AIR QUALITY ANALYSIS TECHNICAL REPORT

RICHMOND HIGHWAY (ROUTE 1) CORRIDOR IMPROVEMENTS
PROJECT BETWEEN JEFF TODD WAY AND NAPPER ROAD,
FAIRFAX COUNTY, VIRGINIA

Prepared in support of the Draft Environmental Assessment

VDOT Project #: 0001-029-205, C501, P101, R201
UPC#: 107187
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<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AADT</td>
<td>Annual Average Daily Traffic</td>
</tr>
<tr>
<td>ADT</td>
<td>Average Daily Traffic</td>
</tr>
<tr>
<td>CAA</td>
<td>Clean Air Act Amendments of 1990</td>
</tr>
<tr>
<td>CEQ</td>
<td>Council on Environmental Quality</td>
</tr>
<tr>
<td>CFR</td>
<td>Code of Federal Regulations</td>
</tr>
<tr>
<td>CLRPA</td>
<td>Constrained Long-Range Transportation Plan</td>
</tr>
<tr>
<td>CO</td>
<td>Carbon Monoxide</td>
</tr>
<tr>
<td>DRPT</td>
<td>Department of Rail and Public Transportation</td>
</tr>
<tr>
<td>EA</td>
<td>Environmental Assessment</td>
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<tr>
<td>EPA</td>
<td>Environmental Protection Agency</td>
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<tr>
<td>FHWA</td>
<td>Federal Highway Administration</td>
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<tr>
<td>FTA</td>
<td>Federal Transit Administration</td>
</tr>
<tr>
<td>FY</td>
<td>Fiscal Year</td>
</tr>
<tr>
<td>LOS</td>
<td>Level of Service</td>
</tr>
<tr>
<td>MOVES</td>
<td>Motor Vehicle Emissions Simulator</td>
</tr>
<tr>
<td>MSAT</td>
<td>Mobile Source Air Toxics</td>
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<tr>
<td>MWCOG</td>
<td>Metropolitan Washington Council of Governments</td>
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<tr>
<td>NAAQS</td>
<td>National Ambient Air Quality Standards</td>
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<tr>
<td>NCHRP</td>
<td>National Cooperative Highway Research Program</td>
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<tr>
<td>NCRTPB</td>
<td>National Capital Region Transportation Planning Board</td>
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<tr>
<td>NEPA</td>
<td>National Environmental Policy Act</td>
</tr>
<tr>
<td>NO₂</td>
<td>Nitrogen Dioxide</td>
</tr>
<tr>
<td>NOₓ</td>
<td>Nitrogen Oxides</td>
</tr>
<tr>
<td>PA</td>
<td>Programmatic Agreement</td>
</tr>
<tr>
<td>Pb</td>
<td>Lead</td>
</tr>
<tr>
<td>PM₁₀</td>
<td>Coarse Particulate Matter</td>
</tr>
<tr>
<td>PM₂.₅</td>
<td>Fine Particulate Matter</td>
</tr>
<tr>
<td>ppb</td>
<td>Parts Per Billion</td>
</tr>
<tr>
<td>ppm</td>
<td>Parts Per Million</td>
</tr>
<tr>
<td>SIP</td>
<td>State Implementation Plan</td>
</tr>
<tr>
<td>SO₂</td>
<td>Sulfur Dioxide</td>
</tr>
<tr>
<td>TIP</td>
<td>Transportation Improvement Program</td>
</tr>
<tr>
<td>VDEQ</td>
<td>Virginia Department of Environmental Quality</td>
</tr>
<tr>
<td>VDOT</td>
<td>Virginia Department of Transportation</td>
</tr>
<tr>
<td>VMT</td>
<td>Vehicle Miles Traveled</td>
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<tr>
<td>VPHPL</td>
<td>Vehicles per Hour per Lane</td>
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</table>
EXECUTIVE SUMMARY

The Virginia Department of Transportation (VDOT), in cooperation with the Federal Highway Administration (FHWA), is preparing an Environmental Assessment (EA) for the Richmond Highway (Route 1) Corridor Improvements Project between Jeff Todd Way and Napper Road. Improvements are proposed for an approximate 2.9-mile section of Richmond Highway between Route 235 (Mount Vernon Memorial Highway – South) to 0.07 miles north of Route 235 (Mount Vernon Highway – North) at Napper Road. The environmental study area extends a little further north along the Richmond Highway to Sherwood Lane. The EA is being prepared in accordance with the National Environmental Policy Act (NEPA), FHWA regulations at 23 Code of Federal Regulations (CFR) § 771 and Technical Advisory T 6640.8, and Council on Environmental Quality (CEQ) guidance at 40 CFR §1500-1508.

NEPA requires consideration of whether the proposed action will have an adverse effect on air quality in the Study Area. Accordingly, qualitative carbon monoxide (CO), Mobile Source Air Toxics (MSATs), and indirect effects and cumulative impacts analyses have been prepared. This analysis included the application of the VDOT-FHWA Programmatic Agreement (PA) for Project-Level Air Quality Analyses for CO (2016)\(^1\) to screen intersections for CO impacts.

**Regional Air Quality Status:** The United States Environmental Protection Agency (EPA) Green Book shows that Fairfax County is designated a nonattainment area for ozone and an attainment area for all other National Ambient Air Quality Standards (NAAQS). The county was previously designated a maintenance area\(^2\) for fine particulate matter (PM\(_{2.5}\)) for the 1997 primary annual standard, but that standard was revoked by the EPA.

Note, federal conformity requirements (specifically 40 CFR§ 93.114 and 40 CFR §93.115) for regional conformity (not project-level) apply as the Study Area is located in a nonattainment area for ozone. More specifically, there must be a currently conforming transportation plan and program at the time of the project approval, and the project must come from a conforming plan and program (or otherwise meet criteria specified in 40 CFR §93.109(b)).

**Transportation Plan and Program Status:** The project is included in the National Capital Region Transportation Planning Board’s (NCRTPB) (federally-designated metropolitan planning organization for metropolitan Washington) 2040 Constrained Long-Range Plan (CLRP)\(^3\) (ID 1942), and the Fiscal Year (FY) 2017 – 2022 Transportation Improvement Program (TIP)\(^4\) (ID 6443). The project is found in the Air Quality Conformity Analysis for 2016 CLRP Amendment\(^5\) as Project ID VP1U.

**Carbon Monoxide (CO):** As the project is located in a region that is in attainment of the NAAQS for CO, only NEPA applies, and EPA project-level (“hot-spot”) transportation conformity requirements do not apply. For purposes of NEPA, the potential for CO impacts from the project in terms of potential violations are evaluated.

