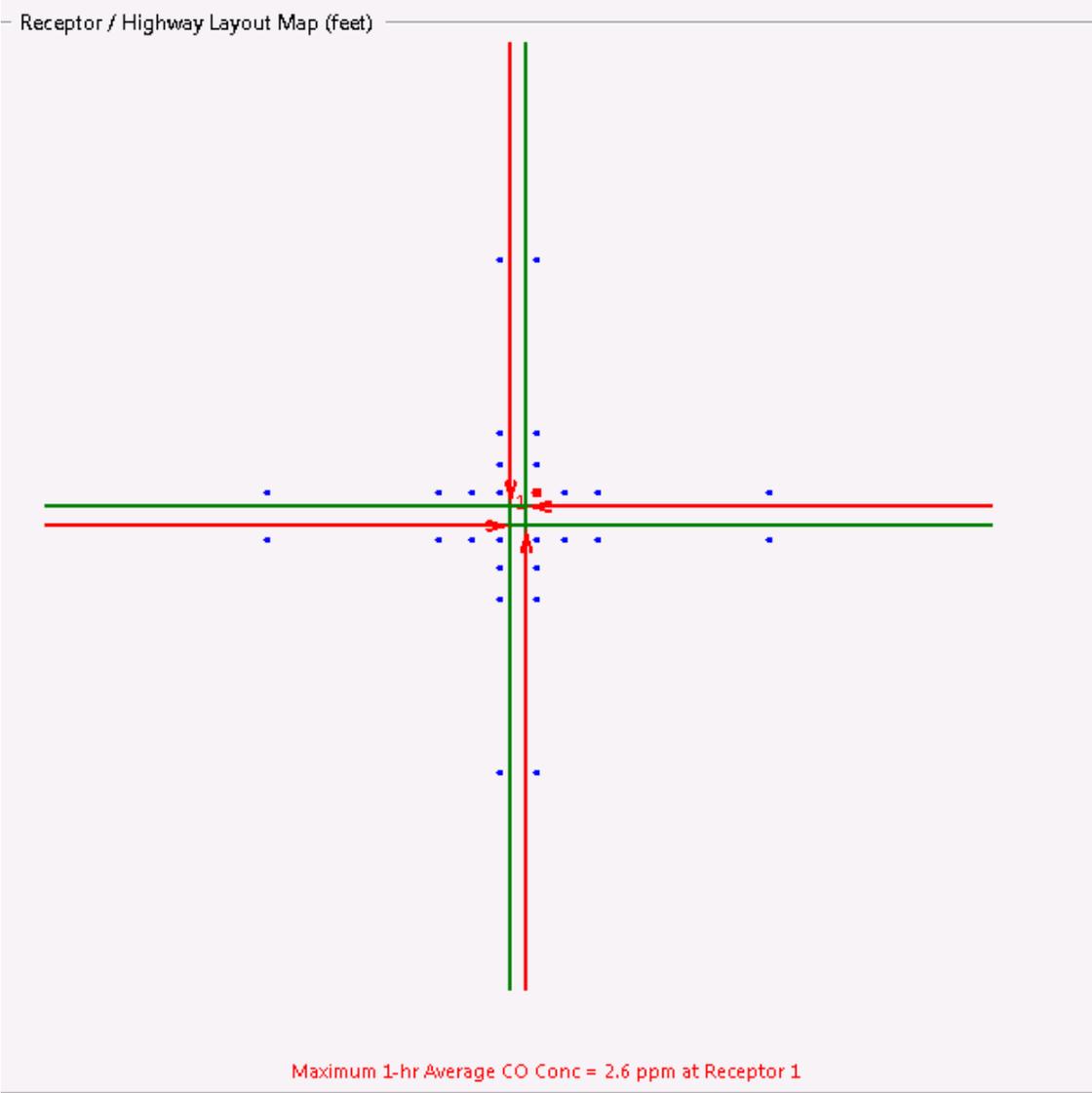
\* Unless otherwise specified, all inputs were taken from or consistent with those specified in the VDOT Resource Document.

