Robert Andrew Joyner, P.E  
Project Development and Environmental Analysis Unit  
Human Environment Section Head

Date: 7/20/2016

Gregory A. Smith, P.E  
Project Development and Environmental Analysis Unit  
Human Environment Section  
Traffic Noise & Air Quality Supervisor

Date: 7/20/2016

For additional information or inquiries, contact:

Traffic Noise & Air Quality Group  
Human Environment Section  
598 Mail Service Center  
Raleigh, North Carolina 27699-1598  
(919) 707-6060
Contents

1 Introduction .................................................................................................................................................. 4
   1.1 Purpose of the Manual......................................................................................................................... 4
   1.2 Policy Statement .................................................................................................................................. 5
   1.3 Legal Justification ................................................................................................................................. 5
      1.3.1 Federal and State Acts, Laws, and Regulation ................................................................................. 5
      1.3.2 Criteria Pollutants ............................................................................................................................ 7
2 Regional Conformity Documentation ......................................................................................................... 10
   2.1 Legal Requirements ............................................................................................................................ 11
   2.2 EPA Classification of Attainment Status ............................................................................................. 11
   2.3 Required Conformity Information in NEPA Documents ..................................................................... 11
3 Reporting Requirements for Project-Level Air Quality Analyses ............................................................ 12
   3.1 NEPA Documentation for Pollutants of Concern ............................................................................... 12
      3.1.1 CO Documentation......................................................................................................................... 12
      3.1.2 Particle Pollution Documentation .................................................................................................. 14
      3.1.3 MSAT Documentation .................................................................................................................... 15
      3.1.4 Conformity Documentation ........................................................................................................... 15
   3.2 Project-Level Air Quality Report Content ........................................................................................... 15
   3.3 Technical File Requirements and Content ........................................................................................... 16
4 Initial Project-Level Scoping and Determining the Appropriate Level of Air Quality Analyses .............. 17
   4.1 Appropriate Level of Analysis ............................................................................................................. 17
   4.2 Project-Level Scoping ......................................................................................................................... 17
      4.2.1 Scoping CO Analysis for NEPA Documents ..................................................................................... 17
5 Technical Procedures for CO Modeling ..................................................................................................... 18
   5.1 Appropriate Level of Analysis ............................................................................................................. 18
      5.1.1 Qualitative Analysis........................................................................................................................ 18
      5.1.2 Quantitative Analysis ..................................................................................................................... 18
   5.2 EPA / FHWA Approved Models .......................................................................................................... 18
      5.2.1 MOVES2014 ................................................................................................................................... 18
      5.2.2 CAL3QHC / CAL3QHCR ................................................................................................................... 19
   5.3 Micro-Scale CO Modeling Guidance ................................................................................................... 20
      5.3.1 Consideration of Areas Sensitive to Air Quality Impacts ............................................................... 20
5.3.2 Receptor Locations ........................................................................................................................ 20
5.3.3 Determination of Analysis Years ........................................................................................................ 21
5.3.4 Determination of Background Concentrations .................................................................................. 21
5.3.5 NAAQS for CO and Required Averaging Periods ............................................................................ 22
5.3.6 Micro-scale Modeling Defaults ........................................................................................................ 23
5.3.7 Data Needs ..................................................................................................................................... 24
5.4 Compliance with NAAQS for CO ......................................................................................................... 25
5.5 Model Refinement and Air Quality Impact Mitigation ......................................................................... 25
6 Technical Procedures for Particle Pollution Analyses ........................................................................... 25
  6.1 Introduction ....................................................................................................................................... 25
  6.2 Qualitative Analyses ........................................................................................................................... 25
  6.3 Quantitative Analyses ........................................................................................................................ 26
    6.3.1 Purpose of the Guidance ............................................................................................................... 26
    6.3.2 Background .................................................................................................................................... 26
    6.3.3 Completing a Quantitative Particle Pollution Hot-Spot Analysis ................................................... 26
7 Technical Procedures for MSAT Analyses ............................................................................................. 29
  7.1 Background ........................................................................................................................................ 29
  7.2 MSAT Analytical Procedures .............................................................................................................. 29
    7.2.1 Projects with No Meaningful Potential MSAT Effects or Exempt Projects ..................................... 29
    7.2.2 Projects with Low Potential MSAT Effects ..................................................................................... 30
    7.2.3 Projects with Higher Potential MSAT Effects ................................................................................. 30
8 Contact Information .................................................................................................................................. 34
## Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>AADT</td>
<td>average annual daily traffic</td>
</tr>
<tr>
<td>CAA</td>
<td>Clean Air Act of 1970</td>
</tr>
<tr>
<td>CAAA</td>
<td>Clean Air Act Amendments of 1977/1990</td>
</tr>
<tr>
<td>CE</td>
<td>Categorical Exclusion</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>CICG</td>
<td>Conformity Interagency Consultation Group</td>
</tr>
<tr>
<td>CO</td>
<td>carbon monoxide</td>
</tr>
<tr>
<td>EA</td>
<td>Environmental Assessment</td>
</tr>
<tr>
<td>EIS</td>
<td>Environmental Impact Statement</td>
</tr>
<tr>
<td>EPA</td>
<td>United States Environmental Protection Agency</td>
</tr>
<tr>
<td>FAST</td>
<td>Fixing America’s Surface Transportation Act</td>
</tr>
<tr>
<td>FHWA</td>
<td>Federal Highway Administration</td>
</tr>
<tr>
<td>FONSI</td>
<td>Finding of No Significant Impact</td>
</tr>
<tr>
<td>FTA</td>
<td>Federal Transit Administration</td>
</tr>
<tr>
<td>HCS</td>
<td>Highway Capacity Software</td>
</tr>
<tr>
<td>I/M</td>
<td>Inspection/Maintenance</td>
</tr>
<tr>
<td>ISTEA</td>
<td>Intermodal Surface Transportation Efficiency Act of 1991</td>
</tr>
<tr>
<td>LOS</td>
<td>level of service</td>
</tr>
<tr>
<td>LRTP</td>
<td>long range transportation plan</td>
</tr>
<tr>
<td>μg/m³</td>
<td>micrograms per cubic meter</td>
</tr>
<tr>
<td>m/s</td>
<td>meter per second</td>
</tr>
<tr>
<td>MAP-21</td>
<td>Moving Ahead for Progress in the 21st Century</td>
</tr>
<tr>
<td>MOVES</td>
<td>Motor Vehicle Emission Simulator</td>
</tr>
<tr>
<td>MPO</td>
<td>metropolitan planning organization</td>
</tr>
<tr>
<td>MSAT</td>
<td>mobile source air toxics</td>
</tr>
<tr>
<td>MTP</td>
<td>Metropolitan Transportation Plan</td>
</tr>
<tr>
<td>NCDEQ/DAQ</td>
<td>North Carolina Department of Environmental Quality Division of Air Quality</td>
</tr>
<tr>
<td>NCDOT</td>
<td>North Carolina Department of Transportation</td>
</tr>
<tr>
<td>NEPA</td>
<td>National Environmental Policy Act</td>
</tr>
<tr>
<td>NO₂</td>
<td>nitrogen dioxide</td>
</tr>
<tr>
<td>O₃</td>
<td>ozone</td>
</tr>
<tr>
<td>Pb</td>
<td>lead</td>
</tr>
<tr>
<td>PM₂.₅</td>
<td>particle pollution 2.5 microns and smaller</td>
</tr>
<tr>
<td>PM₁₀</td>
<td>particle pollution smaller than 10 microns but larger than 2.5 microns</td>
</tr>
<tr>
<td>ppb</td>
<td>parts per billion</td>
</tr>
<tr>
<td>ppm</td>
<td>parts per million</td>
</tr>
<tr>
<td>ROD</td>
<td>Record of Decision</td>
</tr>
<tr>
<td>SAFETEA-LU</td>
<td>Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users</td>
</tr>
<tr>
<td>SEPA</td>
<td>State Environmental Policy Act</td>
</tr>
<tr>
<td>SIP</td>
<td>state implementation plan</td>
</tr>
<tr>
<td>SO₂</td>
<td>sulfur dioxide</td>
</tr>
<tr>
<td>TEA-21</td>
<td>Transportation Equity Act for the 21st Century</td>
</tr>
<tr>
<td>TIP</td>
<td>Transportation Improvement Program</td>
</tr>
<tr>
<td>USDOT</td>
<td>United States Department of Transportation</td>
</tr>
<tr>
<td>vpd</td>
<td>vehicles per day</td>
</tr>
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</table>
1 Introduction

The North Carolina Department of Transportation (NCDOT) Air Quality Manual provides background information, guidelines, and standards for conducting project-level air quality analyses within the state of North Carolina. Any transportation project utilizing federal-aid funding or requiring Federal Highway Administration (FHWA) approval must be evaluated for its potential impacts on the natural and human environment. Air quality is one of several elements within the human environment to be considered as a part of the project’s National Environmental Policy Act (NEPA) evaluation. The NEPA requirements related to project-level air quality analyses are outlined in Title 23, Part 771 of the Code of Federal Regulations (23 CFR 771).