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\(^1\) See: [http://virginiadot.org/projects/environmental_air_section.asp](http://virginiadot.org/projects/environmental_air_section.asp)

\(^2\) EPA revoked this NAAQS effective October 24, 2916. Specifically, on August 24, 2016, EPA issued a final rule (81 FR 58010) 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.” Accordingly, Fairfax County is no longer designated as maintenance for PM\(_{2.5}\), and the associated EPA regulatory requirements for conformity for PM\(_{2.5}\) are eliminated for northern Virginia.


of the NAAQS was assessed and no potential impacts were identified. More specifically, each of the 11 Study Area intersections were considered for project-specific modeling. All were determined to not require project-specific modeling but could be instead screened out using a weight-of-evidence approach and/or the “worst-case” modeling that forms the basis for the VDOT-FHWA Programmatic Agreement for Project-Level Air Quality Analyses for Carbon Monoxide. The “weight of evidence” approach was used to qualitatively screen out three intersections that did not quite fit the criteria within the PA, supporting a conclusion that project would not result in a violation of the CO NAAQS at these locations.

**Mobile Source Air Toxics:** A qualitative analysis was conducted for MSATs as the Build Alternative is considered a minor-widening project where the design year traffic is projected to be less than the 140,000 to 150,000 annual average daily traffic (AADT) threshold noted in the Updated Interim Guidance on MSAT Analysis in NEPA Documents NEPA (2016). Therefore, this project is best characterized as one with “Low Potential MSAT Effects”.

Overall, however, 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.

It is possible that localized increases in MSAT emissions may occur as a result of this project. For example, there may be localized areas where ambient concentrations of MSATs could be higher under the Build Alternative than the No-Build Alternative. The localized increases in MSAT concentrations would likely be most pronounced along the expanded roadway sections along Richmond Highway. Even in these locations, however, 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.

**Greenhouse Gases:** With the recent withdrawal of federal guidance addressing greenhouse gas analyses and climate change\(^6\), the Department protocol (VDOT Resource Document, Section 4.7)\(^7\) for greenhouse gas (GHG) analyses was reviewed for applicability to this project. Based on that protocol, a GHG analysis is not warranted for this project as it involves an EA and not an Environmental Impact Statement.

**Indirect and Cumulative Impacts:** The CO and MSAT assessments conducted for the project are considered indirect effects analyses because they take into account air quality impacts attributable to the project that occur at a later time in the future. These qualitative assessments indicate that the potential for indirect effects associated with the project are not expected to be significant.

The annual regional conformity analysis (Air Quality Conformity Analysis of the CLRP Amendment and FY 2017-2022 TIP) conducted by the NCRTPB 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 emission from past and present actions, and these pollutants serve as a

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\(^7\) Available from the VDOT website referenced above for the FHWA-VDOT Programmatic Agreement for CO.
baseline for the current conformity analysis. That conformity analysis quantifies the amount of mobile
source emissions for which the area is designated nonattainment/maintenance that will result from the
implementation of all reasonably foreseeable (i.e., those proposed for construction funding over the life
of the region’s transportation plan) and regionally significant transportation projects in the region.

As noted above, the conformity analysis conducted for the NCRTPB CLRP 2016 Amendment includes the
project. Therefore, this demonstrates 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 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 the EPA.

Overall, the potential for indirect and cumulative effects of the project is not expected to be significant.

**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*.

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 “…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.”

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9 Spreadsheet entitled: “DEQ SERP Comments rev8b”, March 2017, downloaded from the online data repository for the VDOT
11 See: [http://leg1.state.va.us/cgi-bin/legp504.exe?000+reg+9VAC5-45-760](http://leg1.state.va.us/cgi-bin/legp504.exe?000+reg+9VAC5-45-760)
12 See: [http://leg1.state.va.us/cgi-bin/legp504.exe?000+reg+9VAC5-50-60](http://leg1.state.va.us/cgi-bin/legp504.exe?000+reg+9VAC5-50-60)
1. INTRODUCTION

1.1 PROJECT DESCRIPTION

The Virginia Department of Transportation (VDOT), in cooperation with the Federal Highway Administration (FHWA), is preparing an Environmental Assessment (EA) for the Richmond Highway (Route 1) Corridor Improvements Project between Jeff Todd Way and Napper Road. Improvements are proposed for an approximate 2.9-mile section of Richmond Highway between Route 235 (Mount Vernon Memorial Highway – South) to 0.07 miles north of Route 235 (Mount Vernon Highway – North) at Napper Road. The environmental study area extends a little further north along the Richmond Highway to Sherwood Lane (Figure 1-1). The EA is being prepared in accordance with the National Environmental Policy Act (NEPA), FHWA regulations at 23 Code of Federal Regulations (CFR) § 771 and Technical Advisory T 6640.8, and Council on Environmental Quality (CEQ) guidance at 40 CFR §1500-1508.

Based on historical connections to the state capital in Richmond, Route 1 is also known as the “Richmond Highway.” Richmond Highway is the principal north-south route for local traffic in eastern Fairfax County for shopping and other general-purpose trips, and serves as a major commuter route and an alternate north-south route for nearby Interstate 95 (I-95). The section of Richmond Highway evaluated in this EA is in the southeast portion of Fairfax County between Hybla Valley to the north and Fort Belvoir to the south.

Richmond Highway on either side of the Study Area has six general purpose lanes (Figure 1-2). Beginning at the southwest end of the current Study Area at the Mount Vernon Memorial Highway (VA 235)/Jeff Todd Way intersection, a construction project is underway that widens Richmond Highway to six lanes extending 3.68 miles south through Fort Belvoir and ending at Telegraph Road. Richmond Highway has also been previously widened to six general purpose lanes from approximately the Ladson Lane intersection in the northern Study Area, north to I-95/I-495.

The purpose of this Air Quality Technical Report is to identify the existing air quality characteristics of the Study Area and assess the potential impacts of the No-Build and Build Alternative to air quality. This report supports discussions presented in the EA.