Exhibit 4.2.13 (a): CO Dispersion Modeling Worst-Case Configuration & Receptor Locations –  
Route 123 & Fairfax County Pkwy SB Ramps/ Robert Carter Rd



Source: Excerpted from FHWA Cal3i model output.

Exhibit 4.2.13 (b): CO Dispersion Modeling Worst-Case Configuration & Receptor Locations –  
Fairfax County Pkwy & Roberts Pkwy/ Karmich St



Source: Excerpted from FHWA Cal3i model output.

Overall, the results indicate that, even assuming worst-case traffic volumes, ambient levels of CO in the vicinity of the project are expected to decline significantly over time and to remain below both the one-hour and the eight-hour NAAQS. The project therefore is not expected to cause or contribute to a violation of the CO standards.

Exhibit 4.2.14: Worst-Case CAL3QHC Modeling Results for CO

Intersection	Averaging Period	2026 <sup>1,2</sup> (ppm)	2046 <sup>1,2</sup> (ppm)	NAAQS (ppm)
Route 123 & Fairfax County Pkwy SB Ramps/ Robert Carter Rd	1-Hour	4.1	2.9	35
	8-Hour	3.4	2.4	9
Fairfax County Pkwy & Roberts Pkwy/ Karmich St	1-Hour	4.2	2.8	35
	8-Hour	3.4	2.3	9

*Notes:*

1. Including background concentrations of 1.6 and 1.4 ppm for the one- and eight-hour standards respectively, based on trend data for Northern Virginia, as specified in the VDOT Resource Document (2016). Receptor locations noted are only for the first location if more than one location has the same value.
2. In keeping with the FHWA-VDOT 2009 Agreement for No-Build Analyses, a no-build scenario analysis was determined to not be needed for this project, given: a) the project location (not within a nonattainment or maintenance area for CO), and b) the level of environmental documentation planned for this project (i.e., not an environmental impact statement).

#### 4.2.9 Construction Emissions

Construction of this project would cause only temporary increases in emissions. A quantitative assessment of construction emissions is not required as the project location is not in an area subject to project-level conformity requirements for CO. Additionally, even if conformity did apply, the primary criterion for conducting construction emission analyses for conformity purposes (five years, per 40 CFR 93.123(c)(5))<sup>46</sup> would not be expected to be exceeded for the construction of this project.

#### 4.2.10 Summary of Assumptions for the Worst-Case Analysis

All modeling inputs including all worst-case assumptions applied in this analysis were made consistent with all applicable EPA and FHWA requirements and guidance. Worst-case assumptions included:

*For emission factor modeling:*

- Regional registration (age) distributions were applied that were not adjusted (as a limitation of the EPA MOVES model) for mileage accumulation rates that generally decline with age. This assumption effectively weights older higher-emitting vehicles the same as newer lower-emitting vehicles, resulting in higher estimates for fleet-average emission factors.

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<sup>46</sup> See: <https://www.gpo.gov/fdsys/pkg/CFR-2014-title40-vol20/xml/CFR-2014-title40-vol20-sec93-123.xml>

- Worst-case emission factor selected as that for the maximum (or higher) road grade for each link.

*For dispersion modeling:*

- Traffic volumes representing LOS E conditions, which typically exceeds actual opening and design year ADT forecasts for build scenarios by substantial margins. Depending on the project, volumes may also be increased with the worst-case assumption of additional through lane(s) to account for auxiliary lanes or ramps.
- Worst-case receptor locations on the edge of the roadway right-of-way, i.e., at the closest possible point to roadway.
- Worst-case geometric assumptions that serve to concentrate traffic, emissions and concentrations to the greatest extent possible:
  - Zero vertical separation for the grade separation (interchange)
  - Zero median widths for arterial streets and minimum distance for freeways
  - Lane widths of 12 ft
- Other federal default data for most model inputs (e.g., low wind speeds, surface roughness, and stability class), which result in higher modeled estimates of ambient concentrations than are expected to occur in practice.

Overall, the use of worst-case modeling inputs for all scenarios significantly increased modeled emissions and concentrations of CO over what would reasonably be expected. Despite the worst-case assumptions, the NAAQS are still met in each case.