Project-level air quality analyses will vary from one project to another, based on the following considerations:

- FHWA guidance allows for considerable flexibility in performing air quality analyses, in which the scope, content, assumptions, and level of technical detail are typically coordinated between the State Department of Transportation (NCDOT), the State Air Quality Agency [the North Carolina Department of Environmental Quality Division of Air Quality (NCDEQ/DAQ)], and local air quality agencies.
- Local conditions such as project location, topography, and meteorology influence the type and level of analysis. Large projects located in urbanized areas, as well as controversial projects, typically require detailed analyses. Detailed air quality analyses may also be required for projects located in geographical areas with unique topography or adverse meteorology.
- There are three types of environmental documentation required by NEPA: Categorical Exclusion (CE), Environmental Assessment (EA), and Environmental Impact Statement (EIS). The end result of the EA process is a summary document called a Finding of No Significant Impact (FONSI), which is issued by the lead Federal Agency. FHWA and Federal Transit Administration (FTA) regulations regarding the preparation of an EA can be found in 23 CFR 771.119. The end result of the EIS process is a summary document called a Record of Decision (ROD), which is issued by the lead Federal Agency. FHWA and FTA regulations regarding the preparation of an EIS can be found in 23 CFRs 771.123 through 771.130.

1.1 Purpose of the Manual

This Manual is intended to assist NCDOT and its consultants in the completion of project-level air quality analyses to satisfy state and federal air quality requirements for transportation improvement projects. The Manual includes:

- A process to analyze air quality impacts on transportation improvement projects
- Background information and citations to relevant state and federal rules, regulations, and guidance documents
- Guidance on scoping the appropriate level of project-level air quality analysis
A screening process to identify projects that may be of air quality concern and a process to
determine the need for air quality modeling during the NEPA process
• Technical guidance and procedures on modeling carbon monoxide (CO) at the project-level
• Technical guidance and procedures for assessing particulate matter (PM$_{2.5}$ and PM$_{10}$) at the project-
level
• Technical guidance and procedures for assessing Mobile Source Air Toxics (MSAT) at the project-level
• Guidance on documenting regional conformity analysis for NEPA documentation

1.2 Policy Statement

This Manual incorporates all pertinent issues relating to air quality analysis at the project-level in North
Carolina. The Manual will be updated on an as-needed basis.

It is NCDOT’s policy to assess the air quality impacts of transportation improvement projects and to give
consideration to the incorporation of appropriate avoidance and mitigation strategies into preliminary
engineering designs and construction for projects which have potential air quality impacts.

These new guidelines are in compliance with 23 CFR 771, and also reflect recent procedures regarding
conformity as published in Title 40, Parts 51 and 93 of the Code of Federal Regulations (40 CFR 51 & 93). It is
NCDOT’s policy to follow regulations and guidance issued by the United States Environmental Protection
Agency (EPA), FHWA, and NCDEQ/DAQ.

The Manual is applicable to both state-funded and federally-funded transportation projects. Guidance
provided herein should be referenced during the project scoping and analysis phases of the transportation
development process.

1.3 Legal Justification

The procedures and processes described in this Manual conform to the legal documentation listed in the
following sections.

1.3.1 Federal and State Acts, Laws, and Regulation

Below is a summary of the relevant state and federal regulations pertaining to air quality analysis for
transportation improvement projects.

1.3.1.1 The Clean Air Act and Amendments

The Clean Air Act (CAA) was enacted in 1970 and established National Ambient Air Quality Standards
(NAAQS). Amended in 1977 and again in 1990, the Clean Air Act (CAA) includes strategies to achieve and
maintain the NAAQS, to reduce air pollutant and pollutant precursor emissions from mobile sources, and to
provide enforcement sanctions for not achieving and maintaining the NAAQS.

Reference: http://www.epa.gov/oar/caa
1.3.1.2 Federal Transportation Legislation

The Moving Ahead for Progress in the 21st Century Act (MAP-21) was signed into law July 6, 2012, and builds upon the groundwork established by prior legislative actions relating to surface transportation, namely the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), the Transportation Equity Act for the 21st Century (TEA-21), and the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). In addition to providing guaranteed funding for highways, this legislation provides a link between transportation and environmental goals by providing funding flexibility and strengthening the role of metropolitan planning organizations (MPOs) in transportation planning and programming. MAP-21 refines the programmatic framework for investments needed to maintain and grow the nation’s transportation infrastructure. MAP-21 addresses the challenges facing the nation’s transportation system challenges such as improving safety, reducing intermodal connectivity, and protecting the environment – as well as laying the groundwork for addressing future challenges.

Building upon and expanding the principles of MAP-21, the Fixing America’s Surface Transportation (FAST) Act was signed into law December 4, 2015. The FAST Act increases transportation funding by 11 percent over five years. The law also makes changes and reforms to many Federal transportation programs, including streamlining the approval processes for new transportation projects, providing new safety tools, and establishing new programs to advance critical freight projects.


1.3.1.3 National Environmental Policy Act (NEPA)

The National Environmental Policy Act of 1969 (NEPA) is the basic national charter for the protection of the environment. It establishes environmental policy, provides an interdisciplinary framework to prevent undue environmental damage, and contains procedures to ensure that decision-makers consider environmental factors. The NEPA process evaluates alternative courses of action based on the dual purpose of environmental protection and transportation improvement goals. The range of alternatives analyzed encompasses a variety of factors including social, economic, and environmental effects.

The project-level air quality analysis required during North Carolina’s NEPA process will vary considerably in content and in level of detail from one project to another based on its size, geographic location, and anticipated impacts. The project-level air quality analysis, which primarily addresses localized emissions of carbon monoxide, is performed to ensure violations of the NAAQS will not occur as a result of the proposed project. Ozone is considered to be a regional pollutant and is evaluated as part of the regional conformity analyses during the project planning phases. Particle pollution and Mobile Source Air Toxics are addressed at varying levels of detail depending on the nature of the project and the regional attainment status for these pollutants.

Reference: http://www.epa.gov/compliance/nepa/epacompliance/

1.3.1.4 North Carolina State Environmental Policy Act (SEPA)

The North Carolina (or State) Environmental Policy Act of 1971 (SEPA) requires state agencies to review and report the environmental effects of all activities that involve an action by a state agency, an expenditure of
public monies or private use of public land, and have a potential negative environmental effect upon natural
resources, public health and safety, natural beauty, or historical or cultural elements of the state. If a report
has been prepared for NEPA, and submitted for review through the State Clearinghouse process, then
additional filing under SEPA is not required.

For any proposed project or activity that fall under SEPA, an Environmental Assessment (EA) or an
Environmental Impact Statement (EIS) must be prepared. Generally, an environmental assessment is
prepared for a proposed project or activity which is not anticipated to include significant environmental
impacts. If the environmental document does not satisfy a Finding of No Significant Impact (FONSI), then an
EIS must be prepared. Thus, if it is known prior to document preparation that a project will have significant
impacts, an EIS can be prepared initially. All air quality analyses performed for SEPA documents will follow
NEPA guidelines.

Reference: http://portal.ncDEQ.org/web/deao/sepa/general-information

1.3.2 Criteria Pollutants

The EPA Office of Air Quality Planning Standards has established primary (to protect public health) and
secondary (to protect public welfare) NAAQS for seven pollutants, referred to as the criteria air pollutants.
The pollutants are ozone (O₃), nitrogen dioxide (NO₂), particulate pollution (PM₂.₅ and PM₁₀), sulfur dioxide
(SO₂), carbon monoxide (CO), and lead (Pb). The standards are provided in TABLE 1.

1.3.2.1 Carbon Monoxide

Carbon monoxide is a colorless, odorless gas that is formed when carbon in fuel is not burned completely. It
is a component of motor vehicle exhaust, which contributes approximately 56 percent of all carbon emissions
nationally. State and federal guidance suggests using CO predictions as the primary indicator for vehicular-
induced pollution. CO is sensitive to variations in temperature; emissions are twice as high in winter months
as compared to summer months. CO is also sensitive to vehicle speed; emissions decrease with an increase in
speed (up to 50 mph), and then increase again at higher speeds. Idling and low speeds (less than 15 mph) can
produce the highest CO levels. Recent trends in air quality indicate CO levels have dramatically improved. The
decline in CO concentrations is primarily due to stricter controls on automobile exhaust resulting in cleaner
cars. This drop is remarkable because it is occurring while the nation’s population is growing rapidly yielding
more traffic and urban sprawl.

1.3.2.2 Lead

Lead is a metal found naturally in the environment. The major sources of lead emissions were historically
motor vehicles. However, due to a phase-out of leaded gasoline in the 1970s, metal processing is currently
the major source of lead emissions. Lead is not a pollutant of concern for project-level analyses for
transportation projects.

1.3.2.3 Nitrogen Dioxide

Nitrogen oxides are a group of highly reactive gases. One of these gases, nitrogen dioxide, along with
particles in the air, is often seen as a reddish-brown layer over urban areas. The primary source of nitrogen
oxides are motor vehicles, electric utilities, and industrial, commercial, and residential sources that burn fuel. Motor vehicles emit approximately 49 percent of the nation’s level of nitrogen oxides. Nitrogen dioxide (along with other oxides of nitrogen) is considered an ozone precursor and is evaluated as part of the regional conformity requirements during the project planning phases. Therefore, nitrogen dioxide is not considered in project-level analyses.

1.3.2.4 Ozone

Ozone (i.e., a gaseous component of ground-level photochemical smog) results from a chemical reaction between volatile organic compounds and oxides of nitrogen in the presence of sunlight. Also, the concentration and dispersion of ozone are significantly affected by an area’s meteorology and topography. Because it is primarily an area-wide pollutant, it is typically assessed in system-level planning as part of the air quality State Implementation Plan (SIP) development and conformity process. Through the Transportation Improvement Program (TIP)/SIP evaluation process, this pollutant is evaluated on a regional level, but is not evaluated at the project-level.