- **Section 1** provides an overview of the study.
- **Section 2** provides an overview of the regulatory requirements for air quality.
- **Section 3** provides an overview of the existing air quality conditions.
- **Section 4** provides an overview of the carbon monoxide (CO) analysis and the mobile source air toxics (MSAT) analysis.
- **Section 5** provides an overview of the mitigation.
- **Section 6** summarizes the regional conformity status of the project.
- **Section 7** summarizes the indirect effects and cumulative impacts analysis.
Figure 1-1: Richmond Highway Study Area
Figure 1-2: Richmond Highway Six-lane Segments Adjacent to Study Area
1.2 PURPOSE AND NEED

The Richmond Highway Corridor Improvements EA will address the following purpose and needs:

- Accommodate Travel Demand – better accommodate existing and future travel demand at peak travel hours, reducing congestion and increasing corridor accessibility and mobility (including Bus Rapid Transit (BRT) implementation based on the Department of Rail and Public Transportation (DRPT) Multimodal Study and Fairfax County Board of Supervisors Resolution)

- Improve Safety – implement access control; provide adequately spaced signalized intersections; provide turn lanes where needed; improve structures at natural stream crossings; and enhance pedestrian and bicycle facilities

1.3 ALTERNATIVES

1.3.1 No-Build Alternative

The No-Build Alternative includes continued road maintenance and repairs of existing transportation infrastructure within the Study Area. The Metropolitan Washington Council of Governments (MWCOG) Transportation Improvement Program does not have any planned improvement projects listed for Richmond Highway within the Study Area. The MWCOG Constrained Long-Range Plan includes the current study for widening Richmond Highway, and the separate study of future BRT in the Richmond Highway median from the Huntington Metro Station approximately 3.5 miles north of the Study Area, continuing approximately 8 miles south to the Woodbridge Virginia Railway Express Station, consistent with the DRPT Multimodal Study / Fairfax County Board of Supervisors Resolution. For the purposes of this study, the No-Build Alternative does not include either proposed project. The No-Build Alternative serves as the baseline against which the potential environmental effects of the Build Alternative are compared.

1.3.2 Build Alternative

The Build Alternative is generated from the 2015 US Route 1 Multimodal Alternatives Analysis Locally Preferred Alternative (Alternative 4 BRT / Metrorail Hybrid) selected by Fairfax County and the DRPT. The identified Build Alternative is to widen Richmond Highway from a four-lane undivided roadway to divided six-lane facility with bicycle and pedestrian accommodations, and a median wide enough to accommodate BRT as called for in the DRPT Multimodal Study / Fairfax County Board of Supervisors Resolution. The median would be maintained as a grass strip until the implementation of the BRT.

1.4 METHODOLOGY

The study corridor for detailed evaluation of direct effects is generally defined as 300 feet on either side of the existing Richmond Highway centerline, with additional areas extending as much as 1,000 feet for access management (Figure 1-1).

Individual air quality assessments are presented for the different pollutants. The methodology for each analysis for different pollutants is presented in the following sections: CO and MSATs in Section 4; and indirect effects and cumulative impacts in Section 7.
2. REGULATORY REQUIREMENTS

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

2.1 NATIONAL ENVIRONMENTAL POLICY ACT

The CEQ NEPA regulations (40 CFR §1500-1508) and FHWA’s NEPA regulations (23 CFR §771) do not contain specific requirements for air quality analyses, but air quality is an environmental concern within the broad purview of NEPA. NEPA applies to all federally funded projects and other federal discretionary decisions or approvals of state or private developments. For air quality, FHWA has issued guidance for MSAT and CO analyses. This project-level air quality analysis assesses and documents the potential air quality impacts of the proposed project.

2.2 CLEAN AIR ACT

The Clean Air Act (CAA) requires the US Environmental Protection Agency (EPA) to establish National Ambient Air Quality Standards (NAAQS), based on the latest science to protect the public welfare. The NAAQS apply to the concentration of a pollutant in outdoor ambient air. The EPA sets and revises the NAAQS for common and widespread pollutants. Currently, the NAAQS are set for six pollutants known as “criteria pollutants”. These include: CO, ozone, particulate matter (PM$_{2.5}$ and PM$_{10}$), nitrogen dioxide (NO$_2$), lead (Pb), and sulfur dioxide (SO$_2$). The NAAQS, as defined by the EPA, are shown in Table 2-1 below. The primary standards provide public health protection that includes the health of sensitive subpopulations such as asthmatics, children and the elderly with an adequate margin of safety. The secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation and buildings.

Section 176(c) of the CAA requires federal agencies to ensure that all of their actions conform to applicable implementation plans for achieving and maintaining the NAAQS. Federal actions must not cause or contribute to any new violation of any standard, increase the frequency or severity of any existing violation, or delay timely attainment of any standard in nonattainment and maintenance areas.

The NAAQS apply to the concentration of a pollutant in outdoor ambient air. If the air quality in a geographic area is equal to, or is better than the national standard, the EPA will designate the region as an attainment area. Areas where air quality does not meet the national standards are designated as non-attainment areas. Once the air quality in a non-attainment area improves to the point where it meets the standards and the additional re-designation requirements in the CAA (Section 107(d)(3)(E)), the EPA may re-designate the area as an attainment/maintenance area, which are typically referred to as “maintenance areas.”

The CAA requires the EPA to designate the status of all areas as being in or out of compliance with the NAAQS. The CAA further defines non-attainment areas for ozone based on the severity of the violation as marginal, moderate, serious, severe, and extreme.
### Table 2-1: National Ambient Air Quality Standards

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Averaging Time</th>
<th>Primary Standards (^{[1,2]})</th>
<th>Secondary Standards (^{[1,3]})</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>8-hour</td>
<td>9 ppm (10 mg/m(^3))</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>1-hour</td>
<td>35 ppm</td>
<td></td>
</tr>
<tr>
<td>Lead</td>
<td>Rolling 3-Month Average(^{[5]})</td>
<td>0.15 µg/m(^3)</td>
<td>Same as Primary</td>
</tr>
<tr>
<td>NO(_2)</td>
<td>Annual Arithmetic Mean</td>
<td>0.053 ppm (100 µg/m(^3))</td>
<td>Same as Primary</td>
</tr>
<tr>
<td></td>
<td>1-hour</td>
<td>0.100 ppm(^{[6]})</td>
<td>None</td>
</tr>
<tr>
<td>Ozone</td>
<td>8-hour (2015 standard)(^{[10]})</td>
<td>0.070 ppm</td>
<td>Same as Primary</td>
</tr>
<tr>
<td></td>
<td>8-hour (2008 standard)</td>
<td>0.075 ppm</td>
<td>Same as Primary</td>
</tr>
<tr>
<td></td>
<td>8-hour (1997 standard)</td>
<td>0.08 ppm</td>
<td>Same as Primary</td>
</tr>
<tr>
<td>PM(_{2.5})</td>
<td>Annual Arithmetic Mean</td>
<td>12 µg/m(^3)(^{[4,9]})</td>
<td>15 µg/m(^3)</td>
</tr>
<tr>
<td></td>
<td>24-hour</td>
<td>35 µg/m(^3)</td>
<td>Same as Primary</td>
</tr>
<tr>
<td>PM(_{10})</td>
<td>24-Hours</td>
<td>150 µg/m(^3)(^{[4]})</td>
<td>Same as Primary</td>
</tr>
<tr>
<td>SO(_2)</td>
<td>1-hour</td>
<td>75 ppb(^{[8]})</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>3-hour</td>
<td>None</td>
<td>0.5 ppm</td>
</tr>
</tbody>
</table>