### 4.3 Mobile Source Air Toxic (MSAT) Assessment

FHWA most recently updated its guidance for the assessment of MSATs in the NEPA process for highway projects in 2016<sup>47</sup>. The updated guidance states that “EPA identified nine compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers or contributors and non-cancer hazard contributors from the 2011 National Air Toxics Assessment (NATA)<sup>48</sup>. These are 1,3-butadiene, acetaldehyde, acrolein, benzene, diesel particulate matter (diesel PM), ethylbenzene, formaldehyde, naphthalene, and polycyclic organic matter.” It also specifies three possible categories or tiers of analysis, namely, 1) projects with no meaningful potential MSAT effects or exempt projects (for which MSAT analyses are not required), 2) projects with low potential MSAT effects (requiring only qualitative analyses), and 3) projects with higher potential MSAT effects (requiring quantitative analyses).

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<sup>47</sup> FHWA, “*INFORMATION: Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents*”, October 18, 2016. See:

[https://www.fhwa.dot.gov/environment/air\\_quality/air\\_toxics/policy\\_and\\_guidance/](https://www.fhwa.dot.gov/environment/air_quality/air_toxics/policy_and_guidance/)

<sup>48</sup> See: <https://www.epa.gov/national-air-toxics-assessment>

### **4.3.1 Level of Analysis Determination**

As this project involves an EA and is not exempt, it does not qualify as a Tier 1 project under FHWA MSAT Guidance. It also does not meet the criteria for a Tier 3 project in FHWA guidance, as total traffic is forecast to reach only 118,200 AWDT for the build scenario, which is well below the 140-150 thousand ADT criteria (AWDT is higher than ADT for a given location) specified in FHWA guidance for Tier 3 projects (i.e., ones for which quantitative analyses for MSATs would be required). Additionally, this project does not involve the creation or alteration of a major intermodal freight facility that has the potential to concentrate high levels of diesel particulate matter in a single location.

This project was therefore categorized as a Tier 2 project, i.e., one with “Low Potential MSAT Effects”. Projects in this category are addressed with a qualitative analysis, which as FHWA guidance states provides a basis for identifying and comparing potential differences for MSAT emissions, if any, from the various alternatives.

The qualitative assessment presented below follows FHWA guidance. It is derived in part from a study conducted by the FHWA entitled “A Methodology for Evaluating Mobile Source Air Toxic Emissions among Transportation Project Alternatives”.

### **4.3.2 MSAT Analysis**

#### **4.3.2.1 Background**

Controlling air toxic emissions became a national priority with the passage of the Clean Air Act Amendments (CAAA) of 1990, whereby Congress mandated that the U.S. Environmental Protection Agency (EPA) regulate 188 air toxics, also known as hazardous air pollutants. The EPA assessed this expansive list in its rule on the Control of Hazardous Air Pollutants from Mobile Sources (Federal Register, Vol. 72, No. 37, page 8430, February 26, 2007), and identified a group of 93 compounds emitted from mobile sources that are part of EPA’s Integrated Risk Information System (IRIS). In addition, EPA identified nine compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers or contributors and non-cancer hazard contributors from the 2011 National Air Toxics Assessment (NATA).<sup>4</sup> These are 1,3-butadiene, acetaldehyde, acrolein, benzene, diesel particulate matter (diesel PM), ethylbenzene, formaldehyde, naphthalene, and 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.

#### **4.3.2.2 Motor Vehicle Emissions Simulator (MOVES)**

According to EPA, MOVES2014 is a major revision to MOVES2010 and improves upon it in many respects. MOVES2014 includes new data, new emissions standards, and new functional improvements and features. It incorporates substantial new data for emissions, fleet, and activity developed since the release of MOVES2010. These new emissions data are for light- and heavy-duty vehicles, exhaust and evaporative emissions, and fuel effects. MOVES2014 also adds updated vehicle sales, population, age distribution, and vehicle miles travelled (VMT) data. MOVES2014 incorporates the effects of three new Federal emissions standard rules not

included in MOVES2010. These new standards are all expected to impact MSAT emissions and include Tier 3 emissions and fuel standards starting in 2017 (79 FR 60344), heavy-duty greenhouse gas regulations that phase in during model years 2014-2018 (79 FR 60344), and the second phase of light duty greenhouse gas regulations that phase in during model years 2017-2025 (79 FR 60344). Since the release of MOVES2014, EPA has released MOVES2014a. In the November 2015 MOVES2014a Questions and Answers Guide<sup>49</sup>, EPA states that for on-road emissions, MOVES2014a adds new options requested by users for the input of local 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.