1.3.2.5 Particle Pollution

Particle pollution is a term used to describe particles in the air including dust, dirt, soot, smoke, and liquid droplets. Sources that directly emit particle pollution include motor vehicles, construction activities, and unpaved roads. Sources of particles that form in the air from chemical processes involving sunlight and water vapor include fuel combustion in motor vehicles, at power plants, and in industrial processes. Particle pollution is of increased interest because diesel vehicles emit significant levels of the pollutant and diesel particulate has been identified as a probable carcinogen by the EPA.

PM₁₀ is used as a measure of “coarse” particulate, in which the particles are 10 microns or less in size. Coarse particles of this size are typically formed by earth-based materials such as brake or tire wear. PM₂.₅ is used as a measure of “fine” particulate, in which the particles are 2.5 microns or less in size. Fine particles of this size are typically formed as a product of combustion. There are three counties (Catawba, Davidson, and Guilford) that are PM₂.₅ maintenance areas in North Carolina, and project-level PM₂.₅ hot-spot analyses may be required if it is deemed an air quality concern according to the conformity regulations.

1.3.2.6 Sulfur Dioxide

Sulfur dioxide belongs to a family of sulfur oxide gases. Approximately 65 percent of the sulfur dioxide released into the air comes from electric utilities. Locomotives, large ships, and some non-road diesel equipment currently burn high-sulfur fuel and emit sulfur dioxide. Overall, on-road motor vehicles are not considered to be a significant source of sulfur dioxide. Sulfur dioxide is not a pollutant of concern for project-level analyses.
## TABLE 1
### NATIONAL AND NORTH CAROLINA AMBIENT AIR QUALITY STANDARDS

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Primary/Secondary</th>
<th>Averaging Time</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Monoxide (CO)</td>
<td>Primary</td>
<td>8-hours</td>
<td>9 ppm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1-hour</td>
<td>35 ppm</td>
</tr>
<tr>
<td>Lead (Pb)</td>
<td>Primary and secondary</td>
<td>Rolling 3-month period</td>
<td>0.15 μg/m³ (^{(1)})</td>
</tr>
<tr>
<td>Nitrogen Dioxide (NO₂)</td>
<td>Primary</td>
<td>1-hour</td>
<td>100 ppb</td>
</tr>
<tr>
<td></td>
<td>Primary and secondary</td>
<td>1 year</td>
<td>53 ppb (^{(2)})</td>
</tr>
<tr>
<td>Ozone (O₃)</td>
<td>Primary and secondary</td>
<td>8-hour</td>
<td>0.070 ppm (^{(3)})</td>
</tr>
<tr>
<td>Particle Pollution (PM(_{2.5}))</td>
<td>Primary</td>
<td>1 year</td>
<td>12 μg/m³</td>
</tr>
<tr>
<td></td>
<td>Secondary</td>
<td>1 year</td>
<td>15 μg/m³</td>
</tr>
<tr>
<td></td>
<td>Primary and secondary</td>
<td>24-hours</td>
<td>35 μg/m³</td>
</tr>
<tr>
<td>Sulfur Dioxides (SO₂)</td>
<td>Primary</td>
<td>1-hour</td>
<td>75 ppb (^{(4)})</td>
</tr>
<tr>
<td></td>
<td>Secondary</td>
<td>3-hours</td>
<td>0.5 ppm</td>
</tr>
</tbody>
</table>

(1) In areas designated nonattainment for the Pb standards prior to the promulgation of the current (2008) standards, and for which implementation plans to attain or maintain the current (2008) standards have not been submitted and approved, the previous standards (1.5 μg/m³ as a calendar quarter average) also remain in effect.

(2) The level of the annual NO₂ 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.


(4) The previous SO₂ 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 SO₂ standards or is not meeting the requirements of a SIP call under the previous SO₂ 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: [http://www3.epa.gov/ttn/naaqs/criteria.html](http://www3.epa.gov/ttn/naaqs/criteria.html)
Regional Conformity Documentation

In addition to evaluating projects at the micro-scale level, transportation improvement projects must be also be considered at the macro-scale level when located in areas designated by the EPA as “nonattainment” or “maintenance.” Regional “conformity” analyses are conducted to ensure that total emissions associated with transportation plans and programs are within regional emission budgets identified in SIPs. SIPs are agreements between EPA and state air quality agencies, developed to demonstrate how the state will comply with the CAA. It ensures that emissions associated with transportation activities do not worsen air quality or interfere with the attainment of EPA standards for pollutants of concern. Conformity is a way to ensure that federal funding and approval are only given to those transportation activities that are consistent with air quality goals for a given region, as identified in the SIP.

NCDOT currently has several nonattainment and maintenance areas, primarily for \(O_3\) and \(PM_{2.5}\). These areas (with current or historic monitored levels above the NAAQS) are required to undergo regional macro-scale modeling to ensure yearly emission budgets are met. Ultimately, programmed (funded) projects located within nonattainment or maintenance areas must come from an approved Metropolitan Transportation Plan (MTP) and TIP that has been determined to be consistent (and conforming) with the emission budgets identified in the SIP.

CO regional and project-level conformity requirements in North Carolina (Durham, Forsyth, Mecklenburg, and Wake counties) have ended. According to 40 CFR 93.102(b)(3), a transportation conformity determination applies to maintenance areas through the last year of a maintenance area’s approved CAA section 175A(b) maintenance plan, unless the applicable implementation plan specifies that the provisions of this subpart shall apply for more than 20 years. Durham, Forsyth, Mecklenburg, and Wake counties met their 20-year maintenance period requirement on September 18, 2015. Therefore, regional and project-level transportation conformity requirements no longer apply to CO in North Carolina. As such, project-level CO hot-spot analyses using MOVES2014 and CAL3QHC emission and dispersion models are no longer required in North Carolina as part of the NEPA/SEPA process, unless they are deemed necessary to respond to public or agency comments.

MPOs are responsible for the initial conformity determinations in metropolitan areas, while NCDOT takes responsibility for conformity in rural regions that are not governed by an MPO. During the regional conformity analysis, projects are grouped by horizon years and modeled to determine if the MTP conforms to the purpose of the SIP. All federally funded and non-federally funded regionally significant projects must be included in the regional emissions analysis conducted for the region.

The United States Department of Transportation (USDOT) along with EPA, NCDEQ/DAQ and NCDOT consultation, must approve all region-specific conformity determinations performed by local planning organizations or NCDOT. It is the role of the project-level air quality analyst to verify and document that all regionally significant projects being evaluated at the project-level are part of a conforming MTP and TIP that has been approved by both the metropolitan planning organization and FHWA.
2.1 Legal Requirements

In order to satisfy federal requirements, every transportation project is required to be evaluated regarding regional air quality concerns. The Clean Air Act Amendments (CAAA) of 1990 mandate improvements to the nation’s air quality. The final conformity regulations promulgated by the US EPA in 1997, as part of 40 CFR 93 (as amended), require transportation plans and programs to conform to the SIP. The final conformity rule requires that transportation plans in nonattainment areas are consistent with the most recent estimates of mobile source emissions; provide for the expeditious implementation of transportation control measures in the applicable implementation plan; and contribute to annual emission reductions for criteria pollutants in nonattainment areas.

2.2 EPA Classification of Attainment Status

Based on the proposed project’s location, the analyst must identify the latest EPA attainment status for the area or region in which the project is located. If the county is designated as being in attainment for all pollutants of concern, the NEPA document should state the area is in attainment for transportation-related pollutants and indicate that conformity does not apply. If a project is located in a nonattainment or maintenance area and is federally-funded or considered to be regionally significant, the project must be considered as part of a conforming MTP/TIP. This finding (and relevant approval dates) should be included in the NEPA document. Additional information is available in “Air Quality Guidelines for Environmental Documents” published by FHWA’s North Carolina Division. Currently, North Carolina has nonattainment or maintenance areas for ozone and PM$_{2.5}$. Prior to the effective date of this Manual, four counties were designated as maintenance areas for CO. EPA provides up-to-date mapping to identify attainment designations for all criteria pollutants at the following web site:

Reference: http://www.epa.gov/airquality/greenbook/

2.3 Required Conformity Information in NEPA Documents

It is important to verify that the project description (size and scope of the project) is consistent with the project description in the MTP/TIP to ensure that the project is accurately reflected in the regional conformity determination. In the event that the project description has changed and differs from the project description in the MTP/TIP evaluation, it is recommended that NCDOT be notified as soon as possible to ensure the current project specifications can be included and reevaluated in the conformity determination, if necessary.

The following information is required in all NEPA documents to satisfy the conformity requirements as outlined by the CAAA of 1990 and all subsequent amendments.

- Attainment status of the project area
- Nonattainment status by pollutant, if applicable
- Name and title of the current MTP/TIP
- Date of MPO/NCDOT adoption of the MTP/TIP
- Date of FHWA approval of MTP/TIP
3 Reporting Requirements for Project-Level Air Quality Analyses

3.1 NEPA Documentation for Pollutants of Concern

The following sections present the relevant discussions that should be included in the NEPA document where applicable for each of the pollutants of concern associated with transportation improvement projects. Sample documentation is provided below on a per-pollutant basis.