**Notes:**

1. National standards (other than ozone, particulate matter, and those based on annual averages) are not to be exceeded more than once per year.
2. Primary Standards: Levels necessary to protect public health with an adequate margin of safety.
3. Secondary Standards: Levels necessary to protect the public from any known or anticipated adverse effects.
4. For PM\(_{10}\), the 24-hour standard not to be exceeded more than once per year on average over 3 years. For PM\(_{2.5}\), the 24-hour standard is attained when 98% of the daily concentrations, averaged over three years, are equal to or are less than the standard.
6. To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 0.100 ppm (effective January 22, 2010).
7. EPA revoked the 1-hour ozone standard in all areas; however, some areas have continuing obligations under that standard.
8. Final rule signed June 2, 2010. To attain this standard, the 3-year average of the 99th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 75 ppb.
9. EPA updated the NAAQS for PM\(_{2.5}\) to strengthen the primary annual standard to 12 ug/m\(^3\).
10. EPA updated the NAAQS for ozone to strengthen the primary 8-hour standard to 0.07 ppm on October 1, 2015. An area will meet the standard if the fourth-highest maximum daily 8-hour ozone concentration per year, averaged over three years is equal to or less than 70 ppb.
11. 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.”

Source: [https://www.epa.gov/criteria-air-pollutants/naaqs-table](https://www.epa.gov/criteria-air-pollutants/naaqs-table)
2.3 MOBILE SOURCE AIR TOXICS (MSAT)

On October 18, 2016, FHWA issued updated interim guidance regarding MSATs in a NEPA analysis to include the EPA’s recent Motor Vehicle Emissions Simulator (MOVES), Version 2014a, emission model along with updated research on air toxic emissions from mobile sources.\(^{13}\)

The EPA identified nine compounds with significant contributions from mobile sources that are among the national and regional-scale cancer drivers from their 1999 National Air Toxics Assessment. The nine compounds identified were: acetaldehyde; acrolein; benzene; 1, 3-butadiene; diesel particulate matter (PM) plus diesel exhaust organic gases; ethylbenzene; formaldehyde; naphthalene; and polycyclic organic matter (POM). While FHWA considers these the priority MSATs, the list is subject to change and may be adjusted in consideration of future EPA rules.

The FHWA guidance of October 18, 2016, presents a tiered approach for assessing MSATs in NEPA documents. The three levels are for projects with: (1) no meaningful MSAT effects; (2) low potential MSAT effects; and (3) high potential MSAT effects, respectively. The FHWA guidance defines the levels of analysis for each type of MSAT effect as:

- No analysis for projects with no potential for meaningful MSAT effects;
- Qualitative analysis for projects with low potential MSAT effects; and
- Quantitative analysis for projects with high potential MSAT effects.

The Build Alternative is evaluated against the threshold criteria to determine the appropriate level of MSAT analysis for this project.

2.4 CARBON MONOXIDE

In 1987, FHWA issued a Technical Advisory providing guidance for preparing and processing of environmental impacts for EAs and Environmental Impact Statements (EIS) under NEPA.\(^{14}\) Section V(G)(8) pertains to air quality, including a summary of the project-related CO analysis. VDOT and FHWA have developed programmatic agreements to streamline the analysis requirements for projects using worst-case modeling results, consistent with the EPA and FHWA guidance. The next section presents a summary of the latest Programmatic Agreement (PA), which sets the procedures and thresholds recommended for a CO air quality study for projects in Virginia.

2.5 PROGRAMMATIC AGREEMENTS (PA)

The Programmatic Agreement (PA) for Project-Level Air Quality Analyses for Carbon Monoxide (2016 PA)\(^{15}\) was implemented on May 16, 2016 between FHWA and VDOT. This 2016 PA was developed based on a national template created in the recently completed National Cooperative Highway Research Program (NCHRP) 25-25(78) study. This PA uses the number of lanes, approach speeds, roadway grades, and other criteria to screen projects that include highway links, 90 degree intersections, and interchanges with adjacent 90 degree intersections. The 2016 PA also incorporates by reference, the skewed intersection and accompanying average daily traffic (ADT) criteria from the previously executed (2009) Project-Level Carbon Monoxide Air Quality Studies Agreement (2009 PA), and so may be applied to screen skewed intersections as well. Intersections that cannot be screened out are subject to project-specific modeling.

\(^{13}\) See: https://www.fhwa.dot.gov/Environment/air_quality/air_toxics/policy_and_guidance/msat/index.cfm

\(^{14}\) See: https://www.environment.fhwa.dot.gov/projdev/impTA6640.asp#aq

\(^{15}\) See: http://www.virginiadot.org/projects/resources/air/2016_FHWA-VDOT_PA_for_CO_from_NCHRP25-2578_Attachment2_FiNAL.pdf
3. EXISTING CONDITIONS

3.1 AIR QUALITY ATTAINMENT STATUS OF THE PROJECT AREA

The CAA requires a transportation conformity demonstration with a State Implementation Plan (SIP) for any EPA designated criteria pollutant in non-attainment or maintenance areas. The EPA Green Book\(^\text{16}\) shows that Fairfax County is in the Washington DC-MD-VA Area air shed and designated as non-attainment for the 2008 ozone standard. The county is designated as attainment for all other NAAQS. The county was previously designated as a maintenance area for PM\(_{2.5}\) for the 1997 primary annual standard, but the EPA revoked that NAAQS\(^\text{17}\). Therefore, transportation conformity requirements no longer apply for the PM\(_{2.5}\) standard and no analysis is necessary.

3.2 AMBIENT AIR QUALITY DATA AND TRENDS

Virginia Department of Environmental Quality’s (VDEQ) annual air quality monitoring report shows that the measured pollutant concentrations from all stations representative of the Study Area are below the NAAQS. Figure 3-1 and Figure 3-2 present the VDEQ 10-year monitoring data for CO and ozone concentrations since 2006 in the Northern Region of Virginia. CO has decreased in concentration from 2006 to 2014; however, there was a noticeable spike in concentration in 2010. Ozone concentrations decreased from 2006 to 2009 and then saw a sharp increase in 2010. Since 2010, ozone concentrations have been generally decreasing once again. Although there has been fluctuation in concentration, the overall reductions, since 2006, have occurred due to a variety of control measures that have been implemented over the last two decades, including motor vehicle engine controls, reductions in evaporative emissions from gasoline stations and consumer products, as well as reductions from power plants, businesses, and residential combustion sources.