Using EPA's MOVES2014a model, as shown in the figure below, FHWA estimates that even if VMT increases by 45 percent from 2010 to 2050 as forecast, a combined reduction of 91 percent in the total annual emissions for the priority MSAT is projected for the same time period.

Diesel PM is the dominant component of MSAT emissions, making up 50 to 70 percent of all priority MSAT pollutants by mass, depending on calendar year. Users of MOVES2014a will notice some differences in emissions compared with MOVES2010b. MOVES2014a is based on updated data on some emissions and pollutant processes compared to MOVES2010b, and reflects the latest Federal emissions standards in place at the time of its release. In addition, MOVES2014a emissions forecasts are based on lower VMT projections than MOVES2010b, consistent with recent trends suggesting reduced nationwide VMT growth compared to historical trends.

The implications of MOVES on MSAT emissions estimates compared to MOBILE are: lower estimates of total MSAT emissions; significantly lower benzene emissions; significantly higher diesel PM emissions, especially for lower speeds. Consequently, diesel PM is projected to be the dominant component of the emissions total.

#### **4.3.2.3 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 arise on highway projects during the NEPA process. Even as the science emerges, the public and other agencies expect FHWA to address MSAT impacts in its 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 will continue to

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<sup>49</sup> <https://nepis.epa.gov/Exec/ZyPDF.cgi?Dockey=PI00NNR0.txt>

monitor the developing research in this field. An overview of recent research is provided in Appendix D of FHWA guidance<sup>50</sup>.

#### 4.3.2.4 Project-Level MSAT Discussion

Following FHWA guidance, this project has been determined to have low potential MSAT effects, thereby requiring a qualitative MSAT analysis. A qualitative analysis provides a basis for identifying and comparing the potential differences among MSAT emissions, if any, from the various alternatives. The qualitative assessment presented below is derived in part from a study conducted by FHWA entitled *A Methodology for Evaluating Mobile Source Air Toxic Emissions among Transportation Project Alternatives*<sup>51</sup>.

The amount of MSATs emitted is proportional to vehicle miles traveled, or VMT, assuming that other variables such as fleet mix are the same for each alternative. The VMT estimated for a Build Alternative therefore may be slightly higher than that for the No-Build Alternative, because additional capacity increases the efficiency of the roadway and attracts rerouted trips from elsewhere in the transportation network. This increase in VMT could lead to higher MSAT emissions for the build alternative along a highway corridor, along with a corresponding decrease in MSAT emissions along the parallel routes. The emissions increase would be offset somewhat by lower MSAT emission rates due to increased speeds; according to EPA's MOVES2014 model, emissions of all of the priority MSATs decrease as speed increases.