3.1.1 CO Documentation

3.1.1.1 Screened/Exempt Projects

Projects that fall under the exempt criteria found in TABLE 2 (consistent with 40 CFR 93.126 and 93.128) have minimal potential to impact air quality and therefore do not warrant air quality analysis. Documentation for such projects can be limited to the following text:

*Projects Exempt per 40 CFR 93.126*

*The subject project has been identified as being exempt from project-level air quality analysis in accordance with 40 CFR 93.126. It can therefore be concluded that the project will have no significant adverse impact on air quality.*

3.1.1.2 Detailed Modeling Projects

For all projects in which an air quality analysis has been conducted, documentation in the NEPA document should be provided as outlined in this section of the guidance. When a quantitative CO assessment is performed, the NEPA document should summarize the results and methodology of the analysis with supporting data supplied in a detailed Project-Level Air Quality Report. A tabular summary of results should be provided in the NEPA document for each analysis year and alternative under consideration (including the no build option). Additional requirements may also be necessary in the NEPA document for MSAT, PM_{2.5}, and Regional Conformity. For those projects that satisfy the NAAQS, the following statement should conclude the write-up in the NEPA document:

*A project-level air quality analysis for CO has been conducted for the subject project. No receptor sites are forecast to experience concentrations in excess of the current one-hour or eight-hour NAAQS for CO. It can therefore be concluded that the project will have no significant adverse impact on air quality as a result of CO concentrations.*
### TABLE 2. EXEMPT PROJECTS (40 CFR 93.126)

#### SAFETY
- Railroad/highway crossing
- Hazard elimination program
- Safer non-Federal-aid system roads
- Shoulder improvements
- Increasing sight distance
- Safety Improvement Program
- Traffic control devices and operating assistance other than signalization projects
- Railroad/highway crossing warning devices
- Guardrails, median barriers, crash cushions
- Pavement resurfacing and/or rehabilitation
- Fencing
- Skid treatments
- Safety roadside rest areas
- Adding medians
- Truck climbing lanes outside the urbanized area
- Lighting improvements
- Widening narrow pavements or reconstructing bridges (no additional travel lanes)
- Emergency truck pullovers

#### MASS TRANSIT
- Operating assistance to transit agencies
- Purchase of support vehicles
- Rehabilitation of transit vehicles
- Purchase of office, shop, and operating equipment for existing facilities
- Purchase of operating equipment for vehicles (e.g., radios, fareboxes, lifts, etc.)
- Construction or renovation of power, signal, and communications systems
- Reconstruction or renovation of transit buildings and structures (e.g., rail or bus buildings, storage and maintenance
- Rehabilitation or reconstruction of track structures, track, and trackbed in existing rights-of-way
- Purchase of new buses and rail cars to replace existing vehicles or for minor expansions of the fleet
- Construction of new bus or rail storage/maintenance facilities categorically excluded in 23 CFR 771

#### AIR QUALITY
- Continuation of ride-sharing and van-pooling promotion activities at current levels
- Bicycle and pedestrian facilities

#### OTHER
- Specific activities which do not involve or lead directly to construction, such as:
  - Planning and technical studies
  - Grants for training and research programs
  - Planning activities conducted pursuant to titles 23 and 49 U.S.C.
  - Federal-aid systems revisions
- Engineering to assess social, economic, and environmental effects of the proposed action or alternatives to that action
- Noise attenuation
- Emergency or hardship advance land acquisitions (23 CFR 710.503)
- Acquisition of scenic easements
- Plantings, landscaping, etc.
- Sign removal
- Directional and informational signs
- Transportation enhancement activities (except rehabilitation and operation of historic transportation buildings, structures, or facilities)
- Repair of damage caused by natural disasters, civil unrest, or terrorist acts, except projects involving substantial functional, locational or capacity changes
3.1.2 Particle Pollution Documentation

3.1.2.1 Projects in Attainment Areas

For projects located in attainment areas, a conformity determination and a qualitative PM$_{2.5}$ or PM$_{10}$ hot-spot analysis is not required. In addition to the county and area, the following statement should be included in the environmental report:

_The proposed project is located in an attainment area for the particle pollution standards. The project does not require a project-level conformity determination. According to the PM2.5 and PM10 hot-spot analysis requirements established in the March 10, 2006, final transportation conformity rule (40 CFR 93) no further project-level air quality analysis for these pollutants is required._

3.1.2.2 Projects Exempt from Hot-Spot Requirements

For projects located in nonattainment or maintenance PM$_{2.5}$ or PM$_{10}$ areas that are considered exempt according to the latest version of 40 CFR 93.126 and 93.128, a conformity determination or a quantitative hot-spot analysis is not required. In addition to the county and area, and the following statement should be included in the environmental report:

_The proposed project is located in [county] which has been designated as being in [nonattainment/maintenance] for PM2.5 and/or PM10. According to the 40 CFR 93.126 and 93.128, the project is considered exempt from qualitative analysis because the project type is [exempt project type]. No further project-level conformity determination or air quality analysis for this/these pollutant(s) is required._

3.1.2.3 Non-Exempt Projects that Are Not “Projects of Air Quality Concern”

For projects located in nonattainment or maintenance PM$_{2.5}$ or PM$_{10}$ areas that are not considered exempt according to 40 CFR 93.126 and 93.128, a determination must be made to determine if the project is considered to be of “air quality concern” under 40 CFR 93.123(b)(1)(i-v) and as further described in the November 2013 EPA guidance, “Transportation Conformity Guidance for Quantitative Hot-Spot Analyses in PM$_{2.5}$ and PM$_{10}$ Nonattainment and Maintenance Areas.”

Documentation explaining why the project is not considered to be of air quality concern or additional information or conclusions based on Conformity Interagency Consultation Group (CICG) review of the project data should be included in the project record / NEPA documentation. Documentation should identify the county and area where the project is located and include the following statement in the environmental report:
The proposed project is located in [county] which has been designated as being in [nonattainment/maintenance] for PM2.5 and/or PM10. Though the project is not exempt, it is not considered to be a project of air quality concern according to 40 CFR 93.123 (b)(1)(i-v) and as further described in the November 2013 EPA guidance, ‘Transportation Conformity Guidance for Quantitative Hot-Spot Analyses in PM2.5 and PM10 Nonattainment and Maintenance Areas.’

3.1.3 MSAT Documentation


3.1.4 Conformity Documentation

The following statements (or something similar) should appear under a conformity heading in NEPA documents. Typically the conformity section should appear as the last section of the air quality analysis documentation and should include the following information:

- Brief description of conformity
- Date final rule was issued (April 2012)
- Documentation of final rule (40 CFR 93)

The following statements must also appear under the conformity section of the air quality analysis.

The final conformity rule requires that transportation plans and programs in nonattainment areas:

- Are consistent with the most-recent estimates of mobile source emissions
- Provide for the expeditious implementation of transportation control measures in the applicable implementation plan
- Contribute to annual emissions reductions in nonattainment areas

3.2 Project-Level Air Quality Report Content

For all NEPA documents (Categorical Exclusions, Environmental Assessments, and Environmental Impact Statements), an air quality technical report should be prepared as a self-sufficient, standalone, comprehensive document. The air quality analysis results and all relevant information should be summarized in the body of the document. The air quality summary in the NEPA document should reference the standalone air quality report. In order to develop a consistent reporting style, NCDOT has developed the following guidelines when preparing an air quality analysis technical report:
• Introduction – The introduction should include a brief synopsis of laws governing air quality, a brief discussion on NAAQS, and pertinent history / information about the project area.

• Methodology – The methodology should include a complete description of the project and any alternatives (including the no build alternative). This section should also include a discussion on the air quality modeling approach, computer programs used, pertinent guidance, and any assumptions used for the analysis. Discussion on attainment status and the general air quality of the study area should also be included.

• Existing Conditions – The existing conditions section should include a discussion of the background CO concentrations used or developed for the analysis as well as the calculated CO levels using existing traffic volumes and roadway geometry.

• Future Conditions – The future conditions section should include a discussion on CO levels as they relate to the NAAQS for opening and design year scenarios for each alternative under consideration (including the no build alternative).

• PM$_{2.5}$/PM$_{10}$ Analysis – The PM$_{2.5}$/PM$_{10}$ analysis section should include a discussion on attainment status of the project location based on EPA’s latest classifications and whether or not a hot-spot analysis is required. It is suggested that all analyses follow the appropriate criteria including 40 CFR 93.123.

• MSAT Analysis – The MSAT analysis section should include a discussion on emissions relative to mobile transportation sources.

• Conformity Documentation – The conformity documentation section should include a brief synopsis of the Final Conformity regulations and subsequent regulations. Eight-hour ozone, CO, and PM$_{2.5}$ attainment status for where the project is located should be discussed. Additionally, if the project is located in a nonattainment or maintenance area, conformity requirements apply. Documentation should include the date FHWA makes its conformity determination on the MTP/TIP.

• Construction Emission Analysis – Air quality impacts resulting from roadway construction activities are typically not a concern when contractors utilize appropriate control measures. In North Carolina, contractors shall perform all construction activities with adequate control measures in place, e.g. watering exposed surfaces, covering or maintaining free board space on haul trucks, limiting vehicle speeds on unpaved roads, and minimizing equipment idling time. The following statement should be included in the report: “The temporary air quality impacts from construction are not expected to be significant.”

• Conclusion – A brief conclusion section is recommended to summarize the results of the air quality analysis.

### 3.3 Technical File Requirements and Content

The submission of the air quality report should be accompanied by the following information as report appendices for review:

- Project mapping showing receptors (if needed)
- Emission factor and dispersion model software input and output files (if needed)
Traffic data used in analysis (if needed)
- Conformity documentation
- A completed copy of the PDEA Environmental Document Air Quality Conformity Form

4 Initial Project-Level Scoping and Determining the Appropriate Level of Air Quality Analyses

4.1 Appropriate Level of Analysis
Air quality should be considered for all transportation improvement projects. Historically, CO concentrations have been evaluated as the best indicator of vehicle-induced pollution on the micro-scale (i.e., project-level). While project-level analyses will continue to evaluate CO levels associated with transportation improvement projects, EPA and FHWA now require an evaluation of particle pollution and MSAT to ensure compliance with established standards. As of April 5, 2006, all relevant projects in PM$_{2.5}$ and PM$_{10}$ nonattainment and maintenance areas for both the annual and daily standards must be screened to identify if a PM hot-spot analysis is required.