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\(^{16}\) EPA Green Book: [https://www3.epa.gov/airquality/greenbook/faq.html](https://www3.epa.gov/airquality/greenbook/faq.html)

\(^{17}\) For background, the 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](https://www.gpo.gov/fdsys/pkg/FR-2016-08-24/pdf/2016-18768.pdf)). Accordingly, Fairfax County is no longer designated as maintenance for PM\(_{2.5}\), and the associated EPA regulatory requirements for conformity for PM\(_{2.5}\) are eliminated for northern Virginia.
Figure 3-1: VDEQ 10-Year Trend for 8-hour Carbon Monoxide (ppm) – Northern Region

Source: VDEQ Ambient Air Monitoring 2015 Data Report

Figure 3-2: VDEQ 10-Year Trend for Ozone (ppm) – Northern Region

Source: VDEQ Ambient Air Monitoring 2015 Data Report
4. PROJECT ASSESSMENT

4.1 CARBON MONOXIDE (CO)

Carbon monoxide is a colorless, odorless gas that is produced by incomplete burning of carbon compounds in fossil fuels (gasoline, natural gas, coal, oil, etc.). Over half of the CO emissions in the country come from motor vehicle exhaust. Other sources include construction equipment, boats, lawn mowers, wood stoves, forest fires, and industrial manufacturing processes (VDEQ, 2015).

Carbon monoxide concentrations are higher near heavily traveled highways, and drop rapidly the further the distance from the road. Ambient levels of CO tend to be higher in the colder months due to “thermal inversions” that trap pollutants close to the ground (VDEQ, 2015).

Carbon monoxide is harmful because it reacts in the bloodstream, reducing the amount of oxygen that is supplied to the heart and brain. CO can be harmful at lower levels to people who suffer from cardiovascular disease. At high levels, CO can impair brain function, causing vision problems, reduce manual dexterity, and reduce ability to perform complicated tasks. At very high levels, CO can be deadly (VDEQ, 2015).

4.1.1 Methodology

The CO analysis included a review of 11 signalized intersections in the Study Area using the VDOT-FHWA Programmatic Agreement for Project-Level Air Quality Analyses for Carbon Monoxide (2016). The 2016 PA establishes the type of projects and conditions that would not require project-specific modeling or a quantitative air quality analysis for compliance with the NAAQS.

For background, the 2016 PA was based on the recent NCHRP 25-25 Task 78 study templates. Virginia-specific background concentrations and persistence factor were applied as specified in the VDOT Project-Level Air Quality Resource Document (2016). The ADT thresholds, project type, and project conditions detailed or incorporated by reference in the PA were developed and approved based on modeling using “worst-case” traffic and meteorological assumptions. Study corridor intersections that meet these criteria do not require project-specific modeling for CO. Therefore, the Build Alternative’s Design Year forecast volume, roadway grades, and intersection skew angles were compared to the thresholds specified in the current 2016 PA.

As the 2016 PA does not include skewed intersections, it incorporates, by reference, the criteria specified in the previously existing 2009 PA for skewed intersections. Under the terms of the 2009 Agreement, project-level air quality (hot-spot) analyses are typically only conducted for CO projects that exceed specified ADT and Level of Service (LOS) thresholds or for any project for which an EIS is being prepared. The thresholds in the 2009 PA were originally established based on worst-case modeling for typical arterial intersections, with different thresholds applying for different intersection skew angles.

The 2016 PA, and by reference, the criteria for skewed intersections from the 2009 PA, were then applied to screen the intersections for the Build Alternative, including skewed and non-skewed intersections. The results of the screening-methodology are discussed further in the next section.

4.1.2 Intersections Studied

There were 11 intersections evaluated and these are shown in Figure 4-1 and identified in Table 4-1.
Figure 4-1: Richmond Highway Intersections Studied
Table 4-1: Richmond Highway Intersections Studied

<table>
<thead>
<tr>
<th>Map ID</th>
<th>Intersection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ladson Ln (VA 921)</td>
</tr>
<tr>
<td>2</td>
<td>Mt. Vernon Hwy (VA 235)/Buckman Rd (VA 836)</td>
</tr>
<tr>
<td>3</td>
<td>Janna Lee Ave (VA 1202)</td>
</tr>
<tr>
<td>4</td>
<td>Russel Rd/Reddick Ave (VA 3111/VA 1097)</td>
</tr>
<tr>
<td>5</td>
<td>Mohawk Ln (VA 924)</td>
</tr>
<tr>
<td>6</td>
<td>Buckman Rd (VA 836)</td>
</tr>
<tr>
<td>7</td>
<td>Frye Rd (VA 3191)</td>
</tr>
<tr>
<td>8</td>
<td>Lukens Ln (VA 624)</td>
</tr>
<tr>
<td>9</td>
<td>Cooper Rd (VA 3105)</td>
</tr>
<tr>
<td>10</td>
<td>Sacramento Dr (VA 5282)</td>
</tr>
<tr>
<td>11</td>
<td>Mt. Vernon Memorial Hwy (VA 235)/Jeff Todd Way (VA 619)</td>
</tr>
</tbody>
</table>

Based on the use of the aforementioned methodology and the data presented in Table 4-2, three intersections did not meet the criteria specified in the 2016 PA.

- The Route 836 / Route 235 (Buckman Road / Mount Vernon Highway) intersection did not meet the criteria for the 2016 PA as it is a skewed intersection (80 degrees). In addition, it did not meet the criteria for skewed intersections as the Design Year ADT (86,025) was greater than the 59,000 ADT threshold for skewed intersections 60 degrees and greater.

- The Route 836 / Route 888 (Buckman Road / Radford Avenue) intersection did not meet the criteria for the 2016 PA as it is a skewed intersection (23 degrees) and has an existing maximum approach grade of three percent. In addition, it did not meet the criteria for skewed intersections as the 23-degree skew angle was less than the minimum of 30 degrees.