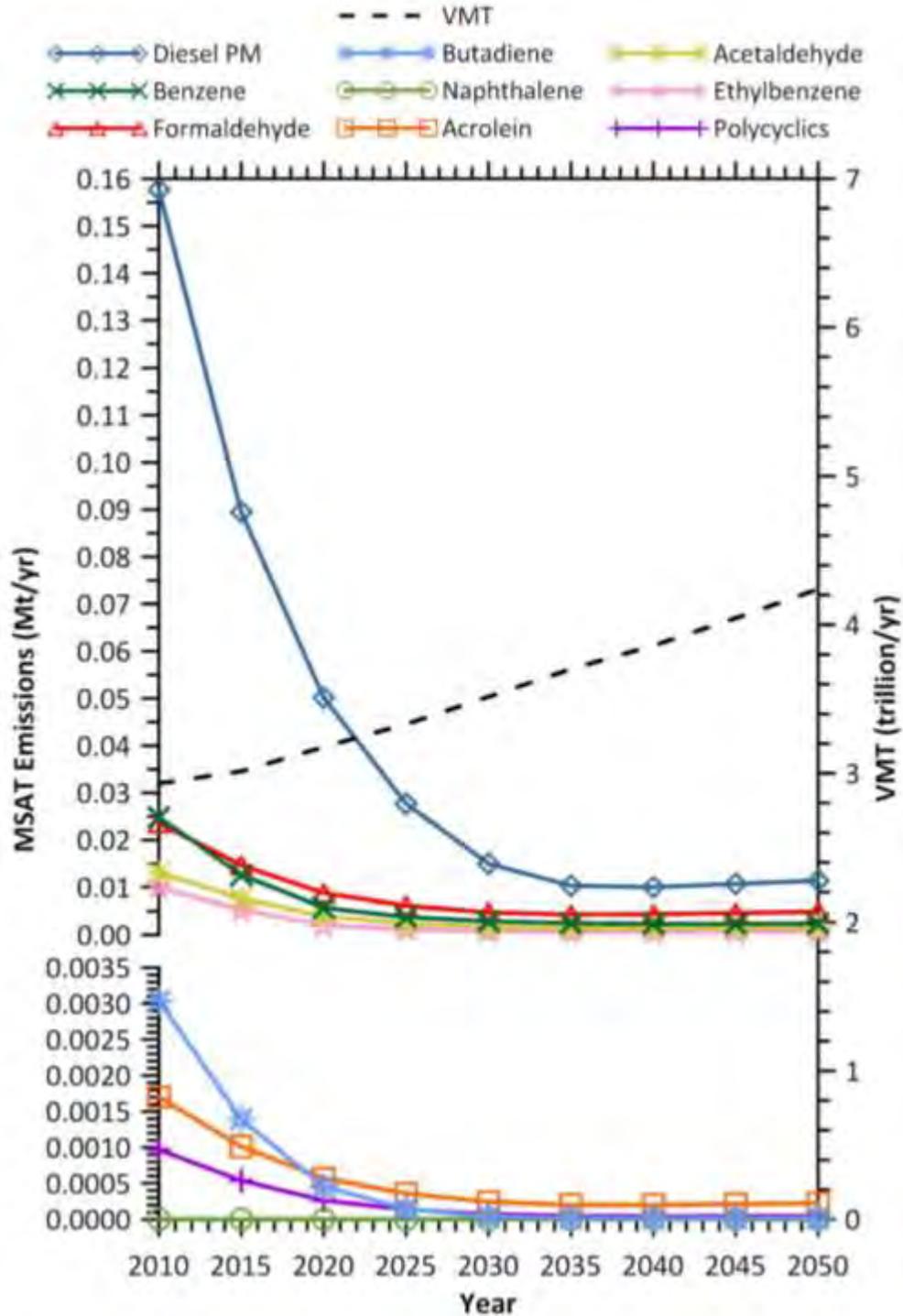
There may also be localized areas where VMT would increase and other areas where it would decrease. Therefore, it is possible that localized increases and decreases in MSAT emissions may occur. However, even if these increases do occur, they too will be substantially reduced in the future due to implementation of EPA's vehicle and fuel regulations. Also, regardless of the alternative chosen, emissions will likely be lower than present levels in the design year as a result of EPA's national control programs that are projected to reduce annual MSAT emissions by over 90 percent between 2010 and 2050 (Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents, Federal Highway Administration, October 2016). Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the study area are likely to be lower in the future in nearly all cases.

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<sup>50</sup> See: [https://www.fhwa.dot.gov/environment/air\\_quality/air\\_toxics/policy\\_and\\_guidance/msat/page04.cfm](https://www.fhwa.dot.gov/environment/air_quality/air_toxics/policy_and_guidance/msat/page04.cfm)

<sup>51</sup> See: [https://www.fhwa.dot.gov/environment/air\\_quality/air\\_toxics/research\\_and\\_analysis/](https://www.fhwa.dot.gov/environment/air_quality/air_toxics/research_and_analysis/)

Exhibit 4.3.1: FHWA Projected National MSAT Emission Trends 2010 – 2050 for Vehicles Operating on Roadways **Using EPA's MOVES2014a Model**



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

Source: EPA MOVES2014a model runs conducted by FHWA, September 2016.