The appropriate level of analysis for documenting potential air quality impacts for transportation improvement projects is determined based on the magnitude and scope of the proposed project; the overall efficiency of existing and proposed signalized intersections; the presence of quality sensitive receptors; and existing air quality conditions. The appropriate level of air quality analysis may vary from a brief qualitative (narrative) discussion to a detailed modeling analysis.

4.2 Project-Level Scoping
This scoping process has been developed to determine the appropriate level of air quality analysis for transportation improvement projects in North Carolina. The goal is to identify highway projects which, based on their type, configuration, projected traffic volume, congestion, and location, are not considered to be projects of air quality concern. These projects are to be assessed qualitatively and do not require any detailed air quality analysis. Projects that exceed the thresholds are to be assessed quantitatively through detailed atmospheric dispersion modeling.

4.2.1 Scoping CO Analysis for NEPA Documents
In an effort to streamline the NEPA process, NCDOT has determined that quantitative CO project-level analyses are not required in any CO attainment areas within the state. In rare instances, special circumstances may necessitate a quantitative CO project-level analysis. These will be included in scopes of work and performed at the discretion of NCDOT,
5 Technical Procedures for CO Modeling

5.1 Appropriate Level of Analysis

As stated in section 2 of this document, project-level CO hot-spot analyses are no longer required in North Carolina as part of the NEPA/SEPA process, unless they are deemed necessary to respond to public or agency comments.

5.1.1 Qualitative Analysis

A qualitative analysis should be performed for transportation improvement projects that are determined to be insignificant from an air quality perspective, per 40 CFR 93.126. For exempt projects, a qualitative analysis will consist of a project description, and a general overview of the existing and future CO air quality. For non-exempt projects, qualitative analyses may be adequate if a project is not expected to adversely impact project-level air quality levels.

5.1.2 Quantitative Analysis

A quantitative analysis should be performed only for projects that meet special approval by NCDOT. A quantitative analysis will consist of a detailed hot-spot analysis. Detailed micro-scale CO modeling uses site-specific and area-specific data to predict CO concentrations under actual operating conditions.

5.1.2.1 Detailed Micro-Scale CO Modeling

Detailed air quality modeling consists of running the EPA emission factor model (MOVES) in conjunction with the highway dispersion model (CAL3QHC/CAL3QHCR). This detailed modeling approach will account for all modeling parameters and provide the analyst with a more accurate representation of existing and future worst-case CO levels within the corridor.

5.2 EPA / FHWA Approved Models

The micro-scale CO modeling process relies on EPA-approved air quality models to simulate pollutant emissions of highway sources and the dispersion of those pollutants to near-by receivers. This section of the document describes the applicable air quality emission and dispersion models and provides guidance for completing detailed micro-scale CO modeling studies in North Carolina.

5.2.1 MOVES2014

EPA’s MOVES software replaces the previous model, MOBILE6.2, for estimating on-road mobile source emissions. MOVES2014, the latest version of the software, can be used to estimate air pollution emissions from cars, trucks, motorcycles, and buses. MOVES2014 is approved for use in official state implementation plan (SIP) submissions to EPA and for transportation conformity analyses. It can also be used to estimate the benefits from a range of mobile source control strategies, for more general analyses of national or local emissions trends, and for policy evaluation. MOVES2014 is EPA’s best available tool for quantifying criteria pollutant and precursor emissions, as well as for other emissions analyses of the transportation sector. MOVES2014 is EPA’s approved motor vehicle emission factor model for estimating volatile organic
compounds, nitrogen oxides, carbon monoxide, particle pollution, and other pollutants and precursors from cars, trucks, motorcycles, and buses by state and local agencies outside of California. EPA has established a grace period ending October 7, 2016, for using MOVES2014 instead of the previous version, MOVES2010b, for regional transportation conformity purposes and transportation conformity hot-spot analyses.

Reference: http://www.epa.gov/otaq/stateresources/transconf/policy.htm#models.

5.2.2 CAL3QHC / CAL3QHCR

CAL3QHC is an EPA-approved mobile source dispersion model used to predict CO (and other inert pollutants) concentrations at sensitive locations adjacent to roadways and roadway intersections. The CAL3QHC model is an effective tool for predicting pollutant concentrations due to motor vehicles operating under free-flow conditions, as well as from idling vehicles under stop-and-go conditions (near signalized intersections). The model considers roadway geometries, receptor locations, meteorological conditions, and vehicular emission rates. Additionally, it incorporates intersection-specific parameters and detailed signal information (e.g., signal timing and intersection lane assignments) to predict pollutant concentrations at near-by sensitive receivers. The current version of the CAL3QHC model is available for download from EPA’s web site (see link below).

CAL3QHCR is a refined version of the original CAL3QHC program that was developed as a modeling tool to predict roadside CO concentrations. CAL3QHCR can be used to estimate ambient CO concentrations and to process hourly meteorological data over a year, hourly emissions, traffic volume, and signal data. To run CAL3QHCR, the air quality analyst needs meteorological, traffic, and vehicle emissions data at specified intervals over some time period, such as hourly average data for a year. The line source dispersion model CAL3QHCR can be obtained from the EPA website below.

Reference: http://www.epa.gov/scram001/dispersion_prefrec.htm
5.3 Micro-Scale CO Modeling Guidance

If micro-scale CO modeling is required based on the project scoping, the detailed emission/dispersion analysis should be performed using the EPA/FHWA approved models described in the previous section and the modeling parameters described below. Additional EPA guidance for micro-scale CO modeling is provided in EPA-420-B-15-028, Using MOVES2014 in Project-Level Carbon Monoxide Analyses, March 2015 and in EPA-454/R-92-005, Guidelines for Modeling Carbon Monoxide from Roadway Intersections, November 1992.

5.3.1 Consideration of Areas Sensitive to Air Quality Impacts

Consideration of areas sensitive to air quality should be identified during the scoping phase of the project. As a general rule, the modeling analysis should focus on those areas where the general public has continuous access and where maximum project-related pollutant concentrations are likely to occur. For projects that include signalized intersections, the three intersections with the worst-case levels of service (only including those operating at LOS D or worse in the peak hour) in the project design year build condition should be selected for the analysis. The intersections should be modeled for the existing year, opening year, and design year under no build conditions. The intersections should be modeled for the opening year and design year under build conditions. The project’s design should mitigate any air quality concentration exceedances in both the opening year and design year.

5.3.2 Receptor Locations

An important step for the air quality analyst is selecting reasonable locations for air quality receptors. Generally, these locations are places where the general public has continuous access and where maximum total project-related CO concentrations are likely to occur. Since the highest CO concentrations tend to occur near signalized intersections, sidewalks are often a good choice when identifying reasonable receptor locations.

In general, receptors should be placed at each approach on both sides of the road (refer to EPA-454/R-92-005 for additional guidance). Receptors should be placed at 1.8 meters (5.9 feet) above the ground to represent the typical breathing height of the general public.

The following are all examples of reasonable receptor sites:

- Sidewalks which the general public can access
- Portions of a nearby parking lot to which pedestrians have access
- Residences, hospitals, rest homes, schools, playgrounds and the entrances and ground-level air intakes to all other buildings
The following are unreasonable receptor site locations:

- Roadway medians
- Locations within the right-of-way on limited access highways
- Within intersections or in intersection crosswalks
- Tunnel approaches
- Tollbooths

5.3.3 Determination of Analysis Years

The air quality analysis should model the no build alternative for existing year, opening year, and design year traffic conditions and the build alternative for opening year and design year traffic conditions. Prior to the effective date of this Manual, the air quality analysis was required to include both the no build and build alternatives for the opening year, opening year plus five years, and design year.

5.3.4 Determination of Background Concentrations

The project-level CO modeling analysis must consider not only pollutant concentrations associated with the proposed project, but also background CO concentrations that may be present in a given area. In order to determine background CO concentrations in a given project area, a number of different methods or assumptions can be used. For the purposes of this guidance, the following sections are recommended when determining background CO concentrations.

5.3.4.1 Department of Environmental Quality Data

NCDEQ/DAQ maintains a network of air quality monitoring stations across North Carolina. The goals of North Carolina’s ambient air monitoring program are to evaluate compliance with federal and state air quality standards, provide real-time monitoring of air pollutant episodes, develop data for trend analysis, support the development and implementation of air quality regulations, and provide information to the public on daily air quality conditions. NCDEQ/DAQ monitors air quality in areas having high population densities, high levels of expected contaminants, or a combination of both factors. There are currently a total of three CO monitoring sites located throughout the state.

Reference: https://xapps.ncDEQ.org/aq/ambient/AmbtPollutant.jsp

Whenever possible or practical, the air quality analyst should reference the closest NCDEQ/DAQ monitoring station to document the second-highest one-hour and eight-hour CO concentration during the last reporting year at the nearest monitoring site. In the event that the monitoring site is located more than 20 miles from the project site or does not adequately represent the project area, a default value should be assumed. TABLE 3 provides these locally-specific background concentrations. The following section discusses appropriate default background concentrations for both urban and rural areas.