- The Route 619 / Route 235 (Jeff Todd Way / Mount Vernon Memorial Highway) intersection did not meet the criteria for the 2016 PA as it is a skewed intersection (85 degrees). In addition, it did not meet the criteria for skewed intersections as the Design Year ADT (68,873) was greater than the 59,000 ADT threshold for skewed intersections 60 degrees and greater.
Table 4-2: 2045 Build Alternative Traffic Data and Programmatic Agreement Application

<table>
<thead>
<tr>
<th>Map ID</th>
<th>Intersection</th>
<th>Skew Angle (Deg.)</th>
<th>Road Grade [%]</th>
<th>Design Year Forecast ADT</th>
<th>Peak Hour Volume</th>
<th>Vehicles Per Hour Per Lane</th>
<th>Posted Speed Limit (mph)</th>
<th>Maximum Lanes at Intersection (single leg)</th>
<th>Concept 2 2045 Build Worst Case LOS (sec/veh)</th>
<th>Screen Out with PA? (Year)</th>
<th>Skewed Intersection?</th>
<th>Road Grade 2% or less?</th>
<th>Approach Speed Greater than 15 mph?</th>
<th>Maximum Lanes at the Intersection Greater than 6?</th>
<th>Vehicles per Hour per Lane Greater than 1037?</th>
<th>ADT Less than 59,000 (Skew Angle &gt;60 deg)?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Route 921 (Ladson Ln)</td>
<td>90</td>
<td>2</td>
<td>94,911</td>
<td>7,498</td>
<td>1,071</td>
<td>25</td>
<td>4</td>
<td>C (29.1)</td>
<td>Yes (2016)</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>2</td>
<td>Route 836/Route 235 (Buckman Rd/ Mt. Vernon Hwy)</td>
<td>80</td>
<td>1</td>
<td>86,025</td>
<td>6,796</td>
<td>850</td>
<td>25</td>
<td>6</td>
<td>E (68.7)</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>3</td>
<td>Route 1202 (Janna Lee Ave)</td>
<td>90</td>
<td>1</td>
<td>57,823</td>
<td>4,568</td>
<td>653</td>
<td>25</td>
<td>4</td>
<td>C (20.1)</td>
<td>Yes (2009)</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>4</td>
<td>Route 3112/Route 1097 (Russell Rd/ Reddick Ave)</td>
<td>90</td>
<td>&lt;1</td>
<td>60,051</td>
<td>4,744</td>
<td>593</td>
<td>25</td>
<td>4</td>
<td>E (57.4)</td>
<td>Yes (2016)</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>5</td>
<td>Route 924 (Mohawk Ln)</td>
<td>80</td>
<td>&lt;1</td>
<td>54,620</td>
<td>4,315</td>
<td>539</td>
<td>25</td>
<td>4</td>
<td>B (26.8)</td>
<td>Yes (2009)</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>6</td>
<td>Route 836/Route 888 (Buckman Rd / Radford Ave)</td>
<td>23</td>
<td>3</td>
<td>55,342</td>
<td>4,372</td>
<td>547</td>
<td>25</td>
<td>4</td>
<td>B (17.4)</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>7</td>
<td>Route 3191 (Frye Rd)</td>
<td>79</td>
<td>1</td>
<td>57,392</td>
<td>4,534</td>
<td>567</td>
<td>25</td>
<td>5</td>
<td>C (31.6)</td>
<td>Yes (2009)</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>8</td>
<td>Route 624 (Lukens Ln)</td>
<td>77</td>
<td>4</td>
<td>54,418</td>
<td>4,299</td>
<td>537</td>
<td>25</td>
<td>4</td>
<td>C (31.1)</td>
<td>Yes (2009)</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>9</td>
<td>Route 3105 (Cooper Rd)</td>
<td>90</td>
<td>2</td>
<td>52,608</td>
<td>4,156</td>
<td>520</td>
<td>25</td>
<td>5</td>
<td>E (56.2)</td>
<td>Yes (2009)</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>10</td>
<td>Route 5282 (Sacramento Dr)²</td>
<td>89</td>
<td>2</td>
<td>53,848</td>
<td>4,254</td>
<td>30</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Route 619/Route 235 (Jeff Todd Way / Mt. Vernon Memorial Hwy)</td>
<td>85</td>
<td>1.5</td>
<td>68,873</td>
<td>5,441</td>
<td>605</td>
<td>35</td>
<td>4</td>
<td>E (65.8)</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Notes:
1. Existing roadway grades estimated from Google Earth.
2. Under Concept 2, Sacramento Drive is realigned with Cooper Road. The traffic data for Cooper Road takes this realignment into account.
However, these three intersections can be assessed based on a weight-of-evidence approach that makes it clear that project-specific modeling is not required. The evidence to be considered include the 2009 PA criteria and the data provided in Table 4-2, the effective ADT, and the effect on emission factors of continued fleet turnover to the project opening year of 2025. Note, for this purpose, the effective ADT is determined by prorating the design year ADT by the ratio of vehicles per hour per lane (vphpl) to the FHWA-default value used in the 2009 PA (1037 vphpl).

- **Route 836 / Route 235 (Buckman Road / Mount Vernon Memorial Highway) (Map ID 2):** First and foremost, the intersection is only slightly skewed (80 degrees vs 90 degrees unskewed), so the modeled ambient concentrations would differ only slightly from those for an unskewed intersection that would be cleared with the 2016 PA. Given that the 2016 PA used emission factors for 2015 and the project opening year is 2025, the emission factors for this project would be much lower for CO given the continued fleet turnover to new vehicles which are designed to meet more stringent emission standards set by the EPA. It therefore would reasonably be expected to be cleared using the 2016 PA if the project opening year emission factors were used.

  Second, and building on the point above, the 2009 PA applied emission factors in worst-case modeling for an opening year of 2009. The emission factors for CO would be much lower for the project opening year of 2025, given continued fleet turnover to new vehicles designed to meet ever-more stringent emission standards set by the EPA. In other words, this project would therefore reasonably be expected to again be cleared for CO using the criteria from the 2009 PA if the actual project opening year emission factors were used.

  Third, this intersection has a vphpl value of 850 which is below the 1,037 vphpl used in the 2009 PA for skewed intersections. Therefore, the effective ADT would be reduced correspondingly (to 70,512); which is significantly closer to the 59,000 ADT threshold value for a skewed intersection 60 degrees or greater. Related to this note, the worst-case delay for the 2045 No-Build scenario is 149.2 seconds per vehicle in comparison to the 68.7 second per vehicle delay under the 2045 Build Concept 2 scenario.

Given the weight of evidence, (i.e., all of these factors), a hot-spot analysis is not warranted for this intersection.

- **Route 836 / Route 888 (Buckman Road / Radford Avenue) (Map ID 6):** This intersection has a vphpl value of 547 which is well below the FHWA-default value of 1,037 vphpl that was applied in the 2009 PA for skewed intersections. Therefore, by proration, the effective ADT would be only 29,192 which is well below the lowest threshold value for skewed intersections (39,000 ADT). The intersection is also forecasted to operate at a LOS B in the 2045 Build Concept 2 scenario. In addition, the 2009 PA used emission factors in the worst-case modeling for an opening year of 2009. Based on this project’s opening year of 2025, the emission factors would be much lower for CO given the continued fleet turnover to new vehicles which are designed to meet more stringent emission standards set by the EPA.