Any additional travel lanes contemplated as part of the project may have the effect of moving some traffic closer to nearby homes, schools, and businesses; therefore, there may be localized areas where ambient concentrations of MSATs could be higher for a Build Alternative than for the No-Build Alternative. However, the magnitude and the duration of these potential increases compared to the No-Build alternative cannot be reliably quantified due to incomplete or unavailable information in forecasting project-specific MSAT health impacts.

In summary, when capacity is added, the localized level of MSAT emissions for the Build Alternative could be higher relative to the No-Build Alternative, but this could be offset due to increases in speeds and reductions in congestion (which are associated with lower MSAT emissions). In addition, MSAT emissions will be lower in other locations when traffic shifts away from them. However, on a regional basis, EPA's vehicle and fuel regulations, coupled with fleet turnover, will over time cause substantial reductions that, in almost all cases, will cause region-wide MSAT levels to be significantly lower than today.

#### **4.3.2.5 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 mobile source air toxic (MSAT) emissions associated with a proposed set of highway alternatives. The outcome of such an assessment, adverse or not, would be influenced more by the uncertainty introduced into the process through assumption and speculation rather than any genuine insight into the actual health impacts directly attributable to MSAT exposure associated with a proposed action.

The Environmental Protection Agency (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 Clean Air Act 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, <https://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). A number of HEI studies are summarized in Appendix D of FHWA's Updated Interim Guidance 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 Special Report 16, <https://www.healtheffects.org/publication/mobile-source-air-toxics-critical-review->

[literature-exposure-and-health-effects](#)) or in the future as vehicle emissions substantially decrease.

The methodologies for forecasting health impacts include emissions modeling; dispersion modeling; exposure modeling; and then final determination of health impacts – each step in the process 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 determine the portion of time that people are actually exposed at a specific location; and to 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 (Special Report 16, <https://www.healtheffects.org/publication/mobile-source-air-toxics-critical-review-literature-exposure-and-health-effects>). 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 states that with respect to diesel engine exhaust, “[t]he absence of adequate data to develop a sufficiently confident dose-response relationship from the epidemiologic studies has prevented the estimation of inhalation carcinogenic risk (<https://www.epa.gov/iris>).”

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 Clean Air Act 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 ([https://www.cadc.uscourts.gov/internet/opinions.nsf/284E23FFE079CD59852578000050C9DA/\\$file/07-1053-1120274.pdf](https://www.cadc.uscourts.gov/internet/opinions.nsf/284E23FFE079CD59852578000050C9DA/$file/07-1053-1120274.pdf)).

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

#### 4.3.2.6 Conclusions for MSATs

As discussed above, technical shortcomings of emissions and dispersion models and uncertain science with respect to health effects prevent meaningful or reliable estimates of MSAT emissions and effects of this project at this time. While it is possible that localized increases in MSAT emissions may occur as a result of this project, emissions will likely be lower than present levels in the design year of this project as a result of EPA's national control programs that are projected to reduce annual MSAT emissions by over 80 percent between 2010 and 2050. Although local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures, the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the study area are likely to be lower in the future in nearly all cases.

#### 4.4 Indirect Effects and Cumulative Impacts (IECI) Assessment

Indirect effects are defined by the CEQ as “effects which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water or other natural systems, including ecosystems” (40 CFR 1508.8(b)). For transportation projects, induced growth is attributed to changes in accessibility caused by the project that influences the location and/or magnitude of future development.<sup>52</sup>

Cumulative impacts are “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.” (40 CFR 1508.7). According to the Federal Highway Administration’s (FHWA) *Interim Guidance: Questions and Answers Regarding the Consideration of Indirect and Cumulative Impacts in the NEPA Process*, cumulative impacts include the total of all impacts to a particular resource that have occurred, are occurring, and will likely occur as a result of any action or influence, including the direct and reasonably foreseeable indirect impacts of a proposed project. Cumulative impacts 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 significant for two reasons.