Temperature data (for use in CO modeling) is also available from each of the NCDEQ/DAQ monitoring stations. Historic weather data is also available from a host of on-line sources in the event that no NCDEQ/DAQ monitoring sites are present in proximity to a given project area.
5.3.4.2 Default Background Assumptions

In the event that air quality monitoring data is not available or appropriate for the project corridor, a default background level should be assumed. In North Carolina, typically a one-hour background concentration for rural conditions should be assumed at 2.9 parts per million (ppm). For urban and suburban conditions, a typical one-hour background concentration of 2.7 ppm should be assumed. For eight-hour CO predictions, a background concentration of 2.3 ppm should be assumed for those areas where no NCDEQ/DAQ CO monitoring data is available. These assumed background levels are intended to represent worst-case ambient conditions based on review of recent conditions and trends at current monitoring stations throughout the state.

In all cases, either monitored or assumed background CO concentrations should be added to project-specific CO predictions after the modeling protocol is complete and worst-case project-level CO concentrations are predicted. This applies to both the estimation of both one-hour and eight-hour CO levels.

5.3.5 NAAQS for CO and Required Averaging Periods

The NAAQS for CO are 35 ppm and 9 ppm for the second-highest one-hour and eight-hour periods, respectively. These are “primary standards” adopted to protect against adverse health effects to the general public, including sensitive populations such as asthmatics, children, and the elderly.

Consistent with these EPA standards, total CO concentrations (i.e., the sum of project-level and background concentrations) for project-level analyses should be projected to represent worst-case one-hour and eight-hour averaging periods. The air modeling emission/dispersion analysis should be conducted using a one-hour averaging period. Eight-hour concentrations should be derived by applying a “persistence” factor to the one-hour level to predict eight-hour levels.

The concept of a persistence factor represents a combination of the variability in both traffic and meteorological conditions, focusing on one-hour and eight-hour durations. FHWA guidance for the calculation of project-specific persistence factors is provided in FHWA Southern Resource Center, Manual for Air Quality Considerations in Environmental Documents, January 2001, as well as in EPA-454/R-92-005, Guidelines for Modeling Carbon Monoxide from Roadway Intersections, November 1992.

For the purposes of most project-level air quality modeling assessments, air quality impacts are not anticipated (i.e., project does not have the potential for causing a violation of the one-hour or eight-hour NAAQS for CO). EPA supports the concept of using a worst-case assumed persistence factor to simplify the conversion of one-hour concentrations to eight hour concentrations. EPA recommends the use of a default factor of 0.7 to convert from peak one-hour concentrations to peak eight-hour concentrations, while NCDEQ/DAQ recommends a persistence factor of 0.79 NCDEQ/DAQ’s persistence factor is reasonably conservative based on review of state-wide CO monitoring data. Generally, this approach will be adequate to
show compliance with the NAAQS for most CO modeling analyses. NCDOT requires the use of a persistence factor of 0.79 for all CO modeling.

**TABLE 3. BACKGROUND CO CONCENTRATIONS AND PERSISTENCE FACTORS**

<table>
<thead>
<tr>
<th>County City</th>
<th>Site Location</th>
<th>Site Average</th>
<th>Regional Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Background (ppm)</td>
<td>Persistence Factor</td>
</tr>
<tr>
<td>Cumberland</td>
<td>1705 Owen Dr</td>
<td>2.9</td>
<td>0.78</td>
</tr>
<tr>
<td>Fayetteville</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forsyth</td>
<td>1401 Corporation Pkwy</td>
<td>2.8</td>
<td>0.81</td>
</tr>
<tr>
<td>Winston-Salem</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forsyth</td>
<td>100 SW Stratford Rd</td>
<td>2.8</td>
<td>0.73</td>
</tr>
<tr>
<td>Winston-Salem</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guilford</td>
<td>401 W Wendover Ave</td>
<td>2.4</td>
<td>0.86</td>
</tr>
<tr>
<td>Greensboro</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mecklenburg</td>
<td>301 N Tryon St</td>
<td>2.6</td>
<td>0.82</td>
</tr>
<tr>
<td>Charlotte</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Hanover</td>
<td>Oleander St &amp; College Rd</td>
<td>2.4</td>
<td>0.73</td>
</tr>
<tr>
<td>Wilmington</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wake</td>
<td>420 S Person St</td>
<td>3.8</td>
<td>0.81</td>
</tr>
<tr>
<td>Raleigh</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Statewide</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Site average background and persistence factors are valid only if the project is located within 1000’ of the monitor site; regional or statewide averages are applicable elsewhere.

If the conversion from one-hour to eight-hour concentrations using a persistence factor of 0.79 leads to total CO concentrations above the NAAQS (i.e., has the potential for contributing to a violation of the NAAQS for CO), more refined (less conservative) techniques are available. These more refined techniques rely on the review of area-specific CO monitoring data, project-specific traffic data, or more refined modeling practices to avoid unrealistically high eight-hour predictions (above the NAAQS).

**5.3.6 Micro-scale Modeling Defaults**

EPA-454/R-92-005, *Guidelines for Modeling Carbon Monoxide from Roadway Intersections*, November 1992 provides guidance for the appropriate meteorological conditions (and other model defaults) that should be specified for dispersion modeling (CAL3QHC/CAL3QHCR). **Table 4** provides a general summary of the input parameters that should be used for CO modeling purposes in North Carolina.
### Table 4. CAL3QHC Default Values

<table>
<thead>
<tr>
<th>Modeling Parameter</th>
<th>Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>Minimum, maximum, and/or average temperatures for January conditions</td>
</tr>
<tr>
<td>Wind Speed</td>
<td>1.0 meter per second (m/s)</td>
</tr>
<tr>
<td>Wind Direction</td>
<td>Varying wind direction 0 to 350 degrees at 10 degree increments</td>
</tr>
<tr>
<td>Atmospheric Stability Class</td>
<td>Urban – stability class D; Rural – stability class E</td>
</tr>
<tr>
<td>Mixing Height</td>
<td>1000 meters</td>
</tr>
<tr>
<td>Surface Roughness</td>
<td>Refer to EPA guidance</td>
</tr>
<tr>
<td>Saturation Flow Rate</td>
<td>1600 vphg (when value is not available)</td>
</tr>
<tr>
<td>Clearance Time Lost</td>
<td>2 seconds (average driver)</td>
</tr>
<tr>
<td>Arrival Rates</td>
<td>Average progression</td>
</tr>
<tr>
<td>Receptor Heights</td>
<td>1.8 meters (5.9 feet)</td>
</tr>
<tr>
<td>Settling Velocity</td>
<td>0 for carbon monoxide</td>
</tr>
<tr>
<td>Deposition Velocity</td>
<td>0 for carbon monoxide</td>
</tr>
</tbody>
</table>

#### 5.3.7 Data Needs

In order for the air quality analyst to accurately predict CO concentrations for all project scenarios, an array of information is required. Data needs include but are not limited to the following:

- **Detailed Traffic Data Reports** – Detailed traffic software (including HCS, Synchro, Trans Modeler, VISSIM, etc.) reports provide the air quality analyst with total traffic volumes, turning movement volumes, saturation flow rates, cycle lengths, and signal phasing. The air quality analyst will need to obtain the data for existing year no build, opening year no build and build, and design year no build and build conditions.

- **Detailed Intersection Schematics** – The air quality analyst will need to obtain the existing and proposed intersection design plans for the study intersections to ensure the analysis accurately represents the no build and build roadway geometry.

- **MOVES Inputs** – The air quality analyst will need to coordinate with the appropriate MPO, NCDEQ/DAQ, or NCDOT to obtain the most recent MOVES2014 inputs for a particular region. This information is crucial for accurately predicting CO emissions in those areas where detailed Inspection/Maintenance (I/M) and anti-tampering programs exist. MOVES2014 input data (used for regional air quality conformity evaluations) should be requested from the appropriate agency to assist in the development of project-specific MOVES2014 input parameters. In situations where local/regional air quality control information is not available, worst-case input variables should be assumed to yield worst-case CO results.

- **Temperature Data** – The analyst will need to coordinate with NCDEQ/DAQ (or other applicable sources) for region-specific temperature data for use in MOVES2014 modeling. In order to ensure worst-case predictions, all CO modeling in North Carolina should be performed to simulate the current date of the analysis conditions, the time of year when CO emissions are generally greatest due to the incomplete combustion of fossil fuels in cold conditions. Therefore, the air quality analyst should request the minimum, maximum, and average temperatures for the most recently available January conditions.
5.4 Compliance with NAAQS for CO
At the completion of the micro-scale air quality modeling analysis, total CO concentrations (i.e., the sum of project-level and background concentrations) for existing, opening, and design years, for each alternative evaluated (including the no build option) should be compared to the NAAQS for CO. The NAAQS for CO are 35 ppm and 9 ppm for the second-highest one-hour and eight-hour periods, respectively.

5.5 Model Refinement and Air Quality Impact Mitigation
Generally, due to its worst-case nature, mobile source air quality modeling typically over-predicts CO concentrations when compared to actual operating conditions. These over-predictions do not pose a problem as long as predicted levels fall below the NAAQS. In this case, the modeling exercise is used to ensure a proposed project does not have the potential for causing a violation of the NAAQS for CO. If a detailed micro-scale modeling analysis predicts CO concentrations above the NAAQS, refined modeling techniques are available to more accurately predict real-world conditions. Refined modeling techniques may include the use of local meteorological data or development of area- and project-specific (eight-hour) persistence factors.