Given the weight of evidence, a hot-spot analysis is not warranted for this intersection.

- **Route 619 / Route 235 (Jeff Todd Way / Mount Vernon Memorial Highway) (Map ID 11):** This intersection has a vphpl value of 605 which is well below the FHWA-default value of 1,037 vphpl that was applied in the 2009 PA for skewed intersections. Therefore, by proration, the effective ADT is 40,181 which is well below the 59,000 ADT threshold value specified in the 2009 PA for a
skewed intersection 60 degrees or greater. This intersection is also forecasted to operate at LOS E in the 2045 Build Concept 2 scenario in comparison to LOS F in the 2045 No-Build scenario.

In addition, the 2009 PA used emission factors in the worst-case modeling for an opening year of 2009. Based on this project’s opening year of 2025, the emission factors would be much lower for CO given the continued fleet turnover to new vehicles which are designed to meet more stringent emission standards set by the EPA.

Given the weight of evidence, a hot-spot analysis is not warranted for this intersection.

4.1.3 CO Conclusions

In sum, each of the 11 Study Area intersections were screened out using the 2016 PA (and by reference the 2009 PA) along with consideration of the “weight of evidence” approach for three intersections that did not quite fit the criteria from the PA. These results demonstrate that these intersections would not cause or contribute to a violation of the CO NAAQS within the Study Area.

4.2 MOBILE SOURCE AIR TOXICS

4.2.1 MSAT Background

Controlling air toxic emissions became a national priority with the passage of the CAA, when Congress mandated that the EPA regulate 188 air toxics, also known as hazardous air pollutants. The EPA assessed this expansive list in their 2007 rule on the Control of Hazardous Air Pollutants from Mobile Sources and identified a group of 93 compounds emitted from mobile sources that are listed in their Integrated Risk Information System. In addition, EPA identified seven compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers from their 1999 National Air Toxics Assessment. The seven compounds identified were: acrolein; benzene; 1,3 butadiene; diesel particulate matter; formaldehyde; naphthalene; and polycyclic organic matter. While FHWA considers these the priority MSATs, the list is subject to change and may be adjusted in consideration of future EPA rules.

4.2.2 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 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 in to 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. 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. FHWA will continue to monitor developing research in this field.

4.2.3 Methodology

Per the Updated Interim Guidance on MSAT Analysis in NEPA Documents (2016), this project is considered a minor widening project in which the Design-Year traffic is projected to be well under the FHWA threshold of 140,000 to 150,000 ADT to be considered a project with high potential effects. As shown in Figure 4-2 and Table 4-3 the highest projected 2045 Build Alternative ADT along a roadway segment within the Study
Area is 89,350 (Map ID J). Therefore, in accordance with the FHWA guidance, this project is likely to have Low Potential for MSAT Effects, and a Tier 2 (qualitative) analysis is presented in the following section.

### 4.2.4 Qualitative MSAT Analysis

For the Build and No-Build Alternative, the amount of MSATs emitted would be proportional to the Vehicle Miles Traveled (VMT). The VMT estimated for the Build Alternative is slightly higher (Table 4-4) than that for the No-Build Alternative, because the additional capacity increases the efficiency of the roadway and attracts rerouted trips from elsewhere in the transportation network. This increase in VMT would lead to higher MSAT emissions for the Build Alternative along the project corridor, along with corresponding decrease in MSAT emissions along parallel routes. The emission increase is offset somewhat by lower MSAT emission rates due to increased speeds; according to the EPA’s MOVES2014 model, emissions of all the priority MSATs decrease as speed increases. Because the estimated VMT between the No-Build and Build Alternatives are nearly the same, varying by less than eight percent, it is expected there would be no appreciable difference in overall MSAT emissions. 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. 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.

The additional travel lanes proposed as part of the Build Alternative will have the effect of moving some traffic closer to nearby homes, schools, and businesses; therefore, there may be localized areas where ambient concentrations of MSATs could be higher under the Build Alternative than the No-Build Alternative. The localized increases in MSAT concentrations would likely be most pronounced along the expanded roadway sections along Richmond Highway. However, the magnitude and the duration of the 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 sum, when a highway is widened, 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). Also, MSATs will be lower in other locations when traffic shifts away from them. However, on a regional basis, EPA’s vehicle and fuel registrations, coupled with fleet turnover, will over time cause substantial reductions that, in almost all cases, will cause region-side MSAT levels to be significantly lower than today.
Figure 4-2: Study Area Average Daily Traffic
Table 4-3: Average Daily Traffic – Existing, Opening, Design Year

<table>
<thead>
<tr>
<th>Map ID</th>
<th>2016 Existing</th>
<th>2025 No-Build</th>
<th>2025 Build</th>
<th>2045 No-Build</th>
<th>2045 Build</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>34,500</td>
<td>38,050</td>
<td>39,000</td>
<td>47,400</td>
<td>51,000</td>
</tr>
<tr>
<td>B</td>
<td>14,000</td>
<td>15,450</td>
<td>15,800</td>
<td>19,250</td>
<td>20,650</td>
</tr>
<tr>
<td>C</td>
<td>14,750</td>
<td>16,300</td>
<td>16,650</td>
<td>20,250</td>
<td>21,800</td>
</tr>
<tr>
<td>D</td>
<td>32,300</td>
<td>35,650</td>
<td>36,450</td>
<td>44,350</td>
<td>47,650</td>
</tr>
<tr>
<td>E</td>
<td>7,700</td>
<td>8,450</td>
<td>8,650</td>
<td>10,550</td>
<td>11,350</td>
</tr>
<tr>
<td>F</td>
<td>36,800</td>
<td>40,600</td>
<td>41,500</td>
<td>50,500</td>
<td>54,250</td>
</tr>
<tr>
<td>G</td>
<td>38,650</td>
<td>42,650</td>
<td>43,600</td>
<td>53,100</td>
<td>57,000</td>
</tr>
<tr>
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<td>12,150</td>
<td>12,450</td>
<td>15,150</td>
<td>16,300</td>
</tr>
<tr>
<td>I</td>
<td>11,500</td>
<td>12,700</td>
<td>12,950</td>
<td>15,800</td>
<td>16,950</td>
</tr>
<tr>
<td>J</td>
<td>60,550</td>
<td>66,800</td>
<td>68,325</td>
<td>83,150</td>
<td>89,350</td>
</tr>
</tbody>
</table>

Note: Map ID corresponds to road segments found in Figure 4-2.