First, regarding the potential for indirect effects, the quantitative assessments conducted for project-specific CO, qualitative analyses for MSAT impacts and the regional conformity analysis conducted for ozone can all be considered indirect effects analyses because they look at air quality impacts attributable to the project that occur in the future. These analyses demonstrate that, in the future: 1) air quality impacts from CO will not cause or contribute to violations of the CO NAAQS, 2) MSAT emissions will be significantly lower than they are today, and 3) the

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<sup>52</sup> See: [http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp\\_rpt\\_466.pdf](http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_466.pdf)

mobile source emissions budgets established for the region for purposes of meeting the ozone NAAQS will not be exceeded.

Second, regarding the potential for cumulative impacts, the most recent regional conformity analysis conducted by the NCRTPB, Visualize 2045 Long Range Transportation Plan and Fiscal Year 2019-2024 Transportation Improvement Program, 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 regionally significant transportation projects in the region (i.e. those proposed for construction funding over the life of the region's transportation plan).
- The most recent conformity analysis referenced above was completed in October 2018, with FHWA and FTA issuing a conformity finding on December 18, 2018. This analysis demonstrated 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.

## 5.0 Mitigation

Emissions may be produced in the construction of this project from heavy equipment and vehicle travel to and from the site, as well as from fugitive sources. Construction emissions are short term or temporary in nature. To mitigate these emissions, all construction activities are to be performed in accordance with VDOT *Road and Bridge Specifications*<sup>53</sup>.

In addition, as noted previously, the Virginia Department of Environmental Quality (VDEQ) provides general comments for projects by county. Their comments in part address mitigation<sup>54</sup>: *"...all reasonable precautions should be taken to limit the emissions of VOC and NOx. 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<sup>55</sup>; 9 VAC 5-45, Article 7, Cutback Asphalt restrictions<sup>56</sup>; and 9 VAC 5-50, Article 1, Fugitive Dust precautions<sup>57</sup>."*

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<sup>53</sup> See <http://www.virginiadot.org/business/const/spec-default.asp>

<sup>54</sup> Spreadsheet entitled: "DEQ SERP Comments rev8b", March 2017

<sup>55</sup> See: <https://law.lis.virginia.gov/admincode/title9/agency5/chapter130/section100/>

<sup>56</sup> See: <http://leg1.state.va.us/cgi-bin/legp504.exe?000+reg+9VAC5-45-760>

<sup>57</sup> See: <http://leg1.state.va.us/cgi-bin/legp504.exe?000+reg+9VAC5-50-60>

## 6.0 Consultation

### 6.1.1 Public Consultation

Public consultation is generally conducted and documented within the overall NEPA process, and not separately by subject area (including air quality). Please refer to the overall NEPA documentation for a summary of public consultation activities for this project.

### 6.1.2 Inter-Agency Consultation - Models, Methods, Assumptions and Protocols Specified in the VDOT Resource Document

All models, methods, assumptions and protocols specified or referenced within the VDOT Resource Document<sup>58</sup> for projects in northern Virginia were subjected to inter-agency consultation for conformity (IACC) and NEPA (IAC) with FHWA, EPA, DEQ and other agencies prior to being finalized in 2016. IACC was required at that time as it was before project-level conformity requirements in northern Virginia were eliminated for CO (with the expiry of the CO maintenance plan on March 16, 2016) and PM<sub>2.5</sub> (with the revocation by EPA of the applicable annual primary NAAQS effective October 24, 2016). Appendix A of the Resource Document provides a summary of the consultation process and results. Currently, inter-agency consultation for projects is limited to that needed for purposes of NEPA.

## 7.0 Conclusions

The proposed improvements were assessed for potential air quality impacts and compliance with applicable air quality regulations and requirements. All models, methods/protocols and assumptions applied in modeling and analyses were made consistent with those provided or specified in the VDOT Resource Document. The assessment indicates that the project would meet all applicable air quality requirements of the National Environmental Policy Act (NEPA) and federal and state transportation conformity regulations. As such, the project will not cause or contribute to a new violation of the NAAQS established by EPA.

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<sup>58</sup> See: [http://www.virginiadot.org/projects/environmental\\_air\\_section.asp](http://www.virginiadot.org/projects/environmental_air_section.asp)

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**Appendices Available for Review upon Request**

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