If refined modeling techniques are necessary, consultation with NCDOT and NCDEQ/DAQ is recommended. In the event that refined modeling still predicts CO concentrations above the NAAQS, the addition of air quality impact mitigation measures as part of the project’s design may be necessary.

Although relief strategies are somewhat limited, any activity which reduces congestion or increases facility speeds will typically improve local air quality. Some possible relief strategies include roadway/intersection design modifications (e.g., adding or removing turning lanes), intersection operational changes (e.g., signal coordination, retiming, or re-phasing), or other congestion management strategies. Such considerations should be coordinated with the project’s highway and traffic engineering staff.

6 Technical Procedures for Particle Pollution Analyses
6.1 Introduction
On March 10, 2006, the EPA published a Final Rule (40 CFR 93.116) that establishes transportation conformity criteria and procedures for determining which transportation projects must be analyzed for localized impacts in PM$_{2.5}$ and PM$_{10}$ nonattainment and maintenance areas. The rule was followed by a March 29, 2006, guidance document issued jointly by the EPA and FHWA that provides information for state and local agencies to meet the hot-spot requirements established in the final transportation conformity rule. Currently, a “quantitative” analysis is required for those projects determined to be of air quality concern. There is guidance published in the Federal Register for completing a PM$_{2.5}$ quantitative analysis for projects of air quality concern.

6.2 Qualitative Analyses
To meet statutory requirements, the March 10, 2006, final rule requires PM$_{2.5}$ and PM$_{10}$ hot-spot analyses to be performed for projects of air quality concern. Through the final rule, EPA determined that projects not
identified in 40 CFR 93.123(b)(1) as projects of air quality concern have also met statutory requirements without any further hot-spot analyses (40 CFR 93.116(a)).

6.3 Quantitative Analyses

Once a quantitative analysis is deemed necessary for a project, the air quality analyst should coordinate with NCDOT to establish the analysis methodology and parameters. Interagency consultation with NCDOT, NCDEQ, and FHWA will be necessary to ensure compliance with national best practices and procedures.

The EPA has released final guidance for quantifying the local air quality impacts of certain transportation projects and comparing them to the PM$_{2.5}$ and PM$_{10}$ NAAQS. This guidance, “Transportation Conformity Guidance for Quantitative Hot-Spot Analyses in PM$_{2.5}$ and PM$_{10}$ Nonattainment and Maintenance Areas,” is to be used by state and local agencies to conduct quantitative “hot-spot” analyses for new or expanded highway or transit projects with significant increases in diesel traffic. See the Federal Register notice of availability for more information on EPA’s approval. EPA developed this guidance in coordination with the Department of Transportation, state and local agencies, and other stakeholder groups.

6.3.1 Purpose of the Guidance

This guidance describes how to complete quantitative PM hot-spot analyses. A hot-spot analysis is an analysis of a transportation project’s impact on future localized pollutant concentrations and a comparison of those concentrations to the relevant NAAQS. These analyses are required only for new or expanded highway or transit projects with significant increases in diesel traffic. While this guidance addresses quantitative PM hot-spot analyses for transportation conformity purposes, certain sections of this guidance may be applicable when completing air quality analyses for transportation projects for other purposes.

The following sections describe how to estimate project emissions using EPA’s MOVES model, California’s EMFAC model, and other methods. It also outlines how to apply air quality models (AERMOD and CAL3QHCR) for PM hot-spot analyses.

6.3.2 Background

Transportation conformity is a Clean Air Act requirement that ensures that federally-supported highway and transit projects are consistent with state air quality implementation plans. Conformity helps protect public health through early consideration of the air quality impacts of transportation decisions in places where air quality does not currently meet the NAAQS or has not met them in the past.

6.3.3 Completing a Quantitative Particle Pollution Hot-Spot Analysis

The basic steps for completing a quantitative PM hot-spot analysis is described in EPA’s final guidance. In general, a hot-spot analysis compares the air quality concentrations with the proposed project (the build scenario) to air quality concentrations without the project (the no build scenario). For either scenario, it is necessary to consider emissions from the project and any nearby sources, as well as determine background concentrations. From this information, design values can be calculated to determine if a project conforms. If the build design values are less than or equal to the relevant NAAQS, the project is considered to be
conforming. A project will also conform if the build scenario design values are greater than the NAAQS but less than or equal to the design values for the no build scenario.

6.3.4 PM2.5 Quantitative Analysis – Methodology/Approach

Step 1: Determine Need for PM Hot-spot Analysis

Section 93.109(b) of the conformity rule outlines the requirements for project-level conformity determinations. A PM2.5 hot-spot analysis is required for projects of local air quality concern, per Section 93.123(b)(1). The need for a quantitative PM2.5 analysis for projects located in the nonattainment/maintenance areas (Guilford, Davidson, and Catawba Counties) will be reviewed by the ICG (Interagency Consultation Group). The project’s environmental document will be developed as a CE, EA, FONSI and noted that the project is located in a PM2.5 nonattainment area with an increase in the number of diesel vehicles expected in future years. The ICG concludes that the project is a Project of Air Quality Concern and agrees that a project level hot-spot analysis would be conducted for the project.

Step 2: Determine Approach, Models and Data

Geographic Area and Emission Sources

PM hot-spot analyses must examine the air quality impacts for the relevant PM NAAQS in the area substantially affected by the project (40 CFR 93.123(c)(1)). It is appropriate in some cases to focus the PM hot-spot analysis only on the locations of highest air quality concentrations. For large projects, it may be necessary to analyze multiple locations that are expected to have the highest air quality concentrations and, consequently, the most likely new or worsened NAAQS violations.

The length of the project study area will fall within the NC PM2.5 non-attainment/maintenance area. To assist PM2.5 Quantitative Hot-spot Analysis in identifying the location of potential highest emissions, the ICG reviewed available traffic data including NCDOT traffic counts and forecast (2035) no-build and build volumes from the NCDOT Statewide Travel Demand Model (NCSTDM). The average annual daily traffic (AADT) and truck percentages are summarized. Results from NC MPO regional traffic modeling will be evaluated to determine how local traffic patterns would likely be affected by the project.

- Analysis Approach and Year(s)

The project opening year will determine the year for the analysis. This decision is based on several key factors. PM2.5 vehicle emissions are predominately generated by truck traffic. Average truck emissions are dropping rapidly as older vehicles are retired and replaced with vehicles meeting more stringent emission requirements. Previous analysis completed for NCDOT confirmed this trend in truck emissions at the project level and found it offset traffic growth by a sizable margin. Based on available NCSTDM and MPO modeling, truck volumes within the study area may/may not increase at a significant rate that would offset newer engine technology.

According to EPA guidance and, the hot-spot analysis focus is the project’s build alternative. A hot-spot evaluation of the no-build analysis is not required to demonstrate conformity when the build alternative does not show a new or worsened violation of the NAAQS.

- PM NAAQS Evaluated
The project is located in an area designated as nonattainment for the 1997 annual PM$_{2.5}$ NAAQS (15 micrograms per cubic meter $\mu$g/m$^3$). The area is currently in maintenance/attainment for the 24-hour PM$_{2.5}$ NAAQS and 24-hour PM$_{10}$ NAAQS.
7 Technical Procedures for MSAT Analyses

7.1 Background

The Clean Air Act identified 188 air toxics referred to as hazardous air pollutants. The EPA has assessed this list of toxics and identified a group of 21 as Mobile Source Air Toxics. The EPA also identified a subset of this list that is now considered as the seven priority MSAT. These are acrolein, benzene, 1,3-butadiene, diesel particulate matter plus diesel exhaust organic gases (diesel PM), formaldehyde, naphthalene, and polycyclic organic matter. While these MSAT are considered the priority transportation toxics, the EPA has indicated that the lists are subject to change in future rulings.

Relative to project-level analysis, the tools and techniques for assessing project-specific health impacts from MSAT are limited. These limitations restrict NCDOT’s and FHWA’s ability to evaluate how MSAT’ health risks should factor into project-level decision-making under NEPA. It is anticipated that the EPA will provide further clarification and analytical tools for assessing MSAT on a project-level in the future.

FHWA recognizes that air toxics continue to be an area of concern on transportation projects during the NEPA process. As such, FHWA has issued the Interim Guidance on Air Toxic Analysis in NEPA Documents (December 2012) to provide guidance on how MSAT should be addressed in NEPA documents for highway projects. This interim guidance and an expanded discussion of MSAT can be referenced on the FHWA’s website:

http://www.fhwa.dot.gov/environment/air_quality/air_toxics/policy_and_guidance/aqintguidmem.cfm

7.2 MSAT Analytical Procedures

There are currently no established criteria for determining the scope of MSAT emissions analyses. Therefore, a range of options should be considered when addressing this issue in NEPA documentation. FHWA has developed a tiered approach for analyzing MSAT in NEPA documents. Depending on the specific project circumstances, FHWA has identified three levels of analysis:

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

7.2.1 Projects with No Meaningful Potential MSAT Effects or Exempt Projects

Three types of projects included in this category are:

- Projects qualifying as a categorical exclusion under 23 CFR 771.117(c)
- Projects exempt under the Clean Air Act conformity rule under 40 CFR 93.126
- Other projects with no meaningful impacts on traffic volumes or vehicle mix
For projects that are categorically excluded under 23 CFR 771.117(c), or are exempt from conformity requirements under the Clean Air Act pursuant to 40 CFR 93.126, no analysis or discussion of MSAT is necessary. Documentation sufficient to demonstrate that the project qualifies as a categorical exclusion and/or exempt project will suffice. For other projects with no or negligible traffic impacts, regardless of the class of NEPA environmental document, no MSAT analysis is recommended. However, the project record should document the basis for the determination of "no meaningful potential impacts" with a brief description of the factors considered.