Table 4-4: Vehicle Miles Traveled – Existing, Opening, Design Year

<table>
<thead>
<tr>
<th>Map ID</th>
<th>2016 Existing</th>
<th>2025 No-Build</th>
<th>2025 Build</th>
<th>2045 No-Build</th>
<th>2045 Build</th>
</tr>
</thead>
<tbody>
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<td>19,110</td>
<td>23,226</td>
<td>24,990</td>
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<tr>
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<td>7,416</td>
<td>7,584</td>
<td>9,240</td>
<td>9,912</td>
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<tr>
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<td>40,098</td>
<td>40,959</td>
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<td>53,628</td>
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<tr>
<td>D</td>
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<td>47,415</td>
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<td>2,873</td>
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<td>3,859</td>
</tr>
<tr>
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<td>13,280</td>
<td>16,160</td>
<td>17,360</td>
</tr>
<tr>
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<td>67,830</td>
</tr>
<tr>
<td>H</td>
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<td>9,836</td>
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<td>12,877</td>
</tr>
<tr>
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<td>6,096</td>
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<td>8,136</td>
</tr>
<tr>
<td>J</td>
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<td>213,092</td>
<td>217,957</td>
<td>265,249</td>
<td>285,027</td>
</tr>
<tr>
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<td>408,978</td>
<td>418,245</td>
<td>509,004</td>
<td>546,993</td>
</tr>
</tbody>
</table>

Note: Map ID corresponds to road segments found in Figure 4-2.

4.2.5 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 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 EPA is responsible for protecting the public health and welfare from any known or anticipated effect of an air pollutant. They are the lead authority for administering the CAA and its amendments and have specific statutory obligations with respect to hazardous air pollutants and MSAT. The EPA is in the continual process of assessing human health effects, exposures, and risks posed by air pollutants.
pollutants. They maintain the Integrated Risk Information System\(^{18}\), which is “a compilation of electronic reports on specific substances found in the environment and their potential to cause human health effects”. 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. Several Health Effects Institute studies are summarized in Appendix D of FHWA’s 2016 Updated Interim Guidance on MSATs 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\(^{19}\) 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 with each step in the process building on the model predictions obtained in the previous step. All are encumbered by technical shortcomings or uncertain science that prevents a more complete differentiation of the MSAT health impacts among a set of project alternatives. These difficulties are magnified for lifetime (i.e., 70 year) assessments, particularly because unsupported 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 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 the Health Effects Institute. 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 (EPA IRIS database, Diesel Engine Exhaust, Section II.C.).”

There is also the lack of a national consensus on an acceptable level of risk. The current context is the process used by the EPA as provided by the CAA to determine whether more stringent controls are required 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

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\(^{18}\) EPA, [https://www.epa.gov/iris](https://www.epa.gov/iris)

\(^{19}\) Health Effects Institute, [https://www.healtheffects.org/publication/mobile-source-air-toxics-critical-review-literature-exposure-and-health-effects](https://www.healtheffects.org/publication/mobile-source-air-toxics-critical-review-literature-exposure-and-health-effects)
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 US Court of Appeals for the District of Columbia Circuit upheld EPA’s approach to addressing risk in its two-step decision framework. Information is incomplete or unavailable to establish that even the largest of highway projects would result in levels of risk greater than deemed acceptable.

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

4.2.6 MSAT Conclusions

The information known regarding MSATs is still evolving. Information is currently incomplete or unavailable to credibly predict the project-specific health impacts due to changes in MSAT emissions associated with the No-Build and Build Alternatives. Under the Build Alternative, there may be slightly higher MSAT emission in the design year relative to the No-Build Alternative due to increased VMT. There could also be increases in MSAT levels in a few localized areas where VMT increases. However, the EPA’s vehicle and fuel regulations are expected to result in significantly lower MSAT levels in the future than exist today due to cleaner engine standards coupled with fleet turnover. The magnitude of the EPA-projected reductions is so great, that even after accounting for VMT growth, MSAT emissions in the study area would be significantly lower in the future that they are today, regardless of the alternative chosen.

5. 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’s Road and Bridge Specifications.20

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 are21 “…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.”

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23 See: http://leg1.state.va.us/cgi-bin/legp504.exe?000+reg+9VAC5-45-760
24 See: http://leg1.state.va.us/cgi-bin/legp504.exe?000+reg+9VAC5-50-60
6. REGIONAL CONFORMITY STATUS OF THE PROJECT

The EPA’s transportation rule conformity requirements (40 CFR §93.114 and 40 CFR §93.115) for regional analyses apply as the Study Area (in Fairfax County) is designated as nonattainment for ozone. Therefore, a currently conforming transportation plan and program is required at the time of project approval, and the project must come from a conforming plan and program. The project is included in the National Capital Regional Transportation Planning Board’s Fiscal Year 2017-2022 Transportation Improvement Program (TIP) as TIP ID 6443, and the Financially Constrained Long-Range Transportation Plan (CLRP) for the National Capital Region as CLRP ID 1942. The project is found in the Air Quality Conformity Analysis for 2016 CLRP Amendment as Project ID VP1U.

7. INDIRECT EFFECTS AND CUMULATIVE IMPACTS

Effects of the project that would occur at a later date or are fairly distant from the project are referred to as indirect effects. Cumulative impacts are those effects that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts are inclusive of the indirect effects. As summarized below, the potential for indirect effects or cumulative impacts to air quality that may be attributable to this project is not expected to be significant.

The CO and MSAT assessments conducted for the project are considered indirect effects analyses because they take into account air quality impacts attributable to the project that occur at a later time in the future. These qualitative assessments indicate that the potential for indirect effects associated with the project are not expected to be significant. They demonstrate that in the future: (1) impacts from CO emissions will not cause or contribute to violations of the CO NAAQS; and (2) the project is considered to have low potential for MSAT impacts and emissions will be significantly lower than they are today.

The annual regional conformity analysis (Air Quality Conformity Analysis of the CLRP Amendment and FY 2017-2022 TIP) conducted by the NCRTPB 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 emission from past and present actions, and these pollutants serve as a baseline for the current conformity analysis. That conformity analysis quantifies the amount of mobile source emissions for which the area is designated nonattainment/maintenance that will result from the implementation of all reasonably foreseeable (i.e., those proposed for construction funding over the life of the region’s transportation plan) and regionally significant transportation projects in the region.

As noted above, the conformity analysis conducted for the NCRTPB CLRP 2016 Amendment includes the project. Therefore, this demonstrates 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 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 the EPA. In conclusion, the indirect and cumulative effects of the project are not expected to be significant.

Overall, the potential for indirect effects and cumulative impacts associated with the project is not expected to be significant.

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For additional information regarding Indirect Effects and Cumulative Impacts, please refer to the *Richmond Highway Improvements – Jeff Todd Way to Napper Road Indirect Effects and Cumulative Impacts Technical Report.*
8. REFERENCES