7.2.2 Projects with Low Potential MSAT Effects

The types of projects included in this category are those that serve to improve operations of highway, transit, or freight without adding substantial new capacity or without creating a facility that is likely to meaningfully increase MSAT emissions. This category covers a broad range of projects. Most highway projects that need an MSAT assessment will fall into this category. Examples of these types of projects are minor widening projects, new interchanges, replacing a signalized intersection on a surface street, or projects where the design year traffic is projected to be less than 140,000 to 150,000 vpd.

For these projects, a qualitative assessment of emissions projections should be conducted. This qualitative assessment would compare, in narrative form, the expected effect of the project on traffic volumes, vehicle mix, or routing of traffic and the associated changes in MSAT for the project alternatives, including no build, based on VMT, vehicle mix, and speed. It would also discuss national trend data projecting substantial overall reductions in emissions due to stricter engine and fuel regulations issued by EPA. Because the emission effects of these projects typically are low, no appreciable difference in overall MSAT emissions among the various alternatives is expected.

In addition to the qualitative assessment, a NEPA document for this category of projects must include a discussion of information that is incomplete or unavailable for a project specific assessment of MSAT impacts, in compliance with the Council on Environmental Quality (CEQ) regulations (40 CFR 1502.22(b)). This discussion should explain how current scientific techniques, tools, and data are not sufficient to accurately estimate human health impacts that could result from a transportation project in a way that would be useful to decision-makers. Also in compliance with 40 CFR 150.22(b), it should contain information regarding the health impacts of MSAT.

7.2.3 Projects with Higher Potential MSAT Effects

This category includes projects that have the potential for meaningful differences in MSAT emissions among project alternatives. A limited number of projects are expected to meet this two-pronged test. To fall into this category, a project should:
• Create or significantly alter a major intermodal freight facility that has the potential to concentrate high levels of diesel particulate matter in a single location, involving a significant number of diesel vehicles for new projects or accommodating with a significant increase in the number of diesel vehicles for expansion projects, or
• Create new capacity or add significant capacity to urban highways such as interstates, urban arterials, or urban collector-distributor routes with traffic volumes where the AADT is projected to be in the range of 140,000 to 150,000 or greater by the design year, and
• Proposed to be located in proximity to populated areas

Once a quantitative analysis is deemed necessary for a project, the air quality analyst should coordinate with NCDOT to establish the analysis methodology and parameters. Interagency consultation with NCDOT, NCDEQ, and FHWA will be necessary to ensure compliance with national best practices and procedures. Projects falling within this category should be more rigorously assessed for impacts. If a project falls within this category, the air quality analyst should contact NCDOT and the Office of Natural Environment and the Office of Project Development and Environmental Review in FHWA Headquarters for assistance in developing a specific approach for assessing impacts.

Reference:
http://www.fhwa.dot.gov/environment/air_quality/air_toxics/policy_and_guidance/moves_msat_faq.cfm

This approach would include a quantitative analysis to forecast local-specific emission trends of the priority MSAT for each alternative, to use as a basis of comparison. This analysis also may address the potential for cumulative impacts, where appropriate, based on local conditions. How and when cumulative impacts should be considered would be addressed as part of the assistance outlined above. The NEPA document for this project should also include relevant language on unavailable information provided by FHWA.

If the analysis for a project in this category indicates meaningful differences in levels of MSAT emissions among alternatives, mitigation options should be identified and considered.

7.2.4 Quantitative Analysis – Methodology/Approach

The purpose of a quantitative MSAT analysis is to determine the changes in MSAT emissions as a result of a proposed project and compare the emission quantities between the project alternatives. There is currently no federally-approved guidance or model to perform a quantitative MSAT analysis. The technical information provided will highlight NCDOT’s MSAT analysis process and the technical recommendations from FHWA.

A Quantitative MSAT analysis, in general, can be broken down into 7 steps:

1) Determine the need for a quantitative MSAT analysis;
2) Identify and define the project area;
3) Develop the modeling approach;
4) Gather the applicable traffic data;
5) Process the traffic data in MOVES2014;
6) Document and summarize the results in a report; and  
7) Submit report to NCDOT for review coordination.

The seven (7) steps listed below provide a basic approach and highlight the process necessary to complete a quantitative MSAT analysis.

Note: Coordination with NCDOT should occur throughout the analysis to streamline the process and identify the appropriate methods, assumptions, and tools to be used for a quantitative analysis.

**Step 1: Determine the Need for a Quantitative MSAT Analysis**

The FHWA requires a quantitative analysis for highway projects that meet the following criteria:

- Create or significantly alter a major intermodal freight facility that has the potential to concentrate high levels of diesel particulate matter in a single location;

- Create new capacity or add significant capacity to urban highways such as interstates, arterials, or collector-distributor routes where the AADT is projected to be in the range of 140,000 – 150,000 or greater by the design year; and

- Any project proposed to be located in proximity to populated areas (e.g. 500+ feet from the project area).

Defining the affected transportation network requires available project-specific information from supporting technical traffic analyses. Projects that meet the criteria for a quantitative MSAT analysis will be determined during the project scoping process. In addition, the analyst should also contact NCDOT and FHWA (NC Division) to coordinate communication with FHWA Headquarters for assistance in developing a specific project approach for assessing impacts if needed. Consult NCDOT for scoping assistance. Written concurrence that a Quantitative MSAT analysis is required must be received by NCDOT prior to moving forward with the analysis.

**Step 2: Identify and Define the Project Area**

Identifying the project area and project limits will typically be defined during the initial determinations of NCDOT/Consultant coordination. In most cases, this is typically referred to as the “affected network”. The project area usually includes all segments associated with the project plus those segments expecting meaningful changes in MSAT emissions. A meaningful change in MSAT emissions, for example, could potentially include:

1) Changes of +/- 5% or more in AADT on congested highway links of LOS D or worse;  
2) Changes of +/- 10% or more in AADT on uncongested highway links of LOS C or better;  
3) Changes of +/- 10% or more in travel time; or  
4) Changes of +/- 10% or more in intersection delay
Step 3: Develop the Modeling Approach

Coordination with NCDOT, and FHWA (NC Division) should occur throughout the development of the modeling approach to streamline the process and to ensure all project requirements are met.

Step 4: Gather the Applicable Traffic Data

The following traffic information and MOVES2014 inputs, at a minimum, is required in order to develop a MOVES2014 run specification and complete a quantitative MSAT analysis:

- Vehicle age distributions, average speed distributions, vehicle miles traveled (VMT) data, fuel supply data, vehicle type population, meteorological data, ramp fractions, and road type distribution NCDEQ/DAQ.

Step 5: Process the Traffic Data in MOVES2014

MOVES2014 is the recommended modeling program for estimating MSAT emissions from highway networks. The MOVES2014 user guide should be referenced during the analysis to help guide the user step-by-step through the MOVES program. The use of this guide is essential to understanding the MOVES Graphical User Interface (GUI) and provides the user with all the necessary information and details on how to use the MOVES2014 model to estimate air pollution emissions from cars, trucks, and non-highway mobile sources.

Step 6: Document and Summarize the Results in a Report

A Quantitative MSAT analysis report should include, at a minimum, the following:

- Project description – including project location, project scope, completion date, travel projections;
- Information and documentation on any coordination with NCDOT, United States Environmental Protection Agency (EPA), FHWA (NC Division), NCDEQ/DAQ and or other resource agencies;
- Background information on MSATs, including the overall objective of the analysis;
- A map depicting the identified “affected network”;
- A description of the sensitive land areas included in the analysis;
- A description of the average daily volumes for the road segments that make up the affected traffic network with ADT comparison between analysis years;
- A description and comparison with detailed figures between existing, opening year build/no-build, and design year build/no-build scenarios of the priority MSAT emissions;
- A conclusion summarizing the modeling results; and
- Appendices should include, at a minimum, the following: project location diagram, sensitive land areas diagram, Appendices C, D, and E provided from the FHWA website, and a list of references.
Step 7: Submit Report to NCDOT for Review

A completed quantitative MSAT report must be submitted electronically and in hard copy, upon request, to NCDOT/Human Environment Section/Traffic Noise and Air Quality Group for review. The air quality analyst must also submit electronic copies, of all the MOVES input/output files used during the analysis.

Step 8: Include the Final MSAT Report in the Project NEPA Documentation

At the conclusion of the MSAT analysis process, the report must be included in the project NEPA documentation as a streamlined text and the report location referenced back to the PDEA Project Engineer if applicable.

8 Contact Information

- NCDOT (http://www.ncdot.gov/)
  - Greg Smith, Traffic Noise & Air Quality Group Leader
    - gasmith@ncdot.gov
    - 919-707-6087
  - Bobby Dunn, Air Quality Engineer
    - bbdunn@ncdot.gov
    - 919-707-6064
  - Heather Hildebrandt, Air Quality Engineer
    - hjhildebrandt@ncdot.gov
    - 919-707-0964

- FHWA (https://www.fhwa.dot.gov/ncdiv/)
  - Eddie Dancausse, Air Quality Specialist
    - edward.dancausse@dot.gov
    - 919-747-7026

- NCDEQ/DAQ (http://portal.ncdenr.org/web/guest)
  - Todd Pasley, Planning Engineer
    - todd.pasley@ncdenr.gov
    - 919-707-8713
  - Phyllis Jones, Technical Services Engineer
    - phyllis.d.jones@ncdenr.gov
    - 919-707-8424